PROJECT DOCUMENTS
AND
SPECIFICATIONS

FOR

DELAWARE MUNICIPAL AIRPORT
DELAWARE, OHIO

RUNWAY 10-28 EXTENSION & OVERLAY
FAA AIP NO. 3-39-032-021-2015

PREPARED BY:

BURKE LAKEFRONT AIRPORT
1501 NORTH MARGINAL ROAD
CLEVELAND, OH 44114-3737

ISSUED FOR BID
APRIL 2015

PROJECT NO.: 28972

CERTIFICATIONS

The Plans and Specifications covered by these Contract Documents were prepared under the supervision and direction of the undersigned Registered Engineers whose seals are affixed below.

CIVIL & ELECTRICAL ENGINEERING

Todd Schultheis, P.E.
CHA Consulting
1501 North Marginal Road
Ste. 200
Cleveland, OH 44114
(216) 443-1780

4/15/15

<u>This Seal Covers the following Technical Specifications:</u>

Sections: P-101, P-152, P-153, P-154, P-155, P-156, P-209, P-401, P-602, P-603, P-610, P-620, P-621, F-162, D-701, D-705, D-752, T-901, T-904, T-905, T-908, L-107, L-108, L-109, L-110, MST-01, MST-02, MST-03, MST-04, MST-05, MST-06. LST-01, LST-02, ODOT-451, ODOT-499, ODOT-701, ODOT-703, ODOT-705, ODOT-709

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NOTICE TO BIDDERS

NOTICE TO BIDDERS

Pursuant to Article XV Sections 73-75 of the Delaware Charter, sealed bids will be received by the City of Delaware, Ohio, City Hall, 1 South Sandusky Street, Delaware, Ohio 43015 until 3:00 P.M EDT, on Tuesday, May 26, 2015 at the Office of the City Manager and opened immediately thereafter, for the following:

CONTRACT	ESTIMATE OF COST	
Runway 10/28 Extension & Overlay	Base Bid	$4,920,000
Delaware Municipal Airport	Bid Alternate No. 1	$751,000
Bid Number 12-15	Bid Alternate No. 2	$76,500
	Bid Alternate No. 3	$120,000

This project consists of the extending Runway 10/28 800 feet, rehabilitation of the existing 5,000' runway, drainage, Taxiway 'A' extension, navigational aid relocations, and the installation of signs and lighting.

DOCUMENTS: **Project Manual, Specifications, Drawings, and Bid Form, and any additional information may be secured from SE Blueprint, 2035 Hamilton Avenue, Cleveland, Ohio 44114, (216) 241-2250 at actual printing costs preset, plus shipping, if requested. The contract documents and plans may be viewed at www.seblueprint.com and purchased on line upon registration.**

Each bid must be accompanied by a Bid Guaranty meeting the requirements 153.54 to 153.57 of the Ohio Revised Code. Bids shall be sealed and addressed to:

City of Delaware, Ohio
City Manager's Office
City Hall
One South Sandusky Street
Delaware, Ohio 43015

A pre-bid meeting will be held at the City of Delaware, Ohio, City Hall Council Chambers, 1 S. Sandusky St., Delaware, Ohio 43015 at 11:00 a.m. EDT, on Thursday, May 7, 2015.

All prospective bidders should address inquiries and questions to Chad Green at **cgreen@delawareohio.net**. No phone calls will be responded to. All inquiries and questions must be submitted no later than 5:00 p.m. EDT on Friday, May 15, 2015.

No bidder may withdraw his/her bid within sixty (60) days after the actual date of the opening thereof. The City of Delaware reserves the right to reject any or all bids, to waive any informality and to award the bid or bids to the lowest responsive and responsible bidder as deemed to be in the best interest of the City, as determined by the City Manager. The bidder may also be asked to hold his/her bid past 60 days as the project is dependent on Airport Improvement Program funding from the FAA. The project will not be awarded until after the AIP grant offer is issued by FAA.

Bidder's attention is called to all of the requirements contained in this bid packet, particularly to the Federal Labor Standards Provisions, Davis-Bacon Wages, various insurance requirements, and various equal employment opportunity provisions.

Award of contract is subject to the following Federal provisions:

DOT Regulation 49 CFR Part 26 Disadvantaged Business Enterprise Participation

Executive Order 11246 and DOL Regulation 41 CFR PART 60 - Affirmative Action to Ensure Equal Employment Opportunity

DOL Regulation 29 CFR Part 5 – Davis Bacon Act

Certification Regarding Debarment and Suspension (Non-Procurement) Title 2 CFR Par 180 & Title 2 CFR Part 1200

Drug-Free Workplace Act of 1988 – 41 U.S.C. 702 through 706

DOT Regulation 49 CFR PART 30 - Denial of Public Works Contracts to Suppliers of Goods and Services of Countries that Deny Contracts to Suppliers of Goods and Services of Countries that Deny Procurement Market Access to U.S. Contractors (Foreign Trade Restriction).

TITLE 49 United States Code, SECTION 50101 – Buy American Preferences

City of Delaware, Ohio
R. Thomas Homan
City Manager

Posted to the City of Delaware Website on or before Monday, April 20, 2015.

INSTRUCTIONS TO BIDDERS

INSTRUCTIONS TO BIDDERS

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A. BIDDER'S PLEDGE AND AGREEMENT

1. Each Bidder acknowledges that this is a public project involving public funds and that the Owner expects and requires that each successful Bidder adhere to the highest ethical and performance standards. Each Bidder by submitting a bid pledges and agrees that (a) it will act at all times with absolute integrity and truthfulness in its dealings with the Owner and the Engineer, (b) it will use its best efforts to cooperate with the Owner and the Engineer and all other Contractors on the Project and at all times will act with professionalism and dignity in its dealings with the Owner, Engineer, and other Contractors, (c) it will assign only competent supervisors and workers to the Project, each of whom is fully qualified to perform the tasks that are assigned to him/her, and (d) it has read, understands and will comply with the terms of the Project Documents.

B. EXAMINATION OF PROJECT DOCUMENTS AND SITE CONDITIONS AND RELIANCE UPON TECHNICAL DATA

1. Each Bidder shall have a competent person carefully and diligently review each part of the Project Documents, including the Divisions of the Specifications and parts of the Drawings that are not directly applicable to the Work on which the Bidder is submitting its bid. By submitting its bid, each Bidder represents and agrees, based upon its careful and diligent review of the Project Documents, that it is not aware of any conflicts, inconsistencies, errors, or omissions in the Project Documents for which it has not notified the Engineer in writing at least seven (7) days prior to the bid opening. If there are any such conflicts, inconsistencies, errors, or omissions in the Project Documents, the Bidder (i) will provide the labor, equipment, or materials of the better quality or greater quantity of Work and/or (ii) will comply with the more stringent requirements. The Bidder will not be entitled to any additional compensation for any conflicts, inconsistencies, errors, or omissions that would have been discovered by such careful and diligent review, unless it has given prior written notice to the Engineer.

2. Each Bidder shall have a competent person carefully and diligently inspect and examine the entire site and the surrounding area, including all parts of the site applicable to the Work for which it is submitting its bid, including location, condition, and layout of the site and the location of utilities, and carefully correlate the results of the inspection with the requirements of the Project Documents. The Bidder's bid shall include all costs attributable to site and surrounding area conditions that would have been discovered by such careful and diligent inspection and examination of the site and the surrounding area, and the Bidder shall not be entitled to any Change Order, additional compensation, or additional time on account of such conditions.

3. The Bidder may rely upon the general accuracy of any technical data identified in the Owner-Contractor Agreement (e.g., any soils exploration reports, soil boring logs, site survey, or abatement reports) in preparing its bid, but such technical data are not part of the Project Documents. Except for the limited reliance described in the preceding sentence, Bidder may not, if awarded a contract for the Work, rely upon or make any Claim against the Owner or Engineer, or any of their agents or employees, with respect to any of the following:

    (a) the completeness of such reports and drawings for Bidder's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by the successful Bidder and safety precautions and programs incident thereto; or

(b) any interpretation by the successful Bidder of or conclusion drawn from any technical data or any such other data, interpretations, opinions, or information. For example, all interpolations and extrapolations of data performed by the Bidder to estimate locations or quantities of subsurface strata are independent factual assumptions, which Owner does not warrant.

4. Each Bidder will be deemed to have actual knowledge of all information provided or discussed at the pre-bid meeting.

C. OWNER & ENGINEER

1. The Owner is:

   The City of Delaware
   One South Sandusky Street
   Delaware, Ohio 43015

   The Owner's Representative is: Chad Green, City of Delaware

2. The Engineer (referred to as the "Engineer" or "Architect" in the Project Documents) is:

   CHA Consulting
   Burke Lakefront Airport
   1501 N. Marginal Road
   Cleveland, Ohio 44114

   The Engineer's Representative is: Mark Heckroth

D. PROJECT

1. The Project and Work for the Project consists of all labor, materials, equipment, and services necessary for construction of the project identified as **Delaware Municipal Airport – Runway 10-28 Extension & Overlay** ("the Project"), all in accordance with the Drawings and Specifications prepared by the Engineer. The Project will be substantially complete by July 27, 2016.

E. WORK

1. Only one contract will be issued by the Owner for constructing the Project, the General Contract, which will cover all scopes of work necessary to construct the Project, including, but not limited to sitework, general trades work, plumbing work, and electrical work.

2. The Contractor awarded the General Contract (General Contractor) will be responsible for the performance and coordination of any and all subcontractors and suppliers either directly or indirectly contracted with the General Contractor.

3. On request, Owner will provide Bidders access to the Project site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates.

F. ESTIMATE OF COST

This estimate is a result of careful calculations and is believed to be correct. The estimated quantities are given only as a basis for comparison of proposals and the award of contract. The Owner does not expressly or impliedly agree that the actual quantities involved will correspond exactly with the estimated quantities. The Bidder shall not please misunderstandings or deception because of such estimates of quantities, or of the character, location or other conditions pertaining to the work. Payment to the Contractor will be made only for the actual quantities of work performed or materials furnished in accordance with the plans and specifications. It is understood that the quantities may be increased or decreased as hereinafter provided in the subsection titles "Alteration of Work and Quantities" of the general provisions without in any way invalidating the unit bid prices.

1. The total estimated construction cost for both base bids for the Project for which bids are being solicited at this time is:

   Base Bid $4,920,000.00
   Bid Alternate No. 1 $751,000.00
   Bid Alternate No. 2 $76,500.00
   Bid Alternate No. 3 $120,000.00

G. PROJECT DOCUMENTS

The Project Documents consist of the following: Advertisement for Bids, Instructions-to-Bidders, General Provisions, Supplemental General Provisions, Technical Provisions, Supplemental Technical Provisions, Project Drawings, Proposal Form with attachments, Owner-Contractor Agreement, any authorized addenda issued by the Owner and any document incorporated in whole or in part by reference therein.

The term "Project Documents" as used herein shall be construed as being equivalent to the above defined bid documents. All documents comprising the Project Documents are complementary to one another and together establish the complete terms, conditions and obligations of the successful Bidder. No part of those individual elements of the Project Documents that are bound together may be removed or detached.

Complete sets of Project Documents will be available for sale at SE Blueprint, 2035 Hamilton Avenue, Cleveland, Ohio 44114, 216-241-2250 at actual printing costs per set.

Bidders may also view the Project Documents online at: www.seblueprint.com

Bidders shall use complete sets of Project Documents in preparing bids. Neither the Owner nor the Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Project Documents.

The Owner or the Engineer, in making the Project Documents available on the above terms, does so only for the purpose of obtaining bids on the Work and does not confer a license or grant for any other use.

A pre-bid conference will be held on Thursday, May 7, 2015 at 11:00 am, local time at City Hall Council Chambers, One South Sandusky Street, Delaware, Ohio 43015.

H. PREPARATION OF BIDS

1. All bids must be submitted on the "Bid Form" furnished with the Project Documents.

2. All blank spaces shall be filled in, in ink or typewritten, in words and figures, and in figures only where no space is provided for words, and signed by the Bidder. The wording on the Bid Form shall be used without change, alteration, or addition. Any change in the wording or omission of specified accompanying documents may cause the bid to be rejected. If both numbers and words are requested for any bid item, the amount in words shall prevail if there is an inconsistency between the numbers and words written.

3. Bidders shall note receipt of Addenda on the Bid Form. If the Bidder fails to acknowledge receipt of each Addendum, the Bid shall be deemed non-responsive, unless the Bid amount clearly and unambiguously reflects receipt of the Addendum or the Addendum involves only a matter of form and does not affect the price, quantity or quality of the Work to be performed.

4. Each Bidder shall submit two (2) copies of its bid to the Owner. The Bid Form shall be signed with the name typed or printed below the signature. A Bid shall not be submitted by facsimile transmission. A Bidder that is a corporation shall sign its bid with the legal name of the corporation followed by the name of the state of incorporation and the legal signature of an officer authorized to bind the corporation to a contract.

5. Each Bid shall be enclosed in a sealed opaque envelope with the Bidder's name and the title of the Project printed in the upper left hand corner and addressed as follows:

   The City of Delaware
   Attn: Chad Green
   One South Sandusky Street
   Delaware, Ohio 43015

   Bids must be received at the designated location for the bid opening before 3:00 p.m., local time, on Tuesday, May 26, 2015.

6. **<u>The completed Bid Form shall be accompanied by the following documents</u>:**
   a. **Bid Guaranty and if applicable, Contract Bond (See Paragraph H.8 below.)**
   b. **Contractor's Qualification Statement (See Paragraph I.4 below.)**

7. The Bidder shall take the following precautions in preparing its bid:
   a. Sign the bid and check to ensure all blank spaces have been filled in with requested information and that the specified accompanying documents (listed in Paragraph H.6 above) have been included in a sealed opaque envelope addressed as described in item 5 above.
   b. When the Bid Form provides for quoting either an addition or deduction for an Alternate item, indicate whether the sum named is an addition or deduction. If it is not indicated, it will be conclusively presumed that the amount is a deduction.

c. When the Bid Form provides for quoting a unit price, the Bidder should quote the unit price as set forth in the Bid Documents.

d. When applicable, make sure that the Bid Guaranty is properly executed and signed by:

   1) The Bidder
   2) The Surety or Sureties

e. Make sure that the amount of the Bid Guaranty (if the Bid Guaranty is in the form of a certified check, letter of credit, or cashier's check) is for a specific sum in an amount as instructed in Paragraph H.8.a below. If the Bid Guaranty is in the form of the Bid Guaranty and Contract Bond, the amount may be left blank; if an amount is inserted, it must equal the total of the base bid and all add alternates included. If inserted, then the failure to state an amount equal to the total of the base bid and all add alternates shall make the bid non-responsive if the Owner selects alternates not included in the amount.

f. Make sure that if applicable, the appropriate bid package and scope of work is inserted in the correct space on the Bid Guaranty and Contract Bond Form. Failure to include work covered by the bid submitted may make the bid non-responsive.

8. Bonds and Guarantees

a. Bid Guaranty: Bidder shall furnish a Bid Guaranty, as prescribed in Sections 153.54, 153.57, and 153.571 of the Ohio Revised Code, in the form of either: (1) a bond for the full amount of the bid in the form of the Bid Guaranty and Contract Bond included in the Bid Documents; or (2) a certified check, cashier's check, or irrevocable letter of credit in a form satisfactory to the Owner in an amount equal to 10% of the bid. Bid amount shall be the total of all sums bid, including all add alternatives, but excluding all deduct alternatives. NOTE: AIA Bid Bond forms are not acceptable.

b. Contract Bond: The successful Bidder, who, as a Bid Guaranty, submits a certified check, cashier's check, or irrevocable letter of credit in an amount equal to 10% of the bid, shall furnish a Contract Bond in the form Contract Bond included in the Bid Documents in an amount equal to 100% of the Contract Sum. NOTE: AIA Bond forms are not acceptable.

c. The bond must be issued by a surety company authorized by the Ohio Department of Insurance to transact business in the State of Ohio and acceptable to the Owner. The bond must be issued by a surety capable of demonstrating a record of competent underwriting, efficient management, adequate reserves, and sound investments. These criteria will be deemed to be met if the surety currently has an A.M. Best Company Policyholders Rating of "A-" or better and has or exceeds the Best Financial Size Category of Class VI. Other sureties may be acceptable to the Owner, in its sole discretion

d. All bonds shall be signed by an authorized agent of an acceptable surety and by the Bidder.

e. Surety bonds shall be supported by credentials showing the Power of Attorney of the agent, a certificate showing the legal right of the Surety Company to do business in the State of Ohio, and a financial statement of the Surety.

f. The Bid Guaranty, as applicable, shall be in the name of or payable to the order of the Owner.

g. The name and address of the Surety and the name and address of the Surety's Agent should be typed or printed on each bond.

I. METHOD OF AWARD

1. All bids shall remain open for acceptance for sixty (60) days following the day of the bid opening, but the Owner may, in its sole discretion, release any bid and return the Bid Guaranty prior to that date. The Bid Guaranty shall be subject to forfeiture, as provided in the Ohio Revised Code, if a bid is withdrawn during the period when bids are being held.

2. The Owner reserves the right to reject any, part of any, or all bids and to waive any informalities and irregularities. The Bidder expressly acknowledges this right of the Owner to reject any or all bids or to reject any incomplete or irregular bid. Bidders must furnish all information requested on or accompanying the Bid Form. Failure to do so may result in disqualification of the bid.

3. Determination of the Lowest Responsible and Responsive Bid. Subject to the right of the Owner to reject any or all bids, the Owner will award the Contract for the Work to the responsible bidder submitting the lowest responsive bid, taking into consideration accepted alternates. In evaluating bids, the Owner may consider the qualifications of the Bidders, whether or not the bids comply with the prescribed requirements, and alternates and unit prices, if requested, on the Bid Form. The Owner may also consider the qualifications and experience of subcontractors and suppliers. The Owner may conduct such investigations as are deemed necessary to establish the qualifications and financial ability of the Bidder and its subcontractors and suppliers. The factors the Owner may consider in determining which bid is lowest responsive and responsible include the factors set forth below. The Owner, in its discretion, may consider and give such weight to these criteria as it deems appropriate.

   a. The Bidder's work history. The Bidder should have a record of consistent customer satisfaction and of consistent completion of projects, including projects that are comparable to or larger and more complex than the Owner's Project, on time and in accordance with the applicable Project Documents, and the Bidder’s claims history. If the Bidder's management operates or has operated another construction company, the Owner may consider the work history of that company in determining whether the Bidder submitted the lowest responsive and responsible bid.

      The Owner will consider the Bidder's prior experience on other projects of similar scope and/or complexity including prior projects with the Owner and/or Engineer, including the Bidder's demonstrated ability to complete its work on these projects in accordance with the Project Documents and on time, and will also consider its ability to work with the Owner and Engineer as a willing, cooperative, and successful team member. Bringing overstated claims, an excessive number of claims, acting uncooperatively, and filing lawsuits against project owners and/or their design professionals on prior projects of similar scope and/or complexity will be deemed evidence of a Bidder’s inability to work with the Owner and Engineer as a willing, cooperative, and successful team member.

      The Bidder authorizes the Owner and its representatives to contact the owners and design professionals (and construction managers, if applicable) on projects on which the Bidder has worked and authorizes and requests such owners and design professionals (and construction managers) to provide the Owner with a candid evaluation of the Bidder's performance. By submitting its bid, the Bidder agrees that if it or any person, directly or indirectly, on its behalf or for its benefit brings an action against any of such

owners or design professionals (or construction managers) or the employees of any of them as a result of or related to such candid evaluation, the Bidder will indemnify and hold harmless such owners, design professionals (and construction managers) and the employees of any of them from any claims whether or not proven that are part of or are related to such action and from all legal fees and expenses incurred by any of them arising out of or related to such legal action. This obligation is expressly intended for the benefit of such owners, design professionals (and construction managers), and the employees of each of them.

b. The Bidder's financial ability to complete the Contract successfully and on time without resort to its Surety.

c. The Bidder's prior experience with similar work on comparable or more complex projects.

d. The Bidder's prior history for the successful and timely completion of projects, including the Bidder's history of filing claims and having claims filed against it.

e. The Bidder's equipment and facilities.

f. The adequacy, in numbers and experience, of the Bidder's work force to complete the Contract successfully and on time.

g. The Bidder's compliance with federal, state, and local laws, rules, and regulations, including but not limited to the Occupational Safety and Health Act, and Ohio ethics laws.

h. The foregoing information with respect to each of the Subcontractors and Suppliers that the Bidder intends to use on the Project.

i. The Bidder's participation in a drug-free workplace program acceptable to the Owner, and the Bidder's record for both resolved and unresolved findings of the Auditor of State for recovery as defined in Section 9.24 of the Ohio Revised Code.

j. The Owner's prior experience with the Bidder's surety.

k. The Bidder's interest in the Project as evidenced by its attendance at any pre-bid meetings or conferences for bidders.

l. Depending upon the type of the work, other essential factors, as the Owner may determine and as are included in the Specifications.

4. Qualifications Statement. Each Bidder will submit with its bid a completed Contractor Qualifications Statement, which is included with the Project Documents, and thereafter provide the Engineer promptly with such additional information as the Engineer may request regarding the Bidder's qualifications. A Bidder shall submit any requested additional information within three (3) business days of the date on the request.

5. The failure to submit requested information on a timely basis may result in the determination that the Bidder has not submitted the lowest responsive and responsible bid.

6. By submitting its bid, the Bidder agrees that the Owner's determination of which bidder is the lowest responsive and responsible bidder shall be final and conclusive, and that if the Bidder or any person on its behalf challenges such determination in any legal proceeding, the Bidder will indemnify and hold the Owner and its employees and agents harmless from any claims included or related to such legal proceeding, whether or not proven, and from

legal fees and expenses incurred by the Owner, its employees, or agents that arise out of or are related to such challenge.

7. Affidavit as to Personal Property Taxes. Each successful Bidder shall submit, prior to the time of the entry into the Contract, an affidavit in the form required by Section 5719.042, Ohio Revised Code, regarding the status of the Bidder's personal property taxes. A copy of the affidavit form is included with the Contract Documents.

8. Declaration of Material Assistance. Each successful bidder shall complete the Declaration of Material Assistance/Nonassistance to a Terrorist Organization form ("Declaration Form") issued by the Ohio Department of Public Safety, Division of Homeland Security. A copy of the Declaration Form is included with the Contract Documents.

9. No Bidder may withdraw its bid within sixty (60) days after the date bids are opened. The Owner reserves the right to waive any formalities or irregularities or to reject any or all bids.

10. The Owner reserves the right to disqualify bids, before or after opening, upon evidence of collusion with intent to defraud or other illegal practices on the part of the Bidder.

11. Award of Contract. The award of the Contract, when required, will only be made pursuant to a duly adopted resolution of the Owner.

J. EXECUTION OF CONTRACT

1. Within the time designated by the Engineer after award of the Contract, the successful Bidder shall execute and deliver to the Engineer the required number of copies of the Owner-Contractor Agreement, in the form included in the Project Documents, and all accompanying documents requested, including, but not limited to, a Contract Bond (if applicable), insurance certificates, and a valid Workers' Compensation Certificate. The successful Bidder shall have no property interest or rights under the Owner-Contractor Agreement until the Agreement is executed by the Owner.

K. SUBSTITUTIONS/NON-SPECIFIED PRODUCTS

1. Certain brands of material or apparatus are specified. Each bid will be based on these brands, which may be referred to in the Project Documents as Standards. The use of another brand (referred to as a substitution or proposed equal in the Project Documents, when a bidder or the contractor seeks to have a different brand of material or apparatus than that specified approved by the Owner for use in the Project) may be requested as provided herein.

2. The products specified in the Project Documents establish a standard of required function, dimension, appearance, and quality.

3. Bidders wishing to obtain approval to bid non-specified products shall submit written requests to the Engineer a minimum of ten (10) calendar days before the bid date and hour.The following will be cause for rejection of a proposed substitution:

    a. Requests submitted by subcontractors, material suppliers, and individuals other than Bidders;

    b. Requests submitted without adequate documentation;

    c. Requests received after the specified cut-off date.

4. When the Engineer approves a product submission before receipt of bids, the approval will be included in an Addendum, and Bidders may include the pricing of this product in their bid. Bidders shall not rely on approvals made in any other manner.

5. In proposing a non-specified product or a substitution, the Bidder represents and warrants that each proposed product will not result in any changes to the Project, including changes to the Work of other contractors, or any decrease in the performance of any equipment or systems to be installed in the Project and agrees to pay any additional costs incurred by the Owner and the Owner's consultants as a result of a non-specified or substitute product that is accepted.

6. Following the award of the Contract, there shall be no substitutions for specified products, except pursuant to a Change Order. The Owner in its sole discretion may decline to consider any substitution for a Change Order.

L. ALTERNATES

1. The Owner may request bids on alternates. If the Owner requests bids on alternates, the Bidder should include the cost of the alternates requested on its Bid Form.

2. At the time of awarding the contract, the Owner will select or reject alternates as it determines is in its best interest. A Bidder's failure to include on its Bid Form the cost of an alternate selected by the Owner and applicable to the Bidder's work shall render the bid non-responsive and be grounds for the rejection of the bid. Otherwise, the failure to include the cost of an alternate will not be deemed material.

3. The Bidder acknowledges that although there is an estimate for the cost of the Project, the market conditions may and frequently do result in the estimate being different from the sum of the bids received, either higher or lower. The Bidder understands that the Owner may include alternates, which may include deduct alternates as well as add alternates, to give it flexibility to build the Project with the funds available. The Bidder further understands and acknowledges that use of add and deduct alternates is a long held customary practice in the construction industry in the State of Ohio. The Bidder also acknowledges that the Owner will not make a decision about the alternates on which to base the award of contracts until the bids are received, and the Owner can compare its available funds with the base bids and the cost or savings from selecting different alternates. The Bidder understands that the award to the Bidder submitting the lowest responsive and responsible bid will be based on the lowest base bid plus selected alternates, and may result in an award to a Bidder other than the Bidder that submitted the lowest base bid.

4. If, during the progress of the Work, the Owner desires to reinstate any alternate not included in the Contract, the Owner reserves the right to reinstate the alternate at the price bid by the Contractor provided that such action is taken in sufficient time so as not to delay the progress of the work or cause the Contractor additional expense.

M. UNIT PRICES

1. Where unit prices are requested in the Bid Form the Bidder should quote a unit price. Unless otherwise expressly provided in the Bid Documents, such unit prices shall include all labor, materials, and services necessary for the timely and proper installation of the item for which the unit prices are requested. The unit prices quoted in the bid shall be the basis for any Change Orders entered into under the Owner-Contractor Agreement, unless the Engineer determines that the use of such unit prices will cause substantial inequity to either the Contractor or the Owner.

N. ADDENDA

1. The Owner reserves the right to issue Addenda changing, altering, or supplementing the Project Documents prior to the time set for receiving bids. The Engineer will issue the Addenda to clarify bidders' questions and/or to change, alter, or supplement the Project Documents.

2. Any explanation, interpretation, correction, or modification of the Project Documents will be issued in writing in the form of an Addendum, which shall be the only means considered binding; explanations, interpretations, etc., made by any other means shall NOT be legally binding. All Addenda shall become a part of the Project Documents.

3. Bidders shall submit written questions to the Engineer in sufficient time in advance of the bid opening to allow sufficient time for the Engineer to respond, as set forth in Paragraph O.1 herein. All Addenda will be issued, except as hereafter provided, and mailed or otherwise furnished to persons who have obtained Project Documents for the Project, at least seventy-two (72) hours prior to the published time for the opening of bids, excluding Saturdays, Sundays, and legal holidays. If any Addendum is issued within such seventy-two (72) hour period, then the time for opening of bids shall be extended one (1) week with no further advertising of bids required.

4. Copies of each Addendum will be sent only to the Bidders to whom Project Documents have been issued and to Plan Rooms where copies of the Project Documents are maintained. Receipt of Addenda shall be indicated by Bidders in the space provided on the Bid Form. Bidders are responsible for acquiring issued Addenda in time to incorporate them into their bid. Bidders should contact the Engineer prior to the bid opening to verify the number of Addenda issued.

5. Each Bidder shall carefully read and review the Project Documents and immediately bring to the attention of the Engineer any error, omission, inconsistency, or ambiguity therein.

6. If a Bidder fails to indicate receipt of all Addenda through the last Addendum issued by the Engineer on its Bid Form, the bid of such Bidder will be deemed to be responsive only if:

   a. The bid received clearly indicates that the Bidder received the Addendum, such as where the Addendum added another item to be bid upon and the Bidder submitted a bid on that item; or

   b. The Addendum involves only a matter of form or is one which has either no effect or has merely a trivial or negligible effect on price, quantity, quality, or delivery of the item bid upon.

O. INTERPRETATION

1. If a Bidder contemplating submitting a bid for the proposed Project is in doubt as to the true meaning of any part of the Project Documents, it may submit a written request for an interpretation thereof to the Owner's representative via email at cgreen@delawareohio.net. Requests received after Friday May 15, 2015 will not be answered. Any interpretation of the proposed documents will be made by Addendum only, duly signed by the Engineer, and a copy of such Addendum will be mailed or delivered to each Bidder receiving a set of Project Documents and each plan room where the Project Documents are maintained. The Owner will not be responsible for any other explanation or interpretation of the proposed documents.

2. In interpreting the Project Documents, words describing materials that have a well-known technical or trade meaning, unless otherwise specifically defined in the Project Documents, shall be construed in accordance with the well-known meaning recognized by the trade.

3. Bidders are responsible for notifying the Engineer in a timely manner of any ambiguities, inconsistencies, errors, or omissions in the Project Documents. The Bidder shall not, at any time after the execution of the Contract, be compensated for a claim alleging insufficient data, incomplete Project Documents, or incorrectly assumed conditions regarding the nature or character of the Work, if no request was made by the Bidder prior to the bid opening.

P. STATE SALES AND USE TAXES

1. The Owner is a political subdivision of the State of Ohio and is exempt from taxation under the Ohio Sales Tax and Use Tax Laws. Building materials that the successful Bidder purchases for incorporation into the Project will be exempt from state sales and use taxes if the successful Bidder provides a properly completed Ohio Department of Taxation Construction Contract Exemption Certificate to the vendors or suppliers when the materials are acquired. The Owner will execute properly completed certificates on request.

Q. DATE FOR SUBSTANTIAL COMPLETION/LIQUIDATED DAMAGES

1. Date for Substantial Completion. Each successful Bidder shall have its Work on the Project Substantially Complete (as Substantial Completion is defined in the Project Documents) by July 27, 2016. The Date for Substantial Completion Date and the Contract Time may be extended only by Change Order, by other Modification, or by a Claim that is Finally Resolved. **By submitting its Bid, each Bidder agrees that the period for performing its Work is reasonable**.

2. Liquidated Damages. If the successful Bidder does not have its Work Substantially Complete by its Date for Substantial Completion and/or Finally Complete within thirty (30) days of achieving Substantial Completion, whichever may be applicable, the successful Bidder shall pay the Owner and the Owner may set off from amounts otherwise due the successful Bidder Liquidated Damages. The daily amounts of Liquidated Damages are set forth in the tables included in the Owner-Contractor Agreement. The total amounts of Liquidated Damages will be calculated based on the total number of calendar days beyond the Date for Substantial Completion that the Bidder's Work is not Substantially Complete and/or to the extent that its Work is not Finally Complete more than thirty (30) after the Substantial Completion of its Work, i.e., number of late days times the per diem rate(s) for Liquidated Damages in the tables.

3. The Bidder acknowledges and agrees, by submitting its bid for the Work and entering into a Contract with the Owner, that such amounts of Liquidated Damages represent a reasonable estimate of the actual damages for loss of or interference with the intended use of the Project that the Owner would incur if the Bidder's Work is not Substantially Complete by its Date for Substantial Completion and/or not Finally Complete by thirty (30) of the Date of Substantial Completion. The Bidder further acknowledges, agrees and understands that it may seek an extension of the Contract Time (and its Date for Substantial Completion) to avoid or reduce Liquidated Damages by properly following the Claim procedures in the Project Documents.

R. OWNER'S RIGHT TO WAIVE DEFECTS AND IRREGULARITIES

1. The Owner reserves the right to waive any and all irregularities provided that the defects and irregularities do not affect the amount of the bid in any material respect or otherwise give the Bidder a competitive advantage.

S. MODIFICATION/WITHDRAWAL OF BIDS

1. Modification. A Bidder may modify its bid by written communication to the Owner addressed to the Owner's Representative at any time prior to the scheduled closing time for receipt of bids, provided such written communication is received by Owner's Representative prior to the bid deadline. The written communication shall not reveal the bid price, but should provide the addition or subtraction or other modification so that the final prices or terms will not be known until the sealed bid is opened. If the Bidder's written instructions with the change in bid reveal the bid amount in any way prior to the bid opening, the bid may be rejected as non-responsive.

2. Withdrawal Prior to Bid Deadline. A Bidder may withdraw its bid at any time for any reason prior to the bid deadline for the opening of bids established in the Legal Notice. The request to withdraw shall be made in writing to and received by the Owner's Representative prior to the time of the bid opening.

3. Withdrawal after Bid Deadline.

   a. All bids shall remain valid and open for acceptance for a period of at least 60 days after the bid opening; provided, however, that a Bidder may withdraw its bid from consideration after the bid deadline when all of the following apply:

      (1) the price bid was substantially lower than the other bids;

      (2) the reason for the bid being substantially lower was a clerical mistake, rather than a mistake in judgment, and was due to an unintentional and substantial error in arithmetic or an unintentional omission of a substantial quantity of work, labor, or material;

      (3) the bid was submitted in good faith; and

      (4) the Bidder provides written notice to the Owner, to the attention of the Owner's Representative, within two (2) business days after the bid opening for which the right to withdraw is claimed.

   b. No bid may be withdrawn under this provision if the result would be the awarding of the contract on another bid for the bid package from which the Bidder is withdrawing its bid to the same Bidder.

   c. If a bid is withdrawn under this provision, the Owner may award the Contract to another Bidder determined by the Owner to be the lowest responsive and responsible bidder or the Owner may reject all bids and advertise for other bids. In the event the Owner advertises for other bids, the withdrawing Bidder shall pay the costs incurred in connection with the rebidding by the Owner, including the cost of printing new Contract Documents, required advertising, and printing and mailing notices to prospective bidders, if the Owner finds that such costs would not have been incurred but for such withdrawal.

T. COMPLIANCE WITH APPLICABLE LAWS

1. By submitting a bid for Work on the Project, the Bidder acknowledges that it is in compliance with applicable federal, state, and local laws and regulations, including, but not limited to, the following:

   a. Equal Employment Opportunity/Nondiscrimination. The Bidder agrees that if it is awarded a contract that in the hiring of employees for performance of work under the contract or any subcontract, neither it nor any subcontractor, or any person acting on its behalf or its subcontractor's behalf, by reason of race, creed, sex, disability as defined in Section 4112.01 of the Ohio Revised Code, or color, shall discriminate against any citizen of the state in the employment of labor or workers who are qualified and available to perform work to which the employment relates. The Bidder further agrees that neither it nor any subcontractor or any person on its behalf or on behalf of any subcontractor, in any manner, shall discriminate against or intimidate any employees hired for the performance of the work under the contract on account of race, creed, sex, disability as defined in Section 4112.01 of the Ohio Revised Code, or color.

   b. Ethics Laws. The Bidder represents that it is familiar with all applicable ethics law requirements, including without limitation Sections 102.04 and 3517.13 of the Ohio Revised Code, and certifies that it is in compliance with such requirements.

   c. Buy America Preference. As a matter of bid responsiveness, Bidder must indicate within their proposal how they intend to comply with the Buy America preferences established by 49 USC 50101. The Bidder may choose to certify it will comply with Buy America preferences by only installing steel and manufactured products that are 100% made in the United States. The Bidder may also certify that they cannot fully comply with Buy America preferences and thus requests a waiver to Buy America preferences. A Bidder that certifies they will meet Buy America preferences by requesting a waiver also agrees to prepare and submit a formal waiver request and the associated component cost calculation if selected by the Owner as the apparent low Bidder. The apparent low Bidder must submit their formal waiver request and component cost calculation to the Owner within the timeframe prescribed on the Buy America certification.

   d. Disadvantage Business Enterprise (DBE). The requirements of 49 CFR Part 26, Regulations of the U.S. Department of Transportation, apply to this contract. The Owner has established a DBE contract goal of 13 percent for this contract. Award of this contract will be conditioned upon satisfying the requirements of this section. The Bidder/Offeror shall make good faith efforts, as defined in Appendix A, 49 CFR Part 26, to subcontract 13% of the dollar value of the prime contract to certified DBE firms as defined in 49 CFR Part 26. These requirements apply to all Bidders/Offerors, including those who qualify as a Disadvantaged Business Enterprise. Per the provisions of Federal Regulation 29 CFR Part 26.55, qualified DBE firms that subcontract work to a non-DBE firm shall deduct the amount of the non-DBE subcontract from the total amount of the DBE participation that counts toward meeting the Owner's DBE participation goal.

All Bidders shall submit the following information with their proposal on the Utilization Statement provided in the Bid Proposal:

(1) The names and addresses of DBE firms that will participate in the contract;
(2) A description of the work that each DBE firm will perform;

(3) The dollar amount of the participation of each DBE firm participating;
(4) Written documentation of the Bidder/Offeror's commitment to use a DBE subcontractor whose participation it submits to meet the contract goal;
(5) Evidence of good faith efforts undertaken by the Bidder, as described in appendix A to 49 CFR Part 26.
(6) Letter of Intent from participating DBE firms verifying their intent to participate in the project.

U. FINDINGS FOR RECOVERY

1. By submitting its bid, each Bidder certifies for reliance of the Owner that it has no unresolved finding for recovery against it issued by the Auditor of the State of Ohio on or after January 1, 2001, except as permitted by Section 9.24 (F) of the Ohio Revised Code.

V. PREVAILING WAGES

1. The successful Bidder and all of its subcontractors, regardless of tier, is subject to the provisions of the Davis Bacon Act. The successful Bidder accepts the requirement to pay prevailing wages for each classification and type of worker as established in the wage rater determination included in the Project Documents as issued by the United States Department of Labor. The successful Bidder also acknowledges and accepts their requirements to incorporate the provision to pay the established prevailing wages in every subcontract agreement entered into by the Bidder under this project.

W. OHIO PUBLIC WORKS COMMISSION FUNDING

1. (Reserved.)

END OF INSTRUCTIONS TO BIDDERS

GENERAL PROVISIONS

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Section 10 Definition of Terms

Whenever the following terms are used in these specifications, in the contract, or in any documents or other instruments pertaining to construction where these specifications govern, the intent and meaning shall be interpreted as follows:

10-01 AASHTO. The American Association of State Highway and Transportation Officials, the successor association to AASHO.

10-02 Access road. The right-of-way, the roadway and all improvements constructed thereon connecting the airport to a public highway.

10-03 Advertisement. A public announcement, as required by local law, inviting bids for work to be performed and materials to be furnished.

10-04 Airport Improvement Program (AIP). A grant-in-aid program, administered by the Federal Aviation Administration (FAA).

10-05 Air operations area (AOA). For the purpose of these specifications, the term air operations area (AOA) shall mean any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operation area shall include such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiway, or apron.

10-06 Airport. Airport means an area of land or water which is used or intended to be used for the landing and takeoff of aircraft; an appurtenant area used or intended to be used for airport buildings or other airport facilities or rights of way; and airport buildings and facilities located in any of these areas, and includes a heliport.

10-07 ASTM International (ASTM). Formerly known as the American Society for Testing and Materials (ASTM).

10-08 Award. The Owner's notice to the successful bidder of the acceptance of the submitted bid.

10-09 Bidder. Any individual, partnership, firm, or corporation, acting directly or through a duly authorized representative, who submits a proposal for the work contemplated.

10-10 Building area. An area on the airport to be used, considered, or intended to be used for airport buildings or other airport facilities or rights-of-way together with all airport buildings and facilities located thereon.

10-11 Calendar day. Every day shown on the calendar.

10-12 Change order. A written order to the Contractor covering changes in the plans, specifications, or proposal quantities and establishing the basis of payment and contract time adjustment, if any, for the work affected by such changes. The work, covered by a change order, must be within the scope of the contract.

10-13 Contract. The written agreement covering the work to be performed. The awarded contract shall include, but is not limited to: Advertisement, Contract Form, Proposal, Performance Bond, Payment Bond, any required insurance certificates, Specifications, Plans, and any addenda issued to bidders.

10-14 Contract item (pay item). A specific unit of work for which a price is provided in the contract.

10-15 Contract time. The number of calendar days or working days, stated in the proposal, allowed for completion of the contract, including authorized time extensions. If a calendar date of completion is stated in the proposal, in lieu of a number of calendar or working days, the contract shall be completed by that date.

10-16 Contractor. The individual, partnership, firm, or corporation primarily liable for the acceptable performance of the work contracted and for the payment of all legal debts pertaining to the work who acts directly or through lawful agents or employees to complete the contract work.

10-17 Contractor's laboratory. The Contractor's quality control organization in accordance with the Contractor Quality Control Program.

10-18 Construction Safety and Phasing Plan (CSPP). The overall plan for safety and phasing of a construction project developed by the airport operator, or developed by the airport operator's consultant and approved by the airport operator. It is included in the invitation for bids and becomes part of the project specifications.

10-19 Drainage system. The system of pipes, ditches, and structures by which surface or subsurface waters are collected and conducted from the airport area.

10-20 Engineer. The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for engineering observation of the contract work and acting directly or through an authorized representative.

10-21 Equipment. All machinery, together with the necessary supplies for upkeep and maintenance, and also all tools and apparatus necessary for the proper construction and acceptable completion of the work.

10-22 Extra work. An item of work not provided for in the awarded contract as previously modified by change order or supplemental agreement, but which is found by the Engineer to be necessary to complete the work within the intended scope of the contract as previously modified.

10-23 FAA. The Federal Aviation Administration of the U.S. Department of Transportation. When used to designate a person, FAA shall mean the Administrator or his or her duly authorized representative.

10-24 Federal specifications. The Federal Specifications and Standards, Commercial Item Descriptions, and supplements, amendments, and indices thereto are prepared and issued by the General Services Administration of the Federal Government.

10-25 Force account. Force account work is planning, engineering, or construction work done by the Sponsor's employees.

10-26 Inspector. An authorized representative of the Engineer assigned to make all necessary observations and/or observation of tests of the work performed or being performed, or of the materials furnished or being furnished by the Contractor.

10-27 Intention of terms. Whenever, in these specifications or on the plans, the words "directed," "required," "permitted," "ordered," "designated," "prescribed," or words of like import are used, it shall be understood that the direction, requirement, permission, order, designation, or prescription of the Engineer is intended; and similarly, the words "approved," "acceptable," "satisfactory," or words of like

import, shall mean approved by, or acceptable to, or satisfactory to the Engineer, subject in each case to the final determination of the Owner.

Any reference to a specific requirement of a numbered paragraph of the contract specifications or a cited standard shall be interpreted to include all general requirements of the entire section, specification item, or cited standard that may be pertinent to such specific reference.

10-28 Laboratory. The official testing laboratories of the Owner or such other laboratories as may be designated by the Engineer. Also referred to as "Engineer's Laboratory" or "quality assurance laboratory."

10-29 Lighting. A system of fixtures providing or controlling the light sources used on or near the airport or within the airport buildings. The field lighting includes all luminous signals, markers, floodlights, and illuminating devices used on or near the airport or to aid in the operation of aircraft landing at, taking off from, or taxiing on the airport surface.

10-30 Major and minor contract items. A major contract item shall be any item that is listed in the proposal, the total cost of which is equal to or greater than 20% of the total amount of the award contract. All other items shall be considered minor contract items.

10-31 Materials. Any substance specified for use in the construction of the contract work.

10-32 Notice to Proceed (NTP). A written notice to the Contractor to begin the actual contract work on a previously agreed to date. If applicable, the Notice to Proceed shall state the date on which the contract time begins.

10-33 Owner. The term "Owner" shall mean the party of the first part or the contracting agency signatory to the contract. Where the term "Owner" is capitalized in this document, it shall mean airport Sponsor only.

10-34 Passenger Facility Charge (PFC). Per 14 CFR Part 158 and 49 USC § 40117, a PFC is a charge imposed by a public agency on passengers enplaned at a commercial service airport it controls."

10-35 Pavement. The combined surface course, base course, and subbase course, if any, considered as a single unit.

10-36 Payment bond. The approved form of security furnished by the Contractor and his or her surety as a guaranty that the Contractor will pay in full all bills and accounts for materials and labor used in the construction of the work.

10-37 Performance bond. The approved form of security furnished by the Contractor and his or her surety as a guaranty that the Contractor will complete the work in accordance with the terms of the contract.

10-38 Plans. The official drawings or exact reproductions which show the location, character, dimensions and details of the airport and the work to be done and which are to be considered as a part of the contract, supplementary to the specifications.

10-39 Project. The agreed scope of work for accomplishing specific airport development with respect to a particular airport.

10-40 Proposal. The written offer of the bidder (when submitted on the approved proposal form) to perform the contemplated work and furnish the necessary materials in accordance with the provisions of the plans and specifications.

10-41 Proposal guaranty. The security furnished with a proposal to guarantee that the bidder will enter into a contract if his or her proposal is accepted by the Owner.

10-42 Runway. The area on the airport prepared for the landing and takeoff of aircraft.

10-43 Specifications. A part of the contract containing the written directions and requirements for completing the contract work. Standards for specifying materials or testing which are cited in the contract specifications by reference shall have the same force and effect as if included in the contract physically.

10-44 Sponsor. A Sponsor is defined in 49 USC § 47102(24) as a public agency that submits to the FAA for an AIP grant; or a private Owner of a public-use airport that submits to the FAA an application for an AIP grant for the airport.

10-45 Structures. Airport facilities such as bridges; culverts; catch basins, inlets, retaining walls, cribbing; storm and sanitary sewer lines; water lines; underdrains; electrical ducts, manholes, handholes, lighting fixtures and bases; transformers; flexible and rigid pavements; navigational aids; buildings; vaults; and, other manmade features of the airport that may be encountered in the work and not otherwise classified herein.

10-46 Subgrade. The soil that forms the pavement foundation.

10-47 Superintendent. The Contractor's executive representative who is present on the work during progress, authorized to receive and fulfill instructions from the Engineer, and who shall supervise and direct the construction.

10-48 Supplemental agreement. A written agreement between the Contractor and the Owner covering (1) work that would increase or decrease the total amount of the awarded contract, or any major contract item, by more than 25%, such increased or decreased work being within the scope of the originally awarded contract; or (2) work that is not within the scope of the originally awarded contract.

10-49 Surety. The corporation, partnership, or individual, other than the Contractor, executing payment or performance bonds that are furnished to the Owner by the Contractor.

10-50 Taxiway. For the purpose of this document, the term taxiway means the portion of the air operations area of an airport that has been designated by competent airport authority for movement of aircraft to and from the airport's runways, aircraft parking areas, and terminal areas.

10-51 Work. The furnishing of all labor, materials, tools, equipment, and incidentals necessary or convenient to the Contractor's performance of all duties and obligations imposed by the contract, plans, and specifications.

10-52 Working day. A working day shall be any day other than a legal holiday, Saturday, or Sunday on which the normal working forces of the Contractor may proceed with regular work for at least six (6) hours toward completion of the contract. When work is suspended for causes beyond the Contractor's control, it will not be counted as a working day. Saturdays, Sundays and holidays on which the Contractor's forces engage in regular work will be considered as working days.

END OF SECTION 10

Section 20 Proposal Requirements and Conditions

20-01 Advertisement (Notice to Bidders). The official Invitation to Bid stating the work to be undertaken and the time and place for submission of bids is contained in the front of these specifications.

20-02 Qualification of bidders. Each bidder shall furnish the Owner satisfactory evidence of his or her competency to perform the proposed work. Such evidence of competency, unless otherwise specified, shall consist of statements covering the bidder's past experience on similar work, a list of equipment that would be available for the work, and a list of key personnel that would be available. In addition, each bidder shall furnish the Owner satisfactory evidence of his or her financial responsibility. Such evidence of financial responsibility, unless otherwise specified, shall consist of a confidential statement or report of the bidder's financial resources and liabilities as of the last calendar year or the bidder's last fiscal year. Such statements or reports shall be certified by a public accountant. At the time of submitting such financial statements or reports, the bidder shall further certify whether his or her financial responsibility is approximately the same as stated or reported by the public accountant. If the bidder's financial responsibility has changed, the bidder shall qualify the public accountant's statement or report to reflect the bidder's true financial condition at the time such qualified statement or report is submitted to the Owner.

Unless otherwise specified, a bidder may submit evidence that he or she is prequalified with the State Highway Division and is on the current "bidder's list" of the state in which the proposed work is located. Such evidence of State Highway Division prequalification may be submitted as evidence of financial responsibility in lieu of the certified statements or reports specified above.

Each bidder shall submit "evidence of competency" and "evidence of financial responsibility" to the Owner at the time of bid opening.

20-03 Contents of proposal forms. The Owner shall furnish bidders with proposal forms. All papers bound with or attached to the proposal forms are necessary parts and must not be detached.

The plans, specifications, and other documents designated in the proposal form shall be considered a part of the proposal whether attached or not.

20-04 Issuance of proposal forms. The Owner reserves the right to refuse to issue a proposal form to a prospective bidder should such bidder be in default for any of the following reasons:

a. Failure to comply with any prequalification regulations of the Owner, if such regulations are cited, or otherwise included, in the proposal as a requirement for bidding.

b. Failure to pay, or satisfactorily settle, all bills due for labor and materials on former contracts in force with the Owner at the time the Owner issues the proposal to a prospective bidder.

c. Documented record of Contractor default under previous contracts with the Owner.

d. Documented record of unsatisfactory work on previous contracts with the Owner.

20-05 Interpretation of estimated proposal quantities. An estimate of quantities of work to be done and materials to be furnished under these specifications is given in the proposal. It is the result of careful calculations and is believed to be correct. It is given only as a basis for comparison of proposals and the award of the contract. The Owner does not expressly, or by implication, agree that the actual quantities involved will correspond exactly therewith; nor shall the bidder plead misunderstanding or deception because of such estimates of quantities, or of the character, location, or other conditions pertaining to the work. Payment to the Contractor will be made only for the actual quantities of work performed or materials furnished in accordance with the plans and specifications. It is understood that the quantities may be increased or decreased as hereinafter provided in the subsection 40-02 titled ALTERATION OF WORK AND QUANTITIES of Section 40 without in any way invalidating the unit bid prices.

20-06 Examination of plans, specifications, and site. The bidder is expected to carefully examine the site of the proposed work, the proposal, plans, specifications, and contract forms. Bidders shall satisfy themselves as to the character, quality, and quantities of work to be performed, materials to be furnished, and as to the requirements of the proposed contract. The submission of a proposal shall be prima facie evidence that the bidder has made such examination and is satisfied as to the conditions to be encountered in performing the work and as to the requirements of the proposed contract, plans, and specifications.

Boring logs and other records of subsurface investigations and tests are available for inspection of bidders. It is understood and agreed that such subsurface information, whether included in the plans, specifications, or otherwise made available to the bidder, was obtained and is intended for the Owner's design and estimating purposes only. Such information has been made available for the convenience of all bidders. It is further understood and agreed that each bidder is solely responsible for all assumptions, deductions, or conclusions which the bidder may make or obtain from his or her examination of the boring logs and other records of subsurface investigations and tests that are furnished by the Owner.

20-07 Preparation of proposal. The bidder shall submit his or her proposal on the forms furnished by the Owner. All blank spaces in the proposal forms must be correctly filled in where indicated for each and every item for which a quantity is given. The bidder shall state the price (written in ink or typed) both in words and numerals for which they propose to do for each pay item furnished in the proposal. In case of conflict between words and numerals, the words, unless obviously incorrect, shall govern.

The bidder shall sign the proposal correctly and in ink. If the proposal is made by an individual, his or her name and post office address must be shown. If made by a partnership, the name and post office address of each member of the partnership must be shown. If made by a corporation, the person signing the proposal shall give the name of the state under the laws of which the corporation was chartered and the name, titles, and business address of the president, secretary, and the treasurer. Anyone signing a proposal as an agent shall file evidence of his or her authority to do so and that the signature is binding upon the firm or corporation.

20-08 Responsive and responsible bidder. A responsive bid conforms to all significant terms and conditions contained in the Sponsor's invitation for bid. It is the Sponsor's responsibility to decide if the exceptions taken by a bidder to the solicitation are material or not and the extent of deviation it is willing to accept.

A responsible bidder has the ability to perform successfully under the terms and conditions of a proposed procurement, as defined in 49 CFR § 18.36(b)(8). This includes such matters as Contractor

integrity, compliance with public policy, record of past performance, and financial and technical resources.

20-09 Irregular proposals. Proposals shall be considered irregular for the following reasons:

a. If the proposal is on a form other than that furnished by the Owner, or if the Owner's form is altered, or if any part of the proposal form is detached.

b. If there are unauthorized additions, conditional or alternate pay items, or irregularities of any kind that make the proposal incomplete, indefinite, or otherwise ambiguous.

c. If the proposal does not contain a unit price for each pay item listed in the proposal, except in the case of authorized alternate pay items, for which the bidder is not required to furnish a unit price.

d. If the proposal contains unit prices that are obviously unbalanced.

e. If the proposal is not accompanied by the proposal guaranty specified by the Owner.

The Owner reserves the right to reject any irregular proposal and the right to waive technicalities if such waiver is in the best interest of the Owner and conforms to local laws and ordinances pertaining to the letting of construction contracts.

20-10 Bid guarantee. Each separate proposal shall be accompanied by a certified check, or other specified acceptable collateral, in the amount specified in the proposal form. Such check, or collateral, shall be made payable to the Owner.

20-11 Delivery of proposal. Each proposal submitted shall be placed in a sealed envelope plainly marked with the project number, location of airport, and name and business address of the bidder on the outside. When sent by mail, preferably registered, the sealed proposal, marked as indicated above, should be enclosed in an additional envelope. No proposal will be considered unless received at the place specified in the advertisement or as modified by Addendum before the time specified for opening all bids. Proposals received after the bid opening time shall be returned to the bidder unopened.

20-12 Withdrawal or revision of proposals. A bidder may withdraw or revise (by withdrawal of one proposal and submission of another) a proposal provided that the bidder's request for withdrawal is received by the Owner in writing or by before the time specified for opening bids. Revised proposals must be received at the place specified in the advertisement before the time specified for opening all bids.

20-13 Public opening of proposals. Proposals shall be opened, and read, publicly at the time and place specified in the advertisement. Bidders, their authorized agents, and other interested persons are invited to attend. Proposals that have been withdrawn (by written or telegraphic request) or received after the time specified for opening bids shall be returned to the bidder unopened.

20-14 Disqualification of bidders. A bidder shall be considered disqualified for any of the following reasons:

a. Submitting more than one proposal from the same partnership, firm, or corporation under the same or different name.

b. Evidence of collusion among bidders. Bidders participating in such collusion shall be disqualified as bidders for any future work of the Owner until any such participating bidder has been reinstated by the Owner as a qualified bidder.

c. If the bidder is considered to be in "default" for any reason specified in the subsection 20-04 titled ISSUANCE OF PROPOSAL FORMS of this section.

END OF SECTION 20

Section 30 Award and Execution of Contract

30-01 Consideration of proposals. After the proposals are publicly opened and read, they will be compared on the basis of the summation of the products obtained by multiplying the estimated quantities shown in the proposal by the unit bid prices. If a bidder's proposal contains a discrepancy between unit bid prices written in words and unit bid prices written in numbers, the unit price written in words shall govern.

Until the award of a contract is made, the Owner reserves the right to reject a bidder's proposal for any of the following reasons:

a. If the proposal is irregular as specified in the subsection 20-09 titled IRREGULAR PROPOSALS of Section 20.

b. If the bidder is disqualified for any of the reasons specified in the subsection 20-14 titled DISQUALIFICATION OF BIDDERS of Section 20.

In addition, until the award of a contract is made, the Owner reserves the right to reject any or all proposals, waive technicalities, if such waiver is in the best interest of the Owner and is in conformance with applicable state and local laws or regulations pertaining to the letting of construction contracts; advertise for new proposals; or proceed with the work otherwise. All such actions shall promote the Owner's best interests.

30-02 Award of contract. The award of a contract, if it is to be awarded, shall be made within 60 calendar days of the date specified for publicly opening proposals, unless otherwise specified herein.

Award of the contract shall be made by the Owner to the lowest, qualified bidder whose proposal conforms to the cited requirements of the Owner.

For AIP contracts, unless otherwise specified in this subsection, no award shall be made until the FAA has concurred in the Owner's recommendation to make such award and has approved the Owner's proposed contract to the extent that such concurrence and approval are required by 49 CFR Part 18.

30-03 Cancellation of award. The Owner reserves the right to cancel the award without liability to the bidder, except return of proposal guaranty, at any time before a contract has been fully executed by all parties and is approved by the Owner in accordance with the subsection 30-07 titled APPROVAL OF CONTRACT of this section.

30-04 Return of proposal guaranty. All proposal guaranties, except those of the two lowest bidders, will be returned immediately after the Owner has made a comparison of bids as specified in the subsection 30-01 titled CONSIDERATION OF PROPOSALS of this section. Proposal guaranties of the two lowest bidders will be retained by the Owner until such time as an award is made, at which time, the unsuccessful bidder's proposal guaranty will be returned. The successful bidder's proposal guaranty will be returned as soon as the Owner receives the contract bonds as specified in the subsection 30-05 titled REQUIREMENTS OF CONTRACT BONDS of this section.

30-05 Requirements of contract bonds. At the time of the execution of the contract, the successful bidder shall furnish the Owner a surety bond or bonds that have been fully executed by the bidder and the surety guaranteeing the performance of the work and the payment of all legal debts that may be incurred by reason of the Contractor's performance of the work. The surety and the form of the bond or bonds shall be acceptable to the Owner. Unless otherwise specified in this subsection, the surety bond or bonds shall be in a sum equal to the full amount of the contract.

30-06 Execution of contract. The successful bidder shall sign (execute) the necessary agreements for entering into the contract and return the signed contract to the Owner, along with the fully executed surety bond or bonds specified in the subsection 30-05 titled REQUIREMENTS OF CONTRACT BONDS of this section, within 15 calendar days from the date mailed or otherwise delivered to the successful bidder.

30-07 Approval of contract. Upon receipt of the contract and contract bond or bonds that have been executed by the successful bidder, the Owner shall complete the execution of the contract in accordance with local laws or ordinances, and return the fully executed contract to the Contractor. Delivery of the fully executed contract to the Contractor shall constitute the Owner's approval to be bound by the successful bidder's proposal and the terms of the contract.

30-08 Failure to execute contract. Failure of the successful bidder to execute the contract and furnish an acceptable surety bond or bonds within the 15 calendar day period specified in the subsection 30-06 titled EXECUTION OF CONTRACT of this section shall be just cause for cancellation of the award and forfeiture of the proposal guaranty, not as a penalty, but as liquidation of damages to the Owner.

END OF SECTION 30

Section 40 Scope of Work

40-01 Intent of contract. The intent of the contract is to provide for construction and completion, in every detail, of the work described. It is further intended that the Contractor shall furnish all labor, materials, equipment, tools, transportation, and supplies required to complete the work in accordance with the plans, specifications, and terms of the contract.

40-02 Alteration of work and quantities. The Owner reserves and shall have the right to make such alterations in the work as may be necessary or desirable to complete the work originally intended in an acceptable manner. Unless otherwise specified herein, the Engineer shall be and is hereby authorized to make such alterations in the work as may increase or decrease the originally awarded contract quantities, provided that the aggregate of such alterations does not change the total contract cost or the total cost of any major contract item by more than 25% (total cost being based on the unit prices and estimated quantities in the awarded contract). Alterations that do not exceed the 25% limitation shall not invalidate the contract nor release the surety, and the Contractor agrees to accept payment for such alterations as if the altered work had been a part of the original contract. These alterations that are for work within the general scope of the contract shall be covered by "Change Orders" issued by the Engineer. Change orders for altered work shall include extensions of contract time where, in the Engineer's opinion, such extensions are commensurate with the amount and difficulty of added work.

Should the aggregate amount of altered work exceed the 25% limitation hereinbefore specified, such excess altered work shall be covered by supplemental agreement. If the Owner and the Contractor are unable to agree on a unit adjustment for any contract item that requires a supplemental agreement, the Owner reserves the right to terminate the contract with respect to the item and make other arrangements for its completion.

Supplemental agreements shall be approved by the FAA and shall include all applicable Federal contract provisions for procurement and contracting required under AIP. Supplemental agreements shall also require consent of the Contractor's surety and separate performance and payment bonds.

40-03 Omitted items. The Engineer may, in the Owner's best interest, omit from the work any contract item, except major contract items. Major contract items may be omitted by a supplemental agreement. Such omission of contract items shall not invalidate any other contract provision or requirement.

Should a contract item be omitted or otherwise ordered to be non-performed, the Contractor shall be paid for all work performed toward completion of such item prior to the date of the order to omit such item. Payment for work performed shall be in accordance with the subsection 90-04 titled PAYMENT FOR OMITTED ITEMS of Section 90.

40-04 Extra work. Should acceptable completion of the contract require the Contractor to perform an item of work for which no basis of payment has been provided in the original contract or previously issued change orders or supplemental agreements, the same shall be called "Extra Work." Extra Work that is within the general scope of the contract shall be covered by written change order. Change orders for such Extra Work shall contain agreed unit prices for performing the change order work in accordance

with the requirements specified in the order, and shall contain any adjustment to the contract time that, in the Engineer's opinion, is necessary for completion of such Extra Work.

When determined by the Engineer to be in the Owner's best interest, the Engineer may order the Contractor to proceed with Extra Work as provided in the subsection 90-05 titled PAYMENT FOR EXTRA WORK of Section 90. Extra Work that is necessary for acceptable completion of the project, but is not within the general scope of the work covered by the original contract shall be covered by a Supplemental Agreement as defined in the subsection 10-48 titled SUPPLEMENTAL AGREEMENT of Section 10.

Any claim for payment of Extra Work that is not covered by written agreement (change order or supplemental agreement) shall be rejected by the Owner.

40-05 Maintenance of traffic. It is the explicit intention of the contract that the safety of aircraft, as well as the Contractor's equipment and personnel, is the most important consideration.

a. It is understood and agreed that the Contractor shall provide for the free and unobstructed movement of aircraft in the air operations areas (AOAs) of the airport with respect to his or her own operations and the operations of all subcontractors as specified in the subsection 80-04 titled LIMITATION OF OPERATIONS of Section 80. It is further understood and agreed that the Contractor shall provide for the uninterrupted operation of visual and electronic signals (including power supplies thereto) used in the guidance of aircraft while operating to, from, and upon the airport as specified in the subsection 70-15 titled CONTRACTOR'S RESPONSIBILITY FOR UTILITY SERVICE AND FACILITIES OF OTHERS in Section 70.

b. With respect to his or her own operations and the operations of all subcontractors, the Contractor shall provide marking, lighting, and other acceptable means of identifying personnel, equipment, vehicles, storage areas, and any work area or condition that may be hazardous to the operation of aircraft, fire-rescue equipment, or maintenance vehicles at the airport.

c. When the contract requires the maintenance of vehicular traffic on an existing road, street, or highway during the Contractor's performance of work that is otherwise provided for in the contract, plans, and specifications, the Contractor shall keep such road, street, or highway open to all traffic and shall provide such maintenance as may be required to accommodate traffic. The Contractor shall be responsible for the repair of any damage caused by the Contractor's equipment and personnel. The Contractor shall furnish, erect, and maintain barricades, warning signs, flag person, and other traffic control devices in reasonable conformity with the Manual on Uniform Traffic Control Devices (MUTCD) (http://mutcd.fhwa.dot.gov/), unless otherwise specified. The Contractor shall also construct and maintain in a safe condition any temporary connections necessary for ingress to and egress from abutting property or intersecting roads, streets or highways.

40-06 Removal of existing structures. All existing structures encountered within the established lines, grades, or grading sections shall be removed by the Contractor, unless such existing structures are otherwise specified to be relocated, adjusted up or down, salvaged, abandoned in place, reused in the work or to remain in place. The cost of removing such existing structures shall not be measured or paid for directly, but shall be included in the various contract items.

Should the Contractor encounter an existing structure (above or below ground) in the work for which the disposition is not indicated on the plans, the Engineer shall be notified prior to disturbing such

structure. The disposition of existing structures so encountered shall be immediately determined by the Engineer in accordance with the provisions of the contract.

Except as provided in the subsection 40-07 titled RIGHTS IN AND USE OF MATERIALS FOUND IN THE WORK of this section, it is intended that all existing materials or structures that may be encountered (within the lines, grades, or grading sections established for completion of the work) shall be used in the work as otherwise provided for in the contract and shall remain the property of the Owner when so used in the work.

40-07 Rights in and use of materials found in the work. Should the Contractor encounter any material such as (but not restricted to) sand, stone, gravel, slag, or concrete slabs within the established lines, grades, or grading sections, the use of which is intended by the terms of the contract to be either embankment or waste, the Contractor may at his or her option either:

a. Use such material in another contract item, providing such use is approved by the Engineer and is in conformance with the contract specifications applicable to such use; or,

b. Remove such material from the site, upon written approval of the Engineer; or

c. Use such material for the Contractor's own temporary construction on site; or,

d. Use such material as intended by the terms of the contract.

Should the Contractor wish to exercise option a., b., or c., the Contractor shall request the Engineer's approval in advance of such use.

Should the Engineer approve the Contractor's request to exercise option a., b., or c., the Contractor shall be paid for the excavation or removal of such material at the applicable contract price. The Contractor shall replace, at his or her own expense, such removed or excavated material with an agreed equal volume of material that is acceptable for use in constructing embankment, backfills, or otherwise to the extent that such replacement material is needed to complete the contract work. The Contractor shall not be charged for use of such material used in the work or removed from the site.

Should the Engineer approve the Contractor's exercise of option a., the Contractor shall be paid, at the applicable contract price, for furnishing and installing such material in accordance with requirements of the contract item in which the material is used.

It is understood and agreed that the Contractor shall make no claim for delays by reason of his or her exercise of option a., b., or c.

The Contractor shall not excavate, remove, or otherwise disturb any material, structure, or part of a structure which is located outside the lines, grades, or grading sections established for the work, except where such excavation or removal is provided for in the contract, plans, or specifications.

40-08 Final cleanup. Upon completion of the work and before acceptance and final payment will be made, the Contractor shall remove from the site all machinery, equipment, surplus and discarded materials, rubbish, temporary structures, and stumps or portions of trees. The Contractor shall cut all brush and woods within the limits indicated and shall leave the site in a neat and presentable condition. Material cleared from the site and deposited on adjacent property will not be considered as having been disposed of satisfactorily, unless the Contractor has obtained the written permission of such property Owner.

END OF SECTION 40

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Section 50 Control of Work

50-01 Authority of the Engineer. The Engineer shall decide any and all questions which may arise as to the quality and acceptability of materials furnished, work performed, and as to the manner of performance and rate of progress of the work. The Engineer shall decide all questions that may arise as to the interpretation of the specifications or plans relating to the work. The Engineer shall determine the amount and quality of the several kinds of work performed and materials furnished which are to be paid for the under contract.

The Engineer does not have the authority to accept pavements that do not conform to FAA specification requirements.

50-02 Conformity with plans and specifications. All work and all materials furnished shall be in reasonably close conformity with the lines, grades, grading sections, cross-sections, dimensions, material requirements, and testing requirements that are specified (including specified tolerances) in the contract, plans or specifications.

If the Engineer finds the materials furnished, work performed, or the finished product not within reasonably close conformity with the plans and specifications but that the portion of the work affected will, in his or her opinion, result in a finished product having a level of safety, economy, durability, and workmanship acceptable to the Owner, the Engineer will advise the Owner of his or her determination that the affected work be accepted and remain in place. In this event, the Engineer will document the determination and recommend to the Owner a basis of acceptance that will provide for an adjustment in the contract price for the affected portion of the work. The Engineer's determination and recommended contract price adjustments will be based on sound engineering judgment and such tests or retests of the affected work as are, in the Engineer's opinion, needed. Changes in the contract price shall be covered by contract change order or supplemental agreement as applicable.

If the Engineer finds the materials furnished, work performed, or the finished product are not in reasonably close conformity with the plans and specifications and have resulted in an unacceptable finished product, the affected work or materials shall be removed and replaced or otherwise corrected by and at the expense of the Contractor in accordance with the Engineer's written orders.

For the purpose of this subsection, the term "reasonably close conformity" shall not be construed as waiving the Contractor's responsibility to complete the work in accordance with the contract, plans, and specifications. The term shall not be construed as waiving the Engineer's responsibility to insist on strict compliance with the requirements of the contract, plans, and specifications during the Contractor's execution of the work, when, in the Engineer's opinion, such compliance is essential to provide an acceptable finished portion of the work.

For the purpose of this subsection, the term "reasonably close conformity" is also intended to provide the Engineer with the authority, after consultation with the FAA, to use sound engineering judgment in

his or her determinations as to acceptance of work that is not in strict conformity, but will provide a finished product equal to or better than that intended by the requirements of the contract, plans and specifications.

The Engineer will not be responsible for the Contractor's means, methods, techniques, sequences, or procedures of construction or the safety precautions incident thereto.

50-03 Coordination of contract, plans, and specifications. The contract, plans, specifications, and all referenced standards cited are essential parts of the contract requirements. A requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete work. In case of discrepancy, calculated dimensions will govern over scaled dimensions; contract technical specifications shall govern over contract general provisions, plans, cited standards for materials or testing, and cited advisory circulars (ACs); contract general provisions shall govern over plans, cited standards for materials or testing, and cited ACs; plans shall govern over cited standards for materials or testing and cited ACs. If any paragraphs contained in the Special Provisions conflict with General Provisions or Technical Specifications, the Special Provisions shall govern.

From time to time, discrepancies within cited testing standards occur due to the timing of the change, edits, and/or replacement of the standards. If the Contractor discovers any apparent discrepancy within standard test methods, the Contractor shall immediately ask the Engineer for an interpretation and decision, and such decision shall be final.

50-04 Cooperation of Contractor. The Contractor will be supplied with a digital pdf file for copying each of the plans and specifications. The Contractor shall have available on the work at all times one copy each of the plans and specifications.

The Contractor shall give constant attention to the work to facilitate the progress thereof, and shall cooperate with the Engineer and his or her inspectors and with other contractors in every way possible. The Contractor shall have a competent superintendent on the work at all times who is fully authorized as his or her agent on the work. The superintendent shall be capable of reading and thoroughly understanding the plans and specifications and shall receive and fulfill instructions from the Engineer or his or her authorized representative.

In addition, the Contractor shall at all times plan and coordinate his work with the Owner in such a manner as to ensure safety and a minimum hindrance to flight operations or other functions of the airport. It shall be the responsibility of the Contractor to keep the Owner advised of this schedule of operations.

The Contractor shall advise the Owner of any existing installations within the limits of the proposed improvements and not shown on the plans, in sufficient time for said Owner to have such installation relocated.

The Contractor shall also assume all risk and liability for any inconvenience, delay or expense that may be occasioned by him by such cooperation, installations, or relocations within the limits of the proposed improvements, and shall do no work which will injure or damage such property until arrangement has been made with the Owner for his protection.

50-05 Cooperation between contractors. The Owner reserves the right to contract for and perform other or additional work on or near the work covered by this contract.

When separate contracts are let within the limits of any one project, each Contractor shall conduct the work so as not to interfere with or hinder the progress of completion of the work being performed by other Contractors. Contractors working on the same project shall cooperate with each other as directed.

Each Contractor involved shall assume all liability, financial or otherwise, in connection with his or her contract and shall protect and save harmless the Owner from any and all damages or claims that may arise because of inconvenience, delays, or loss experienced because of the presence and operations of other Contractors working within the limits of the same project.

The Contractor shall arrange his or her work and shall place and dispose of the materials being used so as not to interfere with the operations of the other Contractors within the limits of the same project. The Contractor shall join his or her work with that of the others in an acceptable manner and shall perform it in proper sequence to that of the others.

50-06 Construction layout and stakes. The Engineer shall establish horizontal and vertical control only. The Contractor must establish all layout required for the construction of the work. Such stakes and markings as the Engineer may set for either their own or the Contractor's guidance shall be preserved by the Contractor. In case of negligence on the part of the Contractor, or their employees, resulting in the destruction of such stakes or markings, an amount equal to the cost of replacing the same may be deducted from subsequent estimates due the Contractor at the discretion of the Engineer.

The Contractor will be required to furnish all lines, grades and measurements from the control points necessary for the proper execution and control of the work contracted for under these specifications.

The Contractor must give weekly copies of survey notes to the Engineer for each area of construction and for each placement of material as specified to allow the Engineer to make periodic checks for conformance with plan grades, alignments and grade tolerances required by the applicable material specifications. All surveys must be provided to the Engineer prior to commencing work items that will cover or disturb the survey staking as set by the Contractor's surveyor. Survey(s) and notes shall be provided in the following format(s): PDF and XML. In the case of error, on the part of the Contractor, their surveyor, employees or subcontractors, resulting in established grades, alignment or grade tolerances that do not concur with those specified or shown on the plans, the Contractor is solely responsible for correction, removal, replacement and all associated costs at no additional cost to the Owner.

Payment will be made under MST-03, Construction Engineering, for this labor, materials, or other expenses.

Construction Staking and Layout includes but is not limited to:

a. Clearing and Grubbing perimeter staking

b. Rough Grade slope stakes at 100-foot stations

c. Drainage Swales slope stakes and flow line blue tops at 50-foot stations

Subgrade blue tops at 25-foot stations and 25-foot offset distance (maximum) for the following section locations:

a. Runway – minimum five (5) per station

b. Taxiways – minimum three (3) per station

c. Holding apron areas – minimum three (3) per station

d. Roadways – minimum three (3) per station

Base Course blue tops at 25-foot stations and 25-foot offset distance (maximum) for the following section locations:

a. Runway – minimum five (5) per station

b. Taxiways – minimum three (3) per station

c. Holding apron areas – minimum three (3) per station

Pavement areas:

a. Edge of Pavement hubs and tacks (for stringline by Contractor) at 100-foot stations.

b. Between Lifts at 25-foot stations for the following section locations:

(1) Runways – each paving lane width

(2) Taxiways – each paving lane width

(3) Holding areas – each paving lane width

c. After finish paving operations at 50-foot stations:

(1) All paved areas – Edge of each paving lane prior to next paving lot

Not Pavement Areas:

d. Shoulder and safety area blue tops at 50-foot stations and at all break points with maximum of 50-foot offsets.

e. Fence lines at 100-foot stations minimum.

f. Electrical and Communications System locations, lines and grades including but not limited to duct runs, connections, fixtures, signs, lights, Visual Approach Slope Indicators (VASIs), Precision Approach Path Indicators (PAPIs), Runway End Identifier Lighting (REIL), Wind Cones, Distance Markers (signs), pull boxes and manholes.

g. Drain lines, cut stakes and alignment on 25-foot stations, inlet and manholes.

h. Painting and Striping layout (pinned with 1.5 inch PK nails) marked for paint Contractor. (All nails shall be removed after painting).

i. Laser, or other automatic control devices, shall be checked with temporary control point or grade hub at a minimum of once per 400 feet per pass (that is, paving lane).

The establishment of Survey Control and/or reestablishment of survey control shall be by a State Licensed Land Surveyor.

Controls and stakes disturbed or suspect of having been disturbed shall be checked and/or reset as directed by the Engineer without additional cost to the Owner.

50-07 Automatically controlled equipment. Whenever batching or mixing plant equipment is required to be operated automatically under the contract and a breakdown or malfunction of the automatic controls occurs, the equipment may be operated manually or by other methods for a period 48 hours following the breakdown or malfunction, provided this method of operations will produce results which conform to all other requirements of the contract.

50-08 Authority and duties of inspectors. Inspectors shall be authorized to inspect all work done and all material furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. Inspectors are not authorized to revoke, alter, or waive any provision of the contract. Inspectors are not authorized to issue instructions contrary to the plans and specifications or to act as foreman for the Contractor.

Inspectors are authorized to notify the Contractor or his or her representatives of any failure of the work or materials to conform to the requirements of the contract, plans, or specifications and to reject such nonconforming materials in question until such issues can be referred to the Engineer for a decision.

50-09 Inspection of the work. All materials and each part or detail of the work shall be subject to inspection. The Engineer shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection.

If the Engineer requests it, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be paid for as extra work; but should the work so exposed or examined prove unacceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be at the Contractor's expense.

Any work done or materials used without supervision or inspection by an authorized representative of the Owner may be ordered removed and replaced at the Contractor's expense unless the Owner's representative failed to inspect after having been given reasonable notice in writing that the work was to be performed.

Should the contract work include relocation, adjustment, or any other modification to existing facilities, not the property of the (contract) Owner, authorized representatives of the Owners of such facilities shall have the right to inspect such work. Such inspection shall in no sense make any facility owner a party to the contract, and shall in no way interfere with the rights of the parties to this contract.

50-10 Removal of unacceptable and unauthorized work. All work that does not conform to the requirements of the contract, plans, and specifications will be considered unacceptable, unless otherwise determined acceptable by the Engineer as provided in the subsection 50-02 titled CONFORMITY WITH PLANS AND SPECIFICATIONS of this section.

Unacceptable work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or any other cause found to exist prior to the final acceptance of the work, shall be removed immediately and replaced in an acceptable manner in accordance with the provisions of the subsection 70-14 titled CONTRACTOR'S RESPONSIBILITY FOR WORK of Section 70.

No removal work made under provision of this subsection shall be done without lines and grades having been established by the Engineer. Work done contrary to the instructions of the Engineer, work done beyond the lines shown on the plans or as established by the Engineer, except as herein specified, or any extra work done without authority, will be considered as unauthorized and will not be paid for under the provisions of the contract. Work so done may be ordered removed or replaced at the Contractor's expense.

Upon failure on the part of the Contractor to comply with any order of the Engineer made under the provisions of this subsection, the Engineer will have authority to cause unacceptable work to be

remedied or removed and replaced and unauthorized work to be removed and to deduct the costs incurred by the Owner from any monies due or to become due the Contractor.

50-11 Load restrictions. The Contractor shall comply with all legal load restrictions in the hauling of materials on public roads beyond the limits of the work. A special permit will not relieve the Contractor of liability for damage that may result from the moving of material or equipment.

The operation of equipment of such weight or so loaded as to cause damage to structures or to any other type of construction will not be permitted. Hauling of materials over the base course or surface course under construction shall be limited as directed. No loads will be permitted on a concrete pavement, base, or structure before the expiration of the curing period. The Contractor shall be responsible for all damage done by his or her hauling equipment and shall correct such damage at his or her own expense.

50-12 Maintenance during construction. The Contractor shall maintain the work during construction and until the work is accepted. Maintenance shall constitute continuous and effective work prosecuted day by day, with adequate equipment and forces so that the work is maintained in satisfactory condition at all times.

In the case of a contract for the placing of a course upon a course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.

All costs of maintenance work during construction and before the project is accepted shall be included in the unit prices bid on the various contract items, and the Contractor will not be paid an additional amount for such work.

50-13 Failure to maintain the work. Should the Contractor at any time fail to maintain the work as provided in the subsection 50-12 titled MAINTENANCE DURING CONSTRUCTION of this section, the Engineer shall immediately notify the Contractor of such noncompliance. Such notification shall specify a reasonable time within which the Contractor shall be required to remedy such unsatisfactory maintenance condition. The time specified will give due consideration to the exigency that exists.

Should the Contractor fail to respond to the Engineer's notification, the Owner may suspend any work necessary for the Owner to correct such unsatisfactory maintenance condition, depending on the exigency that exists. Any maintenance cost incurred by the Owner, shall be deducted from monies due or to become due the Contractor.

50-14 Partial acceptance. If at any time during the execution of the project the Contractor substantially completes a usable unit or portion of the work, the occupancy of which will benefit the Owner, the Contractor may request the Engineer to make final inspection of that unit. If the Engineer finds upon inspection that the unit has been satisfactorily completed in compliance with the contract, the Engineer may accept it as being complete, and the Contractor may be relieved of further responsibility for that unit. Such partial acceptance and beneficial occupancy by the Owner shall not void or alter any provision of the contract.

50-15 Final acceptance. Upon due notice from the Contractor of presumptive completion of the entire project, the Engineer and Owner will make an inspection. If all construction provided for and contemplated by the contract is found to be complete in accordance with the contract, plans, and specifications, such inspection shall constitute the final inspection. The Engineer shall notify the Contractor in writing of final acceptance as of the date of the final inspection.

If, however, the inspection discloses any work, in whole or in part, as being unsatisfactory, the Engineer will give the Contractor the necessary instructions for correction of same and the Contractor shall immediately comply with and execute such instructions. Upon correction of the work, another inspection will be made which shall constitute the final inspection, provided the work has been satisfactorily completed. In such event, the Engineer will make the final acceptance and notify the Contractor in writing of this acceptance as of the date of final inspection.

50-16 Claims for adjustment and disputes. If for any reason the Contractor deems that additional compensation is due for work or materials not clearly provided for in the contract, plans, or specifications or previously authorized as extra work, the Contractor shall notify the Engineer in writing of his or her intention to claim such additional compensation before the Contractor begins the work on which the Contractor bases the claim. If such notification is not given or the Engineer is not afforded proper opportunity by the Contractor for keeping strict account of actual cost as required, then the Contractor hereby agrees to waive any claim for such additional compensation. Such notice by the Contractor and the fact that the Engineer has kept account of the cost of the work shall not in any way be construed as proving or substantiating the validity of the claim. When the work on which the claim for additional compensation is based has been completed, the Contractor shall, within 10 calendar days, submit a written claim to the Engineer who will present it to the Owner for consideration in accordance with local laws or ordinances.

Nothing in this subsection shall be construed as a waiver of the Contractor's right to dispute final payment based on differences in measurements or computations.

END OF SECTION 50

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Section 60 Control of Materials

60-01 Source of supply and quality requirements. The materials used in the work shall conform to the requirements of the contract, plans, and specifications. Unless otherwise specified, such materials that are manufactured or processed shall be new (as compared to used or reprocessed).

In order to expedite the inspection and testing of materials, the Contractor shall furnish complete statements to the Engineer as to the origin, composition, and manufacture of all materials to be used in the work. Such statements shall be furnished promptly after execution of the contract but, in all cases, prior to delivery of such materials.

At the Engineer's option, materials may be approved at the source of supply before delivery is stated. If it is found after trial that sources of supply for previously approved materials do not produce specified products, the Contractor shall furnish materials from other sources.

The Contractor shall furnish airport lighting equipment that conforms to the requirements of cited materials specifications. In addition, where an FAA specification for airport lighting equipment is cited in the plans or specifications, the Contractor shall furnish such equipment that is:

a. Listed in advisory circular (AC) 150/5345-53, Airport Lighting Equipment Certification Program, and Addendum that is in effect on the date of advertisement; and,

b. Produced by the manufacturer as listed in the Addendum cited above for the certified equipment part number.

60-02 Samples, tests, and cited specifications. Unless otherwise designated, all materials used in the work shall be inspected, tested, and approved by the Engineer before incorporation in the work. Any work in which untested materials are used without approval or written permission of the Engineer shall be performed at the Contractor's risk. Materials found to be unacceptable and unauthorized will not be paid for and, if directed by the Engineer, shall be removed at the Contractor's expense.

Unless otherwise designated, quality assurance tests in accordance with the cited standard methods of ASTM, American Association of State Highway and Transportation Officials (AASHTO), Federal Specifications, Commercial Item Descriptions, and all other cited methods, which are current on the date of advertisement for bids, will be made by and at the expense of the Engineer.

The testing organizations performing on-site quality assurance field tests shall have copies of all referenced standards on the construction site for use by all technicians and other personnel, including the Contractor's representative at his or her request. Unless otherwise designated, samples for quality assurance will be taken by a qualified representative of the Engineer. All materials being used are subject to inspection, test, or rejection at any time prior to or during incorporation into the work. Copies of all tests will be furnished to the Contractor's representative at their request after review and approval of the Engineer.

The Contractor shall employ a testing organization to perform all Contractor required Quality Control tests. The Contractor shall submit to the Engineer resumes on all testing organizations and individual persons who will be performing the tests. The Engineer will determine if such persons are qualified. All

the test data shall be reported to the Engineer after the results are known. A legible, handwritten copy of all test data shall be given to the Engineer daily, along with printed reports, in an approved format, on a weekly basis. After completion of the project, and prior to final payment, the Contractor shall submit a final report to the Engineer showing all test data reports, plus an analysis of all results showing ranges, averages, and corrective action taken on all failing tests.

60-03 Certification of compliance. The Engineer may permit the use, prior to sampling and testing, of certain materials or assemblies when accompanied by manufacturer's certificates of compliance stating that such materials or assemblies fully comply with the requirements of the contract. The certificate shall be signed by the manufacturer. Each lot of such materials or assemblies delivered to the work must be accompanied by a certificate of compliance in which the lot is clearly identified.

Materials or assemblies used on the basis of certificates of compliance may be sampled and tested at any time and if found not to be in conformity with contract requirements will be subject to rejection whether in place or not.

The form and distribution of certificates of compliance shall be as approved by the Engineer.

When a material or assembly is specified by "brand name or equal" and the Contractor elects to furnish the specified "brand name," the Contractor shall be required to furnish the manufacturer's certificate of compliance for each lot of such material or assembly delivered to the work. Such certificate of compliance shall clearly identify each lot delivered and shall certify as to:

a. Conformance to the specified performance, testing, quality or dimensional requirements; and,

b. Suitability of the material or assembly for the use intended in the contract work.

Should the Contractor propose to furnish an "or equal" material or assembly, the Contractor shall furnish the manufacturer's certificates of compliance as hereinbefore described for the specified brand name material or assembly. However, the Engineer shall be the sole judge as to whether the proposed "or equal" is suitable for use in the work.

The Engineer reserves the right to refuse permission for use of materials or assemblies on the basis of certificates of compliance.

60-04 Plant inspection. The Engineer or his or her authorized representative may inspect, at its source, any specified material or assembly to be used in the work. Manufacturing plants may be inspected from time to time for the purpose of determining compliance with specified manufacturing methods or materials to be used in the work and to obtain samples required for acceptance of the material or assembly.

Should the Engineer conduct plant inspections, the following conditions shall exist:

a. The Engineer shall have the cooperation and assistance of the Contractor and the producer with whom the Engineer has contracted for materials.

b. The Engineer shall have full entry at all reasonable times to such parts of the plant that concern the manufacture or production of the materials being furnished.

c. If required by the Engineer, the Contractor shall arrange for adequate office or working space that may be reasonably needed for conducting plant inspections. Office or working space should be conveniently located with respect to the plant.

It is understood and agreed that the Owner shall have the right to retest any material that has been tested and approved at the source of supply after it has been delivered to the site. The Engineer shall have the right to reject only material which, when retested, does not meet the requirements of the contract, plans, or specifications.

60-05 Engineer's field office. The Contractor shall furnish for the duration of the project one building for the use of the field Engineers and inspectors, as a field office. This facility shall meet the requirements contained within MST-01 Field Office and Laboratory.

60-06 Storage of materials. Materials shall be so stored as to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located to facilitate their prompt inspection. The Contractor shall coordinate the storage of all materials with the Engineer. Materials to be stored on airport property shall not create an obstruction to air navigation nor shall they interfere with the free and unobstructed movement of aircraft. Unless otherwise shown on the plans, the storage of materials and the location of the Contractor's plant and parked equipment or vehicles shall be as directed by the Engineer. Private property shall not be used for storage purposes without written permission of the Owner or lessee of such property. The Contractor shall make all arrangements and bear all expenses for the storage of materials on private property. Upon request, the Contractor shall furnish the Engineer a copy of the property Owner's permission.

All storage sites on private or airport property shall be restored to their original condition by the Contractor at his or her entire expense, except as otherwise agreed to (in writing) by the Owner or lessee of the property.

60-07 Unacceptable materials. Any material or assembly that does not conform to the requirements of the contract, plans, or specifications shall be considered unacceptable and shall be rejected. The Contractor shall remove any rejected material or assembly from the site of the work, unless otherwise instructed by the Engineer.

Rejected material or assembly, the defects of which have been corrected by the Contractor, shall not be returned to the site of the work until such time as the Engineer has approved its use in the work.

60-08 Owner furnished materials. The Contractor shall furnish all materials required to complete the work, except those specified, if any, to be furnished by the Owner. Owner-furnished materials shall be made available to the Contractor at the location specified.

All costs of handling, transportation from the specified location to the site of work, storage, and installing Owner-furnished materials shall be included in the unit price bid for the contract item in which such Owner-furnished material is used.

After any Owner-furnished material has been delivered to the location specified, the Contractor shall be responsible for any demurrage, damage, loss, or other deficiencies that may occur during the Contractor's handling, storage, or use of such Owner-furnished material. The Owner will deduct from any monies due or to become due the Contractor any cost incurred by the Owner in making good such loss due to the Contractor's handling, storage, or use of Owner-furnished materials.

END OF SECTION 60

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Section 70 Legal Regulations and Responsibility to Public

70-01 Laws to be observed. The Contractor shall keep fully informed of all Federal and state laws, all local laws, ordinances, and regulations and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any manner affect those engaged or employed on the work, or which in any way affect the conduct of the work. The Contractor shall at all times observe and comply with all such laws, ordinances, regulations, orders, and decrees; and shall protect and indemnify the Owner and all his or her officers, agents, or servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by the Contractor or the Contractor's employees.

70-02 Permits, licenses, and taxes. The Contractor shall procure all permits and licenses, pay all charges, fees, and taxes, and give all notices necessary and incidental to the due and lawful execution of the work.

70-03 Patented devices, materials, and processes. If the Contractor is required or desires to use any design, device, material, or process covered by letters of patent or copyright, the Contractor shall provide for such use by suitable legal agreement with the Patentee or Owner. The Contractor and the surety shall indemnify and hold harmless the Owner, any third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, material or process, or any trademark or copyright, and shall indemnify the Owner for any costs, expenses, and damages which it may be obliged to pay by reason of an infringement, at any time during the execution or after the completion of the work.

70-04 Restoration of surfaces disturbed by others. The Owner reserves the right to authorize the construction, reconstruction, or maintenance of any public or private utility service, FAA or National Oceanic and Atmospheric Administration (NOAA) facility, or a utility service of another government agency at any time during the progress of the work. Contact information for the Owner:

City of Delaware
Contact: Kevin Piatt, Airport Manager
1075 Pittsburgh Drive
Delaware, Ohio 43015
(740) 203-1870
kpiatt@delawareohio.net

Except as listed above, the Contractor shall not permit any individual, firm, or corporation to excavate or otherwise disturb such utility services or facilities located within the limits of the work without the written permission of the Engineer.

Should the Owner of public or private utility service, FAA, or NOAA facility, or a utility service of another government agency be authorized to construct, reconstruct, or maintain such utility service or facility during the progress of the work, the Contractor shall cooperate with such Owners by arranging and performing the work in this contract to facilitate such construction, reconstruction or maintenance by others whether or not such work by others is listed above. When ordered as extra work by the Engineer,

the Contractor shall make all necessary repairs to the work which are due to such authorized work by others, unless otherwise provided for in the contract, plans, or specifications. It is understood and agreed that the Contractor shall not be entitled to make any claim for damages due to such authorized work by others or for any delay to the work resulting from such authorized work.

70-05 Federal aid participation. For Airport Improvement Program (AIP) contracts, the United States Government has agreed to reimburse the Owner for some portion of the contract costs. Such reimbursement is made from time to time upon the Owner's request to the FAA. In consideration of the United States Government's (FAA's) agreement with the Owner, the Owner has included provisions in this contract pursuant to the requirements of Title 49 of the USC and the Rules and Regulations of the FAA that pertain to the work.

As required by the USC, the contract work is subject to the inspection and approval of duly authorized representatives of the FAA Administrator, and is further subject to those provisions of the rules and regulations that are cited in the contract, plans, or specifications.

No requirement of the USC, the rules and regulations implementing the USC, or this contract shall be construed as making the Federal Government a party to the contract nor will any such requirement interfere, in any way, with the rights of either party to the contract.

70-06 Sanitary, health, and safety provisions. The Contractor shall provide and maintain in a neat, sanitary condition such accommodations for the use of his or her employees as may be necessary to comply with the requirements of the state and local Board of Health, or of other bodies or tribunals having jurisdiction.

Attention is directed to Federal, state, and local laws, rules and regulations concerning construction safety and health standards. The Contractor shall not require any worker to work in surroundings or under conditions that are unsanitary, hazardous, or dangerous to his or her health or safety.

70-07 Public convenience and safety. The Contractor shall control his or her operations and those of his or her subcontractors and all suppliers, to assure the least inconvenience to the traveling public. Under all circumstances, safety shall be the most important consideration.

The Contractor shall maintain the free and unobstructed movement of aircraft and vehicular traffic with respect to his or her own operations and those of his or her subcontractors and all suppliers in accordance with the subsection 40-05 titled MAINTENANCE OF TRAFFIC of Section 40 hereinbefore specified and shall limit such operations for the convenience and safety of the traveling public as specified in the subsection 80-04 titled LIMITATION OF OPERATIONS of Section 80 hereinafter.

70-08 Barricades, warning signs, and hazard markings. The Contractor shall furnish, erect, and maintain all barricades, warning signs, and markings for hazards necessary to protect the public and the work. When used during periods of darkness, such barricades, warning signs, and hazard markings shall be suitably illuminated. Unless otherwise specified, barricades, warning signs, and markings for hazards that are in the air operations area (AOAs) shall be a maximum of 18 inches high. Unless otherwise specified, barricades shall be spaced not more than 4 feet apart. Barricades, warning signs, and markings shall be paid for under subsection 40-05.

For vehicular and pedestrian traffic, the Contractor shall furnish, erect, and maintain barricades, warning signs, lights and other traffic control devices in reasonable conformity with the Manual on Uniform Traffic Control Devices.

When the work requires closing an air operations area of the airport or portion of such area, the Contractor shall furnish, erect, and maintain temporary markings and associated lighting conforming to the requirements of advisory circular (AC) 150/5340-1L, Standards for Airport Markings.

The Contractor shall furnish, erect, and maintain markings and associated lighting of open trenches, excavations, temporary stock piles, and the Contractor's parked construction equipment that may be hazardous to the operation of emergency fire-rescue or maintenance vehicles on the airport in reasonable conformance to AC 150/5370-2F, Operational Safety on Airports During Construction.

The Contractor shall identify each motorized vehicle or piece of construction equipment in reasonable conformance to AC 150/5370-2F.

The Contractor shall furnish and erect all barricades, warning signs, and markings for hazards prior to commencing work that requires such erection and shall maintain the barricades, warning signs, and markings for hazards until their removal is directed by the Engineer.

Open-flame type lights shall not be permitted.

70-09 Use of explosives. When the use of explosives is necessary for the execution of the work, the Contractor shall exercise the utmost care not to endanger life or property, including new work. The Contractor shall be responsible for all damage resulting from the use of explosives.

All explosives shall be stored in a secure manner in compliance with all laws and ordinances, and all such storage places shall be clearly marked. Where no local laws or ordinances apply, storage shall be provided satisfactory to the Engineer and, in general, not closer than 1,000 feet from the work or from any building, road, or other place of human occupancy.

The Contractor shall notify each property Owner and public utility company having structures or facilities in proximity to the site of the work of his or her intention to use explosives. Such notice shall be given sufficiently in advance to enable them to take such steps as they may deem necessary to protect their property from injury.

The use of electrical blasting caps shall not be permitted on or within 1,000 feet of the airport property.

70-10 Protection and restoration of property and landscape. The Contractor shall be responsible for the preservation of all public and private property, and shall protect carefully from disturbance or damage all land monuments and property markers until the Engineer has witnessed or otherwise referenced their location and shall not move them until directed.

The Contractor shall be responsible for all damage or injury to property of any character, during the execution of the work, resulting from any act, omission, neglect, or misconduct in manner or method of executing the work, or at any time due to defective work or materials, and said responsibility shall not be released until the project has been completed and accepted.

When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work, or in consequence of the non-execution thereof by the Contractor, the Contractor shall restore, at his or her own expense, such property to a condition similar or equal to that existing before such damage or injury was done, by repairing, or otherwise restoring as may be directed, or the Contractor shall make good such damage or injury in an acceptable manner.

70-11 Responsibility for damage claims. The Contractor shall indemnify and save harmless the Engineer and the Owner and their officers, and employees from all suits, actions, or claims, of any character,

brought because of any injuries or damage received or sustained by any person, persons, or property on account of the operations of the Contractor; or on account of or in consequence of any neglect in safeguarding the work; or through use of unacceptable materials in constructing the work; or because of any act or omission, neglect, or misconduct of said Contractor; or because of any claims or amounts recovered from any infringements of patent, trademark, or copyright; or from any claims or amounts arising or recovered under the "Workmen's Compensation Act," or any other law, ordinance, order, or decree. Money due the Contractor under and by virtue of his or her contract considered necessary by the Owner for such purpose may be retained for the use of the Owner or, in case no money is due, his or her surety may be held until such suits, actions, or claims for injuries or damages shall have been settled and suitable evidence to that effect furnished to the Owner, except that money due the Contractor will not be withheld when the Contractor produces satisfactory evidence that he or she is adequately protected by public liability and property damage insurance.

70-11A Insurance. The Contractor shall not commence any work until he obtains, at his own expense, all required insurance. Such insurance must have the approval of the Owner as to limit, form, and amount. The Contractor will not permit any subcontractor to commence work on this project until the same insurance requirements have been complied with by such subcontractor.

a. Types - The types of insurance the Contractor is required to obtain and maintain for the full period of the contract will be: Worker's Compensation Insurance, and Comprehensive General Liability Insurance, as detailed in the following portions of this specification.

b. Evidence - As evidence of specified insurance coverage, the Owner may, in lieu of actual policies, accept certificates issued by the insurance carrier showing such policies in force for the specified period. Each policy or certificate will bear an endorsement or statement waiving right of cancellation or reduction in coverage without 10 days notice in writing to be delivered by registered mail to the Owner. Should any policy be canceled before final payment to the Contractor and the Contractor fails immediately to procure other insurance as specified, the Owner reserves the right to procure such insurance and to deduct the cost thereof from any sum due the Contractor under this Contract.

c. Adequacy of Performance - Any insurance bearing on adequacy of performance shall be maintained after completion of the project for the full guaranty period. Should such insurance be canceled before the end of the guaranty period and the Contractor fails immediately to procure other insurance as specified, the Owner reserves the right to procure such insurance and charge the cost thereof to the Contractor.

d. Payment of Damages - Nothing contained in these insurance requirements is to be construed as limiting the extent of the Contractor's responsibility for payment of damages resulting from his operations under this Contract.

e. The costs of all insurance shall be included in the various items of the contract and no additional compensation will be allowed.

70-11B Workmen's Compensation Insurance. Before the Agreement between the Owner and the Contractor is entered into, the Contractor shall submit written evidence that he and all subcontractors have obtained, for the period of the Contract, full Worker's Compensation Insurance coverage for all persons whom they employ or may employ in carrying out the work under this Contract. This insurance shall be in strict accordance with the requirements of the most current and applicable state Worker's Compensation Insurance Laws.

COVERAGE TYPE	MINIMUM LIMIT REQUIREMENT	
Workers' Compensation	Statutory	Statutory
Employers' Liability	$500,000	Each Accident
Employers' Liability	$500,000	Disease Per Policy
Employers' Liability	$500,000	Disease Per Employee

70-11C Comprehensive General and Umbrella Liability Insurance. The Contractor, prior to execution of the contract, shall file with the Owner copies of complete certificates of insurance, as evidence that he carries adequate insurance, satisfactory to the Owner, to afford protection against all claims for damages to public or private property, and injuries to persons arising out of and during the progress of the proposal, similar insurance to protect the Owner of the premises on or near which construction operations are to be performed.

Such insurance shall include, but not be limited to, coverage for: (a) Underground damage to facilities due to drilling and excavating with mechanical equipment; and (b) collapse or structural injury to structures due to blasting or explosion, excavation, tunneling, pile driving, cofferdam work, or building moving or demolition.

a. Owner's Protective Liability - Bodily injury and property damage protection shall include as Additional Insureds: the Owner, the Engineer and his consultants, each of their officers, employees and agents, and any other persons with an insurable interest designated by the Owner as an Additional Insured.

COMPREHENSIVE GENERAL LIABILITY

COVERAGE TYPE	MINIMUM LIMIT REQUIREMENT	
General Aggregate	$2,000,000	Aggregate
Premises & Operations and Products & Completed	$1,000,000	Per Occurrence
Products & Completed Operations	$2,000,000	Aggregate
Personal & Advertising Injury	$1,000,000	Aggregate
Fire Damage Legal Liability	$100,000	Any One Fire
Medical Expense	$10,000	Any One Person

UMBRELLA LIABILITY

COVERAGE TYPE	MINIMUM LIMIT REQUIREMENT	
Umbrella Liability – Occurrence Form	$10,000,000	Per Occurrence
Umbrella Liability – Occurrence Form	$10,000,000	Aggregate
Umbrella Liability – Occurrence Form	$10,000	Self-Insured Retention

b. Bodily Injury Liability and Property Damage Liability Automobiles - Unless otherwise specifically required by provisions in the proposal, the minimum limits of bodily injury liability and property damage liability shall be:

COVERAGE TYPE	MINIMUM LIMIT REQUIREMENT	
Owned Autos	$1,000,000	Combined Single Limit
Non-Owned Autos	$1,000,000	Combined Single Limit
Hired Autos	$1,000,000	Combined Single Limit

c. Indemnity - Included in such insurance will be contractual coverage sufficiently broad to ensure the provisions of Paragraph 70-11A.

70-12 Third party beneficiary clause. It is specifically agreed between the parties executing the contract that it is not intended by any of the provisions of any part of the contract to create for the public or any member thereof, a third party beneficiary or to authorize anyone not a party to the contract to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of the contract.

70-13 Opening sections of the work to traffic. Should it be necessary for the Contractor to complete portions of the contract work for the beneficial occupancy of the Owner prior to completion of the entire contract, such “phasing” of the work shall be specified herein and indicated on the plans. When so specified, the Contractor shall complete such portions of the work on or before the date specified or as otherwise specified. The Contractor shall make his or her own estimate of the difficulties involved in arranging the work to permit such beneficial occupancy by the Owner.

Upon completion of any portion of the work listed above, such portion shall be accepted by the Owner in accordance with the subsection 50-14 titled PARTIAL ACCEPTANCE of Section 50.

No portion of the work may be opened by the Contractor for public use until ordered by the Engineer in writing. Should it become necessary to open a portion of the work to public traffic on a temporary or intermittent basis, such openings shall be made when, in the opinion of the Engineer, such portion of the work is in an acceptable condition to support the intended traffic. Temporary or intermittent openings are considered to be inherent in the work and shall not constitute either acceptance of the portion of the work so opened or a waiver of any provision of the contract. Any damage to the portion of the work so opened that is not attributable to traffic which is permitted by the Owner shall be repaired by the Contractor at his or her expense.

The Contractor shall make his or her own estimate of the inherent difficulties involved in completing the work under the conditions herein described and shall not claim any added compensation by reason of delay or increased cost due to opening a portion of the contract work.

Contractor shall be required to conform to safety standards contained AC 150/5370-2F (see Special Provisions).

Contractor shall refer to the approved Construction Safety Phasing Plan (CSPP) to identify barricade requirements and other safety requirements prior to opening up sections of work to traffic.

70-14 Contractor’s responsibility for work. Until the Engineer’s final written acceptance of the entire completed work, excepting only those portions of the work accepted in accordance with the subsection

50-14 titled PARTIAL ACCEPTANCE of Section 50, the Contractor shall have the charge and care thereof and shall take every precaution against injury or damage to any part due to the action of the elements or from any other cause, whether arising from the execution or from the non-execution of the work. The Contractor shall rebuild, repair, restore, and make good all injuries or damages to any portion of the work occasioned by any of the above causes before final acceptance and shall bear the expense thereof except damage to the work due to unforeseeable causes beyond the control of and without the fault or negligence of the Contractor, including but not restricted to acts of God such as earthquake, tidal wave, tornado, hurricane or other cataclysmic phenomenon of nature, or acts of the public enemy or of government authorities.

If the work is suspended for any cause whatever, the Contractor shall be responsible for the work and shall take such precautions necessary to prevent damage to the work. The Contractor shall provide for normal drainage and shall erect necessary temporary structures, signs, or other facilities at his or her expense. During such period of suspension of work, the Contractor shall properly and continuously maintain in an acceptable growing condition all living material in newly established planting, seeding, and sodding furnished under the contract, and shall take adequate precautions to protect new tree growth and other important vegetative growth against injury.

70-15 Contractor's responsibility for utility service and facilities of others. As provided in the subsection 70-04 titled RESTORATION OF SURFACES DISTURBED BY OTHERS of this section, the Contractor shall cooperate with the Owner of any public or private utility service, FAA or NOAA, or a utility service of another government agency that may be authorized by the Owner to construct, reconstruct or maintain such utility services or facilities during the progress of the work. In addition, the Contractor shall control their operations to prevent the unscheduled interruption of such utility services and facilities.

To the extent that such public or private utility services, FAA, or NOAA facilities, or utility services of another governmental agency are known to exist within the limits of the contract work, the approximate locations have been indicated on the plans. Private utility contacts are indicated as follows:

<u>Electric</u>
American Electric Power (AEP)
Contact: Thomas Goodrich
Distribution Line Coordinator
Delaware Service Center
(740) 368-7133
tegoodrich@aep.com

<u>Communications</u>
Frontier Communications
Contact: Chris Avery
(740) 383-8424
ira.avery@ftr.com

FAA and City-owned facilities shall be coordinated through the Airport Manager.

It is understood and agreed that the Owner does not guarantee the accuracy or the completeness of the location information relating to existing utility services, facilities, or structures that may be shown on the plans or encountered in the work. Any inaccuracy or omission in such information shall not relieve the Contractor of the responsibility to protect such existing features from damage or unscheduled interruption of service.

It is further understood and agreed that the Contractor shall, upon execution of the contract, notify the Owners of all utility services or other facilities of his or her plan of operations. Such notification shall be

in writing addressed to THE PERSON TO CONTACT as provided in this subsection and subsection 70-04 titled RESTORATION OF SURFACES DISTURBED BY OTHERS of this section. A copy of each notification shall be given to the Engineer.

In addition to the general written notification provided, it shall be the responsibility of the Contractor to keep such individual Owners advised of changes in their plan of operations that would affect such Owners.

Prior to beginning the work in the general vicinity of an existing utility service or facility, the Contractor shall again notify each such Owner of their plan of operation. If, in the Contractor's opinion, the Owner's assistance is needed to locate the utility service or facility or the presence of a representative of the Owner is desirable to observe the work, such advice should be included in the notification. Such notification shall be given by the most expeditious means to reach the utility owner's PERSON TO CONTACT no later than two normal business days prior to the Contractor's commencement of operations in such general vicinity. The Contractor shall furnish a written summary of the notification to the Engineer.

The Contractor's failure to give the two days' notice shall be cause for the Owner to suspend the Contractor's operations in the general vicinity of a utility service or facility.

Where the outside limits of an underground utility service have been located and staked on the ground, the Contractor shall be required to use hand excavation methods within 3 feet of such outside limits at such points as may be required to ensure protection from damage due to the Contractor's operations.

Should the Contractor damage or interrupt the operation of a utility service or facility by accident or otherwise, the Contractor shall immediately notify the proper authority and the Engineer and shall take all reasonable measures to prevent further damage or interruption of service. The Contractor, in such events, shall cooperate with the utility service or facility owner and the Engineer continuously until such damage has been repaired and service restored to the satisfaction of the utility or facility owner.

The Contractor shall bear all costs of damage and restoration of service to any utility service or facility due to their operations whether due to negligence or accident. The Owner reserves the right to deduct such costs from any monies due or which may become due the Contractor, or his or her surety.

70-15.1 FAA facilities and cable runs. The Contractor is hereby advised that the construction limits of the project include existing facilities and buried cable runs that are owned, operated and maintained by the FAA. The Contractor, during the execution of the project work, shall comply with the following:

a. The Contractor shall permit FAA maintenance personnel the right of access to the project work site for purposes of inspecting and maintaining all existing FAA owned facilities.

b. The Contractor shall provide notice to the FAA Air Traffic Organization (ATO)/Technical Operations/System Support Center (SSC) Point-of-Contact through the Airport Manager a minimum of seven (7) calendar days prior to commencement of construction activities in order to permit sufficient time to locate and mark existing buried cables and to schedule any required facility outages.

c. If execution of the project work requires a facility outage, the Contractor shall contact the FAA Point-of-Contact a minimum of 72 hours prior to the time of the required outage.

d. Any damage to FAA cables, access roads, or FAA facilities during construction caused by the Contractor's equipment or personnel whether by negligence or accident will require the Contractor

to repair or replace the damaged cables, access road, or FAA facilities to FAA requirements. The Contractor shall not bear the cost to repair damage to underground facilities or utilities improperly located by the FAA.

e. If the project work requires the cutting or splicing of FAA owned cables, the FAA Point-of-Contact shall be contacted a minimum of 72 hours prior to the time the cable work commences. The FAA reserves the right to have a FAA representative on site to observe the splicing of the cables as a condition of acceptance. All cable splices are to be accomplished in accordance with FAA specifications and require approval by the FAA Point-of-Contact as a condition of acceptance by the Owner. The Contractor is hereby advised that FAA restricts the location of where splices may be installed. If a cable splice is required in a location that is not permitted by FAA, the Contractor shall furnish and install a sufficient length of new cable that eliminates the need for any splice.

70-16 Furnishing rights-of-way. The Owner will be responsible for furnishing all rights-of-way upon which the work is to be constructed in advance of the Contractor's operations.

70-17 Personal liability of public officials. In carrying out any of the contract provisions or in exercising any power or authority granted by this contract, there shall be no liability upon the Engineer, his or her authorized representatives, or any officials of the Owner either personally or as an official of the Owner. It is understood that in such matters they act solely as agents and representatives of the Owner.

70-18 No waiver of legal rights. Upon completion of the work, the Owner will expeditiously make final inspection and notify the Contractor of final acceptance. Such final acceptance, however, shall not preclude or stop the Owner from correcting any measurement, estimate, or certificate made before or after completion of the work, nor shall the Owner be precluded or stopped from recovering from the Contractor or his or her surety, or both, such overpayment as may be sustained, or by failure on the part of the Contractor to fulfill his or her obligations under the contract. A waiver on the part of the Owner of any breach of any part of the contract shall not be held to be a waiver of any other or subsequent breach.

The Contractor, without prejudice to the terms of the contract, shall be liable to the Owner for latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards the Owner's rights under any warranty or guaranty.

70-19 Environmental protection. The Contractor shall comply with all Federal, state, and local laws and regulations controlling pollution of the environment. The Contractor shall take necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs with fuels, oils, bitumens, chemicals, or other harmful materials and to prevent pollution of the atmosphere from particulate and gaseous matter.

70-20 Archaeological and historical findings. Unless otherwise specified in this subsection, the Contractor is advised that the site of the work is not within any property, district, or site, and does not contain any building, structure, or object listed in the current National Register of Historic Places published by the United States Department of Interior.

Should the Contractor encounter, during his or her operations, any building, part of a building, structure, or object that is incongruous with its surroundings, the Contractor shall immediately cease operations in that location and notify the Engineer. The Engineer will immediately investigate the Contractor's finding and the Owner will direct the Contractor to either resume operations or to suspend operations as directed.

Should the Owner order suspension of the Contractor's operations in order to protect an archaeological or historical finding, or order the Contractor to perform extra work, such shall be covered by an appropriate contract change order or supplemental agreement as provided in the subsection 40-04 titled EXTRA WORK of Section 40 and the subsection 90-05 titled PAYMENT FOR EXTRA WORK of Section 90. If appropriate, the contract change order or supplemental agreement shall include an extension of contract time in accordance with the subsection 80-07 titled DETERMINATION AND EXTENSION OF CONTRACT TIME of Section 80.

END OF SECTION 70

Section 80 Execution and Progress

80-01 Subletting of contract. The Owner will not recognize any subcontractor on the work. The Contractor shall at all times when work is in progress be represented either in person, by a qualified superintendent, or by other designated, qualified representative who is duly authorized to receive and execute orders of the Engineer.

The Contractor shall provide copies of all subcontracts to the Engineer. The Contractor shall perform, with his organization, an amount of work equal to at least 25 percent of the total contract cost.

Should the Contractor elect to assign his or her contract, said assignment shall be concurred in by the surety, shall be presented for the consideration and approval of the Owner, and shall be consummated only on the written approval of the Owner.

80-02 Notice to proceed. The notice to proceed shall state the date on which it is expected the Contractor will begin the construction and from which date contract time will be charged. The Contractor shall begin the work to be performed under the contract within 10 days of the date set by the Engineer in the written notice to proceed, but in any event, the Contractor shall notify the Engineer at least 24 hours in advance of the time actual construction operations will begin. The Contractor shall not commence any actual construction prior to the date on which the notice to proceed is issued by the Owner.

80-03 Execution and progress. Unless otherwise specified, the Contractor shall submit their progress schedule for the Engineer's approval within 10 days after the effective date of the notice to proceed. The Contractor's progress schedule, when approved by the Engineer, may be used to establish major construction operations and to check on the progress of the work. The Contractor shall provide sufficient materials, equipment, and labor to guarantee the completion of the project in accordance with the plans and specifications within the time set forth in the proposal.

If the Contractor falls significantly behind the submitted schedule, the Contractor shall, upon the Engineer's request, submit a revised schedule for completion of the work within the contract time and modify their operations to provide such additional materials, equipment, and labor necessary to meet the revised schedule. Should the execution of the work be discontinued for any reason, the Contractor shall notify the Engineer at least 24 hours in advance of resuming operations.

The Contractor shall not commence any actual construction prior to the date on which the notice to proceed is issued by the Owner.

80-04 Limitation of operations. The Contractor shall control his or her operations and the operations of his or her subcontractors and all suppliers to provide for the free and unobstructed movement of aircraft in the air operations areas (AOA) of the airport.

When the work requires the Contractor to conduct his or her operations within an AOA of the airport, the work shall be coordinated with airport operations (through the Engineer) at least 48 hours prior to commencement of such work. The Contractor shall not close an AOA until so authorized by the Engineer

and until the necessary temporary marking and associated lighting is in place as provided in the subsection 70-08 titled BARRICADES, WARNING SIGNS, AND HAZARD MARKINGS of Section 70.

When the contract work requires the Contractor to work within an AOA of the airport on an intermittent basis (intermittent opening and closing of the AOA), the Contractor shall maintain constant communications as specified; immediately obey all instructions to vacate the AOA; immediately obey all instructions to resume work in such AOA. Failure to maintain the specified communications or to obey instructions shall be cause for suspension of the Contractor's operations in the AOA until the satisfactory conditions are provided. See contract drawings for AOA restrictions.

Contractor shall be required to conform to safety standards contained in AC 150/5370-2F, Operational Safety on Airports During Construction (see Special Provisions).

80-04.1 Operational safety on airport during construction. All Contractors' operations shall be conducted in accordance with the project Construction Safety and Phasing Plan (CSPP) and the provisions set forth within the current version of AC 150/5370-2F. The CSPP included within the contract documents conveys minimum requirements for operational safety on the airport during construction activities. The Contractor shall prepare and submit a Safety Plan Compliance Document that details how it proposes to comply with the requirements presented within the CSPP.

The Contractor shall implement all necessary safety plan measures prior to commencement of any work activity. The Contractor shall conduct routine checks to assure compliance with the safety plan measures.

The Contractor is responsible to the Owner for the conduct of all subcontractors it employs on the project. The Contractor shall assure that all subcontractors are made aware of the requirements of the CSPP and that they implement and maintain all necessary measures.

No deviation or modifications may be made to the approved CSPP unless approved in writing by the Owner or Engineer.

80-05 Character of workers, methods, and equipment. The Contractor shall, at all times, employ sufficient labor and equipment for prosecuting the work to full completion in the manner and time required by the contract, plans, and specifications.

All workers shall have sufficient skill and experience to perform properly the work assigned to them. Workers engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform the work satisfactorily.

Any person employed by the Contractor or by any subcontractor who violates any operational regulations or operational safety requirements and, in the opinion of the Engineer, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the Engineer, be removed forthwith by the Contractor or subcontractor employing such person, and shall not be employed again in any portion of the work without approval of the Engineer.

Should the Contractor fail to remove such persons or person, or fail to furnish suitable and sufficient personnel for the proper execution of the work, the Engineer may suspend the work by written notice until compliance with such orders.

All equipment that is proposed to be used on the work shall be of sufficient size and in such mechanical condition as to meet requirements of the work and to produce a satisfactory quality of work. Equipment

used on any portion of the work shall be such that no injury to previously completed work, adjacent property, or existing airport facilities will result from its use.

When the methods and equipment to be used by the Contractor in accomplishing the work are not prescribed in the contract, the Contractor is free to use any methods or equipment that will accomplish the work in conformity with the requirements of the contract, plans, and specifications.

When the contract specifies the use of certain methods and equipment, such methods and equipment shall be used unless others are authorized by the Engineer. If the Contractor desires to use a method or type of equipment other than specified in the contract, the Contractor may request authority from the Engineer to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed and of the reasons for desiring to make the change. If approval is given, it will be on the condition that the Contractor will be fully responsible for producing work in conformity with contract requirements. If, after trial use of the substituted methods or equipment, the Engineer determines that the work produced does not meet contract requirements, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining work with the specified methods and equipment. The Contractor shall remove any deficient work and replace it with work of specified quality, or take such other corrective action as the Engineer may direct. No change will be made in basis of payment for the contract items involved nor in contract time as a result of authorizing a change in methods or equipment under this subsection.

80-06 Temporary suspension of the work. The Owner shall have the authority to suspend the work wholly, or in part, for such period or periods as the Owner may deem necessary, due to unsuitable weather, or such other conditions as are considered unfavorable for the execution of the work, or for such time as is necessary due to the failure on the part of the Contractor to carry out orders given or perform any or all provisions of the contract.

In the event that the Contractor is ordered by the Owner, in writing, to suspend work for some unforeseen cause not otherwise provided for in the contract and over which the Contractor has no control, the Contractor may be reimbursed for actual money expended on the work during the period of shutdown. No allowance will be made for anticipated profits. The period of shutdown shall be computed from the effective date of the Engineer's order to suspend work to the effective date of the Engineer's order to resume the work. Claims for such compensation shall be filed with the Engineer within the time period stated in the Engineer's order to resume work. The Contractor shall submit with his or her claim information substantiating the amount shown on the claim. The Engineer will forward the Contractor's claim to the Owner for consideration in accordance with local laws or ordinances. No provision of this article shall be construed as entitling the Contractor to compensation for delays due to inclement weather, for suspensions made at the request of the Owner, or for any other delay provided for in the contract, plans, or specifications.

If it should become necessary to suspend work for an indefinite period, the Contractor shall store all materials in such manner that they will not become an obstruction nor become damaged in any way. The Contractor shall take every precaution to prevent damage or deterioration of the work performed and provide for normal drainage of the work. The Contractor shall erect temporary structures where necessary to provide for traffic on, to, or from the airport.

80-07 Determination and extension of contract time. The number of calendar or working days allowed for completion of the work shall be stated in the proposal and contract and shall be known as the CONTRACT TIME.

Should the contract time require extension for reasons beyond the Contractor's control, it shall be adjusted as follows:

a. CONTRACT TIME based on WORKING DAYS shall be calculated weekly by the Engineer. The Engineer will furnish the Contractor a copy of his or her weekly statement of the number of working days charged against the contract time during the week and the number of working days currently specified for completion of the contract (the original contract time plus the number of working days, if any, that have been included in approved CHANGE ORDERS or SUPPLEMENTAL AGREEMENTS covering EXTRA WORK).

The Engineer shall base his or her weekly statement of contract time charged on the following considerations:

(1) No time shall be charged for days on which the Contractor is unable to proceed with the principal item of work under construction at the time for at least six (6) hours with the normal work force employed on such principal item. Should the normal work force be on a double-shift, 12 hours shall be used. Should the normal work force be on a triple-shift, 18 hours shall apply. Conditions beyond the Contractor's control such as strikes, lockouts, unusual delays in transportation, temporary suspension of the principal item of work under construction or temporary suspension of the entire work which have been ordered by the Owner for reasons not the fault of the Contractor, shall not be charged against the contract time.

(2) The Engineer will not make charges against the contract time prior to the effective date of the notice to proceed.

(3) The Engineer will begin charges against the contract time on the first working day after the effective date of the notice to proceed.

(4) The Engineer will not make charges against the contract time after the date of final acceptance as defined in the subsection 50-15 titled FINAL ACCEPTANCE of Section 50.

(5) The Contractor will be allowed one (1) week in which to file a written protest setting forth his or her objections to the Engineer's weekly statement. If no objection is filed within such specified time, the weekly statement shall be considered as acceptable to the Contractor.

The contract time (stated in the proposal) is based on the originally estimated quantities as described in the subsection 20-05 titled INTERPRETATION OF ESTIMATED PROPOSAL QUANTITIES of Section 20. Should the satisfactory completion of the contract require performance of work in greater quantities than those estimated in the proposal, the contract time shall be increased in the same proportion as the cost of the actually completed quantities bears to the cost of the originally estimated quantities in the proposal. Such increase in contract time shall not consider either the cost of work or the extension of contract time that has been covered by change order or supplemental agreement and shall be made at the time of final payment.

b. Contract Time based on calendar days shall consist of the number of calendar days stated in the contract counting from the effective date of the notice to proceed and including all Saturdays, Sundays, holidays, and non-work days. All calendar days elapsing between the effective dates of the Owner's orders to suspend and resume all work, due to causes not the fault of the Contractor, shall be excluded.

At the time of final payment, the contract time shall be increased in the same proportion as the cost of the actually completed quantities bears to the cost of the originally estimated quantities in the

proposal. Such increase in the contract time shall not consider either cost of work or the extension of contract time that has been covered by a change order or supplemental agreement. Charges against the contract time will cease as of the date of final acceptance.

c. When the contract time is a specified completion date, it shall be the date on which all contract work shall be substantially complete.

If the Contractor finds it impossible for reasons beyond his or her control to complete the work within the contract time as specified, or as extended in accordance with the provisions of this subsection, the Contractor may, at any time prior to the expiration of the contract time as extended, make a written request to the Owner for an extension of time setting forth the reasons which the Contractor believes will justify the granting of his or her request. Requests for extension of time on calendar day projects, caused by inclement weather, shall be supported with National Weather Bureau data showing the actual amount of inclement weather exceeded what could normally be expected during the contract period. The Contractor's plea that insufficient time was specified is not a valid reason for extension of time. If the supporting documentation justify the work was delayed because of conditions beyond the control and without the fault of the Contractor, the Owner may extend the time for completion by a change order that adjusts the contract time or completion date. The extended time for completion shall then be in full force and effect, the same as though it were the original time for completion.

80-08 Failure to complete on time. For each calendar day or working day, as specified in the contract, that any work remains uncompleted after the contract time (including all extensions and adjustments as provided in the subsection 80-07 titled DETERMINATION AND EXTENSION OF CONTRACT TIME of this Section) the sum specified in the contract and proposal as liquidated damages will be deducted from any money due or to become due the Contractor or his or her surety. Such deducted sums shall not be deducted as a penalty but shall be considered as liquidation of a reasonable portion of damages including but not limited to additional engineering services that will be incurred by the Owner should the Contractor fail to complete the work in the time provided in their contract.

Phase	Liquidated Damages Cost	Allowed Construction Time
1A	$500 Per Hour	48 Hours
1B	$1,500 Per Calendar Day	61 Calendar Days
1C	$500 Per Hour	48 Hours
2A	$500 Per Hour	48 Hours
2B	$1,500 Per Calendar Day	87 Calendar Days
2C	$2,500 Per Calendar Day*	11 Calendar Days
2D	$2,000 Per Calendar Day	5 Calendar Days

***Failure to complete all work in Phase 2C by July 27, 2016 shall result in liquidated damages in the amount of $2,500 per calendar days, in addition to any liquidated damages assessed from the prior phase.**

80-09 Default and termination of contract. The Contractor shall be considered in default of his or her contract and such default will be considered as cause for the Owner to terminate the contract for any of the following reasons if the Contractor:

a. Fails to begin the work under the contract within the time specified in the Notice to Proceed, or

b. Fails to perform the work or fails to provide sufficient workers, equipment and/or materials to assure completion of work in accordance with the terms of the contract, or

c. Performs the work unsuitably or neglects or refuses to remove materials or to perform anew such work as may be rejected as unacceptable and unsuitable, or

d. Discontinues the execution of the work, or

e. Fails to resume work which has been discontinued within a reasonable time after notice to do so, or

f. Becomes insolvent or is declared bankrupt, or commits any act of bankruptcy or insolvency, or

g. Allows any final judgment to stand against the Contractor unsatisfied for a period of 10 days, or

h. Makes an assignment for the benefit of creditors, or

i. For any other cause whatsoever, fails to carry on the work in an acceptable manner.

Should the Engineer consider the Contractor in default of the contract for any reason above, the Engineer shall immediately give written notice to the Contractor and the Contractor's surety as to the reasons for considering the Contractor in default and the Owner's intentions to terminate the contract.

If the Contractor or surety, within a period of 10 days after such notice, does not proceed in accordance therewith, then the Owner will, upon written notification from the Engineer of the facts of such delay, neglect, or default and the Contractor's failure to comply with such notice, have full power and authority without violating the contract, to take the execution of the work out of the hands of the Contractor. The Owner may appropriate or use any or all materials and equipment that have been mobilized for use in the work and are acceptable and may enter into an agreement for the completion of said contract according to the terms and provisions thereof, or use such other methods as in the opinion of the Engineer will be required for the completion of said contract in an acceptable manner.

All costs and charges incurred by the Owner, together with the cost of completing the work under contract, will be deducted from any monies due or which may become due the Contractor. If such expense exceeds the sum which would have been payable under the contract, then the Contractor and the surety shall be liable and shall pay to the Owner the amount of such excess.

80-10 Termination for national emergencies. The Owner shall terminate the contract or portion thereof by written notice when the Contractor is prevented from proceeding with the construction contract as a direct result of an Executive Order of the President with respect to the execution of war or in the interest of national defense.

When the contract, or any portion thereof, is terminated before completion of all items of work in the contract, payment will be made for the actual number of units or items of work completed at the contract price or as mutually agreed for items of work partially completed or not started. No claims or loss of anticipated profits shall be considered.

Reimbursement for organization of the work, and other overhead expenses, (when not otherwise included in the contract) and moving equipment and materials to and from the job will be considered, the intent being that an equitable settlement will be made with the Contractor.

Acceptable materials, obtained or ordered by the Contractor for the work and that are not incorporated in the work shall, at the option of the Contractor, be purchased from the Contractor at actual cost as shown by receipted bills and actual cost records at such points of delivery as may be designated by the Engineer.

Termination of the contract or a portion thereof shall neither relieve the Contractor of his or her responsibilities for the completed work nor shall it relieve his or her surety of its obligation for and concerning any just claim arising out of the work performed.

80-11 Work area, storage area and sequence of operations. The Contractor shall obtain approval from the Engineer prior to beginning any work in all areas of the airport. No operating runway, taxiway, or air operations area (AOA) shall be crossed, entered, or obstructed while it is operational. The Contractor shall plan and coordinate his or her work in such a manner as to ensure safety and a minimum of hindrance to flight operations. All Contractor equipment and material stockpiles shall be stored a minimum of 500 feet from the centerline of an active runway. No equipment will be allowed to park within the approach area of an active runway at any time. No equipment shall be within 500 feet of an active runway at any time.

END OF SECTION 80

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Section 90 Measurement and Payment

90-01 Measurement of quantities. All work completed under the contract will be measured by the Engineer, or his or her authorized representatives, using United States Customary Units of Measurement or the International System of Units.

The method of measurement and computations to be used in determination of quantities of material furnished and of work performed under the contract will be those methods generally recognized as conforming to good engineering practice.

Unless otherwise specified, longitudinal measurements for area computations will be made horizontally, and no deductions will be made for individual fixtures (or leave-outs) having an area of 9 square feet or less. Unless otherwise specified, transverse measurements for area computations will be the neat dimensions shown on the plans or ordered in writing by the Engineer.

Structures will be measured according to neat lines shown on the plans or as altered to fit field conditions.

Unless otherwise specified, all contract items which are measured by the linear foot such as electrical ducts, conduits, pipe culverts, underdrains, and similar items shall be measured parallel to the base or foundation upon which such items are placed.

In computing volumes of excavation the average end area method or other acceptable methods will be used.

The thickness of plates and galvanized sheet used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing will be specified and measured in decimal fraction of inch.

The term “ton” will mean the short ton consisting of 2,000 lb avoirdupois. All materials that are measured or proportioned by weights shall be weighed on accurate, approved scales by competent, qualified personnel at locations designed by the Engineer. If material is shipped by rail, the car weight may be accepted provided that only the actual weight of material is paid for. However, car weights will not be acceptable for material to be passed through mixing plants. Trucks used to haul material being paid for by weight shall be weighed empty daily at such times as the Engineer directs, and each truck shall bear a plainly legible identification mark.

Materials to be measured by volume in the hauling vehicle shall be hauled in approved vehicles and measured therein at the point of delivery. Vehicles for this purpose may be of any size or type acceptable for the materials hauled, provided that the body is of such shape that the actual contents may be readily and accurately determined. All vehicles shall be loaded to at least their water level capacity, and all loads shall be leveled when the vehicles arrive at the point of delivery.

When requested by the Contractor and approved by the Engineer in writing, material specified to be measured by the cubic yard may be weighed, and such weights will be converted to cubic yards for payment purposes. Factors for conversion from weight measurement to volume measurement will be

determined by the Engineer and shall be agreed to by the Contractor before such method of measurement of pay quantities is used.

Bituminous materials will be measured by the gallon or ton. When measured by volume, such volumes will be measured at 60°F or will be corrected to the volume at 60°F using ASTM D1250 for asphalts or ASTM D633 for tars.

Net certified scale weights or weights based on certified volumes in the case of rail shipments will be used as a basis of measurement, subject to correction when bituminous material has been lost from the car or the distributor, wasted, or otherwise not incorporated in the work.

When bituminous materials are shipped by truck or transport, net certified weights by volume, subject to correction for loss or foaming, may be used for computing quantities.

Cement will be measured by the ton or hundredweight.

Timber will be measured by the thousand feet board measure (MFBM) actually incorporated in the structure. Measurement will be based on nominal widths and thicknesses and the extreme length of each piece.

The term “lump sum” when used as an item of payment will mean complete payment for the work described in the contract.

When a complete structure or structural unit (in effect, “lump sum” work) is specified as the unit of measurement, the unit will be construed to include all necessary fittings and accessories.

Rental of equipment will be measured by time in hours of actual working time and necessary traveling time of the equipment within the limits of the work. Special equipment ordered by the Engineer in connection with force account work will be measured as agreed in the change order or supplemental agreement authorizing such force account work as provided in the subsection 90-05 titled PAYMENT FOR EXTRA WORK of this section.

When standard manufactured items are specified such as fence, wire, plates, rolled shapes, pipe conduit, etc., and these items are identified by gauge, unit weight, section dimensions, etc., such identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by tolerances in cited specifications, manufacturing tolerances established by the industries involved will be accepted.

Scales for weighing materials which are required to be proportioned or measured and paid for by weight shall be furnished, erected, and maintained by the Contractor, or be certified permanently installed commercial scales.

Scales shall be accurate within 1/2% of the correct weight throughout the range of use. The Contractor shall have the scales checked under the observation of the inspector before beginning work and at such other times as requested. The intervals shall be uniform in spacing throughout the graduated or marked length of the beam or dial and shall not exceed one-tenth of 1% of the nominal rated capacity of the scale, but not less than 1 pound. The use of spring balances will not be permitted.

Beams, dials, platforms, and other scale equipment shall be so arranged that the operator and the inspector can safely and conveniently view them.

Scale installations shall have available ten standard 50-pound weights for testing the weighing equipment or suitable weights and devices for other approved equipment.

Scales must be tested for accuracy and serviced before use at a new site. Platform scales shall be installed and maintained with the platform level and rigid bulkheads at each end.

Scales "overweighing" (indicating more than correct weight) will not be permitted to operate, and all materials received subsequent to the last previous correct weighting-accuracy test will be reduced by the percentage of error in excess of one-half of 1%.

In the event inspection reveals the scales have been underweighing (indicating less than correct weight), they shall be adjusted, and no additional payment to the Contractor will be allowed for materials previously weighed and recorded.

All costs in connection with furnishing, installing, certifying, testing, and maintaining scales; for furnishing check weights and scale house; and for all other items specified in this subsection, for the weighing of materials for proportioning or payment, shall be included in the unit contract prices for the various items of the project.

When the estimated quantities for a specific portion of the work are designated as the pay quantities in the contract, they shall be the final quantities for which payment for such specific portion of the work will be made, unless the dimensions of said portions of the work shown on the plans are revised by the Engineer. If revised dimensions result in an increase or decrease in the quantities of such work, the final quantities for payment will be revised in the amount represented by the authorized changes in the dimensions.

90-02 Scope of payment. The Contractor shall receive and accept compensation provided for in the contract as full payment for furnishing all materials, for performing all work under the contract in a complete and acceptable manner, and for all risk, loss, damage, or expense of whatever character arising out of the nature of the work or the execution thereof, subject to the provisions of the subsection 70-18 titled NO WAIVER OF LEGAL RIGHTS of Section 70.

When the "basis of payment" subsection of a technical specification requires that the contract price (price bid) include compensation for certain work or material essential to the item, this same work or material will not also be measured for payment under any other contract item which may appear elsewhere in the contract, plans, or specifications.

90-03 Compensation for altered quantities. When the accepted quantities of work vary from the quantities in the proposal, the Contractor shall accept as payment in full, so far as contract items are concerned, payment at the original contract price for the accepted quantities of work actually completed and accepted. No allowance, except as provided for in the subsection 40-02 titled ALTERATION OF WORK AND QUANTITIES of Section 40 will be made for any increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor which results directly from such alterations or indirectly from his or her unbalanced allocation of overhead and profit among the contract items, or from any other cause.

90-04 Payment for omitted items. As specified in the subsection 40-03 titled OMITTED ITEMS of Section 40, the Engineer shall have the right to omit from the work (order nonperformance) any contract item, except major contract items, in the best interest of the Owner.

Should the Engineer omit or order nonperformance of a contract item or portion of such item from the work, the Contractor shall accept payment in full at the contract prices for any work actually completed and acceptable prior to the Engineer's order to omit or non-perform such contract item.

Acceptable materials ordered by the Contractor or delivered on the work prior to the date of the Engineer's order will be paid for at the actual cost to the Contractor and shall thereupon become the property of the Owner.

In addition to the reimbursement hereinbefore provided, the Contractor shall be reimbursed for all actual costs incurred for the purpose of performing the omitted contract item prior to the date of the Engineer's order. Such additional costs incurred by the Contractor must be directly related to the deleted contract item and shall be supported by certified statements by the Contractor as to the nature the amount of such costs.

90-05 Payment for extra work. Extra work, performed in accordance with the subsection 40-04 titled EXTRA WORK of Section 40, will be paid for at the contract prices or agreed prices specified in the change order or supplemental agreement authorizing the extra work.

90-06 Partial payments. Partial payments will be made to the Contractor at least once each month as the work progresses. Said payments will be based upon estimates, prepared by the Engineer, of the value of the work performed and materials complete and in place, in accordance with the contract, plans, and specifications. Such partial payments may also include the delivered actual cost of those materials stockpiled and stored in accordance with the subsection 90-07 titled PAYMENT FOR MATERIALS ON HAND of this section. No partial payment will be made when the amount due to the Contractor since the last estimate amounts to less than five hundred dollars.

The Contractor is required to pay all subcontractors for satisfactory performance of their contracts no later than 30 days after the Contractor has received a partial payment. The Owner must ensure prompt and full payment of retainage from the prime Contractor to the subcontractor within 30 days after the subcontractor's work is satisfactorily completed. A subcontractor's work is satisfactorily completed when all the tasks called for in the subcontract have been accomplished and documented as required by the Owner. When the Owner has made an incremental acceptance of a portion of a prime contract, the work of a subcontractor covered by that acceptance is deemed to be satisfactorily completed.

From the total of the amount determined to be payable on a partial payment, ten (10) percent of such total amount will be deducted and retained by the Owner until the final payment is made, except as may be provided (at the Contractor's option) in the subsection 90-08 titled PAYMENT OF WITHHELD FUNDS of this section. The balance, 90% of the amount payable, less all previous payments, shall be certified for payment. Should the Contractor exercise his or her option, as provided in the subsection 90-08 titled PAYMENT OF WITHHELD FUNDS of this section, no such percent retainage shall be deducted.

When at least 95% of the work has been completed, the Engineer shall, at the Owner's discretion and with the consent of the surety, prepare estimates of both the contract value and the cost of the remaining work to be done.

The Owner may retain an amount not less than twice the contract value or estimated cost, whichever is greater, of the work remaining to be done. The remainder, less all previous payments and deductions, will then be certified for payment to the Contractor.

It is understood and agreed that the Contractor shall not be entitled to demand or receive partial payment based on quantities of work in excess of those provided in the proposal or covered by approved change orders or supplemental agreements, except when such excess quantities have been determined by the Engineer to be a part of the final quantity for the item of work in question.

No partial payment shall bind the Owner to the acceptance of any materials or work in place as to quality or quantity. All partial payments are subject to correction at the time of final payment as provided in the subsection 90-09 titled ACCEPTANCE AND FINAL PAYMENT of this section.

The Contractor shall deliver to the Owner a complete release of all claims for labor and material arising out of this contract before the final payment is made. If any subcontractor or supplier fails to furnish such a release in full, the Contractor may furnish a bond or other collateral satisfactory to the Owner to indemnify the Owner against any potential lien or other such claim. The bond or collateral shall include all costs, expenses, and attorney fees the Owner may be compelled to pay in discharging any such lien or claim.

90-07 Payment for materials on hand. Partial payments may be made to the extent of the delivered cost of materials to be incorporated in the work, provided that such materials meet the requirements of the contract, plans, and specifications and are delivered to acceptable sites on the airport property or at other sites in the vicinity that are acceptable to the Owner. Such delivered costs of stored or stockpiled materials may be included in the next partial payment after the following conditions are met:

a. The material has been stored or stockpiled in a manner acceptable to the Engineer at or on an approved site.

b. The Contractor has furnished the Engineer with acceptable evidence of the quantity and quality of such stored or stockpiled materials.

c. The Contractor has furnished the Engineer with satisfactory evidence that the material and transportation costs have been paid.

d. The Contractor has furnished the Owner legal title (free of liens or encumbrances of any kind) to the material so stored or stockpiled.

e. The Contractor has furnished the Owner evidence that the material so stored or stockpiled is insured against loss by damage to or disappearance of such materials at any time prior to use in the work.

It is understood and agreed that the transfer of title and the Owner's payment for such stored or stockpiled materials shall in no way relieve the Contractor of his or her responsibility for furnishing and placing such materials in accordance with the requirements of the contract, plans, and specifications.

In no case will the amount of partial payments for materials on hand exceed the contract price for such materials or the contract price for the contract item in which the material is intended to be used.

No partial payment will be made for stored or stockpiled living or perishable plant materials.

The Contractor shall bear all costs associated with the partial payment of stored or stockpiled materials in accordance with the provisions of this subsection.

90-08 Payment of withheld funds. At the Contractor's option, if an Owner withholds retainage in accordance with the methods described in subsection 90-06 PARTIAL PAYMENTS, the Contractor may request that the Owner deposit the retainage into an escrow account. The Owner's deposit of retainage into an escrow account is subject to the following conditions:

a. The Contractor shall bear all expenses of establishing and maintaining an escrow account and escrow agreement acceptable to the Owner.

b. The Contractor shall deposit to and maintain in such escrow only those securities or bank certificates of deposit as are acceptable to the Owner and having a value not less than the retainage that would otherwise be withheld from partial payment.

c. The Contractor shall enter into an escrow agreement satisfactory to the Owner.

d. The Contractor shall obtain the written consent of the surety to such agreement.

90-09 Acceptance and final payment. When the contract work has been accepted in accordance with the requirements of the subsection 50-15 titled FINAL ACCEPTANCE of Section 50, the Engineer will prepare the final estimate of the items of work actually performed. The Contractor shall approve the Engineer's final estimate or advise the Engineer of the Contractor's objections to the final estimate which are based on disputes in measurements or computations of the final quantities to be paid under the contract as amended by change order or supplemental agreement. The Contractor and the Engineer shall resolve all disputes (if any) in the measurement and computation of final quantities to be paid within 30 calendar days of the Contractor's receipt of the Engineer's final estimate. If, after such 30-day period, a dispute still exists, the Contractor may approve the Engineer's estimate under protest of the quantities in dispute, and such disputed quantities shall be considered by the Owner as a claim in accordance with the subsection 50-16 titled CLAIMS FOR ADJUSTMENT AND DISPUTES of Section 50.

After the Contractor has approved, or approved under protest, the Engineer's final estimate, and after the Engineer's receipt of the project closeout documentation required in subsection 90-11 Project Closeout, final payment will be processed based on the entire sum, or the undisputed sum in case of approval under protest, determined to be due the Contractor less all previous payments and all amounts to be deducted under the provisions of the contract. All prior partial estimates and payments shall be subject to correction in the final estimate and payment.

If the Contractor has filed a claim for additional compensation under the provisions of the subsection 50-16 titled CLAIMS FOR ADJUSTMENTS AND DISPUTES of Section 50 or under the provisions of this subsection, such claims will be considered by the Owner in accordance with local laws or ordinances. Upon final adjudication of such claims, any additional payment determined to be due the Contractor will be paid pursuant to a supplemental final estimate.

90-10 Construction warranty.

a. In addition to any other warranties in this contract, the Contractor warrants that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, workmanship, or design furnished, or performed by the Contractor or any subcontractor or supplier at any tier.

b. This warranty shall continue for a period of one year from the date of final acceptance of the work. If the Owner takes possession of any part of the work before final acceptance, this warranty shall continue for a period of one year from the date the Owner takes possession. However, this will not relieve the Contractor from corrective items required by the final acceptance of the project work.

c. The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Owner real or personal property, when that damage is the result of:

(1) The Contractor's failure to conform to contract requirements; or

(2) Any defect of equipment, material, workmanship, or design furnished by the Contractor.

d. The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for one year from the date of repair or replacement.

e. The Owner will notify the Contractor, in writing, within seven (7) days after the discovery of any failure, defect, or damage.

f. If the Contractor fails to remedy any failure, defect, or damage within 14 days after receipt of notice, the Owner shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

g. With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall: (1) Obtain all warranties that would be given in normal commercial practice; (2) Require all warranties to be executed, in writing, for the benefit of the Owner, as directed by the Owner, and (3) Enforce all warranties for the benefit of the Owner.

h. This warranty shall not limit the Owner's rights with respect to latent defects, gross mistakes, or fraud.

90-11 Project closeout. Approval of final payment to the Contractor is contingent upon completion and submittal of the items listed below. The final payment will not be approved until the Engineer approves the Contractor's final submittal. The Contractor shall:

a. Provide two (2) copies of all manufacturers warranties specified for materials, equipment, and installations.

b. Provide weekly payroll records (not previously received) from the general Contractor and all subcontractors.

c. Complete final cleanup in accordance with subsection 40-08, FINAL CLEANUP.

d. Complete all punch list items identified during the Final Inspection.

e. Provide complete release of all claims for labor and material arising out of the Contract.

f. Provide a certified statement signed by the subcontractors, indicating actual amounts paid to the Disadvantaged Business Enterprise (DBE) subcontractors and/or suppliers associated with the project.

g. When applicable per state requirements, return copies of sales tax completion forms.

h. Manufacturer's certifications for all items incorporated in the work.

i. All required record drawings, as-built drawings or as-constructed drawings.

j. Project Operation and Maintenance (O&M) Manual.

k. Security for Construction Warranty.

l. Equipment commissioning documentation submitted, if required.

END OF SECTION 90

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Section 100 Contractor Quality Control Program

100-01 General. When the specification requires a Contractor Quality Control Program, the Contractor shall establish, provide, and maintain an effective Quality Control Program that details the methods and procedures that will be taken to assure that all materials and completed construction required by this contract conform to contract plans, technical specifications and other requirements, whether manufactured by the Contractor, or procured from subcontractors or vendors. Although guidelines are established and certain minimum requirements are specified here and elsewhere in the contract technical specifications, the Contractor shall assume full responsibility for accomplishing the stated purpose.

The intent of this section is to enable the Contractor to establish a necessary level of control that will:

a. Adequately provide for the production of acceptable quality materials.

b. Provide sufficient information to assure both the Contractor and the Engineer that the specification requirements can be met.

c. Allow the Contractor as much latitude as possible to develop his or her own standard of control.

The Contractor shall be prepared to discuss and present, at the preconstruction conference, their understanding of the quality control requirements. The Contractor shall not begin any construction or production of materials to be incorporated into the completed work until the Quality Control Program has been reviewed and accepted by the Engineer. No partial payment will be made for materials subject to specific quality control requirements until the Quality Control Program has been reviewed.

The quality control requirements contained in this section and elsewhere in the contract technical specifications are in addition to and separate from the acceptance testing requirements. Acceptance testing requirements are the responsibility of the Engineer.

Paving projects over $250,000 shall have a Quality Control (QC)/Quality Assurance (QA) workshop with the Engineer, Contractor, subcontractors, testing laboratories, and Owner's representative and the FAA prior to or at start of construction. The workshop shall address QC and QA requirements of the project specifications. The Contractor shall coordinate with the Airport and the Engineer on time and location of the QC/QA workshop.

100-02 Description of program.

a. General description. The Contractor shall establish a Quality Control Program to perform quality control inspection and testing of all items of work required by the technical specifications, including those performed by subcontractors. This Quality Control Program shall ensure conformance to applicable specifications and plans with respect to materials, workmanship, construction, finish, and functional performance. The Quality Control Program shall be effective for control of all construction work performed under this Contract and shall specifically include surveillance and tests required by the technical specifications, in addition to other requirements of this section and any other activities deemed necessary by the Contractor to establish an effective level of quality control.

b. Quality Control Program. The Contractor shall describe the Quality Control Program in a written document that shall be reviewed and approved by the Engineer prior to the start of any production, construction, or off-site fabrication. The written Quality Control Program shall be submitted to the Engineer for review and approval at least ten (10) calendar days before the preconstruction conference. The Contractor's Quality Control Plan and Quality Control testing laboratory must be approved in writing by the Engineer prior to the Notice to Proceed (NTP).

The Quality Control Program shall be organized to address, as a minimum, the following items:

a. Quality control organization

b. Project progress schedule

c. Submittals schedule

d. Inspection requirements

e. Quality control testing plan

f. Documentation of quality control activities

g. Requirements for corrective action when quality control and/or acceptance criteria are not met

The Contractor is encouraged to add any additional elements to the Quality Control Program that is deemed necessary to adequately control all production and/or construction processes required by this contract.

100-03 Quality control organization. The Contractor Quality Control Program shall be implemented by the establishment of a separate quality control organization. An organizational chart shall be developed to show all quality control personnel and how these personnel integrate with other management/production and construction functions and personnel.

The organizational chart shall identify all quality control staff by name and function, and shall indicate the total staff required to implement all elements of the Quality Control Program, including inspection and testing for each item of work. If necessary, different technicians can be used for specific inspection and testing functions for different items of work. If an outside organization or independent testing laboratory is used for implementation of all or part of the Quality Control Program, the personnel assigned shall be subject to the qualification requirements of paragraph 100-03a and 100-03b. The organizational chart shall indicate which personnel are Contractor employees and which are provided by an outside organization.

The quality control organization shall, as a minimum, consist of the following personnel:

a. Program Administrator. The Program Administrator shall be a full-time employee of the Contractor, or a consultant engaged by the Contractor. The Program Administrator shall have a minimum of five (5) years of experience in airport and/or highway construction and shall have had prior quality control experience on a project of comparable size and scope as the contract.

Additional qualifications for the Program Administrator shall include at least one of the following requirements:

(1) Professional Engineer with one (1) year of airport paving experience.

(2) Engineer-in-training with two (2) years of airport paving experience.

(3) An individual with three (3) years of highway and/or airport paving experience, with a Bachelor of Science Degree in Civil Engineering, Civil Engineering Technology or Construction.

(4) Construction materials technician certified at Level III by the National Institute for Certification in Engineering Technologies (NICET).

(5) Highway materials technician certified at Level III by NICET.

(6) Highway construction technician certified at Level III by NICET.

(7) A NICET certified engineering technician in Civil Engineering Technology with five (5) years of highway and/or airport paving experience.

The Program Administrator shall have full authority to institute any and all actions necessary for the successful implementation of the Quality Control Program to ensure compliance with the contract plans and technical specifications. The Program Administrator shall report directly to a responsible officer of the construction firm. The Program Administrator may supervise the Quality Control Program on more than one project provided that person can be at the job site within two (2) hours after being notified of a problem.

b. Quality control technicians. A sufficient number of quality control technicians necessary to adequately implement the Quality Control Program shall be provided. These personnel shall be either Engineers, engineering technicians, or experienced craftsman with qualifications in the appropriate field equivalent to NICET Level II or higher construction materials technician or highway construction technician and shall have a minimum of two (2) years of experience in their area of expertise.

The quality control technicians shall report directly to the Program Administrator and shall perform the following functions:

(1) Inspection of all materials, construction, plant, and equipment for conformance to the technical specifications, and as required by subsection 100-06.

(2) Performance of all quality control tests as required by the technical specifications and subsection 100-07.

(3) Performance of density tests for the Engineer when required by the technical specifications.

Certification at an equivalent level, by a state or nationally recognized organization will be acceptable in lieu of NICET certification.

c. Staffing levels. The Contractor shall provide sufficient qualified quality control personnel to monitor each work activity at all times. Where material is being produced in a plant for incorporation into the work, separate plant and field technicians shall be provided at each plant and field placement location. The scheduling and coordinating of all inspection and testing must match the type and pace of work activity. The Quality Control Program shall state where different technicians will be required for different work elements.

100-04 Project progress schedule. The Contractor shall submit a coordinated construction schedule for all work activities. The schedule shall be prepared as a network diagram in Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), or other format, or as otherwise specified in the contract. As a minimum, it shall provide information on the sequence of work activities, milestone dates, and activity duration.

The Contractor shall maintain the work schedule and provide an update and analysis of the progress schedule on a twice monthly basis, or as otherwise specified in the contract. Submission of the work schedule shall not relieve the Contractor of overall responsibility for scheduling, sequencing, and coordinating all work to comply with the requirements of the contract.

100-05 Submittals schedule. The Contractor shall submit a detailed listing of all submittals (for example, mix designs, material certifications) and shop drawings required by the technical specifications. The listing can be developed in a spreadsheet format and shall include:

a. Specification item number

b. Item description

c. Description of submittal

d. Specification paragraph requiring submittal

e. Scheduled date of submittal

100-06 Inspection requirements. Quality control inspection functions shall be organized to provide inspections for all definable features of work, as detailed below. All inspections shall be documented by the Contractor as specified by subsection 100-07.

Inspections shall be performed daily to ensure continuing compliance with contract requirements until completion of the particular feature of work. These shall include the following minimum requirements:

a. During plant operation for material production, quality control test results and periodic inspections shall be used to ensure the quality of aggregates and other mix components, and to adjust and control mix proportioning to meet the approved mix design and other requirements of the technical specifications. All equipment used in proportioning and mixing shall be inspected to ensure its proper operating condition. The Quality Control Program shall detail how these and other quality control functions will be accomplished and used.

b. During field operations, quality control test results and periodic inspections shall be used to ensure the quality of all materials and workmanship. All equipment used in placing, finishing, and compacting shall be inspected to ensure its proper operating condition and to ensure that all such operations are in conformance to the technical specifications and are within the plan dimensions, lines, grades, and tolerances specified. The Program shall document how these and other quality control functions will be accomplished and used.

100-07 Quality control testing plan. As a part of the overall Quality Control Program, the Contractor shall implement a quality control testing plan, as required by the technical specifications. The testing plan shall include the minimum tests and test frequencies required by each technical specification Item, as well as any additional quality control tests that the Contractor deems necessary to adequately control production and/or construction processes.

The testing plan can be developed in a spreadsheet fashion and shall, as a minimum, include the following:

a. Specification item number (for example, P-401)

b. Item description (for example, Plant Mix Bituminous Pavements)

c. Test type (for example, gradation, grade, asphalt content)

d. Test standard (for example, ASTM or American Association of State Highway and Transportation Officials (AASHTO) test number, as applicable)

e. Test frequency (for example, as required by technical specifications or minimum frequency when requirements are not stated)

f. Responsibility (for example, plant technician)

g. Control requirements (for example, target, permissible deviations)

The testing plan shall contain a statistically-based procedure of random sampling for acquiring test samples in accordance with ASTM D3665. The Engineer shall be provided the opportunity to witness quality control sampling and testing.

All quality control test results shall be documented by the Contractor as required by subsection 100-08.

100-08 Documentation. The Contractor shall maintain current quality control records of all inspections and tests performed. These records shall include factual evidence that the required inspections or tests have been performed, including type and number of inspections or tests involved; results of inspections or tests; nature of defects, deviations, causes for rejection, etc.; proposed remedial action; and corrective actions taken.

These records must cover both conforming and defective or deficient features, and must include a statement that all supplies and materials incorporated in the work are in full compliance with the terms of the contract. Legible copies of these records shall be furnished to the Engineer daily. The records shall cover all work placed subsequent to the previously furnished records and shall be verified and signed by the Contractor's Program Administrator.

Specific Contractor quality control records required for the contract shall include, but are not necessarily limited to, the following records:

a. Daily inspection reports. Each Contractor quality control technician shall maintain a daily log of all inspections performed for both Contractor and subcontractor operations. These technician's daily reports shall provide factual evidence that continuous quality control inspections have been performed and shall, as a minimum, include the following:

(1) Technical specification item number and description

(2) Compliance with approved submittals

(3) Proper storage of materials and equipment

(4) Proper operation of all equipment

(5) Adherence to plans and technical specifications

(6) Review of quality control tests

(7) Safety inspection.

The daily inspection reports shall identify inspections conducted, results of inspections, location and nature of defects found, causes for rejection, and remedial or corrective actions taken or proposed.

The daily inspection reports shall be signed by the responsible quality control technician and the Program Administrator. The Engineer shall be provided at least one copy of each daily inspection report on the work day following the day of record.

b. Daily test reports. The Contractor shall be responsible for establishing a system that will record all quality control test results. Daily test reports shall document the following information:

(1) Technical specification item number and description

(2) Test designation

(3) Location

(4) Date of test

(5) Control requirements

(6) Test results

(7) Causes for rejection

(8) Recommended remedial actions

(9) Retests

Test results from each day's work period shall be submitted to the Engineer prior to the start of the next day's work period. When required by the technical specifications, the Contractor shall maintain statistical quality control charts. The daily test reports shall be signed by the responsible quality control technician and the Program Administrator.

100-09 Corrective action requirements. The Quality Control Program shall indicate the appropriate action to be taken when a process is deemed, or believed, to be out of control (out of tolerance) and detail what action will be taken to bring the process into control. The requirements for corrective action shall include both general requirements for operation of the Quality Control Program as a whole, and for individual items of work contained in the technical specifications.

The Quality Control Program shall detail how the results of quality control inspections and tests will be used for determining the need for corrective action and shall contain clear sets of rules to gauge when a process is out of control and the type of correction to be taken to regain process control.

When applicable or required by the technical specifications, the Contractor shall establish and use statistical quality control charts for individual quality control tests. The requirements for corrective action shall be linked to the control charts.

100-10 Surveillance by the Engineer. All items of material and equipment shall be subject to surveillance by the Engineer at the point of production, manufacture or shipment to determine if the Contractor, producer, manufacturer or shipper maintains an adequate quality control system in conformance with the requirements detailed here and the applicable technical specifications and plans. In addition, all items of materials, equipment and work in place shall be subject to surveillance by the Engineer at the site for the same purpose.

Surveillance by the Engineer does not relieve the Contractor of performing quality control inspections of either on-site or off-site Contractor's or subcontractor's work.

100-11 Noncompliance.

a. The Engineer will notify the Contractor of any noncompliance with any of the foregoing requirements. The Contractor shall, after receipt of such notice, immediately take corrective action. Any notice, when delivered by the Engineer or his or her authorized representative to the Contractor or his or her authorized representative at the site of the work, shall be considered sufficient notice.

b. In cases where quality control activities do not comply with either the Contractor Quality Control Program or the contract provisions, or where the Contractor fails to properly operate and maintain an effective Quality Control Program, as determined by the Engineer, the Engineer may:

(1) Order the Contractor to replace ineffective or unqualified quality control personnel or subcontractors.

(2) Order the Contractor to stop operations until appropriate corrective actions are taken.

END OF SECTION 100

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Section 105 Mobilization

105-1 Description. This item shall consist of work and operations, but is not limited to, work and operations necessary for the movement of personnel, equipment, material and supplies to and from the project site for work on the project except as provided in the contract as separate pay items.

105-1.1 Posted notices. Prior to commencement of construction activities the Contractor must post the following documents in a prominent and accessible place where they may be easily viewed by all employees of the prime Contractor and by all employees of subcontractors engaged by the prime Contractor: Equal Employment Opportunity (EEO) Poster "Equal Employment Opportunity is the Law" in accordance with the Office of Federal Contract Compliance Programs Executive Order 11246, as amended; Davis Bacon Wage Poster (WH 1321) - DOL "Notice to All Employees" Poster; and Applicable Davis-Bacon Wage Rate Determination. These notices must remain posted until final acceptance of the work by the Owner.

105-2 Basis of measurement and payment. Based upon the contract lump sum price for "Mobilization" partial payments will be allowed as follows:

a. With first pay request, 25%.

b. When 25% or more of the original contract is earned, an additional 25%.

c. When 50% or more of the original contract is earned, an additional 40%.

d. After Final Inspection, Staging area clean-up and delivery of all Project Closeout materials as required by 90-11, the final 10%.

END OF SECTION 105

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Section 110 Method of Estimating Percentage of Material Within Specification Limits (PWL)

110-01 General. When the specifications provide for acceptance of material based on the method of estimating percentage of material within specification limits (PWL), the PWL will be determined in accordance with this section. All test results for a lot will be analyzed statistically to determine the total estimated percent of the lot that is within specification limits. The PWL is computed using the sample average (X) and sample standard deviation (S_n) of the specified number (n) of sublots for the lot and the specification tolerance limits, L for lower and U for upper, for the particular acceptance parameter. From these values, the respective Quality index, Q_L for Lower Quality Index and/or Q_U for Upper Quality Index, is computed and the PWL for the lot for the specified n is determined from Table 1. All specification limits specified in the technical sections shall be absolute values. Test results used in the calculations shall be to the significant figure given in the test procedure.

There is some degree of uncertainty (risk) in the measurement for acceptance because only a small fraction of production material (the population) is sampled and tested. This uncertainty exists because all portions of the production material have the same probability to be randomly sampled. The Contractor's risk is the probability that material produced at the acceptable quality level is rejected or subjected to a pay adjustment. The Owner's risk is the probability that material produced at the rejectable quality level is accepted.

It is the intent of this section to inform the Contractor that, in order to consistently offset the Contractor's risk for material evaluated, production quality (using population average and population standard deviation) must be maintained at the acceptable quality specified or higher. In all cases, it is the responsibility of the Contractor to produce at quality levels that will meet the specified acceptance criteria when sampled and tested at the frequencies specified.

110-02 Method for computing PWL. The computational sequence for computing PWL is as follows:

a. Divide the lot into n sublots in accordance with the acceptance requirements of the specification.

b. Locate the random sampling position within the sublot in accordance with the requirements of the specification.

c. Make a measurement at each location, or take a test portion and make the measurement on the test portion in accordance with the testing requirements of the specification.

d. Find the sample average (X) for all sublot values within the lot by using the following formula:

$$X = (x_1 + x_2 + x_3 + \ldots x_n) / n$$

Where: X = Sample average of all sublot values within a lot

x_1, x_2 = Individual sublot values

n = Number of sublots

e. Find the sample standard deviation (S_n) by use of the following formula:

$$S_n = [(d_1^2 + d_2^2 + d_3^2 + \ldots d_n^2)/(n-1)]^{1/2}$$

Where: S_n = Sample standard deviation of the number of sublot values in the set

d_1, d_2 = Deviations of the individual sublot values x_1, x_2, … from the average value X

that is: $d_1 = (x_1 - X)$, $d_2 = (x_2 - X)$ … $d_n = (x_n - X)$

n = Number of sublots

f. For single sided specification limits (that is, L only), compute the Lower Quality Index Q_L by use of the following formula:

$$Q_L = (X - L) / S_n$$

Where: L = specification lower tolerance limit

Estimate the percentage of material within limits (PWL) by entering Table 1 with Q_L, using the column appropriate to the total number (n) of measurements. If the value of Q_L falls between values shown on the table, use the next higher value of PWL.

g. For double-sided specification limits (that is, L and U), compute the Quality Indexes Q_L and Q_U by use of the following formulas:

$$Q_L = (X - L) / S_n$$

and

$$Q_U = (U - X) / S_n$$

Where: L and U = specification lower and upper tolerance limits

Estimate the percentage of material between the lower (L) and upper (U) tolerance limits (PWL) by entering Table 1 separately with Q_L and Q_U, using the column appropriate to the total number (n) of measurements, and determining the percent of material above P_L and percent of material below P_U for each tolerance limit. If the values of Q_L fall between values shown on the table, use the next higher value of P_L or P_U. Determine the PWL by use of the following formula:

$$PWL = (P_U + P_L) - 100$$

Where: P_L = percent within lower specification limit

P_U = percent within upper specification limit

EXAMPLE OF PWL CALCULATION

Project: Example Project

Test Item: Item P-401, Lot A.

A. PWL Determination for Mat Density.

1. Density of four random cores taken from Lot A.

A-1 = 96.60

A-2 = 97.55

A-3 = 99.30

A-4 = 98.35

n = 4

2. Calculate average density for the lot.

$X = (x_1 + x_2 + x_3 + . . . x_n) / n$

X = (96.60 + 97.55 + 99.30 + 98.35) / 4

X = 97.95% density

3. Calculate the standard deviation for the lot.

$S_n = [((96.60 - 97.95)^2 + (97.55 - 97.95)^2 + (99.30 - 97.95)^2 + (98.35 - 97.95)^2)) / (4 - 1)]^{1/2}$

$S_n = [(1.82 + 0.16 + 1.82 + 0.16) / 3]^{1/2}$

$S_n = 1.15$

4. Calculate the Lower Quality Index Q_L for the lot. (L=96.3)

$Q_L = (X - L) / S_n$

$Q_L = (97.95 - 96.30) / 1.15$

$Q_L = 1.4348$

5. Determine PWL by entering Table 1 with Q_L= 1.44 and n= 4.

PWL = 98

B. PWL Determination for Air Voids.

1. Air Voids of four random samples taken from Lot A.

A-1 = 5.00

A-2 = 3.74

A-3 = 2.30

A-4 = 3.25

2. Calculate the average air voids for the lot.

$X = (x_1 + x_2 + x_3 . . . n) / n$

X = (5.00 + 3.74 + 2.30 + 3.25) / 4

X = 3.57%

3. Calculate the standard deviation S_n for the lot.

$S_n = [((3.57 - 5.00)^2 + (3.57 - 3.74)^2 + (3.57 - 2.30)^2 + (3.57 - 3.25)^2) / (4 - 1)]^{1/2}$

$S_n = [(2.04 + 0.03 + 1.62 + 0.10) / 3]^{1/2}$

$S_n = 1.12$

4. Calculate the Lower Quality Index Q_L for the lot. (L= 2.0)

$Q_L = (X - L) / S_n$

$Q_L = (3.57 - 2.00) / 1.12$

$Q_L = 1.3992$

5. Determine P_L by entering Table 1 with $Q_L = 1.41$ and n = 4.

$P_L = 97$

6. Calculate the Upper Quality Index Q_U for the lot. (U= 5.0)

$Q_U = (U - X) / S_n$

$Q_U = (5.00 - 3.57) / 1.12$

$Q_U = 1.2702$

7. Determine P_U by entering Table 1 with $Q_U = 1.29$ and n = 4.

$P_U = 93$

8. Calculate Air Voids PWL

$PWL = (P_L + P_U) - 100$

$PWL = (97 + 93) - 100 = 90$

EXAMPLE OF OUTLIER CALCULATION (REFERENCE ASTM E178)

Project: Example Project

Test Item: Item P-401, Lot A.

A. Outlier Determination for Mat Density.

1. Density of four random cores taken from Lot A arranged in descending order.

A-3 = 99.30

A-4 = 98.35

A-2 = 97.55

A-1 = 96.60

2. Use n=4 and upper 5% significance level of to find the critical value for test criterion = 1.463.

3. Use average density, standard deviation, and test criterion value to evaluate density measurements.

a. For measurements greater than the average:

If (measurement - average)/(standard deviation) is less than test criterion, then the measurement is not considered an outlier

For A-3, check if (99.30 - 97.95) / 1.15 is greater than 1.463.

Since 1.174 is less than 1.463, the value is not an outlier.

b. For measurements less than the average:

If (average - measurement)/(standard deviation) is less than test criterion, then the measurement is not considered an outlier.

For A-1, check if (97.95 - 96.60) / 1.15 is greater than 1.463.

Since 1.435 is less than 1.463, the value is not an outlier.

Note: In this example, a measurement would be considered an outlier if the density were:

Greater than (97.95 + 1.463 × 1.15) = 99.63%

OR

less than (97.95 - 1.463 × 1.15) = 96.27%.

Table 1. Table for Estimating Percent of Lot Within Limits (PWL)

Percent Within Limits (P_L and P_U)	Positive Values of Q (Q_L and Q_U)							
	n=3	n=4	n=5	n=6	n=7	n=8	n=9	n=10
99	1.1541	1.4700	1.6714	1.8008	1.8888	1.9520	1.9994	2.0362
98	1.1524	1.4400	1.6016	1.6982	1.7612	1.8053	1.8379	1.8630
97	1.1496	1.4100	1.5427	1.6181	1.6661	1.6993	1.7235	1.7420
96	1.1456	1.3800	1.4897	1.5497	1.5871	1.6127	1.6313	1.6454
95	1.1405	1.3500	1.4407	1.4887	1.5181	1.5381	1.5525	1.5635
94	1.1342	1.3200	1.3946	1.4329	1.4561	1.4717	1.4829	1.4914
93	1.1269	1.2900	1.3508	1.3810	1.3991	1.4112	1.4199	1.4265
92	1.1184	1.2600	1.3088	1.3323	1.3461	1.3554	1.3620	1.3670
91	1.1089	1.2300	1.2683	1.2860	1.2964	1.3032	1.3081	1.3118
90	1.0982	1.2000	1.2290	1.2419	1.2492	1.2541	1.2576	1.2602
89	1.0864	1.1700	1.1909	1.1995	1.2043	1.2075	1.2098	1.2115
88	1.0736	1.1400	1.1537	1.1587	1.1613	1.1630	1.1643	1.1653
87	1.0597	1.1100	1.1173	1.1192	1.1199	1.1204	1.1208	1.1212
86	1.0448	1.0800	1.0817	1.0808	1.0800	1.0794	1.0791	1.0789
85	1.0288	1.0500	1.0467	1.0435	1.0413	1.0399	1.0389	1.0382
84	1.0119	1.0200	1.0124	1.0071	1.0037	1.0015	1.0000	0.9990
83	0.9939	0.9900	0.9785	0.9715	0.9671	0.9643	0.9624	0.9610
82	0.9749	0.9600	0.9452	0.9367	0.9315	0.9281	0.9258	0.9241
81	0.9550	0.9300	0.9123	0.9025	0.8966	0.8928	0.8901	0.8882
80	0.9342	0.9000	0.8799	0.8690	0.8625	0.8583	0.8554	0.8533
79	0.9124	0.8700	0.8478	0.8360	0.8291	0.8245	0.8214	0.8192
78	0.8897	0.8400	0.8160	0.8036	0.7962	0.7915	0.7882	0.7858
77	0.8662	0.8100	0.7846	0.7716	0.7640	0.7590	0.7556	0.7531
76	0.8417	0.7800	0.7535	0.7401	0.7322	0.7271	0.7236	0.7211
75	0.8165	0.7500	0.7226	0.7089	0.7009	0.6958	0.6922	0.6896
74	0.7904	0.7200	0.6921	0.6781	0.6701	0.6649	0.6613	0.6587
73	0.7636	0.6900	0.6617	0.6477	0.6396	0.6344	0.6308	0.6282
72	0.7360	0.6600	0.6316	0.6176	0.6095	0.6044	0.6008	0.5982
71	0.7077	0.6300	0.6016	0.5878	0.5798	0.5747	0.5712	0.5686
70	0.6787	0.6000	0.5719	0.5582	0.5504	0.5454	0.5419	0.5394
69	0.6490	0.5700	0.5423	0.5290	0.5213	0.5164	0.5130	0.5105
68	0.6187	0.5400	0.5129	0.4999	0.4924	0.4877	0.4844	0.4820
67	0.5878	0.5100	0.4836	0.4710	0.4638	0.4592	0.4560	0.4537
66	0.5563	0.4800	0.4545	0.4424	0.4355	0.4310	0.4280	0.4257
65	0.5242	0.4500	0.4255	0.4139	0.4073	0.4030	0.4001	0.3980
64	0.4916	0.4200	0.3967	0.3856	0.3793	0.3753	0.3725	0.3705
63	0.4586	0.3900	0.3679	0.3575	0.3515	0.3477	0.3451	0.3432
62	0.4251	0.3600	0.3392	0.3295	0.3239	0.3203	0.3179	0.3161
61	0.3911	0.3300	0.3107	0.3016	0.2964	0.2931	0.2908	0.2892
60	0.3568	0.3000	0.2822	0.2738	0.2691	0.2660	0.2639	0.2624
59	0.3222	0.2700	0.2537	0.2461	0.2418	0.2391	0.2372	0.2358
58	0.2872	0.2400	0.2254	0.2186	0.2147	0.2122	0.2105	0.2093
57	0.2519	0.2100	0.1971	0.1911	0.1877	0.1855	0.1840	0.1829
56	0.2164	0.1800	0.1688	0.1636	0.1607	0.1588	0.1575	0.1566
55	0.1806	0.1500	0.1406	0.1363	0.1338	0.1322	0.1312	0.1304
54	0.1447	0.1200	0.1125	0.1090	0.1070	0.1057	0.1049	0.1042
53	0.1087	0.0900	0.0843	0.0817	0.0802	0.0793	0.0786	0.0781
52	0.0725	0.0600	0.0562	0.0544	0.0534	0.0528	0.0524	0.0521
51	0.0363	0.0300	0.0281	0.0272	0.0267	0.0264	0.0262	0.0260
50	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Percent Within Limits (P_L and P_U)	Negative Values of Q (Q_L and Q_U)							
	n=3	n=4	n=5	n=6	n=7	n=8	n=9	n=10
49	-0.0363	-0.0300	-0.0281	-0.0272	-0.0267	-0.0264	-0.0262	-0.0260
48	-0.0725	-0.0600	-0.0562	-0.0544	-0.0534	-0.0528	-0.0524	-0.0521
47	-0.1087	-0.0900	-0.0843	-0.0817	-0.0802	-0.0793	-0.0786	-0.0781
46	-0.1447	-0.1200	-0.1125	-0.1090	-0.1070	-0.1057	-0.1049	-0.1042
45	-0.1806	-0.1500	-0.1406	-0.1363	-0.1338	-0.1322	-0.1312	-0.1304
44	-0.2164	-0.1800	-0.1688	-0.1636	-0.1607	-0.1588	-0.1575	-0.1566
43	-0.2519	-0.2100	-0.1971	-0.1911	-0.1877	-0.1855	-0.1840	-0.1829
42	-0.2872	-0.2400	-0.2254	-0.2186	-0.2147	-0.2122	-0.2105	-0.2093
41	-0.3222	-0.2700	-0.2537	-0.2461	-0.2418	-0.2391	-0.2372	-0.2358
40	-0.3568	-0.3000	-0.2822	-0.2738	-0.2691	-0.2660	-0.2639	-0.2624
39	-0.3911	-0.3300	-0.3107	-0.3016	-0.2964	-0.2931	-0.2908	-0.2892
38	-0.4251	-0.3600	-0.3392	-0.3295	-0.3239	-0.3203	-0.3179	-0.3161
37	-0.4586	-0.3900	-0.3679	-0.3575	-0.3515	-0.3477	-0.3451	-0.3432
36	-0.4916	-0.4200	-0.3967	-0.3856	-0.3793	-0.3753	-0.3725	-0.3705
35	-0.5242	-0.4500	-0.4255	-0.4139	-0.4073	-0.4030	-0.4001	-0.3980
34	-0.5563	-0.4800	-0.4545	-0.4424	-0.4355	-0.4310	-0.4280	-0.4257
33	-0.5878	-0.5100	-0.4836	-0.4710	-0.4638	-0.4592	-0.4560	-0.4537
32	-0.6187	-0.5400	-0.5129	-0.4999	-0.4924	-0.4877	-0.4844	-0.4820
31	-0.6490	-0.5700	-0.5423	-0.5290	-0.5213	-0.5164	-0.5130	-0.5105
30	-0.6787	-0.6000	-0.5719	-0.5582	-0.5504	-0.5454	-0.5419	-0.5394
29	-0.7077	-0.6300	-0.6016	-0.5878	-0.5798	-0.5747	-0.5712	-0.5686
28	-0.7360	-0.6600	-0.6316	-0.6176	-0.6095	-0.6044	-0.6008	-0.5982
27	-0.7636	-0.6900	-0.6617	-0.6477	-0.6396	-0.6344	-0.6308	-0.6282
26	-0.7904	-0.7200	-0.6921	-0.6781	-0.6701	-0.6649	-0.6613	-0.6587
25	-0.8165	-0.7500	-0.7226	-0.7089	-0.7009	-0.6958	-0.6922	-0.6896
24	-0.8417	-0.7800	-0.7535	-0.7401	-0.7322	-0.7271	-0.7236	-0.7211
23	-0.8662	-0.8100	-0.7846	-0.7716	-0.7640	-0.7590	-0.7556	-0.7531
22	-0.8897	-0.8400	-0.8160	-0.8036	-0.7962	-0.7915	-0.7882	-0.7858
21	-0.9124	-0.8700	-0.8478	-0.8360	-0.8291	-0.8245	-0.8214	-0.8192
20	-0.9342	-0.9000	-0.8799	-0.8690	-0.8625	-0.8583	-0.8554	-0.8533
19	-0.9550	-0.9300	-0.9123	-0.9025	-0.8966	-0.8928	-0.8901	-0.8882
18	-0.9749	-0.9600	-0.9452	-0.9367	-0.9315	-0.9281	-0.9258	-0.9241
17	-0.9939	-0.9900	-0.9785	-0.9715	-0.9671	-0.9643	-0.9624	-0.9610
16	-1.0119	-1.0200	-1.0124	-1.0071	-1.0037	-1.0015	-1.0000	-0.9990
15	-1.0288	-1.0500	-1.0467	-1.0435	-1.0413	-1.0399	-1.0389	-1.0382
14	-1.0448	-1.0800	-1.0817	-1.0808	-1.0800	-1.0794	-1.0791	-1.0789
13	-1.0597	-1.1100	-1.1173	-1.1192	-1.1199	-1.1204	-1.1208	-1.1212
12	-1.0736	-1.1400	-1.1537	-1.1587	-1.1613	-1.1630	-1.1643	-1.1653
11	-1.0864	-1.1700	-1.1909	-1.1995	-1.2043	-1.2075	-1.2098	-1.2115
10	-1.0982	-1.2000	-1.2290	-1.2419	-1.2492	-1.2541	-1.2576	-1.2602
9	-1.1089	-1.2300	-1.2683	-1.2860	-1.2964	-1.3032	-1.3081	-1.3118
8	-1.1184	-1.2600	-1.3088	-1.3323	-1.3461	-1.3554	-1.3620	-1.3670
7	-1.1269	-1.2900	-1.3508	-1.3810	-1.3991	-1.4112	-1.4199	-1.4265
6	-1.1342	-1.3200	-1.3946	-1.4329	-1.4561	-1.4717	-1.4829	-1.4914
5	-1.1405	-1.3500	-1.4407	-1.4887	-1.5181	-1.5381	-1.5525	-1.5635
4	-1.1456	-1.3800	-1.4897	-1.5497	-1.5871	-1.6127	-1.6313	-1.6454
3	-1.1496	-1.4100	-1.5427	-1.6181	-1.6661	-1.6993	-1.7235	-1.7420
2	-1.1524	-1.4400	-1.6016	-1.6982	-1.7612	-1.8053	-1.8379	-1.8630
1	-1.1541	-1.4700	-1.6714	-1.8008	-1.8888	-1.9520	-1.9994	-2.0362

END OF SECTION 110

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SUPPLEMENTAL GENERAL PROVISIONS

SUPPLEMENTAL GENERAL PROVISIONS

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SUPPLEMENTAL GENERAL PROVISIONS

SGP-1 SCOPE OF WORK. The Contractor shall, upon receipt of approval by the Federal Aviation Administration, perform everything required to be performed and shall provide and furnish all of the labor, necessary tools, incidentals, expendable equipment, and materials, if applicable, and all utility and transportation services required for the Runway 10-28 Extension & Overlay project at Delaware Municipal Airport, Delaware, Ohio in strict accordance with the plans and specifications, including any and all addenda, prepared by CHA Consulting, Inc. acting and in these project documents referred to as the Engineer, which plans and specifications are made a part of this contract, and in strict compliance with the Contractor's proposal and other contract documents herein mentioned which are a part of this contract; and the Contractor shall do everything required by this contract and the other documents constituting a part hereof.

The project is broken down into a base bid with a series of alternate bids. The scope of work will be set after bids are received and evaluated by the Owner. The Owner's objective is to complete as much of the project as possible without exceeding available funding.

The Contractor shall make a bid on all parts of the project (i.e. Base Bid and all alternates) as set out in the bid proposal packet. The Owner's intent is to award one contract to one contractor for a project consisting of the base bid and alternate bids in no particular order or number depending upon the bid prices and the amount of the available funding. Therefore, in preparing the bids, the Contractor shall consider the alternates as additions to the base bid and not as stand alone projects.

SGP-2 PROJECT FAMILIARIZATION. The Bidder's attention is directed to Section 20-06 of the General Provisions. Not all the details, characteristics, and nuances of the project are shown on the plans; therefore, the Bidder shall visit the site and familiarize himself with the project before submitting a proposal.

SGP-3 NOTICE TO PROCEED. The Notice to Proceed will be issued immediately after receiving the Federal Grant and will state the date that construction is to begin.

SGP-4 CONTRACT TIME. The contract time for the base bid and all alternate bids shall be substantially complete by July 27, 2016. The time limit is given in calendar days and includes time required for delivery of equipment and materials. Time will not be deleted for unaccepted bid alternates. The contract time is further broken down into the following phases as detailed on the Safety and Phasing plan sheets:

Phase 1A – 48 hours
Phase 1B – 61 calendar days
Phase 1C – 48 hours
Phase 2A – 48 hours
Phase 2B – 87 calendar days
Phase 2C – 11 calendar days
Phase 2D – 5 calendar days

The Notice to Proceed will state the date on which the contract time will begin (see Section 80-02).

SGP-5 LIQUIDATED DAMAGES. In accordance with General Provision Section 80-08, liquidated damages will be charged for failure to complete the contract work within the contract time as follows:

Phase 1A – $500 per hour
Phase 1B – $1,500 per calendar day
Phase 1C – $500 per hour
Phase 2A – $500 per hour
Phase 2B – $1,500 per calendar day
Phase 2C – $2,500 per calendar day
Phase 2D – $2,000 per calendar day

SGP-6 SCHEDULE OF WORK. Within ten (10) days following award of the contract, the Contractor shall submit a detailed schedule which takes into account expected dates for delivery of materials and sequence of construction. Monthly updates of the Contractor's schedule will be required.

SGP-7 RESPONSIBILITY FOR DAMAGE CLAIMS. The Contractor shall save and hold harmless the Owner and the Engineer, their officers, agents, and employees from and against all suits or claims that may be based upon alleged injury to any person or property that may occur, or may be alleged to have occurred, in the course of the performance of the contract by the Contractor, whether such claims shall be made by an employee of the Contractor or by a third person, and whether or not it shall be claimed that the alleged injury was caused by a negligent act or omission of the Contractor; and the Contractor shall, at his own cost and expense, pay all charges of attorneys and all costs and other expenses arising therefrom or incurred in connection therewith; and if any judgment shall be rendered against the Owner, the Engineer, or any officer, agent or employee of any thereof, the Contractor shall at his own cost and expense satisfy and discharge same.

SGP-8 PERMITS. The Contractor shall be responsible for obtaining all necessary permits from the affected agencies.

SGP-9 PROTECTION OF EXISTING PROPERTY. The Contractor shall take all necessary precautions, and perform the work in such a manner as to adequately protect and safeguard the existing properties including structures, utilities, etc., pavements, from any damage due to their operations. The Contractor shall be responsible for the cost of any repairs or replacement of any property, as directed by the Engineer, damaged by the Contractor's operations.

SGP-10 ITEMIZED PROPOSAL. A separately bound set of documents entitled Bid Proposal will be issued with the plans and Project Documents and Specifications. Proposals shall be prepared and submitted as directed in the Bid Proposal. For information, the pay item/quantity sheets are also included on the following pages.

SGP-11 CONTRACTOR PAYMENT. The Contractor may apply for progress payments in accordance with Section 90-06 of the General Provisions. The Contractor shall submit his invoice to the Engineer for certification on or before the monthly deadline date for doing such. The Engineer will check and certify the billing and forward to the Airport for payment. The Airport, upon receipt of the bill will submit a payment request to the FAA for releasing the necessary grant monies to pay the bill. The process normally takes 45 - 60 days from the time the billing is certified by the Engineer to when payment is received by the Contractor. The Airport cannot commit payment of a progress billing until the requested grant monies are released by the FAA.

SGP-12 CONTRACTOR'S STAGING AREA. See the Safety and Phasing plan sheets for the Contractor's Staging Area.

SGP-13 PREVAILING WAGE RATES. Wage rates for this project shall be in accordance with the schedules which are located in the Attachments section.

SGP-14 DAMAGE CLAIMS/INSURANCE. The Bidder's attention is called to General Provision 70-11.

Paragraph 70-11D of the General Provisions **shall not** be construed to mean that the Contractor is required to purchase a separate insurance policy for the Owner and the Engineer. The intent of this paragraph is that the Contractor's policy shall include the Owner and the Engineer as **Additional Insureds** to afford protection against all claims for damages resulting from the operations of the Contractor.

Should an Owner's and Contractor's Protective Liability (OCP) Policy or other special endorsement to Contractor's policies be needed to effectuate Engineer's status as Additional Named Insured due to lack of contractual privity between Engineer and Contractor, Contractor shall obtain such OCP Policy or endorsement.

SGP-15 PAVEMENT CLEANING OPERATIONS. The Contractor shall maintain a pavement cleaning operation during all times of work activity. All debris deposited on the pavement due to construction, equipment, or transit of materials, shall be removed immediately. Methods for the immediate removal of large debris, such as gravel, dirt clods, concrete chunks, material canisters, formwork, etc., shall be at the Contractor's discretion, subject to the approval of the Engineer. Dust control for debris, such as sand, concrete sawing residue, mud, etc., shall be performed with hand tools and self-propelled truck-type vacuum cleaners, as approved by the Engineer.

SGP-16 PRECONSTRUCTION CONFERENCE. The Contractor shall attend a preconstruction conference prior to beginning work to coordinate work procedures with all interested parties. The Contractor shall also attend any job meetings called by the Engineer.

SGP-17 AIRPORT SAFETY REQUIREMENTS/SAFETY PLAN. The Contractor's special attention is directed to the Airport Safety Requirements section of the specifications and the Safety Plan sheets of the plans, which shall be strictly enforced.

SGP-18 APPROVAL OF EQUIPMENT AND MATERIALS. No later than seven (7) days after the date of contract award, the Contractor shall submit to the Engineer for review and approval a minimum of five (5) copies (3 required by Owner/Engineer) of shop drawings, catalog cuts, **written manufacturer certification**, and any other information requested by the Engineer. The Contractor shall not order this material and equipment until specific manufacturer models and design details have been approved in writing by the Engineer.

Detailed shop drawings shall be required for all new equipment specified for this project. Any proposed deviation or alteration from what is being specified or detailed, including any changes to the wiring diagrams of panels to be fabricated, shall be clearly cited in the shop drawings submittal, with a written explanation as to why an alteration is being requested. It will be solely at the Engineer's discretion as to whether any alteration from what is specified will be allowed.

The Contractor is responsible for dimensions which shall be confirmed and correlated at the site; fabrication processes and techniques of construction; coordination of his work with that of all other trades; and the satisfactory performance of his work. Each submittal shall be provided with

the Contractor's stamp, initialed or signed, certifying the review of submittal, verification of field measurements, and compliance with the plans and specifications.

The Contractor shall review and approve shop drawings, product data, and samples prior to submission.

The Contractor shall verify:

a. Field Measurements
b. Field Construction Criteria
c. Catalog Numbers and Similar Data

The Contractor shall coordinate each submittal with requirements of the work and of the plans and specifications.

The Contractor's responsibility for errors and omissions in submittals is not relieved by Engineer's review of submittals.

The Contractor's responsibility for deviations in submittals from requirements of the plans and specifications is not relieved by the Engineer's review of submittals. The Contractor may submit specific deviations to the Engineer for review, but such deviations will require the Engineer's written approval for the specific deviation.

The Contractor shall provide a stamp, initialed or signed, certifying the review of the submittal, verification of field measurements, and compliance with the plans and specifications. All submittals shall include the specification item number, item description, and any other pertinent information.

The Contractor shall not begin work which requires submittals until return of submittals with the Engineer's stamp and initials or signature indicating review.

Where shop drawings prepared by one trade require cross checking with the shop drawings of some other trade or trades, the Contractor shall assemble the shop drawings of all interdependent trades, cross check and coordinate them himself, require corrections as necessary from the various trades and then present the corrected drawings in one submission. As an alternate to this procedure, the Contractor may make composite drawings showing the interrelation of the concerned trades and subsequent shop drawings of these trades shall be required to conform to these reviewed composite drawings. Fragmentary or piecemeal transmittals of shop drawings for individual trades in violation of this requirement will be returned to the Contractor unchecked and will not be accepted.

It shall be the Contractor's responsibility to distribute copies of the submittals following the Engineer's review and return of submittals to the Contractor.

SGP-19 CONTRACT DOCUMENT. The contract document to be executed for this project shall conform to the Sample Contract that is located in the 'Attachments' section of the Contract Documents and Specifications.

SGP-20 VEHICLES. All construction vehicles in use on the construction site shall be marked with the Contractor's name or logo. Only vehicles covered by the Contractor's insurance will be allowed within the construction area. No personally owned vehicles will be allowed within the construction area, except that construction employee parking will be allowed within the Contractor's staging area.

SGP-21 WAIVER OF LIENS. Prior to the Owner making final payment and releasing retainage, the Contractor shall furnish an unconditional waiver of lien from all subcontractors and suppliers providing materials stating they have been paid all money to which they are due. The Contractor shall also agree and warrant to the Owner that no liens shall be attached to the project by virtue of the Contractor's default in paying his employees or any subcontractor or in paying material suppliers. Should such a lien be filed, payments otherwise due the Contractor shall not be due until the Contractor has delivered to the Owner a complete release of such lien or a bond satisfactory to the Owner indemnifying the Owner against such lien.

SGP-22 EXISTING PAVEMENT. It is the responsibility of the Contractor to verify the elevations at all points where the new construction is to match existing pavement. The Contractor shall take all necessary precautionary measures, and perform the work in such a manner as to adequately protect and safeguard the existing pavement or pavement surface to remain in place from any damage due to such operations. The Contractor's attention is also called to the fact that the operation of crawler type construction equipment on those portions of the surface to remain in place will not be permitted, and the operation of overweight or oversize equipment in those areas shall be governed by State Laws and Regulations. Any damaged portion of surface or pavement and surface removed in excess of that required for the construction as set out in plans, shall be satisfactorily replaced or repaired by the Contractor at his own expense.

SGP-23 COOPERATION WITH PUBLIC UTILITIES. The plans show all known utilities located within the limits of this project according to information obtained from various utility companies. The accuracy of the plans in this respect is not guaranteed. The Contractor will be required to cooperate and coordinate his work with all utility companies within the limits of this project as directed by the Engineer.

SGP-24 CONTRACT AWARD. An award of contract will depend on receipt of federal funding. If an award has not been made within the 60 calendar day period after the opening of bids, the lowest responsible and responsive bidder may be asked to continue honoring their bid until federal funds become available. The award of contract will be contingent upon approval from the Federal Aviation Administration.

The Owner prefers to accomplish the entire scope of work shown in the plans. The bid alternates will be evaluated and added as funding allows. The contract will be awarded based on the lowest Responsible and Responsive sum of the base bid and accepted bid alternates.

SGP-25 EROSION CONTROL MEASURE INSPECTION REPORTS: All erosion control measures outlines in the plans and specifications shall be subject to the following additional requirements:

a. Inspection: All erosion and sediment control measures as specified in the erosion control plan shall be inspected by the Contractor as follows:

1) An inspection of erosion control measures in place shall be made at least once every seven (7) days.

2) All erosion control measures in place shall be inspected within 24 hours after any storm event greater that 0.5 inched of rain per 24 hour period.

3) Qualified personnel shall conduct a weekly inspection of the construction site to identify areas contributing to storm water discharges associated with construction activity.

4) Disturbed areas, material storage and equipment storage areas that are exposed to precipitation shall be inspected on a regular basis for evidence of, or the potential for, pollutants entering the drainage system.

5) Storm water discharge locations shall be inspected to determine if erosion control measures are effective in preventing significant impacts to receiving waters.

6) Erosion control devices installed as specified shall be observed to ensure that they are operating properly.

7) Haul routes and construction entrances to work areas shall be periodically inspected for evidence of off-site vehicle tracking of mud and dirt.

8) The Contractor's staging area shall be inspected to ensure that solid and liquid wastes are being properly disposed of and not allowed to be discharged into storm water runoff.

b. Inspection Reports: A report shall be completed summarizing the results of each inspection. The report shall include the name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the erosion control plan and a certification that the facility is in compliance with the plan and identify any incidents of non-compliance.

The attached inspection report form shall be used to record information obtained from field investigation of the erosion control measures. The record and certification shall be signed in accordance with the signatory requirements of the permit.

Inspection reports shall be maintained by the Contractor for two (2) years following board approval of final payment.

Copies of the reports shall be submitted to the Engineer with each invoice.

c. Maintenance: All erosion control measures shall be maintained throughout the project until such time as the distributed areas have been completely stabilized or other provisions have altered the need for these measures.

The Contractor shall:

1) Replace mulch materials to their original level when the level has been substantially reduced due to decomposition of the organic mulches and displacement or disappearance of both the organic and inorganic mulches.

2) Remove rubbish and channel obstructions from bare and vegetated channels within the project limits. The Contractor shall repair damage from scour or bank failure, rodent holes and breaching of diversion structures. Excessive wear, movement, or failure of erosion control blankets shall be repaired immediately. Deposits of sediment shall be removed from the channel.

3) Repair any damage to silt fence barriers immediately and monitor barriers daily during prolonged rainfall.

4) Repair or replace any silt fence fabric which has decomposed or become ineffective prior to its expected usable life.

5) Remove sediment deposits after each storm event. Sediment must be removed when deposits reach approximately half the height of the silt fence barrier.

6) Till and smooth to conform with the existing grade and reseed any sediment deposits remaining in place after the silt fence barrier is no longer required.

7) Maintain the construction entrances in a condition which will prevent tracking or flowing of sediment onto roads. This could require periodic top dressing with additional surface materials as conditions demand. Repair and clean out any features used to trap sediment and remove all sediment spilled, dropped, washed or tracked on road and return to the point of likely origin.

All temporary erosion and sediment control practices shall be removed and disposed of within thirty (30) days after final site stabilization is achieved or after the temporary practices are no longer needed. Trapped sediment shall be permanently stabilized to prevent further erosion.

SGP-26 RESTORATION OF CONSTRUCTION AREAS. All work necessary and incidental to the constructing, maintaining, and restoration to original or acceptable condition of staging areas, waste areas, and stockpile areas shall be considered incidental to the project and not paid for directly.

END OF SECTION

TECHNICAL PROVISIONS

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Item P-101 Surface Preparation

DESCRIPTION

101-1.1 This item shall consist of preparation of existing pavement surfaces for overlay, surface treatments, removal of existing pavement, and other miscellaneous items. The work shall be accomplished in accordance with these specifications and the applicable drawings.

EQUIPMENT

101-2.1 All equipment shall be specified here and in the following paragraphs or approved by the Engineer. The equipment shall not cause damage to the pavement to remain in place.

CONSTRUCTION

101-3.1 Removal of existing pavement.

a. Concrete pavement. The existing concrete pavement to be removed shall be freed from the pavement to remain by sawing through the complete depth of the slab one foot inside the perimeter of the final removal limits or outside the dowels, whichever is greater when the limits of removal are located on the joints. The pavement between the perimeter of the pavement removal and the saw cut shall be carefully broken up and removed using hand-held jackhammers, weighing 30 pounds or less, or other light-duty equipment which will not cause distress in the pavement which is to remain in place. The Contractor shall have the option of sawing through the dowels at the joint, removing the pavement and installing new dowels. Where the perimeter of the removal limits is not located on the joint and there are no dowels present, then the perimeter shall be saw cut the full depth of the pavement. The pavement inside the saw cut shall be removed by methods suitable to the Engineer which will not cause distress in the pavement which is to remain in place. All concrete pavement, including underlying base material, to be removed shall become the property of the Contractor and responsibly disposed off Airport property. The Contractor's removal operation shall not cause damage to cables, utility ducts, pipelines, or drainage structures under the pavement. Concrete slabs that are damaged by under breaking shall be removed. Any damage shall be repaired at the Contractor's expense.

b. Asphalt concrete pavement. Asphalt concrete pavement to be removed shall be cut to the full depth of the bituminous material around the perimeter of the area to be removed. The pavement shall be removed so the joint for each layer of pavement replacement is offset 1 foot from the joint in the preceding layer. This does not apply if the removed pavement is to be replaced with concrete or soil. All asphalt concrete pavement, including underlying base material, to be removed shall become the property of the Contractor and responsibly disposed off Airport property.

101-3.2 Preparation of joints and cracks. Remove all vegetation and debris from cracks to a minimum depth of 1 inch. If extensive vegetation exists treat the specific area with a concentrated solution of a water-based herbicide approved by the Engineer. Fill all cracks, ignoring hairline cracks (< 1/4 inch wide)

with a crack sealant per ASTM D6690. Wider cracks (over 1-1/2 inch wide), along with soft or sunken spots, indicate that the pavement or the pavement base should be repaired or replaced as stated below. Any excess joint or crack sealer on the surface of the pavement shall also be removed from the pavement surface.

Cracks and joints may be filled with a mixture of emulsified asphalt and aggregate. The aggregate shall consist of limestone, volcanic ash, sand, or other material that will cure to form a hard substance. The combined gradation shall be as shown in the following table.

Gradation

Sieve Size	Percent Passing
No. 4	100
No. 8	90-100
No. 16	65-90
No. 30	40-60
No. 50	25-42
No. 100	15-30
No. 200	10-20

Up to 3% cement can be added to accelerate the set time. The mixture shall not contain more than 20% natural sand without approval in writing from the Engineer.

The proportions of asphalt emulsion and aggregate shall be determined in the field and may be varied to facilitate construction requirements. Normally, these proportions will be approximately one part asphalt emulsion to five parts aggregate by volume. The material shall be poured or placed into the joints or cracks and compacted to form a voidless mass. The joint or crack shall be filled within 0 to 1/8 inches of the surface. Any material spilled outside the width of the joint shall be removed from the pavement surface prior to constructing the overlay. Where concrete overlays are to be constructed, only the excess joint material on the pavement surface and vegetation in the joints need to be removed.

101-3.3 Removal of paint and rubber. All paint and rubber over 1 foot wide that will affect the bond of the new overlay shall be removed from the surface of the existing pavement. Chemicals, high-pressure water, heater scarifier (asphaltic concrete only), cold milling, or sandblasting may be used. Any methods used shall not cause major damage to the pavement. Major damage is defined as changing the properties of the pavement or removing pavement over 1/8 inch deep. If chemicals are used, they shall comply with the state's environmental protection regulations. No material shall be deposited on the runway shoulders. All wastes shall be disposed of in areas indicated in this specification or shown on the plans.

101-3.4 Concrete spall or failed asphaltic concrete pavement repair.

a. Repair of concrete spalls in areas to be overlaid with asphalt. The Contractors shall repair all spalled concrete as shown on the plans or as directed by the Engineer. The perimeter of the repair shall be saw cut a minimum of 2 inches outside the affected area and 2 inches deep. The deteriorated material shall be removed to a depth where the existing material is firm or cannot be easily removed with a geologist pick. The removed area shall be filled with asphaltic concrete with a minimum Marshall

stability of 1,200 lbs and maximum flow of 20 (units of 0.01 in). The material shall be compacted with equipment approved by the Engineer until the material is dense and no movement or marks are visible. The material shall not be placed in lifts over 4 inches in depth. This method of repair applies only to pavement to be overlaid.

b. Asphaltic concrete pavement repair. The failed areas shall be removed as specified in paragraph 101-3.1b. All failed material including surface, base course, subbase course, and subgrade shall be removed. The base course and subbase shall be replaced if it has been infiltrated with clay, silt, or other material affecting the load-bearing capacity. Materials and methods of construction shall comply with the other applicable sections of this specification.

101-3.5 Cold milling. Milling shall be performed with a power-operated milling machine or grinder, capable of producing a finished surface that provides a good bond to the new overlay. The milling machine or grinder shall operate without tearing or gouging the under laying surface. The milling machine or grinder shall be equipped with automatic grade and slope controls. All millings shall be removed and disposed off Airport property, unless otherwise specified. If the Contractor mills or grinds deeper or wider than the plans specify, the Contractor shall replace the material that was removed with new material at no additional cost to the Owner.

a. Patching. The milling machine shall be capable of cutting a vertical edge without chipping or spalling the edges of the remaining pavement and it shall have a positive method of controlling the depth of cut. The Engineer shall layout the area to be milled with a straightedge in increments of 1 foot widths. The area to be milled shall cover only the failed area. Any excessive area that is milled because the Contractor doesn't have the appropriate milling machine, or areas that are damaged because of his negligence, shall not be included in the measurement for payment.

b. Profiling, grade correction, or surface correction. The milling machine shall have a minimum width of seven (7) feet and it shall be equipped with electronic grade control devices that will cut the surface to the grade and tolerances specified. The machine shall cut vertical edges. A positive method of dust control shall be provided. The machine shall have the ability to remove the millings or cuttings from the pavement and load them into a truck.

c. Clean-up. The Contractor shall sweep the milled surface daily and immediately after the milling until all residual aggregate and fines are removed from the pavement surface. Prior to paving, the Contractor shall wet down the milled pavement and thoroughly sweep and/or blow the surface to remove any remaining aggregate or fines.

101-3.6. Preparation of asphalt pavement surfaces. Existing asphalt pavements indicated to be treated with a surface treatment shall be prepared as follows:

a. Patch asphalt pavement surfaces that have been softened by petroleum derivatives or have failed due to any other cause. Remove damaged pavement to the full depth of the damage and replace with new asphalt concrete similar to that of the existing pavement in accordance with paragraph 101-3.4.

b. Repair joints and cracks in accordance with paragraph 101-3.2.

c. Remove oil or grease that has not penetrated the asphalt pavement by scraping or by scrubbing with a detergent, then wash thoroughly with clean water. After cleaning, treat these areas with an oil spot primer.

d. Clean pavement surface immediately prior to placing the surface treatment by sweeping, flushing well with water leaving no standing water, or a combination of both, so that it is free of dust, dirt, grease, vegetation, oil or any type of objectionable surface film.

101-3.7 Maintenance. The Contractor shall perform all maintenance work necessary to keep the pavement in a satisfactory condition until the full section is complete and accepted by the Engineer. The surface shall be kept clean and free from foreign material. The pavement shall be properly drained at all times. If cleaning is necessary or if the pavement becomes disturbed, any work repairs necessary shall be performed at the Contractor's expense.

101-3.8 Preparation of Joints in Rigid Pavement.

101-3.8.1 Removal of Existing Joint Sealant. All existing joint sealants will be removed by plowing or use of hand tools. Any remaining sealant and or debris will be removed by use of wire brushes or other tools as necessary. Resaw joints removing no more than 1/16 inch from each joint face. Immediately after sawing, flush out joint with water and other tools as necessary to completely remove the slurry. Allow sufficient time to dry out joints prior to sealing.

101-3.8.2 Cleaning prior to sealing. Immediately before sealing, joints shall be cleaned by removing any remaining laitance and other foreign material. Clean joints by sandblasting, or other method approved by the Engineer, on each joint face with nozzle held at an angle and not more than three inches from face. Following sandblasting, clean joints with air free of oil and water. Joint surfaces will be surface-dry prior to installation of sealant.

101-3.9 Preparation of Cracks in Flexible Pavement.

101-3.9.1 Preparation of Crack. Widen crack with router by removing a minimum of 1/16 inch from each side of crack. Immediately before sealing, joints will be blown out with a hot air lance combined with oil and water-free compressed air.

101-3.9.2 Removal of Existing Sealant. Existing sealants will be removed by routing. Following routing any remaining debris will be removed by use of a hot lance combined with oil and water-free compressed air.

METHOD OF MEASUREMENT

101-4.1 Pavement removal. The unit of measurement for pavement removal shall be the number of square yards removed by the Contractor. Any pavement removed outside the limits of removal because the pavement was damaged by negligence on the part of the Contractor shall not be included in the measurement for payment.

101-4.2 Joint and crack repair. The unit of measurement for joint and crack repair shall be the linear foot of joint.

101-4.3 Paint and rubber removal. The unit of measurement for paint and rubber removal shall be the square foot.

101-4.4 Spalled and failed asphaltic concrete pavement repair (Undistributed):

a. The unit of measure for failed asphaltic concrete pavement shall be square feet.

101-4.5 Cold milling. The unit of measure for cold milling shall be variable depth milling (1.50 inches to 2.41 inches) per square yard. The location and average depth of the cold milling shall be determined and agreed to by the Engineer and the Contractor prior to beginning the work. If the initial cut doesn't correct the condition and surface correction is required, the Contractor shall re-mill the area and will be paid only once for the total depth of milling.

BASIS OF PAYMENT

101-5.1 Payment. Payment shall be made at contract unit price for the unit of measurement as specified above. This price shall be full compensation for furnishing all materials and for all preparation, hauling, and placing of the material and for all labor, equipment, tools, and incidentals necessary to complete this item.

Item P 101-5.1	Pavement Removal -- per square yard
Item P 101-5.2	Crack Repair -- per linear foot
Item P 101-5.3	Paint Removal -- per square foot
Item P-101-5.4	Failed Asphaltic Concrete Pavement Repair (Undistributed) -- per square foot
Item P-101-5.5	Cold Milling -- per square yard

MATERIAL REQUIREMENTS

ASTM D6690	Standard Specification For Joint And Crack Sealants, Hot Applied, For Concrete And Asphalt Pavements

END OF ITEM P-101

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Item P-152 Excavation, Subgrade, and Embankment

DESCRIPTION

152-1.1 This item covers excavation, disposal, placement, and compaction of all materials within the limits of the work required to construct safety areas, runways, taxiways, aprons, and intermediate areas as well as other areas for drainage, building construction, parking, or other purposes in accordance with these specifications and in conformity to the dimensions and typical sections shown on the plans.

152-1.2 Classification. All material excavated shall be classified as defined below:

a. Unclassified excavation. Unclassified excavation shall consist of the excavation and disposal of all material, regardless of its nature.

152-1.3 Unsuitable excavation. Any material containing vegetable or organic matter, such as muck, peat, organic silt, or sod shall be considered unsuitable for use in embankment construction. Material, suitable for topsoil may be used on the embankment slope when approved by the Engineer.

CONSTRUCTION METHODS

152-2.1 General. Before beginning stripping topsoil, excavation, grading, and embankment operations in any area, all erosion, sedimentation and pollution controls shown in the approved SWPPP for the project shall be in placed in accordance with Item P-156.

The suitability of material to be placed in embankments shall be subject to approval by the Engineer. All unsuitable material shall be disposed of in waste areas shown on the plans. All waste areas shall be graded to allow positive drainage of the area and of adjacent areas. The surface elevation of waste areas shall not extend above the surface elevation of adjacent usable areas of the airport, unless specified on the plans or approved by the Engineer.

When the Contractor's excavating operations encounter artifacts of historical or archaeological significance, the operations shall be temporarily discontinued and the Engineer notified per subsection 70-20. At the direction of the Engineer, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and allow for their removal. Such excavation will be paid for as extra work.

Those areas outside of the limits of the pavement areas where the top layer of soil material has become compacted by hauling or other Contractor activities shall be scarified and disked to a depth of 4 inches, to loosen and pulverize the soil.

If it is necessary to interrupt existing surface drainage, sewers or under-drainage, conduits, utilities, or similar underground structures, the Contractor shall be responsible for and shall take all necessary precautions to preserve them or provide temporary services. When such facilities are encountered, the Contractor shall notify the Engineer, who shall arrange for their removal if necessary. The Contractor, at his or her expense, shall satisfactorily repair or pay the cost of all damage to such facilities or structures that may result from any of the Contractor's operations during the period of the contract.

152-2.2 Excavation. No excavation shall be started until the work has been staked out by the Contractor and the Engineer has obtained from the Contractor, the survey notes of the elevations and measurements of the ground surface. All areas to be excavated shall be stripped of vegetation and topsoil. Topsoil shall be stockpiled for future use in areas designated on the plans or by the Engineer. All suitable excavated material shall be used in the formation of embankment, subgrade, or other purposes shown on the plans. All unsuitable material shall be disposed of as shown on the plans.

When the volume of the excavation exceeds that required to construct the embankments to the grades indicated, the excess shall be used to grade the areas of ultimate development or disposed as directed by the Engineer. When the volume of excavation is not sufficient for constructing the embankments to the grades indicated, the deficiency shall be obtained from borrow areas.

The grade shall be maintained so that the surface is well drained at all times. When necessary, temporary drains and drainage ditches shall be installed to intercept or divert surface water that may affect the work.

a. Selective grading. When selective grading is indicated on the plans, the more suitable material designated by the Engineer shall be used in constructing the embankment or in capping the pavement subgrade. If, at the time of excavation, it is not possible to place this material in its final location, it shall be stockpiled in approved areas so that it can be measured for payment as specified in paragraph 152-3.3.

b. Undercutting (Undistributed). Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for safety areas, subgrades, roads, shoulders, or any areas intended for turf shall be excavated to a minimum depth of 12 inches below the subgrade or to the depth specified by the Engineer. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified. Unsuitable materials shall be disposed off the airport. The cost is incidental to this item. This excavated material shall be paid for at the contract unit price per cubic yard for undercut (undistributed). The excavated area shall be backfilled with suitable material obtained from the grading operations or borrow areas and compacted to specified densities. The necessary backfill will constitute a part of the embankment. Where rock cuts are made, backfill with select material. Any pockets created in the rock surface shall be drained in accordance with the details shown on the plans.

c. Overbreak. Overbreak, including slides, is that portion of any material displaced or loosened beyond the finished work as planned or authorized by the Engineer. All overbreak shall be graded or removed by the Contractor and disposed of as directed by the Engineer. The Engineer shall determine if the displacement of such material was unavoidable and his or her decision shall be final. Payment will not be made for the removal and disposal of overbreak that the Engineer determines as avoidable. Unavoidable overbreak will be classified as “Unclassified Excavation.”

d. Removal of utilities. The removal of existing structures and utilities required to permit the orderly progress of work will be accomplished by someone other than the Contractor; for example, the utility unless otherwise shown on the plans. All existing foundations shall be excavated at least 2 feet below the top of subgrade or as indicated on the plans, and the material disposed of as directed by the Engineer. All foundations thus excavated shall be backfilled with suitable material and compacted as specified.

e. Compaction requirements. The subgrade under areas to be paved shall be compacted to depths and densities as shown in Table 152-1.

TABLE 152-1

SUBGRADE COMPACTION REQUIREMENTS

Flexible Pavements								
Design Gross Aircraft Weight (lbs)	NON-COHESIVE SOILS DEPTH OF COMPACTION				COHESIVE SOILS DEPTH OF COMPACTION			
	INCHES				INCHES			
	100%	95%	90%	85%	95%	90%	85%	80%
Single Wheel								
30,000	8	8 - 18	18 - 32	32 - 44	6	6 - 9	9 - 12	12 - 17
50,000	10	10 - 24	24 - 36	36 - 48	6	6 - 9	9 - 16	16 - 20
75,000	12	12 - 30	30 - 40	40 - 52	6	6 - 12	12 - 19	19 - 25
Dual Wheel								
50,000	12	12 - 28	28 - 38	38 - 50	6	6 - 10	10 - 17	17 - 22
100,000	17	17 - 30	30 - 42	42 - 55	6	6 - 12	12 - 19	19 - 25
150,000	19	19 - 32	32 - 46	46 - 60	7	7 - 14	14 - 21	21 - 28
200,000 incl. C-130	21	21 - 37	37 - 53	53 - 69	8	8 - 16	16 - 24	24 - 32

Notes:

1. Compaction densities shall be determined by ASTM D698 (Standard Proctor) when the gross weight of the design aircraft is 60,000 pounds or less, or by ASTM D1557 (Modified Proctor) when the gross weight of the design aircraft is greater than 60,000 pounds. The gross weight of the design aircraft shall be as specified on the Typical Section Sheet.

2. In cut or fill areas, the subgrade should have the natural densities shown or should be compacted from the surface to achieve the required densities. Proof rolling shall be required to determine the acceptability of the in-situ subgrade prior to placement of embankment in fill area or the pavement section in cut areas. A proof roll within the limits of paved areas shall be conducted with a fully loaded pan, a triaxle dump truck with 20 tons of payload, or other method and equipment as approved by the Engineer.

3. After the grade has been excavated to subgrade elevation in cut areas and where proof rolling has shown that soft and yielding soil conditions exist indicating that the compaction requirements in Table 152-1 have not been met, the Engineer may order these areas to be disked, dried, or otherwise manipulated to a depth of 12” and recompacted per Section 152-2.6. There will be no direct payment for this item and the cost to complete this item shall be included in the unit cost for unclassified excavation. If soft and yielding conditions still exist, the Engineer may direct the area to be undercut by removing, manipulating and replacing suitable soil or undercut with “Special Subgrade Treatment” per Section 152-2.2A.

4. Non-cohesive soils for the purpose of determining compaction control are those with a plasticity index (PI) of less than 6.

5. The term flexible pavement, as used in Table 152-1, applies only to those pavements of which the finish surface and other stabilized components of the pavement section are constructed of bituminous materials. The term flexible pavement does not include bituminous materials used

as a stabilized base course for rigid pavements. Compaction requirements for those areas shall be the same as rigid pavements.

The in-place field density shall be determined in accordance with ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. Stones or rock fragments larger than 4 inches in their greatest dimension will not be permitted in the top 6 inches of the subgrade. The finished grading operations, conforming to the typical cross-section, shall be completed and maintained at least 1,000 feet ahead of the paving operations or as directed by the Engineer.

All loose or protruding rocks on the back slopes of cuts shall be pried loose or otherwise removed to the slope finished grade line. All cut-and-fill slopes shall be uniformly dressed to the slope, cross-section, and alignment shown on the plans or as directed by the Engineer.

Blasting shall not be allowed.

f. Proof rolling. After compaction is completed, the subgrade area shall be proof rolled with a heavy pneumatic-tired roller having four or more tires abreast, each tire loaded to a minimum of 30,000 pounds and inflated to a minimum of 125 psi in the presence of the Engineer. Apply a minimum of two (2) coverages, or as specified by the Engineer, to all paved areas. A coverage is defined as the application of one tire print over the designated area. Soft areas of subgrade that deflect more than 1 inch or show permanent deformation greater than 1 inch shall be removed and replaced with suitable material or reworked to conform to the moisture content and compaction requirements in accordance with these specifications.

152-2.2A Special Subgrade Treatment (Undistributed). In cut areas, if soft and yielding conditions still exist after the Contractor has disked, dried, or otherwise manipulated subgrade areas, the Engineer may order the soft and yielding soils to be removed and replaced with aggregate if the areas that have been undercut contain material upon which it is unsuitable to place compacted embankment. The limits and depth of excavation and placement of aggregate will be as directed by the Engineer.

Aggregates shall be ODOT No. 304 or No. 2, as selected by the Engineer, meeting the requirements of the State of Ohio Department of Transportation Construction and Material Specifications. Upon completion of the excavation, the bottom of the excavated area shall be compacted as directed by the Engineer. After compaction of the bottom of the excavation, the aggregate shall be placed in lifts not-to-exceed 8 inches in depth and compacted in accordance with this section. Both the lift thickness and compaction requirements may be altered as directed by the Engineer.

This work shall be paid for as “Special Subgrade Treatment,” which shall include excavation and aggregate backfill. Measurement for areas which are excavated and replaced with aggregate shall be the neat line measurement in cubic yards as directed by the Engineer. If included in the as an item in the bid proposal, the aggregate shall be drained by installing 4” HDPE underdrain pipe as directed by the Engineer.

The Engineer shall determine what materials are unsuitable. Soils with excessive moisture WILL NOT be classified as unsuitable, if in the opinion of the Engineer, drying of the soil would make acceptable embankment and/or subgrade.

152-2.3 Borrow excavation. Borrow areas within the airport property are indicated on the plans. Borrow excavation shall be made only at these designated locations and within the horizontal and vertical limits as staked or as directed by the Engineer.

When borrow sources are outside the boundaries of the airport property, it shall be the Contractor's responsibility to locate and obtain the borrow sources, subject to the approval of the Engineer. The Contractor shall notify the Engineer at least 15 days prior to beginning the excavation so necessary measurements and tests can be made. All borrow pits shall be opened up to expose the various strata of acceptable material to allow obtaining a uniform product. All unsuitable material shall be disposed of by the Contractor. Borrow pits shall be excavated to regular lines to permit accurate measurements, and they shall be drained and left in a neat, presentable condition with all slopes dressed uniformly.

152-2.4 Drainage excavation. Drainage excavation shall consist of excavating for drainage ditches such as intercepting; inlet or outlet ditches; for temporary levee construction; or for any other type as designed or as shown on the plans. The work shall be performed in sequence with the other construction. Intercepting ditches shall be constructed prior to starting adjacent excavation operations. All satisfactory material shall be placed in embankment fills; unsuitable material shall be placed in designated waste areas or as directed by the Engineer. All necessary work shall be performed true to final line, elevation, and cross-section. The Contractor shall maintain ditches constructed on the project to the required cross-section and shall keep them free of debris or obstructions until the project is accepted.

152-2.5 Preparation of embankment area. Where an embankment is to be constructed to a height of 4 feet or less, all sod and vegetative matter shall be removed from the surface upon which the embankment is to be placed. The cleared surface shall be broken up by plowing or scarifying to a minimum depth of 6 inches and shall then be compacted as indicated in paragraph 152-2.6. When the height of fill is greater than 4 feet, sod not required to be removed shall be thoroughly disked and recompacted to the density of the surrounding ground before construction of embankment.

Sloped surfaces steeper than one (1) vertical to four (4) horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill.

No direct payment shall be made for the work performed under this section. The necessary clearing and grubbing and the quantity of excavation removed will be paid for under the respective items of work.

152-2.6 Formation of embankments. Embankments shall be formed in successive horizontal layers of not more than 8 inches in loose depth for the full width of the cross-section, unless otherwise approved by the Engineer.

The layers shall be placed, to produce a soil structure as shown on the typical cross-section or as directed by the Engineer. Materials such as brush, hedge, roots, stumps, grass and other organic matter, shall not be incorporated or buried in the embankment.

Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained because of rain, freezing, or other unsatisfactory weather conditions in the field. Frozen material shall not be placed in the embankment nor shall embankment be placed upon frozen material. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. The Contractor shall drag, blade, or slope the embankment to provide surface drainage at all times.

The material in each layer shall be within ±2% of optimum moisture content before rolling to obtain the prescribed compaction. To achieve a uniform moisture content throughout the layer, the material shall be moistened or aerated as necessary. Samples of all embankment materials for testing, both before

and after placement and compaction, will be taken for each 1,000 square yards of material placed per lift. Based on these tests, the Contractor shall make the necessary corrections and adjustments in methods, materials or moisture content to achieve the specified embankment density.

Rolling operations shall be continued until the embankment is compacted to not less than 95% of maximum density for noncohesive soils, and 90% of maximum density for cohesive soils as determined by ASTM D1557. Under all areas to be paved, the embankments shall be compacted per Table 152-1.

On all areas outside of the pavement areas, no compaction will be required on the top 4 inches.

The in-place field density shall be determined in accordance with ASTM 6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. The Engineer shall perform all density tests**.**

Compaction areas shall be kept separate, and no layer shall be covered by another layer until the proper density is obtained.

During construction of the embankment, the Contractor shall route all construction equipment evenly over the entire width of the embankment as each layer is placed. Layer placement shall begin in the deepest portion of the embankment fill. As placement progresses, the layers shall be constructed approximately parallel to the finished pavement grade line.

When rock and other embankment material are excavated at approximately the same time, the rock shall be incorporated into the outer portion of the embankment and the other material shall be incorporated under the future paved areas. Stones or fragmentary rock larger than 4 inches in their greatest dimensions will not be allowed in the top 6 inches of the subgrade. Rockfill shall be brought up in layers as specified or as directed by the Engineer and the finer material shall be used to fill the voids with forming a dense, compact mass. Rock or boulders shall not be disposed of outside the excavation or embankment areas, except at places and in the manner designated on the plans or by the Engineer.

When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in layers of the prescribed thickness without crushing, pulverizing or further breaking down the pieces, such material may be placed in the embankment as directed in layers not exceeding 2 feet in thickness. Each layer shall be leveled and smoothed with suitable equipment by distribution of spalls and finer fragments of rock. The layer shall not be constructed above an elevation 4 feet below the finished subgrade.

There will be no separate measurement of payment for compacted embankment. All costs incidental to placing in layers, compacting, discing, watering, mixing, sloping, and other operations necessary for construction of embankments will be included in the contract price for excavation, borrow, or other items.

152-2.7 Finishing and protection of subgrade. After the subgrade is substantially complete, the Contractor shall remove any soft or other unstable material over the full width of the subgrade that will not compact properly. All low areas, holes or depressions in the subgrade shall be brought to grade with suitable select material. Scarifying, blading, rolling and other methods shall be performed to provide a thoroughly compacted subgrade shaped to the lines and grades shown on the plans.

Grading of the subgrade shall be performed so that it will drain readily. The Contractor shall protect the subgrade from damage and limit hauling over the finished subgrade to only traffic essential for

construction purposes. All ruts or rough places that develop in the completed subgrade shall be graded and recompacted.

No subbase, base, or surface course shall be placed on the subgrade until the subgrade has been approved by the Engineer.

All proposed and future pavement and building subgrade areas shall be protected by the Contractor and shall not be used as haul routes in embankment areas or in cut areas when within three feet of the proposed subgrade elevation. All subgrade areas damaged by the Contractor shall be undercut and replaced with suitable materials or repaired by other methods approved by the Engineer at no cost to the Owner.

152-2.8 Haul. All hauling will be considered a necessary and incidental part of the work. The Contractor shall include the cost in the contract unit price for the pay of items of work involved. No payment will be made separately or directly for hauling on any part of the work.

152-2.9 Tolerances. In those areas upon which a subbase or base course is to be placed, the top of the subgrade shall be of such smoothness that, when tested with a 12-foot straightedge applied parallel and at right angles to the centerline, it shall not show any deviation in excess of 1/2 inch, or shall not be more than 0.05 feet from true grade as established by grade hubs. Any deviation in excess of these amounts shall be corrected by loosening, adding, or removing materials; reshaping; and recompacting.

On safety areas, intermediate and other designated areas, the surface shall be of such smoothness that it will not vary more than 0.10 feet from true grade as established by grade hubs. Any deviation in excess of this amount shall be corrected by loosening, adding or removing materials, and reshaping.

152-2.10 Topsoil. When topsoil is specified or required as shown on the plans or under Item T-905, it shall be salvaged from stripping or other grading operations. The topsoil shall meet the requirements of Item T-905. If, at the time of excavation or stripping, the topsoil cannot be placed in its final section of finished construction, the material shall be stockpiled at approved locations. Stockpiles shall not be placed within safety areas and clear zones denoted on the project Safety and Phasing Plans for active runway and taxiway pavements and shall not be placed on areas that subsequently will require any excavation or embankment fill. If, in the judgment of the Engineer, it is practical to place the salvaged topsoil at the time of excavation or stripping, the material shall be placed in its final position without stockpiling or further rehandling.

Upon completion of grading operations, stockpiled topsoil shall be handled and placed as directed, or as required in Item T-905.

No direct payment will be made for topsoil under Item P-152. The quantity removed and placed directly or stockpiled and later rehandled shall be considered incidental to this Item.

METHOD OF MEASUREMENT

152-3.1 The quantity of “Unclassified Excavation” will not be field measured, but will be based on the design quantity specified within the neat lines of the cross sections on the plans, increased or decreased by authorized adjustments.

It is not the intent of this specification to change the plan quantity for payment as a result of minor discrepancies in the plotting of cross sections, calculation of the end areas, and the subsequent computation of the plan volume of the earthwork quantities. No adjustment of the plan quantities or

recalculation of the volumes shall be made for any two consecutive cross section end areas found different by less than five percent from the plan quantity. The Contractor shall accept the plan quantity with authorized changes as payment in full unless revised by the Engineer. The burden of proof of a plan discrepancy greater than five percent on two consecutive end areas is on the Contractor. The Contractor shall submit supporting documentation concerning the possible changes. Any adjustments to the plan quantities requested by the Contractor shall be reviewed and a determination made by the Engineer prior to the start of any earth moving operations.

Adjustments to the design quantities of "Unclassified Excavation" will be authorized by the Engineer for the following reasons only:

a. Changes in the quantity of work due to benching, undercutting, changing slopes or grades, removing slides, and any other required procedures.
b. Corrections or major errors in the plans. Major errors are defined as individual mistakes of 5 percent or more in the quantity of earthwork between two consecutive cross sections, for omissions, duplications, or other errors in the survey or in the plans, but not for minor discrepancies in the plotting of cross sections, in the planimetering of cross sections, and in the resulting computation of the volume of earthwork.
c. Mathematical mistakes.

152-3.2 The quantity of "Undercut (Undistributed)" to be paid for shall be the number of cubic yards measured in its original position.

152-3.3 The quantity of "Special Subgrade Treatment (Undistributed)" shall be the neat line measurement in cubic yards for areas which are excavated and replaced with stone and accepted.

Measurement shall not include the quantity of materials excavated without authorization beyond normal slope lines, or the quantity of material used for purposes other than those directed.

BASIS OF PAYMENT

152-4.1 "Unclassified excavation" payment shall be made at the contract unit price per cubic yard. This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item**.**

152-4.2 For "Undercut (Undistributed)" payment shall be made at the contract unit price per cubic yard. This price shall be full compensation for furnishing all materials, labor, equipment, tools, transportation, operation, and work incidental thereto necessary to complete the item.

152-4.3 For "Special Subgrade Treatment (Undistributed)" payment shall be made at the contract unit price per cubic yard of excavation and stone backfill. This price shall be full compensation for all excavation, hauling, material, and compaction as required. Areas that are undercut and replaced with suitable soil shall be paid at the contract unit price for "Undercut (Undistributed)."

Payment will be made under:

Item P-152-4.1	Unclassified Excavation -- per cubic yard
Item P-152-4.2	Undercut (Undistributed) -- per cubic yard
Item P-152-4.3	Special Subgrade Treatment (Undistributed) -- per cubic yard

TESTING REQUIREMENTS

ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2700 kN-m/m^3))
ASTM D2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

END OF ITEM P-152

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Item P-153 Controlled Low-Strength Material (CLSM)

DESCRIPTION

153-1.1 This item shall consist of furnishing, transporting, and placing a controlled low-strength material (CLSM) as flowable backfill in trenches or as backfill around structures, or at other locations shown on the plans or as directed by the Engineer.

MATERIALS

153-2.1 Materials.

a. Portland cement. Portland cement shall conform to the requirements of ASTM 150 Type I. If for any reason, cement becomes partially set or contains lumps of caked cement, it shall be rejected. Cement salvaged from discarded or used bags shall not be used.

b. Fly ash. Fly ash shall conform to ASTM C618, Class C or F.

c. Fine aggregate (sand). Fine aggregate shall conform to the requirements of ASTM C33 except for aggregate gradation. Any aggregate gradation which produces performance characteristics of the CLSM specified here will be accepted, except as follows.

Sieve Size	Percent Passing by weight
3/4 inch	100
No. 200	0 - 12

d. Water. Water used in mixing shall be potable and free of oil, salt, acid, alkali, sugar, vegetable matter, or other substances injurious to the finished product.

MIX DESIGN

153-3.1 Proportions. The Contractor shall submit, to the Engineer, a mix design including the proportions and source of aggregate, fly ash, cement, water, and approved admixtures. No CLSM mixture shall be produced for payment until the Engineer has given written approval of the proportions. The proportions shall be prepared by a laboratory and shall remain in effect for the duration of the project. Laboratory costs are incidental to this item. The proportions shall establish a single percentage or weight for aggregate, fly ash, cement, water, and any admixtures proposed.

a. Compressive strength. CLSM shall be designed to achieve a 28-day compressive strength of 100 to 200 psi when tested in accordance with ASTM D4832. There should be no significant strength gain after 28 days.

b. Consistency. CLSM should be designed to achieve a consistency that will produce an approximate 8-inch diameter circular-type spread without segregation when tested by: (1) filling a 3-inch inside

diameter by 6-inch length flow cylinder (non-absorbent pipe) (2) strike off of the flow cylinder and start of lift within five seconds of filling and (3) by steady upward pull, lift the cylinder in a time period of between two and four seconds. Adjustments of the material proportions should be made to achieve proper solid suspension and flowable characteristics, however the theoretical yield shall be maintained at one cubic yard for the given batch weights.

CONSTRUCTION METHODS

153-4.1 Placement.

a. Placement. CLSM may be placed by any reasonable means from a mixing unit into the space to be filled. Agitation is required during transportation and waiting time. Placement shall be performed so structures or pipes are not displaced from their final position and intrusion of CLSM into unwanted areas is avoided. The material shall be brought up uniformly to the fill line shown on the plans or as directed by the Engineer. Each placement of CLSM shall be as continuous an operation as possible. If CLSM is placed in more than one layer, the base layer shall be free of surface water and loose foreign material prior to placement of the next layer.

b. Limitations of placement. CLSM shall not be placed on frozen ground. Mixing and placing may begin when the air or ground temperature is at least 35°F and rising. At the time of placement, CLSM shall have a temperature of at least 40°F. Mixing and placement shall stop when the air temperature is 40°F and falling or when the anticipated air or ground temperature will be 35°F or less in the 24 hour period following proposed placement.

153-4.2 Curing and protection

a. Curing. The air in contact with the CLSM shall be maintained at temperatures above freezing for a minimum of 72 hours. If the CLSM is subjected to temperatures below 32°F, the material may be rejected by the Engineer if damage to the material is observed.

b. Protection. The CLSM shall not be subject to loads and shall remain undisturbed by construction activities for a period of 48 hours or until a compressive strength of 15 psi is obtained. The Contractor shall be responsible for providing evidence to the Engineer that the material has reached the desired strength. Acceptable evidence shall be based upon compressive tests made in accordance with paragraph 153-3.1a.

153-4.3 Acceptance. Acceptance of CLSM delivered and placed as shown on the plans or as directed by the Engineer shall be based upon mix design approval and batch tickets provided by the Contractor to confirm that the delivered material conforms to the mix design. The Contractor shall verify by additional testing, each 1,000 cubic yards of material used. Verification shall include confirmation of material proportions and tests of compressive strength to confirm that the material meets the original mix design and the requirements of CLSM as defined in this specification. Adjustments shall be made as necessary to the proportions and materials prior to further production.

METHOD OF MEASUREMENT

153-5.1 Measurement. No separate measurement shall be made for Controlled Low-Strength Material (CLSM).

BASIS OF PAYMENT

153-6.1 Payment. No separate payment shall be made for Controlled Low-Strength Material. This item shall be considered incidental to other pay items.

TESTING REQUIREMENTS

ASTM D4832	Standard Test Method for Preparation and Testing of Controlled Low-Strength Material (CLSM) Test Cylinders

MATERIAL REQUIREMENTS

ASTM C33	Standard Specification for Concrete Aggregates
ASTM C150	Standard Specification for Portland Cement
ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C595	Standard Specification for Blended Hydraulic Cements

END OF ITEM P-153

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Item P-154 Subbase Course

DESCRIPTION

154-1.1 This item shall consist of a subbase course composed of granular materials constructed on a prepared subgrade or underlying course in accordance with these specifications, and in conformity with the dimensions and typical cross-section shown on the plans.

MATERIALS

154-2.1 Materials. The subbase material shall consist of hard durable particles or fragments of granular aggregates. This material will be mixed or blended with fine sand, clay, stone dust, or other similar binding or filler materials produced from approved sources. This mixture must be uniform and shall comply with the requirements of these specifications as to gradation, soil constants, and shall be capable of being compacted into a dense and stable subbase. The material shall be free from vegetative matter, lumps or excessive amounts of clay, and other objectionable or foreign substances. Pit-run material may be used, provided the material meets the gradation requirements specified.

Gradation Requirements

Sieve designation (square openings) as per ASTM C136 and ASTM D422	Percentage by weight passing sieves
3 inch (75 mm)	100
No. 10 (2.0 mm)	20-100
No. 40 (0.450 mm)	5-60
No. 200 (0.075 mm)	0-8

The portion of the material passing the No. 40 (0.450 mm) sieve shall have a liquid limit of not more than 25 and a plasticity index of not more than six (6) when tested in accordance with ASTM D4318.

The material finer than 0.02 mm shall be limited to a maximum of 3% and the maximum allowable material passing the No. 200 sieve shall be reduced from 0-8% to 0-5%. Testing per ASTM D422 will be required for the percentage passing the 0.02 mm particle size once per lot.

154-2.2 Sampling and testing. Material used on the project shall be sampled per ASTM D75 and tested per ASTM C136 and ASTM C117. Results shall be furnished to the Engineer by the Contractor prior to the start of construction and once per day during construction.

CONSTRUCTION METHODS

154-3.1 General. The subbase course shall be placed where designated on the plans or as directed by the Engineer. The material shall be shaped and thoroughly compacted within the tolerances specified.

Granular subbases which, due to grain sizes or shapes, are not sufficiently stable to support the construction equipment without movement, shall be mechanically stabilized to the depth necessary to provide stability as directed by the Engineer. The mechanical stabilization shall include the addition of a fine-grained medium to bind the particles of the subbase material sufficiently to furnish a bearing strength, so the course will not deform under construction equipment traffic. The addition of the binding medium to the subbase material shall not increase the soil constants of that material above the specified limits.

154-3.2 Operation in pits. The subbase material shall be obtained from pits or sources that have been approved by the Engineer. The material in the pits shall be excavated and handled to produce a uniform and satisfactory product. All work involved in clearing and stripping pits and handling unsuitable material encountered shall be performed by the Contractor. The cost of this work is incidental to this item.

154-3.3 Preparing underlying course. Prior to constructing the subbase course, clean the underlying course or subgrade of all foreign substances. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. Correct ruts, or soft yielding spots, in the underlying courses and subgrade areas having inadequate compaction and deviations of the surface from the specified requirements by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses or subgrades containing sands or gravels, as defined in ASTM D2487, the surface shall be stabilized prior to placement of the overlying course. Accomplish stabilization by mixing the overlying course material into the underlying course, and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements for the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained in a satisfactory condition until the overlying course is placed. The course shall be checked and accepted by the Engineer before placing and spreading operations are started.

To protect the subgrade and to ensure proper drainage, the spreading of the subbase shall begin along the centerline of the pavement on a crowned section or on the high side of pavements with a one-way slope.

154-3.4 Materials acceptance in existing condition. When the entire subbase material is in a uniform and satisfactory condition at approximately the required moisture content, the approved material may be moved directly to the spreading equipment for placing. The material may be obtained from gravel pits, stockpiles, or may be produced from a crushing and screening plant with proper blending. The materials from these sources shall meet the requirements for gradation, quality, and consistency. The intent of the specifications is to secure materials that will not require further mixing. The moisture content of the material shall be approximately that required to obtain maximum density. Any minor deficiency or excess in moisture content may be corrected by surface sprinkling or by aeration. Some mixing or aeration may be required prior to rolling to obtain the required moisture content. Blading or dragging, if necessary, shall be performed to obtain a smooth uniform surface true to line and grade.

154-3.5 Plant mixing. When materials from several sources will be blended and mixed, the subbase material shall be processed in a central or travel mixing plant. The subbase material, together with any blended material, shall be thoroughly mixed with the required amount of water. After the mixing is complete, the material shall be transported to and spread on the underlying course without undue loss of moisture content.

154-3.5.1 Mixed in place. When materials from different sources are to be proportioned and mixed or blended in place, the relative proportions of the components of the mixture shall be as designated by the Engineer.

The subbase material shall be deposited and spread evenly to a uniform thickness and width. Then the binder, filler or other material shall be deposited and spread evenly over the first layer. There shall be as many layers of materials added as the Engineer may direct to obtain the required subbase mixture.

When the required amount of materials have been placed, they shall be thoroughly mixed and blended by means of graders, discs, harrows, rotary tillers, supplemented by other suitable equipment if necessary. The mixing shall continue until the mixture is uniformly blended. Areas of segregated material shall be corrected by the addition of binder or filler material and by thorough remixing. Water shall be uniformly applied prior to and during the mixing operations, if necessary, to maintain the material at its required moisture content. When the mixing and blending has been completed, the material shall be spread in a uniform layer which, when compacted, will meet the requirements of thickness and typical cross-section.

154-3.6 General methods for placing. The subbase course shall be constructed in layers of not less than 3 inches nor more than 8 inches of compacted thickness. The subbase material shall be deposited and spread evenly to a uniform thickness and width. The material, as spread, shall be of uniform gradation with no pockets of fine or coarse materials. The subbase, unless otherwise permitted by the Engineer, shall not be spread more than 2,000 square yards in advance of the rolling. Any necessary sprinkling shall be kept within this limit. No material shall be placed in snow or on a soft, muddy, or frozen course.

When more than one layer is required, the construction procedure described here shall apply similarly to each layer.

During the placing and spreading, sufficient caution shall be exercised to prevent the incorporation of subgrade, shoulder, or foreign material in the subbase course mixture.

154-3.7 Finishing and compacting. After spreading or mixing, the subbase material shall be thoroughly compacted by rolling and sprinkling, when necessary. Sufficient rollers shall be furnished to adequately handle the rate of placing and spreading of the subbase course.

The field density of the compacted material shall be at least 100% of the maximum density of laboratory specimens prepared from samples of the subbase material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with ASTM D1557. The in-place field density shall be determined in accordance with ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. The moisture content of the material at the start of compaction shall be within ±2% of the optimum moisture content. All testing shall be done by the Engineer.

Subbase course shall be accepted for density and moisture on a lot basis. A lot will consist of one day's production if it does not exceed 2,400 square yards. A lot will consist of one-half day's production if a day's production consists of between 2,400 and 4,800 square yards.

The course shall not be rolled when the underlying course is soft or yielding or when the rolling causes undulation in the subbase. When the rolling develops irregularities that exceed 3/8 inch when tested with a 12 feet straightedge, the irregular surface shall be loosened and then refilled with the same kind of material as that used in constructing the course and again rolled as required above.

Along places inaccessible to rollers, the subbase material shall be tamped thoroughly with mechanical or hand tampers.

Sprinkling during rolling, if necessary, shall be by equipment approved by the Engineer. Water shall not be added in manner or quantity that allows free water to reach the underlying layer and cause it to become soft.

154-3.8 Surface tolerance. The surface of the top layer shall show no deviations in excess of 3/8 inch when tested with a 12-foot straightedge. Take measurements in successive positions parallel to the centerline of the area to be paved. Measurements shall also be taken perpendicular to the centerline at 50 foot intervals. Correct deviations exceeding this amount by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

154-3.9 Thickness control. The completed thickness of the course(s) shall be in accordance with the thickness and grade indicated on the drawings. The completed course shall not be more than 1/2 inch deficient in thickness nor more than 1/2 inch above or below the established grade. Where any of these tolerances are exceeded, correct such areas by scarifying, adding new material of proper gradation or removing material, and compacting, as directed. Where the measured thickness is 1/2 inch or more thicker than shown, the course will be considered as conforming with the specified thickness requirements plus 1/2 inch. The average job thickness shall be the average of the job measurements as specified above but within 1/4 inch of the thickness shown. The thickness of the completed subbase course shall be determined by depth tests or sample holes taken at intervals so each test shall represent no more than 500 square yards.

154-3.10 Protection. Work on subbase course shall not be conducted during freezing temperatures nor when the subgrade is wet. When the subbase material contains frozen material or when the underlying course is frozen, the construction shall be stopped. The Contractor shall protect and maintain the subgrade from yielding until the subbase is accepted.

154-3.11 Maintenance. The Contractor shall maintain the completed course in a satisfactory condition until accepted by the Engineer.

METHOD OF MEASUREMENT

154-4.1 Subbase course shall be measured by the number of cubic yards of subbase course material placed, compacted, and accepted in the completed course. The quantity of subbase course material shall be measured in final position based upon depth tests or cores taken as directed by the Engineer, at the rate of one (1) depth test for each 500 square yard of subbase course**.** On individual depth measurements, thicknesses more than 1/2 inch in excess of that shown on the plans shall be considered as the specified thickness plus 1/2 inch in computing the yardage for payment. Subbase materials shall not be included in any other excavation quantities.

BASIS OF PAYMENT

154-5.1 Payment shall be made at the contract unit price per cubic yard for subbase course. This price shall be full compensation for furnishing all materials; for all preparation, hauling, and placing of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-154-5.1 Subbase Course -- per cubic yard

TESTING REQUIREMENTS

ASTM C117	Standard Test Method for Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D422	Standard Test Method for Particle-Size Analysis of Soils
ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))
ASTM D2487	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D4253	Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4718	Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

END OF ITEM P-154

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Item P-155 Lime-Treated Subgrade

DESCRIPTION

155-1.1 This item shall be used for soil modification to achieve specific needs that require strength gain to a specific level. This item shall consist of constructing one or more courses of a mixture of soil, lime, and water in accordance with this specification, and in conformity with the lines, grades, thicknesses, and typical cross-sections shown on the plans.

MATERIALS

155-2.1 Lime. Quicklime and hydrated lime, either high-calcium dolomitic, or magnesium lime, as defined by ASTM C51, shall conform to the requirements of ASTM C977. Lime not produced from calcining limestone shall not be permitted.

155-2.2 Commercial lime slurry. Commercial lime slurry shall be a pumpable suspension of solids in water. The water or liquid portion of the slurry shall not contain dissolved material in sufficient quantity naturally injurious or objectionable for the purpose intended. The solids portion of the mixture, when considered on the basis of "solids content," shall consist principally of hydrated lime of a quality and fineness sufficient to meet the following requirements as to chemical composition and residue.

a. Chemical composition. The "solids content" of the lime slurry shall consist of a minimum of 70%, by weight, of calcium and magnesium oxides.

b. Residue. The percent by weight of residue retained in the "solids content" of lime slurry shall conform to the following requirements:

Residue retained on a No. 6 (3360 micron) sieve = maximum 0.0%

Residue retained on a No. 10 (2000 micron) sieve = maximum 1.0%

Residue retained on a No. 30 (590 micron) sieve = maximum 2.5%

c. Grade. Commercial lime slurry shall conform to one of the following two grades:

Grade 1. The "dry solids content" shall be at least 31% by weight, of the slurry.

Grade 2. The "dry solids content" shall be at least 35%, by weight, of the slurry.

155-2.3 Water. Water used for mixing or curing shall be potable, reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product.

155-2.4 Soil. The soil for this work shall consist of inorganic natural materials on the site or selected materials from other sources; uniform in quality and gradation; and shall be approved by the Engineer. The soil shall be free of roots, sod, weeds, and stones larger than 2-1/2 inches.

COMPOSITION

155-3.1 Soil-lime mixture. 28 days prior to the commencement of the work, the Contractor shall submit a soil-lime mixture, developed by the Contractor's laboratory, showing the amount of lime and water required per cubic yard , and procedures for blending the lime/subgrade mixture for each type of existing soil. The soil-lime mixture shall include process type and number of: lime applications, stages of mixing, slurry injection depths, mixing depths, and depths of compaction lifts. Also, the Contractor shall submit a list of equipment to be used and their relation to method of mix proportioning, spreading, pulverizing and compacting subgrade, slurry injection, jet slurry mixing, and other related work. The soil-lime mixture shall also contain amount of lime, either in sacks or pounds per cubic yard and the amount of water to be used, if slurry method is used. Use the ASTM D3551 laboratory test method when applicable.

For bid estimating purposes, the Contractor shall assume a lime content of 5% by weight of the soil.

155-3.2 Tolerances. At final compaction, the lime and water content for each course of subgrade treatment shall conform to the following tolerances:

Material	Tolerance
Lime	+ 0.5%
Water	+ 2%, -0%

WEATHER LIMITATIONS

155-4.1 Weather limitation. Do not construct subgrade when weather conditions detrimentally affect the quality of the materials. Do not apply lime unless the air temperature is at least 40°F and rising. Do not apply lime to soils that are frozen or contain frost. If the air temperature falls below 35°F, protect completed lime-treated areas by approved methods against the detrimental effects of freezing. Remove and replace any damaged portion of the completed soil-lime treated area with new soil-lime material in accordance with this specification.

EQUIPMENT

155-5.1 Equipment. The equipment required shall include all equipment necessary to complete this item such as: grading and scarifying equipment, a spreader for the lime or lime slurry, mixing or pulverizing equipment, sheepsfoot and pneumatic or vibrating rollers, sprinkling equipment, and trucks.

CONSTRUCTION METHODS

155-6.1 General. This specification is to construct a subgrade consisting of a uniform lime mixture which shall be free from loose or segregated areas. The subgrade shall be of uniform density and moisture content, well mixed for its full depth, and have a smooth surface suitable for placing subsequent courses. The Contractor shall be responsible to meet the above requirements.

Before beginning lime treatment, the subgrade shall be constructed as specified in Item P-152, Excavation, Subgrade and Embankment, and shaped to conform to the typical sections, lines, and grades as shown on the plans. If the Contractor elects to use a cutting and pulverizing machine that will remove the subgrade material accurately to the secondary grade and pulverize the material at the same time, he will not be required to expose the secondary grade nor windrow the material. The machine must give visible indication at all times that it is cutting the material uniformly to the proper depth over the entire width of the cut.

If a cutting and pulverizing machine is not used, the material to be treated shall be excavated to the secondary grade (proposed bottom of lime treatment) and removed or windrowed to expose the secondary grade. The excavated material shall then be spread to the desired cross-section and uniformly mixed and compacted.

155-6.2 Application. Lime shall be spread only over an area where the initial mixing operations can be completed during the same work day. The application and mixing of lime with the soil shall be accomplished by the methods described as “Dry Placing” or “Slurry Placing.” The Contractor may use either method when hydrated lime is specified.

a. Dry placing. The lime shall be spread uniformly over the subgrade by an approved screw-type spreader box or other approved spreading equipment. The amount of lime spread shall be the amount required for mixing to the specified depth that will result in the amount determined in the soil-lime mixture or as specified on the plans. The material shall be sprinkled until the specified moisture content has been reached.

The lime shall be distributed in a manner that will minimize scattering by wind. Lime shall not be applied when wind conditions, in the opinion of the Engineer, are detrimental to proper application. A motor grader shall not be used to spread the lime.

b. Slurry placing. The lime shall be mixed with water in trucks with approved distributors and applied as a thin water suspension or slurry. Commercial lime slurry shall be applied with a lime percentage not less than that applicable for the grade used. The distribution of lime shall be by successive passes over a measured section of subgrade until the specified amount of lime has been spread. The amount of lime spread shall be the amount required for mixing to the specified depth that will result in the amount determined in the soil-lime mixture or as shown on the plans. The distributor truck shall continually agitate the slurry to keep the mixture uniform.

155-6.3 Mixing. The mixing procedure shall be the same for “Dry Placing” or “Slurry Placing” as described below:

a. Preliminary mixing. The full depth of the treated subgrade shall be mixed with an approved mixing machine. Lime shall not be left exposed for more than six (6) hours. The mixing machine shall make two coverages. Water shall be added to the subgrade during mixing to provide a moisture content approximately 5% above the optimum moisture of the material and to ensure chemical action of the lime and subgrade. After mixing, the subgrade shall be lightly rolled to seal the surface and help prevent evaporation of moisture. The water content of the subgrade mixture shall be maintained at a moisture content above the optimum moisture content for a minimum of 48 hours or until the material becomes friable. During the curing period, the material shall be sprinkled as directed by the Engineer.

b. Final mixing. After the required curing time, the material shall be uniformly mixed by approved methods. If the mixture contains clods, they shall be reduced in size by blading, discing, harrowing,

scarifying, or the use of other approved pulverization methods so that the remainder of the clods shall meet the following requirements when tested dry by laboratory sieves. After curing, pulverize lime treated material until soil particles pass a one inch (25 mm) sieve and 60% pass the No. 4 (4.75 mm) sieve. If resultant mixture contains clods, reduce their size by scarifying, remixing, or pulverization to meet specified gradation.

155-6.4 Compaction. Compaction of the mixture shall immediately follow the final mixing operation with no part of the mixture uncompacted more than 30 minutes after final mixing. The material shall be aerated or sprinkled as necessary to provide the optimum moisture content during compaction. The field density of the compacted mixture shall be at least 93% of the maximum density of laboratory specimens prepared from samples taken from the material in place. The specimens shall be compacted and tested in accordance with ASTM D698 to determine maximum density and optimum moisture content. The in-place field density shall be determined in accordance with ASTM D6938, Procedure A, direct transmission method. Testing frequency shall be a minimum of one compaction test per 1,000 square yards of stabilized base or as directed by the Engineer.

The material shall be sprinkled and rolled as directed by the Engineer. All irregularities, depressions, or weak spots that develop shall be corrected immediately by scarifying the areas affected, adding or removing material as required, and reshaping and recompacting. The surface of the subgrade shall be maintained in a smooth condition, free from undulations and ruts, until other work is placed on it or the work is accepted by the Engineer.

The full depth of the material shown on the plans shall be compacted to remain firm and stable under construction equipment. All testing shall be done by the Engineer. Perform in-place density test to determine degree of compaction between 24 and 72 hours after final compaction and 24 hour moist cure period. If the material fails to meet the density requirements, it shall be reworked to meet the density requirements. The shape of the course shall be maintained smooth and shall conform to the typical section shown on the plans and the established lines and grades. If the material loses the specified stability, density, and finish before the next course is placed or the work is accepted by the Engineer, the material shall be recompacted and refinished by the Contractor, and the cost shall be incidental to this item.

155-6.5 Finishing and curing. After the final layer or course of lime-treated subgrade has been compacted, it shall be brought to the required lines and grades in accordance with the typical sections. The completed section shall then be finished by rolling, as directed by the Engineer, with a pneumatic or other suitable roller sufficiently light to prevent hairline cracking. The finished surface shall not vary more than 3/8 inch when tested with a 12 feet straightedge applied parallel with and at right angles to the pavement centerline. Any variations in excess of this tolerance shall be corrected by the Contractor in a manner satisfactory to the Engineer, and the cost shall be incidental to this item.

The completed section shall be moist-cured for a minimum of seven (7) days before further courses are added or any traffic is permitted, unless otherwise directed by the Engineer. Subsequent courses shall be applied within 14 days after the lime-treated subgrade is cured.

155-6.6 Thickness control. The thickness of the final lime-treated subgrade shall be not less than the thickness specified. Thickness shall be determined by depth tests or cores taken at intervals so that each test shall represent no more than 300 square yards. When the base deficiency is more than 1/2 inch, the Contractor shall correct such areas in a manner satisfactory to the Engineer. The Contractor shall replace the base material where borings are taken for test purposes. This cost shall be incidental to this item.

155-6.7 Maintenance. The Contractor shall protect and maintain the lime-treated subgrade from yielding until the lime-treated subgrade is covered by placement of the next layer. The cost of this maintenance shall be incidental to this item.

155-6.8 Handling and safety. The Contractor shall obtain and enforce the lime supplier's instructions for proper safety and handling of the lime to prevent physical eye or skin contact with lime during transport or application.

METHOD OF MEASUREMENT

155-7.1 Lime-treated subgrade shall be paid for by the square yard in the completed and accepted work.

155-7.2 Lime shall be paid by the number of tons of Hydrated Lime, or the calculated equivalent, used in the completed and accepted work. "Calculated Equivalent" will be determined by the Engineer as follows:

a. Hydrated lime delivered to the project in dry form will be measured according to the actual tonnage either spread on the subgrade or batched on site into a slurry, whichever is applicable.

b. Lime delivered to the project in slurry form will be paid for on the basis of certified chemical composition tickets and batch weight tickets. The Owner shall reserve the right to have the dry lime content verified by an independent testing laboratory. If the chemical composition is reported on the basis of Pebble Quicklime, the equivalent hydrated lime will be determined in accordance with paragraph c. below.

c. If Pebble Quicklime is delivered to the project in dry form it will be measured for payment on the basis of the following formula:

$$\left(\begin{array}{c}\text{Total Quicklime}\\ \text{(CaO)(Tons)}\\ \times\\ \text{\% Purity} \times 1.32\text{ Factor}\end{array}\right) + \left(\begin{array}{c}\text{Total Quicklime (CaO)(Tons)}\\ \times\\ \text{\% Impurities} \times 1.00\text{ Factor}\end{array}\right) = \begin{array}{c}\text{Equivalent Hydrated}\\ \text{Lime } Ca(OH)_2\text{(Tons)}\end{array}$$

The above will apply whether the quicklime is spread dry (if allowed) or batched into a slurry.

BASIS OF PAYMENT

155-8.1 Payment shall be made at the contract unit price per square yard for the lime-treated subgrade at the thickness specified. The price shall be full compensation for furnishing all material, except the lime, and for all preparation, delivering, placing and mixing these materials, and all labor, equipment, tools and incidentals necessary to complete this item.

155-8.2 Payment shall be made at the contract unit price per ton of lime. This price shall be full compensation for furnishing, delivery, and placing this material.

Payment will be made under:

Item P-155-8.1	Lime-Treated Subgrade -- per square yard
Item P-155-8.2	Lime -- per ton

TESTING REQUIREMENTS

ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m^3)
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

MATERIAL REQUIREMENTS

ASTM C51	Standard Terminology Relating to Lime and Limestone (as used by the Industry)
ASTM C977	Standard Specification for Quicklime and Hydrated Lime for Soil Stabilization
ASTM D3551	Standard Practice for Laboratory Preparation of Soil-Lime Mixtures Using Mechanical Mixer

END OF ITEM P-155

Item P-156 Temporary Air and Water Pollution, Soil Erosion, and Siltation Control

DESCRIPTION

156-1.1 This item shall consist of temporary control measures as shown on the plans or as ordered by the Engineer during the life of a contract to control water pollution, soil erosion, and siltation through the use of silt fences, berms, dikes, dams, sediment basins, fiber mats, gravel, mulches, grasses, slope drains, and other erosion control devices or methods.

The temporary erosion control measures contained herein shall be coordinated with the permanent erosion control measures specified as part of this contract to the extent practical to assure economical, effective, and continuous erosion control throughout the construction period.

Temporary control may include work outside the construction limits such as borrow pit operations, equipment and material storage sites, waste areas, and temporary plant sites.

Temporary control measures shall be design, installed and maintained to minimize the creation of wildlife attractants that have the potential to attract hazardous wildlife on or near public-use airports.

MATERIALS

156-2.1 Silt fence. The silt fence shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life. Silt fence shall meet the requirements of the City of Delaware Department of Engineering.

156-2.2 Straw/Coconut Fiber Erosion Control Blankets (ECB). Straw/coconut fiber erosion control blankets shall be machine-produced, consisting of 70% agricultural straw and 30% coconut fiber with a biodegradable tissue upon which the seeds are placed. The blankets shall be of consistent thickness with the straw and coconut fiber evenly distributed over the entire area of the mat. The blankets shall be covered on the top side with polypropylene netting (or similar netting material) having a mesh size of approximately 0.625” x 0.625”.

The blankets shall have properties equivalent to the following:

Material Content	70% agricultural straw, 30% coconut fiber
Netting Material,	Top Photo-degradable polypropylene
Netting Weight,	Top, approx. 3 pounds/1,000 square feet
Netting Material,	Bottom Photo-degradable polypropylene
Netting Weight,	Bottom, approx. 1 pound/1,000 square feet
Thread	Cotton

Width,	approx. 6.5 feet
Total Weight,	approx. 0.63 pounds/square yard

156-2.3 Rock Channel Protection With Fliter Fabric. Rock channel protection with filter fabric shall meet the requirements of the City of Delaware Department of Engineering.

156-2.4 Temporary Stream Crossing. Temporary stream crossings shall be installed across a flowing water course for use by construction traffic as detailed on the plans. Temporary stream crossing locations shall be coordinated and approved by the Engineer prior to installation.

156-2.5 Temporary Construction Entrance. Temporary stone construction entrances shall be installed at all locations where construction traffic will be entering the site and shall meet the requirements of the City of Delaware Department of Engineering. Temporary stone construction entrance locations shall be coordinated and approved with the Engineer prior to installation.

156-2.6 Straw Bale Ditch Check. Ditch checks shall be installed to the lines and grades as shown on the plans across the proposed drainage ditches to retain sediment and other waterborne debris. Construction shall comply with City of Delaware Department of Engineering requirements.

156-2.7 Temporary Diversion Ditch. Ditch shall meet the requirements of the Ohio Department of National Resources.

156-2.8 Temporary Seeding. Temporary seeding shall be installed on all disturbed areas where final grades have not been established within seven (7) days as required by the City of Delaware Department of Engineering.

Refer to the City of Delaware Department of Engineering Temporary Seeding and Mulching Chart for appropriate seed types, seeding dates and coverages. No seed shall contain millet or other wildlife attractants. Grass that will not compete with the grasses sown later for permanent cover per Item T-901shall be a quick-growing species (such as ryegrass, Italian ryegrass, or cereal grasses) suitable to the area providing a temporary cover.

156-2.9 Mulches. Mulches may be hay, straw, fiber mats, netting, bark, wood chips, or other suitable material reasonably clean and free of noxious weeds and deleterious materials per ItemT-908. Mulches shall not create a wildlife attractant.

156-2.10 Fertilizer. Fertilizer shall be a standard commercial grade and shall conform to all Federal and ODOT regulations and to the standards of the Association of Official Agricultural Chemists.

156-2.11 Other. All other materials shall meet commercial grade standards and shall be approved by the Engineer before being incorporated into the project.

CONSTRUCTION REQUIREMENTS

156-3.1 General. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other Federal, state, or local agencies, the more restrictive laws, rules, or regulations shall apply.

The Engineer shall be responsible for assuring compliance to the extent that construction practices, construction operations, and construction work are involved.

156-3.2 Schedule. Prior to the start of construction, the Contractor shall submit schedules for accomplishment of temporary and permanent erosion control work for clearing and grubbing; grading; construction; paving; and structures at watercourses. The Contractor shall also submit a proposed method of erosion and dust control on haul roads and borrow pits and a plan for disposal of waste materials. Work shall not be started until the erosion control schedules and methods of operation for the applicable construction have been accepted by the Engineer.

156-3.3 Authority of Engineer. The Engineer has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, to limit the surface area of erodible earth material exposed by excavation, borrow and fill operations, and to direct the Contractor to provide immediate permanent or temporary pollution control measures to minimize contamination of adjacent streams or other watercourses, lakes, ponds, or other areas of water impoundment.

156-3.4 Construction details. The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the accepted schedule. Except where future construction operations will damage slopes, the Contractor shall perform the permanent seeding and mulching and other specified slope protection work in stages, as soon as substantial areas of exposed slopes can be made available. Temporary erosion and pollution control measures will be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.

Where erosion may be a problem, clearing and grubbing operations should be scheduled and performed so that grading operations and permanent erosion control features can follow immediately if project conditions permit; otherwise, temporary erosion control measures may be required.

The Engineer shall limit the area of clearing and grubbing, excavation, borrow, and embankment operations in progress, commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent control measures current with the accepted schedule. If seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified as directed by the Engineer.

The Contractor shall provide immediate permanent or temporary pollution control measures to minimize contamination of adjacent streams or other watercourses, lakes, ponds, or other areas of water impoundment as directed by the Engineer. If temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled or directed by the Engineer, the work shall be performed by the Contractor and the cost shall be incidental to this item.

The Engineer may increase or decrease the area of erodible earth material that can be exposed at any time based on an analysis of project conditions.

The erosion control features installed by the Contractor shall be acceptably maintained by the Contractor during the construction period.

Whenever construction equipment must cross watercourses at frequent intervals, temporary structures should be provided.

Pollutants such as fuels, lubricants, bitumen, raw sewage, wash water from concrete mixing operations, and other harmful materials shall not be discharged into any waterways, impoundments or into natural or manmade channels.

156-3.5 Installation and Maintenance.

a. Silt Fence and Fabric Drop Inlet Protection

Installation. Silt fence shall be installed in accordance to the plans and the manufacturer's written recommendations.

Maintenance. Silt fences and filter barriers shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately.

Should the fabric on a silt fence or filter barrier decompose or become ineffective prior to the end of the expected usable life and the barrier is still necessary, the fabric shall be replaced promptly at no additional cost to the Owner.

Sediment deposits should be removed after each storm event. They must be removed when deposits reach approximately one-half the height of the barrier.

Any sediment deposits remaining in place after the silt fence or filter barrier is no longer required shall be dressed to conform with the existing grade, prepared and seeded.

b. ECB, Channel Lining, and Matting Installation. Erosion control blankets shall be installed in accordance with the manufacturer's written recommendations. Staples shall be utilized to anchor the erosion control blankets to the soil. Erosion control blankets shall be installed where indicated on the plans, and trenched and anchored as detailed. Erosion control blankets shall be placed within 24 hours after seeding. Prior to placing the erosion control blankets, the area to be covered shall be relative free of all rocks or clods over 1-1/2" in diameter and all sticks or other foreign material which prevent the close contact of the erosion control blankets with the seedbed. If, as a result of rain, the prepared seedbed becomes crusted or eroded, or if eroded places, ruts, or depressions exist for any reason, the soil shall be reworked until it is smooth and the reworked area shall be reseeded at no additional cost.

c. Rock Channel Protection Installation. The subgrade for the riprap shall be prepared to the required lines and grades. Any fill required in the subgrade shall be compacted to a density approximating that of the surrounding undisturbed material. Brush, trees, stumps, and other objectionable material shall be removed.

Placement of riprap should follow immediately after subgrade preparation. The riprap should be placed so that it produces a dense well-graded mass of stone with a minimum of voids. The desired distribution of stones throughout the mass may be obtained by selective loading at the quarry, controlled dumping of successive loads during final placing, or by a combination of these methods. The riprap should be placed to its full thickness in one operation, not in layers. The riprap should not be placed by dumping into chutes or similar methods which are likely to cause segregation of the various stone sizes. Care should be taken not to dislodge the underlying material when placing the stones. Some hand placing may be necessary to achieve the required grades and a good distribution of stone sizes.

d. Temporary Stream Crossing
Installation. Clearing and excavation of the streambed and banks shall be kept to a minimum.

The structure shall be removed as soon as it is no longer necessary for project construction.

Upon removal of the structure, the stream shall immediately be reshaped to its original cross section and properly stabilized.

Maintenance. The structure shall be inspected after every rainfall and at least once a week, whether it has rained or not, and all damages repaired immediately.

e. Temporary Construction Entrance
Installation. The area of the entrance must be excavated a minimum of 3" and must be cleared of all vegetation, roots, and other objectionable material.

Conveyance of surface water under entrance, through culverts, shall be provided as required. If such conveyance is impossible, the construction of a "mountable" berm with 5:1 slopes will be permitted.

Maintenance. The entrance shall be maintained in a condition which will prevent tracking or flow of mud onto public rights-of-way. This may require periodic top dressing with additional stone or the washing and reworking of existing stone as conditions demand and repair and/or cleanout of any structures used to trap sediment. All materials spilled, dropped, washed, or tracked from vehicles onto roadways or into storm drains must be removed immediately. The use of water trucks to remove materials dropped, washed, or tracked onto roadways will not be permitted under any circumstances.

f. Straw Bale Ditch Check. Inspect the ditch cheks after each storm event and remove sediment. Check the bales for erosion, piping, or displacement, and repair immediately. Once the contributing drainage area has been permanently stabilized, remove the bale, grade the area to the proposed grades, and stabilize.

g. Temporary Seeding. Grade as needed and feasible to permit the use of conventional equipment for seedbed preparation, seeding, mulch application, and anchoring.

Install the temporary or permanent erosion control measure such as diversions, temporary waterways for diversion outlets, sediment basins, etc. as appropriate prior to temporary seeding.

METHOD OF MEASUREMENT

156-4.1 Temporary erosion and pollution control work required will be performed as scheduled or directed by the Engineer. Completed and accepted work will be measured as follows:

a. Silt Fencing installed, maintained and later removed, will be measured by the linear feet of silt fencing installed and accepted. This item shall be measured one time per location. Any necessary maintenance replacement of silt fence, including replacement, shall not be measured.

b. Sediment Trap with be measured per lump sum for installation, maintenance and removal, complete. No additional measurement will be made.

c. Sediment Basin with be measured per lump sum for installation, maintenance and removal, complete. No additional measurement will be made.

d. Inlet Protection will be measured per each installed, maintained, and later removed. This item shall be measured one time per location. Any replacement will not be measured.

e. Culvert Protection will be measured per each installed, maintained, and later removed. This item shall be measured one time per location. Any replacement will not be measured.

f. Temporary Diversion Ditch will be measured per linear foot installed, maintained and later removed.

g. Straw Bale Ditch Check will be measured per each installed, maintained, and later removed. This item shall be measured one time per location. Any replacement will not be measured.

h. Construction Entrance will be measured per each installed, maintained, and later removed. This item shall be measured one time per location. Any replacement will not be measured.

i. Concrete Washout will be measured per each installed, maintained, and later removed. This item shall be measured one time per location. Any replacement will not be measured.

j. Temporary 18-Inch PVC Drainage Pipe will be measured per linear foot installed, maintained and later removed.

k. Temporary Seeding and Mulching will be measured per acre installed and maintained.

156-4.2 Control work performed for protection of construction areas outside the construction limits, such as borrow and waste areas, haul roads, equipment and material storage sites, and temporary plant sites, will not be measured and paid for directly but shall be considered as a subsidiary obligation of the Contractor.

BASIS OF PAYMENT

156-5.1 Accepted quantities of temporary water pollution, soil erosion, and siltation control work ordered by the Engineer and measured as provided in paragraph 156-4.1 will be paid for under:

Item P-156-5.1	Silt Fence -- per linear foot
Item P-156-5.2	Sediment Trap -- per lump sum
Item P-156-5.3	Sediment Basin -- per lump sum
Item P-156-5.4	Inlet Protection -- per each
Item P-156-5.5	Culvert Protection -- per each
Item P-156-5.6	Temporary Division Ditch -- per linear foot
Item P-156-5.7	Straw Bale Ditch Check -- per each

Item P-156-5.8	Construction Entrance -- per each
Item P-156-5.9	Concrete Washout -- per each
Item P-156-5.10	Temporary 18-Inch PVC Drainage Pipe -- per linear foot
Item P-156-5.11	Temporary Seeding and Mulching -- per acre

Where other directed work falls within the specifications for a work item that has a contract price, the units of work shall be measured and paid for at the contract unit price bid for the various items.

Temporary control features not covered by contract items that are ordered by the Engineer will be paid for in accordance with Section 90-05 Payment for Extra work.

MATERIAL REQUIREMENTS

ASTM D6461	Standard Specification for Silt Fence Materials
AC 150/5200-33	Hazardous Wildlife Attractants

END OF ITEM P-156

Item P-209 Crushed Aggregate Base Course

DESCRIPTION

209-1.1 This item consists of a base course composed of crushed aggregate base constructed on a prepared course in accordance with these specifications and in conformity to the dimensions and typical cross-sections shown on the plans.

MATERIALS

209-2.1 Crushed aggregate base. Crushed aggregate shall consist of clean, sound, durable particles of crushed stone and shall be free from coatings of clay, silt, organic material, or other objectionable materials. Aggregates shall contain no clay lumps or balls. Fine aggregate passing the No. 4 (4.75 mm) sieve shall consist of fines from the coarse aggregate crushing operation. If necessary, fine aggregate may be added to produce the correct gradation. The fine aggregate shall be produced by crushing stone or gravel that meet the coarse aggregate requirements for wear and soundness.

Course or fine aggregates consisting of or containing slag will not be allowed.

The coarse aggregate portion, defined as the material retained on the No. 4 (4.75 mm) sieve, shall not have a loss of greater than 45% when tested per ASTM C131. The sodium sulfate soundness loss shall not exceed 12%, or the magnesium sulfate soundness loss shall not exceed 18%, after five cycles, when tested in accordance with ASTM C88. The aggregate shall contain no more than 15%, by weight, of flat, elongated, or flat and elongated particles per ASTM D4791. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than three (3). The aggregate shall have at least 90% by weight of particles with at least two fractured faces and 100% with at least one fractured face per ASTM D5821. The area of each face shall be equal to at least 75% of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces.

a. Sampling and testing for initial aggregate base requirements. Samples shall be taken by the Contractor in the presence of the Engineer. Material shall meet the requirements in paragraph 209-2.1 and 209-2.2. This sampling and testing will be the basis for approval of the aggregate base quality requirements.

209-2.2 Gradation requirements. The gradation of the aggregate base material shall meet the requirements of the gradation given in the following table when tested per ASTM C117 and ASTM C136. The gradation shall be well graded from coarse to fine as defined by ASTM D2487 and shall not vary from the lower limit on one sieve to the high limit on an adjacent sieve or vice versa. The fraction of material passing the No. 200 (0.075 mm) sieve shall not exceed one-half the fraction passing the No. 40 (0.45 mm) sieve.

The material finer than 0.02 mm shall be limited to a maximum of 3% and the maximum allowable material passing the No. 200 sieve shall be reduced from 0-8% to 0-5%. Testing per ASTM D422 will be required for the percentage passing the 0.02 mm particle size once per lot.

Requirements For Gradation Of Aggregate Base

Sieve Size	Design Range Percentage by Weight	Contractor's Final Gradation	Job Control Grading Band Tolerances for Contractor's Final Gradation Percent
2 inch (50 mm)	100		0
1-1/2 inch (38 mm)	95-100		±5
1 inch (25 mm)	70-95		±8
3/4 inch (19 mm)	55-85		±8
No. 4 (4.75 mm)	30-60		±8
No. 40 (0.45 mm)	10-30		±5
No. 200 (0.075 mm)	0-8		±3

The "Job Control Grading Band Tolerances for Contractor's Final Gradation" in the table shall be applied to "Contractor's Final Gradation" to establish a job control grading band. The full tolerance still applies if application of the tolerances results in a job control grading band outside the design range.

a. Sampling and testing for gradation. Gradation tests shall be performed by the Engineer per ASTM C136 and sieve analysis on material passing the No. 200 sieve (75 mm) per ASTM C112. The Engineer shall take at least two aggregate base samples per lot to check the final gradation. Sampling shall be per ASTM D75. The lot will be consistent with the lot size used for density. The samples shall be taken from the in-place, un-compacted material in the presence of the Engineer. Sampling points and intervals will be designated by the Engineer.

CONSTRUCTION METHODS

209-3.1 Preparing underlying subgrade and/or subbase. The underlying subgrade and/or subbase shall be checked and accepted by the Engineer before base course placing and spreading operations begin. Re-proof rolling of the subgrade or proof rolling of the subbase in accordance with P-152, at the Contractor's expense, may be required by the Engineer if the Contractor fails to ensure proper drainage or protect the subgrade and/or subbase. Any ruts or soft, yielding areas due to improper drainage conditions, hauling, or any other cause, shall be corrected before the base course is placed. To ensure proper drainage, the spreading of the base shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope.

209-3.2 Production. The aggregate shall be uniformly blended and, when at a satisfactory moisture content per paragraph 209-3.4, the approved material may be transported directly to the spreading equipment.

209-3.3 Placing. The aggregate base material shall be placed on the prepared underlying subgrade and/or subbase and compacted in layers to the thickness shown on the plans. Work shall progress without interruption. The material shall be deposited and spread in lanes in a uniform layer without segregation to such loose depth that, when compacted, the layer shall have the specified thickness. The aggregate base course shall be constructed in layers of uniform thickness of not less than 3 inches nor

more than 6 inches of compacted thickness. The aggregate as spread shall be of uniform grading with no pockets of fine or coarse materials. The aggregate, unless otherwise permitted by the Engineer, shall not be spread more than 2,000 square yards in advance of the rolling. Any necessary sprinkling shall be kept within these limits. Care shall be taken to prevent cutting into the underlying layer during spreading. No material shall be placed in snow or on a soft, muddy, or frozen course. The aggregate base material shall be spread by spreader boxes or other approved devices. This equipment shall have positive thickness controls that spread the aggregate in the required amount to avoid or minimize the need for hand manipulation. Dumping from vehicles that require re-handling shall not be permitted. Hauling over the uncompacted base course shall not be permitted.

When more than one layer is required, the construction procedure described herein shall apply similarly to each layer.

209-3.4 Compaction. Immediately after completion of the spreading operations, compact each layer of the base course, as specified, with approved compaction equipment. The number, type, and weight of rollers shall be sufficient to compact the material to the required density within the same day that the aggregate is placed on the subgrade. The moisture content of the material during placing operations shall be within ±2 percentage points of the optimum moisture content as determined by ASTM D1557.

209-3.5 Acceptance sampling and testing for density. Aggregate base course shall be accepted for density on a lot basis. A lot will consist of one day's production if it does not exceed 2,400 square yards. A lot will consist of one-half day's production if a day's production consists of between 2,400 and 4,800 square yards. The Engineer shall perform all density tests.

Each lot shall be divided into two equal sublots. One test shall be made for each sublot and shall consist of the average of two random locations for density determination. Sampling locations will be determined by the Engineer on a random basis per ASTM D3665.

Each lot will be accepted for density when the field density is at least 100% of the maximum density of laboratory specimens. The specimens shall be compacted and tested per ASTM D1557. The in-place field density shall be determined per ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. If the specified density is not attained, the entire lot shall be reworked and/or recompacted and two additional random tests made at the Contractor's expense. This procedure shall be followed until the specified density is reached.

209-3.6 Surface tolerances. After the course has been compacted, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches, reshaped and recompacted to grade. until the required smoothness and accuracy are obtained and approved by the Engineer. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense. The smoothness and accuracy requirements specified here apply only to the top layer when base course is constructed in more than one layer.

a. Smoothness. The finished surface shall not vary more than 3/8 inch when tested with a 12-foot straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously at half the length of the 12-foot straightedge for the full length of each line on a 50-foot grid.

b. Accuracy. The grade and crown shall be measured on a 50-foot grid and shall be within +0 and -1/2 inch of the specified grade.

209-3.7 Thickness control. The thickness of the base course shall be within +0 and -1/2 inch of the specified thickness as determined by depth tests taken by the Contractor in the presence of the Engineer. Tests shall be taken at intervals representing no more than 300 square yards per test. Sampling locations will be determined by the Engineer per ASTM D3665. Where the thickness is deficient by more than 1/2 inch, the Contractor shall correct such areas at no additional cost by scarifying to a depth of at least 3 inches, adding new material of proper gradation, and the material shall be blended and recompacted to grade. Additional test holes may be required to identify the limits of deficient areas. The Contractor shall replace, at his expense, base material where depth tests have been taken.

209-3.8 Protection. Perform construction when the atmospheric temperature is above 35°F. When the temperature falls below 35°F, protect all completed areas by approved methods against detrimental effects of freezing. Correct completed areas damaged by freezing, rainfall, or other weather conditions to meet specified requirements. When the aggregates contain frozen materials or when the underlying course is frozen or wet, the construction shall be stopped. Hauling equipment may be routed over completed portions of the base course, provided no damage results. Equipment shall be routed over the full width of the base course to avoid rutting or uneven compaction. The Engineer will stop all hauling over completed or partially completed base course when, in the Engineer's opinion, such hauling is causing damage. Any damage to the base course shall be repaired by the Contractor at the Contractor's expense.

209-3.9 Maintenance. The Contractor shall maintain the base course in a satisfactory condition until the full pavement section is completed and accepted by the Engineer. The surface shall be kept clean and free from foreign material and properly drained at all times. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact. Any base course that is not paved over prior to the onset of winter shall be retested to verify that it still complies with the requirements of this specification. Any area of base course that is damaged shall be reworked or replaced as necessary to comply with this specification.

Equipment used in the construction of an adjoining section may be routed over completed base course, if no damage results and the equipment is routed over the full width of the base course to avoid rutting or uneven compaction.

The Contractor shall remove all survey and grade hubs from the base courses prior to placing any bituminous surface course.

METHOD OF MEASUREMENT

209-4.1 The quantity of crushed aggregate base course will be determined by measurement of the number of cubic yards of material actually constructed and accepted by the Engineer as complying with the plans and specifications. Base materials shall not be included in any other excavation quantities.

BASIS OF PAYMENT

209-5.1 Payment shall be made at the contract unit price per cubic yard for crushed aggregate base course. This price shall be full compensation for furnishing all materials, for preparing and placing these materials, and for all labor, equipment tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-209-5.1	Crushed Aggregate Base Course -- per cubic yard

TESTING REQUIREMENTS

ASTM C29	Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D422	Standard Test Method for Particle-Size Analysis of Soils
ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2700 kN-m/m^3))
ASTM D2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM D4718	Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles
ASTM D4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D5821	Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate

ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

END OF ITEM P-209

Item P-401 Hot Mix Asphalt (HMA) Pavements

DESCRIPTION

401-1.1 This item shall consist of pavement courses composed of mineral aggregate and asphalt cement binder (asphalt binder) mixed in a central mixing plant and placed on a prepared course in accordance with these specifications and shall conform to the lines, grades, thicknesses, and typical cross-sections shown on the plans. Each course shall be constructed to the depth, typical section, and elevation required by the plans and shall be rolled, finished, and approved before the placement of the next course.

MATERIALS

401-2.1 Aggregate. Aggregates shall consist of crushed stone, crushed gravel, crushed slag, screenings, natural sand and mineral filler, as required. The aggregates should be free of ferrous sulfides, such as pyrite, that would cause "rust" staining that can bleed through pavement markings. The portion retained on the No. 4 (4.75 mm) sieve is coarse aggregate. The portion passing the No. 4 (4.75 mm) sieve and retained on the No. 200 (0.075 mm) sieve is fine aggregate, and the portion passing the No. 200 (0.075 mm) sieve is mineral filler.

a. Coarse aggregate. Coarse aggregate shall consist of sound, tough, durable particles, free from films of matter that would prevent thorough coating and bonding with the bituminous material and free from organic matter and other deleterious substances. The percentage of wear shall not be greater than 40% when tested in accordance with ASTM C131. The sodium sulfate soundness loss shall not exceed 12%, or the magnesium sulfate soundness loss shall not exceed 18%, after five cycles, when tested in accordance with ASTM C88. Clay lumps and friable particles shall not exceed 1.0% when tested in accordance with ASTM C142.

Aggregate shall contain at least 75% percent by weight of individual pieces having two or more fractured faces and 85% percent by weight having at least one fractured face. The area of each face shall be equal to at least 75% of the smallest midsectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces. Fractured faces shall be achieved by crushing.

The aggregate shall not contain more than a total of 8%, by weight, of flat particles, elongated particles, and flat and elongated particles, when tested in accordance with ASTM D4791 with a value of 5:1.

b. Fine aggregate. Fine aggregate shall consist of clean, sound, tough, durable, angular shaped particles produced by crushing stone, slag, or gravel that meets the requirements for wear and soundness specified for coarse aggregate. The aggregate particles shall be free from coatings of clay, silt, or other objectionable matter.

The fine aggregate, including any blended material for the fine aggregate, shall have a plasticity index of not more than six (6) and a liquid limit of not more than 25 when tested in accordance with ASTM D4318.

The soundness loss shall not exceed 10% when sodium sulfate is used or 15% when magnesium sulfate is used, after five cycles, when tested per ASTM C88.

Clay lumps and friable particles shall not exceed 1.0%, by weight, when tested in accordance with ASTM C142.

Natural (non-manufactured) sand may be used to obtain the gradation of the aggregate blend or to improve the workability of the mix. The amount of sand to be added will be adjusted to produce mixtures conforming to requirements of this specification. The fine aggregate shall not contain more than 15% natural sand by weight of total aggregates. If used, the natural sand shall meet the requirements of ASTM D1073 and shall have a plasticity index of not more than six (6) and a liquid limit of not more than 25 when tested in accordance with ASTM D4318.

The aggregate shall have sand equivalent values of 45 or greater when tested in accordance with ASTM D2419.

c. Sampling. ASTM D75 shall be used in sampling coarse and fine aggregate, and ASTM C183 shall be used in sampling mineral filler.

401-2.2 Mineral filler. If filler, in addition to that naturally present in the aggregate, is necessary, it shall meet the requirements of ASTM D242.

401-2.3 Asphalt cement binder. Asphalt cement binder shall conform to ASTM D6373 Performance Grade (PG) 70-22M for the surface course and 64-28M for the intermediate and leveling courses. A certificate of compliance from the manufacturer shall be included with the mix design submittal.

The supplier's certified test report with test data indicating grade certification for the asphalt binder shall be provided to the Engineer for each load at the time of delivery to the mix plant. A certified test report with test data indicating grade certification for the asphalt binder shall also be provided to the Engineer for any modification of the asphalt binder after delivery to the mix plant and before use in the HMA.

401-2.4 Preliminary material acceptance. Prior to delivery of materials to the job site, the Contractor shall submit certified test reports to the Engineer for the following materials:

a. Coarse aggregate:

(1) Percent of wear

(2) Soundness

(3) Clay lumps and friable particles

(4) Percent fractured faces

(5) Flat and elongated particles

b. Fine aggregate:

(1) Liquid limit and Plasticity index

(2) Soundness

(3) Clay lumps and friable particles

(4) Percent natural sand

(5) Sand equivalent

c. Mineral filler.

d. Asphalt binder. Test results for asphalt binder shall include temperature/viscosity charts for mixing and compaction temperatures.

The certifications shall show the appropriate ASTM tests for each material, the test results, and a statement that the material meets the specification requirement.

The Engineer may request samples for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

401-2.5 Anti-stripping agent. Any anti-stripping agent or additive if required shall be heat stable, shall not change the asphalt cement viscosity beyond specifications, shall contain no harmful ingredients, shall be added in recommended proportion by approved method, and shall be a material approved by the Department of Transportation of the State in which the project is located.

COMPOSITION

401-3.1 Composition of mixture. The HMA mix shall be composed of a mixture of well-graded aggregate, filler and anti-strip agent if required, and asphalt binder. The several aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF).

401-3.2 Job mix formula (JMF). No hot-mixed asphalt (HMA) for payment shall be produced until a JMF has been approved in writing by the Engineer. The asphalt mix-design and JMF shall be prepared by an accredited laboratory that meets the requirements of paragraph 401-3.4. The HMA shall be designed using procedures contained in Asphalt Institute MS-2 Mix Design Manual, 7th Edition. Samples shall be prepared at various asphalt contents and compacted using the gyratory compactor in accordance with ASTM D6925.

Tensile strength ratio (TSR) of the composite mixture, as determined by ASTM D4867, shall not be less than 75 when tested at a saturation of 70-80% or an anti-stripping agent shall be added to the HMA, as necessary, to produce a TSR of not less than 75 when tested at a saturation of 70-80%. If an anti-strip agent is required, it shall be provided by the Contractor at no additional cost to the Owner.

The JMF shall be submitted in writing by the Contractor at least 28 days prior to the start of paving operations. The JMF shall be developed within the same construction season using aggregates currently being produced.

The submitted JMF shall be stamped or sealed by the responsible professional Engineer of the laboratory and shall include the following items as a minimum:

a. Percent passing each sieve size for total combined gradation, individual gradation of all aggregate stockpiles and percent by weight of each stockpile used in the job mix formula.

b. Percent of asphalt cement.

c. Asphalt performance grade and type of modifier if used.

d. Number of gyrations.

e. Laboratory mixing temperature.

f. Laboratory compaction temperature.

g. Temperature-viscosity relationship of the PG asphalt cement binder showing acceptable range of mixing and compaction temperatures; and for modified binders include supplier recommended mixing and compaction temperatures.

h. Plot of the combined gradation on a 0.45 power gradation curve.

i. Graphical plots of air voids, voids in the mineral aggregate, and unit weight versus asphalt content.

j. Specific Gravity and absorption of each aggregate.

k. Percent natural sand.

l. Percent fractured faces.

m. Percent by weight of flat particles, elongated particles, and flat and elongated particles (and criteria).

n. Tensile Strength Ratio (TSR).

o. Anti-strip agent (if required).

p. Date the JMF was developed. Mix designs that are not dated or which are from a prior construction season shall not be accepted.

q. Percentage and properties (asphalt content, binder properties, and aggregate properties) of reclaimed asphalt pavement (RAP) in accordance with paragraph "Reclaimed Hot-Mix Asphalt," if RAP is used.

The Contractor shall submit to the Engineer the results of verification testing of three (3) asphalt samples prepared at the optimum asphalt content. The average of the results of this testing shall indicate conformance with the JMF requirements specified in Tables 1 and 3.

When the project requires asphalt mixtures of differing aggregate gradations, a separate JMF and the results of JMF verification testing shall be submitted for each mix.

The JMF for each mixture shall be in effect until a modification is approved in writing by the Engineer. Should a change in sources of materials be made, a new JMF must be submitted within 15 days and approved by the Engineer in writing before the new material is used. After the initial production JMF has been approved by the Engineer and a new or modified JMF is required for whatever reason, the subsequent cost of the Engineer's approval of the new or modified JMF will be borne by the Contractor. There will be no time extension given or considerations for extra costs associated with the stoppage of production paving or restart of production paving due to the time needed for the Engineer to approve the initial, new or modified JMF.

The Gyratory Design Criteria applicable to the project shall meet the criteria specified in Table 1.

Table 1. Gyratory Compaction Criteria

Test Property	Value
Number of compactor gyrations	75
Air voids (%)	3.5
Percent voids in mineral aggregate, minimum	See Table 2

Table 2. Minimum Percent Voids In Mineral Aggregate (VMA)

Aggregate (See Table 3)	Minimum VMA
Gradation 3	16%
Gradation 2	15%
Gradation 1	14%

The mineral aggregate shall be of such size that the percentage composition by weight, as determined by laboratory sieves, will conform to the gradation or gradations specified in Table 3 when tested in accordance with ASTM C136 and ASTM C117.

The gradations in Table 3 represent the limits that shall determine the suitability of aggregate for use from the sources of supply; be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa.

Table 3. Aggregate - HMA Pavements

Sieve Size	**Percentage by Weight Passing Sieves**		
	Gradation 1	**Gradation 2**	**Gradation 3**
1 inch (25 mm)	100	--	--
3/4 inch (19 mm)	76-98	100	--
1/2 inch (12 mm)	66-86	79-99	100
3/8 inch (9 mm)	57-77	68-88	79-99
No. 4 (4.75 mm)	40-60	48-68	58-78
No. 8 (2.36 mm)	26-46	33-53	39-59
No. 16 (1.18 mm)	17-37	20-40	26-46
No. 30 (0.600 mm)	11-27	14-30	19-35
No. 50 (0.300 mm)	7-19	9-21	12-24
No. 100 (0.150 mm)	6-16	6-16	7-17
No. 200 (0.075 mm)	3-6	3-6	3-6

Sieve Size	Percentage by Weight Passing Sieves		
	Gradation 1	**Gradation 2**	**Gradation 3**
Asphalt percent:			
Stone or gravel	4.5-7.0	5.0-7.5	5.5-8.0
Slag	N/A	N/A	N/A

The aggregate gradations shown are based on aggregates of uniform specific gravity. The percentages passing the various sieves shall be corrected when aggregates of varying specific gravities are used, as indicated in the Asphalt Institute MS-2 Mix Design Manual, 7th Edition.

401-3.3 Reclaimed asphalt pavement (RAP). Reclaimed HMA shall consist of reclaimed asphalt pavement (RAP), coarse aggregate, fine aggregate, mineral filler, and asphalt cement. Recycled asphalt shingles (RAS) shall not be allowed. The RAP shall be of a consistent gradation and asphalt content and properties. When RAP is fed into the plant, the maximum RAP chunk size shall not exceed 1-1/2 inches. The reclaimed asphalt pavement mix shall be designed using procedures contained in the Asphalt Institute MS-2 Mix Design Manual, 7th Edition. The percentage of asphalt in the RAP shall be established for the mixture design according to ASTM D2172 using the appropriate dust correction procedure. The JMF shall meet the requirements of paragraph 401-3.2. RAP shall only be used for shoulder surface course mixes and for any intermediate courses. The use of RAP containing Coal Tar shall not be allowed. Coal Tar surface treatments must be removed prior to recycling underlying asphalt material. The amount of RAP shall be limited to 20% percent**.** In addition to the requirements of paragraph 401-3.2, the JMF shall indicate the percent of reclaimed asphalt pavement and the percent and grade of new asphalt binder. For the PG graded asphalt binder selected in 401-2.3, adjust as follows:

For 0-20% RAP, there is no change in virgin binder content.

For >20 to 30% RAP, select binder one grade softer, i.e., PG 64-22 would soften to PG 58-28.

401-3.4 Job mix formula (JMF) laboratory. The Contractor's laboratory used to develop the JMF shall be accredited in accordance with ASTM D3666. The laboratory accreditation must be current and listed on the accrediting authority's website. All test methods required for developing the JMF must be listed on the lab accreditation. A copy of the laboratory's current accreditation and accredited test methods shall be submitted to the Engineer prior to start of construction.

401-3.5 Test section. Prior to full production, the Contractor shall prepare and place a quantity of HMA according to the JMF. The amount of HMA shall be sufficient to construct a test section 300 feet long and 20 feet wide, placed in two lanes along a taxiway, with a longitudinal cold joint, and shall be of the same depth specified for the construction of the course which it represents. A cold joint for this test section is an exposed construction joint at least four (4) hours old or whose mat has cooled to less than 160°F. The cold joint must be cut back using the same procedure that will be used during production in accordance with 401-4.13. The underlying grade or pavement structure upon which the test section is to be constructed shall be the same as the remainder of the course represented by the test section. The equipment used in construction of the test section shall be the same type and weight to be used on the remainder of the course represented by the test section.

The test section shall be evaluated for acceptance as a single lot in accordance with the acceptance criteria in paragraph 401-5.1 and 401-5.2. The test section shall be divided into equal sublots. As a minimum the test section shall consist of three (3) sublots.

The test section shall be considered acceptable if (1) mat density, air voids, and joint density are 90% or more within limits, (2) gradation and asphalt content are within the action limits specified in paragraphs 401-6.5a and 5b, and (3) the voids in the mineral aggregate are within the limits of Table 2.

If the initial test section should prove to be unacceptable, the necessary adjustments to the JMF, plant operation, placing procedures, and/or rolling procedures shall be made. A second test section shall then be placed. If the second test section also does not meet specification requirements, both sections shall be removed at the Contractor's expense. Additional test sections, as required, shall be constructed and evaluated for conformance to the specifications. Any additional sections that are not acceptable shall be removed at the Contractor's expense. Full production shall not begin until an acceptable test section has been constructed and accepted in writing by the Engineer. Once an acceptable test section has been placed, payment for the initial test section and the section that meets specification requirements shall be made in accordance with paragraph 401-8.1.

Job mix control testing shall be performed by the Contractor at the start of plant production and in conjunction with the calibration of the plant for the JMF. If aggregates produced by the plant do not satisfy the gradation requirements or produce a mix that meets the JMF, it will be necessary to reevaluate and redesign the mix using plant-produced aggregates. Specimens shall be prepared and the optimum asphalt content determined in the same manner as for the original JMF tests.

Contractor will not be allowed to place the test section until the Contractor Quality Control Program, showing conformance with the requirements of Paragraph 401-6.1, has been approved, in writing, by the Engineer.

CONSTRUCTION METHODS

401-4.1 Weather limitations. The HMA shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 4. The temperature requirements may be waived by the Engineer, if requested; however, all other requirements including compaction shall be met.

Table 4. Surface Temperature Limitations of Underlying Course

Mat Thickness	Base Temperature (Minimum)
	°F
3 inches or greater	40
Greater than 2 inches but less than 3 inches	45

401-4.2 HMA plant. Plants used for the preparation of HMA shall conform to the requirements of American Association of State Highway and Transportation Officials (AASHTO) M156 with the following changes:

Requirements for all plants include:

a. Truck scales. The HMA shall be weighed on approved scales furnished by the Contractor, or on certified public scales at the Contractor's expense. Scales shall be inspected and sealed as often as the Engineer deems necessary to assure their accuracy. Scales shall conform to the requirements of the General Provisions, subsection 90-01.

In lieu of scales, and as approved by the Engineer, HMA weight may be determined by the use of an electronic weighing system equipped with an automatic printer that weighs the total HMA production and as often thereafter as requested by the Engineer.

b. Testing facilities. The Contractor shall ensure laboratory facilities are provided at the plant for the use of the Engineer. The lab shall have sufficient space and equipment so that both testing representatives (Engineer's and Contractor's) can operate efficiently. The lab shall meet the requirements of ASTM D3666 including all necessary equipment, materials, calibrations, current reference standards to comply with the specifications and a masonry saw with diamond blade for trimming pavement cores and samples.

The plant testing laboratory shall have a floor space area of not less than 200 square feet, with a ceiling height of not less than 7-1/2 feet. The laboratory shall be weather tight, sufficiently heated in cold weather, air-conditioned in hot weather to maintain temperatures for testing purposes of 70°F ±5°F. The plant testing laboratory shall be located on the plant site to provide an unobstructed view, from one of its windows, of the trucks being loaded with the plant mix materials. In addition, the facility shall include the minimum:

(1) Adequate artificial lighting.

(2) Electrical outlets sufficient in number and capacity for operating the required testing equipment and drying samples.

(3) A minimum of two (2) Underwriter's Laboratories approved fire extinguishers of the appropriate types and class.

(4) Work benches for testing.

(5) Desk with chairs and file cabinet.

(6) Sanitary facilities convenient to testing laboratory.

(7) Exhaust fan to outside air.

(8) Sink with running water.

Failure to provide the specified facilities shall be sufficient cause for disapproving HMA plant operations.

Laboratory facilities shall be kept clean, and all equipment shall be maintained in proper working condition. The Engineer shall be permitted unrestricted access to inspect the Contractor's laboratory facility and witness quality control activities. The Engineer will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting the test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

c. Inspection of plant. The Engineer, or Engineer's authorized representative, shall have access, at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant:

verifying weights, proportions, and material properties; and checking the temperatures maintained in the preparation of the mixtures.

d. Storage bins and surge bins. The HMA stored in storage and surge bins shall meet the same requirements as HMA loaded directly into trucks and may be permitted under the following conditions:

(1) Stored in non-insulated bins for a period of time not to exceed three (3) hours.

(2) Stored in insulated bins for a period of time not to exceed eight (8) hours.

If the Engineer determines that there is an excessive amount of heat loss, segregation, or oxidation of the HMA due to temporary storage, no temporary storage will be allowed.

401-4.3 Hauling equipment. Trucks used for hauling HMA shall have tight, clean, and smooth metal beds. To prevent the HMA from sticking to the truck beds, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other material approved by the Engineer. Petroleum products shall not be used for coating truck beds. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary, to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers shall be securely fastened.

401-4.3.1 Material transfer vehicle (MTV). Material transfer vehicles used to transfer the material from the hauling equipment to the paver, shall use a self-propelled, material transfer vehicle with a swing conveyor that can deliver material to the paver without making contact with the paver. The MTV shall be able to move back and forth between the hauling equipment and the paver providing material transfer to the paver, while allowing the paver to operate at a constant speed. The Material Transfer Vehicle will have remixing and storage capability to prevent physical and thermal segregation**.**

Material transfer vehicles are not required**.**

401-4.4 HMA pavers. HMA pavers shall be self-propelled with an activated heated screed, capable of spreading and finishing courses of HMA that will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the HMA uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

If, during construction, it is found that the spreading and finishing equipment in use leaves tracks or indented areas, or produces other blemishes in the pavement that are not satisfactorily corrected by the scheduled operations, the use of such equipment shall be discontinued and satisfactory equipment shall be provided by the Contractor.

401-4.4.1 Automatic grade controls. The HMA paver shall be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated from either a reference line and/or through a system of mechanical sensors or sensor-directed mechanisms or devices that will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller shall be capable of maintaining the screed at the desired slope within ±0.1%.

The controls shall be capable of working in conjunction with any of the following attachments:

a. Ski-type device of not less than 30 feet in length.

b. Taut string-line (wire) set to grade.

c. Short ski or shoe.

d. Laser control.

A maximum of two cold joints is allowed on either side of the runway centerline. Along straight segments of taxiway, a maximum of one cold joint is allowed on either side of taxiway centerline. Fewer cold joints are preferred, and may be accomplished by operating two pavers in tandem.

401-4.5 Rollers. Rollers of the vibratory, steel wheel, and pneumatic-tired type shall be used. They shall be in good condition, capable of operating at slow speeds to avoid displacement of the HMA. The number, type, and weight of rollers shall be sufficient to compact the HMA to the required density while it is still in a workable condition.

All rollers shall be specifically designed and suitable for compacting HMA concrete and shall be properly used. Rollers that impair the stability of any layer of a pavement structure or underlying soils shall not be used. Depressions in pavement surfaces caused by rollers shall be repaired by the Contractor at their own expense.

The use of equipment that causes crushing of the aggregate will not be permitted.

401-4.6. Density device. The Contractor shall have on site a density gauge during all paving operations in order to assist in the determination of the optimum rolling pattern, type of roller and frequencies, as well as to monitor the effect of the rolling operations during production paving. The Contractor shall also supply a qualified technician during all paving operations to calibrate the gauge and obtain accurate density readings for all new HMA. These densities shall be supplied to the Engineer upon request at any time during construction. No separate payment will be made for supplying the density gauge and technician.

401-4.7 Preparation of asphalt binder. The asphalt binder shall be heated in a manner that will avoid local overheating and provide a continuous supply of the asphalt binder to the mixer at a uniform temperature. The temperature of unmodified asphalt binder delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles, but shall not exceed 325°F when added to the aggregate. The temperature of modified asphalt binder shall be no more than 350°F when added to the aggregate.

401-4.8 Preparation of mineral aggregate. The aggregate for the HMA shall be heated and dried. The maximum temperature and rate of heating shall be such that no damage occurs to the aggregates. The temperature of the aggregate and mineral filler shall not exceed 350°F when the asphalt binder is added. Particular care shall be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

401-4.9 Preparation of HMA. The aggregates and the asphalt binder shall be weighed or metered and introduced into the mixer in the amount specified by the JMF. The combined materials shall be mixed until the aggregate obtains a uniform coating of asphalt binder and is thoroughly distributed throughout the mixture. Wet mixing time shall be the shortest time that will produce a satisfactory mixture, but not

less than 25 seconds for batch plants. The wet mixing time for all plants shall be established by the Contractor, based on the procedure for determining the percentage of coated particles described in ASTM D2489, for each individual plant and for each type of aggregate used. The wet mixing time will be set to achieve 95% of coated particles. For continuous mix plants, the minimum mixing time shall be determined by dividing the weight of its contents at operating level by the weight of the mixture delivered per second by the mixer. The moisture content of all HMA upon discharge shall not exceed 0.5%.

401-4.10 Preparation of the underlying surface. Immediately before placing the HMA, the underlying course shall be cleaned of all dust and debris. A prime coat or tack coat shall be applied in accordance with Item P-602 or P-603, if shown on the plans.

401-4.11 Laydown plan, transporting, placing, and finishing. Prior to the placement of the HMA, the Contractor shall prepare a laydown plan for approval by the Engineer. This is to minimize the number of cold joints in the pavement. The laydown plan shall include the sequence of paving laydown by stations, width of lanes, temporary ramp locations, and laydown temperature. The laydown plan shall also include estimated time of completion for each portion of the work (that is, milling, paving, rolling, cooling, etc.). Modifications to the laydown plan shall be approved by the Engineer.

The HMA shall be transported from the mixing plant to the site in vehicles conforming to the requirements of paragraph 401-4.3. Deliveries shall be scheduled so that placing and compacting of HMA is uniform with minimum stopping and starting of the paver. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to atmospheric temperature.

The Contractor may use a material transfer vehicle to deliver HMA to the paver.

The alignment and elevation of the paver shall be regulated from outside reference lines established for this purpose for the first lift of all runway and taxiway pavements. Successive lifts of HMA surface course may be placed using a ski, or laser control per paragraph 401-4.4.1, provided grades of the first lift of HMA surface course meet the tolerances of paragraphs 401-5.2b(6) as verified by a survey. Contractor shall survey each lift of HMA surface course and certify to Engineer that every lot of each lift meets the grade tolerances of paragraph 401-5.2b(6) before the next lift can be placed.

The initial placement and compaction of the HMA shall occur at a temperature suitable for obtaining density, surface smoothness, and other specified requirements but not less than 250°F.

Edges of existing HMA pavement abutting the new work shall be saw cut and carefully removed as shown on the drawings and coated with asphalt tack coat before new material is placed against it.

Upon arrival, the HMA shall be placed to the full width by a HMA paver. It shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the HMA mat. Unless otherwise permitted, placement of the HMA shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope. The HMA shall be placed in consecutive adjacent strips having a minimum width of 15 feet on the runway and 10 feet on the taxiway, except where edge lanes require less width to complete the area. Additional screed sections shall not be attached to widen paver to meet the minimum lane width requirements specified above unless additional auger sections are added to match. The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 1 foot; however, the joint in the

surface top course shall be at the centerline of crowned pavements. Transverse joints in one course shall be offset by at least 10 feet from transverse joints in the previous course.

Transverse joints in adjacent lanes shall be offset a minimum of 10 feet.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the HMA may be spread and luted by hand tools.

Areas of segregation in the surface course, as determined by the Engineer, shall be removed and replaced at the Contractor's expense. The area shall be removed by saw cutting and milling a minimum of 2 inches deep. The area to be removed and replaced shall be a minimum width of the paver and a minimum of 10 feet long.

401-4.12 Compaction of HMA. After placing, the HMA shall be thoroughly and uniformly compacted by power rollers. The surface shall be compacted as soon as possible when the HMA has attained sufficient stability so that the rolling does not cause undue displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once.

Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until the surface is of uniform texture, true to grade and cross-section, and the required field density is obtained. To prevent adhesion of the HMA to the roller, the wheels shall be equipped with a scraper and kept properly moistened but excessive water will not be permitted.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with approved power driven tampers. Tampers shall weigh not less than 275 pounds, have a tamping plate width not less than 15 inches, be rated at not less than 4,200 vibrations per minute, and be suitably equipped with a standard tamping plate wetting device.

Any HMA that becomes loose and broken, mixed with dirt, contains check-cracking, or in any way defective shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense. Skin patching shall not be allowed.

401-4.13 Joints. The formation of all joints shall be made in such a manner as to ensure a continuous bond between the courses and obtain the required density. All joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.

The roller shall not pass over the unprotected end of the freshly laid HMA except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing the adjacent lane. In both methods, all contact surfaces shall be coated with an asphalt tack coat before placing any fresh HMA against the joint.

Longitudinal joints which have been left exposed for more than four (4) hours; the surface temperature has cooled to less than 175°F; or are irregular, damaged, uncompacted or otherwise defective shall be cut back 3 inches to 6 inches to expose a clean, sound, uniform vertical surface for the full depth of the course. All cutback material shall be removed from the project. Asphalt tack coat or other product approved by the Engineer shall be applied to the clean, dry joint, prior to placing any additional fresh

HMA against the joint. Any laitance produced from cutting joints shall be removed by vacuuming and washing. The cost of this work shall be considered incidental to the cost of the HMA.

401-4.14 Saw-cut grooving. If shown on the plans, saw cut grooves shall be provided as specified in Item P-621.

401-4.15 Diamond grinding. When required, diamond grinding shall be accomplished by sawing with saw blades impregnated with industrial diamond abrasive. The saw blades shall be assembled in a cutting head mounted on a machine designed specifically for diamond grinding that will produce the required texture and smoothness level without damage to the pavement. The saw blades shall be 1/8-inch wide and there shall be a minimum of 55 to 60 blades per 12 inches of cutting head width; the actual number of blades will be determined by the Contractor and depend on the hardness of the aggregate. Each machine shall be capable of cutting a path at least 3 feet wide. Equipment that causes ravels, aggregate fractures, spalls or disturbance to the pavement will not be permitted. The depth of grinding shall not exceed 1/2 inch and all areas in which diamond grinding has been performed will be subject to the final pavement thickness tolerances specified. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. Areas that have been ground will be sealed with a P-608 surface treatment as directed by the Engineer. It may be necessary to seal a larger area to avoid surface treatment creating any conflict with runway or taxiway markings.

401-4.16 Nighttime paving requirements. Paving during nighttime construction shall require the following:

a. All paving machines, rollers, distribution trucks and other vehicles required by the Contractor for his operations shall be equipped with artificial illumination sufficient to safely complete the work.

b. Minimum illumination level shall be twenty (20) horizontal foot-candles and maintained in the following areas:

(1) An area of 30 feet wide by 30 feet long immediately behind the paving machines during the operations of the machines.

(2) An area 15 feet wide by 30 feet long immediately in front and back of all rolling equipment, during operation of the equipment.

(3) An area 15 feet wide by 15 feet long at any point where an area is being tack coated prior to the placement of pavement.

c. As partial fulfillment of the above requirements, the Contractor shall furnish and use, complete artificial lighting units with a minimum capacity of 3,000 watt electric beam lights, affixed to all equipment in such a way to direct illumination on the area under construction.

d. A lighting plan must be submitted by the Contractor and approved by the Engineer prior to the start of any nighttime work.

If the Contractor places any out of specification mix in the project work area, the Contractor is required to remove it at its own expense, to the satisfaction of the Engineer. If the Contractor has to continue placing non-payment HMA, as directed by the Engineer, to make the surfaces safe for aircraft operations, the Contractor shall do so to the satisfaction of the Engineer. It is the Contractor's responsibility to leave the facilities to be paved in a safe condition ready for aircraft operations. No consideration for extended closure time of the area being paved will be given. As a first order of work for the next paving shift, the Contractor shall remove all out of specification material and replace with

approved material to the satisfaction of the Engineer. When the above situations occur, there will be no consideration given for additional construction time or payment for extra costs.

MATERIAL ACCEPTANCE

401-5.1 Acceptance sampling and testing. Unless otherwise specified, all acceptance sampling and testing necessary to determine conformance with the requirements specified in this section will be performed by the Engineer at no cost to the Contractor except that coring and profilograph testing as required in this section shall be completed and paid for by the Contractor.

Testing organizations performing these tests **(**except profilograph) shall be accredited in accordance with ASTM D3666. The laboratory accreditation must be current and listed on the accrediting authority's website. All test methods required for acceptance sampling and testing must be listed on the lab accreditation. A copy of the laboratory's current accreditation and accredited test methods shall be submitted to the Engineer prior to start of construction. All equipment in Contractor furnished laboratories shall be calibrated by an independent testing organization prior to the start of operations at the Contractor's expense.

a. Hot mixed asphalt. Plant-produced HMA shall be tested for air voids on a lot basis. Sampling shall be from material deposited into trucks at the plant or from trucks at the job site. Samples shall be taken in accordance with ASTM D979.

A standard lot shall be equal to one day's production or 2,000 tons whichever is smaller. If the day's production is expected to exceed 2,000 tons, but less than 4,000 tons, the lot size shall be 1/2 day's production. If the day's production exceeds 4,000 tons, the lot size shall be an equal sized fraction of the day's production, but shall not exceed 2,000 tons.

Where more than one plant is simultaneously producing HMA for the job, the lot sizes shall apply separately for each plant.

(1) Sampling. Each lot will consist of four equal sublots. Sufficient HMA for preparation of test specimens for all testing will be sampled by the Engineer on a random basis, in accordance with the procedures contained in ASTM D3665. Samples will be taken in accordance with ASTM D979.

The sample of HMA may be put in a covered metal tin and placed in an oven for not less than 30 minutes nor more than 60 minutes to stabilize to compaction temperature. The compaction temperature of the specimens shall be as specified in the JMF. If absorptive aggregates are used, the hold times shall be increased to not less than 60 minutes nor more than 90 minutes.

(2) Testing. Air voids will be determined by the Engineer in accordance with ASTM D3203. One set of laboratory compacted specimens will be prepared for each sublot in accordance with ASTM D6925 at the number of gyrations required by paragraph 401-3.2, Table 1. Each set of laboratory compacted specimens will consist of three test specimens prepared from the same sample.

Prior to testing, the bulk specific gravity of each test specimen shall be measured by the Engineer in accordance with ASTM D2726 using the procedure for laboratory-prepared thoroughly dry specimens for use in computing air voids and pavement density.

For air voids determination, the theoretical maximum specific gravity of the mixture shall be measured one time for each sublot in accordance with ASTM D2041. The value used in the air voids computation for each sublot shall be based on theoretical maximum specific gravity measurement for the sublot.

(3) Acceptance. Acceptance of plant produced HMA for air voids shall be determined by the Engineer in accordance with the requirements of paragraph 401-5.2b.

b. In-place HMA. HMA placed in the field shall be tested for mat and joint density on a lot basis. A standard lot shall be equal to one day's production or 2,000 tons whichever is smaller. If the day's production is expected to exceed 2,000 tons, but less than 4,000 tons, the lot size shall be 1/2 day's production. If the day's production exceeds 4,000 tons, the lot size shall be an equal sized fraction of the day's production, but shall not exceed 2,000 tons.

(1) Mat density. The lot size shall be the same as that indicated in paragraph 401-5.1a and shall be divided into four equal sublots. One core of finished, compacted HMA shall be taken by the Contractor from each sublot. Core locations will be determined by the Engineer on a random basis in accordance with procedures contained in ASTM D3665. Cores for mat density shall not be taken closer than one foot from a transverse or longitudinal joint.

(2) Joint density. The lot size shall be the total length of longitudinal joints constructed by a lot of HMA as defined in paragraph 401-5.1a. The lot shall be divided into four equal sublots. One core of finished, compacted HMA shall be taken by the Contractor from each sublot. Core locations will be determined by the Engineer on a random basis in accordance with procedures contained in ASTM D3665. All cores for joint density shall be taken centered on the joint. The minimum core diameter for joint density determination shall be 5 inches.

(3) Sampling. Samples shall be neatly cut with a diamond core drill bit. Samples will be taken in accordance with ASTM D979. The minimum diameter of the sample shall be 5 inches. Samples that are clearly defective, as a result of sampling, shall be discarded and another sample taken. The Contractor shall furnish all tools, labor, and materials for cutting samples, cleaning, and filling the cored pavement. Cored pavement shall be cleaned and core holes shall be filled in a manner acceptable to the Engineer and within one day after sampling. Laitance produced by the coring operation shall be removed immediately.

The top most lift of HMA shall be completely bonded to the underlying layer. If any of the cores reveal that the surface is not bonded to the layer immediately below the surface then additional cores shall be taken as directed by the Engineer in accordance with paragraph 401-5.1b to determine the extent of any delamination. All delaminated areas shall be completely removed by milling to the limits and depth and replaced as directed by the Engineer at no additional cost.

(4) Testing. The bulk specific gravity of each cored sample will be measured by the Engineer in accordance with ASTM D2726. Samples will be taken in accordance with ASTM D979. The percent compaction (density) of each sample will be determined by dividing the bulk specific gravity of each sublot sample by the average bulk specific gravity of all laboratory prepared specimens for the lot, as determined in paragraph 401-5.1a(2). The bulk specific gravity used to determine the joint density at joints formed between different lots shall be the lowest of the bulk specific gravity values from the two different lots.

(5) Acceptance. Acceptance of field placed HMA for mat density will be determined by the Engineer in accordance with the requirements of paragraph 401-5.2b(1). Acceptance for joint

density will be determined by the Engineer in accordance with the requirements of paragraph 401-5.2b(3).

c. Partial lots. When operational conditions cause a lot to be terminated before the specified number of tests have been made for the lot, or when the Contractor and Engineer agree in writing to allow overages or other minor tonnage placements to be considered as partial lots, the following procedure will be used to adjust the lot size and the number of tests for the lot.

The last batch produced where production is halted will be sampled, and its properties shall be considered as representative of the particular sublot from which it was taken. In addition, an agreed to minor placement will be sampled, and its properties shall be considered as representative of the particular sublot from which it was taken. Where three sublots are produced, they shall constitute a lot. Where one or two sublots are produced, they shall be incorporated into the next lot, and the total number of sublots shall be used in the acceptance plan calculation, that is, n = 5 or n = 6, for example. Partial lots at the end of asphalt production on the project shall be included with the previous lot. The lot size for field placed material shall correspond to that of the plant material, except that, in no cases, shall less than three (3) cored samples be obtained, that is, n = 3.

401-5.2 Acceptance criteria.

a. General. Acceptance will be based on the following characteristics of the HMA and completed pavement as well as the implementation of the Contractor Quality Control Program and test results:

(1) Air voids

(2) Mat density

(3) Joint density

(4) Thickness

(5) Smoothness

(6) Grade

Mat density and air voids will be evaluated for acceptance in accordance with paragraph 401-5.2b(1). Joint density will be evaluated for acceptance in accordance with paragraph 401-5.2b(3).

Thickness will be evaluated by the Engineer for compliance in accordance with paragraph 401-5.2b(4). Acceptance for smoothness will be based on the criteria contained in paragraph 401-5.2b(5). Acceptance for grade will be based on the criteria contained in paragraph 401-5.2b(7).

The Engineer may at any time, reject and require the Contractor to dispose of any batch of HMA which is rendered unfit for use due to contamination, segregation, incomplete coating of aggregate, or improper mix temperature. Such rejection may be based on only visual inspection or temperature measurements. In the event of such rejection, the Contractor may take a representative sample of the rejected material in the presence of the Engineer, and if it can be demonstrated in the laboratory, in the presence of the Engineer, that such material was erroneously rejected, payment will be made for the material at the contract unit price.

b. Acceptance criteria.

(1) Mat density and air voids. Acceptance of each lot of plant produced material for mat density and air voids shall be based on the percentage of material within specification limits (PWL). If

the PWL of the lot equals or exceeds 90%, the lot shall be acceptable. Acceptance and payment shall be determined in accordance with paragraph 401-8.1.

(2) Joint density. Acceptance of each lot of plant produced HMA for joint density shall be based on the PWL. If the PWL of the lot is equal to or exceeds 90%, the lot shall be considered acceptable. If the PWL is less than 90%, the Contractor shall evaluate the reason and act accordingly. If the PWL is less than 80%, the Contractor shall cease operations and until the reason for poor compaction has been determined. If the PWL is less than 71%, the pay factor for the lot used to complete the joint shall be reduced by five (5) percentage points. This lot pay factor reduction shall be incorporated and evaluated in accordance with paragraph 401-8.1.

(3) Thickness. Thickness of each lift of surface course shall be evaluated by the Engineer for compliance to the requirements shown on the plans. Measurements of thickness shall be made by the Engineer using the cores extracted for each sublot for density measurement. The maximum allowable deficiency at any point shall not be more than 1/4 inch less than the thickness indicated for the lift. Average thickness of lift, or combined lifts, shall not be less than the indicated thickness. Where the thickness tolerances are not met, the lot or sublot shall be corrected by the Contractor at his expense by removing the deficient area and replacing with new pavement. The Contractor, at his expense, may take additional cores as approved by the Engineer to circumscribe the deficient area.

(4) Smoothness. The final surface shall be free from roller marks. After the final rolling, but not later than 24 hours after placement, the surface of each lot shall be tested in both longitudinal and transverse directions for smoothness to reveal all surface irregularities exceeding the tolerances specified. The Contractor shall furnish paving equipment and employ methods that produce a surface for each pavement lot having an average profile index meeting the requirements of paragraph 401-8.1d when evaluated with a profilograph; and the finished surface course of the pavement shall not vary more than 1/4 inch when evaluated with a 12-foot straightedge. When the surface course smoothness exceeds specification tolerances which cannot be corrected by diamond grinding of the surface course, full depth removal and replacement of surface course corrections shall be to the limit of the longitudinal placement. Corrections involving diamond grinding will be subject to the final pavement thickness tolerances specified. The Contractor shall apply a surface treatment per Item P-608 or P-609 to all areas that have been subject to grinding as directed by the Engineer.

(a) Transverse measurements. Transverse measurements will be taken for each lot placed. Transverse measurements will be taken perpendicular to the pavement centerline each 50 feet or more often as determined by the Engineer.

(i) Testing shall be continuous across all joints, starting with one-half the length of the straightedge at the edge of pavement section being tested and then moved ahead one-half the length of the straightedge for each successive measurement. Smoothness readings will not be made across grade changes or cross slope transitions; at these transition areas, the straightedge position shall be adjusted to measure surface smoothness and not design grade or cross slope transitions. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points. High spots on final surface course >

1/4 inch in transverse direction shall be corrected with diamond grinding per paragraph 401-4.15 or by removing and replacing full depth of surface course. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The area corrected by grinding should not exceed 10% of the total area and these areas shall be retested after grinding.

(ii) The joint between lots shall be tested separately to facilitate smoothness between lots. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface, with half the straightedge on one side of the joint and the other half of the straightedge on the other side of the joint. Measure the maximum gap between the straightedge and the pavement surface in the area between these two high points. One measurement shall be taken at the joint every 50 feet or more often if directed by the Engineer. Deviations on final surface course > 1/4 inch in transverse direction shall be corrected with diamond grinding per paragraph 401-4.15 or by removing and replacing full depth of surface course. Each measurement shall be recorded and a copy of the data shall be furnished to the Engineer at the end of each days testing.

(b) Longitudinal measurements. Longitudinal measurements will be taken for each lot placed. Longitudinal tests will be parallel to the centerline of paving; at the center of paving lanes when widths of paving lanes are less than 20 feet; and at the third points of paving lanes when widths of paving lanes are 20 ft or greater.

(i) Longitudinal Short Sections. Longitudinal Short Sections are when the longitudinal lot length is less than 200 feet and areas not requiring a profilograph. When approved by the Engineer, the first and last 15 feet of the lot can also be considered as short sections for smoothness. The finished surface shall not vary more than 1/4 inch when evaluated with a 12-foot straightedge. Smoothness readings will not be made across grade changes or cross slope transitions; at these transition areas, the straightedge position shall be adjusted to measure surface smoothness and not design grade or cross slope transitions. Testing shall be continuous across all joints, starting with one-half the length of the straightedge at the edge of pavement section being tested and then moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points. Deviations on final surface course > 1/4 inch in longitudinal direction will be corrected with diamond grinding per paragraph 401-4.15 or by removing and replacing full depth of surface course. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The area corrected by grinding should not exceed 10% of the total area and these areas shall be retested after grinding.

(ii) Profilograph Testing. Profilograph testing shall be performed by the contractor using approved equipment and procedures as described as ASTM E1274. The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate “must grind” bumps and the Profile Index for the pavement using a 0.2 inch blanking band. The bump template must span one inch with an offset of 0.4 inches. The

profilograph must be calibrated prior to use and operated by a factory or State DOT approved operator. Profilograms shall be recorded on a longitudinal scale of one inch equals 25 feet and a vertical scale of one inch equals one inch. A copy of the reduced tapes shall be furnished to the Engineer at the end of each days testing.

The pavement must have an average profile index meeting the requirements of paragraph 401-8.1d. High spots, or "must grind" spots, on final surface course in longitudinal direction shall be corrected with diamond grinding per paragraph 401-4.15 or by removing and replacing full depth of surface course. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The area corrected by grinding should not exceed 10% of the total area and these areas shall be retested after grinding.

Where corrections are necessary, second profilograph runs shall be performed to verify that the corrections produced an average profile index of 15 inches per mile or less. If the initial average profile index was less than 15 inches, only those areas representing greater than 0.4 inch deviation will be re-profiled for correction verification.

(iii) Final profilograph of runway. Final profilograph, full length of runway, shall be performed to facilitate testing of smoothness between lots. Profilograph testing shall be performed by the contractor using approved equipment and procedures as described as ASTM E1274.The pavement must have an average profile index meeting the requirements of paragraph 401-8.1d. The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate "must grind" bumps and the Profile Index for the pavement using a 0.2 inch blanking band. The bump template must span one inch with an offset of 0.4 inches. The profilograph must be calibrated prior to use and operated by a factory or State DOT approved, trained operator. Profilograms shall be recorded on a longitudinal scale of one inch equals 25 feet and a vertical scale of one inch equals one inch. A copy of the reduced tapes shall be furnished to the Engineer at the end of each days testing. Profilograph of final runway shall be performed one foot right and left of runway centerline and 15 feet right and left of centerline. Any areas that indicate "must grind" will be corrected as directed by the Engineer.

Smoothness testing indicated in the above paragraphs except paragraph (iii) shall be performed within 24 hours of placement of material. Smoothness testing indicated in paragraph (iii) shall be performed within 48 hours of paving completion. The primary purpose of smoothness testing is to identify areas that may be prone to ponding of water which could lead to hydroplaning of aircraft. If the contractor's machines and/or methods are producing significant areas that need corrective actions then production should be stopped until corrective measures can be implemented. If corrective measures are not implemented and when directed by the Engineer, production shall be stopped until corrective measures can be implemented.

(5) Grade. Grade shall be evaluated on the first day of placement and then as a minimum, every paving day following to allow adjustments to paving operations if measurements do not meet specification requirements. The Contractor must submit the survey data to the Engineer by the following day after measurements have been taken. The finished surface of the pavement shall not vary from the gradeline elevations and cross-sections shown on the plans by more than 1/2

inch. The finished grade of each lot will be determined by running levels at intervals of 50 feet or less longitudinally and all breaks in grade transversely (not to exceed 50 feet) to determine the elevation of the completed pavement. The Contractor shall pay the cost of surveying of the level runs that shall be performed by a licensed surveyor. The documentation, stamped and signed by a licensed surveyor, shall be provided by the Contractor to the Engineer. The lot size shall be 2,000 square yards. When more than 15% of all the measurements within a lot are outside the specified tolerance, or if any one shot within the lot deviates 3/4 inch or more from planned grade, the Contractor shall remove the deficient area to the depth of the final course plus 1/2 inch of pavement and replace with new material. Skin patching shall not be permitted. Isolated high points may be ground off provided the course thickness complies with the thickness specified on the plans. The surface of the ground pavement shall have a texture consisting of grooves between 0.090 and 0.130 inches wide. The peaks and ridges shall be approximately 1/32 inch higher than the bottom of the grooves. The pavement shall be left in a clean condition. The removal of all of the slurry resulting from the grinding operation shall be continuous The grinding operation should be controlled so the residue from the operation does not flow across other lanes of pavement. High point grinding will be limited to 15 square yards. Areas in excess of 15 square yards will require removal and replacement of the pavement in accordance with the limitations noted above. The Contractor shall apply a surface treatment per P-608 to all areas that have been subject to grinding.

c. Percentage of material within specification limits (PWL). The PWL shall be determined in accordance with procedures specified in Section 110 of the General Provisions. The specification tolerance limits (L) for lower and (U) for upper are contained in Table 5.

Table 5. Gyratory Acceptance Limits For Air Voids, Density

TEST PROPERTY	Specification Tolerance	
	L	U
Air Voids Total Mix (%)	2	5
Mat Density (%)	96.3	101.3
Joint Density (%)	93.3	-

d. Outliers. All individual tests for mat density and air voids shall be checked for outliers (test criterion) in accordance with ASTM E178, at a significance level of 5%. Outliers shall be discarded, and the PWL shall be determined using the remaining test values.The criteria in Table 5 is based on production processes which have a variability with the following standard deviations: Surface Course Mat Density (%), 1.30; Base Course Mat Density (%), 1.55; Joint Density (%), 2.1.

The Contractor should note that (1) 90 PWL is achieved when consistently producing a surface course with an average mat density of at least 98% with 1.30% or less variability, (2) 90 PWL is achieved when consistently producing a base course with an average mat density of at least 97.5% with 1.55% or less variability, and (3) 90 PWL is achieved when consistently producing joints with an average joint density of at least 96% with 2.1% or less variability.

401-5.3 Resampling pavement for mat density.

a. General. Resampling of a lot of pavement will only be allowed for mat density, and then, only if the Contractor requests same, in writing, within 48 hours after receiving the written test results from the Engineer. A retest will consist of all the sampling and testing procedures contained in paragraphs 401-5.1b and 401-5.2b(1). Only one resampling per lot will be permitted.

(1) A redefined PWL shall be calculated for the resampled lot. The number of tests used to calculate the redefined PWL shall include the initial tests made for that lot plus the retests.

(2) The cost for resampling and retesting shall be borne by the Contractor.

b. Payment for resampled lots. The redefined PWL for a resampled lot shall be used to calculate the payment for that lot in accordance with Table 6.

c. Outliers. Check for outliers in accordance with ASTM E178, at a significance level of 5%.

401-5.4 Leveling course. Any course used for trueing and leveling shall meet the aggregate gradation in Table 3, paragraph 401-3.2. The trueing and leveling course shall meet the requirements of paragraph 401-3.2, 401-5.2b(1) for air voids, but shall not be subject to the density requirements of paragraph 401-5.2b(1) for mat density and 401-5.2b(3) for joint density. The leveling course shall be compacted with the same effort used to achieve density of the test section. The trueing and leveling course shall not exceed the maximum lift thickness associated with each gradation in Table 3, paragraph 401-3.2. The leveling course is the first variable thickness lift of an overlay placed prior to subsequent courses.

CONTRACTOR QUALITY CONTROL

401-6.1 General. The Contractor shall develop a Quality Control Program in accordance with Section 100 of the General Provisions. The program shall address all elements that affect the quality of the pavement including, but not limited to:

a. Mix design

b. Aggregate grading

c. Quality of materials

d. Stockpile management

e. Proportioning

f. Mixing and transportation

g. Placing and finishing

h. Joints

i. Compaction

j. Surface smoothness

k. Personnel

l. Laydown plan

The Contractor shall perform quality control sampling, testing, and inspection during all phases of the work and shall perform them at a rate sufficient to ensure that the work conforms to the contract requirements, and at minimum test frequencies required by paragraph 401-6.3 and Section 100 of the General Provisions. As a part of the process for approving the Contractor's plan, the Engineer may require the Contractor's technician to perform testing of samples to demonstrate an acceptable level of performance.

No partial payment will be made for materials that are subject to specific quality control requirements without an approved plan.

401-6.2 Contractor testing laboratory. The lab shall meet the requirements of ASTM D3666 including all necessary equipment, materials, and current reference standards to comply with the specifications.

401-6.3 Quality control testing. The Contractor shall perform all quality control tests necessary to control the production and construction processes applicable to these specifications and as set forth in the approved Quality Control Program. The testing program shall include, but not necessarily be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, field compaction, and surface smoothness. A Quality Control Testing Plan shall be developed as part of the Quality Control Program.

a. Asphalt content. A minimum of two asphalt content tests shall be performed per lot in accordance with ASTM D6307 or ASTM D2172 if the correction factor in ASTM D6307 is greater than 1.0. The asphalt content for the lot will be determined by averaging the test results.

b. Gradation. Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of extracted aggregate in accordance with ASTM D5444, ASTM C136, and ASTM C117.

c. Moisture content of aggregate. The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C566.

d. Moisture content of HMA. The moisture content shall be determined once per lot in accordance with ASTM D1461 or AASHTO T329.

e. Temperatures. Temperatures shall be checked, at least four times per lot, at necessary locations to determine the temperatures of the dryer, the asphalt binder in the storage tank, the HMA at the plant, and the HMA at the job site.

f. In-place density monitoring. The Contractor shall conduct any necessary testing to ensure that the specified density is being achieved. A nuclear gauge may be used to monitor the pavement density in accordance with ASTM D2950.

g. Additional testing. Any additional testing that the Contractor deems necessary to control the process may be performed at the Contractor's option.

h. Monitoring. The Engineer reserves the right to monitor any or all of the above testing.

401-6.4 Sampling. When directed by the Engineer, the Contractor shall sample and test any material that appears inconsistent with similar material being sampled, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

401-6.5 Control charts. The Contractor shall maintain linear control charts both for individual measurements and range (that is, difference between highest and lowest measurements) for aggregate gradation, asphalt content, and VMA. The VMA for each sublot will be calculated and monitored by the Quality Control laboratory.

Control charts shall be posted in a location satisfactory to the Engineer and shall be kept current. As a minimum, the control charts shall identify the project number, the contract item number, the test number, each test parameter, the Action and Suspension Limits applicable to each test parameter, and the Contractor's test results. The Contractor shall use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the Contractor's projected data during production indicates a problem and the Contractor is not taking satisfactory corrective action, the Engineer may suspend production or acceptance of the material.

a. Individual measurements. Control charts for individual measurements shall be established to maintain process control within tolerance for aggregate gradation, asphalt content, and VMA. The control charts shall use the job mix formula target values as indicators of central tendency for the following test parameters with associated Action and Suspension Limits:

Control Chart Limits For Individual Measurements		
Sieve	**Action Limit**	**Suspension Limit**
3/4 inch (19 mm)	±6%	±9%
1/2 inch (12 mm)	±6%	±9%
3/8 inch (9 mm)	±6%	±9%
No. 4 (4.75 mm)	±6%	±9%
No. 16 (1.18 mm)	±5%	±7.5%
No. 50 (0.30 mm)	±3%	±4.5%
No. 200 (0.075 mm)	±2%	±3%
Asphalt Content	±0.45%	±0.70%
VMA	-1.00%	-1.50%

b. Range. Control charts for range shall be established to control process variability for the test parameters and Suspension Limits listed below. The range shall be computed for each lot as the difference between the two test results for each control parameter. The Suspension Limits specified below are based on a sample size of n = 2. Should the Contractor elect to perform more than two tests per lot, the Suspension Limits shall be adjusted by multiplying the Suspension Limit by 1.18 for n = 3 and by 1.27 for n = 4.

Control Chart Limits Based On Range (Based On n = 2)	
Sieve	**Suspension Limit**
1/2 inch (12 mm)	11%
3/8 inch (9 mm)	11%
No. 4 (4.75 mm)	11%
No. 16 (1.18 mm)	9%
No. 50 (0.30 mm)	6%
No. 200 (0.075 mm)	3.5%
Asphalt Content	0.8%

c. Corrective Action. The Contractor Quality Control Program shall indicate that appropriate action shall be taken when the process is believed to be out of tolerance. The Plan shall contain sets of rules to gauge when a process is out of control and detail what action will be taken to bring the process into control. As a minimum, a process shall be deemed out of control and production stopped and corrective action taken, if:

(1) One point falls outside the Suspension Limit line for individual measurements or range; or

(2) Two points in a row fall outside the Action Limit line for individual measurements.

401-6.6 Quality control reports. The Contractor shall maintain records and shall submit reports of quality control activities daily, in accordance with the Contractor Quality Control Program described in General Provisions, Section 100.

METHOD OF MEASUREMENT

401-7.1 Measurement. HMA shall be measured by the number of tons of HMA used in the accepted work. Recorded batch weights or truck scale weights will be used to determine the basis for the tonnage.

BASIS OF PAYMENT

401-8.1 Payment. Payment for a lot of HMA meeting all acceptance criteria as specified in paragraph 401-5.2 shall be made based on results of tests for smoothness, mat density and air voids. Payment for acceptable lots shall be adjusted according to paragraph 401-8.1a for mat density and air voids and 401-8.1c for smoothness, subject to the limitation that:

a. The total project payment for plant mix bituminous concrete pavement shall not exceed 100 percent of the product of the contract unit price and the total number of tons of HMA used in the accepted work (See Note 1 under Table 6).

b. The price shall be compensation for furnishing all materials, for all preparation, mixing, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

c. Basis of adjusted payment. The pay factor for each individual lot shall be calculated in accordance with Table 6. A pay factor shall be calculated for both mat density and air voids. The lot pay factor shall be the higher of the two values when calculations for both mat density and air voids are 100% or higher. The lot pay factor shall be the product of the two values when only one of the calculations for either mat density or air voids is 100% or higher. The lot pay factor shall be the lower of the two values when calculations for both mat density and air voids are less than 100%. If PWL for joint density is less than 71 percent then the lot pay factor shall be reduced by 5% but be no higher than 95%.

For each lot accepted, the adjusted contract unit price shall be the product of the lot pay factor for the lot and the contract unit price. Payment shall be subject to the total project payment limitation specified in paragraph 401-8.1. Payment in excess of 100% for accepted lots of HMA shall be used to offset payment for accepted lots of bituminous concrete pavement that achieve a lot pay factor less than 100%.

Table 6. Price adjustment schedule[1]

Percentage of material within specification limits (PWL)	Lot pay factor (percent of contract unit price)
96 – 100	106
90 – 95	PWL + 10
75 – 89	0.5 PWL + 55
55 – 74	1.4 PWL – 12
Below 55	Reject [2]

[1] Although it is theoretically possible to achieve a pay factor of 106% for each lot, actual payment above 100% shall be subject to the total project payment limitation specified in paragraph 401-8.1.

[2] The lot shall be removed and replaced. However, the Engineer may decide to allow the rejected lot to remain. In that case, if the Engineer and Contractor agree in writing that the lot shall not be removed, it shall be paid for at 50% of the contract unit price and the total project payment shall be reduced by the amount withheld for the rejected lot.

d. Profilograph smoothness. When the final average profile index (subsequent to any required corrective action) does not exceed 7 inches per mile, payment will be made at the contract unit price for the completed pavement. If the final average profile index (subsequent to any required corrective action) exceeds 7 inches per mile, but does not exceed 15 inches per mile, the Contractor may elect to accept a contract unit price adjustment in lieu of reducing the profile index.

e. Basis of adjusted payment for smoothness. Price adjustment for pavement smoothness will be made in accordance with Table 7. The adjustment will apply to the total tonnage of HMA within a lot of pavement and shall be applied with the following equation:

(Tons of asphalt concrete in lot) × (lot pay factor) × (unit price per ton) × (smoothness pay factor) = payment for lot

Table 7. Profilograph Average Profile Index Smoothness Pay Factor

Inches/miles per 1/10 mile	Short Sections	Pay Factor
0.0 - 7	00.0 - 15.0	100%
7.1 - 9	15.1 - 16	98%
9.1 - 11	16.1 - 17	96%
11.1 - 13	17.1 - 18	94%
13.1 - 14	18.1 - 20	92%
14.1 - 15	20.1 - 22	90%
15.1 and up	22.1 and up	Corrective work required[1]

[1] The Contractor shall correct pavement areas not meeting these tolerances by removing and replacing the defective work. If the Contractor elects to construct an overlay to correct deficiencies, the minimum thickness of the overlay should be at least three times the maximum aggregate size (approximately four (4) times the nominal maximum aggregate size). The corrective overlay shall not violate grade Criteria and butt joints shall be constructed by sawing and removing the original pavement in compliance with the thickness/ maximum aggregate size ratio. Skin patching shall not be permitted.

HMA placed above the specified grade shall not be included in the quantities for payment.

401-8.1.1. Payment. Payment will be made under:

Item P-401-8.1 Bituminous Leveling Course - - per ton

Item P-401-8.2 Bituminous Intermediate Course, 2-Inch Depth- - per ton

Item P-401-8.3 Bituminous Surface Course, 2-Inch Depth -- per ton

TESTING REQUIREMENTS

ASTM C29 Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate

ASTM C88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

ASTM C117 Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

ASTM C127 Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate

ASTM C131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

ASTM C136 Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates

ASTM C183	Standard Practice for Sampling and the Amount of Testing of Hydraulic Cement
ASTM C566	Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D979	Standard Practice for Sampling Bituminous Paving Mixtures
ASTM D1073	Standard Specification for Fine Aggregate for Bituminous Paving Mixtures
ASTM D2172	Standard Test Method for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D1461	Standard Test Method for Moisture or Volatile Distillates in Bituminous Paving Mixtures
ASTM D2041	Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D2489	Standard Practice for Estimating Degree of Particle Coating of Bituminous-Aggregate Mixtures
ASTM D2726	Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
ASTM D2950	Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods
ASTM D3203	Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM D3666	Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D4867	Standard Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures
ASTM D5444	Standard Test Method for Mechanical Size Analysis of Extracted Aggregate
ASTM D6084	Standard Test Method for Elastic Recovery of Bituminous Materials by Ductilometer
ASTM D6307	Standard Test Method for Asphalt Content of Hot Mix Asphalt by Ignition Method
ASTM D6752	Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Automatic Vacuum Sealing Method

ASTM D6925	Standard Test Method for Preparation and Determination of the Relative Density of Hot Mix Asphalt (HMA) Specimens by Means of the SuperPave Gyratory Compactor
ASTM D6926	Standard Practice for Preparation of Bituminous Specimens Using Marshall Apparatus
ASTM E11	Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves
ASTM E178	Standard Practice for Dealing with Outlying Observations
ASTM E1274	Standard Test Method for Measuring Pavement Roughness Using a Profilograph
AASHTO T030	Standard Method of Test for Mechanical Analysis of Extracted Aggregate
AASHTO T110	Standard Method of Test for Moisture or Volatile Distillates in Hot Mix Asphalt (HMA)
AASHTO T275	Standard Method of Test for Bulk Specific Gravity (Gmb) of Compacted Hot Mix Asphalt (HMA) Using Paraffin-Coated Specimens
AASHTO M156	Standard Specification for Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
AASHTO T329	Standard Method of Test for Moisture Content of Hot Mix Asphalt (HMA) by Oven Method
Asphalt Institute Handbook MS-26,	Asphalt Binder
Asphalt Institute MS-2	Mix Design Manual, 7th Edition

MATERIAL REQUIREMENTS

ASTM D242	Standard Specification for Mineral Filler for Bituminous Paving Mixtures
ASTM D946	Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction
ASTM D3381	Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D4552	Standard Practice for Classifying Hot-Mix Recycling Agents
ASTM D6373	Standard Specification for Performance Graded Asphalt Binder

END OF ITEM P-401

Item P-602 Bituminous Prime Coat

DESCRIPTION

602-1.1 This item shall consist of an application of bituminous material on the prepared base course in accordance with these specifications and in reasonably close conformity to the lines shown on the plans.

MATERIALS

602-2.1 Bituminous material. The bituminous material shall be an emulsified asphalt indicated in ASTM D3628 as a bituminous application for prime coat appropriate to local conditions or as designated by the Engineer.

CONSTRUCTION METHODS

602-3.1 Weather limitations. The prime coat shall be applied only when the existing surface is dry; the atmospheric temperature is 50°F or above, and the temperature has not been below 35°F for the 12 hours prior to application; and when the weather is not foggy or rainy. The temperature requirements may be waived when directed by the Engineer.

602-3.2 Equipment. The equipment shall include a self-powered pressure bituminous material distributor and equipment for heating bituminous material.

Provide a distributor with pneumatic tires of such size and number that the load produced on the base surface does not exceed 65.0 psi of tire width to prevent rutting, shoving or otherwise damaging the base, surface or other layers in the pavement structure. Design and equip the distributor to spray the bituminous material in a uniform coverage at the specified temperature, at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard, with a pressure range of 25 to 75 psi and with an allowable variation from the specified rate of not more than ±5%, and at variable widths. Include with the distributor equipment a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. Equip the distributor to circulate and agitate the bituminous material during the heating process. If the distributor is not equipped with an operable quick shutoff valve, the prime operations shall be started and stopped on building paper. The Contractor shall remove blotting sand prior to asphalt concrete lay down operations at no additional expense to the Owner.

A power broom and power blower suitable for cleaning the surfaces to which the bituminous coat is to be applied shall be provided.

602-3.3 Application of bituminous material. Immediately before applying the prime coat, the full width of the surface to be primed shall be swept with a power broom to remove all loose dirt and other objectionable material.

The bituminous material shall be uniformly applied with a bituminous distributor at the rate of 0.15 to 0.30 gallons per square yard depending on the base course surface texture. The type of bituminous material and application rate shall be approved by the Engineer prior to application.

Following application of the bituminous material and prior to application of the succeeding layer of pavement, allow the bituminous coat to cure and to obtain evaporation of any volatiles or moisture. Maintain the coated surface until the succeeding layer of pavement is placed, by protecting the surface against damage and by repairing and recoating deficient areas. Allow the prime coat to cure without being disturbed for a period of at least 48 hours or longer, as may be necessary to attain penetration into the treated course. Furnish and spread enough sand to effectively blot up and cure excess bituminous material. Keep traffic off surfaces freshly treated with bituminous material. Provide sufficient warning signs and barricades so that traffic will not travel over freshly treated surfaces.

602-3.4 Trial applications. Before providing the complete bituminous coat, the Contractor shall apply three lengths of at least 100 feet for the full width of the distributor bar to evaluate the amount of bituminous material that can be satisfactorily applied with the equipment. Apply three different trial application rates of bituminous materials within the application range specified in paragraph 602-3.3. Other trial applications will be made using various amounts of material as deemed necessary by the Engineer.

602-3.5 Bituminous material Contractor's responsibility. The Contractor shall provide a statement of source and character of the proposed bituminous material which must be submitted to and approved by the Engineer before any shipment of bituminous materials to the project. The Contractor shall furnish vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the project. The test reports shall be provided to and approved by the Engineer before the bituminous material is applied. If the bituminous material does not meet the specifications, it shall be replaced at the Contractor's expense. Furnishing the vendor's certified test report for the bituminous material shall not be interpreted as basis for final acceptance.

602-3.6 Freight and weigh bills. The Contractor shall submit waybills and delivery tickets during the progress of the work. Before the final estimate is allowed, file with the Engineer certified waybills and certified delivery tickets for all bituminous materials used in the construction of the pavement covered by the contract. Do not remove bituminous material from storage until the initial outage and temperature measurements have been taken. The delivery or storage units will not be released until the final outage has been taken.

METHOD OF MEASUREMENT

602-4.1 The bituminous material for prime coat shall be measured by the square yard.

BASIS OF PAYMENT

602-5.1 Payment shall be made at the contract unit price per square yard for bituminous prime coat. This price shall be full compensation for furnishing all materials and for all preparation, delivering, and applying the materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

Payment will be made under:

Item P-602-5.1	Bituminous Prime Coat -- per square yard

TESTING REQUIREMENTS

ASTM D1250	Standard Guide for Use of the Petroleum Measurement Tables

MATERIAL REQUIREMENTS

ASTM D977	Standard Specification for Emulsified Asphalt
ASTM D2028	Standard Specification for Cutback Asphalt (Rapid-Curing Type)
ASTM D2397	Standard Specification for Cationic Emulsified Asphalt
ASTM D3628	Standard Practice for Selection and Use of Emulsified Asphalts

END OF ITEM P-602

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Item P-603 Bituminous Tack Coat

DESCRIPTION

603-1.1 This item shall consist of preparing and treating a bituminous or concrete surface with bituminous material in accordance with these specifications and in reasonably close conformity to the lines shown on the plans.

MATERIALS

603-2.1 Bituminous materials. The bituminous material shall be an emulsified asphalt indicated in ASTM D3628 as a bituminous application for tack coat appropriate to local conditions or as designated by the Engineer.

CONSTRUCTION METHODS

603-3.1 Weather limitations. The tack coat shall be applied only when the existing surface is dry and the atmospheric temperature is 50°F or above; the temperature has not been below 35°F for the 12 hours prior to application; and when the weather is not foggy or rainy. The temperature requirements may be waived when directed by the Engineer.

603-3.2 Equipment. The Contractor shall provide equipment for heating and applying the bituminous material.

Provide a distributor with pneumatic tires of such size and number that the load produced on the base surface does not exceed 65.0 psi of tire width to prevent rutting, shoving or otherwise damaging the base, surface or other layers in the pavement structure. Design and equip the distributor to spray the bituminous material in a uniform coverage at the specified temperature, at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard, with a pressure range of 25 to 75 psi and with an allowable variation from the specified rate of not more than ±5%, and at variable widths. Include with the distributor equipment a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. Equip the distributor to circulate and agitate the bituminous material during the heating process. If the distributor is not equipped with an operable quick shutoff valve, the tack operations shall be started and stopped on building paper. The Contractor shall remove blotting sand prior to asphalt concrete lay down operations at no additional expense to the Owner.

A power broom and/or power blower suitable for cleaning the surfaces to which the bituminous tack coat is to be applied shall be provided.

603-3.3 Application of bituminous material. Immediately before applying the tack coat, the full width of surface to be treated shall be swept with a power broom and/or power blower to remove all loose dirt and other objectionable material.

Emulsified asphalt shall be diluted by the addition of water when directed by the Engineer and shall be applied a sufficient time in advance of the paver to ensure that all water has evaporated before the overlying mixture is placed on the tacked surface.

The bituminous material including vehicle shall be uniformly applied with a bituminous distributor at the rate of 0.05 to 0.10 gallons per square yard depending on the condition of the existing surface. The type of bituminous material and application rate shall be approved by the Engineer prior to application.

After application of the tack coat, the surface shall be allowed to cure without being disturbed for the period of time necessary to permit drying and setting of the tack coat. This period shall be determined by the Engineer. The Contractor shall protect the tack coat and maintain the surface until the next course has been placed.

603-3.4 Bituminous material Contractor's responsibility. The Contractor shall provide a statement of source and character of the proposed bituminous material which must be submitted and approved by the Engineer before any shipment of bituminous materials to the project.

The Contractor shall furnish the vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the project. The tests reports shall be provided to and approved by the Engineer before the bituminous material is applied. If the bituminous material does not meet the specifications, it shall be replaced at the Contractor's expense. Furnishing the vendor's certified test report for the bituminous material shall not be interpreted as a basis for final acceptance.

603-3.5 Freight and weigh bills The Contractor shall submit waybills and delivery tickets, during progress of the work. Before the final statement is allowed, file with the Engineer certified waybills and certified delivery tickets for all bituminous materials used in the construction of the pavement covered by the contract. Do not remove bituminous material from storage until the initial outage and temperature measurements have been taken. The delivery or storage units will not be released until the final outage has been taken.

METHOD OF MEASUREMENT

603-4.1 The bituminous material for tack coat shall be measured by the square yard.

BASIS OF PAYMENT

603.5-1 Payment shall be made at the contract unit price per square yard of bituminous material. This price shall be full compensation for furnishing all materials, for all preparation, delivery, and application of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-603-5.1 Bituminous Tack Coat -- per square yard

MATERIAL REQUIREMENTS

ASTM D633	Standard Volume Correction Table for Road Tar
ASTM D977	Standard Specification for Emulsified Asphalt
ASTM D1250	Standard Guide for Use of the Petroleum Measurement Tables
ASTM D2028	Standard Specification for Cutback Asphalt (Rapid-Curing Type)
ASTM D2397	Standard Specification for Cationic Emulsified Asphalt
ASTM D3628	Standard Practice for Selection and Use of Emulsified Asphalts

END ITEM P-603

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Item P-610 Structural Portland Cement Concrete

DESCRIPTION

610-1.1 This item shall consist of plain or reinforced structural portland cement concrete (PCC), prepared and constructed in accordance with these specifications, at the locations and of the form and dimensions shown on the plans. This specification shall be used for all structural and miscellaneous concrete including signage bases.

MATERIALS

610-2.1 General. Only approved materials, conforming to the requirements of these specifications, shall be used in the work. Materials may be subject to inspection and tests at any time during their preparation or use. The source of all materials shall be approved by the Engineer before delivery or use in the work. Representative preliminary samples of the materials shall be submitted by the Contractor, when required, for examination and test. Materials shall be stored and handled to ensure preservation of their quality and fitness for use and shall be located to facilitate prompt inspection. All equipment for handling and transporting materials and concrete must be clean before any material or concrete is placed in them.

The use of pit-run aggregates shall not be permitted unless the pit-run aggregate has been screened and washed, and all fine and coarse aggregates stored separately and kept clean. The mixing of different aggregates from different sources in one storage stockpile or alternating batches of different aggregates shall not be permitted.

a. Reactivity. Fine and Coarse aggregates to be used in all concrete shall be evaluated and tested by the Contractor for alkali-aggregate reactivity in accordance with both ASTM C1260 and C1567. Aggregate and mix proportion reactivity tests shall be performed for each project.

(1) Coarse and fine aggregate shall be tested separately in accordance with ASTM C1260. The aggregate shall be considered innocuous if the expansion of test specimens, tested in accordance with ASTM C1260, does not exceed 0.10% at 28 days (30 days from casting).

(2) Combined coarse and fine aggregate shall be tested in accordance with ASTM C1567, modified for combined aggregates, using the proposed mixture design proportions of aggregates, cementitious materials, and/or specific reactivity reducing chemicals. If lithium nitrate is proposed for use with or without supplementary cementitious materials, the aggregates shall be tested in accordance with Corps of Engineers (COE) CRD C662. If lithium nitrate admixture is used, it shall be nominal 30% ±0.5% weight lithium nitrate in water.

(3) If the expansion of the proposed combined materials test specimens, tested in accordance with ASTM C1567, modified for combined aggregates, or COE CRD C662, does not exceed 0.10% at 28 days, the proposed combined materials will be accepted. If the expansion of the proposed combined materials test specimens is greater than 0.10% at 28 days, the aggregates will not be accepted unless

adjustments to the combined materials mixture can reduce the expansion to less than 0.10% at 28 days, or new aggregates shall be evaluated and tested.

610-2.2 Coarse aggregate. The coarse aggregate for concrete shall meet the requirements of ASTM C33. Crushed stone aggregate shall have a durability factor, as determined by ASTM C666, greater than or equal to 95. The Engineer may consider and reserve final approval of other State classification procedures addressing aggregate durability.

Coarse aggregate shall be well graded from coarse to fine and shall meet the following gradation shown in the table below when tested per ASTM C136.

Gradation For Coarse Aggregate

Sieve Designation (square openings)	**Percentage by Weight Passing Sieves**
	1" (25 mm)
No. 4 to 3/4 in. (4.75-19 mm)	**100**
No. 4 to 1 in. (4.75-25 mm)	**90-100**

610-2.2.1 Aggregate susceptibility to durability (D) cracking. Coarse aggregate may be accepted from sources that have a 20 year service history for the same gradation to be supplied with no durability issues.

The Contractor shall submit a current certification that the aggregate does not have a history of D-cracking and that the aggregate meets the state specifications for use in PCC pavement for use on interstate highways. Certifications, tests and any history reports must be for the same gradation as being proposed for use on the project. Certifications which are not dated or which are over one (1) year old or which are for different gradations will not be accepted. Test results will only be accepted when tests were performed by a State Department of Transportation (DOT) materials laboratory or an accredited laboratory.

610-2.3 Fine aggregate. The fine aggregate for concrete shall meet the requirements of ASTM C33.

The fine aggregate shall be well graded from fine to coarse and shall meet the requirements of the table below when tested in accordance with ASTM C136:

Gradation For Fine Aggregate

Sieve Designation (square openings)	**Percentage by Weight Passing Sieves**
3/8 inch (9 mm)	100
No. 4 (4.75 mm)	95-100
No. 16 (1.18 mm)	45-80
No. 30 (0.60 mm)	25-55
No. 50 (0.30 mm)	10-30
No. 100 (0.15 mm)	2-10

Blending will be permitted, if necessary, to meet the gradation requirements for fine aggregate. Fine aggregate deficient in the percentage of material passing the No. 50 mesh sieve may be accepted, if the deficiency does not exceed 5% and is remedied by the addition of pozzolanic or cementitious materials other than Portland cement, as specified in paragraph 610-2.6, Admixtures, in sufficient quantity to produce the required workability as approved by the Engineer.

610-2.4 Cement. Cement shall conform to the requirements of ASTM C150 – Type I.

If aggregates are deemed innocuous when tested in accordance with paragraph 610-2.1.a.1 and accepted in accordance with paragraph 610-2.1.a.3, higher equivalent alkali content in the cement may be allowed if approved by the Engineer and FAA. If cement becomes partially set or contains lumps of caked cement, it shall be rejected. Cement salvaged from discarded or used bags shall not be used.

The Contractor shall furnish vendors' certified test reports for each carload, or equivalent, of cement shipped to the project. The report shall be delivered to the Engineer before use of the cement is granted. All test reports shall be subject to verification by testing sample materials received for use on the project.

610-2.5 Water. The water used in concrete shall be fresh, clean and potable; free from injurious amounts of oils, acids, alkalies, salts, organic materials or other substances deleterious to concrete.

610-2.6 Admixtures. The Contractor shall submit certificates indicating that the material to be furnished meets all of the requirements indicated below. In addition, the Engineer may require the Contractor to submit complete test data from an approved laboratory showing that the material to be furnished meets all of the requirements of the cited specifications. Subsequent tests may be made of samples taken by the Engineer from the supply of the material being furnished or proposed for use on the work to determine whether the admixture is uniform in quality with that approved.

a. Air-entraining admixtures. Air-entraining admixtures shall meet the requirements of ASTM C260 and shall consistently entrain the air content in the specified ranges under field conditions. The air-entrainment agent and any water reducer admixture shall be compatible.

b. Water-reducing admixtures. Water-reducing admixture shall meet the requirements of ASTM C494, Type A, B, or D. ASTM C494, Type F and G high range water reducing admixtures and ASTM C1017 flowable admixtures shall not be used.

c. Other chemical admixtures. The use of set retarding, and set-accelerating admixtures shall be approved by the Engineer. Retarding shall meet the requirements of ASTM C494, Type A, B, or D and set-accelerating shall meet the requirements of ASTM C494, Type C. Calcium chloride and admixtures containing calcium chloride shall not be used.

d. Lithium nitrate. The lithium admixture shall be a nominal 30% aqueous solution of Lithium Nitrate, with a density of 10 pounds/gallon (1.2 kg/L), and shall have the approximate chemical form as shown below:

Constituent	Limit (Percent by Mass)
LiNO3 (Lithium Nitrate)	30 ±0.5
SO4 (Sulfate Ion)	0.1 (max)
Cl (Chloride Ion)	0.2 (max)
Na (Sodium Ion)	0.1 (max)
K (Potassium Ion)	0.1 (max)

Provide a trained representative to supervise the lithium nitrate admixture dispensing and mixing operations.

610-2.7 Premolded joint material. Premolded joint material for expansion joints shall meet the requirements of ASTM D1751.

610-2.8 Joint filler. The filler for joints shall meet the requirements of Item P-605, unless otherwise specified.

610-2.9 Steel reinforcement. Reinforcing shall conform to the following requirements:

Reinforcing Steel	ASTM A615
Welded Steel Wire Fabric	ASTM A1064

610-2.10 Materials for curing concrete. Curing materials shall conform to one of the following specifications:

Waterproof paper	ASTM C171
Clear or white Polyethylene Sheeting	ASTM C171
White-pigmented Liquid Membrane-Forming Compound, Type 2, Class B	ASTM C309

CONSTRUCTION METHODS

610-3.1 General. The Contractor shall furnish all labor, materials, and services necessary for, and incidental to, the completion of all work as shown on the drawings and specified here. All machinery and equipment used by the Contractor on the work, shall be of sufficient size to meet the requirements of the work. All work shall be subject to the inspection and approval of the Engineer.

610-3.2 Concrete composition. The concrete shall develop a compressive strength of 4,000 psi in 28 days as determined by test cylinders made in accordance with ASTM C31 and tested in accordance with ASTM C39. The concrete shall contain not less than 470 pounds of cement per cubic yard. The concrete shall contain 5% of entrained air, ±1%, as determined by ASTM C231 and shall have a slump of not more than 4 inches as determined by ASTM C143.

610-3.3 Acceptance sampling and testing. Concrete for each structure will be accepted on the basis of the compressive strength specified in paragraph 610-3.2. The concrete shall be sampled in accordance with ASTM C172. Concrete cylindrical compressive strength specimens shall be made in accordance with ASTM C31 and tested in accordance with ASTM C39. The Contractor shall cure and store the test specimens under such conditions as directed by the Engineer. The Engineer will make the actual tests on the specimens at no expense to the Contractor.

610-3.4 Qualifications for concrete testing service. Perform concrete testing by an approved laboratory and inspection service experienced in sampling and testing concrete. Testing agency must meet the requirements of ASTM C1077 or ASTM E329.

610-3.5 Proportioning and measuring devices. When package cement is used, the quantity for each batch shall be equal to one or more whole sacks of cement. The aggregates shall be measured separately by weight. If aggregates are delivered to the mixer in batch trucks, the exact amount for each mixer charge shall be contained in each batch compartment. Weighing boxes or hoppers shall be

approved by the Engineer and shall provide means of regulating the flow of aggregates into the batch box so the required, exact weight of aggregates is obtained.

610-3.6 Consistency. The consistency of the concrete shall be determined by the slump test specified in ASTM C143.

610-3.7 Mixing. Concrete may be mixed at the construction site, at a central point, or wholly or in part in truck mixers. The concrete shall be mixed and delivered in accordance with the requirements of ASTM C94.

610-3.8 Mixing conditions. The concrete shall be mixed only in quantities required for immediate use. Concrete shall not be mixed while the air temperature is below 40°F (4°C) without permission of the Engineer. If permission is granted for mixing under such conditions, aggregates or water, or both, shall be heated and the concrete shall be placed at a temperature not less than 50°F (10°C) nor more than 100°F (38°C). The Contractor shall be held responsible for any defective work, resulting from freezing or injury in any manner during placing and curing, and shall replace such work at his expense.

Retempering of concrete by adding water or any other material shall not be permitted.

The rate of delivery of concrete to the job shall be sufficient to allow uninterrupted placement of the concrete.

610-3.9 Forms. Concrete shall not be placed until all the forms and reinforcements have been inspected and approved by the Engineer. Forms shall be of suitable material and shall be of the type, size, shape, quality, and strength to build the structure as shown on the plans. The forms shall be true to line and grade and shall be mortar-tight and sufficiently rigid to prevent displacement and sagging between supports. The surfaces of forms shall be smooth and free from irregularities, dents, sags, and holes. The Contractor shall be responsible for their adequacy.

The internal form ties shall be arranged so no metal will show in the concrete surface or discolor the surface when exposed to weathering when the forms are removed. All forms shall be wetted with water or with a non-staining mineral oil, which shall be applied immediately before the concrete is placed. Forms shall be constructed so they can be removed without injuring the concrete or concrete surface. The forms shall not be removed until at least 30 hours after concrete placement for vertical faces, walls, slender columns, and similar structures. Forms supported by falsework under slabs, beams, girders, arches, and similar construction shall not be removed until tests indicate the concrete has developed at least 60% of the design strength.

610-3.10 Placing reinforcement. All reinforcement shall be accurately placed, as shown on the plans, and shall be firmly held in position during concrete placement. Bars shall be fastened together at intersections. The reinforcement shall be supported by approved metal chairs. Shop drawings, lists, and bending details shall be supplied by the Contractor when required.

610-3.11 Embedded items. Before placing concrete, all embedded items shall be firmly and securely fastened in place as indicated. All embedded items shall be clean and free from coating, rust, scale, oil, or any foreign matter. The concrete shall be spaded and consolidated around and against embedded items. The embedding of wood shall not be allowed.

610-3.12 Placing concrete. All concrete shall be placed during daylight hours, unless otherwise approved. The concrete shall not be placed until the depth and condition of foundations, the adequacy of forms and falsework, and the placing of the steel reinforcing have been approved by the Engineer.

Concrete shall be placed as soon as practical after mixing, but in no case later than one (1) hour after water has been added to the mix. The method and manner of placing shall avoid segregation and displacement of the reinforcement. Troughs, pipes, and chutes shall be used as an aid in placing concrete when necessary. The concrete shall not be dropped from a height of more than 5 feet. Concrete shall be deposited as nearly as practical in its final position to avoid segregation due to rehandling or flowing. Do not subject concrete to procedures which cause segregation. Concrete shall be placed on clean, damp surfaces, free from running water, or on a properly consolidated soil foundation.

610-3.13 Vibration. Vibration shall follow the guidelines in American Concrete Institute (ACI) Committee 309, Guide for Consolidation of Concrete. Where bars meeting ASTM A775 or A934 are used, the vibrators shall be equipped with rubber or non-metallic vibrator heads. Furnish a spare, working, vibrator on the job site whenever concrete is placed. Consolidate concrete slabs greater than 4 inches in depth with high frequency mechanical vibrating equipment supplemented by hand spading and tamping. Consolidate concrete slabs 4 inches or less in depth by wood tampers, spading, and settling with a heavy leveling straightedge. Operate internal vibrators with vibratory element submerged in the concrete, with a minimum frequency of not less than 6000 cycles per minute when submerged. Do not use vibrators to transport the concrete in the forms. Penetrate the previously placed lift with the vibrator when more than one lift is required. Use external vibrators on the exterior surface of the forms when internal vibrators do not provide adequate consolidation of the concrete. Vibrators shall be manipulated to work the concrete thoroughly around the reinforcement and embedded fixtures and into corners and angles of the forms. The vibration at any point shall be of sufficient duration to accomplish compaction but shall not be prolonged to where segregation occurs. Concrete deposited under water shall be carefully placed in a compact mass in its final position by means of a tremie or other approved method and shall not be disturbed after placement.

610-3.14 Construction joints. If the placement of concrete is suspended, necessary provisions shall be made for joining future work before the placed concrete takes its initial set. For the proper bonding of old and new concrete, provisions shall be made for grooves, steps, reinforcing bars or other devices as specified. The work shall be arranged so that a section begun on any day shall be finished during daylight of the same day. Before depositing new concrete on or against concrete that has hardened, the surface of the hardened concrete shall be cleaned by a heavy steel broom, roughened slightly, wetted, and covered with a neat coating of cement paste or grout.

610-3.15 Expansion joints. Expansion joints shall be constructed at such points and dimensions as indicated on the drawings. The premolded filler shall be cut to the same shape as the surfaces being joined. The filler shall be fixed firmly against the surface of the concrete already in place so that it will not be displaced when concrete is deposited against it.

610-3.16 Defective work. Any defective work discovered after the forms have been removed, which in the opinion of the Engineer cannot be repaired satisfactorily, shall be immediately removed and replaced at the expense of the Contractor. Defective work shall include deficient dimensions, or bulged, uneven, or honeycomb on the surface of the concrete.

610-3.17 Surface finish. All exposed concrete surfaces shall be true, smooth, and free from open or rough areas, depressions, or projections. All concrete horizontal plane surfaces shall be brought flush to the proper elevation with the finished top surface struck-off with a straightedge and floated. Mortar finishing shall not be permitted, nor shall dry cement or sand-cement mortar be spread over the concrete during the finishing of horizontal plane surfaces.

The surface finish of exposed concrete shall be a rubbed finish. If forms can be removed while the concrete is still green, the surface shall be wetted and then rubbed with a wooden float until all irregularities are removed. If the concrete has hardened before being rubbed, a carborundum stone shall be used to finish the surface. When approved, the finishing can be done with a finishing machine.

610-3.18 Curing and protection. All concrete shall be properly cured and protected by the Contractor. The concrete shall be protected from the weather, flowing water, and from defacement of any nature during the project. The concrete shall be cured by covering with an approved material as soon as it has sufficiently hardened. Water-absorptive coverings shall be thoroughly saturated when placed and kept saturated for at least three (3) days following concrete placement. All curing mats or blankets shall be sufficiently weighted or tied down to keep the concrete surface covered and to prevent the surface from being exposed to air currents. Wooden forms shall be kept wet at all times until removed to prevent opening of joints and drying out of the concrete. Traffic shall not be allowed on concrete surfaces for seven (7) days after the concrete has been placed.

610-3.19 Drains or ducts. Drainage pipes, conduits, and ducts that are to be encased in concrete shall be installed by the Contractor before the concrete is placed. The pipe shall be held rigidly so that it will not be displaced or moved during the placing of the concrete.

610-3.20 Cold weather placing. When concrete is placed at temperatures below 40°F, the Contractor shall provide satisfactory methods and means to protect the mix from injury by freezing. The aggregates, or water, or both, shall be heated to place the concrete at temperatures between 50°F and 100°F.

Calcium chloride may be incorporated in the mixing water when directed by the Engineer. Not more than pounds of Type 1 nor more than 1.6 pounds of Type 2 shall be added per bag of cement. After the concrete has been placed, the Contractor shall provide sufficient protection such as cover, canvas, framework, heating apparatus, etc., to enclose and protect the structure and maintain the temperature of the mix at not less than 50°F until at least 60% of the designed strength has been attained.

610-3.21 Hot weather placing. Concrete shall be properly placed and finished with procedures previously submitted. The concrete-placing temperature shall not exceed 90°F when measured in accordance with ASTM C1064. Cooling of the mixing water and aggregates, or both, may be required to obtain an adequate placing temperature. A retarder meeting the requirements of paragraph 610-2.6 may be used to facilitate placing and finishing. Steel forms and reinforcement shall be cooled prior to concrete placement when steel temperatures are greater than 120°F. Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature. Submit the proposed materials and methods for review and approval by the Engineer, if concrete is to be placed under hot weather conditions.

610-3.22 Filling joints. All joints that require filling shall be thoroughly cleaned, and any excess mortar or concrete shall be cut out with proper tools. Joint filling shall not start until after final curing and shall be done only when the concrete is completely dry. The cleaning and filling shall be done with proper equipment to obtain a neat looking joint free from excess filler.

METHOD OF MEASUREMENT

610-4.1 No specific measurement will be made for concrete, reinforcing steel, joint filler or any other material required by this section. These items shall be included in the unit prices of the items of which they are a part.

BASIS OF PAYMENT

610-5.1 No separate payment will be made for concrete, reinforcing steel, joint filler or any other items required by this section. These items shall be included in the unit prices of the items of which they are a part.

TESTING REQUIREMENTS

ASTM C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C138	Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C143	Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C666	Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
ASTM C1017	Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1064	Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1077	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1260	Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1567	Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregates (Accelerated Mortar-Bar Method)
ASTM E329	Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

U.S. Army Corps of Engineers (USACE) Concrete Research Division (CRD) C662
Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials, Lithium Nitrate Admixture and Aggregate (Accelerated Mortar-Bar Method)

MATERIAL REQUIREMENTS

ASTM A184	Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A185	Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A704	Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement
ASTM A706	Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A775	Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A934	Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM A1064	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM C150	Standard Specification for Portland Cement
ASTM C171	Standard Specification for Sheet Materials for Curing Concrete
ASTM C172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM C260	Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C595	Standard Specification for Blended Hydraulic Cements
ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM D1751	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types)
ASTM D1752	Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ACI 305R	Hot Weather Concreting
ACI 306R	Cold Weather Concreting
ACI 309R	Guide for Consolidation of Concrete

END OF ITEM P-610

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Item P-620 Runway and Taxiway Marking

DESCRIPTION

620-1.1 This item shall consist of the preparation and painting of numbers, markings, and stripes on the surface of runways, taxiways, and aprons, in accordance with these specifications and at the locations shown on the plans, or as directed by the Engineer. The terms "paint" and "marking material" as well as "painting" and "application of markings" are interchangeable throughout this specification.

MATERIALS

620-2.1 Materials acceptance. The Contractor shall furnish manufacturer's certified test reports for materials shipped to the project. The certified test reports shall include a statement that the materials meet the specification requirements. The reports can be used for material acceptance or the Engineer may perform verification testing. The reports shall not be interpreted as a basis for payment. The Contractor shall notify the Engineer upon arrival of a shipment of materials to the site. All material shall arrive in sealed containers 55 gallons or smaller for inspection by the Engineer. Material shall not be loaded into the equipment until inspected by the Engineer.

620-2.2 Marking materials. Paint shall be waterborne in accordance with the requirements of paragraph 620-2.2a. Paint shall be furnished in White (37925), Yellow (33538 or 33655), Black (37038) and Red (31136) in accordance with Federal Standard No. 595.

a. Waterborne. Paint shall meet the requirements of Federal Specification TT-P-1952E, Type I. The non-volatile portion of the vehicle for all paint types shall be composed of a 100% acrylic polymer as determined by infrared spectral analysis.

620-2.3 Reflective media. Glass beads shall meet the requirements for Federal Specification TT-B-1325D, Type I, Gradation A. Glass beads shall be treated with all compatible coupling agents recommended by the manufacturers of the paint and reflective media to ensure adhesion and embedment.

Paint Color	Glass Beads, Type I, Gradation A
White	See Table 1
Yellow	See Table 1
Red	See Table 1 and Note

CONSTRUCTION METHODS

620-3.1 Weather limitations. The painting shall be performed only when the surface is dry and when the surface temperature is at least 45°F and rising and the pavement surface temperature is at least 5°F above the dew point or meets the manufacturer's recommendations. Markings shall not be applied when the pavement temperature is greater than 130°F. The half application rate paint is not subject to the temperature limitations.

Markings shall not be applied when the wind speed exceeds 10 mph unless windscreens are used to shroud the material guns.

620-3.2 Equipment. Equipment shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, a bead dispensing machine, and such auxiliary hand-painting equipment as may be necessary to satisfactorily complete the job.

The mechanical marker shall be an atomizing spray-type or airless-type marking machine suitable for application of traffic paint. It shall produce an even and uniform film thickness at the required coverage and shall apply markings of uniform cross-sections and clear-cut edges without running or spattering and without over spray.

620-3.3 Preparation of surface. Immediately before application of the paint, the surface shall be dry and free from dirt, grease, oil, laitance, or other foreign material that would reduce the bond between the paint and the pavement. The area to be painted shall be cleaned by waterblasting, sandblasting or by other methods as required to remove all contaminants without damage to the pavement surface. Use of any chemicals or impact abrasives during surface preparation shall be approved in advance by the Engineer. After the cleaning operations, sweeping, blowing, or rinsing with pressurized water shall be performed to ensure the surface is clean and free of grit or other debris left from the cleaning process.

At least 24 hours prior to remarking existing markings, the existing markings must be removed such that 75% of the existing markings are removed with low (3,500-10,000 psi) waterblaster. After waterblasting, the surface shall be cleaned of all residue or debris either with sweeping or blowing with compressed air or both.

Prior to the initial application of markings, the Contractor shall certify in writing that the surface has been prepared in accordance with the paint manufacturer's requirements, that the application equipment is appropriate for the type of marking paint and that environmental conditions are appropriate for the material being applied. This certification along with a copy of the paint manufacturer's surface preparation and application requirements must be submitted and approved by the Engineer prior to the initial application of markings.

620-3.4 Layout of markings. The proposed markings shall be laid out in advance of the paint application. The locations of markings to receive glass beads shall be shown on the plans.

620-3.5 Application. Paint shall be applied at the locations and to the dimensions and spacing shown on the plans. Paint shall not be applied until the layout and condition of the surface has been approved by the Engineer. The edges of the markings shall not vary from a straight line more than 1/2 inch in 50 feet, and marking dimensions and spacings shall be within the following tolerances:

Dimension and Spacing	Tolerance
36 inch or less	±1/2 inch
greater than 36 inch to 6 feet	±1 inch
greater than 6 feet to 60 feet	±2 inch
greater than 60 feet	±3 inch

The paint shall be mixed in accordance with the manufacturer's instructions and applied to the pavement with a marking machine at the rate shown in Table 1. The addition of thinner will not be permitted. A period of 30days shall elapse between placement of a bituminous surface course or seal coat and application of the full application paint. The half application rate paint shall be painted at the completion of the paving operation.

Prior to the initial application of markings, the Contractor shall certify in writing that the surface has been prepared in accordance with the paint manufacturer's requirements, that the application equipment is appropriate for the marking paint and that environmental conditions are appropriate for the material being applied. This certification along with a copy of the paint manufactures application and surface preparation requirements must be submitted to the Engineer prior to the initial application of markings.

620-3.6 Test strip. Prior to the full application of airfield markings, the Contractor shall produce a test strip in the presence of the Engineer. The test strip shall include the application of a minimum of 5 gallons of paint and application of 35 lbs of Type I glass beads. The test strip shall be used to establish thickness/darkness standard for all markings. The test strip shall cover no more than the maximum area prescribed in Table 1 (e.g., for 5 gallons of waterborne paint shall cover no more than 575 square feet).

Table 1. Application Rates For Paint And Glass Beads
(See Note regarding Red Paint)

Paint Type	Paint Square feet per gallon, ft^2/gal	Glass Beads, Type I, Gradation A Pounds per gallon of paint-lb/gal
Waterborne (Full Application)	115 ft^2/gal max	7 lb/gal min
Waterborne (Half Application)	230 ft^2/gal max	---

Note: The glass bead application rate for Red paint shall be reduced by 2 lb/gal for Type I beads.

Glass beads shall be distributed upon the marked areas at the locations shown on the plans to receive glass beads immediately after application of the paint. A dispenser shall be furnished that is properly designed for attachment to the marking machine and suitable for dispensing glass beads. Glass beads shall be applied at the rate shown in Table 1. Glass beads shall not be applied to black paint or green paint. Glass beads shall adhere to the cured paint or all marking operations shall cease until corrections are made. Different bead types shall not be mixed. Regular monitoring of glass bead embedment should be performed.

All emptied containers shall be returned to the paint storage area for checking by the Engineer. The containers shall not be removed from the airport or destroyed until authorized by the Engineer.

METHOD OF MEASUREMENT

620-4.1 The quantity of runway and taxiway markings to be paid for shall be the number of square feet of painting performed in accordance with the specifications and accepted by the Engineer. Reflective media (Glass Beads) in the full rate application of paint will not be measured separately but are considered incidental to the painting.

BASIS OF PAYMENT

620-5.1 Payment shall be made at the respective contract price per square feet for runway and taxiway marking at the specified application rate. This price shall be full compensation for furnishing all materials, including glass beads, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-620-5.1	Runway and Taxiway Marking, Full Application with Glass Beads -- per square foot
Item P-620-5.2	Runway and Taxiway Marking, Half Application -- per square foot

TESTING REQUIREMENTS

ASTM C371	Standard Test Method for Wire-Cloth Sieve Analysis of Nonplastic Ceramic Powders
ASTM D92	Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester
ASTM D711	Standard Test Method for No-Pick-Up Time of Traffic Paint
ASTM D968	Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D1652	Standard Test Method for Epoxy Content of Epoxy Resins
ASTM D2074	Standard Test Method for Total, Primary, Secondary, and Tertiary Amine Values of Fatty Amines by Alternative Indicator Method
ASTM D2240	Standard Test Method for Rubber Property - Durometer Hardness
ASTM D7585	Standard Practice for Evaluating Retroreflective Pavement Markings Using Portable Hand-Operated Instruments
ASTM E1710	Standard Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable Retroreflectometer
ASTM E2302	Standard Test Method for Measurement of the Luminance Coefficient Under Diffuse Illumination of Pavement Marking Materials Using a Portable Reflectometer

ASTM G154 Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials

MATERIAL REQUIREMENTS

ASTM D476 Standard Classification for Dry Pigmentary Titanium Dioxide Products

40 CFR Part 60, Appendix A-7, Method 24
Determination of volatile matter content, water content, density, volume solids, and weight solids of surface coatings

29 CFR Part 1910.1200 Hazard Communication

FED SPEC TT-B-1325D
Beads (Glass Spheres) Retro-Reflective

American Association of State Highway and Transportation Officials (AASHTO) M247
Standard Specification for Glass Beads Used in Pavement Markings

FED SPEC TT-P-1952E
Paint, Traffic and Airfield Marking, Waterborne

Commercial Item Description A-A-2886B
Paint, Traffic, Solvent Based

FED STD 595 Colors used in Government Procurement

AC 150/5340-1 Standards for Airport Markings

END OF ITEM P-620

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Item P-621 Saw-Cut Grooves

DESCRIPTION

621-1.1 This item consists of providing a skid resistant surface that prevents hydroplaning during wet weather in accordance with these specifications and at the locations shown on the plans, or as directed by the Engineer.

CONSTRUCTION METHODS

621-2.1 Procedures. The Contractor shall submit to the Engineer the grooving sequence and method of placing guide lines to control grooving operation. Transverse grooves saw-cut in the pavement must form a 1/4 inch (+1/16 inch, -0 inch) wide by 1/4 inch (±1/16 inch) deep by 1-1/2 inch (-1/8 inch, +0 inch) center-to-center configuration. The grooves must be continuous for the entire runway length. They must be saw-cut transversely (perpendicular to centerline) in the runway and high-speed taxiway pavement to not less than 10 feet from the runway pavement edge to allow adequate space for equipment operation.

The saw-cut grooves must meet the following tolerances. The tolerances apply to each day's production and to each piece of grooving equipment used for production. The Contractor is responsible for all controls and process adjustments necessary to meet these tolerances. The Contractor shall routinely spot check for compliance each time the equipment aligns for a grooving pass.

a. Alignment tolerance. The grooves shall not vary more than ±1-1/2 inch in alignment for 75 feet along the runway length, allowing for realignment every 500 feet along the runway length.

b. Groove tolerance. Depth. The standard depth is 1/4 inch. At least 90% of the grooves must be at least 3/16 inch, at least 60% of the grooves must be at least 1/4 inch, and not more than 10% of the grooves may exceed 5/16 inch.

c. Width. The standard width is 1/4 inch. At least 90% of the grooves must be at least 3/16 inch, at least 60% of the grooves must be at least 1/4 inch, and not more than 10% of the grooves may exceed 5/16 inch.

d. Center-to-center spacing. The standard spacing is 1-1/2 inch. Minimum spacing 1-3/8 inch. Maximum spacing 1-1/2 inch.

Saw-cut grooves must not be closer than 3 inches or more than 9 inches from transverse joints in concrete pavements. Grooves must not be closer than 6 inches and no more than 18 inches from in-pavement light fixtures. Grooves may be continued through longitudinal construction joints. Where neoprene compression seals have been installed and the compression seals are recessed sufficiently to prevent damage from the grooving operation, grooves may be continued through the longitudinal joints. Where neoprene compression seals have been installed and the compression seals are not recessed sufficiently to prevent damage from the grooving operation, grooves must not be closer than 3 inches or

more than 5 inches from the longitudinal joints. Where lighting cables are installed, grooving through longitudinal or diagonal saw kerfs shall not be allowed.

621-2.2 Environmental requirements. Grooving operations will not be permitted when freezing conditions prevent the immediate removal of debris and/or drainage of water from the grooved area. Discharge and disposal of waste slurry shall be the Contractor's responsibility.

621-2.3 Test section. Groove a test section in an area of the pavement outside of the trafficked area, as approved by the Engineer. The area shall be 40 feet long by two lanes wide. Demonstrate the setup and alignment process, the grooving operation, and the waste slurry disposal.

621-2.4 Existing pavements. Bumps, depressed areas, bad or faulted joints, and badly cracked and/or spalled areas in the pavement shall not be grooved until such areas are adequately repaired or replaced.

621-2.5 New pavements. New asphalt concrete pavements shall be allowed to cure for a minimum of 30 days before grooving, to allow the material to become stable enough to prevent closing of the grooves under normal use. Permit new Portland cement concrete pavements to cure for a minimum of 28 days before grooving. Spalling along or tearing or raveling of the groove edges shall not be allowed.

621-2.6 Grooving machine. Provide a grooving machine that is power driven, self-propelled, specifically designed and manufactured for pavement grooving, and has a self-contained and integrated continuous slurry vacuum system as the primary method for removing waste slurry. The grooving machine shall be equipped with diamond-saw cutting blades, and capable of making at least 18 inches in width of multiple parallel grooves in one pass of the machine. Thickness of the cutting blades shall be capable of making the required width and depth of grooves in one pass of the machine. The cutting head shall not contain a mixture of new and worn blades or blades of unequal wear or diameter. Match the blade type and configuration with the hardness of the existing airfield pavement. The wheels on the grooving machine shall be of a design that will not scar or spall the pavement. Provide the machine with devices to control depth of groove and alignment.

621-2.7 Water supply. Water for the grooving operation shall be provided by the Contractor.

621-2.8 Clean-up. During and after installation of saw-cut grooves, the Contractor must remove from the pavement all debris, waste, and by-products generated by the operations to the satisfaction of the Engineer. Cleanup of waste material must be continuous during the grooving operation. Flush debris produced by the machine to the edge of the grooved area or pick it up as it forms. The dust coating remaining shall be picked up or flushed to the edge of the area if the resultant accumulation is not detrimental to the vegetation or storm drainage system. Accomplish all flushing operations in a manner to prevent erosion on the shoulders or damage to vegetation. Waste material must be disposed of in an approved manner. Waste material must not be allowed to enter the airport storm sewer system. The Contractor must dispose of these wastes in strict compliance with all applicable state, local, and Federal environmental statutes and regulations

621-2.9 Repair of damaged pavement. Grooving must be stopped and damaged pavement repaired at the Contractor's expense when, in the opinion of the Engineer, the result of the grooving operation will be detrimental to aircraft tires.

ACCEPTANCE

621-3.1 Acceptance testing. Grooves will be accepted based on results of zone testing. All acceptance testing necessary to determine conformance with the groove tolerances specified will be performed by the Engineer.

Instruments for measuring groove width and depth must have a range of at least 0.5 inch and a resolution of at least 0.005 inch. Gauge blocks or gauges machined to standard grooves width, depth, and spacing may be used.

Instruments for measuring center-to-center spacing must have a range of at least 3 inches and a resolution of at least 0.02 inch.

The Engineer will measure grooves in five zones across the pavement width. Measurements will be made at least three times during each day's production. Measurements in all zones will be made for each cutting head on each piece of grooving equipment used for each day's production.

The five zones are as follows:

Zone 1	Centerline to 5 feet left or right of the centerline.
Zone 2	5 feet to 25 feet left of the centerline.
Zone 3	5 feet 25 feet right of the centerline.
Zone 4	25 feet to edge of grooving left of the centerline.
Zone 5	25 feet to edge of grooving right of the centerline.

At a random location within each zone, five consecutive grooves sawed by each cutting head on each piece of grooving equipment will be measured for width, depth, and spacing. The five consecutive measurements must be located about the middle blade of each cutting head ±4 inches. Measurements will be made along a line perpendicular to the grooves.

Width or depth measurements less than 0.170 inch shall be considered less than 3/16 inch.

Width or depth measurements more than 0.330 inch shall be considered more than 5/16 inch.

Width or depth measurements more than 0.235 inch shall be considered more than 1/4 inch.

Production must be adjusted when more than one groove on a cutting head fails to meet the standard depth, width, or spacing in more than one zone.

METHOD OF MEASUREMENT

621-4.1 The quantity of grooving to be paid for shall be the number of square yards of grooving performed in accordance with the specifications and accepted by the Engineer per paragraph 621-3.1.

BASIS OF PAYMENT

621-5.1 Payment for saw-cut grooving. Payment for saw-cut grooving will be made at the contract unit price per square yard for saw-cut grooving. This price shall be full compensation for furnishing all materials, and for all preparation, delivering, and application of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-621-5.1 Runway Grooving -- per square yard

END OF ITEM P-621

Item F-162 Chain-Link Fence

DESCRIPTION

162-1.1 This item shall consist of furnishing and erecting a chain-link fence in accordance with these specifications, the details shown on the plans, and in conformity with the lines and grades shown on the plans or established by the Engineer.

MATERIALS

162-2.1 Fabric. The fabric shall be woven with a 9-gauge polyvinyl chloride (PVC)-coated steel in a 2-inch mesh and shall meet the requirements of ASTM F668, Class 2b.

162-2.2 Barbed wire. Not used.

162-2.3 Posts, rails, and braces. Line posts, rails, and braces shall conform to the requirements of ASTM F1043 or ASTM F1083 as follows:

Vinyl or polyester coated steel shall conform to the requirements of ASTM F1043, Paragraph 7.3, Optional Supplemental Color Coating.

Posts, rails, and braces, with the exception of galvanized steel conforming to ASTM F1043 or ASTM F1083, Group 1A, Type A, or aluminum alloy, shall demonstrate the ability to withstand testing in salt spray in accordance with ASTM B117 as follows:

- External: 1,000 hours with a maximum of 5% red rust.
- Internal: 650 hours with a maximum of 5% red rust.

The dimensions of the posts, rails, and braces shall be in accordance with Tables I through VI of Federal Specification RR-F-191/3.

162-2.4 Gates. Gate frames shall consist of polymer-coated steel pipe and shall conform to the specifications for the same material under paragraph 162-2.3. The fabric shall be of the same type material as used in the fence.

162-2.5 Wire ties and tension wires. Wire ties for use in conjunction with a given type of fabric shall be of the same material and coating weight identified with the fabric type. Tension wire shall be 7-gauge marcelled steel wire with the same coating as the fabric type and shall conform to ASTM A824.

All material shall conform to Federal Specification RR-F-191/4.

162-2.6 Miscellaneous fittings and hardware. Miscellaneous steel fittings and hardware for use with zinc-coated steel fabric shall be of commercial grade steel or better quality, wrought or cast as appropriate to the article, and sufficient in strength to provide a balanced design when used in conjunction with fabric posts, and wires of the quality specified herein. All steel fittings and hardware shall be protected with a zinc coating applied in conformance with ASTM A153. Barbed wire support arms shall withstand a load of 250 pounds applied vertically to the outermost end of the arm.

162-2.7 Concrete. Concrete shall be of a commercial grade with a minimum 28-day compressive strength of 4,000 psi per section 610-3.2 of the P-610 specification.

162-2.8 Marking. Each roll of fabric shall carry a tag showing the kind of base metal (steel, aluminum, or aluminum alloy number), kind of coating, the gauge of the wire, the length of fencing in the roll, and the name of the manufacturer. Posts, wire, and other fittings shall be identified as to manufacturer, kind of base metal (steel, aluminum, or aluminum alloy number), and kind of coating.

CONSTRUCTION METHODS

162-3.1 Clearing fence line. All trees, brush, stumps, logs, and other debris which would interfere with the proper construction of the fence in the required location shall be removed a minimum width of 5 feet on each side of the fence centerline before starting fencing operations. The cost of removing and disposing of the material shall not constitute a pay item and shall be considered incidental to fence construction.

162-3.2 Installing posts. All posts shall be set in concrete at the required dimension and depth and at the spacing shown on the plans.

The concrete shall be thoroughly compacted around the posts by tamping or vibrating and shall have a smooth finish slightly higher than the ground and sloped to drain away from the posts. All posts shall be set plumb and to the required grade and alignment. No materials shall be installed on the posts, nor shall the posts be disturbed in any manner within seven (7) days after the individual post footing is completed.

Should rock be encountered at a depth less than the planned footing depth, a hole 2 inches larger than the greatest dimension of the posts shall be drilled to a depth of 12 inches. After the posts are set, the remainder of the drilled hole shall be filled with grout, composed of one part Portland cement and two parts mortar sand. Any remaining space above the rock shall be filled with concrete in the manner described above.

In lieu of drilling, the rock may be excavated to the required footing depth. No extra compensation shall be made for rock excavation.

162-3.3 Installing top rails. The top rail shall be continuous and shall pass through the post tops. The coupling used to join the top rail lengths shall allow for expansion.

162-3.4 Installing braces. Horizontal brace rails, with diagonal truss rods and turnbuckles, shall be installed at all terminal posts.

162-3.5 Installing fabric. The wire fabric shall be firmly attached to the posts and braced as shown on the plans. All wire shall be stretched taut and shall be installed to the required elevations. The fence shall generally follow the contour of the ground, with the bottom of the fence fabric no less than one inch or more than 4 inches from the ground surface. Grading shall be performed where necessary to provide a neat appearance.

At locations of small natural swales or drainage ditches and where it is not practical to have the fence conform to the general contour of the ground surface, longer posts may be used and multiple strands of barbed wire stretched to span the opening below the fence. The vertical clearance between strands of barbed wire shall be 6 inches or less.

162-3.6 Electrical grounds. Electrical grounds shall be constructed at 500 feet intervals. The ground shall be accomplished with a copper clad rod 8 feet long and a minimum of 5/8 inches in diameter driven vertically until the top is 6 inches below the ground surface. A No. 6 solid copper conductor shall be clamped to the rod and to the fence in such a manner that each element of the fence is grounded. Installation of ground rods shall not constitute a pay item and shall be considered incidental to fence construction. The Contractor shall comply with FAA-STD-019, Lightning and Surge Protection, Grounding, Bonding and Shielding Requirements for Facilities and Electronic Equipment, Paragraph 4.2.3.8, Lightning Protection for Fences and Gates, when fencing is adjacent to FAA facilities.

162-3.7 Cleaning up. The Contractor shall remove from the vicinity of the completed work all tools, buildings, equipment, etc., used during construction. All disturbed areas shall be seeded per T-901.

METHOD OF MEASUREMENT

162-4.1 Chain-link fence will be measured for payment by the linear foot. Measurement will be along the top of the fence from center to center of end posts, excluding the length occupied by gate openings.

162-4.2 Gates will be measured as complete units.

BASIS OF PAYMENT

162-5.1 Payment for chain-link fence will be made at the contract unit price per linear foot.

162-5.2 Payment for vehicle gates will be made at the contract unit price for each gate.

The price shall be full compensation for furnishing all materials, including signs, and for all preparation, erection, and installation of these materials, and for all labor equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item F-162-5.1	8-Foot Green Vinyl Chain-Link Fence -- per linear foot
Item F-162-5.2	16-Foot Manual Double-Swing Gate, Green Vinyl Chain Link -- per each

MATERIAL REQUIREMENTS

ASTM A121	Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
ASTM A123	Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A392	Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A491	Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric
ASTM A572	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A824	Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence
ASTM A1011	Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High Strength Low Alloy with Improved Formability, and Ultra High Strength
ASTM B117	Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B221	Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles and Tubes
ASTM B429	Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM F668	Standard Specification for Polyvinyl Chloride(PVC), Polyolefin and other Organic Polymer Coated Steel Chain-Link Fence Fabric
ASTM F1043	Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework
ASTM F1083	Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
ASTM F1183	Standard Specification for Aluminum Alloy Chain Link Fence Fabric
ASTM F1345	Standard Specification for Zinc 5% Aluminum-Mischmetal Alloy Coated Steel Chain-Link Fence Fabric
ASTM G152	Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM G153	Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM G154	Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials
ASTM G155	Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials
FED SPEC RR-F-191/3	Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces)
FED SPEC RR-F-191/4	Fencing, Wire and Post, Metal (Chain-Link Fence Accessories)
FAA-STD-019	Lightning and Surge Protection, Grounding, Bonding and Shielding Requirements for Facilities and Electronic Equipment

END OF ITEM F-162

Item D-701 Pipe for Storm Drains and Culverts

DESCRIPTION

701-1.1 This item shall consist of the construction of pipe culverts and storm drains in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans.

MATERIALS

701-2.1 Materials shall meet the requirements shown on the plans and specified below.

701-2.2 Pipe. The pipe shall be of the type called for on the plans or in the proposal and shall be in accordance with the following appropriate requirements:

ASTM C76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

701-2.3 Concrete. Concrete for pipe bedding, encasement and collars shall conform to Item P-610.

701-2.4 Rubber gaskets. Rubber gaskets for rigid pipe shall conform to the requirements of ASTM C443.

701-2.5 Joint mortar. Pipe joint mortar shall consist of one part Portland cement and two parts sand. The Portland cement shall conform to the requirements of ASTM C150, Type I. The sand shall conform to the requirements of ASTM C144.

701-2.6 Joint fillers. Not used.

701-2.7 Plastic gaskets. Not used.

701-2.8. Controlled low-strength material (CLSM). Controlled low-strength material shall conform to the requirements of Item P-153. When CLSM is used all joints shall have gaskets.

CONSTRUCTION METHODS

701-3.1 Excavation. The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe, but it shall not be less than the external diameter of the pipe plus 6 inches on each side. The trench walls shall be approximately vertical.

The Contractor shall comply with all current Federal, state and local rules and regulations governing the safety of men and materials during the excavation, installation and backfilling operations. Specifically, the Contractor shall observe that all requirements of the Occupational Safety and Health Administration (OSHA) relating to excavations, trenching and shoring are strictly adhered to. The width of the trench shall be sufficient to permit satisfactorily jointing of the pipe and thorough compaction of the bedding material under the pipe and backfill material around the pipe, but it shall not be greater than the widths shown on the plans trench detail. The trench bottom shall be shaped to fully and uniformly support the bottom quadrant of the pipe.

Where rock, hardpan, or other unyielding material is encountered, the Contractor shall remove it from below the foundation grade for a depth of at least 8 inch or 1/2 inch for each foot of fill over the top of the pipe (whichever is greater) but for no more than three-quarters of the nominal diameter of the pipe. The excavation below grade shall be backfilled with selected fine compressible material, such as silty clay or loam, and lightly compacted in layers not over 6 inches in uncompacted depth to form a uniform but yielding foundation.

Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, the unstable soil shall be removed and replaced with approved granular material for the full trench width. The Engineer shall determine the depth of removal necessary. The granular material shall be compacted to provide adequate support for the pipe.

The excavation for pipes placed in embankment fill shall not be made until the embankment has been completed to a height above the top of the pipe as shown on the plans.

701-3.2 Bedding. The pipe bedding shall conform to the class specified on the plans. The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe. When no bedding class is specified or detailed on the plans, the requirements for Class C bedding shall apply.

a. Rigid pipe. Class A bedding shall consist of a continuous concrete cradle conforming to the plan details.

Class B bedding shall consist of a bed of granular material having a thickness of at least 6 inches below the bottom of the pipe and extending up around the pipe for a depth of not less than 30% of the pipe's vertical outside diameter. The layer of bedding material shall be shaped to fit the pipe for at least 10% of the pipe's vertical diameter and shall have recesses shaped to receive the bell of bell and spigot pipe. The bedding material shall be sand or select sandy soil with 100% passing a 3/8 inch (9 mm) sieve and not more than 10% passing a No. 200 (0.075 mm) sieve.

Class C bedding shall consist of bedding the pipe in its natural foundation material to a depth of not less than 10% of the pipe's vertical outside diameter. The bed shall be shaped to fit the pipe and shall have recesses shaped to receive the bell of bell and spigot pipe.

701-3.3 Laying pipe. The pipe laying shall begin at the lowest point of the trench and proceed upgrade. The lower segment of the pipe shall be in contact with the bedding throughout its full length. Bell or groove ends of rigid pipes and outside circumferential laps of flexible pipes shall be placed facing upgrade.

Paved or partially lined pipe shall be placed so that the longitudinal center line of the paved segment coincides with the flow line.

Elliptical and elliptically reinforced concrete pipes shall be placed with the manufacturer's reference lines designating the top of the pipe within five degrees of a vertical plane through the longitudinal axis of the pipe.

701-3.4 Joining pipe. Joints shall be made with (1) Portland cement mortar, (2) Portland cement grout, (3) rubber gaskets, (4) plastic gaskets, or (5) coupling bands.

Mortar joints shall be made with an excess of mortar to form a continuous bead around the outside of the pipe and shall be finished smooth on the inside. Molds or runners shall be used for grouted joints to retain the poured grout. Rubber ring gaskets shall be installed to form a flexible watertight seal.

a. Concrete pipe. Concrete pipe may be either bell and spigot or tongue and groove. The method of joining pipe sections shall be so the ends are fully entered and the inner surfaces are reasonably flush and even. Joints shall be thoroughly wetted before applying mortar or grout.

b. PVC, polyethylene and polypropylene pipe. Joints for PVC, Polyethylene, and Polypropylene pipe shall conform to the requirements of ASTM D3212 when water tight joints are required. Joints for PVC and Polyethylene pipe shall conform to the requirements of AASHTO M304 when soil tight joints are required. Fittings for polyethylene pipe shall conform to the requirements of AASHTO M252 or ASTM M294. Fittings for polypropylene pipe shall conform to ASTM F2881, ASTM F2736, or ASTM F2764.

701-3.5 Backfilling. Pipes shall be inspected before any backfill is placed; any pipes found to be out of alignment, unduly settled, or damaged shall be removed and relaid or replaced at the Contractor's expense.

Material for backfill shall be fine, readily compatible soil or granular material selected from the excavation or a source of the Contractor's choosing . It shall not contain frozen lumps, stones that would be retained on a 2-inch (50 mm) sieve, chunks of highly plastic clay, or other objectionable material. Granular backfill material shall have 95% or more passing the a 1/2 inch (12 mm) sieve, with 95% or more being retained on the No. 4 (4.75 mm) sieve.

When the top of the pipe is even with or below the top of the trench, the backfill shall be compacted in layers not exceeding 6 inches on each side of the pipe and shall be brought up one foot above the top of the pipe or to natural ground level, whichever is greater. Thoroughly compact the backfill material under the haunches of the pipe without displacing the pipe. Material shall be brought up evenly on each side of the pipe for the full length of the pipe.

When the top of the pipe is above the top of the trench, the backfill shall be compacted in layers not exceeding 6 inches and shall be brought up evenly on each side of the pipe to one foot above the top of the pipe. The width of backfill on each side of the pipe for the portion above the top of the trench shall be equal to twice the pipe's diameter or 12 feet, whichever is less.

For PVC, polyethylene, and polypropylene pipe, the backfill shall be placed in two stages; first to the top of the pipe and then at least 12 inches over the top of the pipe. The backfill material shall meet the requirements of paragraph 701-3.2c.

All backfill shall be compacted to the density required under Item P-152.

It shall be the Contractor's responsibility to protect installed pipes and culverts from damage due to construction equipment operations. The Contractor shall be responsible for installation of any extra strutting or backfill required to protect pipes from the construction equipment.

METHOD OF MEASUREMENT

701-4.1 The length of pipe shall be measured in linear feet of pipe in place, completed, and approved. It shall be measured along the centerline of the pipe from end or inside face of structure to the end or inside face of structure, whichever is applicable. The several classes, types and size shall be measured separately. All fittings shall be included in the footage as typical pipe sections in the pipe being measured.

BASIS OF PAYMENT

701-5.1 Payment will be made at the contract unit price per linear foot for each kind of pipe of the type and size designated.

These prices shall fully compensate the Contractor for furnishing all materials and for all preparation, excavation, and installation of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item 701-5.1	18 inch Reinforced Concrete Pipes, Class V, Class B Bedding -- per linear foot
Item 701-5.2	2-18 inch Reinforced Concrete Pipes, Class III, Class B Bedding – per linear foot

MATERIAL REQUIREMENTS

AASHTO M167	Standard Specification for Corrugated Steel Structural Plate, Zinc-Coated, for Field-Bolted Pipe, Pipe-Arches, and Arches
AASHTO M190	Standard Specification for Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches
AASHTO M196	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
AASHTO M198	Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
AASHTO M219	Standard Specification for Corrugated Aluminum Alloy Structural Plate for Field-Bolted Pipe, Pipe-Arches, and Arches
AASHTO M243	Standard Specification for Field Applied Coating of Corrugated Metal Structural Plate for Pipe, Pipe-Arches, and Arches
AASHTO M252	Standard Specification for Corrugated Polyethylene Drainage Pipe
AASHTO M294	Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter
AASHTO M304	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter
AASHTO MP20	Standard Specification for Steel Reinforced Polyethylene (PE) Ribbed Pipe, 300- to 900-mm (12- to 36-in.) Diameter
ASTM A760	Standard Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drains
ASTM A761	Standard Specification for Corrugated Steel Structural Plate, Zinc Coated, for Field-Bolted Pipe, Pipe-Arches, and Arches
ASTM A762	Standard Specification for Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM A849	Standard Specification for Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe

ASTM B745	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
ASTM C14	Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C94	Standard Specification for Ready Mixed Concrete
ASTM C144	Standard Specification for Aggregate for Masonry Mortar
ASTM C150	Standard Specification for Portland Cement
ASTM C443	Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C506	Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
ASTM C507	Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe
ASTM C655	Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain and Sewer Pipe
ASTM C1433	Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers
ASTM D1056	Standard Specification for Flexible Cellular Materials Sponge or Expanded Rubber
ASTM D3034	Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3212	Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D6690	Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ASTM F477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F667	Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings
ASTM F714	Standard Specification for Polyethylene (PE) Plastic Pipe (DR PR) Based on Outside Diameter
ASTM F794	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe & Fittings Based on Controlled Inside Diameter
ASTM F894	Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
ASTM F949	Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings

ASTM F2435	Standard Specification for Steel Reinforced Polyethylene (PE) Corrugated Pipe
ASTM F2562	Specification for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage
ASTM F2736	Standard Specification for 6 to 30 in. (152 to 762 mm) Polypropylene (PP) Corrugated Single Wall Pipe and Double Wall Pipe
ASTM F2764	Standard Specification for 30 to 60 in. (750 to 1500 mm) Polypropylene (PP) Triple Wall Pipe and Fittings for Non-Pressure Sanitary Sewer Applications
ASTM F2881	Standard Specification for 12 to 60 in. (300 to 1500 mm) Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications

END ITEM D-701

Item D-705 Pipe Underdrains for Airports

DESCRIPTION

705-1.1 This item shall consist of the construction of pipe drains in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans.

MATERIALS

705-2.1 General. Materials shall meet the requirements shown on the plans and specified below.

705-2.2 Pipe. The pipe shall be of the type called for on the plans or in the proposal and shall be in accordance with the following appropriate requirements.

Smooth Wall PVC (SDR 35)

ASTM D3034	Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM F758	Standard Specification for Smooth-Wall Poly (Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage

Joints shall be solvent glued with solvent conforming to ASTM D2564. Fittings shall be solvent glued, shall not restrict flow, and shall be of the same composition and have the same properties as the pipe.

Corrugated PVC

ASTM F949	Standard Specification for Poly (Vinyl Chloride)(PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings

Perforated pipe shall have holes or slots evenly spaced on the underside of the pipe; the holes or slots shall be clean, smooth and free of burrs. Slots or holes shall provide a water inlet area of at least 1.5 square inches per foot of pipe length.

PVC pipe supplied as meeting this specification shall be marked with the manufacturer's identification symbols regularly at not more than 10 foot intervals and in addition may be required to carry an approved symbol designating the manufacturer's assurance of compliance also at regular intervals along the pipe. Fittings shall bear the identification symbols of the manufacturer. Each bundle shall bear the date, month and year of manufacture.

705-2.3 Joint mortar. Pipe joint mortar shall consist of one part by volume of Portland cement and two parts sand. The Portland cement shall conform to the requirements of ASTM C150, Type I. The sand shall conform to the requirements of ASTM C144.

705-2.4 Elastomeric seals. Elastomeric seals shall conform to the requirements of ASTM F477.

705-2.5 Porous backfill. Porous backfill shall be ODOT No. 8 or 9 granular material (ODOT 605.02).

705-2.6. Granular material. Granular material used for backfilling shall be ODOT No. 8 or 9.

705-2.7. Filter fabric. The filter fabric shall conform to the requirements of AASHTO M288 Class 2.

Table 2

Fabric Property	Test Method	Test Requirement
Grab Tensile Strength, lbs	ASTM D4632	125 min
Grab Tensile Elongation %	ASTM D4632	50 min
Burst Strength, psi	ASTM D3785	125 min
Trapezoid Tear Strength, lbs	ASTM D4533	55 min
Puncture Strength, lbs	ASTM D4833	40 min
Abrasion, lbs	ASTM D4886	15 max loss
Equivalent Opening Size	ASTM D4751	70-100
Permittivity sec^{-1}	ASTM D4491	0.80
Accelerated Weathering (UV Stability) (Strength Retained - %)	ASTM D4355 *(500 hrs exposure)	70

705-2.8. Controlled low-strength material (CLSM). Controlled low-strength material shall conform to the requirements of Item P-153. When CLSM is used all joints shall have elastomeric seals.

705-2.9. Cleanouts. The cleanout and lid shall consist of a heavy duty, aircraft rated, cast iron, 6 5/8 inch square inside diameter by 15 inch (minimum) extreme to to extreme bottom depth fitting, with a 7 5/8 inch square bolted lid, as approved by the Engineer.

CONSTRUCTION METHODS

705-3.1 Equipment. All equipment required for the construction of pipe underdrains shall be on the project, in good working condition, and approved by the Engineer before construction is permitted to start.

705-3.2 Excavation. The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe, but shall not be less than the external diameter of the pipe plus 6 inches on each side of the pipe. The trench walls shall be approximately vertical.

Where rock, hardpan, or other unyielding material is encountered, it shall be removed below the foundation grade for a depth of at least 4 inches. The excavation below grade shall be backfilled with selected fine compressible material, such as silty clay or loam, and lightly compacted in layers not over 6 inches in uncompacted depth to form a uniform but yielding foundation.

Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, the unstable soil shall be removed and replaced with approved granular material for the full trench width. The Engineer shall determine the depth of removal necessary. The granular material shall be compacted to provide adequate support for the pipe.

Excavated material not required or acceptable for backfill shall be disposed of by the Contractor as directed by the Engineer. The excavation shall not be carried below the required depth; if this occurs, the trench shall be backfilled at the Contractor's expense with material approved by the Engineer and compacted to the density of the surrounding material.

The pipe bed shall be shaped so at least the lower quarter of the pipe shall be in continuous contact with the bottom of the trench. Spaces for the pipe bell shall be excavated to allow the pipe barrel to support the entire weight of the pipe.

The Contractor shall do trench bracing, sheathing, or shoring necessary to perform and protect the excavation as required for safety and conformance to Federal, state and local laws. Unless otherwise provided, the bracing, sheathing, or shoring shall be removed by the Contractor after the backfill has reached at least 12 inches over the top of the pipe. The sheathing or shoring shall be pulled as the granular backfill is placed and compacted to avoid any unfilled spaces between the trench wall and the backfill material. The cost of bracing, sheathing, or shoring, and the removal of same, shall be included in the unit price bid per foot for the pipe.

705-3.3 Laying and installing pipe.

a. PVC or polyethylene pipe. PVC or polyethylene pipe shall be installed in accordance with the requirements of ASTM D2321 or AASHTO Standard Specification for Highway Bridges Section 30. Perforations shall meet the requirements of AASHTO M252 or AASHTO M294 Class 2, unless otherwise indicated on the plans. The pipe shall be laid accurately to line and grade.

b. All types of pipe. The upgrade end of pipelines, not terminating in a structure, shall be plugged or capped as approved by the Engineer.

Unless otherwise shown on the plans, a 4 inch bed of granular backfill material shall be spread in the bottom of the trench throughout the entire length under all perforated pipe underdrains.

Pipe outlets for the underdrains shall be constructed when required or shown on the plans. The pipe shall be laid with tight-fitting joints. Porous backfill is not required around or over pipe outlets for underdrains. All connections to other drainage pipes or structures shall be made as required and in a satisfactory manner. If connections are not made to other pipes or structures, the outlets shall be protected and constructed as shown on the plans.

c. Filter fabric. The filter fabric shall be installed in accordance with the manufacturer's recommendations, or in accordance with AASHTO M288 Appendix, unless otherwise shown on the plans.

705-3.4 Mortar. The mortar shall be of the desired consistency for caulking and filling the joints of the pipe and for making connections to other pipes or to structures. Mortar that is not used within 45 minutes after water has been added shall be discarded. Retempering of mortar shall not be permitted.

705-3.5 Joints in concrete pipe. When open or partly open joints are required or specified, they shall be constructed as indicated on the plans. The pipe shall be laid with the ends fitted together as designed. If bell and spigot pipe is used, mortar shall be placed along the inside bottom quarter of the bell to center the following section of pipe.

The open or partly open joints shall be surrounded with granular material meeting requirements of porous backfill No. 2 in Table 1 or as indicated on the plans. This backfill shall be placed so its thickness will be not less than 3 inches nor more than 6 inches, unless otherwise shown on the plans.

When the original material excavated from the trench is impervious, commercial concrete sand or granular material meeting requirements of porous backfill No. 1 shall surround porous backfill No. 2 (Table 1), as shown on the plans or as directed by the Engineer.

When the original material excavated from the trench is pervious and suitable, it may be used as backfill in lieu of porous backfill No. 1, when indicated on the plans or as directed by the Engineer.

705-3.6 Backfilling.

a. Earth. All trenches and excavations shall be backfilled soon after the pipes are installed, unless additional protection of the pipe is directed. The backfill material shall be select material from excavation or borrow and shall be approved by the Engineer. The select material shall be placed on each side of the pipe out to a distance of the nominal pipe diameter and one foot over the top of the pipe and shall be readily compacted. It shall not contain stones 3 inches or larger in size, frozen lumps, chunks of highly plastic clay, or any other material that is objectionable to the Engineer. The material shall be moistened or dried, as required to aid compaction. Placement of the backfill shall not cause displacement of the pipe. Thorough compaction under the haunches and along the sides to the top of the pipe shall be obtained.

The backfill shall be placed in loose layers not exceeding 6 inches in depth under and around the pipe, and not exceeding 8 inches over the pipe. Successive layers shall be added and thoroughly compacted by hand and pneumatic tampers, approved by the Engineer, until the trench is completely filled and brought to the planned elevation. Backfilling shall be done to avoid damaging top or side pressures on the pipe.

In embankments and other unpaved areas, the backfill shall be compacted per Item P-152 to the density required for embankments in unpaved areas. Under paved areas, the subgrade and any backfill shall be compacted per Item P-152 to the density required for embankments for paved areas.

b. Granular backfill. When granular backfill is required, placement in the trench and about the pipe shall be as shown on the plans. The granular backfill shall not contain an excessive amount of foreign matter, nor shall soil from the sides of the trench or from the soil excavated from the trench be allowed to filter into the granular backfill. When required by the Engineer, a template shall be used to properly place and separate the two sizes of backfill. The backfill shall be placed in loose layers not exceeding 6 inches in depth. The granular backfill shall be compacted by hand and pneumatic tampers to the requirements as given for embankment. Backfilling shall be done to avoid damaging top or side pressure on the pipe. The granular backfill shall extend to the elevation of the trench or as shown on the plans.

When perforated pipe is specified, granular backfill material shall be placed along the full length of the pipe. The position of the granular material shall be as shown on the plans. If the original material excavated from the trench is pervious and suitable, it shall be used in lieu of porous backfill No. 1.

If porous backfill is placed in paved or adjacent to paved areas before grading or subgrade operations is completed, the backfill material shall be placed immediately after laying the pipe. The depth of the granular backfill shall be not less than 12 inches, measured from the top of the underdrain. During subsequent construction operations, a minimum depth of 12 inches of backfill shall be maintained over the underdrains. When the underdrains are to be completed, any unsuitable material shall be removed exposing the porous backfill. Porous backfill containing

objectionable material shall be removed and replaced with suitable material. The cost of removing and replacing any unsuitable material shall be at the Contractor's expense.

If a granular subbase blanket course is used which extends several feet beyond the edge of paving to the outside edge of the underdrain trench, the granular backfill material over the underdrains shall be placed in the trench up to an elevation of 2 inches above the bottom surface of the granular subbase blanket course. Immediately prior to the placing of the granular subbase blanket course, the Contractor shall blade this excess trench backfill from the top of the trench onto the adjacent subgrade where it can be incorporated into the granular subbase blanket course. Any unsuitable material that remains over the underdrain trench shall be removed and replaced. The subbase material shall be placed to provide clean contact between the subbase material and the underdrain granular backfill material for the full width of the underdrain trench.

c. Controlled low-strength material (CLSM). Controlled low-strength material shall conform to the requirements of Item P-153.

d. Deflection testing. The Engineer may at any time, notwithstanding previous material acceptance, reject or require re-installation of pipe that exceeds 5% deflection when measured in accordance with ASTM D2321, including Appendices.

705-3.7 Connections. When the plans call for connections to existing or proposed pipe or structures, these connections shall be watertight and made to obtain a smooth uniform flow line throughout the drainage system.

705-3.8 Cleaning and restoration of site. After the backfill is completed, the Contractor shall dispose of all surplus material, soil, and rubbish from the site. Surplus soil may be deposited in embankments, shoulders, or as directed by the Engineer. Except for paved areas of the airport, the Contractor shall restore all disturbed areas to their original condition.

METHOD OF MEASUREMENT

705-4.1 The length of pipe shall be the number of linear feet of pipe underdrains in place, completed, and approved; measured along the centerline of the pipe from end or inside face of structure to the end or inside face of structure, whichever is applicable. The several classes, types, and sizes shall be measured separately. All fittings shall be included in the footage as typical pipe sections in the pipeline being measured.

705-4.2 The quantity of underdrain cleanouts, endwalls and connections to reinforced concrete pipe shall be on the basis of the contract unit price per each, which price shall be full compensation for all labor, equipment, material and incidentals necessary to satisfactorily contruct each cleanout. The price for each cleanout, endwall or connection will include the surface fitting and concrete block, steel reinforcement, non-perforated pipe, fittings, excavation, backfill, and protection during subsequent construction operations.

BASIS OF PAYMENT

705-5.1 Payment will be made at the contract unit price per linear foot COMPLETE (including porous backfill and filter fabric) for pipe underdrains of the type, class and size designated; and at the contract unit price per each COMPLETE underdrain cleanout, endwall or connection to reinforced concrete pipe.

These prices shall be full compensation for furnishing all materials and for all preparation, excavation and installation of these materials, and for all labor, equipment, tools and incidentals necessary to complete the item.

Payment will be made under:

Item D-705-5.1	6 Inch Perforated Collector Underdrain Pipe -- per linear foot
Item D-705-5.2	6 Inch Non-Perforated Outfall Underdrain Pipe -- per linear foot
Item D-705-5.3	Underdrain Cleanout -- per each
Item D-705-5.4	Endwall for Underdrain Cleanout -- per each
Item D-705-5.5	Underdrain Connection to Reinforced Concrete Pipe -- per each

MATERIAL REQUIREMENTS

ASTM A760	Standard Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drains
ASTM A762	Standard Specification for Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C144	Standard Specification for Aggregate for Masonry Mortar
ASTM C150	Standard Specification for Portland Cement
ASTM C444	Standard Specification for Perforated Concrete Pipe
ASTM C654	Standard Specification for Porous Concrete Pipe
ASTM D2321	Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D3034	Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM F477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F758	Standard Specification for Smooth Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage
ASTM F794	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe & Fittings Based on Controlled Inside Diameter
ASTM F949	Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings
ASTM F2562	Specification for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage
AASHTO M190	Standard Specification for Bituminous - Coated Corrugated Metal Culvert Pipe and Pipe Arches

AASHTO M196	Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains
AASHTO M252	Standard Specification for Corrugated Polyethylene Drainage Pipe
AASHTO M288	Standard Specification for Geotextile Specification for Highway Applications
AASHTO M294	Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500- mm (12- to 60-in.) Diameter
AASHTO M304	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter
AASHTO MP20	Standard Specification for Steel-Reinforced Polyethylene (PE) Ribbed Pipe, 300- to 900-mm (12- to 36-in.) diameter
AASHTO	Standard Specifications for Highway Bridges

END OF ITEM D-705

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Item D-752 Concrete Culverts, Headwalls, and Miscellaneous Drainage Structures

DESCRIPTION

752-1.1 This item shall consist of reinforced concrete culverts, headwalls, and miscellaneous drainage structures constructed in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the plans or required by the Engineer.

MATERIALS

752-2.1 Concrete. Reinforced concrete shall meet the requirements of Item P-610.

CONSTRUCTION METHODS

752-3.1 Unclassified excavation.

a. Trenches and foundation pits for structures or structure footings shall be excavated to the lines and grades and elevations shown on the plans. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown. The elevations of the bottoms of footings, as shown on the plans, shall be considered as approximate only; and the Engineer may approve, in writing, changes in dimensions or elevations of footings necessary to secure a satisfactory foundation.

b. Boulders, logs, or any other objectionable material encountered in excavation shall be removed. All rock or other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped, or serrated, as directed by the Engineer. All seams or crevices shall be cleaned out and grouted. All loose and disintegrated rock and thin strata shall be removed. When concrete will rest on a surface other than rock, the bottom of the excavation shall not be disturbed and excavation to final grade shall not be made until immediately before the concrete or reinforcing steel is placed.

c. The Contractor shall do all bracing, sheathing, or shoring necessary to perform and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheathing, or shoring shall be included in the unit price bid for excavation.

d. All bracing, sheathing, or shoring shall be removed by the Contractor after the completion of the structure. Removal shall be not disturb or damage the finished concrete. The cost of removal shall be included in the unit price bid for excavation.

e. After each excavation is completed, the Contractor shall notify the Engineer. No concrete or reinforcing steel shall be placed until the Engineer has approved the depth of the excavation and the character of the foundation material.

752-3.2 Backfilling.

a. After a structure has been completed, backfilling with approved material shall be accomplished by applying the fill in horizontal layers not to exceed 8 inches in loose depth, and compacted. The field density of the compacted material shall be at least 90% of the maximum density for cohesive soils and 95% of the maximum density for noncohesive soils. The maximum density shall be determined in accordance with ASTM D698. The field density shall be determined in accordance with ASTM D1556.

b. No backfilling shall be placed against any structure until approved by the Engineer. For concrete, approval shall not be given until the concrete has been in place seven (7) days, or until tests establish that the concrete has attained sufficient strength to withstand any pressure created by the backfill or the placement methods.

c. Fill placed around concrete culverts shall be deposited on each side at the same time and to approximately the same elevation. All slopes bounding or within the areas to be backfilled shall be stepped or serrated to prevent wedge action against the structure.

d. Backfill will not be measured for direct payment. Performance of this work shall be considered as a subsidiary obligation of the Contractor, covered under the contract unit price for "unclassified excavation for structures."

752-3.3 Weep holes. Weep holes shall be constructed as shown on the plans.

752-3.4 Cleaning and restoration of site. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankment, shoulders, or as approved by the Engineer. The Contractor shall restore all disturbed areas to their original condition. The Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

METHOD OF MEASUREMENT

752-4.1 The quantity of headwalls shall be on the basis of the contract unit price per each, which price shall be full compensation for all labor, equipment, material and incidentals necessary to satisfactorily construct each headwall. The price for each headwall will include the excavation, bracing, sheeting or shoring, bedding material, concrete, steel reinforcement, weep holes, backfill, and clearing and restoration of the site.

BASIS OF PAYMENT

752-5.1 Payment will be made at the contract unit price per each COMPLETE headwall. These prices shall be full compensation for furnishing all materials and for all preparation, excavation and installation of these materials, and for all labor, equipment, tools and incidentals necessary to complete the item.

Payment will be made under:

Item D-752-5.1	Half-Height Headwall, 18 Inch Reinforced Concrete Pipe -- per each
Item D-752-5.2	Half-Height Headwall, 18 Inch Reinforced Concrete Pipe with Rock Channel Protection -- per each

TESTING REQUIREMENTS

ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3 (600 kN-m/m^3))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

END OF ITEM D-752

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Item T-901 Seeding

DESCRIPTION

901-1.1 This item shall consist of soil preparation, seeding, liming and fertilizing the areas shown on the plans or as directed by the Engineer in accordance with these specifications.

MATERIALS

901-2.1 Seed. The species and application rates of grass, legume, and cover-crop seed furnished shall be those stipulated herein. Seed shall conform to the requirements of Federal Specification JJJ-S-181, Federal Specification, Seeds, Agricultural.

Seed shall be furnished separately or in mixtures in standard containers labeled in conformance with the Agricultural Marketing Service (AMS) Seed Act and applicable state seed laws with the seed name, lot number, net weight, percentages of purity and of germination and hard seed, and percentage of maximum weed seed content clearly marked for each kind of seed. The Contractor shall furnish the Engineer duplicate signed copies of a statement by the vendor certifying that each lot of seed has been tested by a recognized laboratory for seed testing within six (6) months of date of delivery. This statement shall include: name and address of laboratory, date of test, lot number for each kind of seed, and the results of tests as to name, percentages of purity and of germination, and percentage of weed content for each kind of seed furnished, and, in case of a mixture, the proportions of each kind of seed. Wet, moldy, or otherwise damaged seed will be rejected.

Seed shall be applied per ODOT 659, Table 659.07-1, Germination Rates. All seed types shall be endophyte enhanced to reduce attractiveness to birds and other wildlife. Seeding shall occur per the schedules listed in ODOT 659.12

901-2.2 Lime. Lime shall be ground limestone containing not less than 85% of total carbonates, and shall be ground to such fineness that 90% will pass through a No. 20 mesh sieve and 50% will pass through a No. 100 mesh sieve. Coarser material will be acceptable, providing the rates of application are increased to provide not less than the minimum quantities and depth specified in the special provisions on the basis of the two sieve requirements above. Dolomitic lime or a high magnesium lime shall contain at least 10% of magnesium oxide. Lime shall be applied at the rate of 92 pounds per 1,000 square feet (2 tons per acre) per ODOT 659.03. All liming materials shall conform to the requirements of ASTM C602.

901-2.3 Fertilizer. Fertilizer shall be standard commercial fertilizers supplied separately or in mixtures containing the percentages of total nitrogen, available phosphoric acid, and water-soluble potash. They shall be applied at the rate and to the depth specified, and shall meet the requirements of applicable state laws. They shall be furnished in standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon. No cyanamide compounds or hydrated lime shall be permitted in mixed fertilizers.

The fertilizers may be supplied in one of the following forms:

a. A dry, free-flowing fertilizer suitable for application by a common fertilizer spreader;

b. A finely-ground fertilizer soluble in water, suitable for application by power sprayers; or

c. A granular or pellet form suitable for application by blower equipment.

Fertilizers shall be 10-20-10 commercial fertilizer (liquid or dry) and shall be spread at the standard dry application rate of 20 pounds per 1,000 square feet (875 pounds per acre) per ODOT 659.04. Furnish liquid application rates for approval by the Engineer.

901-2.4 Soil for repairs. The soil for fill and topsoiling of areas to be repaired shall be at least of equal quality to that which exists in areas adjacent to the area to be repaired. The soil shall be relatively free from large stones, roots, stumps, or other materials that will interfere with subsequent sowing of seed, compacting, and establishing turf, and shall be approved by the Engineer before being placed.

CONSTRUCTION METHODS

901-3.1 Advance preparation and cleanup. After grading of areas has been completed and before applying fertilizer and ground limestone, areas to be seeded shall be raked or otherwise cleared of stones larger than 2 inches in any diameter, sticks, stumps, and other debris that might interfere with sowing of seed, growth of grasses, or subsequent maintenance of grass-covered areas. If any damage by erosion or other causes has occurred after the completion of grading and before beginning the application of fertilizer and ground limestone, the Contractor shall repair such damage include filling gullies, smoothing irregularities, and repairing other incidental damage.

An area to be seeded shall be considered a satisfactory seedbed without additional treatment if it has recently been thoroughly loosened and worked to a depth of not less than 5 inches as a result of grading operations and, if immediately prior to seeding, the top 3 inches of soil is loose, friable, reasonably free from large clods, rocks, large roots, or other undesirable matter, and if shaped to the required grade.

When the area to be seeded is sparsely sodded, weedy, barren and unworked, or packed and hard, any grass and weeds shall first be cut or otherwise satisfactorily disposed of, and the soil then scarified or otherwise loosened to a depth not less than 5 inches. Clods shall be broken and the top 3 inches of soil shall be worked into a satisfactory seedbed by discing, or by use of cultipackers, rollers, drags, harrows, or other appropriate means.

901-3.2 Dry application method.

a. Liming. Lime shall be applied separately and prior to the application of any fertilizer or seed and only on seedbeds that have previously been prepared as described above. The lime shall then be worked into the top 3 inches of soil after which the seedbed shall again be properly graded and dressed to a smooth finish.

b. Fertilizing. Following advance preparations and cleanup fertilizer shall be uniformly spread at the rate that will provide not less than the minimum quantity stated in paragraph 901-2.3.

c. Seeding. Grass seed shall be sown at the rate specified in paragraph 901-2.1 immediately after fertilizing. The fertilizer and seed shall be raked within the depth range stated in the special provisions. Seeds of legumes, either alone or in mixtures, shall be inoculated before mixing or sowing, in accordance with the instructions of the manufacturer of the inoculant. When seeding is required at

other than the seasons shown on the plans or in the special provisions, a cover crop shall be sown by the same methods required for grass and legume seeding.

d. Rolling. After the seed has been properly covered, the seedbed shall be immediately compacted by means of an approved lawn roller, weighing 40 to 65 pounds per foot of width for clay soil (or any soil having a tendency to pack), and weighing 150 to 200 pounds per foot of width for sandy or light soils.

901-3.3 Wet application method.

a. General. The Contractor may elect to apply seed and fertilizer (and lime, if required) by spraying them on the previously prepared seedbed in the form of an aqueous mixture and by using the methods and equipment described herein. The rates of application shall be as specified in the special provisions.

b. Spraying equipment. The spraying equipment shall have a container or water tank equipped with a liquid level gauge calibrated to read in increments not larger than 50 gallons over the entire range of the tank capacity, mounted so as to be visible to the nozzle operator. The container or tank shall also be equipped with a mechanical power-driven agitator capable of keeping all the solids in the mixture in complete suspension at all times until used.

The unit shall also be equipped with a pressure pump capable of delivering 100 gallons per minute at a pressure of 100 lb / sq inches. The pump shall be mounted in a line that will recirculate the mixture through the tank whenever it is not being sprayed from the nozzle. All pump passages and pipe lines shall be capable of providing clearance for 5/8 inch solids. The power unit for the pump and agitator shall have controls mounted so as to be accessible to the nozzle operator. There shall be an indicating pressure gauge connected and mounted immediately at the back of the nozzle.

The nozzle pipe shall be mounted on an elevated supporting stand in such a manner that it can be rotated through 360 degrees horizontally and inclined vertically from at least 20 degrees below to at least 60 degrees above the horizontal. There shall be a quick-acting, three-way control valve connecting the recirculating line to the nozzle pipe and mounted so that the nozzle operator can control and regulate the amount of flow of mixture delivered to the nozzle. At least three different types of nozzles shall be supplied so that mixtures may be properly sprayed over distance varying from 20 to 100 feet. One shall be a close-range ribbon nozzle, one a medium-range ribbon nozzle, and one a long-range jet nozzle. For case of removal and cleaning, all nozzles shall be connected to the nozzle pipe by means of quick-release couplings.

In order to reach areas inaccessible to the regular equipment, an extension hose at least 50 feet in length shall be provided to which the nozzles may be connected.

c. Mixtures. Lime, if required, shall be applied separately, in the quantity specified, prior to the fertilizing and seeding operations. Not more than 220 pounds of lime shall be added to and mixed with each 100 gallons of water. Seed and fertilizer shall be mixed together in the relative proportions specified, but not more than a total of 220 pounds of these combined solids shall be added to and mixed with each 100 gallons of water.

All water used shall be obtained from fresh water sources and shall be free from injurious chemicals and other toxic substances harmful to plant life. Brackish water shall not be used at any time. The Contractor shall identify to the Engineer all sources of water at least two (2) weeks prior to use. The Engineer may take samples of the water at the source or from the tank at any time and have a laboratory test the samples for chemical and saline content. The Contractor shall not use any water from any source that is disapproved by the Engineer following such tests.

All mixtures shall be constantly agitated from the time they are mixed until they are finally applied to the seedbed. All such mixtures shall be used within two (2) hours from the time they were mixed or they shall be wasted and disposed of at approved locations.

d. Spraying. Lime, if required, shall be sprayed only upon previously prepared seedbeds. After the applied lime mixture has dried, the lime shall be worked into the top 3 inches, after which the seedbed shall again be properly graded and dressed to a smooth finish.

Mixtures of seed and fertilizer shall only be sprayed upon previously prepared seedbeds on which the lime, if required, shall already have been worked in. The mixtures shall be applied by means of a high-pressure spray that shall always be directed upward into the air so that the mixtures will fall to the ground like rain in a uniform spray. Nozzles or sprays shall never be directed toward the ground in such a manner as might produce erosion or runoff.

Particular care shall be exercised to ensure that the application is made uniformly and at the prescribed rate and to guard against misses and overlapped areas. Proper predetermined quantities of the mixture in accordance with specifications shall be used to cover specified sections of known area.

Checks on the rate and uniformity of application may be made by observing the degree of wetting of the ground or by distributing test sheets of paper or pans over the area at intervals and observing the quantity of material deposited thereon.

On surfaces that are to be mulched as indicated by the plans or designated by the Engineer, seed and fertilizer applied by the spray method need not be raked into the soil or rolled. However, on surfaces on which mulch is not to be used, the raking and rolling operations will be required after the soil has dried.

901-3.4 Maintenance of seeded areas. The Contractor shall protect seeded areas against traffic or other use by warning signs or barricades, as approved by the Engineer. Surfaces gullied or otherwise damaged following seeding shall be repaired by regrading and reseeding as directed. The Contractor shall mow, water as directed, and otherwise maintain seeded areas in a satisfactory condition until final inspection and acceptance of the work.

When either the dry or wet application method outlined above is used for work done out of season, it will be required that the Contractor establish a good stand of grass of uniform color and density to the satisfaction of the Engineer. A grass stand shall be considered adequate when bare spots are one square foot or less, randomly dispersed, and do not exceed 3% of the area seeded.

METHOD OF MEASUREMENT

901-4.1 The quantity of seeding to be paid for shall be the number of acres measured on the ground surface, completed and accepted.

BASIS OF PAYMENT

901-5.1 Payment shall be made at the contract unit price per acre or fraction thereof, which price and payment shall be full compensation for furnishing and placing all material and for all labor, equipment, tools, and incidentals necessary to complete the work prescribed in this item.

Payment will be made under:

Item 901-5.1	Seeding -- per acre

MATERIAL REQUIREMENTS

ASTM C602	Standard Specification for Agricultural Liming Materials
ASTM D977	Standard Specification for Emulsified Asphalt
FED SPEC	JJJ-S-181, Federal Specification, Seeds, Agricultural

END OF ITEM T-901

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Item T-904 Sodding

DESCRIPTION

904-1.1 This item shall consist of furnishing, hauling, and placing approved live sod on prepared areas in accordance with this specification at the locations shown on the plans or as directed by the Engineer.

MATERIALS

904-2.1 Sod. Sod furnished by the Contractor shall have a good cover of living or growing grass. This shall be interpreted to include grass that is seasonally dormant during the cold or dry seasons and capable of renewing growth after the dormant period. All sod shall be obtained from areas where the soil is reasonably fertile and contains a high percentage of loamy topsoil. Sod shall be cut or stripped from living, thickly matted turf relatively free of weeds or other undesirable foreign plants, large stones, roots, or other materials that might be detrimental to the development of the sod or to future maintenance. At least 70% of the plants in the cut sod shall be composed of the species stated in the special provisions, and any vegetation more than 6 inches in height shall be mowed to a height of 3 inches or less before sod is lifted. Sod, including the soil containing the roots and the plant growth showing above, shall be cut uniformly to a thickness not less than that stated in the special provisions.

904-2.2 Lime. Lime shall be ground limestone containing not less than 85% of total carbonates, and shall be ground to such fineness that 90% will pass through a No. 20 mesh sieve and 50% will pass through a No. 100 mesh sieve. Coarser material will be acceptable, providing the rates of application are increased to provide not less than the minimum quantities and depth specified in the special provisions on the basis of the two sieve requirements above. Dolomitic lime or a high magnesium lime shall contain at least 10% of magnesium oxide. Lime shall be applied at the rate of 92 pounds per 1,000 square feet (2 tons per acre) per ODOT 659.03. All liming materials shall conform to the requirements of ASTM C602.

904-2.3 Fertilizer. Fertilizer shall be standard commercial fertilizers supplied separately or in mixtures containing the percentages of total nitrogen, available phosphoric acid, and water-soluble potash. They shall be applied at the rate and to the depth specified, and shall meet the requirements of applicable state laws. They shall be furnished in standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon. No cyanamide compounds or hydrated lime shall be permitted in mixed fertilizers.

The fertilizers may be supplied in one of the following forms:

a. A dry, free-flowing fertilizer suitable for application by a common fertilizer spreader;

b. A finely-ground fertilizer soluble in water, suitable for application by power sprayers; or

c. A granular or pellet form suitable for application by blower equipment.

Fertilizers shall be 10-20-10 commercial fertilizer (liquid or dry) and shall be spread at the standard dry application rate of 20 pounds per 1,000 square feet (875 pounds per acre) per ODOT 659.04. Furnish liquid application rates for approval by the Engineer.

904-2.4 Water. The water shall be sufficiently free from oil, acid, alkali, salt, or other harmful materials that would inhibit the growth of grass. It shall be subject to the approval of the Engineer prior to use.

904-2.5 Soil for repairs. The soil for fill and topsoiling of areas to be repaired shall be at least of equal quality to that which exists in areas adjacent to the area to be repaired. The soil shall be relatively free from large stones, roots, stumps, or other materials that will interfere with subsequent sowing of seed, compacting, and establishing turf, and shall be approved by the Engineer before being placed.

CONSTRUCTION METHODS

904-3.1 General. Areas to be solid, strip, or spot sodded shall be shown on the plans. Areas requiring special ground surface preparation such as tilling and those areas in a satisfactory condition that are to remain undisturbed shall also be shown on the plans.

Suitable equipment necessary for proper preparation of the ground surface and for the handling and placing of all required materials shall be on hand, in good condition, and shall be approved by the Engineer before the various operations are started. The Contractor shall demonstrate to the Engineer before starting the various operations that the application of required materials will be made at the specified rates.

904-3.2 Preparing the ground surface. After grading of areas has been completed and before applying fertilizer and limestone, areas to be sodded shall be raked or otherwise cleared of stones larger than 2 inches in any diameter, sticks, stumps, and other debris which might interfere with sodding, growth of grasses, or subsequent maintenance of grass-covered areas. If any damage by erosion or other causes occurs after grading of areas and before beginning the application of fertilizer and ground limestone, the Contractor shall repair such damage. This may include filling gullies, smoothing irregularities, and repairing other incidental damage.

904-3.3 Applying fertilizer and ground limestone. Following ground surface preparation, fertilizer shall be uniformly spread at a rate which will provide not less than the minimum quantity of each fertilizer ingredient, as stated in the special provisions. If use of ground limestone is required, it shall then be spread at a rate that will provide not less than the minimum quantity stated in the special provisions. These materials shall be incorporated into the soil to a depth of not less than 2 inches by discing, raking, or other suitable methods. Any stones larger than 2 inches in any diameter, large clods, roots, and other litter brought to the surface by this operation shall be removed.

904-3.4 Obtaining and delivering sod. After inspection and approval of the source of sod by the Engineer, the sod shall be cut with approved sod cutters to such a thickness that after it has been transported and placed on the prepared bed, but before it has been compacted, it shall have a uniform thickness of not less than 2 inches. Sod sections or strips shall be cut in uniform widths, not less than 10 inches, and in lengths of not less than 18 inches, but of such length as may be readily lifted without breaking, tearing, or loss of soil. Where strips are required, the sod must be rolled without damage with the grass folded inside. The Contractor may be required to mow high grass before cutting sod.

The sod shall be transplanted within 24 hours from the time it is stripped, unless circumstances beyond the Contractor's control make storing necessary. In such cases, sod shall be stacked, kept moist, and protected from exposure to the air and sun and shall be kept from freezing. Sod shall be cut and moved only when the soil moisture conditions are such that favorable results can be expected. Where the soil is

too dry, permission to cut sod may be granted only after it has been watered sufficiently to moisten the soil to the depth the sod is to be cut.

904-3.5 Laying sod. Sodding shall be performed only during the seasons when satisfactory results can be expected. Frozen sod shall not be used and sod shall not be placed upon frozen soil. Sod may be transplanted during periods of drought with the approval of the Engineer, provided the sod bed is watered to moisten the soil to a depth of at least 4 inches immediately prior to laying the sod.

The sod shall be moist and shall be placed on a moist earth bed. Pitch forks shall not be used to handle sod, and dumping from vehicles shall not be permitted. The sod shall be carefully placed by hand, edge to edge and with staggered joints, in rows at right angles to the slopes, commencing at the base of the area to be sodded and working upward. The sod shall immediately be pressed firmly into contact with the sod bed by tamping or rolling with approved equipment to provide a true and even surface, and ensure knitting without displacement of the sod or deformation of the surfaces of sodded areas. Where the sod may be displaced during sodding operations, the workmen, when replacing it, shall work from ladders or treaded planks to prevent further displacement. Screened soil of good quality shall be used to fill all cracks between sods. The quantity of the fill soil shall not cause smothering of the grass. Where the grades are such that the flow of water will be from paved surfaces across sodded areas, the surface of the soil in the sod after compaction shall be set approximately one inch below the pavement edge. Where the flow will be over the sodded areas and onto the paved surfaces around manholes and inlets, the surface of the soil in the sod after compaction shall be placed flush with pavement edges.

On slopes steeper than one (1) vertical to 2-1/2 horizontal and in v-shaped or flat-bottom ditches or gutters, the sod shall be pegged with wooden pegs not less than 12 inches in length and have a cross-sectional area of not less than 3/4 sq inch. The pegs shall be driven flush with the surface of the sod.

904-3.6 Watering. Adequate water and watering equipment must be on hand before sodding begins, and sod shall be kept moist until it has become established and its continued growth assured. In all cases, watering shall be done in a manner that will avoid erosion from the application of excessive quantities and will avoid damage to the finished surface.

904-3.7 Establishing turf.

a. General. The Contractor shall provide general care for the sodded areas as soon as the sod has been laid and shall continue until final inspection and acceptance of the work.

b. Protection. All sodded areas shall be protected against traffic or other use by warning signs or barricades approved by the Engineer.

c. Mowing. The Contractor shall mow the sodded areas with approved mowing equipment, depending upon climatic and growth conditions and the needs for mowing specific areas. In the event that weeds or other undesirable vegetation are permitted to grow to such an extent that, either cut or uncut, they threaten to smother the sodded species, they shall be mowed and the clippings raked and removed from the area.

904-3.8 Repairing. When the surface has become gullied or otherwise damaged during the period covered by this contract, the affected areas shall be repaired to re-establish the grade and the condition of the soil, as directed by the Engineer, and shall then be sodded as specified in paragraph 904-3.5.

METHOD OF MEASUREMENT

904-4.1 This item shall be measured on the basis of the area in square yards of the surface covered with sod and accepted.

BASIS OF PAYMENT

904-5.1 This item will be paid for on the basis of the contract unit price per square yard for sodding, which price shall be full compensation for all labor, equipment, material, staking, and incidentals necessary to satisfactorily complete the items as specified.

Payment will be made under:

Item T-904-5.1	Sodding -- per square yard

MATERIAL REQUIREMENTS

ASTM C602	Standard Specification for Agricultural Liming Materials

END OF ITEM T-904

Item T-905 Topsoiling

DESCRIPTION

905-1.1 This item shall consist of preparing the ground surface for topsoil application, removing topsoil from designated stockpiles or areas to be stripped on the site or from approved sources off the site, and placing and spreading the topsoil on prepared areas in accordance with this specification at the locations shown on the plans or as directed by the Engineer.

MATERIALS

905-2.1 Topsoil. Topsoil shall be the surface layer of soil with no admixture of refuse or any material toxic to plant growth, and it shall be reasonably free from subsoil and stumps, roots, brush, stones (2 inches or more in diameter), and clay lumps or similar objects. Brush and other vegetation that will not be incorporated with the soil during handling operations shall be cut and removed. Ordinary sod and herbaceous growth such as grass and weeds are not to be removed, but shall be thoroughly broken up and intermixed with the soil during handling operations. Heavy sod or other cover, which cannot be incorporated into the topsoil by discing or other means, shall be removed. The topsoil or soil mixture, unless otherwise specified or approved, shall have a pH range of approximately 5.5 pH to 7.6 pH, when tested in accordance with the methods of testing of the Association of Official Agricultural Chemists in effect on the date of invitation of bids. The organic content shall be not less than 3% nor more than 20% as determined by the wet-combustion method (chromic acid reduction). There shall be not less than 20% nor more than 80% of the material passing the 200 mesh (0.075 mm) sieve as determined by the wash test in accordance with ASTM C117.

Natural topsoil may be amended by the Contractor with approved materials and methods to meet the above specifications.

905-2.2 Inspection and tests. Within 10 days following acceptance of the bid, the Engineer shall be notified of the source of topsoil to be furnished by the Contractor. The topsoil shall be inspected to determine if the selected soil meets the requirements specified and to determine the depth to which stripping will be permitted. At this time, the Contractor may be required to take representative soil samples from several locations within the area under consideration and to the proposed stripping depths, for testing purposes as specified in paragraph 905-2.1.

CONSTRUCTION METHODS

905-3.1 General. Areas to be topsoiled shall be shown on the plans. If topsoil is available on the site, the location of the stockpiles or areas to be stripped of topsoil and the stripping depths shall be shown on the plans.

Suitable equipment necessary for proper preparation and treatment of the ground surface, stripping of topsoil, and for the handling and placing of all required materials shall be on hand, in good condition, and approved by the Engineer before the various operations are started.

905-3.2 Preparing the ground surface. Immediately prior to dumping and spreading the topsoil on any area, the surface shall be loosened by discs or spike-tooth harrows, or by other means approved by the Engineer, to a minimum depth of 2 inches to facilitate bonding of the topsoil to the covered subgrade soil. The surface of the area to be topsoiled shall be cleared of all stones larger than 2 inches in any diameter and all litter or other material which may be detrimental to proper bonding, the rise of capillary moisture, or the proper growth of the desired planting. Limited areas, as shown on the plans, which are too compact to respond to these operations shall receive special scarification.

Grades on the area to be topsoiled, which have been established by others as shown on the plans, shall be maintained in a true and even condition. Where grades have not been established, the areas shall be smooth-graded and the surface left at the prescribed grades in an even and compacted condition to prevent the formation of low places or pockets where water will stand.

905-3.3 Obtaining topsoil. Prior to the stripping of topsoil from designated areas, any vegetation, briars, stumps and large roots, rubbish or stones found on such areas, which may interfere with subsequent operations, shall be removed using methods approved by the Engineer. Heavy sod or other cover, which cannot be incorporated into the topsoil by discing or other means shall be removed.

When suitable topsoil is available on the site, the Contractor shall remove this material from the designated areas and to the depth as directed by the Engineer. The topsoil shall be spread on areas already tilled and smooth-graded, or stockpiled in areas approved by the Engineer. Any topsoil stockpiled by the Contractor shall be rehandled and placed without additional compensation. Any topsoil that has been stockpiled on the site by others, and is required for topsoiling purposes, shall be removed and placed by the Contractor. The sites of all stockpiles and areas adjacent thereto which have been disturbed by the Contractor shall be graded if required and put into a condition acceptable for seeding.

When suitable topsoil is secured off the airport site, the Contractor shall locate and obtain the supply, subject to the approval of the Engineer. The Contractor shall notify the Engineer sufficiently in advance of operations in order that necessary measurements and tests can be made. The Contractor shall remove the topsoil from approved areas and to the depth as directed. The topsoil shall be hauled to the site of the work and placed for spreading, or spread as required. Any topsoil hauled to the site of the work and stockpiled shall be rehandled and placed without additional compensation.

905-3.4 Placing topsoil. The topsoil shall be evenly spread on the prepared areas to a uniform depth of 2 inches after compaction, unless otherwise shown on the plans or stated in the special provisions. Spreading shall not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the work. Spreading shall be carried on so that turfing operations can proceed with a minimum of soil preparation or tilling.

After spreading, any large, stiff clods and hard lumps shall be broken with a pulverizer or by other effective means, and all stones or rocks (2 inches or more in diameter), roots, litter, or any foreign matter shall be raked up and disposed of by the Contractor. after spreading is completed, the topsoil shall be satisfactorily compacted by rolling with a cultipacker or by other means approved by the Engineer. The compacted topsoil surface shall conform to the required lines, grades, and cross-sections.

Any topsoil or other dirt falling upon pavements as a result of hauling or handling of topsoil shall be promptly removed.

METHOD OF MEASUREMENT

905-4.1 No separate measurement will be made for topsoiling.

BASIS OF PAYMENT

905-5.1 No direct payment will be made for topsoiling under this item. Payment for topsoiling is incidental to the P-152 pay items.

TESTING MATERIALS

ASTM C117	Materials Finer than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing

END OF ITEM T-905

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Item T-908 Mulching

DESCRIPTION

908-1.1 This item shall consist of furnishing, hauling, placing, and securing mulch on surfaces indicated on the plans or designated by the Engineer.

MATERIALS

908-2.1 Mulch material. Acceptable mulch shall be the materials listed below or any approved locally available material that is similar to those specified. Mulch shall be free from noxious weeds, mold, and other deleterious materials. Mulch materials, which contain matured seed of species that would volunteer and be detrimental to the proposed overseeding, or to surrounding farm land, will not be acceptable. Straw or other mulch material which is fresh and/or excessively brittle, or which is in such an advanced stage of decomposition as to smother or retard the planted grass, will not be acceptable.

a. Hay. Hay shall be native hay in an air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Hay shall be sterile, containing no fertile seed.

b. Straw. Straw shall be the stalks from threshed plant residue of oats, wheat, barley, rye, or rice from which grain has been removed. Furnish in air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Straw shall contain no fertile seed.

c. Hay mulch containing seed. Hay mulch shall be mature hay containing viable seed of native grasses or other desirable species stated in the special provisions or as approved by the Engineer. The hay shall be cut and handled so as to preserve the maximum quantity of viable seed. Hay mulch that cannot be hauled and spread immediately after cutting shall be placed in weather-resistant stacks or baled and stored in a dry location until used.

d. Manufactured mulch. Cellulose-fiber or wood-pulp mulch shall be products commercially available for use in spray applications.

e. Asphalt binder. Asphalt binder material shall conform to the requirements of ASTM D977, Type SS-1 or RS-1.

908-2.2 Inspection. The Engineer shall be notified of sources and quantities of mulch materials available and the Contractor shall furnish him with representative samples of the materials to be used 30 days before delivery to the project. These samples may be used as standards with the approval of the Engineer and any materials brought on the site that do not meet these standards shall be rejected.

CONSTRUCTION METHODS

908-3.1 Mulching. Before spreading mulch, all large clods, stumps, stones, brush, roots, and other foreign material shall be removed from the area to be mulched. Mulch shall be applied immediately

after seeding. The spreading of the mulch may be by hand methods, blower, or other mechanical methods, provided a uniform covering is obtained.

Mulch material shall be furnished, hauled, and evenly applied on the area shown on the plans or designated by the Engineer. Straw or hay shall be spread over the surface to a uniform thickness at the rate of 2 to 3 tons per acre to provide a loose depth of not less than 1-1/2 inches nor more than 3 inches. Other organic material shall be spread at the rate directed by the Engineer. Mulch may be blown on the slopes and the use of cutters in the equipment for this purpose will be permitted to the extent that at least 95% of the mulch in place on the slope shall be 6 inches or more in length. When mulches applied by the blowing method are cut, the loose depth in place shall be not less than one inch nor more than 2 inches.

908-3.2 Securing mulch. The mulch shall be held in place by light discing, a very thin covering of topsoil, pins, stakes, wire mesh, asphalt binder, or other adhesive material approved by the Engineer. Where mulches have been secured by either of the asphalt binder methods, it will not be permissible to walk on the slopes after the binder has been applied. When an application of asphalt binder material is used to secure the mulch, the Contractor must take every precaution to guard against damaging or disfiguring structures or property on or adjacent to the areas worked and will be held responsible for any such damage resulting from the operation.

If the “peg and string” method is used, the mulch shall be secured by the use of stakes or wire pins driven into the ground on 5-foot centers or less. Binder twine shall be strung between adjacent stakes in straight lines and crisscrossed diagonally over the mulch, after which the stakes shall be firmly driven nearly flush to the ground to draw the twine down tight onto the mulch.

908-3.3 Care and repair.

a. The Contractor shall care for the mulched areas until final acceptance of the project. Care shall consist of providing protection against traffic or other use by placing warning signs, as approved by the Engineer, and erecting any barricades that may be shown on the plans before or immediately after mulching has been completed on the designated areas.

b. The Contractor shall be required to repair or replace any mulch that is defective or becomes damaged until the project is finally accepted. When, in the judgment of the Engineer, such defects or damages are the result of poor workmanship or failure to meet the requirements of the specifications, the cost of the necessary repairs or replacement shall be borne by the Contractor.

c. If the “asphalt spray” method is used, all mulched surfaces shall be sprayed with asphalt binder material so that the surface has a uniform appearance. The binder shall be uniformly applied to the mulch at the rate of approximately 8 gallons per 1,000 square feet, or as directed by the Engineer, with a minimum of 6 gallons and a maximum of 10 gallons per 1,000 square feet depending on the type of mulch and the effectiveness of the binder securing it. Bituminous binder material may be sprayed on the mulched slope areas from either the top or the bottom of the slope. An approved spray nozzle shall be used. The nozzle shall be operated at a distance of not less than 4 feet from the surface of the mulch and uniform distribution of the bituminous material shall be required. A pump or an air compressor of adequate capacity shall be used to ensure uniform distribution of the bituminous material.

d. If the “asphalt mix” method is used, the mulch shall be applied by blowing, and the asphalt binder material shall be sprayed into the mulch as it leaves the blower. The binder shall be uniformly

applied to the mulch at the rate of approximately 8 gallons per 1,000 square feet or as directed by the Engineer, with a minimum of 6 gallons and a maximum of 10 gallons per 1,000 square feet depending on the type of mulch and the effectiveness of the binder securing it.

METHOD OF MEASUREMENT

908-4.1 Mulching shall be measured in acres on the basis of the actual surface area acceptably mulched.

BASIS OF PAYMENT

908-5.1 Payment will be made at the contract unit price per acres for mulching. The price shall be full compensation for furnishing all materials and for placing and anchoring the materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item T-908-5.1	Mulching -- per acre

MATERIAL REQUIREMENTS

ASTM D977	Standard Specification for Emulsified Asphalt

END OF ITEM T-908

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Item L-107 Airport Wind Cones

DESCRIPTION

107-1.1 This item shall consist of furnishing and installing an airport wind cone per these specifications and per the dimensions, design, and details shown in the plans.

The work shall include the furnishing and installation of a support for mounting the wind cone, the specified interconnecting wire, and a concrete foundation. The item shall also include all cable connections, conduit and conduit fittings, the furnishing and installation of all lamps, ground rod and ground connection, the testing of the installation, and all incidentals necessary to place the wind cone in operation (as a completed unit) to the satisfaction of the Engineer.

EQUIPMENT AND MATERIALS

107-2.1 General.

a. Airport lighting equipment and materials covered by advisory circulars (ACs) shall be certified and listed in AC 150/5345-53, Airport Lighting Equipment Certification Program.

b. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Engineer.

c. Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications. Materials supplied and/or installed that do not comply with these specifications shall be removed (when directed by the Engineer) and replaced with materials that comply with these specifications, at the Contractor's cost.

d. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete any non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment to which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). Contractor is solely responsible for delays in the project that may accrue directly or indirectly from late submissions or resubmissions of submittals.

e. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be neatly bound in a properly sized 3-ring binder, tabbed by specification section. The Engineer reserves the right to reject any and all equipment, materials or procedures, that do not meet the system design and the standards and codes, specified in this document.

f. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for at least twelve (12) months from the date of final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

107-2.2 Wind cones. The supplemental wind cone assembly shall be Type L-806 (L), Style 1B, Size 1 meeting the requirements of AC 150/5345-27, Specification for Wind Cone Assemblies. Wind cone shall be powered from the 6.6 amp taxiway series circuit.

107-2.3 Electrical wire and cable. Cable rated up to 5,000 volts in conduit shall conform to AC 150/5345-7, Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits. For ratings up to 600 volts, moisture and heat resistant thermoplastic wire conforming to Commercial Item Description A-A-59544A Type THWN-2 shall be used. The wires shall be of the type, size, number of conductors, and voltage shown in the plans or in the proposal.

107-2.4 Conduit. Rigid steel conduit and fittings shall conform to the requirements of Underwriters Laboratories Standards 6, 514B, and 1242.

107-2.5 Plastic conduit (for use below grade only). Plastic conduit and fittings shall be per the following:

- UL 514B covers W-C-1094 - Conduit fittings all types, Classes 1 thru 3 and 6 thru 10
- UL 514C covers W-C-1094 - all types, Class 5 junction box and cover in plastic (polyvinyl chloride (PVC))
- UL 651 covers W-C-1094 - Rigid PVC Conduit, types I and II, Class 4
- UL 651A covers W-C-1094 - Rigid PVC Conduit and high density polyethylene (HDPE) Conduit type III and Class 4

Underwriters Laboratories Standard UL-651 shall be one of the following, as shown in the plans:

a. Type I–Schedule 40 PVC suitable for underground use either direct-buried or encased in concrete.

b. Type II–Schedule 40 PVC suitable for either above ground or underground use.

Plastic conduit adhesive shall be a solvent cement manufactured specifically for the purpose of gluing the type of plastic conduit and fitting.

107-2.6 Concrete. The concrete for foundations shall be proportioned, placed, and cured per Item P-610, Structural Portland Cement Concrete.

107-2.7 Paint.

a. Priming paint for non-galvanized metal surfaces shall be a high solids alkyd primer per Society for Protective Coatings (SSPC) Specification - Paint 25, Primer, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments).

b. Priming paint for galvanized metal surfaces shall be zinc dust-zinc oxide primer paint conforming to MIL-DTL-24441C/19B. Use MIL-24441 thinner per paint manufacturer's recommendations.

c. Orange paint for the body and the finish coats on metal and wood surfaces shall consist of a ready-mixed non-fading paint per Master Painter's Institute (MPI) Reference #9 (gloss). The color shall be per Federal Standards 595, International Orange, Number 12197.

d. White paint for body and finish coats on metal and wood surfaces shall be ready-mixed paint conforming to the MPI, Reference #9, Exterior Alkyd, Gloss.

e. Priming paint for wood surfaces shall be mixed on the job by thinning the above specified aviation-orange or white paint by adding 1/2 pint (0.24 liter) of raw linseed oil to each gallon (liter).

CONSTRUCTION METHODS

107-3.1 Installation. The hinged support or hinged pole shall be installed on a concrete foundation per the plans.

107-3.2 Support pole erection. The Contractor shall erect the pole on the foundation following the manufacturer's requirements and erection details. The pole shall be level and secure.

107-3.3 Electrical connection. The Contractor shall furnish all labor and materials and shall make complete electrical connections per the wiring diagram furnished with the project plans. The electrical installation shall conform to the requirements of the latest edition of National Fire Protection Association, NFPA-70, National Electric Code (NEC).

If underground cable from the transformer vault to the wind cone site and duct for this cable installation is required, the cable and duct shall be installed in accordance with and paid for as described in Item L-108, Underground Power Cables for Airports, and Item L-110, Airport Underground Electrical Duct Banks and Conduits.

107-3.4 Booster transformer. NOT USED

107-3.5 Ground connection and ground rod. The Contractor shall furnish and install a ground rod, grounding cable, and ground clamps for grounding the pipe support of the 8-foot (2.4-m) support near the base. The ground rod shall be of the type, diameter and length specified in Item L-108, Underground Power Cable for Airports. The ground rod shall be driven into the ground adjacent to the concrete foundation (minimum distance from foundation of 2 feet (60 cm)) so that the top is at least 6 inches (150 mm) below grade. The grounding cable shall consist of No. 6**]** American wire gauge (AWG) minimum stranded copper wire or larger and shall be firmly attached to the ground rod by exothermic welding. If an exothermic weld is not possible, connections to the grounding bus shall be made by using connectors approved for direct burial in soil or concrete per UL 467. The other end of the grounding cable shall be securely attached to a leg of the frame or to the base of the pipe support with non-corrosive metal and shall be of substantial construction. The resistance to ground shall not exceed 25 ohms. If a single rod grounding electrode has a resistance to earth of over 25 ohms, then install one supplemental rod not less than 10 feet from the first rod.

107-3.6 Painting. Three coats of paint shall be applied (one prime, one body, and one finish) to all exposed material installed under this item except the fabric cone, obstruction light globe, and lamp reflectors. The wind cone assembly, if already painted upon receipt, shall be given one finish coat of paint in lieu of the three coats specified above. The paint shall be per MPI Reference #9 (gloss). The color shall be per Federal Standard 595, International Orange, Number 12197.

107-3.7 Light sources. The Contractor shall furnish and install lamps per the manufacturer's instruction book.

107-3.8 Chain and padlock. The Contractor shall furnish and install a suitable operating chain for lowering and raising the hinged top section. The chain shall be attached to the pole support in a manner to prevent the light fixture assembly from striking the ground in the lowered position.

A padlock shall also be furnished by the Contractor on the 8-foot (2.4-m) wind cone for securing the hinged top section to the fixed lower section. Keys for the padlock shall be delivered to the Engineer.

107-3.9 Segmented circle. The segmented circle shall be constructed in accordance with AC 150/5340-5, Segmented Circle Airport Marker System, and the details in the Plans.

METHOD OF MEASUREMENT

107-4.1 The quantity to be paid shall be the number of wind cones installed as completed units in place, accepted, and ready for operation.

107-4.2 The quantity of segmented circle airport marker systems to be paid for shall be the number of systems installed as completed units in place, accepted, and ready for operation.

BASIS OF PAYMENT

107-5.1 Payment will be made at the contract unit price for each completed and accepted job. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

Payment will be made under:

Item L-107-5.1	Relocate Supplemental Wind Cone -- per each

MATERIAL REQUIREMENTS

AC 150/5340-5	Segmented Circle Airport Marker System
AC 150/5340-30	Design and Installation Details for airport Visual Aids
AC 150/5345-7	Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
AC 150/5345-27	Specification for Wind Cone Assemblies
AC 150/5345-53	Airport Lighting Equipment Certification Program
Commercial Item Description A-A-59544	Cable and Wire, Electrical (Power, Fixed Installation)
FED STD 595	Colors Used in Government Procurement
MIL-DTL-24441C/19B	Paint, Epoxy-Polyamide, Zinc Primer, Formula 159, Type III
Underwriters Laboratories Standard 6	Electrical Rigid Metal Conduit – Steel
Underwriters Laboratories Standard 514B	Conduit, Tubing, and Cable Fittings

Underwriters Laboratories Standard 514C
Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

Underwriters Laboratories Standard 651
Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

Underwriters Laboratories Standard 651A
Type EB and A Rigid PVC Conduit and HDPE Conduit

Underwriters Laboratories Standard 1242
Electrical Intermediate Metal Conduit - Steel

NFPA-70 National Electric Code (NEC)

END OF ITEM L-107

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Item L-108 Underground Power Cable for Airports

DESCRIPTION

108-1.1 This item shall consist of furnishing and installing power cables that are direct buried and furnishing and/or installing power cables within conduit or duct banks per these specifications at the locations shown on the plans. It includes excavation and backfill of trench for direct-buried cables only. Also included are the installation of counterpoise wires, ground wires, ground rods and connections, cable splicing, cable marking, cable testing, and all incidentals necessary to place the cable in operating condition as a completed unit to the satisfaction of the Engineer. This item shall not include the installation of duct banks or conduit, trenching and backfilling for duct banks or conduit, or furnishing or installation of cable for FAA owned/operated facilities. Requirements and payment for trenching and backfilling for the installation of underground conduit and duct banks is in Item L-110, Airport Underground Electrical Duct Banks and Conduits.

EQUIPMENT AND MATERIALS

108-2.1 General.

a. Airport lighting equipment and materials covered by advisory circulars (AC) shall be approved under the Airport Lighting Equipment Certification Program per AC 150/5345-53, current version.

b. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification, when requested by the Engineer.

c. Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications. Materials supplied and/or installed that do not comply with these specifications shall be removed (when directed by the Engineer) and replaced with materials that comply with these specifications at the Contractor's cost.

d. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete any non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment to which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in the project that may accrue directly or indirectly from late submissions or resubmissions of submittals.

e. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be neatly bound in a properly sized 3-ring binder, tabbed by specification section.The Engineer reserves the right to reject any and all

equipment, materials, or procedures that do not meet the system design and the standards and codes, specified in this document.

f. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for at least twelve (12) months from the date of final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner. The Contractor shall be responsible to maintain a minimum insulation resistance per AC 150/5340-26B, Maintenance Airport Visual aid Facilities, Table 5-1 and paragraph 5.1.3.1, with isolation transformers connected in new circuits and new segments of existing circuits through the end of the contract warranty period.

108-2.2 Cable. Underground cable for airfield lighting facilities (runway and taxiway lights and signs) shall conform to the requirements of AC 150/5345-7, Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits latest edition. Conductors for use on 6.6 ampere primary airfield lighting series circuits shall be single conductor, seven strand, #8 American wire gauge AWG), L-824 Type C , 5,000 volts, nonshielded, with cross-linked polyethylene insulation. L-824 conductors for use on the L-830 secondary of airfield lighting series circuits shall be sized in accordance with the manufacturer's recommendations. All other conductors shall comply with FAA and National Electric Code (NEC) requirements. Conductor sizes noted above shall not apply to leads furnished by manufacturers on airfield lighting transformers and fixtures.

Wire for electrical circuits up to 600 volts shall comply with Specification L-824 and/or Federal Specification J-C-30 and shall be type THWN-2, 75°C. Conductors for parallel (voltage) circuits shall be sized and installed in accordance with NFPA-70, National Electrical Code.

Unless noted otherwise, all 600-volt and less non-airfield lighting conductor sizes are based on a 75°C, THWN-2, 600 volt insulation, copper conductors, not more than three single insulated conductors, in raceway, in free air. The conduit/duct sizes are based on the use of THWN-2, 600 volt insulated conductors. The Contractor shall make the necessary increase in conduit/duct sizes for other types of wire insulation. In no case shall the conduit/duct size be reduced. The minimum power circuit wire size shall be #12 AWG.

Conductor sizes may have been adjusted due to voltage drop or other engineering considerations. Equipment provided by the Contractor shall be capable of accepting the quantity and sizes of conductors shown in the Contract Documents. All conductors, pigtails, cable step-down adapters, cable step-up adapters, terminal blocks and splicing materials necessary to complete the cable termination/splice shall be considered incidental to the respective pay items provided.

Cable type, size, number of conductors, strand and service voltage shall be as specified in the Contract Document.

108-2.3 Bare copper wire (counterpoise, bare copper wire ground and ground rods). Wire for counterpoise or ground installations for airfield lighting systems shall be No. 6 AWG bare solid copper wire for counterpoise and/or No. 6 AWG insulated stranded for ground wire per ASTM B3 and ASTM B8, and shall be bare copper wire per ASTM B33. See AC 150/5340-30 for additional details about counterpoise and ground wire types and installation. For voltage powered circuits, the equipment ground conductor shall be minimum No. 6 AWG, 600V rated, Type XHHW insulated, green color, stranded copper equipment ground conductor.

Ground rods shall be copper-clad steel. The ground rods shall be of the length and diameter specified on the plans, but in no case be less than 8 feet long and 5/8 inch in diameter.

108-2.4 Cable connections. In-line connections or splices of underground primary cables shall be of the type called for on the plans, and shall be one of the types listed below. No separate payment will be made for cable connections.

a. The cast splice. A cast splice, employing a plastic mold and using epoxy resin equivalent to that manufactured by 3M™ Company, "Scotchcast" Kit No. 82-B, or as manufactured by Hysol® Corporation, "Hyseal Epoxy Splice" Kit No. E1135, or an approved equivalent, used for potting the splice is acceptable.

b. The field-attached plug-in splice. Figure 3 of AC 150/5345-26, Specification for L-823 Plug and Receptacle, Cable Connectors, employing connector kits, is acceptable for field attachment to single conductor cable. It shall be the Contractor's responsibility to determine the outside diameter of the cable to be spliced and to furnish appropriately sized connector kits and/or adapters and heat shrink tubing with integral sealant.

c. The factory-molded plug-in splice. Specification for L-823 Connectors, Factory-Molded to Individual Conductors, is acceptable.

d. The taped or heat-shrink splice. Taped splices employing field-applied rubber, or synthetic rubber tape covered with plastic tape is acceptable. The rubber tape should meet the requirements of ASTM D4388 and the plastic tape should comply with Military Specification MIL-I-24391 or Commercial Item Description A-A-55809. Heat shrinkable tubing shall be heavy-wall, self-sealing tubing rated for the voltage of the wire being spliced and suitable for direct-buried installations. The tubing shall be factory coated with a thermoplastic adhesive-sealant that will adhere to the insulation of the wire being spliced forming a moisture- and dirt-proof seal. Additionally, heat shrinkable tubing for multi-conductor cables, shielded cables, and armored cables shall be factory kits that are designed for the application. Heat shrinkable tubing and tubing kits shall be manufactured by Tyco Electronics/ Raychem Corporation, Energy Division, or approved equivalent.

In all the above cases, connections of cable conductors shall be made using crimp connectors using a crimping tool designed to make a complete crimp before the tool can be removed. All L-823/L-824 splices and terminations shall be made per the manufacturer's recommendations and listings.

All connections of counterpoise, grounding conductors and ground rods shall be made by the exothermic process or approved equivalent, except that a light base ground clamp connector shall be used for attachment to the light base. See AC 150/5340-30 for additional information about methods of attaching a ground to a galvanized light base. All exothermic connections shall be made per the manufacturer's recommendations and listings.

108-2.5 Splicer qualifications. Every airfield lighting cable splicer shall be qualified in making airport cable splices and terminations on cables rated at or above 5,000 volts AC. The Contractor shall submit to the Engineer proof of the qualifications of each proposed cable splicer for the airport cable type and voltage level to be worked on. Cable splicing/terminating personnel shall have a minimum of three (3) years continuous experience in terminating/splicing medium voltage cable.

108-2.6 Concrete. Concrete for cable markers shall be per Specification Item P-610, Structural Portland Cement Concrete.

108-2.7 Flowable backfill. Flowable material used to backfill trenches for power cable trenches shall conform to the requirements of Item P-153, Controlled Low Strength Material.

108-2.8 Cable identification tags. Cable identification tags shall be made from a non-corrosive material with the circuit identification stamped or etched onto the tag. The tags shall be of the type as detailed on the plans.

108-2.9 Tape. Electrical tapes shall be Scotch™ Electrical Tapes –Scotch™ 88 (1-1/2 inch (38 mm) wide) and Scotch™ 130C® linerless rubber splicing tape (2-inch wide), as manufactured by the Minnesota Mining and Manufacturing Company (3M™), or an approved equivalent.

108-2.10 Electrical coating. Electrical coating shall be Scotchkote™ as manufactured by 3M™, or an approved equivalent.

108-2.11 Existing circuits. Whenever the scope of work requires connection to an existing circuit, the circuit's insulation resistance shall be tested, in the presence of the Engineer. The test shall be performed per this item and prior to any activity that will affect the respective circuit. The Contractor shall record the results on forms acceptable to the Engineer. When the work affecting the circuit is complete, the circuit's insulation resistance shall be checked again, in the presence of the Engineer. The Contractor shall record the results on forms acceptable to the Engineer. The second reading shall be equal to or greater than the first reading or the Contractor shall make the necessary repairs to the circuit to bring the second reading above the first reading. All repair costs including a complete replacement of the L-823 connectors, L-830 transformers and L-824 cable, if necessary, shall be borne by the Contractor. All test results shall be submitted in the Operation and Maintenance (O&M) Manual.

108-2.12 Detectable warning tape. Plastic, detectable, American Wood Preservers Association (AWPA) Red (electrical power lines, cables, conduit and lighting cable) with continuous legend magnetic tape shall be polyethylene film with a metalized foil core and shall be 3-6 inches wide. Detectable tape is incidental to the respective bid item.

CONSTRUCTION METHODS

108-3.1 General. The Contractor shall install the specified cable at the approximate locations indicated on the plans. Unless otherwise shown on the plans, all cable required to cross under pavements expected to carry aircraft loads shall be installed in concrete encased duct banks. Wherever possible, cable shall be run without splices, from connection to connection.

Cable connections between lights will be permitted only at the light locations for connecting the underground cable to the primary leads of the individual isolation transformers. The Contractor shall be responsible for providing cable in continuous lengths for home runs or other long cable runs without connections unless otherwise authorized in writing by the Engineer or shown on the plans.

In addition to connectors being installed at individual isolation transformers, L-823 cable connectors for maintenance and test points shall be installed at locations shown on the plans. Cable circuit identification markers shall be installed on both sides of the L-823 connectors installed or at least once in each access point where L-823 connectors are not installed.

Provide not less than 3 feet of cable slack on each side of all connections, isolation transformers, light units, and at points where cable is connected to field equipment. Where provisions must be made for testing or for future above grade connections, provide enough slack to allow the cable to be extended at

least one foot (30 cm) vertically above the top of the access structure. This requirement also applies where primary cable passes through empty light bases, junction boxes, and access structures to allow for future connections, or as designated by the Engineer.

Primary airfield lighting cables installed shall have cable circuit identification markers attached on both sides of each L-823 connector and on each airport lighting cable entering or leaving cable access points, such as manholes, hand holes, pull boxes, junction boxes, etc. Markers shall be of sufficient length for imprinting the cable circuit identification legend on one line, using letters not less than 1/4 inch (6 mm) in size. The cable circuit identification shall match the circuits noted on the construction plans.

108-3.2 Installation in duct banks or conduits. This item includes the installation of the cable in duct banks or conduit per the following paragraphs. The maximum number and voltage ratings of cables installed in each single duct or conduit, and the current-carrying capacity of each cable shall be per the latest version of the National Electric Code, or the code of the local agency or authority having jurisdiction.

The Contractor shall make no connections or splices of any kind in cables installed in conduits or duct banks.

Unless otherwise designated in the plans, where ducts are in tiers, use the lowest ducts to receive the cable first, with spare ducts left in the upper levels. Check duct routes prior to construction to obtain assurance that the shortest routes are selected and that any potential interference is avoided.

Duct banks or conduits shall be installed as a separate item per Item L-110, Airport Underground Electrical Duct Banks and Conduit. The Contractor shall run a mandrel through duct banks or conduit prior to installation of cable to ensure that the duct bank or conduit is open, continuous and clear of debris. The mandrel size shall be compatible with the conduit size. The Contractor shall swab out all conduits/ducts and clean light bases, manholes, etc., interiors immediately prior to pulling cable. Once cleaned and swabbed, the light bases and all accessible points of entry to the duct/conduit system shall be kept closed except when installing cables. Cleaning of ducts, light bases, manholes, etc., is incidental to the pay item of the item being cleaned. All raceway systems left open, after initial cleaning, for any reason shall be re-cleaned at the Contractor's expense. The Contractor shall verify existing ducts proposed for use in this project as clear and open. The Contractor shall notify the Engineer of any blockage in the existing ducts.

The cable shall be installed in a manner that prevents harmful stretching of the conductor, damage to the insulation, or damage to the outer protective covering. The ends of all cables shall be sealed with moisture-seal tape providing moisture-tight mechanical protection with minimum bulk, or alternately, heat shrinkable tubing before pulling into the conduit and it shall be left sealed until connections are made. Where more than one cable is to be installed in a conduit, all cable shall be pulled in the conduit at the same time. The pulling of a cable through duct banks or conduits may be accomplished by hand winch or power winch with the use of cable grips or pulling eyes. Maximum pulling tensions shall not exceed the cable manufacturer's recommendations. A non-hardening cable-pulling lubricant recommended for the type of cable being installed shall be used where required.

The Contractor shall submit the recommended pulling tension values to the Engineer prior to any cable installation. If required by the Engineer, pulling tension values for cable pulls shall be monitored by a dynamometer in the presence of the Engineer. Cable pull tensions shall be recorded by the Contractor and reviewed by the Engineer. Cables exceeding the maximum allowable pulling tension values shall be removed and replaced by the Contractor at the Contractor's expense.

The manufacturer's minimum bend radius or NEC requirements (whichever is more restrictive) shall apply. Cable installation, handling and storage shall be per manufacturer's recommendations. During cold weather, particular attention shall be paid to the manufacturer's minimum installation temperature. Cable shall not be installed when the temperature is at or below the manufacturer's minimum installation temperature. At the Contractor's option, the Contractor may submit a plan, for review by the Engineer, for heated storage of the cable and maintenance of an acceptable cable temperature during installation when temperatures are below the manufacturer's minimum cable installation temperature.

Cable shall not be dragged across base can or manhole edges, pavement or earth. When cable must be coiled, lay cable out on a canvas tarp or use other appropriate means to prevent abrasion to the cable jacket.

108-3.3 Installation of direct-buried cable in trenches. Unless otherwise specified, the Contractor shall not use a cable plow for installing the cable. Cable shall be unreeled uniformly in place alongside or in the trench and shall be carefully placed along the bottom of the trench. The cable shall not be unreeled and pulled into the trench from one end. Slack cable sufficient to provide strain relief shall be placed in the trench in a series of S curves. Sharp bends or kinks in the cable shall not be permitted.

Where cables must cross over each other, a minimum of 3 inches vertical displacement shall be provided with the topmost cable depth at or below the minimum required depth below finished grade.

a. Trenching. Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored. Trenches for cables may be excavated manually or with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of surface is disturbed. Graders shall not be used to excavate the trench with their blades. The bottom surface of trenches shall be essentially smooth and free from coarse aggregate. Unless otherwise specified, cable trenches shall be excavated to a minimum depth of 18 inches below finished grade per NEC Table 300.5, except as follows:

(1) When off the airport or crossing under a roadway or driveway, the minimum depth shall be 36 inches unless otherwise specified.

(2) Minimum cable depth when crossing under a railroad track, shall be 42 inches unless otherwise specified.

Dewatering necessary for cable installation, erosion and turbidity control, per Federal, state, and local requirements is incidental to its respective pay items as part of Item L-108. The cost of all excavation regardless of type of material encountered, shall be included in the unit price bid for the L-108 Item.

The Contractor shall excavate all cable trenches to a width not less than 6 inches. Unless otherwise specified on the plans, all cables in the same location and running in the same general direction shall be installed in the same trench.

When rock is encountered, the rock shall be removed to a depth of at least 3 inches below the required cable depth and it shall be replaced with bedding material of earth or sand containing no mineral aggregate particles that would be retained on a 1/4 inch sieve. Flowable backfill material may alternatively be used. The Contractor shall ascertain the type of soil or rock to be excavated before bidding. All such rock removal shall be performed and paid for under Item P-152.

Duct bank or conduit markers temporarily removed for trench excavations shall be replaced as required.

It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Where existing active cables cross proposed installations, the Contractor shall ensure that these cables are adequately protected. Where crossings are unavoidable, no splices will be allowed in the existing cables, except as specified on the plans. Installation of new cable where such crossings must occur shall proceed as follows:

(1) Existing cables shall be located manually. Unearthed cables shall be inspected to assure absolutely no damage has occurred.

(2) Trenching, etc., in cable areas shall then proceed, with approval of the Engineer, with care taken to minimize possible damage or disruption of existing cable, including careful backfilling in area of cable.

In the event that any previously identified cable is damaged during the course of construction, the Contractor shall be responsible for the complete repair or replacement.

b. Backfilling. After the cable has been installed, the trench shall be backfilled. The first layer of backfill in the trench shall be 3 inches deep, loose measurement, and shall be either earth or sand containing no mineral aggregate particles that would be retained on a 1/4 inch sieve. This layer shall not be compacted. The second layer shall be 5 inches deep, loose measurement, and shall contain no particles that would be retained on a one inch sieve. The remaining third and subsequent layers of backfill shall not exceed 8 inches of loose measurement and be excavated or imported material and shall not contain stone or aggregate larger than 4 inches maximum diameter.

The second and subsequent layers shall be thoroughly tamped and compacted to at least the density of the adjacent undisturbed soil, and to the satisfaction of the Engineer. If necessary to obtain the desired compaction, the backfill material shall be moistened or aerated as required.

If the cable is to be installed in locations or areas where other compaction requirements are specified (under pavements, embankments, etc.) the compaction requirements per Item P-152 for that area shall be followed.

Trenches shall not contain pools of water during backfilling operations. The trench shall be completely backfilled and tamped level with the adjacent surface, except that when turf is to be established over the trench, the backfilling shall be stopped at an appropriate depth consistent with the type of turfing operation to be accommodated. A proper allowance for settlement shall also be provided. Any excess excavated material shall be removed and disposed of per the plans and specifications.

Underground electrical warning (caution) tape shall be installed in the trench above all direct-buried cable. Contractor shall submit a sample of the proposed warning tape for acceptance by the Engineer. If not shown on the plans, the warning tape shall be located 6 inches above the direct-buried cable or the counterpoise wire if present. A 4-6 inch wide polyethylene film detectable tape, with a metalized foil core, shall be installed above all direct buried cable or counterpoise. The tape shall be of the color and have a continuous legend as indicated on the plans. The tape shall be installed 8 inch minimum below finished grade.

c. Restoration. Following restoration of all trenching near airport movement surfaces, the Contractor shall visually inspect the area for foreign object debris (FOD) and remove any that is found. Where soil and sod has been removed, it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by work shall be restored to its original condition. The restoration shall include the sodding, topsoiling, fertilizing, liming, seeding and mulching as shown on the plans. The

Contractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance. When trenching is through paved areas, restoration shall be equal to existing conditions and compaction shall meet the requirements of Item P-152. Restoration shall be considered incidental to the pay item of which it is a component part.

108-3.4 Cable markers for direct-buried cable. The location of direct buried circuits shall be marked by a concrete slab marker, 2 feet square and 4-6 inch thick, extending approximately one inch above the surface. Each cable run from a line of lights and signs to the equipment vault shall be marked at approximately every 200 feet along the cable run, with an additional marker at each change of direction of cable run. All other direct-buried cable shall be marked in the same manner. Cable markers shall be installed directly above the cable. The Contractor shall impress the word "CABLE" and directional arrows on each cable marking slab. The letters shall be approximately 4 inches high and 3 inches wide, with width of stroke 1/2 inch and 1/4 inch deep.

At the location of each underground cable connection, except at lighting units, or isolation transformers, or power a concrete marker slab must mark adapters placed above the connection. The Contractor shall impress the word "SPLICE" on each slab. The Contractor also shall impress additional circuit identification symbols on each slab as directed by the Engineer. All cable markers and splice markers shall be painted international orange. Paint shall be specifically manufactured for uncured exterior concrete. After placement, all cable or splice markers shall be given one coat of high-visibility aviation orange paint as approved by the Engineer. Furnishing and installation of cable markers is incidental to the respective cable pay item.

108-3.5 Splicing. Connections of the type shown on the plans shall be made by experienced personnel regularly engaged in this type of work and shall be made as follows:

a. Cast splices. These shall be made by using crimp connectors for jointing conductors. Molds shall be assembled, and the compound shall be mixed and poured per the manufacturer's instructions and to the satisfaction of the Engineer.

b. Field-attached plug-in splices. These shall be assembled per the manufacturer's instructions. These splices shall be made by plugging directly into mating connectors. In all cases the joint where the connectors come together shall be wrapped with at least one layer of rubber or synthetic rubber tape and one layer of plastic tape, one-half lapped, extending at least 1-1/2 inches on each side of the joint.

c. Factory-molded plug-in splices. These shall be made by plugging directly into mating connectors. In all cases, the joint where the connectors come together shall be wrapped with at least one layer of rubber or synthetic rubber tape and one layer of plastic tape, one-half lapped, extending at least 1-1/2 inches on each side of the joint.

d. Taped or heat-shrink splices. A taped splice shall be made in the following manner:

Bring the cables to their final position and cut so that the conductors will butt. Remove insulation and jacket allowing for bare conductor of proper length to fit compression sleeve connector with 1/4 inch of bare conductor on each side of the connector. Prior to splicing, the two ends of the cable insulation shall be penciled using a tool designed specifically for this purpose and for cable size and type. Do not use emery paper on splicing operation since it contains metallic particles. The copper conductors shall be thoroughly cleaned. Join the conductors by inserting them equidistant into the compression connection sleeve. Crimp conductors firmly in place with crimping tool that requires a complete crimp before tool

can be removed. Test the crimped connection by pulling on the cable. Scrape the insulation to assure that the entire surface over which the tape will be applied (plus 3 inches on each end) is clean. After scraping wipe the entire area with a clean lint-free cloth. Do not use solvents.

Apply high-voltage rubber tape one-half lapped over bare conductor. This tape should be tensioned as recommended by the manufacturer. Voids in the connector area may be eliminated by highly elongating the tape, stretching it just short of its breaking point. Throughout the rest of the splice less tension should be used. Always attempt to exactly half-lap to produce a uniform buildup. Continue buildup to 1-1/2 times cable diameter over the body of the splice with ends tapered a distance of approximately one inch over the original jacket. Cover rubber tape with two layers of vinyl pressure-sensitive tape one-half lapped. Do not use glyptol or lacquer over vinyl tape as they react as solvents to the tape. No further cable covering or splice boxes are required.

Heat shrinkable tubing shall be installed following manufacturer's instructions. Direct flame heating shall not be permitted unless recommended by the manufacturer. Cable surfaces within the limits of the heat-shrink application shall be clean and free of contaminates prior to application.

Surfaces of equipment or conductors being terminated or connected shall be prepared in accordance with industry standard practice and manufacturer's recommendations. All surfaces to be connected shall be thoroughly cleaned to remove all dirt, grease, oxides, nonconductive films, or other foreign material. Paints and other nonconductive coatings shall be removed to expose base metal. Clean all surfaces at least 1/4 inch (6.4 mm) beyond all sides of the larger bonded area on all mating surfaces. Use a joint compound suitable for the materials used in the connection. Repair painted/coated surface to original condition after completing the connection.

108-3.6 Bare counterpoise wire installation for lightning protection and grounding. If shown on the plans or included in the job specifications, bare solid #6 AWG copper counterpoise wire shall be installed for lightning protection of the underground cables. The Engineer shall select one of two methods of lightning protection for the airfield lighting circuit based on the frequency of local lightning:

a. Equipotential. – may be used by the Engineer for areas that have high rates of lightning strikes. This is where the counterpoise is bonded to the light base (edge lights included) and counterpoise size is determined by the Engineer.

b. Isolation – used in areas where lightning strikes are not common. The counterpoise is not bonded to edge light fixtures, in-pavement fixtures are boned to the counterpoise. Counterpoise size is selected by the Engineer.

Counterpoise wire shall be installed in the same trench for the entire length of buried cable, conduits and duct banks that are installed to contain airfield cables.

For edge light fixtures installed in turf (stabilized soils) and for raceways or cables adjacent to the full strength pavement edge, the counterpoise conductor shall be installed halfway between the pavement edge and the light base, mounting stake, raceway, or cable.

The counterpoise conductor shall be installed 8 inches minimum below grade.

Each light base or mounting stake shall be provided with a grounding electrode.

When a metallic light base is used, the grounding electrode shall be bonded to the metallic light base or mounting stake with a No. 6 AWG bare, annealed or soft drawn, solid copper conductor.

When a nonmetallic light base is used, the grounding electrode shall be bonded to the metallic light fixture or metallic base plate with a No. 6 AWG bare, annealed or soft drawn, solid copper conductor.

For raceways installed under pavement; for raceways and cables not installed adjacent to the full strength pavement edge; for fixtures installed in full strength pavement and shoulder pavement and for optional method of edge lights installed in turf (stabilized soils); and for raceways or cables adjacent to the full strength pavement edge, the counterpoise conductor shall be centered over the raceway or cable to be protected as described below.

The counterpoise conductor shall be installed no less than 8 inches above the raceway or cable to be protected, except as permitted below.

The minimum counterpoise conductor height above the raceway or cable to be protected shall be permitted to be adjusted subject to coordination with the airfield lighting and pavement designs.

Where raceway is installed by the directional bore, jack and bore, or other drilling method, the counterpoise conductor shall be permitted to be installed concurrently with the directional bore, jack and bore, or other drilling method raceway, external to the raceway or sleeve.

The counterpoise conductor shall be installed no more than 12 inches above the raceway or cable to be protected.

The counterpoise conductor height above the protected raceway(s) or cable(s) shall be calculated to ensure that the raceway or cable is within a 45-degree area of protection.

The counterpoise conductor shall be bonded to each metallic light base, mounting stake, and metallic airfield lighting component.

All metallic airfield lighting components in the field circuit on the output side of the constant current regulator (CCR) or other power source shall be bonded to the airfield lighting counterpoise system.

The counterpoise wire shall also be exothermically welded to ground rods installed as shown on the plans but not more than 500 feet apart around the entire circuit. The counterpoise system shall be continuous and terminate at the transformer vault or at the power source. It shall be securely attached to the vault or equipment external ground ring or other made electrode-grounding system. The connections shall be made as shown on the plans and in the specifications.

If shown on the plans or in the specifications, a separate equipment (safety) ground system shall be provided in addition to the counterpoise wire using one of the following methods:

c. A ground rod installed at and securely attached to each light fixture base, mounting stake, and to all metal surfaces at junction/access structures via #6 AWG wire.

d. For parallel voltage systems only, install a #6 AWG green insulated equipment ground conductor internal to the conduit system and securely attached it to each light fixture base internal grounding lug and to all metal surfaces at junction/access structures. Dedicated ground rods shall be installed and exothermically welded to the counterpoise wires at each end of a duct bank crossing under pavement.

Where an existing airfield lighting system is being extended or modified, the new counterpoise conductors shall be interconnected to existing counterpoise conductors at each intersection of the new and existing airfield lighting counterpoise systems.

108-3.7 Counterpoise installation above multiple conduits and duct banks. Counterpoise wires shall be installed above multiple conduits/duct banks for airfield lighting cables, with the intent being to provide a complete area of protection over the airfield lighting cables. When multiple conduits and/or duct banks for airfield cable are installed in the same trench, the number and location of counterpoise wires above the conduits shall be adequate to provide a complete cone of protection measured 22-1/2 degrees each side of vertical.

Where duct banks pass under pavement to be constructed in the project, the counterpoise shall be placed above the duct bank. Reference details on the construction plans.

108-3.8 Counterpoise installation at existing duct banks. When airfield lighting cables are indicated on the plans to be routed through existing duct banks, the new counterpoise wiring shall be terminated at ground rods at each end of the existing duct bank where the cables being protected enter and exit the duct bank. The new counterpoise conductor shall be bonded to the existing counterpoise system.

108-3.9 Exothermic bonding. Bonding of counterpoise wire shall be by the exothermic welding process. Only personnel experienced in and regularly engaged in this type of work shall make these connections.

Contractor shall demonstrate to the satisfaction of the Engineer, the welding kits, materials and procedures to be used for welded connections prior to any installations in the field. The installations shall comply with the manufacturer's recommendations and the following:

a. All slag shall be removed from welds.

b. Using an exothermic weld to bond the counterpoise to a lug on a galvanized light base is not recommended unless the base has been specially modified. Consult the manufacturer's installation directions for proper methods of bonding copper wire to the light base. See also AC 150/5340-30 for galvanized light base exception.

c. If called for in the plans, all buried copper and weld material at weld connections shall be thoroughly coated with 6 mm of 3M™ Scotchkote™, or approved equivalent, or coated with coal tar Bitumastic® material to prevent surface exposure to corrosive soil or moisture.

108-3.10 Testing. The Contractor shall furnish all necessary equipment and appliances for testing the airport electrical systems and underground cable circuits before and after installation. The Contractor shall perform all tests in the presence of the Engineer. The Contractor shall demonstrate the electrical characteristics to the satisfaction of the Engineer. All costs for testing are incidental to the respective item being tested. For phased projects, the tests must be completed by phase. The Contractor must maintain the test results throughout the entire project as well as during the warranty period that meet the following:

a. Earth resistance testing methods shall be submitted to the Engineer for approval. Earth resistance testing results shall be recorded on an approved form and testing shall be performed in the presence of the Engineer. All such testing shall be at the sole expense of the Contractor.

b. Should the counterpoise or ground grid conductors be damaged or suspected of being damaged by construction activities the Contractor shall test the conductors for continuity with a low resistance ohmmeter. The conductors shall be isolated such that no parallel path exists and tested for continuity. The Engineer shall approve of the test method selected. All such testing shall be at the sole expense of the Contractor.

After installation, the Contractor shall test and demonstrate to the satisfaction of the Engineer the following:

c. That all affected lighting power and control circuits (existing and new) are continuous and free from short circuits.

d. That all affected circuits (existing and new) are free from unspecified grounds.

e. That the insulation resistance to ground of all new non-grounded high voltage series circuits or cable segments is not less than 50 megohms.

f. That the insulation resistance to ground of all new non-grounded conductors of new multiple circuits or circuit segments is not less than 50 megohms.

g. That all affected circuits (existing and new) are properly connected per applicable wiring diagrams.

h. That all affected circuits (existing and new) are operable. Tests shall be conducted that include operating each control not less than 10 times and the continuous operation of each lighting and power circuit for not less than 1/2 hour.

i. That the impedance to ground of each ground rod does not exceed 25 ohms prior to establishing connections to other ground electrodes. The fall-of-potential ground impedance test shall be used, as described by American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE) Standard 81, to verify this requirement. As an alternate, clamp-on style ground impedance test meters may be used to satisfy the impedance testing requirement. Test equipment and its calibration sheets shall be submitted for review and approval by the Engineer prior to performing the testing.

Two copies of tabulated results of all cable tests performed shall be supplied by the Contractor to the Engineer. Where connecting new cable to existing cable, ground resistance tests shall be performed on the new cable prior to connection to the existing circuit.

There are no approved “repair” procedures for items that have failed testing other than complete replacement.

METHOD OF MEASUREMENT

108-4.1 Trenching shall be measured by the linear feet (meters) of trench, including the excavation, backfill, and restoration, completed, measured as excavated, and accepted as satisfactory. When specified, separate measurement shall be made for trenches of various specified widths.

The cost of all excavation, backfill, dewatering and restoration regardless of the type of material encountered shall be included in the unit price bid for the work.

108-4.2 Cable or counterpoise wire installed in trench, duct bank or conduit shall be measured by the number of linear feet (meters) installed and grounding connectors, and trench marking tape ready for operation, and accepted as satisfactory. Separate measurement shall be made for each cable or counterpoise wire installed in trench, duct bank or conduit. The measurement for this item shall include additional quantities required for slack.

108-4.3 Ground rods shall be measured by each 8-foot section installed complete.

BASIS OF PAYMENT

108-5.1 Payment will be made at the contract unit price for trenching, cable and bare counterpoise wire installed in trench (direct-buried), or cable and equipment ground installed in duct bank or conduit, in place by the Contractor and accepted by the Engineer. This price shall be full compensation for furnishing all materials and for all preparation and installation of these materials, and for all labor, equipment, tools, and incidentals, including ground rods and ground connectors and trench marking tape, necessary to complete this item.

Payment will be made under:

Item L-108-5.1	Cable Trench and Backfill w/o Counterpoise - per linear foot
Item L-108-5.2	No. 8, 5 kV , L-824 C Cable, Installed in Trench - per liner foot
Item L-108-5.3	No. 6, 600V, L-824 C Cable, Installed in Trench - per linear foot
Item L-108-5.4	No. 4, 600V, L-824 C Cable, Installed in Trench - per linear foot
Item L-108-5.5	No. 6, Bare Counterpoise Wire, Installed by Plowing- per linear foot
Item L-108-5.6	Cable Trench with #2 Counterpoise – per linear foot

MATERIAL REQUIREMENTS

AC 150/5340-26	Maintenance of Airport Visual Aid Facilities
AC 150/5340-30	Design and Installation Details for Airport Visual Aids
AC 150/5345-7	Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
AC 150/5345-26	Specification for L-823 Plug and Receptacle, Cable Connectors
AC 150/5345-53	Airport Lighting Equipment Certification Program
Commercial Item Description A-A-59544	Cable and Wire, Electrical (Power, Fixed Installation)
Commercial Item Description A-A-55809	Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic
ASTM B3	Standard Specification for Soft or Annealed Copper Wire
ASTM B8	Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B33	Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes
ASTM D4388	Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes
FED SPEC J-C-30	Cable and Wire, Electrical (Power, Fixed Installation)
MIL-I-24391	Insulation Tape, Electrical, Plastic, Pressure Sensitive

REFERENCE DOCUMENTS

NFPA-70	National Electrical Code (NEC)
NFPA-780	Standard for the Installation of Lightning Protection Systems
MIL-S-23586F	Performance Specification: Sealing Compound (with Accelerator), Silicone Rubber, Electrical
ANSI/IEEE STD 81	IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

END OF ITEM L-108

Item L-109 Airport Transformer Vault and Vault Equipment

DESCRIPTION

109-1.1 This item shall consist of constructing an airport transformer vault or a prefabricated metal housing per these specifications and per the design and dimensions shown in the plans. This work shall also include the installation of conduits in the floor and foundation, painting and lighting of the vault or metal housing, and the furnishing of all incidentals that are necessary to produce a completed unit. Included as a separate part under this item or as a separate item where an existing vault is to be used shall be the furnishing of all vault equipment, wiring, electrical buses, cable, conduit, potheads, and grounding systems. This work shall also include the painting of equipment and conduit; the marking and labeling of equipment and the labeling or tagging of wires; the testing of the installation; and the furnishing of all incidentals necessary to place it in operating condition as a completed unit to the satisfaction of the Engineer.

EQUIPMENT AND MATERIALS

109-2.1 General.

a. Airport lighting equipment and materials covered by advisory circulars (AC) shall be certified and listed in AC 150/5345-53, Airport Lighting Equipment Certification Program.

b. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Engineer.

c. Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications. Materials supplied and/or installed that do not comply with these specifications shall be removed (when directed by the Engineer) and replaced with materials that comply with these specifications at the Contractor's cost.

d. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete any non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment to which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in the project that may accrue directly or indirectly from late submissions or resubmissions of submittals.

e. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be neatly bound in a properly

sized 3-ring binder, tabbed by specification section. The Engineer reserves the right to reject any and all equipment, materials or procedures that do not meet the system design and the standards and codes, specified in this document.

f. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

CONSTRUCTION OF VAULT AND PREFABRICATED METAL HOUSING

109-2.1 Concrete. The concrete for the vault shall be proportioned, placed, and cured per Item P-610, Structural Portland Cement Concrete, using 3/4 inch maximum size coarse aggregate.

109-2.2 Reinforcing steel. Reinforcing steel bars shall be intermediate or structural grade deformed-type bars and shall be per ASTM A615.

109-2.3 Brick. Brick shall be per ASTM C62, Grade SW.

109-2.4 Rigid steel conduit. Rigid steel conduit and fittings shall be per Underwriters Laboratories Standards 6 and 514B.

109-2.5 Plastic Conduit and fittings. Plastic Conduit and fittings shall conform to the requirements of Federal Specification W-C-1094 and UL-651 and UL-654 schedule 40 polyvinyl chloride (PVC) suitable for use above or below ground.

109-2.6 Lighting. Vault or metal-housing light fixtures shall be of a vapor-proof type.

109-2.7 Outlets. Convenience outlets shall be heavy-duty duplex units designed for industrial service.

109-2.8 Switches. Vault or metal-housing light switches shall be single-pole switches.

109-2.9 Paint.

a. Priming paint for non-galvanized metal surfaces shall be a high solids alkyd primer per Society for Protective Coatings (SSPC) Specification – Paint 25, Primer, Raw Linseed Oil and Alkyd Primer, (Without Lead and Chromate Pigments).

b. White paint for body and finish coats on metal and wood surfaces shall be ready-mixed paint conforming to the Master Painter's Institute (MPI), Reference #9, Exterior Alkyd, Gloss.

c. Priming paint for wood surfaces shall be mixed on the job by thinning the specified white paint by adding 1/2 pint (0.24 liter) of raw linseed oil to each gallon (liter).

d. Paint for the floor, ceiling, and inside walls shall be per Porter Paint Company 69, 71, and 79 or equivalent. Walls and ceiling shall be light gray and the floor shall be medium gray.

e. The roof coating shall be hot asphalt material per ASTM D2823. Asbestos-free roof coating per ASTM D4479 may be substituted if required by local codes.

109-2.10 Ground bus. Ground bus shall be $1/4 \times 2$ inch minimum copper bus bar.

109-2.11 Square duct. Duct shall be square similar to that manufactured by the Square D Company (or equivalent), or the Trumbull Electric Manufacturing Company (or equivalent). The entire front of the

duct on each section shall consist of hinged or removable cover for ready access to the interior. The cross-section of the duct shall be not less than 6 × 6 inch except where otherwise shown in the plans.

109-2.12 Ground rods. Ground rods shall be in accordance with L-108.

109-2.13 Potheads. NOT USED

109-2.14 Vault prefabricated concrete housing. The prefabricated concrete housing shall be a commercially available unit.

109-2.15 FAA-approved equipment. Certain items of airport lighting equipment installed in vaults are covered by individual ACs listed below:

AC 150/5345-3	Specification for L-821, Panels for Remote Control of Airport Lighting
AC 150/5345-5	Circuit Selector Switch
AC 150/5345-7	Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
AC 150/5345-10	Specification for Constant Current Regulators and Regulator Monitors
AC 150/5345-13	Specification for L-841 Auxiliary Relay Cabinet Assembly for Pilot Control of Airport Lighting Circuits.
AC 150/5345-49	Specification for L-854, Radio Control Equipment

109-2.16 Other electrical equipment. Distribution transformers, oil switches, cutouts, relays, terminal blocks, transfer relays, circuit breakers, and all other regularly used commercial items of electrical equipment not covered by FAA equipment specifications and ACs shall conform to the applicable rulings and standards of the Institute of Electrical and Electronic Engineers (IEEE) or the National Electrical Manufacturers Association (NEMA). When specified, test reports from a testing laboratory indicating that the equipment meets the specifications shall be supplied. In all cases, equipment shall be new and a first-grade product. This equipment shall be supplied in the quantities required for the specific project and shall incorporate the electrical and mechanical characteristics specified in the proposal and plans. Equipment selected and installed by the Contractor shall maintain the interrupting current rating of the existing systems or specified rating whichever is greater.

109-2.17 Wire. Wire (in conduit) rated up to 5,000 volts shall be per AC 150/5345-7, Specification for L-824 Underground Electrical Cables for Airport Lighting Circuits. For ratings up to 600 volts, moisture and heat resistant thermoplastic wire conforming to Commercial Item Description A-A-59544A Type THWN-2 shall be used. The wires shall be of the type, size, number of conductors, and voltage shown in the plans or in the proposal.

a. Control circuits. Unless otherwise indicated on the plans, wire shall be not less than No. 12 American wire gauge (AWG) and shall be insulated for 600 volts. If telephone control cable is specified, No. 19 AWG telephone cable per ANSI/Insulated Cable Engineers Association (ICEA) S-85-625-2007 specifications shall be used.

b. Power circuits.

(1) 600 volts maximum-Wire shall be No. 6 AWG or larger and insulated for at least 600 volts.

(2) 3,000 volts maximum-Wire shall be No. 6 AWG or larger and insulated for at least 3,000 volts.

(3) Over 3,000 volts-Wire shall be No. 6 AWG or larger and insulated for at least the circuit voltage.

109-2.18 Short circuit / coordination / device evaluation / arc flash analysis. The Contractor shall, based upon the equipment provided, include as a part of the submittal process the electrical system "Short Circuit / Coordination / Device evaluation / Arc Flash Analysis". The analysis shall be performed by the equipment manufacturer and submitted in a written report. The analysis shall be signed and sealed by a registered professional Engineer from the state in which the project is located. The analysis shall comply with NFPA-70E and IEEE 1584.

The analysis will include: one line diagrams, short circuit analysis, coordination analysis, equipment evaluation, arc flash analysis and arc flash labels containing at a minimum, equipment name, voltage/current rating, available incident energy and flash protection boundary.

The selected firms field service Engineer shall perform data gathering for analysis completion and device settings, perform device setting as recommended by the analysis and will furnish and install the arc flash labels. The components worst case incident energy will be considered the available arc flash energy at that specific point in the system. Submit three written copies and one electronic copy of the report.

CONSTRUCTION METHODS

CONSTRUCTION OF VAULT AND PREFABRICATED METAL HOUSING

109-3.1 General. The Contractor shall construct the transformer vault or prefabricated concrete housing at the location indicated in the plans. Vault construction shall be reinforced concrete, concrete masonry, or brick wall as specified. The concrete housing prefabricated equipment enclosure shall be supplied in the size specified. The mounting pad or floor details, installation methods, and equipment placement are shown in the plans.

The Contractor shall clear, grade, and seed the area around the vault or metal housing for a minimum distance of 10 feet on all sides. The slope shall be not less than 1/2 inch per foot away from the vault or metal housing in all directions.

The vault shall provide adequate protection against weather elements, including rain, wind-driven dust, snow, ice and excessive heat. The vault shall have sufficient filtered ventilation, to assure that the interior room temperatures and conditions do not exceed the recommended limits of the electrical equipment to be installed in the vault. The Contractor is responsible for contacting the manufacturer of the equipment to be installed to obtain environmental limitations of the equipment to be installed. Refer to the electrical vault detail plan sheets for construction requirements. The prefabricated building shall include roof, walls and floor in accordance with the details and these specifications.

109-3.2 Foundation and walls.

a. Reinforced concrete construction. The Contractor shall construct the foundation and walls per the details shown in the plans. Unless otherwise specified, internal ties shall be of the mechanical type so that when the forms are removed the ends of the ties shall be at least one inch beneath the concrete surface; the holes shall be plugged and finished to prevent discoloration. Reinforcing steel shall be

placed, as shown in the drawings, and secured in position to prevent displacement during the concrete placement.

The external surfaces of the concrete shall be thoroughly worked during the placing operation to force all coarse aggregate from the surface. Thoroughly work the mortar against the forms to produce a smooth finish free from air pockets and honeycomb.

The surface film of all pointed surfaces shall be removed before setting occurs. As soon as the pointing has set sufficiently, the entire surface inside and outside of the vault shall be thoroughly wet with water and rubbed with a No. 16 carborundum stone, or equivalent quality abrasive, bringing the surface to a paste. All form marks and projections shall be removed. The surface produced shall be smooth and dense without pits or irregularities. The materials which have been ground into a paste during the rubbing process shall be spread or brushed uniformly over the entire surface (except the interior surfaces that are to be painted shall have all paste removed by washing before painting) and permitted to reset. Final exterior finish shall be obtained by rubbing with No. 30 carborundum stone, or an equivalent quality abrasive. The surface shall be rubbed until the entire surface is smooth and uniform in color.

b. Brick and concrete construction. When this type of construction is specified, the foundation shall be concrete conforming to the details shown in the plans. The outer edge of the foundation at the floor level shall be beveled 1-1/2 inches at 45 degrees. Brick walls shall be 8 inches thick, laid in running bond with every sixth course a header course. Brick shall be laid in cement mortar (one part masonry cement and 3 parts sand) with full mortar bed and shoved joints. All joints shall be completely filled with mortar, and facing brick shall be back-parged with mortar as work progresses. All joints shall be 3/8 inch thick, exterior joints tooled concave, and interior joints struck flush. Both interior and exterior brick surfaces shall be cleaned and nail holes, cracks and other defects filled with mortar. When specified, a nonfading mineral pigment mortar coloring shall be added to the mortar. Steel reinforcing bars, 3/8 inch in diameter and 12 inches long, shall be set vertically in the center of the brick wall on not more than 2 feet centers to project 2-1/2 inches into the concrete roof slab. Lintels for supporting the brickwork over doors, windows, and louvers shall consist of two $4 \times 3 \times 3/8$ inch steel angles. Lintels shall be painted with one coat of corrosion-inhibiting primer before installation, and all exposed parts shall be painted similar to doors and window sash after installation.

Window sills may be concrete poured in place or precast concrete as indicated in the plans. All exposed surfaces shall have a rubbed finish as specified under reinforced concrete construction. After completion, all interior and exterior faces of walls shall be scrubbed with a solution of muriatic acid and water in the proportions of not less than one part acid to 10 parts of water. All traces of efflorescence, loose mortar, and mortar stain shall be removed, and the walls washed down with clear water.

c. Concrete masonry construction. When this type of construction is specified, the foundation shall be concrete conforming to the details shown in the plans. The concrete masonry units shall be standard sizes and shapes and shall conform to ASTM C90 and shall include the closures, jambs, and other shapes required by the construction as shown in the plans. Standard construction practice shall be followed for this type of work including mortar, joints, reinforcing steel for extensions into roof slab, etc. Plaster for interior walls, if specified, shall be Portland cement plaster.

109-3.3 Roof. The roof shall be reinforced concrete as shown in the plans. Reinforcing steel shall be placed as shown in the drawing and secured in position to prevent displacement during the pouring of the concrete. The concrete shall be poured monolithically and shall be free of honeycombs and voids.

The surface shall have a steel-troweled finish and shall be sloped as shown in the drawing. The underside of the roof slab shall be finished in the same manner as specified for walls.

One brush or mop coat of hot asphalt roof coating shall be applied to the top surface of the roof slab. The asphalt material shall be heated to within the range specified by the manufacturer and immediately applied to the roof. The finished coat shall be continuous over the roof surface and free from holidays and blisters. Smears and dribbles of asphalt on the roof edges and building walls shall be removed.

109-3.4 Floor. The floor shall be reinforced concrete as shown in the drawings. When present, all sod, roots, refuse, and other perishable material shall be removed from the area under the floor to a depth of 8 inches, unless a greater depth is specified in the invitation for bids. This area shall be backfilled with materials consisting of sand, cinders, gravel, or stone. Fill shall be placed in layers not to exceed 4 inches and shall be thoroughly compacted by tamping or rolling. A layer of building paper shall be placed over the fill prior to placing concrete. The floor surfaces shall have a steel-troweled finish. The floor shall be level unless a drain is specified, in which case the floor shall be pitched 1/4 inch per foot downward toward the drain. A 1/4-inch asphalt felt expansion joint shall be placed between floor and foundation walls. The floor shall be poured monolithically and shall be free of honeycombs and voids.

109-3.5 Floor drain. If shown in the plans, a floor drain and dry well shall be installed in the center of the floor of the equipment room. The dry well shall be excavated 4 × 4 feet square and to a depth of 4 feet below the finished floor elevation and shall be backfilled to the elevation of the underside of the floor with gravel - which shall all pass a 2 inches mesh sieve and shall all be retained on a 1/4 inch mesh sieve. The gravel backfill shall be placed in 6 inch maximum layers, and the entire surface of each layer shall be tamped either with a mechanical tamper or with a hand tamper weighing not less than 25 pounds and having a face area of not more than 36 square inches nor less than 16 square inches. The drain inlet shall be set flush in the concrete floor. The drain shall have a clear opening of not less than 8 inch in diameter.

109-3.6 Conduits in floor and foundation. Conduits shall be installed in the floor and through the foundation walls per the details shown in the plans. All underground conduit shall be painted with a bituminous compound. Conduit shall be installed with a coupling or metal conduit adapter flush with the top of the floor. All incoming conduit shall be closed with a pipe plug to prevent the entrance of foreign material during construction. Space conduit entrances shall be left closed.

109-3.7 Doors. Doors shall be metal-clad fireproof Class A (three (3) hour rated) doors conforming to requirements of the National Electrical Code (NEC) and local electrical codes. Panic bar exit hardware shall be installed per NEC requirements. Refer to the new electrical vault detail plan sheets for construction requirements."

109-3.8 Painting. The floor, ceiling, and inside walls of concrete construction shall first be given a hardening treatment, after which the Contractor shall apply two coats of paint as specified below, except that interior face brick walls need not be painted. The hardening treatment shall consist of applying two coats of either a commercial floor hardener or a solution made by dissolving 2 pounds of magnesium fluorosilicate or zinc sulfate crystals in one gallon of water. Each coat shall be allowed to dry at least 48 hours before the next application. After the second treating coat has dried, the surfaces shall be brushed clean of all crystals and thoroughly washed with clear water. Paint for walls and ceiling shall be a light gray color approved by the Engineer. The floor paint shall be a medium gray color approved by the Engineer. Before painting, the surfaces shall be dry and clean. The first coat shall be thinned by adding 2/3-quart of spar varnish and 1/3-quart of turpentine to each gallon of paint. The second coat

shall be applied without thinning. All doors, lintels, and windows shall be cleaned to remove any rust or foreign material and shall be given one body and one finish coat of white paint. Bare metal surfaces shall be given a prime coat of corrosion-inhibiting primer prior to the body and finish coats.

109-3.9 Lights and switches. The Contractor shall furnish and install a minimum of two duplex convenience outlets in the vault room. Where a control room is specified, at least two duplex outlets shall be installed.

INSTALLATION OF EQUIPMENT IN VAULT OR PREFABRICATED CONCRETE HOUSING

109-3.10 General. The Contractor shall furnish, install, and connect all equipment, equipment accessories, conduit, cables, wires, buses, grounds, and support necessary to ensure a complete and operable electrical distribution center for the airport lighting system as specified herein and shown in the plans. When specified, an emergency power supply and transfer switch shall be provided and installed.

The equipment installation and mounting shall comply with the requirements of the National Electrical Code and local code agency having jurisdiction.

109-3.11 Power supply equipment. Transformers, regulators, booster transformers, and other power supply equipment items shall be furnished and installed at the location shown in the plans or as directed by the Engineer. The power supply equipment shall be set on steel “H” sections, “I” beams, channels, or concrete blocks to provide a minimum space of 1-1/2 inch between the equipment and the floor. The equipment shall be placed so as not to obstruct the oil-sampling plugs of the oil-filled units; and name-plates shall, so far as possible, not be obscured.

If specified in the plans and specifications, equipment for an alternate power source or an emergency power generator shall be furnished and installed. The alternate power supply installation shall include all equipment, accessories, an automatic changeover switch, and all necessary wiring and connections. The emergency power generator set shall be the size and type specified.

109-3.12 Switchgear and panels. Oil switches, fused cutouts, relays, transfer switches, panels, panel boards, and other similar items shall be furnished and installed at the location shown in the plans or as directed by the Engineer. Wall or ceiling mounted items shall be attached to the wall or ceiling with galvanized bolts of not less than 3/8 inch diameter engaging metal expansion shields or anchors in masonry or concrete vaults.

109-3.13 Duct and conduit. The Contractor shall furnish and install square-type exposed metallic ducts with hinged covers for the control circuits in the vault. These shall be mounted along the walls behind all floor-mounted equipment and immediately below all wall-mounted equipment. The hinged covers shall be placed to open from the front side with the hinges at the front bottom.

Wall brackets for square ducts shall be installed at all joints 2 feet or more apart with intermediate brackets as specified. Conduit shall be used between square ducts and equipment or between different items of equipment when the equipment is designed for conduit connection. When the equipment is not designed for conduit connection, conductors shall enter the square-type control duct through insulating bushings in the duct or on the conduit risers.

109-3.14 Wiring and connections. The Contractor shall make all necessary electrical connections in the vault per the wiring diagrams furnished and as directed by the Engineer. In wiring to the terminal blocks,

the Contractor shall leave sufficient extra length on each control lead to make future changes in connections at the terminal block. This shall be accomplished by running each control lead the longest way around the box to the proper terminal. Leads shall be neatly laced in place.

109-3.15 Marking and labeling. All equipment, control wires, terminal blocks, etc., shall be tagged, marked, or labeled as specified below:

a. Wire identification. The Contractor shall furnish and install self-sticking wire labels or identifying tags on all control wires at the point where they connect to the control equipment or to the terminal blocks. Wire labels, if used, shall be of the self-sticking preprinted type and of the manufacturer's recommended size for the wire involved. Identification -markings designated in the plans shall be followed. Tags, if used, shall be of fiber not less than 3/4 inch in diameter and not less than 1/32 inch thick. Identification markings designated in the plans shall be stamped on tags by means of small tool dies. Each tag shall be securely tied to the proper wire by a nonmetallic cord.

b. Labels. The Contractor shall stencil identifying labels on the cases of regulators, breakers, and distribution and control relay cases with white oil paint as designated by the Engineer. The letters and numerals shall be not less than one inch in height and shall be of proportionate width. The Contractor shall also mark the correct circuit designations per the wiring diagram on the terminal marking strips, which are a part of each terminal block.

METHOD OF MEASUREMENT

109-4.1 Correct existing NFPA 70 code violations, install grounding for CCR unit and install type S1 cutouts per contract drawings.

109-4.2 NOT USED

109-4.3 The quantity of vault or prefabricated concrete housing equipment to be paid for under this item shall consist of all equipment installed, connected, and accepted as a complete unit ready for operation.

BASIS OF PAYMENT

109-5.1 Payment will be made at the contract unit price for each completed and accepted vault or prefabricated metal housing equipment installation. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item L-109-5.1	Existing Vault Code Corrections – per lump sum
Item L-109-5.3	Construction of Prefabricated Concrete Building and Foundation in Place - per unit

MATERIAL REQUIREMENTS

AC 150/5340-30	Design and Installation Details for Airport Visual Aids

AC 150/5345-3	Specification for L-821, Panels for Remote Control of Airport Lighting
AC 150/5345-5	Circuit Selector Switch
AC 150/5345-7	Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
AC 150/5345-10	Specification for Constant Current Regulators and Regulator Monitors
AC 150/5345-13	Specification for L-841 Auxiliary Relay Cabinet Assembly for Pilot Control of Airport Lighting Circuits
AC 150/5345-49	Specification L-854, Radio Control Equipment;
AC 150/5345-53	Airport Lighting Equipment Certification Program
American National Standards Institute / Insulated Cable Engineers Association (ANSI/ICEA) S-85-625	Standard for Telecommunications Cable Aircore, Polyolefin Insulated, Copper Conductor Technical Requirements
ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C62	Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C90	Standard Specification for Loadbearing Concrete Masonry Units
ASTM D2823	Standard Specification for Asphalt Roof Coatings, Asbestos Containing
ASTM D4479	Standard Specification for Asphalt Roof Coatings – Asbestos-Free
Commercial Item Description (CID) A-A 59544	Cable and Wire, Electrical (Power, Fixed Installation)
FED SPEC W-C-1094	Conduit and Conduit Fittings Plastic, Rigid
IEEE 1584	Guide for Performing Arc-Flash Hazard Calculations
MPI Reference #9	Alkyd, Exterior, Gloss (MPI Gloss Level 6)
SSPC Paint 25 BCS	Zinc Oxide, Alkyd, Linseed Oil, Primer for
Underwriters Laboratories Standard 6	Electrical Rigid Metal Conduit – Steel
NFPA-70	National Electrical Code (NEC)
NFPA-70E	Standard for Electrical Safety in the Workplace
NFPA-780	Standard for the Installation of Lightning Protection Systems

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Item L-110 Airport Underground Electrical Duct Banks and Conduits

DESCRIPTION

110-1.1 This item shall consist of underground electrical conduits and duct banks (single or multiple conduits encased in concrete or buried in sand) installed per this specification at the locations and per the dimensions, designs, and details shown on the plans. This item shall include furnishing and installing of all underground electrical duct banks and individual and multiple underground conduits. It shall also include all turfing trenching, backfilling, removal, and restoration of any paved or turfed areas; concrete encasement, mandrelling, pulling lines, duct markers, plugging of conduits, and the testing of the installation as a completed system ready for installation of cables per the plans and specifications. This item shall also include furnishing and installing conduits and all incidentals for providing positive drainage of the system. Verification of existing ducts is incidental to the pay items provided in this specification.

EQUIPMENT AND MATERIALS

110-2.1 General.

a. All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Engineer.

b. Manufacturer's certifications shall not relieve the Contractor of the responsibility to provide materials per these specifications and acceptable to the Engineer. Materials supplied and/or installed that do not comply with these specifications shall be removed, when directed by the Engineer and replaced with materials, that comply with these specifications, at the Contractor's cost.

c. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be made bold and clear with arrows or circles (highlighting is not acceptable). The Contractor is solely responsible for delays in project that accrue directly or indirectly from late submissions or resubmissions of submittals.

d. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. The Contractor's submittals shall be neatly bound in a properly sized 3-ring binder, tabbed by specification section.The Engineer reserves the right to reject any and

all equipment, materials or procedures that do not meet the system design and the standards and codes specified in this document.

e. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

110-2.2 Steel conduit. Rigid galvanized steel (RGS) conduit and fittings shall be hot dipped galvanized inside and out and conform to the requirements of Underwriters Laboratories Standards 6, 514B, and 1242. All RGS conduits or RGS elbows installed below grade, in concrete, permanently wet locations or other similar environments shall be painted with a 10 mil thick coat of asphaltum sealer or shall have a factory bonded polyvinyl chloride (PVC) cover. Any exposed galvanizing or steel shall be coated with 10 mil of asphaltum sealer. When using PVC coated RGS conduit, care shall be exercised not to damage the factory PVC coating. Damaged PVC coating shall be repaired per the manufacturer's written instructions.

110-2.3 Plastic conduit. Plastic conduit and fittings-shall conform to the following requirements:

- UL 514B covers W-C-1094-Conduit fittings all types, classes 1 thru 3 and 6 thru 10.
- UL 514C covers W-C-1094- all types, Class 5 junction box and cover in plastic (PVC).
- UL 651 covers W-C-1094-Rigid PVC Conduit, types I and II, Class 4.
- UL 651A covers W-C-1094-Rigid PVC Conduit and high density polyethylene (HDPE) Conduit type III and Class 4.

Underwriters Laboratories Standards UL-651 and Article 352 of the current National Electrical Code shall be one of the following, as shown on the plans:

a. Type I–Schedule 40 PVC suitable for underground use either direct-buried or encased in concrete.

b. Type II–Schedule 40 PVC suitable for either above ground or underground use.

c. Type III – Schedule 80 PVC suitable for either above ground or underground use either direct-buried or encased in concrete.

d. Type III –HDPE pipe, minimum standard dimensional ratio (SDR) 11, suitable for placement with directional boring under pavement.

The type of solvent cement shall be as recommended by the conduit/fitting manufacturer.

110-2.4 Split conduit. Split conduit shall be pre-manufactured for the intended purpose and shall be made of steel or plastic.

110-2.5 Conduit spacers. Conduit spacers shall be prefabricated interlocking units manufactured for the intended purpose. They shall be of double wall construction made of high grade, high density polyethylene complete with interlocking cap and base pads, They shall be designed to accept No. 4 reinforcing bars installed vertically.

110-2.6 Concrete. Concrete shall conform to Item P-610, Structural Portland Cement Concrete, using 1 inch maximum size coarse aggregate with a minimum 28-day compressive strength of 4000 psi. Where reinforced duct banks are specified, reinforcing steel shall conform to ASTM A615 Grade 60.

Concrete and reinforcing steel are incidental to the respective pay item of which they are a component part.

110-2.7 Flowable backfill. Flowable material used to back fill conduit and duct bank trenches shall conform to the requirements of Item P-153, Controlled Low Strength Material. Fill shall be designed to achieve a 28-day compressive strength of 200 psi (1.4 MPa) under pavement.

110-2.8 Detectable warning tape. Plastic, detectable, American Wood Preservers Association (AWPA) Red (electrical power lines, cables, conduit and lighting cable) with continuous legend magnetic tape shall be polyethylene film with a metallized foil core and shall be 3-6 inches wide. Legend shall read "Warning Electric Cable Below" Detectable tape is incidental to the respective bid item.

CONSTRUCTION METHODS

110-3.1 General. The Contractor shall install underground duct banks and conduits at the approximate locations indicated on the plans. The Engineer shall indicate specific locations as the work progresses, if required to differ from the plans. Duct banks and conduits shall be of the size, material, and type indicated on the plans or specifications. Where no size is indicated on the plans or in the specifications, conduits shall be not less than 2 inches inside diameter or comply with the National Electrical Code based on cable to be installed, whichever is larger. All duct bank and conduit lines shall be laid so as to grade toward access points and duct or conduit ends for drainage. Unless shown otherwise on the plans, grades shall be at least 3 inches per 100 feet. On runs where it is not practicable to maintain the grade all one way, the duct bank and conduit lines shall be graded from the center in both directions toward access points or conduit ends, with a drain into the storm drainage system. Pockets or traps where moisture may accumulate shall be avoided. No duct bank or underground conduit shall be less than 18 inches below finished grade. Where under pavement, the top of the duct bank shall not be less than 18 inches below the subgrade.

The Contractor shall mandrel each individual conduit whether the conduit is direct-buried or part of a duct bank. An iron-shod mandrel, not more than 1/4 inch smaller than the bore of the conduit shall be pulled or pushed through each conduit. The mandrel shall have a leather or rubber gasket slightly larger than the conduit hole.

The Contractor shall swab out all conduits/ducts and clean base can, manhole, pull boxes, etc., interiors IMMEDIATELY prior to pulling cable. Once cleaned and swabbed the light bases, manholes, pull boxes, etc., and all accessible points of entry to the duct/conduit system shall be kept closed except when installing cables. Cleaning of ducts, base cans, manholes, etc., is incidental to the pay item of the item being cleaned. All raceway systems left open, after initial cleaning, for any reason shall be recleaned at the Contractor's expense. All accessible points shall be kept closed when not installing cable. The Contractor shall verify existing ducts proposed for use in this project as clear and open. The Contractor shall notify the Engineer of any blockage in the existing ducts.

For pulling the permanent wiring, each individual conduit, whether the conduit is direct-buried or part of a duct bank, shall be provided with a 200 pound test polypropylene pull rope. The ends shall be secured and sufficient length shall be left in access points to prevent it from slipping back into the conduit. Where spare conduits are installed, as indicated on the plans, the open ends shall be plugged with removable tapered plugs, designed for this purpose.

All conduits shall be securely fastened in place during construction and shall be plugged to prevent contaminants from entering the conduits. Any conduit section having a defective joint shall not be installed. Ducts shall be supported and spaced apart using approved spacers at intervals not to exceed 5 feet.

Unless otherwise shown on the plans, concrete encased duct banks shall be used when crossing under pavements expected to carry aircraft loads, such as runways, taxiways, taxilanes, ramps and aprons. When under paved shoulders and other paved areas, conduit and duct banks shall be encased using flowable fill for protection.

All conduits within concrete encasement of the duct banks shall terminate with female ends for ease in current and future use. Install factory plugs in all unused ends. Do not cover the ends or plugs with concrete.

Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored.

Trenches for conduits and duct banks may be excavated manually or with mechanical trenching equipment unless in pavement, in which case they shall be excavated with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed. Blades of graders shall not be used to excavate the trench.

When rock is encountered, the rock shall be removed to a depth of at least 3 inches below the required conduit or duct bank depth and it shall be replaced with bedding material of earth or sand containing no mineral aggregate particles that would be retained on a 1/4 inch sieve. Flowable backfill may alternatively be used The Contractor shall ascertain the type of soil or rock to be excavated before bidding. All such rock removal shall be performed and paid for under Item P-152.

Underground electrical warning (Caution) tape shall be installed in the trench above all underground duct banks and conduits in unpaved areas. Contractor shall submit a sample of the proposed warning tape for approval by the Engineer. If not shown on the plans, the warning tape shall be located 6 inches above the duct/conduit or the counterpoise wire if present.

Joints in plastic conduit shall be prepared per the manufacturer's recommendations for the particular type of conduit. Plastic conduit shall be prepared by application of a plastic cleaner and brushing a plastic solvent on the outside of the conduit ends and on the inside of the couplings. The conduit fitting shall then be slipped together with a quick one-quarter turn twist to set the joint tightly. Where more than one conduit is placed in a single trench, or in duct banks, joints in the conduit shall be staggered a minimum of 2 feet.

Changes in direction of runs exceeding 10 degrees, either vertical or horizontal, shall be accomplished using manufactured sweep bends.

Whether or not specifically indicated on the drawings, where the soil encountered at established duct bank grade is an unsuitable material, as determined by the Engineer, the unsuitable material shall be removed per Item P-152 and replaced with suitable material. Alternatively, additional duct bank supports that are adequate and stable shall be installed, as approved by the Engineer.

All excavation shall be unclassified and shall be considered incidental to the respective L-110 pay item of which it is a component part. Dewatering necessary for duct installation, erosion and turbidity control, per Federal, state, and local requirements is incidental to its respective pay item as a part of Item L-110.

The cost of all excavation regardless of type of material encountered, shall be included in the unit price bid for the L-110 Item.

Unless otherwise specified, excavated materials that are deemed by the Engineer to be unsuitable for use in backfill or embankments shall be removed and disposed of offsite.

Any excess excavation shall be filled with suitable material approved by the Engineer and compacted per Item P-152.

It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Where existing active cables) cross proposed installations, the Contractor shall ensure that these cables are adequately protected. Where crossings are unavoidable, no splices will be allowed in the existing cables, except as specified on the plans. Installation of new cable where such crossings must occur shall proceed as follows:

a. Existing cables shall be located manually. Unearthed cables shall be inspected to assure absolutely no damage has occurred

b. Trenching, etc., in cable areas shall then proceed with approval of the Engineer, with care taken to minimize possible damage or disruption of existing cable, including careful backfilling in area of cable.

In the event that any previously identified cable is damaged during the course of construction, the Contractor shall be responsible for the complete repair.

110-3.2 Duct banks. Unless otherwise shown in the plans, duct banks shall be installed so that the top of the concrete envelope is not less than 18 inches below the bottom of the base or stabilized base course layers where installed under runways, taxiways, aprons, or other paved areas, and not less than 18 inches (0.5 m) below finished grade where installed in unpaved areas.

Unless otherwise shown on the plans, duct banks under paved areas shall extend at least 3 feet beyond the edges of the pavement or 3 feet beyond any under drains that may be installed alongside the paved area. Trenches for duct banks shall be opened the complete length before concrete is placed so that if any obstructions are encountered, provisions can be made to avoid them. Unless otherwise shown on the plans, all duct banks shall be placed on a layer of concrete not less than 3 inches thick prior to its initial set. The Contractor shall space the conduits not less than 3 inch apart (measured from outside wall to outside wall). All such multiple conduits shall be placed using conduit spacers applicable to the type of conduit. As the conduit laying progresses, concrete shall be placed around and on top of the conduits not less than 3 inches thick unless otherwise shown on the plans. All conduits shall terminate with female ends for ease of access in current and future use. Install factory plugs in all unused ends. Do not cover the ends or plugs with concrete.

Conduits forming the duct bank shall be installed using conduit spacers. No. 4 reinforcing bars shall be driven vertically into the soil a minimum of 6 inches to anchor the assembly into the earth prior to placing the concrete encasement. For this purpose, the spacers shall be fastened down with locking collars attached to the vertical bars. Spacers shall be installed at 5-foot intervals. Spacers shall be in the proper sizes and configurations to fit the conduits. Locking collars and spacers shall be submitted to the Engineer for review prior to use.

When specified, the Contractor shall reinforce the bottom side and top of encasements with steel reinforcing mesh or fabric or other approved metal reinforcement. When directed, the Contractor shall supply additional supports where the ground is soft and boggy, where ducts cross under roadways, or

where shown on the plans. Under such conditions, the complete duct structure shall be supported on reinforced concrete footings, piers, or piles located at approximately 5-foot intervals.

All pavement surfaces that are to have ducts installed therein shall be neatly saw cut to form a vertical face. All excavation shall be included in the contract with price for the duct.

Install a plastic, detectable, color as noted, 3 to 6 inches wide tape, 8 inches minimum below grade above all underground conduit or duct lines not installed under pavement. Utilize the 3-inch wide tape only for single conduit runs. Utilize the 6-inch wide tape for multiple conduits and duct banks. For duct banks equal to or greater than 24 inches in width, utilize more than one tape for sufficient coverage and identification of the duct bank as required.

When existing cables are to be placed in split duct, encased in concrete, the cable shall be carefully located and exposed by hand tools. Prior to being placed in duct, the Engineer shall be notified so that he may inspect the cable and determine that it is in good condition. Where required, split duct shall be installed as shown on the drawings or as required by the Engineer.

110-3.3 Conduits without concrete encasement. Trenches for single-conduit lines shall be not less than 6 inches nor more than 12 inches wide. The trench for 2 or more conduits installed at the same level shall be proportionately wider. Trench bottoms for conduits without concrete encasement shall be made to conform accurately to grade so as to provide uniform support for the conduit along its entire length.

Unless otherwise shown on the plans, a layer of fine earth material, at least 4 inches thick (loose measurement) shall be placed in the bottom of the trench as bedding for the conduit. The bedding material shall consist of soft dirt, sand or other fine fill, and it shall contain no particles that would be retained on a 1/4 inch sieve. The bedding material shall be tamped until firm. Flowable backfill may alternatively be used.

Unless otherwise shown on plans, conduits shall be installed so that the tops of all conduits within the Airport's secured area where trespassing is prohibited are at least 18 inches below the finished grade. Conduits outside the Airport's secured area shall be installed so that the tops of the conduits are at least 24 inches below the finished grade per National Electric Code (NEC), Table 300.5.

When two or more individual conduits intended to carry conductors of equivalent voltage insulation rating are installed in the same trench without concrete encasement, they shall be spaced not less than 3 inches apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6 inches apart in a vertical direction. Where two or more individual conduits intended to carry conductors of differing voltage insulation rating are installed in the same trench without concrete encasement, they shall be placed not less than 3 inches apart (measured from outside wall to outside wall) in a horizontal direction and lot less than 6 inches apart in a vertical direction.

Trenches shall be opened the complete length between normal termination points before conduit is installed so that if any unforeseen obstructions are encountered, proper provisions can be made to avoid them.

Conduits shall be installed using conduit spacers. No. 4 reinforcing bars shall be driven vertically into the soil a minimum of 6 inches to anchor the assembly into the earth while backfilling. For this purpose, the spacers shall be fastened down with locking collars attached to the vertical bars. Spacers shall be installed at 5-foot intervals. Spacers shall be in the proper sizes and configurations to fit the conduits. Locking collars and spacers shall be submitted to the Engineer for review prior to use.

110-3.4 Markers. The location of each end and of each change of direction of conduits and duct banks shall be marked by a concrete slab marker 2 feet square and 4 - 6 inches thick extending approximately one inch above the surface. The markers shall also be located directly above the ends of all conduits or duct banks, except where they terminate in a junction/access structure or building. Each cable or duct run from a line of lights and signs to the equipment vault must be marked at approximately every 200 feet along the cable or duct run, with an additional marker at each change of direction of cable or duct run.

The Contractor shall impress the word "DUCT" or "CONDUIT" on each marker slab. Impression of letters shall be done in a manner, approved by the Engineer, for a neat, professional appearance. All letters and words must be neatly stenciled. After placement, all markers shall be given one coat of high-visibility orange paint, as approved by the Engineer. The Contractor shall also impress on the slab the number and size of conduits beneath the marker along with all other necessary information as determined by the Engineer. The letters shall be 4 inches high and 3 inches wide with width of stroke 1/2 inch and 1/4 inch deep or as large as the available space permits. Furnishing and installation of duct markers is incidental to the respective duct pay item.

110-3.5 Backfilling for conduits. For conduits, 8 inches of sand, soft earth, or other fine fill (loose measurement) shall be placed around the conduits ducts and carefully tamped around and over them with hand tampers. The remaining trench shall then be backfilled and compacted per Item P-152 "Excavation and Embankment" except that material used for back fill shall be select material not larger than 4 inches in diameter.

Flowable backfill may alternatively be used.

Trenches shall not contain pools of water during back filling operations.

The trench shall be completely backfilled and tamped level with the adjacent surface; except that, where sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of per instructions issued by the Engineer.

110-3.6 Backfilling for duct banks. After the concrete has cured, the remaining trench shall be backfilled and compacted per Item P-152 "Excavation and Embankment" except that the material used for backfill shall be select material not larger than 4 inches in diameter. In addition to the requirements of P-152, where duct banks are installed under pavement, one moisture/density test per lift shall be made for each 250 linear feet of duct bank or one work period's construction, whichever is less.

Flowable backfill may alternatively be used.

Trenches shall not contain pools of water during backfilling operations.

The trench shall be completely backfilled and tamped level with the adjacent surface; except that, where sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of per instructions issued by the Engineer.

110-3.7 Restoration. Where sod has been removed, it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by the work shall be restored to its original condition. The restoration shall include sodding, topsoiling, fertilizing, liming, seeding, sprigging and mulching shown on the plans. The Contractor shall be held responsible for maintaining all disturbed surfaces and

replacements until final acceptance. All restoration shall be considered incidental to the respective L-110 pay item. Following restoration of all trenching near airport movement surfaces, the Contractor shall thoroughly visually inspect the area for foreign object debris (FOD), and remove any such FOD that is found. This FOD inspection and removal shall be considered incidental to the pay item of which it is a component part.

METHOD OF MEASUREMENT

110-4.1 Underground conduits and duct banks shall be measured by the linear feet of conduits and duct banks installed, including encasement, locator tape, trenching and backfill with designated material, and for drain lines, the termination at the drainage structure, all measured in place, completed, and accepted. Separate measurement shall be made for the various types and sizes.

BASIS OF PAYMENT

110-5.1 Payment will be made at the contract unit price per linear foot for each type and size of conduit and duct bank completed and accepted, including trench and backfill with the designated material, and, for drain lines, the termination at the drainage structure. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item per the provisions and intent of the plans and specifications.

Payment will be made under:

Item L-110-5.1	2-Inch, 2-way PVC Conduit, Concrete Encased - per linear foot

MATERIAL REQUIREMENTS

Advisory Circular (AC) 150/5340-30	Design and Installation Details for Airport Visual Aids
AC 150/5345-53	Airport Lighting Equipment Certification Program
ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3(2,700 kN-m/m^3))
ASTM D2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2922	Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
NFPA-70	National Electrical Code (NEC)

Underwriters Laboratories Standard 6
Electrical Rigid Metal Conduit - Steel

Underwriters Laboratories Standard 514B
Conduit, Tubing, and Cable Fittings

Underwriters Laboratories Standard 514C
Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

Underwriters Laboratories Standard 1242
Electrical Intermediate Metal Conduit Steel

Underwriters Laboratories Standard 651
Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

Underwriters Laboratories Standard 651A
Type EB and A Rigid PVC Conduit and HDPE Conduit

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SUPPLEMENTAL TECHNICAL PROVISIONS

SUPPLEMENTAL TECHNICAL PROVISIONS

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ITEM MST-01 FIELD OFFICE AND LABORATORY

DESCRIPTION

01-1.1 The Contractor shall provide a field office for the exclusive use of the Engineer and shall be located as directed by the Engineer. The field office shall be provided and maintained in good condition by the Contractor as specified herein and shall become the property of the Contractor upon completion of the contract.

REQUIREMENTS

01-2.1 The building or trailer furnished for a field office shall meet the following requirements:

a. Minimum dimensions shall be: width 8 feet, height (floor to ceiling) 7 feet, minimum of 300 square feet of area of which 80 square feet shall be private office for use of the Engineer's project representative.

b. There shall be at least two hinged or sliding windows.

c. There shall be at least one door. Door shall have satisfactory locks with a sufficient number of keys requested by the Engineer.

d. It shall have a satisfactory floor and weatherproof roof and be dustproof and wind-tight.

e. Doors and windows shall be provided with satisfactory screens.

f. It shall be provided with satisfactory lighting, heating and air conditioning equipment and electric outlets. The heating and air conditioning system shall be controlled by a thermostat and be capable of maintaining a constant temperature.

g. It shall contain two desks for general office use, each about 3 feet by 5 feet; one with desk chair of armchair swivel type and one with secretary's chair.

h. It shall contain one upright, floorstanding drafting table with at least two drawers and a stool.

i. It shall contain a freestanding plan rack.

j. It shall contain one conference table, approximately 30 inches by 72 inches.

k. It shall contain four visitor's chairs.

l. A private telephone with answering machine shall be provided.

m. A four-drawer, fire-resistant, steel filing cabinet with a lock and with a Class D (or higher) classification established by Underwriters Laboratories, Inc., or Safe Manufacturers National Association, shall be provided.

n. Suitable toilet facilities shall be provided at the location of the field office.

o. It shall contain a broom and dustpan.

p. Copy machine capable of copying bound booklets shall be provided.

q. One portable ABC fire extinguisher shall be provided.

r. A continuous supply of commercial bottled water and dispenser.

s. Fax machine.

t. High-Speed internet access (Maximum DSL speed available)

u. Letter Quality Inkjet Color Printer with a printer stand, print cartridges and 8-1/2" x 11" printer paper to be supplied and replenished as needed.

The requirements shown herein shall be considered as minimum requirements. The Contractor may furnish equipment or software which exceeds these requirements, except where an operating system is specified.

01-2.2 The Engineer's field office shall meet the approval of the Engineer.

01-2.3 The field office shall be the property of the Contractor, who shall maintain the office and provide necessary utilities for the duration of the contract. The office shall be located at the job site within ten (10) days of the signing of the contract, and shall be removed within ten (10) days of the date of acceptance of the work.

METHOD OF MEASUREMENT

01-3.1 The field office will be measured for payment per month, or portion thereof, based on a 30 day month.

BASIS OF PAYMENT

01-4.1 Payment will be made at the contract unit price, complete and in place as specified, until released.

Payment will be made under:

Item MST-01-4.1 Engineer's Field Office -- per month

END OF ITEM MST-01

ITEM MST-02

MAINTENANCE AND PROTECTION OF AIR TRAFFIC DURING CONSTRUCTION

DESCRIPTION

02-1.1 This item includes work required to maintain aircraft and vehicle traffic on the airfield or public roads during the duration of this Contract for the safe and proper execution of work on this project. The work involves controlling and performing construction activities in a manner that will cause a minimum of interference with air traffic or ground traffic. The Contractor is required to cooperate with the FAA, the Engineer, the Airport, Airport tenants, and other contractors working in the area to perform work safely and efficiently without causing unplanned disruptions in aircraft movements, and minimal interruptions to ground vehicle movements. All work shall be completed in accordance with FAA Advisory Circular 150/5370-2F, the Construction Safety and Phasing Plans, and Safety Plan Compliance Document for this project.

The Contractor shall submit a Safety Plan Compliance Document (SPCD) to the Engineer/Airport in accordance with FAA AC 150/5370-2F, on the Contract's approach to comply with the safety requirements of the project (see 5370-2F, 103.B).

The specific items of work include Contractor-furnished communications equipment and procedures, flagmen, construction and maintenance of temporary haul roads, radios, maintenance of positive drainage, steel plates for temporary covering of excavations and structures as required, barricades, temporary threshold establishment and threshold restoration, traffic controls such as barrels or cones, construction area safety fence, omni-directional red flashers and/or signs, marking and lighting of equipment, temporary jumper cables and connections for airfield lighting and navigational aids, performance of work in accordance with the requirements of the Construction Safety and Phasing Plans, highway traffic control devices, and any and all necessary labor, equipment, materials, and incidentals required to complete the work.

All items shall be maintained by the Contractor in good working order at all times. Barricades, traffic cones, flashers, signs, and other temporary items remaining in place through a construction shut down periods shall likewise be maintained in good working order through the shut down period.

As part of this item, the Contractor shall attend weekly Project Progress Meetings with the Engineer, Airport, and other parties as deemed appropriate by the Airport.

The Construction Safety and Phasing Plan for this project has been reviewed and accepted by the FAA and the Airport. Any proposed changes to the Construction Safety and Phasing Plan, including the use of equipment in excess of the maximum equipment heights indicated in the Plans must be reviewed and accepted by these agencies. The review and approval process requires plan revisions and the completion of FAA Form 7460-1, Notice of Proposed Construction or Alteration. The Contractor is responsible for all plan revisions and the preparation of FAA Form 7460-1 if changes to the Construction Safety and Phasing Plan are proposed. The plan must be prepared and submitted to the Airport Engineer through the Engineer. The Airport Engineer will review the proposed changes, and if deemed acceptable, will forward the prepared FAA Form 7460-1 to the FAA Detroit Airports District Office for review.

MATERIALS

02-2.1 CONTROL AND WARNING DEVICES. During construction operations near active taxiways or runways the Contractor shall furnish and maintain low profile barricades equipped with red warning lights along the edges of the construction area to warn the air and ground traffic to stay clear of the construction area. These devices shall be placed as shown on the plans or as directed by the Engineer. The Contractor shall maintain red warning lights and orange warning stakes around all equipment, stockpiles or other areas as directed.

The Contractor shall employ designated personnel to maintain and service all traffic control equipment in proper condition and working order. This includes periods of construction inactivity during the contract duration. Contact information for designated personnel shall be provided to the Engineer and Airport personnel prior to Notice to Proceed.

02-2.2 RED WARNING LIGHTS. Red warning lights shall be omni-directional flashing red lights meeting the requirements of the "Manual on Uniform Traffic Control Devices for Streets and Highways" for Type A, Type B, and Type C flashers.

02-2.3 BARRICADES. Barricades shall be of the type detailed on the plans or as approved by the Engineer. Barricades shall be painted with alternating orange and white vertical striping. Two battery operated flashing red lights shall be mounted on each end of each barricade. Barricades shall be furnished and maintained by the Contractor, and at the completion of the Contract shall become property of the Contractor and shall be removed from the site.

02-2.4 RADIOS. Two-way radios shall be capable of monitoring Airport CTAF/Unicom. The frequency is 122.70 MHz at the Airport.

02-2.5 RUNWAY AND TAXIWAY CLOSURE MARKERS. Two (2) runway closure markers and one (1) taxiway closure marker will be provided by Contractor use for this project. The Contractor will set up and take down the runway closure markers for each use. The Contractor shall be responsible for the maintenance of the runway closure markers while in use. The Contractor shall be responsible for repair or full replacement if the runway closure markers are damaged by the Contractor or any of his subcontractors while in use.

02-2.6 PORTABLE FLOODLIGHTING. Portable floodlighting shall be provided, as required, for construction during periods of limited visibility (i.e., nighttime construction). Portable floodlighting for any nighttime paving operations shall be per the requirements of P-401-4.10. For nighttime work other than paving, the Contractor shall provide sufficient units so that all work areas are illuminated to a minimum level of 5 horizontal foot-candles. The lighting levels shall be calculated and measured in accordance with the current standards of the Illumination Engineering Society. The Contractor shall provide, place and operate sufficient portable floodlighting for each work area, and for other areas, such as testing facilities, as may be directed by the Engineer.

02-2.7 CONSTRUCTION PROTECTION. Protection of existing pavement using steel plates shall be provided as necessary. Plates or covers of adequate size and thickness shall be furnished as necessary to cover temporary excavations, unfinished structures, or surfaces requiring protection for safety purposes. Plates shall be securely fastened down to safely support any anticipated loadings to be imposed.

02-2.8 RUNWAY AND TAXIWAY LIGHTING CIRCUITS. – Runway and taxiway lighting circuits in construction areas shall be maintained and remain operational at all times. Where sections of taxiway lighting are to be demolished the taxiway lighting circuit shall be completed by installing temporary cable jumpers around the affected area(s). When cable jumpers are to be installed across taxiway pavement closed to air traffic the

cable(s) shall be marked and protected by barricades. Temporary cable jumpers outside of paved areas shall be flagged or marked in such a manner as to ensure that cables are visible to airport operations personnel and mowing crew operators. Temporary lighting cables shall not be driven over by vehicles unless protected in such a manner as to prevent damage. Temporary cable jumpers and connectors shall be of the size and type described in Item L-108.

The contractor shall visually inspect temporary cable jumpers and energize taxiway circuit(s) before the suspension of daily work activities and ensure the circuit(s) is ready for night operations.

CONSTRUCTION METHODS

02-3.1 CONSTRUCTION BARRICADES. Construction barricades shall be placed as indicated on the Plans or as directed by the Engineer. Barricades will typically be placed perpendicular to runway or taxiway centerlines. Barricades shall remain in place from the beginning of a construction phase or work area until required for removal or relocation as authorized by the Engineer or Airport personnel. All flashing red lights shall be inspected daily by the Contractor and remain in operation at all times for the duration of the Contract.

02-3.2 RADIO COMMUNICATIONS. The frequency utilized for two-way radio transmissions shall be selected by the Contractor and approved by the Engineer, but shall not conflict with or overlay any of the Airport's radio frequencies. The Contractor's personnel required to be provided with radio equipment shall, at minimum, include the Project Superintendent, Foreman of all work groups physically separated from the general vicinity of the Project Superintendent, flaggers, and/or others who may be working in a separate and remote area. Sufficient numbers of radios shall be deployed to allow each remote area to have direct communications ability. Contractor-supplied cellular telephones shall be an acceptable substitute for radios.

02-3.3 DUST CONTROL. Contractor shall control dust and debris at all times. Control measures are as detailed on the Plans.

02-3.4 CLOSING AND REOPENING OF RUNWAY. Work on this project will be performed during off peak hours through nightly and/or weekend closures of the runway. The Airport Manager has the final say on the acceptable condition of pavements, safety areas, lighting, signing, and marking prior to opening. No section of the project will be opened to aircraft without authorization from the Airport Manager.

At a minimum, the following conditions must be met before inviting the Airport Manager for his/her inspection of the areas to be opened to aircraft traffic:

- The runway and taxiway pavement must be swept free of all dust debris or other FOD potential
- The runway and taxiway pavement transitions and milled surfaces must be in place as indicated on the plans and all testing requirements must be completed and yield acceptable results
- Runway and Taxiway pavement marking must be in place and in accordance with the details provided on the plans
- The runway and taxiway safety areas must be graded as indicated on the plans and be free of objects, ruts, holes, open trenches, standing water, or other condition unacceptable to the Engineer or the Airport Manager. Object free areas must be free of objects in accordance with FAA criteria to the limits shown on the plans.
- All runway lighting and signing circuits must be operational.
- All taxiway lighting and signing circuits on open taxiways must be in working order.
- The pavement surface must be no greater than 3 inches above the adjacent ground surface and preferably 1 ½ inches.

- The navigational aids (PAPI and REIL) must be checked by the Engineer and Airport Manager and powered on.
- The runway closure crosses must be removed by the Contractor.

RESPONSIBILITIES

02-4.1 CONTROL REQUIREMENTS. The Contractors responsibilities for work areas are as follows:

A. The Contractor shall be held responsible for controlling his employees, subcontractors and their employees with regard to traffic movement.

B. The Contractor shall rebuild, repair, restore and make good at his own expense all injuries or damages to any portion of the work occasioned by his use of these facilities before completion and acceptance of his work.

C. The Contractor shall submit to the Engineer in writing a plan for controlling construction equipment and vehicular movements in the Air Operations Area (AOA). This plan shall be submitted prior to the start of work. The Plan must include material haul roads.

D. The Contractor shall provide a responsible Traffic Manager whose duty shall be to direct all traffic on or near active runways, taxiways, haul roads and highways. Paved surfaces shall be kept clear at all times and specifically must be kept free from all debris, which might damage aircraft.

02-4.2 VEHICLE AND PEDESTRIAN CONTROL. Vehicle and access routes for airport construction shall be controlled to prevent inadvertent or unauthorized entry of persons, vehicles or animals onto air operation areas. No vehicle shall enter the air operations area except at predetermined locations. Contractor personnel who operate vehicles in the AOA shall comply with the airport operator's rules and regulations for vehicle marking, lighting and operation.

02-4.3 VEHICLE MARKING AND IDENTIFICATION. All vehicles continuously operating on the airfield and all Contractor escort vehicles shall be marked with orange and white checkered flags, each checkerboard color being one (1) foot square. Flags shall be three (3) feet square and shall be tacked along a staff having a length of four (4) feet and a minimum thickness of one (1) inch. A revolving yellow light may be used in lieu of a checkerboard flag. Vehicles shall include identification lettering as required by the Engineer.

02-4.4 VEHICLE TRAFFIC AND OPERATIONS. When any vehicle other than those approved for use in the AOA is required to travel to or from the work area or over any portion of the work area, a vehicle properly identified to operate in the area shall escort it. Such vehicles shall be provided with a flag on a staff attached to the vehicle. Any deviation from this rule must be approved by the Engineer.

02-4.5 VEHICLE PARKING. All vehicles shall be parked and serviced in the designated staging area(s) shown on the plans, outside of areas critical to airport operations. Prior to parking construction vehicles at locations other than the staging area(s), submit a plan indicating the areas where parking is desired for review and approval by the Engineer and Airport.

02-4.6 RADIO COMMUNICATIONS. The contractor shall furnish radios to the project superintendents. The frequency shall be the contractor’s option but can only be used in maintaining the safe operation of the project. The frequency must be reported to the Airport Manager prior to use to avoid conflicts with local airfield operations. Cell phones are an acceptable substitute.

02-4.7 PERSONNEL AND VEHICLE BADGES. Not used.

02-4.8 VIOLATION OF RESPONSIBILITIES. Any violation of 003-4.1 through 003-4.7 shall be considered a violation of the Contract and shall be sufficient cause for halting the work without extending the time limit of the job.

COORDINATION OF CONSTRUCTION ACTIVITIES

02-5.1 WORK SCHEDULING AND ACCOMPLISHMENT. Where any work is to be done on or near any operational runway, taxiway or taxilane, the Contractor shall notify the Engineer who will request closure from the Airport Manager so that provisions can be made to close the taxiway or runway to aircraft traffic. Such work shall then be completed in the most expeditious manner practicable so that the taxiway or runway can be reopened to air traffic at the earliest possible time.

The Contractor shall contact the Engineer each day before he begins work to coordinate the status and nature of work to be done that day. The Contractor shall also report to the Engineer at the end of each day to schedule the work he plans to do on the following day.

The Contractor shall submit to the Engineer a schedule of planned activities broken down to each shift of work. Any shifts of no work shall be noted in this submission, as well as planned allowances for weather impacts. This plan shall be submitted not less than 72 hours prior to the start of each work area.

Violations of any coordination requirements shall be considered a violation of the Contract and shall be sufficient cause for halting the work without extending the time limit of the job.

SAFETY REQUIREMENTS

02-6.1 GENERAL. Before entering upon or crossing any active runway or taxiway, the Contractor shall receive proper clearance. Emergencies and operating conditions may necessitate sudden changes, both in Airport operations and in the operations of the Contractor. Aircraft operations shall always have priority over any and all of the Contractor's operations. Should runways or taxiways be required for the use of aircraft and should Airport operations, the Airport Manager or the Engineer deem the Contractor to be too close to active runways, or taxiways the Contractor shall suspend his operations, remove his personnel, plant, equipment and materials to a safe distance and stand by until the runways and taxiways are no longer required for use by aircraft. There will be no compensation or time extensions for delays or inefficiencies due to these changes.

Through the duration of the job any practice or situations that the Engineer determines to be unsafe or a hindrance to regular Airport operations shall be immediately rectified.

Any violation of these or the following safety requirements, shall be considered a violation of the Contract itself and shall be sufficient cause for halting the work without extending the time limit of the job.

02-6.2 HAZARD MARKING. Hazard-marking barricades, traffic cones, flashers, etc. should be used: to identify and define the limits of construction, making them visible to aircraft, personnel or vehicles; to identify hazards such as open manholes, small areas under repair, stockpiled material, waste areas, etc.; to prevent aircraft from taxiing onto a closed runway for takeoff; and to identify FAA, Airport, and National Weather Service facilities, cables, power lines, instrument landing system (ILS) critical areas, and other sensitive areas to prevent damage, interference, and facility shutdown. Hazardous areas, in which no part of

an aircraft may enter, should be indicated by the use of barricades marked with vertical, alternating orange and white stripes. During reduced visibility or night hours, the barricades should be supplemented with flashing red lights. The intensity of the lights and spacing for barricades, lights should be adequate to delineate the hazardous area without ambiguity. The Contractor shall have a designated person on call 24 hours a day for emergency maintenance of airport hazard lighting and barricades. The layout of all hazard marking shall be approved by the Engineer prior to the start of construction. All warning markers and lighting shall be removed from the site upon the completion of the project.

02-6.3 CONSTRUCTION AREA MARKING AND LIGHTING. Barricades shall be provided and erected by the Contractor as shown on the plans or as directed by the Engineer. All construction areas, including closed runways and taxiways, should be clearly and visibly separated from active air operation areas, hazard areas, facilities, cables and power lines should also be clearly identified by the Contractor. The Contractor is responsible for maintaining the condition and visibility of all markers identifying above-mentioned areas and that marking and lighting aids remain in place. Omni-directional red flashers, and/or signs should be used as necessary to clearly separate all construction/maintenance areas from other parts of the air operations area. All barricades, temporary markers, and other objects placed and left in safety areas on any open runway, taxiway, or taxilane should be: as low as possible to the ground; of low mass; easily collapsible upon contact with an aircraft or any of its components; weighted down or sturdily attached to the surface to prevent displacement from propwash, jet blast, wing vortex, or other surface wind currents; and if affixed to the surface, frangible at ground level.

The Engineer shall approve the layout of construction area markings prior to the start of construction.

All warning markers and lighting shall be removed from the site upon the completion of the project unless specified to be turned over to the Airport.

02-6.4 CONSTRUCTION NEAR NAVIGATIONAL AIDS. Construction materials and equipment shall not be placed or parked where they may interfere with the line-of-sight of the navigational aids in operation. The Engineer and the Airport shall determine if any materials or equipment will cause any type of interference.

02-6.5 CONSTRUCTION SITE ACCESS AND HAUL ROADS. The Contractor will not be permitted to use any access or haul roads other than those designated on the contract drawings. The Contractor should submit specific proposed access routes associated with specific construction activities to the Engineer for evaluation and approval prior to commencing construction activities. Aircraft Rescue and Fire-fighting (ARFF) right-of-way on access roads, haul roads, taxiways, and runways shall not be impeded at any time.

02-6.6 TRENCHES AND EXCAVATIONS. Open trenches or excavations are not permitted within an operational runway safety area. Coverings for open trenches or excavations should be of sufficient strength to support the weight of the heaviest aircraft operating on the runway or taxiway. Open trenches and excavations at the construction site should be prominently marked as approved by the Engineer, and lighted with red light units during hours of restricted visibility or darkness.

Excavations and open trenches may be permitted up to the edge of structural taxiways provided the drop-off is adequately signed, marked and lighted.

02-6.7 CONSTRUCTION MATERIALS STOCKPILING AND EQUIPMENT STORAGE. Stockpiling of construction materials and equipment storage is not permitted within operating runway or taxiway safety areas. Stockpiled materials and equipment should be prominently marked and lighted during hours of restricted visibility or darkness if in the air operations area. Stockpiled material or equipment should not be stored near aircraft turning areas or operational movement areas, aprons, or excavations and trenches. Stockpiled

materials or equipment should not be stored near NAVAIDs, visual or approach aids. The Engineer should ensure that stockpiled construction materials and equipment do not cause degraded or hazardous conditions to airport operations safety. This includes determining and verifying that stockpiled materials and equipment are stored or parked at an approved location, that they are properly stowed to prevent foreign object debris (FOD), attraction by wildlife, or obstruction of air operations either by their proximity to NAVAIDs or to aircraft movement areas. No un-lidded dumpsters may be used in the AOA.

02-6.8 OTHER LIMITATIONS ON CONSTRUCTION. Open flame welding or torch cutting operations are prohibited unless adequate fire and safety precautions are provided and have been approved for use by the Engineer. Under no circumstances should flare pots be used near aircraft turning areas.

02-6.9 FOREIGN OBJECT DEBRIS (FOD) MANAGEMENT. Waste and loose materials capable of causing damage to aircraft landing gear or propellers or capable of being ingested in jet engines should not be left or placed on or near active aircraft movement areas. Materials tracked onto these areas should be continuously removed during the construction project. It is also recommended that waste or loose materials that would attract wildlife be carefully controlled and removed on a continuous basis. The contractor shall have sufficient mechanized sweepers on site to comply with this requirement at all times.

02-6.10 RUNWAYS AND TAXIWAYS. Nothing shall be placed upon runways, taxiways, taxilanes or aircraft parking aprons without prior authorization from the Engineer. Nothing shall be placed in runway or taxiway object free areas without prior authorization from the Engineer.

METHOD OF MEASUREMENT

02-7.1 Maintenance and Protection of Air Traffic shall be measured as the work covered under this section and completed in accordance with the Safety and Work Area Plans.

BASIS OF PAYMENT

02-8.1 Payment for this item will be made in an proportionate manner on the basis of current estimates for each phase of work.

Payment will be made under:

Item MST-02-8.1 Maintenance and Protection of Air Traffic – per lump sum

END OF ITEM MST-02

ITEM MST-03 CONSTRUCTION ENGINEERING

DESCRIPTION

03-1.1 The Contractor shall perform the construction engineering, including layout. Construction engineering shall include re-establishing the survey points and survey centerlines; re-referencing the necessary control points; running a level circuit to check or re-establish plan bench marks; setting stakes for right-of-way, culverts, slopes, subbase, surface drains, paving, subgrade, and any other stakes required for control lines and grades; and setting vertical control elevations, such as screed elevations. Construction engineering also encompasses record drawings and their associated requirements.

CONSTRUCTION

03-2.1 The Contractor shall furnish all stakes, templates, straightedges, and other devices necessary for checking, marking, and maintaining point, lines, and grades. The level circuit to check the plan bench marks shall be run the length of the contract. Field notes shall be kept in standard field notebooks in a clear, orderly, and neat manner consistent with standard engineering practices including titles, number, and indexes. The field books shall become the property of the Owner upon completion of the work. The field books may be inspected by the project personnel at any time.

When staking culverts, the Contractor shall perform the necessary checking to establish the proper location and grade to fit best the conditions on the site. The Contractor will not be responsible to verify that the culvert is of adequate opening.

The supervision of the Contractor's construction engineering personnel shall be the responsibility of the Contractor, and any errors resulting from the operations of such personnel shall be corrected at the expense of the Contractor and at no additional cost to the Owner.

03-2.2 Record Drawings Upon completion of the work, the Contractor shall furnish a red-lined set of record drawings to the Engineer. The record drawing set shall include all field adjustments, utilities not shown on the plan set (including invert elevations), structures, obstructions, etc. which occurred throughout the course of the work. The Engineer will maintain a concurrent set of red-lined record drawings. In no instance shall the Engineer’s drawings be accepted in lieu of the Contractor-produced set.

METHOD OF MEASUREMENT

03-3.1 Construction engineering, including red-lined record drawings, as specified herein, shall be measured as a lump sum item.

BASIS OF PAYMENT

03-4.1 Construction engineering shall be paid for based upon the approximate amount of this work actually completed, but in no case shall more than 30% of this item be paid on the first progress payment. This work shall include furnishing all necessary personnel, equipment, redline record drawings, and supplies to accomplish the work.

Payment will be made under:

Item MST-03-4.1 Construction Engineering -- per lump sum

END OF ITEM MST-03

ITEM MST-04

NON-DIRECTIONAL BEACON DEMOLITION

GENERAL

04-1.1 This specification describes the requirements for the demolition of the Non-Directional Beacon. The demolition includes the removal of the antennas and supports, transmitter enclosure, fence and all foundations, all of which shall become property of the Contractor and responsibly disposed off-Airport property. Underground power shall be abandoned in place, except in areas where the proposed grading conflicts. The transmitter shall be salvaged and turned over to the Engineer. Power to the NDB cannot be disconnected until the antenna towers have been dismantled, as the obstruction lights must be lit while the towers are in place.

MATERIALS AND INSTALLATION

04-2.1 Site Restoration. Following removal of the Non-Directional Beacon antennas and supports, transmitter enclosure, fence and all foundations, the site shall be restored by backfilling and grading per the P-152 specification. Positive drainage must be maintained. The site shall be seeded per specification T-901 and mulched per specification T-908. Quantities associated with the Non-Directional Beacon site restoration shall be paid for using the pay items listed in the respective specifications (P-152, T-901, and T-908).

METHOD OF MEASUREMENT

04-3.1 Non-Directional Beacon demolition shall be measured by the lump sum, complete.

BASIS OF PAYMENT

04-4.1 The accepted Non-Directional Beacon demolition will be paid for at the contract unit price per lump sum when completed. This price shall be full compensation for removal and responsible off-Airport disposal of the towers, structures and foundations, and for backfilling foundations; and for all labor, equipment, tools and incidentals necessary to complete the demolition per the contract documents. No separate payments will be made.

Payment will be made under:

Item MST-04-4.1 Demolish Non-Directional Beacon – per lump sum

END OF ITEM MST-04

ITEM MST-05 MOBILIZATION/DEMOBILIZATION

DESCRIPTION

05-1.1 Mobilization and Demobilization shall consist of all work necessary for the movement of personnel and equipment to and from the project site and for the establishment and removal of all Contractor's staging area, equipment storage areas, haul routes, field offices, buildings, and other facilities necessary to the performance of the work.

LIMITATIONS

05-2.1 For the purpose of measurement and payment, this item will be limited to the schedule listed in General Provision Section 105-2.

METHOD OF MEASUREMENT

05-3.1 No measurement will be made.

BASIS OF PAYMENT

05-4.1 This work will be paid for at the contract lump sum price for "Mobilization and Demobilization," which price shall include materials, equipment, tools, labor, transportation, operations and all work incidental thereto.

Payment will be made under:

Item MST-05-4.1 Mobilization/Demobilization -- per lump sum

END OF ITEM MST-05

ITEM MST-06 STATE OF OHIO DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS

ITEM 451, REINFORCED PORTLAND CEMENT CONCRETE PAVEMENT

DESCRIPTION

06-1.1 It is the intent that the construction and materials specifications for items so designated in the plans conform to the State of Ohio Department of Transportation (ODOT) Standard Specifications, and ODOT Standard Specifications are hereby included in these specifications by reference. Unless stated otherwise, the most recent State of Ohio Department of Transportation Standard Specifications shall apply to all ODOT referenced items.

If there is a conflict between the Ohio Department of Transportation Standard Specifications and the contents of the General Provisions, Supplemental General Provisions, Technical Provisions, or Supplemental Technical Provisions of these specifications, the General Provisions, Supplemental General Provisions, Technical Provisions, and Supplemental Technical Provisions shall govern.

DEFINITION OF TERMS

06-2.1 Deviations from the requirements of ODOT Items are as follows:

a. “Department” shall mean the Engineer or Owner’s representative

b. “Commissioner” shall mean Engineer

c. “Engineer” shall mean the designated representative of the Owner

d. “Laboratory” shall mean the Engineer or the Owner’s designated testing firm

e. “Owner” shall mean Delaware Municipal Airport

f. “Division of Materials and Tests” shall mean the Engineer

g. “State” shall mean the Owner

06-2.2 The following provisions of ODOT Item 451, Reinforced Portland Cement Concrete Pavement are revised as follows:

451.02 Recycled Concrete (Class RLA) will not be allowed.

451.03 Deleted

451.09 Joints Joints shall be installed per the details in the drawing set.

451.13 Deleted.

451.14 Deleted.

451.15 Deleted.

451.17 Deleted.

MATERIALS

06-3.1 The Contractor shall perform the mix design and establish the job-mix formula which shall be submitted to the Engineer for approval at least 14 calendar days prior to start of paving.

END OF ITEM MST-06

ITEM 451 REINFORCED PORTLAND CEMENT CONCRETE PAVEMENT

451.01 Description. This work consists of constructing a pavement composed of reinforced portland cement concrete on a prepared surface.

451.02 Materials. Furnish materials conforming to:

Concrete,
either Class QC 1, QC MS, QC FS..... 499
* Class RCA..... Supplement 1117
Joint sealer..... 705.04
Preformed filler..... 705.03
Curing materials..... 705.05, 705.06, 705.07 Type 2
Tiebar steel, epoxy coated..... 709.00
Reinforcing steel..... 709.09, 709.10, 709.12
Dowel bars and basket assemblies..... 709.13

* Use of Recycled Concrete aggregate as part of a concrete mix can be accepted with conformance to Supplement 1117

451.03 Pavement Quality Control. When the concrete pavement bid item includes "with QC/QA", provide complete quality control of the concrete manufacturing, placing and curing operations and quality control testing of the work conforming to Item 455. The Engineer will review and accept the plan prior to beginning of any paving operations.

When the concrete pavement bid item includes "with QC/QA" the Engineer will perform Quality Assurance conforming to Item 455.

451.04 Equipment. Furnish self-propelled spreading and finishing machines capable of consolidating and finishing the concrete and producing a finished surface meeting the requirements specified.

Construct pavement using either fixed forms or slip form paving equipment that conforms to the following:

A. Fixed Form Construction. Spread, screed, and consolidate concrete using one or more machines between previously set side forms. Furnish an adequate number and capacity of machines to perform the work at a rate equal to the concrete delivery rate. Furnish machines capable of uniformly distributing and consolidating the concrete without segregation.

Provide machines capable of operating on two side forms, on adjacent lanes of pavement and one side form or on two adjacent lanes as necessary. When placing concrete adjacent to an existing pavement lane, take measures to protect the adjacent pavement from damage. Remove from the work any machine that causes displacement of the side forms from the line or grade or causes undue delay, as determined by the Engineer, due to mechanical difficulties.

Finish small or irregular areas that are inaccessible to finishing equipment using other methods as approved by the Engineer. Accomplish vibration of these areas using hand held or machine mounted internal vibrators. Continue vibration to achieve adequate consolidation, without segregation, for the full depth and width of the area placed.

Use straight edge side forms made of steel and of a depth equal to the specified pavement thickness. Do not use bent or damaged side forms or forms with damaged joint locks or pin pockets. Provide forms in sections of not less than 10 ft (3 m) in length without horizontal joints in the height of the form. Utilize forms with a nominal base width of at least 3 inches (75 mm). Assure forms are capable of supporting the paving equipment without shifting or deforming during paving. Clean and oil all forms each time they are used. If the radius of the circular pavement edge is 100 feet (30 m) or less, use flexible or curved forms of a design acceptable to the Engineer. Provide adequate devices to securely set forms and withstand operation of the paving equipment. Do not use built-up forms except to construct pavement of a specified thickness whose total area for the project is less than 2000 square yards (1650 m^2). Provide forms with adequate joint locks to tightly join ends of abutting form sections together.

B. Slip Form Construction. Place concrete using an industry-standard slip form paver designed to spread, consolidate, screed, and finish the freshly placed concrete in one complete pass of the machine and with a minimum of hand finishing providing a dense and homogeneous pavement.

Consolidate the full width and depth of concrete pavement placed by a single pass of a series of approved internal vibrators operating at a frequency range of 7000 to 11,000 impulses per minute. Attach vibrators to either the spreading or finishing equipment in such a manner that they do not come in contact with preset dowel basket assemblies, the subgrade, reinforcing mesh or side forms. Do not operate vibrators in a manner to cause a separation of the mix ingredients (segregation); i.e., either a downward displacement of large aggregate particles or an accumulation of laitance on the surface of the concrete. Avoidance of segregation of the concrete mix may require reduction in the vibration frequency within the range specified when forward motion of the paver is reduced. Connect the power to all vibrators so that they cease when the machine motion is stopped. Stop paving operations if any vibrator fails to operate within the above specified range.

Provide an electronic monitoring device that displays the operating frequency of each internal vibrator on all paving machines used on mainline and ramp paving. The monitoring device shall have a readout display near the paver operator's controls that is visible to the operator and the Engineer. Operate the monitoring device continuously while paving and display all vibrator frequencies with manual or automatic sequencing among individual vibrators. Using the monitoring system record the following minimum information: time of day, station location, paver track speed, and the frequency of each individual vibrator. Make recordings after each 25 feet (8 m) of paving or after 5-minute intervals of time. If not using a monitoring system with a recorder, make and record readings every 30 minutes. If requested by the Engineer, provide a record of the data.

Electronic vibration monitoring devices are not required for paving machines used to construct shoulders and gores or for any construction project with a total of less than 10,000 square yards (8000 m^2) of pavement. When electronic monitoring devices are not required, use a tachometer or similar device to demonstrate to the Engineer the paving equipment vibration meets specification.

Operate the slip form paver with as nearly a continuous forward movement as possible, and coordinate all operations of mixing, delivering, and spreading concrete to provide uniform progress with minimal stopping and starting of the paver. If for any reason it is necessary to stop the forward movement of the paver, immediately stop the tamping elements. Unless controlled from the machine, do not apply any other tractive force to the machine.

Accurately control the finish grade of the pavement from a pre-set grade line parallel to the finish grade using equipment with controls that will trace the grade line and automatically adjust the grade of the screeds or extension meters.

In areas where adjoining concrete pavement is to be constructed, ensure that the surface at the edge of the pavement on either side of the longitudinal joint does not vary more than 1/4 inch (6 mm) below the typical section. Ensure that the outside edges of the pavement does not vary more than 1/2 inch (13 mm) below the typical section. Ensure that all pavement edges are nearly vertical with no projections or keyways exceeding 1/2 inch (13 mm).

In the area of construction joints placed at the end of the days run, the Engineer will allow a reduction of approximately 2 inches (50 mm) in overall width.

451.05 Setting Forms. Set all forms in conformance to the required grade and alignment and support the entire length of forms on thoroughly compacted material during the entire operation of placing and finishing of the concrete. Set side forms with the top face of the form varying not more than 1/8 inch in 10 feet (3 mm in 3 m) from true plane, and the vertical face varying not more than 1/4 inch in 10 feet (6 mm in 3 m) from true plane. Test the forms for variations from the above requirements and reset the forms as necessary. Do not use loose earth, pebbles, etc., to shim the forms. Immediately before placing concrete, the Engineer will approve the alignment and grade of all forms set.

451.06 Fine Grading of Subgrade or Subbase.

A. Fixed Form Construction. After side forms have been set to line and grade and securely fastened, use a subbase or subgrade planer to remove a slight amount of material and bring the subgrade or subbase to final grade and to a smooth dense condition. Check the subgrade or subbase using a multiple pin template operated on the forms or other methods approved by the Engineer. Correct and retest all high or low spots.

Instead of the above operation, the Contractor may place forms on subbase or subgrade prepared according to 451.06.B.

B. Slip Form Construction. After the subgrade or base is placed and compacted to the required density, use an automatic subgrading machine to cut the areas for pavement and the areas that will support the paving machine to the plan elevation. Construct the grade sufficiently in advance of placing the concrete to permit the Engineer to check the grade.

451.07 Placing Concrete. When constructing on subbase or subgrade, immediately before placing concrete, bring the subgrade or subbase to a thoroughly moistened condition by sprinkling with water at such times and in such manner as directed by the Engineer.

When constructing on asphalt concrete, coat the asphalt concrete with curing membrane at least one day prior to placing concrete. Apply the curing membrane at a minimum rate of 1 gallon (1 L) for each 150 square feet (3.7 m^2) of surface treated using an approved self-propelled mechanical sprayer. Provide an adequate shield to protect the fog spray from the wind. Thoroughly agitate the curing material before use.

Deposit concrete on the grade in a manner that requires as little rehandling as possible. Do not allow workers to walk in the freshly mixed concrete unless wearing clean boots or shoes free of earth or any foreign material.

At expansion and contraction joints, deposit concrete near the joints to ensure the dowel basket assemblies are not disturbed. Do not allow concrete to discharge onto any dowel basket assembly unless the hopper is well centered on the assembly. Use a separate internal vibrator to consolidate concrete around dowel basket assemblies.

Provided the curing compound damage caused by sawing is repaired according to 451.11 and to the Engineer's satisfaction, the Contractor may operate the sawing equipment necessary to saw joints on the newly constructed pavement. Do not operate other mechanical equipment upon existing lane of pavement for seven days and specimen beams attain a modulus of rupture of 600 psi (4.2 MPa). If only finishing equipment is carried on an existing lane, paving may be permitted after that lane has been in place for at least 3 days and after specimen beams shall have attained a modulus of rupture of 500 psi (3.5 MPa).

When the width of pavement being placed in one operation is 12 feet (3.6 m) or more and the total area of any given width of pavement on the project exceeds 10,000 square yards (8300 m^2), use a separate standard manufacture, self-propelled concrete placer/spreader that receives concrete into a hopper adjacent to the area to be paved and delivers the concrete in front of the slipform paver and uniformly spreads the concrete at the proper thickness for the full width being paved. When a slipform paver is equipped with a dowel bar inserter the separate placer/spreader requirement may be waived provided the concrete is delivered in front of the slipform paver at a consistent and uniform thickness for the full width being paved and the slipform paver is capable of spreading, consolidating, screeding, and float finishing the freshly placed concrete. Provide the Engineer documentation that the slipform paver will meet this specification.

Do not mix, place, or finish concrete after dark without operating an adequate and approved lighting system.

When the air temperature is 35 °F (2 °C) or below, assure the concrete has a temperature of between 50 and 80 °F (10 and 27 °C) at the point of placement.

When the air temperature is greater than 35 °F (2 °C) before placing, maintain a concrete temperature of not more than 95 °F (35 °C).

Do not place concrete on any surface that is frozen or has frost.

Make two test beams from each 7500 square yards (6300 m^2) of concrete or fraction thereof incorporated in the work each day.

451.08 Placing Reinforcement. Place pavement mesh of the size and at the locations within the concrete slab shown on the standard construction drawings. When placing reinforced concrete pavement in two layers, strike off the entire width of the bottom layer to a length and depth that allows laying the mat of reinforcement on the concrete and in its final position without further manipulation. After installing reinforcement directly upon the concrete, place, strike off, and screed the top layer of concrete. When reinforced concrete pavement is placed in one layer and in advance of placing concrete, position and securely anchor the reinforcement to the underlying base or pavement. As an alternative, after spreading the concrete and while it is in a plastic condition, use mechanical or vibratory means to place reinforcement in the concrete.

Where reinforcement is overlapped, securely fasten mats of reinforcement together at the edges of the sheets and at two additional points along the lap. Use reinforcing steel free from dirt, oil, paint, and grease.

451.09 Joints. Unless otherwise directed, construct all transverse joints normal to the centerline of the pavement lane and of the type, dimensions, and at locations specified.

Determine contraction and longitudinal joint sawing time limits to protect the concrete from early cracking by using HIPERPAV software. Obtain the software according to Supplement 1033.

Twenty four (24) hours before placing concrete pavement create a HIPERPAV project date file according to Supplement 1033.

Provide the completed file and the printout to the Engineer. When HIPERPAV predicts early age slab cracking will occur, whether due to standard construction practices, joint sawing methods, mix design or curing, either do not start construction until modifications have been made to eliminate HIPERPAV's predicted slab cracking or do not pave.

Perform a HIPERPAV analysis for each pour.

If software analysis determines joint sawing could exceed twenty four (24) hours, assure all joints are sawed by the 24th hour.

A HIPERPAV analysis showing paving can proceed does not eliminate the requirements of 451.17.

Accurately mark the correct locations of all joints that will be saw cut along both edges of the pavement. Ensure the method of marking remains clearly visible after the paver passes and until the joint saw cut is completed.

A. Longitudinal Joint. Construct longitudinal joints between simultaneously placed lanes by sawing.

When a standard (water cooled diamond bladed) concrete saw is used to make the longitudinal joint between simultaneously placed lanes, saw the joint within the timeframe provided in the HIPERPAV output. For pavement less than or equal to 10 inches (255 mm), saw the joint to a minimum depth of one-fourth the specified pavement thickness. For pavements greater than 10 inches (255 mm) thick, saw the joint to a minimum depth of one-third the specified pavement thickness. Saw joints 1/4 ± 1/16 inch (6 ± 1.6 mm) wide measured at the time of sawing.

When using early-entry (dry cut, light weight) saws to make the longitudinal joint between simultaneously placed lanes, only use saw blades and skid plates as recommended by the saw manufacturer for the coarse aggregate type being used in the concrete. Perform the early-entry sawing after initial set and before final set. Saw the joint 1/8 inch (3 mm) wide and 2 1/4 to 2 1/2 inches (56 to 63 mm) deep.

Place deformed epoxy coated steel tiebars or the epoxy coated hook bolt alternate (wiggle bolt) with epoxy coated coupling, in longitudinal joints during consolidation of the concrete. Install them at mid-depth in the slab by approved mechanical equipment. As an alternate procedure, rigidly secure them on chairs or other approved supports to prevent displacement. Provide tie bars or wiggle bolts of the size and spaced as shown on the standard construction drawings. If used, securely fasten hook bolts or wiggle bolts with couplings to the form at the longitudinal construction joint as shown on the standard construction drawings.

B. Transverse Joints

Unless otherwise directed, construct all transverse joints normal to the centerline of the pavement lane and of the type, dimensions, and at locations specified.

For all transverse joints, install round, straight, smooth, steel dowel bars of the size shown in Table 451.09-1.

TABLE 451.09-1 DOWEL SIZE

Thickness of Pavement (T)	Diameter of Steel Dowel
Less than 8 1/2 inches (215 mm)	1 inch (25 mm)
8 1/2 to 10 inches (215 to 255 mm)	1 1/4 inches (32 mm)
Over 10 inches (255 mm)	1 1/2 inches (38 mm) or as shown on the plans

Within 2 hours prior of placing concrete coat the full length of all dowels with a thin uniform coat of new light form oil as a bond-breaking material.

Load Transfer Assemblies.

Use load transfer (dowel basket) assemblies in transverse contraction joints conforming to and placed according to the standard drawings to hold the dowels in a position parallel to the surface and centerline of the slab at mid-depth of the slab thickness.

Preset all dowel basket assemblies before the day's paving unless the Engineer determines complete presetting is impractical.

Completely install dowel basket assemblies before shipping and spacer wires are removed.

Immediately before paving, remove all shipping and spacer wires from the dowel basket assemblies; check the dowel basket assemblies are held firmly in place; check the dowels are parallel to the grade and parallel to centerline of pavement.

For each joint assembly used to hold dowels in position, provide a continuous assembly between longitudinal joints or between the longitudinal joint and pavement edge. Drive at least eight 1/2-inch (13 mm) diameter steel pins a minimum of 18 inches (460 mm) long at an angle to brace the assembly from lateral and vertical displacements during the placing of concrete. Drive two of these pins opposite each other at each end of the assembly, and drive the remaining pins in staggered positions on each side of the assembly. Where it is impractical to use the 18-inch (460 mm) length pins, such as where hardpan or rock is encountered, and provided the assembly is held firmly, the Engineer may authorize use of shorter pins. Where the dowel basket assembly is placed on granular material that may allow settlement or distortion, anchor the assembly with a combination of pins and steel plates, or by some other means satisfactory to the Engineer to prevent settlement.

When concrete pavement is placed on an existing concrete pavement or on a stabilized base, secure dowel basket assemblies from lateral and vertical displacement during concrete placement using power-driven fasteners and appropriate clips or pins driven in predrilled holes of a diameter slightly less than the pin diameter. Use either of the above methods or a combination of the two in sufficient numbers to adequately secure the basket assemblies.

Where widths other than 12 feet (3.6 m) are specified, the Contractor may use standard dowel basket assemblies with dowel spacings adjusted as follows. Maintain 6-inch (150 mm) dowel spacing at the longitudinal joint and increase the spacing at the outer edge of the lane up to 12 inches (300 mm). Where an odd width of lane occurs and if the standard dowel basket assembly would provide for a space exceeding 12 inches (300 m), place a dowel 6 inches (150 mm) from the outer edge of the lane). Hold such a dowel rigidly in proper position by a method satisfactory to the Engineer or cut and splice a dowel basket assembly of greater length than required to attain the required length.

Slip Form Paver with Mechanical Dowel Bar Inserter.

The Contractor may propose to use a slip form paver with mechanical dowel bar inserter (DBI) to place dowels in transverse contraction joints the full thickness of pavement and spaced per the requirements of the standard construction drawings. Submit details and specifications of the proposed equipment to the Engineer at least 14 calendar days prior to mobilizing the equipment to the project.

The use of any slip form paver with DBI is allowed only after acceptable performance is demonstrated with a test section and approved by the Engineer. Continued verification during all contract paving is required for each production day as detailed below.

Provide all equipment, perform all testing, and evaluate the slip form paver with DBI as detailed in the following sections.

1. MIT Scan-2 Equipment and Reporting

Provide MIT Scan-2 equipment to determine the location of dowel bars in either fresh or hardened concrete including horizontal and vertical alignment, side shift, depth, and horizontal translation.

Provide equipment for determining dowel bar alignment that has an onboard computer that runs the test; collects and stores the test data on a memory card; performs the preliminary evaluation; and provides a printout of results immediately after scanning. Provide MagnoProof software to provide a detailed report of all required alignment parameters in an Excel spreadsheet and a graphical color representation.

Ensure the equipment is properly calibrated per the manufacturer's specifications. Establish a standard protocol for scanning direction.

Provide trained personnel to operate the equipment.

Provide a print out, at the time of scanning, for horizontal translation, longitudinal translation, depth, horizontal rotation and vertical rotation for each bar in each joint. Provide a complete report to the Engineer at the completion of scanning with all data provided in the manufacturer's native file format as well as all calibration files. Include the standard report generated using the MagnoProof software in Excel format and with color graphical representation of each joint. Include in the report project contract number, county-route-section,

placement date, scan date, station location and lane, joint ID number, name of operator, and all required alignment parameters.

2. Acceptance/Rejection

The required dowel bar tolerances are given in Table 451.09-2. Dowel bar alignment is measured as detailed below. Any dowel bar exceeding any Acceptance Tolerance in Table 451.09-2 is considered misaligned. Rejection Criteria is in absolute inches.

Table 451.09-2

Dowel Bar Tolerances

Alignment Parameter	**Acceptance Tolerance (inches)**	**Rejection Criteria (inches)**
Horizontal Translation [a]	±0.50	±2
Longitudinal Translation [b]	±2.0	±2.30
Depth Translation [c]	±0.50	±0.66
Horizontal Rotation [d]	±0.50	±0.70
Vertical Rotation [e]	±0.50	±0.70

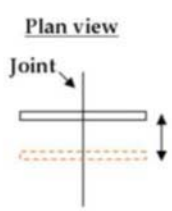
a. Horizontal Translation - the total difference, measured horizontally, between the actual dowel bar location and the plan required dowel bar location along the transverse contraction joint.

b. Longitudinal Translation - the total difference, measured in the longitudinal direction, from the center of the transverse contraction joint to the actual dowel bar center. Also termed as “side shift”.

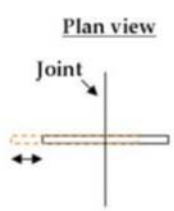
c. Depth - the total difference, measured vertically, between the actual dowel bar location and the mid-depth of the slab.

d. Horizontal Rotation - the total difference, measured from end to end of a dowel bar, of the dowel in the horizontal plane.

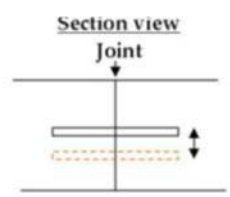
e. Vertical Rotation - the total difference, measured from end to end of a dowel bar, of the dowel bar in the vertical plane.



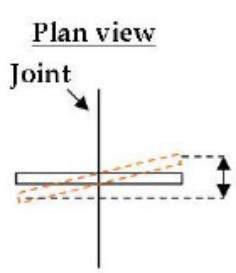
Horizontal Translation

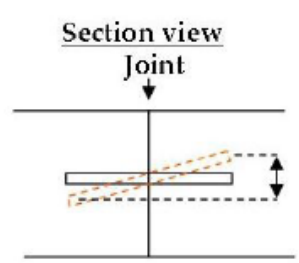


Longitudinal Translation



Depth





Horizontal Rotation Vertical Rotation

Perform a Joint Score Analysis per CPTP Tech Brief *Best Practices for Dowel Placement Tolerances* (FHWA-HIF-07-021) for every joint. Joint Score is a measure of the combined effects of rotational misalignment. Calculate the Joint Score: determine the square root of the sum of the squares of the Horizontal Rotation and Vertical Rotation of each dowel in the joint; assign a Weight for each misalignment category for each bar; sum the product of the Weight and the number of bars in each misalignment category and add 1.

Include the Joint Score for every joint scanned in the report to the Engineer.

3. Test Section

Prior to production use, perform a minimum 500-feet test section when using a slip form paver with DBI for acceptance of the machine. Evaluate all joints (all bars in each joint) for required dowel alignment using the MIT Scan-2. Do not place additional pavement until the slip form paver is accepted for use on the project.

a. Evaluation and Acceptance

The slip form paver and DBI can be accepted by the Engineer if one of the following requirements is met.

Ninety-Five (95%) of the dowels in every test section are within the Acceptance Tolerances.

Each Joint Score is less than 10, and there is no Horizontal Rotation or Vertical Rotation greater than the Rejection Criteria, and the Longitudinal Translation and Depth all of bars are within the Acceptance Tolerances.

Reject any slip form paver and DBI not meeting the above requirements. Repair or replace any rejected slip form paver and DBI and repeat the test section.

Perform corrective action of all joints in the test section as per Section 5 below.

Perform the test strip for any new slip form paver and DBI that will be used for any contract item of work. New test strips are required at the beginning of every construction season; after major paver maintenance/repairs; at mobilization and remobilization to a project, after major concrete mix design changes; and as required by Section 4 of this specification.

4. Paving

When using the accepted slip form paver and DBI for any contract item of work, scan 10% of all joints (all dowels in the joint), randomly selected by the Engineer. Run additional scans as needed. Perform scanning, calculate the Joint Score, and submit the completed report to the Engineer within 24 hours of each day's production. The Engineer may accept an initial report to determine whether paving can continue.

Continue paving ONLY if one of the following requirements is met:

All Joint Scores are less than 10 and all other alignment parameters are less than the Rejection Criteria.

Isolated Joint Scores greater than 10 are allowed if dowel bar Longitudinal Translation and Depth are less than the Rejection Criteria and there are three (3) joints ahead and behind the joint with Joint Scores of less than 10 (with Longitudinal Translation and Depth less than the Rejection Criteria).

Discontinue paving, repair or replace the slip form paver and DBI, and repeat the Test Section when the above requirements are not met.

Investigate and fix any accepted slip form paver with DBI that exhibits systematic misaligned dowel bar installations.

5. Corrective Action

The following conditions require removal and replacement per SCD BP-2.5:

Any Joint Score greater than 10 that does not meet the above criteria for continuing paving.

Any joint where the dowel Longitudinal Translation is greater than the Rejection Criteria in the first 4 dowels from a longitudinal joint.

Any joint where the dowel Depth deviation is greater than the Rejection Criteria in the first 4 dowels from a longitudinal joint.

Any joint where the dowel Horizontal deviation is greater than the Rejection Criteria in the first 4 dowels from a longitudinal joint.

C. Expansion Joints. Where a pressure relief joint is not provided adjacent to a bridge structure, construct expansion joints at the first two regularly spaced joint locations adjacent to the bridge approach slab on each side of the bridge. If the pavement is constructed in two or more separately placed lanes, construct the transverse expansion joints in a continuous line for the full width of the pavement and shoulders.

Construct expansion joints according to the standard construction drawings. Install the face of the expansion joint perpendicular to the concrete surface except when expansion joint is installed at a skewed bridge approach slab.

Use round, straight, smooth, steel dowels, and within 2 hours of placing concrete, coat the dowels with a thin uniform coat of new light form oil as a bond-breaking material to provide free movement. After coating the dowel, install a sleeve of metal or other approved material approximately 3 inches (75 mm) long, with crimped end, overlapping seams fitting closely around the dowel, and a depression or interior projection to stop the dowel a sufficient distance from the crimped end to allow 1 inch (25 mm) for longitudinal dowel movement with pavement expansion on one free end of each dowel. If approved by the Engineer, use other means to allow for 1 inch (25 mm) of expansion.

Punch or drill proper size dowel holes into the preformed expansion joint filler to assure a tight fit around each dowel.

Form a 1-inch (25 mm) wide and 1-inch (25 mm) deep opening on top of the expansion joint filler and seal this opening with 705.04 joint sealers.

D. Contraction Joints. For pavement less than or equal to 10 inches (225 mm) thick, saw contraction joints with a standard (water cooled diamond bladed) concrete saw to a minimum depth of one-fourth of the specified pavement thickness. For pavement greater than 10-inches (255 mm) thick, saw contraction joints to a minimum depth of one-third the specified pavement thickness. When cutting joints using a standard (water cooled diamond blade) saw assure the joint is 1/4 ± 1/16-inch (6 ± 1.6 mm) wide when measured at the time of sawing.

When using the option of early-entry (dry cut, light weight) saws, only use saw blades and skid plates as recommended by the saw manufacturer for the coarse aggregate type being used in the concrete. Perform the early entry contraction joint sawing after initial set and before final set. Saw the contraction joint 2-1/4 to 2-1/2-inches (56 to 63 mm) deep. Ensure any early entry saw joints are approximately 1/8-inch (3 mm) wide at the time of sawing.

If the pavement is constructed in two or more separately placed lanes, install the joints continuous for the full width of the pavement. Saw the pavement with sawing equipment approved by the Engineer as soon as the saw can be operated without damaging the concrete. Provide saws with adequate guides, blade guards, and a method of controlling the depth of cut. After wet sawing, clean the joint using a jet of water. After dry sawing clean the joint using air under pressure. During sawing of contraction joints, maintain a standby saw in working condition with an adequate supply of blades.

E. Construction Joints. Install dowelled construction joints at the end of each day's work and when work is suspended for a period of more than 30 minutes.

Use dowels in transverse construction joints. Within 2 hours of placing concrete, coat the free half of all dowels with a thin uniform coat of new light form oil. Use an adequate bulkhead, with openings provided for dowel bars spaced as specified and shaped to fit the typical section of the pavement, to form a straight joint. During placing of concrete, hold dowels rigidly in position.

Locate construction joints at or between contraction joints. If located between contraction joints, construct the construction joint no closer than 10 feet (3 m) to the last contraction joint.

451.10 Finishing. Use 10-foot (3 m) straightedges to continually check the finished concrete surface for trueness. If the pavement surface is dragged with a diagonal pipe float machine, occasionally check the surface while the concrete is plastic. Do not add water to aid finishing.

Before the concrete initially sets, round the edges of the pavement along each side of each slab and on each side of transverse expansion joints to the radius specified using an approved edging tool. Before texturing the surface, eliminate tool marks left by the edging tool.

Texture the surface in the longitudinal or transverse direction using a broom to produce a uniform, gritty, texture. Immediately following the broom drag texture, tine the pavement in the longitudinal direction using an approved device that produces uniform tine spacing 3/4-inch wide (19 mm), 1/8-inch deep (3 mm) and 1/8-inch wide (3 mm). Do not tine within 3 inches (75 mm) of pavement edges or longitudinal joints. Only use equipment

that will tine the full width of the pavement in one operation and uses string line controls for line and grade to ensure straight tining texture.

Use transverse tining in small areas only with the approval of the Engineer. Use equipment that produces a random pattern of grooves, 0.05 to 0.08-inch (1.3 to 2.0 mm) deep and 0.10-inch (3 mm) wide, spaced at 3/8 to 1-3/4 inches (10 to 45 mm), with 50 percent of spacings less than 1 inch (25 mm).

Demonstrate to the Engineer methods to assure the groove depth meets this specification.

Before the concrete finally sets, impress complete station numbers into the pavement every 100 feet (50 m), e.g., 1+00 (2+050). Mark station equations in the pavement as shown on the plans. Ensure that the numerals are 3 to 4 inches (75 to 100 mm) high and 1/4 inch (6 mm) deep. Place the station numbers parallel with and facing the right edge of the pavement, and centered 12 inches (0.30 m) in from the right edge. On divided highways, provide station numbers on both pavements. When placing concrete shoulders with the traveled lane, place station numbers 12 inches (0.30 m) in from the outside edge of the shoulder and facing the pavement.

451.11 Curing. Immediately after the finishing operations have been completed and after all free water has dissipated, spray and seal all exposed concrete surfaces with a uniform application of curing membrane in such a manner as to provide a continuous uniform film without marring the surface of the concrete. Apply a minimum of 1 gallon (1 L) of material for each 150 square feet (3.7 m^2) of surface treated using an approved self-propelled mechanical sprayer. Provide an adequate shield to protect the fog spray from the wind. Before each use, thoroughly agitate the curing material.

On pavement with integral curb or small and irregular areas that are inaccessible to the mechanical spray machine, apply the curing material by a hand-held sprayer.

As soon as the forms have been removed, immediately correct all honey-comb areas and coat the edges of the pavement with the curing material.

Respray all areas of curing material film damaged during the sawing of joints.

The Contractor may water cure concrete with wet burlap cloth, waterproof paper, or polyethylene sheeting. Apply curing as soon as possible and without marring the concrete surface. Unless the specimen beams have attained a modulus of rupture of 600 psi (4.2 MPa) keep the entire surface of the top and sides of the newly placed concrete covered for seven days. Protect concrete from freezing until beams attain a strength of 600 psi (4.2 MPa).

The above requirements for curing are minimum requirements only. Repair or replace all concrete showing injury or damage due to noncompliance to curing requirements at no additional cost to the Department.

451.12 Removing Forms. Remove forms in a manner that doesn't damage the pavement.

451.13 Surface Smoothness. After final concrete curing and cleaning the pavement surface, test the pavement surface for smoothness using a 10-foot (3 m) rolling straightedge. Provide a two or four-wheeled device 10 feet (3 m) in length with an indicator wheel at the center which detects high and low areas in the pavement surface. Provide equipment which actuates a pointer scale, an audio alert, or marks the pavement with paint or dye when encountering any high or low areas in excess of a preset tolerance. Tow the 10-foot (3 m) rolling straightedge or walk the equipment over the completed pavement. Test all wheel paths in the presence of the Engineer. Locate wheel paths parallel to the pavement centerline and approximately 3 feet (1 m) measured transversely inside all lane edges. Maintain alignment of the 10-foot (3 m) rolling straightedge with reference to the pavement edge at all times. Other devices such as approved profilers conforming to S1058 and using ProVAL software may be used with approval of the Engineer.

Correct all surface variations so indicated to within the specified tolerance and in a manner that provides a surface texture conforming to 451.10. For corrective grinding provide equipment conforming to 451.14. Ensure pavement surface variations do not exceed 1/8 inch in a 10-foot (3 mm in a 3 m) length of pavement. For ramp pavements and for those pavements with curvature greater than 8 degrees, or with grades exceeding 6 percent, ensure the surface variations do not exceed 1/4 inch in 10 feet (6 mm in 3 m).

Repair or replace sections of pavement containing depressions that cannot be corrected by grinding as directed by the Engineer.

451.14 Profile Grinding. To correct surface variations exceeding tolerances specified in 451.13 use grinding equipment conforming to Item 257.

451.15 Pavement Grooving Corrections. When pavement tining locations are found out of conformance with 451.10 restore the tining using power driven, self-propelled machines specifically designed to groove

concrete pavement with diamond impregnated blades or diamond impregnated cylinder rings. Furnish blades or cylinder rings mounted on an arbor head so that the resulting grooves comply with 451.10. Furnish grooving equipment with a depth control device that will detect variations in the pavement surface and enable adjustment of the cutting head to maintain the specified groove depth.

If a pavement area was diamond ground to bring the pavement's surface smoothness within the tolerances of 451.13, that pavement area does not require tining restoration conforming to 451.10.

Vary from these requirements only for small areas and only with written permission from the Engineer.

451.16 Sealing Expansion Joints. As soon as feasible after completing sawing, but before the pavement is open to construction equipment and traffic, seal expansion joints with material conforming to 705.04. Just before sealing, thoroughly clean each joint of all foreign material, using approved equipment. Ensure the joint faces are clean and dry when the seal is installed.

451.17 Opening to Traffic. When 7 days have elapsed, the Contractor may use the completed pavement for traffic, including construction traffic. If a modulus of rupture of 600 psi (4.2 MPa) has been attained, the Contractor may open the pavement to traffic when 5 days have elapsed. If necessary to open a portion of the pavement in less than 5 days, with the proviso that the pavement will be cured for a minimum of 3 days, use a high early strength concrete composed of additional 701.04 or 701.05 cement, or non-chloride accelerating admixture to obtain a modulus of rupture of 600 psi (4.2 MPa) in 3 days or less.

Pavement Repairs before Department Acceptance. Repair diagonally cracked full depth pavement; longitudinally cracked full depth pavement; spalled pavement surfaces and any Portland cement concrete pavement panels with cement balls or mud balls; at no cost to the Department. Repair transverse cracks except do not repair a single hairline transverse crack in the middle third of panels with reinforcing conforming to BP1.1.

Repair transverse or diagonally cracked PCC pavement with a full depth repair according to Item 255 and applicable standard construction drawings. Repair cracks by replacing the pavement the full width between longitudinal joints, perpendicular to the centerline and at least 6 feet (1.8 m) longitudinally. Install smooth dowel bars at the interface between the original pavement and the replaced pavement section. Locate and size the repairs to ensure that the repair limits are at least 7 feet (2.1 m) away from any transverse joint.

Repair longitudinal cracks within 15 inches (380 mm) of a tied longitudinal joint by routing and sealing the crack according to Item 423. For other longitudinal cracks, repair the same as for transverse or diagonal cracks stated above.

Repair spalled pavement with Item 256 Bonded Patching of Portland Cement Concrete Pavement.

Repair cement balls or mud balls by coring out the area, full depth, with a diamond core bit and replacing the removed concrete with the same concrete as in the pavement. Remove and replace any pavement panel with 5 or more cement balls or mudballs. Locate the limits of the repair along the longitudinal joints and at least 1-foot (0.3 m) past the transverse joints to remove any existing dowel bars. Install smooth dowel bars at the transverse limits of the repairs. Install Type D (Drilled Tied Longitudinal) Joint along the longitudinal limits.

451.18 Pavement Thickness and Concrete Strength.

A. Thickness. As determined by measurement of cores cut as specified in this section, construct the concrete not more than 0.2 inch (5 mm) less than the specified thickness. Core pavement at the direction of the Engineer and at locations the Engineer determines according to Supplement 1064.

For the purpose of coring, the Department will consider the entire pavement area of a specified thickness a lot. To determine the number of cores, each pavement lot will be divided into sublots. A sublot consists of 2000 yd2 (1650 m2) of a pavement lot or major fraction thereof.

Take one random core for each sublot but not less than 3 cores for any pavement lot cored. If a core shows a deficiency in thickness of more than 1/2 inch (13 mm) from the specified thickness take additional cores to determine the limits of the deficiency. Follow the procedures below:

1. Take a core five (5) feet (1.5 m) longitudinally on both sides of the deficient core. If both the cores are less than 1/2-inch (13 mm) deficient in thickness the zone of deficiency has been determined.

2. If either or both 451.18.A.1 cores are more than 1/2 inch (13 mm) deficient in thickness, cut a core 50 feet (15 m) longitudinally from the deficient core(s). If the 50 foot (15 m) core(s) is more than 1/2 inch (13 mm) deficient, cut additional cores at 100 foot (30 m) longitudinal intervals until a core is less than 1/2 inch (13 mm) deficient; until the pavement ends; or until overlapping an adjacent pavement sublot's core in the same lane.

3. If a pavement sublot has cores more than 1/2 inch (13 mm) deficient in thickness and the sublot's constructed width is greater than 12 feet (3.6 m) obtain cores transverse to the location of the deficient cores. Obtain transverse cores at a location 1/2 the distance from the deficient core to the furthest edge of pavement. Obtain a transverse core for each core more than 1/2 inch (13 mm) deficient.

4. The Engineer will use the cores that measure less than 1/2 inch (13 mm) deficient in thickness to define the limits of the deficiency.

If any deficient core is greater than 1 inch (25 mm) deficient in thickness determine the limits of over 1 inch (25 mm) deficiency by following 451.18.A.1 thru 4 to determine the limits. Remove and replace those areas greater than 1 inch (25 mm) deficient in thickness.

The Engineer will calculate average thickness of concrete pavement placed as follows:

When zones of deficient thickness greater than 1/2 inch (13 mm) to 1 inch (25 mm) are allowed to remain in place, the Engineer will calculate two average thicknesses. A Project Average Thickness (PAT) including all cores not more than 1/2 inch (13 mm) deficient. Cores that exceed the specified thickness by more than ½ inch (13 mm) will be considered as the specified thickness plus 1/2 inch (13 mm) when calculating the PAT. A second Deficient Zone Average (DZA) will include all cores with thickness deficiency greater than 1/2 inch (13 mm) to 1 inch (25 mm). The pavement represented by each of the two averages, PAT or DZA, will be calculated and paid separately.

The Engineer will determine and apply deductions to each separately placed width of pavement.

For any pavement areas removed and replaced, re-core those areas replaced following this section of the specifications. Include those core values into the calculations for average pavement thickness.

Unless the Director requests, do not core any widening less than 5 feet (1.5 m) in width or any pavement area less than 2000 square yards (1650 square meters).

Fill all core holes with concrete of the same proportions and materials used in the pavement.

B. Strength. Obtain an additional core at the same location as the thickness core from each pavement sublot to determine compressive strength. .

For concrete pavement bid items "with QC/QA", the AMRL accredited laboratory will test the QC cores for compressive strength according to ASTM C 42. Test the QC cores from 28 to 90 days of age. Notify the Engineer when the QC cores will be tested.

The Engineer will require one QA core for every 10 sublots for verification testing of compressive strength. Obtain the QA core from the same location as the QC core tested for compressive strength. At least one QA core will be required per lot. Provide the QA cores to the Engineer for testing at the Department's laboratory. Notify the Engineer of the date that the corresponding QC core will be tested. The QA cores will be tested on the same date. The Engineer will verify the QC cores versus the QA cores according to 455.

Calculate an average and standard deviation for each lot according to Supplement 1127. Determine the pay factors according to Table 451.19-2.

Do not calculate an average and standard deviation for high-early strength concrete QC cores. Determine the pay factors for individual sublots according to Table 451.19-2.

For concrete pavements bid items "without QC/QA", the Department will perform the strength testing. Provide the Engineer with the cores for strength testing. Pay factors for sublot cores will be calculated based on the high-early strength concrete pay factors in Table 451.19-2.

451.19 Price Adjustments. Payment will be made at the unit bid price upon completion of any section of pavement. Final pay adjustments to the bid price will be made upon completion of the pavement operations and all thickness, strength and smoothness data is tabulated and pay adjustments applied per 451.19.A thru 451.19.D.

A. Pavement Thickness. Price adjustments for thickness deficiencies will be calculated according to the Table 451.19-1

TABLE 451.19-1	
CONCRETE PAVEMENT THICKNESS PAY FACTOR (PF_T)	
Deficiency in Thickness as Determined by Cores	**Proportional Part of Contract Price**
0.0 to 0.2 inch (0.0 to 5 mm)	100 percent
0.3 to 0.5 inch (6 to 13 mm)	$Ratio\left[\frac{PAT}{PST}\right]^6$
0.6 to 1.0 inch (15 to 25 mm)*	$Ratio\left[\frac{DZA}{PST}\right]^6$
Greater than 1.0 inch (25 mm)	Remove and replace

* The District Construction Engineer will determine whether pavement areas from 0.6 inch (15 mm) up to 1 inch (25 mm) deficient in thickness will be allowed to remain in place at the reduced price or must be removed and replaced.

PAT = Project Average Thickness

PST = Plan Specified Thickness

DZA = Deficient Zone Average

B. Concrete Strength. Record the compressive strength results for each sublot of concrete. High-early strength mixes, QC MS and QC FS, mixes, are calculated separately. Determine the strength pay factor according to Table 451.19-2.

ITEM 499 CONCRETE—GENERAL

499.01 Description. This specification consists of proportioning requirements for Portland concrete mix designs, mixing, and controls of Portland cement concrete.

499.02 Materials. Furnish materials conforming to:

Portland cement..... 701.01, 701.02, 701.04
..... 701.05 and 701.09 or blended cement[1]
Microsilica..... 701.10
Ground granulated blast furnace slag
.... (GGBFS)..... 701.11
Fly ash..... 701.13
Fine aggregate [2][3]..... 703.02
Coarse aggregate[3]..... 703.02, 703.13(4)
Recycled Concrete Aggregate (RCA)..... Supplement 1117
Air-entraining admixture..... 705.10
Chemical admixture for concrete[5]..... 705.12

[1] If blended cement is used, provide mill certification of all the cement and pozzolanic components and final product for approval by the Office of Materials Management

[2] 703.02 natural sand or sand manufactured from stone as specified in Item 703.02.A.3 is required in 255, 256, 451, 452, 526, and 511 deck slabs.

[3] Aggregates may be standard gradation sizes from 703.02 and Table 703.01-1 or they may be a modified gradation defined with the mix design submittal and certified by the office of Materials Management under Supplement 1069.

[4] Applies only to 305, 451and 452 concrete.

[5] Admixtures shall contain no more than 50 parts per million chloride ions by weight of cement except for Type C accelerating admixtures or calcium chloride for QC-FS only

Use water for concrete mixing free from sewage, oil, acid, strong alkalis, vegetable matter, clay, and loam. Potable water is satisfactory for use in concrete. Non-potable water will meet the requirements of ASTM C1602. Water from a reclaiming system will contain no more than 0.06% chlorides. Test the non-potable water monthly and maintain data verifying that the water meets the requirements. Provide the data at Engineer's request.

499.03 Concrete Mix Designs. Develop concrete mix designs with 1 inch maximum nominal size coarse aggregate according to ACI 301, Section 4 meeting the requirements of Table 499.03-1.; Limit the pozzolan content of any developed mix designs according to Table 499.03-2. Conform to the requirements and procedures of this specification and Supplement 1126 for concrete mix design submittals and approvals.

Only use mix designs accepted by the Department and issued a JMF number.

TABLE 499.03-1 CONCRETE MIX DESIGN REQUIREMENTS

Quantities per Cubic Yard Provide Concrete with 6±2% Air Content				
Class	Design Strength psi (MPa)	Permeability [1] Maximum (Coulombs)	Cementitious Content [2] Minimum. lbs (kg)	Aggregate Requirements
QC 1	4,000 (28.0) at 28 days	2,000	520 (236)	Well-Graded
QC 2	4,500 (31.0) at 28 days	1,500	520 (236)	Well-Graded
QC 3 Special	As per plan	1,500 or as per plan	520 (236) or as per plan	Well-Graded
QC 4 Mass Concrete	As per plan [3]	2,000 or as per plan	470 (213) [4] [5] or as per plan	Well-Graded
QC MS [7]	See Supplement 1126	N/A	800 [7] (475)	1 inch nominal maximum size
QC FS [7]	See Supplement 1126	N/A	900 [7] (534)	1 inch nominal maximum size
QC Misc [6]	4,000 (28.0) at 28 days	N/A	550[8](233)	1 inch nominal maximum size

[1] AASHTO T277 Modified
[2] Cementitious Content includes cement and pozzolan materials, denoted as Cm
[3] Strength for Mass Concrete (QC 4) may be tested at either 28 or 56 days.
[4] Do not use Type III cement or accelerating admixtures in mass concrete.
[5] The maximum fly ash or GGBF slag content may be increased up to 50%.
[6] For QC Misc mixes only –Water/Cementitious ratio limited to 0.50 maximum
[7] Cement Only – No pozzolan materials
[8] Cement of cement and up to15% fly ash or up to 30% GGBF slag

Determine the permeability by testing according to AASHTO T277 except moist cure the permeability samples for 7 days at 73 °F followed by 21 days of moist curing at 100 °F. Perform permeability testing at 28 days.

Observe the following limitations on the pozzolan materials as a percent of total cementitious content:

TABLE 499.03-2 POZZOLAN MATERIALS

Material	Maximum Content (%)
Fly Ash	25
GGBF Slag	30
Micro-Silica	10
When using multiple pozzolan materials, do not exceed the individual maximum contents above for each material. A combination of pozzolan materials may not exceed 50% of the total cementitious content by weight.	

A. Slump. Maintain slump within the nominal slump range in Table 499.03-3. If below the maximum water-cementititous ratio of the Job Mix Formula (JMF), then adjust the quantity of water to meet slump requirements. Do not use concrete with a slump greater than the maximum shown in Table 499.03-3. When the slump exceeds

the nominal slump limit of Table 499.03-3 but is below the maximum limit, the Contractor may use an occasional load of concrete in this condition, provided the mixture of succeeding loads is immediately adjusted to reduce the slump to within the nominal range. Conduct tests on the plastic concrete for pavement at the point of placement or at an Engineer-designated location.

TABLE 499.03-3 CONCRETE SLUMP

Type of Work	**Nominal Slump inch (mm)[1]**	**Maximum Slump inch (mm)[2]**
Concrete pavement (305, 451, 452, 615)	1 to 3 (25 to 75)	4 (100)
Structural Concrete (511, 610, 622)	1 to 4 (25 to 100)	5 (125)
Superstructure concrete (511, 526)	2 to 4 (50 to 100)	4 (100)
Non-reinforced concrete (601, 602, 611, 608, 609, 622)	1 to 4 (25 to 100)	5 (125)
[1] This nominal slump may be increased to 6 inches (150 mm), provided the increase in slump is achieved by adding a chemical admixture conforming to the requirements of 705.12, Type F or G.		
[2] This maximum slump may be increased to 7 inches (180 mm), provided the increase in slump is achieved by adding a chemical admixture conforming to the requirements of 705.12, Type F or G.		

B. Air Content. Ensure that the air content in all concrete at the point of placement is within the percentage range specified in Table 499.03-1.

499.04 Adjustments and Controls. Provide the following adjustments and controls during batching and placement of the concrete:

1. Batch the concrete to the proportions of the accepted JMF. Provide a workable and finishable mix. Adjustments to the JMF's aggregate proportions up to 100 lbs (44 kg) for workability may be made. Adjustments greater than 100 lbs (44 kg) may be made if approved by the Engineer. Maintain an absolute volume of 27.0 cubic feet/cubic yard for the adjusted concrete mix. For Well Graded JMF adjustments, maintain the combined aggregate gradation within the optimal zone II requirements for well-graded mixes as defined in Supplement 1126. If outside the optimal zone II of the Coarseness Factor Chart adjust the JMF's proportions to maintain the combined gradation within Zone II and report the JMF changes to the Engineer.

2. Handle, haul and store aggregates to minimize segregation, avoid contamination, and assure a uniform grading within the specified gradation. Do not combine aggregates from different sources or of different gradings in the same stockpile. Do not use segregated or contaminated aggregates.

3. Remove all wash water by reversing each truck drum at the plant immediately prior to reloading.

4. Adjust the SSD aggregate design weights In the JMF to compensate for the moisture contained in the aggregates and moisture the aggregates will absorb during batching. Adjust the mix water to compensate for the aggregate moistures.

5. Do not exceed the maximum water-cementitious ratio of the JMF.

6. Use only compatible admixtures in the concrete. Dispense all admixtures according to the manufacturer's recommendations. Furnish a volumetric dispenser for the Type F or G admixture or ensure that there is a gage on each truck-mounted Type F or G admixture dispensing tank. If any admixture is added at the job site, mix the load for a minimum of 5 minutes.

7. Do not exceed the maximum water/cementitious ratio of the accepted JMF. Use a water-reducing admixture conforming to 705.12; proportionately increase the cementitious content; or develop and submit for acceptance a new JMF. Adjust the absolute volume of the aggregates if the cement content is increased.

8. Reject concrete loads, if during placement of any concrete, cement or microsilica balling is observed. Revise the mixing process and/or loading sequence to prevent further balling.

9. If slump loss occurs before placement of the concrete, the concrete may be "replasticized" with an admixture to restore plasticity. The Engineer will recheck the slump range and air content to ensure

conformance to the specifications. If after "replasticizing" the components of the load are segregated, the Department will reject the load.

10. Completely discharge the concrete from each delivery truck within the time requirements of 499.08.

11. Provide sufficient quality control at the plant to assure conformance with this specification and project requirements.

12. Use an approved set-retarding admixture conforming to 705.12, Type B or D when the concrete temperature exceeds a nominal temperature of 75 °F (24 °C).

499.05 Equipment. Use a Department approved batch plant and trucks. Provide batching and mixing equipment meeting the following requirements:

A. Batching Plants. Operate each plant so that aggregate materials are not segregated and there is no intermingling of the materials before batching. Use weighing mechanisms that allow a visible means of checking weights and produce a printed record. Use dispensing mechanisms for water and admixtures that allow a visible means of checking quantities and produce a printed record.

Use cement and aggregate weighing mechanisms that are accurate to within ±0.5 percent of the correct weight. Ensure that devices for weighing or metering water are accurate to ±1.0 percent throughout the range used.

Maintain a certification from a Sealer of Weights and Measures or a scale servicing company attesting to the accuracy of the weighing and metering devices. Have this service performed within a 12-month period before use of the plant. A Certificate of Performance issued by the National Ready Mixed Concrete Association may be used instead of the Sealer of Weights and Measures or a scale servicing company.

Maintain the services of a scale servicing company or ten standard test weights to reach a capacity of 500 pounds (227 kg) for testing the weighing devices at the batch plant. The Ohio Department of Agriculture will seal all device-testing weights every 3 years.

The Engineer will test weighing and dispensing devices as often as deemed necessary to ensure continued accuracy.

B. Mixers. Provide mixers and agitators conforming to AASHTO M 157, Sections 10, 11.2, 11.5, and 11.6, except that the Department will allow mechanical counters.

For bodies of non-agitating concrete hauling equipment, provide smooth, mortar-tight, metal containers capable of discharging the concrete at a satisfactory controlled rate without segregation. Provide covers when required by the Engineer. The Engineer will allow trucks having dump bodies with rounded corners and no internal ribs or projections for non-agitating hauling.

499.06 Handling, Measuring, and Batching Materials. Do not stockpile aggregates from different sources or different gradations together. The Engineer may direct reworking or cleaning, or may reject aggregates that have become segregated or mixed with earth or foreign material.

Prior to and during batching, maintain all coarse aggregates at a uniform moisture content.

For all slag aggregates or other aggregates with a reported absorption above 3.0 percent, only use aggregates with moisture contents at or above the ODOT-reported SSD for that aggregate as follows:

1. Use appropriate stockpile watering systems capable of raising and maintaining aggregate moisture at or above SSD. Test the moisture content of the watered aggregate stockpiles at least five (5) locations to assure the stockpile is at or above SSD.

2. Have processes to maintain the aggregate stockpile at SSD until stockpile draining for SSD consistency has begun. Twenty-four (24) hours before batching concrete with the aggregate, shut down the stockpile watering process to allow drainage and to establish a uniform moisture content.

3. Run moisture content tests at least twice a day during concrete production. If the moisture content varies between tests by more than 1% increase the moisture testing frequency to assure correct batching information.

4. Provide the moisture content test results as part of all quality control plant ticket information.

Separately weigh the amounts of fine aggregate and coarse aggregate, as determined by the Engineer and outlined in 499.03. Use a separate weighing device for cementitious materials.

Conduct batching such that the weight of cement is within a tolerance of ±1.0 of the weight required and the weight of each aggregate batched is within ±2.0 percent of the weight required. Measure water by weight or volume to within a tolerance of ±1.0 percent of the required amount. Dispense admixtures to within a tolerance of ±3.0 percent of the required amount.

The Engineer will approve methods and equipment used to add admixtures into the batch. Add air-entraining admixture at the time of batching.

499.07 Batch Plant Tickets. Furnish a concrete batch plant ticket to the Engineer for each load of concrete delivered for use on the project. Use computer generated batch tickets. At a minimum, include the information listed in Table 499.07-1 on each ticket:

TABLE 499.07-1 EVERY BATCH TICKET

Name of ready-mix batch plant	
Batch plant No.	
Batch plant location	
Serial number of ticket	
Date	
Truck number	
Class of concrete	
JMF Number	
Batch time	
Batch size	yd^3 (m^3)
Actual weights of cementitious material:	
Cement	lb (kg)
Fly ash	lb (kg)
Ground granulated blast furnace slag	lb (kg)
Microsilica	lb (kg)
Other	lb (kg)
Actual weights of aggregates:	
Coarse	lb (kg)
Intermediate	lb (kg)
Fine	lb (kg)
Other	lb (kg)
Actual weight of water	lb (kg)
Actual volume of admixtures:	
Air-entrainer	fl oz (mL)
Superplasticizer	fl oz (mL)
Water-reducer	fl oz (mL)
Retarder	fl oz (mL)
Other	fl oz (mL)
Aggregate moisture contents:	
Coarse aggregate	%
Intermediate aggregate	%
Fine aggregate	%
Water-cementitious ratio, leaving the plant	

Provide the information in Table 499.07-2 with batch tickets for each day's first load of concrete and for each JMF. Include Table 499.07-2 information on the batch ticket or furnish the information on a separate computer-generated or handwritten form attached to the batch ticket.

If during the concrete manufacturing process any of the information listed in Table 499.07-2 changes, resubmit Table 499.07-2 information with the first batch ticket supplied with the changed concrete.

TABLE 499.07-2 FIRST TICKET EACH DAY, EACH JMF

Cementitious Materials:	Source:	Grade or Type:
Cement		
Fly ash		
GGBF slag		
Microsilica		
Other		
Admixtures	Brand:	Type:
Air-entrainer		
Retarder		
Superplasticizer		
Water-reducer		
Other		

The provided concrete batch ticket information is according to ASTM C 94/C 94M, Section 13.

The Engineer may require supporting data to validate the basis for furnished aggregate moisture contents.

Include the cost for generating and supplying the information of this section and the concrete batch tickets in the individual concrete items.

499.08 Mixing Concrete. Use a central mix plant or in truck mixers to mix the concrete.

When using a central mix plant, mix the concrete not less than 60 seconds Begin the mixing time when all materials are in the drum and end the mixing time when discharge begins. Include transfer time in multiple drum mixers in the mixing time. Remove the contents of an individual mixer drum before a succeeding batch is emptied into the drum.

When concrete is mixed using a truck mixer for complete mixing, mix each batch of concrete at the rotation rate designated on the mixer as mixing speed for not less than 70 revolutions of the drum. Transport mixed concrete from the central mixers in truck mixers, truck agitators, or trucks having non-agitating bodies. Within 60 minutes after cement and water are combined, deliver and completely discharge concrete. If an approved set-retarding (705.12, Type B) or water-reducing and set-retarding (705.12, Type D or G) admixture is used at no expense to the Department, complete discharge within 90 minutes after combining the water and the cement.

When concrete is delivered in transit mixers and before discharging any of a batch, the Engineer may allow adding water within the specified water-cement ratio limits. Perform sufficient mixing, a minimum of 30 revolutions at mixing speed, to adjust the slump and to regenerate the specified air content throughout the batch. Adding water will not extend the above 60 and 90-minute time limitations.

When approved by the Engineer, the Contractor may use approved admixtures (705.12, Type F or G) for retempering the load to adjust the slump after the start of discharge. Mix for a minimum of 30 revolutions at mixing speed after addition of the admixture.

Use admixtures containing no more than 50 parts per million chloride by weight of cement only when specified in the Contract Documents, the accepted JMF, or with the Engineer’s written permission.

The procedure to make and test concrete beams for the modulus of rupture is Supplement 1023.

Until discharged in the work, ensure that the temperature of all concrete does not exceed 95 °F (35 °C).

TABLE 451.19-2

CONCRETE PAVEMENT STRENGTH PAY FACTOR
Design Strength = f'c from 499 or as per plan
Individual Sublot Core Strength = x
Project Average Strength ($\bar{x}$) = $\sum_1^n x \div n$
Project Standard Deviation (δ) = $\sqrt{\sum(x-\bar{x})^2/(n-1)}$
Project Required Strength (f'cr) = f'c + 1.65 δ
Strength Pay Factor (PF_S) = $\bar{x}$ / f'cr *
* When PF_S is greater than 1.00, pay the unit bid price
For high-early strength sublots, determine the pay factor separately as follows:
If the individual sublot core strength (x) is greater than f'c,
PF_S = 100% of the Unit bid price for the quantity represented.
If the individual sublot core strength (x) is less than f'c, the
PF_S = (x/f'c) of the Unit bid price for the quantity represented.

C. Pavement Smoothness. When the Project plans include Proposal Note 420 determine a lump sum payment adjustment following the requirements of Proposal Note 420.

D. Multiple Deficiencies. When a pavement exhibits multiple deficiencies for thickness and strength, the reduced unit price will be calculated for each deficiency and the lowest reduced unit price will be used. Adjustment for smoothness under 451.19.C will conform to the lump sum requirements of 451.19.C.

451.20 Method of Measurement. The Department will measure Reinforced Concrete Pavement by the number of square yards (square meters) completed and accepted in place. The width equals the pavement width shown on the typical cross-section of the plans plus additional widening as the Engineer directs in writing. The Department will field measure the length along the centerline of each roadway or ramp. The Department will determine the area based on the above width and length.

451.21 Basis of Payment. Payment is full compensation for furnishing and placing all materials including reinforcing steel, dowels, and joint materials; for furnishing the 10-foot (3 m) rolling straightedge; and for coring and testing the pavement. For pavement found deficient in thickness or compressive strength, the Department will pay a reduced price according to 451.19.

The Department will not pay extra for pavement with an average thickness in excess of that shown on the plans.

The Department will pay for accepted quantities at the contract price as follows:

Item Unit Description

451 Square Yard Reinforced Concrete Pavement
(Square Meter)
451 Square Yard Reinforced Concrete Pavement with QC/QA
(Square Meter)
451 Square Yard Reinforced Concrete Pavement Class
(Square Meter)
451 Square Yard Reinforced Concrete Pavement Class with QC/QA
(Square Meter)

701 CEMENTITIOUS MATERIALS

701.00 Acceptance. Provide cements meeting 701.01, 701.02, 701.04, 701.05, 701.07 and 701.09 and certified according to Supplement 1028; fly ash meeting 701.13 and certified according to Supplement 1026; ground, granulated blast furnace slag meeting 701.11 and certified according to Supplement 1034; and micro silica meeting 701.10 and certified according to Supplement 1045 without prior sampling, testing and approval by the Department. Lists for certified cement, fly ash, GGBF slag and micro silica sources are maintained by the Laboratory.

701.01 Air-Entraining Portland Cement. Provide air-entraining portland cement according to ASTM C 150, Type IA. The Gillmore time of set and the air permeability (fineness) tests will govern.

701.02 Portland Cement. Provide portland cement according to ASTM C 150, Type II. The Gillmore time of set and the air permeability (fineness) tests will govern.

701.04 Portland Cement. Provide portland cement according to ASTM C 150, Type I. The Gillmore time of set and the air permeability (fineness) tests will govern.

701.05 High Early Strength Portland Cement. Provide high early strength portland cement according to ASTM C 150, Type III. The Gillmore time of set test shall govern.

701.07 Masonry Cement. Provide masonry cement according to ASTM C 91.

701.09 Slag Modified Portland Cement. Provide slag modified portland cement according to ASTM C 595, Type IS (< 25

701.10 Micro-Silica. Provide micro-silica according to ASTM C 1240. Do not use micro-silica admixtures in dissolvable bags.

701.11 Ground Granulated Blast Furnace (GGBF) Slag. Provide ground granulated blast furnace (GGBF) according to ASTM C 989, Grade 100 minimum.

701.13 Fly Ash for Use in Portland Cement Concrete. Provide fly ash according to ASTM C 618, Class C or F, except ensure a maximum loss on ignition (LOI) of 3 percent.

Fly ash from sources certified according to Supplement 1026 and with an LOI greater than 3 percent may be approved for use by the Department if the fly ash is treated with a chemical conforming to Supplement 1115.

703 AGGREGATE

703.01 General.

The following abbreviations apply:

CCS Crushed Carbonate Stone.
ACBFS Air Cooled Blast Furnace Slag
GS Granulated Slag
RACP Reclaimed Asphalt Concrete Pavement
RPCC Recycled Portland Cement Concrete
OH Open Hearth Slag
EAF Electric Arc Furnace Slag
BOF Basic Oxygen Furnace Slag
PCS Petroleum Contaminated Soil

Pre-qualified Aggregate Supplier Program (Supplement 1069). Provide aggregate materials to the Ohio Department of Transportation from pre-qualified suppliers.

A. Soundness. When the major portion of the unsound material in a coarse aggregate acquires a mud-like condition when tested for soundness, ensure that the maximum loss for all uses is 5 percent.

B. Stockpiles. Use stockpiling and loading methods that permit ready identification of the aggregates and to minimize segregation. Clean the sites for stockpiles before storing materials. Do not remove aggregates from stockpiles within 1 foot (0.3 m) of the ground until final cleanup of the work. Do not use material that has become mixed with foreign matter, wood or other size or grades of aggregates.

Handle aggregates in such a manner that the moisture content is reasonably uniform for each day's run.

C. Size. Provide aggregate according to the size specified in the material specification, the construction item, or as shown in AASHTO M 43.

D. Method of Test. Provide aggregate tested by the following methods:

Amount finer than No. 200 (75 µm) sieve..... S1004
Clay lumps..... S1017
Coal and lignite..... AASHTO T 113
Crushed pieces..... ASTM D 5821
Deleterious materials..... S1029
Effect of organic impurities on
strength of mortar..... AASHTO T 71
Liquid limit..... AASHTO T 89
Percent of wear, Los Angeles
.... abrasion test..... AASHTO T 96 or ASTM C 535
Plasticity index..... AASHTO T 90
Sieve analysis..... S1004, S1005
Sieve analysis of mineral filler..... AASHTO T 37
Sodium sulfate soundness test,
.... 5 cycle..... AASHTO T 104
Specific Gravity and percent absorption
.... for fine and coarse aggregate..... S1031
Unit weight..... AASHTO T 19
Lightweight chert in aggregates..... AASHTO T 113
Sand equivalent..... AASHTO T 176
Uncompacted void content..... AASHTO T 304
Flat and elongated..... ASTM D 4791
Rapid freezing and thawing..... ASTM C 666, Procedure B
Insoluble residue of carbonate
.... aggregates..... ASTM D 3042
Compaction testing of Unbound Materials..... S1015
In place gradation sampling..... S1090

Sulfur leachate test..... S1027
Soundness of aggregate by freezing
.... and thawing..... AASHTO T 103
Micro-Deval..... AASHTO T 327
Silicon Dioxide..... ASTM C 146
Sodium sulfate soundness test,
.... Rock slabs..... ASTM D 5240

E. Steel Slag Aggregate. Provide open-hearth (OH), basic oxygen furnace (BOF), and electric arc furnace (EAF) steel slag aggregate (known as steel slag) according to the following requirements when 703.04 aggregate for asphalt concrete base or 703.05 aggregate for asphalt intermediate course is specified. Do not use OH, BOF, or EAF slag as the fine or coarse aggregate (virgin or recycled) for asphalt surface courses.

Supply all steel slag from sources according to Supplement 1071. Furnish steel slag to a size meeting the specified grading requirements. Provide steel slag aggregate meeting the specified coarse or fine aggregate quality requirements. Ensure that measurements of soft pieces includes soft lime, lime oxide, or magnesia agglomerations or any foreign materials prone to rapid disintegration under construction processing and weathering conditions. Ensure that additional testing beyond those listed are performed or required any time poor quality steel slag is suspected due to visual inspection, testing, or field performance problems.

Provide a letter of certification to the Engineer from the steel slag processor for every shipment of steel slag to the Contractor. In addition the steel slag processor must provide the Engineer with the following:

Quality control records (created in accordance with Supplement 1071).

Documentation of the steel slag production, processing, and stockpile retrieval

Failure to follow the processor QC plan or continued problems with performance recognized by the Laboratory attributable to steel slag is cause for limiting steel slag use from that processor.

F. Restrictions. When an aggregate source is specially designated with a "SR or SRH" according to *Guidelines for Maintaining Adequate Pavement Friction in Surface Pavements*, the aggregate source will be restricted for use in surface pavement according to the methods in the guidelines. The document, *Guidelines for Maintaining Adequate Pavement Friction in Surface Pavements*, is available on the OMM website under "Material Information by Category, Aggregate", or the Office of Pavement Engineering's website.

TABLE 703.01-1 SIZE OF COARSE AGGREGATE (AASHTO M 43)

Size No.	Nominal size [1] square openings inch	mm	Amounts finer than each laboratory sieve (square openings), percent by weight														
			4 in. 100 mm	3 1/2 in. 90 mm	3 in. 75 mm	2 1/2 in. 63 mm	2 in. 50 mm	1 1/2 in. 37.5 mm	1 in. 25 mm	3/4 in. 19 mm	1/2 in. 12.5 mm	3/8 in. 9.5 mm	No. 4 4.75 mm	No. 8 2.36 mm	No. 16 1.18 mm	No. 50 300 µm	No. 100 150 µm
1	3 1/2 to 1 1/2	90 to 37.5	100	90 to 100		25 to 60		0 to 15		0 to 5							
2	2 1/2 to 1 1/2	63 to 37.5			100	90 to 100	35 to 70	0 to 15		0 to 5							
24	3 1/2 to 3/4	63 to 19			100	90 to 100		25 to 60		0 to 10	0 to 5						
3	2 to 1	50 to 25				100	90 to 100	35 to 70	0 to 15		0 to 5						
357	2 to No. 4	50 to 4.75				100	95 to 100		35 to 70		10 to 30		0 to 5				
4	1 1/2 to 3/4	37.5 to 19					100	90 to 100	20 to 55	0 to 15		0 to 5					
467	1 1/2 to No. 4	37.5 to 4.75					100	95 to 100		35 to 70		10 to 30	0 to 5				
5	1 to 1/2	25 to 12.5						100	90 to 100	20 to 55	0 to 10	0 to 5					
56	1 to 3/8	25 to 9.5						100	90 to 100	40 to 75	15 to 35	0 to 15	0 to 5				
57	1 to No. 4	25 to 4.75						100	95 to 100		25 to 60		0 to 10	0 to 5			
6	3/4 to 3/8	19 to 9.5							100	90 to 100	20 to 55	0 to 15	0 to 5				
67	3/4 to No. 4	19 to 4.75							100	90 to 100		20 to 55	0 to 10	0 to 5			
68	3/4 to No. 8	19 to 2.36							100	90 to 100		30 to 65	5 to 25	0 to 10	0 to 5		
7	1/2 to No. 4	12.5 to 4.75								100	90 to 100	40 to 70	0 to 15	0 to 5			
78	1/2 to No. 8	12.5 to 2.36								100	90 to 100	40 to 75	5 to 25	0 to 10	0 to 5		
8	3/8 to No. 8	9.5 to 2.36									100	85 to 100	10 to 30	0 to 10	0 to 5		
89	3/8 to No. 16	9.5 to 1.18									100	90 to 100	20 to 55	5 to 30	0 to 10	0 to 5	
9	No. 4 to 16	4.75 to 1.18										100	85 to 100	10 to 40	0 to 10	0 to 5	
10	No. 4 to 0 [2]	4.75 to 0 [2]										100	85 to 100				10 to 30

[1] Numbered sieves are those of the United States Standard Sieve Series.
[2] Screenings.
Where standard size of coarse aggregate designated by two or three digit numbers are specified, obtain the specified gradation by combining the appropriate single digit standard size aggregates by a suitable proportioning device which has a separate compartment for each coarse aggregate combined. Perform the blending as directed by the Laboratory.

703.02 Aggregate for Portland Cement Concrete.

A. Fine Aggregate.

1. Provide fine aggregate consisting of natural sand or sand manufactured from stone.

2. Sieve analysis.

Sieve Size	Total Percent Passing
3/8 inch (9.5 mm)	100
No. 4 (4.75 mm)	95 to 100
No. 8 (2.36 mm)	70 to 100
No. 16 (1.18 mm)	38 to 80
No. 30 (600 µm)	18 to 60
No. 50 (300 µm)	5 to 30
No. 100 (150 µm)	0 to 10
No. 200 (75 µm)	0 to 5

Should the fineness modulus of a job control sample of sand from any source vary by more than 0.20 percent from that of the representative sample from that source, the sand may be rejected.

3. Physical properties.

	Maximum
Loss, sodium sulfate soundness test	
Item 305	12 %
Items 255, 256, 451, 452, 511, 515, 519, 526, 602, 611, 608, 609, 610, 622, and 625	10 %
Aggregations of soil, silt, etc. by weight	0.5 %

When tested for the effect of organic impurities on strength of mortar, ensure that the compressive strength at 3 and 7 days of mortar made with untreated sand is not less than 95 percent of the compressive strength of mortar made with treated sand.

Provide fine aggregate for Items 255, 256, 451, 452, 526, and 511 deck slabs with at least 25 percent siliceous particles as determined by the acid insoluble residue test [ASTM D3042]. Ensure material has been tested and results are on file at the Laboratory. For sources not tested and on file at the laboratory, submit certified test data from an AMRL accredited independent laboratory verifying the minimum 25 percent.

B. Coarse Aggregate.

1. Provide coarse aggregate consisting of washed gravel, CCS, or crushed ACBFS.

2. Physical properties.

Percent of wear, Los Angeles test, maximum (CCS or washed gravel)	40 %
Unit weight, compacted, minimum (slag)	70 lb/ft^3 (1120 kg/m^3)
Loss, sodium sulfate soundness test, maximum:	
Item 305	15 %
Items 255, 256, 451, 452, 511, 519, 526, 602, 611, 608, 609, 610, 622, and 625	12 %
Item 515	10 %

Deleterious substances shall not exceed the following:

	Percent by Weight	
Material Type	Super-Structure	All Other Concrete
Soft pieces	2.0	3.0
Coal and lignite	0.25	1.0
Clay lumps	0.25	0.25
Pieces having a length greater than 5 times the average thickness	15	15
Shale and shaly material	0.5	1.0
Limonitic concretions	0.5	1.0
Alkali	0.5	1.0
Metallic particles	0.5	1.0
Chert, that disintegrates in 5 cycles of the soundness test	0.5	1.0

Additional requirement for ACBFS aggregate:

Total Sulfur as S, maximum (ASTM C114)	2.0%

3. Amount passing the No. 200 (75 µm) sieve. Ensure that the percent by weight of material passing the No. 200 (75 µm) sieve in the aggregate portion of the concrete mix does not exceed the following:

	Percent by Weight	
Material Type	Super-Structure	All Other Concrete
CCS and crushed ACBFS	3.4	3.8
Washed gravel	2.0	2.2

703.03 Fine Aggregate for Mortar or Grout.

A. Provide fine aggregate consisting of natural sand or sand manufactured from stone or ACBFS.

B. Sieve Analysis.

	Natural Sand	Manufactured Sand
Sieve Size	Total Percent Passing	
No. 4 (4.75 mm)	100	100
No. 8 (2.36 mm)	95 to 100	95 to 100
No. 50 (300 µm)	10 to 40	20 to 40
No. 100 (150 µm)	0 to 15	10 to 25
No. 200 (75 µm)	0 to 5	0 to 10

C. Physical properties.

	Maximum
Loss, sodium sulfate soundness test	10 %
Aggregations of soil, silt, etc. by weight	0.5 %

When tested for the effect of organic impurities on strength of mortar, ensure that the compressive strength of mortar made with untreated sand is not less than 95 percent of the compressive strength of mortar made with treated sand.

703.04 Aggregate for Asphalt Concrete Base (301 and 302).

A. Provide coarse aggregate for asphalt concrete base used in combination with rigid pavement consisting of CCS, gravel, or crushed ACBFS.

Provide coarse aggregate for asphalt concrete base used in flexible pavements consisting of CCS, gravel (see note [1] in table below), or crushed ACBFS. Provide fine aggregate for asphalt concrete base consisting of natural sand or sand manufactured from stone, gravel, or ACBFS. Crushed Steel Slag (OH, EAF or BOF) conforming to 703.01.E and 401.03 may be used for coarse and fine aggregate in asphalt concrete base used in flexible pavements.

B. Physical properties.

Percent of wear, Los Angeles test, maximum (CCS or washed gravel)	50 %
Unit weight, compacted, minimum (slag)	65 lb/ft^3 (1040 kg/m^3)
Loss, sodium sulfate soundness test, maximum	15 %
Percent by weight of fractured pieces (one or more faces), minimum	40 %
Micro-Deval Abrasion Loss test, maximum (for coarse aggregate gravel only)	22 % [1]
[1] If the MD value is greater than the specification limit conform to Supplement 1010.	

Deleterious substances shall not exceed the following:

Material Type	Percent by Weight
Soft pieces	3.0
Coal and lignite	1.0
Clay lumps	0.25
Pieces having a length greater than 5 times the average thickness	15
Shale and shaly material	2.5
Chert that disintegrates in 5 cycles of the soundness test	2.5

703.05 Aggregate for Asphalt Concrete (Intermediate and Surface Courses), Prime Coat (408), Chip Coat (422), and Microsurfacing (421).

A. Fine Aggregate.

1. Provide fine aggregate consisting of natural sand or sand manufactured from stone, gravel, ACBFS or, for intermediate courses only, steel slag (OH, EAF or BOF) conforming to 703.01.E and 401.03.

2. Sieve analysis.

Sieve Size	Total Percent Passing
3/8 inch (9.5 mm)	100
No. 4 (4.75 mm)	90 to 100
No. 8 (2.36 mm)	65 to 100
No. 16 (1.18 mm)	40 to 85
No. 30 (600 µm)	20 to 60
No. 50 (300 µm)	7 to 40
No. 100 (150 µm)	0 to 20
No. 200 (75 µm)	0 to 10

3. Physical properties.

	Maximum
Loss, sodium sulfate soundness test	15 %
Aggregations of soil, silt, etc., by weight	0.5 %

B. Coarse Aggregate.

1. Provide coarse aggregate consisting of CCS, crushed ACBFS, washed gravel, or for intermediate courses only, steel slag (OH, EAF or BOF) conforming to 703.01.E and 401.03.

2. Physical properties.

Percent of wear, Los Angeles test, maximum (CCS or washed gravel)	40 %
Unit weight, compacted, minimum (slag):	
Asphalt Concrete, 408 and 422	70 lb/ft^3 (1120 kg/m^3)
Loss, sodium sulfate soundness test, maximum:	
Asphalt Concrete and 422	12 %
421	15 %
Percent by weight of fractured pieces (one or more faces), minimum	40 %
Micro-Deval Abrasion Loss test, maximum (for gravel only)	20 % [1]
[1] If the MD value is greater than the specification limit conform to Supplement 1010.	

Deleterious substances shall not exceed the following:

Material Type	Percent by Weight
Soft pieces	3.0
Coal and lignite	1.0
Clay lumps	0.25
Amount finer than No. 200 (75 µm) sieve	3.0
Pieces having a length greater than 5 times the average thickness	15
Shale and shaly material	2.5
Limonitic concretions	2.5
Alkali	2.5
Chert that disintegrates in 5 cycles of the soundness test	2.5

C. General Requirements for Fine Aggregate. For fine aggregate calculate each individual sieve fraction soundness loss and ensure that the fractional size does not exceed 13.0 percent for all surface courses, intermediate courses and any asphalt concrete course directly below an open graded friction course.

703.06 Sand Cover (407 and 408).

A. Furnish sand cover consisting of natural sand or sand manufactured from stone or ACBFS.

B. Sieve analysis.

Sieve Size	Total Percent Passing
No. 4 (4.75 mm)	90 to 100
No. 50 (300 µm)	7 to 40
No. 200 (75 µm)	0 to 10

703.07 Mineral Filler.

A. Furnish mineral filler consisting of limestone dust, portland cement, or other inert mineral matter. Ensure the mineral filler is thoroughly dry and free from lumps.

B. Sieve analysis.

Sieve Size	Total Percent Passing
No. 30 (600 µm)	100
No. 50 (300 µm)	95 to 100
No. 200 (75 µm)	65 to 100

703.08 Granulated Slag.

A. Furnish Granulated Slag (GS) consisting of glassy, granular materials formed when molten blast furnace slag or electric-furnace slag is rapidly chilled, as by immersion in water. The Department may reject material containing mill waste, cinders, large pieces of ungranulated slag, or other matter foreign to the production of slag in the normal operation of the blast furnace or electric furnace.

Furnish material of such nature that it will compact to the satisfaction of the Engineer.

B. Sieve analysis.

Sieve Size	Total Percent Passing
2 inch (50 mm)	100
1 inch (25 mm)	85 to 100
No. 100 (150 µm)	0 to 15

703.10 Screenings.

A. Furnish screenings for No. 10 size gravel, stone, or ACBFS. Where crushed material is specified, ensure that it is crushed from material larger than the 1/2-inch (12.5 mm) sieve.

B. Physical properties.

	Maximum
Loss, sodium sulfate soundness test	15 %

703.11 Structural Backfill for 611 Bedding and Backfill. Furnish structural backfill for 611 bedding and backfill consisting of CCS, gravel, natural sand, sand manufactured from stone, foundry sand, ACBFS, GS, or RPCC.

Furnish ACBF Slag according to Supplement 1027.

Furnish granulated slag according to 703.08.

Do not use GS for Type 3 Structural Backfill.

The use of RPCC is permitted without wear testing or sodium soundness testing requirements if the Contractor provides information proving the material met this specification at the time of its original incorporation. The use of RPCC is not permitted in conjunction with aluminum pipe or aluminum coated steel pipe. Ensure that the RPCC use does not contain more than two percent steel.

Reclaimed asphalt concrete is not allowed for any bedding or backfill materials.

Use foundry sand if the material meets these requirements and meets the requirements of the Ohio EPA, Division of Surface Water, Policy 400.007 "Beneficial use of Non-Toxic Bottom Ash, Fly Ash and Spent Foundry Sand and Other Exempt Waste," and all other regulations. Ten days before using foundry sand on the project, submit written permission from the Ohio EPA to the Engineer. Instead of written permission from the Ohio EPA, the Contractor may elect to have an independent consultant pre-qualified by ODOT in remedial design environmental site assessment review the proposed usage. The consultant will provide all documentation utilized to ensure that the proposed usage is according to all Ohio EPA regulations. Ensure that the consultant

coordinates all EPA required meetings, documentation, and testing requirements. Ensure that the consultant certifies this to the Department.

A. Structural Backfill Type 1 and 3.

1. Furnish Type 1 structural backfill that meets the gradations of Items 304, 411, or 617, except 0 to 20 percent may pass the No. 200 sieve. Furnish Type 3 structural backfill that meets the gradations of Size No. 57 or 67 from Table 703.01-1.

2. Physical properties.

Percent of wear, Los Angeles test, maximum (CCS or washed gravel)	50 %
Loss, sodium, sulfate soundness test, maximum	15 %
Percent by weight of fractured pieces (one or more faces), minimum (Type 3 only)	90 %

Deleterious substances shall not exceed the following:

Material Type	Percent by weight
Shale and shaly material	5.0
Chert, that disintegrates in 5 cycles of the soundness test	5.0

Ensure that the portion of the material passing through the No. 40 (425 µm) sieve has a maximum liquid limit of 25 and a maximum plasticity index of 6.

Crush gravel for Type 3 from material retained on the 1/2 inch (12.5 mm) sieve.

B. Structural Backfill Type 2.

1. Furnish Type 2 structural backfill that meets the gradations of 703.05.A, 703.02.A, or one of the gradations below:

Sieve Size	Total Percent Passing	
2 1/2 inch (63 mm)	–	100
1 inch (25.0 mm)	–	70 to 100
3/4 inch (19.0 mm)	100	–
3/8 inch (9.5 mm)	80 to 100	–
No. 4 (4.75 mm)	60 to 100	25 to 100
No. 8 (2.36 mm)	45 to 95	–
No. 40 (425 µm)	–	10 to 50
No. 50 (300 µm)	7 to 55	–
No. 200 (75 µm)	0 to 15	5 to 15

2. Physical properties:

Percent of wear, Los Angeles test, maximum (CCS or gravel)	50 %
Loss, sodium sulfate soundness test, maximum	15 %

Ensure that the portion of the material passing through the No. 40 (425 µm) sieve has a maximum liquid limit of 25 and a maximum plastic index of 6.

703.13 Coarse Aggregate for Items 305, 451 and 452. In addition to the requirements of 703.02, the following aggregate requirements apply.

When the total combined quantity of the listed items is greater than 10,000 square yards (8000 m^2), provide size No. 57 or 67 from Table 703.01-1. If the total combined quantity of the listed items is less than 10,000 square yards (8000 m^2), then provide one of the following sizes from Table 703.01-1: No. 7, 78, 8, 57, or 67.

If gravel or limestone No. 57 or 67 size is selected in either of the above cases, then ensure that the coarse aggregate incorporated into the concrete is tested according to ASTM C 666, Procedure B. Ensure that the area generated under the curve obtained by plotting the expansions of test specimens verses the number of test cycles does not exceed 2.05 at 350 or less cycles.

Ensure that the validity of results of freeze thaw-resistance testing is as outlined below:

Range of Area under Curve[1]	Status of Source Approval
0.00 to 1.00	Valid for two years from date approved[2]
1.01 to 2.05	Valid for one year from date approved[2]
2.06 to 4.00	Not Approved, one retest allowed[3]
> 4.00	Not Approved, no retesting allowed[3]
[1] As measured at 350 cycles.	
[2] If a notable change in the properties of the aggregate originating from the affected source is determined from quality control testing, a retest of freeze-thaw resistance may be requested before the original expiration date. The Laboratory will make the determination to retest.	
[3] Except as noted, the Department will not retest the material unless the producer of the material sends a written request to the Department with substantiation that significant changes in operation have been made (e.g., new processing equipment, material from a new ledge, etc.).	

The Laboratory will maintain a list of approved sources.

703.14 Non Pavement Open-Hearth, Electric Arc Furnace, and Basic Oxygen Furnace Steel Slag Aggregate Use. Provide steel slag according to the following requirements.

1. Non-confined Applications. When using OH, EAF, and BOF slag in applications where the steel slag will not be confined, ensure that the slag meets the requirements in 703.14.A (deleterious substances and crushing), and in 703.14.B (aging and stockpiling requirements). Recycled steel slag from Department or non-Department projects may be used in applications where the recycled steel slag will not be confined.

2. Confined Applications. When using OH, EAF, and BOF slag in applications where the steel slag will be confined, ensure the steel slag meets all requirements of 703.14. The use of recycled steel slag from Department or non-Department projects is not allowed in confined applications.

A. Deleterious Substances (soft pieces). Deleterious substances include soft lime, lime oxide, or magnesia agglomerations or any foreign materials prone to rapid disintegration under construction processing and weathering conditions.

Furnish steel slag with less than 3 percent deleterious substances (soft pieces) by weight. The Department will use Supplement 1029 (hand crushing of soft pieces) to determine the soft pieces.

Crushing of steel slag is not allowed.

B. Aging and Stockpiling Requirements. Stockpile and age all steel slag as follows:

1. Grade and stockpile the material into maximum size piles of 25,000 ton (23,000 metric tons). Before and during the stockpiling operation, add water to these materials to provide a uniform moisture content not less than their absorbed moisture. Ensure that the stockpile is maintained in a moist condition during the required stockpiling period.

2. Ensure that the producer mixes the stockpile when the outside surface of the pile has crusted over. The Department will inspect the stockpile every 2 months to ensure no crusting occurs. Do not mix frozen stockpile material. Suspend the aging period when the stockpile is frozen for more than one month.

3. Ensure that this aging period is at least 6 months in duration and starts over if any new material is added to the pile during the aging period.

C. Identification of Steel Slag. Clear, definitive, and undisputable identification of the proposed material being steel slag is required.

The producer will show the Department evidence that the material supplied is steel slag. This information will consist of, but is not limited to, the following:

1. Steel producer.
2. Production dates.
3. Production rates.
4. Stockpiling dates.
5. Type of steel furnace(s).
6. All known Department and non-Department projects where the material was previously used.

This identification of steel slag and the source may be supplemented by other information approved by the Department or by using 10 years of good performance data. Ensure that the producer submits to the Department projects where the steel slag has been used without expansion or tufa problems. The Department will review the above projects as part of the identification approval process.

D. Tufa Performance Verification of Steel Slag. Tufa is a precipitate form of calcium carbonate that can clog up the underdrain systems. Some steel slag sources clog up underdrain systems and some do not. Tufa performance verification is based on field performance and Department's inspection of the underdrain systems.

Tufa performance verification is required.

Ensure that the producer submits past projects that are at least 10 years old that used the proposed steel slag source to the Department. The Department may consider projects that are less than 10 years old for tufa performance verification if it can be determined by the Department that the age of the steel slag incorporated in the project was 10 years old or greater. Ensure the producer supplies the Department with construction plans with the underdrains and underdrain outlets marked on the plans, or other suitable method, approved by the Department, showing the underdrain system. Ensure the producer marks the underdrain outlets in the field for inspection. The Department will inspect the underdrain systems for tufa deposits. If tufa deposits are found in the outlets or in the underdrain system, the Department will reject the steel slag source.

E. Expansion Testing of Steel Slag. After the aging and stockpiling requirements are met, expansion testing is required for steel slag.

Perform expansion testing according to Pennsylvania Department of Transportation PTM No. 130, the ODOT equivalent to this test or expansion testing acceptable to the Department.

Ensure that the producer hires an independent AASHTO accredited and Department approved laboratory to perform at least half of the expansion testing. At the producer's option, up to half of the required expansion testing may be performed by the producer's laboratory. The Laboratory will observe the expansion testing and approve each independent and producer laboratory.

Perform expansion testing for every 2500 tons (2300 metric tons) or fraction thereof of the material stockpiled in accordance with 703.14.B. For steel slag less than 10 years old, retain a spilt portion of the expansion sample. Reduce the split sample to 5 lbs (2500 g) and test for total percent MgO by X-Ray florescence and total percent periclase (hard burned MgO) by X-Ray diffraction.

The maximum allowable total expansion for each test is less than 0.50 percent. If any one test fails in the stockpile, the Department will reject the entire stockpile.

When sampling for expansion, ensure that the producer notifies the Department at least 48 hours before the sampling. The Department will verify that the sample came from the correct stockpile and take independent split samples, if required.

Submit the expansion test data and a suitably presented summary of the expansion test data to the Department for approval. Submit X-Ray florescence and X-Ray diffraction data to the Department. The Department reserves the right to perform independent testing to verify the laboratory results at any time.

The Department expansion test data takes precedence over the producer or independent laboratory expansion testing results in the event of a conflict. The Department will make the final determination on all conflicting data.

If the material fails the expansion testing, then stockpile the material for a minimum of two additional months from the date of last sampling and retest for expansion. Only materials that pass the expansion test are approved for use.

703.16 Suitable Materials for Embankment Construction. Natural soil, natural granular material, granular material types, slag material, brick, shale, rock, random material, RACP, RPCC, or PCS as further defined below are suitable for use in embankment construction. The Engineer will submit samples of soils not identified from the plan subsurface investigation, from borrow sources or materials appearing questionable in the field.

Furnish ACBFS according to Supplement 1027.

Furnish RPCC with the reinforcing steel cut to a maximum length of 1 inch (25 mm) outside the pieces.

Ensure that pieces of RACP do not exceed 4 inches (100 mm) in the largest dimension.

Furnish steel slag according to 703.14.

When using steel slag, RPCC, or RACP, completely blend it with at least 30 percent natural soil or natural granular material.

When using coal, completely blend it with natural soil or natural granular materials. Make at least 90 percent of the blend natural soil or natural granular materials.

A. Natural Soils. Furnish natural soils as defined in 203.02.I and classified as Department Group Classifications A-4-a, A-4-b, A-6-a, A-6-b, and A-7-6 as further defined below: Furnish soils with a maximum dry density of at least 90 pounds per cubic foot (1450 kg/m^3).

Do not use soils having a liquid limit in excess of 65 or soils identified as Department Group Classifications A-5, or A-7-5 in the work.

B. Granular Embankment Materials. Furnish natural granular materials as defined in 203.02.H and classified as Department Group Classifications A-1-a, A-1-b, A-3, A-3-a, A-2-4, A-2-6, or A-2-7.

Do not use granular material classified as A-2-5.

C. Granular Material Types. Furnish CCS, gravel, ACBFS, durable sandstone, durable siltstone, GS, or blended natural soil or natural granular materials blended with OH, BOF, EAF, or RPCC as detailed above. Furnish durable sandstone and siltstone with a slake durability index greater than 90 percent according to ASTM D 4644.

Except for GS, furnish the following gradations for the granular material types, by weight:

1. Granular Material, Type A. Furnish material having less than 25 percent by weight of the grains or particles passing the No. 200 (75 µm) sieve.

2. Granular Material Type B. For Item 204, furnish the gradation of Items 304, 411, or 617. For Item 203, furnish the gradation of Items 304, 411, or 617 except 0 to 20 percent will be allowed to pass the No. 200 (75 µm) sieve.

3. Granular Material Type C. Furnish well graded material that meets the following gradation:

Sieve Size	Total Percent Passing
3 inch (75 mm)	100
2 inch (50 mm)	70 to 90
1/2 inch (12.5 mm)	30 to 60
No. 200 (75 µm)	0 to 13

4. Granular Material Type D. Furnish the gradation of 100 percent passing the 8 inch (200 mm) sieve, less than 60 percent passing the 3 inch (76 mm) sieve, less than 40 percent passing the 3/4 inch (19 mm) sieve, and 0 to 20 percent passing the No. 200 (75 µm) sieve.

5. Granular Material Type E. Furnish any of the coarse aggregates from No. 1 through 67 inclusive on Table 703.01-1.

6. Granular Material Type F. Furnish material according to the following:

a. Well graded material.

b. A gradation with a top size from 8 inches (200 mm) to 3 inches (76 mm) and a bottom size of No. 200 (75 µm) sieve.
c. An evenly graded material between the top and bottom size.
d. Compactable, stable, and serves the intended use.

D. Shale. Furnish shale as defined in 203.02 and as further defined below. Ensure that the shale is tested for durability to determine whether the shale is durable or nondurable shale. Test the shale according to the following procedure:

1. Obtain a piece of shale that is typical and representative of the rest of the shale. The size of the piece should be about 6 inches (150 mm). If a 6-inch (150 mm) sample is not available, then the shale is nondurable.

2. Place the piece of shale in a bucket of water. Examine the deterioration or slaking of the shale after 48 hours. If the shale has deteriorated, then the shale is nondurable.

3. If the shale has not deteriorated after being in water for 48 hours, then break down the shale over a 3/4 inch (19.0 mm) sieve by hand pressure. If 75 percent or less of the shale is retained on the 3/4 inch (19.0 mm), then the shale is nondurable.

4. If more than 75 percent of the shale is retained on the 3/4 inch (19.0 mm) sieve or, then perform a field test for durability. The field test for durability consists of compacting the shale with six passes of a steel drum roller which has a minimum compaction force of 500 pounds per lineal inch (57 kN/mm) of roller drum width. Provide documentation to the Engineer to verify the roller meets the compaction force requirement.

a. If more than 40 percent of the shale breaks down, by visual inspection, then the shale is nondurable.
b. If less than 40 percent of the shale breaks down, by visual inspection, then the shale is durable.

703.17 Aggregate Materials for 304. Furnish aggregate that is CCS, crushed gravel, crushed ACBFS, GS, or steel slag.

Furnish GS according to the requirements of 703.08.

Furnish steel slag according to 703.14

Furnish ACBFS according to Supplement 1027.

Determine aggregate acceptance before incorporation into the work based on samples taken from stockpiles.

A. Furnish CCS, crushed gravel, crushed ACBFS, and steel slag that meets the following gradation:

Sieve Size	Total Percent Passing
2 inch (50 mm)	100
1 inch (25.0 mm)	70 to 100
3/4 inch (19.0 mm)	50 to 90
No. 4 (4.75 mm)	30 to 60
No. 30 (600 µm)	9 to 33
No. 200 (75 µm)	0 to 15 [1]
[1] Furnish steel slag that has 0 to 10 percent passing through the No. 200 (75µm) sieve	

Furnish gravel used under Item 304 that is crushed from material retained on the 1/2 inch (12.5 mm) sieve.

B. Furnish CCS, crushed gravel, ACBFS, and steel slag that meets the physical property requirements:

Percent of wear, Los Angeles test, maximum (CCS or crushed gravel)	50 %
Loss, sodium sulfate soundness test, maximum	15 %
Percent by weight of fractured pieces (one or more faces), minimum	90 % [1]
[1] Does not apply to steel slag	

Ensure deleterious substances in CCS, crushed gravel, and ACBFS do not exceed the following:

Material Type	Percent by weight
Shale and shaly material	5.0
Chert, that disintegrates in 5 cycles of the soundness test	5.0

Except for GS, ensure that the portion of the material passing through the No. 40 (425 µm) sieve has a maximum liquid limit of 25 and a maximum plasticity index of 6.

703.18 Materials for Items 410, 411, and 617. Furnish CCS, gravel, ACBFS, GS, OH slag, BOF slag, EAF slag, RPCC, or RACP for materials.

If RPCC and RACP are used, provide the following information:

1. Specification item that the material was originally constructed under.
2. The applicable material requirements of the original construction item.

If the original construction requirements meet or exceed the requirements of this specification, then the shale, sodium soundness and Los Angeles abrasion test for RACP and RPCC may be waived. The plastic index and clay requirements are not required for RACP. Use RPCC that is free of steel.

Furnish OH, BOF, and EAF slag according to 703.14

Use ACBFS according to Supplement 1027.

Furnish GS according to 703.08.

A. Gradations. Furnish for Items 617, 410, and 411 RACP materials according to the following gradation:

Sieve Size	Total Percent Passing
1 1/2 inch (37.5 mm)	100
3/4 inch (19.0 mm)	80 to 100
3/8 inch (9.5 mm)	60 to 90
No. 4 (4.75 mm)	30 to 90
No. 30 (600 µm)	3 to 20

Except for GS and RACP, use the following gradations for Items 410, 411, and 617.

Furnish materials for Item 410 according to one of the following gradations:

	Type A	Type B	Type C
Sieve Size	Total Percent Passing		
1 1/2 inch (37.5 mm)	100	100	Size No. 4 or 57 from Table 703.01-1
1 inch (25.0 mm)	90 to 100	75 to 100	
3/4 inch (19.0 mm)	60 to 100	60 to 100	
3/8 inch (9.5 mm)	40 to 60	35 to 75	
No. 4 (4.75 mm)	15 to 30	30 to 60	

Do not use RACP for Type C material.

Furnish materials for Item 411 according to the following gradation:

Sieve Size	Total Percent Passing
1 1/2 inch (37.5 mm)	100
1 inch (25.0 mm)	75 to 100
3/4 inch (19.0 mm)	60 to 100
3/8 inch (9.5 mm)	35 to 75
No. 4 (4.75 mm)	30 to 60
No. 30 (600 µm)	7 to 30
No. 200 (75 µm)	3 to 15

Furnish materials for Item 617 according to the following gradation:

Sieve Size	Total Percent Passing
1 inch (25.0 mm)	100
3/4 inch (19.0 mm)	60 to 100
3/8 inch (9.5 mm)	35 to 75
No. 4 (4.75 mm)	30 to 60
No. 30 (600 µm)	9 to 33
No. 200 (75 µm)	0 to 15

B. Physical properties.

	Item 410	Item 411	Item 617
Percent of wear, Los Angeles test, maximum	50 %	–	–
Loss, sodium sulfate soundness test, maximum	–	15 %	–
Percent by weight of fractured pieces (one or more faces), minimum	–	–	90 %
Gravel used, portion retained on a No. 4 (4.75 mm) sieve (one or more faces) minimum crushed	–	40 %	–
Maximum plasticity index of material passing No. 40 (425 µm) sieve	–	6	–

Deleterious substances shall not exceed the following:

	Percent by weight		
Material Type	Item 410	Item 411	Item 617
Shale and shaly material	–	5 % [1]	12 %
Clay	10 %	–	–
[1] Where the major portion of the material in a coarse aggregate, from a source on record at the Laboratory, has shown the characteristics of acquiring a mud-like condition when tested for soundness, test it for soundness and ensure that the maximum loss is 5 percent.			

703.19 Rock and Aggregate Materials for Item 601.

A. Crushed Aggregate Slope Protection and Filter Aggregate for Dump Rock Fill**.** Furnish crushed gravel, limestone, sandstone, RPCC, ACBFS, OH slag, BOF slag, or EAF slag for crushed aggregate slope protection and filter aggregate for dump rock fill.

Use ACBFS slag according to Supplement 1027.

Use OH, BOF, and EAF slag according to 703.14

Furnish Size No. 1 or 2 from Table 703.01-1, or according to the following gradation for crushed aggregate slope protection:

Sieve Size	Total Percent Passing
4 inch (100 mm)	100
3 1/2 inch (90 mm)	90 to 100
2 1/2 inch (63 mm)	25 to 90
1 1/2 inch (37.5 mm)	0 to 25
3/4 inch (19.0 mm)	0 to 10

For a filter for rock channel protection, use Size No. 3 or 4 from Table 703.01-1.

Physical properties.

Percent of wear, Los Angeles Test, maximum (CCS or gravel)	50 %
Loss, sodium sulfate soundness test, maximum (except for RPCC)	15 %
Percent by weight of fractured pieces minimum (CCS or gravel)	90 %
Loss for RPCC, AASHTO T 103 Soundness of Aggregates by Freezing and Thawing	20 % [1]
[1] Use Method C using 25 cycles.	

B. Dumped Rock Fill and Rock Channel Protection. Furnish gravel, broken recycled portland cement concrete (RPCC), broken sandstone, broken siltstone, and broken limestone for dumped rock fill and rock channel protection. Furnish sandstone, siltstone, and limestone that is free of laminations, seams, and fractures, or injury due to blasting.

Except for RPCC, test for soundness according to ASTM D 5240. Use materials having a maximum 30 percent single slab loss and a maximum 20 percent cumulative loss. Slab heights and lengths will be a minimum of 8 inches. For RPCC, test for soundness according to AASHTO T 103 as stated in 703.18.A**.**

The Department may waive testing when the stone source has a known durability history.

Do not use thin, slab-like pieces, or any pieces having a dimension larger than 36 inches (1 m). Do not use RPCC with reinforcing steel protruding more than 1 inch (25 mm) beyond the outside surface of the concrete pieces.

Furnish dumped rock fill and rock channel protection materials consisting of the four material types defined below:

1. Type A material has at least 85 percent of the total material by weight larger than an 18-inch (0.5 m) but less than a 30-inch (0.8 m) square opening and at least 50 percent of the total material by weight larger than a 24-inch (0.6 m) square opening. Furnish material smaller than an 18-inch (0.5 m) square opening that consists predominantly of rock spalls and rock fines, and that is free of soil.

2. Type B material has at least 85 percent of the total material by weight larger than a 12-inch (0.3 m) but less than a 24-inch (0.6 m) square opening and at least 50 percent of the total material by weight larger than an 18-inch (0.5 m) square opening. Furnish material smaller than a 12-inch (0.3 m) square opening that consists predominantly of rock spalls and rock fines, and that is free of soil.

3. Type C material has at least 85 percent of the total material by weight larger than a 6-inch (150 mm) but less than an 18-inch (0.5 m) square opening and at least 50 percent of the total material by weight larger than a 12-inch (0.3 m) square opening. Furnish material smaller than a 6-inch (150 mm) square opening that consists predominantly of rock spalls and rock fines, and that is free of soil.

4. Type D material has at least 85 percent of the total material by weight larger than a 3-inch (75 mm) but less than a 12-inch (0.3 m) square opening and at least 50 percent of the total material by weight larger than a 6-inch (150 mm) square opening. Furnish material smaller than a 3-inch (75 mm) square opening that consists predominantly of rock spalls and rock fines, and that is free of soil.

705 CONCRETE INCIDENTALS

705.01 Fiber Reinforced Polymer (FRP) Dowel Bars. Furnish round and straight fiber reinforced polymer (FRP) dowel bars. Ensure that the resin used to manufacture the FRP bars consists of an acrylic modified epoxy resin with a minimum of 5 percent and a maximum of 7 percent tensile elongation at break. Ensure that the minimum glass fiber content is 70 percent by weight. Furnish dowels of a type meeting the dimensional requirements of the standard construction drawings Provide certified test data according to 101.03 with each shipment.

705.03 Preformed Fillers. Furnish preformed fillers according to AASHTO M 153 or AASHTO M 213, with the following modification:

5.7 For materials manufactured as described in 4.1.1 and 4.1.2, ensure that the producer certifies to the Engineer that the asphalt content is at least 35 percent by weight of the filler.

Furnish materials according to the Department's Qualified Products List (QPL).

705.04 Hot Applied Joint Sealer, Furnish hot applied joint sealer conforming to ASTM D 6690, Type II Use this material as the primer for Type 3 membrane.

705.05 Burlap Cloth. Furnish burlap cloth according to AASHTO M 182, Class 2.

705.06 Sheet Materials for Concrete Curing. Furnish sheet materials conforming to AASHTO M 171 for moisture loss and reflectance only.

705.07 Liquid Membrane-Forming Compounds for Curing Concrete. Furnish liquid membrane-forming compounds conforming to ASTM C 309, with the following modification:

5.3 In addition - liquid membrane-forming compounds will have a minimum solids content of 25%.

6.1 Water Retention - Liquid membrane-forming compound, when tested in accordance with 10.1, shall have a water loss of not more than: 0.15 kg/m^2 @ 24 hours and 0.40 kg/m^2 @ 72 hours.

7.1 Reflectance - Type 2 curing compound will have a minimum daylight reflectance of 65%.

10.4 In addition - Mix Type 2 curing compound until uniform in color and consistency, and then pour into a glass graduated cylinder (Kimax 150 ml) to the 150 ml mark. The Type 2 curing compound should have a rate of settling such that its uniformly white portion as visible to the eye is not less than 145 ml at 2 hours and not less than 125 ml at 24 hours after filling the Kimax cylinder. The test should be performed at 73.0 ± 3.5 ^{o}F (23 ± 2 ^{o}C). During this test the glass cylinder should be stoppered and left undisturbed.

11.1 In addition, Equip the containers for Type 2 white pigmented liquid membrane forming compounds with mechanical agitators. Assign each container in any batch or lot, a number as the container is being filled.

Furnish materials according to the Department's Qualified Products List (QPL)

705.10 Air-Entraining Admixtures. Provide air-entraining admixtures conforming to AASHTO M 154. Conform to Supplement 1001 for approval.

Furnish materials according to the Department's Qualified Products List (QPL)

705.11 Preformed Elastomeric Compression Joint Seal for Concrete.

A. General. Provide preformed elastomeric compression joint seal conforming to ASTM D 2628, with the following modifications:

5.1 Ensure that the size and design is as shown on the plans.

7.2 The Engineer will perform inspection at the project site.

7.3 If sampled, provide a minimum of 3 feet (1.0 m), with all manufacturers' markings,

12.1 In addition, ensure that markings are every 1 foot (305 mm). Use lubricants recommended by the seal manufacturer to install preformed compression seals.

B. Qualification. Obtain Department approval of each design, shape, width, depth, web, and shell thickness before use. Submit drawings of the seals showing all dimensions and dimension tolerances and weight per foot (meter) with the request for approval.

Furnish materials according to the Department's Qualified Products List (QPL)

705.12 Chemical Admixture for Concrete. Provide chemical admixtures conforming to ASTM C 494. Ensure that the minimum relative durability factor is 90.

Furnish materials according to the Department's Qualified Products List (QPL)

705.13 Neoprene Sheeting. Provide material conforming to the following:

Test Description	Specification	Requirement
Thickness (inch)	ASTM D751	0.094±0.01
Breaking Strength, Grab (lb)	ASTM D751	700 × 700 (long. × trans.)
Adhesive Strip, 1" wide × 2" long (lb)	ASTM D751	9
Burst Strength (psi)	ASTM D751	1400
Heat Aging, 70 hr., 212 ºF, 180 º bend without cracking	ASTM D2136	No cracking of coating
Low temperature brittleness, 1 hr., -40 º F, bend around ¼" mandrel	ASTM D2136	No cracking of coating

Furnish material according to the Department's Approved Products List.

705.15 High Molecular Weight Methacrylate (HMWM) Resin. Provide low viscosity, non-fuming high molecular weight methacrylate (HMWM) resin conforming to the following:

Viscosity	Less than 25 cps (Brookfield viscometer, Model RVT with UL adaptor or Model LVF, # spindle and UL adaptor C @ 77 °F (25 °C) (ASTM D 2849)
Density	Greater than 8.4 lb/gal Ca 77 °F (25 °C) (ASTM D 2849)
Flash Point	Greater than 200 °F (93 ºC) (PenskyMartens CC) (ASTM D 93)
Vapor Pressure	Less than 1.0 mm Hg C @ 77 °F (25 °C) (ASTM D 323)
TG (DSC)	Greater than 135 °F (58 °C) (ASTM D3418)
Shelf Life	Must be 1 year minimum at manufacturers recommended environmental considerations
Gel Time	Greater than 40 min, 100 g mass (ASTM D 2471) (thin film)
Percent Solids	Greater than 90% by weight
Bond Strength	Greater than 1500 psi (10.5 MPa) (ASTM C 882)

Furnish materials according to the Department's Qualified Products List (QPL)

705.20 Non Shrink, Non Metallic Materials. Provide anchoring materials for installing anchor bolts, dowels and similar material in concrete which are non-shrink, 100% solids, two part (resin and hardener), fast setting, and moisture insensitive.

A. Provide certified test data according to 101.03 showing compliance with the following requirements. Include manufacturer's installation and application requirements.

Test Description	Specification	Requirements	Notes
Bond Strength (dry)	ASTM C882	2 day, Min. 1800 psi	Average of three samples [1]
Bond Strength after subjected to 300 cycles freeze/thaw testing	ASTM C882 specimens subjected to ASTM C666 Method B testing and the tested conforming to C882	Min. 1600 psi	Average of three samples [1]
Heat Deflection	ASTM D648	7 day, Min. 130 ºF	
Linear Coefficient of Shrinkage	ASTM C531	% Max. 0.005	
Pullout Strength Test (dry)	See procedure below	24 hours, Min. Load 22,500 lbs	Average of three cylinders in dry condition
Pullout Strength Test (wet)	See procedure below	24 hours, Min. Load 22,500 lbs	Average of three cylinders in wet condition

[1] A total of six samples will be made under C882. Three of the C882 samples will be tested under C666 Method B and those samples tested.

Pullout Strength Test Procedure. Perform pullout strength tests under dry and wet conditions as follows:

1. Dry Condition (epoxy steel)

Cast three concrete test blocks or cylinders, a minimum of 6 inches (150 mm) in width or diameter by 12 inch (300 mm) in depth. Use concrete with a compressive strength of 4000+/- 500 psi at 28-days Center a 6 3/4 inch (170 mm) deep hole, drilled the diameter required by the manufacturer's requirements for installing a No. 6 (20M) rebar, in the block or cylinder by drilling or forming. Dry the hole surfaces and clean the holes following manufacturer instructions. Fill the hole with adhesive materials according to manufacturer recommendations. Insert a No. 6 (20M) deformed reinforcing bar 30 inches (760 mm) long, cleaned and degreased, into the hole. Hold and center the bar perpendicular to the concrete surface in the grout-filled hole during the curing period.

2. Wet Condition (epoxy steel)

Cast three concrete test blocks or cylinders, a minimum of 6 inches (150 mm) in width or diameter by 12 inch (300 mm) in depth. Use concrete with a compressive strength of 4000+/- 500 psi at 28-days. Center a 6-3/4 inch (170 mm) deep hole, drilled the diameter required by the manufacturer's requirements for installing a No. 6 (20M) rebar, in the blocks or cylinders by drilling or forming. Wet the hole's surfaces prior to applying the anchoring material by filling the hole with water and letting stand for five minutes. Turn the samples over for two minutes to allow the excess water to drain from the hole, Turn all samples over to the upright positions and immediately fill hole with adhesive materials according to manufacturer recommendations. Insert a No. 6 (20M) deformed reinforcing bar 30 inches (760 mm) long, cleaned and degreased into the hole. Hold and center the bar perpendicular to the concrete surface in the adhesive-filled hole during the curing period.

Cure Period. Cure the specimen at 77 ± 5 °F (25 ± 3 °C) for 24 hours.

Pullout Strength Test Apply an axial load to the bar at a rate of 1/2 inch (13 mm) per minute until the bar pulls out of the specimen, or the concrete block or cylinder cracks or spalls. Record the failure mode and applied load.

B. Epoxy materials will also conform to ASTM C881, Type IV, Grade 3, Class A, B or C.

Supply the anchoring material in non-reactive containers and with their MSDS. Label containers with the name of the product, the manufacturer, the shelf life expiration date, the batch number, quantity, and provide application instructions.

Maintain storage areas between 40 and 100 °F (5 and 38 °C).

Only use materials on the Department's Qualified Products List (QPL).

705.21 Quick Setting Concrete Mortar. Provide prepackaged mortar material that requires the addition of water only.

Only use materials meeting the following criteria:

A. Capable of being extended 50 percent by dry mortar weight with aggregate meeting the following requirements:

(a) Gradation requirements of Table 703.01-1 for No. 8, 89, 9, or a combination thereof.

(b) AASHTO M 43, Maximum Passing No. 200 (75 µm) sieve - Not to exceed 0.2 percent.

(c) AASHTO T 84 and T 85, Absorption - Not more than 2 percent.

(d) AASHTO T 104, Soundness Loss - Not more than 2 percent.

1. Ensure that the material meets the following requirements:

Test		**Type 1**	**Type 2**
Compressive Strength ASTM C 109[2]			
psi (MPa)	@ 1 Hour	100 (0.7)	2000 (14)
	@ 3 Hour	250 (1.7)	---
	@ 24 Hours	2000 (14)	5000 (34)
	@ 7 Days	---	7000 (48)
Compressive Strength ASTM C 39[1],[2]			
psi (MPa)	@ 1 Hour	100 (0.7)	(2000) (14)
	@ 3 Hour	150 (1.0)	---
	@ 24 Hours	1000 (10)	3500 (24)
	@ 7 Days	---	6000 (41)
Initial Set Time (min) ASTM C 266[2]		5 Minutes	10 Minutes
Bond Strength, ASTM C 882[1]			
psi (MPa)	@ 24 Hours	1000 (7)	1000 (7)
	@ 7 Days	1500 (11)	1500 (11)
Flexural Strength ASTM C 78[1]			
psi (MPa)	@ 4 Hour	---	200 (1.4)
	@ 3 Day	650 (4.5)	500 (3.4)
Freeze and Thaw ASTM C 666 (use either Procedure B or A) [1]			
Procedure B (350 Cycles) Durability Factor		80%	80%
Procedure A (300 Cycles) Durability Factor		79%	79%
[1] Extend test specimens 50 percent by dry mortar weight with aggregate.			
[2] Test the mortar as received with the addition of water. Ensure that the amount of water is designated on the packing container by the manufacturer.			

B. Prequalify the material by placing and having the material evaluated conforming to Supplement 1070 for 3 years. At the end of the 3 year rating the material will meet the following criteria:

1. Percentage debonding/delamination ≤ 5%

2. Percentage spalling ≤ 5%

3. Mid panel average crack width ≤ 1/16 inch (1.6 mm) and total length of mid panel cracks ≤ 20 feet (6.1 m) total length

4. Edge Cracking/debonding average crack width ≤ 1/16 inch (1.6 mm) and total length of cracks ≤ 12 feet (3.6 m)

Furnish the Laboratory with a certified copy of test results from a recognized laboratory showing compliance with the requirements of this specification for item A. Furnish the laboratory written documentation of the method of surface preparation and any primers, adhesives, or activators used in the field test. Those will become requirements of the material system for subsequent approval or use. A recognized laboratory is one that is regularly inspected by the Cement and Concrete Reference Laboratory of the National Institute of Standards and Technology.

Provide quick setting concrete mortar packaged in strong moisture resistant paper bags or other suitable containers capable of withstanding shipping, normal handling, and storage without breakage. The package will protect the material from deterioration when stored in a dry condition for a period of 1 year. Each package or container must display information regarding the minimum nominal yield and instructions for mixing. Calculate volumetric yield determinations using the manufacturers' recommended water content.

Furnish materials listed on the Department's Qualified Products List (QPL).

705.22 Nonshrink Mortar. Provide nonshrink mortar conforming to ASTM C 1107, with the following modification:

9.1 In addition, ensure that the fluidity of the grout at the maximum water content is at least equal to a flowable mixture as defined in ASTM C 827, Section 8.2.2 and that the minimum flow is 125 @ 5 drops of the flow table in 3 seconds.

Furnish materials according to the Department's Approved materials list.

705.23 Concrete Sealers

A. Provide an Epoxy-Urethane sealer incorporating a two component cross linked urethane and conforming to the following requirements:

1. Absorption - ASTM C642 (non-air entrained concrete). Proportion and mix concrete according to ASTM C672. Sealed concrete, under total immersion, will not exceed 1.0% after 48 hours or 2.0% after 50 days

2. Scaling Resistance - ASTM C672 A rating of "No scaling" after 100 cycles on the sealed concrete (non-air entrained concrete) as compared to "Severe Scaling" on untreated concrete.

3. NCHRP 244, Series 11 - Cube Test

3.1 Weight gain - not to exceed 25% of untreated cube

3.2 Absorbed chloride - not to exceed 25% of untreated cube

4. NCHRP 244, Series IV - Southern Exposure

4.1 Absorbed chloride - not to exceed 10% of untreated concrete

5. Volatile Organic Compounds (VOC) maximum, ASTM D 3960, 3.33 lbs./gal(0.399 g/ml), as applied

Record and report the application rate (square footage/gallon) of sealer during the tests.

Provide test data from an approved independent testing facility. The sealer manufacturer funds the testing costs.

Furnish the test data, a one quart (one liter) sample, and the MSDS to the Office of Materials Management (OMM). OMM will determine material acceptance.

Furnish materials according to the Department's Qualified Products List (QPL)

B. Provide an Non-Epoxy sealer conforming to the following requirements:

1. Absorption - ASTM C642 (non-air entrained concrete). Proportion and mix concrete according to ASTM C672. Sealed concrete, under total immersion, will not exceed 1.0% after 48 hours or 2.0% after 50 days

2. Scaling Resistance - ASTM C672 A rating of "No scaling" after 100 cycles on the sealed concrete (non-air entrained concrete) as compared to "Severe Scaling" on untreated concrete.

3. NCHRP 244, Series 11 - Cube Test

3.1 Weight gain - not to exceed 25% of untreated cube

3.2 Absorbed chloride - not to exceed 25% of untreated cube

4. NCHRP 244, Series IV - Southern Exposure

4.1 Absorbed chloride - not to exceed 10% of untreated concrete

5. Volatile Organic Compounds (VOC) maximum, ASTM D 3960, 3.33 lbs./gal(0.399 g/ml), as applied

Record and report the application rate (square footage/gallon) of sealer during the tests.

Provide test data from an approved independent testing facility. The sealer manufacturer funds the testing costs.

Furnish the test data, a one quart (one liter) sample, and the MSDS to the OMM. OMM will determine material acceptance.

Furnish materials according to the Department's Qualified Products List (QPL).

705.24 Soluble Reactive Silicate Provide a soluble reactive silicate (SRS) that is a blend of $Na/K/Fl_xSiO_x$ (sodium, potassium, fluoro or other silicate), surfactants, polymers, and stabilizers capable of thoroughly saturating and sealing concrete. The treatment system will meet the following performance requirements:

A. Scaling Resistance - Treated concrete will pass ASTM C 672, Scaling Resistance test with a rating of 'No Scaling' after 100 cycles (non-air entrained concrete) as compared to "Severe Scaling' on untreated concrete.

B. Absorption - The absorption of treated concrete under total immersion will not exceed 1.0 percent after 48 hours or 2.0 percent after 50 days (ASTM C 642, non-air entrained concrete). Concrete should be proportioned and mixed in accordance with ASTM C 672.

C. Skid resistance - The skid resistance of treated concrete pavement will not be reduced by more than 10 percent as compared to the same untreated pavement. ASTM E 274 using ASTM E 501 ribbed tire at 40 mph (64 kph), five test average.

D. AASHTO T 259 as modified. The standard T 259 Resistance of Concrete to Chloride Ion Penetration will; be modified as follows:

In addition to section 3.1, intentionally break the specimens so they have a full depth crack through the middle of the slab.

Install section 3.2 dams around the perimeter of the re-assembled, cracked, concrete specimens. Caulk around the perimeter of the dam to assure that only the crack and the concrete will allow water to pass through or be absorbed. After assembly, measure the crack width at three locations and report the crack width.

Perform the ponding of 3.4 until the 3% solution comes through the specimen's crack. Record and report the time required for the solution to appear through the specimen's crack. Remove the solution from the specimens and re-dry according to 3.3 (T 259).

After drying apply the SRS to the specimen's top surface at the manufacturer's recommended rate of application. Record and report the rate of application. Air dry the SRS coated dammed sample specimens for 7 days. After 7 days, re perform the ponding with 3% chloride solution until solution comes through the specimen's crack or 14 days. Record the time the till the ponded solution comes through the crack.

Acceptable SRS materials will have a value of 2 or more when the ponding time before SRS application is divided into the ponding time after SRS application.

Sections 3.5, 3,6, 4.1,4.2 and 5.1 (of T 259) will not apply.

Have tests performed by an approved independent testing facility acceptable to the Department.

Submit test data and a one quart (one liter) a technical data sheet and the MSDS to the OMM for approval

Furnish materials according to the Department's Qualified Products List (QPL).

705.25 Gravity-Fed Resin Provide non shrink, non metallic resin conforming to ASTM C 881, Type 1, Grade 1, Class B or C and the following:

The maximum viscosity at the lowest allowable temperature will be 250 cps. The manufacturer will provide test data to verify the viscosity at the lowest temperature for the class for which it is to be approved.

A minimum average sand retention of 95.0% for three samples tested according to the Sand Penetration Test Method described below.

Show no signs of cracking, debonding or insufficient curing during the sand penetration test

A. Sand Penetration Test Method. This test will be conducted with the following equipment and materials:

1. 4 oz (118 ml) wax coated paper cup. Maximum top diameter 2 5/16" (59 mm); bottom diameter 1 11/16" (43 mm0; height 2 3/8" 960 mm).

2. 20 - 30 grade sand (ASTM C 778)

3. 1 Pint non-absorbent container

4. 8 oz (240 ml) plastic cup

5. Stirring stick or spatula

6. Scale accurate to 0.1 g

7. Disposable gloves

8. Stop watch

9. Thermometer

10. Paint brush

B. Perform the test as follows

1. Assure the material and the room is at 73 °F (23 °C)

2. Determine and record the tare weight of the paper cup (1).

3. Introduce 100.0 grams of 20 - 30 graded sand (2) into the paper cup.

4. Record the weight of the cup and the sand.

5. Consolidate the sand in the cup by lifting the cup approximately ½ " (13 mm) and dropping 25 to 30 times. Then lightly tap the sides of the cup 25 to 30 times with the fingers. The sample may also be placed on a vibrating table for 10 to 15 seconds.

6. Measure enough material into the 8 oz plastic cups (4) to make at least a 200 g sample.

7. Combine the components into the non-absorbent container (3) and mix according to the manufacturer's recommendations using a spatula or stirring stick (5).

8. Pour 40.0g of material over the sand and record the weight of the resin, cup and sand

9. Allow the resin, sand and cup to set undisturbed for 24 hours at 73 °F (23 °C). Re-weigh the resin, cup and sand

10. Remove as much of the paper cup from around the hardened resin and sand matrix as possible. Lightly brush any loose sand from the matrix. Weigh the hardened matrix.

11. Calculate the percent of sand retained, F, as follows:

$$F = [E / (D - A)] \times 100$$

Where,
A = Tare weight of paper cup (g)
B = Weight of cup and sand (g)
C = Weight of fresh mixture of resin, cup and sand (g)
D = Weight of cured mixture of resin, cup and sand (g)
E = Weight of resin sand matrix as measured in step 10 (g)

12. Report the average of three specimens mixed separately

13. Also calculate and report the percent loss due to curing G as follows:

$$G = [(D - C) / (C - B)] \times 100$$

14. Examine the sand / resin matrix for signs of insufficient curing and bond, or excessive shrinkage.

Material Approval. The manufacturer will provide certified test data verifying compliance with the above requirements; technical data sheet; current MSDS for the material; 1 gallon sample; and a letter certifying that the product formulation will not be altered without notification to the Department and OMM.

OMM will determine materials acceptance and include in the Department's qualified Products list (QPL).

Furnish materials according to the Department's Qualified Products List (QPL).

705.26 Epoxy injection Resin. Provide epoxy injection resin capable of application, positive adherence and strength development when applied to moist or wet surfaces at temperatures of 33 °F (1 °C) and above.

Use products that contain 100% solids material and no non-reactive diluents, solvents or other fillers. Provide materials that meet the following requirements:

A. The injection material will meet the requirements of ASTM C 881 Type IV, Grade 1 and Class B or C and have a maximum viscosity of 600 cps at the lowest ambient material and substrate temperature to be used.

B. The paste materials will meet the requirements of ASTM C 881 Type I, Grade 3 and Class B or C.

Material Approval. The manufacturer of the materials is responsible for prequalifying the material and submitting the following to the OMM:

A. An Independent certified test data indicating that the materials, when mixed according to the manufacturer's recommendations, meet the requirements listed above.

B. Manufacturer's technical data sheet for the paste and injection materials.

C. MSDS for paste and injection materials.

D. 1 Gallon Sample or 2 kits of the injection materials

Furnish materials according to the Department's Qualified Products List (QPL).

709 REINFORCING STEEL

709.00 Epoxy Coated Reinforcing Steel. Provide epoxy coated reinforcing steel according to ASTM A 775/A 775M, with the following modifications:

5.1 Ensure that steel reinforcing bars to be coated conform to 709.01, 709.03, or 709.05, and are free of oil, grease, or paint.

5.2 Ensure that the coating material meets the requirements listed in Annex A1 and is a color that facilitates inspection of the installed bar. The color is subject to approval of the Director.

5.3 Sample required.

8.3.1 Evaluate the adhesion of the coating by bending production coated bars around a mandrel of specified size according to the bending tables in ASTM A 615 (ASTM A 615M) or ASTM A 996 (ASTM A 996M) as applicable. Perform the bend test for adhesion of the coating at a uniform rate, and ensure that it takes up to 90 seconds to complete. Place the two longitudinal deformations in a plane perpendicular to the mandrel radius, and ensure that the test specimens are at thermal equilibrium between 68 and 86 °F (20 and 30 °C).

12.1 Perform tests, inspection, and sampling at a site specified by the Director. Sampling for testing requires three 30-inch (1 m) samples for each bar size, for each coating lot, and for each heat of steel reinforcing bars.

14.1 Report of test results required.

Where reinforcing bar cages for prestressed concrete beams are fabricated by tack welding, patch the areas damaged by the tack welding according to ASTM A 775, Section 11, permissible Amount of Damaged Coating and Repair of Damaged Coating.

709.01 Deformed and Plain Billet Steel Bars for Concrete Reinforcement. Provide deformed and plain billet steel bars for concrete reinforcement according to ASTM A 615 (ASTM A 615M), with the following modification:

13.1 Where positive identification of a heat can be made, perform one tension test and one bend test from each bar designation number of each heat in the Lot. Where identification of the heat is not practical, perform one tension test and one bend test for each bar designation number in each lot of 10 tons (10 metric tons) or fraction thereof.

Furnish certified material according to Supplement 1068.

709.03 Rail Steel Deformed and Plain Bars for Concrete Reinforcement. Provide rail steel deformed and plain bars for concrete reinforcement according to ASTM A 996/A 996M.

Furnish certified material according to Supplement 1068.

709.05 Axle Steel Deformed and Plain Bars for Concrete Reinforcement. Provide axle steel deformed and plain bars for concrete reinforcement according to ASTM A 996/A 996M.

Furnish certified material according to Supplement 1068.

709.08 Cold-Drawn Steel Wire for Concrete Reinforcement. Provide cold drawn steel wire for concrete reinforcement according to ASTM A 82 or ASTM A 1064, with the following modification:

7.2 Completely cover galvanized wire with a coating of pure zinc of uniform thickness, so applied that it will adhere firmly to the surface of the wire. Ensure that the minimum weight of zinc coating is 0.8 ounces per square foot (244 g/m^2) of surface as determined by ASTM A 90.

Furnish certified material according to Supplement 1068.

709.09 Fabricated Steel Bar or Rod Mats for Concrete Reinforcement. Provide fabricated steel bar or rod mats for concrete reinforcement according to ASTM A 184/A 184M, with the following modifications:

4 Use deformed bars.

4.1 Provide longitudinal bars conforming to Grade 60 of 709.01, 709.03, or 709.05.

4.2 Provide longitudinal bars according to 709.01, Grade 60. Provide transverse bars according to 709.01.

Furnish certified material according to Supplement 1068.

709.10 Welded Steel Wire Fabric For Concrete Reinforcement. Provide welded steel wire fabric for concrete reinforcement according to ASTM A 185 or ASTM A 1064.

Furnish certified material according to Supplement 1068.

709.11 Deformed Steel Wire for Concrete Reinforcement. Provide deformed steel wire for concrete reinforcement according to ASTM A 496 or ASTM A 1064.

Furnish certified material according to Supplement 1068.

709.12 Welded Deformed Steel Wire Fabric for Concrete Reinforcement. Provide welded deformed steel wire fabric for concrete reinforcement according to ASTM A 497 or ASTM A 1064.

Furnish certified material according to Supplement 1068.

709.13 Coated Dowel Bars. Provide coated dowel bars according to AASHTO M 254, with the following modifications:

4.1 The core material will consist of steel according to 709.01, 709.03, or 709.05.

Coat all surfaces of dowel bars. Suitably re-coat ends of dowel bars that have been cut to length after coating or have not had the uncoated ends coated during manufacturing or fabrication. Prepare surface and patch uncoated bar ends with material equivalent to the original epoxy coating.

If the Contractor elects to use basket supports for positioning of the above dowel bars as specified in 451.08.B or as shown on the plans, provide a fusion-bonded epoxy coated basket dowel bar assembly. Repair uncoated areas with surface preparation and patching material equivalent to the original epoxy coating.

Suitably repair coating on the dowel bars or baskets damaged during installation.

Do not expose coated dowels to weather or sunlight for a period exceeding 180 days.

Furnish certified material according to Supplement 1068.

709.14 Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement. Provide epoxy coated steel wire and welded wire fabric for reinforcement according to ASTM A 884, with the following modifications:

5.1 Ensure that plain or deformed steel wire or welded wire fabric to be coated conform to 709.08, 709.10, 709.11, or 709.12, and is free of oil, grease, or paint.

8.1 Ensure that the coating thickness conforms to Type A. Provide dry film thickness of 5 to 12 mils (0.13 to 0.31 mm).

8.4 Test coated steel wire or welded wire fabric at the manufacturer's plant before shipment or at other sites as designated by the Laboratory.

Furnish certified material according to Supplement 1068.

709.15 Plastic Supports for Reinforcing Steel. Conform to Supplement 1125.

709.16 Galvanized Reinforcing Steel Option for Bridge Structure Spirals. As an option to 709.00 provide galvanized reinforcing steel for the spiral bars only in round column and drilled shaft reinforcing steel cages. Galvanized steel will conform to ASTM A767, Class 1. The galvanized coated reinforcing steel will meet all other requirements of 509.

The galvanized coating will be applied after the reinforcing has been fabricated. If the galvanized surface becomes damaged during handling in the field, repairs will conform to ASTM A780.

Where a sample is requested, provide a replacement splice conforming to the lap length requirements for epoxy coated reinforcing.

Furnish certified material according to Supplement 1068.

LST-01 AIRPORT LIGHTING

DESCRIPTION

01-1.1 This item shall consist of airfield lighting furnished and installed in accordance with this specification, the referenced specifications, and the applicable advisory circulars. The airfield lighting fixtures are installed at the location and in accordance with the dimensions, design, and details shown in the plans. This item shall include the furnishing of all equipment, materials, services, and incidentals necessary to place the airfield lighting in operation as completed units to the satisfaction of the Engineer. Requirements for base cans are covered under Item L-115, Electrical Manholes and Junction Structures.

EQUIPMENT AND MATERIALS

01-2.1 GENERAL:

a. Airport lighting equipment and materials covered by FAA specifications shall have the prior approval of the Federal Aviation Administration, Airports Service, Washington, D.C. 20591, and shall be listed in the latest version of Advisory Circular 150/5345-53, Approved Airport Lighting Equipment. The fixtures shall conform to the requirements of the latest version of Advisory Circular 150/5345-46, Specification for Runway and Taxiway Light Fixtures. Additionally, LED fixtures shall conform to the requirements of FAA Engineering Brief No. 67, Light Sources other than Incandescent and Xenon for Airport Lighting and Obstruction Lighting Fixtures and shall be ETL certified.

b. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through the manufacturer's certification of compliance with the applicable specifications.

c. Manufacturer’s certifications shall not relieve the Contractor of the Contractor’s responsibility to provide materials in accordance with these specifications and acceptable to the Engineer. Materials supplied and installed that do not materially comply with these specifications shall be removed, when directed by the Engineer and replaced with materials, which do comply with these specifications, at the sole cost of the Contractor.

d. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components or electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be boldly and clearly made with arrows or circles (highlighting is not acceptable). Contractor is

solely responsible for delays in project accruing directly or indirectly from late submissions or resubmissions of submittals.

e. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the Contract Documents plans and specifications. The Contractor's lighting submittal shall be neatly bound in a properly sized report binder with clear cover, tabbed by equipment.

01-2.2 TAPE: Rubber and plastic electrical tapes shall be Scotch Electrical Tape Numbers 23 and 88, respectively, as manufactured by the Minnesota Mining and Manufacturing Company, or an approved equal.

01-2.3 CONCRETE: Concrete for light bases or foundations shall conform to Specification Item P-610 “Structural Portland Cement Concrete”.

Concrete for backfill shall be proportioned not leaner than 1-3-6 mix by volume and shall have a compressive strength of not less than 2,000 psi. Approved clean aggregate shall be used to produce the concrete.

01-2.4 CONNECTORS: Connectors shall conform to the requirements of AC 150/5345-26, FAA Specification for L-823, Plug and Receptacle, Cable Connectors. Connectors for cable shall match connectors chosen in L-108 to ensure proper connectivity.

01-2.5 AIRFIELD LIGHTING FIXTURES: The airfield lighting fixtures shall meet the requirements of AC 150/5345-46, Specification for Runway and Taxiway Light Fixtures and shall be of the type as indicated on the plans.

01-2.6 TRANSFORMER: Transformers shall meet the requirements of AC 150/5345-47, Specification for Series to Series Isolation Transformers for Airport Lighting Systems.

01-2.7 LED TAXIWAY FIXTURES: The light source shall be an electroluminescent diode assembly. Fixture shall use a multiple LED array or single source. If a multiple LED array is used, the design must ensure the fixture remains illuminated even if individual LEDs cease to operate. In accordance with FAA Engineering Brief No. 67, up 25% of the individual LEDs must not be operating before the fixture automatically shuts down. Additionally, shutdown will also occur if not operating LEDs form a horizontal or vertical pattern.

The fixture shall have an adjustment mechanism that allows ±4.5° vertical adjustment in the field. It shall be possible to install the lights on existing circuits in addition to, or in replacement of, conventional incandescent or halogen lights without having to change any other element (CCR, primary and secondary cabling, series transformer, etc.). The fixture light output shall match quartz-incandescent fixtures at all brightness levels on a 3-step and 5-step regulator. The required beam color shall be obtained without the use of a color filter. The optical column shall be manufactured with a blue colored, UV resistant acrylic in order to insure optimal daytime visibility.

The fixture electronics shall be mounted inside the LED chamber to provide optimum protection from water and ice in the base can. No active electronic LED elements are allowed in the base can. The fixture shall use robust, solid-state devices and withstand damage if the fixture is knocked over. Fixture

shall use the same frangible couplings, columns, clamp bands, and flat gaskets as traditional fixtures for ease of maintenance.

CONSTRUCTION METHODS

01-3.1 GENERAL: The installation and testing details for the airfield lighting shall be as specified in the applicable advisory circulars and as required in AC 150-5340-30, Design and Installation Details for Airport Visual Aids.

01-3.2 FIXTURE INSTALLATION: The light fixtures shall be installed at the approximate location indicated in the plans. The exact location shall be as directed by the Engineer.

01-3.3 SALVAGED MATERIALS: The Contractor shall remove certain existing airfield lighting fixtures, base cans, isolation transformers, cable, conduit, counterpoise, and ground rods. Complete airfield lighting fixtures including bulbs, frangible couplings, bolts, transformers, covers, and other reusable components will remain airport property, they are to be salvaged by the Contractor and placed in storage at a location on the airport designated by the Resident Engineer and in a manner as to prevent damage to the salvageable items. All items determined unsalvageable by the Owner and Resident Engineer shall be removed from the site by the Contractor.

01-3.4 REMOVAL: Existing airfield lighting fixtures, base cans, isolation transformers, cable, conduit, counterpoise, and ground rods shall be removed as shown on the drawings. Salvage of re-useable portions of the existing fixtures shall be as described in section 01-3.3.

METHOD OF MEASUREMENT

01-4.1 AIRFIELD LIGHTING FIXTURES: The quantity of lights to be paid for under this item shall be the number of each type installed as completed units in place, including excavation and restoration, ready for operation and accepted by the Engineer.

01-4.2 AIRFIELD LIGHTING FIXTURE REMOVAL: The quantity of existing fixtures removed and properly disposed off site, shall be measured on a per each basis, including excavation and restoration.

01-4.3 CABLE REMOVAL: The quantity of direct buried cable removed and properly disposed off site, shall be measured on a per linear foot basis, including excavation and restoration.

01-4.4 COUNTERPOISE AND GROUND ROD REMOVAL: The quantity of counterpoise and ground rods removed and properly disposed off site, shall be measured on a per lineal foot basis, including excavation and restoration. Removal of ground rods shall be included in the cost of removing the counterpoise, no additional payment will be made.

BASIS OF PAYMENT

01-5.1 Payment will be made at the contract unit price for each complete item listed below and installed in place by the Contractor and accepted by the Engineer. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

The price paid shall be full compensation for airfield lighting fixtures, lamps, base plates, base cans, conduit, foundation, isolation transformers, power adapters, connectors and all additional equipment required for a complete working fixture. The price shall also include restoration of disturbed areas.

Payment will be made under:

Item LST-01-5.1	Relocate Existing L-861E Runway Threshold Light, Complete – per each
Item LST-01-5.2	New L-861 Runway Edge Light, Complete – per each
Item LST-01-5.3	New L-861T Taxiway Edge Light, Complete – per each
Item LST-01 5.4	Guidance Sign on Concrete Foundation, Complete – per each
Item LST-01-5.5	Guidance Sign Panel Replacement – per each
Item LST-01-5.6	Demolish Existing L-861T Taxiway Edge Light and Transformer– per each
Item LST-01-5.7	Demolish Existing L-858 Guidance Sign – per each
Item LST-01-5.8	Replace Yellow Lenses with White Lenses in Runway Edge Lights – per each

FEDERAL SPECIFICATIONS REFERENCED IN ITEM LST-01

Number	Title
WW-C-581	Conduit, Metal, Rigid; and Coupling, Elbow; and Nipple, Electrical Conduit: Zinc-Coated

FAA SPECIFICATIONS REFERENCED IN ITEM LST-01

Number	Title
AC 150/5340-4	Installation Details for Centerline and Touchdown Zone Lighting Systems
AC 150/5340-14B	Economy Approach Lighting Aids
AC 150/5340-24	Runway and Taxiway Edge Lighting System
AC 150/5340-28	Low Visibility Taxiway Lighting Systems
AC 150/5345-42C	Specification for Airport Light Base and Transformer Housings, Junction Boxes, and Accessories
AC 150/5345-46B	Specification for Runway and Taxiway Light Fixtures

END OF ITEM LST-01

ITEM LST-02

FEDERAL AVIATION ADMINISTRATION (FAA) FACILITY RELOCATIONS/INSTALLATIONS RUNWAY 28

DESCRIPTION

02-1.1 Work under this item shall consist of relocating the existing FAA-owned Runway 28 Precision Approach Path Indicator (PAPI) System and Runway End Identifier Light (REIL) system. The Contractor shall complete all work shown in the plans and described in the specifications.

02-1.2 RUNWAY 28 PAPI RELOCATION. This item shall consist of all work required to remove, relocate and re-install the existing FAA-owned PAPI system as shown in the plans and described in the specifications. The work includes, but is not limited to: demolition of the existing PAPI foundations, aggregate surfacing, concrete access road, conduits, control unit supports, cables, etc.; and re-installation of existing PAPI Light Housing Units (LHAs) on new supports and concrete foundations; re-installation of the existing PAPI power and control unit on a new concrete foundation, including new conduits, rock, cables, electrical equipment, etc. furnish and installation of power and control cables between the LHA's and power and control unit; furnish and installation of grounding and earth electrode systems (EES); installation of new frangible connectors, conduit, elbows, mounting hardware and other electrical items, furnish and install aggregate surfacing around the LHAs and the power and control unit; and provide all other miscellaneous items associated with the relocation as shown in the drawings and as directed by the FAA.

The FAA will conduct a ground and flight inspection of the PAPI system. The Contractor shall be available to assist the FAA during both inspections and make any necessary adjustments to the equipment.

02-1.3 RUNWAY 28 REIL RELOCATION. This item shall consist of all work required to relocate and re-install the existing FAA-owned REIL system as shown in the plans and described in the specifications. The work includes, demolition of the existing REIL foundations, aggregate surfacing, conduits, control unit supports, cables, etc.; and re-installation of existing REIL Lights on new conduit supports and concrete foundations; re-installation of the existing REIL power and control cabinet on a new concrete foundation , including new conduits, rock, cables, electrical equipment, etc.; furnish and installation of power and control cables to both REILs and power and control cabinet; furnish and installation of grounding and earth electrode systems (EES); installation of new frangible connectors, conduit, elbows, mounting hardware and other electrical items, furnish and install aggregate surfacing around the REILs and the power and control cabinet; and provide all other miscellaneous items associated with the relocation as shown in the drawings and as directed.

The FAA will conduct a ground and flight inspection of the REIL system. The Contractor shall be available to assist the FAA during both inspections and make any necessary adjustments to the equipment as directed by the FAA.

02-1.4 Additional details pertaining to a specific system covered in this item are contained in the following advisory circulars. The Contractor shall have a copy of these in his files:

a. Order 6850.2B Visual Guidance Lighting Systems

b. AC 150/5345-26D Specifications for L-823 Plug and Receptacle Cable Connectors

c. AC 150/5345-7F Specifications for L-824 Underground Electrical Cable for Airport Lighting Circuits

d. AC 150/5345-42G Specifications for Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories

e. AC 150/5345-28F Precision Approach Path Indicator (PAPI) System

f. AC 150/5345-53D Airport Lighting Equipment Certification

EQUIPMENT AND MATERIALS

02-2.1 GENERAL. Equipment and materials supplied by the Contractor shall be in accordance with the applicable Technical Specifications.

a. Airport lighting equipment and materials covered by FAA specifications shall have the prior approval of the Federal Aviation Administration, Airports Service, Washington, D.C. 20591, and shall be listed in the latest version of Advisory Circular 150/5345-53D, Approved Airport Lighting Equipment.

b. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through the manufacturer's certification of compliance with the applicable specifications.

c. Lists of the equipment and materials required for a particular system are contained in the applicable advisory circulars.

02-2.2 TAPE. Rubber and plastic electrical tapes shall be Scotch Electrical Tape Numbers 23 and 88, respectively, as manufactured by the Minnesota Mining and Manufacturing Company, or an approved equal.

02-2.3 CONCRETE. Concrete for foundations and backfill shall be in accordance with Item P-610.

02-2.4 CONDUIT. Rigid steel conduit and fittings shall conform to the requirements of Federal Specification WW-C-581.

CONSTRUCTION

02-3.1 INSTALLATION. The equipment and components shall be installed by personnel experienced with the requirements and techniques involved with similar installations. The personnel shall be thoroughly familiar with National Electrical Code, Federal Communications Commission (FCC), and FAA requirements. The personnel shall be thoroughly familiar with airport rules and regulations, and applicable safety requirements.

02-3.2 INSPECTION.

A. Ground Inspection: Contractor shall assist the FAA with any periodic inspections. The Contractor shall conduct all tests requested by the FAA. All necessary adjustments to the

system shall be made by the Contractor as requested by FAA.

B. Once the Contractor has indicated that construction is complete, the Contractor shall participate in a "Contractors Acceptance Inspection" (CAI) with FAA and Airport representatives. Any deficiencies found during the CAI shall be corrected by the Contractor within 7 calendar days of receiving written notice of such deficiencies.

C. After the facility has been commissioned by the FAA, the Contractor shall participate in a "Joint Acceptance Inspection" (JAI) with Government and Airport representatives. Any deficiencies or defects found during the JAI shall be corrected by the Contractor within 7 calendar days of receiving written notice of the deficiencies or defects.

D. The FAA will perform the commissioning flight inspection for the new PAPI and REIL relocations. The Contractor shall be available to assist the FAA during the equipment flight check to make any necessary adjustments.

02-3.3 CLEANUP. Upon completion of the project, the Contractor shall clean around the project site and seed and mulch all disturbed areas. The Contractor shall correct or repair damage done during the execution of this contract. Scrap and debris resulting from the construction and/or installation shall be removed from the premises by the Contractor on a daily basis.

02-3.4 FRANGIBLE MOUNTINGS. When installing the frangible coupling, care shall be taken to use a wrench which will grip the lower hexagonal head of the coupling, i.e., that portion immediately below the breakoff groove. If the upper portion of the hexagonal head is gripped by the wrench, the coupling may break when pressure is applied. Plumber's pipe joint compounds shall be applied to the threads of frangible couplings to facilitate removal. The frangible coupling shall be screwed down tightly into the conduit coupling to lock clamping ring in place and prohibit turning of lampholder. The joint between the cable assemblies in the frangible coupling shall not be taped.

02-3.5 PAINTING. Damaged areas of painted items shall be touched up. Galvanized surfaces, damaged in any manner, shall be thoroughly cleaned and treated with a cold galvanizing such as "Dry Galv," manufactured by American Solder and Flux Company, or approved equal.

02-3.6 TESTING. Contractor shall test all cables in accordance with specification L-108 and submit completed forms found in the Attachments section of the spec book.

Contractor shall demonstrate that both Papi and REIL systems are operational with FAA personnel present and submit completed forms found in the Attachment to this item.

METHOD OF MEASUREMENT

02-4.1 The method of measurement for the relocation of the Runway 28 PAPI system completed in place, including excavation, foundations, secondary power and control cables, relocation of LHA's and power and control equipment, aggregate surfacing, etc., ready for operation and accepted by the FAA will be made on a lump sum basis.

02-4.2 The method of measurement for the relocation of the Runway 28 REIL system completed in place, including excavation, foundations, secondary power and control cables, relocation of LHA's and power and control equipment, aggregate surfacing, etc., ready for operation and accepted by the FAA will be made on a lump sum basis.

BASIS OF PAYMENT

02-5.1 Payment for the relocation of the Runway 28 PAPI System will be made at the contract lump sum price. The lump sum price shall include all work necessary to relocate the existing FAA-owned PAPI facility and for providing all materials, labor, tools, and equipment required to complete the installation. This price shall include removal of existing foundations, access roads and site improvements, installing existing equipment on new foundations, furnishing all cables, foundations, aggregate surfacing, secondary power and control cable, electrical connections, assisting during FAA inspections and flight check and all other incidental items necessary to complete the relocation. Cost for the concrete access road and primary power cable installation will be made under separate items.

02-5.2 Payment for the relocation of the Runway 28 REIL System will be made at the contract lump sum price. The lump sum price shall include all work necessary to relocate the existing FAA-owned equipment and provide all materials, labor, tools, equipment required to complete the installation. This price shall include removal of existing foundations, access roads and site improvements, installing existing equipment on new foundations, furnishing all cables, foundations, secondary power and control cable, electrical connections, assisting during FAA inspections and flight check and all other incidental items necessary to complete the relocation. Concrete access road and primary power cable installation will be made under separate items.

Payment will be made under:

Item LST-02-5.1 Relocate Runway 28 PAPI System – per lump sum

Item LST-02-5.2 Relocate Runway 28 REIL System – per lump sum

END OF ITEM LST-02

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared				(3) Page No.	
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code	(7) Facility Ident. Code	S	C	F	T	M	
		REIL	3313BC	3	3	1	3	BC	
(8) Equipment/System Type		(9) Serial No.	(10) Frequency	(11) Date Commissioned					
FA 10264									
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection					

(16) Reference Handbook/Directive (Number and Title/Subject)
6850.5C MAINTENANCE OF LIGHTED NAVIGATIONAL AIDS

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
115	Lamp Operation	All on	same as standard	same as standard				
116	Remote Control Function	Operational	same as standard	same as standard				
117	Vertical Alignment (L)							
b.	Without baffles	10 Deg.	+1 Deg.	-1 Deg.				
117	Vertical Alignment (R)							
b.	Without baffles	10 Deg.	+1 Deg.	-1 Deg.				
118	Horizontal Alignment (L)							
b.	Without baffles	15 Deg.	+1 Deg.	-1 Deg.				
118	Horizontal Alignment (R)							
b.	Without baffles	15 Deg.	+1 Deg.	-1 Deg.				
119	Flashing Rate							
a.	REIL (L)	120 flashes/min.	+2 flashes/min.	-2 flashes/min.				
119	Flashing Rate							
a.	REIL (R)	120 flashes/min.	+2 flashes/min.	-2 flashes/min.				
120	Input Voltage	120V, 240V, xfmr tap voltage	+3%	-3%				
121	Obstructions	No obstruction	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

FAA Form 6000-10 (9-08)

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared			(3) Page No. 1	
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code	(7) Facility Ident. Code	S	C	F	T	M
		REIL	3313BC	3	3	1	3	BC
(8) Equipment/System Type		(9) Serial No.	(10) Frequency	(11) Date Commissioned				
REIL EES								
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection				

(16) Reference Handbook/Directive (Number and Title/Subject)

FAA-HNDBK-010 Recommended Practices and Procedures for Lightning and Surge Protection, Grounding, Bonding and Shielding Implementation.

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
3.1.5.1.5	EES System Resistance	Less than 10 Ω	Same as Standard	Same as Standard				

(24) Other Data Specified by Washington or District Offices:

FAA Form 6000-10 (9-08)

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared			(3) Page No. 2	
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code REIL	(7) Facility Ident. Code 3313BC	S 3	C 3	F 1	T 3	M BC
(8) Equipment/System Type FA-10264 REIL Rack		(9) Serial No.	(10) Frequency	(11) Date Commissioned				
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection				

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.17B MAINTENANCE OF ELECTRICAL SYSTEMS IN BUILDINGS

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
3-2.	Service Entrance Voltage	Site Specific	Standard +5%	Standard -5%				
3-3.	Grounding Systems							
a.	System ground resistance…Resistance between neutral (grounded conductor) or equipment grounding conductor to earth ground.	Not exceeding 10 ohms (or as required by facility drawings)	Same as Standard	Same as Standard				
b.	NAS Electronic equipment… ground. Resistance between exposed non-current carrying metalparts and any other point of the signal reference structure.	Not exceeding 10 ohms (value superceded value set by 6950.17A)	Same as Standard	Same as Standard				
3-4.	Lightning and Surge Arresters… In AC service entrance power.	MIB	Same as Standard	Same as Standard				
3-5.	Lightning Protection System	Installation drawings	N/A	N/A				

(24) Other Data Specified by Washington or District Offices:

TECHNICAL REFERENCE DATA RECORD	(1) Location (City/State)	(2) Date Prepared	(3) Page No. 3

(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code	(7) Facility Ident. Code	S	C	F	T	M
		REIL	3313BC	3	3	1	3	BC

(8) Equipment/System Type	(9) Serial No.	(10) Frequency	(11) Date Commissioned
FA-10264 REIL Rack			

(12) Latitude	(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.22A MAINTENANCE OF ELECTRICAL POWER CABLES

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
3-2.	Power cable 600V insulation							
a. (1)	Conductor-to-conductor insulation resistance							
	Transfomer to REIL Rack							
	L1 to L2	50M ohm min. at 500V dc	same as standard	same as standard				
	L1 to N	50M ohm min. at 500V dc	same as standard	same as standard				
	L2 to N	50M ohm min. at 500V dc	same as standard	same as standard				
b. (1)	Transfomer to REIL Rack							
	Transformer to Shelter							
	L1 to ground	50M ohm min. at 500V dc	same as standard	same as standard				
	L2to ground	50M ohm min. at 500V dc	same as standard	same as standard				
	N to ground	50M ohm min. at 500V dc	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

FAA Form 6000-10 (9-08)

TECHNICAL REFERENCE DATA RECORD	(1) Location (City/State)	(2) Date Prepared	(3) Page No. 4

(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code	(7) Facility Ident. Code	S	C	F	T	M
		REIL	3313BC	3	3	1	3	BC

(8) Equipment/System Type	(9) Serial No.	(10) Frequency	(11) Date Commissioned
FA-10264 REIL Flasher			

(12) Latitude	(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.22A MAINTENANCE OF ELECTRICAL POWER CABLES

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
3-2.	Power cable 600V insulation							
a. (1)	Conductor-to-conductor insulation resistance							
	REIL Rack to Flasher #1							
	L1 to L2	50M ohm min. at 500V dc	same as standard	same as standard				
	L1 to N	50M ohm min. at 500V dc	same as standard	same as standard				
	L2 to N	50M ohm min. at 500V dc	same as standard	same as standard				
b. (1)	Conductor-to-ground insulation resistance							
	REIL Rack to Flasher #1							
	L1 to ground	50M ohm min. at 500V dc	same as standard	same as standard				
	L2 to ground	50M ohm min. at 500V dc	same as standard	same as standard				
	N to ground	50M ohm min. at 500V dc	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

TECHNICAL REFERENCE DATA RECORD	(1) Location (City/State)	(2) Date Prepared	(3) Page No. 5

(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code	(7) Facility Ident. Code	S	C	F	T	M
		REIL	3313BC	3	3	1	3	BC

(8) Equipment/System Type	(9) Serial No.	(10) Frequency	(11) Date Commissioned
FA-10264 REIL Flasher			
(12) Latitude	(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.22A MAINTENANCE OF ELECTRICAL POWER CABLES

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
3-2.	Power cable 600V insulation							
a. (1)	Conductor-to-conductor insulation resistance							
	REIL Rack to Flasher #2							
	L1 to L2	50M ohm min. at 500V dc	same as standard	same as standard				
	L1 to N	50M ohm min. at 500V dc	same as standard	same as standard				
	L2 to N	50M ohm min. at 500V dc	same as standard	same as standard				
b. (1)	Conductor-to-ground insulation resistance							
	REIL Rack to Flasher #2							
	L1 to ground	50M ohm min. at 500V dc	same as standard	same as standard				
	L2 to ground	50M ohm min. at 500V dc	same as standard	same as standard				
	N to ground	50M ohm min. at 500V dc	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

TECHNICAL REFERENCE DATA RECORD	(1) Location (City/State)	(2) Date Prepared	(3) Page No. 6

(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code	(7) Facility Ident. Code	S	C	F	T	M
		REIL	3313BC	3	3	1	3	BC

(8) Equipment/System Type	(9) Serial No.	(10) Frequency	(11) Date Commissioned
FA-10264 REIL Flasher			

(12) Latitude	(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.22 MAINTENANCE OF ELECTRICAL POWER AND CONTROL CABLES

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
32.b.	Control cable 600V insulation							
(1) (a)	Conductor-to-conductor insulation resistance							
	REIL Rack to Flasher #1							
	Conductor No.							
	#1 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#2 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#3 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#4 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#5 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#6 Pair	50M ohm min. at 500V dc	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared			(3) Page No. 7	
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code REIL	(7) Facility Ident. Code 3313BC	S 3	C 3	F 1	T 3	M BC
(8) Equipment/System Type FA-10264 REIL Flasher		(9) Serial No.	(10) Frequency	(11) Date Commissioned				
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection				

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.22 MAINTENANCE OF ELECTRICAL POWER AND CONTROL CABLES

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
32.b.	Control cable 600V insulation							
(2) (a)	Conductor-to-ground insulation resistance							
	REIL Rack to Flasher #1							
	Conductor No.							
	#1 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#2 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#3 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#4 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#5 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#6 Pair	50M ohm min. at 500V dc	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

TECHNICAL REFERENCE DATA RECORD	(1) Location (City/State)	(2) Date Prepared	(3) Page No. 8

(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code	(7) Facility Ident. Code	S	C	F	T	M
		REIL	3313BC	3	3	1	3	BC

(8) Equipment/System Type	(9) Serial No.	(10) Frequency	(11) Date Commissioned
FA-10264 REIL Flasher			
(12) Latitude	(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.22 MAINTENANCE OF ELECTRICAL POWER AND CONTROL CABLES

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
32.b.	Control cable 600V insulation							
(1) (a)	Conductor-to-conductor insulation resistance							
	REIL Rack to Flasher #2							
	Conductor No.							
	#1 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#2 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#3 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#4 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#5 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#6 Pair	50M ohm min. at 500V dc	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared			(3) Page No. 9	
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code REIL	(7) Facility Ident. Code 3313BC	S 3	C 3	F 1	T 3	M BC
(8) Equipment/System Type FA-10264 REIL Flasher		(9) Serial No.	(10) Frequency	(11) Date Commissioned				
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection				

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.22 MAINTENANCE OF ELECTRICAL POWER AND CONTROL CABLES

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
32.b.	Control cable 600V insulation							
(2) (a)	Conductor-to-ground insulation resistance							
	REIL Rack to Flasher #2							
	Conductor No.							
	#1 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#2 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#3 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#4 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#5 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#6 Pair	50M ohm min. at 500V dc	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

TECHNICAL REFERENCE DATA RECORD	(1) Location (City/State)	(2) Date Prepared	(3) Page No. 1

(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code	(7) Facility Ident. Code	S	C	F	T	M
		PAPI	33193A	3	3	1	9	3A

(8) Equipment/System Type	(9) Serial No.	(10) Frequency	(11) Date Commissioned
PAPI EES			

(12) Latitude	(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection

(16) Reference Handbook/Directive (Number and Title/Subject)

FAA-HNDBK-010 Recommended Practices and Procedures for Lightning and Surge Protection, Grounding, Bonding and Shielding Implementation.

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
3.1.5.1.5	EES System Resistance	Less than 10 Ω	Same as Standard	Same as Standard				

(24) Other Data Specified by Washington or District Offices:

FAA Form 6000-10 (9-08)

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared			(3) Page No. 2		
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code PAPI	(7) Facility Ident. Code 33193A		S 3	C 3	F 1	T 9	M 3A
(8) Equipment/System Type PAPI Rack		(9) Serial No.	(10) Frequency	(11) Date Commissioned					
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection					

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.17B MAINTENANCE OF ELECTRICAL SYSTEMS IN BUILDINGS

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
3-2.	Service Entrance Voltage	Site Specific	Standard +5%	Standard -5%				
3-3.	Grounding Systems							
a.	System ground resistance…Resistance between neutral (grounded conductor) or equipment grounding conductor to earth ground.	Not exceeding 10 ohms (or as required by facility drawings)	Same as Standard	Same as Standard				
b.	NAS Electronic equipment… ground. Resistance between exposed non-current carrying metalparts and any other point of the signal reference structure.	Not exceeding 10 ohms (value superceded value set by 6950.17A)	Same as Standard	Same as Standard				
3-4.	Lightning and Surge Arresters… In AC service entrance power.	MIB	Same as Standard	Same as Standard				
3-5.	Lightning Protection System	Installation drawings	N/A	N/A				

(24) Other Data Specified by Washington or District Offices:

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared			(3) Page No. 3	
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code PAPI	(7) Facility Ident. Code 33193A	S 3	C 3	F 1	T 9	M 3A
(8) Equipment/System Type PAPI Rack		(9) Serial No.	(10) Frequency	(11) Date Commissioned				
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection				

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.22A MAINTENANCE OF ELECTRICAL POWER CABLES

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
3-2.	Power cable 600V insulation							
a. (1)	Conductor-to-conductor insulation resistance							
	Power Source to PAPI Rack							
	L1 to L2	50M ohm min. at 500V dc	same as standard	same as standard				
	L1 to N	50M ohm min. at 500V dc	same as standard	same as standard				
	L2 to N	50M ohm min. at 500V dc	same as standard	same as standard				
b. (1)	Conductor-to-ground insulation resistance							
	Power Source to PAPI Rack							
	L1 to ground	50M ohm min. at 500V dc	same as standard	same as standard				
	L2to ground	50M ohm min. at 500V dc	same as standard	same as standard				
	N to ground	50M ohm min. at 500V dc	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

FAA Form 6000-10 (9-08)

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared			(3) Page No. 4		
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code PAPI	(7) Facility Ident. Code 33193A		S 3	C 3	F 1	T 9	M 3A
(8) Equipment/System Type FA 10265		(9) Serial No.	(10) Frequency	(11) Date Commissioned					
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection					

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.22A MAINTENANCE OF ELECTRICAL POWER CABLES

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
3-2.	Power cable 600V insulation							
a. (1)	Conductor-to-conductor insulation resistance							
	PAPI P&C Rack to LHA1							
	TB1-9/TB1-1 to TB1-10/TB1-4	50M ohm min. at 500V dc	same as standard	same as standard				
b. (1)	Conductor-to-ground insulation resistance							
	PAPI P&C Rack to LHA1							
	TB1-9/TB1-1 to ground	50M ohm min. at 500V dc	same as standard	same as standard				
	TB1-10/TB1-4 to Ground	50M ohm min. at 500V dc	same as standard	same as standard				
a. (1)	Conductor-to-conductor insulation resistance							
	PAPI P&C Rack to LHA2							
	TB1-11TB1-4 to TB1-10/TB1-1	50M ohm min. at 500V dc	same as standard	same as standard				
b. (1)	Conductor-to-ground insulation resistance							
	PAPI P&C Rack to LHA2							
	TB1-10/TB1-1 to ground	50M ohm min. at 500V dc	same as standard	same as standard				
	TB1-11/TB1-4 to Ground	50M ohm min. at 500V dc	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

TECHNICAL REFERENCE DATA RECORD	(1) Location (City/State)	(2) Date Prepared	(3) Page No. 5

(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code	(7) Facility Ident. Code	S	C	F	T	M
		PAPI	33193A	3	3	1	9	3A

(8) Equipment/System Type	(9) Serial No.	(10) Frequency	(11) Date Commissioned
FA 10265			
(12) Latitude	(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.22A MAINTENANCE OF ELECTRICAL POWER CABLES

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
3-2.	Power cable 600V insulation							
a. (1)	Conductor-to-conductor insulation resistance							
	PAPI P&C Rack to LHA3							
	TB1-14/TB1-1 to TB1-13/TB1-4	50M ohm min. at 500V dc	same as standard	same as standard				
b. (1)	Conductor-to-ground insulation resistance							
	PAPI P&C Rack to LHA3							
	TB1-14/TB1-1 to ground	50M ohm min. at 500V dc	same as standard	same as standard				
	TB1-13/TB1-4 to Ground	50M ohm min. at 500V dc	same as standard	same as standard				
a. (1)	Conductor-to-conductor insulation resistance							
	PAPI P&C Rack to LHA4							
	TB1-13/TB1-1 to TB1-12/TB1-4	50M ohm min. at 500V dc	same as standard	same as standard				
b. (1)	Conductor-to-ground insulation resistance							
	PAPI P&C Rack to LHA4							
	TB1-13/TB1-1 to ground	50M ohm min. at 500V dc	same as standard	same as standard				
	TB1-12/TB1-4 to Ground	50M ohm min. at 500V dc	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared			(3) Page No. 6		
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code PAPI	(7) Facility Ident. Code 33193A		S 3	C 3	F 1	T 9	M 3A
(8) Equipment/System Type FA 10265		(9) Serial No.	(10) Frequency	(11) Date Commissioned					
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection					

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.22 MAINTENANCE OF ELECTRICAL POWER AND CONTROL CABLES

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
32.b.	Control cable 600V insulation							
(1) (a)	Conductor-to-conductor insulation resistance							
	PAPI P&C Rack to LHA1							
	Conductor No.							
	#1 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#2 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#3 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#4 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#5 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#6 Pair	50M ohm min. at 500V dc	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared			(3) Page No. 7		
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code PAPI	(7) Facility Ident. Code 33193A		S 3	C 3	F 1	T 9	M 3A
(8) Equipment/System Type FA 10265		(9) Serial No.	(10) Frequency	(11) Date Commissioned					
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection					

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.22 MAINTENANCE OF ELECTRICAL POWER AND CONTROL CABLES

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
32.b.	Control cable 600V insulation							
(2) (a)	Conductor-to-ground insulation resistance							
	PAPI P&C Rack to LHA1							
	Conductor No.							
	#1 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#2 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#3 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#4 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#5 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#6 Pair	50M ohm min. at 500V dc	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared			(3) Page No. 8		
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code PAPI	(7) Facility Ident. Code 33193A		S 3	C 3	F 1	T 9	M 3A
(8) Equipment/System Type FA 10265		(9) Serial No.	(10) Frequency	(11) Date Commissioned					
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection					

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.22 MAINTENANCE OF ELECTRICAL POWER AND CONTROL CABLES

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
32.b.	Control cable 600V insulation							
(1) (a)	Conductor-to-conductor insulation resistance							
	PAPI P&C Rack to LHA2							
	Conductor No.							
	#1 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#2 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#3 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#4 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#5 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#6 Pair	50M ohm min. at 500V dc	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

FAA Form 6000-10 (9-08)

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared			(3) Page No. 9	
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code PAPI	(7) Facility Ident. Code 33193A	S 3	C 3	F 1	T 9	M 3A
(8) Equipment/System Type FA 10265		(9) Serial No.	(10) Frequency	(11) Date Commissioned				
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection				

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.22 MAINTENANCE OF ELECTRICAL POWER AND CONTROL CABLES

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
32.b.	Control cable 600V insulation							
(2) (a)	Conductor-to-ground insulation resistance							
	PAPI P&C Rack to LHA2							
	Conductor No.							
	#1 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#2 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#3 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#4 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#5 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#6 Pair	50M ohm min. at 500V dc	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared			(3) Page No. 10	
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code PAPI	(7) Facility Ident. Code 33193A	S 3	C 3	F 1	T 9	M 3A
(8) Equipment/System Type FA 10265		(9) Serial No.	(10) Frequency	(11) Date Commissioned				
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection				

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.22 MAINTENANCE OF ELECTRICAL POWER AND CONTROL CABLES

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
32.b.	Control cable 600V insulation							
(1) (a)	Conductor-to-conductor insulation resistance							
	PAPI P&C Rack to LHA3							
	Conductor No.							
	#1 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#2 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#3 pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#4 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#5 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#6 Pair	50M ohm min. at 500V dc	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared			(3) Page No. 11	
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code PAPI	(7) Facility Ident. Code 33193A	S 3	C 3	F 1	T 9	M 3A
(8) Equipment/System Type FA 10265		(9) Serial No.	(10) Frequency	(11) Date Commissioned				
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection				

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.22 MAINTENANCE OF ELECTRICAL POWER AND CONTROL CABLES

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
32.b.	Control cable 600V insulation							
(2) (a)	Conductor-to-ground insulation resistance							
	PAPI P&C Rack to LHA3							
	Conductor No.							
	#1 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#2 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#3 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#4 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#5 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#6 Pair	50M ohm min. at 500V dc	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared			(3) Page No. 12	
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code PAPI	(7) Facility Ident. Code 33193A	S 3	C 3	F 1	T 9	M 3A
(8) Equipment/System Type FA 10265		(9) Serial No.	(10) Frequency	(11) Date Commissioned				
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection				

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.22 MAINTENANCE OF ELECTRICAL POWER AND CONTROL CABLES

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
32.b.	Control cable 600V insulation							
(1) (a)	Conductor-to-conductor insulation resistance							
	PAPI P&C Rack to LHA4							
	Conductor No.							
	#1 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#2 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#3 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#4 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#5 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#6 Pair	50M ohm min. at 500V dc	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared			(3) Page No. 13	
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code PAPI	(7) Facility Ident. Code 33193A	S 3	C 3	F 1	T 9	M 3A
(8) Equipment/System Type FA 10265		(9) Serial No.	(10) Frequency	(11) Date Commissioned				
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection				

(16) Reference Handbook/Directive (Number and Title/Subject)

6950.22 MAINTENANCE OF ELECTRICAL POWER AND CONTROL CABLES

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
32.b.	Control cable 600V insulation							
(2) (a)	Conductor-to-ground insulation resistance							
	PAPI P&C Rack to LHA4							
	Conductor No.							
	#1 pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#2 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#3 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#4 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#5 Pair	50M ohm min. at 500V dc	same as standard	same as standard				
	#6 Pair	50M ohm min. at 500V dc	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared				(3) Page No.
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code	(7) Facility Ident. Code	S	C	F	T	M
		PAPI	33193A	3	3	1	9	3A
(8) Equipment/System Type		(9) Serial No.	(10) Frequency	(11) Date Commissioned				
FA 10265								
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection				

(16) Reference Handbook/Directive (Number and Title/Subject)
6850.5C MAINTENANCE OF LIGHTED NAVIGATIONAL AIDS

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
93	PAPI Angular Elevation							
a.	Standard Installation							
(1)	Light Unit 1 (Unit Nearest Runway)	Comm. Angle + 30 Min.	+2 Min	-2 Min				
95	PAPI Light Hor. Alignment	Perp. To RWY Ctrline	same as standard	same as standard				
98	Tilt Switch Operation							
a.	Upper Limit	Aim Angle +.5 Deg to 1 Deg.	same as standard	same as standard				
b.	Lower Limit	Aim Angle -.25 Deg to -.5 Deg.	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

FAA Form 6000-10 (9-08)

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared				(3) Page No.
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code	(7) Facility Ident. Code	S	C	F	T	M
		PAPI	33193A	3	3	1	9	3A
(8) Equipment/System Type		(9) Serial No.	(10) Frequency	(11) Date Commissioned				
FA 10265								
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection				

(16) Reference Handbook/Directive (Number and Title/Subject)
6850.5C MAINTENANCE OF LIGHTED NAVIGATIONAL AIDS

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
93	PAPI Angular Elevation							
a.	Standard Installation							
(1)	Light Unit 2	Comm. Angle + 30 Min.	+2 Min	-2 Min				
95	PAPI Light Hor. Alignment	Perp. To RWY Ctrline	same as standard	same as standard				
98	Tilt Switch Operation							
a.	Upper Limit	Aim Angle +.5 Deg to 1 Deg.	same as standard	same as standard				
b.	Lower Limit	Aim Angle -.25 Deg to -.5 Deg.	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

FAA Form 6000-10 (9-08)

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared				(3) Page No.
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code	(7) Facility Ident. Code	S	C	F	T	M
		PAPI	33193A	3	3	1	9	3A
(8) Equipment/System Type		(9) Serial No.	(10) Frequency	(11) Date Commissioned				
FA 10265								
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection				

(16) Reference Handbook/Directive (Number and Title/Subject)
6850.5C MAINTENANCE OF LIGHTED NAVIGATIONAL AIDS

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
1	PAPI Angular Elevation							
a.	Standard Installation							
(1)	Light Unit 3	Comm. Angle + 30 Min.	+2 Min	-2 Min				
95	PAPI Light Hor. Alignment	Perp. To RWY Ctrline	same as standard	same as standard				
98	Tilt Switch Operation							
a.	Upper Limit	Aim Angle +.5 Deg to 1 Deg.	same as standard	same as standard				
b.	Lower Limit	Aim Angle -.25 Deg to -.5 Deg.	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

FAA Form 6000-10 (9-08)

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared				(3) Page No.
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code	(7) Facility Ident. Code	S	C	F	T	M
		PAPI	33193A	3	3	1	9	3A
(8) Equipment/System Type		(9) Serial No.	(10) Frequency	(11) Date Commissioned				
FA 10265								
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection				

(16) Reference Handbook/Directive (Number and Title/Subject)
6850.5C MAINTENANCE OF LIGHTED NAVIGATIONAL AIDS

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
1	PAPI Angular Elevation							
a.	Standard Installation							
(1)	Light Unit 4	Comm. Angle + 30 Min.	+2 Min	-2 Min				
95	PAPI Light Hor. Alignment	Perp. To RWY Ctrline	same as standard	same as standard				
98	Tilt Switch Operation							
a.	Upper Limit	Aim Angle +.5 Deg to 1 Deg.	same as standard	same as standard				
b.	Lower Limit	Aim Angle -.25 Deg to -.5 Deg.	same as standard	same as standard				

(24) Other Data Specified by Washington or District Offices:

FAA Form 6000-10 (9-08)

TECHNICAL REFERENCE DATA RECORD		(1) Location (City/State)		(2) Date Prepared				(3) Page No.	
(4) Cost Center Code	(5) Location Ident.	(6) Facility Alpha Code	(7) Facility Ident. Code	S	C	F	T	M	
		PAPI	33193A	3	3	1	9	3A	
(8) Equipment/System Type		(9) Serial No.	(10) Frequency	(11) Date Commissioned					
FA 10265									
(12) Latitude		(13) Longitude	(14) MSL	(15) Date of Commissioning Flight Inspection					

(16) Reference Handbook/Directive (Number and Title/Subject)
6850.5C MAINTENANCE OF LIGHTED NAVIGATIONAL AIDS

(17)Reference PAR/DOC Number	(18) Parameter	(19) STD Value	(20) Initial Max	(21) Tolerance Min	(22) Measured Value	(23) Revisions Type	Date	Initials
99	Photoelectric Control							
a.	Switching Time to High Intensity	Within 1 minute	Same as standard	Same as standard				
b.	Switching Time to Low Intensity	Within 1 minute	Same as standard	Same as standard				
c.	Orientation	Toward north sky	Same as standard	Same as standard				
101	Two-Step Brightness System Lamp Current							
102	Input Voltage	Rated input	+5%	-5%				
103	Red Filters	All filters on	Same as standard	Same as standard				
104	Obstructions	No obstruction	Same as standard	Same as standard				
105	Remote Control Function	Operational	Same as standard	Same as standard				

(24) Other Data Specified by Washington or District Offices:

FAA Form 6000-10 (9-08)

ATTACHMENTS

ITEMIZED PROPOSAL

ITEMIZED PROPOSAL

28972

DELAWARE MUNICIPAL AIRPORT
DELAWARE, OHIO
RUNWAY 10/28 EXTENSION & OVERLAY

ITEM NO.	SPEC. REF.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE (WORDS)	UNIT PRICE	EXTENSION
BASE BID							
1	P-101-5.1	PAVEMENT REMOVAL	6,000	SY			
2	P-101-5.2	CRACK REPAIR	35,000	LF			
3	P-101-5.3	PAINT REMOVAL	1,000	SF			
4	P-101-5.4	FAILED ASPHALTIC CONCRETE PAVEMENT REPAIR (UNDISTRIBUTED)	100	SF			
5	P-101-5.5	COLD MILLING	58,925	SY			
6	P-152-4.1	UNCLASSIFIED EXCAVATION	47,171	CY			
7	P-152-4.2	UNDERCUT (UNDISTRIBUTED)	2,020	CY			
8	P-152-4.3	SPECIAL SUBGRADE TREATMENT (UNDISTRIBUTED)	2,020	CY			
9	P-154-5.1	SUBBASE COURSE	8,235	CY			
10	P-155-8.1	LIME-TREATED SUBGRADE	20,250	SY			
11	P-155-8.2	LIME	545	TN			
12	P-156-5.1	SILT FENCE	5,500	LF			
13	P-156-5.2	SEDIMENT TRAP	1	LS			
14	P-156-5.3	SEDIMENT BASIN	1	LS			
15	P-156-5.4	INLET PROTECTION	2	EA			
16	P-156-5.5	CULVERT PROTECTION	12	EA			
17	P-156-5.6	TEMPORARY DIVERSION DITCH	725	LF			
18	P-156-5.7	STRAW BALE DITCH CHECK	13	EA			
19	P-156-5.8	CONSTRUCTION ENTRANCE	1	EA			
20	P-156-5.9	CONCRETE WASHOUT	1	EA			
21	P-156-5.10	TEMPORARY 18-INCH PVC DRAINAGE PIPE	32	LF			
22	P-156-5.11	TEMPORARY SEEDING AND MULCHING	35	AC			
23	P-209-5.1	CRUSHED AGGREGATE BASE COURSE	3,540	CY			

ITEMIZED PROPOSAL

28972

DELAWARE MUNICIPAL AIRPORT
DELAWARE, OHIO
RUNWAY 10/28 EXTENSION & OVERLAY

ITEM NO.	SPEC. REF.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE (WORDS)	UNIT PRICE	EXTENSION
24	P-401-8.1	BITUMINOUS LEVELING COURSE	1,360	TON			
25	P-401-8.2	BITUMINOUS INTERMEDIATE COURSE, 2-INCH DEPTH	2,245	TON			
26	P-401-8.3	BITUMINOUS SURFACE COURSE, 2-INCH DEPTH	9,205	TON			
27	P-602-5.1	BITUMINOUS PRIME COAT	19,000	SY			
28	P-603-5.1	BITUMINOUS TACK COAT	140,000	SY			
29	P-620-5.1	RUNWAY AND TAXIWAY MARKING, FULL APPLICATION W/ GLASS BEADS	50,000	SF			
30	P-620-5.2	RUNWAY AND TAXIWAY MARKING, HALF APPLICATION	50,000	SF			
31	P-621-5.1	RUNWAY GROOVING	51,400	SY			
32	F-162-5.1	8-FOOT GREEN VINYL CHAIN LINK FENCE	64	LF			
33	F-162-5.2	16-FOOT MANUAL DOUBLE-SWING GATE, GREEN VINYL CHAIN LINK	1	EA			
34	D-701-5.1	18 INCH REINFORCED CONCRETE PIPE, CLASS V, CLASS B BEDDING	204	LF			
35	D-701-5.2	2-18 INCH REINFORCED CONCRETE PIPES, CLASS III, CLASS B BEDDING	68	LF			
36	D-705-5.1	6 INCH PERFORATED COLLECTOR UNDERDRAIN PIPE	5,157	LF			
37	D-705-5.2	6 INCH NON-PERFORATED OUTFALL UNDERDRAIN PIPE	318	LF			
38	D-705-5.3	UNDERDRAIN CLEANOUT	25	EA			
39	D-705-5.4	ENDWALL FOR UNDERDRAIN CLEANOUT	1	EA			
40	D-705-5.5	UNDERDRAIN CONNECTION TO REINFORCED CONCRETE PIPE	6	EA			
41	D-752-5.1	HALF-HEIGHT HEADWALL, 18 INCH REINFORCED CONCRETE PIPE	3	EA			
42	D-752-5.2	HALF-HEIGHT HEADWALL, 18 INCH REINFORCED CONCRETE PIPE WITH ROCK CHANNEL PROTECTION	3	EA			
43	T-901-5.1	SEEDING	35	AC			
44	T-904-5.1	SODDING	5,725	SY			
45	T-908-5.1	MULCHING	35	AC			
46	L-107-5.1	RELOCATE SUPPLEMENTAL WIND CONE (UNLIGHTED)	1	EA			

ITEMIZED PROPOSAL

28972

DELAWARE MUNICIPAL AIRPORT
DELAWARE, OHIO
RUNWAY 10/28 EXTENSION & OVERLAY

ITEM NO.	SPEC. REF.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE (WORDS)	UNIT PRICE	EXTENSION
47	L-108-5.1	CABLE TRENCH AND BACKFILL W/O COUNTERPOISE	6,200	LF			
48	L-108-5.2	NO. 8 5KV L-824C CABLE, INSTALLED IN TRENCH	7,200	LF			
49	L-108-5.3	NO. 6 600V L-824C CABLE, INSTALLED IN TRENCH	10,200	LF			
50	L-108-5.4	NO. 4 600 V L-824C CABLE, INSTALLED IN TRENCH	10,100	LF			
51	L-108-5.5	NO. 6 BARE COUNTERPOISE WIRE, INSTALLED BY PLOWING	5,100	LF			
52	L-108-5.6	CABLE TRENCH WITH #2 COUNTERPOISE	3,500	LF			
53	L-109-5.1	EXISTING VAULT CODE CORRECTIONS	1	LS			
54	L-110-5.1	2-INCH, 2-WAY PVC CONDUIT, CONCRETE ENCASED	290	LF			
55	LST-01-5.1	RELOCATE EXISTING L-861E RUNWAY THRESHOLD LIGHT, COMPLETE	8	EA			
56	LST-01-5.2	NEW L-861 RUNWAY EDGE LIGHT, COMPLETE	7	EA			
57	LST-01-5.3	NEW L-861T TAXIWAY EDGE LIGHT, COMPLETE	47	EA			
58	LST-01-5.4	GUIDANCE SIGN, ON CONCRETE FOUNDATION, COMPLETE	9	EA			
59	LST-01-5.5	GUIDANCE SIGN PANEL REPLACEMENT	9	EA			
60	LST-01-5.6	DEMOLISH EXISTING L-861T TAXIWAY EDGE LIGHT AND TRANSFORMER	16	EA			
61	LST-01-5.7	DEMOLISH EXISTING L-858 GUIDANCE SIGN	4	EA			
62	LST-01-5.8	REPLACE YELLOW LENSES WITH WHITE LENSES IN RUNWAY EDGE LIGHTS	8	EA			
63	LST-02-5.1	RELOCATE RUNWAY 28 PAPI SYSTEM	1	LS			
64	LST-02-5.2	RELOCATE RUNWAY 28 REIL SYSTEM	1	LS			
65	MST-01-4.1	ENGINEER'S FIELD OFFICE	6	MO			
66	MST-02-8.1	MAINTENANCE AND PROTECTION OF AIR TRAFFIC	1	LS			
67	MST-03-4.1	CONSTRUCTION ENGINEERING	1	LS			
68	MST-04-4.1	DEMOLISH NON-DIRECTIONAL BEACON	1	LS			
69	MST-05-4.1	MOBILIZATION / DEMOBILIZATION	1	LS			
70	MST-06-3.1	ODOT 451 REINFORCED PCCP, 6-INCH	585	SY			
					TOTAL BASE BID:		

ITEMIZED PROPOSAL

28972

DELAWARE MUNICIPAL AIRPORT
DELAWARE, OHIO
RUNWAY 10/28 EXTENSION & OVERLAY

ITEM NO.	SPEC. REF.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE (WORDS)	UNIT PRICE	EXTENSION
BID ALTERNATE #1							
1	P-101-5.1	PAVEMENT REMOVAL	7,325	SY			
2	P-152-4.1	UNCLASSIFIED EXCAVATION	1,350	CY			
3	P-152-4.2	UNDERCUT (UNDISTRIBUTED)	810	CY			
4	P-152-4.3	SPECIAL SUBGRADE TREATMENT (UNDISTRIBUTED)	810	CY			
5	P-154-5.1	SUBBASE COURSE	3,300	CY			
6	P-155-8.1	LIME-TREATED SUBGRADE	8,100	SY			
7	P-155-8.2	LIME	220	TN			
8	P-156-5.1	SILT FENCE	1,560	LF			
9	P-156-5.5	CULVERT PROTECTION	1	EA			
10	P-156-5.7	STRAW BALE DITCH CHECK	2	EA			
11	P-209-5.1	CRUSHED AGGREGATE BASE COURSE	1,350	CY			
12	P-401-8.2	BITUMINOUS INTERMEDIATE COURSE, 2-INCH DEPTH	865	TON			
13	P-401-8.3	BITUMINOUS SURFACE COURSE, 2-INCH DEPTH	865	TON			
14	P-602-5.1	BITUMINOUS PRIME COAT	7,325	SY			
15	P-603-5.1	BITUMINOUS TACK COAT	7,325	SY			
16	P-620-5.1	RUNWAY AND TAXIWAY MARKING, FULL APPLICATION W/ GLASS BEADS	1,000	SF			
17	D-705-5.1	6 INCH PERFORATED COLLECTOR UNDERDRAIN PIPE	3,076	LF			
18	D-705-5.2	6 INCH NON-PERFORATED OUTFALL UNDERDRAIN PIPE	156	LF			
19	D-705-5.3	UNDERDRAIN CLEANOUT	16	EA			
20	D-705-5.4	ENDWALL FOR UNDERDRAIN CLEANOUT	2	EA			
21	D-705-5.5	UNDERDRAIN CONNECTION TO REINFORCED CONCRETE PIPE	2	EA			
22	T-904-5.1	SODDING	3,650	SY			
					TOTAL BID ALTERNATE #1:		

ITEMIZED PROPOSAL

28972

DELAWARE MUNICIPAL AIRPORT
DELAWARE, OHIO
RUNWAY 10/28 EXTENSION & OVERLAY

ITEM NO.	SPEC. REF.	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE (WORDS)	UNIT PRICE	EXTENSION
BID ALTERNATE #2							
1	L-109-5.1	EXISTING VAULT CODE CORRECTIONS (BASE BID)	-1	LS			
2	L-109-5.3	CONSTRUCTION OF PREFABRICATED CONCRETE BUILDING AND FOUNDATION, I	1	UNIT			
					TOTAL BID ALTERNATE #2:		
BID ALTERNATE #3							
1	F-162-5.1	8-FOOT GREEN VINYL CHAIN LINK FENCE	2,400	LF			
					TOTAL BID ALTERNATE #3:		

SUBMITTED BY: _____

TITLE: _____

ADDRESS: _____

_____

END OF ITEMIZED PROPOSAL

SAMPLE CONTRACT

Form of
CONTRACT AGREEMENT
{Insert Sponsor Name}
{Insert AIP Project Number}

THIS AGREEMENT, made as of ***{Insert Effective Date Of Agreement}*** is

BY AND BETWEEN

the OWNER: *{Insert Owner's Name, Address,City/State/Zip Code}*

And the CONTRACTOR: *{Insert Owner's Name, Address, City/State/Zip Code}*

WITNESSETH:

WHEREAS it is the intent of the Owner to make improvements at {Insert Name of Airport} generally described as follows;

hereinafter referred to as the Project.

NOW THEREFORE in consideration of the mutual covenants hereinafter set forth, OWNER and CONTRACTOR agree as follows:

Article 1 - Work

It is hereby mutually agreed that for and in consideration of the payments as provided for herein to the CONTRACTOR by the OWNER, CONTRACTOR shall faithfully furnish all necessary labor, equipment, and material and shall fully perform all necessary work to complete the Project in strict accordance with this Contract Agreement and the Contract Documents.

Article 2 – Contract Documents

CONTRACTOR agrees that the Contract Documents consist of the following: this Agreement, General Provisions, Supplementary Provisions, Specifications, Drawings, all issued addenda, Notice to Bidders, Instructions to Bidders, Proposal and associated attachments, Performance Bond, Payment Bond, Wage Rate Determination, Insurance certificates, documents incorporated by reference, documents incorporated by attachment, and all OWNER authorized change orders issued subsequent to the date of this agreement. All documents comprising the Contract Documents are complementary to one another and together establish the complete terms, conditions and obligations of the CONTRACTOR. All said Contract Documents are incorporated by reference into the Contract Agreement as if fully rewritten herein or attached thereto.

Article 3 – Contract Price

In consideration of the faithful performance and completion of the Work by the CONTRACTOR in accordance with the Contract Documents, OWNER shall pay the CONTRACTOR an amount equal to:

$_____ ($_____)

(Amount in Written Words) *(Amount in Numerals)*

subject to the following;

a. Said amount is based on the schedule of prices and estimated quantities stated in CONTRACTOR'S Bid Proposal, which is attached to and made a part of this Agreement;
b. Said amount is the aggregate sum of the result of the CONTRACTOR'S stated unit prices multiplied by the associated estimated quantities;
c. CONTRACTOR and OWNER agree that said estimated quantities are not guaranteed and that the determination of actual quantities is to be made by the OWNER'S ENGINEER;
d. Said amount is subject to modification for additions and deductions as provided for within the Contract General Provisions.

Article 4 – Payment

Upon the completion of the work and its acceptance by the OWNER, all sums due the CONTRACTOR by reason of faithful performance of the work, taking into consideration additions to or deductions from the Contract price by reason of alterations or modifications of the original Contract or by reason of "Extra Work" authorized under this Contract, will be paid to the CONTRACTOR by the OWNER after said completion and acceptance.

The acceptance of final payment by the CONTRACTOR shall be considered as a release in full of all claims against the OWNER, arising out of, or by reason of, the work completed and materials furnished under this Contract.

OWNER shall make progress payments to the CONTRACTOR in accordance with the terms set forth in the General Provisions. Progress payments shall be based on estimates prepared by the ENGINEER for the value of work performed and materials completed in place in accordance with the Contract Drawings and Specifications.

Progress payments are subject to retainage requirements as set forth in the General Provisions.

Article 5 – Contract Time

The CONTRACTOR agrees to commence work within ten (10) calendar days of the date specified in the OWNER'S Notice-to-Proceed. CONTRACTOR further agrees to complete said work within ***{insert # working days/calendar days}*** of the commencement date stated within the Notice-to-Proceed.

It is expressly understood and agreed that the stated Contract Time is reasonable for the completion of the Work, taking all factors into consideration. Furthermore, extensions of the Contract Time may only be permitted by execution of a formal modification to this Contract Agreement in accordance with the General Provisions and as approved by the OWNER.

Article 6 – Liquidated Damages

The CONTRACTOR and OWNER understand and agree that time is of essence for completion of the Work and that the OWNER will suffer additional expense and financial loss if said Work is not completed within the authorized Contract Time. Furthermore, the CONTRACTOR and OWNER recognize and understand the difficulty, delay, and expense in establishing the exact amount of actual financial loss and additional expense. Accordingly, in place of requiring such proof, the CONTRACTOR expressly agrees to pay the OWNER as liquidated damages the non-penal sum of $_____ per day for each calendar/work day required in excess of the authorized Contract Time.

Furthermore, the CONTRACTOR understands and agrees that;

a. the OWNER has the right to deduct from any moneys due the CONTRACTOR, the amount of said liquidated damages;
b. the OWNER has the right to recover the amount of said liquidated damages from the CONTRACTOR, SURETY or both.

Article 7 – CONTRACTOR'S Representations

The CONTRACTOR understands and agrees that all representations made by the CONTRACTOR within the Proposal shall apply under this Agreement as if fully rewritten herein.

Article 8 – CONTRACTOR'S Certifications

The CONTRACTOR understands and agrees that all certifications made by the CONTRACTOR within the Proposal shall apply under this Agreement as if fully rewritten herein. The CONTRACTOR further certifies the following;

a. Certification of Eligibility (29 CFR Part 5.5)
    i. By Entering into this contract, the CONTRACTOR certifies that neither he or she nor any person or firm who has an interest in the CONTRACTOR'S firm is a person or firm ineligible to be awarded Government contracts by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1);
    ii. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1);
    iii. The penalty for making false statements is prescribed in the U.S. Criminal Code 18 U.S.C.

b. Certification of Non-Segregated Facilities (41 CFR Part 60-1.8)The federally-assisted construction CONTRACTOR, certifies that it does not maintain or provide, for its employees, any segregated facilities at any of its establishments and that it does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The BIDDER certifies that it will not maintain or provide, for its employees, segregated facilities at any of its establishments and that it will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Bidder agrees that a breach of this certification is a violation of the Equal Opportunity Clause, which is to be incorporated in the contract.

    As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms, and washrooms, restaurants and other eating areas, timeclocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated on the basis of race, color, religion, or national origin because of habit, local custom, or any other reason. The Bidder agrees that (except where it has obtained identical certifications from proposed subcontractors for specific time periods) it will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity Clause and that it will retain such certifications in its files.

Article 9 – Miscellaneous

a. CONTRACTOR understands that it shall be solely responsible for the means, methods, techniques, sequences and procedures of construction in connection with completion of the Work;

b. CONTRACTOR understands and agrees that it shall not accomplish any work or furnish any materials that are not covered or authorized by the Contract Documents unless authorized in writing by the OWNER or ENGINEER;

c. The rights of each party under this Agreement shall not be assigned or transferred to any other person, entity, firm or corporation without prior written consent of both parties;

d. OWNER and CONTRACTOR each bind itself, their partners, successors, assigns and legal representatives to the other party in respect to all covenants, agreements, and obligations contained in the Contract Documents.

Article 10 – OWNER'S Representative

The OWNER'S Representative, herein referred to as ENGINEER, is defined as follows:

NAME OF FIRM
ADDRESS
CITY/STATE

Said ENGINEER will act as the OWNER'S representative and shall assume all rights and authority assigned to the ENGINEER as stated within the Contract Documents in connection with the completion of the Project Work.

IN WITNESS WHEREOF, OWNER and CONTRACTOR have executed five (5) copies of this Agreement on the day and year first noted herein.

OWNER	**CONTRACTOR**
Name: _____	Name: _____
Address: _____	Address: _____
_____	_____
_____	_____
By: _____	By: _____
Signature	*Signature*
_____	_____
Title of Representative	*Title of Representative*
ATTEST	ATTEST
By: _____	By: _____
Signature	*Signature*
_____	_____
Title	*Title*

CONTRACT REQUIREMENTS FOR FEDERAL AID PROGRAMS

CONTRACT REQUIREMENTS FOR
FEDERAL AID PROJECTS

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Federal Provisions Required for all Construction and Equipment Contracts

General Civil Rights Provisions - Airport and Airway Improvement Act of 1982, Section 520
(Version 2, 4/23/90)

This provision also obligates the tenant/concessionaire/lessee or its transferee for the period during which Federal assistance is extended to the airport through the Airport Improvement Program, except where Federal assistance is to provide, or is in the form of personal property; real property or interest therein; structures or improvements thereon.

In these cases the provision obligates the party or any transferee for the longer of the following periods:

(a) the period during which the property is used by the airport sponsor or any transferee for a purpose for which Federal assistance is extended, or for another purpose involving the provision of similar services or benefits; or

(b) the period during which the airport sponsor or any transferee retains ownership or possession of the property.

Access to Records and Reports (49 CFR Part 18.36(i))

The Contractor must maintain an acceptable cost accounting system. The Contractor agrees to provide the Sponsor, the Federal Aviation Administration, and the Comptroller General of the United States or any of their duly authorized representative's access to any books, documents, papers, and records of the contractor which are directly pertinent to the specific contract for the purpose of making audit, examination, excerpts and transcriptions. The Contractor agrees to maintain all books, records and reports required under this contract for a period of not less than three years after final payment is made and all pending matters are closed.

Notice of Requirement For Affirmative Action (41 CFR Part 60)

1. The Offeror's or Bidders's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.

2. The goals and timetables for minority and female participation, expressed in percentage terms for the contractor's aggregate work force in each trade on all construction work in the covered area, are as follows:

Timetables

Goals for Minority Participation for each Trade	Vol. 45 Federal Register pg. 65984 10/3/80 (Proper Goal from Attachment A)
Goals for Female Participation for each Trade	6.9 % (Nation-wide percentage)

These goals are applicable to all of the contractor's construction work (whether or not it is Federal or federally-assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor is also subject to the goals for both federally funded and non-federally funded construction regardless of the percentage of federal participation in funding.

The contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training shall be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from contractor to contractor or from project to project, for the sole purpose of meeting the contractor's goals, shall be a violation of the contract, the Executive Order, and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The contractor shall provide written notification to the Director, OFCCP, within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of subcontract; and the geographical area in which the subcontract is to be performed.

4. As used in this notice and in the contract resulting from this solicitation, the "covered area" means the geographical area described in the solicitation from which the contract results.

<u>Buy American Preference – Title 49 U.S.C. Chapter 501</u>

The Buy American Preferences under 49 U.S.C. § 50101 require that all steel and manufactured goods used in Airport Improvement Program (AIP) funded projects be produced in the United States. In accepting AIP funding, grant recipients must certify that all steel or manufactured products used on any portion of the AIP-funded project are produced in the United States and are of 100 percent U.S. materials.

Under 49 U.S.C.§ 50101(b), the FAA has the authority to waive these Buy American Preferences if certain market or product conditions exist. These are:

1) applying the provision is not in the public interest;

2) the steel or manufactured goods are not available in sufficient quantity or quality in the United States;

3) the cost of components and subcomponents produced in the United States is more than 60 percent of the total components of a facility or equipment, and final assembly has taken place in the United States. Items that have an FAA standard specification item number (such as specific airport lighting equipment) is considered the equipment in this case. For construction of a facility, the application of this subsection is determined after bid opening; or

4) applying this provision would increase the cost of the overall project by more than 25 percent.

Determinations under exceptions 1 and 2 normally would be made prior to formulating a solicitation. Exception 3 is more of a definition of a domestic product. Exception 4 can only be determined after bid opening. There is no restriction against a company offering foreign produced items in its bid (although the bid should identify those items). A sponsor, however may not award to that company unless it is pursuant to one of the exceptions listed above.

1. The Aviation Safety and Capacity Expansion of 1990 provides that preference be given to steel and manufactured products produced in the United States when funds are expended pursuant to a

grant issued under the Airport Improvement Program. The following apply:

a. Steel and manufactured products. As used in this clause, steel and manufactured products include (1) steel produced in the United States or (2) a manufactured product produced in the United States, if the cost of its components mined, produced or manufactured in the United States exceeds 60 percent of the cost of all its components and final assembly has taken place in the United States. Components of foreign origin of the same class or kind as the products referred to in subparagraphs b. (1) or (2) shall be treated as domestic.

b. Components. As used in this clause, components mean those articles, materials, and supplies incorporated directly into steel and manufactured products.

c. Cost of Components. This means the costs for production of the components, exclusive of final assembly labor costs.

2. The successful bidder will be required to deliver only domestic steel and manufactured products, except those:

   a. that the US Department of Transportation has determined, under the Aviation Safety and Capacity Expansion Act of 1990, are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality;

   b. that the US Department of Transportation has determined, under the Aviation Safety and Capacity Expansion Act of 1990, that domestic preference would be inconsistent with the public interest; or

   c. that inclusion of domestic material will increase the cost of the overall project contract by more than 25 percent.

3. List of Supplies/Materials that the US Government has determined are not produced in the United States in sufficient and reasonably available quantities and of sufficient quality (Jan 1991):

Acetylene, black
Agar, bulk
Anise
Antimony, as metal or oxide
Asbestos, amosite, chrysolite & crocidolite
Bananas
Bauxite or similar forms; nickel oxide and nickel salts
Beef, corned, canned
Beef extract
Bephenium Hydroxynapthoate
Bismuth
Books, trade, text, technical, or scientific; newspapers, pamphlets; magazines, periodicals, printed briefs and films; not printed in the United States and for which domestics editions are not
Manganese
Menthol
Mica
Microprocessor chips (brought onto a construction site as separate units for incorporation into building systems during construction, repair and alteration of real property)
Nickel, primary, in ingots, pigs, shots, cathodes,
Nitroguanidine (also known as picrite)
Nux vomica, crude
Oiticica oil
Olive oil
Olives (green), pitted or unpitted, or stuffed, in bulk
Opium, crude
Oranges, mandarin, canned
Petroleum, crude oil, unfinished oils, and

available
Brazil nuts, unroasted
Cadmium, ores and flue dust
Calcium cyanamide
Capers
Cashew nuts
Castor beans and castor oil
Chalk, English
Chestnuts
Chicle
Chrome ore or chomite
Cinchona bark
Cobalt, in cathodes, rondelles, or other primary ore & metal forms
Cocoa beans
Coconut and coconut meat, un-sweetened in shredded, desiccated or similarly prepared form
Coffee, raw or green bean
Colchicine alkaloid, raw
Copra
Cork, wood or bark & waste
Cover glass, microscope slide
Cryolite, natural
Cammar gum
Diamonds, industrial, stones & abrasives
Emetine, bulk
Ergot, crude
Erthrityl tetranitrate
Fair linen, altar
Fibers of the following types: abaca abace, agave, coir, flax, jute, jute burlaps, palmyra & sisal
Goat & kidskins
Graphite, natural, crystalline, crucible grade
Handsewing needles
Hemp yarn
Hog bristles for brushes
Hyoscine, bulk
Ipecac, root
Iodine, crude
Kaurigum
Lac
Leather, sheepskin, hair type
Lavender Oil
unfinished products (see definitions below)
Pine needle oil
Platinum and related group metals, refined, as sponge, powder, ingots, or cast bars
Pyrethrum flowers
Quartz crystals
Quebracho
Quinidine
Quinine
Rabbit fur felt
Radium salts, source & special nuclear materials
Rosettes
Rubber, crude & latex
Rutile
Santonin, crude
Secretin
Shellac
Silk, raw & unmanufactured
Spare and replacement parts for equipment of foreign manufacture, and for which domestic parts are not available
Spices & herbs, in bulk
Sugars, raw
Swords & scabbards
Talc, block, steatite
Tantalum
Tapioca flour & cassava
Tartar, crude; tartaric acid & cream of tartar in
Tea in bulk
Thread, metallic (gold)
Thyme oil
Tin in bars, blocks & pigs
Triprolidine hydrochloride
Tungsten
Vanilla beans
Venom, cobra
Wax, canauba
Woods; logs, veneer, & lumber of the following species: Alaskan yellow cedar, angelique, balsa, ekki, greenheart, lignum vitae, mahogany & teak
Yarn, 50 Denier rayon

Petroleum terms are used as follows:

"Crude oil" means crude petroleum, as it is produced at the wellhead, and liquids (under atmospheric conditions) that have not been recovered from mixtures of hydrocarbons that existed in a vaporous phase in a reservoir and that are not natural gas products.

"Finished products" means any one or more of the following petroleum oils, or a mixture or combination of these oils, to be used without further processing blending by mechanical means:

1. "Asphalt" – a solid or semi-solid cementitious material that (1) gradually liquefies when heated, (2) has bitumins as its predominating constituents, and (3) is obtained in refined crude oil.

2. "Fuel oil" – a liquid or liquefiable petroleum product burned for lighting or for the generation of heat or power and derived directly or indirectly from crude oil, such as kerosene, range oil, distillate fuel oils, gas oil, diesel fuel, topped crude oil, or residues.

3. "Gasoline" – a refined petroleum distillate that, by its consumption, is suitable for use as a carburant in internal combustion engines.

4. "Jet fuel" – a refined petroleum distillate used to fuel jet propulsion engines.

5. "Liquefied gases" – hydrocarbon gases recovered from natural gas or produced from petroleum refining and kept under pressure to maintain a liquid stat at ambient temperatures.

6. "Lubricating oil" – a refined petroleum distillate or specifically treated petroleum residue used to lessen friction between surfaces.

7. "Naphtha" – a refined petroleum distillate falling within a distillation range overlapping the higher gasoline and the lower kerosenes.

8. "Natural gas products" – liquids (under atmospheric conditions) including natural gasoline, that:

    a. are recovered by a process of absorption, compression, refrigeration, cycling, or a combination of these processes, from mixtures of hydrocarbons that existed in a vaporous phase in a reservoir, and

    b. when recovered and without processing in a refinery, definitions of products contained in subdivision (2), (3), and (7) above.

9. "Residual fuel oil" – a topped crude oil or viscous residuum that, as obtained in refining or after blending with other fuel oil, meets or is the equivalent of MILSPEC Mil-F-859 for Navy Special Fuel Oil and any more viscous fuel oil, such as No. 5 or Bunker C.

"Unfinished oils" means one or more of the petroleum oils listed under "finished products" above, or a mixture or combination of these oils, that are to be further processed other than by blending by mechanical means.

Civil Rights Act of 1964, Title VI - 49 CFR Part 21 Contractual Requirements (Version 1, 1/5/90)

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

1. **Compliance with Regulations:** The contractor (hereinafter includes consultants) will comply with the **Title VI List of Pertinent Nondiscrimination Statutes and Authorities**, as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.

2. **Non-discrimination:** The contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor will not participate directly or indirectly in the discrimination prohibited by the Acts and the Regulations, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR part 21.

3. **Solicitations for Subcontracts, Including Procurements of Materials and Equipment:** In all solicitations, either by competitive bidding, or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the contractor of the contractor's obligations under this contract and the Acts and the Regulations relative to Non-discrimination on the grounds of race, color, or national origin.

4. **Information and Reports:** The contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the sponsor or the Federal Aviation Administration to be pertinent to ascertain compliance with such Acts, Regulations, and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the contractor will so certify to the sponsor or the Federal Aviation Administration, as appropriate, and will set forth what efforts it has made to obtain the information.

5. **Sanctions for Noncompliance:** In the event of a contractor's noncompliance with the Non-discrimination provisions of this contract, the sponsor will impose such contract sanctions as it or the Federal Aviation Administration may determine to be appropriate, including, but not limited to:

    a. Withholding payments to the contractor under the contract until the contractor complies; and/or

    b. Cancelling, terminating, or suspending a contract, in whole or in part.

6. **Incorporation of Provisions:** The contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations and directives issued pursuant thereto. The contractor will take action with respect to any subcontract or procurement as the sponsor or the Federal Aviation Administration may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the contractor may request the sponsor to enter into any litigation to protect the interests of the sponsor. In addition, the contractor may request the United States to enter into the litigation to protect the interests of the United States.

DBE Required Statements (49 CFR Part 26 (2/2/99)

Contract Assurance (§ 26.13) - The contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy, as the recipient deems appropriate.

Prompt Payment (§26.29)- The prime contractor agrees to pay each subcontractor under this prime contract for satisfactory performance of its contract no later than {specify number} days from the receipt of each payment the prime contractor receives from {Name of recipient}. The prime contractor agrees further to return retainage payments to each subcontractor within {specify the same number as above} days after the subcontractor's work is satisfactorily completed. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of the {Name of Recipient}. This clause applies to both DBE and non-DBE subcontractors.

DBE Administration

1. **Eligibility of DBE's:** Those firms currently certified as DBE's by the State Department of Roads are eligible to participate as DBE's on this contract. A list of these firms can be obtained from the State, the consulting firm, or the Sponsor. Firms certified as DBE's by other states are subject to the Sponsor's review. A bidder may request a review of potential DBE prior to the bid opening. The bidder should allow ten working days from the Sponsor's determination regarding certification of the potential DBE. Previous acceptance of a DBE by FAA, State or Sponsor does not ensure acceptance of this project.

2. **Award Documentation and Procedure:** All bidders shall certify in the bid proposal their intent to meet or exceed the established goal or to demonstrate good faith effort to meet the goal. Failure to make such certification or failure to demonstrate good faith effort will render a bid non-responsive.

    a. **DBE Participation Form:** The Contractor shall submit within 5 working days of the bid the following information on the proposed DBE Participation Form included with the proposal. Along with the DBE Participation Form the bidder shall submit a DBE Confirmation Form for each DBE subcontractor signed by the DBE subcontractor. The information shall demonstrate the Contractor's intended participation by certified DBE's including information on good faith if the DBE goal is not met. When the information is not provided by the apparent low bidder, the bid will be ruled non-responsive and will not be considered. The information furnished shall consist of the following:

        1. The names and addresses of the DBE firms that will participate in the contract.

        2. A description of the work that each DBE firm will perform.

        3. The dollar amount of the participation of each DBE firm participating.

        4. Written documentation from the DBE that it is participating in the contract as provided in the prime contracts commitment. This can be accomplished by submittal of the DBE Commitment Form for each DBE proposed. This form is included with the Proposal.

        5. If the DBE goal is not met, the bidder shall provide a written statement of why the goal

could not be met and a demonstration of the good faith effort taken to meet the goal.

b. **Sponsor's Evaluation:** The Sponsor will evaluate the DBE information provided by the bidder. The Sponsor will review the information for completeness and accuracy, and see that the bidder has adequately documented good faith efforts to meet the DBE requirements.

c. **Administrative Reconsideration:** If it is determined that the bidder has failed to obtain enough DBE participation or failed to show good faith effort the bidder/offer may request an administrative reconsideration within 3 days of such notification as follows:

1. The bidder/offer has the opportunity to provide written documentation or argument concerning the issue of whether it met the goal or made adequate good faith effort to do so.

2. The documentation and argument for administrative reconsideration should be sent to the Executive Director.

3. The bidder/offer has the opportunity to meet with the official conducting the administrative review.

4. The official will make a decision on the review and will provide in writing the basis for the final decision that the bidder/offer did or did not meet the goal or make good faith efforts to do so. The final decision is not administratively appealable to the Department of Transportation.

3. **DBE Termination:** The prime Contractor may not terminate for convenience a DBE subcontractor or an approved substitute DBE firm and then perform the work of the terminated subcontractor with its own forces or those of an affiliate without prior written consent of the Sponsor.

When a DBE subcontractor is terminated or fails to complete its work on the contract for any reason the Contractor shall make good faith efforts to find another DBE subcontractor to substitute for the original DBE. These good faith efforts shall be directed at finding another DBE to perform at least the same amount of work under the contract as the DBE that was terminated, to the extent needed to meet the contract goal. If the Sponsor is not satisfied with the efforts, liquidated damages may be assessed for the difference between the approved and actual DBE participation.

4. **Counting DBE Participation towards DBE Goals**.

a. **Counting DBE Participation towards DBE Goals:** DBE participation toward attainment of the goal will be counted by the Sponsor only for the value of the work actually performed by the DBE toward the goal. The cost of supplies and materials obtained by the DBE for the work of the contract including supplies purchased or equipment leased by the DBE can be counted. The cost of supplies and equipment the DBE subcontractor purchases or leases from the prime contractor or its affiliate cannot be counted. The Sponsor will count fees or commissions for services, such as professional, technical, consultant, or managerial services provided that they are reasonable. When the DBE subcontracts part of its work to another firm, that work may be counted only if the DBE's subcontractor is a DBE itself.

b. **Joint Venture:** When a joint venture contract is involved, the Sponsor will count a portion of the total dollar value of the contract equal to the distinct, clearly defined portion of the work of

the contract that the DBE performs with its own forces.

c. **Commercially Useful Function:** The Sponsor will count towards the DBE goal only those expenditures to DBE's that perform a commercially useful function on the contract. A DBE performs a commercially useful function when it is responsible for execution of the work of the contract and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. To determine if the DBE is performing a commercially useful function the amount of work subcontracted, industry practices, whether the amount the firm is to be paid under the contract is commensurate with the work it is actually performing and the DBE credit claimed by its performances of the work and other relevant factors will be evaluated.

d. **DBE Trucking:** The Sponsor will consider trucking a commercially useful function if the DBE trucking subcontractor is responsible for the management and supervision of the entire trucking operation for which it is responsible on a particular contract. The DBE must itself own and operate at least one fully licenses, insured, and operational truck used on the contract. The DBE will receive credit for the total value of the transportation services it provides on the contract using trucks it owns, insures, and operates using drivers it employs. The DBE who leases trucks from a non-DBE is entitled to credit only for the fee or commission it receives as a result of the lease arrangement.

e. **Materials and Supplies:** The Sponsor will count toward the DBE goal the expenditures for materials and supplies obtained from DBE suppliers and manufacturers as described below.

   1. If the materials or supplies are obtained from a DBE manufacturer the sponsor may count 100 percent of the cost toward the goal. A manufacturer must operate or maintain a factory or establishment that produces on the premises the materials or supplies that are obtained.

   2. Sixty percent of the cost of materials or supplies purchased from a DBE regular dealer may be counted. A regular dealer is a firm that owns, operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles or equipment are bought, kept in stock, and regularly sold or leased to the public in the usual course of business. Bulk items such as steel, cement, gravel, stone and petroleum products need not be kept in stock, but he dealer must own and operate distribution equipment.

   3. With respect to purchase of materials and supplies from a DBE which is neither a manufacturer not a regular dealer, the Sponsor will count the fees or commission charged for assistance in the procurement of the items.

f. A DBE firm's participation will not be counted if they were not certified as a DBE at the time of the execution of the contract.

g. A DBE firm's work performed after it has ceased to be certified will not be counted.

h. The DBE subcontractor's participation will not be counted toward the prime contractor's DBE achievement until the subcontractor has been paid.

5. **Records and Reports:** The contractor shall keep records as necessary to determine compliance with the DBE obligations. The records shall include but are not limited to:

a. **Record of DBE Participation:** The names of disadvantaged and non-disadvantaged subcontractors, regular dealers, manufacturers, consultant and service agencies; the type of work or materials or services performed on or incorporated in the project; and the actual value of such work.

b. **Efforts to Utilize DBE Firms:** Documentation of all efforts made to seek out disadvantaged contractor organizations and individual disadvantaged contractors for work on this project. All correspondence, personal contacts, telephone calls, etc., to obtain the services of DBE's should be documented.

c. **Final DBE Certification:** Upon completion of the individual DBE firm's work, the prime contractor shall submit a certification attesting to the actual work performed by the DBE firm and the amount paid the DBE firm. This certification shall be signed by both the prime contractor and the DBE firm.

6. **Good Faith Efforts:** Bidders can meet the requirements to make good faith efforts in two ways. First, the bidder can meet the goal, documenting the commitments for DBE participation by DBE firms sufficient for this purpose. Second, even if it doesn't meet the goal, the bidder can document adequate good faith efforts. This means that the bidder must show that it took all necessary and reasonable steps to achieve a DBE goal.

Energy Conservation Requirements (49 CFR Part 18.36)

The Contractor agrees to comply with mandatory standards and policies relating to energy efficiency that are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (Public Law 94-163).

Federal Fair Labor Standards Act (Federal Minimum Wage)

All contracts and subcontracts that result from this solicitation incorporate the following provisions by reference, with the same force and effect as if given in full text. The contractor has full responsibility to monitor compliance to the referenced statute or regulation. The contractor must address any claims or disputes that pertain to a referenced requirement directly with the Federal Agency with enforcement responsibilities.

Requirement	**Federal Agency with Enforcement Responsibilities**
Federal Fair Labor Standards Act (29 USC 201)	U.S. Department of Labor – Wage and Hour Division

Lobbying & Influencing Federal Employees (49 CFR Part 20)

The bidder or offeror certifies by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the bidder or offeror, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Occupational Safety and Health Act of 1970

All contracts and subcontracts that result from this solicitation incorporate the following provisions by reference, with the same force and effect as if given in full text. The contractor has full responsibility to monitor compliance to the referenced statute or regulation. The contractor must address any claims or disputes that pertain to a referenced requirement directly with the Federal Agency with enforcement responsibilities.

Requirement	**Federal Agency with Enforcement Responsibilities**
Occupational Safety and Health Act of 1970 (20 CFR Part 1910)	U.S. Department of Labor – Occupational Safety and Health Administration

Rights to Inventions (49 CFR Part 18 (Version 1, 1/5/90)

All rights to inventions and materials generated under this contract are subject to requirements and regulations issued by the FAA and the Sponsor of the Federal grant under which this contract is executed.

Trade Restriction Clause (49 CFR Part 30 (Version 1, 1/5/90)

The contractor or subcontractor, by submission of an offer and/or execution of a contract, certifies that it:

a. is not owned or controlled by one or more citizens of a foreign country included in the list of countries that discriminate against U.S. firms published by the Office of the United States Trade Representative (USTR);

b. has not knowingly entered into any contract or subcontract for this project with a person that is a citizen or national of a foreign country on said list, or is owned or controlled directly or indirectly by one or more citizens or nationals of a foreign country on said list;

c. has not procured any product nor subcontracted for the supply of any product for use on the project that is produced in a foreign country on said list.

Unless the restrictions of this clause are waived by the Secretary of Transportation in accordance with 49 CFR 30.17, no contract shall be awarded to a contractor or subcontractor who is unable to certify to the above. If the contractor knowingly procures or subcontracts for the supply of any product or service of a foreign country on said list for use on the project, the Federal Aviation Administration may direct through the Sponsor cancellation of the contract at no cost to the Government.

Further, the contractor agrees that, if awarded a contract resulting from this solicitation, it will incorporate this provision for certification without modification in each contract and in all lower tier subcontracts. The contractor may rely on the certification of a prospective subcontractor unless it has knowledge that the certification is erroneous.

The contractor shall provide immediate written notice to the sponsor if the contractor learns that its certification or that of a subcontractor was erroneous when submitted or has become erroneous by reason of changed circumstances. The subcontractor agrees to provide written notice to the contractor if at any time it learns that its certification was erroneous by reason of changed circumstances.

This certification is a material representation of fact upon which reliance was placed when making the award. If it is later determined that the contractor or subcontractor knowingly rendered an erroneous certification, the Federal Aviation Administration may direct through the Sponsor cancellation of the contract or subcontract for default at no cost to the Government.

Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by this provision. The knowledge and information of a contractor is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

This certification concerns a matter within the jurisdiction of an agency of the United States of America and the making of a false, fictitious, or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code, Section 1001.

Veteran's Preference (April 8, 2013)

In the employment of labor (except in executive, administrative, and supervisory positions), preference must be given to Vietnam era veterans, Persian Gulf veterans, Afghanistan-Iraq war veterans, disabled veterans, and small business concerns owned and controlled by disabled veterans as defined in Title 49 United States Code, Section 47112. However, this preference shall apply only where the individuals are available and qualified to perform the work to which the employment relates.

Ban on Texting When Driving

In accordance with Executive Order 13513, Federal Leadership on Reducing Text Messaging While Driving, October 1, 2009, and DOT Order 3902.10, Text Messaging While Driving, December 30, 2009, the Sponsor is encouraged to:

1. Adopt and enforce workplace safety policies to decrease crashes caused by distracted drivers including policies to ban text messaging while driving when performing any work for, or on behalf of, the Federal government, including work relating to a grant or subgrant.

2. Conduct workplace safety initiatives in a manner commensurate with the size of the business, such as:

    a. Establishment of new rules and programs or re-evaluation of existing programs to prohibit text messaging while driving; and

    b. Education, awareness, and other outreach to employees about the safety risks associated with texting while driving.

The Sponsor must insert the substance of this clause on banning texting when driving in all subgrants, contracts and subcontracts.

Additional Provisions Required for all Construction Contracts Exceeding $2,000

Davis-Bacon Requirements (29 CFR Part 5 (updated 2/14/12)

1. Minimum Wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by the Secretary of Labor under the Copeland Act (29 CFR Part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalent thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR Part 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided*, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under (1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can easily be seen by the workers.

(ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, D.C. 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (1)(ii) (B) or (C) of this paragraph, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided*, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

2 Withholding.

The Federal Aviation Administration or the Sponsor shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of work, all or part of the wages required by the contract, the Federal Aviation Administration may, after written notice to the contractor, sponsor, applicant, or owner, take such

action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual costs incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the (write in name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency). The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (*e.g.* , the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division Web site at *http://www.dol.gov/esa/whd/forms/wh347instr.htm* or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the (write in name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit them to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency), the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, sponsor, or owner).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5(a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer and mechanic (including each helper, apprentice and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations 29 CFR Part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (3)(i) of this section available for inspection, copying or transcription by authorized representatives of the Sponsor, the Federal Aviation Administration or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the contractor, sponsor, applicant or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and Trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio

permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal Employment Opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

5. Compliance With Copeland “Anti-Kickback” Act Requirements.

The United States Department of Labor Wage and Hours Division oversees the Copeland “Anti-Kickback” Act requirements. All contracts and subcontracts must meet comply with the Occupational Safety and Health Act of 1970.

United States Department of Labor Wage and Hours Division can provide information regarding any specific clauses or assurances pertaining to the Copeland “Anti-Kickback” Act requirements required to be inserted in solicitations, contracts or subcontracts.

The contractor shall comply with the requirements of 29 CFR Part 3, which are incorporated by reference in this contract.

6. Subcontracts.

The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR Part 5.5(a)(1) through (10) and such other clauses as the Federal Aviation Administration may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR Part 5.5.

7. Contract Termination: Debarment.

A breach of the contract clauses in paragraph 1 through 10 of this section may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance With Davis-Bacon and Related Act Requirements.

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes Concerning Labor Standards.

Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6 and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of Eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

Additional Provisions Required for all Construction and Equipment Contracts Exceeding $10,000

Termination of Contract (49 CFR Part 18 (Version 1, 1/5/90)

1. The Sponsor may, by written notice, terminate this contract in whole or in part at any time, either for the Sponsor's convenience or because of failure to fulfill the contract obligations. Upon receipt of such notice services must be immediately discontinued (unless the notice directs otherwise) and all materials as may have been accumulated in performing this contract, whether completed or in progress, delivered to the Sponsor.
2. If the termination is for the convenience of the Sponsor, an equitable adjustment in the contract price will be made, but no amount will be allowed for anticipated profit on unperformed services.
3. If the termination is due to failure to fulfill the contractor's obligations, the Sponsor may take over the work and prosecute the same to completion by contract or otherwise. In such case, the contractor is liable to the Sponsor for any additional cost occasioned to the Sponsor thereby.
4. If, after notice of termination for failure to fulfill contract obligations, it is determined that the contractor had not so failed, the termination will be deemed to have been effected for the convenience of the Sponsor. In such event, adjustment in the contract price will be made as provided in paragraph 2 of this clause.
5. The rights and remedies of the sponsor provided in this clause are in addition to any other rights and remedies provided by law or under this contract.

Additional Provisions Required for all Construction Contracts Exceeding $10,000

Equal Employment Opportunity (41 CFR Part 60-1.4(b) (Version 1, 1/5/90)

During the performance of this contract, the contractor agrees as follows:

1. The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following:

   Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

2. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive considerations for employment without regard to race, color, religion, sex, or national origin.

3. The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided

advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

4. The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, as amended, and of the rules, regulations, and relevant orders of the Secretary of Labor.

5. The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

6. In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedure authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

7. The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provision, including sanctions for noncompliance: Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency the contractor may request the United States to enter into such litigation to protect the interests of the United States.

<u>Standard Federal Equal Employment Opportunity Construction Contract Specifications (41 CFR 60-4.3)</u>

1. As used in these specifications:

   a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;

   b. "Director" means Director, Office of Federal Contract Compliance Programs (OFCCP), U.S. Department of Labor, or any person to whom the Director delegates authority;

   c. "Employer identification number" means the Federal social security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941;

   d. "Minority" includes:

      (1) Black (all) persons having origins in any of the Black African racial groups not of Hispanic origin);

      (2) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin regardless of race);

(3) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

(4) American Indian or Alaskan native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the contractor, or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors shall be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each contractor or subcontractor participating in an approved plan is individually required to comply with its obligations under the EEO clause and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other contractors or subcontractors toward a goal in an approved Plan does not excuse any covered contractor's or subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

4. The contractor shall implement the specific affirmative action standards provided in paragraphs 18.7a through 18.7p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered construction contractors performing construction work in a geographical area where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement nor the failure by a union with whom the contractor has a collective bargaining agreement to refer either minorities or women shall excuse the contractor's obligations under these specifications, Executive Order 11246 or the regulations promulgated pursuant thereto.

6. In order for the non-working training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees shall be employed by the contractor during the training period and the contractor shall have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees shall be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The contractor shall document these efforts fully and

shall implement affirmative action steps at least as extensive as the following:

e. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the contractor's employees are assigned to work. The contractor, where possible, will assign two or more women to each construction project. The contractor shall specifically ensure that all foremen, superintendents, and other onsite supervisory personnel are aware of and carry out the contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

f. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

g. Maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source, or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the contractor by the union or, if referred, not employed by the contractor, this shall be documented in the file with the reason therefore along with whatever additional actions the contractor may have taken.

h. Provide immediate written notification to the Director when the union or unions with which the contractor has a collective bargaining agreement has not referred to the contractor a minority person or female sent by the contractor, or when the contractor has other information that the union referral process has impeded the contractor's efforts to meet its obligations.

i. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the contractor's employment needs, especially those programs funded or approved by the Department of Labor. The contractor shall provide notice of these programs to the sources compiled under 7b above.

j. Disseminate the contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

k. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination, or other employment decisions including specific review of these items with onsite supervisory personnel such a superintendents, general foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

l. Disseminate the contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the contractor's EEO policy with other contractors and subcontractors with whom the contractor does or anticipates doing business.

m. Direct its recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students; and to minority and female recruitment and training organizations serving the contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the contractor shall send written notification to organizations, such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

n. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable provide after school, summer, and vacation employment to minority and female youth both on the site and in other areas of a contractor's workforce.

o. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

p. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel, for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

q. Ensure that seniority practices, job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the contractor's obligations under these specifications are being carried out.

r. Ensure that all facilities and company activities are non-segregated except that separate or single user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

s. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

t. Conduct a review, at least annually, of all supervisor's adherence to and performance under the contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations, which assist in fulfilling one or more of their affirmative action obligations (18.7a through 18.7p). The efforts of a contractor association, joint contractor union, contractor community, or other similar groups of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 18.7a through 18.7p of these specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the contractor. The obligation to comply, however, is the contractor's and failure of such a group to fulfill an obligation shall not be a defense for the contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, if the particular group is employed in a substantially disparate manner (for example, even though the contractor has achieved its goals for women generally,) the contractor may be in violation of the Executive Order if a specific minority group of women is underutilized.

10. The contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.
11. The contractor shall not enter into any subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.
12. The contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination, and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.
13. The contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 18.7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.
14. The contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government, and to keep records. Records shall at least include for each employee, the name, address, telephone number, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.
15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

<u>Notices To Be Posted Per Paragraphs (1) and (3) of the EEO Clause (41 CFR Part 60-1.4(b)</u>

Equal Employment Opportunity is the Law - Discrimination is Prohibited by the Civil Rights Act of 1964 and by Executive Order No. 11246

Title VI of the Civil Rights Act of 1964 - Administered by:

The Equal Employment Opportunity Commission

Prohibits discrimination because of Race, Color, Religion, Sex, or National Origin by Employers with 25 or more employees, by Labor Organizations with a hiring hall of 25 or more members, by Employment Agencies, and by Joint Labor-Management Committees for Apprenticeship or Training.

Any person who believes he or she has been discriminated against should contact:

The Office of Federal Contract Compliance Programs
U.S. Department of Labor
Washington, D.C. 20210

Certification of Nonsegregated Facilities (41 CFR Part 60-1.8)

Notice to Prospective Federally Assisted Construction Contractors

1. A Certification of Non-segregated Facilities shall be submitted prior to the award of a federally-assisted construction contract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity Clause.
2. Contractors receiving federally-assisted construction contract awards exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity Clause will be required to provide for the forwarding of the following notice to prospective subcontractors for supplies and construction contracts where the subcontracts exceed $10,000 and are not exempt from the provisions of the Equal Opportunity Clause.
3. The penalty for making false statements in offers is prescribed in 18 U.S.C. § 1001.

Notice to Prospective Subcontractors of Requirements for Certification of Non-Segregated Facilities

1. A Certification of Non-segregated Facilities shall be submitted prior to the award of a subcontract exceeding $10,000, which is not exempt from the provisions of the Equal Opportunity Clause.
2. Contractors receiving subcontract awards exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity Clause will be required to provide for the forwarding of this notice to prospective subcontractors for supplies and construction contracts where the subcontracts exceed $10,000 and are not exempt from the provisions of the Equal Opportunity Clause.
3. The penalty for making false statements in offers is prescribed in 18 U.S.C. § 1001.

CERTIFICATION OF NONSEGREGATED FACILITIES

The federally-assisted construction contractor certifies that she or he does not maintain or provide, for his employees, any segregated facilities at any of his establishments and that she or he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally-assisted construction contractor certifies that she or he will not maintain or provide, for his employees, segregated facilities at any of his establishments and that she or he will not permit his employees to perform their services at any location under his control where segregated facilities are maintained. The federally-assisted construction contractor agrees that a breach of this certification is a violation of the Equal Opportunity Clause in this contract.

As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms, and washrooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directives or are, in fact, segregated on the basis of race, color, religion, or national origin because of habit, local custom, or any other reason. The federally-assisted construction contractor agrees that (except where she or he has obtained identical certifications from proposed subcontractors for specific time periods) she or he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding

$10,000 which are not exempt from the provisions of the Equal Opportunity Clause and that she or he will retain such certifications in his files.

Additional Provisions for Construction and Equipment Contracts Exceeding $25,000

Certification Regarding Debarment, Suspension (Non-Procurement) (Title 2 CFR Part 180 & Title 2 CFR Part 1200)

The bidder/offeror certifies, by submission of this proposal or acceptance of this contract, that neither it nor its principals is presently debarred or suspended by any Federal department or agency from participation in this transaction. The bidder with the successful bid further agrees to comply with Title 2 CFR Part 1200 and Title 2 CFR Part 180, Subpart C by administering each lower tier subcontract that exceeds $25,000 as a 'covered transaction'.

The successful bidder, by administering each lower tier subcontract that exceeds $25,000 as a "covered transaction", must verify each lower tier participant of a "covered transaction" under the project is not presently debarred or otherwise disqualified from participation in this federally assisted project. The successful bidder will accomplish this by:

1. Checking the System for Award Management at website: http://www.sam.gov
2. Collecting a certification statement similar to the Certificate Regarding Debarment and Suspension (Bidder or Offeror), above.
3. Inserting a clause or condition in the covered transaction with the lower tier contract

Additional Provisions for Construction Contracts Exceeding $100,000

Breach of Contract Terms Sanctions (49 CFR Part 18 (Version 1, 1/5/90)

Any violation or breach of the terms of this contract on the part of the Contractor or subcontractor may result in the suspension or termination of this contract or such other action which may be necessary to enforce the rights of the parties of this agreement. The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law.

Contract Workhours and Safety Standards Act Requirements (29 CFR Part 5)

1. Overtime Requirements.

   No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic, including watchmen and guards, in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

2. Violation; Liability for Unpaid Wages; Liquidated Damages.

   In the event of any violation of the clause set forth in paragraph (1) above, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for

the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph 1 above, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph 1 above.

3. Withholding for Unpaid Wages and Liquidated Damages.

   The Federal Aviation Administration or the Sponsor shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any monies payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph 2 above.

4. Subcontractors.

   The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraphs 1 through 4 and also a clause requiring the subcontractor to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs 1 through 4 of this section.

Additional Provisions for Construction and Equipment Contracts Exceeding $100,000

<u>Clean Air and Water Pollution Control Requirements</u>

Contractors and subcontractors agree:

1. That any facility to be used in the performance of the contract or subcontract or to benefit from the contract is not listed on the Environmental Protection Agency (EPA) List of Violating Facilities;

2. To comply with all the requirements of Section 114 of the Clean Air Act, as amended, 42 U.S.C. 1857 et seq. and Section 308 of the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 et seq. relating to inspection, monitoring, entry, reports, and information, as well as all other requirements specified in Section 114 and Section 308 of the Acts, respectively, and all other regulations and guidelines issued thereunder;

3. That, as a condition for the award of this contract, the Contractor or subcontractor will notify the awarding official of the receipt of any communication from the EPA indicating that a facility to be used for the performance of or benefit from the contract is under consideration to be listed on the EPA List of Violating Facilities;

4. To include or cause to be included in any construction contract or subcontract which exceeds $100,000 the aforementioned criteria and requirements.

ATTACHMENT A

Excerpt from the Federal Register / Vol. 45, No. 194 / Friday, October 3, 1980 / Notices

Goals for Crafts and Trades

Ohio	Goal (percent)
064 Youngstown-Warren, OH	
SMSA Counties	
9320 Youngstown-Warren, OH	9.4
OH Mahoning, OH Trumbull	
Non-SMSA Counties	6.7
OH Columbiana, PA Lawrence, PA Mercer	
065 Cleveland, OH	
SMSA Counties	
0080 Akron, OH	7.8
OH Portage, OH Summit	
1320 Canton, OH	6.1
OH Carroll, OH Stark	
1680 Cleveland, OH	16.1
OH Cuyahoga, OH Geauga, OH Lake, OH Medina	
4440 Lorain-Elyria, OH	9.3
OH Lorain	
4800 Mansfield, OH	6.3
OH Richland	
Non-SMSA Counties	11.3
OH Ashland, OH Ashtabula, OH Coshocton, OH Crawford, OH Erie, OH Holmes, OH Huron, OH Tuscarawas, OH Wayne	
066 Columbus, OH	
SMSA Counties	
1840 Columbus, OH	10.6

OH Delaware, OH Fairfield, OH Franklin, OH Madison, OH Pickaway

Non-SMSA Counties.....7.3

OH Athens, OH Fayette, OH Guernsey, OH Hocking, OH Jackson, OH Knox, OH Licking, OH Marion, OH Meigs, OH Morgan, OH Morrow, OH Muskingum, OH Noble, OH Perry, OH Pike, OH Ross, OH Scioto, OH Union, OH Vinton

067 Cincinnati, OH

SMSA Counties

1640 Cincinnati, OH-KY-IN.....11.0

IN Dearborn, KY Boone, KY Campbell, KY Kenton, OH Clermont, OH Hamilton, OH Warren

3200 Hamilton-Middletown, OH.....5.0

OH Butler

Non-SMSA Counties.....9.2

IN Franklin, IN Ohio, IN Ripley, IN Switzerland, KY Bracken, KY Carroll, KY Fleming, KY Gallatin, KY Brant, KY Lewis, KY Mason, KY Owen, KY Pendleton, KY Robertson, OH Adams, OH Brown, OH Clinton, OH Highland

068 Dayton, OH

SMSA Counties

2000 Dayton, OH.....11.5

OH Greene, OH Miami, OH Montgomery, OH Preble

7960 Springfield, OH 7.8

OH Champaign, OH Clark

Non-SMSA Counties.....9.9

OH Darke, OH Logan, OH Shelby

069 Lima, OH

SMSA Counties

4320 Lima, OH 4.4

OH Allen, OH Auglaize, OH Putnam, OH VanWert

Non-SMSA Counties.....3.5

OH Hardin, OH Mercer

070 Toledo, OH

SMSA Counties

8400 Toledo, OH-MI 8.8

MI Monroe, OH Fulton, OH Lucas, OH Ottawa, OH Wood

Non-SMSA Counties.....7.3

MI Lenawee, OH Hancock, OH Henry, OH Sandusky, OH Seneca, OH Wyandot

ATTACHMENT B

POINTS OF CLARIFICATION CONCERNING 41 CFR 60-4

1. The Model Federal EEO Bid Conditions will no longer be used in solicitations for federally assisted construction contracts.

2. Special Bid Conditions for non-plan areas will no longer be used in solicitations for federally assisted construction contracts.

3. Imposed Plans will no longer be used in solicitations.

4. The notice set forth in 41 CFR 60-4.2 (d) entitled "Notice of Requirements for Affirmative Action to Ensure Equal Employment Opportunity (Executive Order 11246)", hereinafter referred to as the Notice; and the specifications set forth in 41 CFR 60-4.3 (a) entitled "Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246)", hereinafter referred as EEO specifications, will be included in solicitations for federally assisted construction contracts over $10,000 to be performed in the geographical areas designated by the Director, OFCCP.

5. Although Model Federal EEO Bid Conditions referencing Hometown Plans will no longer be used, Hometown Plans which still have OFCCP approval will continue to be in effect. A contractor can satisfy some of the affirmative action requirements of 60-4 by complying with the Hometown Plan as provided in these regulations. However, in order to do so, these contractors must be signatory to the Plan and use labor organizations that are also signatory to the Hometown Plan.

6. The Notice and EEO Specifications shall be used only for construction contracts over $10,000 that will be performed in those geographical areas specified by the OFCCP. The current list of those geographical areas is in the May 5, 1978, Federal Register. (The listing of areas in the April 7, 1978 Federal Register contained a number of errors and should not be used). Construction contracts to be performed outside of the specified geographic area will not contain the Notice or the EEO Specifications.

7. Goals and timetables for the utilization of minorities and women are to be used only if the Notice is used. That is, goals are used only when the construction contract will be performed in one of the geographical areas specified by OFCCP. It is the responsibility of the grant recipient to insert the appropriate goals and timetables in applicable solicitations.

8. The goals to be used in the DOL-OFCCP geographic areas are found in the October 3, 1980 Federal Register. The December 30, 1980 Federal Register contains the female goals. The Director, OFCCP will designate other geographic areas and goals for minority and female utilization from time to time. These will be published in the Federal Register.

9. The current equal opportunity clause at 41 CFR 60-1.4 (b) must continue to be placed in all nonexempt federally assisted construction contracts and subcontracts. Contracts to be performed in the DOL designated areas must, therefore, contain both the equal opportunity clause as well as the new Notice and EEO Specifications.

10. The effective date of 41 CFR 60-4 is May 8, 1978. The effective date was incorrectly published as May 8,

1979, in the Federal Register of April 7, 1978. It was then corrected by the May 2, 1978 Federal Register. The Notice shall therefore be included in all areas; likewise, the EEO Specifications shall be included in all nonexempt construction contracts in these areas. However, it is not necessary to amend earlier contracts that have been let since the effective date because 60-4.9 allows for incorporation by operation of these regulations.

11. Effective October 8, 1978, the compliance agency for all federal construction contractors will be OFFCP of the Department of Labor. Until that time, the compliance agency for construction contractors is in accordance with the Order No. 1 of the OFCCP. That is, with the exceptions of Hawaii and the Pacific Islands, and Alaska, the compliance agency for FAA construction contracts is the FAA Office of Civil Rights. The compliance agency for FAA construction in Hawaii and the Pacific Islands, until October 1, 1978, is the General Services Administration; and in Alaska, it is the Department of Defense.

12. Grant recipients (referred to as applicants) are required by these regulations to give written notice to the Director, OFCCP, within 10 working days of the award of a contract subject to these DOL provisions. Until October 8, 1978, this information should be sent to the applicable compliance agency (number 10 above). The OFCCP has informed us that it will very shortly notify us of where in OFCCP this contracting information should be sent after October 1.

13. Note that under the previous Imposed Plan Bid Conditions, only projects of $500,000 or more were covered by those Imposed Plan Conditions. The new Notice, by contrast, applies to all construction, contracts in excess of 10,000 to be performed in the DOL specified geographic areas.

WAGE RATES

>

General Decision Number: OH150002 04/03/2015 OH2

Superseded General Decision Number: OH20140002

State: Ohio

Construction Types: Heavy and Highway

Counties: Ohio Statewide.

Heavy and Highway Construction Projects

Note: Executive Order (EO) 13658 establishes an hourly minimum wage of $10.10 for 2015 that applies to all contracts subject to the Davis-Bacon Act for which the solicitation is issued on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.10 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/02/2015
1	01/23/2015
2	01/30/2015
3	02/06/2015
4	02/20/2015
5	03/20/2015
6	04/03/2015

BRKY0007-003 06/01/2011

LAWRENCE

	Rates	Fringes
Bricklayer, Stonemason	$ 28.29	16.80

BROH0001-001 07/01/2014

DEFIANCE, FULTON (Excluding Fulton, Amboy & Swan Creek Townships), HENRY (Excluding Monroe, Bartlow, Liberty, Washington, Richfield, Marion, Damascus & Townships & that part of Harrison Township outside corporate limits of city of Napoleon), PAULDING, PUTNAM and WILLIAMS COUNTIES

	Rates	Fringes
Bricklayer, Stonemason	$ 30.05	13.02

BROH0001-004 06/01/2014

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	$ 28.33	11.37

BROH0003-002 07/01/2014

FULTON (Townships of Amboy, Swan Creek & Fulton), HENRY (Townships of Washington, Damascus, Richfield, Bartlow, Liberty, Harrison, Monroe, & Marion), LUCAS and WOOD (Townships of Perrysburg, Ross, Lake, Troy, Freedom, Montgomery, Webster, Center, Portage, Middleton, Plain, Liberty, Henry, Washington, Weston, Milton, Jackson & Grand Rapids) COUNTIES

	Rates	Fringes
Bricklayer, Stonemason.....	$ 30.05	13.02

BROH0005-003 05/01/2014

CUYAHOGA, LORAIN & MEDINA (Hinckley, Granger, Brunswick, Liverpool, Montville, York, Homer, Harrisville, Chatham, Litchfield & Spencer Townships and the city of Medina)

	Rates	Fringes
BRICKLAYER		
BRICKLAYERS; CAULKERS; CLEANERS; POINTERS; & STONEMASONS.....	$ 33.27	12.73
SANDBLASTERS.....	$ 33.27	12.73
SEWER BRICKLAYERS & STACK BUILDERS.....	$ 33.27	12.73
SEWER BRICKLAYERS; STACK BUILDERS; & SWING SCAFFOLDS.	$ 30.91	11.78
SWING SCAFFOLDS.....	$ 33.27	12.73

BROH0006-005 06/01/2014

CARROLL, COLUMBIANA (Knox, Butler, West & Hanover Townships), STARK & TUSCARAWAS

	Rates	Fringes
Bricklayer, Stonemason.....	$ 28.33	11.37

BROH0007-005 09/01/2014

PORTAGE & SUMMIT

	Rates	Fringes
BRICKLAYER.....	$ 29.35	14.36

BROH0007-010 06/01/2014

PORTAGE & SUMMIT

	Rates	Fringes
MASON - STONE.....	$ 28.33	11.37

BROH0008-001 06/01/2014

COLUMBIANA (Salem, Perry, Fairfield, Center, Elk Run, Middleton, & Unity Townships and the city of New Waterford), MAHONING & TRUMBULL

	Rates	Fringes
BRICKLAYER.....	$ 27.10	16.89

BROH0009-002 06/01/2014

BELMONT & MONROE COUNTIES and the Townships of Warren & Mt. Pleasant and the Village of Dillonvale in JEFFERSON COUNTY

	Rates	Fringes
Bricklayer, Stonemason.....	$ 28.33	11.37
Refractory.....	$ 30.24	17.14

BROH0010-002 07/01/2013

COLUMBIANA (St. Clair, Madison, Wayne, Franklin, Washington, Yellow Creek & Liverpool Townships) & JEFFERSON (Brush Creek & Saline Townships)

	Rates	Fringes
Bricklayer, Stonemason.....	$ 26.95	15.66

BROH0014-002 06/01/2014

HARRISON & JEFFERSON (Except Mt. Pleasant, Warren, Brush Creek, Saline & Salineville Townships & the Village of Dillonvale)

	Rates	Fringes
Bricklayer, Stonemason.....	$ 28.33	11.37

BROH0016-002 05/01/2014

ASHTABULA, GEAUGA, and LAKE COUNTIES

	Rates	Fringes
Bricklayer, Stonemason.....	$ 31.69	13.97

BROH0018-002 06/01/2014

BROWN, BUTLER, CLERMONT, HAMILTON, PREBLE (Gasper, Dixon, Israel, Lanier, Somers & Gratis Townships) & WARREN COUNTIES:

	Rates	Fringes
Bricklayer, Stonemason.....	$ 28.33	11.37

BROH0022-004 06/01/2014

CHAMPAIGN, CLARK, CLINTON, DARKE, GREENE, HIGHLAND, LOGAN, MIAMI, MONTGOMERY, PREBLE (Jackson, Monroe, Harrison, Twin, Jefferson & Washington Townships) and SHELBY COUNTIES

	Rates	Fringes
Bricklayer, Stonemason.....	$ 28.33	11.37

BROH0032-001 06/01/2014

GALLIA & MEIGS

	Rates	Fringes
Bricklayer, Stonemason.....	$ 28.33	11.37

BROH0035-002 06/01/2014

ALLEN, AUGLAIZE, MERCER and VAN WERT COUNTIES

	Rates	Fringes
Bricklayer, Stonemason.....	$ 28.33	11.37

BROH0039-002 06/01/2014

ADAMS & SCIOTO

	Rates	Fringes
Bricklayer, Stonemason.....	$ 31.27	15.89

BROH0040-003 06/01/2014

ASHLAND, CRAWFORD, HARDIN, HOLMES, MARION, MORROW, RICHLAND, WAYNE and WYANDOT (Except Crawford, Ridge, Richland & Tymochtee Townships) COUNTIES

	Rates	Fringes
Bricklayer, Stonemason.....	$ 28.14	16.98

FOOTNOTE: Layout Man and Sawman rate: $1.00 per hour above journeyman rate.
Free standing stack work ground level to top of stack; Sandblasting and laying of carbon masonry material in swing stage and/or scaffold; Ramming and spading of plastics and gunniting: $1.50 per hour above journeyman rate.
"Hot" work: $2.50 above journeyman rate.

BROH0044-002 06/01/2014

	Rates	Fringes
Bricklayer, Stonemason COSHOCTON, FAIRFIELD, GUERNSEY, HOCKING, KNOX, KICKING, MORGAN, MUSKINGUM, NOBLE (Beaver, Buffalo, Seneca & Wayne Townships) & PERRY COUNTIES:.....	$ 28.33	11.37

BROH0045-002 06/01/2014

FAYETTE, JACKSON, PIKE, ROSS and VINTON COUNTIES

	Rates	Fringes
Bricklayer, Stonemason.....	$ 29.88	12.89

BROH0046-002 06/01/2014

ERIE, HANCOCK, HURON, OTTAWA, SANDUSKY, SENECA, WOOD (Perry & Bloom Townships) and WYANDOT (Tymochtee, Crawford, Ridge & Richland Townships) COUNTIES & the Islands of Lake Erie north of Sandusky

	Rates	Fringes
Bricklayer, Stonemason.....	$ 28.14	16.98

FOOTNOTE: Layout Man and Sawman rate: $1.00 per hour above journeyman rate.
Free standing stack work ground level to top of stack; Sandblasting and laying of carbon masonry material in swing stage and/or scaffold; Ramming and spading of plastics and gunniting: $1.50 per hour above journeyman rate.
"Hot" work: $2.50 above journeyman rate.

BROH0052-001 06/01/2014

ATHENS COUNTY

	Rates	Fringes
Bricklayer, Stonemason.....	$ 28.33	11.37

BROH0052-003 06/01/2014

NOBLE (Brookfield, Noble, Center, Sharon, Olive, Enoch, Stock, Jackson, Jefferson & Elk Townships) and WASHINGTON COUNTIES

	Rates	Fringes
Bricklayer, Stonemason.....	$ 27.77	14.93

BROH0055-003 06/01/2014

DELAWARE, FRANKLIN, MADISON, PICKAWAY and UNION COUNTIES

	Rates	Fringes
Bricklayer, Stonemason	$ 29.88	12.89

CARP0003-004 05/01/2014

MAHONING & TRUMBULL

	Rates	Fringes
CARPENTER	$ 25.61	15.10

CARP0069-003 05/01/2014

CARROLL, STARK, TUSCARAWAS & WAYNE

	Rates	Fringes
CARPENTER	$ 25.50	13.67

CARP0069-006 05/01/2014

COSHOCTON, HOLMES, KNOX & MORROW

	Rates	Fringes
CARPENTER	$ 23.66	13.05

CARP0171-002 05/01/2014

BELMONT, COLUMBIANA, HARRISON, JEFFERSON & MONROE

	Rates	Fringes
CARPENTER	$ 26.02	15.49

CARP0200-002 05/01/2014

ADAMS, ATHENS, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, GALLIA, GUERNSEY, HIGHLAND, HOCKING, JACKSON, LAWRENCE, LICKING, MADISON, MARION, MEIGS, MORGAN, MUSKINGUM, NOBLE, PERRY, PICKAWAY, PIKE, ROSS, SCIOTO, UNION, VINTON and WASHINGTON COUNTIES

	Rates	Fringes
CARPENTER	$ 28.22	13.50
Diver	$ 39.41	10.40
PILEDRIVERMAN	$ 28.22	13.50

CARP0248-005 07/01/2008

LUCAS & WOOD

	Rates	Fringes

CARPENTER.....$ 27.27 14.58

CARP0248-008 07/01/2008

	Rates	Fringes
CARPENTER DEFIANCE, FULTON, HANCOCK, HENRY, PAULDING & WILLIAMS COUNTIES.....	$ 23.71	13.28

CARP0254-002 05/01/2014

ASHTABULA, CUYAHOGA, GEAUGA & LAKE

	Rates	Fringes
CARPENTER.....	$ 31.61	14.46

CARP0372-002 07/01/2008

ALLEN, AUGLAIZE, HARDIN, MERCER, PUTNAM & VAN WERT

	Rates	Fringes
CARPENTER.....	$ 23.18	13.28

CARP0639-003 05/01/2014

MEDINA, PORTAGE & SUMMIT

	Rates	Fringes
CARPENTER.....	$ 29.59	14.64

CARP0735-002 05/01/2014

ASHLAND, ERIE, HURON, LORAIN & RICHLAND

	Rates	Fringes
CARPENTER.....	$ 24.80	13.29

CARP1311-001 05/01/2014

BROWN, BUTLER, CHAMPAIGN, CLARK, CLERMONT, CLINTON, DARKE, GREENE, HAMILTON, LOGAN, MIAMI, MONTGOMERY, PREBLE, SHELBY & WARREN

	Rates	Fringes
Carpenter & Piledrivermen.....	$ 27.39	14.33
Diver.....	$ 40.58	9.69

CARP1393-002 07/01/2008

CRAWFORD, DEFIANCE, FULTON, HANCOCK, HENRY, LUCAS, OTTAWA, PAULDING, SANDUSKY, SENECA, WILLIAMS & WOOD

	Rates	Fringes
Piledrivermen & Diver's Tender...	$ 27.30	16.05

DIVERS - $250.00 per day

CARP1393-003 07/01/2008

ALLEN, AUGLAIZE, HARDIN, MERCER, PUTNAM, VAN WERT & WYANDOT

	Rates	Fringes
Piledrivermen & Diver's Tender...	$ 25.15	15.92

DIVERS - $250.00 per day

CARP1871-006 06/01/2013

BELMONT, HARRISON, & MONROE

	Rates	Fringes
Diver, Wet.....	$ 47.07	13.92
Piledrivermen; Diver, Dry.....	$ 31.38	13.92

CARP1871-008 06/01/2013

ASHLAND, ASHTABULA, CUYAHOGA, ERIE, GEAUGA, HURON, LAKE, LORAIN, MEDINA, PORTAGE, RICHLAND & SUMMIT

	Rates	Fringes
Diver, Wet.....	$ 44.22	15.49
Piledrivermen; Diver, Dry.....	$ 29.48	15.49

CARP1871-014 06/01/2013

CARROLL, STARK, TUSCARAWAS & WAYNE

	Rates	Fringes
Diver, Wet.....	$ 37.40	13.81
Piledrivermen; Diver, Dry.....	$ 24.93	13.81

CARP1871-015 06/01/2013

COSHOCTON, HOLMES, KNOX & MORROW

	Rates	Fringes
Diver, Wet.....	$ 36.53	12.96
Piledrivermen; Diver, Dry.....	$ 24.35	12.96

CARP1871-017 06/01/2013

MAHONING & TRUMBULL

	Rates	Fringes
Diver, Wet	$ 39.44	14.16
Piledrivermen; Diver, Dry	$ 26.29	14.16

CARP2235-012 01/01/2014

COLUMBIANA & JEFFERSON

	Rates	Fringes
PILEDRIVERMAN	$ 31.74	16.41

CARP2239-001 07/01/2008

CRAWFORD, OTTAWA, SANDUSKY, SENECA & WYANDOT

	Rates	Fringes
CARPENTER	$ 23.71	13.28

ELEC0008-002 05/26/2014

DEFIANCE, FULTON, HANCOCK, HENRY, LUCAS, OTTAWA, PAULDING, PUTNAM, SANDUSKY, SENECA, WILLIAMS & WOOD

	Rates	Fringes
CABLE SPLICER	$ 38.98	18.96
ELECTRICIAN	$ 37.12	18.88

ELEC0032-003 06/01/2014

ALLEN, AUGLAIZE, HARDIN, LOGAN, MERCER, SHELBY, VAN WERT & WYANDOT (Crawford, Jackson, Marseilles, Mifflin, Ridgeland, Ridge & Salem Townships)

	Rates	Fringes
ELECTRICIAN	$ 28.32	15.18

ELEC0032-004 06/01/1998

ALLEN, HARDIN, VAN WERT & WYANDOT (Crawford, Jackson, Marseilles, Mifflin, Richland, Ridge & Salem Townships)

	Rates	Fringes
Line Construction		
Equipment Operator	$ 20.27	4.12+a
Groundman Truck Driver	$ 14.43	3.63+a
Lineman	$ 22.52	4.31+a

FOOTNOTE: a. Half day's Paid Holiday: The last 4 hours of the workday prior to Christmas or New Year's Day

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ELEC0038-002 04/28/2014

CUYAHOGA, GEAUGA (Bainbridge, Chester & Russell Townships) & LORAIN (Columbia Township)

	Rates	Fringes
ELECTRICIAN		
Excluding Sound & Communications Work	$ 36.78	19.72

FOOTNOTES;
a. 6 Paid Holidays: New Year's Day; Memorial Day; July 4th; Labor Day; Thanksgiving Day; & Christmas Day
b. 1 week's paid vacation for 1 year's service; 2 weeks' paid vacation for 2 or more years' service

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ELEC0038-008 04/28/2014

CUYAHOGA, GEAUGA (Bainbridge, Chester & Russell Townships) & LORAIN (Columbia Township)

	Rates	Fringes
Sound & Communication Technician		
Communications Technician	$ 25.80	10.14+a+b
Installer Technician	$ 24.55	10.11+a+b

FOOTNOTES;
a. 6 Paid Holidays: New Year's Day; Memorial Day; July 4th; Labor Day; Thanksgiving Day; & Christmas Day
b. 1 week's paid vacation for 1 year's service; 2 weeks' paid vacation for 2 or more years' service

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ELEC0064-003 11/25/2013

COLUMBIANA (Butler, Fairfield, Perry, Salem & Unity Townships) MAHONING (Austintown, Beaver, Berlin, Boardman, Canfield, Ellsworth, Coitsville, Goshen, Green, Jackson, Poland, Springfield & Youngstown Townships), & TRUMBULL (Hubbard & Liberty Townships)

	Rates	Fringes
ELECTRICIAN	$ 31.02	12.91

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* ELEC0071-001 12/29/2014

ASHLAND, CHAMPAIGN, CLARK, COSHOCTON, CRAWFORD, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, GUERNSEY, HIGHLAND, HOCKING, JACKSON (Coal, Jackson, Liberty, Milton, Washington & Wellston Townships), KNOX, LICKING, MADISON, MARION, MONROE, MORGAN, MORROW, MUSKINGUM, NOBLE, PERRY, PICKAWAY, PIKE (Beaver,

Benton, Jackson, Mifflin, Pebble, Peepee, Perry & Seal Townships), RICHLAND, ROSS, TUSCARAWAS (Auburn, Bucks, Clay, Jefferson, Oxford, Perry, Salem, Rush, Washington & York Townships), UNION, VINTON (Clinton, Eagle, Elk, Harrison, Jackson, Richland & Swan Townships), and WASHINGTON COUNTIES

	Rates	Fringes
Line Construction		
Equipment Operators	$ 31.52	12.00
Groundmen	$ 22.76	10.07
Linemen & Cable Splicers	$ 35.02	12.76

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* ELEC0071-004 12/29/2014

AUGLAIZE, CLINTON, DARKE, GREENE, LOGAN, MERCER, MIAMI, MONTGOMERY, PREBLE, and SHELBY COUNTIES

	Rates	Fringes
Line Construction		
Equipment Operator	$ 31.52	12.00
Groundman	$ 22.76	10.07
Lineman & Cable Splicers	$ 35.02	12.76

ELEC0071-005 12/30/2013

ASHTABULA, CUYAHOGA, GEAUGA, LAKE & LORAIN

	Rates	Fringes
LINE CONSTRUCTION: Equipment Operator		
DOT/Traffic Signal & Highway Lighting Projects	$ 29.02	11.96
Municipal Power/Transit Projects	$ 37.21	13.93
LINE CONSTRUCTION: Groundman		
DOT/Traffic Signal & Highway Lighting Projects	$ 22.57	10.42
Municipal Power/Transit Projects	$ 28.94	11.95
LINE CONSTRUCTION: Linemen/Cable Splicer		
DOT/Traffic Signal & Highway Lighting Projects	$ 32.39	12.75
Municipal Power/Transit Projects	$ 41.35	14.92

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* ELEC0071-008 12/29/2014

COLUMBIANA, MAHONING, and TRUMBULL COUNTIES

	Rates	Fringes
Line Construction		
Equipment Operator	$ 31.52	12.00
Groundman	$ 22.76	10.07

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     Lineman & Cable Splicers....$ 35.02            12.76
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* ELEC0071-010 12/29/2014

BELMONT, CARROLL, HARRISON, HOLMES, JEFFERSON, MEDINA, PORTAGE,
STARK, SUMMIT, and WAYNE COUNTIES


                                  Rates          Fringes

Line Construction
     Equipment Operator..........$ 31.52            12.00
     Groundman...................$ 22.76            10.07
     Lineman & Cable Splicers....$ 35.02            12.76
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* ELEC0071-013 12/29/2014

BROWN, BUTLER, CLERMONT, HAMILTON, and WARREN COUNTIES

                                  Rates          Fringes

Line Construction
     Equipment Operator..........$ 31.52            12.00
     Groundman...................$ 22.76            10.07
     Lineman & Cable Splicers....$ 35.02            12.76
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* ELEC0071-014 12/29/2014

ADAMS, ATHENS, GALLIA, JACKSON (Bloomfield, Franklin, Hamilton,
Lick, Jefferson, Scioto & Madison Townships), LAWRENCE, MEIGS,
PIKE (Camp Creek, Marion, Newton, Scioto, Sunfish & Union
Townships), SCIOTO & VINTON (Brown, Knox, Madison, Vinton &
Wilkesville Townships)


                                  Rates          Fringes

Line Construction
     Equipment Operator..........$ 31.52            12.00
     Groundman...................$ 22.76            10.07
     Lineman & Cable Splicers....$ 35.02            12.76
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 ELEC0082-002 12/01/2014

CLINTON, DARKE, GREENE, MIAMI, MONTGOMERY, PREBLE & WARREN
(Wayne, Clear Creek & Franklin Townships)


                                  Rates          Fringes

ELECTRICIAN.....................$ 27.70            17.39
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 ELEC0082-006 12/01/2014

CLINTON, DARKE, GREENE, MIAMI, MONTGOMERY, PREBLE & WARREN
(Wayne, Clear Creek & Franklin Townships)


                                  Rates          Fringes
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Sound & Communication
Technician
Cable Puller.....$ 9.14 4.91
Installer/Technician.....$ 27.70 17.39

ELEC0129-003 03/01/2010

LORAIN (Except Columbia Township) & MEDINA (Litchfield & Liverpool Townships)

	Rates	Fringes
ELECTRICIAN.....	$ 31.00	13.80

ELEC0129-004 03/01/2010

ERIE & HURON (Lyme, Ridgefield, Norwalk, Townsend, Wakeman, Sherman, Peru, Bronson, Hartland, Clarksfield, Norwich, Greenfield, Fairfield, Fitchville & New London Townships)

	Rates	Fringes
ELECTRICIAN.....	$ 31.00	13.80

ELEC0141-003 09/01/2014

BELMONT COUNTY

	Rates	Fringes
CABLE SPLICER.....	$ 31.75	23.16
ELECTRICIAN.....	$ 28.35	23.05

ELEC0212-003 07/01/2013

BROWN, CLERMONT & HAMILTON

	Rates	Fringes
Sound & Communication Technician.....	$ 22.50	9.51

ELEC0212-005 06/02/2014

BROWN, CLERMONT, and HAMILTON COUNTIES

	Rates	Fringes
ELECTRICIAN.....	$ 26.74	16.45

ELEC0245-003 08/26/2013

DEFIANCE, FULTON, HANCOCK, HENRY, HURON, LUCAS, OTTAWA, PAULDING, PUTNAM, SANDUSKY, SENECA, WILLIAMS, and WOOD COUNTIES

	Rates	Fringes

Line Construction
Cable Splicer.....$ 39.72 24.77%+$5.00+a
Groundman/Truck Driver.....$ 15.11 24.77%+$5.00+a
Heli-arc Welding.....$ 34.84 24.77%+$5.00+a
Lineman.....$ 24.54 24.77%+$5.00+a
Operator - Class 1.....$ 27.63 24.77%+$5.00+a
Operator - Class 2.....$ 24.18 24.77%+$5.00+a
Traffic Signal & Lighting
Technician.....$ 31.09 24.77%+$5.00+a

FOOTNOTE: a. 6 Observed Holidays: New Year's Day; Memorial Day; Independence Day; Labor Day; Thanksgiving Day; & Christmas Day. Employees who work on a holiday shall be paid at a rate of double their applicable classified straight-time rates for the work performed on such holiday.

ELEC0245-004 09/01/2014

ERIE COUNTY

	Rates	Fringes
Line Construction		
Cable Splicer	$ 40.83	25.20%+$5.00+a
Groundman/Truck Driver	$ 15.53	25.20%+$5.00+a
Lineman	$ 35.50	25.20%+$5.00+a
Operator - Class 1	$ 28.40	25.20%+$5.00+a
Operator - Class 2	$ 24.85	25.20%+$5.00+a

FOOTNOTE: a. 6 Observed Holidays: New Year's Day; Memorial Day; Independence Day; Labor Day; Thanksgiving Day; & Christmas Day. Employees who work on a holiday shall be paid at a rate of double their applicable classified straight-time rates for the work performed on such holiday.

ELEC0246-006 10/29/2012

	Rates	Fringes
ELECTRICIAN	$ 33.00	26.16

ELEC0306-005 05/26/2014

MEDINA (Brunswick, Chatham, Granger, Guilford, Harrisville, Hinckley, Homer, Lafayette, Medina, Montville, Sharon, Spencer, Wadsworth, Westfield & York Townships), PORTAGE (Atwater, Aurora, Brimfield, Deerfield, Franklin, Mantua, Randolph, Ravenna, Rootstown, Shalersville, Streetsboro & Suffield Townships), SUMMIT & WAYNE (Baughman, Canaan, Chester, Chippewa, Congress, Green, Milton, & Wayne Townships)

	Rates	Fringes
CABLE SPLICER	$ 36.22	5%+14.86
ELECTRICIAN	$ 34.04	5%+14.86

ELEC0317-002 05/28/2014

GALLIA & LAWRENCE

	Rates	Fringes
CABLE SPLICER	$ 32.68	18.13
ELECTRICIAN	$ 32.62	21.45

ELEC0540-003 06/05/1997

TUSCARAWAS COUNTY (North of Auburn, Clay, Rush & York Townships)

	Rates	Fringes
Line Construction		
Groundman; & Truck Driver	$ 14.65	8.18
Line Equipment Operator	$ 19.02	8.69
Lineman; & Cable Splicer	$ 21.86	9.01

ELEC0540-005 01/01/2015

CARROLL (Northern half, including Fox, Harrison, Rose & Washington Townhships), COLUMBIANA (Knox Township), HOLMES, MAHONING (Smith Township), STARK, TUSCARAWAS (North of Auburn, Clay, Rush & York Townships), and WAYNE (South of Baughman, Chester, Green & Wayne Townships) COUNTIES

	Rates	Fringes
ELECTRICIAN	$ 29.96	20.82

ELEC0573-003 12/01/2014

ASHTABULA (Colebrook, Wayne, Williamsfield, Orwell & Windsor Townships), GEAUGA (Auburn, Middlefield, Parkman & Troy Townships), MAHONING (Milton Township), PORTAGE (Charlestown, Edinburg, Freedom, Hiram, Nelson, Palmyra, Paris & Windham Townships), and TRUMBULL (Except Liberty & Hubbard Townships)

	Rates	Fringes
ELECTRICIAN	$ 30.65	16.62

ELEC0575-001 06/02/2014

ADAMS, FAYETTE, HIGHLAND, HOCKING, JACKSON (Bloomfield, Franklin, Hamilton, Jefferson, Lick, Madison, Scioto, Coal, Jackson, Liberty, Milton & Washington Townships), PICKAWAY (Deer Creek, Perry, Pickaway, Salt Creek & Wayne Townships), PIKE (Beaver, Benton, Jackson, Mifflin, Pebble, PeePee, Perry, Seal, Camp Creek, Newton, Scioto, Sunfish, Union & Marion Townships), ROSS, SCIOTO & VINTON (Clinton, Eagle, Elk, Harrison, Jackson, Richland & Swan Townships)

	Rates	Fringes
ELECTRICIAN	$ 31.70	14.21

ELEC0648-001 09/01/2014

BUTLER and WARREN COUNTIES (Deerfield, Hamilton, Harlan, Massie, Salem, Turtle Creek, Union & Washington Townships)

	Rates	Fringes
CABLE SPLICER	$ 28.83	16.29
ELECTRICIAN	$ 28.33	16.27

ELEC0673-004 05/26/2014

ASHTABULA (Excluding Orwell, Colebrook, Williamsfield, Wayne & Windsor Townships), GEAUGA (Burton, Chardon, Claridon, Hambden, Huntsburg, Montville, Munson, Newbury & Thompson Townships) and LAKE COUNTIES

	Rates	Fringes
CABLE SPLICER	$ 33.29	17.11
ELECTRICIAN	$ 33.04	17.11

ELEC0683-002 06/02/2014

CHAMPAIGN, CLARK, DELAWARE, FAIRFIELD, FRANKLIN, MADISON, PICKAWAY (Circleville, Darby, Harrison, Jackson, Madison, Monroe, Muhlenberg, Scioto, Walnut & Washington Townships), and UNION COUNTIES

	Rates	Fringes
CABLE SPLICER	$ 31.45	15.85
ELECTRICIAN	$ 30.85	15.85

ELEC0688-003 06/02/2014

ASHLAND, CRAWFORD, HURON (Richmond, New Haven, Ripley & Greenwich Townships), KNOX (Liberty, Clinton, Union, Howard, Monroe, Middleberry, Morris, Wayne, Berlin, Pike, Brown & Jefferson Townships), MARION, MORROW, RICHLAND and WYANDOT (Sycamore, Crane, Eden, Pitt, Antrim & Tymochtee Townships) COUNTIES

	Rates	Fringes
ELECTRICIAN	$ 26.75	15.31

ELEC0972-002 06/01/2014

ATHENS, MEIGS, MONROE, MORGAN, NOBLE, VINTON (Brown, Knox, Madison, Vinton & Wilkesville Townships), and WASHINGTON COUNITES

	Rates	Fringes

CABLE SPLICER.....$ 32.49 21.33
ELECTRICIAN.....$ 32.24 21.33

ELEC1105-001 06/02/2014

COSHOCTON, GUERNSEY, KNOX (Jackson, Clay, Morgan, Miller, Milford, Hilliar, Butler, Harrison, Pleasant & College Townships), LICKING, MUSKINGUM, PERRY, and TUSCARAWAS (Auburn, York, Clay, Jefferson, Rush, Oxford, Washington, Salem, Perry & Bucks Townships) COUNTIES

	Rates	Fringes
ELECTRICIAN	$ 29.18	15.44

ENGI0018-003 05/01/2014

ASHTABULA, CUYAHOGA, ERIE, GEAUGA, LAKE, LORAIN, MEDINA, PORTAGE, and SUMMIT COUNTIES

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1	$ 33.93	13.90
GROUP 2	$ 33.83	13.90
GROUP 3	$ 32.79	13.90
GROUP 4	$ 31.57	13.90
GROUP 5	$ 26.28	13.90
GROUP 6	$ 34.18	13.90
GROUP 7	$ 34.43	13.90

OPERATING ENGINEER CLASSIFICATIONS

GROUP 1 - Air Compressor on Steel Erection; Barrier Moving Machine; Boiler Operator on Compressor or Generator when mounted on a Rig; Cableway; Combination Concrete Mixer & Tower; Concrete Plant (over 4 yd. Capacity); Concrete Pump; Crane (All Types, Including Boom Truck, Cherry Picker); Crane-Compact, Track or Rubber over 4,000 lbs. capacity; Cranes-Self Erecting, Stationary, Track or Truck (All Configurations); Derrick; Dragline; Dredge (Dipper, Clam or Suction); Elevating Grader or Euclid Loader; Floating Equipment (All Types); Gradall; Helicopter Crew (Operator-Hoist or Winch); Hoe (all types); Hoisting Engine on Shaft or Tunnel Work; Hydraulic Gantry (Lifting System); Industrial-Type Tractor; Jet Engine Dryer (D8 or D9) Diesel Tractor; Locomotive (Standard Gauge); Maintenance Operator Class A; Mixer, Paving (Single or Double Drum); Mucking Machine; Multiple Scraper; Piledriving Machine (All Types); Power Shovel; Prentice Loader; Quad 9 (Double Pusher); Rail Tamper (with auto lifting & aligning device); Refrigerating Machine (Freezer Operation); Rotary Drill, on Caisson work; Rough Terrain Fork Lift with Winch/Hoist; Side-Boom; Slip-Form Paver; Tower Derrick; Tree Shredder; Trench Machine (Over 24" wide); Truck Mounted Concrete Pump; Tug Boat; Tunnel Machine and/or Mining Machine; Wheel Excavator; and Asphalt Plant Engineer (Cleveland District

Only).

GROUP 2 - Asphalt Paver; Automatic Subgrader Machine, Self-Propelled (CMI Type); Bobcat Type and/or Skid Steer Loader with Hoe Attachment Greater than 7,000 lbs.; Boring Machine More than 48"; Bulldozer; Endloader; Horizontal Directional Drill (Over 50,000 ft lbs thrust); Hydro Milling Machine; Kolman-type Loader (production type-Dirt); Lead Greaseman; Lighting & Traffic Signal Installation Equipment (includes all groups or classifications); Material Transfer Equipment (Shuttle Buggy) Asphalt; Pettibone-Rail Equipment; Power Grader; Power Scraper; Push Cat; Rotomill (all), Grinders & Planers of All types; Trench Machine (24" wide & under); Vermeer type Concrete Saw; and Maintenance Operators (Portage and Summit Counties Only).

GROUP 3 - A-Frame; Air Compressor on Tunnel Work (low pressure); Asphalt Plant Engineer (Portage and Summit Counties Only); Bobcat-type and/or Skid Steer Loader with or without Attachments; Highway Drills (all types); Locomotive (narrow gauge); Material Hoist/Elevator; Mixer, Concrete (more than one bag capacity); Mixer, one bag capacity (Side Loader); Power Boiler (Over 15 lbs. Pressure) Pump Operator installing & operating Well Points; Pump (4" & over discharge); Roller, Asphalt; Rotovator (lime soil stabilizer); Switch & Tie Tampers (without lifting & aligning device); Utility Operator (Small equipment); Welding Machines; and Railroad Tie Inserter/Remover; Articulating/straight bed end dumps if assigned (minus $4.00 per hour.

GROUP 4 - Backfiller; Ballast Re-locator; Bars, Joint & Mesh Installing Machine; Batch Plant; Boring Machine Operator (48" or less); Bull Floats; Burlap & Curing Machine; Concrete Plant (capacity 4 yd. & under); Concrete Saw (Multiple); Conveyor (Highway); Crusher; Deckhand; Farm-type Tractor with attachments (highway); Finishing Machine; Fireperson, Floating Equipment (all types); Forklift; Form Trencher; Hydro Hammer expect masonary; Hydro Seeder; Pavement Breaker; Plant Mixer; Post Driver; Post Hole Digger (Power Auger); Power Brush Burner; Power Form Handling Equipment; Road Widening Trencher; Roller (Brick, Grade & Macadam); Self-Propelled Power Spreader; Self-Propelled Power Subgrader; Steam Fireperson; Tractor (Pulling Sheepfoot, Roller or Grader); and Vibratory Compactor with Integral Power.

GROUP 5 - Compressor (Portable, Sewer, Heavy & Highway); Drum Fireperson (Asphalt Plant); Generator; Masonry Fork Lift; Inboard-Outboard Motor Boat Launch; Oil Heater (asphalt plant); Oiler/Helper; Power Driven Heater; Power Sweeper & Scrubber; Pump (under 4" discharge); Signalperson; Tire Repairperson; VAC/ALLS; Cranes - Compact, track or rubber under 4,000 pound capacity; fueling and greasing; and Chainmen.

GROUP 6 - Master Mechanic & Boom from 150 to 180.

GROUP 7 - Boom from 180 and over.

ENGI0018-004 05/01/2014

ADAMS, ALLEN, ASHLAND, ATHENS, AUGLAIZE, BELMONT, BROWN, BUTLER, CARROLL, CHAMPAIGN, CLARK, CLERMONT, CLINTON, COSHOCTON, CRAWFORD, DARKE, DEFIANCE, DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, FULTON, GALLIA, GREENE, GUERNSEY, HAMILTON, HANCOCK, HARDIN, HARRISON, HENRY, HIGHLAND, HOCKING, HOLMES, HURON, JACKSON, JEFFERSON, KNOX, LAWRENCE, LICKING, LOGAN, LUCAS, MADISON, MARION, MEIGS, MERCER, MIAMI, MONROE, MONTGOMERY, MORGAN, MORROW, MUSKINGUM, NOBLE, OTTAWA, PAULDING, PERRY, PICKAWAY, PIKE, PREBLE, PUTNAM, RICHLAND, ROSS, SANDUSKY, SCIOTO, SENECA, SHELBY, STARK, TUSCARAWAS, UNION, VAN WERT, VINTON, WARREN, WASHINGTON, WAYNE, WILLIAMS, WOOD, and YANDOT COUNTIES

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1	$ 32.44	13.90
GROUP 2	$ 32.32	13.90
GROUP 3	$ 31.28	13.90
GROUP 4	$ 30.10	13.90
GROUP 5	$ 24.64	13.90
GROUP 6	$ 32.69	13.90
GROUP 7	$ 32.94	13.90

OPERATING ENGINEER CLASSIFICATIONS

GROUP 1 - Air Compressor on Steel Erection; Barrier Moving Machine; Boiler Operator on Compressor or Generator when mounted on a Rig; Cableway; Combination Concrete Mixer & Tower; Concrete Plant (over 4 yd. Capacity); Concrete Pump; Crane (All Types, Including Boom Truck, Cherry Picker); Crane-Compact, Track or Rubber over 4,000 lbs. capacity; Cranes-Self Erecting, Stationary, Track or Truck (All Configurations); Derrick; Dragline; Dredge (Dipper, Clam or Suction); Elevating Grader or Euclid Loader; Floating Equipment (All Types); Gradall; Helicopter Crew (Operator-Hoist or Winch); Hoe (all types); Hoisting Engine on Shaft or Tunnel Work; Hydraulic Gantry (Lifting System); Industrial-Type Tractor; Jet Engine Dryer (D8 or D9) Diesel Tractor; Locomotive (Standard Gauge); Maintenance Operator Class A; Mixer, Paving (Single or Double Drum); Mucking Machine; Multiple Scraper; Piledriving Machine (All Types); Power Shovel; Prentice Loader; Quad 9 (Double Pusher); Rail Tamper (with auto lifting & aligning device); Refrigerating Machine (Freezer Operation); Rotary Drill, on Caisson work; Rough Terrain Fork Lift with Winch/Hoist; Side-Boom; Slip-Form Paver; Tower Derrick; Tree Shredder; Trench Machine (Over 24" wide); Truck Mounted Concrete Pump; Tug Boat; Tunnel Machine and/or Mining Machine; and Wheel Excavator.

GROUP 2 - Asphalt Paver; Automatic Subgrader Machine, Self-Propelled (CMI Type); Bobcat Type and/or Skid Steer Loader with Hoe Attachment Greater than 7,000 lbs.; Boring Machine More than 48"; Bulldozer; Endloader; Hydro Milling

Machine; Horizontal Directional Drill (over 50,000 ft. lbs. thrust);Kolman-type Loader (production type-Dirt); Lead Greaseman; Lighting & Traffic Signal Installation Equipment (includes all groups or classifications); Material Transfer Equipment (Shuttle Buggy) Asphalt; Pettibone-Rail Equipment; Power Grader; Power Scraper; Push Cat; Rotomill (all), Grinders & Planers of All types; Trench Machine (24" wide & under); and Vermeer type Concrete Saw.

GROUP 3 - A-Frame; Air Compressor on Tunnel Work (low pressure); Asphalt Plant Engineer; Bobcat-type and/or Skid Steer Loader with or without Attachments; Highway Drills (all types); Locomotive (narrow gauge); Material Hoist/Elevator; Mixer, Concrete (more than one bag capacity); Mixer, one bag capacity (Side Loader); Power Boiler (Over 15 lbs. Pressure) Pump Operator installing & operating Well Points; Pump (4" & over discharge); Railroad Tie Inserter/Remover; Roller, Asphalt; Rotovator (lime soil stabilizer); Switch & Tie Tampers (without lifting & aligning device); Utility Operator (Small equipment); and Welding Machines; Artiaculating/straight bed end dumps if assigned (minus $4.00 per hour.

GROUP 4 - Backfiller; Ballast Re-locator; Bars, Joint & Mesh Installing Machine; Batch Plant; Boring Machine Operator (48" or less); Bull Floats; Burlap & Curing Machine; Concrete Plant (capacity 4 yd. & under); Concrete Saw (Multiple); Conveyor (Highway); Crusher; Deckhand; Farm-type Tractor with attachments (highway); Finishing Machine; Fireperson, Floating Equipment (all types); Fork Lift; Form Trencher; Hydro Hammer expect masonary; Hydro Seeder; Pavement Breaker; Plant Mixer; Post Driver; Post Hole Digger (Power Auger); Power Brush Burner; Power Form Handling Equipment; Road Widening Trencher; Roller (Brick, Grade & Macadam); Self-Propelled Power Spreader; Self-Propelled Power Subgrader; Steam Fireperson; Tractor (Pulling Sheepfoot, Roller or Grader); and Vibratory Compactor with Integral Power.

GROUP 5 - Compressor (Portable, Sewer, Heavy & Highway); Drum Fireperson (Asphalt Plant); Generator; Masonary Forklift; Inboard-Outboard Motor Boat Launch; Oil Heater (asphalt plant); Oiler/Helper; Power Driven Heater; Power Sweeper & Scrubber; Pump (under 4" discharge); Signalperson; Tire Repairperson; VAC/ALLS; Cranes - Compact, track or rubber under 4,000 pound capacity; fueling and greasing; and Chainmen.

GROUP 6 - Master Mechanic & Boom from 150 to 180.

GROUP 7 - Boom from 180 and over.

ENGI0066-023 06/01/2014

COLUMBIANA, MAHONING & TRUMBULL COUNTIES

	Rates	Fringes
POWER EQUIPMENT OPERATOR		

ASBESTOS; HAZARDOUS/TOXIC
WASTE PROJECTS

GROUP 1 - A & B.....$ 37.55 17.51
ASBESTOS; HAZARDOUS/TOXIC
WASTE PROJECTS

GROUP 2 - A & B.....$ 37.22 17.51
ASBESTOS; HAZARDOUS/TOXIC
WASTE PROJECTS

GROUP 3 - A & B.....$ 33.49 17.51
ASBESTOS; HAZARDOUS/TOXIC
WASTE PROJECTS

GROUP 4 - A & B.....$ 29.54 17.51
ASBESTOS; HAZARDOUS/TOXIC
WASTE PROJECTS

GROUP 5 - A & B.....$ 26.15 17.51
HAZARDOUS/TOXIC WASTE
PROJECTS

GROUP 1 - C & D.....$ 34.42 17.51
HAZARDOUS/TOXIC WASTE
PROJECTS

GROUP 2 - C & D.....$ 34.12 17.51
HAZARDOUS/TOXIC WASTE
PROJECTS

GROUP 3 - C & D.....$ 30.70 17.51
HAZARDOUS/TOXIC WASTE
PROJECTS

GROUP 4 - C & D.....$ 27.08 17.51
HAZARDOUS/TOXIC WASTE
PROJECTS

GROUP 5 - C & D.....$ 23.97 17.51
ALL OTHER WORK

GROUP 1.....$ 31.29 17.51
ALL OTHER WORK

GROUP 2.....$ 31.02 17.51
ALL OTHER WORK

GROUP 3.....$ 27.91 17.51
ALL OTHER WORK

GROUP 4.....$ 24.62 17.51
ALL OTHER WORK

GROUP 5.....$ 21.79 17.51

GROUP 1 - Rig, Pile Driver or Caisson Type; & Rig, Pile Hydraulic Unit Attached

GROUP 2 - Asphalt Heater Planer; Backfiller with Drag

Attachment; Backhoe; Backhoe with Shear attached; Backhoe-Rear Pivotal Swing; Batch Plant-Central Mix Concrete; Batch Plant, Portable concrete; Berm Builder-Automatic; Boat Derrick; Boat-Tug; Boring Machine Attached to Tractor; Bullclam; Bulldozer; C.M.I. Road Builder & Similar Type; Cable Placer & Layer; Carrier-Straddle; Carryall-Scraper or Scoop; Chicago Boom; Compactor with Blade Attached; Concrete Saw (Vermeer or similar type); Concrete Spreader Finisher; Combination, Bidwell Machine; Crane; Crane-Electric Overhead; Crane-Rough Terrain; Crane-Side Boom; Crane-Truck; Crane-Tower; Derrick-Boom; Derrick-Car; Digger-Wheel (Not trencher or road widener); Double Nine; Drag Line; Dredge; Drill-Kenny or Similar Type; Easy Pour Median Barrier Machine (or similar type); Electromatic; Frankie Pile; Gradall; Grader; Gurry; Self-Propelled; Heavy Equipment Robotics Operator/Mechanic; Hoist-Monorail; Hoist-Stationary & Mobile Tractor; Hoist, 2 or 3 drum; Horizontal Directional Drill Operator; Jackall; Jumbo Machine; Kocal & Kuhlman; Land-Seagoing Vehicle; Loader, Elevating; Loader, Front End; Loader, Skid Steer; Locomotive; Mechanic/Welder; Metro Chip Harvester with Boom; Mucking Machine; Paver-Asphalt Finishing Machine; Paver-Road Concrete; Paver-Slip Form (C.M.I. or similar); Place Crete Machine with Boom; Post Driver (Carrier mounted); Power Driven Hydraulic Pump & Jack (When used in Slip Form or Lift Slab Construction); Pump Crete Machine; Regulator-Ballast; Hydraulic Power Unit not attached to Rig for Pile Drillings; Rigs-Drilling; Roto Mill or similar Full Lane (8' Wide & Over); Roto Mill or similar type (Under 8'); Shovel; Slip Form Curb Machine; Speedwing; Spikemaster; Stonecrusher; Tie Puller & Loader; Tie Tamper; Tractor-Double Boom; Tractor with Attachments; Truck-Boom; Truck-Tire; Trench Machine; Tunnel Machine (Mark 21 Java or similar); & Whirley (or similar type)

GROUP 3 - Asphalt Plant; Bending Machine (Pipeline or similar type); Boring machine, Motor Driven; Chip Harvester without Boom; Cleaning Machine, Pipeline Type; Coating Machine, Pipeline Type; Compactor; Concrete Belt Placer; Concrete Finisher; Concrete Planer or Asphalt; Concrete Spreader; Elevator; Fork Lift (Home building only); Fork lift & Lulls; Fork Lift Walk Behind (Hoisting over 1 buck high); Form Line Machine; Grease Truck operator; Grout Pump; Gunnite Machine; Horizontal Directional Drill Locator; Single Drum Hoist with or without Tower; Huck Bolting Machine; Hydraulic Scaffold (Hoisting building materials); Paving Breaker (Self-propelled or Ridden); Pipe Dream; Pot Fireperson (Power Agitated); Refrigeration Plant; Road Widener; Roller; Sasgen Derrick; Seeding Machine; Soil Stabilizer (Pump type); Spray Cure Machine, Self-Propelled; Straw Blower Machine; Sub-Grader; Tube Finisher or Broom C.M.I. or similar type; & Tugger Hoist

GROUP 4 - Air Curtain Destructor & Similar Type; Batch Plant-Job Related; Boiler Operator; Compressor; Conveyor; Curb Builder, self-propelled; Drill Wagon; Generator Set; Generator-Steam; Heater-Portable Power; Hydraulic Manipulator Crane; Jack-Hydraulic Power driven; Jack-Hydraulic (Railroad); Ladavator; Minor Machine

Operator; Mixer-Concrete; Mulching Machine; Pin Puller; Power Broom; Pulverizer; Pump; Road Finishing Machine (Pull Type); Saw-Concrete-Self-Propelled (Highway Work); Signal Person; Spray Cure Machine-Motor Powered; Stump Cutter; Tractor; Trencher Form; Water Blaster; Steam Jenny; Syphon; Vibrator-Gasoline; & Welding Machine

GROUP 5 - Brakeperson; Fireperson; & Oiler

IRON0017-002 05/01/2014

ASHTABULA (North of Route 6, starting at the Geauga County Line, proceeding east to State Route 45), CUYAHOGA, ERIE (Eastern 2/3), GEAUGA, HURON (East of a line drawn from the north border through Monroeville & Willard), LAKE, LORAIN, MEDINA (North of Old Rte. #224), PORTAGE (West of a line from Middlefield to Shalersville to Deerfield), and SUMMIT (North of Old Rte. #224, including city limits of Barberton) COUNTIES

	Rates	Fringes
IRONWORKER		
Ornamental, Reinforcing, & Structural	$ 31.30	20.68

IRON0017-010 05/01/2014

ASHTABULA (Eastern part from Lake Erie on the north to route #322 on the south to include Conneaut, Kingsville, Sheffield, Denmark, Dorset, Cherry Valley, Wayne, Monroe, Pierpont, Richmond, Andover & Williamsfield Townships)

	Rates	Fringes
IRONWORKER		
Structural, including metal building erection & Reinforcing	$ 31.30	20.68

IRON0044-002 08/27/2014

CLINTON (South of a line drawn from Blanchester to Lynchburg), HAMILTON, HIGHLAND (Excluding eastern one-fifth & portion of county inside lines drawn from Marshall to Lynchburg from the northern county line through E. Monroe to Marshall) & WARREN (South of a line drawn from Blanchester through Morrow to the west county line)

	Rates	Fringes
IRONWORKER		
Fence Erector	$ 23.09	18.40
Ornamental; Structural	$ 25.65	18.40

IRON0055-003 07/01/2013

CRAWFORD (Area Between lines drawn from where Hwy #598 & #30 meet through N. Liberty to the northern border & from said Hwy junction point due west to the border), DEFIANCE (S. of a line drawn from where Rte. #66 meets the northern line through Independence to the eastern county border), ERIE (Western 1/3), FULTON, HANCOCK, HARDIN (North of a line drawn from Maysville to a point 4 miles south of the northern line on the eastern line), HENRY, HURON (West of a line drawn from the northern border through Monroeville & Willard), LUCAS, OTTAWA, PUTNAM (East of a line drawn from the northern border down through Miller City to where #696 meets the southern border), SANDUSKY, SENECA, WILLIAMS (East of a line drawn from Pioneer through Stryker to the southern border), WOOD & WYANDOT (North of Rte. #30)

	Rates	Fringes
IRONWORKER		
Fence Erector	$ 19.40	18.32
Flat Road Mesh	$ 20.75	18.00
Tunnels & Caissons Under Pressure	$ 28.50	18.00
All Other Work	$ 28.32	19.35

IRON0147-002 06/01/2014

ALLEN (Northern half), DEFIANCE (Northern part, excluding south of a line drawn from where Rte. #66 meets the northern line through Independence to the eastern county border), MERCER (Northern half), PAULDING, PUTNAM (Western part, excluding east of a line drawn from the northern border down through Miller City to where #696 meets the southern border), VAN WERT, and WILLIAMS (Western part, excluding east of a line drawn from Pioneer through Stryker to the southern border) COUNTIES

	Rates	Fringes
IRONWORKER	$ 25.39	19.12

IRON0172-002 06/01/2014

CHAMPAIGN (Eastern one-third), CLARK (Eastern one-fourth), COSHOCTON (West of a line beginning at the northwestern county line going through Walhonding & Tunnel Hill to the southern county line), CRAWFORD (South of Rte. #30), DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, HARDIN (Excluding a line drawn from Roundhead to Maysville), HIGHLAND (Eastern one-fifth), HOCKING, JACKSON (Northern half), KNOX, LICKING, LOGAN (Eastern one-third), MADISON, MARION, MORROW, MUSKINGUM (West of a line starting at Adams Mill going to Adamsville & going from Adamsville through Blue Rock to the southern border), PERRY, PICKAWAY, PIKE (Northern half), ROSS, UNION, VINTON and WYANDOT (South of Rte. #30) COUNTIES

	Rates	Fringes
IRONWORKER	$ 27.67	18.25

IRON0207-004 06/01/2013

ASHTABULA (Southern part starting at the Geauga County line), COLUMBIANA (E. of a line from Damascus to Highlandtown), MAHONING (N. of Old Route #224), PORTAGE (E. of a line from Middlefield to Shalersville to Deerfield) & TRUMBULL

	Rates	Fringes
IRONWORKER		
Layout; Sheeter	$ 29.06	19.36
Ornamental; Reinforcing; Structural	$ 28.06	19.36

IRON0290-002 06/01/2014

ALLEN (Southern half), AUGLAIZE, BUTLER (North of a line drawn from east to the west county line going through Oxford, Darrtown & Woodsdale), CHAMPAIGN (Excluding east of a line drawn from Catawla to the point where #68 intersects the northern county line), CLARK (Western two-thirds), CLINTON (Excluding south of a line drawn from Blanchester to Lynchburg), DARKE, GREENE, HIGHLAND (Inside lines drawn from Marshall to Lynchburg & from the northern county line through East Monroe to Marshall), LOGAN (West of a line drawn from West Liberty to where the northern county line meets the western county line of Hardin), MERCER (Southern half), MIAMI, MONTGOMERY, PREBLE, SHELBY & WARREN (Excluding south of a line drawn from Blanchester through Morrow to the western county line) COUNTIES

	Rates	Fringes
IRONWORKER	$ 26.73	19.50

IRON0372-002 07/01/2014

ADAMS (Western Part), BROWN, BUTLER (Southern Part), CLERMONT, CLINTON (South of a line drawn from Blanchester to Lynchburg), HAMILTON, HIGHLAND (Excluding eastern one-fifth & portion of county inside lines drawn from Marshall to Lynchburg from the northern county line through E. Monroe to Marshall) and WARREN (South of a line drawn from Blanchester through Morrow to the west county line) COUNTIES

	Rates	Fringes
IRONWORKER, REINFORCING		
Beyond 30-mile radius of Hamilton County Courthouse	$ 26.50	18.45
Up to & including 30-mile radius of Hamilton County Courthouse	$ 26.25	18.45

IRON0549-003 12/01/2012

BELMONT, GUERNSEY, HARRISON, JEFFERSON, MONROE & MUSKINGUM
(Excluding portion west of a line starting at Adams Mill going
to Adamsville and going from Adamsville through Blue Rock to
the south border)

	Rates	Fringes
IRONWORKER	$ 30.00	16.49

IRON0550-004 06/01/2014

ASHLAND, CARROLL, COLUMBIANA (W. of a line from Damascus to
Highlandtown), COSHOCTON (E. of a line beginning at NW Co. line
going through Walhonding & Tunnel Hill to the South Co. line),
HOLMES, HURON (S. of Old Rte. #224), MAHONING (S. of Old Rte.
#224), MEDINA (S. of Old Rte. #224), PORTAGE (S. of Old Rte.
#224), RICHLAND, STARK, SUMMIT (S. of Old Rte. #224, Excluding
city limits of Barberton), TUSCARAWAS, & WAYNE

	Rates	Fringes
Ironworkers:Structural, Ornamental and Reinforcing	$ 25.82	18.09

IRON0769-004 12/01/2012

ADAMS (Eastern Half), GALLIA, JACKSON (Southern Half), LAWRENCE
& SCIOTO

	Rates	Fringes
IRONWORKER	$ 32.54	20.18

IRON0787-003 06/01/2013

ATHENS, MEIGS, MORGAN, NOBLE, and WASHINGTON COUNTIES

	Rates	Fringes
IRONWORKER	$ 30.87	19.15

LABO0265-008 05/01/2014

	Rates	Fringes
LABORER		
ASHTABULA, ERIE, HURON, LORAIN, LUCAS, MAHONING, MEDINA, OTTAWA, PORTAGE, SANDUSKY, STARK, SUMMIT, TRUMBULL & WOOD COUNTIES		
GROUP 1	$ 28.15	9.80
GROUP 2	$ 28.32	9.80
GROUP 3	$ 28.65	9.80
GROUP 4	$ 29.10	9.80
CUYAHOGA AND GEAUGA COUNTIES ONLY: SEWAGE		

PLANTS, WASTE PLANTS,
WATER TREATMENT
FACILITIES, PUMPING
STATIONS, & ETHANOL PLANTS
CONSTRUCTION.....$ 30.76 9.80
CUYAHOGA, GEAUGA & LAKE
COUNTIES
GROUP 1.....$ 29.38 9.80
GROUP 2.....$ 29.55 9.80
GROUP 3.....$ 29.88 9.80
GROUP 4.....$ 30.33 9.80
REMAINING COUNTIES OF OHIO
GROUP 1.....$ 27.72 9.80
GROUP 2.....$ 27.89 9.80
GROUP 3.....$ 28.22 9.80
GROUP 4.....$ 28.67 9.80

LABORER CLASSIFICATIONS

GROUP 1 - Asphalt Laborer; Carpenter Tender; Concrete Curing Applicator; Dump Man (Batch Truck); Guardrail and Fence Installer; Joint Setter; Laborer (Construction); Landscape Laborer; Mesh Handlers & Placer; Right-of-way Laborer; Riprap Laborer & Grouter; Scaffold Erector; Seal Coating; Surface Treatment or Road Mix Laborer; Sign Installer; Slurry Seal; Utility Man; Bridge Man; Handyman; Waterproofing Laborer; Flagperson; Hazardous Waste (level D); Diver Tender; Zone Person & Traffic Control

GROUP 2 - Asphalt Raker; Concrete Puddler; Kettle Man Pipeline); Machine Driven Tools (Gas, Electric, Air); Mason Tender; Brick Paver; Mortar Mixer; Power Buggy or Power Wheelbarrow; Sheeting & Shoring Man; Surface Grinder Man; Plastic Fusing Machine Operator; Pug Mill Operator; & Vacuum Devices (wet or dry); Rodding Machine Operator; Diver; Screwman or Paver; Screed Person; Water Blast, Hand Held Wand; Pumps 4" & Under (Gas, Air or Electric) & Hazardous Waste (level C); Air Track and Wagon Drill; Bottom Person; Cofferdam (below 25 ft. deep); Concrete Saw Person; Cutting with Burning Torch; Form Setter; Hand Spiker (Railroad); Pipelayer; Tunnel Laborer (without air) & Caisson; Underground Person (working in Sewer and Waterline, Cleaning, Repairing & Reconditioning); Sandblaster Nozzle Person; & Hazardous Waste (level B)

GROUP 3 - Blaster; Mucker; Powder Person; Top Lander; Wrencher (Mechanical Joints & Utility Pipeline); Yarner; Hazardous Waste (level A); Concrete Specialist; Concrete Crew in Tunnels (With Air-pressurized - $1.00 premium); Curb Setter & Cutter; Grade Checker; Utility Pipeline Tapper; Waterline; and Caulker

GROUP 4 - Miner (With Air-pressurized - $1.00 premium); & Gunite Nozzle Person

TUNNEL LABORER WITH AIR-PRESSURIZED ADD $1.00 TO BASE RATE

SIGNAL PERSON WILL RECEIVE THE RATE EQUAL TO THE RATE PAID THE LABORER CLASSIFICATION FOR WHICH HE OR SHE IS SIGNALING.

PAIN0006-002 05/01/2014

ASHTABULA, CUYAHOGA, GEAUGA, LAKE, LORAIN, PORTAGE (N. of the East-West Turnpike) & SUMMIT (N. of the East-West Turnpike)

	Rates	Fringes
PAINTER		
COMMERCIAL NEW WORK; REMODELING; & RENOVATIONS		
GROUP 1	$ 27.57	12.69
GROUP 2	$ 27.97	12.69
GROUP 3	$ 28.27	12.69
GROUP 4	$ 29.27	12.69
COMMERCIAL REPAINT		
GROUP 1	$ 26.07	12.69
GROUP 2	$ 26.47	12.69
GROUP 3	$ 26.77	12.69

PAINTER CLASSIFICATIONS - COMMERCIAL NEW WORK; REMODELING; & RENOVATIONS

GROUP 1 - Brush; & Roller

GROUP 2 - Sandblasting & Buffing

GROUP 3 - Spray Painting; Closed Steel Above 55 feet; Bridges & Open Structural Steel; Tanks - Water Towers; Bridge Painters; Bridge Riggers; Containment Builders

GROUP 4 - Bridge Blaster

PAINTER CLASSIFICATIONS - COMMERCIAL REPAINT

GROUP 1 - Brush; & Roller

GROUP 2 - Sandblasting & Buffing

GROUP 3 - Spray Painting

PAIN0007-002 07/01/2014

FULTON, HENRY, LUCAS, OTTAWA (Excluding Allen, Bay, Bono, Catawba Island, Clay Center, Curtice, Danbury, Eagle Beach, Elliston, Elmore, Erie, Fishback, Gem Beach & Genova) & WOOD

	Rates	Fringes
PAINTER		
NEW COMMERCIAL WORK		
GROUP 1	$ 24.47	14.66
GROUP 2	$ 24.72	14.66
GROUP 3	$ 24.97	14.66
GROUP 4	$ 25.07	14.66
GROUP 5	$ 25.17	14.66
GROUP 6	$ 25.47	14.66

GROUP 7.....$ 25.47 14.66
GROUP 8.....$ 25.77 14.66
GROUP 9.....$ 24.81 13.22

REPAINT IS 90% OF JR

PAINTER CLASSIFICATIONS

GROUP 1 - Brush; Spray & Sandblasting Pot Tender

GROUP 2 - Refineries & Refinery Tanks; Surfaces 30 ft. or over where material is applied to or labor performed on above ground level (exterior), floor level (interior)

GROUP 3 - Swing Stage & Chair

GROUP 4 - Lead Abatement

GROUP 5 - All Methods of Spray

GROUP 6 - Solvent-Based Catalized Epoxy Materials of 2 or More Component Materials, to include Solvent-Based Conversion Varnish (excluding water based)

GROUP 7 - Spray Solvent Based Material; Sand & Abrasive Blasting

GROUP 8 - Towers; Tanks; Bridges; Stacks Over 30 Feet

GROUP 9 - Epoxy Spray (excluding water based)

PAIN0012-008 05/01/2014

BUTLER COUNTY

	Rates	Fringes
PAINTER		
GROUP 1	$ 20.73	8.71
GROUP 2	$ 23.39	8.71
GROUP 3	$ 23.89	8.71
GROUP 4	$ 24.14	8.71
GROUP 5	$ 24.39	8.71

PAINTER CLASSIFICATIONS

GROUP 1: Bridge Equipment Tender; Bridge/Containment Builder

GROUP 2: Brush & Roller

GROUP 3: Spray

GROUP 4: Sandblasting; & Waterblasting

GROUP 5: Elevated Tanks; Steeplejack Work; Bridge; & Lead Abatement

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PAIN0012-010 05/01/2014

BROWN, CLERMONT, CLINTON, HAMILTON & WARREN

	Rates	Fringes
PAINTER		
HEAVY & HIGHWAY BRIDGES-		
GUARDRAILS-LIGHTPOLES-		
STRIPING		
Bridge Equipment Tender and Containment Builder....	$ 20.73	8.71
Bridges when highest point of clearance is 60 feet or more; & Lead Abatement Projects.....	$ 24.39	8.71
Brush & Roller.....	$ 23.39	8.71
Sandblasting & Hopper Tender; Water Blasting.....	$ 24.14	8.71
Spray.....	$ 23.89	8.71

PAIN0012-014 05/01/2014

DELAWARE, FAIRFIELD, FAYETTE, FRANKLIN, MADISON, PICKAWAY, ROSS & UNION

	Rates	Fringes
PAINTER		
Bridges.....	$ 34.13	10.56
Brush; Roller.....	$ 24.65	10.56
Sandblasting; Steamcleaning; Waterblasting (3500 PSI or Over)& Hazardous Work.....	$ 25.35	10.56
Spray.....	$ 25.15	10.56
Stacks; Tanks; & Towers.....	$ 28.16	10.56
Structural Steel & Swing Stage.....	$ 24.95	10.56

PAIN0093-001 12/01/2014

ATHENS, GUERNSEY, HOCKING, MONROE, MORGAN, NOBLE and WASHINGTON COUNTIES

	Rates	Fringes
PAINTER		
Bridges; Locks; Dams; Tension Towers; & Energized Substations.....	$ 30.19	14.50
Power Generating Facilities.	$ 27.04	14.50

PAIN0249-002 05/01/2014

CLARK, DARKE, GREENE, MIAMI, MONTGOMERY & PREBLE

	Rates	Fringes
PAINTER		
GROUP 1 - Brush & Roller....	$ 23.24	8.98
GROUP 2 - Swing, Scaffold Bridges; Structural Steel; Open Acid Tank; High Tension Electrical Equipment; & Hot Pipes.....	$ 23.24	8.98
GROUP 3 - Spray; Sandblast; Steamclean; Lead Abatement.....	$ 23.99	8.98
GROUP 4 - Steeplejack Work..	$ 24.19	8.98
GROUP 5 - Coal Tar.....	$ 24.74	8.98
GROUP 6 - Bridge Equipment Tender & or Containment Builder.....	$ 26.48	8.98
GROUP 7 - Tanks, Stacks & Towers.....	$ 26.88	8.98
GROUP 8 - Bridge Blaster, Rigger.....	$ 32.85	8.98

PAIN0356-002 09/01/2009

KNOX, LICKING, MUSKINGUM, and PERRY

	Rates	Fringes
PAINTER		
Bridge Equipment Tenders and Containment Builders....	$ 27.93	7.25
Bridges; Blasters; andRiggers.....	$ 34.60	7.25
Brush and Roller.....	$ 20.93	7.25
Sandblasting; Steam Cleaning; Waterblasting; and Hazardous Work.....	$ 25.82	7.25
Spray.....	$ 21.40	7.25
Structural Steel and Swing Stage.....	$ 25.42	7.25
Tanks; Stacks; and Towers...	$ 28.63	7.25

PAIN0438-002 12/01/2014

BELMONT, HARRISON and JEFFERSON COUNTIES

	Rates	Fringes
PAINTER		
Bridges, Locks, Dams, Tension Towers & Energized Substations.....	$ 30.88	13.98
Power Generating Facilities.	$ 27.73	13.98

PAIN0476-001 06/01/2014

COLUMBIANA, MAHONING, and TRUMBULL COUNITES

	Rates	Fringes

PAINTER

GROUP 1	$ 24.92	10.73
GROUP 2	$ 26.92	10.73
GROUP 3	$ 25.13	10.73
GROUP 4	$ 25.42	10.73
GROUP 5	$ 25.57	10.73
GROUP 6	$ 25.82	10.73
GROUP 7	$ 26.92	10.73

PAINTER CLASSIFICATIONS:

GROUP 1: Painters, Brush & Roller

GROUP 2: Bridges

GROUP 3: Structural Steel

GROUP 4: Spray, Except Bar Joist/Deck

GROUP 5: Epoxy/Mastic; Spray- Bar Joist/Deck; Working Above 50 Feet; and Swingstages

GROUP 6: Tanks; Sandblasting

GROUP 7: Towers; Stacks

PAIN0555-002 06/01/2014

ADAMS, HIGHLAND, JACKSON, PIKE & SCIOTO

	Rates	Fringes
PAINTER		
GROUP 1	$ 29.26	13.67
GROUP 2	$ 30.58	13.67
GROUP 3	$ 31.91	13.67
GROUP 4	$ 34.49	13.67

PAINTER CLASSIFICATIONS

GROUP 1 - Containment Builder

GROUP 2 - Brush; Roller; Power Tools, Under 40 feet

GROUP 3 - Sand Blasting; Spray; Steam Cleaning; Pressure Washing; Epoxy & Two Component Materials; Lead Abatement; Hazardous Waste; Toxic Materials; Bulk & Storage Tanks of 25,000 Gallon Capacity or More; Elevated Tanks

GROUP 4 - Stacks; Bridges

PAIN0603-002 06/01/2012

CARROLL, COSHOCTON, HOLMES, STARK, TUSCARAWAS & WAYNE

	Rates	Fringes

PAINTER
Bridges; Towers, Poles &
Stacks; Sandblasting
Steel; Structural Steel &
Metalizing.....$ 20.71 11.00
Brush & Roller.....$ 20.00 11.00
Spray; Tank Interior &
Exterior.....$ 20.53 11.00

PAIN0639-001 05/01/2011

	Rates	Fringes
Sign Painter & Erector	$ 20.61	3.50+a+b+c

FOOTNOTES: a. 7 Paid Holidays: New Year's Day; Memorial Day; July 4th; Labor Day; Thanksgiving Day; Christmas Day & 1 Floating Day
b. Vacation Pay: After 1 year's service - 5 days' paid vacation; After 2, but less than 10 years' service - 10 days' paid vacation; After 10, but less than 20 years' service - 15 days' paid vacation; After 20 years' service - 20 days' paid vacation
c. Funeral leave up to 3 days maximum paid leave for death of mother, father, brother, sister, spouse, child, mother-in-law, father-in-law, grandparent and inlaw provided employee attends funeral

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PAIN0788-002 06/01/2014

ASHLAND, CRAWFORD, ERIE, HANCOCK, HURON, MARION, MORROW, OTTAWA (Allen, Bay, Bono, Catawba Island, Clay Center, Curtice, Danbury, Eagle Beach, Elliston, Elmore, Erie, Fishback, Gem Beach & Genoa), RICHLAND, SANDUSKY, SENECA & WYANDOT

	Rates	Fringes
PAINTER		
Brush & Roller	$ 22.97	11.12
Structural Steel	$ 24.57	11.12

WINTER REPAINT: Between December 1 to March 31 - 90%JR

$.50 PER HOUR SHALL BE ADDED TO THE RATE OF PAY FOR THE CLASSIFICATION OF WORK:

While working swingstage, boatswain chair, needle beam and horizontal cable. While operating sprayguns, sandblasting, cobblasting and high pressure waterblasting (4000psi).

$1.00 PER HOUR SHALL BE ADDED TO THE RATE OF PAY FOR THE CLASSIFICATION OF WORK:

For the application of catalized epoxy, including latex epoxy that is deemed hazardous, lead abatement, or for work or material where special precautions beyond normal work duties must be taken. For working on stacks, tanks, and towers over 40 feet in height.

PAIN0813-005 12/01/2008

GALLIA, LAWRENCE, MEIGS & VINTON

	Rates	Fringes
PAINTER		
Base Rate	$ 24.83	10.00
Bridges, Locks, Dams & Tension Towers	$ 27.83	10.00

PAIN0841-001 06/01/2014

MEDINA, PORTAGE (South of and including Ohio Turnpike), and SUMMIT (South of and including Ohio Turnpike) COUNTIES

	Rates	Fringes
Painters:		
GROUP 1	$ 24.86	12.19
GROUP 2	$ 25.51	12.19
GROUP 3	$ 25.61	12.19
GROUP 4	$ 25.71	12.19
GROUP 5	$ 26.11	12.19
GROUP 6	$ 39.20	11.75
GROUP 7	$ 26.11	12.19

PAINTER CLASSIFICATIONS:

GROUP 1 - Brush, Roller & Paperhanger

GROUP 2 - Epoxy Application

GROUP 3 - Swing Scaffold, Bosum Chair, & Window Jack

GROUP 4 - Spray Gun Operator of Any & All Coatings

GROUP 5 - Sandblast, Painting of Standpipes, etc. from Scaffolds, Bridge Work and/or Open Structural Steel, Standpipes and/or Water Towers

GROUP 6 - Public & Commerce Transportation, Steel or Galvanized, Bridges, Tunnels & Related Support Items (concrete)

GROUP 7 - Synthetic Exterior, Drywall Finisher and/or Taper, Drywall Finisher and Follow-up Man Using Automatic Tools

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PAIN1020-002 04/01/2014

ALLEN, AUGLAIZE, CHAMPAIGN, DEFIANCE, HARDIN, LOGAN, MERCER, PAULDING, PUTNAM, SHELBY, VAN WERT, and WILLIAMS COUNTIES

	Rates	Fringes

PAINTER

Brush & Roller	$ 22.88	11.25
Drywall Finishing & Taping	$ 21.78	11.25
Lead Abatement	$ 24.63	11.25
Spray, Sandblasting Pressure Cleaning, & Refinery	$ 23.63	11.25
Swing Stage, Chair, Spiders, & Cherry Pickers	$ 23.63	11.25
Wallcoverings	$ 20.48	11.25

All surfaces 40 ft. or over where material is applied to or labor performed on, above ground level (exterior), floor level (interior) - $.50 premium

Applying Coal Tar Products - $1.00 premium

PLUM0042-002 07/01/2014

ASHLAND, CRAWFORD, ERIE, HURON, KNOX, LORAIN, MORROW, RICHLAND & WYANDOT

	Rates	Fringes
Plumber, Pipefitter, Steamfitter	$ 31.40	18.87

PLUM0050-002 09/01/2013

DEFIANCE, FULTON, HANCOCK, HENRY, LUCAS, OTTAWA, PAULDING, PUTNAM, SANDUSKY, SENECA, WILLIAMS & WOOD

	Rates	Fringes
Plumber, Pipefitter, Steamfitter	$ 36.65	22.54

PLUM0055-003 05/01/2014

ASHTABULA, CUYAHOGA, GEAUGA, LAKE, MEDINA (N. of Rte. #18 & Smith Road) & SUMMIT (N. of Rte. #303, including the corporate limits of the city of Hudson)

	Rates	Fringes
PLUMBER	$ 34.60	20.92

PLUM0083-001 07/01/2013

BELMONT & MONROE (North of Rte. #78)

	Rates	Fringes
Plumber and Steamfitter	$ 25.42	27.83

PLUM0094-002 05/01/2013

CARROLL (Northen Half), STARK, and WAYNE COUNTIES

	Rates	Fringes
PLUMBER/PIPEFITTER.....	$ 32.08	16.04

PLUM0120-002 05/01/2014

ASHTABULA, CUYAHOGA, GEAUGA, LAKE, LORAIN (the C.E.I. Power House in Avon Lake), MEDINA (N. of Rte. #18) & SUMMIT (N. of #303)

	Rates	Fringes
PIPEFITTER.....	$ 35.69	20.72

PLUM0162-002 06/01/2014

CHAMPAIGN, CLARK, CLINTON, DARKE, FAYETTE, GREENE, MIAMI, MONTGOMERY & PREBLE

	Rates	Fringes
Plumber, Pipefitter, Steamfitter.....	$ 28.25	20.77

PLUM0168-002 06/01/2013

MEIGS, MONROE (South of Rte. #78), MORGAN (South of Rte. #78) & WASHINGTON

	Rates	Fringes
PLUMBER/PIPEFITTER.....	$ 33.83	18.47

PLUM0189-002 06/01/2013

DELAWARE, FAIRFIELD, FRANKLIN, HOCKING, LICKING, MADISON, MARION, PERRY, PICKAWAY, ROSS & UNION

	Rates	Fringes
Plumber, Pipefitter, Steamfitter.....	$ 34.08	20.06

PLUM0219-002 06/01/2013

MEDINA (Rte. #18 from eastern edge of Medina Co., west to eastern corporate limits of the city of Medina, & on the county road from the west corporate limits of Medina running due west to and through community of Risley to the western edge of Medina County - All territory south of this line), PORTAGE, and SUMMIT (S. of Rte. #303) COUNTIES

	Rates	Fringes
Plumber and Steamfitter.....	$ 33.82	21.09

PLUM0392-002 06/01/2014

BROWN, BUTLER, CLERMONT, HAMILTON & WARREN

	Rates	Fringes
PLUMBER/PIPEFITTER.....	$ 29.80	17.79

PLUM0396-001 06/01/2014

COLUMBIANA (Excluding Washington & Yellow Creek Townships & Liverpool Twp. - Secs. 35 & 36 - West of County Road #427), MAHONING and TRUMBULL COUNTIES

	Rates	Fringes
PLUMBER/PIPEFITTER.....	$ 32.56	18.40

PLUM0495-002 06/01/2014

CARROLL (Rose, Monroe, Union, Lee, Orange, Perry & Loudon Townships), COLUMBIANA (Washington & Yellow Creek Townships & Liverpool Township, Secs. 35 & 36, West of County Rd. #427), COSHOCTON, GUERNSEY, HARRISON, HOLMES, JEFFERSON, MORGAN (South to State Rte. #78 & from McConnelsville west on State Rte. #37 to the Perry County line), MUSKINGUM, NOBLE, and TUSCARAWAS COUNTIES

	Rates	Fringes
Plumber, Pipefitter, Steamfitter.....	$ 30.42	20.06

PLUM0577-002 06/01/2014

ADAMS, ATHENS, GALLIA, HIGHLAND, JACKSON, LAWRENCE, PIKE, SCIOTO & VINTON

	Rates	Fringes
Plumber, Pipefitter, Steamfitter.....	$ 26.80	21.88

PLUM0776-002 07/01/2013

ALLEN, AUGLAIZE, HARDIN, LOGAN, MERCER, SHELBY and VAN WERT COUNTIES

	Rates	Fringes
Plumber, Pipefitter, Steamfitter.....	$ 32.20	20.24

TEAM0377-003 05/01/2012

STATEWIDE, EXCEPT CUYAHOGA, GEAUGA & LAKE

	Rates	Fringes
TRUCK DRIVER		
GROUP 1	$ 23.38	13.18
GROUP 2	$ 23.80	13.18

TRUCK DRIVER CLASSIFICATIONS

GROUP 1 - Asphalt Distributor; Batch; 4- Wheel Service; 4-Wheel Dump; Oil Distributor & Tandem

GROUP 2 - Tractor-Trailer Combination: Fuel; Pole Trailer; Ready Mix; Semi-Tractor; & Asphalt Oil Spraybar Man When Operated From Cab; 5 Axles & Over; Belly Dump; End Dump; Articulated Dump; Heavy Duty Equipment; Low Boy; & Truck Mechanic

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TEAM0436-002 05/01/2014

CUYAHOGA, GEAUGA & LAKE

	Rates	Fringes
TRUCK DRIVER		
GROUP 1	$ 26.15	14.85
GROUP 2	$ 26.65	14.85

GROUP 1: Straight & Dump, Straight Fuel

GROUP 2: Semi Fuel, Semi Tractor, Euclids, Darts, Tank, Asphalt Spreaders, Low Boys, Carry-All, Tourna-Rockers, Hi-Lifts, Extra Long Trailers, Semi-Pole Trailers, Double Hook-Up Tractor Trailers including Team Track & Railroad Siding, Semi-Tractor & Tri-Axle Trailer, Tandem Tractor & Tandem Trailer, Tag Along Trailer, Expandable Trailer or Towing Requiring Road Permits, Ready-Mix (Agitator or Non-Agitator), Bulk Concrete Driver, Dry Batch Truck, Articulated End Dump

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage

determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

AIRPORT SAFETY REQUIREMENTS

U.S. Department
of Transportation

Federal Aviation
Administration

Advisory Circular

Subject: Operational Safety on Airports During Construction

Date: 9/29/11

Initiated by: AAS-100

AC No: 150/5370-2F

1. Purpose. This AC sets forth guidelines for operational safety on airports during construction.

2. What this AC Cancels. This AC cancels AC 150/5370-2E, Operational Safety on Airports During Construction, dated January 17, 2003.

3. Whom This AC Affects. This AC assists airport operators in complying with Title 14 Code of Federal Regulations (CFR) Part 139, Certification of Airports (Part 139). For those certificated airports, this AC provides one way, but not the only way, of meeting those requirements. The use of this AC is mandatory for those airport construction projects receiving funds under the Airport Improvement Program (AIP) or the Passenger Facility Charge (PFC) Program. See Grant Assurance No. 34, "Policies, Standards, and Specifications," and PFC Assurance No. 9, "Standard and Specifications." While we do not require non-certificated airports without grant agreements to adhere to these guidelines, we recommend that they do so to help these airports maintain operational safety during construction.

4. Principal Changes.

a. Construction activities are prohibited in safety areas while the associated runway or taxiway is open to aircraft.

b. Guidance is provided in incorporating Safety Risk Management.

c. Recommended checklists are provided for writing Construction Safety and Phasing Plans and for daily inspections.

5. Reading Material Related to this AC. Numerous ACs are referenced in the text of this AC. These references do not include a revision letter, as they are to be read as referring to the latest version. Appendix 1 contains a list of reading material on airport construction, design, and potential safety hazards during construction, as well as instructions for obtaining these documents.

Michael J. O'Donnell
Director of Airport Safety and Standards

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Chapter 1. Planning an Airfield Construction Project

101. Overview. Airports are complex environments, and procedures and conditions associated with construction activities often affect aircraft operations and can jeopardize operational safety. Safety considerations are paramount and may make operational impacts unavoidable. However, careful planning, scheduling, and coordination of construction activities can minimize disruption of normal aircraft operations and avoid situations that compromise the airport's operational safety. The airport operator must understand how construction activities and aircraft operations affect one another to be able to develop an effective plan to complete the project. While the guidance in this AC is primarily used for construction operations, some of the concepts, methods and procedures described may also enhance the day-to-day airport maintenance operations, such as lighting maintenance and snow removal operations.

102. Plan for Safety. Safety, maintaining aircraft operations, and construction costs are all interrelated. Since safety must not be compromised, the airport operator must strike a balance between maintaining aircraft operations and construction costs. This balance will vary widely depending on the operational needs and resources of the airport and will require early coordination with airport users and the FAA. As the project design progresses, the necessary construction locations, activities, and associated costs will be identified. As they are identified, their impact to airport operations must be assessed. Adjustments are made to the proposed construction activities, often by phasing the project, and/or to airport operations in order to maintain operational safety. This planning effort will ultimately result in a project Construction Safety and Phasing Plan (CSPP). The development of the CSPP takes place through the following five steps:

a. Identify Affected Areas. The airport operator must determine the geographic areas on the airport affected by the construction project. Some, such as a runway extension, will be defined by the project. Others may be variable, such as the location of haul routes and material stockpiles.

b. Describe Current Operations. Identify the normal airport operations in each affected area for each phase of the project. This becomes the baseline from which the impact on operations by construction activities can be measured. This should include a narrative of the typical users and aircraft operating within the affected areas. It should also include information related to airport operations: the Aircraft Reference Code (ACRC) for each runway; Airplane Design Group (ADG) and Taxiway Design Group (TDG)[1] for each affected taxiway; designated approach visibility minimums; available approach and departure procedures; most demanding aircraft; declared distances; available air traffic control services; airport Surface Movement Guidance and Control System plan; and others. The applicable seasons, days and times for certain operations should also be identified as applicable.

c. Allow for Temporary Changes to Operations. To the extent practical, current airport operations should be maintained during the construction. In consultation with airport users, Aircraft Rescue and Fire Fighting (ARFF) personnel, and FAA Air Traffic Organization (ATO) personnel, the airport operator should identify and prioritize the airport's most important operations. The construction activities should be planned, through project phasing if necessary, to safely accommodate these operations. When the construction activities cannot be adjusted to safely maintain current operations, regardless of their importance, then the operations must be revised accordingly. Allowable changes include temporary revisions to approach procedures, restricting certain aircraft to specific runways and taxiways, suspension of certain operations, decreased weights for some aircraft due to shortened runways,

[1] Taxiway Design Group will be introduced in AC 150/5300-13A.

and other changes. An example of a table showing temporary operations versus current operations is shown in Table 3-1 Sample Operations Effects.

d. Take Required Measures to Revised Operations. Once the level and type of aircraft operations to be maintained are identified, the airport operator must determine the measures required to safely conduct the planned operations during the construction. These measures will result in associated costs, which can be broadly interpreted to include not only direct construction costs, but also loss of revenue from impacted operations. Analysis of costs may indicate a need to reevaluate allowable changes to operations. As aircraft operations and allowable changes will vary so widely among airports, this AC presents general guidance on those subjects.

e. Manage Safety Risk. Certain airport projects may require the airport operator to provide a Project Proposal Summary to help the FAA to determine the appropriate level of Safety Risk Management (SRM) documentation. The airport operator must coordinate with the appropriate FAA Airports Regional or District Office early in the development of the CSPP to determine the need for SRM documentation. See FAA Order 5200.11, FAA Airports (ARP) Safety Management System (SMS), for more information. If the FAA requires SRM documentation, the airport operator must at a minimum:

(1) Notify the appropriate FAA Airports Regional or District Office during the project "scope development" phase of any project requiring a CSPP.

(2) Provide documents identified by the FAA as necessary to conduct SRM.

(3) Participate in the SRM process for airport projects.

(4) Provide a representative to participate on the SRM panel.

(5) Ensure that all applicable SRM identified risks elements are recorded and mitigated within the CSPP.

103. Develop a Construction Safety and Phasing Plan (CSPP). Development of an effective CSPP will require familiarity with many other documents referenced throughout this AC. See Appendix 1, Related Reading Material for a list of related reading material.

a. List Requirements. A CSPP must be developed for each on-airfield construction project funded by the Airport Improvement Program (AIP) or the Passenger Facility Charge (PFC) program or located on an airport certificated under Part 139. As per Order 5200.11, such projects do not include construction, rehabilitation, or change of any facility that is entirely outside the air operations area, does not involve any expansion of the facility envelope and does not involve construction equipment, haul routes or placement of material in locations that require access to the air operations area, increase the facility envelope, or impact line-of-sight. Such facilities may include passenger terminals and parking or other structures. However, extraordinary circumstances may trigger the need for a Safety Assessment and a CSPP. The CSPP is subject to subsequent review and approval under the FAA's Safety Risk Management procedures (see paragraph 102.e above). Additional information may be found in Order 5200.11.

b. Prepare a Safety Plan Compliance Document. The Safety Plan Compliance Document (SPCD) details how the contractor will comply with the CSPP. Also, it will not be possible to determine all safety plan details (for example specific hazard equipment and lighting, contractor's points of contact, construction equipment heights) during the development of the CSPP. The successful contractor must define such details by preparing an SPCD that the airport operator reviews for approval prior to issuance of a notice-to-proceed. The SPCD is a subset of the CSPP, similar to how a shop drawing review is a subset to the technical specifications.

c. Assume Responsibility for the CSPP. The airport operator is responsible for establishing and enforcing the CSPP. The airport operator may use the services of an engineering consultant to help develop the CSPP. However, writing the CSPP cannot be delegated to the construction contractor. Only those details the airport operator determines cannot be addressed before contract award are developed by the contractor and submitted for approval as the SPCD. The SPCD does not restate nor propose differences to provisions already addressed in the CSPP.

104. Who Is Responsible for Safety During Construction?

a. Establish a Safety Culture. Everyone has a role in operational safety on airports during construction: the airport operator, the airport's consultants, the construction contractor and subcontractors, airport users, airport tenants, ARFF personnel, Air Traffic personnel, including Technical Operations personnel, FAA Airports Division personnel, and others. Close communication and coordination between all affected parties is the key to maintaining safe operations. Such communication and coordination should start at the project scoping meeting and continue through the completion of the project. The airport operator and contractor should conduct onsite safety inspections throughout the project and immediately remedy any deficiencies, whether caused by negligence, oversight, or project scope change.

b. Assess Airport Operator's Responsibilities. An airport operator has overall responsibility for all activities on an airport, including construction. This includes the predesign, design, preconstruction, construction, and inspection phases. Additional information on the responsibilities listed below can be found throughout this AC. The airport operator must:

(1) Develop a CSPP that complies with the safety guidelines of Chapter 2, Construction Safety and Phasing Plans, and Chapter 3, Guidelines for Writing a CSPP. The airport operator may develop the CSPP internally or have a consultant develop the CSPP for approval by the airport operator. For tenant sponsored projects, approve a CSPP developed by the tenant or its consultant.

(2) Require, review and approve the SPCD by the contractor that indicates how it will comply with the CSPP and provides details that cannot be determined before contract award.

(3) Convene a preconstruction meeting with the construction contractor, consultant, airport employees and, if appropriate, tenant sponsor and other tenants to review and discuss project safety before beginning construction activity. The appropriate FAA representatives should be invited to attend the meeting. See AC 150/5300-9, *Predesign, Prebid, and Preconstruction Conferences for Airport Grant Projects.* (Note "FAA" refers to the Airports Regional or District Office, the Air Traffic Organization, Flight Standards Service, and other offices that support airport operations, flight regulations, and construction/environmental policies.)

(4) Ensure contact information is accurate for each representative/point of contact identified in the CSPP and SPCD.

(5) Hold weekly or, if necessary, daily safety meetings with all affected parties to coordinate activities.

(6) Notify users, ARFF personnel, and FAA ATO personnel of construction and conditions that may adversely affect the operational safety of the airport via Notices to Airmen (NOTAM) and other methods, as appropriate. Convene a meeting for review and discussion if necessary.

(7) Ensure construction personnel know of any applicable airport procedures and of changes to those procedures that may affect their work.

(8) Ensure construction contractors and subcontractors undergo training required by the CSPP and SPCD.

(9) Ensure vehicle and pedestrian operations addressed in the CSPP and SPCD are coordinated with airport tenants, the airport traffic control tower (ATCT), and construction contractors.

(10) At certificated airports, ensure each CSPP and SPCD is consistent with Part 139.

(11) Conduct inspections sufficiently frequently to ensure construction contractors and tenants comply with the CSPP and SPCD and that there are no altered construction activities that could create potential safety hazards.

(12) Resolve safety deficiencies immediately. At airports subject to 49 CFR Part 1542, Airport Security, ensure construction access complies with the security requirements of that regulation.

(13) Notify appropriate parties when conditions exist that invoke provisions of the CSPP and SPCD (for example, implementation of low-visibility operations).

(14) Ensure prompt submittal of a Notice of Proposed Construction or Alteration (Form 7460-1) for conducting an aeronautical study of potential obstructions such as tall equipment (cranes, concrete pumps, other.), stock piles, and haul routes. A separate form may be filed for each potential obstruction, or one form may be filed describing the entire construction area and maximum equipment height. In the latter case, a separate form must be filed for any object beyond or higher than the originally evaluated area/height. The FAA encourages online submittal of forms for expediency. The appropriate FAA Airports Regional or District Office can provide assistance in determining which objects require an aeronautical study.

(15) Promptly notify the FAA Airports Regional or District Office of any proposed changes to the CSPP prior to implementation of the change. Changes to the CSPP require review and approval by the airport operator and the FAA. Coordinate with appropriate local and other federal government agencies, such as EPA, OSHA, TSA, and the state environmental agency.

c. Define Construction Contractor's Responsibilities. The contractor is responsible for complying with the CSPP and SPCD. The contractor must:

(1) Submit a Safety Plan Compliance Document (SPCD) to the airport operator describing how it will comply with the requirements of the CSPP and supplying any details that could not be determined before contract award. The SPCD must include a certification statement by the contractor that indicates it understands the operational safety requirements of the CSPP and it asserts it will not deviate from the approved CSPP and SPCD unless written approval is granted by the airport operator. Any construction practice proposed by the contractor that does not conform to the CSPP and SPCD may impact the airport's operational safety and will require a revision to the CSPP and SPCD and re-coordination with the airport operator and the FAA in advance.

(2) Have available at all times copies of the CSPP and SPCD for reference by the airport operator and its representatives, and by subcontractors and contractor employees.

(3) Ensure that construction personnel are familiar with safety procedures and regulations on the airport. Provide a point of contact who will coordinate an immediate response to correct any construction-related activity that may adversely affect the operational safety of the airport. Many projects will require 24-hour coverage.

(4) Identify in the SPCD the contractor's on-site employees responsible for monitoring compliance with the CSPP and SPCD during construction. At least one of these employees must be on-site whenever active construction is taking place.

(5) Conduct inspections sufficiently frequently to ensure construction personnel comply with the CSPP and SPCD and that there are no altered construction activities that could create potential safety hazards.

(6) Restrict movement of construction vehicles and personnel to permitted construction areas by flagging, barricading, erecting temporary fencing, or providing escorts, as appropriate and as specified in the CSPP and SPCD.

(7) Ensure that no contractor employees, employees of subcontractors or suppliers, or other persons enter any part of the air operations area (AOA) from the construction site unless authorized.

(8) Ensure prompt submittal through the airport operator of Form 7460-1 for the purpose of conducting an aeronautical study of contractor equipment such as tall equipment (cranes, concrete pumps, other equipment), stock piles, and haul routes when different from cases previously filed by the airport operator. The FAA encourages online submittal of forms for expediency.

d. Define Tenant's Responsibilities if planning construction activities on leased property. Airport tenants, such as airline operators, fixed base operators, and FAA ATO/Technical Operations sponsoring construction must:

(1) Develop, or have a consultant develop, a project specific CSPP and submit it to the airport operator for certification and subsequent approval by the FAA. The approved CSPP must be made part of any contract awarded by the tenant for construction work.

(2) In coordination with its contractor, develop an SPCD and submit it to the airport operator for approval to be issued prior to issuance of a Notice to Proceed.

(3) Ensure that construction personnel are familiar with safety procedures and regulations on the airport.

(4) Provide a point of contact of who will coordinate an immediate response to correct any construction-related activity that may adversely affect the operational safety of the airport.

(5) Identify in the SPCD the contractor's on-site employees responsible for monitoring compliance with the CSPP and SPCD during construction. At least one of these employees must be on-site whenever active construction is taking place.

(6) Ensure that no tenant or contractor employees, employees of subcontractors or suppliers, or any other persons enter any part of the AOA from the construction site unless authorized.

(7) Restrict movement of construction vehicles to construction areas by flagging and barricading, erecting temporary fencing, or providing escorts, as appropriate, and as specified in the CSPP and SPCD.

(8) Ensure prompt submittal through the airport operator of Form 7460-1 for the purpose of conducting an aeronautical study of contractor equipment such as tall equipment (cranes, concrete pumps, other.), stock piles, and haul routes. The FAA encourages online submittal of forms for expediency.

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Chapter 2. Construction Safety and Phasing Plans

Section 1. Basic Considerations

201. Overview. Aviation safety is the primary consideration at airports, especially during construction. The airport operator's Construction Safety and Phasing Plan (CSPP) and the contractor's Safety Plan Compliance Document (SPCD) are the primary tools to ensure safety compliance when coordinating construction activities with airport operations. These documents identify all aspects of the construction project that pose a potential safety hazard to airport operations and outline respective mitigation procedures for each hazard. They must provide all information necessary for the Airport Operations department to conduct airfield inspections and expeditiously identify and correct unsafe conditions during construction. All aviation safety provisions included within the project drawings, contract specifications, and other related documents must also be reflected in the CSPP and SPCD.

202. Assume Responsibility. Operational safety on the airport remains the airport operator's responsibility at all times. The airport operator must develop, certify, and submit for FAA approval each CSPP. It is the airport operator's responsibility to apply the requirements of the FAA approved CSPP. The airport operator must revise the CSPP when conditions warrant changes and must submit the revised CSPP to the FAA for approval. The airport operator must also require and approve a SPCD from the project contractor.

203. Submit the CSPP. Construction Safety and Phasing Plans should be developed concurrently with the project design. Milestone versions of the CSPP should be submitted for review and approval as follows. While these milestones are not mandatory, early submission will help to avoid delays. Submittals are preferred in 8.5 x 11 in or 11 x 17 in format for compatibility with the FAA's Obstruction Evaluation / Airport Airspace Analysis (OE / AAA) process.

a. Submit an Outline/Draft. By the time approximately 25% to 30% of the project design is completed, the principal elements of the CSPP should be established. Airport operators are encouraged to submit an outline or draft, detailing all CSPP provisions developed to date, to the FAA for review at this stage of the project design.

b. Submit a Construction Safety and Phasing Plan (CSPP). The CSPP should be formally submitted for FAA approval when the project design is 80% to 90% complete. Since provisions in the CSPP will influence contract costs, it is important to obtain FAA approval in time to include all such provisions in the procurement contract.

c. Submit a Safety Plan Compliance Document (SPCD). The contractor should submit the SPCD to the airport operator for approval to be issued prior to the Notice to Proceed.

d. Submit CSPP Revisions. All revisions to the CSPP or SPCD should be submitted to the FAA for approval as soon as required changes are identified.

204. Meet CSPP Requirements.

a. To the extent possible, the CSPP should address the following as outlined in Section 2, Plan Requirements and Chapter 3, Guidelines for Writing a CSPP, as appropriate. Details that cannot be determined at this stage are to be included in the SPCD.

(1) Coordination.

(a) Contractor progress meetings.

(b) Scope or schedule changes.

(c) FAA ATO coordination.

(2) Phasing.

(a) Phase elements.

(b) Construction safety drawings

(3) Areas and operations affected by the construction activity.

(a) Identification of affected areas.

(b) Mitigation of effects.

(4) Protection of navigation aids (NAVAIDs).

(5) Contractor access.

(a) Location of stockpiled construction materials.

(b) Vehicle and pedestrian operations.

(6) Wildlife management.

(a) Trash.

(b) Standing water.

(c) Tall grass and seeds.

(d) Poorly maintained fencing and gates.

(e) Disruption of existing wildlife habitat.

(7) Foreign Object Debris (FOD) management.

(8) Hazardous materials (HAZMAT) management

(9) Notification of construction activities.

(a) Maintenance of a list of responsible representatives/ points of contact.

(b) Notices to Airmen (NOTAM).

(c) Emergency notification procedures.

(d) Coordination with ARFF Personnel.

(e) Notification to the FAA.

(10) Inspection requirements.

(a) Daily (or more frequent) inspections.

(b) Final inspections.

(11) Underground utilities.

(12) Penalties.

(13) Special conditions.

(14) Runway and taxiway visual aids. Marking, lighting, signs, and visual NAVAIDs.

(a) General.

(b) Markings.

(c) Lighting and visual NAVAIDs.

(d) Signs.

(15) Marking and signs for access routes.

(16) Hazard marking and lighting.

(a) Purpose.

(b) Equipment.

(17) Protection. Of runway and taxiway safety areas, object free areas, obstacle free zones, and approach/departure surfaces

(a) Runway Safety Area (RSA).

(b) Runway Object Free Area (ROFA).

(c) Taxiway Safety Area (TSA).

(d) Taxiway Object Free Area (TOFA).

(e) Obstacle Free Zone (OFZ).

(f) Runway approach/departure surfaces.

(18) Other limitations on construction.

(a) Prohibitions.

(b) Restrictions.

b. The Safety Plan Compliance Document (SPCD) should include a general statement by the construction contractor that he/she has read and will abide by the CSPP. In addition, the SPCD must include all supplemental information that could not be included in the CSPP prior to the contract award. The contractor statement should include the name of the contractor, the title of the project CSPP, the approval date of the CSPP, and a reference to any supplemental information (that is, "I , Name of Contractor , have read the Title of Project CSPP, approved on Date , and will abide by it as written and with the following additions as noted:"). The supplemental information in the SPCD should be written to match the format of the CSPP indicating each subject by corresponding CSPP subject number and title. If no supplemental information is necessary for any specific subject, the statement, "No supplemental information," should be written after the corresponding subject title. The SPCD should not duplicate information in the CSPP:

(1) Coordination. Discuss details of proposed safety meetings with the airport operator and with contractor employees and subcontractors.

(2) Phasing. Discuss proposed construction schedule elements, including:

(a) Duration of each phase.

(b) Daily start and finish of construction, including "night only" construction.

(c) Duration of construction activities during:

(i) Normal runway operations.

(ii) Closed runway operations.

(iii) Modified runway "Aircraft Reference Code" usage.

(3) Areas and operations affected by the construction activity. These areas and operations should be identified in the CSPP and should not require an entry in the SPCD.

(4) Protection of NAVAIDs. Discuss specific methods proposed to protect operating NAVAIDs.

(5) Contractor access. Provide the following:

(a) Details on how the contractor will maintain the integrity of the airport security fence (gate guards, daily log of construction personnel, and other).

(b) Listing of individuals requiring driver training (for certificated airports and as requested).

(c) Radio communications.

(i) Types of radios and backup capabilities.

(ii) Who will be monitoring radios.

(iii) Whom to contact if the ATCT cannot reach the contractor's designated person by radio.

(d) Details on how the contractor will escort material delivery vehicles.

(6) Wildlife management. Discuss the following:

(a) Methods and procedures to prevent wildlife attraction.

(b) Wildlife reporting procedures.

(7) Foreign Object Debris (FOD) management. Discuss equipment and methods for control of FOD, including construction debris and dust.

(8) Hazardous material (HAZMAT) management. Discuss equipment and methods for responding to hazardous spills.

(9) Notification of construction activities. Provide the following:

(a) Contractor points of contact.

(b) Contractor emergency contact.

(c) Listing of tall or other requested equipment proposed for use on the airport and the timeframe for submitting 7460-1 forms not previously submitted by the airport operator.

(d) Batch plant details, including 7460-1 submittal.

(10) Inspection requirements. Discuss daily (or more frequent) inspections and special inspection procedures.

(11) Underground utilities. Discuss proposed methods of identifying and protecting underground utilities.

(12) Penalties. Penalties should be identified in the CSPP and should not require an entry in the SPCD.

(13) Special conditions. Discuss proposed actions for each special condition identified in the CSPP.

(14) Runway and taxiway visual aids. Including marking, lighting, signs, and visual NAVAIDs. Discuss proposed visual aids including the following:

(a) Equipment and methods for covering signage and airfield lights.

(b) Equipment and methods for temporary closure markings (paint, fabric, other).

(c) Types of temporary Visual Guidance Slope Indicators (VGSI).

(15) Marking and signs for access routes. Discuss proposed methods of demarcating access routes for vehicle drivers.

(16) Hazard marking and lighting. Discuss proposed equipment and methods for identifying excavation areas.

(17) Protection of runway and taxiway safety areas. including object free areas, obstacle free zones, and approach/departure surfaces. Discuss proposed methods of identifying, demarcating, and protecting airport surfaces including:

(a) Equipment and methods for maintaining Taxiway Safety Area standards.

(b) Equipment and methods for separation of construction operations from aircraft operations, including details of barricades.

(18) Other limitations on construction should be identified in the CSPP and should not require an entry in the SPCD.

Section 2. Plan Requirements

205. Coordination. Airport operators, or tenants conducting construction on their leased properties, should use predesign, prebid, and preconstruction conferences to introduce the subject of airport operational safety during construction (see AC 150/5300-9). In addition, the following should be coordinated as required:

a. Contractor Progress Meetings. Operational safety should be a standing agenda item for discussion during progress meetings throughout the project.

b. Scope or Schedule Changes. Changes in the scope or duration of the project may necessitate revisions to the CSPP and review and approval by the airport operator and the FAA.

c. FAA ATO Coordination. Early coordination with FAA ATO is required to schedule airway facility shutdowns and restarts. Relocation or adjustments to NAVAIDs, or changes to final grades in critical areas, may require an FAA flight inspection prior to restarting the facility. Flight inspections must be coordinated and scheduled well in advance of the intended facility restart. Flight inspections may require a reimbursable agreement between the airport operator and FAA ATO. Reimbursable agreements should be coordinated a minimum of 12 months prior to the start of construction. (See 213.e(3)(b) for required FAA notification regarding FAA owned NAVAIDs.)

206. Phasing. Once it has been determined what types and levels of airport operations will be maintained, the most efficient sequence of construction may not be feasible. In such a case, the sequence of construction may be phased to gain maximum efficiency while allowing for the required operations. The development of the resulting construction phases should be coordinated with local Air Traffic personnel and airport users. The sequenced construction phases established in the CSPP must be incorporated into the project design and must be reflected in the contract drawings and specifications.

a. Phase Elements. For each phase the CSPP should detail:

- Areas closed to aircraft operations

- Duration of closures
- Taxi routes
- ARFF access routes
- Construction staging areas
- Construction access and haul routes
- Impacts to NAVAIDs
- Lighting and marking changes
- Available runway length
- Declared distances (if applicable)
- Required hazard marking and lighting
- Lead times for required notifications

b. Construction Safety Drawings. Drawings specifically indicating operational safety procedures and methods in affected areas (that is, construction safety drawings) should be developed for each construction phase. Such drawings should be included in the CSPP as referenced attachments and should likewise be included in the contract drawing package.

207. Areas and Operations Affected by Construction Activity. Runways and taxiways should remain in use by aircraft to the maximum extent possible without compromising safety. Pre-meetings with the FAA Air Traffic Organization (ATO) will support operational simulations. See Chapter 3 for an example of a table showing temporary operations versus current operations.

a. Identification of Affected Areas. Identifying areas and operations affected by the construction will help to determine possible safety problems. The affected areas should be indentified in the construction safety drawings for each construction phase. (See 206.b above.) Of particular concern are:

(1) Closing, or partial closing, of runways, taxiways and aprons. When a runway is partially closed, a portion of the pavement is unavailable for any aircraft operation, meaning taxiing, landing, or taking off in either direction on that pavement is prohibited. A displaced threshold, by contrast, is established to ensure obstacle clearance and adequate safety area for landing aircraft. The pavement prior to the displaced threshold is available for take-off in the direction of the displacement and for landing and taking off in the opposite direction. Misunderstanding this difference, and issuance of a subsequently inaccurate NOTAM, can lead to a hazardous condition.

(2) Closing of Aircraft Rescue and Fire Fighting access routes.

(3) Closing of access routes used by airport and airline support vehicles.

(4) Interruption of utilities, including water supplies for fire fighting.

(5) Approach/departure surfaces affected by heights of objects.

(6) Construction areas, storage areas, and access routes near runways, taxiways, aprons, or helipads.

b. Mitigation of Effects. Establishment of specific procedures is necessary to maintain the safety and efficiency of airport operations. The CSPP must address:

(1) Temporary changes to runway and/or taxi operations.

(2) Detours for ARFF and other airport vehicles.

(3) Maintenance of essential utilities.

(4) Temporary changes to air traffic control procedures. Such changes must be coordinated with the ATO.

208. Navigation Aid (NAVAID) Protection. Before commencing construction activity, parking vehicles, or storing construction equipment and materials near a NAVAID, coordinate with the appropriate FAA ATO/Technical Operations office to evaluate the effect of construction activity and the required distance and direction from the NAVAID. (See paragraph 213.e(3) below.) Construction activities, materials/equipment storage, and vehicle parking near electronic NAVAIDs require special consideration since they may interfere with signals essential to air navigation. If any NAVAID may be affected, the CSPP and SPCD must show an understanding of the "critical area" associated with each NAVAID and describe how it will be protected. Where applicable, the operational critical areas of NAVAIDs should be graphically delineated on the project drawings. Pay particular attention to stockpiling material, as well as to movement and parking of equipment that may interfere with line of sight from the ATCT or with electronic emissions. Interference from construction equipment and activities may require NAVAID shutdown or adjustment of instrument approach minimums for low visibility operations. This condition requires that a NOTAM be filed (see paragraph 213.b below). Construction activities and materials/equipment storage near a NAVAID must not obstruct access to the equipment and instruments for maintenance. Submittal of a 7460-1 form is required for construction vehicles operating near FAA NAVAIDs. (See paragraph 213.e(1) below.)

209. Contractor Access. The CSPP must detail the areas to which the contractor must have access, and explain how contractor personnel will access those areas. Specifically address:

a. Location of Stockpiled Construction Materials. Stockpiled materials and equipment storage are not permitted within the RSA and OFZ, and if possible should not be permitted within the Object Free Area (OFA) of an operational runway. Stockpiling material in the OFA requires submittal of a 7460-1 form and justification provided to the appropriate FAA Airports Regional or District Office for approval. The airport operator must ensure that stockpiled materials and equipment adjacent to these areas are prominently marked and lighted during hours of restricted visibility or darkness. (See paragraph 218.b below.) This includes determining and verifying that materials are stabilized and stored at an approved location so as not to be a hazard to aircraft operations and to prevent attraction of wildlife and foreign object damage. See paragraphs 210 and 211 below.

b. Vehicle and Pedestrian Operations. The CSPP should include specific vehicle and pedestrian requirements. Vehicle and pedestrian access routes for airport construction projects must be controlled to prevent inadvertent or unauthorized entry of persons, vehicles, or animals onto the AOA. The airport operator should coordinate requirements for vehicle operations with airport tenants, contractors, and the FAA air traffic manager. In regard to vehicle and pedestrian operations, the CSPP should include the following, and detail associated training requirements:

(1) Construction site parking. Designate in advance vehicle parking areas for contractor employees to prevent any unauthorized entry of persons or vehicles onto the AOA. These areas should provide reasonable contractor employee access to the job site.

(2) Construction equipment parking. Contractor employees must park and service all construction vehicles in an area designated by the airport operator outside the OFZ and never in the safety area of an active runway or taxiway. Unless a complex setup procedure makes movement of specialized equipment infeasible, inactive equipment must not be parked on a closed taxiway or runway. If it is necessary to leave specialized equipment on a closed taxiway or runway at night, the equipment must be well lighted. Employees should also park construction vehicles outside the OFA when not in use by

construction personnel (for example, overnight, on weekends, or during other periods when construction is not active). Parking areas must not obstruct the clear line of sight by the ATCT to any taxiways or runways under air traffic control nor obstruct any runway visual aids, signs, or navigation aids. The FAA must also study those areas to determine effects on airport design criteria, surfaces established by 14 CFR Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace (Part 77), and on NAVAIDs and Instrument Approach Procedures (IAP). See paragraph 213.e(1) below for further information.

(3) Access and haul roads. Determine the construction contractor's access to the construction sites and haul roads. Do not permit the construction contractor to use any access or haul roads other than those approved. Access routes used by contractor vehicles must be clearly marked to prevent inadvertent entry to areas open to airport operations. Pay special attention to ensure that if construction traffic is to share or cross any ARFF routes that ARFF right of way is not impeded at any time, and that construction traffic on haul roads does not interfere with NAVAIDs or approach surfaces of operational runways.

(4) Marking and lighting of vehicles in accordance with AC 150/5210-5, Painting, Marking, and Lighting of Vehicles Used on an Airport.

(5) Description of proper vehicle operations on various areas under normal, lost communications, and emergency conditions.

(6) Required escorts.

(7) Training requirements for vehicle drivers to ensure compliance with the airport operator's vehicle rules and regulations. Specific training should be provided to those vehicle operators providing escorts. See AC 150/5210-20, Ground Vehicle Operations on Airports, for information on training and records maintenance requirements.

(8) Situational awareness. Vehicle drivers must confirm by personal observation that no aircraft is approaching their position (either in the air or on the ground) when given clearance to cross a runway, taxiway, or any other area open to airport operations. In addition, it is the responsibility of the escort vehicle driver to verify the movement/position of all escorted vehicles at any given time.

(9) Two-way radio communication procedures.

(a) General. The airport operator must ensure that tenant and construction contractor personnel engaged in activities involving unescorted operation on aircraft movement areas observe the proper procedures for communications, including using appropriate radio frequencies at airports with and without ATCT. When operating vehicles on or near open runways or taxiways, construction personnel must understand the critical importance of maintaining radio contact, as directed by the airport operator, with:

(i) Airport operations

(ii) ATCT

(iii) Common Traffic Advisory Frequency (CTAF), which may include UNICOM, MULTICOM.

(iv) Automatic Terminal Information Service (ATIS). This frequency is useful for monitoring conditions on the airport. Local air traffic will broadcast information regarding construction related runway closures and "shortened" runways on the ATIS frequency.

(b) Areas requiring two-way radio communication with the ATCT. Vehicular traffic crossing active movement areas must be controlled either by two-way radio with the ATCT, escort, flagman, signal light, or other means appropriate for the particular airport.

(c) Frequencies to be used. The airport operator will specify the frequencies to be used by the contractor, which may include the CTAF for monitoring of aircraft operations. Frequencies may also be assigned by the airport operator for other communications, including any radio frequency in compliance with Federal Communications Commission requirements. At airports with an ATCT, the airport operator will specify the frequency assigned by the ATCT to be used between contractor vehicles and the ATCT.

(d) Proper radio usage, including read back requirements.

(e) Proper phraseology, including the International Phonetic Alphabet.

(f) Light gun signals. Even though radio communication is maintained, escort vehicle drivers must also familiarize themselves with ATCT light gun signals in the event of radio failure. See the FAA safety placard "Ground Vehicle Guide to Airport Signs and Markings." This safety placard may be downloaded through the Runway Safety Program Web site at http://www.faa.gov/airports/runway_safety/publications/ (See "Signs & Markings Vehicle Dashboard Sticker".) or obtained from the FAA Airports Regional Office.

(10) Maintenance of the secured area of the airport, including:

(a) Fencing and gates. Airport operators and contractors must take care to maintain security during construction when access points are created in the security fencing to permit the passage of construction vehicles or personnel. Temporary gates should be equipped so they can be securely closed and locked to prevent access by animals and unauthorized people. Procedures should be in place to ensure that only authorized persons and vehicles have access to the AOA and to prohibit "piggybacking" behind another person or vehicle. The Department of Transportation (DOT) document DOT/FAA/AR-00/52, Recommended Security Guidelines for Airport Planning and Construction, provides more specific information on fencing. A copy of this document can be obtained from the Airport Consultants Council, Airports Council International, or American Association of Airport Executives.

(b) Badging requirements.

(c) Airports subject to 49 CFR Part 1542, Airport Security, must meet standards for access control, movement of ground vehicles, and identification of construction contractor and tenant personnel.

210. Wildlife Management. The CSPP and SPCD must be in accordance with the airport operator's wildlife hazard management plan, if applicable. See also AC 150/5200-33, Hazardous Wildlife Attractants On or Near Airports, and Certalert 98-05, Grasses Attractive to Hazardous Wildlife. Construction contractors must carefully control and continuously remove waste or loose materials that might attract wildlife. Contractor personnel must be aware of and avoid construction activities that can create wildlife hazards on airports, such as:

a. Trash. Food scraps must be collected from construction personnel activity.

b. Standing Water.

c. Tall Grass and Seeds. Requirements for turf establishment can be at odds with requirements for wildlife control. Grass seed is attractive to birds. Lower quality seed mixtures can contain seeds of plants (such as clover) that attract larger wildlife. Seeding should comply with the guidance in AC 150/5370-10, Standards for Specifying Construction of Airports, Item T-901, Seeding. Contact the local office of the United Sates Department of Agriculture Soil Conservation Service or the State University Agricultural Extension Service (County Agent or equivalent) for assistance and recommendations. These agencies can also provide liming and fertilizer recommendations.

d. Poorly Maintained Fencing and Gates. See 209.b(10)(a) above.

e. Disruption of Existing Wildlife Habitat. While this will frequently be unavoidable due to the nature of the project, the CSPP should specify under what circumstances (location, wildlife type) contractor personnel should immediately notify the airport operator of wildlife sightings.

211. Foreign Object Debris (FOD) Management. Waste and loose materials, commonly referred to as FOD, are capable of causing damage to aircraft landing gears, propellers, and jet engines. Construction contractors must not leave or place FOD on or near active aircraft movement areas. Materials capable of creating FOD must be continuously removed during the construction project. Fencing (other than security fencing) may be necessary to contain material that can be carried by wind into areas where aircraft operate. See AC 150/5210-24, Foreign Object Debris (FOD) Management.

212. Hazardous Materials (HAZMAT) Management. Contractors operating construction vehicles and equipment on the airport must be prepared to expeditiously contain and clean-up spills resulting from fuel or hydraulic fluid leaks. Transport and handling of other hazardous materials on an airport also requires special procedures. See AC 150/5320-15, Management of Airport Industrial Waste.

213. Notification of Construction Activities. The CSPP and SPCD must detail procedures for the immediate notification of airport users and the FAA of any conditions adversely affecting the operational safety of the airport. It must address the notification actions described below, as applicable.

a. List of Responsible Representatives/ points of contact for all involved parties, and procedures for contacting each of them, including after hours.

b. NOTAMs. Only the airport operator may initiate or cancel NOTAMs on airport conditions, and is the only entity that can close or open a runway. The airport operator must coordinate the issuance, maintenance, and cancellation of NOTAMs about airport conditions resulting from construction activities with tenants and the local air traffic facility (control tower, approach control, or air traffic control center), and must provide information on closed or hazardous conditions on airport movement areas to the FAA Flight Service Station (FSS) so it can issue a NOTAM. The airport operator must file and maintain a list of authorized representatives with the FSS. Refer to AC 150/5200-28, Notices to Airmen (NOTAMs) for Airport Operators, for a sample NOTAM form. Only the FAA may issue or cancel NOTAMs on shutdown or irregular operation of FAA owned facilities. Any person having reason to believe that a NOTAM is missing, incomplete, or inaccurate must notify the airport operator. See paragraph 207.a(1) above regarding issuing NOTAMs for partially closed runways versus runways with displaced thresholds.

c. Emergency notification procedures for medical, fire fighting, and police response.

d. Coordination with ARFF. The CSPP must detail procedures for coordinating through the airport sponsor with ARFF personnel, mutual aid providers, and other emergency services if construction requires:

- The deactivation and subsequent reactivation of water lines or fire hydrants, or
- The rerouting, blocking and restoration of emergency access routes, or
- The use of hazardous materials on the airfield.

e. Notification to the FAA.

(1) Part 77. Any person proposing construction or alteration of objects that affect navigable airspace, as defined in Part 77, must notify the FAA. This includes construction equipment and proposed

parking areas for this equipment (i.e. cranes, graders, other equipment) on airports. FAA Form 7460-1, Notice of Proposed Construction or Alteration, can be used for this purpose and submitted to the appropriate FAA Airports Regional or District Office. See Appendix 1, Related Reading Material, to download the form. Further guidance is available on the FAA web site at oeaaa.faa.gov.

(2) Part 157. With some exceptions, Title 14 CFR Part 157, Notice of Construction, Alteration, Activation, and Deactivation of Airports, requires that the airport operator notify the FAA in writing whenever a non-Federally funded project involves the construction of a new airport; the construction, realigning, altering, activating, or abandoning of a runway, landing strip, or associated taxiway; or the deactivation or abandoning of an entire airport. Notification involves submitting FAA Form 7480-1, Notice of Landing Area Proposal, to the nearest FAA Airports Regional or District Office. See Appendix 1, Related Reading Material to download the form.

(3) NAVAIDS. For emergency (short-notice) notification about impacts to both airport owned and FAA owned NAVAIDs, contact: 866-432-2622.

(a) Airport owned/FAA maintained. If construction operations require a shutdown of more than 24 hours, or more than 4 hours daily on consecutive days, of a NAVAID owned by the airport but maintained by the FAA, provide a 45-day minimum notice to FAA ATO/Technical Operations prior to facility shutdown.

(b) FAA owned.

(i) General. The airport operator must notify the appropriate FAA ATO Service Area Planning and Requirements (P&R) Group a minimum of 45 days prior to implementing an event that causes impacts to NAVAIDs. (Impacts to FAA equipment covered by a Reimbursable Agreement (RA) do not have to be reported by the airport operator.)

(ii) Coordinate work for an FAA owned NAVAID shutdown with the local FAA ATO/Technical Operations office, including any necessary reimbursable agreements and flight checks. Detail procedures that address unanticipated utility outages and cable cuts that could impact FAA NAVAIDs. In addition, provide seven days notice to schedule the actual shutdown.

214. Inspection Requirements.

a. Daily Inspections. Inspections should be conducted at least daily, but more frequently if necessary to ensure conformance with the CSPP. A sample checklist is provided in Appendix 3, Safety and Phasing Plan Checklist. See also AC 150/5200-18, Airport Safety Self-Inspection.

b. Final Inspections. New runways and extended runway closures may require safety inspections at certificated airports prior to allowing air carrier service. Coordinate with the FAA Airport Certification Safety Inspector (ACSI) to determine if a final inspection will be necessary.

215. Underground Utilities. The CSPP and/or SPCD must include procedures for locating and protecting existing underground utilities, cables, wires, pipelines, and other underground facilities in excavation areas. This may involve coordinating with public utilities and FAA ATO/Technical Operations. Note that “One Call” or “Miss Utility” services do not include FAA ATO/Technical Operations

216. Penalties. The CSPP should detail penalty provisions for noncompliance with airport rules and regulations and the safety plans (for example, if a vehicle is involved in a runway incursion). Such penalties typically include rescission of driving privileges or access to the AOA.

217. Special Conditions. The CSPP must detail any special conditions that affect the operation of the

airport and will require the activation of any special procedures (for example, low-visibility operations, snow removal, aircraft in distress, aircraft accident, security breach, Vehicle / Pedestrian Deviation (VPD) and other activities requiring construction suspension/resumption).

218. Runway and Taxiway Visual Aids. Includes marking, lighting, signs, and visual NAVAIDS. The CSPP must ensure that areas where aircraft will be operating are clearly and visibly separated from construction areas, including closed runways. Throughout the duration of the construction project, verify that these areas remain clearly marked and visible at all times and that marking, lighting, signs, and visual NAVAIDs remain in place and operational. The CSPP must address the following, as appropriate:

a. General. Airport markings, lighting, signs, and visual NAVAIDs must be clearly visible to pilots, not misleading, confusing, or deceptive. All must be secured in place to prevent movement by prop wash, jet blast, wing vortices, or other wind currents and constructed of materials that would minimize damage to an aircraft in the event of inadvertent contact.

b. Markings. Markings must be in compliance with the standards of AC 150/5340-1, Standards for Airport Markings. Runways and runway exit taxiways closed to aircraft operations are marked with a yellow X. The preferred visual aid to depict temporary runway closure is the lighted X signal placed on or near the runway designation numbers. (See paragraph 218.b(1)(b) below.)

(1) Closed Runways and Taxiways.

(a) Permanently Closed Runways. For runways, obliterate the threshold marking, runway designation marking, and touchdown zone markings, and place Xs at each end and at 1,000-foot (300 m) intervals.

(b) Temporarily Closed Runways. For runways that have been temporarily closed, place an X at the each end of the runway directly on or as near as practicable to the runway designation numbers. Figure 2-1 illustrates.

Figure 2-1 Markings for a Temporarily Closed Runway

(c) Partially Closed Runways and Displaced Thresholds. When threshold markings are needed to identify the temporary beginning of the runway that is available for landing, the markings must comply with AC 150/5340-1. An X is not used on a partially closed runway or a runway with a displaced threshold. See paragraph 207.a(1) above for the difference between partially closed runways and runways with displaced thresholds.

(i) Partially Closed Runways. Pavement markings for temporary closed portions of the runway consist of a runway threshold bar and yellow chevrons to identify pavement areas that are unsuitable for takeoff or landing (see AC 150/5340-1).

(ii) Displaced Thresholds. Pavement markings for a displaced threshold consist of a runway threshold bar and white arrowheads with and without arrow shafts. These markings are required to identify the portion of the runway before the displaced threshold to provide centerline guidance for pilots during approaches, takeoffs, and landing rollouts from the opposite direction. See AC 150/5340-1.

(d) Taxiways.

(i) Permanently Closed Taxiways. AC 150/5300-13 notes that it is preferable to remove the pavement, but for pavement that is to remain, place an X at the entrance to both ends of the closed section. Obliterate taxiway centerline markings, including runway leadoff lines, leading to the closed taxiway. Figure 2-2 illustrates.

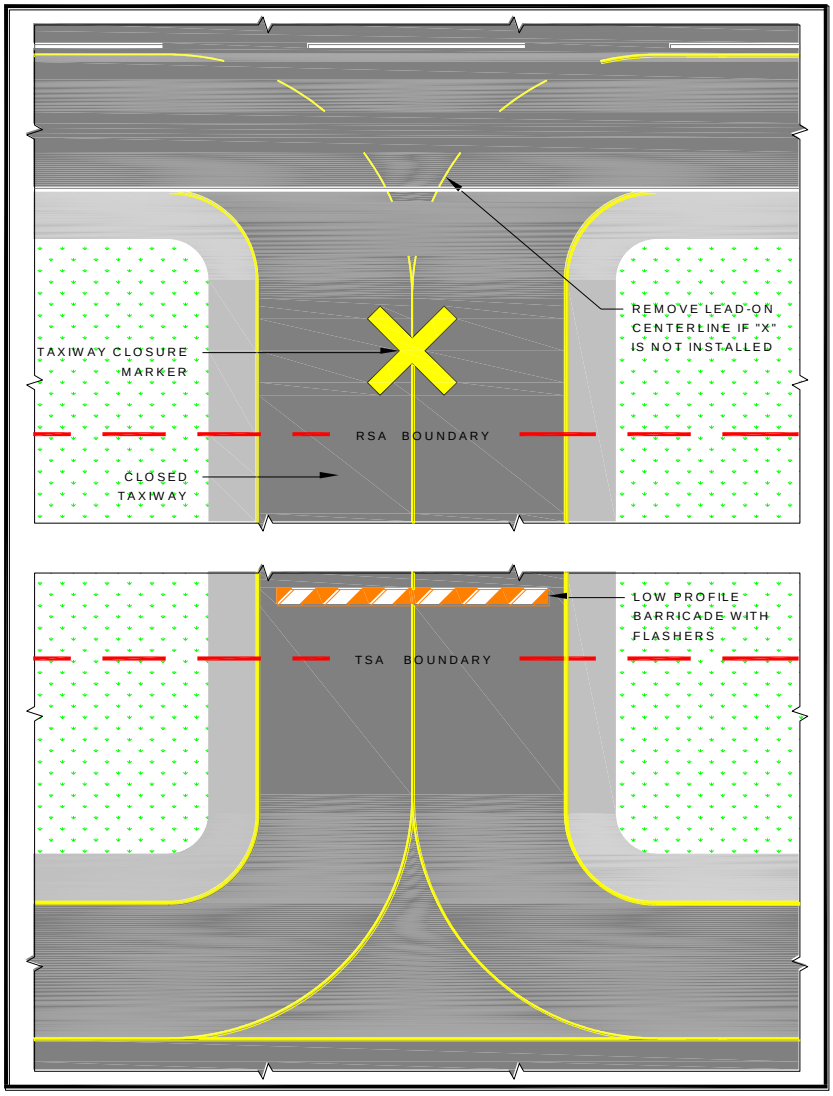

Figure 2-2 Taxiway Closure

(ii) Temporarily Closed Taxiways. Place barricades outside the safety area of intersecting taxiways. For runway/taxiway intersections, place an X at the entrance to the closed taxiway from the runway. If the taxiway will be closed for an extended period, obliterate taxiway centerline markings, including runway leadoff lines, leading to the closed section. If the centerline markings will be reused upon reopening the taxiway, it is preferable to paint over the marking. This will result in less damage to the pavement when the upper layer of paint is ultimately removed.

(e) Temporarily Closed Airport. When the airport is closed temporarily, mark all the runways as closed.

(i) If unable to paint temporary markings on the pavement, construct them from any of the following materials: fabric, colored plastic, painted sheets of plywood, or similar materials. They must be properly configured and appropriately secured to prevent movement by prop wash, jet blast, or other wind currents.

(ii) It may be necessary to remove or cover runway markings, including but not limited to, runway designation markings, threshold markings, centerline markings, edge stripes, touchdown zone markings and aiming point markings, depending on the length of construction and type of activity at the airport. When removing runway markings, apply the same treatment to areas between stripes or numbers, as the cleaned area will appear to pilots as a marking in the shape of the treated area.

(iii) If it is not possible to install threshold bars, chevrons, and arrows on the pavement, temporary outboard markings may be used. Locate them outside of the runway pavement surface on both sides of the runway. The dimension along the runway direction must be the same as if installed on the pavement. The lateral dimension must be at least one-half that of on-pavement markings. If the markings are not discernable on grass or snow, apply a black background with appropriate material over the ground to ensure they are clearly visible.

(iv) The application rate of paint to mark a short-term temporary runway and taxiway markings may deviate from the standard (see Item P-620, "Runway and Taxiway Painting," in AC 150/5370-10), but the dimensions must meet the existing standards.

(f) Lighting and Visual NAVAIDs. This paragraph refers to standard runway and taxiway lighting systems. See below for hazard lighting. Lighting must be in conformance with AC 150/5340-30, Design and Installation Details for Airport Visual Aids, and AC 150/5345-50, Specification for Portable Runway and Taxiway Lights. When disconnecting runway and taxiway lighting fixtures, disconnect the associated isolation transformers. Alternately, cover the light fixture in such a way as to prevent light leakage. Avoid removing the lamp from energized fixtures because an excessive number of isolation transformers with open secondaries may damage the regulators and/or increase the current above its normal value. Secure, identify, and place any above ground temporary wiring in conduit to prevent electrocution and fire ignition sources.

(2) Permanently Closed Runways and Taxiways. For runways and taxiways that have been permanently closed, disconnect the lighting circuits.

(3) Temporarily Closed Runways. If available, use a lighted X, both at night and during the day, placed at each end of the runway facing the approach. The use of a lighted X is required if night work requires runway lighting to be on. See AC 150/5345-55, Specification for L-893, Lighted Visual Aid to Indicate Temporary Runway Closure. For runways that have been temporarily closed, but for an extended period, and for those with pilot controlled lighting, disconnect the lighting circuits or secure switches to prevent inadvertent activation. For runways that will be opened periodically, coordinate procedures with the FAA air traffic manager or, at airports without an ATCT, the airport operator. Activate stop bars if available. Figure 2-3 shows a lighted X by day. Figure 2-4 shows a lighted X at night.

Figure 2-3 Lighted X in Daytime

Figure 2-4 Lighted X at Night

(4) Partially Closed Runways and Displaced Thresholds. When a runway is partially closed, a portion of the pavement is unavailable for any aircraft operation, meaning taxiing and landing or

taking off in either direction. A displaced threshold, by contrast, is put in place to ensure obstacle clearance by landing aircraft. The pavement prior to the displaced threshold is available for takeoff in the direction of the displacement, and for landing and takeoff in the opposite direction. Misunderstanding this difference and issuance of a subsequently inaccurate NOTAM can result in a hazardous situation. For both partially closed runways and displaced thresholds, approach lighting systems at the affected end must be placed out of service

(a) Partially Closed Runways. Disconnect edge and threshold lights on that part of the runway at and behind the threshold (that is, the portion of the runway that is closed). Alternately, cover the light fixture in such a way as to prevent light leakage.

(b) Displaced Thresholds. Edge lighting in the area of the displacement emits red light in the direction of approach and yellow light in the opposite direction. Centerline lights are blanked out in the direction of approach if the displacement is 700 ft or less. If the displacement is over 700 ft, place the centerline lights out of service. See AC 150/5340-30 for details on lighting displaced thresholds.

(c) Temporary runway thresholds and runway ends must be lighted if the runway is lighted and it is the intended threshold for night landings or instrument meteorological conditions.

(d) A temporary threshold on an unlighted runway may be marked by retroreflective, elevated markers in addition to markings noted in paragraph 218.b(1)(c) above. Markers seen by aircraft on approach are green. Markers at the rollout end of the runway are red. At certificated airports, temporary elevated threshold markers must be mounted with a frangible fitting (see 14 CFR Part 139.309). At non-certificated airports, the temporary elevated threshold markings may either be mounted with a frangible fitting or be flexible. See AC 150/5345-39, Specification for L-853, Runway and Taxiway Retroreflective Markers.

(e) Temporary threshold lights and end lights and related visual NAVAIDs are installed outboard of the edges of the full-strength pavement only when they cannot be installed on the pavement. They are installed with bases at grade level or as low as possible, but not more than 3 in (7.6 cm) above ground. When any portion of a base is above grade, place properly compacted fill around the base to minimize the rate of gradient change so aircraft can, in an emergency, cross at normal landing or takeoff speeds without incurring significant damage. See AC 150/5370-10.

(f) Maintain threshold and edge lighting color and spacing standards as described in AC 150/5340-30. Battery powered, solar, or portable lights that meet the criteria in AC 150/5345-50 may be used. These systems are intended primarily for visual flight rules (VFR) aircraft operations but may be used for instrument flight rules (IFR) aircraft operations, upon individual approval from the Flight Standards Division of the applicable FAA Regional Office.

(g) Reconfigure yellow lenses (caution zone), as necessary. If the runway has centerline lights, reconfigure the red lenses, as necessary, or place the centerline lights out of service.

(h) Relocate the visual glide slope indicator (VGSI), such as VASI and PAPI; other airport lights, such as Runway End Identifier Lights (REIL); and approach lights to identify the temporary threshold. Another option is to disable the VGSI or any equipment that would give misleading indications to pilots as to the new threshold location. Installation of temporary visual aids may be necessary to provide adequate guidance to pilots on approach to the affected runway. If the FAA owns and operates the VGSI, coordinate its installation or disabling with the local ATO/Technical Operations Office. Relocation of such visual aids will depend on the duration of the project and the benefits gained from the relocation, as this can result in great expense.

(i) Issue a NOTAM to inform pilots of temporary lighting conditions.

(5) Temporarily Closed Taxiways. If possible, deactivate the taxiway lighting circuits. When deactivation is not possible (for example other taxiways on the same circuit are to remain open),

cover the light fixture in such a way as to prevent light leakage.

c. Signs. To the extent possible, signs must be in conformance with AC 150/5345-44, Specification for Runway and Taxiway Signs and AC 150/5340-18, Standard for Airport Sign Systems. Any time a sign does not serve its normal function; it must be covered or removed to prevent misdirecting pilots. Note that information signs identifying a crossing taxiway continue to perform their normal function even if the crossing taxiway is closed. For long term construction projects, consider relocating signs, especially runway distance remaining signs.

219. Marking and Signs for Access Routes. The CSPP should indicate that pavement markings and signs for construction personnel will conform to AC 150/5340-18 and, to the extent practicable, with the Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD) and/or State highway specifications. Signs adjacent to areas used by aircraft must comply with the frangibility requirements of AC 150/5220-23, Frangible Connections, which may require modification to size and height guidance in the MUTCD.

220. Hazard Marking, Lighting and Signing.

a. Hazard Marking and Lighting Prevents Pilots from entering areas closed to aircraft, and prevents construction personnel from entering areas open to aircraft. The CSPP must specify prominent, comprehensible warning indicators for any area affected by construction that is normally accessible to aircraft, personnel, or vehicles. Hazard marking and lighting must also be specified to identify open manholes, small areas under repair, stockpiled material, waste areas, and areas subject to jet blast. Also consider less obvious construction-related hazards and include markings to identify FAA, airport, and National Weather Service facilities cables and power lines; instrument landing system (ILS) critical areas; airport surfaces, such as RSA, OFA, and OFZ; and other sensitive areas to make it easier for contractor personnel to avoid these areas.

b. Equipment.

(1) Barricades, including traffic cones, (weighted or sturdily attached to the surface) are acceptable methods used to identify and define the limits of construction and hazardous areas on airports. Careful consideration must be given to selecting equipment that poses the least danger to aircraft but is sturdy enough to remain in place when subjected to typical winds, prop wash and jet blast. The spacing of barricades must be such that a breach is physically prevented barring a deliberate act. For example, if barricades are intended to exclude vehicles, gaps between barricades must be smaller than the width of the excluded vehicles, generally 4 ft. Provision must be made for ARFF access if necessary. If barricades are intended to exclude pedestrians, they must be continuously linked. Continuous linking may be accomplished through the use of ropes, securely attached to prevent FOD.

(2) Lights must be red, either steady burning or flashing, and must meet the luminance requirements of the State Highway Department. Batteries powering lights will last longer if lights flash. Lights must be mounted on barricades and spaced at no more than 10 ft. Lights must be operated between sunset and sunrise and during periods of low visibility whenever the airport is open for operations. They may be operated by photocell, but this may require that the contractor turn them on manually during periods of low visibility during daytime hours.

(3) Supplement barricades with signs (for example “No Entry,” “No Vehicles”) as necessary.

(4) Air Operations Area – General. Barricades are not permitted in any active safety area. Within a runway or taxiway object free area, and on aprons, use orange traffic cones, flashing or steady burning red lights as noted above, collapsible barricades marked with diagonal, alternating orange and

white stripes; and/or signs to separate all construction/maintenance areas from the movement area. Barricades may be supplemented with alternating orange and white flags at least 20 by 20 in (50 by 50 cm) square and securely fastened to eliminate FOD. All barricades adjacent to any open runway or taxiway / taxilane safety area, or apron must be as low as possible to the ground, and no more than 18 in high, exclusive of supplementary lights and flags. Barricades must be of low mass; easily collapsible upon contact with an aircraft or any of its components; and weighted or sturdily attached to the surface to prevent displacement from prop wash, jet blast, wing vortex, or other surface wind currents. If affixed to the surface, they must be frangible at grade level or as low as possible, but not to exceed 3 in (7.6 cm) above the ground. Figure 2-5 and Figure 2-6 show sample barricades with proper coloring and flags.

Figure 2-5 Interlocking Barricades

Figure 2-6 Low Profile Barricades

(5) Air Operations Area – Runway/Taxiway Intersections. Use highly reflective barricades with lights to close taxiways leading to closed runways. Evaluate all operating factors when determining how to mark temporary closures that can last from 10 to 15 minutes to a much longer period of time. However, even for closures of relatively short duration, close all taxiway/runway intersections with barricades. The use of traffic cones is appropriate for short duration closures.

(6) Air Operations Area – Other. Beyond runway and taxiway object free areas and

aprons, barricades intended for construction vehicles and personnel may be many different shapes and made from various materials, including railroad ties, sawhorses, jersey barriers, or barrels.

(7) Maintenance. The construction specifications must include a provision requiring the contractor to have a person on call 24 hours a day for emergency maintenance of airport hazard lighting and barricades. The contractor must file the contact person's information with the airport operator. Lighting should be checked for proper operation at least once per day, preferably at dusk.

221. Protection of Runway and Taxiway Safety Areas. Runway and taxiway safety areas, Obstacle Free zones (OFZ), object free areas (OFA), and approach surfaces are described in AC 150/5300-13. Protection of these areas includes limitations on the location and height of equipment and stockpiled material. An FAA airspace study may be required. Coordinate with the appropriate FAA Airports Regional or District Office if there is any doubt as to requirements or dimensions (See paragraph 213.e above.) as soon as the location and height of materials or equipment are known. The CSPP should include drawings showing all safety areas, object free areas, obstacle free zones and approach departure surfaces affected by construction.

a. Runway Safety Area (RSA). A runway safety area is the defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway (see AC 150/5300-13). Construction activities within the existing RSA are subject to the following conditions:

(1) No construction may occur within the existing RSA while the runway is open for aircraft operations. The RSA dimensions may be temporarily adjusted if the runway is restricted to aircraft operations requiring an RSA that is equal to the RSA width and length beyond the runway ends available during construction. (see AC 150/5300-13). The temporary use of declared distances and/or partial runway closures may provide the necessary RSA under certain circumstances. Coordinate with the appropriate FAA Airports Regional or District Office to have declared distances information published. See AC 150/5300-13 for guidance on the use of declared distances.

(2) The airport operator must coordinate the adjustment of RSA dimensions as permitted above with the appropriate FAA Airports Regional or District Office and the local FAA air traffic manager and issue a NOTAM.

(3) The CSPP and SPCD must provide procedures for ensuring adequate distance for protection from blasting operations, if required by operational considerations.

(4) Excavations.

(a) Open trenches or excavations are not permitted within the RSA while the runway is open. If possible, backfill trenches before the runway is opened. If the runway must be opened before excavations are backfilled, cover the excavations appropriately. Covering for open trenches must be designed to allow the safe operation of the heaviest aircraft operating on the runway across the trench without damage to the aircraft.

(b) Construction contractors must prominently mark open trenches and excavations at the construction site with red or orange flags, as approved by the airport operator, and light them with red lights during hours of restricted visibility or darkness.

(5) Erosion Control. Soil erosion must be controlled to maintain RSA standards, that is, the RSA must be cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations, and capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and fire fighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft.

b. Runway Object Free Area (ROFA). Construction, including excavations, may be permitted in the ROFA. However, equipment must be removed from the ROFA when not in use, and material should not be stockpiled in the ROFA if not necessary. Stockpiling material in the OFA requires submittal of a 7460-1 form and justification provided to the appropriate FAA Airports Regional or District Office for approval.

c. Taxiway Safety Area (TSA). A taxiway safety area is a defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway. (See AC 150/5300-13.) Construction activities within the TSA are subject to the following conditions:

(1) No construction may occur within the TSA while the taxiway is open for aircraft operations. The TSA dimensions may be temporarily adjusted if the taxiway is restricted to aircraft operations requiring a TSA that is equal to the TSA width available during construction (see AC 150/5300-13, Table 4-1).

(2) The airport operator must coordinate the adjustment of the TSA width as permitted above with the appropriate FAA Airports Regional or District Office and the FAA air traffic manager and issue a NOTAM.

(3) The CSPP and SPCD must provide procedures for ensuring adequate distance for protection from blasting operations.

(4) Excavations.

(a) Open trenches or excavations are not permitted within the TSA while the taxiway is open. If possible, backfill trenches before the taxiway is opened. If the taxiway must be opened before excavations are backfilled, cover the excavations appropriately. Covering for open trenches must be designed to allow the safe operation of the heaviest aircraft operating on the taxiway across the trench without damage to the aircraft.

(b) Construction contractors must prominently mark open trenches and excavations at the construction site with red or orange flags, as approved by the airport operator, and light them with red lights during hours of restricted visibility or darkness.

(5) Erosion Control. Soil erosion must be controlled to maintain TSA standards, that is, the TSA must be cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations, and capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and fire fighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft.

d. Taxiway Object Free Area (TOFA). Unlike the Runway Object Free Area, aircraft wings regularly penetrate the taxiway object free area during normal operations. Thus the restrictions are more stringent. Except as provided below, no construction may occur within the taxiway object free area while the taxiway is open for aircraft operations.

(1) The taxiway object free area dimensions may be temporarily adjusted if the taxiway is restricted to aircraft operations requiring a taxiway object free area that is equal to the taxiway object free area width available.

(2) Offset taxiway pavement markings may be used as a temporary measure to provide the required taxiway object free area. Where offset taxiway pavement markings are provided, centerline lighting or reflectors are required.

(3) Construction activity may be accomplished without adjusting the width of the taxiway object free area, subject to the following restrictions:

(a) Appropriate NOTAMs are issued.

(b) Marking and lighting meeting the provisions of paragraphs 218 and 220 above are implemented.

(c) Five-foot clearance is maintained between equipment and materials and any part of an aircraft (includes wingtip overhang). In these situations, flaggers must be used to direct construction equipment, and wing walkers will be necessary to guide aircraft. Wing walkers should be airline/aviation personnel rather than construction workers. If such clearance can only be maintained if an aircraft does not have full use of the entire taxiway width (with its main landing gear at the edge of the pavement), then it will be necessary to move personnel and equipment for the passage of that aircraft.

e. Obstacle Free Zone (OFZ). In general, personnel, material, and/or equipment may not penetrate the OFZ while the runway is open for aircraft operations. If a penetration to the OFZ is necessary, it may be possible to continue aircraft operations through operational restrictions. Coordinate with the FAA through the appropriate FAA Airports Regional or District Office.

f. Runway Approach/Departure Areas and Clearways. All personnel, materials, and/or equipment must remain clear of the applicable threshold siting surfaces, as defined in Appendix 2, "Threshold Siting Requirements," of AC 150/5300-13. Objects that do not penetrate these surfaces may still be obstructions to air navigation and may affect standard instrument approach procedures. Coordinate with the FAA through the appropriate FAA Airports Regional or District Office.

(1) Construction activity in a runway approach/departure area may result in the need to partially close a runway or displace the existing runway threshold. Partial runway closure, displacement of the runway threshold, as well as closure of the complete runway and other portions of the movement area also require coordination through the airport operator with the appropriate FAA air traffic manager (FSS if non-towered) and ATO/Technical Operations (for affected NAVAIDS) and airport users.

(2) Caution regarding partial runway closures. When filing a NOTAM for a partial runway closure, clearly state to OCC personnel that the portion of pavement located prior to the threshold is not available for landing and departing traffic. In this case, the threshold has been moved for both landing and takeoff purposes (this is different than a displaced threshold). There may be situations where the portion of closed runway is available for taxiing only. If so, the NOTAM must reflect this condition).

(3) Caution regarding displaced thresholds. : Implementation of a displaced threshold affects runway length available for aircraft landing over the displacement. Depending on the reason for the displacement (to provide obstruction clearance or RSA), such a displacement may also require an adjustment in the landing distance available and accelerate-stop distance available in the opposite direction. If project scope includes personnel, equipment, excavation, other work. within the existing RSA of any usable runway end, do not implement a displaced threshold unless arrivals and departures toward the construction activity are prohibited. Instead, implement a partial closure.

222. Other Limitations on Construction. The CSPP must specify any other limitations on construction, including but not limited to:

a. Prohibitions.

(1) No use of tall equipment (cranes, concrete pumps, and so on) unless a 7460-1 determination letter is issued for such equipment.

(2) No use of open flame welding or torches unless fire safety precautions are provided and the airport operator has approved their use.

(3) No use of electrical blasting caps on or within 1,000 ft (300 m) of the airport property.

See AC 150/5370-10.

(4) **No use of flare pots** within the AOA.

b. Restrictions.

(1) **Construction suspension required during specific airport operations.**

(2) **Areas that cannot be worked on simultaneously.**

(3) **Day or night construction restrictions.**

(4) **Seasonal construction restrictions.**

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Chapter 3. Guidelines for Writing a CSPP

301. General Requirements. The CSPP is a standalone document written to correspond with the subjects outlined in Chapter 2, Section 1, paragraph 204. The CSPP is organized by numbered sections corresponding to each subject listed in Chapter 2, Section 1, paragraph 204, and described in detail in Chapter 2, Section 2. Each section number and title in the CSPP matches the corresponding subject outlined in Chapter 2, paragraph 204 (for example, 1. Coordination, 2. Phasing, 3. Areas and Operations Affected by the Construction Activity, and so on.). With the exception of the project scope of work outlined in Section 2. Phasing, only subjects specific to operational safety during construction should be addressed.

302. Applicability of Subjects. Each section should, to the extent practical, focus on the specific subject. Where an overlapping requirement spans several sections, the requirement should be explained in detail in the most applicable section. A reference to that section should be included in all other sections where the requirement may apply. For example, the requirement to protect existing underground FAA Instrument Landing System (ILS) cables during trenching operations could be considered FAA ATO coordination (Section 1. Coordination, paragraph 205.c), an area and operation affected by the construction activity (Section 3. Areas and Operations Affected by the Construction Activity, paragraph 207.a(4)), a protection of a NAVAID (Section 4. Protection of Navigational Aids (NAVAIDs),paragraph 208), or a notification to the FAA of construction activities (Section 9. Notification of Construction Activities, paragraph 210.e(3)(b)). However, it is more specifically an underground utility requirement (Section 11. Underground Utilities, paragraph 215). The procedure for protecting underground ILS cables during trenching operations should therefore be described in Section 11: "*The contractor must coordinate with the local FAA System Support Center (SSC) to mark existing ILS cable routes along Runway 17-35. The ILS cables will be located by hand digging whenever the trenching operation moves within 10 feet of the cable markings.*" All other applicable sections should include a reference to Section 11: "*ILS cables shall be identified and protected as described in Section 11*" or "*See Section 11 for ILS cable identification and protection requirements.*" Thus, the CSPP should be considered as a whole, with no need to duplicate responses to related issues.

303. Graphical Representations. Construction safety drawings should be included in the CSPP as attachments. When other graphical representations will aid in supporting written statements, the drawings, diagrams, and/or photographs should also be attached to the CSPP. References should be made in the CSPP to each graphical attachment and may be made in multiple sections.

304. Reference Documents. The CSPP must not incorporate a document by reference unless reproduction of the material in that document is prohibited. In that case, either copies of or a source for the referenced document must be provided to the contractor.

305. Restrictions. The CSPP should not be considered as a project design review document. The CSPP should also avoid mention of permanent ("as-built") features such as pavements, markings, signs, and lighting, except when such features are intended to aid in maintaining operational safety during the construction.

306. Coordination. Include in this section a detailed description of conferences and meetings both before and during the project. Include appropriate information from AC 150/5300-9. Discuss coordination procedures and schedules for each required FAA ATO airway facility shutdown and restart and all required flight inspections.

307. Phasing. Include in this section a detailed scope of work description for the project as a whole and each phase of work covered by the CSPP. This includes all locations and durations of the work proposed. Attach drawings to graphically support the written scope of work. Detail in this section the sequenced phases of the proposed construction. Include a reference to paragraph 308 below, as appropriate.

308. Areas and Operations Affected By Construction. Focus in this section on identifying the areas and operations affected by the construction. Describe corresponding mitigation that is not covered in detail elsewhere in the CSPP. Include references to paragraphs below as appropriate. Attach drawings as necessary to graphically describe affected areas and mechanisms proposed. Tables and charts such as the following may be helpful in highlighting issues to be addressed.

Table 3-1 Sample Operations Effects

Project	Runway 15-33 Reconstruction	
Phase	Phase II: Reconstruct Runway 15 End	
Scope of Work	Reconstruct 1,000 ft of north end of Runway 15-33 with Portland Cement Concrete (PCC).	
Operational Requirements	**Normal (Existing)**	**Phase II (Anticipated)**
Runway 15 Average Aircraft Operations	Carrier: 52 /day GA: 26 /day Military: 11 /day	Carrier: 52 / day GA: 20 / day Military: 0 /day
Runway 33 Average Aircraft Operations	Carrier: 40 /day GA: 18 /day Military: 10 /day	Carrier: 20 /day GA: 5 /day Military: 0 /day
Runway 15-33 ARC	C-IV	C-IV
Runway 15 Approach Visibility Minimums	¾ mile	1 mile
Runway 33 Approach Visibility Minimums	¾ mile	1 mile
Runway 15 Declared Distances	TORA: 7,820	TORA: 6,420
	TODA: 7,820	TODA: 6,420
	ASDA: 7,820	ASDA: 6,420
	LDA: 7,820	LDA: 6,420
Runway 33 Declared Distances	TORA: 8,320	TORA: 6,920
	TODA: 8,320	TODA: 6,920
	ASDA: 8,320	ASDA: 6,920
	LDA: 7,820	LDA: 6,420
Runway 15 Approach Procedures	ILS	LOC only
	RNAV	N/A
	VOR	N/A
Runway 33 Approach Procedures	ILS	Visual only
	RNAV	N/A
	VOR	N/A
Runway 15 NAVAIDs	ILS/DME, MALSR, RVR	LOC/DME, PAPI (temp), RVR

Runway 33 NAVAIDs	ILS/DME, MALSF, PAPI, RVR	MALSF, PAPI, RVR
Taxiway G ADG	IV	IV (N/A between T/W H and R/W 15 end)
Taxiway E ADG	IV	IV
ATCT (hours open)	06:00 – 24:00 local	06:00 – 24:00 local
ARFF Index	D	D
Special Conditions	Air National Guard (ANG) military operations	Military operations relocated to alternate ANG Base
	Airline XYZ requires VGSI	Airline XYZ requires VGSI

Complete the following chart for each phase to determine the area that must be protected along the runway edges:

Runway	**Aircraft Approach Category*** **A, B, C, or D**	**Airplane Design Group*** **I, II, III, or IV**	**RSA Width in Feet Divided by 2***
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
*See AC 150/5300-13 to complete the chart for a specific runway.			

Complete the following chart for each phase to determine the area that must be protected before the runway threshold:

Runway End Number	**Airplane Design Group*** **I, II, III, or IV**	**Aircraft Approach Category*** **A, B, C, or D**	**Minimum Safety Area Prior to the Threshold***	**Minimum Distance to Threshold Based on Required Approach Slope***	
_____	_____	_____	_____ ft	_____ ft	_____: 1
_____	_____	_____	_____ ft	_____ ft	_____: 1
_____	_____	_____	_____ ft	_____ ft	_____: 1
_____	_____	_____	_____ ft	_____ ft	_____: 1
*See AC 150/5300-13 to complete the chart for a specific runway.					

309. Navigation Aid (NAVAID) Protection. List in this section all NAVAID facilities that will be affected by the construction. Identify NAVAID facilities that will be placed out of service at any time prior to or during construction activities. Identify individuals responsible for coordinating each shutdown and when each facility will be out of service. Include a reference to paragraph 306 above for FAA ATO NAVAID shutdown, restart, and flight inspection coordination. Outline in detail procedures to protect each NAVAID facility remaining in service from interference by construction activities. Include a reference to paragraph 314 for the issuance of NOTAMs as required. Include a reference to paragraph 316 for the protection of underground cables and piping serving NAVAIDs. If temporary visual aids are proposed to replace or supplement existing facilities, include a reference to paragraph 319. Attach drawings to graphically indicate the affected NAVAIDS and the corresponding critical areas.

310. Contractor Access. This will necessarily be the most extensive section of the CSPP. Provide

sufficient detail so that a contractor not experienced in working on airports will understand the unique restrictions such work will require. Due to this extent, it should be broken down into subsections as described below:

a. Location of Stockpiled Construction Materials. Describe in this section specific locations for stockpiling material. Note any height restrictions on stockpiles. Include a reference to paragraph 321 for hazard marking and lighting devices used to identify stockpiles. Include a reference to paragraph 311 for provisions to prevent stockpile material from becoming wildlife attractants. Include a reference to paragraph 312 for provisions to prevent stockpile material from becoming FOD. Attach drawings to graphically indicate the stockpile locations.

b. Vehicle and Pedestrian Operations. While there are many items to be addressed in this major subsection of the CSPP, all are concerned with one main issue: keeping people and vehicles from areas of the airport where they don't belong. This includes preventing unauthorized entry to the AOA and preventing the improper movement of pedestrians or vehicles on the airport. In this section, focus on mechanisms to prevent construction vehicles and workers traveling to and from the worksite from unauthorized entry into movement areas. Specify locations of parking for both employee vehicles and construction equipment, and routes for access and haul roads. In most cases, this will best be accomplished by attaching a drawing. Quote from AC 150/5210-5 specific requirements for contractor vehicles rather than referring to the AC as a whole, and include special requirements for identifying Hazardous Material (HAZMAT) vehicles. Quote from, rather than incorporate by reference, AC 150/5210-20 as appropriate to address the airport's rules for ground vehicle operations, including its training program. Discuss the airport's recordkeeping system listing authorized vehicle operators.

c. Two-Way Radio Communications. Include a special section to identify all individuals who are required to maintain communications with Air Traffic (AT) at airports with active towers, or monitor Common Traffic Advisory Frequencies (CTAF) at airports without or with closed ATCT. Include training requirements for all individuals required to communicate with AT. Individuals required to monitor AT frequencies should also be identified. If construction employees are also required to communicate by radio with Airport Operations, this procedure should be described in detail. Usage of vehicle mounted radios and/or portable radios should be addressed. Communication procedures for the event of disabled radio communication (that is, light signals, telephone numbers, others) must be included. All radio frequencies should by identified (Tower, Ground Control, CTAF, UNICOM, ATIS, and so on).

d. Airport Security. Address security as it applies to vehicle and pedestrian operations. Discuss TSA requirements, security badging requirements, perimeter fence integrity, gate security, and other needs. Attach drawings to graphically indicate secured and/or Security Identification Display Areas (SIDA), perimeter fencing, and available access points.

311. Wildlife Management. Discuss in this section wildlife management procedures. Describe the maintenance of existing wildlife mitigation devices, such as perimeter fences, and procedures to limit wildlife attractants. Include procedures to notify Airport Operations of wildlife encounters. Include a reference to paragraph 310 for security (wildlife) fence integrity maintenance as required.

312. Foreign Object Debris (FOD) Management. In this section, discuss methods to control and monitor FOD: worksite housekeeping, ground vehicle tire inspections, runway sweeps, and so on. Include a reference to paragraph 315 for inspection requirements as required.

313. Hazardous Materials (HAZMAT) Management. Describe in this section HAZMAT management procedures: fuel deliveries, spill recovery procedures, Material Safety Data Sheet (MSDS) availability, and other considerations. Any specific airport HAZMAT restrictions should also be

identified. Include a reference to paragraph 310 for HAZMAT vehicle identification requirements. Quote from, rather than incorporate by reference, AC 150/5320-15.

314. Notification of Construction Activities. List in this section the names and telephone numbers of points of contact for all parties affected by the construction project. We recommend a single list that includes all telephone numbers required under this section. Include emergency notification procedures for all representatives of all parties potentially impacted by the construction. Identify individual representatives – and at least one alternate – for each party. List both on-duty and off-duty contact information for each individual, including individuals responsible for emergency maintenance of airport construction hazard lighting and barricades. Describe procedures to coordinate immediate response to events that might adversely affect the operational safety of the airport (such as interrupted NAVAID service). Explain requirements for and the procedures for the issuance of Notices to Airmen (NOTAMs), notification to FAA required by 14 CFR Part 77 and Part 157 and in the event of affected NAVAIDs. For NOTAMs, identify an individual, and at least one alternate, responsible for issuing and cancelling each specific type of Notice to Airmen (NOTAM) required. Detail notification methods for police, fire fighting, and medical emergencies. This may include 911, but should also include direct phone numbers of local police departments and nearby hospitals. The local Poison Control number should be listed. Procedures regarding notification of Airport Operations and/or the ARFF Department of such emergencies should be identified, as applicable. If airport radio communications are identified as a means of emergency notification, include a reference to paragraph 310. Differentiate between emergency and nonemergency notification of ARFF personnel, the latter including activities that affect ARFF water supplies and access roads. Identify the primary ARFF contact person and at least one alternate. If notification is to be made through Airport Operations, then detail this procedure. Include a method of confirmation from the ARFF department.

315. Inspection Requirements. Describe in this section inspection requirements to ensure airfield safety compliance. Include a requirement for routine inspections by the resident engineer (RE) and the construction contractors. If the engineering consultants and/or contractors have a Safety Officer who will conduct such inspections, identify this individual. Describe procedures for special inspections, such as those required to reopen areas for aircraft operations. Part 139 requires daily airfield inspections at certificated airports, but these may need to be more frequent when construction is in progress. Discuss the role of such inspections on areas under construction. Include a requirement to immediately remedy any deficiencies, whether caused by negligence, oversight, or project scope change.

316. Underground Utilities. Explain how existing underground utilities will be located and protected. Identify each utility owner and include contact information for each company/agency in the master list. Address emergency response procedures for damaged or disrupted utilities. Include a reference to paragraph 314 above for notification of utility owners of accidental utility disruption as required.

317. Penalties. Describe in this section specific penalties imposed for noncompliance with airport rules and regulations, including the CSPP: SIDA violations, Vehicle/Pedestrian Deviations (VPD), and others.

318. Special Conditions. Identify any special conditions that may trigger specific safety mitigation actions outlined in this CSPP: low visibility operations, snow removal, aircraft in distress, aircraft accident, security breach, VPD, and other activities requiring construction suspension/resumption. Include a reference to paragraph 310 above for compliance with airport safety and security measures and for radio communications as required. Include a reference to paragraph 319 below for emergency notification of all involved parties, including police/security, ARFF, and medical services.

319. Runway and Taxiway Visual Aids. Include marking, lighting, signs, and visual NAVAIDS.

Detail temporary runway and taxiway marking, lighting, signs, and visual NAVAIDs required for the construction. Discuss existing marking, lighting, signs, and visual NAVAIDs that are temporarily, altered, obliterated, or shut down. Consider non-federal facilities and address requirements for reimbursable agreements necessary for alteration of FAA facilities and for necessary flight checks. Identify temporary TORA signs or runway distance remaining signs if appropriate. Identify required temporary visual NAVAIDs such as REIL or PAPI. Quote from, rather than incorporate by reference, AC 150/5340-1, Standards for Airport Markings, AC 150/5340-18, Standards for Airport Sign Systems, and AC 150/5340-30, as required. Attach drawings to graphically indicate proposed marking, lighting, signs, and visual NAVAIDs.

320. Marking and Signs for Access Routes. Detail plans for marking and signs for vehicle access routes. To the extent possible, signs should be in conformance with the Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD) and/or State highway specifications, not hand lettered. Detail any modifications to the guidance in the MUTCD necessary to meet frangibility/height requirements.

321. Hazard Marking and Lighting. Specify all marking and lighting equipment, including when and where each type of device is to be used. Specify maximum gaps between barricades and the maximum spacing of hazard lighting. Identify one individual and at least one alternate responsible for maintenance of hazard marking and lighting equipment in the master telephone list. Include a reference to paragraph 314 above. Attach drawings to graphically indicate the placement of hazard marking and lighting equipment.

322. Protection of Runway and Taxiway Safety Areas. This section should focus exclusively on procedures for protecting all safety areas, including those altered by the construction: methods of demarcation, limit of access, movement within safety areas, stockpiling and trenching restrictions, and so on. Reference AC 150/5300-13: Airport Design as required. Include a reference to paragraph 310 above for procedures regarding vehicle and personnel movement within safety areas. Include a reference to paragraph 310 above for material stockpile restrictions as required. Detail requirements for trenching, excavations, and backfill. Include a reference to paragraph 321 for hazard marking and lighting devices used to identify open excavations as required. If runway and taxiway closures are proposed to protect safety areas, or if temporary displaced thresholds and/or revised declared distances are used to provide adequate Runway Safety Area, include a reference to paragraphs 314 and 319 above. Detail procedures for protecting the runway OFZ, runway OFA, taxiway OFA and runway approach surfaces including those altered by the construction: methods of demarcation, limit of cranes, storage of equipment, and so on. Quote from, rather than incorporate by reference, AC 150/5300-13: Airport Design as required. Include a reference to paragraph 323 for height (i.e. crane) restrictions as required. One way to address the height of equipment that will move during the project is to establish a three-dimensional “box” within which equipment will be confined that can be studied as a single object. Attach drawings to graphically indicate the safety area, OFZ, and OFA boundaries.

323. Other Limitations on Construction. This section should describe what limitations must be applied to each area of work and when each limitation will be applied: limitations due to airport operations, height (i.e. crane) restrictions, areas which cannot be worked at simultaneously, day/night work restrictions, winter construction, and other limitations. Include a reference to paragraph 307 above for project phasing requirements based on construction limitations as required.

Appendix 1. Related Reading Material

Obtain the latest version of the following free publications from the FAA on its Web site at http://www.faa.gov/airports/.

AC	Title and Description
AC 150/5200-28	Notices to Airmen (NOTAMs) for Airport Operators
	Guidance for using the NOTAM System in airport reporting.
AC 150/5200-30	Airport Winter Safety and Operations
	Guidance for airport owners/operators on the development of an acceptable airport snow and ice control program and on appropriate field condition reporting procedures.
AC 150/5200-33	Hazardous Wildlife Attractants On or Near Airports
	Guidance on locating certain land uses that might attract hazardous wildlife to public-use airports.
AC 150/5210-5	Painting, Marking, and Lighting of Vehicles Used on an Airport.
	Guidance, specifications, and standards for painting, marking, and lighting vehicles operating in the airport air operations areas.
AC 150/5210-20	Ground Vehicle Operations on Airports
	Guidance to airport operators on developing ground vehicle operation training programs.
AC 150/5300-13	Airport Design
	FAA standards and recommendations for airport design, establishes approach visibility minimums as an airport design parameter, and contains the Object Free area and the obstacle free-zone criteria.
AC 150/5310-24	Airport Foreign Object Debris Management
	Guidance for developing and managing an airport foreign object debris (FOD) program
AC 150/5220-4	Water Supply Systems for Aircraft Fire and Rescue Protection.
	Guidance on selecting a water source and meeting standards for a distribution system to support aircraft rescue and fire fighting service operations on airports.
AC 150/5320-15	Management of Airport Industrial Waste
	Basic information on the characteristics, management, and regulations of industrial wastes generated at airports. Guidance for developing a Storm Water Pollution Prevention Plan (SWPPP) that applies best management practices to eliminate, prevent, or reduce pollutants in storm water runoff with particular airport industrial activities.
AC 150/5340-1	Standards for Airport Markings
	FAA standards for markings used on airport runways, taxiways, and aprons.
AC 150/5340-18	Standards for Airport Sign Systems
	FAA standards for the siting and installation of signs on airport runways and taxiways.
AC 150/5345-28	Precision Approach Path Indicator (PAPI) Systems
	FAA standards for PAPI systems, which provide pilots with visual glide slope guidance during approach for landing.

AC	Title and Description
AC 150/5340-30	Design and Installation Details for Airport Visual Aids
	Guidance and recommendations on the installation of airport visual aids.
AC 150/5345-39	Specification for L-853, Runway and Taxiway Retroreflective Markers
AC 150/5345-44	Specification for Runway and Taxiway Signs
	FAA specifications for unlighted and lighted signs for taxiways and runways.
AC 150/5345-53	Airport Lighting Certification Program
	Details on the Airport Lighting Equipment Certification Program (ALECP).
AC 150/5345-50	Specification for Portable Runway and Taxiway Lights
	FAA standards for portable runway and taxiway lights and runway end identifier lights for temporary use to permit continued aircraft operations while all or part of a runway lighting system is inoperative.
AC 150/5345-55	Specification for L-893, Lighted Visual Aid to Indicate Temporary Runway Closure
AC 150/5370-10	Standards for Specifying Construction of Airports
	Standards for construction of airports, including earthwork, drainage, paving, turfing, lighting, and incidental construction.
FAA Order 5200.11	FAA Airports (ARP) Safety Management System (SMS)
	Basics for implementing SMS within ARP. Includes roles and responsibilities of ARP management and staff as well as other FAA lines of business that contribute to the ARP SMS.
FAA Certalert 98-05	Grasses Attractive to Hazardous Wildlife
	Guidance on grass management and seed selection.
FAA Form 7460-1	Notice of Proposed Construction or Alteration
FAA Form 7480-1	Notice of Landing Area Proposal

Obtain the latest version of the following free publications from the Electronic Code of Federal Regulations at http://ecfr.gpoaccess.gov/.

Title 14 CFR Part 139	Certification of Airports
Title 49 CFR Part 1542	Airport Security

Obtain the latest version of the Manual on Uniform Traffic Control Devices from the Federal Highway Administration at http://mutcd.fhwa.dot.gov/.

Appendix 2. Definition of Terms

Term	Definition
7460-1	Notice Of Proposed Construction Or Alteration. For on-airport projects, the form submitted to the FAA regional or airports division office as formal written notification of any kind of construction or alteration of objects that affect navigable airspace, as defined in 14 CFR Part 77, safe, efficient use, and preservation of the navigable airspace. (See guidance available on the FAA web site at oeaaa.faa.gov.) The form may be downloaded at http://www.faa.gov/airports/resources/forms/, or filed electronically at: https://oeaaa.faa.gov.
7480-1	Notice Of Landing Area Proposal. Form submitted to the FAA Airports Regional Division Office or Airports District Office as formal written notification whenever a project without an airport layout plan on file with the FAA involves the construction of a new airport; the construction, realigning, altering, activating, or abandoning of a runway, landing strip, or associated taxiway; or the deactivation or abandoning of an entire airport The form may be downloaded at http://www.faa.gov/airports/resources/forms/.
AC	Advisory Circular
ACRC	Aircraft Reference Code
ACSI	Airport Certification Safety Inspector
ADG	Airplane Design Group
AIP	Airport Improvement Program
ALECP	Airport Lighting Equipment Certification Program
ANG	Air National Guard
AOA	Air Operations Area. Any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operations area includes such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runways, taxiways, or aprons.
ARFF	Aircraft Rescue and Fire Fighting
ARP	FAA Office of Airports
ASDA	Accelerate-Stop Distance Available
ATCT	Airport Traffic Control Tower
ATIS	Automatic Terminal Information Service
ATO	Air Traffic Organization
Certificated Airport	An airport that has been issued an Airport Operating Certificate by the FAA under the authority of 14 CFR Part 139, Certification of Airports.
CFR	Code of Federal Regulations
Construction	The presence and movement of construction-related personnel, equipment, and materials in any location that could infringe upon the movement of aircraft.
CSPP	Construction Safety And Phasing Plan. The overall plan for safety and phasing of a construction project developed by the airport operator, or developed by the airport operator's consultant and approved by the airport operator. It is included in the invitation for bids and becomes part of the project specifications.

Term	Definition
CTAF	Common Traffic Advisory Frequency
Displaced Threshold	A threshold that is located at a point on the runway other than the designated beginning of the runway. The portion of pavement behind a displaced threshold is available for takeoffs in either direction or landing from the opposite direction.
DOT	Department of Transportation
EPA	Environmental Protection Agency
FOD	Foreign Object Debris
HAZMAT	Hazardous Materials
IFR	Instrument Flight Rules
ILS	Instrument Landing System
LDA	Landing Distance Available
LOC	Localizer antenna array
Movement Area	The runways, taxiways, and other areas of an airport that are used for taxiing or hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading aprons and aircraft parking areas (reference 14 CFR Part 139).
MSDS	Material Safety Data Sheet
MUTCD	Manual on Uniform Traffic Control Devices
NAVAID	Navigation Aid
NAVAID Critical Area	An area of defined shape and size associated with a NAVAID that must remain clear and graded to avoid interference with the electronic signal.
Non-Movement Area	The area inside the airport security fence exclusive of the Movement Area. It is important to note that the non-movement area includes pavement traversed by aircraft.
NOTAM	Notices to Airmen
Obstruction	Any object/obstacle exceeding the obstruction standards specified by 14 CFR Part 77, subpart C.
OE / AAA	Obstruction Evaluation / Airport Airspace Analysis
OFA	Object Free Area. An area on the ground centered on the runway, taxiway, or taxi lane centerline provided to enhance safety of aircraft operations by having the area free of objects except for those objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes. (See AC 150/5300-13, for additional guidance on OFA standards and wingtip clearance criteria.)
OFZ	Obstacle Free Zone. The airspace below 150 ft (45 m) above the established airport elevation and along the runway and extended runway centerline that is required to be clear of all objects, except for frangible visual NAVAIDs that need to be located in the OFZ because of their function, in order to provide clearance protection for aircraft landing or taking off from the runway and for missed approaches. The OFZ is subdivided as follows: Runway OFZ, Inner Approach OFZ, Inner Transitional OFZ, and Precision OFZ. Refer to AC 150/5300-13 for guidance on OFZ.
OSHA	Occupational Safety and Health Administration
P&R	Planning and Requirements Group

Term	Definition
PAPI	Precision Approach Path Indicators
PFC	Passenger Facility Charge
PLASI	Pulse Light Approach Slope Indicators
Project Proposal Summary	A clear and concise description of the proposed project or change that is the object of Safety Risk Management.
RE	Resident Engineer
REIL	Runway End Identifier Lights
RNAV	Area Navigation
ROFA	Runway Object Free Area
RSA	Runway Safety Area. A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway, in accordance with AC 150/5300-13.
SIDA	Security Identification Display Area
SMS	Safety Management System
SPCD	Safety Plan Compliance Document. Details developed and submitted by a contractor to the airport operator for approval providing details on how the performance of a construction project will comply with the CSPP.
SRM	Safety Risk Management
Taxiway Safety Area	A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway, in accordance with AC 150/5300-13.
TDG	Taxiway Design Group
Temporary	Any condition that is not intended to be permanent.
Temporary Runway End	The beginning of that portion of the runway available for landing and taking off in one direction, and for landing in the other direction. Note the difference from a displaced threshold.
Threshold	The beginning of that portion of the runway available for landing. In some instances, the landing threshold may be displaced.
TODA	Takeoff Distance Available
TOFA	Taxiway Object Free Area
TORA	Takeoff Run Available. The length of the runway less any length of runway unavailable and/or unsuitable for takeoff run computations. See AC 150/5300-13 for guidance on declared distances.
TSA	Taxiway Safety Area Transportation Security Administration
UNICOM	A radio communications system of a type used at small airports.
VASI	Visual Approach Slope Indicators

Term	Definition
VGSI	Visual Glide Slope Indicator. A device that provides a visual glide slope indicator to landing pilots. These systems include precision approach path indicators (PAPI), visual approach slope indicators (VASI), and pulse light approach slope indicators (PLASI).
VFR	Visual Flight Rules
VOR	VHF Omnidirectional Radio Range
VPD	Vehicle / Pedestrian Deviation

Appendix 3. Safety and Phasing Plan Checklist

This appendix is keyed to Section 2. Plan Requirements. In the electronic version of this AC, clicking on the paragraph designation in the Reference column will access the applicable paragraph. There may be instances where the CSPP requires provisions that are not covered by the list in this appendix.

This checklist is intended as an aid, not as a required submittal.

Coordination	Reference	Addressed			Remarks
General Considerations					
Requirements for predesign, prebid, and preconstruction conferences to introduce the subject of airport operational safety during construction are specified.	205	☐ Yes	☐ No	☐ NA	
Operational safety is a standing agenda item for construction progress meetings.	205	☐ Yes	☐ No	☐ NA	
Scheduling of the construction phases is properly addressed.	206	☐ Yes	☐ No	☐ NA	
Areas and Operations Affected by Construction Activity					
Drawings showing affected areas are included.	207.a	☐ Yes	☐ No	☐ NA	
Closed or partially closed runways, taxiways, and aprons are depicted on drawings.	207.a(1)	☐ Yes	☐ No	☐ NA	
Access routes used by ARFF vehicles affected by the project are addressed.	207.a(2)	☐ Yes	☐ No	☐ NA	
Access routes used by airport and airline support vehicles affected by the project are addressed.	207.a(3)	☐ Yes	☐ No	☐ NA	
Underground utilities, including water supplies for fire fighting and drainage.	207.a(4)	☐ Yes	☐ No	☐ NA	
Approach/departure surfaces affected by heights of temporary objects are addressed.	207.a(5)	☐ Yes	☐ No	☐ NA	
Construction areas, storage areas, and access routes near runways, taxiways, aprons, or helipads are properly depicted on drawings.	207.a	☐ Yes	☐ No	☐ NA	
Temporary changes to taxi operations are addressed.	207.b(1)	☐ Yes	☐ No	☐ NA	

Coordination	Reference	Addressed			Remarks
Detours for ARFF and other airport vehicles are identified.	207.b(2)	☐ Yes	☐ No	☐ NA	
Maintenance of essential utilities and underground infrastructure is addressed.	207.b(3)	☐ Yes	☐ No	☐ NA	
Temporary changes to air traffic control procedures are addressed.	207.b(4)	☐ Yes	☐ No	☐ NA	
NAVAIDS					
Critical areas for NAVAIDs are depicted on drawings.	208	☐ Yes	☐ No	☐ NA	
Effects of construction activity on the performance of NAVAIDS, including unanticipated power outages, are addressed.	208	☐ Yes	☐ No	☐ NA	
Protection of NAVAID facilities is addressed.	208	☐ Yes	☐ No	☐ NA	
The required distance and direction from each NAVAID to any construction activity is depicted on drawings.	208	☐ Yes	☐ No	☐ NA	
Procedures for coordination with FAA ATO/Technical Operations, including identification of points of contact, are included.	208, 213.a, 213.e(3)(a), 218.a	☐ Yes	☐ No	☐ NA	
Contractor Access					
The CSPP addresses areas to which contractor will have access and how the areas will be accessed.	209	☐ Yes	☐ No	☐ NA	
The application of 49 CFR Part 1542 Airport Security, where appropriate, is addressed.	209	☐ Yes	☐ No	☐ NA	
The location of stockpiled construction materials is depicted on drawings.	209.a	☐ Yes	☐ No	☐ NA	
The requirement for stockpiles in the ROFA to be approved by FAA is included.	209.a	☐ Yes	☐ No	☐ NA	
Requirements for proper stockpiling of materials are included.	209.a	☐ Yes	☐ No	☐ NA	

Coordination	Reference	Addressed			Remarks
Construction site parking is addressed.	209.b(1)	☐ Yes	☐ No	☐ NA	
Construction equipment parking is addressed.	209.b(2)	☐ Yes	☐ No	☐ NA	
Access and haul roads are addressed.	209.b(3)	☐ Yes	☐ No	☐ NA	
A requirement for marking and lighting of vehicles to comply with AC 150/5210-5, Painting, Marking and Lighting of Vehicles Used on an Airport, is included.	209.b(4)	☐ Yes	☐ No	☐ NA	
Proper vehicle operations, including requirements for escorts, are described.	209.b(5), 209.b(6)	☐ Yes	☐ No	☐ NA	
Training requirements for vehicle drivers are addressed.	209.b(7)	☐ Yes	☐ No	☐ NA	
Two-way radio communications procedures are described.	209.b(9)	☐ Yes	☐ No	☐ NA	
Maintenance of the secured area of the airport is addressed.	209.b(10)	☐ Yes	☐ No	☐ NA	
Wildlife Management					
The airport operator's wildlife management procedures are addressed.	210	☐ Yes	☐ No	☐ NA	
Foreign Object Debris Management					
The airport operator's FOD management procedures are addressed.	211	☐ Yes	☐ No	☐ NA	
Hazardous Materials Management					
The airport operator's hazardous materials management procedures are addressed.	212	☐ Yes	☐ No	☐ NA	
Notification of Construction Activities					
Procedures for the immediate notification of airport user and local FAA of any conditions adversely affecting the operational safety of the airport are detailed.	213	☐ Yes	☐ No	☐ NA	

Coordination	Reference	Addressed			Remarks
Maintenance of a list by the airport operator of the responsible representatives/points of contact for all involved parties and procedures for contacting them 24 hours a day, seven days a week is specified.	213.a	☐ Yes	☐ No	☐ NA	
A list of local ATO/Technical Operations personnel is included.	213.a	☐ Yes	☐ No	☐ NA	
A list of ATCT managers on duty is included.	213.a	☐ Yes	☐ No	☐ NA	
A list of authorized representatives to the OCC is included.	213.b	☐ Yes	☐ No	☐ NA	
Procedures for coordinating, issuing, maintaining and cancelling by the airport operator of NOTAMS about airport conditions resulting from construction are included.	208, 213.b, 218.b(4)(i)	☐ Yes	☐ No	☐ NA	
Provision of information on closed or hazardous conditions on airport movement areas by the airport operator to the OCC is specified.	213.b	☐ Yes	☐ No	☐ NA	
Emergency notification procedures for medical, fire fighting, and police response are addressed.	213.c	☐ Yes	☐ No	☐ NA	
Coordination with ARFF personnel for non-emergency issues is addressed.	213.d	☐ Yes	☐ No	☐ NA	
Notification to the FAA under 14 CFR parts 77 and 157 is addressed.	213.e	☐ Yes	☐ No	☐ NA	
Reimbursable agreements for flight checks and/or design and construction for FAA owned NAVAIDs are addressed.	213.e(3)(b)	☐ Yes	☐ No	☐ NA	
Inspection Requirements					
Daily inspections by both the airport operator and contractor are specified.	214.a	☐ Yes	☐ No	☐ NA	
Final inspections at certificated airports are specified when required.	214.b	☐ Yes	☐ No	☐ NA	
Underground Utilities					
Procedures for protecting existing underground facilities in excavation areas are described.	215	☐ Yes	☐ No	☐ NA	

Coordination	Reference	Addressed			Remarks
Penalties					
Penalty provisions for noncompliance with airport rules and regulations and the safety plans are detailed.	216	☐ Yes	☐ No	☐ NA	
Special Conditions					
Any special conditions that affect the operation of the airport or require the activation of any special procedures are addressed.	217	☐ Yes	☐ No	☐ NA	
Runway and Taxiway Visual Aids - Marking, Lighting, Signs, and Visual NAVAIDs					
The proper securing of temporary airport markings, lighting, signs, and visual NAVAIDs is addressed.	218.a	☐ Yes	☐ No	☐ NA	
Frangibility of airport markings, lighting, signs, and visual NAVAIDs is specified.	218.a, 218.c, 219, 220.b(4)	☐ Yes	☐ No	☐ NA	
The requirement for markings to be in compliance with AC 150/5340-1, Standards for Airport Markings is specified.	218.b	☐ Yes	☐ No	☐ NA	
The requirement for lighting to conform to AC 150/5340-30, Design and Installation Details for Airport Visual Aids, AC 150/5345-50, Specification for Portable Runway and Taxiway Lights , and AC 150/5345-53 Airport Lighting Certification Program, is specified.	218.b(1)(f)	☐ Yes	☐ No	☐ NA	
The use of a lighted X is specified where appropriate.	218.b(1)(b), 218.b(3)	☐ Yes	☐ No	☐ NA	
The requirement for signs to conform to AC 150/5345-44, Specification for Runway and Taxiway Signs, AC 50/5340-18, Standards for Airport Sign Systems, and AC 150/5345-53, Airport Lighting Certification Program, is specified.	218.c	☐ Yes	☐ No	☐ NA	
Marking and Signs For Access Routes					
The CSPP specifies that pavement markings and signs intended for construction personnel should conform to AC 150/5340-18 and, to the extent practicable, with the MUTCD and/or State highway specifications.	219	☐ Yes	☐ No	☐ NA	
Hazard Marking and Lighting					
Prominent, comprehensible warning indicators for any area affected by construction that is normally accessible to aircraft, personnel, or vehicles are specified.	220.a	☐ Yes	☐ No	☐ NA	

Coordination	Reference	Addressed			Remarks
Hazard marking and lighting are specified to identify open manholes, small areas under repair, stockpiled material, and waste areas.	220.a	☐ Yes	☐ No	☐ NA	
The CSPP considers less obvious construction-related hazards.	220.a	☐ Yes	☐ No	☐ NA	
Equipment that poses the least danger to aircraft but is sturdy enough to remain in place when subjected to typical winds, prop wash and jet blast is specified.	220.b(1)	☐ Yes	☐ No	☐ NA	
The spacing of barricades is specified such that a breach is physically prevented barring a deliberate act.	220.b(1)	☐ Yes	☐ No	☐ NA	
Red lights meeting the luminance requirements of the State Highway Department are specified.	220.b(2)	☐ Yes	☐ No	☐ NA	
Barricades, temporary markers, and other objects placed and left in areas adjacent to any open runway, taxiway, taxi lane, or apron are specified to be as low as possible to the ground, and no more than 18 in high.	220.b(4)	☐ Yes	☐ No	☐ NA	
Barricades marked with diagonal, alternating orange and white stripes are specified to indicate construction locations in which no part of an aircraft may enter.	220.b(4)	☐ Yes	☐ No	☐ NA	
Highly reflective barriers with lights are specified to barricade taxiways leading to closed runways.	220.b(5)	☐ Yes	☐ No	☐ NA	
Markings for temporary closures are specified.	220.b(5)	☐ Yes	☐ No	☐ NA	
The provision of a contractor's representative on call 24 hours a day for emergency maintenance of airport hazard lighting and barricades is specified.	220.b(7)	☐ Yes	☐ No	☐ NA	
Protection of Runway and Taxiway Safety Areas					
The CSPP clearly states that no construction may occur within a safety area while the associated runway or taxiway is open for aircraft operations.	221.a(1), 221.c(1)	☐ Yes	☐ No	☐ NA	
The CSPP specifies that the airport operator coordinates the adjustment of RSA or TSA dimensions with the ATCT and the appropriate FAA Airports Regional or District Office and issues a local NOTAM.	221.a(2), 221.c(2)	☐ Yes	☐ No	☐ NA	

Coordination	Reference	Addressed			Remarks
Procedures for ensuring adequate distance for protection from blasting operations, if required by operational considerations, are detailed.	221.c(3)	☐ Yes	☐ No	☐ NA	
The CSPP specifies that open trenches or excavations are not permitted within a safety area while the associated runway or taxiway is open.	221.a(4)	☐ Yes	☐ No	☐ NA	
Appropriate covering of excavations in the RSA or TSA that cannot be backfilled before the associated runway or taxiway is open is detailed.	221.a(4)	☐ Yes	☐ No	☐ NA	
The CSPP includes provisions for prominent marking of open trenches and excavations at the construction site.	221.a(4)	☐ Yes	☐ No	☐ NA	
Grading and soil erosion control to maintain RSA/TSA standards are addressed.	221.c(5)	☐ Yes	☐ No	☐ NA	
The CSPP specifies that equipment is to be removed from the ROFA when not in use.	221.b	☐ Yes	☐ No	☐ NA	
The CSPP clearly states that no construction may occur within a taxiway safety area while the taxiway is open for aircraft operations.	221.c	☐ Yes	☐ No	☐ NA	
Appropriate details are specified for any construction work to be accomplished in a taxiway object free area.	221.d	☐ Yes	☐ No	☐ NA	
Measures to ensure that personnel, material, and/or equipment do not penetrate the OFZ or threshold siting surfaces while the runway is open for aircraft operations are included.	221.e	☐ Yes	☐ No	☐ NA	
Provisions for protection of runway approach/departure areas and clearways are included.	221.f	☐ Yes	☐ No	☐ NA	
Other Limitations on Construction					
The CSPP prohibits the use of open flame welding or torches unless adequate fire safety precautions are provided and the airport operator has approved their use.	222.a(2)	☐ Yes	☐ No	☐ NA	
The CSPP prohibits the use of flare pots within the AOA at any time.	222.a(4)	☐ Yes	☐ No	☐ NA	
The CSPP prohibits the use of electrical blasting caps on or within 1,000 ft (300 m) of the airport property.	222.a(3)	☐ Yes	☐ No	☐ NA	

Appendix 4. Construction Project Daily Safety Inspection Checklist

The situations identified below are potentially hazardous conditions that may occur during airport construction projects. Safety area encroachments, unauthorized and improper ground vehicle operations, and unmarked or uncovered holes and trenches near aircraft operating surfaces pose the most prevalent threats to airport operational safety during airport construction projects. The list below is one tool that the airport operator or contractor may use to aid in identifying and correcting potentially hazardous conditions. It should be customized as appropriate for each project.

Potentially Hazardous Conditions

Item	Action Required	or	None
Excavation adjacent to runways, taxiways, and aprons improperly backfilled.			☐
Mounds of earth, construction materials, temporary structures, and other obstacles near any open runway, taxiway, or taxi lane; in the related Object Free area and aircraft approach or departure areas/zones; or obstructing any sign or marking.			☐
Runway resurfacing projects resulting in lips exceeding 3 in (7.6 cm) from pavement edges and ends.			☐
Heavy equipment (stationary or mobile) operating or idle near AOA, in runway approaches and departures areas, or in OFZ.			☐
Equipment or material near NAVAIDs that may degrade or impair radiated signals and/or the monitoring of navigation and visual aids. Unauthorized or improper vehicle operations in localizer or glide slope critical areas, resulting in electronic interference and/or facility shutdown.			☐
Tall and especially relatively low visibility units (that is, equipment with slim profiles) — cranes, drills, and similar objects — located in critical areas, such as OFZ and approach zones.			☐
Improperly positioned or malfunctioning lights or unlighted airport hazards, such as holes or excavations, on any apron, open taxiway, or open taxi lane or in a related safety, approach, or departure area.			☐
Obstacles, loose pavement, trash, and other debris on or near AOA. Construction debris (gravel, sand, mud, paving materials) on airport pavements may result in aircraft propeller, turbine engine, or tire damage. Also, loose materials may blow about, potentially causing personal injury or equipment damage.			☐

Item	Action Required	or	None
Inappropriate or poorly maintained fencing during construction intended to deter human and animal intrusions into the AOA. Fencing and other markings that are inadequate to separate construction areas from open AOA create aviation hazards.			☐
Improper or inadequate marking or lighting of runways (especially thresholds that have been displaced or runways that have been closed) and taxiways that could cause pilot confusion and provide a potential for a runway incursion. Inadequate or improper methods of marking, barricading, and lighting of temporarily closed portions of AOA create aviation hazards.			☐
Wildlife attractants — such as trash (food scraps not collected from construction personnel activity), grass seeds, tall grass, or standing water — on or near airports.			☐
Obliterated or faded temporary markings on active operational areas.			☐
Misleading or malfunctioning obstruction lights. Unlighted or unmarked obstructions in the approach to any open runway pose aviation hazards.			☐
Failure to issue, update, or cancel NOTAMs about airport or runway closures or other construction related airport conditions.			☐
Failure to mark and identify utilities or power cables. Damage to utilities and power cables during construction activity can result in the loss of runway / taxiway lighting; loss of navigation, visual, or approach aids; disruption of weather reporting services; and/or loss of communications.			☐
Restrictions on ARFF access from fire stations to the runway / taxiway system or airport buildings.			☐
Lack of radio communications with construction vehicles in airport movement areas.			☐
Objects, regardless of whether they are marked or flagged, or activities anywhere on or near an airport that could be distracting, confusing, or alarming to pilots during aircraft operations.			☐
Water, snow, dirt, debris, or other contaminants that temporarily obscure or derogate the visibility of runway/taxiway marking, lighting, and pavement edges. Any condition or factor that obscures or diminishes the visibility of areas under construction.			☐
Spillage from vehicles (gasoline, diesel fuel, oil) on active pavement areas, such as runways, taxiways, aprons, and airport roadways.			☐

Item	Action Required	or	None
Failure to maintain drainage system integrity during construction (for example, no temporary drainage provided when working on a drainage system).			☐
Failure to provide for proper electrical lockout and tagging procedures. At larger airports with multiple maintenance shifts/workers, construction contractors should make provisions for coordinating work on circuits.			☐
Failure to control dust. Consider limiting the amount of area from which the contractor is allowed to strip turf.			☐
Exposed wiring that creates an electrocution or fire ignition hazard. Identify and secure wiring, and place it in conduit or bury it.			☐
Site burning, which can cause possible obscuration.			☐
Construction work taking place outside of designated work areas and out of phase.			☐

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AIRPORT LIGHTING EQUIPMENT CERTIFICATION PROGRAM

FAA/AC 150-5345-53D

U.S. Department
of Transportation

Federal Aviation Administration

Advisory Circular

Subject: AIRPORT LIGHTING EQUIPMENT CERTIFICATION PROGRAM

Date: 9/26/2012
Initiated by: AAS-100

AC No: 150/5345-53D
Change:

1. PURPOSE. This advisory circular (AC) describes the Airport Lighting Equipment Certification Program (ALECP). It provides information on how an organization can get Federal Aviation Administration (FAA) acceptance as a third party certification body (third party certifier) and how manufacturers may get equipment qualified under the program. It includes a list of the equipments that are certified under the program. This AC does not impose requirements or mandate participation in the ALECP by any party. This revision to the AC is intended to clarify the criteria that FAA will use to determine whether a certification body qualifies for participation and how equipment may be qualified.

2. CANCELLATION. AC 150/5345-53C, *Airport Lighting Equipment Certification Program*, dated September 30, 2005, is cancelled.

3. BACKGROUND. Until December 31, 1989, the FAA administered the Airport Lighting Approval Program under the Federal airport grant programs. Under this program the FAA inspected equipment to confirm that it met FAA standards and to ensure quality control. The program was discontinued as of December 31, 1989, as a result of declining FAA resources. The listing of equipment in AC 150/5345-1, *Approved Lighting Equipment*, was no longer maintained.

On January 1, 1990, a new program was established which named a commercial testing laboratory under the oversight of an Industry Technical Advisory Committee (ITAC), as the program certification body. On May 15, 1995, the FAA, realizing that there were additional commercial laboratories that may want to participate as certification bodies instituted and established ALECP. This program provided that any commercial laboratory meeting certain criteria may participate as a certification body and provided for FAA oversight and acceptance of certification bodies.

Under the ALECP, the FAA has established a list of accepted certification bodies. The certification bodies evaluate and certify airport lighting equipment and license suppliers to mark qualifying products. The FAA maintained a list of certified equipment as part of the AC Addendum. This list was provided to assist airport sponsors in discharging their duty to determine that equipment met the applicable FAA specifications, which is required for eligibility for funding under Federal grant assistance program for airports and to assist the general public in identifying equipment meeting FAA requirements specified in referenced Advisory Circulars.

This AC, as a continuing refinement of the ALECP, institutes and establishes a recertification requirement for the equipment under ALECP (Appendix 2) and a list of the type of equipment with their applicable ACs that are under this program (Appendix 3). The FAA maintains on the Internet lists of currently certified equipment, of manufacturers' addresses, and of third party certifiers that can be used.

4. PRINCIPAL CHANGES. The following changes have been incorporated:

a. Paragraph 5, Acceptance Criteria: Updated to replace ANSI Z34.1, Third Party Certification Programs for Products, Processes, and Services with ISO/IEC Guide 65/ISO 17065.

b. Paragraph 8, Letter of Acceptance -- Letter validity is changed from 2 to 4 years.

c. Appendix 2, Paragraph 5, a, iv -- Modification of minimum warranty statement:
...during a period of 1 year from date of installation or "at least" 2 years from the date of shipment...

d. Appendix 2, Paragraph 5, c, ii, Recertification --The last sentence is deleted:
Interim limited testing associated with product modification or Advisory Circular revisions is not applicable toward recertification.

e. Appendix 2, Paragraph j, iv --Change:
... the third party certifier will obtain a production sample of the challenged product from the challenged manufacturer (either by purchase on the open market or by selection during a surprise visit).

f. Appendix 3 additions --
Add L-891, Frangible Support Structure (lower to service) (AC 150/5345-45)
Add L-892, Frangible Support Structure (lower to service) mounted on rigid steel tower (AC 150/5345-45)
Add L-893, Lighted Visual Aid to indicate runway closure (AC 150/5345-55)

g. Appendix 7 -- Add the following to the Certification Form (line 6) -- This Certificate is only confirmable in conjunction with equipment being listed in AC 150/5345-53, Appendix 3, Addendum, as currently published by the FAA.

5. INTERNET ACCESS. This AC, the latest certified equipment list, the address list of certified airport lighting equipment manufacturers, and list of third party certifiers are available on the Internet at: http://www.faa.gov/airports/. From the Airports page, select "Advisory Circulars," and continue to "AC 150/5345-53D Addendum."

MICHAEL J. O'DONNELL
Director of Airport Safety and Standards

AIRPORT LIGHTING EQUIPMENT CERTIFICATION PROGRAM

1. GENERAL. The FAA has established the Airport Lighting Equipment Certification Program (ALECP). Third party certification bodies found acceptable to the FAA implement this program. The program is primarily intended for equipment funded under the FAA airport grant program. The purpose of the program is to assist airport sponsors in discharging their duty to ensure that airport lighting equipment meets the applicable FAA standards for safety, performance, quality, and standardization.

2. COSTS. The program is funded entirely by fees paid by participating manufacturers. The fee schedule may be obtained from the third party certification body(s) listed in Appendix 1.

3. PROCEDURES. Manufacturers of lighting and visual aids equipment that desire to participate in the program may select any third party certification body from the list obtainable by direction in Appendix 1, Third Party Certification Bodies. An exclusive licensing agreement, as outlined in Appendix 2, paragraph 4, detailing the relationship between the manufacturer and the third party certification body and their respective responsibilities is then developed. A procedural guide as outlined in Appendix 2, paragraph 5, supplements the license agreement and describes the operational aspects of the program. The third party certification body under the procedures contained in Appendix 2, Third Party Certification Program and Procedures evaluates equipment. The manufacturer is issued a Certificate of Conformance by the third party certifier for each type of equipment that meets the applicable FAA standards. A copy of each Certificate of Conformance shall be submitted to the FAA by the third party certification body. On a monthly basis, the certified equipment will be added to Appendix 3 in the Addendum of this Advisory Circular, under the Internet home page for FAA Airports. Copies of this file may be obtained from the FAA Airport Engineering Division or from FAA Regional Airports and District/Field Offices (http://www.faa.gov/airports/news_information/contact_info/regional/).

4. THIRD PARTY CERTIFICATION BODY. In addition to administering the qualification program in accordance with this AC, a third party certification body must assure that the manufacturer provides and maintains a quality control system in accordance with FAA-STD-013, *Quality Control Program Requirements*, or suitable alternative, such as the ISO 9000 family of standards or Department of Defense quality standards. It must also assure that testing laboratories that perform qualification testing conform to the requirements of the International Organization for Standardization/ International Electrotechnical Commission (ISO/IEC) Guide 17025, "General Requirements for the Competence of Testing and Testing Laboratories."

5. ACCEPTANCE CRITERIA. An independent testing laboratory may become an FAA accepted third party certification body if it demonstrates conformance with the International Organization for Standardization (ISO) / International Electrotechnical Commission (IEC) Guide 65, General requirements for bodies operating product certification system/ISO 17065, and:

a. complies to FAA sponsored audit under the requirements of this AC;

b. demonstrates the ability and competency to perform required testing in the areas of electrical, mechanical, environmental, and photometry;

c. has been in operation as a third party certification body for a minimum of 3 years;

d. has a permanent assigned staff, knowledgeable in photometrics, if required for the scope of services offered and other disciplines related to testing and quality control;

e. is under the supervision of a professional (Bachelor of Science Degree in related field; i.e., engineering, physics, physical science, etc.) with a minimum 4 years of experience in interpreting testing standards/specifications, test methods; and evaluating test reports and quality assurance programs.

6. APPLICATION. To be listed as a third party certification body, the certification body must agree to undergo an assessment to determine if it qualifies. The FAA will provide application information upon request. Requests should be submitted to:

Federal Aviation Administration
Airport Engineering Division, AAS-100
800 Independence Ave., SW
Washington, DC 20591

The following information must be submitted with the application:

a. summary of background as a third party certification body;

b. documentation confirming the laboratory has competency in testing in related disciplines; (ANSI audit report, etc.);

c. resumes of permanent staff members who will be assigned to the certification program;

d. draft copy of procedural guide and licensing agreement for the Airport Lighting Equipment Certification Program. A schedule of fees does not have to be included in the licensing agreement.

7. INSPECTION OF FACILITIES. Each participating third party certification body must agree to make facilities and program records available to the auditing party (per paragraph 5) for an initial compliance audit, and scheduled audits thereafter with reports including compliance with this AC to be provided to FAA. The FAA reserves the right to accompany the auditing party during the visit to the third party certifier for review of its program. The FAA also reserves the right to accompany the third party certification body to a manufacturer's facility or testing laboratory to witness qualification tests, quality assurance audits, site production tests, or inspections.

8. LETTER OF ACCEPTANCE. If the FAA determines that the third party certification body conforms to all criteria, a letter of acceptance will be issued to that body and they will be listed as stated in Appendix 1. A letter of acceptance by the FAA is valid for a period of 4 years. A third party certification body that wishes to continue in the program shall reapply by resubmitting the information called for in paragraph 6 above, and demonstrate successful compliance of scheduled audit. However, should a third party certifier make any changes in their program prior to that time, the FAA is to be notified and changes approved before said changes are implemented. Any questions concerning this program or the operation of any of the accepted third party certification bodies should be sent to:

Federal Aviation Administration
Airport Engineering Division, AAS-100
800 Independence Ave., SW
Washington, DC 20591

9. THIRD PARTY CERTIFICATION PROGRAM. Manufacturers of airport lighting equipment may request to participate in a third party certification program, be licensed by the third party certifier, and use a Certificate of Conformance as evidence that the Qualifying Equipment has been evaluated, tested to and meets the provisions of Appendix 2 of FAA AC 150/5345-53 (current revision) "Third Party Certification Program and Procedures." Products certified in the Program are included in the list of FAA "Certified Airport Equipment" in Appendix 3 in the Addendum of AC 150/5345-53 published by the FAA. Manufacturers submitting products for qualification must have a representative in North America to provide aftermarket services to purchasers of the equipment.

Requirements of Appendix 2 "Third Party Certification Program and Procedures" include:

a. Procedural Guide. The Procedural Guide describes the operational aspects of the third party certification program, the relationship between third party certifier and manufacturer, and the equipment qualification procedures.

b. License Agreement. The licensing agreement details the relationship between the manufacturer and the third party certifier, and their respective responsibilities in the program. A schedule of fees for participation in the program, including at a minimum the yearly Administrative Services fee and fees for quality control review and witnessing of tests will be part of the agreement.

c. Equipment Qualification. Manufacturers' equipment qualification tests must be conducted in accordance with guidelines of Appendix 2, "Third Party Certification Program and Procedures."

d. Certificate of Conformance. The third party certifier will issue a Certificate of Conformance to a licensed manufacturer upon successful equipment qualification. The Certificate of Conformance must be representative of the sample shown in Appendix 7.

10. CHALLENGE PROCEDURE: INTER-PROGRAM MANUFACTURERS. In the event the performance and/or design of a certified manufacturer's product is challenged by a manufacturer licensed by another third party certification body, the process below will be followed. The third party certifiers and FAA will maintain the confidentiality of each manufacturer. The costs associated with the challenge process are the responsibility of the challenger, not the FAA or third party certifier (see Appendix 2, paragraph 5j. for procedure). Testing can be accomplished or witnessed by either third party certifier.

a. The challenging manufacturer must submit to their third body certifier supporting documentation--outlining details of the challenge including applicable test data. The documentation must specify the section(s) of the applicable specification being challenged.

b. The challenger's third party certifier will evaluate the documentation and applicable test data to determine if the documentation supports the challenge. If the third party certifier determines that the supporting documentation is not sufficient, that data supplied with support documentation requires retesting with a witness, or additional testing is required, the third party certifier will notify the challenger. Costs associated with further activities are the responsibility of the challenger.

c. The third party certifier must submit a documentation package to the FAA.

d. Within 10 business days of submission to the FAA, the FAA will notify the challenged manufacturer's third party certifier, and forward submitted documentation to the challenged manufacturer's third party certifier.

e. Within 60 business days of notice by the FAA, the challenged manufacturer's third party certifier must submit to the FAA verification that the challenged product has been determined to be in compliance with the requirements of the applicable Advisory Circular and any related provisions of this AC. Activities culminating in data associated with the challenge are coordinated between the challenged party and their third party certifier.

f. If the product is found to be non-compliant, notification to rescind the product certification and/or details of corrective action plan will be submitted by the challenged manufacturer's third party certifier to the FAA. The challenged manufacturer's third party certifier must contact the challenged manufacturer and direct appropriate changes be made to all applicable support documentation, advertising media, and websites

g. The FAA will forward disposition documentation to the challenger's third party certifier.

h. The challenger's third party certifier will notify the challenger only of the completion of the challenge. Details of the challenge disposition may not be revealed to any party other than the third party certifiers and the FAA.

11. CHALLENGE PROCEDURE: THIRD PARTY CERTIFICATION BODY. If the FAA receives documentation from a third party certification body to support that another third party certification body is not performing in accordance with the minimum criteria of this AC, the FAA will notify the challenged party and investigate the charges. If the challenge is upheld, and the third party certifier is not performing in accordance with the criteria set forth in this Advisory Circular, at the end of 30 days, the FAA reserves the right to withdraw the letter of acceptance.

12. REVISION OF SPECIFICATIONS. The FAA may, at times, revise the specification for a particular equipment to reflect changing needs of aviation or of new technology. The process of specification revision is intended to allow for constructive interaction between the FAA and other affected parties.

a. The process of specification revision is generally as follows:

i. The FAA distributes a draft revised Advisory Circular to allow for comment from third party certifiers, certified manufacturers, and selected users of the equipment.

ii. Once the FAA has received comments, either a meeting of affected parties is scheduled for discussion of comments or resolution will be by direct communication based on the changes requested.

iii. The FAA distributes a second draft to all parties and posts it on the Internet for general comment from the public. Certified manufacturers in the program are advised of the posting.

iv. Once the FAA has considered all comments, FAA releases the new revised equipment specification as a new revised Advisory Circular.

v. The Advisory Circular will contain an effective date, normally 6 months from date of issue, at which time the prior equipment certification automatically expires unless the manufacturer has been requalified to the revised specification. Manufacturers will be informed by the FAA by letter and supplied a copy of the revised specification.

b. If a manufacturer has a form of new airport lighting technology to be considered for inclusion in a particular Advisory Circular, the following process is to be followed:

i. The manufacturer must coordinate with a third party certification body to determine the level of compliance with the existing Advisory Circular.

ii. The manufacturer/third party certifier must submit to the FAA the proposal for inclusion of the new technology into the Advisory Circular, including a detailed explanation of proposed changes.

iii. If the FAA determines that a revision to the Advisory Circular is required, the process listed in paragraph 12a above will be followed.

13. WITHDRAWAL OF LETTER OF ACCEPTANCE. In the event the third party certification body does not meet the criteria of this Advisory Circular, the FAA reserves the right to withdraw the letter of acceptance. A third party certifier may reapply for reinstatement after 3 months.

14. LISTING OF CERTIFIED AIRPORT LIGHTING EQUIPMENT. A listing of equipment that has been certified by third party certification bodies will be published on a monthly basis by the FAA under the Internet home page for Airports as an Addendum file to this Advisory Circular. FAA will update Appendix 3 of the Addendum only upon notification from the third party certifier.

This AC, the latest certified equipment list (Appendix 3), the address list of certified airport lighting equipment manufacturers (Appendix 4), and the list of third party certifiers (Appendix 1) are available at Internet address: http://www.faa.gov/airports/. From the Airports page, select “Advisory Circulars” and continue to “AC 150/5345-53D Addendum.”

APPENDIX 1. THIRD PARTY CERTIFICATION BODIES.

The Third Party Certification Bodies (Third Party Certifiers) meeting the requirements contained in this Advisory Circular and accepted are listed in Appendix 1in the Addendum to the AC on the Internet (see prior paragraph 14).

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APPENDIX 2. THIRD PARTY CERTIFICATION PROGRAM AND PROCEDURES.

1. BASIS OF QUALIFICATION PROGRAM. The purpose of the qualification program is to provide airport operators with a list of equipment that meets the required standards for safety, performance, quality, and standardization. Manufacturers of lighting and visual aids equipment that desire to participate in the program may select any third party certification body from the list contained in Appendix 1 in the Addendum Third Party Certification Bodies. Manufacturers of airport lighting equipment may request to be approved by a third party certifier and use a Certificate of Conformance as evidence that the Qualifying Equipment has been tested to and meets the requirements of this Appendix, "Third Party Certification Program and Procedures." Products certified in the Program are included in the list of FAA "Certified Airport Equipment" in Appendix 3 in the Addendum of this AC.

2. THIRD PARTY CERTIFIER'S ROLE. A testing laboratory accepted by the Federal Aviation Administration (FAA) as a third party certification body as defined in this Advisory Circular evaluates and certifies airport lighting equipment for manufacturers. The third party certification body, under the procedures contained in the Procedural Guide, evaluates equipment. The manufacturer is issued a Certificate of Conformance by the third party certifier for each type of equipment that meets the applicable FAA standards. A copy of each Certificate of Conformance must be submitted to the FAA by the third party certification body. FAA accepts this Program, and products qualified under this Program will be subsequently listed as certified equipment in Appendix 3 in the Addendum of this AC. The third party certification body may also serve the function of a testing laboratory when necessary or when requested by the manufacturer.

3. PARTICIPANT'S ROLE. The manufacturer must certify to the third party certifier by notarized affidavit that the equipment initially and continuously meets all provisions of the applicable FAA Advisory Circular. Any manufacturer of airport lighting equipment may participate by satisfying all program requirements and signing an exclusive license agreement with a third party certifier and paying the appropriate schedule of fees. The program is funded entirely out of fees paid by the manufacturers. A principal feature of the program is that it is accepted by the Federal Aviation Administration as a means of meeting the FAA equipment certification requirements. Manufacturers are subject to a quality audit and twice yearly quality assurance inspections by the third party certifier. Manufacturers submitting products for qualification must have a representative in North America to provide aftermarket services to purchasers of the equipment.

4. LICENSE AGREEMENT. An exclusive licensing agreement details the relationship between the manufacturer and the third party certification body and their respective roles. It is the responsibility of each manufacturer/participant to conduct its business related to a certified product in a manner which is consistent with the pertinent FAA Advisory Circular and the provisions of the Procedural Guide and License Agreement for this certification program. The Procedural Guide supplements the License Agreement.

Prior to entering into a License Agreement with an equipment manufacturer and issuance of the Certificate of Conformance, an initial quality audit in accordance with FAA-STD-013, "Quality Control Program Requirements," or suitable alternative, of the manufacturer and all manufacturing facilities must be performed by the third party certifier.

a. Any manufacturer of airport lighting equipment within the scope of the FAA Advisory Circular 150/5345 series may participate by satisfying all program requirements, including demonstrating that equipment produced is eligible for qualification. Upon entering the program, an initial facility audit will be scheduled. The facility audit must include a review of the manufacturer's Quality Control Program.

b. Each manufacturing facility of the Licensee and/or Licensee's subcontractor must be licensed individually (except for multiple operations under the same control located in the same city or within 30 miles of each other), and equipment therefrom tested, inspected and certified separately and apart from equipment manufactured in other facilities or branches of any Licensee.

5. PROCEDURAL GUIDE. The Procedural Guide supplements the License Agreement, describes the operational aspects of the third party certification program, and details the manufacturer requirements and equipment qualification process.

a. Equipment Qualification Request. Only complete systems of airport lighting equipment conforming to all the requirements of the applicable Advisory Circular(s) may be certified. No individual components of these systems may be considered for certification. Request for equipment qualification shall be submitted in writing to a third party certifier listed in Appendix 1 of this Advisory Circular. At a minimum, this request must include the following:

i. A list of the types, classes, styles, and sizes of equipment, along with the manufacturer's catalog number(s) for which qualification certification is requested. Manufacturer's catalog numbers must be representative of specific equipment certified and not a series of equipment. A list of equipment options should also be included when so specified in individual equipment specifications.

ii. Engineering assembly and schematic drawings of the equipment to permit determination of adherence to specification design requirements.

iii. A copy of the proposed test procedures and test data sheets, and a statement as to whether the manufacturer proposes to conduct the tests at its own facility, or the name and location of a third party testing laboratory where the tests are to be conducted. Third party certifier may provide testing services for the manufacturer. Since the third party certifier reserves the right to witness any or all tests, the manufacturer should not commence the tests without authorization from the third party certification body. The third party certifier may conduct initial inspections and audits of any laboratories used for testing. The third party certifier may elect to witness or waive the option to witness the tests. In any instance, the third party certifier must verify that laboratories conducting testing conform to the requirements of International Organization for Standardization /International Electrotechnical Commission (ISO/IEC) Guide 17025 for applicable testing. The manufacturer must give the third party certifier at least a 2 week notice prior to starting tests.

iv. A statement that the manufacturer agrees to provide the following minimum warranty for the equipment:

"That the equipment has been manufactured and will perform in accordance with applicable specifications and that any defect in design, materials, (excluding lamps), or workmanship which may occur during proper and normal use during a period of 1 year from date of installation or at least 2 years from date of shipment will be corrected by repair or replacement by the manufacturers f.o.b. factory."

v. A statement that the manufacturer agrees to provide and maintain a quality control program in accordance with FAA-STD-013 or suitable alternative such as ISO 9000 family of standards or Department of Defense quality standards. The manufacturer should provide a copy of the proposed quality control program.

vi. A copy of the proposed instruction manual for the equipment and a copy of each product listed Product Description Sheet (i.e. marketing material).

vii. Lamp life test procedure, if applicable, in accordance with Appendix 5.

b. Review Procedure for Qualification Testing Request. After receipt by the third party certifier of the request for equipment qualification documentation, the manufacturer will be notified as to whether the proposed test procedures, test data sheets, and other documentation are acceptable. Notification of acceptance, or of changes required for acceptance, will be made to the manufacturer.

c. Tests. All equipment and each configuration of equipment (for example: size, type, class, style, wattage, color) offered for certification to the program will be subject to the required qualification tests of each applicable Advisory Circular before it can be certified.

i. **Qualification Tests.** The tests may be conducted at the third party certifier laboratory, or witnessed by the third party certifier at the manufacturer's laboratory or at a third party laboratory. All testing laboratories utilized must conform to the requirements of the ISO/IEC Guide 17025, "General Requirements for the Competence of Testing and Testing Laboratories." Where the third party certifier waives the option to witness tests, the manufacturer must submit a certified copy of all test reports. Only test data collected after contact with the third party certifier may be utilized toward certification of equipment. The manufacturer must bear all associated costs.

ii. **Recertification.** Each piece of equipment must be requalified to the applicable Advisory Circular in its entirety every 8 years, or as specified in the applicable AC.

iii. **Equipment Requirements.** The equipment must meet all of the design requirements described in the applicable Advisory Circular. The third party certifier may require additional testing of equipment and/or system components to demonstrate compliance to design requirements in areas where qualification testing does not address a specific requirement.

iv. **Modification To Equipment.** Once an equipment type has been certified, the manufacturer may not make any changes in the equipment without submission of the changes to and recertification by the third party certification body. Requests for design or component changes must be submitted in writing to the third party certification body and must be accompanied by supporting documentation plus (if applicable) copies of the revised instruction manual pages, which reflect the proposed change. The third party certifier will review the modification. If acceptable and required, it will issue a revised Certificate of Conformance. Substitution of stock electrical items such as resistors, capacitors, which are identical in form, fit, and function and which are equal or better in quality and rating is permissible. Although such substitution does not necessarily require recertification, the manufacturer must supply the third party certifier a list of the substituted items for filing with the inspection records. This exception does not apply to light sources.

v. **Substitution of Lamp/Light Sources**. Once an equipment type has been certified, only the lamp or light sources (for example: a light emitting diode (LED) array) subjected to all applicable specifications per the applicable Advisory Circular, and as referenced in conjunction with equipment listed in AC150/5345-53 Appendix 3 in the Addendum as currently published by the FAA, Lamp Descriptions, may be utilized. When a manufacturer chooses to utilize an alternative lamp or light source (i.e. different OEM, wattage, voltage amperage, type) in any fixture, complete photometry and chromaticity testing, and any other testing related to light source/lamp operation must be conducted successfully.

vi. **Production Tests.** In addition to qualification tests and equipment requirements, each equipment specification requires some tests to be conducted on production units. The manufacturer must demonstrate/document acceptable production testing processes to the third party certifier during initial and annual Quality Assurance Audits. Records of production test results must be traceable to equipment serial numbers or production lots when not serialized and retained for a minimum period of 3 years.

vii. **Lamp Life Tests.** Within 6 months of certification, lamp life tests, if applicable, shall be conducted in accordance with the procedures contained in Appendix 5, Lamp Life Test Procedure.

d. Requirements for Certification. The manufacturer must be a licensee to have its equipment certified in the program. The equipment must successfully pass all qualification tests described in the applicable Advisory Circular. If a manufacturer has no product certified for a period of 180 days, or does not produce any certified product for a period of 180 days, that manufacturer may not be a licensee.

e. Product Acceptance. Prior to issuance of the Certificate of Conformance, the following documentation is required for review:

i. The written test report(s) covering all required testing and design verification.

ii. Within 6 months of certification, lamp life test procedure, if applicable, in accordance with Appendix 5.

iii. Required documentation as listed in paragraph 5a of Appendix 2.

iv. Each certified product's Listed Products Description Sheet (marketing material). Reference to "FAA" approval or certification is unacceptable. Reference to non-certified product characteristics or components must be denoted clearly as such.

After the last submittal of the required documentation, if acceptable, the manufacturer will be notified that the equipment is certifiable. The Certificate of Conformance is then issued. A complete file, containing all supporting documentation, must be maintained by the third party certifier for every certified product.

f. Quality Control. After the manufacturer has entered the program, inspections and audits will be conducted on a semi-annual basis at each manufacturing facility.

i. Quality Assurance Audit. Prior to licensing, and once annually thereafter, the manufacturing facility will be subjected to an in-depth Quality Audit. At a minimum, the audit must evaluate the following:

- Management Commitment Organization Documentation of the quality System
- Control of Procured Material
- Manufacturing Quality Controls
- Final Inspection and Testing
- Equipment Calibration and Maintenance
- Control of Non-conforming Material
- Corrective Action Program
- Handling, Packaging and Storage
- Product Identification
- Periodic Product Qualification
- Collection and Analysis of Field Performance Data

ii. Inspections. Production of certified equipment is audited annually to verify that the product is the same as the sample subjected to the qualification tests. It is intended that samples of all certified equipment produced in a given year be inspected.

a) The inspections may be scheduled or unannounced, at the option of the third party certifier.

b) Production test records must be made available for review for compliance to applicable FAA Advisory Circulars, and production testing may be witnessed by the third party certifier.

c) If equipment is not being produced during the inspection, production test records and test data will be reviewed.

d) After verbal review of findings with a designated representative of the manufacturer, a formal report documenting the inspection will be made by the third party certifier to the manufacturer detailing the status of certification and identifying any actions that are required to correct any deficiencies.

e) Nonconformance to specifications found during these inspections will result in suspension of the model, as certified, unless corrections are made. Additional inspections or testing may be necessary to resolve any suspension or withdrawal of certification.

g. Revision of Specifications. The FAA may, at times, revise the specification for a particular equipment to reflect changing needs of aviation or of new technology. The procedure for requalification of currently qualified equipment is the same as for the original qualification as discussed in Appendix 2, paragraph 5 with the following exceptions:

i. The manufacturer does not have to resubmit the quality control plan unless changed.

ii. Depending on the nature of an Advisory Circular revision, it may not be necessary to perform all qualification tests. The manufacturer must submit an action plan to the third party certifier, which will in turn complete an engineering review to determine the extent of testing required complying with the revised Advisory Circular.

h. Certificate of Conformance. The manufacturer must have a Certificate of Conformance (see Appendix 7) issued by the third party certifier verifying the acceptance of the equipment by the program. Optional labeling and/or other markings may be utilized, but is not recognized as proof of certification. The certification will be subject to the condition that it may be rescinded if:

i. The manufacturer fails to provide the required documentation.

ii. The manufacturer fails to honor the warranty or does not maintain quality control in accordance with the approved plan.

iii. The equipment has an unsatisfactory failure rate. Since reliable equipment is of prime importance to safety of airport operations, equipment that proves unreliable in use (as determined by the FAA) may be removed from the certified listing. The determination of unreliability will be based on judgment and experience with equipment of a like nature. Where any such equipment is deemed to have an unsatisfactory failure rate or is deficient in workmanship or materials, the FAA will notify the manufacturer in writing. The manufacturer must then notify the FAA in writing within 15 working days as to its plan of action for correcting the problem. If the manufacturer does not resolve the problem within a reasonable time (the time frame will, of necessity, be based on safety considerations and/or the nature of the problem), the manufacturer and third party certifier will be notified and the equipment will be removed from the certified listing. The FAA reserves the right to require the equipment to be subjected to any or all qualification tests when the equipment has been deemed unreliable.

iv. The manufacturer fails to perform the required production tests.

v. Changes are made in the equipment without approval from the third party certifier.

vi. The equipment specification is canceled or is revised and the manufacturer fails to requalify.

vii. The manufacturer is found not in conformance with the quality control requirements of paragraph 5f in this appendix or other program and licensing requirements.

viii. The equipment does not comply with the requirements for recertification (Appendix 2, paragraph 5c(ii)).

ix. The equipment is determined to be non-compliant as a result of a manufacturer challenge.

The third party certifier must notify the manufacturer and the FAA within 24 hours of any suspension or withdrawal of equipment. Non-conformance to FAA specifications found during inspection visits may result in suspension of the equipment model as certified unless corrections are made to the satisfaction of the third party certifier. Corrective action must be taken by the manufacturer. Manufacturers are given 15 working days to advise the third party certifier of corrective action to be taken, including a schedule for any necessary retesting and/or inspections. Corrective action schedules may not be longer than 30 days.

i. Infractions. It is the responsibility of each manufacturer to conduct its business related to the program in a manner which is consistent with the pertinent FAA Advisory Circular(s) and the provisions of the Program Procedural Guide and License Agreement.

Appropriate sanctions may be imposed by the third party certifier if it is determined that a manufacturer within their program is manufacturing/marketing a product in a manner inconsistent with the program requirements. Penalties will be proportional to the offense or infraction.

j. Challenge Procedure - Intra-Program Manufacturer. In the event the performance and/or design of a certified manufacturer's product is challenged by a maufacturer licensed by the same third party certifier, the process below must be followed. The confidentiality of each manufacturer must be maintained by the third party certifier at all times. The challenged manufacturer's equipment will remain on the Certified Airport Lighting Equipment list while the challenge is underway.

i. The challenger must submit in writing by certified mail to the third party certifier supporting documentation outlining details of the challenge and applicable test data. The documentation must specify the section(s) of the particular specification being challenged.

ii. The third party certifier will estimate the full cost of testing and or audits that will be required to verify the challenge and invoice the challenger for that amount.

iii. The challenger must then agree to accept the challenge costs or discontinue the challenge.

iv. Within 30 days of the challenger's acceptance of costs, the third party certifier will obtain a production sample of the challenged product from the challenged manufacturer (either by purchase on the open market or by selection during a surprise visit). The third party certifier will then perform testing and/or audits within 15 days of procurement as necessary to confirm or deny the challenge.

v. An initial determination will be made by the third party certifier whether each challenged characteristic is controlled in manufacturing solely by the design of the product or by control of variation in the maufacturing process. Testing or auditing will be performed only on the challenged characteristics of the challenged model. Non-conformance found by test or audit will constitute challenge confirmation. If the challenge is confirmed, then the challenge applies to all other models from the manufacturer sharing the same design characteristics.

vi. If the characteristic is controlled solely by design, testing of a randomly acquired unit should be sufficient to confirm or deny the challenge.

vii. If the characteristic is also controlled by process (i.e., by adjustments, set up, technique, methods) an audit at the maufacturer's facility will be performed.

viii. After a challenge confirmation (test or audit failure), the third party certifier must notify the challenged party and the challenger within 24 hours. A challenged product may not be shipped until corrective action and/or a retest is completed.

ix. Upon failure of tests, the challenged party is given 15 days working days to correct the discrepancy and submit the product for retest. The third party certifier will use the means necessary (e.g., testing and auditing) to assure that the subsequent modifications by the manufacturerer to meet FAA specification did not adversely affect any other performance characteristics, and that tests, inspections, and/or procedures are in practice at the challenged manufacturer's facility to assure 100% product conformance to specifications.

x. Upon failure of an audit, the challenged party, within the same 15 day period, must submit a detailed auditable test/inspection plan to control the characteristics. The third party certifier will increase the frequency of facility visits to assure conformance to approved plan.

xi. If no redesigned product is submitted within the 15 day period, or the resubmitted product fails any test, or no acceptable test/inspection plan (if required) is submitted within the 15 day period, then the product will be removed from the Certified Equipment List until full qualification tests are performed on the resubmitted product. The FAA, challenger, and challenged manufacturer are notified by the third party certifier.

xii. Equipment utilized in the challenge becomes the property of the third party certifier and will be destroyed 90 days after completion of the challenge process.

xiii. The full costs of the challenge procedure must be paid by the challenger or the challenged manufacturer. If the challenge is found to have merit, the challenged party pays all costs plus any costs for

requalification testing and/or follow up facility audits. If the challenge is without merit, the challenger pays all costs associated with the challenge.

k. Appeals Procedure. A manufacturer who is affected by an adverse determination by their third party certifier with respect to its certified equipment or its participation in the program may appeal the determination to the third party certification body per the guidelines detailed in the third party certifier's procedural guide.

l. Forms. The use and function of forms to be used in administering the program shall be addressed in the third party certifier's procedural guide. The Certificate of Conformance must follow the sample shown in Appendix 7.

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APPENDIX 3. CERTIFIED AIRPORT LIGHTING EQUIPMENT.

NOTICE TO USERS

This appendix provides a list of the current equipment under the certification program. The specification for each type of equipment listed below in this document is contained in the AC given. The equipment specification defines the type, class, and style classifications used in the listing. Not all combinations of type, class, and style are permissible. The equipment specification should be consulted for approved equipment configurations.

An addendum to this appendix listing all current certified equipment with the manufacturer is updated monthly. It is available on the Internet at http://www.faa.gov/airports/ under "Advisory Circulars" in the file titled "150/5345-53 Addendum". This addendum can also be obtained from the Office of Airport Safety and Standards, Attention: AAS-100, Federal Aviation administration, 800 Independence Ave., SW, Washington, DC or from FAA Regional Airports and District/Field Offices:

http://www.faa.gov/airports/news_information/contact_info/regional/

Users should consult equipment manufacturers' catalogs or literature for complete ordering. For each fixture listed in the addendum, the number in parentheses ( ) after the manufacturer's catalog number indicates the specific lamp type used in testing the equipment. A description of each lamp used is provided in the addendum.

For latest approved equipment specification go to the Internet address list above for ACs.

L-801 Beacons, Medium Intensity (AC 150/5345-12)

L-802 Beacons, High Intensity (AC 150/5345-12)

L-804 Light, Holding Position Edge (AC 150/5345-46)

L-806 Wind Cones, Frangible (AC 150/5345-27)

L-807 Wind Cones, Rigid (AC 150/5345-27)

L-810 Lights, Obstruction (AC 150/5345-43)

L-821 Panel, Airport Lighting Control (AC 150/5345-3)

L-823 Connectors, Cable (AC 150/5345-26)

L-824 Underground Electrical Cable for Airport Lighting Circuits (AC 150/5345-7)

L-827 Monitors, Regulator (AC 150/5345-10)

L-828 Regulators, Constant Current (AC 150/5345-10)

L-829 Regulators, Monitored Constant Current (AC 150/5345-10)

L-830 Isolation Transformers, 60Hz (AC 150/5345-47)

L-831 Isolation Transformers, 50Hz (AC 150/5345-47)

L-841 Cabinet, Auxiliary Relay (AC 150/5345-13)

L-847 Switch, Circuit Selector (AC 150/5345-5)

L-849 Lights, Runway End Identification (AC 150/5345-51)

L-850 Lights, Runway, Inpavement (AC 150/5345-46)

L-852 Lights, Taxiway, Inpavement (AC 150/5345-46)

L-853 Markers, Retroreflective (AC 150/5345-39)

L-854 Radio Controls (AC 150/5345-49)

L-856 Lights, Obstruction, High Intensity, White, 40 FPM (AC 150/5345-43)

L-857 Lights, Obstruction, High Intensity, White, 60 FPM (AC 150/5345-43)

L-858 Signs, Runway and Taxiway (AC 150/5345-44)

L-859 Lights, Flashing, Omnidirectional (AC 150/5345-51)

L-860 Lights, Runway Edge, Low Intensity (AC 150/5345-46)

L-861 Lights, Runway & Taxiway Edge, Medium Intensity (AC 150/5345-46)

L-862 Lights, Runway Edge, High Intensity (AC 150/5345-46)

L-863 Lights, Portable Runway (AC 150/5345-50)

L-864 Lights, Obstruction, Red, 20-40 FPM (AC 150/5345-43)

L-865 Lights, Obstruction, Medium Intensity, White, 40 FPM (AC 150/5345-43)

L-866 Lights, Obstruction, Medium Intensity, White, 60 FPM (AC 150/5345-43)

L-867 Light Base, Non-Load Bearing (AC 150/5345-42)

L-868 Light Base, Load Bearing (AC 150/5345-42)

L-880 Precision Approach Path Indicator (AC 150-5345-28)

L-881 Abbreviated Precision Approach Path Indicator (AC 150/5345-28)

L-882 Generic Visual Approach Descent Indicator (AC 150/5345-52)

L-883 Generic Visual Approach Descent Indicator (AC 150/5345-52)

L-884 Power and Control Unit for Land and Hold Short Lighting Systems (AC 150/5345-54)

L-885 Lights, Obstruction (AC 150/5345-43)

L-890 Airport Lighting Control and Monitoring Systems (AC 150/5345-56)

L-891 Frangible Support Structure (lower to service) (AC 150/5345-45)

L-892 Frangible Support Structure (lower to service) mounted on a rigid steel tower (AC 150/5345-45)

L-893 Lighted Visual Aid to indicate runway closure (AC 150/5345-55)

APPENDIX 4. ADDRESS LIST OF CERTIFIED AIRPORT LIGHTING EQUIPMENT MANUFACTURERS.

An addendum to this appendix, listing all current certified equipment manufacturer's addresses, is updated monthly. The addendum is available on the Internet at http://www.faa.gov/airports/ under "Advisory Circulars" in the file titled "150/5345-53C Addendum." The addendum can also be obtained from the Office of Airport Safety and Standards, Attention: AAS-100, Federal Aviation administration, 800 Independence Ave., SW, Washington, DC 20591, or from FAA Regional Airports and District/Field Offices (http://www.faa.gov/airports/news_information/contact_info/regional/).

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APPENDIX 5. LAMP LIFE TEST PROCEDURE.

1. PURPOSE. This appendix specifies a test method for establishing lamp life for airport lighting fixtures. This procedure shall be accomplished on each new fixture, design or on any design change which will affect lamp life.

2. SCOPE. This procedure shall be performed on all lamps having a specified lamp useful life of 8,750 hours or less.

3. DEFINITIONS. The following terms are defined for the purpose of this procedure:

a. RATED LAMP LIFE. The mean life of the lamp while installed and operated in a lighting fixture as established by test and calculation described in this procedure.

b. LAMP USEFUL LIFE. The portion of the lamp operating characteristic where the photometric output of the lamp operating in the fixture is within specification requirements.

c. LAMP OPERATING TIME. The time that electrical service to the lighting system is on and contacts to lamp circuits are closed.

d. ACCELERATED TESTING. The testing technique used to compress the time to operate a lamp to end of useful life while under test. A correlation between performance of the lamp under normal operating conditions and the conditions for accelerated testing must be established. Note: Accelerated testing cannot be performed on tungsten halogen lamps***, or any other current controlled lamp***.

4. CONDITIONAL CERTIFICATION OF EQUIPMENT. Equipment submitted for qualification testing prior to completion of lamp life tests may be given a conditional certification if the following conditions have been met:

a. The lighting fixture manufacturer has submitted its written procedure for conducting the lamp life tests in accordance with paragraph 5 below.

b. A schedule for conducting the tests has been established.

c. The procedure has been reviewed and approved by a third party certification body.

If a conditional certification has been given for a piece of equipment and it subsequently does not pass the lamp life tests, the certification will be rescinded.

5. TEST SPECIFICATION. The test procedure is divided into two parts: normal and accelerated testing. Although normal testing is preferred, accelerated testing is acceptable under special circumstances. When accelerated testing is performed, the test shall be backed up with a normal test as soon as practical. Accelerated test reports shall include a schedule indicating when normal testing will be completed. Normal testing may be waived by the third party certifier if a correlation, verified by test, exists.

The lighting fixture manufacturer shall use the most conservative lamp designer's life rating, derated by 15 percent, in determining lamp life. No credit shall be given for any techniques or devices used to extend lamp life. Lamp life shall be quoted as "Lamp life estimated" during this period.

a. Normal Testing.

(1) The test shall consist of a minimum of 10 randomly selected lamps installed in the fixture for which life data is being established. If additional lamps are to be tested, the tests shall be performed in multiples of 10 lamps.

(2) Lamps shall be installed in the fixture and tested in the configuration which simulates the actual "as installed" condition of the light system (e.g., in-pavement lights should be tested with the lamp fixture installed on the smallest base can which in turn is buried in a non-heat absorbing medium, such as sand).

(3) Where lighting system power conditioning equipment is located remote from lamp units in the field, cabling between lamp and system components shall be shortest allowed by design.

(4) A light system shall be operated at highest lamp manufacturer rated voltage or current using approved regulators or a current supply having one percent regulation. The duty cycle shall consist of 20 hours lamp operating time and 4 hours deenergized. A voltage controlled system shall be operated from a supply having three percent regulation.

(5) Testing shall continue until 90 percent of all lamps have reached the end of useful life.

(6) Tests shall be performed in a controlled environment at an ambient temperature between 60 and 80 degrees Fahrenheit.

(7) Electrical service voltage and current; lamp voltage and current; and for discharge type lights, pulse train wave shape and frequency shall be randomly recorded using calibrated instruments during the test period to verify that control circuits are functioning and that input energy is maintained within tolerance. As a minimum, these parameters shall be checked twice a week.

(8) A daily log shall be maintained at the test site. The log shall record lamp condition (e.g., whether the photometric output of the lamp exceeds minimum specification requirements), date, time, comments, and person performing the check.

(9) The pulse train wave shapes shall be monitored regularly during the duty cycle for discharge type lamps. Out-of-tolerance condition shall be logged. As a minimum, the following shall be monitored for out of tolerance conditions:

(a) Pulse train wave shape.

(b) Pulse train frequency.

(c) Voltage or current to lamp circuits.

b. Accelerated Testing.

(1) Accelerated testing shall be conducted in acordance with the applicable IES guideline on voltage controlled lamps only. Accelerated testing may be performed when normal testing is estimated to exceed 180 calendar days or to provide a basis for estimating lamp life on short notice, such as when evaluating new designs. Under no circumstances should accelerated testing reduce the normal test time by more than 1/3 of the normal test time based on lamp manufacturer life estimates. All accelerated tests shall be followed by normal testing in accordance with paragraph 5a to establish a correlation between accelerated and normal test rated lamp life test results.

(2) Accelerated tests shall follow the procedure described in paragraph 5a with the exception that the appropriate parameters are increased so that the estimated test time is reduced as specified above.

(3) In addition to the documentation requirements defined below, the testing authority should provide the rationale for selecting the parameters for the accelerated tests. Lamp vendor data shall form the basis for the rationale.

6. ANALYSIS OF DATA.

a. Form a list of the 90 percent of the lamps which have reached the end of lamp useful life. The list should include lamp number and lamp operating time as calculated below. This information should be arranged in ascending order of lamp operating time.

b. Lamp operating time is calculated by multiplying the number of full days that the lamp was operating by 20 (hours).

c. Delete the lamps with the 10 percent lowest lamp operating times from the calculations below.

d. Calculate the mean and standard deviation for the 80 percent of the lamps remaining on the list.

e. If the standard deviation is greater than 50 percent of the mean, delete the lamps with the 10 percent highest and 10 percent lowest lamp operating times from the table. Recalculate the mean and standard deviation for the remaining 60 percent of the lamps on the list.

f. Lamp life is the mean calculated above, rounded to the nearest 50 hours.

7. DOCUMENTATION. A test report documenting the test results and containing a copy of' the calculations shall be prepared. As a minimum, the report shall include the information listed below.

a. A drawing or sketch of the test setup indicating installation of the test fixture(s), instrumentation, and a block diagram indicating all electrical interconnections. This drawing shall be of sufficient detail so that an independent laboratory may perform the test and replicate the test results.

b. A calculation sheet indicating number of days each lamp operated, lamp operating hours, and data used in calculating the mean and standard deviation.

c. Copy of all wave shapes recorded in paragraph 5a(9) with calibration markings.

d. A description of all malfunctions which occurred during the test period including type of malfunction, date of occurrence, corrective action taken, and quality assurance concurrence on resolution.

e. A summary of the pulse train out-of-tolerance conditions shall be included. The summary shall list specific type of out-of-tolerance condition, number of times occurred, and frequency of occurrence.

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APPENDIX 6. PROCEDURAL GUIDE OUTLINE.

1. SCOPE.

- **a.** Basis of Program
- **b.** Certifier's Role
- **c.** Manufacturer's Role
- **d.** FAA Role

2. LICENSE AGREEMENTS.

- **a.** License Agreement
- **b.** Fee schedule
- **c.** Certification Affidavit

3. EQUIPMENT QUALIFICATION PROCEDURES.

Use procedures in Appendix 2 as a guide.

4. SEMIANNUAL INSPECTIONS.

- **a.** Timing of Inspections
- **b.** Production Records
- **c.** Inspection Review Report
- **d.** Corrective Action
- **e.** FAA Notification

5. QUALITY CONTROL.

- **a.** Quality Assurance
- **b.** Quality Assurance Audit
- **c.** Inspections

6. PRODUCTION TESTING.

7. CHALLENGE PROCEDURE.

- **a.** Written Challenge
- **b.** Documentation
- **c.** Costs
- **d.** Sample Product
- **e.** Testing
- **f.** Corrective Action
- **g.** Payment

8. APPEALS PROCEDURE.

9. USE AND FUNCTION OF FORMS.

10. FORMS

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APPENDIX 1. THIRD PARTY CERTIFICATION BODIES.

The following Third Party Certification Bodies (Third Party Certifiers) have met the requirements contained in ADVISORY CIRCULAR 150/5345-53D, AIRPORT LIGHTING EQUIPMENT CERTIFICATION PROGRAM, dated 09/26/12 and have been accepted as Third Party Certifiers under the Airport Lighting Equipment Certification Program.

Intertek Testing Services
(Formerly ETL Testing Laboratories, Inc.)
3933 U.S. Route 11
Cortland, New York 13045
(607) 753-6711 or (800) 345-3851

THIS LISTING CONTAINS A COMPLETE UPDATE OF THE CERTIFIED EQUIPMENT AND MANUFACTURERS LISTS, ADDENDUM TO APPENDIX 3 AND APPENDIX 4, OF ADVISORY CIRCULAR 150/5345-53D, AIRPORT LIGHTING EQUIPMENT CERTIFICATION PROGRAM, DATED 09/26/12. EQUIPMENT NOT LISTED HERE, BUT LISTED IN PRIOR ADDENDUMS TO THE ADVISORY CIRCULAR HAVE BEEN DELETED.

Users should consult equipment manufacturers' catalogs or literature for complete ordering. For each lighting fixture listed in the addendum, the number in parentheses () after the manufacturer's catalog number indicates the specific lamp used in certification of the equipment. The (L), in parentheses (), the last letter after the L- number designation indicated a LED lamp required for the listed manufacturer part numbers.

L-801--Beacons, Medium Intensity
(AC 150/5345-12F)

Manufacturer	Manufacturer's Catalog Number					
	Type L-801A		Type L-801S		Type L-801H	
	Class 1	Class 2	Class 1	Class 2	Class 1	Class 2
Hali-Brite, Inc.	L801A1116 (252) (253) (350) (410)	L801A1216 (252) (253) (350) (410)			L801H7116 (410)	L801H7216 (410)
Manairco, Inc.	AB-1000D (88) AB-1000F (88)	AB-1000DA (88) AB-1000FA (88)				

L-802--Beacons, High Intensity
(AC 150/5345-12E)

Manufacturer	Manufacturer's Catalog Number							
	Type L-802A		Type L-802S		Type L-802H		Type L-802M	
	Class 1	Class 2	Class 1	Class 2	Class 1	Class 2	Class 1	Class 2
Hali-Brite Inc.	L802A6116 (208)	L802A6216 (208)			L801H7116 (410)	L801H7216 (410)	L802M6116 (327)	L802M6216 (327)

L-804--Light, Runway Guard
(AC 150/5345-46D)

Manufacturer	L-804	Mode	Manufacturer's Catalog Number
ADB Airfield Solutions, LLC		1	44A4744-1X11 (152)
	(L)	1	ERGL-11110 (328)(599), ERGL-31110 (328)(599)
		2	44A4744-2X12 (152), 44A4744-3X12 (152)
	(L)	2	ERGL-21120 (328), ERGL-41120 (328)
	(L)	2	ERGL-51120 (599), ERGL-61120 (599)
Airport Lighting Co.	(L)	1, 2	RGL-X-M-S (518)
Crouse-Hinds ALP		1	804E2-066-X-X(196)
	(L)	1, 2	804E4-066-X (433), 804E4-120-X (433)
Multi-Electric Mfg		1	6804-1-YY-X-X (127) (286)
		2	6804-2-YY-X-X (127) (286)

Any runway fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. **(L)** Indicates LED fixture. (###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment

L-806--Wind Cones, Frangible
(AC 150/5345-27D)

Manufacturer	L-806	Size	Manufacturer's Catalog Number	
			Externally Lighted	Unlighted
Crouse-Hinds ALP		1	71043 (276)(277)	71044
Point Lighting Corporation		1 1	PWC-8061L-1-ON (4#147) PWC-8061L-6 (97)	PWC-8061U-0-ON

L-806--Wind Cones, Frangible
(AC 150/5345-27E)

Manufacturer	L-806	Size	Manufacturer's Catalog Number		
			Lighted		Unlighted
			Style 1A External	Style 1B Internal	
ADB Airfield Solutions, LLC	(L) (L)	1 1	WC806-1CX0 (558) WC806-1EX0 (558)		WC806-10X0
Hali-Brite Inc.	(L) (L) (L)	1 1 1 1	L806-S1-EX-120-ON-N (226) L806-S1-EX-12-ON-5 (428) L806-S1-EX-120-ON-5 (427) L806-S1-EX-66A-ON-5 (429)	L-806-S1-IN-120-ON-5 (601) L-806-S1-IN-66A-ON-5 (602)	L806-S1-UN-NON-ON-N

Any fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. **(L)** Indicates LED fixture (###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment

L-807—Wind Cones, Rigid
(AC 150/5345-27D)

Manufacturer			Manufacturer's Catalog Number		
	L-807	Size	Lighted		Unlighted
			Style 1A External	Style 1B Internal	
Crouse-Hinds ALP		1	44481(276)(277)		44482
		1	44483(276); 44484(277)		
		2	48310(276)(277)		48311
		2	48312(276); 48313(277)		
Point Lighting Corp		1	PWC-8071L-1-ON (4/#147)		PWC-8071U-0-ON
		1	PWC-8071L-6 (97)		
		2	PWC-8072L-1-ON (6/#147)		PWC-8072U-0-ON

L-807—Wind Cones, Rigid
(AC 150/5345-27E)

Manufacturer	L-807	Size	Manufacturer's Catalog Number		
			Lighted		Unlighted
			Style 1A External	Style 1B Internal	
ADB Airfield Solutions, LLC	(L)	1	WC807-1XCX0(558)		WC807-1X0X0
	(L)	1	WC807-1XEX0(558)		
	(L)	2	WC807-2XCX0(558)	WC807-2XDX0 (558)	
	(L)	2	WC807-2XEX0(558)	WC807-2XBX0(558)	
		2		WC807-2X7X0(274)	WC807-2X0X0
Hali-Brite Inc.		1	L807-S1-EX-120-ON-N (226)		L807-S1-UN-NON-ON-N
	(L)	1	L807-S1-EX-120-ON-5 (427)	L807-S1-IN-120-ON-5 (601)	
	(L)	1	L807-S1-EX-12-ON-5 (428)	L807-S1-IN-66A-ON-5 (602)	
	(L)	1	L807-S1-EX-66A-ON-5 (429)		
		2	L807-S2-EX-120-ON-N (226)	L807-S2-IN-120-ON-N (434)	L807-S2-UN-NON-ON-N
	(L)	2	L807-S2-EX-120-ON-5 (430)	L807-S2-IN-66A-ON-3 (423)	
	(L)	2	L807-S2-EX-12-ON-5 (431)	L807-S2-IN-120-ON-5 (443)	
	(L)	2	L807-S2-EX-66A-ON-5 (432)		

Any fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. **(L)** Indicates LED fixture (###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment

L-810—Lights, Obstruction
(AC 150/5345-43F)

Manufacturer	L-810	Manufacturer's Catalog Number	
		Single unit	Double unit
Cooper Crouse Hinds	(L)	OX2LFSR/120 (174)	OX2LFDR/120 (174)
	(L)	OX2LFSR/240 (300)	OX2LFDR/240 (300)
Farlight LLC	(L)	L810LED-XXXX-XXX (283)(284)	L810LED-XXXX-XXX (283)(284)
	(L)	L-810LED1XXXX-XXX (283)(284)(349)	L810LED1-XXXX-XXX (283)(284)(349)
	(L)	L-810LED2-XXXX-XXX (283)(284)	L810LED2-XXXX-XXX (283)(284)
Specialty Tower Lighting Ltd.		SL-1 (32B)	

L-810—Lights, Obstruction
(AC 150/5345-43G)

Manufacturer	L-810	Manufacturer's Catalog Number	
		Single unit	Double unit
ADB Airfield Solutions LLC		44C1005-1 (267)	44C1007-1 (267)
	(L)	SBOL-1120 (441) (561), SBOL-1130 (441) (561)	SBOL-1320 (441) (561), SBOL-1330 (441) (561)
	(L)	SBOL-1140 (441) (561), SBOL-1220 (441) (561)	SBOL-1340 (441) (561), SBOL-1520 (441) (561)
	(L)	SBOL-1230 (441) (561), SBOL-1240 (441) (561)	SBOL-1530 (441) (561), SBOL-1540 (441) (561)
Avlite Systems	(L)	AV-OL-FL810-12-R (565)	AV-OL-FL810-12-R-D (565)
	(L)	AV-OL-FL810-12-RIR (566*)	AV-OL-FL810-12-RIR-D (566*)
	(L)	AV-OL-FL810-UM-R (567)	AV-OL-FL810-UM-R-D (567)
	(L)	AV-OL-FL810-UM-RIR (568*)	AV-OL-FL810-UM-RIR-D (568*)
Austin Insulators Inc.	(L)	A-L810 (411)	
Crouse-Hinds ALP		40940-R-116 (389)(506), 50033-R-116 (389)(506)	50021-R-116(389)(506)
Cooper Crouse Hinds	(L)	OWLFSR/120 (174)	OWLFDR/120 (174)
	(L)	OWLFSR/240 (300)	OWLFDR/240 (300)
	(L)	OWLFSR/12 (232)	OWLFDR/12 (232)
	(L)	OWLFSR/48 (234)	OWLFDR/48 (234)
	(L)	OWLFSR/24 (233)	OWLFDR/24 (233)
	(L)	RTLSF/120-240 (378)	RTLDF/120-240 (378)
	(L)	EOLRTL/120-240 (378)	RTLDF/12-48 (379)
	(L)	RTLSF/12-48 (379)	
	(L)	EOLRTL/12-48 (379)	
Dialight Corp	(L)	860-1R01-001 (174)	860-1R01-002 (174)
	(L)	860-1R02-001 (300)	860-1R02-002 (300)
	(L)	860-1R03-001 (232)	860-1R03-002 (232)
	(L)	860-1R04-001 (234)	860-1R04-002 (234)
	(L)	860-1R05-001 (233)	860-1R05-002 (233)
	(L)	860-2R01-001 (174)	860-2R01-002 (174)
	(L)	860-2R02-001 (300)	860-2R02-002 (300)

(L) Indicates LED fixture. Any fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. (###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment.

L-810—Lights, Obstruction
(AC 150/5345-43G)

Manufacturer	L-810	Manufacturer's Catalog Number	
		Single unit	Double unit
Dialight Corp	(L)	RTO-1R08-001 (379), RTO-1R08-004 (379)	RTO-1R08-002 (379)
	(L)	RTO-1R07-001 (378), RTO-1R07-004 (378)	RTO-1R07-002 (378)
	(L)	RTO-1R06-001 (377), RTO-1R06-004 (377)	RTO-1R06-002 (377)
	(L)	RTO-CR07-001 (438), RTO-CR08-001 (439)	RTO-CR07-002 (438)
	(L)	RTO-1R18-001 (456), RTO-1R18-004 (456)	RTO-CR08-002 (439), RTO-1R18-002 (456)
Farlight LLC	(L)	L810LED-XXXX-XXX (515*)	L810LED-XXXX-XXX (515*)
	(L)	NV-L810LED1-XXXX-XXX (515*)	NV-L810LED1-XXXX-XXX (515*)
Flash Technology		1112000 (32A)(32B)(390)	1112200 (32A)(32B)(390)
	(L)	MKR 370 DC (551), MKR 370 DC IR(583*)	
	(L)	MKR 370 AC (563), MKR 370 AC IR (582*)	
Flight Light Inc.		FL-810-R-116-XXX-S1 (32A)(32B)	FL-810-R-116-XXX-D1 (32A)(32B)
Hughey & Phillips, LLC		OB20A31 (399), OB20A41 (399)	OB22A31 (399), OB22A41 (399)
		OB21A31 (399), OB21A41 (399)	OB24A31 (399), OB24A41 (399)
			OB22A31TM1 (399), OB22A41TM1 (399)
			OB24A31TM1 (399), OB24A41TM1 (399)
	(L)	45-1000-001 (477), 45-1001-001 (477)	45-1004-001 (477), 45-1005-001 (477)
	(L)	45-1002-001 (477), 45-1003-001 (477)	45-1006-001 (477), 45-1007-001 (477)
	(L)	45-1008-001 (478), 45-1009-001 (478)	45-1012-001 (478), 45-1013-001 (478)
	(L)	45-1010-001 (478), 45-1011-001 (478)	45-1014-001 (478), 45-1015-001 (478)
International Tower Lighting LLC	(L)	MKR-ILED-0DH (384)	MKR-ILED-DBL (384)
	(L)	MKR-ILED-1DH (384)	MKR-ILED-DB1 (384)
	(L)	MKR-LTE1-000(592)	MKR-LTE2-000(592)
	(L)	MKR-LTE1-01R(622)	MKR-LTE2-01R(662)
		MKR-S750-0DH (507)	MKR-D750-000 (507)
OBSTA	(L)	NAVILITE B 13950 (414), HISTI 13110 (417)	
Point Lighting Corporation		POL-20000 (32B)	POL-20000-DJ (32B)
	(L)	POL-21003-R-1F-XXX-S-XX (281)	POL-21003-R-1F-XXX-D-XX (281)
	(L)	POL-21003-R-2F-XXX-S-XX (281)	POL-21003-R-2F-XXX-D-XX (281)
	(L)	POL-21003-R-3F-XXX-S-XX (281)	POL-21003-R-3F-XXX-D-XX (281)
	(L)	POL-21003-R-4F-XXX-S-XX (281)	POL-21003-R-4F-XXX-D-XX (281)
	(L)	POL-21003-R-5F-XXX-S-XX (281)	POL-21003-R-5F-XXX-D-XX (281)
	(L)	POL-21004-R-1F-XXX-S (461)	POL-21004-R-1F-XXX-D (461)
	(L)	POL-21004-R-2F-XXX-S (461)	POL-21004-R-2F-XXX-D (461)
	(L)	POL-21004-R-3F-XXX-S (461)	POL-21004-R-3F-XXX-D (461)
	(L)	POL-21004-R-4F-XXX-S (461)	POL-21004-R-4F-XXX-D (461)
	(L)	POL-21004-R-5F-XXX-S (461)	POL-21004-R-5F-XXX-D (461)
	(L)	POL-21004-R-6F-XXX-S (461)	POL-21004-R-6F-XXX-D (461)
TWR Lighting, Inc.		OL-1 (32B)	OL-2 (32B)
	(L)	OL1VLED2 (297),	
	(L)	OL1VLED3 (297), OL1VLED4 (297),	

(L) Indicates LED fixture. Any fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. (###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment.

L-821--Panel, Airport Lighting Control
(AC 150/5345-3G)

Manufacturer	Type	Class	Style	Mode	Manufacturer's Catalog Number
ADB Airfield Solutions, LLC	I	F, S, W	1	1	L-821
	III	W	3	I	44A6579/XXXXXX-000
Controlled Power Inc.	I	F, S, W	1	1	RLP-10, RLP-20, RLP-30, RLP-40, RLP-50
	I	F, S, W	1	1	RLP-60, RLP-70, RLP-80
Rural Electric Inc.	I	F, S, W	1	1	L-821

L-823—Connectors, Cable
(AC 150/5345-26D)

Manufacturer	Type	Style	Class	Manufacturer's Catalog Number
ADB Airfield Solutions, LLC	I	2	A	73A0151
	I	9	A	73A0152
	II	8	A	73A0153-12, 73A0153-14
ADB BVBA	I	2	A	1458.03.500
	I	9	A	1458.03.510
	II	1	A	1458.03.530
	II	4	B	SCK2PXX
	II	5	B	SCK1PXX
	II	8	A	1458.03.520
	II	11	B	SCK2RXX
	II	12	B	SCK1RXX
Thomas & Betts Ltd.	I	2	A	54MPN-X, 54MPPN-X
	I	9	A	54MRN-X, 54MRRN-X
	I	2,9	A	54MPRN-X
	I	3, 10	B	54XXXX, 54Super XX-XX, 52SUPER-I-XXX-XXX
	II	1	A	95MPX-X
	II	1,7	A	96MPR7R7X-X, 96MPPR7X-X
	II	1,8	A	96MPPR8X-X
	II	6	A	95MP6X-X
	II	7	A	95MR7X-X
	II	8	A	95MR8X-X
	II	5, 12	B	91PX-X, 91RX-X
	II	4, 11	B	90PX-X, 90RX-X
EFLA Oy	I	2	A	KDCP510.X.X
	I	9	A	KDCR510.X.X
	I	3, 10	B	KD510, KD510.1, KD510.2, KD510.3, KD510.4, KD510.5, KD510.6
	I	3, 10	B	KD500, KD500.1, KD500.2, KD500.3, KD500.4, KD500.5, KD500.6
	II	1,7	A	KDC501.X.XX, KDC502.X.XX
	II	5	B	KD501, KD501.X
	II	12	B	KD502, KD502.X
	II	1	A	KDC501.X.XX, KDC503.X.XX
	II	6	A	KDCT506.X.XX, KDC506.X.XX
	II	7	A	KDC502.X.XX, KDC503R.X.XX
	II	8	A	KDC508.X.X
	II	4	B	KD503, KD503.X
	II	11	B	KD503R, KD503R.X
Integro, LCC	I	2	A	10949-02-YYY
	I	3, 10	B	11174-01,11174-02 11174-04, 1174-05
	I	3, 10	B	11805-01, 11805-02, 11805-04, 11805-05
	I	9	A	10950-02-YYY
	II	1	A	10518-01-XXX, 10518-14-XXX, 10518-15-XXX, 10518-16-XXX, 10518-17-XXX
	II	1	A	10518-18-XXX, 10518-19-XXX
	II	4	B	11254-11, 11254-12, 11254-21, 11254-22
	II	5	B	11432-31, 11432-32, 11432-41,11432-42
	II	6	A	11155-01-XXX, 11155-03-XXX
	II	7	A	10519-07-YYY, 10519-08-YYY
	II	8	A	10875-05-YYY
	II	11	B	11255-11, 11255-12, 11255-21, 11255-22
	II	12	B	11433-31, 11433-32, 11433-41, 11433-42
Youyang Airport Lighting	I	2	A	FMC-1-P(N)T-XX-XX
	I	9	A	FMC-1-R(N)T-XX-XX
	II	1	A	FMC-2-P(N)T-XX-XX
	II	8	A	FMC-2-R(N)T-XX-XX

L-824—Underground Electrical Cable for Airport Lighting Circuits (AC 150/5345-7F)

Manufacturer	Type	Voltage Rating	Manufacturer's Catalog No.
Coleman Cable, Inc.	C	600	19104; 19106; 19108; 19110; 19112
	C	5000	19004; 19006; 19008; 19204; 19206; 19208; 19214; 19216; 19218
Conductores Monterrey, S.A. de C.V./Viakon	C	5000	AIR5KV8V, AIR5KV6, AIR5KV4
Draka Cableteq USA	B	5000	388270; 388270-XX; 388271; 388271-XX; 388150; 388150-XX 388278; 388278-XX; 388785; 388785-XX; 388152; 388152-XX
	C	5000	389171; 389171-XX; 389172; 389172-XX; 389181; 389181-XX 389201; 389201-XX; 389202; 389202-XX; 389203; 389203-XX 389221; 389221-XX; 389222; 389222-XX; 389223; 389223-XX 032632, 032632XX, 032633, 032633XX, 032634, 032634XX
	C	5000	CLR-XLPE 393000; CLR-XLPE 393001; CLR-XLPE 393002; CLR-XLPE 393003; CLR-XLPE 393004; CLR-XLPE 393005; CLR-XLPE 393006; CLR-XLPE 393007; CLR-XLPE 393008; CLR-XLPE 393009; CLR-XLPE 393010; CLR-XLPE 393011; CLR-XLPE 393012; CLR-XLPE 393013; CLR-XLPE 393014; CLR-XLPE 393015; CLR-XLPE 393016; CLR-XLPE 393017; CLR-XLPE 393018; CLR-XLPE 393019; CLR-XLPE 393020; CLR-XLPE 393021; CLR-XLPE 393022; CLR-XLPE 393023; CLR-XLPE 393024; CLR-XLPE 393025; CLR-XLPE 393026; CLR-XLPE 393027; CLR-XLPE 393028; CLR-XLPE 393029; CLR-XLPE 393030; CLR-XLPE 393031; CLR-XLPE 393032; CLR-XLPE 393033; CLR-XLPE 393034; CLR-XLPE 393035; CLR-XLPE 393036; CLR-XLPE 393037; CLR-XLPE 393038; CLR-XLPE 393039 CLR-XLPE 393040; CLR-XLPE 393041; CLR-XLPE 393042; CLR-XLPE 393043; CLR-XLPE 393044; CLR-XLPE 393045; CLR-XLPE 393046; CLR-XLPE 393047; CLR-XLPE 393048; CLR-XLPE 393049; CLR-XLPE 393050; CLR-XLPE 393051; CLR-XLPE 393052; CLR-XLPE 393053; CLR-XLPE 393054; CLR-XLPE 393055; CLR-XLPE 393056; CLR-XLPE 393057; CLR-XLPE 393058; CLR-XLPE 393059
	C	5000	EXT SEMI-CON/XLPE/PVC 389421; EXT SEMI-CON/XLPE/PVC 389422; EXT SEMI-CON/XLPE/PVC 389423; EXT SEMI-CON/XLPE/PVC 389424; EXT SEMI-CON/XLPE/PVC 389425; EXT SEMI-CON/XLPE/PVC 389426; EXT SEMI-CON/XLPE/PVC 389427; EXT SEMI-CON/XLPE/PVC 389428; EXT SEMI-CON/XLPE/PVC 389429; EXT SEMI-CON/XLPE/PVC 389430
	C	5000	EXT SEMI-CON/XLPE 389431; EXT SEMI-CON/XLPE 389432, EXT SEMI-CON/XLPE 389433; EXT SEMI-CON/XLPE 389434; EXT SEMI-CON/XLPE 389435; EXT SEMI-CON/XLPE 389436; EXT SEMI-CON/XLPE 389437; EXT SEMI-CON/XLPE 389438; EXT SEMI-CON/XLPE 389439; EXT SEMI-CON/XLPE 389440; EXT SEMI-CON/XLPE 389441; EXT SEMI-CON/XLPE 389442; EXT SEMI-CON/XLPE 389443; EXT SEMI-CON/XLPE 389444; EXT SEMI-CON/XLPE 389445; EXT SEMI-CON/XLPE 389446; EXT SEMI-CON/XLPE 389447; EXT SEMI-CON/XLPE 389448; EXT SEMI-CON/XLPE 389449; EXT SEMI-CON/XLPE 389450; EXT SEMI-CON/XLPE 389451; EXT SEMI-CON/XLPE 389452; EXT SEMI-CON/XLPE 389453; EXT SEMI-CON/XLPE 389454; EXT SEMI-CON/XLPE 389455; EXT SEMI-CON/XLPE 389456; EXT SEMI-CON/XLPE 389457; EXT SEMI-CON/XLPE 389458; EXT SEMI-CON/XLPE 389459, EXT SEMI-CON/XLPE 389460; EXT SEMI-CON/XLPE 389461; EXT SEMI-CON/XLPE 389462, EXT SEMI-CON/XLPE 389463; EXT SEMI-CON/XLPE 389464; EXT SEMI-CON/XLPE 389465; EXT SEMI-CON/XLPE 389466; EXT SEMI-CON/XLPE 389467; EXT SEMI-CON/XLPE 389468; EXT SEMI-CON/XLPE 389469; EXT SEMI-CON/XLPE 389470; EXT SEMI-CON/XLPE 389471; EXT SEMI-CON/XLPE 389472; EXT SEMI-CON/XLPE 389473; EXT SEMI-CON/XLPE 389474; EXT SEMI-CON/XLPE 389475; EXT SEMI-CON/XLPE 389476; EXT SEMI-CON/XLPE 389477; EXT SEMI-CON/XLPE 389478; EXT SEMI-CON/XLPE 389479; EXT SEMI-CON/XLPE 389480

L-824—Underground Electrical Cable for Airport Lighting Circuits (AC 150/5345-7F)

Manufacturer	Type	Voltage Rating	Manufacturer's Catalog No.
Nehring Electrical Works Company	C C	600 5000	8-7/W SD AIR600V, 6-7/W SD AIR600V, 4-7W SD AIR600V 8-7/W SD AIR5000V, 6-7/W SD AIR5000V, 4-7W SD AIR5000V 8-19/W SD AIR 5000V, 6-19W SD AIR 5000V, 4-19/W SD AIR 5000V
Nexans Energy USA Inc	C	5000	611491, 611533, 635290, 660615, 660616
The Okonite Company	B	5000	114-24-2213, 114-24-2214, 114-24-2215, 114-24-2216, 114-24-2217, 114-24-2219 114-24-2319, 114-24-2320, 114-24-2321, 114-24-2413, 114-24-2414, 114-24-2415, 114-24-2416, 114-24-2417, 114-24-2419 114-24-2420, 114-24-2421, 114-24-2425, 114-24-2426, 114-24-2427, 114-24-2412, 114-24-2430, 114-24-2431, 114-24-2432, 114-24-2418 114-24-2525, 114-24-2526, 114-24-2527, 114-24-2512, 114-24-2530, 114-24-2531, 114-24-2532, 114-24-2518
Prysmian Power Cables and Systems USA, LLC	C	5000	#4-303362, #6-303361, #8-303334
Southwire Company	C C C	600 5000 5000	14727-xxxxx; 24111-xxxxx; 14728-xxxxx; 14729-xxxxx; 14730-xxxxx; 19707-xxxxx; 19708-xxxxx; 24051-xxxxx; 19709-xxxxx; 34629-xxxxx; 19710-xxxxx; 23840-xxxxx; 19712-xxxxx; 19715-xxxxx; 26900-xxxxx; 30801-xxxxx; 30802-xxxxx; 34630-xxxxx; 39261-xxxxx; 20030-xxxxx; 20031-xxxxx; 30321-xxxxx 14723-xxxxx; 34423-xxxxx; 14720-xxxxx; 23888-xxxxx; 14724-xxxxx; 14721-xxxxx; 14726-xxxxx; 14722-xxxxx 19758-XXXXX, 25702-XXXXX, 19760-XXXXX, 19761-XXXXX, 19762-XXXXX,
Unika Universal Karlo Sanayi ve Tic A.S.	C	5000	TExYBAP 8AWG, KExYBAP 8AWG, TExYPAP 8AWG, KExYPAP 8AWG, TExYBAY 8AWG, KExYBAY 8AWG, TExYPAY 8AWG, KExYPAY 8AWG, x=XLPE

L-827--Monitors, Regulator
(AC 150/5345-10F)

Manufacturer	Manufacturer's Catalog No.	Compatible Regulator Types
ADB Airfield Solutions, LLC	ACE 44A6016-XXXX	ADB Airfield Solutions Air Cooled CCR
	ACE 44A6125-XXX0	ADB Airfield Solutions Air Cooled CCR
	ACE 44A6212	ADB Airfield Solutions Air Cooled CCR
		Manairco
Manairco, Inc.	MRML8273B-01	MSR02L8283B-XX, MSR02L8285B-XX
	MRML8273B-01	MSR04L8283B-XX, MSR04L8285B-XX
	MRML8273B-02	MSR07L8283B-XX, MSR07L8285B-XX
	MRML8273B-03	MR10L8283B-XX, MR10L8285B-XX
	MRML8273B-04	MR15L8283B-XX, MR15L8285B-XX
	MRML8273B-05	MR20L8283B-XX, MR20L8285B-XX
	MRML8273B-06	MR30L8283B-XX, MR30L8285B-XX, MR30L82820-XX
	MRML8275B-08	MR50L82820-XX

L-827--Monitors, Regulator
(AC 150/5345-10G)

Manufacturer	Manufacturer's Catalog No.	Compatible Regulator Types
ADB Airfield Solutions, LLC	ACE2 44A6602-XXXXX0	ADB Airfield Solutions Air Cooled CCR
	ACE2 44A6505-X0	ADB Airfield Solutions Air Cooled CCR
	ACE2 44A6507-XXX0	ADB Airfield Solutions Air Cooled CCR

L-828—Regulators, Constant Current
(AC 150/5345-10F)

Manufacturer	Rating (kW)	Class	Style	Manufacturer's Catalog Number
ADB Airfield Solutions, LLC	4	1	1,2	PPF6604-XXX, CCT6604-XXXX, PPSF6604-XXXX
	4	1	1, 2	CCF6604-X3XX-XXX, CCT6604-XXXX
	5	1	1,2	CCT6605-XXXX
	7.5	1	1,2	PPF6607-XXX, CCT6607-XXXX, PPSF6607-XXXX
	7.5	1	1,2	CCF6607- X3XX-XXX, CCF6607-X3XX
	10	1	1,2	PPF6610-XXX, CCT6610-XXXX, PPSF6610-XXXX
	10	1	1,2	CCF6610-X3XX-XXX, CCT6610-X3XX,
	15	1	1,2	CCF6615-X3XX-XXX, CHF6615-XXXX
	15	1,2	1,2	CCFXX15-XXXX, PPFXX15-XXXX, PPSFXX15-XXXX
	15	1,2	1,2	CCTXX15-XXXX
	15	2	1,2	CCT2015-XXXX
	20	1	1,2	CCF6620-X3XX-XXX, CHF6620-XXXX
	20	1,2	1,2	CCFXX20-XXXX,PPFXX20-XXXX PPSFXX20-XXXX
	20	1,2	1,2	CCTXX20-XXXX
	20	2	1,2	CCT2020-XXXX
	25	1,2	1,2	CCTXX25-XXXX
	30	1	1,2	CCF6630-X3XX-XXX, CHF6630-XXXX
	30	1,2	1,2	CCFXX30-XXXX, PPFXX30-XXXX, PPSFXX30-XXXX
	30	1,2	1,2	CCTXX30-XXXX
	15, 20, 30	1,2	1,2	PPF6615-XXX, PPF6620-XXX, PPF6630-XXX
				PPF2015-XXX, PPF2020-XXX, PPF2030-XXX
	30	2	1,2	CCT2030-XXXX
	50	2	2	CCF2050-XXXX, PPF2050-XXXX
	50	2	2	CCF2050-X3XX-XXX, PPSF2050-XXXX
	70	2	2	CCF2070-XXXX, PPF2070-XXXX, PPSF2070-XXXX
	70	2	2	CCF2070-X3XX-XXX
Crouse-Hinds ALP	4	1	1,2	828SGS-XXX-04-66-X
(Air cooled)	7.5	1	1,2	828SGS-XXX-07-66-X
	10	1	1,2	828SGS-XXX-10-66-X
	15	1,2	1,2	828SGS-XXX-15-XX-X
	20	1,2	1,2	828SGS-XXX-20-XX-X
	20	1,2	1,2	828XX-D-20-X-XX-XX, 828SGS-480-21-X
	20	1,2	1,2	82860F1-XXX-20-X, 82860F1-XXX-21-X
	30	1,2	1,2	828SGS-480-30-XX-X
	30	1,2	1,2	828XX-D-30-X-XX-XX,
Liberty Airport Systems, Inc	1	1,2	1,2	SST8-01X1XX-XX, SST8-01X2XX-XX,
(Air cooled)	1	1,2	1,2	SST8-01X3XX-XX, SST8-01X4XX-XX
	2	1,2	1,2	SST8-02X1XX-XX, SST8-02X2XX-XX,
	2	1,2	1,2	SST8-02X3XX-XX, SST8-02X4XX-XX
	4	1,2	1,2	SST8-04X1XX-XX, SST8-04X2XX-XX,
	4	1,2	1,2	SST8-04X3XX-XX, SST8-04X4XX-XX
	7.5	1,2	1,2	SST8-07X1XX-XX, SST8-07X2XX-XX,
	7.5	1,2	1,2	SST8-07X3XX-XX, SST8-07X4XX-XX
	10	1,2	1,2	SST8-10X1XX-XX, SST8-10X2XX-XX,
	10	1,2	1,2	SST8-10X3XX-XX, SST8-10X4XX-XX
	15	1,2	1,2	SST8-15X1XX-XX, SST8-15X2XX-XX,
	15	1,2	1,2	SST8-15X3XX-XX, SST8-15X4XX-XX
	20	1,2	1,2	SST8-20X1XX-XX, SST8-20X2XX-XX,
	20	1,2	1,2	SST8-20X3XX-XX, SST8-20X4XX-XX
	25	1,2	1,2	SST8-25X1XX-XX, SST8-25X2XX-XX,
	25	1,2	1,2	SST8-25X3XX-XX, SST8-25X4XX-XX
	30	1,2	1,2	SST8-30X1XX-XX, SST8-30X2XX-XX,
	30	1,2	1,2	SST8-30X3XX-XX, SST8-30X4XX-XX

L-828—Regulators, Constant Current
(AC 150/5345-10F)

Manufacturer	Rating (kW)	Class	Style	Manufacturer's Catalog Number
Manairco, Inc.	2	1	1	MSR02L8283B-XX
(Air cooled)	2	1	2	MSR02L8285B-XX
	4	1	1	MSR04L8283B-XX
	4	1	2	MSR04L8285B-XX
	7.5	1	1	MSR07L8283B-XX
	7.5	1	2	MSR07L8285B-XX
	10	1	1	MR10L8283B-XX
	10	1	2	MR10L8285B-XX
	15	1	1	MR15L8283B-XX
	15	1	2	MR15L8285B-XX
	20	1	1	MR20L8283B-XX
	20	1	2	MR20L8285B-XX
	30	1	1	MR30L8283B-XX
	30	1	2	MR30L8285B-XX
	30	2	2	MR30L82820-XX
	50	2	2	MR50L82820-XX

L-828—Regulators, Constant Current
(AC 150/5345-10G)

Manufacturer	Rating (kW)	Class	Style	Manufacturer's Catalog Number
ADB Airfield Solutions, LLC	2.5	1	1,2	CSF6602-X1XX, CSF6602-X2XX, CSF6602-X3XX, CSF6602-X4XX
	2.5	1	1,2	CSF6602-X5XX, CSF6602-XBXX, CSF6602-XDXX
	2.5	1	1,2	PSSF6602-X1XX, PSSF6602-X2XX, PSSF6602-X3XX, PSSF6602-X4XX
	2.5	1	1,2	PSSF6602-X5XX, PSSF6602-XBXX, PSSF6602-XDXX
	2.5	1	1,2	PSF6602-X1XX, PSF6602-X2XX, PSF6602-X3XX, PSF6602-X4XX
	2.5	1	1,2	PSF6602-X5XX, PSF6602-XBXX, PSF6602-XDXX
	4	1	1,2	CHF6604-XXXX, PHF6604-XXXX, PHSF6604-XXXX
	4	1	1,2	CSF6604-X1XX, CSF6604-X2XX, CSF6604-X3XX, CSF6604X4XX
	4	1	1.2	CSF6604-X5XX, CSF6604-XBXX, CSF6604-XDXX
	4	1	1,2	PSSF6604-X1XX, PSSF6604-X2XX, PSSF6604-X3XX, PSSF6604-X4XX
	4	1	1,2	PSSF6604-X5XX, PSSF6604-XBXX, PSSF6604-XDXX
	4	1	1,2	PSF6604-X1XX, PSF6604-X2XX, PSF6604-X3XX, PSF6604-X4XX
	4	1	1,2	PSF6604-X5XX, PSF6604-XBXX, PSF6604-XDXX
	5	1	1,2	CHF6605-XXXX
	5	1	1,2	CSF6605-X1XX, CSF6605-X2XX, CSF6605-X3XX, CSF6605-X4XX
	5	1	1,2	CSF6605-X5XX, CSF6605-XBXX, CSF6605-XDXX
	5	1	1,2	PSSF6605-X1XX, PSSF6605-X2XX, PSSF6605-X3XX, PSSF6605-X4XX
	5	1	1,2	PSSF6605-X5XX, PSSF6605-XBXX, PSSF6605-XDXX
	5	1	1,2	PSF6605-X1XX, PSF6605-X2XX, PSF6605-X3XX, PSF6605-X4XX
	5	1	1,2	PSF6605-X5XX, PSF6605-XBXX, PSF6605-XDXX
	7.5	1	1,2	CHF6607-XXXX, PHF6607- XXXX, PHSF6607-XXXX
	7.5	1	1,2	CSF6607-X1XX, CSF6607-X2XX, CSF6607-X3XX, CSF6607-X4XX
	7.5	1	1,2	CSF6607-X5XX, CSF6607-XBXX, CSF6607-XDXX
	7.5	1	1,2	PSSF6607-X1XX, PSSF6607-X2XX, PSSF6607-X3XX, PSSF6607-X4XX
	7.5	1	1,2	PSSF6607-X5XX, PSSF6607-XBXX, PSSF6607-XDXX
	7.5	1	1,2	PSF6607-X1XX, PSF6607-X2XX, PSF6607-X3XX, PSF6607-X4XX
	7.5	1	1,2	PSF6607-X5XX, PSF6607-XBXX, PSF6607-XDXX
	10	1	1,2	CHF6610-XXXX, PHF6610- XXXX, PHSF6610-XXXX
	10	1	1,2	CSF6610-X1XX, CSF6610-X2XX, CSF6610-X3XX, CSF6610-X4XX
	10	1	1,2	CSF6610-X5XX, CSF6610-XBXX, CSF6610-XDXX
	10	1	1,2	PSSF6610-X1XX, PSSF6610-X2XX, PSSF6610-X3XX, PSSF6610-X4XX
	10	1	1,2	PSSF6610-X5XX, PSSF6610-XBXX, PSSF6610-XDXX
	10	1	1,2	PSF6610-X1XX, PSF6610-X2XX, PSF6610-X3XX, PSF6610-X4XX
	10	1	1,2	PSF6610-X5XX, PSF6610-XBXX, PSF6610-XDXX
	15	1	1,2	CHFXX15-XXXX
	15	1,2	1,2	PHFXX15-XXXX, PHSFXX15-XXXX
	15	1,2	1,2	CSFXX15-X1XX, CSFXX15-X2XX, CSFXX15-X3XX, CSFXX15-X4XX
	15	1,2	1,2	CSFXX15-X5XX, CSFXX15-XBXX, CSFXX15-XDXX
	15	1,2	1,2	PSSF6615-X1XX, PSSF6615-X2XX, PSSF6615-X3XX, PSSF6615-X4XX
	15	1,2	1,2	PSSF6615-X5XX, PSSF6615-XBXX, PSSF6615-XDXX
	15	1,2	1,2	PSFXX15-X1XX, PSFXX15-X2XX, PSFXX15-X3XX, PSFXX15-X4XX
	15	1,2	1,2	PSFXX15-X5XX, PSFXX15-XBXX, PSFXX15-XDXX
	20	1	1,2	CHFXX20-XXXX
	20	1,2	1,2	PHFXX20-XXXX, PHSFXX20-XXXX
	20	1,2	1,2	CSFXX20-X1XX, CSFXX20-X2XX, CSFXX20-X3XX, CSFXX20-X4XX
	20	1,2	1,2	CSFXX20-X5XX, CSFXX20-XBXX, CSFXX20-XDXX
	20	1,2	1,2	PSSF6620-X1XX, PSSF6620-X2XX, PSSF6620-X3XX, PSSF6620-X4XX
	20	1,2	1,2	PSSF6620-X5XX, PSSF6620-XBXX, PSSF6620-XDXX
	20	1,2	1,2	PSFXX20-X1XX, PSFXX20-X2XX, PSFXX20-X3XX, PSFXX20-X4XX
	20	1,2	1,2	PSFXX20-X5XX, PSFXX20-XBXX, PSFXX20-XDXX
	25	1,2	1,2	CHFXX25-XXXX
	25	1,2	1,2	CSFXX25-X1XX, CSFXX25-X2XX, CSFXX25-X3XX, CSFXX25-X4XX
	25	1,2	1,2	CSFXX25-X5XX, CSFXX25-XBXX, CSFXX25-XDXX

L-828—Regulators, Constant Current (AC 150/5345-10G)

Manufacturer	Rating (kW)	Class	Style	Manufacturer's Catalog Number
ADB Airfield Solutions, LLC	25	1,2	1,2	PSSF6625-X1XX, PSSF6625-X2XX, PSSF6625-X3XX, PSSF6625-X4XX
	25	1,2	1,2	PSSF6625-X5XX, PSSF6625-XBXX, PSSF6625-XDXX
	25	1,2	1,2	PSFXX25-X1XX, PSFXX25-X2XX, PSFXX25-X3XX, PSFXX25-X4XX
	25	1,2	1,2	PSFXX25-X5XX, PSFXX25-XBXX, PSFXX25-XDXX,,
	30	1,2	1,2	CHFXX30-XXXX
	30	1,2	1,2	PHFXX30-XXXX, PHSFXX30-XXXX
	30	1,2	1,2	CSFXX30-X1XX, CSFXX30-X2XX, CSFXX30-X3XX, CSFXX30-X4XX
	30	1,2	1,2	CSFXX30-X5XX, CSFXX30-XBXX, CSFXX30-XDXX
	30	1,2	1,2	PSSF6630-X1XX, PSSF6630-X2XX, PSSF6630-X3XX, PSSF6630-X4XX
	30	1,2	1,2	PSSF6630-X5XX, PSSF6630-XBXX, PSSF6630-XDXX
	30	1,2	1,2	PSFXX30-X1XX, PSFXX30-X2XX, PSFXX30-X3XX, PSFXX30-X4XX
	30	1,2	1,2	PSFXX30-X5XX, PSFXX30-XBXX, PSFXX30-XDXX
	50	2	2	PHF2050-XXXX, CHF2050-XXXX, PHSF2050-XXXX
	70	2	2	PHF2070-XXXX, CHF2070-XXXX, PHSF2070-XXXX
ATG Airports Limited	2.5	1	1,2	M100CCR-66-02-XXX-XX-LA
	4.0	1	1,2	M100CCR-66-04-XXX-XX-LA
	5.0	1	1,2	M100CCR-66-05-XXX-XX-LA
	7,5	1	1,2	M100CCR-66-07-XXX-XX-LA
	10	1	1,2	M100CCR-66-10-XXX-XX-LA
	12,5	1	1,2	M100CCR-66-12-XXX-XX-LA
	15	1	1,2	M100CCR-66-15-XXX-XX-LA
	20	1	1,2	M100CCR-66-20-XXX-XX-LA
	25	1	1,2	M100CCR-66-25-XXX-XX-LA
	30	1	1,2	M100CCR-66-30-XXX-XX-LA
Honeywell Airport Systems	4	1	1, 2	L828X04-A6XXXXBX
	7.5	1	1, 2	L828X07-A6XXXXBX
	10	1	1, 2	L828X10-A6XXXXBX
	15	1	1, 2	L828X15-A6XXXXBX
	20	1, 2	1, 2	L828X20-A6XXXXBX
	30	1, 2	1, 2	L828X30-A6XXXXBX
	50	2	1, 2	L828X50-A6XXXXBX
	70	2	1, 2	L828X70-A6XXXXBX
Honeywell Airport Systems	4	1	1, 2	L828F04-A6XXXXBX
	7.5	1	1, 2	L828F07-A6XXXXBX
	10	1	1, 2	L828F10-A6XXXXBX
	15	1	1, 2	L828F15-A6XXXXBX
	20	1, 2	1, 2	L828F20-A6XXXXBX
	30	1, 2	1, 2	L828F30-A6XXXXBX
	50	2	1, 2	L828F50-A6XXXXBX
	70	2	1, 2	L828F70-A6XXXXBX
Crouse-Hinds ALP (Air cooled)	4	1	1,2	828XX-D-04-X-66-XX, 828SGS-480-04-X
	7.5	1	1,2	828XX-D-07-X-66-XX, 828SGS-480-07-X
	4, 7.5, 10	1	1,2	82860F-XXX-XX-X, 82862F-XXX-XX-X
	10	1	1,2	828XX-D-10-X-66-XX, 828SGS-480-10-X, 828XX-D-11-X-66-XX
	15	1,2	1,2	82860F1-XXX-15-X, 82860F1-XXX-16-X, 828SGS-480-15-X
	15	1,2	1,2	828XX-D-15-X-XX-XX, 828SGS-480-16-X
	20	1,2	1,2	828SGS-480-20-
	20	1,2	1,2	82860F1-XXX-20-X, 82860F1-XXX-21-X
	20	1,2	1,2	828XX-D-20-X-XX-XX, 828SGS-480-21-X
	30	1	1,2	82860F2-XXX-30-X, 82860F2-XXX-30-X-S592
	30	2	1,2	82860F2-XXX-31-X, 82860F2-XXX-31-X-S592
	30	1,2	1,2	828SGS-480-30-X, 828SGS-480-31-X

L-828—Regulators, Constant Current (AC 150/5345-10G)

Manufacturer	Rating (kW)	Class	Style	Manufacturer's Catalog Number
(Oil cooled)	10	1	1,2	828XX-W-11-X-66-XX-XX
	15	1	1,2	828XX-W-15-X-66-XX-XX
	20	1,2	1,2	828XX-W-20-X-XX-XX-XX
	30	1,2	1,2	828XX-W-30-X-XX-XX-XX
	37.5	2	1,2	82860-W-37-X-20-XX-XX
	50	2	1,2	828XX-W-50-X-20-XX-XX
Liberty Airport Systems, Inc (Air cooled)	4	1,2	1,2	FSF8X-04XXX-X
	7.5	1,2	1,2	FSF8X-07XXX-X
	10	1,2	1,2	FSF8X-10XXX-X
	15	1,2	1,2	FSF8X-15XXX-X
	20	1,2	1,2	FSF8X-20XXX-X
	25	1,2	1,2	FSF8X-25XXX-X
	30	1,2	1,2	FSF8X-30XXX-X
Youyang Airport Lighting	4	1	1,2	CCR2-1X042
	5	1	1,2	CCR2-1X052
	7	1	1,2	CCR2-1X072
	10	1	1,2	CCR2-1X102
	15	1	1,2	CCR2-1X152
	20	1	1,2	CCR2-1X202
	25	1	1,2	CCR2-1X252

L-829—Regulators, Monitored Constant Current (AC 150/5345-10F)

Manufacturer	Rating (kw)	Class	Style	Manufacturer's Catalog Number
ADB Airfield Solutions, LLC	4	1	1,2	PPF6604-XXX, CCT6604-XXXX, PPSF6604-XXXX
	4	1	1, 2	CCF6604-X3XX-XXX, CCT6604-XXXX
	5	1	1,2	CCT6605-XXXX
	7.5	1	1,2	PPF6607-XXX, CCT6607-XXXX, PPSF6607-XXXX
	7.5	1	1,2	CCF6607- X3XX-XXX, CCF6607-X3XX
	10	1	1,2	PPF6610-XXX, CCT6610-XXXX, PPSF6610-XXXX
	10	1	1,2	CCF6610-X3XX-XXX, CCT6610-X3XX,
	15	1	1,2	CCF6615-X3XX-XXX, CHF6615-XXXX
	15	1,2	1,2	CCFXX15-XXXX, PPFXX15-XXXX, PPSFXX15-XXXX
	15	1,2	1,2	CCTXX15-XXXX
	15	2	1,2	CCT2015-XXXX
	20	1	1,2	CCF6620-X3XX-XXX, CHF6620-XXXX
	20	1,2	1,2	CCFXX20-XXXX,PPFXX20-XXXX PPSFXX20-XXXX
	20	1,2	1,2	CCTXX20-XXXX
	20	2	1,2	CCT2020-XXXX
	25	1,2	1,2	CCTXX25-XXXX
	30	1	1,2	CCF6630-X3XX-XXX, CHF6630-XXXX
	30	1,2	1,2	CCFXX30-XXXX, PPFXX30-XXXX, PPSFXX30-XXXX
	30	1,2	1,2	CCTXX30-XXXX
	15, 20, 30	1,2	1,2	PPF6615-XXX, PPF6620-XXX, PPF6630-XXX PPF2015-XXX, PPF2020-XXX, PPF2030-XXX
	30	2	1,2	CCT2030-XXXX
	50	2	2	CCF2050-XXXX, PPF2050-XXXX, PPSF2050-XXXX
	50	2	2	CCF2050-X3XX-XXX, CHF2050-XXXX
	70	2	2	CCF2070-XXXX, PPF2070-XXXX, PPSF2070-XXXX
	70	2	2	CCF2070-X3XX-XXX, CHF2070-XXXX
Liberty Airport Systems, Inc (Air cooled)	1	1,2	1,2	SST9-01X1XX-XX, SST9-01X2XX-XX,
	1	1,2	1,2	SST9-01X3XX-XX, SST9-01X4XX-XX
	2	1,2	1,2	SST9-02X1XX-XX, SST9-02X2XX-XX,
	2	1,2	1,2	SST9-02X3XX-XX, SST9-02X4XX-XX
	4	1,2	1,2	SST9-04X1XX-XX, SST9-04X2XX-XX,
	4	1,2	1,2	SST9-04X3XX-XX, SST9-04X4XX-XX
	7.5	1,2	1,2	SST9-07X1XX-XX, SST9-07X2XX-XX,
	7.5	1,2	1,2	SST9-07X3XX-XX, SST9-07X4XX-XX
	10	1,2	1,2	SST9-10X1XX-XX, SST9-10X2XX-XX,
	10	1,2	1,2	SST9-10X3XX-XX, SST9-10X4XX-XX
	15	1,2	1,2	SST9-15X1XX-XX, SST9-15X2XX-XX,
	15	1,2	1,2	SST9-15X3XX-XX, SST9-15X4XX-XX
	20	1,2	1,2	SST9-20X1XX-XX, SST9-20X2XX-XX,
	20	1,2	1,2	SST9-20X3XX-XX, SST9-20X4XX-XX
	25	1,2	1,2	SST9-25X1XX-XX, SST9-25X2XX-XX,
	25	1,2	1,2	SST9-25X3XX-XX, SST9-25X4XX-XX
	30	1,2	1,2	SST9-30X1XX-XX, SST9-30X2XX-XX,
	30	1,2	1,2	SST9-30X3XX-XX, SST9-30X4XX-XX

L-829—Regulators, Monitored Constant Current (AC 150/5345-10F)

Manufacturer	Rating (kw)	Class	Style	Manufacturer's Catalog Number
Manairco, Inc.	2	1	1	MSR02L8293B-XX
	2	1	2	MSR02L8295B-XX
	4	1	1	MSR04L8293B-XX
	4	1	2	MSR04L8295B-XX
	7.5	1	1	MSR07L8293B-XX
	7.5	1	2	MSR07L8295B-XX
	10	1	1	MR10L8293B-XX
	10	1	2	MR10L8295B-XX
	15	1	1	MR15L8293B-XX
	15	1	2	MR15L8295B-XX
	20	1	1	MR20L8293B-XX
	20	1	2	MR20L8295B-XX
	30	1	1	MR30L8293B-XX
	30	1	2	MR30L8295B-XX
	30	2	2	MR30L82920-XX
	50	2	2	MR50L82920-XX

L-829—Regulators, Monitored Constant Current (AC 150/5345-10G)

Manufacturer	Rating (kw)	Class	Style	Manufacturer's Catalog Number
ADB Airfield Solutions, LLC	2.5	1	1,2	CSF6602-X1XX, CSF6602-X2XX, CSF6602-X3XX, CSF6602-X4XX
	2.5	1	1,2	CSF6602-X5XX, CSF6602-XBXX, CSF6602-XDXX
	2.5	1	1,2	PSSF6602-X1XX, PSSF6602-X2XX, PSSF6602-X3XX PSSF6602-X4XX
	2.5	1	1,2	PSSF6602-X5XX, PSSF6602-XBXX, PSSF6602-XDXX
	2.5	1	1,2	PSF6602-X1XX, PSF6602-X2XX, PSF6602-X3XX, PSF6602-X4XX
	2.5	1	1,2	PSF6602-X5XX, PSF6602-XBXX, PSF6602-XDXX
	4	1	1,2	CHF6604-XXXX, PHF6604-XXXX, PHSF6604-XXXX
	4	1	1,2	CSF6604-X1XX, CSF6604-X2XX, CSF6604-X3XX, CSF6604-X4XX
	4	1	1.2	CSF6604-X5XX, CSF6604-XBXX, CSF6604-XDXX,
	4	1	1,2	PSSF6604-X1XX, PSSF6604-X2XX, PSSF6604-X3XX, PSSF6604-X4XX
	4	1	1,2	PSSF6604-X5XX, PSSF6604-XBXX, PSSF6604-XDXX
	4	1	1,2	PSF6604-X1XX, PSF6604-X2XX, PSF6604-X3XX, PSF6604-X4XX
	4	1	1,2	PSF6604-X5XX, PSF6604-XBXX, PSF6604-XDXX
	5	1	1,2	CHF6605-XXXX
	5	1	1,2	CSF6605-X1XX, CSF6605-X2XX, CSF6605-X3XX, CSF6605-X4XX
	5	1	1,2	CSF6605-X5XX, CSF6605-XBXX, CSF6605-XDXX
	5	1	1,2	PSSF6605-X1XX, PSSF6605-X2XX, PSSF6605-X3XX, PSSF6605-X4XX
	5	1	1,2	PSSF6605-X5XX, PSSF6605-XBXX, PSSF6605-XDXX
	5	1	1,2	PSF6605-X1XX, PSF6605-X2XX, PSF6605-X3XX, PSF6605-X4XX
	5	1	1,2	PSF6605-X5XX, PSF6605-XBXX, PSF6605-XDXX
	7.5	1	1,2	CHF6607-XXXX, PHF6607- XXXX, PHSF6607-XXXX
	7.5	1	1,2	CSF6607-X1XX, CSF6607-X2XX, CSF6607-X3XX, CSF6607-X4XX
	7.5	1	1,2	CSF6607-X5XX, CSF6607-XBXX, CSF6607-XDXX
	7.5	1	1,2	PSSF6607-X1XX, PSSF6607-X2XX, PSSF6607-X3XX, PSSF6607-X4XX
	7.5	1	1,2	PSSF6607-X5XX, PSSF6607-XBXX, PSSF6607-XDXX
	7.5	1	1,2	PSF6607-X1XX, PSF6607-X2XX, PSF6607-X3XX, PSF6607-X4XX
	7.5	1	1,2	PSF6607-X5XX, PSF6607-XBXX, PSF6607-XDXX

L-829—Regulators, Monitored Constant Current (AC 150/5345-10F)

Manufacturer	Rating (kw)	Class	Style	Manufacturer's Catalog Number
ADB Airfield Solutions, LLC	10	1	1,2	CHF6610-XXXX, PHF6610- XXXX, PHSF6610-XXXX
	10	1	1,2	CSF6610-X1XX, CSF6610-X2XX, CSF6610-X3XX, CSF6610-X4XX
	10	1	1,2	CSF6610-X5XX, CSF6610-XBXX, CSF6610-XDXX
	10	1	1,2	PSSF6610-X1XX, PSSF6610-X2XX, PSSF6610-X3XX, PSSF6610-X4XX
	10	1	1,2	PSSF6610-X5XX, PSSF6610-XBXX, PSSF6610-XDXX
	10	1	1,2	PSF6610-X1XX, PSF6610-X2XX, PSF6610-X3XX, PSF6610-X4XX
	10	1	1,2	PSF6610-X5XX, PSF6610-XBXX, PSF6610-XDXX
	15	1	1,2	CHFXX15-XXXX
	15	1,2	1,2	PHFXX15-XXXX, PHSFXX15-XXXX
	15	1,2	1,2	CSFXX15-X1XX, CSFXX15-X2XX, CSFXX15-X3XX, CSFXX15-X4XX
	15	1,2	1,2	CSFXX15-X5XX, CSFXX15-XBXX, CSFXX15-XDXX
	15	1,2	1,2	PSSF6615-X1XX, PSSF6615-X2XX, PSSF6615-X3XX, PSSF6615-X4XX
	15	1,2	1,2	PSSF6615-X5XX, PSSF6615-XBXX, PSSF6615-XDXX
	15	1,2	1,2	PSFXX15-X1XX, PSFXX15-X2XX, PSFXX15-X3XX, PSFXX15-X4XX
	15	1,2	1,2	PSFXX15-X5XX, PSFXX15-XBXX, PSFXX15-XDXX
	20	1	1,2	CHFXX20-XXXX
	20	1,2	1,2	PHFXX20-XXXX, PHSFXX20-XXXX
	20	1,2	1,2	CSFXX20-X1XX, CSFXX20-X2XX, CSFXX20-X3XX, CSFXX20-X4XX
	20	1,2	1,2	CSFXX20-X5XX, CSFXX20-XBXX, CSFXX20-XDXX
	20	1,2	1,2	PSSF6620-X1XX, PSSF6620-X2XX, PSSF6620-X3XX, PSSF6620-X4XX
	20	1,2	1,2	PSSF6620-X5XX, PSSF6620-XBXX, PSSF6620-XDXX
	20	1,2	1,2	PSFXX20-X1XX, PSFXX20-X2XX, PSFXX20-X3XX, PSFXX20-X4XX
	20	1,2	1,2	PSFXX20-X5XX, PSFXX20-XBXX, PSFXX20-XDXX
	25	1,2	1,2	CHFXX25-XXXX
	25	1,2	1,2	CSFXX25-X1XX, CSFXX25-X2XX, CSFXX25-X3XX, CSFXX25-X4XX
	25	1,2	1,2	CSFXX25-X5XX, CSFXX25-XBXX, CSFXX25-XDXX
	25	1,2	1,2	PSSF6625-X1XX, PSSF6625-X2XX, PSSF6625-X3XX, PSSF6625-X4XX
	25	1,2	1,2	PSSF6625-X5XX, PSSF6625-XBXX, PSSF6625-XDXX
	25	1,2	1,2	PSFXX25-X1XX, PSFXX25-X2XX, PSFXX25-X3XX, PSFXX25-X4XX
	25	1,2	1,2	PSFXX25-X5XX, PSFXX25-XBXX, PSFXX25-XDXX
	30	1	1,2	CHFXX30-XXXX
	30	1,2	1,2	PHFXX30-XXXX, PHSFXX30-XXXX
	30	1,2	1,2	CSFXX30-X1XX, CSFXX30-X2XX, CSFXX30-X3XX, CSFXX30-X4XX
	30	1,2	1,2	CSFXX30-X5XX, CSFXX30-XBXX, CSFXX30-XDXX
	30	1,2	1,2	PSSF6630-X1XX, PSSF6630-X2XX, PSSF6630-X3XX, PSSF6630-X4XX
	30	1,2	1,2	PSSF6630-X5XX, PSSF6630-XBXX, PSSF6630-XDXX
	30	1,2	1,2	PSFXX30-X1XX, PSFXX30-X2XX, PSFXX30-X3XX, PSFXX30-X4XX
	30	1,2	1,2	PSFXX30-X5XX, PSFXX30-XBXX, PSFXX30-XDXX
	50	2	2	PHF2050-XXXX, CHF2050-XXXX, PHSF2050-XXXX
	70	2	2	PHF2070-XXXX, CHF2070-XXXX, PHSF2070-XXXX
ATG Airports Limited	2.5	1	1,2	M100CCR-66-02-XXX-XX-LI/LF/LA
	4.0	1	1,2	M100CCR-66-04-XXX-XX-LI/LF/LA
	5.0	1	1,2	M100CCR-66-05-XXX-XX-LI/LF/LA
	7,5	1	1,2	M100CCR-66-07-XXX-XX-LI/LF/LA
	10	1	1,2	M100CCR-66-10-XXX-XX-LI/LF/LA
	12,5	1	1,2	M100CCR-66-12-XXX-XX-LI/LF/LA
	15	1	1,2	M100CCR-66-15-XXX-XX-LI/LF/LA
	20	1	1,2	M100CCR-66-20-XXX-XX-LI/LF/LA
	25	1	1,2	M100CCR-66-25-XXX-XX-LI/LF/LA
	30	1	1,2	M100CCR-66-30-XXX-XX-LI/LF/LA

L-829—Regulators, Monitored Constant Current (AC 150/5345-10F)

Manufacturer	Rating (kw)	Class	Style	Manufacturer's Catalog Number
Crouse-Hinds ALP (Air Cooled)	4	1	1,2	829XX-D-04-X-66-XX
	7.5	1	1,2	829XX-D-07-X-66-XX
	10	1	1,2	829XX-D-10-X-66-XX
	10	1	1,2	829XX-D-11-X-66-XX
	15	1,2	1,2	829XX-D-15-X-XX-XX
	20	1,2	1,2	829XX-D-20-X-XX-XX
	30	1,2	1,2	829XX-D-30-X-XX-XX
Crouse-Hinds ALP (Oil Cooled)	10	1	1,2	829XX-W-11-X-66-XX-XX
	15	1,2	1,2	829XX-W-15-X-66-XX-XX
	20	1,2	1,2	829XX-W-20-X-XX-XX-XX
	30	1,2	1,2	829XX-W-30-X-XX-XX-XX
	37.5	2	1,2	82960-W-37-X-20-XX-XX
	50	2	1,2	829XX-W-50-X-20-XX-XX
Honeywell Airport Systems	4	1	1, 2	L829X04-A6XXXXBX
	7.5	1	1, 2	L829X07-A6XXXXBX
	10	1	1, 2	L829X10-A6XXXXBX
	15	1	1, 2	L829X15-A6XXXXBX
	20	1, 2	1, 2	L829X20-A6XXXXBX
	30	1, 2	1, 2	L829X30-A6XXXXBX
	50	2	1, 2	L829X50-A6XXXXBX
	70	2	1, 2	L829X70-A6XXXXBX
Honeywell Airport Systems	4	1	1, 2	L829F04-A6XXXXBX
	7.5	1	1, 2	L829F07-A6XXXXBX
	10	1	1, 2	L829F10-A6XXXXBX
	15	1	1, 2	L829F15-A6XXXXBX
	20	1, 2	1, 2	L829F20-A6XXXXBX
	30	1, 2	1, 2	L829F30-A6XXXXBX
	50	2	1, 2	L829F50-A6XXXXBX
	70	2	1, 2	L829F70-A6XXXXBX
Liberty Airport Systems, Inc (Air cooled)	4	1,2	1,2	FSF9X-04XXX-X
	7.5	1,2	1,2	FSF9X-07XXX-X
	10	1,2	1,2	FSF9X-10XXX-X
	15	1,2	1,2	FSF9X-15XXX-X
	20	1,2	1,2	FSF9X-20XXX-X
	25	1,2	1,2	FSF9X-25XXX-X
	30	1,2	1,2	FSF9X-30XXX-X
Youyang Airport Lighting	4	1	1,2	CCR2-12042
	5	1	1,2	CCR2-12052
	7	1	1,2	CCR2-12072
	10	1	1,2	CCR2-12102
	15	1	1,2	CCR2-12152
	20	1	1,2	CCR2-12202
	25	1	1,2	CCR2-12252

L-830--Isolation Transformers, 60Hz
(AC 150/5345-47C)

L-830			Manufacturer's Catalog Number				
Type	Watts	Amperes Pri/Sec	**ADB Airfield Solutions, LLC**	**Thomas & Betts Ltd.**	**Youyang Airport Lighting Equipment Inc.**	**EFLA Oy**	**Integro, LCC**
L-830-1	30/45	6.6/6.6	1ST045666010	TA045666-01 TA045666-10 TA04566D-01 TA04566D-10	IT1-066-045-60	KR531.1A KR631.1A	11680
L-830-2	30/45	20/6.6		TA045266-01 TA045266-10 TA04526D-01 TA04526D-10			11681
L-830-3	65	6.6/6.6	1ST065666010	TA065666-01 TA065666-10 TA06566D-01 TA06566D-10		KR536.1A KR636.1A	11682
L-830-4	100	6.6/6.6	1ST100666010	TA10066D-01 TA10066D-10	IT1-066-100-60	KR541.1A KR641.1A	11683
L-830-5	100	20/6.6		TA100266-01 TA100266-10			11684
L-830-6	200	6.6/6.6	1ST200666010	TA200666-01 TA200666-10	IT1-066-200-60	KR551.1A KR651.1A	11685
L-830-7	200	20/6.6		TA200266-01 TA200266-10			11686
L-830-8	300	6.6/20		TA300626-01 TA300626-10			
L-830-9	300	20/20		TA300226-01 TA300226-10			
L-830-10	300	6.6/6.6	1ST300666010	TA300666-01 TA300666-10	IT1-066-300-60	KR561.1A KR661.1A	11736
L-830-11	300	20/6.6		TA300266-01 TA300266-10			11760
L-830-12	500	6.6/20		TA500626-01 TA500626-10			
L-830-13	500	20/20		TA500226-01 TA500226-10			
L-830-14	500	6.6/6.6		TA500666-01 TA500666-10			
L-830-15	500	20/6.6		TA500266-01 TA500266-10			

L-830--Isolation Transformers, 60Hz
(AC 150/5345-47C)

L-830			Manufacturer's Catalog Number					
Type	Watts	Amperes Pri/Sec	**ADB Airfield Solutions, LLC**	**Thomas & Betts Ltd.**	**Youyang Airport Lighting Equipment Inc.**		**EFLA Oy**	**Integro, LCC**
L-830-16	10/15	6.6/6.6	1ST010666010	TA010666-01 TA010666-10	IT1-066-015-60			11717
L-830-17	20/25	6.6/6.6	1ST020666010	TA025666-01 TA025666-10				11729
L-830-18	150	6.6/6.6	1ST150666010	TA150666-01 TA150666-10	IT1-066-150-60		KR546.1A KR646.1A	11730
L-830-19	150	20/6.6		TA150266-01 TA150266-10				11731

L-830--Isolation Transformers, 60Hz
(AC 150/5345-47B)

L-830			Manufacturer's Catalog Number					
Type	Watts	Amperes Pri/Sec	ADB BVBA	Thomas & Betts Ltd	Crouse Hinds Airport Lighting Products		EFLA Oy	Integro, LCC
L-830-1	30/45	6.6/6.6	RST-045-6-6-6-O					
L-830-3	65	6.6/6.6	RST-065-6-6-6-O					
L-830-4	100	6.6/6.6	RST-100-6-6-6-O					
L-830-6	200	6.6/6.6	RST-200-6-6-6-O					
L-830-10	300	6.6/6.6	RST-300-6-6-6-O					
L-830-18	150	6.6/6.6	RST-150-6-6-6-0					

L-831—Isolation Transformers, 50Hz (AC 150/5345-47C)

L-831			Manufacturer's Catalog Number					
Type	Watts	Amperes Pri/Sec	**ADB BVBA**	**Thomas & Betts Ltd**	**Youyang Airport Lighting Equipment Inc.**		**EFLA Oy**	**Integro, LCC**
L-831-1	30/45	6.6/6.6		TA045665-01 TA045665-10 TA04566D-01 TA04566D-10	IT1-066-045-50		KR531.1 KR631.1	11710
L-831-2	30/45	20/6.6		TA045265-01 TA045265-10 TA04526D-01 TA04526D-10				11723
L-831-3	65	6.6/6.6		TA065665-01 TA065665-10 TA06566D-01 TA06566D-10			KR536.1 KR636.1	11712
L-831-4	100	6.6/6.6		TA10066D-01 TA10066D-10	IT1-066-100-50		KR541.1 KR641.1	11683
L-831-5	100	20/6.6		TA100265-01 TA100265-10				11714
L-831-6	200	6.6/6.6		TA200665-01 TA200665-10	IT1-066-200-50		KR551.1 KR651.1	11715
L-831-7	200	20/6.6		TA200265-01 TA200265-10				11716
L-831-8	300	6.6/20		TA300625-01 TA300625-10				
L-831-9	300	20/20		TA300225-01 TA300225-10				
L-831-10	300	6.6/6.6		TA300665-01 TA300665-10	IT1-066-300-50		KR561.1 KR661.1	
L-831-11	300	20/6.6		TA300265-01 TA300265-10				
L-831-12	500	6.6/20		TA500625-01 TA500625-10				
L-831-13	500	20/20		TA500225-01 TA500225-10				
L-831-14	500	6.6/6.6		TA500665-01 TA500665-10				
L-831-15	500	20/6.6		TA500265-01 TA500265-10				
L-831-16	10/15	6.6/6.6		TA010665-01	IT1-066-015-50			11732

L-831—Isolation Transformers, 50Hz (AC 150/5345-47C)

L-831			Manufacturer's Catalog Number					
Type	Watts	Amperes Pri/Sec	**ADB BVBA**	**Thomas & Betts Ltd**	**Youyang Airport Lighting Equipment Inc.**		**EFLA Oy**	**Integro, LCC**
				TA010665-10				
L-831-17	20/25	6.6/6.6		TA025665-01 TA025665-10				11733
L-831-18	150	6.6/6.6		TA150665-01 TA150665-10	IT1-066-150-50		KR546.1 KR646-1	11734
L-831-19	150	20/6.6		TA150265-01 TA150265-10				11731

L-831—Isolation Transformers, 50Hz (AC 150/5345-47B)

L-831			Manufacturer's Catalog Number						
Type	Watts	Amperes Pri/Sec	ADB BVBA	Thomas & Betts, Ltd	Crouse-Hinds Airport Lighting Products		EFLA Oy	Integro, LCC	
L-831-1	30/45	6.6/6.6	RST-045-6-6-5-O						
L-831-3	65	6.6/6.6	RST-065-6-6-5-O						
L-831-4	100	6.6/6.6	RST-100-6-6-5-O						
L-831-6	200	6.6/6.6	RST-200-6-6-5-O						
L-831-10	300	6.6/6.6	RST-300-6-6-5-O						
L-831-18	150	6.6/6.6	RST-150-6-6-5-0						

L841—Cabinet, Auxiliary Relay (AC 150/5345-13A)

Manufacturer	Manufacturer's Catalog Number

L-847--Switch, Circuit Selector
(AC 150/5345-5B)

Manufacturer	Type	Class	Rating	Catalog No.
ADB Airfield Solutions, LLC	1, 2, 3, 4	A, B	1, 2	44D4520-XXX0
Crouse-Hinds Airport Lighting Products	1, 2, 3, 4	A, B	1	84700-XX-X
Liberty Airport Systems, Inc	1, 2, 3, 4	A, B	1, 2	SCS-XX-XX

L-849--Lights, Runway End Identification
(AC 150/5345-51B)

Manufacturer	L-849	Type	Style	Manufacturer's Catalog Number
ADB Airfield Solutions LLC	(L)	I	A	REIL-A1X0X011 (562)
	(L)	I	C	REIL-C1XXX010 (321)
	(L)	I	E	REIL-E1X0X011 (562)
	(L)	V	A	REIL-A2X0X011 (562)
	(L)	V	C	REIL-C2XXX010 (321)
	(L)	V	E	REIL-E2X0X011 (562)
		V	A, C, E	44A1161-XX (171)
Astronics DME Corporation	(L)	V	E	P2-08-0001-002 (619)
Flash Technology		I	A, E	FTS 832 (157)
		I	B, F	FTS 432 (75)
		V	B, F	FTS 412 (75)
		V	A, E	FTS 812 (157)
Strobe Approach Lighting Technology		I	A, E	PSFH-UC01 (282), PSFH-UC02 (282)
		I	B, F	PSFH-OC01 (287), PSFH-OC02 (287)
	(L)	I	A	SAL1030-I-A (525)
	(L)	I	E	SAL1030-I-E (525)
		V	A, E	PSFH-UV01 (282), PSFH-UV02 (282)
		V	B, F	PSFH-OV01 (287), PSFH-OV02 (287)
	(L)	V	A, E	SAL 1030V (525)
	(L)	V	A	SAL1030-V-A (525)
	(L)	V	E	SAL1030-V-E (525)

Any runway fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. **(L)** Indicates LED fixture.

L-850--Lights, Runway, Inpavement (AC 150/5345-46D)

Manufacturer	Type	Class	Style	Manufacturer's Catalog Number
ADB Airfield Solutions, LLC	A	2	3	44A4817-XX11 (124)(315), 44A4817-XX31 (124)(315), 44A4817-X2X1 (124)(594)
	A(L)	2	3	IRCL-XXXXX0 (387)(388), IRCL-X11XX0, (387)(388)
	B	2	3	44A4763-2X1 (124)(594)
	B(L)	2	3	TDZL-XXXX0 (388), TDZL-X11X0 (388)
	C	2	3	44A6009-XXXX (123)
	C(L)	2	2	IREL-XXX0XX0 (499)(500)(501)(502)
	D	2	2	44A6656-01XX (318), 44A6656-21XX (318), 44A6656-31XX (318)
	D	2	2	44A6656-20XX (318), 44A6656-30XX (318)
	D(L)	2	2	IREL-C4X0XX0 (499)(500), IREL-4BX0XX0 (499)(500), IREL-44X0XX0 (500)
	D(L)	2	2	IREL-C0X0XX0 (499), IREL40X0XX0 (500), IREL-0BX0XX0(499)
	E	2	2	44A6248-1X10 (123)
	F	2	3	44A5950-0X11 (124) (315), 44A5950-0211 (124) (594)
	T(L)	2	3	THL-1X0 (600)
ADB BVBA	A(L)	1, 2	2	DRC-A-2-XX-0-A-S-XXXXX (516)(517)
	B(L)	1, 2	2	DTZ-A-2-WN-X-A-S-XXXXX (516)
	T(L)	1, 2	2	DRC-A-2-RN-0-A-S-XXXXX (517)
Airsafe Airport Equipment Co Ltd	A	1, 2	2	RCL-08-XXX-CC (220), RCL-08-XXX-CR (220), RCL-08-XXX-R (220)
	A	1, 2	2	RCL-08-XXX-048-C (220)
	B	1, 2	2	TDZ-08-X-048-C (220)
atg airports, Inc.	A	1, 2	2	ZA181i-WW-X (126), ZA181i-WR-X (126), ZA181i-W-X (126),
	A	1, 2	2	ZA181i-R-X (126), ZA484-WW-X (126), ZA484-WR-X (126),
	A	1, 2	2	ZA484-W-X (126), ZA484-R-X (126),
	B	1, 2	2	ZA184i-W-X (126), ZA480-W-X (126),
	C	1, 2	2	ZA183-WW-X (160), ZA183-WY-X (160), ZA183-WR-X (160)
	C	1, 2	2	ZA183-YR (160), ZA183-YG-X (160), ZA483-WW-X (160)
	C	1, 2	2	ZA483-WY-X (160), ZA483-WR-X (160), ZA483-YR (160), ZA483-YG-X (160)
	D	1, 2	2	ZA188-GR-X (160), ZA188-RR-X (160), ZA188-G-X (160),
	D	1, 2	2	ZA488-GR-X (160), ZA488-RR-X (160), ZA488-G-X (160)
	E	1, 2	2	ZA485-G-X (160)
ATG Airports Limited	A	1, 2	2	ZA181i-WW-X (126), ZA181i-WR-X (126), ZA181i-W-X (126),
	A	1, 2	2	ZA181i-R-X (126), ZA484-WW-X (126), ZA484-WR-X (126),
	A	1, 2	2	ZA484-W-X (126), ZA484-R-X (126),
	A(L)	1, 2	3	IR850A-11WW-110 (611), IR850A-12WN-110 (611), IR850A-21NW-110 (611),
	A(L)	1, 2	3	IR850A-11WR-110 (611)(612), IR850A-11RW-110 (612)(611)
	A(L)	1, 2	3	IR850A-12RN-110 (612), IR850A-21NR-110 (612)
	B	1, 2	2	ZA184i-W-X (126), ZA480-W-X (126),
	B(L)	1, 2	3	IR850B-23WB-110 (614), IR850B-32BW-110 (613)
	B(L)	1, 2	3	IR850B-13WB-110 (611), IR850B-31BW-110 (611)
	C	1, 2	2	ZA183-WW-X (160), ZA183-WY-X (160), ZA183-WR-X (160)
	C	1, 2	2	ZA183-YR (160), ZA183-YG-X (160), ZA483-WW-X (160)
	C	1, 2	2	ZA483-WY-X (160), ZA483-WR-X (160), ZA483-YR (160), ZA483-YG-X (160)
	D	1, 2	2	ZA188-GR-X (160), ZA188-RR-X (160), ZA188-G-X (160),
	D	1, 2	2	ZA488-GR-X (160), ZA488-RR-X (160), ZA488-G-X (160)
	E	1, 2	2	ZA485-G-X (160)
Crouse-Hinds Airport Lighting Products	A	2	3	850A3-CC-XX (219), 850A3-CR-XX (219)
	A	2	3	850A3-Rx-XX (219), 850A3-Cx-XX (219), 850A3-XX-12F-XX (219)
	A(L)	2	3	850A-5-XX-F1-NSR-XX-X(452)(453), 850A-5-XX-F1-12S-XX-X (457)(458)
	A(L)	2	3	850A-AP1-XX-F1-8FS-XX-X-X (574)(575),
	A(L)	2	3	850A-AP1-XX-F1-12S-XX-X-0 (589)(590)

Any runway fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. **(L)** Indicates LED fixture.

L-850--Lights, Runway, Inpavement (AC 150/5345-46D)

Manufacturer	Type	Class	Style	Manufacturer's Catalog Number
Crouse-Hinds Airport Lighting Products	B	2	3	850B3-C-12F-P1-X (219), 850B3-C-XX-X (219)
	B(L)	2	3	850B-5-C0-F1-NSR-XX-X (453), 850B-5-C0-F1-12X-XX-X (458)
	B(L)	2	3	850B-AP1-WN-F1-8FX-XX-X-X (575), 850B-AP1-WN-F1-12X-XX-X-0 (590)
	C	2	3	850C3-XX-XX (219)
	D	2	2	850D6-XX-XX (215)(400)
	E	2	2	850E6-G (194)
	F	2	3	850F3-XX (219)
Hella KGaA Hueck &Co.	A(L)	2	3	8NA 010.759-08 (452)(453); 8NA 010.759-09 (453);
	A(L)	2	3	8NA 010.759-10 (452)(453); 8NA 010.759-11 (453);
	A(L)	2	3	8NA 010.759-12 (452)(453); 8NA 010.759-13 (453);
	A(L)	2	3	8NA 010.759-14 (452)(453); 8NA 010.759-15 (453);
	A(L)	2	3	8NA 011.593-08 (457)(458); 8NA 011.593.09 (458);
	A(L)	2	3	8NA 011.593-10 (457)(458); 8NA 011.593-11 (458);
	A(L)	2	3	8NA 011.593-12 (457)(458); 8NA 011.593-13 (458);
	A(L)	2	3	8NA 011.593-14 (457)(458); 8NA 011.593-15 (458)
	B(L)	2	3	8NA 011.348-02 (453), 8NA 011.348-03 (453)
	B(L)	2	3	8NA 011.594-02 (458), 8NA 011.594-03(458)
Multi-Electric Mfg	A(L)	1, 2	3	LRCL04-F-WW-XX-X-X (534), LRCL04-F-WR-2P-X-X (534)(535)
	A(L)	1, 2	3	LRCL04-F-WR-1P-X-X (534)(535)
	A(L)	1, 2	3	LRCL04-F-WS-1P-X-X (534), LRCL04-F-WM-1P-X-X (534)
	A(L)	1, 2	3	LRCL04-F-RS-1P-X-X (531), LRCL04-F-RM-1P-X-X (531)
	A(L)	1, 2	3	LRCL04-F-WW-XX-X-X (533), LRCL04-F-WR-XX-X-X (533)(532)(536)
	B(L)	1, 2	3	LTDZ04-F-X-X-X (533)
	C(L)	1, 2	3	LRED04-F-WW-XX-X-X (533), LRED04-F-WY-XX-X-X (533)(538)
	C(L)	1, 2	3	LRED04-F-YW-XX-X-X (538)(533), LRED04-F-WR-XX-X-X (533)(536)
	C(L)	1, 2	3	LRED04-F-RW-XX-X-X (536)(533), LRED04-F-YR-XX-X-X (536)(538)
	C(L)	1, 2	3	LRED04-F-RY-XX-X-X (536)(538), LRED04-F-YG-XX-X-X (538)(537)
	C(L)	1, 2	3	LRED04-F-GY-XX-X-X (538)(537)
	D(L)	1, 2	3	LTHE04-F-GR-X-XX-X-X (539)(532), LTHE04-F-RR-L-XX-X-X (532)
	D(L)	1, 2	3	LRCL04-F-GS-X-1P-X-X (539), LTHE04-F-GM-X-1P-X-X (539)
	E(L)	1, 2	3	LRTH04-F-X-X-X (539)
	T(L)	1, 2	3	LRCL04-F-TS-1P-X-X (532), LRCL04-F-TM-1P-X-X (532)
O.C.E.M. Airfield Technology	A	1, 2	3	RCLF-F-CC-090-XP-X-X (293), RCLF-F-CR-090-XP-X-X (293)
	A	1, 2	3	RCLF-F-RC-090-XP-X-X (293), RCLF-F-RX-090-XP-X-X (293)
	A	1, 2	3	RCLF-F-XR-090-XP-X-X (293), RCLF-F-CX-090-XP-X-X (293)
	A	1, 2	3	RCLF-F-XC-090-XP-X-X (293)
	A	1, 2	3	RCLF-F-CC-090-XP-X-F (519); RCLF-F-CR-090-XP-X-F (519)
	A	1, 2	3	RCLF-F-CM-045-1P-X-F (519); RCLF-F-RM-045-1P-X-F (519)
	A(L)	1, 2	3	LIRC-F-WW-XX-X-X-X (534), LIRC-F-WR-2P-X-X-X (534)(535)
	A(L)	1, 2	3	LIRC-F-WR-1P-X-X-X (534)(531)
	A(L)	1, 2	3	LIRC-F-WS-1P-X-X-X (534), LIRC-F-WM-1P-X-X-X (534)
	A(L)	1, 2	3	LIRC-F-RS-1P-X-X-X (531), LIRC-F-RM-1P-X-X-X (531)
	A(L)	1, 2	3	LIRL-F-WW-XX-X-X (533), LIRL-F-WR-XX-X-X (533)(532)(536)
	A(L)	1, 2	3	LIRL-F-WS-1P-X-X (533), LIRL-F-WM-1P-X-X (533)
	A(L)	1, 2	3	LIRL-F-RS-1P-X-X (532), LIRL-F-RM-1P-X-X (532)
	B	1, 2	3	TDZF-F-C-LI-045-X-X (293), TDZF-F-C-RI-045-X-X (293)
	B	1, 2	3	TDZF-F-C-RI-045-X-F (519); TDZF-F-C-LI-045-X-F (519)
	B(L)	1, 2	3	LIRD-F-X-X-X-X (534), LIRZ-F-X-X-X (533)
	C	1, 2	3	SLRE-E-CCP-XP-200-O-F (520); SLRE-E-CPC-XP-200-O-F (520)
	C	1, 2	3	SLRE-E-CPR-XP-200-O-F (520); SLRE-D-CPY-XP-200-O-F (520)
	C	1, 2	3	SLRE-E-CRP-XP-200-O-F (520); SLRE-E-CYP-XP-200-O-F (520)
	C	1, 2	3	SLRE-E-GPY-XP-200-O-F (520); SLRE-E-RPY-XP-200-O-F (520)
	C	1, 2	3	SLRE-E-RYP-XP-200-O-F (520); SLRE-E-YCP-XP-200-O-F (520)
	C	1, 2	3	SLRE-E-YPC-XP-200-O-F (520); SLRE-E-YPG-XP-200-O-F (520)

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L-850--Lights, Runway, Inpavement (AC 150/5345-46D)

Manufacturer	Type	Class	Style	Manufacturer's Catalog Number
O.C.E.M. Airfield Technology	C(L)	1, 2	3	LIRE-F-WW-XX-X-X (533), LIRE-F-WY-XX-X-X (533)(538)
	C(L)	1, 2	3	LIRE-F-YW-XX-X-X (538)(533), LIRE-F-WR-XX-X-X (533)(536)
	C(L)	1, 2	3	LIRE-F-RW-XX-X-X (536)(533), LIRE-F-YR-XX-X-X (538)(536)
	C(L)	1, 2	3	LIRE-F-RY-XX-X-X (536)(538), LIRE-F-YG-XX-X-X (538)(537)
	C(L)	1, 2	3	LIRE-F-GY-XX-X-X (537)(538)
	D	1, 2	3	SLRE-A-GRP-XP-200-O-F (520); SLRE-A-GXP-1P-100-O-F (520)
	D	1, 2	3	SLRE-A-RPG-XP-200-O-F (520); SLRE-A-RPR-XP-200-O-F (520)
	D	1, 2	3	SLRE-A-XPG-1P-100-O-F (520)
	D(L)	1, 2	3	LIRH-F-GR-X-XX-X-X(539)(532), LIRH-F-RR-L-XX-X-X(532)
	D(L)	1, 2	3	LIRH-F-GS-X-1P-X-X(539**)**, LIRH-F-GM-X-1P-X-X(539)
	E	1, 2	3	SLTH-A-ST-200-O-F (520)
	E(L)	1, 2	3	LIRT-F-X-X-X(539)
	T	1, 2	3	RCLF-F-TM-100-1P-X-F (520)
	T(L)	1, 2	3	LIRC-F-TS-1P-X-X-X(535), LIRC-F-TM-1P-X-X-X(535)
	T(L)	1, 2	3	LIRL-F-TS-1P-X-X(532), LIRL-F-TM-1P-X-X(532)
Safegate Group	A	1,2	2	INL-RC+2x45W+XX+XX+XX+L-850A (192)
	A	1,2	2	INL-RTS+1x45W+X+XX+L850A (192)
	A(L)	1,2	3	SafeLEDIQXRC18BSSWWXC (620), SafeLEDIQXRC18BSSWRXC (620)(621)
	B	1,2	2	INL-RTX+1x45W+W+XX+L850B (192)
	B(L)	1,2	3	SafeLEDIQXRZ18UXS-W1C (620)
	C	1,2	2	INL-RE+2x105W+XX+XX+XX+XX+L850C (164)
	E	1,2	2	INL-RNS+2x105W+G+XX+1C+XX+L850E (164)
Youyang Airport Lighting	A	1,2	3	IHG-RCLL-1-048-X-OX-X (216)
	C	2	2	IHF-REDL-105-01-1 (164), IHF-REDL-105-02-1 (164)
	C	2	2	IHF-REDL-105-06-1 (164), IHF-REDL-105-07-1 (164), IHF-REDL-105-08-1 (164)
	D	2	2	IHF-RTHL-105-04-1 (164), IHF-RENL-105-05-1 (164)

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L-852—Lights, Taxiway, Inpavement
(AC 150/5345-46D)

Manufacturer	Type L-852	Class	Style	Manufacturer's Catalog Number
ADB Airfield Solutions, LLC	A(L)	2	3	ITCF-AX0XX0 (345)(346), ITCF-AX03X2 (570)(604)
	B(L)	2	3	ITCF-BX0XX0 (345)(346), ITCF-BX03X2 (570)(604)
	C(L)	2	3	ITCF-CX0XX0 (345)(346), ITCF-CX01X2 (569)(570), ITCF-CX03X2 (569)(570),
	C	2	3	44A4827-3XX1 (317), 44A4764-XX1X (416), 44A4764-XX3X (416)
	D(L)	2	3	ITCF-DX0XX0 (347)(348)(404), ITCF-DX03X2 (596)(597)(598)
	D	2	3	44A4765-XX1X (316), 44A4765-XX3X (316)
	E	2	1	44D1442-212X(249)
	G	2	3	44A5875-211 (123), 44A5988-1211 (123)
	G(L)	2	3	IRGL-XXX10 (426), IRGL XXX11 (426)
	J(L)	2	3	ITCF-JX0XX0 (345)(346), ITCF-JX03X2 (570)(604)
	K(L)	2	3	ITCF-KX0XX0 (347, 348), ITCF-KX03X2 (596)(5984)
	S	2	3	44A5924-X11 (123), 44A5988-1211 (123)
	S(L)	2	3	REL-1XX (420)
	T	2	2	44A6099-XXX (193)
	T(L)	2	3	ITEL-XXXX (256), ITEL-C11X (445), ITEL-C21X (445)
Airsafe Airport Equipment Co Ltd	C	2	2	TCLM-08-S-048-GG (220), TCLM-08-S-048-YY (220), TCLM-08-S-048-GY (220)
	D	2	2	TCLM-08-C-048-G (220), TCLM-08-C-048-Y (220), TCLM-08-C-048-GG (220),
	D	2	2	TCLM-08-C-048-YY (220)
Astronics DME Corp	A(L)	2	3	852A-L-X-XX-X-X(488)(489)
	B(L)	2	3	852B-L-X-XX-X-X(488)(489)
	C(L)	2	3	852C-L-X-XX-X-X(488)(489)
	D(L)	2	3	852D-L-X-XX-X-X(488)(489)(560)
	T(L)	2	3	852T-L-X (444)
atg airports, Inc.	A(L)	1,2	3	IR852A-22GG-XX0 (577), IR852A-22YY-XX0 (578)
	A(L)	1,2	3	IR852A-26YB-XX0 (578) IR852A-62BY-XX0 (578)
	A(L)	1,2	3	IR852A-26GB-XX0 (577) IR852A-62BG-XX0 (577)
	A(L)	1,2	3	IR852A-22-GY-XX0 (577)(578) IR852A-22-YG-XX0 (577)(578)
	B(L)	1,2	3	IR852B-33GG-XX0 (577), IR852B-33YY-XX0 (578)
	B(L)	1,2	3	IR852B-36YB-XX0 (578), IR852B-63BY-XX0 (578)
	B(L)	1,2	3	IR852B-36GB-XX0 (577), IR852B-63-BG-XX0 (577),
	C(L)	1,2	3	IR852C-22GG-XX0 (550), IR852C-22YY-XX0 (576)
	C(L)	1,2	3	IR852C-26YB-XX0 (576) IR852C-62BY-XX0 (576)
	C(L)	1,2	3	IR852C-26GB-XX0 (550) IR852C-62BG-XX0 (550)
	C(L)	1,2	3	IR852C-22-GY-XX0 (550)(576) IR852C-22-YG-XX0 (550)(576)
	D(L)	1,2	3	IR852D-33GG-XX0 (577), IR852D-33YY-XX0 (578)
	D(L)	1,2	3	IR852D-36YB-XX0 (578), IR852D-63BY-XX0 (578)
	D(L)	1,2	3	IR852D-36GB-XX0 (577), IR852D-63-BG-XX0 (577),
	J(L)	1,2	3	IR852J-44GG-XX0 (577), IR852J-55YY-XX0 (578)
	J(L)	1,2	3	IR852J-56YB-XX0 (578), IR852J-65BY-XX0 (578)
	J(L)	1,2	3	IR852J-46GB-XX0 (577), IR852J-64BG-XX0 (577)
	K(L)	1,2	3	IR852K-44GG-XX0 (577), IR852K-55YY-XX0 (578)
	K(L)	1,2	3	IR852K-56YB-XX0 (578), IR852K-65BY-XX0 (578)
	K(L)	1,2	3	IR852K-46GB-XX0 (577), IR852K-64BG-XX0 (577)
ATG Airports Ltd	A(L)	1,2	3	IR852A-22GG-XX0 (609), IR852A-22YY-XX0 (610)
	A(L)	1,2	3	IR852A-26YB-XX0 (610) IR852A-62BY-XX0 (610)
	A(L)	1,2	3	IR852A-26GB-XX0 (609) IR852A-62BG-XX0 (609)
	A(L)	1,2	3	IR852A-22-GY-XX0 (609)(610) IR852A-22-YG-XX0 (609)(610)

L-852—Lights, Taxiway, Inpavement (AC 150/5345-46D)

Manufacturer	Type L-852	Class	Style	Manufacturer's Catalog Number
ATG Airports Ltd	B(L)	1,2	3	IR852B-33GG-XX0 (609), IR852B-33YY-XX0 (610)
	B(L)	1,2	3	IR852B-36YB-XX0 (610), IR852B-63BY-XX0 (610)
	B(L)	1,2	3	IR852B-36GB-XX0 (609), IR852B-63-BG-XX0 (609),
	C(L)	1,2	3	IR852C-22GG-XX0 (607), IR852C-22YY-XX0 (608)
	C(L)	1,2	3	IR852C-26YB-XX0 (608), IR852C-62BY-XX0 (608)
	C(L)	1,2	3	IR852C-26GB-XX0 (607), IR852C-62BG-XX0 (607)
	C(L)	1,2	3	IR852C-22GY-XX0 (607)(608), IR852C-22YG-XX0 (608)(607)
	D(L)	1,2	3	IR852D-33GG-XX0 (609), IR852D-33YY-XX0 (610)
	D(L)	1,2	3	IR852D-36YB-XX0 (610), IR852D-63BY-XX0 (610)
	D(L)	1,2	3	IR852D-36GB-XX0 (609), IR852D-63-BG-XX0 (609),
	J(L)	1,2	3	IR852J-44GG-XX0 (609), IR852J-55YY-XX0 (610)
	J(L)	1,2	3	IR852J-56YB-XX0 (610), IR852J-65BY-XX0 (610)
	J(L)	1,2	3	IR852J-46GB-XX0 (609), IR852J-64BG-XX0 (609)
	K(L)	1,2	3	IR852K-44GG-XX0 (609), IR852K-55YY-XX0 (610)
	K(L)	1,2	3	IR852K-56YB-XX0 (610), IR852K-65BY-XX0 (610)
	K(L)	1,2	3	IR852K-46GB-XX0 (609), IR852K-64BG-XX0 (609)
Crouse-Hinds ALP	A	1,2	3	852A3-XXX-12F-XX (181)
	A	2	3	852A3-XX-PX (181)
	A(L)	2	3	852A-7-XX-F1-XXX-X-X (469)(470), 852A-AP1-XX-F1-12U-XX-X-0 (584) (585)
	A(L)	2	3	852A-AP1-XX-F1-8FS-XX–X-X (584) (585)
	B	1,2	3	852B3-XX-12F-XX (181)
	B	2	3	852B3-XX-PX (181)
	B(L)	2	3	852B-7-GG-F1-XXX-X-X (469), 852B-7-GO-F1-XXX-X-X (469)
	B(L)	2	3	852B-7-YY-F1-XXX-X-X (470), 852B-7-YO-F1-XXX-X-X (470)
	B(L)	2	3	852B-AP1-GN-F1-12U-XX-X-0 (584), 852B-AP1-YN-F1-12U-XX-X-0 (585)
	B(L)	2	3	852B-AP1-GG-F1-12U-XX-X-0 (584), 852B-AP1-YY-F1-12U-XX-X-0 (585)
	B(L)	2	3	852B-AP1-GN-F1-8FS-XX–X-X (584), 852B-AP1-YN-F1-8FS-XX–X-X (585)
	B(L)	2	3	852B-AP1-GG-F1- 8FS-XX–X-X (584), 852B-AP1-YY-F1-8FS-XX–X-X (585)
	C	1,2	3	852C3-XX-12F-XX (181)
	C	2	3	852C3-XX-PX (181)
	C(L)	2	3	852C-5-XX-F1-NSR-XX-X (454)(487), 852C-5-XX-F1-12S-XX-X (454)(487)
	C(L)	2	3	852C-7-XX-F1-XXX-X-X(471)(472), 852C-AP1-XX-F1-12U-XX-X-0 (586) (587)
	C(L)	2	3	852C-AP1-XX-F1-8FS-XX–X-X (586) (587)
	D	1,2	3	852D6-XX-12F-XX (181)
	D	2	3	852D3-XX-PX (181)
	D(L)	2	3	852D-AP1-GN-F1-12U-XX-X-0 (584), 852D-AP1-YN-F1-12U-XX-X-0 (585)
	D(L)	2	3	852D-AP1-GG-F1-12U-XX-X-0 (584), 852D-AP1-YY-F1-12U-XX-X-0 (585)
	D(L)	2	3	852D-AP1-GN-F1-8FS-XX–X-X (584), 852D-AP1-YN-F1-8FS-XX–X-X (585)
	D(L)	2	3	852D-AP1-GG-F1- 8FS-XX–X-X (584), 852D-AP1-YY-F1-8FS-XX–X-X (585)
	D(L)	2	3	852D-5-G0-F1-NSR-XX-X (463); 852D-5-G0-F1-12C-XX-X (463)
	D(L)	2	3	852D-5-0G-F1-NSR-XX-X (463); 852D-5-0G-F1-12C-XX-X (463)
	D(L)	2	3	852D-5-GG-F1-NSR-XX-X (463); 852D-5-GG-F1-12C-XX-X (463)
	D(L)	2	3	852D-5-Y0-F1-NSR-XX-X (464); 852D-5-Y0-F1-12C-XX-X (464);
	D(L)	2	3	852D-5-0Y-F1-NSR-XX-X (464); 852D-5-0Y-F1-12C-XX-X (464)
	D(L)	2	3	852D-5-YY-F1-NSR-XX-X (464); 852D-5-YY-F1-12C-XX-X (464);
	D(L)	2	3	852D-7-GG-F1-XXX-X-X (469), 852D-7-GO-F1-XXX-X-X (469)
	D(L)	2	3	852D-7-YY-F1-XXX-X-X (470), 852D-7-YO-F1-XXX-X-X (470)
	E	2	3	852E3-12X (219), 852E3-12A (219)
	G	2	3	852G3-Y-XXX-X (215), 852GS3-YR-P2 (215), 852GS3-Yx-P1 (215)
	G(L)	2	2	852G-7-YX-F1-12B-P1-X (468), 852G-AP1-YX-F1-12U-PX-X-0 (468)
	J(L)	2	3	852J-AP1-GN-F1-12U-XX-X-0 (584), 852J-AP1-YN-F1-12U-XX-X-0 (585)
	J(L)	2	3	852J-AP1-NG-F1-12U-XX-X-0 (584), 852J-AP1-NY-F1-12U-XX-X-0 (585)
	J(L)	2	3	852J-AP1-GG-F1-12U-XX-X-0 (584), 852J-AP1-YY-F1-12U-XX-X-0 (585)
	J(L)	2	3	852J-AP1-GN-F1-8FL-XX–X-X (584), 852J-AP1-YN-F1-8FL-XX–X-X (585)

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L-852—Lights, Taxiway, Inpavement (AC 150/5345-46D)

Manufacturer	Type L-852	Class	Style	Manufacturer's Catalog Number
Crouse-Hinds ALP	J(L)	2	3	852J-AP1-NG-F1-8FR-XX–X-X (584), 852J-AP1-NY-F1-8FR-XX–X-X (585)
	J(L)	2	3	852J-AP1-GG-F1- 8FC-XX–X-X (584), 852J-AP1-YY-F1-8FC-XX–X-X (585)
	K(L)	2	3	852K-AP1-GN-F1-12U-XX-X-0 (584), 852K-AP1-YN-F1-12U-XX-X-0 (585)
	K(L)	2	3	852K-AP1-NG-F1-12U-XX-X-0 (584), 852K-AP1-NY-F1-12U-XX-X-0 (585)
	K(L)	2	3	852K-AP1-GG-F1-12U-XX-X-0 (584), 852K-AP1-YY-F1-12U-XX-X-0 (585)
	K(L)	2	3	852K-AP1-GN-F1-8FL-XX–X-X (584), 852K-AP1-YN-F1-8FL-XX–X-X (585)
	K(L)	2	3	852K-AP1-NG-F1-8FR-XX–X-X (584), 852K-AP1-NY-F1-8FR-XX–X-X (585)
	K(L)	2	3	852K-AP1-GG-F1- 8FC-XX–X-X (584), 852K-AP1-YY-F1-8FC-XX–X-X (585)
	K(L)	2	3	852K-5-GG-F1-NSR-XX-X (454), 852K-5-GG-F1-12C-XX-X (454)
	K(L)	2	3	852K-5-YY-F1-NSR-XX-X (487), 852K-5-YY-F1-12C-XX-X (487)
	K(L)	2	3	852K-5-G0-F1-NSR-XX-X (454), 852K-5-G0-F1-12C-XX-X (454)
	K(L)	2	3	852K-5-Y0-F1-NSR-XX-X (487), 852K-5-Y0-F1-12C-XX-X (487)
	K(L)	2	3	852K-5-0G-F1-NSR-XX-X (454), 852K-5-0G-F1-12C-XX-X (454)
	K(L)	2	3	852K-5-0Y-F1-NSR-XX-X (487), 852K-5-0Y-F1-12C-XX-X (487)
	S	2	3	852S3-R-XXX-X (215), 852GS3-YR-P2 (215), 852GS3-xR-P1 (215)
	S(L)	2	3	852S-5-R0-F1-XXX-P1-X (484)
	T	2	3	852T3-12X (219), 852T3-12A (219), 852T3-12B (219)
	T(L)	2	3	852T5-12X-1 (397), 852T5-12X (397)
Hella KGaA Hueck & Co	C(L)	2	3	8NA 011.211-04 (454), 8NA 011.211-05 (454), 8NA 011.211-06 (454),
	C(L)	2	3	8NA 011.211-07 (454), 8NA 011.211-12 (454)(487), 8NA 011.211-13 (454)(487),
	C(L)	2	3	8NA 011.211-14 (454)(487), 8NA 011.211-15 (454)(487),
	C(L)	2	3	8NA 011.211-44 (487), 8NA 011.211-45 (487), 8NA 011.211-46 (487), 8NA 011.211-47 (487),
	C(L)	2	3	8NA 011.451-06 (454), 8NA 011.451-07 (454), 8NA 011.451-08 (487), 8NA 011.451-09(487)
	C(L)	2	3	8NA 011.451-18 (487), 8NA 011.451-19 (487)
	C(L)	2	3	8NA 011.548-04 (454), 8NA 011.548-05 (454), 8NA 011.548-06 (454), 8NA 011.548-07(454)
	C(L)	2	3	8NA 011.548-12 (454)(487), 8NA 011.548-13 (454)(487), 8NA 011.548-14 (454)(487)
	C(L)	2	3	8NA 011.548-15 (454)(487), 8NA 011.548-44 (487), 8NA 011.548-45 (487),
	C(L)	2	3	8NA 011.548-46 (487), 8NA 011.548-47 (487), 8NA 011.596-06 (454), 8NA 011.596-07 (454)
	C(L)	2	3	8NA 011.596-08 (487), 8NA 011.596-09 (487) 8NA 011.596-18 (487), 8NA 011.596-19 (487)
	D(L)	2	3	8NA 011.625-04 (463); 8NA 011.625-05 (463)
	D(L)	2	3	8NA 011.625-06 (463); 8NA 011.625-07 (463)
	D(L)	2	3	8NA 011.625-12 (463)(464); 8NA 011.625-13 (463)(464);
	D(L)	2	3	8NA 011.625-14 (463)(464); 8NA 011.625-15 (463)(464);
	D(L)	2	3	8NA 011.625-44 (463)(464); 8NA 011.625-45 (463)(464);
	D(L)	2	3	8NA 011.625-46 (463)(464); 8NA 011.625-47 (463)(464)
	D(L)	2	3	8NA 011.624-06 (463); 8NA 011.624-07 (463);
	D(L)	2	3	8NA 011.624-08 (464): 8NA 011.624-09 (464)
	G(L)	2	3	8NA 011.518-04 (509), 8NA 011.518-05 (509), 8NA 011.518-06 (509), 8NA 011.518-07 (509)
	G(L)	2	3	8NA 012.052-04 (509), 8NA 012.052-05 (509), 8NA 012.052-06 (509), 8NA 012.052-07 (509)
	G(L)	2	3	8NA 011.518-04 (509), 8NA 011.518-05 (509), 8NA 012.052-10 (509), 8NA 012.052-11 (509)
	K(L)	2	3	8NA 011.261-06 (454); 8NA 011.261-07 (454), 8NA 011.261-10 (454); 8NA 011.261-11 (454)
	K(L)	2	3	8NA 011.261-44 (487); 8NA 011.261-45 (487)
	K(L)	2	3	8NA 011.261-46 (487); 8NA 011.261-47 (487)
	K(L)	2	3	8NA 011.549-04 (454); 8NA 011.549-05 (454)
	K(L)	2	3	8NA 011.549-06 (454); 8NA 011.549-07 (454)
	K(L)	2	3	8NA 011.549-44 (487); 8NA 011.549-45 (487), 8NA 011.549-46 (487); 8NA 011.549-47 (487)
	K(L)	2	3	8NA 012.126-00 (454), 8NA 012.126-01 (454), 8NA 012.126-02 (487), 8NA 012.126-03 (487)
Multi-Electric Mfg	A(L)	1, 2	3	LTA0804-F-A-GG-XX-X-X-X (540), LTA0804-F-A-GY-XX-X-X-X (540)(541)
	A(L)	1, 2	3	LTA0804-F-A-YG-XX-X-X-X (541)(540), LTA0804-F-A-YY-XX-X-X-X (541)
	A(L)	1, 2	3	LTA0804-F-A-GS-1P-X-X-X (540), LTA0804-F-A-YS-1P-X-X-X (541)
	A(L)	1, 2	3	LTA0804-F-A-GM-1P-X-X-X (540), LTA0804-F-A-YM-1P-X-X-X (541)
	A(L)	1, 2	3	LTA1204-F-A-GG-XX-0-X (540), LTA1204-F-A-GY-XX-0-X-X (540)(541)
	A(L)	1, 2	3	LTA1204-F-A-YG-XX-0-X-X (541)(540), LTA1204-F-A-YY-XX-0-X-X (541)

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L-852—Lights, Taxiway, Inpavement (AC 150/5345-46D)

Manufacturer	Type L-852	Class	Style	Manufacturer's Catalog Number
Multi-Electric Mfg	A(L)	1, 2	3	LTA1204-F-A-GS-1P-0-X-X (540), LTA1204-F-A-YS-1P-0-X-X (541)
	A(L)	1, 2	3	LTA1204-F-A-GM-1P-0-X-X (540), LTA1204-F-A-YM-1P-0-X-X (541)
	B(L)	1, 2	3	LTA0804-F-B-GG-XX-X-X-X (540), LTA0804-F-B-YY-XX-X-X-X (541)
	B(L)	1, 2	3	LTA0804-F-B-GS-1P-X-X-X (540), LTA0804-F-B-GM-1P-X-X-X (540)
	B(L)	1, 2	3	LTA0804-F-B-YS-1P-X-X-X (541), LTA0804-F-B-YM-1P-X-X-X (541)
	B(L)	1, 2	3	LTA0804-F-B-SG-1P-X-X-X (540), LTA0804-F-B-MG-1P-X-X-X (540)
	B(L)	1, 2	3	LTA0804-F-B-SY-1P-X-X-X (541), LTA0804-F-B-MY-1P-X-X-X (541)
	B(L)	1, 2	3	LTA1204-F-B-GG-XX-0-X-X (540), LTA1204-F-B-YY-XX-0-X-X (541)
	B(L)	1, 2	3	LTA1204-F-B-GS-1P-0-X-X (540), LTA1204-F-B-GM-1P-0-X-X (540)
	B(L)	1, 2	3	LTA1204-F-B-YS-1P-0-X-X (541), LTA1204-F-B-YM-1P-0-X-X (541)
	B(L)	1, 2	3	LTA1204-F-B-SG-1P-0-X-X (540), LTA1204-F-B-MG-1P-0-X-X (540)
	B(L)	1, 2	3	LTA1204-F-B-SY-1P-0-X-X (541), LTA1204-F-B-MY-1P-0-X-X (541)
	C(L)	1, 2	3	LTA0804-F-C-GG-XX-X-X-X (540), LTA0804-F-C-GY-XX-X-X-X (540)(541)
	C(L)	1, 2	3	LTA0804-F-C-YG-XX-X-X-X (541)(540), LTA0804-F-C-YY-XX-X-X-X (541)
	C(L)	1, 2	3	LTA0804-F-C-GS-1P-X-X-X (540), LTA0804-F-C-GM-1P-X-X-X (540)
	C(L)	1, 2	3	LTA0804-F-C-YS-1P-X-X-X (541), LTA0804-F-C-YM-1P-X-X-X (541)
	C(L)	1, 2	3	LTA0804-F-C-SG-1P-X-X-X (540), LTA0804-F-C-MG-1P-X-X-X (540)
	C(L)	1, 2	3	LTA0804-F-C-SY-1P-X-X-X (541), LTA0804-F-C-MY-1P-X-X-X (541)
	C(L)	1, 2	3	LTA1204-F-C-GG-XX-0-X (540), LTA1204-F-C-GY-XX-0-X-X (540)(541)
	C(L)	1, 2	3	LTA1204-F-C-YG-XP-0-X-X (541)(540), LTA1204-F-C-YY-XP-0-X-X (541)
	C(L)	1, 2	3	LTA1204-F-C-GS-1P-0-X-X (540), LTA1204-F-C-GM-1P-0-X-X (540)
	C(L)	1, 2	3	LTA1204-F-C-YS-1P-0-X-X (541), LTA1204-F-C-YM-1P-0-X-X (541)
	C(L)	1, 2	3	LTA1204-F-C-SG-1P-0-X-X (540), LTA1204-F-C-MG-1P-0-X-X (540)
	C(L)	1, 2	3	LTA1204-F-C-SY-1P-0-X-X (541), LTA1204-F-C-MY-1P-0-X-X (541)
	D(L)	1, 2	3	LTA0804-F-D-GG-XX-X-X-X (540), LTA0804-F-D-YY-XX-X-X-X (541)
	D(L)	1, 2	3	LTA0804-F-D-GS-1P-X-X-X (540), LTA0804-F-D-GM-1P-X-X-X (540)
	D(L)	1, 2	3	LTA0804-F-D-YS-1P-X-X-X (541), LTA0804-F-D-YM-1P-X-X-X (541)
	D(L)	1, 2	3	LTA0804-F-D-WS-1P-X-X-X (542), LTA0804-F-D-WM-1P-X-X-X (542)
	D(L)	1, 2	3	LTA0804-F-D-SG-1P-X-X-X (540), LTA0804-F-D-MG-1P-X-X-X (540)
	D(L)	1, 2	3	LTA0804-F-D-SY-1P-X-X-X (541), LTA0804-F-D-MY-1P-X-X-X (541)
	D(L)	1, 2	3	LTA0804-F-D-SW-1P-X-X-X (542), LTA0804-F-D-MW-1P-X-X-X (542)
	D(L)	1, 2	3	LTA1204-F-D-GG-XX-0-X-X (540), LTA1204-F-D-YY-XX-0-X-X (541)
	D(L)	1, 2	3	LTA1204-F-D-GS-1P-0-X-X (540), LTA1204-F-D-GM-1P-0-X-X (540)
	D(L)	1, 2	3	LTA1204-F-D-YS-1P-0-X-X (541), LTA1204-F-D-YM-1P-0-X-X (541)
	D(L)	1, 2	3	LTA1204-F-D-WS-1P-0-X-X (542), LTA1204-F-D-WM-1P-0-X-X (542)
	D(L)	1, 2	3	LTA1204-F-D-SG-1P-0-X-X (540), LTA1204-F-D-MG-1P-0-X-X (540)
	D(L)	1, 2	3	LTA1204-F-D-SY-1P-0-X-X (541), LTA1204-F-D-MY-1P-0-X-X (541)
	D(L)	1, 2	3	LTA1204-F-D-SW-1P-0-X-X (542), LTA1204-F-D-MW-1P-0-X-X (542)
	J(L)	1, 2	3	LTA0804-F-J-GG-XX-X-X-X (540), LTA0804-F-J-YY-XX-X-X-X (541)
	J(L)	1, 2	3	LTA0804-F-J-GS-1P-X-X-X (540), LTA0804-F-J-GM-1P-X-X-X (540)
	J(L)	1, 2	3	LTA0804-F-J-YS-1P-X-X-X (541), LTA0804-F-J-YM-1P-X-X-X (541)
	J(L)	1, 2	3	LTA0804-F-J-SG-1P-X-X-X (540), LTA0804-F-J-MG-1P-X-X-X (540)
	J(L)	1, 2	3	LTA0804-F-J-SY-1P-X-X-X (541), LTA0804-F-J-MY-1P-X-X-X (541)
	J(L)	1, 2	3	LTA1204-F-J-GG-XX-X-X-X (540), LTA1204-F-J-YY-XX-X-X-X (541)
	J(L)	1, 2	3	LTA1204-F-J-GS-1P-X-X-X (540), LTA1204-F-J-GM-1P-X-X-X (540)
	J(L)	1, 2	3	LTA1204-F-J-YS-1P-X-X-X (541), LTA1204-F-J-YM-1P-X-X-X (541)
	J(L)	1, 2	3	LTA1204-F-J-SG-1P-X-X-X (540), LTA1204-F-J-MG-1P-X-X-X (540)
	J(L)	1, 2	3	LTA1204-F-J-SY-1P-X-X-X (541), LTA1204-F-J-MY-1P-X-X-X (541)
	K(L)	1, 2	3	LTA0804-F-K-GG-XX-X-X-X (540), LTA0804-F-K-YY-XX-X-X-X (541)
	K(L)	1, 2	3	LTA0804-F-K-GS-1P-X-X-X (540), LTA0804-F-K-GM-1P-X-X-X (540)
	K(L)	1, 2	3	LTA0804-F-K-YS-1P-X-X-X (541), LTA0804-F-K-YM-1P-X-X-X (541)
	K(L)	1, 2	3	LTA0804-F-K-SG-1P-X-X-X (540), LTA0804-F-K-MG-1P-X-X-X (540)
	K(L)	1, 2	3	LTA0804-F-K-SY-1P-X-X-X (541), LTA0804-F-K-MY-1P-X-X-X (541)
	K(L)	1, 2	3	LTA1204-F-K-GG-XX-0-X (540), LTA1204-F-K-YY-XX-0-X-X (541)
	K(L)	1, 2	3	LTA1204-F-K-GS-1P-0-X-X (540), LTA1204-F-K-GM-1P-0-X-X (540)

Any runway fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. (L) Indicates LED fixture.

L-852—Lights, Taxiway, Inpavement (AC 150/5345-46D)

Manufacturer	Type L-852	Class	Style	Manufacturer's Catalog Number
Multi-Electric Mfg	K(L)	1, 2	3	LTA1204-F-K-YS-1P-0-X-X (541), LTA1204-F-K-YM-1P-0-X-X (541)
	K(L)	1, 2	3	LTA1204-F-K-SG-1P-0-X-X (540), LTA1204-F-K-MG-1P-0-X-X (540)
	K(L)	1, 2	3	LTA1204-F-K-SY-1P-0-X-X (541), LTA1204-F-K-MY-1P-0-X-X (541)
	S(L)	1, 2	3	LTWS04-X-X (532)
	T(L)	1, 2	3	LTO1704-F-X-X-X (543), LTO1804-F-0-X-X (543)
O.C.E.M. Airfield Technology	A	1, 2	3	TWCD-A-F-GG-XP-060-X-F (521), TWCD-A-F-YY-XP-060-X-F (521)
	A	1, 2	3	TWCD-A-F-YG-XP-060-X-F (521), TWCD-A-F-GY-XP-060-O (521)
	A	1, 2	3	TWCS-A-F-GG-030-X-F (521), TWCS-A-F-GM-030-X-F (521)
	A	1, 2	3	TWCS-A-F-GY-030-X-F (521), TWCS-A-F-YG-030-X-F (521)
	A	1, 2	3	TWCS-A-F-YM-030-X-F (521), TWCS-A-F-YY-030-X-F (521)
	A(L)	1, 2	3	LITC08-F-A-GG-XX-X-X-X (540), LITC08-F-A-GY-XX-X-X-X (540)(541)
	A(L)	1, 2	3	LITC08-F-A-YG-XX-X-X-X (541)(540), LITC08-F-A-YY-XX-X-X-X (541)
	A(L)	1, 2	3	LITC08-F-A-GS-1P-X-X-X (540), LITC08-F-A-YS-1P-X-X-X (541)
	A(L)	1, 2	3	LITC08-F-A-GM-1P-X-X-X (540), LITC08-F-A-YM-1P-X-X-X (541),
	A(L)	1, 2	3	LITC12-F-A-GG-XX-0-X-X (540), LITC12-F-A-GY-XX-0-X-X (540)(541)
	A(L)	1, 2	3	LITC12-F-A-YG-XX-0-X-X (541)(540), LITC12-F-A-YY-XX-0-X-X (541)
	A(L)	1, 2	3	LITC12-F-A-GS-1P-0-X-X (540), LITC12-F-A-YS-1P-0-X-X (541)
	A(L)	1, 2	3	LITC12-F-A-GM-1P-0-X-X (540), LITC12-F-A-YM-1P-0-X-X (541)
	B	1, 2	3	TWCD-B-F-GG-XP-060-X-F (521), TWCD-B-F-YY-XP-060-X-F (521)
	B	1, 2	3	TWCS-B-F-GG-030-X-F(521), TWCS-B-F-GM-030-X-F (521)
	B	1, 2	3	TWCS-B-F-YM-030-X-F (521), TWCS-B-F-YY-30-X-F (521)
	B(L)	1, 2	3	LITC08-F-B-GG-XX-X-X-X (540), LITC08-F-B-YY-XX-X-X-X (541)
	B(L)	1, 2	3	LITC08-F-B-GS-1P-X-X-X (540), LITC08-F-B-GM-1P-X-X-X (540)
	B(L)	1, 2	3	LITC08-F-B-YS-1P-X-X-X (541), LITC08-F-B-YM-1P-X-X-X (541)
	B(L)	1, 2	3	LITC08-F-B-SG-1P-X-X-X (540), LITC08-F-B-MG-1P-X-X-X (540)
	B(L)	1, 2	3	LITC08-F-B-SY-1P-X-X-X (541), LITC08-F-B-MY-1P-X-X-X (541)
	B(L)	1, 2	3	LITC12-F-B-GG-XX-0-X-X (540), LITC12-F-B-YY-XX-0-X-X (541)
	B(L)	1, 2	3	LITC12-F-B-GS-1P-0-X-X (540), LITC12-F-B-GM-1P-0-X-X (540)
	B(L)	1, 2	3	LITC12-F-B-YS-1P-0-X-X (541), LITC12-F-B-YM-1P-0-X-X (541)
	B(L)	1, 2	3	LITC12-F-B-SG-1P-0-X-X (540), LITC12-F-B-MG-1P-0-X-X (540)
	B(L)	1, 2	3	LITC12-F-B-SY-1P-0-X-X (541), LITC12-F-B-MY-1P-0-X-X (541)
	C	1, 2	3	TWCD-C-F-GG-XP-090-X-F (519), TWCD-C-F-GY-XP-090-X-F (519)
	C	1, 2	3	TWCD-C-F-YG-XP-090-X-F (519), TWCD-C-F-YY-XP-090-X-F (519)
	C	1, 2	3	TWCS-C-F-GG-045-X-F (519), TWCS-C-F-GM-045-X-F (519), TWCS-C-F-YM-045-X-F (519)
	C	1, 2	3	TWCS-C-F-GY-045-X-F (519), TWCS-C-F-YG-045-X-F (519), TWCS-C-F-YY-045-X-F (519)
	C(L)	1, 2	3	LITC08-F-C-GG-XX-X-X-X (540), LITC08-F-C-GY-XX-X-X-X (541)(540)
	C(L)	1, 2	3	LITC08-F-C-YG-XX-X-X-X (540)(541), LITC08-F-C-YY-XX-X-X-X (541)
	C(L)	1, 2	3	LITC08-F-C-GS-1P-X-X-X (540), LITC08-F-C-GM-1P-X-X-X (540)
	C(L)	1, 2	3	LITC08-F-C-YS-1P-X-X-X (541), LITC08-F-C-YM-1P-X-X-X (541)
	C(L)	1, 2	3	LITC08-F-C-SG-1P-X-X-X (540), LITC08-F-C-MG-1P-X-X-X (540)
	C(L)	1, 2	3	LITC08-F-C-SY-1P-X-X-X (541), LITC08-F-C-MY-1P-X-X-X (541)
	C(L)	1, 2	3	LITC12-F-C-GG-XX-0-X-X (540), LITC12-F-C-GY-XX-0-X-X (540)(541)
	C(L)	1, 2	3	LITC12-F-C-YG-XP-0-X-X (541)(540), LITC12-F-C-YY-XP-0-X-X (541)
	C(L)	1, 2	3	LITC12-F-C-GS-1P-0-X-X (540), LITC12-F-C-GM-1P-0-X-X (540)
	C(L)	1, 2	3	LITC12-F-C-YS-1P-0-X-X (541), LITC12-F-C-YM-1P-0-X-X (541)
	C(L)	1, 2	3	LITC12-F-C-SG-1P-0-X-X (540), LITC12-F-C-MG-1P-0-X-X (540)
	C(L)	1, 2	3	LITC12-F-C-SY-1P-X-X (541), LITC12-F-C-MY-1P-0-X-X (541)
	D	1, 2	3	TWCD-D-F-GG-XP-090-X-F (519), TWCD-D-F-YY-XP-090-X-F (519)
	D	1, 2	3	TWCS-D-F-CM-045-X-F (519), TWCS-D-F-GG-045-X-F (519)
	D	1, 2	3	TWCS-D-F-GM-045-X-F (519), TWCS-D-F-YM-045-X-F (519), TWCS-D-F-YY-045-X-F (519)
	D(L)	1, 2	3	LITC08-F-D-GG-XX-X-X-X (540), LITC08-F-D-YY-XX-X-X-X (541)
	D(L)	1, 2	3	LITC08-F-D-GS-1P-X-X-X (540), LITC08-F-D-GM-1P-X-X-X (540)
	D(L)	1, 2	3	LITC08-F-D-YS-1P-X-X-X (541), LITC08-F-D-YM-1P-X-X-X (541)
	D(L)	1, 2	3	LITC08-F-D-WS-1P-X-X-X (542), LITC08-F-D-WM-1P-X-X-X (542)

Any runway fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. (L) Indicates LED fixture.

L-852—Lights, Taxiway, Inpavement (AC 150/5345-46D)

Manufacturer	Type L-852	Class	Style	Manufacturer's Catalog Number
O.C.E.M. Airfield Technology	D(L)	1, 2	3	LITC08-F-D-SG-1P-X-X-X (540), LITC08-F-D-MG-1P-X-X-X (540)
	D(L)	1, 2	3	LITC08-F-D-SY-1P-X-X-X (541), LITC08-F-D-MY-1P-X-X-X (541)
	D(L)	1, 2	3	LITC08-F-D-SW-1P-X-X-X (542), LITC08-F-D-MW-1P-X-X-X (542)
	D(L)	1, 2	3	LITC12-F-D-GG-XX-0-X-X (540), LITC12-F-D-YY-XX-0-X-X (541)
	D(L)	1, 2	3	LITC12-F-D-GS-1P-0-X-X (540), LITC12-F-D-GM-1P-0-X-X (540)
	D(L)	1, 2	3	LITC12-F-D-YS-1P-0-X-X (541), LITC12-F-D-YM-1P-0-X-X (541)
	D(L)	1, 2	3	LITC12-F-D-WS-1P-0-X-X (542), LITC12-F-D-WM-1P-0-X-X (542)
	D(L)	1, 2	3	LITC12-F-D-SG-1P-0-X-X (540), LITC12-F-D-MG-1P-0-X-X (540)
	D(L)	1, 2	3	LITC12-F-D-SY-1P-0-X-X (541), LITC12-F-D-MY-1P-0-X-X (541)
	D(L)	1, 2	3	LITC12-F-D-SW-1P-0-X-X (542), LITC12-F-D-MW-1P-0-X-X (542)
	E	1, 2	3	TWOF-F-Y-045-X-X (225),), TWOF-F-Y-045-X-X (225)
	E	1, 2	3	TWOF-F-Y-045-X-F (519), TWOFXXX-F-Y-045-O-F (519)
	G	1, 2	3	TWGLF-F-Y-100-X-X (292), TGL12-Y-100-B (292), TWGLF-F-Y-100-X-X (292)
	G	1, 2	3	TGL12-Y-100-B (292), TWGLF-F-Y-100-X-F (520)
	G(L)	1, 2	3	LITG-F-X-X (538)
	J	1, 2	3	TWCD-J-F-GG-XP-060-X-F (521), TWCD-J-F-YY-XP-060-X-F (521)
	J	1, 2	3	TWCS-J-F-GG-030-X-F (521), TWCS-J-F-GM-030-X-F (521), TWCS-J-F-YM-030-X-F (521)
	J	1, 2	3	TWCS-J-F-MG-030-X-F (521), TWCS-J-F-MY-030-X-F (521), TWCS-J-F-YY-030-X-F (521)
	J(L)	1, 2	3	LITC08-F-J-GG-XX-X-X-X (540), LITC08-F-K-YY-XX-X-X-X (541)
	J(L)	1, 2	3	LITC08-F-J-GS-1P-X-X-X (540), LITC08-F-J-GM-1P-X-X-X (540)
	J(L)	1, 2	3	LITC08-F-J-YS-1P-X-X-X (541), LITC08-F-J-YM-1P-X-X-X (541)
	J(L)	1, 2	3	LITC08-F-J-SG-1P-X-X-X (540), LITC08-F-J-MG-1P-X-X-X (540)
	J(L)	1, 2	3	LITC08-F-J-SY-1P-X-X-X (541), LITC08-F-J-MY-1P-X-X-X (541)
	J(L)	1, 2	3	LITC12-F-J-GG-XX-X-X-X (540), LITC12-F-J-YY-XX-X-X-X (541)
	J(L)	1, 2	3	LITC12-F-J-GS-1P-X-X-X (540), LITC12-F-J-GM-1P-X-X-X (540)
	J(L)	1, 2	3	LITC12-F-J-YS-1P-X-X-X (541), LITC12-F-J-YM-1P-X-X-X (541)
	J(L)	1, 2	3	LITC12-F-J-SG-1P-X-X-X (540), LITC12-F-J-MG-1P-X-X-X (540)
	J(L)	1, 2	3	LITC12-F-J-SY-1P-X-X-X (541), LITC12-F-J-MY-1P-X-X-X (541)
	K	1, 2	3	TWCD-K-F-GG-090-X-F (519), TWCD-K-F-YY-XP-090-X-F (519)
	K	1, 2	3	TWCS-K-F-GG-045-X-F (519), TWCS-K-F-GM-045-X-F (519)
	K	1, 2	3	TWCS-K-F-MG-045-X-F (519), TWCS-K-F-MY-045-X-F (519)
	K	1, 2	3	TWCS-K-F-YM-045-X-F (519), TWCS-K-F-YY-045-X-F (519)
	K(L)	1, 2	3	LITC08-F-K-GG-XX-X-X-X (540), LITC08-F-K-YY-XX-X-X-X (541)
	K(L)	1, 2	3	LITC08-F-K-GS-1P-X-X-X (540), LITC08-F-K-GM-1P-X-X-X (540)
	K(L)	1, 2	3	LITC08-F-K-YS-1P-X-X-X (541), LITC08-F-K-YM-1P-X-X-X (541)
	K(L)	1, 2	3	LITC08-F-K-SG-1P-X-X-X (540), LITC08-F-K-MG-1P-X-X-X (540)
	K(L)	1, 2	3	LITC08-F-K-SY-1P-X-X-X (541), LITC08-F-K-MY-1P-X-X-X (541)
	K(L)	1, 2	3	LITC12-F-K-GG-XX-0-X-X (540), LITC12-F-K-YY-XX-0-X-X (541)
	K(L)	1, 2	3	LITC12-F-K-GS-1P-0-X-X (540), LITC12-F-K-GM-1P-0-X-X (540)
	K(L)	1, 2	3	LITC12-F-K-YS-1P-0-X-X (541), LITC12-F-K-YM-1P-0-X-X (541)
	K(L)	1, 2	3	LITC12-F-K-SG-1P-0-X-X (540), LITC12-F-K-MG-1P-0-X-X (540)
	K(L)	1, 2	3	LITC12-F-K-SY-1P-0-X-X (541), LITC12-F-K-MY-1P-0-X-X (541)
	S	1, 2	3	TWSBF-F-R-100-X-X (292)., TWSBF-F-R-100-X-X (292), TWSBF-F-R-100-X-F (520)
	S(L)	1, 2	3	LITS-X-X (532)
	T	1, 2	3	TWOF-F-B-045-X-X (225), TWOF-F-B-045-X-X (225)
	T	1, 2	3	TWOF-F-B-045-X-F (519), TWOFXXX-F-B-045-O-F (519)
	T(L)	1, 2	3	LITE08-F-X-X-X (543), LITE18-F-0-X-X (543)
Safegate Group	C	1,2	2	IN-TON+1x40W+XX+XX+L852C (191), IN-TTN+2x40W+XX+XX+2C+L852C (191)
	C	1,2	2	IN-SBN+1x40W+X+XX+L852C (191)
	C	1,2	3	ILP-TBN+Xx40W+XX+XX+L852C(191), ILP-TUN+1x40W+X+XX+L852C(191)
	C(L)	1, 2	3	SafeLEDXXTC-1-XNXXXXC (402, 403)
	D	1,2	2	IN-TOW+1x40W+GG+XX+L852D (191), IN-TOW+1x40W+YY+XX+L852D (191)
	D	1,2	2	IN-TTC+2x40W+GG+XX+L852D (191), IN-TTC+2x40W+YY+XX+L852D (191)
	D	1,2	2	IN-SBR+2x40W+X+XX+L852D (191), IN-SBL+2x40W+X+XX+L852D (191)

Any runway fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. (L) Indicates LED fixture.

L-852—Lights, Taxiway, Inpavement
(AC 150/5345-46D)

Manufacturer	Type L-852	Class	Style	Manufacturer's Catalog Number
Safegate Group	G	1	2	INL-RG+1x105W+Y+LC+1C+L852G (164)
	K	1,2	3	ILP-TBC+Xx40W+GG+XX+L852K(191), ILP-TBC+Xx40+YY+XX+L852K(191)
	K	1, 2	3	ILP-TUX+1x40+X+XX+L852K(191)
	K(L)	1, 2	3	SafeLEDXXTC-1-XCXXXXC (402, 403)
	T	1,2	2	IN-OMA+1x45W+B+XX+L852T (192)
	T(L)	1, 2	2	SafeLED-TE-I-O-B-1C-6.6A (564)
Youyang Airport Lighting	C	1, 2	3	1MB-TCLL-X-040-X-0X-X-C (312)
	K	1, 2	3	1MB-TCLL-X-040-X-0X-X-L (312), 1MB-TCLL-X-040-X-0X-X-R (312)

Any runway fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. (L) Indicates LED fixture.

L-853--Markers, Retroreflective
(AC 150/5345-39D)

Manufacturer	Manufacturer's Catalog Number			
	Centerline Marker		Retro-reflectors	Elevated Marker
	Style I	Style II	Use	(height in inches for a given row)
FlexStake Inc.			Red Runway End	A650.5, A750.5 (14")**
			Green Runway Threshold	A650.5, A750.5 (14")**
			White Runway Edge	A650.5, A750.5 (14")**
			White Runway Edge	A651, A751 (19")**
			White Runway Edge	A652, A752 (24")**
			White Runway Edge	A652.5, A752.5 (30")**
			Blue Taxiway Edge	A650.5, A750.5 (14")**
			Blue Taxiway Edge	A651, A751 (19")**
			Blue Taxiway Edge	A652, A752 (24")**
			Blue Taxiway Edge	A652.5, A752.5 (30")**
SAFE-HIT			Red Runway End	SH614XXX-XR-12C (14")**
			Green Runway Threshold	SH614XXX-XG-12C (14")**
			White Runway Edge	SH614XXX-XS-12C (14")**
			White Runway Edge	SH618-XXX-XS-14C, SH618XXX-XS-14 (18")**
			White Runway Edge	SH624-XXX-XS-14C, SH624XXX-XS-14 (24")**
			White Runway Edge	SH630-XXX-XS-14C, SH630XXX-XS-14 (30")**
			Blue Taxiway Edge	SH614XXX-XB-12C (14")**
			Blue Taxiway Edge	SH618-XXX-XB-14C, SH618XXX-XB-14 (18")**
			Blue Taxiway Edge	SH624-XXX-XB-14C, SH624XXX-XB-14 (24")**
			Blue Taxiway Edge	SH630-XXX-XB-14C, SH630XXX-XB-14 (30")**
Valley Illuminators			Red Runway End	AR-100 (14")**
			Green Runway Threshold	AR-100 (14")**
			White Runway Edge	AR-100 (14" through 30")**
			Blue Taxiway Edge	AR-100 (14" through 30")**

**These units are certified under AC 150/5345-39D. These designs do not require tethering per paragraph 3.4.3.2.d. When ordering under AIP funding use only L-853 as a designator with appropriate height and the requirement for certification under AC 150/5345-53D. Height requirements are in accordance with AC150/5340-30 based on the type of lights (runway, taxiway, or threshold) these units are replacing and their installation distance from the defined aircraft movement surface. Currently there are two reflector manufacturers for any specified use.

L-854—Radio Controls
(AC 150/5345-49C)

Manufacturer	Type	Manufacturer's Catalog Number
ADB Airfield Solutions, LLC	I	RCE-1X1X
	I	RCE-2X1X
	I	RCE-3X1X
	I	RCE-4X1X
Rural Electric Inc	I	RDL854-1A

L-856--Lights, Obstruction, High Intensity, White, 40 FPM (AC 150/5345-43F)

Manufacturer	L-856	Manufacturer's Catalog Number
Skytec Inc.		8440 (303)**

**Certified for 120 degree horizontal beam spread

L-856--Lights, Obstruction, High Intensity, White, 40 FPM (AC 150/5345-43G)

Manufacturer	L-856	Manufacturer's Catalog Number
Cooper Crouse Hinds		CHB204 (486), CHB205 (486)**
Dialight Corp	(L)	D156-A33-SYS (447)**, D266-A57-SYS (522)**
Flash Technology		FTB 204 (486)**, FTB 205 (486)** FTB 224 (486)**, FTB 225 (486)**
Orga B.V.		L1000-856 (217)**
Technostrobe		HIGH-W120 (398)**

**Certified for 120 degree horizontal beam spread

Any fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. **(L)** Indicates LED fixture (###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment

L-857--Lights, Obstruction, High Intensity, White, 60 FPM (AC 150/5345-43F)

Manufacturer	Manufacturer's Catalog Number
Skytec Inc.	8460 (303)**

**Certified for 120 degree horizontal beam spread

L-857--Lights, Obstruction, High Intensity, White, 60 FPM (AC 150/5345-43G)

Manufacturer	Manufacturer's Catalog Number
Flash Technology	FTB 208 (486)** FTB 207 (486)**

**Certified for 120 degree horizontal beam spread

L-858--Signs, Runway and Taxiway
(AC 150/5345-44J)

Manufacturer	Type	Size	Style	Class	Mode	Manufacturer's Catalog Number
ADB Airfield Solutions, LLC	Y, R, L, (L)	1	2, 3, 5	2	2	SR1X-7XX3XX0 (496)
	Y, R, L, (L)	1	2, 3, 5	2	3	SS1X-7XX3XX0 (496)
	Y, R, L, (L)	2	2, 3, 5	2	2	SR2X-7XX3XX0 (497)
	Y, R, L, (L)	2	2, 3, 5	2	3	SS2X-7XX3XX0 (497)
	Y, R, L, (L)	3	2, 3, 5	2	2	SR3X-7XX3XX0 (498)
	Y, R, L, (L)	3	2, 3, 5	2	3	SS3X-7XX3XX0 (498)
	Y, R, L	1, 2, 3	2, 3, 5	2	2	SHXX-XXXXXXX (124)
	Y, R, L	1, 2, 3	2, 3, 5	2	3	SWXX-XXXXXXX (124)
	B, (L)	4	2, 3, 5	2	2	SR4X-7XX3XX0 (496)
	B, (L)	4	2, 3, 5	2	3	SS4X-7XX3XX0 (496)
	B	4, 5	2, 3, 5	2	2	SHXX-XXXXXXX (124)
	B	4, 5	2, 3, 5	2	3	SWXX-XXXXXXX (124)
	B, (L)	5	2, 3, 5	2	2	SR5X-7XX3XX0 (498)
	B, (L)	5	2, 3, 5	2	3	SS5X-7XX3XX0 (498)
AGM, Airfield Guidancesign Manufacturers, Inc.	Y, R, L	1, 2, 3	4	2	2	D14NXXF, D24NXXF, D34NXXF, D23NXXF
	Y, R, L	1, 2, 3	4	2	2	114NX.XXF, 124NX.XXF, 134NX.XXF
	Y, R, L	1, 2, 3	2, 3	1, 2	2	D12UXXF (11A), D13UXX (11A)
	Y, R, L	1, 2, 3	2, 3	1, 2	2	D22UXXF (11A), D23UXX (11A)
	Y, R, L	1, 2, 3	2, 3	1, 2	2	D32UXXF (11), D33UXX (11A)
	Y, R, L, (L)	1, 2, 3	2	1, 2	2	D12HXXF (462), D22HXXF (462), D32HXXF (462)
	Y, R, L, (L)	1, 2, 3	3	1, 2	2	D13HXXF (462), D23HXXF (462), D33HXXF (462)
	Y, R, L, (L)	1, 2, 3	5	1, 2	2	D15HXXF (462), D25HXXF (462), D35HXXF (462)
	Y, R, L	1, 2, 3	5	2	2	D15AXXF (11A), D25AXXF (11A),), D35AXXF (11A)
	Y, R, L (L)	1	2, 3, 5	1, 2	2	l1XHX.XXF (462)
	Y, R, L (L)	1	2, 3, 5	1, 2	2	l1XHX.XXF3 (462)
	Y, R, L	1	2	1, 2	2	l12GX.XXF (231)
	Y, R, L	1	2	1, 2	3	l12GX.XXF3 (231)
	Y, R, L	1	5	1, 2	2	115CX.XXF (231)
	Y, R, L	1	5	1, 2	3	115CX.XXF3 (231)
	Y, R, L (L)	2	2, 3, 5	1, 2	2	l2XHX.XXF (462)
	Y, R, L (L)	2	2, 3, 5	1, 2	3	l2XHX.XXF3 (462)
	Y, R, L	2	2	1,2	2	122GX.XXF (231)
	Y, R, L	2	2	1, 2	3	l22GX.XXF3 (231)
	Y, R, L	2	5	1, 2	3	125CX.XXF3 (231)
	Y, R, L	2	5	1, 2	2	l25CX.XXF (231)
	Y, R, L (L)	3	2, 3, 5	1, 2	2	l3XHX.XXF (462)
	Y, R, L (L)	3	2, 3, 5	1, 2	3	l3XHX.XXF3 (462)
	Y, R, L	3	2	1, 2	2	l32GX.XXF (231)
	Y, R, L	3	2	1, 2	3	l32GX.XXF3 (231)
	Y, R, L	3	5	1, 2	3	l35CX.XXF3 (231)
	Y, R, L	3	5	1, 2	2	l35CX.XXF (231)
	B (L)	4	2, 3, 5	1, 2	2	l4XH1.0XF (462)
	B (L)	4	2, 3, 5	1, 2	3	l4XH1.0XF3 (462)
	B	4	2	1, 2	3	l42G1.0XF3 (231)
	B	4	5	1,2	3	l45C1.0XF3 (231)
	B, H, (L)	5	2, 3, 5	1, 2	2	D52H1XF (462), D53H1XF (462), D55H1XF (462)
	B, H (L)	5	2, 3, 5	1, 2	2	l5XH1.0XF (462)
	B, H (L)	5	2, 3, 5	1, 2	3	l5XH1.0XF3 (462)
	B, H	5	2	1, 2	2	l52XG1.0XF (231)
	B, H	5	5	1, 2	2	l55C1.0XF (231)
	B, H	5	2, 3, 5	1, 2	2	D52U1XF (11A), D53U1XF (11A), D54U1XF (11A)

(L) Indicates LED fixture. Any fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. (###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment

L-858--Signs, Runway and Taxiway
(AC 150/5345-44J)

Manufacturer	Type	Size	Style	Class	Mode	Manufacturer's Catalog Number
Crouse-Hinds ALP	Y, R, L	1, 2, 3	2, 3, 5	2	2	858XX-X-XX (151)
	Y, R, L, (L)	1, 2, 3	2, 3, 5	2	2	858S5-1X-X-X (448), 858S5-2X-X-X (448)
	Y, R, L, (L)	1, 2, 3	2, 3, 5	2	2	858S5-3X-X-X (448)
	Y, R, L, (L)	3	2, 3, 5	1, 2	2	858S5-F-XX-X-X-XX (448)
	Y, R, L	1, 2, 3	4	2	2	858F4-X-X-X
	B, (L)	4	2, 3, 5	1, 2	2	858S5-F-BF-X-X-XX (448)
	B, (L)	4	2, 3, 5	2	2	858S5-4X-X-X (448)
	B	4, 5	2, 3, 5	2	2	858XX-X-XX (151)
	B, (L)	5	2, 3, 5	1, 2	2	858S5-F-DM-X-X-XX (448)
Standard Signs Inc.	Y, R, L, C	1, 2, 3	4	N/A	2	SUL-4, MUL-4, LUL-4, SUL-6, MUL-6, LUL-6
	Y, R, L	1	2, 3	1, 2	2	SXx (373)
	Y, R, L	1	5	1, 2	2	SXP(11A), SXQ (33)
	Y, R, L, (L)	1	2, 3, 5	2	2, 3	SXL (442)
	Y, R, L, (L)	2	2, 3, 5	2	2, 3	MXL (442)
	Y, R, L	2	2, 3	1, 2	2, 3	MXx (373)
	Y, R, L	2	5	1, 2	2, 3	MXP (11A), MXQ (33)
	Y, R, L, (L)	3	2, 3, 5	2	2, 3	LXL (442)
	Y, R, L	3	2, 3	1, 2	2, 3	LXx (373)
	Y, R, L	3	5	1, 2	2, 3	LXP (11A), LXQ (33)
	B	4	2, 3	1, 2	2, 3	D1x (373)
	B	4	5	1, 2	2, 3	D1P (11A), D1Q (33)
	B, (L)	4	2, 3, 5	2	2, 3	D1L (442)
	B, (L)	5	2, 3, 5	2	2, 3	DL1L (442)
	B	5	2, 3	1, 2	2, 3	DL1x (373)
	B	5	5	1, 2	2, 3	DL1P (11A), DL1Q (33)

(L) Indicates LED fixture. Any fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. (###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment

L-859--Lights, Flashing, Omnidirectional
(AC 150/5345-51B)

Manufacturer	Type	Style	Manufacturer's Catalog Number
Flash Technology	V, I V, I	F F	FTS 417 (75) FTS 437 (75)
Strobe Approach Lighting Technology	V I	F F	PSFH-OV01 (287), PSFH-OV02 (287) PSFH-OC01 (287), PSFH-OC02 (287)

L-860--Lights, Runway Edge, Low Intensity
(AC 150/5345-46D)

Manufacturer	Manufacturer's Catalog Number	
	Type L-860	Type L-860E

L-861--Lights, Runway & Taxiway Edge, Medium Intensity (AC 150/5345-46D)

Manufacturer	Type	Manufacturer's Catalog Number
ADB Airfield Solutions, LLC	L-861	44C1752-22X (33)(249), 44C1752-23X (33)(249), 44C1752-25X (33)(249)
	L-861	44C1752-28X (33)(249), 44C1752-20X (33)(249), 44C1752-2BX (33)(249)
	L-861	44C1081-21XX (11A), 44C1081-22XX (11A), 44C1081-29XX (11A),
	L-861	44C1081-61XX (33)(290), 44C1081-62XX (33)(290) 44C1081-63XX (33)(290),,
	L-861	44C1081-69XX (33)(290), 44C1081-6CXX (33)(290), 44C1081-6DXX (33)(290),
	L-861(L)	EMIL-1XXX0 (419), EMIL-2XXX0 (419), EMIL-3XXX0 (419),
	L-861(L)	EMIL-4XXX0 (419), EMIL-5XXX0 (419), EMIL-BXXX0 (419)
	L-861(L)	IMIL-11X0 (418), IMIL-12XC0 (418), IMIL-21X0 (418), IMIL-22X0 (418)
	L-861(L)	IMIL-31X0 (418), IMIL-32X0 (418), IMIL-41X0 (418) IMIL-42X0 (418),
	L-861(L)	IMIL-51X0 (418), IMIL-52X0 (418)
	L-861E	44C1081-66XX (33)(290), 44C1081-67XX (33)(290),
	L-861E	44C1081-6BXX (33)(290), 44C1081-66EX (33)(290),
	L-861E(L)	EMIL-7XXX0 (421, 422), EMIL-8XXX0 (421), EMIL-9XXX0 (422), EMIL-AXXX0 (421)
	L-861E(L)	EMIL-EXXX0 (603)(422), EMIL-FXXX0 (603), EMIL-GXXX0(603)
	L-861E(L)	IMIL-A1X0 (421, 422), IMIL-B1X0 (421), IMIL-C1X0 (422)
	L-861E(L)	IMIL-A2X0 (421, 422), IMIL-B2X0 (421), IMIL-C2X0 (422)
	L-861E(L)	IMIL-71X0 (421, 422), IMIL-72X0 (421, 422), IMIL-81X0 (421), IMIL-82X0 (421)
	L-861E(L)	IMIL-91X0 (422) IMIL-92X0 (422)
	L-861T(L)	ETES-XXX0, ETES-XXX1, ETEL-XXX2 (211),
	L-861T	44C1752-21X (33)(249), 44C1081-55XX (31)(291)
	L-861T(L)	ETES-1XX0, ETES-1XX1 (247) (445)
	L-861T(L)	ETES-1X10, ETES-1X11, ETES-1X20, ETES1X21 (247)
	L-861T(L)	ETES-6XX0, ETES-6XX1 (247) (445)
	L-861T(L)	ETES-6X10, ETES 6X11, ETES-6X20, ETES-6X21 (247), IMIL-D1X0 (571)
	L-861T(L)	EHP-B2XX1 (247) (445)
	L-861T(L)	EHP-B2XX0, EHP-B3XX0 (247) (445), IMIL-D1X0 (571),), IMIL-D2X0 (571)
	L-861SE	44A2090-16X1(36), 44A2090-18X2(36),
Airport Lighting Company	L-861	216-30-I-CY-XX (10C), 216-30-I-CR-XX (10C), 216-30-I-CC-XX (10C),
	L-861	216-30-Q-CY-XX (31), 216-30-Q-CR-XX (31), 216-30-Q -CC-XX (31)
	L-861	216-45-Q-CY-XX (33), 216-45-Q-YY-XX (33), 216-45-Q-CC-XX (33)
	L-861(L)	ALC-861L-CC-XX-X (553), ALC-861L-CY-XX-X (553), ALC-861L-GY-XX-X (555),
	L-861(L)	ALC-861L-RC-XX-X (553), ALC-861L-RY-XX-X (553), ALC-861L-YY-XX-X (553),
	L-861E	216-45-I -GR-XX (11C) 216-45-I -RR-XX (11C), 216-45-I -GO-XX (11C)
	L-861E	216-45-Q-GR-XX (33), 216-45-Q-RR-XX (33), 216-45-Q-GR-XX (33)
	L-861E(L)	ALC-861L-GO-XX-X (554), ALC-861L-RR-XX-X (557), ALC-861L-RG-XX-X (556),
	L-861SE	216SE-1-120-GR-XX (342), 216SE-1-120-GO-XX (342)
	L-861T	216-30-I -B-XX (10C), 216-30-Q-B-XX (31),
	L-861T(L)	ALC-861L-BB-XX-X (552), 216LED1-XX-X (591)
Airsafe Airport Equipment Co Ltd	L-861T	EOL-TE-LED-066-B (593)
Astronics DME Corporation	L-861	L861-066-WY-XX-XX (31)(33), L861-066-Y-XX-XX (31)(33)
	L-861	L861-066-W-XX-XX (31)(33), L861-066-WR-45-XX (33)
	L-861	L861-066-YR-45-XX (33), L861-066-GY-45-XX (33)
	L-861(L)	861-L-W-XX (495), 861-L-Y-XX (495), 861-L-WY-XX (495), 861-L-WR-XX (495)
	L-861(L)	861-L-YR-XX (495), 861-L-GY-XX (494)(495)
	L-861E	L861E-066-R-45-XX (33), L-861E-066-G-45-XX (33), L861E-066-RG-45-XX (33)
	L-861E(L)	861E-L-GB-XX-0 (495), 861E-L-RG-XX-0 (494)(495), 861E-L-RR-XX-0 (494)
	L-861SE(L)	861SE-L-GB-XX-0 (495), 861SE-L-RG-XX-0 (494)(495)
	L-861T	L861T-066-B-XX-XX (31)(33),
	L-861T(L)	861T-L-B-066-XX-X (331)

Any runway fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. (L) Indicates LED fixture. (###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment

L-861--Lights, Runway & Taxiway Edge, Medium Intensity (AC 150/5345-46D)

Manufacturer	Type	Manufacturer's Catalog Number
ATG Airports Ltd.	L-861	ZA861-C-45T-14 (11A), ZA861-C-45Q-14 (33)
	L-861	ZA861-Y-45T-14 (11A), ZA861-Y-45Q-14 (33)
	L-861E	ZA861-Gx-45T-14 (11A), ZA861-Gx-45Q-14 (33)
	L-861E	ZA861-GR-45T-14 (11A), ZA861-GR-45Q-14 (33)
	L-861E	ZA861-RR-45T-14 (11A), ZA861-RR-45Q-14 (33)
	L-861T	ZA861-B-45T-14 (11A), ZA861-B-45Q-14 (33), ZA861-B-30T-14 (10A)
	L-861T	ZA216-816T-B-45W-M32-14 (424), ZA861-B-30Q-14 (31)
	L-861SE	ZA861-SE-GR-120-XX (36)
Crouse-Hinds ALP	L-861	40938-CY45-XX (17), 40939-CY-45-XX (530)
	L-861	40938-C45-XX (17), 40939-C-45-XX (530)
	L-861E	40938-RG-45-XX (17), 40938-RR-45-XX (17)
	L-861E	40938-XG-45-XX (17), 40939-RG-45-XX (530)
	L-861E	40939-RR-45-XX (530), 40939-XG-45-XX (530)
	L-861T	40938-B-45-XX (17), 40938-B-30-XX (18)
	L-861T	40939-B-45-XX (530), 40939-B-30-XX (529),
	L-861T(L)	8615-T5-B-066-XX-X (397)
	L-861SE	8615-SXX-XX-X (254), 8615-SGx-XX-X (254), 8615-SGR-XX-X (254)
Flight Light Inc.	L-861	FL-861-C-XXQ-XX (31, 33), FL-861-CY-XXQ-XX (31, 33)
	L-861	FL-861-C-45-XX (382), FL-861-CY-45-XX (382)
	L-861E	FL-861-GR-45Q-XX (33), FL-861-GR-45-XX (382)
	L-861T	FL-861-B-XXQ-XX (31, 33), FL-861-B-45-XX (382)
Manairco, Inc.	L-861	7100 (10A), 7100Q (31), 7550Q (291)
	L-861E	7250 (11A), 7250Q (33)
	L-861T	7400 (10A), 7400Q (31)
	L-861T(L)	7400 LED (579)(580)
Multi-Electric Mfg	L-861	6170-M-WW-XX (10A), 6170-M-WA-XX (11C), 6170-H-WW-XX (31)(33)
	L-861	6170-H-WA-XX (31)(33), 6170-M-AA-XX (11C), 6170-H-AA-XX (31)(33)
	L-861T	6170-M-BB-XX (10A)(11B)(11C), 6170-H-BB-XX (31)
O.C.E.M Airfield Technology	L-861T(L)	LETE-F 35-A-X-X (544), LETE-F 50-A-X-X (544)
	L-861T(L)	LETE-F 61-A-X-X (544)
Point Lighting Corporation	L-861	PEL-50000-C-45T-14 (11A), PEL-50000-C-45Q-14 (33)
	L-861	PEL-50000-Y-45T-14 (11A), PEL-50000-Y-45Q-14 (33)
	L-861E	PEL-50000-Gx-45T-14 (11A), PEL-50000-Gx-45Q-14 (33)
	L-861E	PEL-50000-RG-45T -14 (11A), PEL-50000-RG-45Q -14 (33)
	L-861E	PEL-50000-RR-45T -14 (11A), PEL-50000-RR-45Q -14 (33)
	L-861SE	PEH-55100-GR-SE-120-XX (36)
	L-861T	PEL-50000-B-30T-14 (10A), PEL-50000-B-30Q-14 (31),
	L-861T	PEL-50000-B-45T-14 (11A), PEL-50000-B-45Q-14 (33),
Safegate Group	L-861	EL+EAM+NPS+45W+W+1C+L861 (137), EL+EAM+NPS+45W+Y+1C+L861 (137)
	L-861	EL+EAM+NPS+45W+WY+1C+L861 (137), EL+EAM+NPS+45W+WR+1C+L861 (137)
	L-861	EL+EAM+NPS+45W+YR+1C+L861 (137), EL+EAM+NPS+45W+GY+1C+L861 (137)
	L-861E	EL-EAH+45W+G+NPS+L861E (440), EL-EAH+45W+GR+NPS+L861E (440)
	L-861E	EL-EAH+45W+RR+NPS+L861E (440), EL+EAM+NPS+45W+R+1C+L861E (137)
	L-861SE	EL-EAH+100W+G+NPS+L861E (152), EL-EAH+100W+GR+NPS+L861E (152)
	L-861T(L)	SafeLED-TE-E-O-B-NPS-6.6A (528), EL+EAM+NPS+45W+B+1C+L861T (137)

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L-862—Lights, Runway Edge and Threshold (High Intensity) and Stop Bar (AC 150/5345-46D)

Manufacturer	Type	Manufacturer's Catalog Number
ADB Airfield Solutions	L-862	44C1201-21X1 (21), 44C1201-22X1 (21), EREH-1X1X0 (153)
	L-862	44A2071-2X11 (21), 44A2071-2X21 (21), 44A2071-2X31 (21), 44A2071-2X71 (21)
	L-862	44C1201-41X1 (90), 44C1201-42X1 (90), 44C1201-41X9 (90)
	L-862	44C1201-41X0 (90), 44C1201-41XA (90), 44C1201-41XB (90)
	L-862	44A2071-411X (90), 44A2071-4211(90), 44A2071-412X (90), 44A2071-4221(90)
	L-862	44A2071-413X(90), 44A2071-4231(90), 44A2071-417X(90), 44A2071-4271(90)
	L-862(L)	EREX-2XXX-XXX-0000(479)(480)(481)(482)
	L-862E	44C1201-41X4 (90), 44C1201-41X5 (90), 44C1201-41X6 (90), 44C1201-41X7 (90),
	L-862E	44C1201-41X8 (90), 44C1201-41X9 (90), 44C1201-41X0 (90),
	L-862E(L)	EREX-2XXX-XXX-0000(481)(482)
	L-862S	44A5877-X (153)
ADB BVBA	L-862(L)	EREX-2XXX-XXX-0000(479)(480)(481)(482)
	L-862E(L)	EREX-2XXX-XXX-0000(481)(482)
Airport Lighting Company	L-862	213Q-X-120-CY-XX (36, 342), 213Q-X-120-YC-XX (36, 342)
	L-862	213Q-X-120-CC-XX (36, 342)
Astronics DME Corporation	L-862	L-862-120-WW-XX (36), L-862-120-WY-XX (36), L-862-YW-XX (36)
	L-862	L-862-150-WW-XX (391), L-862-150-WY-XX (391), L-862-150-YW-XX (391)
	L-862	L-862-150-GY-XX (391), L-862-150-YG-XX (391), L-862-150-RW-XX (391)
	L-862	L-862-150-WR-XX (391)
	L-862E	L-862E-200-BRL-XX (392), L-862E-200-GRX-XX (392), L-862E-200-GBX-XX (392)
ATG Airports Limited	L-862	ZA163-862-WW-150W-M32-14 (425), ZA163-862-WW-200W-M32-14 (66)
	L-862	ZA163-862-WY-150W-M32-14 (425), ZA163-862-WY-200W-M32-14 (66)
	L-862	ZA163-862-GY-150W-M32-14 (425), ZA163-862-GY-200W-M32-14 (66)
	L-862	ZA862-CC-120-XX (36), ZA862-CY-120-XX (36), ZA862-YC-120-XX (36)
	L-862	ZA862E-GR-200-XX (90), ZA862E-RG-200-XX (90)

Any runway fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. (L) Indicates LED fixture. (###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment

L-862—Lights, Runway Edge and Threshold (High Intensity) and Stop Bar (AC 150/5345-46D)

Manufacturer	Type	Manufacturer's Catalog Number
Crouse-Hinds ALP	L-862	8624X-E-CC-120-XX (254), 8624X-E-CY-120-XX (254)
	L-862	8624X-E-YC-120-XX (254), 8624X-E-CR-120-XX (254), 8624X-E-RC-120-XX (254)
	L-862	8625-ECC-XX-XXX (135)(136)(254), 8625-ECY-XX-XXX (135)(136)(254),
	L-862	8625-EYC-XX-XXX (135)(136)(254), 8625-ECR-XX-XXX (135)
	L-862	8625-ERC-XX-XXX (135), 8625-TYG-XX-XXX(136), 8625-TGY-XX-XXX (136)
	L-862	8625-ERY-XX-XXX (135), 8625-EYR-XX-XXX (135)
	L-862	8624X-E-CC-150-XX (135), 8624X-E-CY-150-XX (135), 8624X-E-RC-150-XX (135)
	L-862	8624X-E-YC-150-XX (135), 8624X-E-CR-150-XX (135)
	L-862	8624X-E-RY-150-XX (135), 8624X-E-YR-150-XX (135)
	L-862E	8625-TRG-XX-XXX (136), 8625-TGR-XX-XXX (136), 8625-SRR-XX-XXX (136)
	L-862E	8625-TGx-XX-XXX (136), 8625-TxG-XX-XXX (136)
	L-862E	8624X-T-RG-200-XX (136), 8624X-T-GR-200-XX (136)
	L-862S	862S-XX (153)
Multi-Electric Mfg, Inc	L-862	6370-R-OW-XX (383), 6370-R-WW-XX (383)
O.C.E.M. Airfield Technology	L-862	FP150-F-CC-150 (153); FP150-F-CR-150 (153); FP150-F-CY-150 (153)
	L-862	FP150-F-GY-150 (153); FP150-F-RC-150 (153); FP150-F-RY-150 (153)
	L-862	FP150-F-YC-150 (153); FP150-F-YG-150 (153); FP150-F-YR-150 (153)
	L-862(L)	LERE-F-T-WW-14-A-X-0 (548), LERE-F-T-WW-20-A-X-0 (548)
	L-862(L)	LERE-F-T-WY-14-A-X-0 (548)(545), LERE-F-T-WY-20-A-X-0 (548)(545)
	L-862(L)	LERE-F-T-YW-14-A-X-0 (548)(545), LERE-F-T-YW-20-A-X-0 (548)(545)
	L-862(L)	LERE-F-T-WR-14-A-X-0 (548)(546), LERE-F-T-WR-20-A-X-0 (548)(546)
	L-862(L)	LERE-F-T-RW-14-A-X-0 (548)(546), LERE-F-T-RW-20-A-X-0 (548)(546)
	L-862(L)	LERE-F-T-YR-14-A-X-0 (546)(545), LERE-F-T-YR-20-A-X-0 (546)(545)
	L-862(L)	LERE-F-T-RY-14-A-X-0 (546)(545), LERE-F-T-RY-20-A-X-0 (546)(545)
	L-862(L)	LERE-F-T-GY-14-A-X-0 (549)(545), LERE-F-T-GY-20-A-X-0 (549)(545)
	L-862(L)	LERE-F-T-YG-14-A-X-0 (549)(545), LERE-F-T-YG-20-A-X-0 (549)(545)
	L-862E(L)	LERE-F-E-RG-14-A-X-0 (546)(549), LERE-F-E-GR-14-A-X-0 (549)(546)
	L-862E(L)	LERE-F-E-RR-14-A-X-0 (546)
	L-862E(L)	LERE-F-E-MG-14-A-X-0 (549), LERE-F-E-GM-14-A-X-0 (549)
	L-862S	FAU-SB-100-P-001 (127)

Any runway fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. (L) Indicates LED fixture. (###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment

L-862—Lights, Runway Edge and Threshold (High Intensity) and Stop Bar (AC 150/5345-46D)

Manufacturer	Type	Manufacturer's Catalog Number
Point Lighting Corporation	L-862	PEH-55000-CC-E1-120-XX (36), PEH-55000-CY-E1-120-XX (36)
	L-862	PEH-55000-YC-E1-120-XX (36)
	L-862E	PEH-55000-GR-T1-200-XX (90), PEH-55000-RG-T1-200-XX (90)
Safegate Group	L-862	EL-EAH+150W+GY+NPS+L862 (153), EL-EAH+150W+WW+NPS+L862 (153),
	L-862	EL-EAH+150W+WR+NPS+L862 (153), EL-EAH+150W+WY+NPS+L862 (153),
	L-862	EL-EAH+150W+RY+NPS+L862 (153),
	L-862E	EL-EAH+150W+G+NPS+L862E (153), EL-EAH+150W+GR+NPS+L862E (153),
	L-862E	EL-EAH+150W+RR+NPS+L862E (153),
	L-862S	EL-ATS+105W+R+NPS+L862S (153)
Youyang Airport Lighting	L-862	EHB-REDL-150-01 (21)
	L-862E	EHA-RTHL-200-02-1 (66)
	L-862S	EHA-STBL-100-02-1 (152)

Any runway fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. (L) Indicates LED fixture. (###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment

L-863--Lights, Portable Runway
(AC 150/5345-50B)

Manufacturer	Type	Manufacturer's Catalog Number
Calzoni S.r.l.	L-863W(L)	POL-W-x-X-R-P-Y(511), POL-W-x-X-R-R-Y (511)
	L-863B(L)	POL-B-x-X-R-P-Y(407), POL-B-x-X-R-R-Y (407)
	L-863R/G(L)	POL-R-G-X-R-P-Y(513, 514), POL-R-G-X-R-R-Y (513, 514)
	L-863R(L)	POL-R-x-X-R-P-Y(513), POL-R-x-X-R-R-Y (513)
	L-863G(L)	POL-G-x-X-R-P-Y(514), POL-G-x-X-R-R-Y (514)

Any fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. **(L)** Indicates LED fixture.
(###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment

L-864--Lights, Obstruction, Red, 20-40 FPM
(AC 150/5345-43F)

Manufacturer	L-864	Manufacturer's Catalog Number
Austin Insulators Inc	(L)	A-L864 (411)
Cooper Crouse Hinds	(L)	BX2LFR/120-240 (304), BWLFR/120-240 (337),
Farlight, LLC	(L)	L-864LED3 (313, 314, 394)
International Tower Lighting LLC		BCN-0300-000 (295)
Orga Manufacturing	(L)	L340-864 (296), L340-864a (296), L350-864 (296)
Specialty Tower Lighting. Ltd.		RB-300 (299), STLDB-1 (302)
	(L)	STLDB-1 (313)

L-864--Lights, Obstruction, Red, 20-40 FPM
(AC 150/5345-43G)

Manufacturer	L-864	Manufacturer's Catalog Number
Argus Renewable Energy Inc.	(L)	AG-AOL 303.2006-B(437)
Automatic Power Inc.	(L)	FA-250LED (372)
Cooper Crouse Hinds		CHB302D (260), CHB302R (260), CHB314 (260), CHB324 (260)
	(L)	DX2RW1LF/120-240 (412), DRW1LF/120-240 (412)
	(L)	CWLFR/120-240 (413), CX2LFR/120-240 (413)
Dialight Corp	(L)	D464-A13-001 (413), D464-B13-001 (413), D464-R13-001 (460 *)
	(L)	D1RW-B13-008 (412), D1RW-C13-008 (412), DIRW-C13-008SP (412)
	(L)	D1RW-C13-009 (526), D1RW-C13-009-CVT (526)
	(L)	D464-A-13-001GPS (413), D266-A57-SYS (522)
	(L)	D1RW-C13-409 (527), D464-A54-001 (413)
	(L)	D564-A13-001GPS (523), D564-A13-001 (523),
	(L)	D1RWC13180-SYS (605)
Farlight, LLC	(L)	NV-L864LED (483*)
Flash Technology		FTB 224 (260), FTB 225 (260), FTB 302D (260), FTB 314 (260)
		FTB 324 (260), FTB 309 (167)
	(L)	FTS 370d (474), FTS 370i (476) (595), FTS 370d 48VDC (474)
	(L)	FTS 361X (485), FTS 370i IR (595), FTS 2301 (616)
Hughey & Phillips, LLC		FG-2009B (144), FG-3000B (144), KG114F0001 (368)
	(L)	50-0002-001 (491), 50-0005-001 (492)
International Tower Lighting LLC		ILS-3400 (334), BCN-0300-000 (588)
	(L)	IFH-1700-000 (446), IFH-1710-000 (446), ILS-D1RW-008 (412)
Orga B.V.	(L)	L450-864 (459), L450-864G (459), L450-864/865(-G)(459)
OTL Solution	(L)	OTL-900 (617)

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(###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment.

L-864--Lights, Obstruction, Red, 20-40 FPM (AC 150/5345-43G)

Manufacturer	L-864	Manufacturer's Catalog Number
Pfannenberg Gmbh	(L)	POL2.000R-B (508)
Point Lighting Corporation		PFB-30000-620 (48B),
	(L)	PFB-37001-R-1 (436), PFB-37001-R-1-EX (436)
	(L)	PFB-37002-R-2 (436), PFB-37001-R-2-EX (436)
	(L)	PFB-37001-R-3 (436), PFB-37001-R-3 EX (436)
	(L)	PFB-37001-R-4 (436), PFB-37001-R-4-EX (436)
Quantec Networks GmbH	(L)	11093 (508)
Technostrobe	(L)	LED-RED-Standard (473), LED-B-HYBRID-G3 (573)
TWR Lighting, Inc.		FB Beacon (48B) (248), E-1DB2 (165, 166)
	(L)	LEDBEACON3 (493), LEDBEACON2 (296), E-1DBSL (296),
Unimar Inc	(L)	USL40X (413), DLS(X)-008 (412), DLS(X)-008SP (412) DLS(X)-029R (526)

Any fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. **(L)** Indicates LED fixture.
(###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment.

L-865--Lights, Obstruction, Medium Intensity, White, 40 FPM (AC 150/5345-43F)

Manufacturer	L-865	Manufacturer's Catalog Number
Skytec Inc.		8445 (303)**, 8340 (303)**
Specialty Tower Lighting. Ltd.		STLB-1 (302), STLDB-1 (302)
Unimar Inc	(L)	DCLSX-008 (435)

**Certified for 120 degree horizontal beam spread

L-865--Lights, Obstruction, Medium Intensity, White, 40 FPM (AC 150/5345-43G)

Manufacturer	L-865	Manufacturer's Catalog Number
Cooper Crouse Hinds		CHB310 (133), CHB324 (133), CHB302 (133), CHB302D (133)
	(L)	DX2RW1LF/120-240 (412), DRW1LF/120-240 (412)
Dialight Corp	(L)	D1RW-C13-008 (412), D165-C13-008 (415)), DIRW-C13-008SP (412)
	(L)	D1RW-B13-008 (412), D165-C13-009 (524), D1RW-C13-409 (527)
	(L)	D1RW-C13-009 (526), D1RW-C13-009-CVT (526)
	(L)	D1RWC13180-SYS (605)
Flash Technology		FTB 302 (133), FTB 302D (133), FTB 304 (486), FTB 305 (486), FTB 310 (133), FTB 324 (133)
	(L)	FTS 370d (474), FTS 370w (475), FTS 370d 48VDC (474)
Hughey & Phillips, LLC	(L)	50-0003-001 (490), 50-0005-001 (492) FG-2000B (144), FG-3000B (144)
International Tower Lighting LLC		ILS-3400 (334), ILS-2400 (334)
	(L)	ILS-D1RW-008 (412)
Orga B.V.	(L)	L450-865(-G) (466), L450-864/865(-G) (466)
OTL Solution	(L)	OTL-900 (617)
Point Lighting Corporation		PSB-38001-MA-16 (581)
Technostrobe	(L)	LED-B-HYBRID-G3 (573) (L)
TWR Lighting, Inc.		E-1DB2 (165, 166), D-1LVS (240), E-1DBSL2 (240)
Unimar Inc	(L)	DLS(X)-008 (412), WLS(X)-008 (412), DLS(X)-029R (526), WLS(X)-029 (526)
	(L)	DLS(X)-008SP (412), WLS(X)-008SP (412)

**Certified for 120 degree horizontal beam spread

Any fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. **(L)** Indicates LED fixture. (###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment

L-866--Lights, Obstruction, Medium Intensity, White, 60 FPM (AC 150/5345-43F)

Manufacturer	L-866	Beam Spread	Manufacturer's Catalog Number
Skytec Inc.		120°	8360 (303)

L-866--Lights, Obstruction, Medium Intensity, White, 60 FPM (AC 150/5345-43G)

Manufacturer	L-866	Beam Spread	Manufacturer's Catalog Number
Dialight Corporation	(L)		D1RW-L13-008 (435)
Flash Technology	(L)		FTB 310C (133) FTS 370w (475), FTS 370d (474)
Unimar Inc.	(L)		DCLSX-008 (435), WCLSX-008 (435)

Any fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. **(L)** Indicates LED fixture.
(###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment

L-867--Light Base, Non-Load Bearing L-868--Light Base, Load Bearing (AC 150/5345-42F)

Manufacturer	Manufacturer's Catalog Number											
					Multiple Section Base							
	Type	Size	Class	Base	Bottom	Middle	Top	Extension	Conversion Ring	Cover Plate	Spacer Rings	Mud Plate
Arctic Insulation & Mfg, LLC	L-867	B	IIA	AIML867								
Airport Lighting Equipment	L-867	B	1A	1224-ADJ-S-INT-PCC								
	L-867	B	1A	1224Q				12S-EXT		L867B-CP-B-S	L867-ER-B-S	
	L-867	B	1B	12242Q-SS								
	L-867	D	1A	16242X-X				16-S-EXT		L867-CP-D-S	L867D-ER-D-S	
	L-868	B	1A	1224-2-S		4714-R	4419F-X	1224-2-EXT		L868B-CP-B-S	5402-Y	
	L-868	B	1A				2419-F				L-868-GR_B_S	
	L-868	B	1B	1224-2-SS	4420SS		2419F-X-SS					
	L-868	B	1B		1224-1B		2419F-SS-1B					
Jaquith Industries Inc. (A*=10” Dia)	L-868	A*	1A									
	L-868	A*	1A									
	L-868	A*	1A									
	L-868	A*	1A									
	L-868	A*	1A									
	L-868	A*	1A									
	L-868	A*	1B									
	L-868	A*	1B									
	L-868	A*	1B									
	L-868	A*	1B									
	L-868	A*	1B									
	L-868	A*	1B									
	L-868	A*	1B									
	L-868	A*	1B									
	L-868	A*	1B									
	L-868	A*	1B									
	L-868	A*	1B									
	L-868	A*	1B									

L-867--Light Base, Non-Load Bearing L-868--Light Base, Load Bearing
(AC 150/5345-42F)

Manufacturer	Manufacturer's Catalog Number											
					Multiple Section Base							
	Type	Size	Class	Base	Bottom	Middle	Top	Extension	Conversion Ring	Cover Plate	Spacer Rings	Mud Plate
Jaquith Industries Inc	L-867	B	1A	AC20XXXXXXXXXXPCC								
	L-867	B	1A	AC21XXXXXXXXXX				AE20XXXX		AK10XXXX	AT2006XX	AM5417
	L-867	D	1A	AC63XXXXXXXXXX				AE60XXXX		AK20XXXX	AT6003XX	AM5527
	L-867	D	1A	AC60XXXXXXXXXXPCC								
	L-867	E	1A	AC67XXXXXXXXXX				AE70XXXX		AK70XXXX	AT7003XX	
	L-867	B	1B	ACS20XXXXXXXXXXPCC								
	L-867	B	1B	ACB20XXXXXXXXXXVKPCC								
	L-867	B	1B	ACS21XXXXXXXXXX				AES2XXXX		AKS10XXXX	ATS2006XX	
	L-867	C	1B	ACB21XXXXXXXXXXVK				AEB2XXXXVK		AK10XXXXVK	ATB2006XXVK	
	L-867	D	1B	ACS63XXXXXXXXXX				AES6XXXX		AKS20XXXX	ATS6003XX	
	L-867	D	1B	ACB63XXXXXXXXXXVK				AEB6XXXXVK		AK20XXXXVK	ATB6003XXVK	
	L-867	E	1B							AKS70XXXX	ATS7003XX	
	L-867	E	1B							AK70XXXXVK	ATB7003XXVK	
	L-868	A	1A	AC08XXXXXXXXXX	AC40XXXXXXXXXX	AE4703M	AF0XXXX	AX0XXXX		AK80XXXX		
	L-868	A	1A									AM5017
	L-868	A	1A									AM5027
	L-868	A	1A								AF0802XX	
	L-868	A	1A								AF0802XXY	
	L-868	A	1A								AR0824	
	L-868	A	1A								AR0821XX	
	L-868	A	1A								AR0821XXY	
	L-868	B	1A	AC24XXXXXXXXXX	AC44XXXXXXXXXX	AE4704M	AF2XXXX	AX2XXXX	AA5423, AA5413	AK40XXXX		AM5417
	L-868	B	1A								AF5402XX	AM5427
	L-868	B	1A					**Adapter Plate**			AF5402XXY	
	L-868	B	1A					AF543412			AF5434XXY	
	L-868	B	1A					AA251220			AR5411XX	
	L-868	B	1A					AA251220CDE			AR5424	
	L-868	B	1A								AR5421XX	
	L-868	B	1A								AR5422XX	
	L-868	B	1A								AF5421XXY	
	L-868	B	1A								AR5424AL	
	L-868	C	1A	AC35XXXXXXXXXX	AC45XXXXXXXXXX	AE4705M	AF3XXXX	AX3XXXX	AA5523, AA5513	AK50XX		AM5527, AM5517
	L-868	C	1A								AF5502XX	
	L-868	C	1A								AF5502XXY	

L-867--Light Base, Non-Load Bearing L-868--Light Base, Load Bearing (AC 150/5345-42F)

Manufacturer	Manufacturer's Catalog Number											
					Multiple Section Base							
	Type	Size	Class	Base	Bottom	Middle	Top	Extension	Conversion Ring	Cover Plate	Spacer Rings	Mud Plate
Jaquith Industries Inc	L-868	C	1A								AF5702XXY	
	L-868	C	1A								AR5511XX	
	L-868	C	1A								AR5524	
	L-868	C	1A								AR5521XX	
	L-868	C	1A								AR5522XX	
	L-868	C	1A								AR5521XXY	
	L-868	C	1A								AR5721XX	
	L-868	C	1A								AR5721XXY	
	L-868	A	1B	ACS08XXXXXXXXXX	ACS08XXXXXXXXXX	AES47078M	AFSO-0XXXX	AXS0XXXX		AK8000XXVK		
	L-868	A	1B	ACB08XXXXXXXXXXVK	ACB08XXXXXXXXXXVK	AEB4708MVK	AFB0XXXXVK	AXB0XXXXVK		AKS8000XX		
	L-868	A	1B								AFS0802XX	
	L-868	A	1B								AF0802XXVK	
	L-868	A	1B								AFS0802XXY	
	L-868	A	1B								AF0802XXYVK	
	L-868	A	1B								ARS0821XX	
	L-868	A	1B								AR0821XXVK	
	L-868	A	1B								ARS0824	
	L-868	A	1B								AR0824VK	
	L-868	A	1B								ARS0821XXY	
	L-868	A	1B								AR0821XXYVK	
	L-868	B	1B	ACS24XXXXXXXXXX	ACS44XXXXXXXXXX	AES4704M	AFS2XXXX	AXS2XXXX		AK40XXXXVK		
	L-868	B	1B	ACB24XXXXXXXXXXVK	ACB44XXXXXXXXXXVK	AEB4704MVK	AFB2XXXXVK	AXB2XXXXVK		AKS40XXXX		
	L-868	B	1B								AFS5402XX	
	L-868	B	1B								AF5402XXVK	
	L-868	B	1B								AFS5402XXY	
	L-868	B	1B								AF5402XXYVK	
	L-868	B	1B								AFS5434XXY	
	L-868	B	1B								ARS5411XX	
	L-868	B	1B								AR5411XXVK	
	L-868	B	1B								ARS5421XX	
	L-868	B	1B								AR5421XXVK	
	L-868	B	1B								ARS5422XX	
	L-868	B	1B								AR5422XXVK	

L-867--Light Base, Non-Load Bearing L-868--Light Base, Load Bearing (AC 150/5345-42F)

Manufacturer	Manufacturer's Catalog Number											
					Multiple Section Base							
	Type	Size	Class	Base	Bottom	Middle	Top	Extension	Conversion Ring	Cover Plate	Spacer Rings	Mud Plate
Jaquith Industries Inc	L-868	B	1B								ARS5424	
	L-868	B	1B								AR5424VK	
	L-868	B	1B								ARS5421XXY	
	L-868	B	1B								AR5421XXYVK	
	L-868	C	1B	ACS35XXXXXXXXXX	ACS45XXXXXXXXXX	AES4705M	AFS3XXXX	AXS3XXXX		AK50XXXXVK		
	L-868	C	1B	ACB35XXXXXXXXXXVK	ACB45XXXXXXXXXXVK	AEB4705MVK	AFB3XXXXVK	AXB3XXXXVK		AKS50XXXX		
	L-868	C	1B								AFS5502XX	
	L-868	C	1B								AF5502XXVK	
	L-868	C	1B								AFS5502XXY	
	L-868	C	1B								AF5502XXYVK	
	L-868	C	1B								AFS5702XXY	
	L-868	C	1B								AF5702XXYVK	
	L-868	C	1B								ARS5511XX	
	L-868	C	1B								AR5511XXVK	
	L-868	C	1B								ARS5521XX	
	L-868	C	1B								AR5521XXVK	
	L-868	C	1B								ARS5721XX	
	L-868	C	1B								AR5721XXVK	
	L-868	C	1B								ARS5524	
	L-868	C	1B								AR5524VK	
	L-868	C	1B								ARS5522XX	
	L-868	C	1B								AR5522XXVK	
	L-868	C	1B								ARS5521XXY	
	L-868	C	1B								AR5521XXYVK	
	L-868	C	1B								ARS5721XXY	
	L-868	C	1B								AR5721XXYVK	
Olson Industries Inc	L-867	B	1A	127ACG(X)PCC								127M1025
	L-867	B	1A	127ACC(X)PCC								127M1025S
	L-867	B	1A	127CC(X)				127E(X)	128CR(X)	127L(X)	127S(X)	
	L-867	B	1B	127ACG(X)PCCSS								
	L-867	B	1B	127ACC(X)PCCSS								
	L-867	B	1B	127CC(X)SS				127E(X)SS	128CR(X)SS	127L(X)SS	127S(X)SS	
	L-867	B	1A	127CG(X)								
	L-867	B	1B	127CG(X)SS								

L-867--Light Base, Non-Load Bearing L-868--Light Base, Load Bearing (AC 150/5345-42F)

Manufacturer	Manufacturer's Catalog Number											
					Multiple Section Base							
	Type	Size	Class	Base	Bottom	Middle	Top	Extension	Conversion Ring	Cover Plate	Spacer Rings	Mud Plate
Olson Industries Inc	L-867	D	1A	167CC(X)				167E(X)	17A0125	167L(X)	167S(X)	
	L-867	D	1A	167CG(X)								158M1425
	L-867	D	1A	167ACG(X)PCC								167M1425
	L-867	D	1B	167ACG(X)PCCSS								
	L-867	D	1B	167ACC(X)PCCSS								
	L-867	D	1A	167ACC(X)PCC								
	L-867	D	1B	167CC(X)SS				167E(X)SS	17A0125SS	167L(X)SS	167S(X)SS	
	L-867	D	1B	167CG(X)SS								
	L-867	E	1A	247ACG(X)PCC								247M215
	L-867	E	1A	247ACC(X)PCC								
	L-867	E	1B	247ACG(X)PCCSS								
	L-867	E	1B	247ACC(X)PCCSS								
	L-867	E	1A	247CC(X)				247E(X)		247L(X)	247S(X)	
	L-867	E	1A	247CG(X)								
	L-867	E	1B	247CC(X)SS				247E(X)SS		247L(X)SS	247S(X)SS	
	L-867	E	1B	247CG(X)SS							108FY(X)SS	
	L-867	E	1A	247CG(X)SSF								88FY(X)
	L-868		1A					108E(X)			108FY(X)	
	L-868		1B					108E(X)SS				
	L-868		1A								108S(X)	
	L-868	A	1A	88CC(X)	88BSC(X)	88MS(X)	88TS(X)				88S(K)	88M0625
	L-868	A	1A	88CG(X)	88BSG(X)						99SY(X)	88M0725
	L-868	A	1A	88CGY(X)				88E(X)	88CR(X)	88L(X)	88F(X)	108M0825
	L-868	A	1A								88SMB(X)	108M0925
	L-868	A	1B	88CG(X)SS	88BSG(X)SS	88MS(X)SS	88TS(X)SS	88E(X)SS	88CR(X)SS	88L(X)SS	88SY(X)SS	
	L-868	A	1B	88CC(X)SS	88BSC(X)SS						88F(X)SS	
	L-868	A	1B								88SMB(X)SS	
	L-868	A	1B								88S(X)SS	
	L-868	A	1B								88FY(X)SS	
	L-868		1B						178A0125SS		108S(X)SS	
	L-868	B	1A	128CC(X)	128BSC(X)	128MS(X)	128TS(X)	128E(X)	127CR(X)	128L(X)	128S(X)	128M1125
	L-868	B	1A	128CG(X)					178A0125		128SY(X)	128M1025
	L-868	B	1A									
	L-868	B	1B	128CG(X)SS	128BSC(X)SS	128MS(X)SS	128TS(X)SS		127CR(X)SS		128SY(X)SS	
	L-868	B	1B	128CGT(X)SS							128S(X)SS	
	L-868	B	1A	128CGY(X)	128BSG(X)				158A0125		128F(X)	
	L-868	B	1A	128CGT(X)								128M1025S

L-867--Light Base, Non-Load Bearing L-868--Light Base, Load Bearing (AC 150/5345-42F)

Manufacturer	Manufacturer's Catalog Number											
					Multiple Section Base							
	Type	Size	Class	Base	Bottom	Middle	Top	Extension	Conversion Ring	Cover Plate	Spacer Rings	Mud Plate
Olson Industries Inc	L-868	B	1A	128CCT(X)								
	L-868	B	1B	128CCT(X)SS							128F(X)SS	
	L-868	B	1A								128FY(X)	
	L-868	B	1B	128CC(X)SS	128BSG(X)SS			128E(X)SS	158A0125SS	128L(X)SS	128FY(X)SS	
	L-868	C	1A	158CC(X)	158BSC(X)	158MS(X)	158TS(X)	158E(X)	158CR(X)	158L(X)	158S(X)	158M1425
	L-868	C	1A	158CG(X)							158SY(X)	158M1325
	L-868	C	1B	158CG(X)SS	158BSC(X)SS		158TS(X)SS				158SY(X)SS	
	L-868	C	1A								158F(X)	
	L-868	C	1B	158CC(X)SS							158F(X)SS	
	L-868	C	1B	158CCT(X)SS								
	L-868	C	1B	158CGT(X)SS								
	L-868	C	1A	158CGT(X)	158BSG(X)						158FY(X)	
	L-868	C	1B	158CG(X)SS		158MS(X)SS			158CR(X)SS		158S(X)SS	
	L-868	C	1A	158CGY(X)							158SMB(X)	
	L-868	C	1B	158CC(X)SS	158BSG(X)SS			158E(X)SS		158L(X)SS	158FY(X)SS	
	L-868	C	1A	158CCT(X)								
Rural Electric Inc.	L-867	B	1A					EXXX12NE		CP37512NP		
	L-867	B	1A									
	L-867	B	1A					AEXX12NE-PCC				
	L-867	D	1A	CAXX16NC						CP37516NP		
	L-867	B	1A	ABXX12NC-PCC								
	L-867	B	1A	CAXX12NC								
	L-867	B	1A	1ATXX12NC-PCC								
	L-867	B	1A	EATXX12NC-PCC								
	L-868	B	1A	CAXX12LC						CP7502LP	CR XX(X)12	
Youyang Airport Lighting Equipment Inc.	L-867	B	1A	ALB-L867-12-24-1A-C4-XX						BCP-L867-12-09-S		
	L-868	B	1A	ALB-L868-12-24-1A-C4-XX						BCP-L868-12-09-S		

Field modification of any certified lighting fixture to fit L-868 and/or L-867 product without original lighting fixture manufacturer’s authorization and the third party certifier’s authorization is prohibited

L-880—Precision Approach Path Indicator (AC 150-5345-28F)

Manufacturer	Style	Class	Manufacturer's Catalog Number
Multi-Electric Mfg, Inc.	A	II	5900-2-XX-XX (213)
	B	II	5900-2-XX-XX (213)

L-880—Precision Approach Path Indicator (AC 150-5345-28G)

Manufacturer	L-880	Style	Class	Manufacturer's Catalog Number
ADB Airfield Solutions, LLC		A	I, II	44A4733-1X2X (66), PAPA-40X0 (164)
	(L)	A	I, II	LPLF-A40100 (606), LPLF-A40200 (606), LPLF-A40300 (606)
		B	I, II	44A5860-211X (66), PAPB-4000 (164)
	(L)	B	I, II	LPLF-B40000 (606)
Airport Lighting Company		A	2	880-V-2-X (385)(386)
		B	2	880-C-2-X (385)(386)
Crouse-Hinds ALP		A	I, II	880A2A-X (289), 880A3A-X (289)
		B	I, II	880A2B-X (289), 880A3B-X (289)

(L) Indicates LED fixture. Any fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. (###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment

L-881—Abbreviated Precision Approach Path Indicator (AC 150-5345-28F)

Manufacturer	Style	Class	Manufacturer's Catalog Number
Multi-Electric Mfg, Inc.	A	II	5900-2-XX-XX (213)
	B	II	5900-2-XX-XX (213)

L-881—Abbreviated Precision Approach Path Indicator (AC 150-5345-28G)

Manufacturer	L-801	Style	Class	Manufacturer's Catalog Number
ADB Airfield Solutions, LLC		A	I, II	44A4733-2X2X (66), PAPA-20X0 (164)
	(L)	A	I, II	LPLF-A20100 (606), LPLF-A20200 (606), LPLF-A20300 (606)
		B	I, II	44A5860-221X (66), PAPB-2000 (164)
	(L)	B	I, II	LPLF-B20000 (606)
Airport Lighting Company		A	2	881-V-2-X (385)(386)
		B	2	881-C-2-X (385)(386)
Crouse-Hinds ALP		A	I, II	881A2A-X (289), 881A3A-X (289)
		B	I, II	881A2B-X (289), 881A3B-X (289)

(L) Indicates LED fixture. Any fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. (###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment

L-882--Generic Visual Approach Descent Indicator (AC 150/5345-52)

Manufacturer	Equipment Type	Manufacturer's Catalog Number		
		Lamp Housing	Adapter Unit	Aiming Bar

NOTE: PAPI Systems L-880 and L-881 are also approved as Type L-882 systems

L-883—Generic Visual Approach Descent Indicator (AC 150/5345-52)

Manufacturer	Equipment Type		Manufacturer's Catalog Number		
	(For Airport installation)	(For Heliport installation)	Lamp housing	Adapter unit	Aiming bar

L-884—Power and Control Unit for Land and Hold Short Lighting Systems (AC 150/5345-54)

Manufacturer	Style	Manufacturer's Catalog Number
ADB Airfield Solutions, LLC	I II	44A6011-XX 44A6012-XX

L-885—Lights, Obstruction (AC 150/5345-43G)

Manufacturer	L-885	Manufacturer's Catalog Number
Dialight Corporation	(L)	D1RW-L13-008 (435)
Flash Technology	(L)	FTS 370r (510), FTS 370d (474)
Unimar Inc	(L)	DCLSX-008 (435)

L-885—Lights, Obstruction (AC 150/5345-43F)

Manufacturer	**L-885**	**Manufacturer's Catalog Number**
Orga B.V.	(L)	L-350-885 (296)

L-890 – Airport Lighting Control and Monitoring system (ALCMS) (AC 150/5345-56A)

Manufacturer	Monitoring Options				Fail-safe Options	
	Control Only (A)	Basic (B)	Advanced (C)	SMGCS Ready (D)	Preset (A)	Last State (B)
Precision Control System of Indianapolis	L-890-A-A L-890-A-B	L-890-B-A L-890-B-B	L-890-C-A L-890-C-B		L-890-A-A L-890-B-A L-890-C-A	L-890-A-B L-890-B-B L-890-C-B
Rural Electric Inc.		L890			L890	

(L) Indicates LED fixture. Any fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. (###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment.

L-890 – Airport Lighting Control and Monitoring System (ALCMS) (AC 150/5345-56B)

	Monitoring Options				Fail-safe Options	
Manufacturer	Control Only (A)	Basic (B)	Advanced (C)	SMGCS Ready (D)	Preset (A)	Last State (B)
Liberty Airport System	L-890-A-A L-890-A-B	L-890-B-A L-890-B-B	L-890-C-A L-890-C-B	L-890-D-A L-890-D-B	L-890-A-A L-890-B-A L-890-C-A L-890-D-A	L-890-A-B L-890-B-B L-890-C-B L-890-D-B
ADB Airfield Solutions, LLC	ALCMS-AY	ALCMS-BY	ALCMS-CY	ALCMS-DY	ALCMS-XA	ALCMS-XB
Crouse-Hinds Airport Lighting Products	L-890A-X 890G1X-A	L-890B-X 890G1X-B	L-890C-X 890G1X-C	L-890D-X	L-890X-A 890G1A-X	L-890X-B 890G1B-X

L-891, L-892 – Low Impact Resistant (LIR) Structures (AC 150/5345-45C)

Manufacturer	Type	Style	Manufacturer's Catalog Number
Jaquith Industries, Inc.	L-891 L-891 L-891 L-892	1 2 3 1	MG-20 MG-30 MG-40 MS-20
Exel Oyj	L-891 L-891 L-891 L-892	1 1, 2 1, 2, 3 1	D51, D86, D106 L400 L500 L500
Pollite Ltd	L-891 L-891 L-891 L-891	1, 2 1, 2 1, 2, 3 1, 2, 3	GFP01/S, GFP01/CA1.2, GFPO1/CA1.5, GFP01/CA2.7 GFP01/CA3, GFP01/CA4.5, GFP01/CA5.4, GFP01/CA6 GFP02/S, GFP02/CA1.2, GFPO2/CA1.5, GFP02/CA2.7 GFP02/CA3, GFP02/CA4.5, GFP02/CA5.4, GFP02/CA6

(L) Indicates LED fixture. Any fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. (###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment.

L-893—Lighted Visual Aid to Indicate Temporary Runway Closure (AC 150/5345-55A)

Manufacturer	Manufacturer's Catalog Number
Hali-Brite Inc.	RCM-D (326)(467)(559)
Sherwin Industries Inc	S1701 (326)

(L) Indicates LED fixture. Any fixture listed above that uses a LED lighting source may not be compatible with Enhanced Flight Vision Systems that use IR energy emissions for imaging. (###*) IR element present is not tested nor certified under this program as to compatible with any night vision equipment.

LAMP DESCRIPTIONS

Lamp	Designation	Watts	Volts	Amps	Lamp Manufacturer
(10)	6.6A/T10/1P	30		6.6	General Electric, Sylvania, Philips
(10A)	6.6A/T10/1P	30		6.6	General Electric
(10C)	6.6A/T10/1P	30		6.6	Philips
(11)	6.6A/T10/P	45		6.6	General Electric, Sylvania, Philips
(11A)	6.6A/T10/P	45		6.6	General Electric
(11B)	6.6A/T10/P	45		6.6	Sylvania
(11C)	6.6A/T10/P	45		6.6	Philips
(16)	20058	115		6.6	Crouse-Hinds
(17)	40732	45		6.6	Crouse-Hinds
(18)	40737	30		6.6	Crouse-Hinds
(21)	EWR	150		6.6	General Electric
(31)	EXL	30		6.6	General Electric
(32A)	116A21/TS	116	120		General Electric
(32B)	116A21/TS	116	120		Philips
(32C)	116A21/TS	116	130		Philips
(33)	EXM	45		6.6	General Electric
(36)	EVV	120		6.6	General Electric
(48B)	620PS40P	620	120		GE
(54)	20538	185		6.6	Crouse-Hinds
(66)	64382	200		6.6	Osram
(72)	3884				Ameriel
(75)	3843				Flash Technology
(78)	5877				Flash Technology
(87A)	Q500PAR56/NSP	500	120		General Electric
(88)	Q1000PAR64/NSP	1000	120		GE
(90)	EZL	200		6.6	GE
(92)	48A0006	30		6.6	ADB Airfield Solutions, LLC
(93)	48A0007	45		6.6	ADB Airfield Solutions, LLC
(97)	64346	100		6.6	Osram
(98)	64386	200		6.6	Osram
(102)	EZC	45			GE
(115)	F24T12/D/HO	35			GE Fluorescent
(116)	F36T/12SGN/HO	45			GE Fluorescent
(117)	F36T12/CW/HO	45			GE Fluorescent
(123)	2990.40.900	105		6.6	ADB BVBA
(124)	2990.40.827 Osram	48		6.6	ADB BVBA
(126)	SLC 08065	49		6.6	Alstom Power Ltd
(127)	64341	100		6.6	Osram
(133)	8384329				Flash Technology
(135)	40925	150		6.6	Crouse-Hinds
(136)	20172	200		6.6	Crouse-Hinds
(137)	64317	45		6.6	Osram
(143)	100A21T2	100	120		Osram
(144)	12S00602				Hughey & Phillips, LLC
(147)	120PAR38/WFL50	120	120		Sylvania Capsylite
(151)	20590	62		6.6	Crouse-Hinds
(152)	HLX64342	100		6.6	PK30d Osram
(153)	HLX64361-Z	150		6.6	PKX30d Osram
(154)	50W/30V	50	30		Train
(155)	F24/T12/CW/HO				Fluorescent
(156)	12V/20W				GE Quartz
(157)	9017				Flash Technology
(160)	SLC 008075	105		6.6	ALSTOM Power Conversion Ltd.
(163)	64338	48		6.6	Osram
(164)	64339	105		6.6	Osram
(165)	STFLSHTB6				Advanced Strobe Products
(166)	STFLSHTB7				Advanced Strobe Products

LAMP DESCRIPTIONS

Lamp	Designation	Watts	Volts	Amps	Lamp Manufacturer
(167)	8777	420		3.5	Flash Technology
(171)	Amglo-HV1-734Q				Kemlite PAR-56
(174)	860-1R01 (LED Module)		120		Dialight
(175)	21116- GE MR-16	48		6.6	Crouse Hinds ALP (GE)
(178)	HLX64341Z	100		6.6	Osram
(180)	21117 – GE	30		6.6	Crouse Hinds ALP (GE)
(181)	21127 – GE MR-16	32		6.6	Crouse Hinds ALP (GE)
(184)	120V/25W Rough Service	25	120		General Electric
(185)	300267	18		6.6	Osram
(186)	400W Venture Metal Halide	400	120		Venture
(187)	250W Venture Pulse Start	250	120		Venture
(188)	SLC 008083	30		6.6	Alstom Power Ltd
(189)	8384308				Flash Technology
(190)	M60-38 PAR38	150		6.6	Sylvania
(191)	64333-B	40		6.6	Osram
(192)	64337-B-45	45		6.6	Osram
(193)	PKX30d	45		6.6	Philips
(194)	21169 MR-16	62		6.6	Crouse Hinds ALP (GE)
(195)	MH175W/U/MED Metal Halide	175			Venture
(196)	10047-2138	100		6.6	Crouse Hinds ALP (Osram PK-30d)
(208)	400W Venture Pulse Start	400	120		Venture
(210)	30WEZA	30		6.6	GE
(211)	Blue LED 44A6227				ADB Airfield Solutions, LLC
(213)	MR-16	105			Osram
(215)	21128 (Osram)	105		6.6	Crouse Hinds ALP (Osram MR-16)
(216)	0021496 MR-16	48		6.6	Sylvania
(217)	XFT 2000 (Linear Xenon Flashtube)				Orga
(218)	GSI-LLS-100 (LED Module)			6.6	G.S.I. INC.
(219)	21116 - Osram MR-16	48		6.6	Crouse Hinds ALP (Osram)
(220)	64337 A45-15	45		6.6	Osram
(221)	10047-1802 Metal Halide	400			Crouse Hinds ALP (Sylvania)
(222)	10047-2292	1000			Crouse Hinds ALP (Sylvania64434 M1000/BD)
(224)	760.2179	30		6.6	OCEM SpA MR-16
(225)	760.2186	48		6.6	OCEM SpA MR-16
(226)	59036 PAR 16 Tungsten Halogen	75	120		Sylvania
(231)	MR-16 EXT	50	12		GE
(232)	860-1R03 (LED Module)		12VDC		Dialight
(233)	860-1R05 (LED Module)		24VDC		Dialight
(234)	860-1R04 (LED Module)		48VDC		Dialight
(235)	55041 6.6A/30T3.5Q EXL	30		6.6	Sylvania
(236)	55048 6.6A/45T3.5Q EXM	45		6.6	Sylvania
(239)	50397 Blue LED			6.6	Crouse Hinds ALP
(240)	STFLSHTB5 flash tube				Advanced Strobe Products
(247)	48A0382 Luxeon Star Side LED blue				ADB Airfield Solutions, LLC
(248)	PS40 Weatherex Codebeacon	620	120		TRW Lighting Inc.
(249)	48A0083 Quartz	45		6.6	Osram
(251)	6134 Quartz EXM	45		6.6	Philips
(252)	UHI-S150DW/A/UVP	150			Hali-Brite USHIO
(253)	UHI-S150DM/A/UVP	150			Hali-Brite USHIO
(254)	20058	120		6.6	GE
(255)	48A0382-2 Luxeon LED - Red		120		ADB Airfield Solutions, LLC
(256)	44A6355-10 Blue LED	5			ADB Airfield Solutions, LLC
(257)	FL4-l810-120VAC 5VA Red LED		120		Farlight LLC
(258)	FL4-l810-240VAC 5VA Red LED		240		Farlight LLC
(260)	8384309 Xenon Flashtube				Flash Technology
(262)	64339-B	105		6.6	Osram
(263)	8671301 Xenon Flashtube				Flash Technology
(265)	0100-3752 LED		120		Hali-Brite Inc.

LAMP DESCRIPTIONS

Lamp	Designation	Watts	Volts	Amps	Lamp Manufacturer
(267)	48A0009	69	120		ADB Airfield Solutions, LLC
(268)	1413.05.100 Green LED			6.6	ADB Airfield Solutions, LLC
(269)	1413.05.110 Yellow LED			6.6	ADB Airfield Solutions, LLC
(272)	48A0376	18			ADB Airfield Solutions, LLC
(273)	48A0078 PAR 38	120			Sylvania
(274)	48A0375	100			Regent
(276)	150/CL RF Option-GE	150	120		Crouse Hinds ALP
(277)	11047-2882 Floodlight, GE Par 38	250	120		Crouse Hinds ALP
(278)	40600536R Red LED Array				Automatic Power Inc.
(279)	10047-2888 Osram	45		6.6	Crouse Hinds ALP
(281)	PL10630-F-8 LED				Point Lighting Corporation
(282)	55-00145 Par 56 Flashtube				Strobe Approach Lighting Technology
(283)	Lighthead 120 LED		120		Farlight LLC
(284)	Lighthead 240 LED		240		Farlight LLC
(285)	6102	40		6.6	Philips
(286)	6116	100		6.6	Philips pk30d
(287)	55-00211 Helical Xenon Flashtube				Strobe Approach Lighting Technology
(289)	58750	200		6.6	Osram
(290)	64320 Quartz	45		6.6	Osram
(291)	64322 Quartz	30		6.6	Osram
(292)	760.2190 (Osram 64339)	105		6.6	OCEM SpA
(293)	760.2186 (Osram 64337))	48		6.6	OCEM SpA
(294)	116A21/TS-120V	116	120		General Electric
(295)	620PS40P-120V	620	120		General Electric
(296)	LA-RO-3-1-O1 LED				Orga
(297)	STD 05006 LED				TWR
(298)	21312 LED			6.6	Crouse Hinds ALP
(299)	620PS40120V	620	120		H&H
(300)	860-1R02 LED		220		Dialight
(302)	H1-808Q Triple Helix Xenon Arc		120		Amglo Kemlite
(303)	803-0419-B Xenon Flashtube		1000		Skytec Inc.
(304)	D164-1010LED		120		Dialight
(305)	411.024.025A LED			6.6	Youyang
(306)	LED-T			6.6	Airport Lighting Co.
(308)	21355 LED			6.6	Crouse Hinds ALP
(309)	21354 LED			6.6	Crouse Hinds ALP
(310)	21317 LED			6.6	Crouse Hinds ALP
(311)	21318 LED			6.6	Crouse Hinds ALP
(312)	6110	40		6.6	Philips
(313)	Farlight LED3 Beacon 120VAC		120		Farlight LLC
(314)	Farlight LED3 Beacon 240VAC		240		Farlight LLC
(315)	2990.40.827 SLI MR 16	48		6.6	ADB Airfield Solutions, LLC
(316)	44A5911 Osram MR 16	30		6.6	ADB Airfield Solutions, LLC
(317)	2990.48.360 Osram PK30d	45		6.6	ADB Airfield Solutions, LLC
(318)	48A0386GE	62			ADB Airfield Solutions, LLC
(319)	H29316-1 Luxeon LED	6			Alstom Power Ltd.
(320)	H29316-2 Luxeon LED	3			Alstom Power Ltd.
(321)	LXK2-PW14-T00 LED Lumiled		240		ADB Airfield Solutions, LLC
(326)	3400-0133 Par 38 Philips 25° Flood	90	120		Hali-Brite Inc.
(327)	59194 Venture Lighting metal halide	320	120		Hali-Brite Inc.
(328)	44A6702-1 LED				ADB Airfield Solutions, LLC
(329)	44A6722 LED				ADB Airfield Solutions, LLC
(330)	LXML-PH01-0050 Red LumiLeds LED				Dialight
(331)	Luxeon LXHL-FB-3C LED Philips				Astronics DME Corporation
(332)	13284	10	12		Philips
(333)	Red LED 16 array 9200-026				Halibrite
(334)	FH0-3400-000 Xenon Discharge		120		International Tower Lighting
(336)	LXHL-FW3C White Luxeon Star LED				Metalite Aviation Lighting

LAMP DESCRIPTIONS

Lamp	Designation	Watts	Volts	Amps	Lamp Manufacturer
(337)	D264-1011 LED		120/240		Dialight
(338)	D264-1013 LED		48VDC		Dialight
(339)	LXHL-FD1C Red Luxeon Star LED				Metalite Aviation Lighting
(340)	LXHL-FB1C Blue Luxeon Star LED				Metalite Aviation Lighting
(341)	48A0396/3 White LED Philips Luxeon	3	120		ADB Airfield Solutions, LLC
(342)	6128 quartz	120		6.6	Philips
(343)	LED2.0 56 White LED Array				AGM
(344)	44A6786 LED				ADB Airfield Solutions, LLC
(345)	48A0400-GRN LED				ADB Airfield Solutions, LLC
(346)	48A0400-YLW LED				ADB Airfield Solutions, LLC
(347)	48A0401-GRN LED				ADB Airfield Solutions, LLC
(348)	48A0401-YLW LED				ADB Airfield Solutions, LLC
(349)	Lighthead 12-48VDC				Farlight
(350)	CMH150TU/942/G12 GE Metal Halide	150			Hali-Brite Inc.
(351)	150.3142Y LED				O.C.E.M. Airfield Technology
(352)	150.3143G LED				O.C.E.M. Airfield Technology
(353)	150.3155Y LED				O.C.E.M. Airfield Technology
(354)	150.3156G LED				O.C.E.M. Airfield Technology
(355)	150.3072G LED				O.C.E.M. Airfield Technology
(356)	150.3095Y LED				O.C.E.M. Airfield Technology
(357)	150.3092Y LED				O.C.E.M. Airfield Technology
(358)	150.3154G LED				O.C.E.M. Airfield Technology
(359)	150.3152Y LED				O.C.E.M. Airfield Technology
(360)	150.3153G LED				O.C.E.M. Airfield Technology
(361)	150.3161Y LED				O.C.E.M. Airfield Technology
(362)	150.3162Y LED				O.C.E.M. Airfield Technology
(363)	150.3035B LED				O.C.E.M. Airfield Technology
(364)	150.3108W LED				O.C.E.M. Airfield Technology
(365)	150.3074R LED				O.C.E.M. Airfield Technology
(366)	150.3116R LED				O.C.E.M. Airfield Technology
(367)	150.3091G LED				O.C.E.M. Airfield Technology
(368)	LH700125HDT Durotest	700	120		Hughey & Phillips, LLC
(369)	150.3215 LED BLUE				O.C.E.M. Airfield Technology
(370)	48A0404-YLW LED				ADB Airfield Solutions, LLC
(371)	LXHL-LB3C LED Lumileds				Farlight LLC
(372)	8083-0014R LED				Automatic Power Inc.
(373)	10V/20W Quartz Wamco	20	10		Standard Signs Inc.
(374)	48A0409 2 LED				ADB Airfield Solutions, LLC
(375)	D1RWFH04 – LED 4 tier Red/White				Dialight
(376)	D1RWFH06 – LED 6 tier Red/White				Dialight
(377)	RTO1R06 Red LED				Dialight
(378)	RTO1R07 Red LED				Dialight
(379)	RTO1R08 Red LED				Dialight
(380)	48A0408 LED				ADB Airfield Solutions, LLC
(381)	D1RWFH03 Red/White 3 tier LED				Dialight
(382)	7654H	45		6.6	Philips
(383)	9696 Philips Quartz	120		6.6	Multi-Electric
(384)	XRCRED-L1-0000-00M01 LED Cree				International Tower Lighting, LLC
(385)	64339A Osram	105		6.6	Airport Lighting Co.
(386)	6105 Philips	105		6.6	Airport Lighting Co.
(387)	48A0405 Red LED				ADB Airfield Solutions, LLC
(388)	48A0405 White LED				ADB Airfield Solutions, LLC
(389)	10047-2993 GE	116	130		Crouse Hinds ALP
(390)	116A21/TS/8M Sylvania	116	120		Flash Technology
(391)	11427-EWR halogen GE	150		6.6	Astronics DME Corporation
(392)	10099-EVV halogen GE	200		6.6	Astronics DME Corporation
(393)	H90PAR38/SP/10 SLi Lighting	90	120		Sweepster Attachments LLC
(394)	Farlight LED3 Beacon		24/48DC		Farlight

LAMP DESCRIPTIONS

Lamp	Designation	Watts	Volts	Amps	Lamp Manufacturer
(395)	48A0396/5 GRE LED PHIL LUXEON	1			ADB Airfield Solutions, LLC
(396)	HH512	116	120		H&H Industries
(397)	21478 Blue Luxeon LED				Crouse Hinds ALP
(398)	FXQSL-103-8 Perkin Elmer	235	120		Technostrobe
(399)	LH116120ASYL	116	120		Honeywell
(400)	21474 Osram	105		6.6	Crouse Hinds ALP
(401)	5W/A19/120V/WH/4100K	5	120		Standard Signs Inc
(402)	SG9625G1 LED green				Safegate Group
(403)	SG9625Y1 LED yellow				Safegate Group
(404)	48A0400 WHT LED				ADB Airfield Solutions, LLC
(405)	B42182 Blue LED Seoul Semiconductor				Youyang Airport Lighting
(406)	LXHL-DWO1 White Luxeon Emitter LED	1			Calzoni S.r.l.
(407)	LXHL-DBO1 Blue Luxeon Emitter LED	1			Calzoni S.r.l.
(408)	LXHL-DDO1 Red Luxeon Emitter LED	1			Calzoni S.r.l.
(409)	LXHL-DMO1 Green Luxeon Emitter LED	1			Calzoni S.r.l.
(410)	CMH150/TU/830/G12 GE	150	120		Hali-Brite
(411)	LXML-PD01-0040 Luxeon Rebel40 lumen Red				Austin Insulators Inc.
(412)	D1RW1018 Red &White 1 tier LED	90	120-240		Dialight
(413)	D4641011 Red 1 tier LED	20	120-240		Dialight
(414)	13950 LED		48VDC		OBSTA
(415)	D1651018 White 1 tier LED	90	120-240		Dialight
(416)	64331-FL Osram MR 16	30		6.6	Osram
(417)	13110 Neon	45			OBSTA
(418)	44A6967/100 LED 6ea White				ADB Airfield Solutions, LLC
(419)	44A6950/100 LED 6ea White				ADB Airfield Solutions, LLC
(420)	48A0415 4ea Red LED				ADB Airfield Solutions, LLC
(421)	44A7062/20 LED 1 ea RED				ADB Airfield Solutions, LLC
(422)	44A70623/10 LED 1 ea GREEN				ADB Airfield Solutions, LLC
(423)	0100-3866 Red LED				Hali-Brite
(424)	6303 Philips PK30d	45		6.6	Philips
(425)	64361 Osram	150		6.6	Osram
(426)	48A0415-TYLW 4ea LED				ADB Airfield Solutions, LLC
(427)	9200-0032 8 Red LED array		120		Hali-Brite
(428)	9200-0033 8 Red LED array		12VDC		Hali-Brite
(429)	9200-0034 8 Red LED array			6.6	Hali-Brite
(430)	9200-0035 8 Red LED array		120		Hali-Brite
(431)	9200-0036 8 Red LED array		12VDC		Hali-Brite
(432)	9200-0032 8 Red LED array			6.6	Hali-Brite
(433)	50547 21 LED Array Yellow				Crouse Hinds ALP
(434)	3400-0100 Regent		120		Hali-Brite
(435)	D1RW1018CAT Red & White 1 tier CAT LED				Dialight
(436)	PL10834-R LED Array				Point Lighting Corporation
(437)	LAW5AM-HZKX-1 LED Golden Dragon Plus				Osram
(438)	RTOCR07 IR Red LED 120-240VAC		120-240		Dialight
(439)	RTOCR08 IR Red LED 12-48 VDC		12-48VDC		Dialight
(440)	64319SZ	45			Osram
(441)	48A0396-2 Luxeon Red LED				ADB Airfield Solutions, LLC
(442)	LED	4			Standard Signs Inc
(443)	9200-0040 Orange LED array		120		Hali-Brite
(444)	LXML-PB01-0040 Luxeon LED				Astronics DME Corporation
(445)	48A0427/BLU LED				ADB Airfield Solutions, LLC
(446)	LED-LXML-PD01-0040 LED		120		International Tower Lighting, LLC
(447)	D156-1021 White LED				Dialight
(448)	62288 LED				Crouse Hinds ALP
(451)	D264-1016 24/48 LED				Dialight
(452)	792.160-00 Red LED				Hella KGaA Hueck & Co.
(453)	792.045-00 White LED				Hella KGaA Hueck & Co.

LAMP DESCRIPTIONS

Lamp	Designation	Watts	Volts	Amps	Lamp Manufacturer
(454)	187.494-10 Green LED				Hella KGaA Hueck & Co.
(456)	RTO1R18 Red LED		12-48VDC		Dialight
(457)	187.493-10 Red LED				Hella KGaA Hueck & Co
(458)	187.493-00 White LED				Hella KGaA Hueck & Co.
(459)	016676 Red LED	25	120-240		Orga B.V.
(460)	D4641017 Red 1 tier IR LED	20	120-240		Dialight
(461)	PL10901-R-F LED Array				Point Lighting Corporation
(462)	C7-LEDV2				AGM
(463)	190.054-00 Green LED				Hella KGaA Hueck & Co
(464)	191.060-00 Yellow LED				Hella KGaA Hueck & Co
(466)	018096 White LED				Orga B.V.
(467)	100PAR38/IRC/FL25		120		Hali-Brite
(468)	21529 LED				Crouse Hinds ALP
(469)	21547- 1 Green LED				Crouse Hinds ALP
(470)	21547- 2 Yellow LED				Crouse Hinds ALP
(471)	21547- 3 Green LED				Crouse Hinds ALP
(472)	21547- 4 Yellow LED				Crouse Hinds ALP
(473)	BE-226-2234 LED				Technostrobe
(474)	1370155 LED				Flash Technology
(475)	1370145 LED				Flash Technology
(476)	1370180 LED				Flash Technology
(477)	45-0001-001 LED		95-277		Hughey & Phillips
(478)	45-0002-001 LED		10-48VDC		Hughey & Phillips
(479)	1593.15.800 White LED				ADB Airfield Solutions, LLC
(480)	1593.15.840 Yellow LED				ADB Airfield Solutions, LLC
(481)	1593.15.810 Green LED				ADB Airfield Solutions, LLC
(482)	1593.15.820 Red LED				ADB Airfield Solutions, LLC
(483)	FAR1012RO Red LED				Farlight
(484)	190.054-00 Red LED				Hella KGaA Hueck & Co.
(485)	1370165 Red LED				Flash Technology
(486)	4587703				Flash Technology
(487)	191.316-00 Yellow LED				Hella KGaA Hueck & Co.
(488)	A1-03-0235-004 Yellow LED				Astronics DME Corporation
(489)	A1-03-0235-002 Green				Astronics DME Corporation
(490)	50-0008-001 LED				Hughey & Phillips
(491)	51-0054-001 LED				Hughey & Phillips
(492)	51-0060-001 LED				Hughey & Phillips
(493)	4060-0625R LED				TWR Lighting Inc.
(494)	A1-14-0086-001 LED				Astronics DME Corporation
(495)	A1-14-0086-002 LED				Astronics DME Corporation
(496)	48A0422-16 LED				ADB Airfield Solutions, LLC
(497)	48A0422-24 LED				ADB Airfield Solutions, LLC
(498)	48A0422-32 LED				ADB Airfield Solutions, LLC
(499)	48A0431GRN LED				ADB Airfield Solutions, LLC
(500)	48A0431RED LED				ADB Airfield Solutions, LLC
(501)	48A0431WHT LED				ADB Airfield Solutions, LLC
(502)	48A0431YLW LED				ADB Airfield Solutions, LLC
(503)					
(504)					
(506)	10047-3100	116	130		Crouse Hinds ALP
(507)	LMP-116W-125-DUR	116	125		International Tower Lighting
(508)	LXM2-PH01-0070 LED				Pfannenberg Gmbh
(509)	192.737-00 Yellow LED				Hella KGaA Hueck & Co.
(510)	1370135 Red LED				Flash Technology
(511)	D0609663 Cool White LED				Calzoni S.r.l.
(512)	D0611100 Yellow LED				Calzoni S.r.l.
(513)	D0607743 Red LED				Calzoni S.r.l.
(514)	D0607742 Green LED				Calzoni S.r.l.

LAMP DESCRIPTIONS

Lamp	Designation	Watts	Volts	Amps	Lamp Manufacturer
(515)	FAR1012RO LED IR				Farlight
(516)	4072.24.920 White LED				ADB BVBA
(517)	4072.24.920 Red LED				ADB BVBA
(518)	RGL-18 LED				Airport Lighting Co.
(519)	760.2186	48			O.C.E.M. Airfield Technology
(520)	760.2190	105			O.C.E.M. Airfield Technology
(521)	760.2181	30			O.C.E.M. Airfield Technology
(522)	D2661019FH LED				Dialight
(523)	D5641011 Red 1 Tier LED				Dialight
(524)	D16561019 White LED				Dialight
(525)	1030LED				Strobe Approach Lighting Technology
(526)	D1RW1019 Dual LED				Dialight
(527)	D1RW1020 Dual LED				Dialight
(528)	SafeLED-TE-E-O-B-NPS-6.6A-1C LED				Safegate Group
(529)					
(530)					
(531)	150.40775 Red LED				O.C.E.M. Airfield Technology
(532)	150.4044 Red LED				O.C.E.M. Airfield Technology
(533)	150.3980 White LED				O.C.E.M. Airfield Technology
(534)	150.3398 White LED				O.C.E.M. Airfield Technology
(535)	150.3399 Red LED				O.C.E.M. Airfield Technology
(536)	150.4076 Red LED				O.C.E.M. Airfield Technology
(537)	150.4164 Green LED				O.C.E.M. Airfield Technology
(538)	150.3979 Yellow LED				O.C.E.M. Airfield Technology
(539)	150.3928 Green LED				O.C.E.M. Airfield Technology
(540)	150.3957 Green LED				O.C.E.M. Airfield Technology
(541)	150.4048 Yellow LED				O.C.E.M. Airfield Technology
(542)	150.4166 White LED				O.C.E.M. Airfield Technology
(543)					
(544)	150.4089 Blue LED				O.C.E.M. Airfield Technology
(545)	150.4061 Yellow LED				O.C.E.M. Airfield Technology
(546)	150.4062 Red LED				O.C.E.M. Airfield Technology
(547)					
(548)	150.4060 White LED				O.C.E.M. Airfield Technology
(549)	150.4063 Green LED				O.C.E.M. Airfield Technology
(550)	IRIS200-LED01 Green LED				atg airports Ltd.
(551)	1370210 Red LED		24Vdc		Flash Technology
(552)	861LEDMOD-BB				Airport Lighting Co.
(553)	861LEDMOD-CC				Airport Lighting Co.
(554)	861LEDMOD-GO				Airport Lighting Co.
(555)	861LEDMOD-GY				Airport Lighting Co.
(556)	861LEDMOD-RG				Airport Lighting Co.
(557)	861LEDMOD-RR				Airport Lighting Co.
(558)					
(559)	238519 Philips	83	120		Hali-Brite
(560)	A1-03-0235-001 White LED				Astronics DME Corporation
(561)	44A7395 LED				ADB Airfield Solutions, LLC
(562)	48A0440-1 LED				ADB Airfield Solutions, LLC
(563)	F1370215 Red LED				Flash Technology
(564)	SG9625B2 (blue) LED				Safegate Group
(565)	AV-OL-FL810-12-R Red LED				Avlite Systems
(566)	AV-OL-FL810-12-RIR Red LED with IR				Avlite Systems
(567)	AV-OL-FL810-UM-R Red LED				Avlite Systems
(568)	AV-OL-FL810-UM-RIR Red LED with IR				Avlite Systems
(569)	48A0444-GRN-300 LED				ADB Airfield Solutions, LLC
(570)	48A0444-YLW-495 LED				ADB Airfield Solutions, LLC
(571)					
(572)					

LAMP DESCRIPTIONS

Lamp	Designation	Watts	Volts	Amps	Lamp Manufacturer
(573)	BE-226-235/236 W/R LED				Technostrobe
(574)	21671-R LED				Crouse Hinds ALP
(575)	21671-W LED				Crouse Hinds ALP
(576)	IRIS200-LED03 Yellow LED				atg airports Ltd.
(577)	IRIS200-LED09 Green LED				atg airports Ltd.
(578)	IRIS200-LED11 Yellow LED				atg airports Ltd.
(579)	M550-1C LED				Manairco, Inc.
(580)	M550-1R LED				Manairco, Inc.
(581)	PL10569-1 Xenon Strobe				Point Lighting Corporation
(582)	1370216				Flash Technology
(583)	1370211				Flash Technology
(584)	21683-1 LED Green				Crouse Hinds ALP
(585)	21683-2 LED Yellow				Crouse Hinds ALP
(586)	21683-3 LED Green				Crouse Hinds ALP
(587)	21683-4 LED Yellow				Crouse Hinds ALP
(588)	LMP-620W-120-LL	620	120		International Tower Lighting
(589)	21671-R-12 Red LED				Crouse Hinds ALP
(590)	21671-W-12 White LED				Crouse Hinds ALP
(591)	216LED1-LED				Airport Lighting Co.
(592)	LMP-0LTE-300 LED				International Tower Lighting
(593)	44521-04 LED				Airsafe Airport Equipment Co Ltd
(594)	2990.40.827	48			ADB Airfield Solutions, LLC
(595)	1370175 LED				Flash Technology
(596)	48A0443-GRN-640 LED				ADB Airfield Solutions, LLC
(597)	48A0443-WHT-640 LED				ADB Airfield Solutions, LLC
(598)	48A0443-YLW-640 LED				ADB Airfield Solutions, LLC
(599)	44A7234/Y1 LED				ADB Airfield Solutions, LLC
(600)	48A0405 THL LED				ADB Airfield Solutions, LLC
(601)	9200-0038 LED		120		Hali-Brite
(602)	9200-0039 LED			6.6	Hali-Brite
(603)	44A7062/31 Red LED				ADB Airfield Solutions, LLC
(604)	48A0444-GRN-495 LED				ADB Airfield Solutions, LLC
(605)	D1RWFH180 LED				Dialight
(606)	44A7274-20 White & Red LED Array				ADB Airfield Solutions, LLC
(607)	IRIS200-LED31 Green LED				atg airports Ltd.
(608)	IRIS200-LED33 Yellow LED				atg airports Ltd.
(609)	IRIS200-LED39 Green LED				atg airports Ltd.
(610)	IRIS200-LED41 Yellow LED				atg airports Ltd.
(611)	IRIS200-LED51 White LED				atg airports Ltd.
(612)	IRIS200-LED52 Red LED				atg airports Ltd.
(613)	IRIS200-LED54 White LED Left				atg airports Ltd.
(614)	IRIS200-LED55 White LED Right				atg airports Ltd.
(615)					
(616)	1370169 LED				Flash Technology
(617)	OTL-202-00 LED				OTL Solution
(618)					
(619)	A1-14-0084-002 White LED				Astronics DME Corporation
(620)	SG17111W1 White LED				Safegate Group
(621)	SG17112R1 Red LED				Safegate Group
(622)	LMP-0LTE-300-IR LED				International Tower Lighting

ADDRESS LIST OF CERTIFIED AIRPORT LIGHTING EQUIPMENT MANUFACTURERS

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977 Gahanna Parkway
P.O. Box 30829
Columbus, Ohio 43230-0829
Tel (614) 861-1304

ADB BVBA
Leuvensesteenweg, 585
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Tel (032) 2 722 17 11
U.S. representative:
ADB Airfield Solutions LLC
(See Above)

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Manufacturers, Inc.
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Fax (315) 682-6758

Airport Lighting Company
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Manlius, NY 13104
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atg airports Inc.
7857 Drew Circle #11
Fort Myers, FL33967
Tel (239) 985-9406
Fax (239) 985-9435
http://www.atgairports.com

Austin Insulators Inc.
7510 Airport Rd
Mississauga, ON L4T 2H5, Canada
Tel (905) 405-1144

Automatic Power Inc.
213 Hutcheson Street
Houston, TX 77003
Tel (713) 228-5208
Fax (713) 228-3717

Avlite Systems
11 Industrial Drive
Somerville, Victoria
3912 Australia
Tel 61 0 3 5977 6128
U.S. representative:
Sealite LLC
172 Lily Pond Rd.
Gilford, NH 03249
Tel (603) 737-1311

ADDRESS LIST OF CERTIFIED AIRPORT LIGHTING EQUIPMENT MANUFACTURERS

Calzoni S.r.l.
Via de Gasperi 7
Calderara di Reno
Bologna Italy 40012
Tel 390514137579
US Representative:
Godfrey Systems International, Inc. (G.S.I. Inc.)
3051 Pine Street
Clearwater, FL 33763-0914
Tel (727) 799-4916
Fax (727) 724-0212
www.gsilight.com, gsiinc@knology.net

Coleman Cable, Inc.
1503 Shields Dr
Waukegan, IL 6085
Tel (847) 672-2495
Fax (847) 689 0103

Conductores Monterrey, S.A. de C.V./Viakon
Avenue Conductores No. 505 Ote
Col. Constituyentes de Queretaro
San Nicholas de Los Garza
Nuevo Leon 66493 Mexico
Tel 5281 8030 8053

Control Industries, Inc.
409 Lafayette Avenue
Urbana, Ohio 43078
Tel (419) 672-8928

Controlled Power Inc.
17909 Bothell Everett Hwy SE
Suite 102
Bothell, WA 98012
Tel (425) 485 1778
Fax (425) 485 0658
www.controlledpowerinc.com

Cooper Crouse Hinds
Wolf & 7th North Sts.
Syracuse, NY 13208
Tel 315 477 5709
Fax 315 477 5118

Crouse-Hinds Airport Lighting Products
1200 Kennedy Road
Windsor, Connecticut 06095
Tel (860) 683-4300

Dialight Corporation
1501 Rt. 34 South
Farmingdale, NJ 07727
Tel (732)-919-3119
Fax: (732)-751-5778
www.dialight.com

Draka Cableteq USA.
1 Tamaqua Blvd. PO Box 347
Schuylkill Haven, PA 17972
Tel (570) 385-4381
Fax (570) 385 1092
www.drakausa.com

EFLA Oy
Sepantie 4
07230 Monninkyla, Finland
Tel 358 (0) 204 76 2367
www.efla.net

Exel Oyj
Muovilaaksontie 2
F1-82110 Heinavaara, Finland
Tel 358 (0)20 754 1200
Fax 358 (0)20 754-1330
U.S. representative:
Godfrey Systems International, Inc. (G.S.I. Inc.)
3051 Pine Street
Clearwater, FL 33763-0914
Tel (727) 799-4916
Fax (727) 724-0212
www.gsilight.com, gsiinc@knology.net

Farlight LLC
846 Watson Ave Unit C
Wilmington, CA 90744
Tel: 310 830 0181
Fax: 310 830 9066

Flash Technology
332 Nichol Mill Lane
Franklin, TN 37067
Tel (615) 503-2000
Fax (615) 261-2600

FlexStake Inc.
2150 Andrea Lane
Fort Myers, FL 33912
Tel (941) 481-3539

Flight Light Inc.
3513 La Grande Blvd.
Sacramento, CA 95823
Tel (916) 394-2800
Fax (916) 394-2809
http://www.flightlight.com

Hali-Brite Inc.
P.O. Box 10
Crosby, Minnesota 56441
Tel (800) 553-6269

ADDRESS LIST OF CERTIFIED AIRPORT LIGHTING EQUIPMENT MANUFACTURERS

Hella KGaA Hueck & Co.
Rixbecker 75,
Lippstadt, 59552 Germany
Tel 49 2841 38 5540
U.S. representative:
Hella Corporate Center USA Inc. (Matt McAmmond)
43811 Plymouth Oaks Blvd.
Plymouth, MI, 48170-2539

Honeywell Airport Systems
709D Cochran St
Simi Valley, CA 93065
Tel (805) 581 5591

Hughey & Phillips, LLC
240 W Twain Ave
Urbana, OH 43078
Tel (937)-652-3500
Fax (937) 652 3508

Integro, LLC.
30 Peter Court
New Britain, Connecticut 06051
Tel (860) 832-8960
Fax (860) 832-8965
www.Integro-USA.com

International Tower Lighting, LLC
3720 Keystone Avenue
Nashville, TN 37211
Tel 615 256 6030
Fax 615 256 6032

Jaquith Industries, Inc.
600 East Brighton Avenue
P.O. Box 780
Syracuse, New York 13205
Tel (315) 478-5700

Liberty Airport Systems, Inc
3375 North Service Rd, Unit C-5
Burlington, Ontario Canada L7N 3G2
Tel (905) 631 1597
Fax: (905) 631 5387

Manairco, Inc.
28 Mansfield Industrial Park
Mansfield, Ohio 44903
Tel (419) 524-2121

Multi-Electric Manufacturing, Inc.
4223-43 West Lake Street
Chicago, Illinois 60624
Tel (773) 722-1900
Fax (773) 722-5694

Nehring Electrical Works Company
PO Box 965
813 East Locust Street
De Kalb, IL 60115
Tel (800) 435-4481
Fax (815) 756-7048
www.info@nehringwire.com

Nexans Energy USA Inc.
25 Oakland Ave.
Chester, NY 10918
Tel 1-845-469-1428
Fax 1-845-469-1406

OBSTA
2, rue Troyon
92316 Sevres France
Tel 33 1 41 23 50 10
U.S. Representative:
OBSTA
10108 USA Today Way
Miramar, FL 33025
Tel (954) 430 6310
(800) 248-3548
Fax (954)-430-7785
www.obsta.us
1pecourt@obsta.us

O.C.E.M. Airfield Technology
a division of Energy Technology S.r.l.
Via 2 Agosto 1980, 11
40016 San Giorgio di Piano
Bologna - Italy
Tel 39 051 665 6611
Fax 39 051 665 6677
U.S. representative:
Multi Electric Mfg Inc.
4223-43Weast Lake St
Chicago, IL 60624
(See Above)

The Okonite Company
102 Hilltop Road
PO Box 340
Ramsey, NJ 07445
Tel (201) 825 0300
Fax (201) 327 0273

ADDRESS LIST OF CERTIFIED AIRPORT LIGHTING EQUIPMENT MANUFACTURERS

Olson Industries, Inc
P.O. Box 880
Star Route 4
Atkinson, Nebraska 68713
Tel (402) 925-5090

Orga B.V.
Strickledeweg 13
3125 At Schiedam
The Netherlands
Tel (011) 31 10 415 0333
Fax (011) 31 10 437 8445
U.S. representative:
Orga Manufacturing Inc.
PO Box 5719
Kingwood, TX 77325
Tel (281) 358-2544
Fax: (281) 358-0788

OTL Solution
3173879 Canada Inc.
4920 Louis-B-Mayer
Laval Quebec CDN H7P 0H7
Tel 450-444-7009

Pfannenberg Gmbh
Werner-Witt Str. 1
D21035
Hamburg, Germany
Tel 49 40 734120 Volker Matthies
U.S. Representative:
Pfannenberg Inc.
68 Ward Rd
Lancaster, NY 14086
Tel: 716 685 6866 Blaine Witt

Precision Control System of Indianapolis
7225 Girls School Ave.
Indianapolis, IN 46241
Tel: (317) 241-3000

Prysmian Power Cables and Systems USA, LLC
710 Industrial Dr
Lexington, SC 29072
Tel (803) 951-4048
Fax (803) 951-4091

Point Lighting Corporation
P.O. Box 686
Simsbury, Connecticut 06070
Tel (860) 243-0600, (800) 900-0433
Fax (860) 243-0665

POLLITE LTD
38 Borough Rd
Darlington DL1 1SW
UK
Tel: 44 1325 355433
U.S. Representative:
Robert R Caggiano
45 Clarken Dr
West Orange, NJ 07052
Tel (973) 271-8431

Quantec Networks GmbH
SilcherstraBe 28
38690 Vienenburg, Germany
Tel: 11-49-5324-780966-222 Alexander Gerdes
U.S. Representative:
Pfannenberg Inc.
68 Ward Rd
Lancaster, NY 14086
Tel: 716 685 6866 Blaine Witt

Rural Electric Inc.
9502 E Main St
Mesa, AZ 85207
Tel (480) 986-1488
Fax (480) 984-0319
SAFE-HIT, A Division of

Energy Absorption Systems, Inc.
35 East Wacker Dr. Suite1100
Chicago, IL 60601
Tel (312) 705-8414
Fax (312) 467-9625
www.safehit.com

Safegate Group
Djurhagegatan 19
213 76 Malmo
Sweden
U.S. Representative:
Safegate Airport Systems Inc.
7101 Northland Circle, Suite 110
Brooklyn Park, MN 55428
Tel (763) 535-9299
www.safegate.com

Sherwin Industries Inc.
2129 W Morgan Ave.
Milwaukee, WI 53221
Tel (414) 281-6400
Fax (414) 281-6404

ADDRESS LIST OF CERTIFIED AIRPORT LIGHTING EQUIPMENT MANUFACTURERS

Skytec Inc.
23 Inland Farm Rd.
Windham, ME 04062
Tel (207) 893-1700
Fax (207) 593-1717

Southwire Co.
One Southwire Dr.
Carrollton, GA 30119
Tel (770) 832-5092

Specialty Tower Lighting Ltd.
1630 Elmview Dr.
Houston, TX 77080
Tel (713) 722 8123
Fax (713) 722 8744

Standard Signs, Inc.
9115 Freeway Drive
Macedonia, OH 44056
Tel (330) 467-2030
Fax (330-467 2076

Strobe Approach Lighting Technology
One Chestnut Street, Suite 4T
Nashua, NH 03060
Tel: 603 598 4100
Fax 603 598 4198

Synergy Cable Ltd
2 Migdale Hakirion,
PO Box 400
Kiriat Bialik 27103 Israel
Tel (972) 4- 846-6222
Fax (972) 4-846-6286
US representative:
Synergy Cable USA Ltd
1850 Parkway Pl
Marietta, GA30067
Tel (770) 226-9898
Fax: (770) 984-2191

Technostrobe
65 Herbert O'Connell
Coteau-du-Lac QC
J10P 1B0 Canada
Tel 450 763 2097

Thomas and Betts Ltd
120 Nashdene Road.
Scarborough, ON M1E 4S7
Canada
Tel (416) 292-9782
Fax (416) 292-1614
http://www.amerace.com

TWR Lighting, Inc.
4300 Windfern Rd #100
Houston, Texas 77041
Tel (713) 973 6905
Fax (713) 490 1273
www.twrlighting.com

Unika Universal Karlo Sanayi ve Tic A.S.
Velikoy Sanai Bolgesi
Sanayi Mah 3 Cadde No. 4
Velikoy Gerkezkoy
Tekirdag, Turkey 59550
U.S. representative:
Eutex International, Inc.
Contact Person: Nick Mair (Operations Director)
3409 Brinkman
Houston, TX, 77018
Tel (832) 358 1177
Fax (832) 358 1165
www.eutex.international.com

Unimar Inc
3195 Vickery Rd
N Syracuse, NY 13212
Tel (315) 699-4400
Fax (315) 699-3700

Valley Illuminators
P.O. Box 3001
Federal Way, WA 98063
Tel (253) 833-3016
Fax (253) 735-5414
www.valleyilluminators.com

Youyang Airport Lighting Equipment Inc.
738-2, Kwanyang-dong, Dongan-gu,
Anyang-si, Gyeonggi-do, Korea 431-060
Tel 82 31 422-0021
Fax 82 31 424-6044
www.youyang.co.kr
U.S. representative:
Pantree Co.
9 Perryville
Irvine, CA 92620
Tel (714) 544-1194
Tel (714) 544-1074

APPENDIX 7. SAMPLE CERTIFICATION.

PROGRAM ADMINISTRATOR

(Name and address of Third party certifier)

_____
_____
_____

REVISION DATE: _____
(This is date of revised certificate if issued)

ORIGINAL ISSUE DATE: _____
(This date is the date certificate is issued)

RECERTIFICATION DUE Date:_____
(Eight years from earliest test report data referenced below in 2(A), or as specified in AC)

AIRPORT LIGHTING EQUIPMENT CERTIFICATION PROGRAM

CERTIFICATION OF CONFORMANCE

Name and Address of Manufacturer
_____
_____
_____

The product described below is hereby approved for listing in the next issue of the Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5345-53, Appendix 3 Addendum, Airport Lighting Equipment Certification Program. The approval is based on successful completion of tests in accordance with the specifications listed in and the requirements for approval described in the AC 150/5345-xx and the reporting to the Program Administrator the results of such tests, accompanied by related documents by (third party certifier) recognized testing laboratory. This Certificate is only confirmable in conjunction with equipment being listed in AC 150/5345-53 Appendix 3 Addendum as currently published by the FAA. The certification is not valid for a product modified with non-OEM replacement parts or non-production components.

_____

L-type – EQUIPMENT NAME
(AC 150/5345-xx)

Mfgr's (column heading/data as detailed per L-type AC in AC 150/5345-53 and Appendix 3 listing in the Addendum)

List lamp used in ( ) after part number. If not listed, indicate lamp designation (number, watts, description designation, volts, amps, as appropriate) and manufacturer

1. This equipment requires continuing validation in accordance with the requirements of AC 150/5345-53.

2. Product tested and report issued by:

(A) Report No.:_____(all applicable test reports issued)_____

(B) Date of Report:___(issue date of report each listed in 2(A))_____

APPROVED FOR CERTIFICATION:

BY: Certifier's Signature_____

Certifier's Typed Name_____

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BORING LOCATION MAP, BORING LOGS AND REFERENCE MATERIAL

Resource International, Inc.

DELWARE MUNICIPAL AIRPORT
RUNWAY 10/28 EXTENSION
DELAWARE, OHIO

SUBSURFACE INVESTIGATION REPORT

Prepared For:
CHA Consulting, Inc.
1501 N. Marginal Road
Suite 200
Cleveland, Ohio 44114

Prepared By:
Resource International, Inc.
6350 Presidential Gateway
Columbus, OH 43231

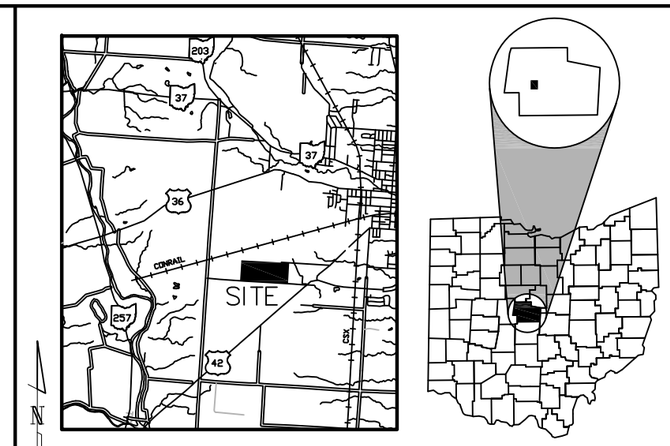
Rii Project No. W-14-127

October 2014

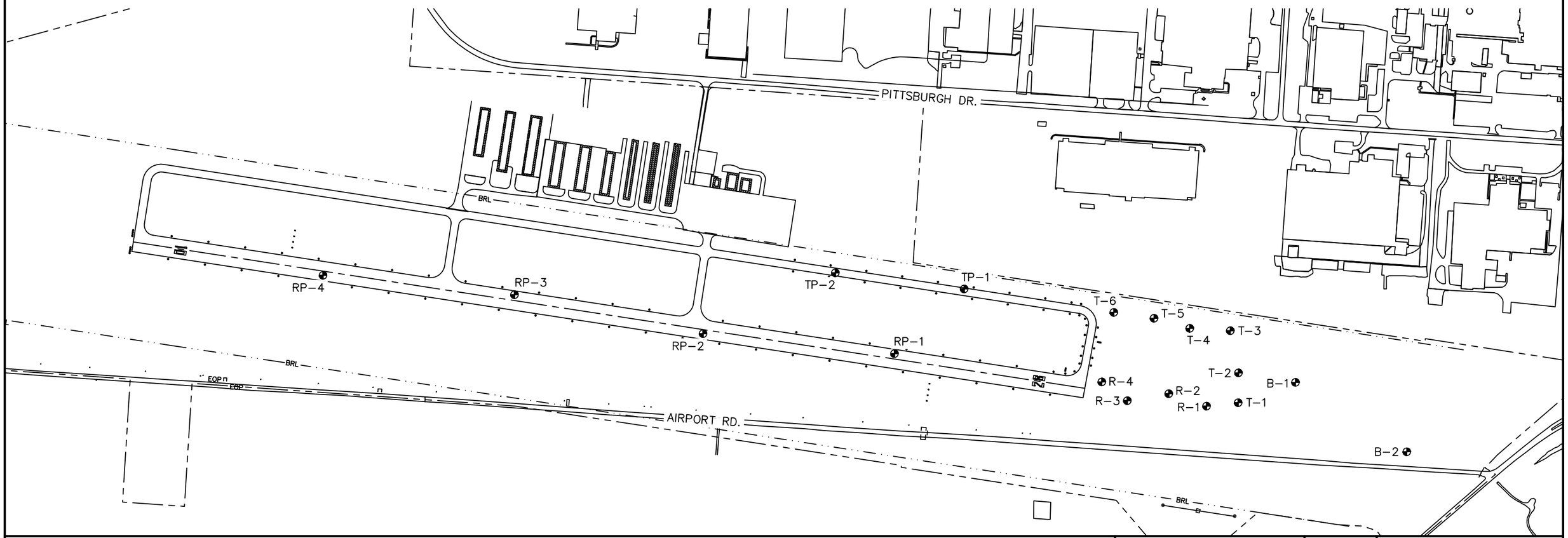
Planning, Engineering, Construction Management, Technology
6350 Presidential Gateway, Columbus, Ohio 43231
P 614.823.4949 F 614.823.4990

APPENDIX II

VICINITY MAP AND BORING PLAN



VICINITY MAP



BORING PLAN
DELAWARE MUNICIPAL AIRPORT
DELAWARE, OHIO

PROJECT NO. Rii # W-14-127	DRAWN RRM	RESOURCE INTERNATIONAL, INC.
SCALE: 1"=500' (0 250 500) N	REVIEWED JRH	
	DATE 10-14-14	

APPENDIX III

DESCRIPTION OF SOIL TERMS

DESCRIPTION OF SOIL TERMS

The following terminology was used to describe soils throughout this report and is generally adapted from ASTM 2487/2488 and ODOT Specifications for Geotechnical Explorations.

Granular Soils - The relative compactness of granular soils is described as:
ODOT A-1, A-2, A-3, A-4 (non-plastic) or USCS GW, GP, GM, GC, SW, SP, SM, SC, ML (non-plastic)

Description	Blows per foot – SPT (N_{60})		
Very Loose	Below		5
Loose	5	-	10
Medium Dense	11	-	30
Dense	31	-	50
Very Dense	Over		50

Cohesive Soils - The relative consistency of cohesive soils is described as:
ODOT A-4, A-5, A-6, A-7, A-8 or USCS ML, CL, OL, MH, CH, OH, PT

Description	Unconfined Compression (tsf)		
Very Soft	Less than		0.25
Soft	0.25	-	0.5
Medium Stiff	0.5	-	1.0
Stiff	1.0	-	2.0
Very Stiff	2.0	-	4.0
Hard	Over		4.0

Gradation - The following size-related denominations are used to describe soils:

Soil Fraction		USCS Size	ODOT Size
Boulders		Larger than 12”	Larger than 12”
Cobbles		12” to 3”	12” to 3”
Gravel	coarse	3” to ¾”	3” to ¾“
	fine	¾” to 4.75 mm (¾” to #4 Sieve)	¾” to 2.0 mm (¾” to #10 Sieve)
Sand	coarse	4.75 mm to 2.0 mm (#4 to #10 Sieve)	2.0 mm to 0.42 mm (#10 to #40 Sieve)
	medium	2.0 mm to 0.42 mm (#10 to #40 Sieve)	-
	fine	0.42 mm to 0.074 mm (#40 to #200 Sieve)	0.42 mm to 0.074 mm (#40 to #200 Sieve)
Silt		0.074 mm to 0.005 mm (#200 to 0.005 mm)	0.074 mm to 0.005 mm (#200 to 0.005 mm)
Clay		Smaller than 0.005 mm	Smaller than 0.005 mm

Modifiers of Components - Modifiers of components are as follows:

Term	Range		
Trace	0%	-	10%
Little	10%	-	20%
Some	20%	-	35%
And	35%	-	50%

Moisture Table - The following moisture-related denominations are used to describe cohesive soils:

Term	Range - USCS	Range - ODOT
Dry	0% to 10%	Well below Plastic Limit
Damp	>2% below Plastic Limit	Below Plastic Limit
Moist	2% below to 2% above Plastic Limit	Above PL to 3% below LL
Very Moist	>2% above Plastic Limit	
Wet	≥ Liquid Limit	3% below LL to above LL

Organic Content – The following terms are used to describe organic soils:

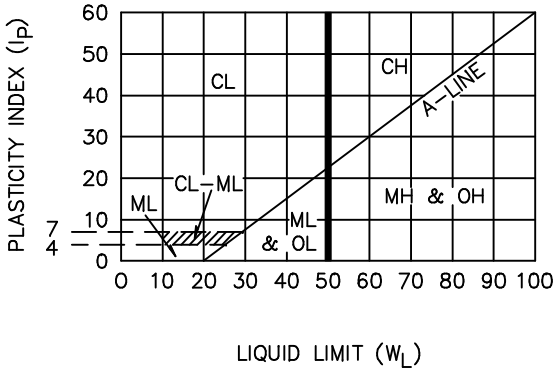
Term	Organic Content (%)
Slightly organic	2-4
Moderately organic	4-10
Highly organic	>10

Bedrock – The following terms are used to describe the relative strength of bedrock:

Description	Field Parameter
Very Weak	Can be carved with knife and scratched by fingernail. Pieces 1 in. thick can be broken by finger pressure.
Weak	Can be grooved or gouged with knife readily. Small, thin pieces can be broken by finger pressure.
Slightly Strong	Can be grooved or gouged 0.05 in deep with knife. 1 in. size pieces from hard blows of geologist hammer.
Moderately Strong	Can be scratched with knife or pick. 1/4 in. size grooves or gouges from blows of geologist hammer.
Strong	Can be scratched with knife or pick with difficulty. Hard hammer blows to detach hand specimen.
Very Strong	Cannot be scratched by knife or pick. Hard repeated blows of geologist hammer to detach hand specimen.
Extremely Strong	Cannot be scratched by knife or pick. Hard repeated blows of geologist hammer to chip hand specimen.

UNIFIED SOIL CLASSIFICATION SYSTEM
(ASTM D 2487)

MAJOR DIVISION			GROUP SYMBOLS	TYPICAL NAMES	CLASSIFICATION CRITERIA	
COARSE-GRAINED SOILS MORE THAN 50% RETAINED ON 75μm (NO. 200) SIEVE	GRAVELS 50% OR MORE OF COARSE FRACTION RETAINED ON 4.75 mm (NO. 4) SIEVE	CLEAN GRAVELS	GW	WELL-GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	CLASSIFICATION ON BASIS PERCENTAGE OF FINES LESS THAN 5% PASS 75 μm SIEVE GW, GP, SW, SP MORE THAN 12% PASS 75 μm SIEVE GM, GC, SM, SC 5% TO 12% PASS 75 μm SIEVE BORDERLINE CLASSIFICATION REQUIRING USE OF DUAL SYMBOLS	$C_U = D_{60}/D_{10}$ GREATER THAN 4 $C_Z = \frac{(D_{30})^2}{D_{10} * D_{60}}$ BETWEEN 1 AND 3
			GP	POORLY GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES		NOT MEETING BOTH CRITERIA FOR GW
		GRAVELS WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES		ATTERBERG LIMITS PLOT BELOW "A" LINE OR PLASTICITY INDEX LESS THAN 4
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES		ATTERBERG LIMITS PLOT ABOVE "A" LINE AND PLASTICITY INDEX GREATER THAN 7
	SANDS MORE THAN 50% OF COARSE FRACTION PASSES 4.75 mm (NO. 4) SIEVE	CLEAN SANDS	SW	WELL-GRADED SAND AND GRAVELLY SANDS, LITTLE OR NO FINES		$C_U = D_{60}/D_{10}$ GREATER THAN 6 $C_Z = \frac{(D_{30})^2}{D_{10} * D_{60}}$ BETWEEN 1 AND 3
			SP	POORLY GRADED SANDS AND GRAVELLY SANDS, LITTLE OR NO FINES		NOT MEETING BOTH CRITERIA FOR SW
		SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES		ATTERBERG LIMITS PLOT BELOW "A" LINE OR PLASTICITY INDEX LESS THAN 4
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES		ATTERBERG LIMITS PLOT ABOVE "A" LINE AND PLASTICITY INDEX GREATER THAN 7

MAJOR DIVISION		GROUP SYMBOLS	TYPICAL NAMES	CLASSIFICATION CRITERIA
FINE-GRAINED SOILS 50% OR MORE PASSES 75 μm (NO. 200) SIEVE	SILTS AND CLAYS LIQUID LIMIT 50% OR LESS	ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS	 PLASTICITY CHART FOR THE CLASSIFICATION OF FINE-GRAINED SOILS
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50%	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS	
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY	
HIGHLY ORGANIC SOILS		PT	PEAT, MUCK AND OTHER HIGHLY ORGANIC SOILS	FIBROUS ORGANIC MATTER; WILL CHAR, BURN, OR GLOW

APPENDIX IV

BORING LOGS

B-1 and B-2
R-1 through R-4
T-1 through T-6

BORING LOGS

Definitions of Abbreviations

AS	=	Auger sample
HP	=	Unconfined compressive strength as determined by a hand penetrometer (tons per square foot)
LOI	=	Percent organic content (by weight) as determined by ASTM D2974 (loss on ignition test)
PID	=	Photo-ionization detector reading (parts per million)
QR	=	Unconfined compressive strength of intact rock core sample as determined by ASTM D2938 (pounds per square inch)
QU	=	Unconfined compressive strength of soil sample as determined by ASTM D2166 (pounds per square foot)
RC	=	Rock core sample
REC	=	Ratio of total length of recovered soil or rock to the total sample length, expressed as a percentage
RQD	=	Rock quality designation – estimate of the degree of jointing or fracture in a rock mass, expressed as a percentage:

$$\frac{\sum \text{segments equal to or longer than 4.0 inches}}{\text{core run length}} \times 100$$

S	=	Sulfate content (parts per million)
SPT	=	Standard penetration test blow counts, per ASTM D1586. Driving resistance recorded in terms of blows per 6-inch interval while letting a 140-pound hammer free fall 30 inches to drive a 2-inch outer diameter (O.D.) split spoon sampler a total of 18 inches. The second and third intervals are added to obtain the number of blows per foot (N_m).
N_{60}	=	Measured blow counts corrected to an equivalent (60 percent) energy ratio (ER) by the following equation: $N_{60} = N_m*(ER/60)$
SS	=	Split spoon sample
2S	=	For instances of no recovery from standard SS interval, a 2.5 inch O.D. split spoon is driven the full length of the standard SS interval plus an additional 6.0 inches to obtain a representative sample. Only the final 6.0 inches of sample is retained. Blow counts from 2S sampling are not correlated with N_{60} values.
3S	=	Same as 2S, but using a 3.0 inch O.D. split spoon sampler.
TR	=	Top of rock
USCS	=	Unified Soil Classification System per ASTM D2487
W	=	Initial water level measured during drilling
▼	=	Water level measured at completion of drilling

Classification Test Data

Gradation (as defined on Description of Soil Terms):

GR	=	% Gravel
SA	=	% Sand
SI	=	% Silt
CL	=	% Clay

Atterberg Limits:

LL	=	Liquid limit
PL	=	Plastic limit
PI	=	Plasticity Index
WC	=	Water content (%)

RESOURCE INTERNATIONAL, INC.

PROJECT: W-14-127	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	NORTHING 223602.569	**EXPLORATION ID**	
NAME: Delaware Municipal Airport	SAMPLING FIRM / LOGGER: RII / K.R.	HAMMER: CME Automatic	EASTING: 1800520.825	**B-1**	
CLIENT: CHA Consulting, Inc.	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 942.0 ft. ±	PAGE	
START: 9-30-14 END: 9-30-14	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.8	COMPLETION DEPTH: 10.0 ft.	1 OF 1	

ELEV. 942.0	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GRADATION (%) GR	SA	SI	CL	ATTERBERG LL	PL	PI	WC	USCS CLASS	BACK FILL
941.5							6.0" - Topsoil										
	1						Very stiff, brown **LEAN CLAY WITH SAND**, and silt, trace fine gravel, damp to moist.										
	2	SS-1	7 6 5	16	83	3.0		6.2	15.6	45.9	32.3	36	22	14	13	CL	
	3																
	4	SS-2	3 4 5	13	61	2.75									19	CL (V)	
	5																
936.5							Very stiff, brown **SANDY LEAN CLAY**, and silt, little fine gravel, moist.										
	6																
	7	SS-3	4 4 6	14	100	2.25		10.7	20.0	38.7	30.6	33	18	15	17	CL	
	8																
	9	SS-4	4 5 6	16	50	3.25										CL (V)	
932.0	EOB 10																

NOTES: Groundwater not encountered during drilling

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Compacted with the auger 50 lbs bentonite chips and soil cuttings

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-14-127	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	NORTHING 223241.983	**EXPLORATION ID**
NAME: Delaware Municipal Airport	SAMPLING FIRM / LOGGER: RII / K.R.	HAMMER: CME Automatic	EASTING: 1801098.795	**B-2**
CLIENT: CHA Consulting, Inc.	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 940.0 ft.±	PAGE
START: 9-30-14 END: 9-30-14	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.8	COMPLETION DEPTH: 10.0 ft.	1 OF 1

ELEV. 940.0	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GRADATION (%) GR	SA	SI	CL	ATTERBERG LL	PL	PI	WC	USCS CLASS	BACK FILL
939.5							6.0" - Topsoil										
	1, 2	SS-1	3 4 4	12	33	4.5	Very stiff to hard, dark brown to dark brownish gray **FAT CLAY**, and silt, trace coarse to fine sand, moist.	0.0	6.5	39.7	53.8	51	21	30	21	CH	
	3																
	4, 5	SS-2	3 3 4	10	56	3.25									21		
934.5							Very stiff to hard, dark brownish gray to gray **SANDY LEAN CLAY WITH GRAVEL**, some silt, moist.										
	6, 7	SS-3	4 5 6	16	100	3.25		15.7	31.3	26.4	26.6	32	18	14	17	CL	
	8																
	9	SS-4	5 5 7	17	86	4.5+	-shale fragments present in SS-4									CL (V)	
930.0	EOB 10																

NOTES: Groundwater not encountered during drilling

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Compacted with the auger 50 lbs bentonite chips and soil cuttings

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-14-127	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	NORTHING 223479.116	**EXPLORATION ID**	
NAME: Delaware Municipal Airport	SAMPLING FIRM / LOGGER: RII / K.R.	HAMMER: CME Automatic	EASTING: 1800058.883	**R-1**	
CLIENT: CHA Consulting, Inc.	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 943.0 ft. ±	PAGE	
START: 10-1-14 END: 10-1-14	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.8	COMPLETION DEPTH: 10.0 ft.	1 OF 1	

ELEV.	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GRADATION (%) GR	SA	SI	CL	ATTERBERG LL	PL	PI	WC	USCS CLASS	BACK FILL
943.0																	
942.6							5.0" - Topsoil										
	1						**FILL**: Hard, dark brown to brownish gray **LEAN CLAY WITH SAND**, and silt, trace fine gravel, moist.										
	2	SS-1	4 5 5	14	33	4.5	-root fibers present in SS-1								18	CL (V)	
940.0	3																
	4	SS-2	3 5 6	16	94	4.25	Hard, brownish gray **LEAN CLAY WITH SAND**, and silt, trace fine gravel, moist.	2.7	21.7	37.0	38.6	35	17	18	17	CL	
	5																
937.5																	
	6						Very stiff to hard, dark brown **SANDY LEAN CLAY**, some silt, trace fine gravel, moist.										
	7	SS-3	3 5 5	14	94	4.5+		4.9	27.8	31.5	35.8	32	19	13	19	CL	
	8																
	9	SS-4	3 4 7	16	89	2.5	-rock fragments present in SS-4									CL (V)	
933.0	EOB 10																

NOTES: Groundwater not encountered during drilling

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Compacted with the auger 25 lbs bentonite chips and soil cuttings

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-14-127	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	NORTHING 223543.637	**EXPLORATION ID**	
NAME: Delaware Municipal Airport	SAMPLING FIRM / LOGGER: RII / K.R.	HAMMER: CME Automatic	EASTING: 1799862.531	**R-2**	
CLIENT: CHA Consulting, Inc.	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 944.0 ft. ±	PAGE	
START: 10-1-14 END: 10-1-14	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.8	COMPLETION DEPTH: 10.0 ft.	1 OF 1	

ELEV.	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GRADATION (%) GR	SA	SI	CL	ATTERBERG LL	PL	PI	WC	USCS CLASS	BACK FILL
944.0																	
943.7							4.0" - Topsoil										
	1						**FILL**: Medium dense, brown **SILTY SAND WITH GRAVEL**, trace clay, moist.										
	2	SS-1	5 7 5	17	33		-root fibers present in SS-1								11	SM (V)	
941.0	3						Stiff, mottled brown and gray **LEAN CLAY**, and silt, trace coarse to fine sand, very moist.										
	4	SS-2	2 4 6	14	83	2.0		0.0	5.7	41.0	53.3	46	19	27	23	CL	
	5																
	6																
	7	SS-3	2 4 4	12	94	1.75										CL (V)	
936.0	8						Hard, gray **SANDY LEAN CLAY**, some silt, trace fine gravel, moist.										
	9	SS-4	3 5 9	20	100	4.5+		4.2	32.7	33.9	29.2	29	18	11	16	CL	
934.0	EOB 10																

NOTES: Groundwater not encountered during drilling

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Compacted with the auger 25 lbs bentonite chips and soil cuttings

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-14-127	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	NORTHING 223507.373	EXPLORATION ID R-3
NAME: Delaware Municipal Airport	SAMPLING FIRM / LOGGER: RII / K.R.	HAMMER: CME Automatic	EASTING: 1799647.359	
CLIENT: CHA Consulting, Inc.	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 944.0 ft. ±	PAGE 1 OF 1
START: 10-1-14 END: 10-1-14	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.8	COMPLETION DEPTH: 10.0 ft.	

ELEV. 944.0	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GR	SA	SI	CL	LL	PL	PI	WC	USCS CLASS	BACK FILL
943.6							5.0" - Topsoil										
	1						**FILL**: Very stiff to hard, mottled brown and gray to brown **FAT CLAY WITH SAND**, some silt, trace fine gravel, moist.										
	2	SS-1	4 5 5	14	33	3.5		0.2	17.7	33.0	49.1	50	20	30	19	CH	
	3																
	4	SS-2	4 5 6	16	83	4.5+									14	CH (V)	
	5																
	6																
	7	SS-3	3 5 6	16	94	3.5										CH (V)	
936.0	8						**FILL**: Stiff, dark brown **SANDY LEAN CLAY**, some silt, trace fine gravel, damp.										
	9	SS-4	1 5 7	17	100	2.0	-root fibers and rock fragments present in SS-4	7.7	27.8	32.2	32.4	32	17	15	10	CL	
934.0	EOB 10																

NOTES: Groundwater not encountered during drilling

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Compacted with the auger 50 lbs bentonite chips and soil cuttings

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-14-127	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	NORTHING 223604.889	**EXPLORATION ID**	
NAME: Delaware Municipal Airport	SAMPLING FIRM / LOGGER: RII / K.R.	HAMMER: CME Automatic	EASTING: 1799514.840	**R-4**	
CLIENT: CHA Consulting, Inc.	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 944.0 ft.±	PAGE	
START: 9-30-14 END: 10-1-14	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.8	COMPLETION DEPTH: 10.0 ft.	1 OF 1	

ELEV. 944.0	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GRADATION (%) GR	SA	SI	CL	ATTERBERG LL	PL	PI	WC	USCS CLASS	BACK FILL
943.7							4.0" - Topsoil										
	1						**FILL**: Hard, brown **LEAN CLAY WITH SAND**, and silt, trace fine gravel, moist.										
	2	SS-1	6 5 6	16	61	4.5+	-root fibers present in SS-1	1.8	15.1	41.9	41.3	39	19	20	17	CL	
	3																
	4	SS-2	3 6 9	22	78	4.5+									17		
	5																
938.5							Very stiff, brownish gray to brown **SANDY LEAN CLAY**, and silt, trace fine gravel, moist.										
	6																
	7	SS-3	6 6 8	20	100	3.5		4.7	27.7	35.1	32.5	29	17	12	16	CL	
	8						-rock fragments present throughout										
	9	SS-4	4 8 8	23	100	4.0											
934.0	EOB 10																

NOTES: Groundwater not encountered during drilling

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Compacted with the auger 50 lbs bentonite chips and soil cuttings

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-14-127	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	NORTHING 223496.948	**EXPLORATION ID**	
NAME: Delaware Municipal Airport	SAMPLING FIRM / LOGGER: RII / K.R.	HAMMER: CME Automatic	EASTING: 1800223.133	**T-1**	
CLIENT: CHA Consulting, Inc.	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 943.0 ft. ±	PAGE	
START: 10-1-14 END: 10-1-14	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.8	COMPLETION DEPTH: 10.0 ft.	1 OF 1	

ELEV.	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GRADATION (%) GR	SA	SI	CL	ATTERBERG LL	PL	PI	WC	USCS CLASS	BACK FILL
943.0																	
942.7							4.0" - Topsoil										
	1						**FILL**: Very stiff, brown **GRAVELLY LEAN CLAY WITH SAND**, some silt, very moist.										
	2	SS-1	4 5 5	14	81	3.5	-root fibers present throughout	27.8	21.4	25.2	25.6	42	18	24	21	CL	
	3																
939.0	4	SS-2	2 2 3	7	72	2.5	Loose, brown **CLAYEY SAND WITH GRAVEL**, some silt, very moist.	28.7	33.5	21.0	16.9	32	17	15	27	CL (V) SC	
937.5	5																
	6						Very stiff to hard, brown **SANDY LEAN CLAY**, some silt, trace fine gravel, moist.										
	7	SS-3	2 3 5	12	100	3.5									18	CL (V)	
	8																
	9	SS-4	4 5 8	19	83	4.5+										CL (V)	
933.0	EOB 10																

NOTES: Groundwater not encountered during drilling

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Compacted with the auger 25 lb. bentonite chips and soil cuttings

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-14-127	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	NORTHING 223651.996	**EXPLORATION ID**	
NAME: Delaware Municipal Airport	SAMPLING FIRM / LOGGER: RII / K.R.	HAMMER: CME Automatic	EASTING: 1800224.689	**T-2**	
CLIENT: CHA Consulting, Inc.	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 940.0 ft.±	PAGE	
START: 10-1-14 END: 10-1-14	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.8	COMPLETION DEPTH: 10.0 ft.	1 OF 1	

ELEV.	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GRADATION (%) GR	SA	SI	CL	ATTERBERG LL	PL	PI	WC	USCS CLASS	BACK FILL
940.0																	
939.7							4.0" - Topsoil										
	1, 2	SS-1	7 9 7	23	78		**FILL**: Medium dense, brown **CLAYEY GRAVEL WITH SAND**, little silt, damp.	54.5	20.3	12.7	12.6	31	18	13	13	GC	
937.0	3																
	4, 5	SS-2	4 6 8	20	83	4.5+	Very stiff to hard, brown **SANDY LEAN CLAY WITH GRAVEL**, some silt, damp. -shale fragments present in SS-2	20.1	29.4	24.9	25.6	31	18	13	15	CL	
	6, 7	SS-3	3 3 4	10	83	3.25										CL (V)	
933.0						0.75	Medium stiff to stiff, brown **LEAN CLAY WITH SAND**, some silt, trace fine gravel, damp.								14	CL (V)	
	8																
	9	SS-4	2 3 6	13	89	2.0										CL (V)	
930.0	EOB 10																

NOTES: Groundwater not encountered during drilling

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Compacted with the auger 25 lbs bentonite chips and soil cuttings

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-14-127	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	NORTHING 223870.799	**EXPLORATION ID**	
NAME: Delaware Municipal Airport	SAMPLING FIRM / LOGGER: RII / K.R.	HAMMER: CME Automatic	EASTING: 1800182.396	**T-3**	
CLIENT: CHA Consulting, Inc.	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 942.0 ft. ±	PAGE	
START: 10-1-14 END: 10-1-14	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.8	COMPLETION DEPTH: 10.0 ft.	1 OF 1	

ELEV.	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GRADATION (%) GR	SA	SI	CL	ATTERBERG LL	PL	PI	WC	USCS CLASS	BACK FILL
942.0																	
941.7							4.0" - Topsoil										
	1						**FILL**: Medium dense, dark brown **CLAYEY GRAVEL WITH SAND**, little silt, very moist.										
	2	SS-1	4 5 4	13	44		-root fibers present in SS-1	39.7	18.4	19.5	22.4	60	17	43	20	GC	
939.0	3						Stiff to very stiff, brown to dark gray **SANDY LEAN CLAY WITH GRAVEL**, some silt, damp to moist.										
	4	SS-2	3 3 6	13	78	2.25		16.3	18.7	26.5	38.4	44	21	23	23	CL	
	5																
	6																
	7	SS-3	2 2 3	7	67	1.75										CL (V)	
	8						-shale fragments present in SS-4										
	9	SS-4	2 3 4	10	75	2.25									16	CL (V)	
932.0	EOB 10																

NOTES: Groundwater not encountered during drilling

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Compacted with the auger 50 lbs bentonite chips and soil cuttings

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-14-127	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	NORTHING 223883.039	**EXPLORATION ID**	
NAME: Delaware Municipal Airport	SAMPLING FIRM / LOGGER: RII / K.R.	HAMMER: CME Automatic	EASTING: 1799971.632	**T-4**	
CLIENT: CHA Consulting, Inc.	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 942.0 ft. ±	PAGE	
START: 10-1-14 END: 10-1-14	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.8	COMPLETION DEPTH: 10.0 ft.	1 OF 1	

ELEV.	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GRADATION (%) GR	SA	SI	CL	ATTERBERG LL	PL	PI	WC	USCS CLASS	BACK FILL
942.0																	
941.7							4.0" - Topsoil										
	1, 2	SS-1	4 5 5	14	72	3.0	**FILL**: Hard, brown **LEAN CLAY WITH SAND**, and silt, trace fine gravel, moist. -root fibers present in SS-1	1.5	22.9	38.7	36.9	35	20	15	22	CL	
939.0	3						Very stiff, brown **LEAN CLAY WITH SAND**, and silt, trace fine gravel, damp.										
	4, 5	SS-2	2 3 6	13	78	4.0									19	CL (V)	
936.5																	
	6, 7	SS-3	3 5 6	16	89	4.5	Very stiff to hard, dark brown **SANDY LEAN CLAY**, some silt, trace fine gravel, moist.	7.7	28.6	32.4	31.2	28	17	11	16	CL	
	8																
	9	SS-4	2 2 6	12	100	2.25										CL (V)	
932.0	EOB 10																

NOTES: Groundwater not encountered during drilling

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Compacted with the auger 25 lbs bentonite chips and soil cuttings

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-14-127	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	NORTHING 223935.376	**EXPLORATION ID**	
NAME: Delaware Municipal Airport	SAMPLING FIRM / LOGGER: RII / K.R.	HAMMER: CME Automatic	EASTING: 1799786.076	**T-5**	
CLIENT: CHA Consulting, Inc.	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 944.0 ft.±	PAGE	
START: 10-1-14 END: 10-1-14	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.8	COMPLETION DEPTH: 10.0 ft.	1 OF 1	

ELEV. 944.0	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GRADATION (%) GR	SA	SI	CL	ATTERBERG LL	PL	PI	WC	USCS CLASS	BACK FILL
943.6							5.0" - Topsoil										
	1						**FILL**: Very stiff, brown **SILT WITH SAND**, and clay, trace fine gravel, damp.										
	2	SS-1	3 4 6	14	56	4.0	-root fibers and rock fragments present in SS-1	4.3	19.1	36.9	39.8	44	31	13	20	ML	
941.0	3						Very stiff to hard, brown to dark brown **SANDY LEAN CLAY**, some silt, trace fine gravel, moist.										
	4	SS-2	2 3 4	10	67	2.25									17	CL (V)	
	5																
	6																
	7	SS-3	4 6 9	22	100	2.75		3.3	28.1	33.8	34.8	28	17	11	16	CL	
	8																
	9	SS-4	3 5 8	19	100	4.5										CL (V)	
934.0	EOB 10																

NOTES: Groundwater not encountered during drilling

ABANDONMENT METHODS, MATERIALS, QUANTITIES: Compacted with the auger 25 lbs bentonite chips and soil cuttings

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RESOURCE INTERNATIONAL, INC.

PROJECT: W-14-127	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	NORTHING 223965.831	EXPLORATION ID T-6
NAME: Delaware Municipal Airport	SAMPLING FIRM / LOGGER: RII / K.R.	HAMMER: CME Automatic	EASTING: 1799577.127	
CLIENT: CHA Consulting, Inc.	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 944.0 ft.±	PAGE 1 OF 1
START: 10-1-14 END: 10-1-14	SAMPLING METHOD: SPT	ENERGY RATIO (%): 86.8	COMPLETION DEPTH: 15.0 ft.	

ELEV. 944.0	DEPTHS	SAMPLE ID	SPT/ RQD	N_{60}	REC (%)	HP (tsf)	MATERIAL DESCRIPTION AND NOTES	GR	SA	SI	CL	LL	PL	PI	WC	USCS CLASS	BACK FILL
943.7							4.0" - Topsoil										
	1, 2	SS-1	6 6 8	20	83	4.5+	**FILL**: Hard, brown **LEAN CLAY WITH SAND**, and silt, trace fine gravel, moist. -root fibers present in SS-1	0.5	18.6	37.3	43.7	37	19	18	17	CL	
941.0	3						**FILL**: Soft to medium stiff, dark brown to dark gray **LEAN CLAY WITH SAND**, and silt, trace fine gravel, very moist.										
	4, 5	SS-2	1 2 2	6	58	0.75									25	CL (V)	
	6, 7	SS-3	1 1 2	4	72	0.25	-root fibers and wood fragments present throughout	4.2	16.4	39.6	39.8	41	21	20	33	CL	
	9, 10	SS-4	2 1 1	3	50	0.25	-rock fragments present in SS-4									CL (V)	
931.0	13						Dense, gray **SILTY GRAVEL WITH SAND**, trace clay, very moist.										
	14	SS-5	21 19 10	42	50											GM (V)	
929.0	EOB 15																

NOTES: groundwater encountered initially @ 8.5' and at completion @ 8.1'; Cave-in depth @ 12.5'

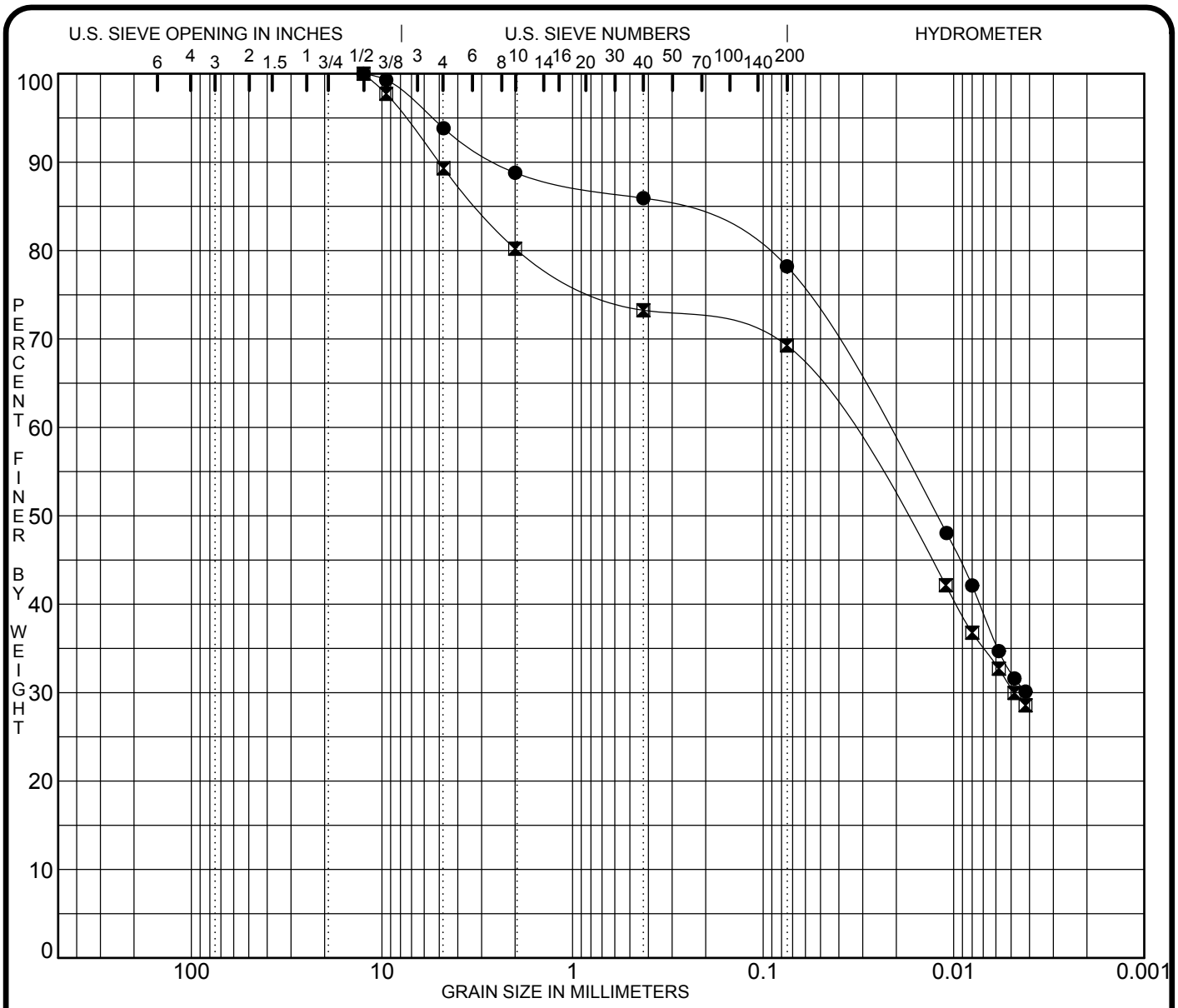
ABANDONMENT METHODS, MATERIALS, QUANTITIES: Compacted with the auger 50 lb. bentonite chips and soil cuttings

2013 STANDARD USCS BORING LOG - RII - OH DOT.GDT - 10/22/14 09:10 - U:\GI8\PROJECTS\2014\W-14-127.GPJ

APPENDIX V

LABORATORY TEST RESULTS

Gradation Curves



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

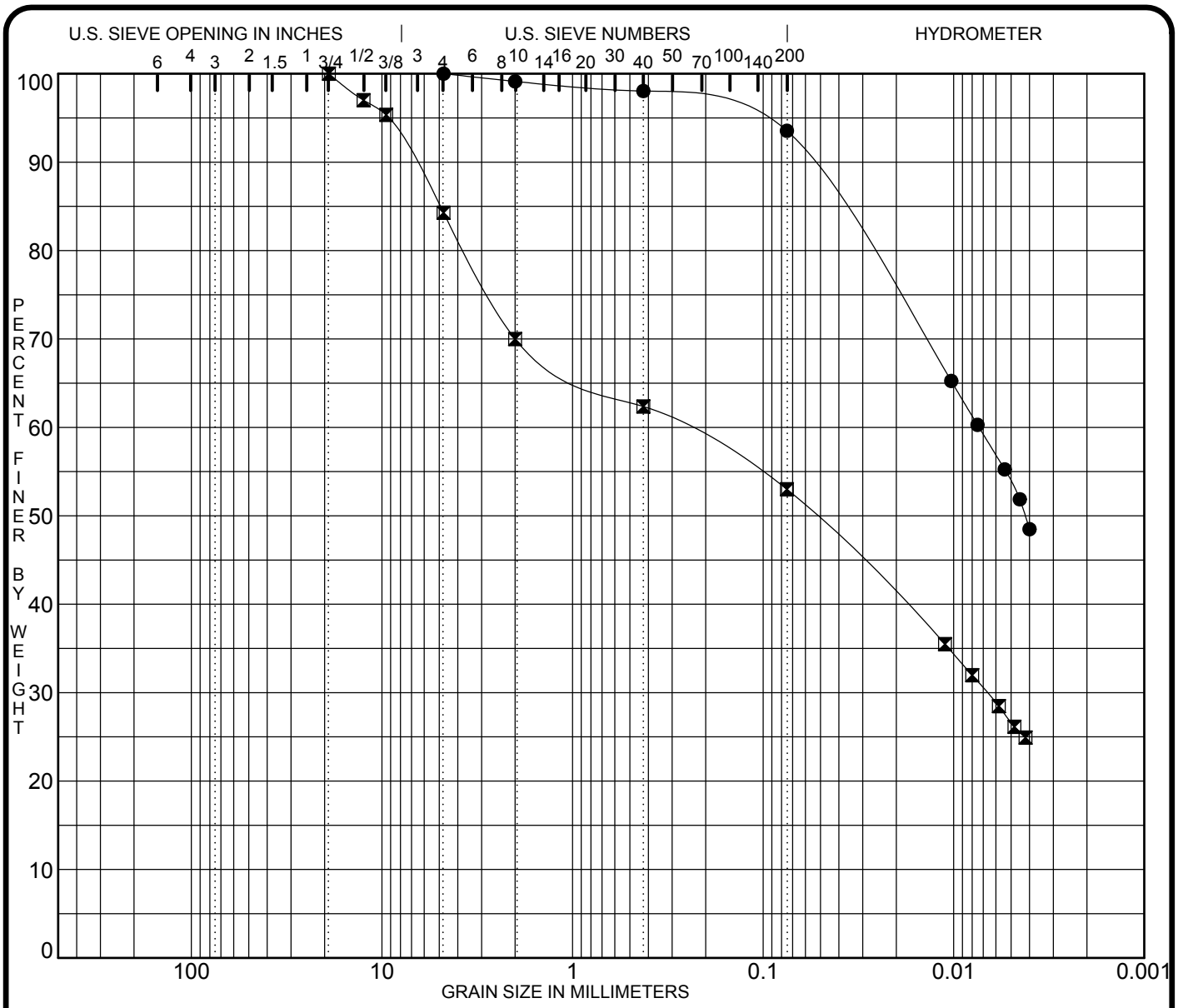
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	B-1	1.0	LEAN CLAY with SAND CL	13	36	22	14		
⊠	B-1	6.0	SANDY LEAN CLAY CL	17	33	18	15		

	Specimen ID	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	B-1	12.50	0.02			0.0	6.2	5.0	2.9	7.7	45.9	32.3
⊠	B-1	12.50	0.04	0.005		0.0	10.7	9.1	7.0	4.0	38.7	30.6

PROJECT **Delaware Municipal Airport** PROJECT NO. **W-14-127**

GRADATION CURVES

Resource International Inc.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

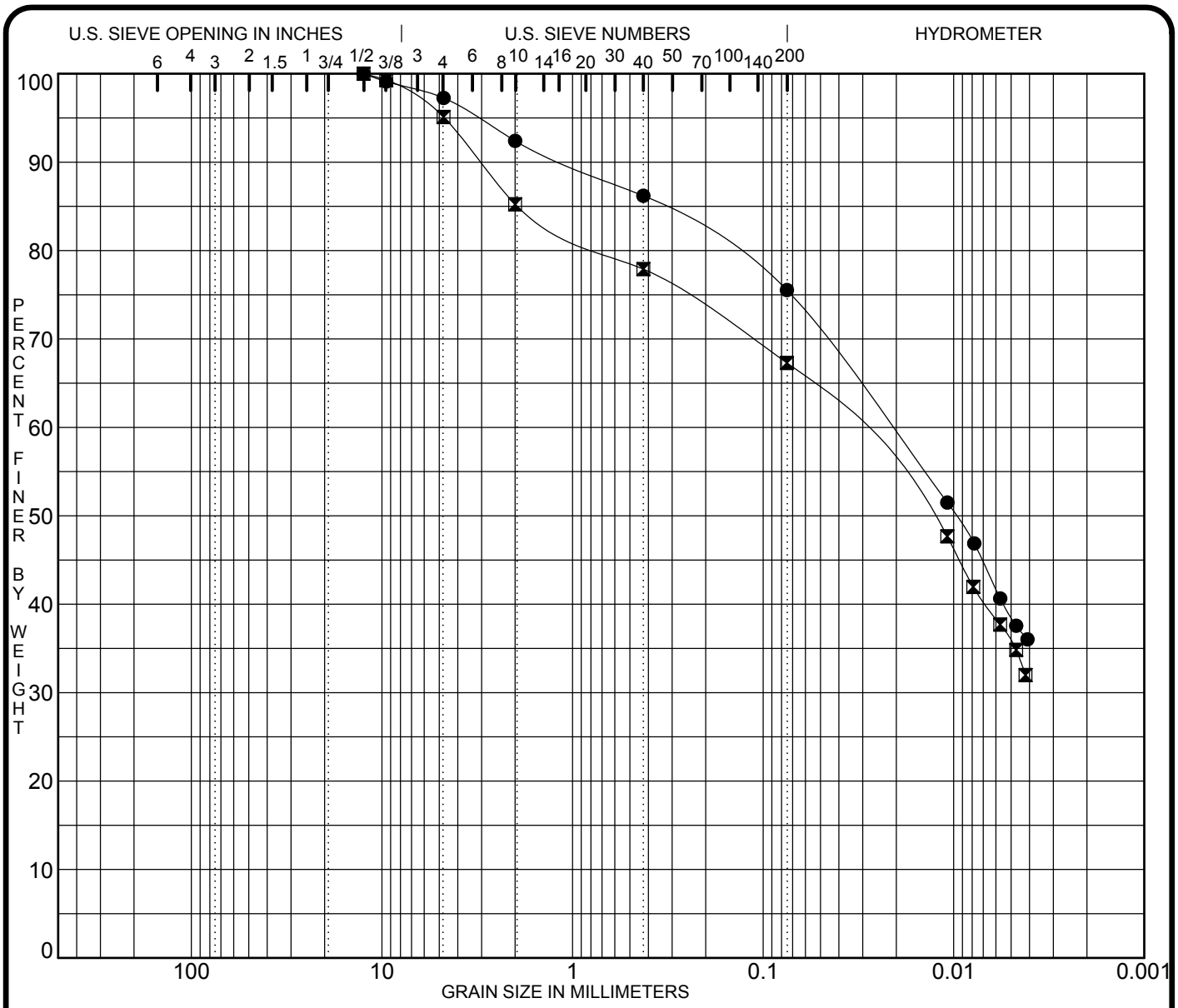
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**B-2**	**1.0**	**FAT CLAY CH**	**21**	**51**	**21**	**30**		
⊠	**B-2**	**6.0**	**SANDY LEAN CLAY with GRAVEL CL**	**17**	**32**	**18**	**14**		

	Specimen ID	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	**B-2**	**4.75**	**0.01**			**0.0**	**0.0**	**0.9**	**1.1**	**4.5**	**39.7**	**53.8**
⊠	**B-2**	**19.00**	**0.27**	**0.007**		**0.0**	**15.7**	**14.3**	**7.6**	**9.4**	**26.4**	**26.6**

PROJECT **Delaware Municipal Airport** PROJECT NO. **W-14-127**

GRADATION CURVES

Resource International Inc.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

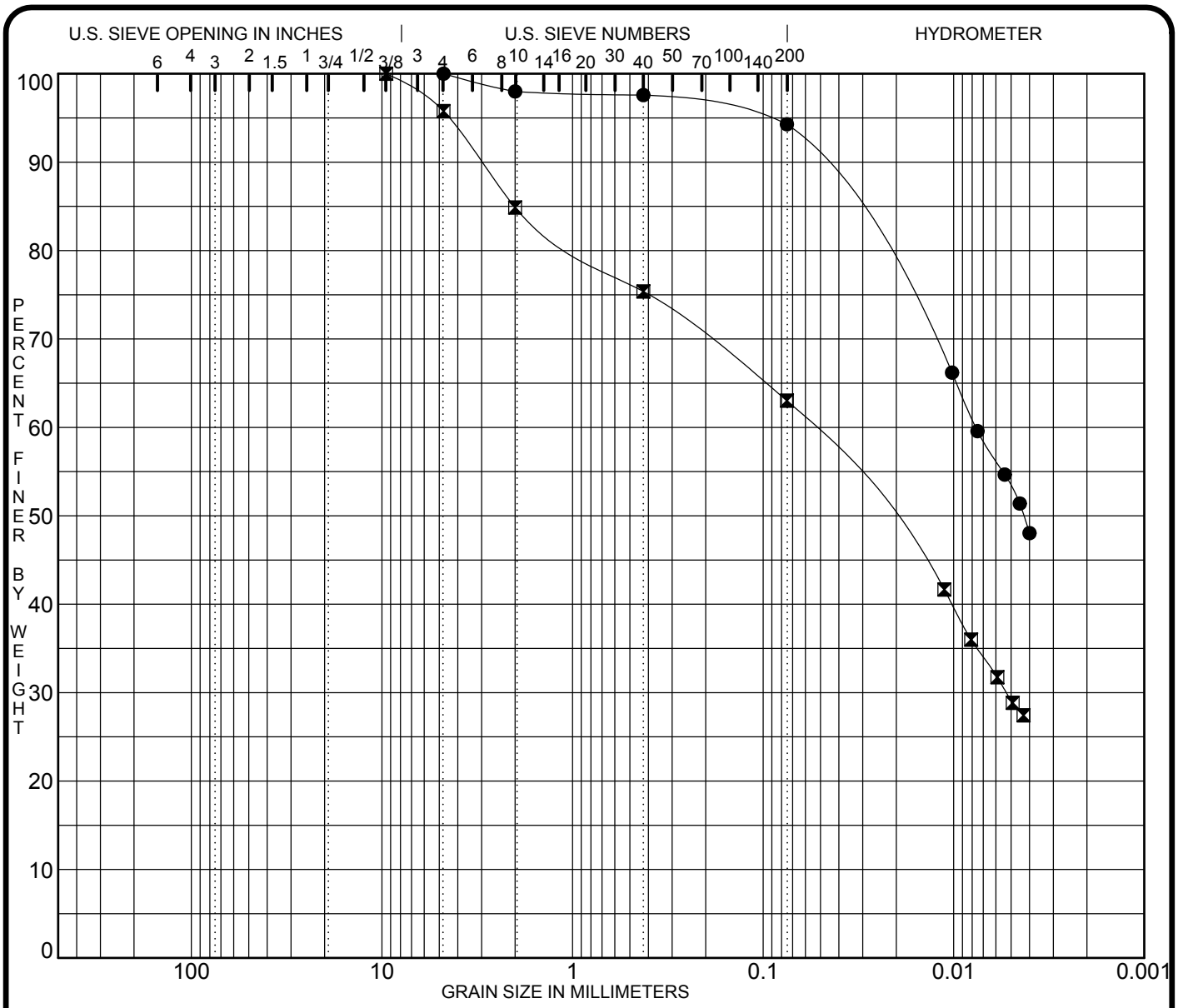
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**R-1**	**3.5**	**LEAN CLAY with SAND CL**	**17**	**35**	**17**	**18**		
⊠	**R-1**	**6.0**	**SANDY LEAN CLAY CL**	**19**	**32**	**19**	**13**		

	Specimen ID	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	**R-1**	**12.50**	**0.02**			**0.0**	**2.7**	**4.9**	**6.2**	**10.7**	**37.0**	**38.6**
⊠	**R-1**	**12.50**	**0.04**			**0.0**	**4.9**	**9.9**	**7.3**	**10.6**	**31.5**	**35.8**

PROJECT **Delaware Municipal Airport** PROJECT NO. **W-14-127**

GRADATION CURVES

Resource International Inc.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

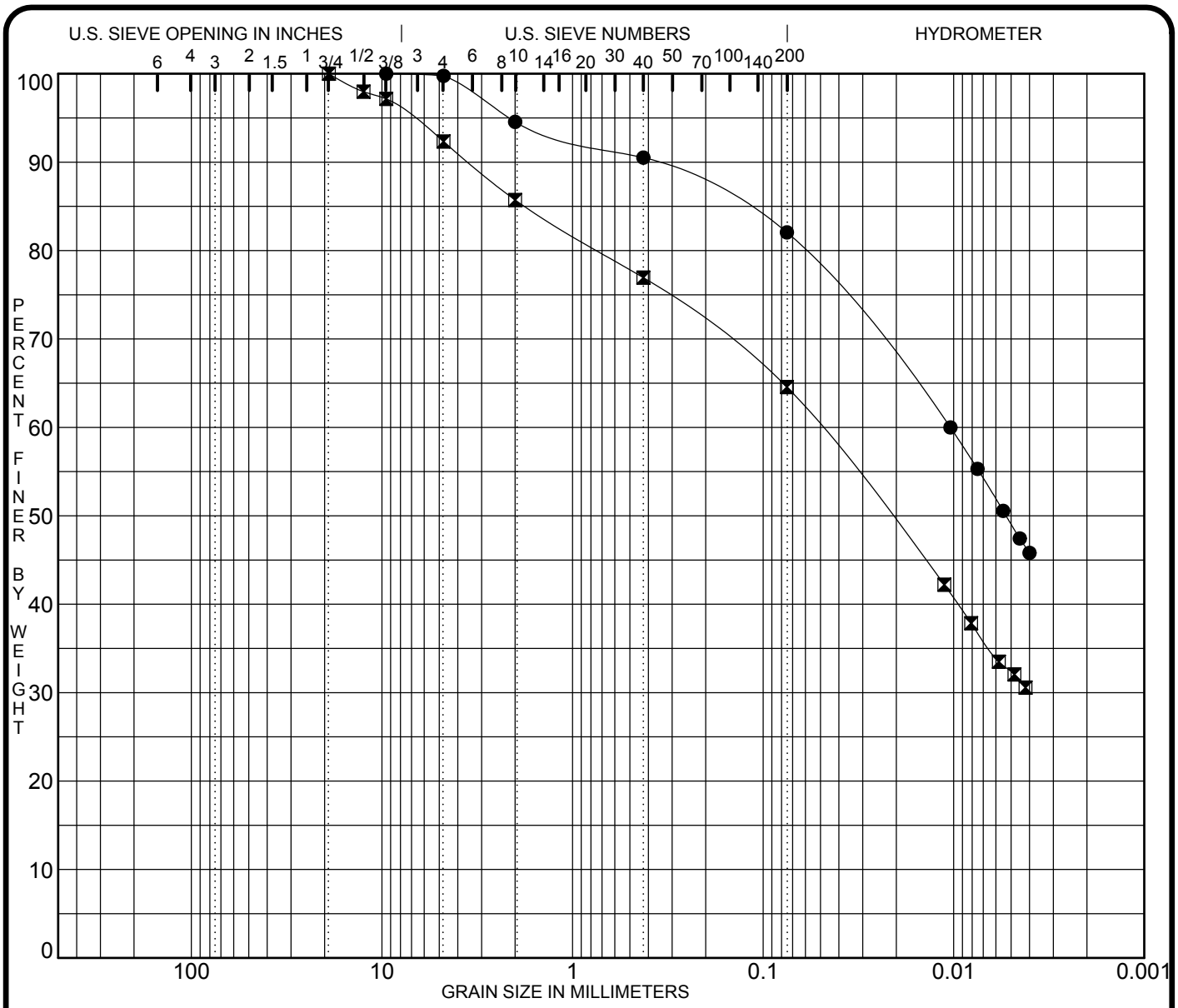
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**R-2**	**3.5**	**LEAN CLAY CL**	**23**	**46**	**19**	**27**		
⊠	**R-2**	**8.5**	**SANDY LEAN CLAY CL**	**16**	**29**	**18**	**11**		

	Specimen ID	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	**R-2**	**4.75**	**0.01**			**0.0**	**0.0**	**2.0**	**0.4**	**3.3**	**41.0**	**53.3**
⊠	**R-2**	**9.50**	**0.06**	**0.005**		**0.0**	**4.2**	**10.9**	**9.5**	**12.4**	**33.9**	**29.2**

PROJECT **Delaware Municipal Airport** PROJECT NO. **W-14-127**

GRADATION CURVES

Resource International Inc.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

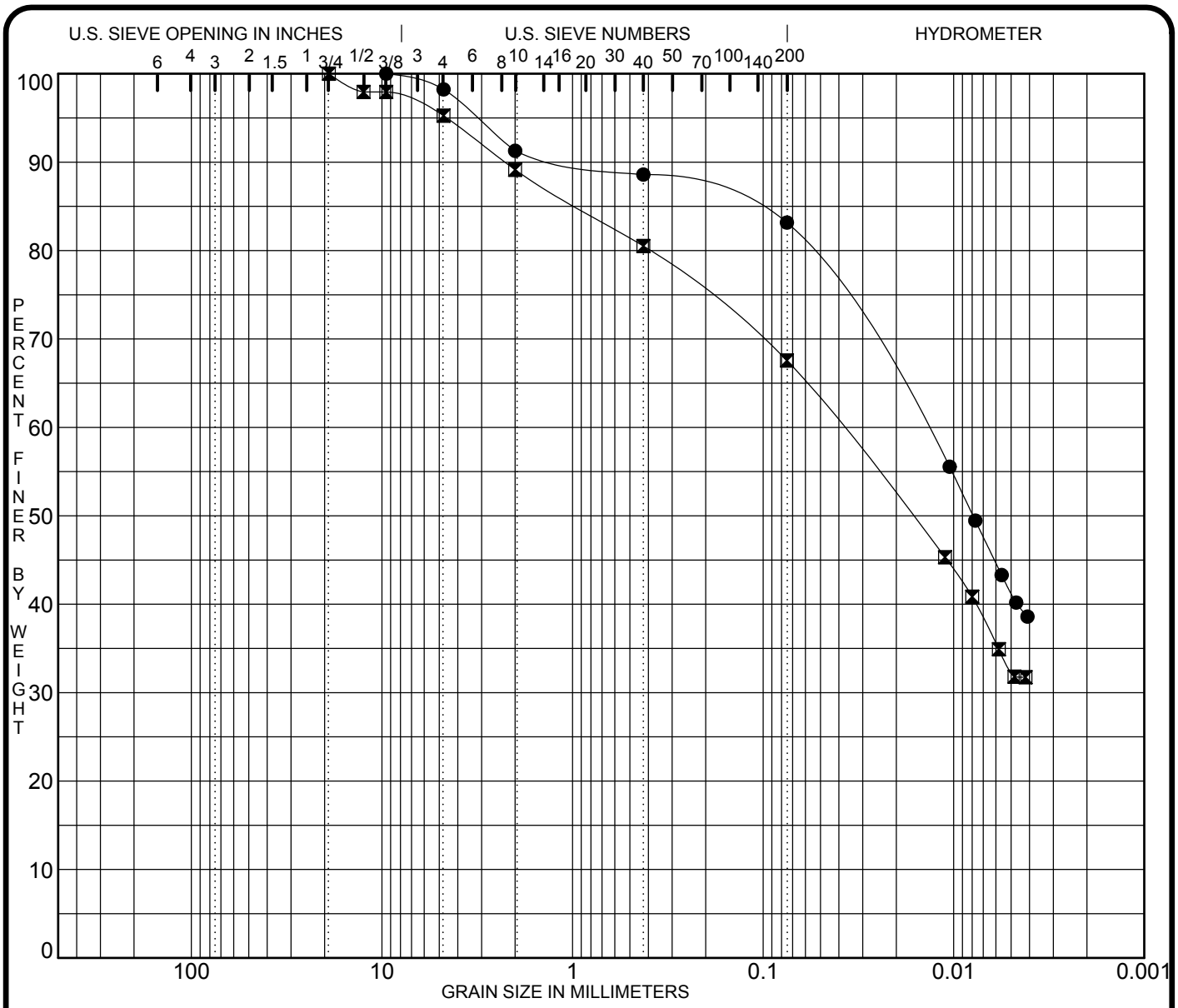
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	R-3	1.0	FAT CLAY with SAND CH	19	50	20	30		
⊠	R-3	8.5	SANDY LEAN CLAY CL	10	32	17	15		

	Specimen ID	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	R-3	9.50	0.01			0.0	0.2	5.2	4.0	8.5	33.0	49.1
⊠	R-3	19.00	0.05			0.0	7.7	6.6	8.8	12.4	32.2	32.4

PROJECT **Delaware Municipal Airport** PROJECT NO. **W-14-127**

GRADATION CURVES

Resource International Inc.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

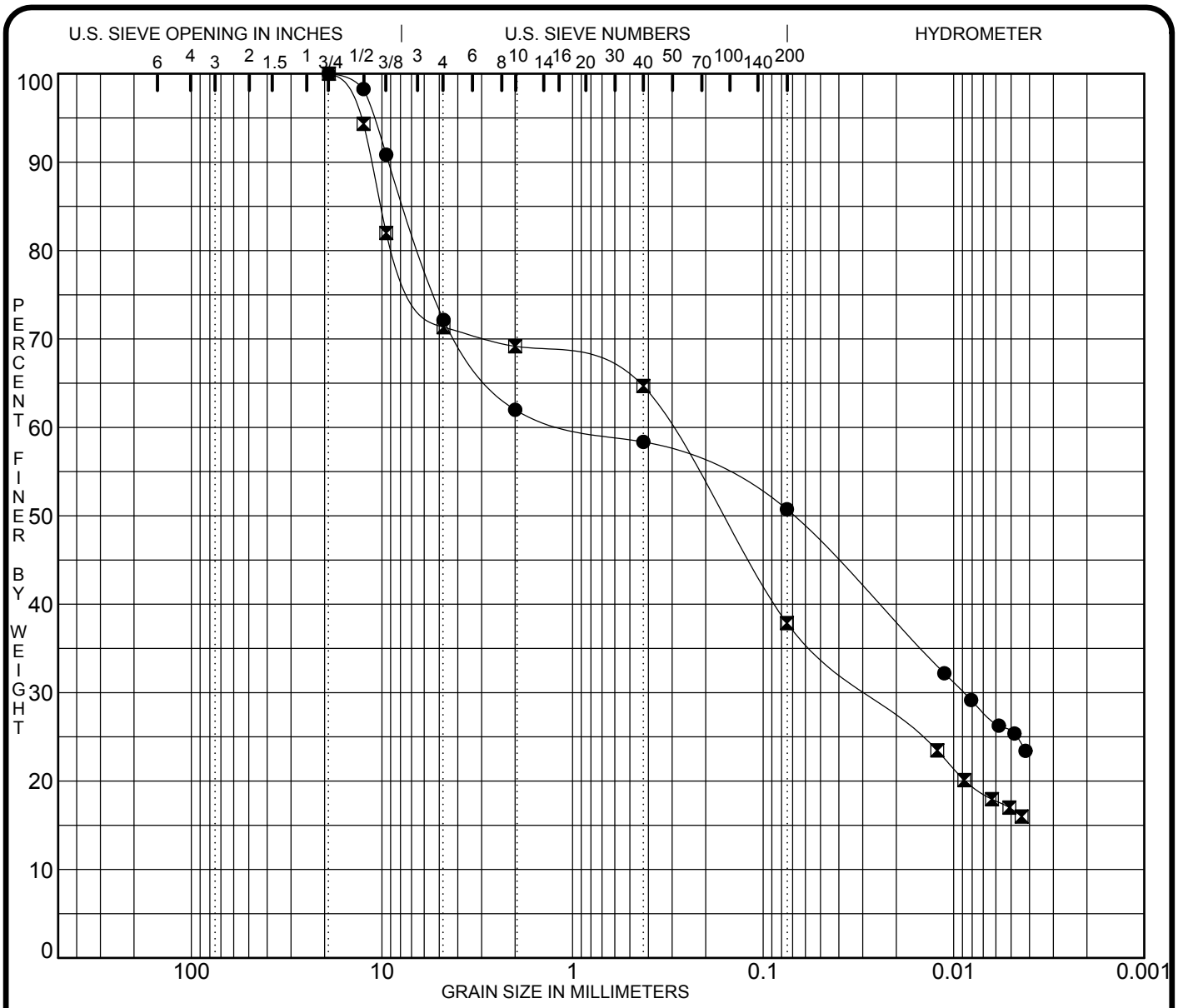
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	R-4	1.0	LEAN CLAY with SAND CL	17	39	19	20		
⊠	R-4	6.0	SANDY LEAN CLAY CL	16	29	17	12		

	Specimen ID	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	R-4	9.50	0.01			0.0	1.8	6.9	2.7	5.4	41.9	41.3
⊠	R-4	19.00	0.04			0.0	4.7	6.1	8.6	13.0	35.1	32.5

PROJECT **Delaware Municipal Airport** PROJECT NO. **W-14-127**

GRADATION CURVES

Resource International Inc.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

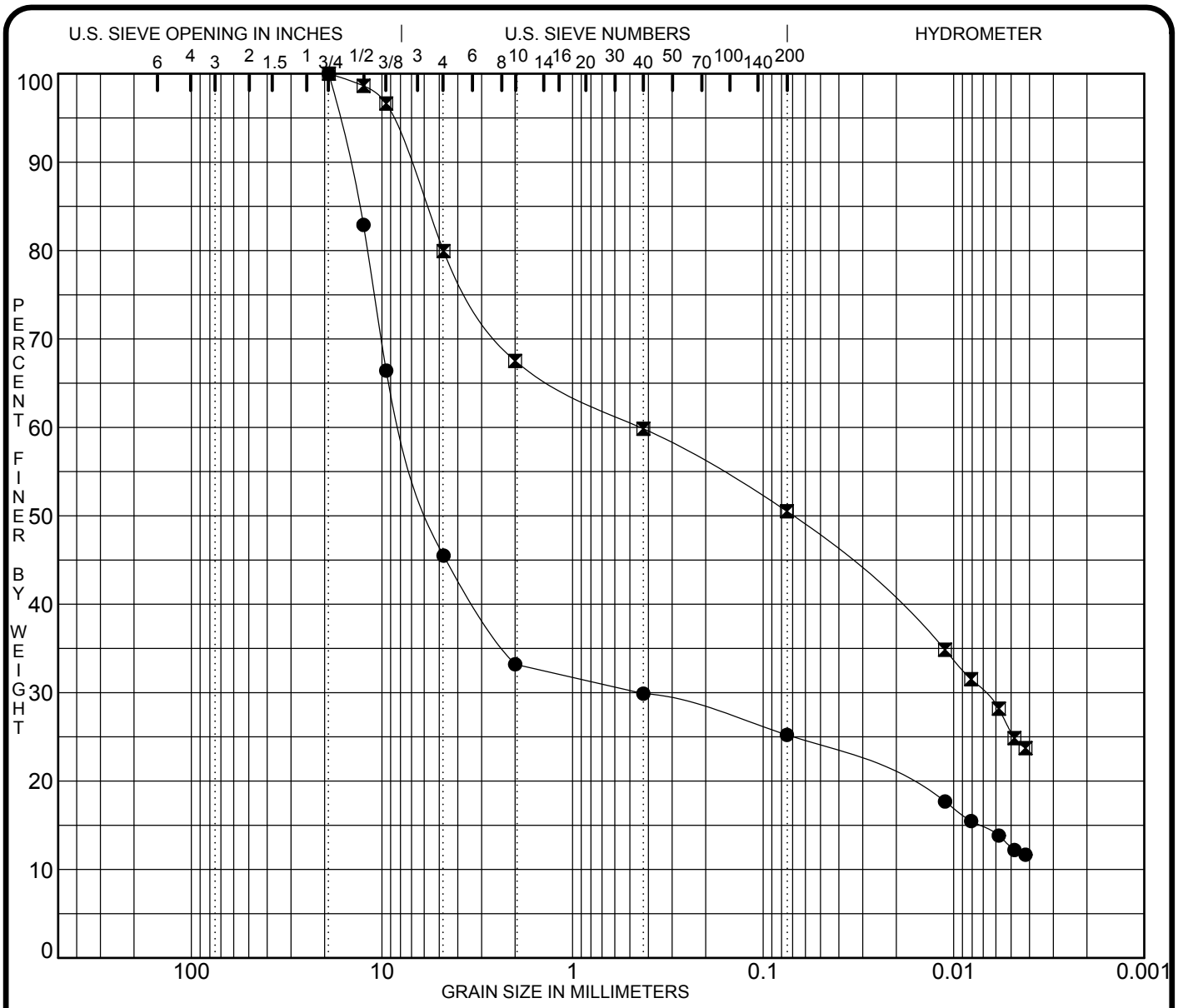
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**T-1**	**1.0**	**GRAVELLY LEAN CLAY with SAND CL**	**21**	**42**	**18**	**24**		
⊠	**T-1**	**4.0**	**CLAYEY SAND with GRAVEL SC**	**27**	**32**	**17**	**15**		

	Specimen ID	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	**T-1**	**19.00**	**0.86**	**0.009**		**0.0**	**27.8**	**10.2**	**3.6**	**7.6**	**25.2**	**25.6**
⊠	**T-1**	**19.00**	**0.31**	**0.028**		**0.0**	**28.7**	**2.2**	**4.5**	**26.8**	**21.0**	**16.9**

PROJECT **Delaware Municipal Airport** PROJECT NO. **W-14-127**

GRADATION CURVES

Resource International Inc.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

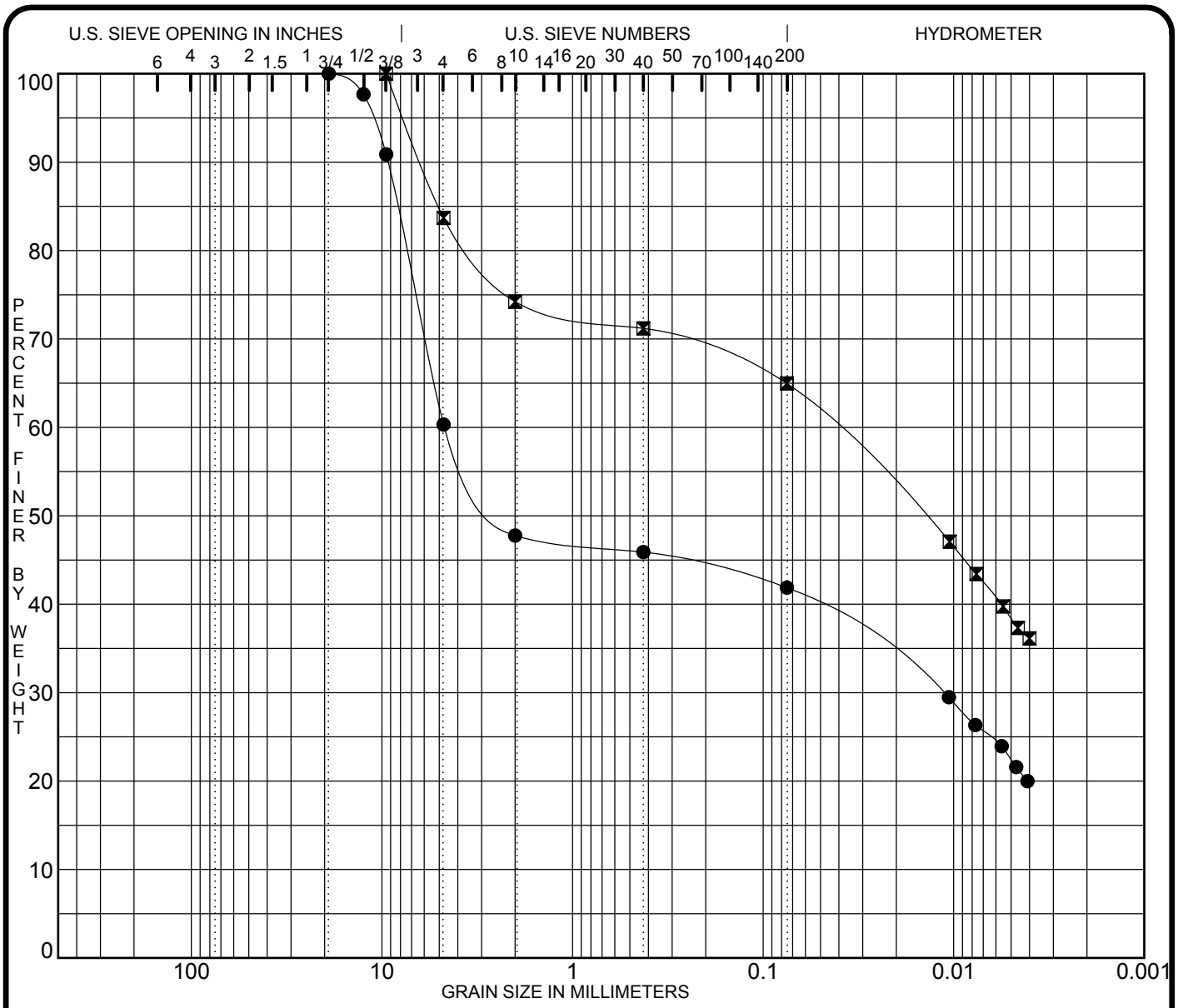
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**T-2**	**1.0**	**CLAYEY GRAVEL with SAND GC**	**13**	**31**	**18**	**13**		
⊠	**T-2**	**3.5**	**SANDY LEAN CLAY with GRAVEL CL**	**15**	**31**	**18**	**13**		

	Specimen ID	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	**T-2**	**19.00**	**7.68**	**0.448**		**0.0**	**54.5**	**12.3**	**3.3**	**4.7**	**12.7**	**12.6**
⊠	**T-2**	**19.00**	**0.44**	**0.007**		**0.0**	**20.1**	**12.4**	**7.7**	**9.3**	**24.9**	**25.6**

PROJECT **Delaware Municipal Airport** PROJECT NO. **W-14-127**

GRADATION CURVES

Resource International Inc.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

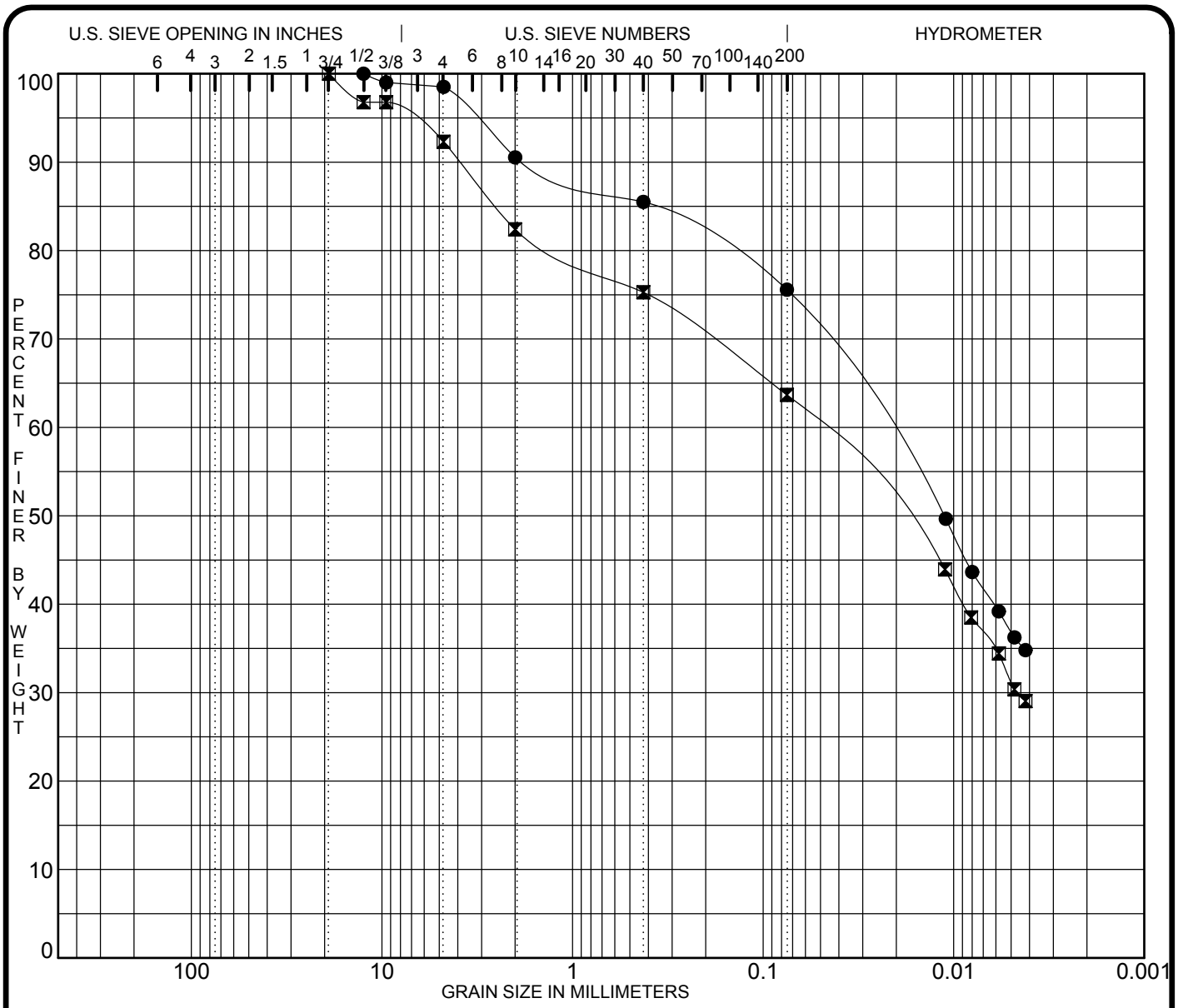
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**T-3**	**1.0**	**CLAYEY GRAVEL with SAND GC**	**20**	**60**	**17**	**43**		
⊠	**T-3**	**3.5**	**SANDY LEAN CLAY with GRAVEL CL**	**23**	**44**	**21**	**23**		

	Specimen ID	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	**T-3**	**19.00**	**4.65**	**0.011**		**0.0**	**39.7**	**12.6**	**1.9**	**4.0**	**19.5**	**22.4**
⊠	**T-3**	**9.50**	**0.04**			**0.0**	**16.3**	**9.5**	**3.0**	**6.2**	**26.5**	**38.4**

PROJECT **Delaware Municipal Airport** PROJECT NO. **W-14-127**

GRADATION CURVES

Resource International Inc.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

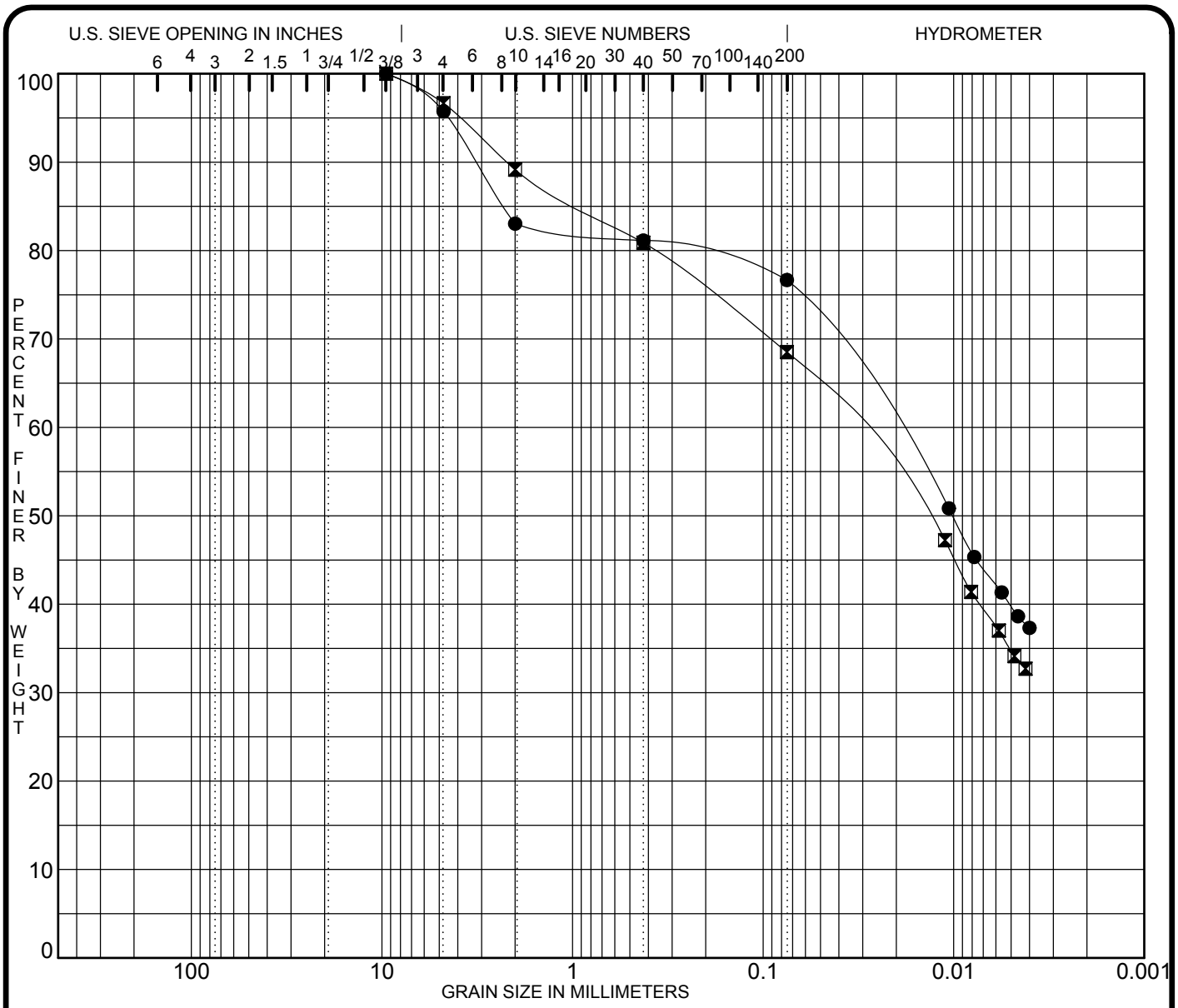
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**T-4**	**1.0**	**LEAN CLAY with SAND CL**	**22**	**35**	**20**	**15**		
⊠	**T-4**	**6.0**	**SANDY LEAN CLAY CL**	**16**	**28**	**17**	**11**		

	Specimen ID	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	**T-4**	**12.50**	**0.02**			**0.0**	**1.5**	**8.0**	**5.0**	**9.9**	**38.7**	**36.9**
⊠	**T-4**	**19.00**	**0.05**	**0.005**		**0.0**	**7.7**	**9.9**	**7.1**	**11.6**	**32.4**	**31.2**

PROJECT **Delaware Municipal Airport** PROJECT NO. **W-14-127**

GRADATION CURVES

Resource International Inc.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

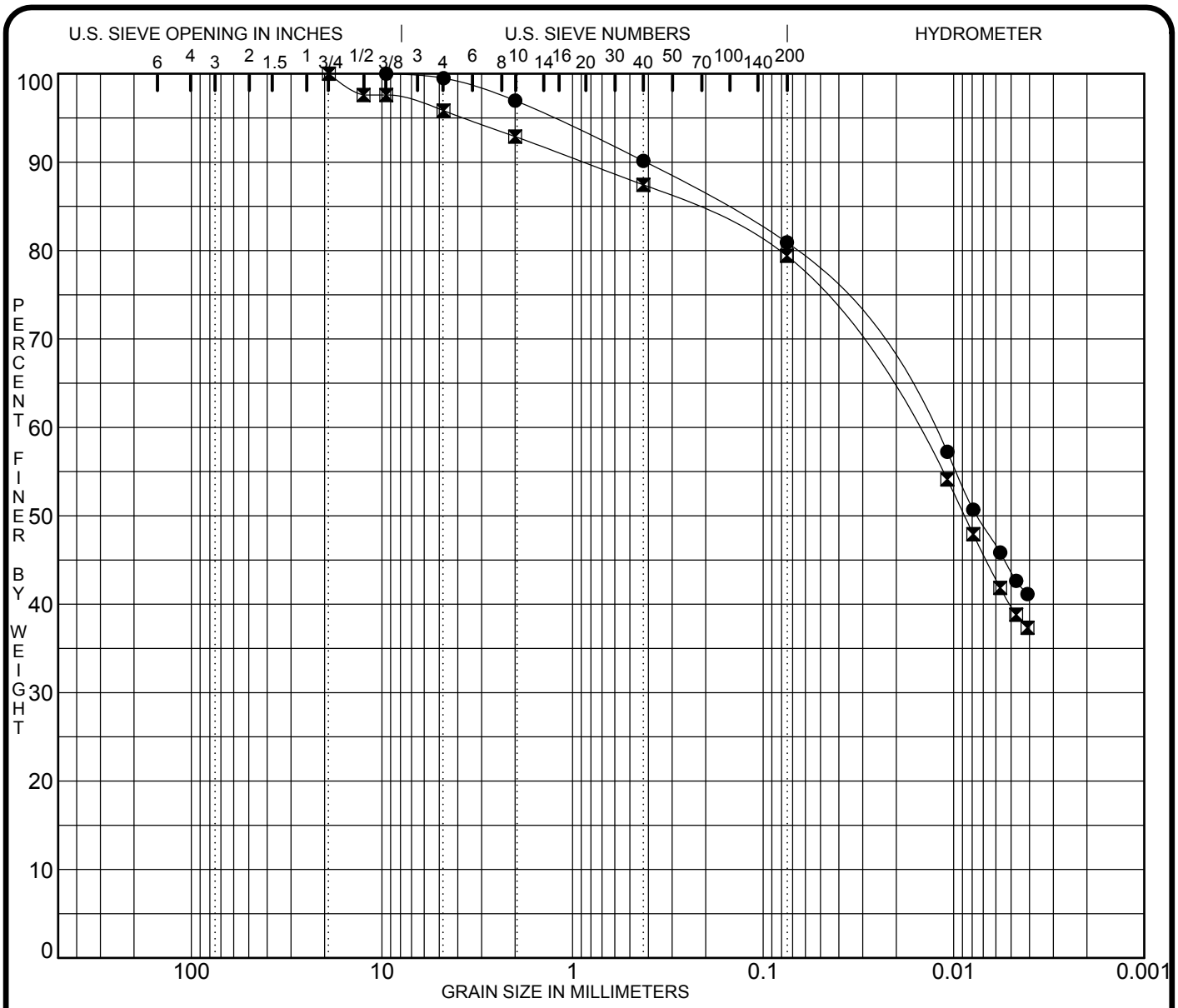
	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**T-5**	**1.0**	**SILT with SAND ML**	**20**	**44**	**31**	**13**		
⊠	**T-5**	**6.0**	**SANDY LEAN CLAY CL**	**16**	**28**	**17**	**11**		

	Specimen ID	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	**T-5**	**9.50**	**0.02**			**0.0**	**4.3**	**12.7**	**1.9**	**4.5**	**36.9**	**39.8**
⊠	**T-5**	**9.50**	**0.03**			**0.0**	**3.3**	**7.5**	**8.3**	**12.4**	**33.8**	**34.8**

PROJECT **Delaware Municipal Airport** PROJECT NO. **W-14-127**

GRADATION CURVES

Resource International Inc.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen ID	Depth	Classification	MC%	LL	PL	PI	Cc	Cu
●	**T-6**	**1.0**	**LEAN CLAY with SAND CL**	**17**	**37**	**19**	**18**		
⊠	**T-6**	**6.0**	**LEAN CLAY with SAND CL**	**33**	**41**	**21**	**20**		

	Specimen ID	D100	D60	D30	D10	%Gravel coarse	%Gravel fine	%Sand coarse	%Sand medium	%Sand fine	%Silt	%Clay
●	**T-6**	**9.50**	**0.01**			**0.0**	**0.5**	**2.5**	**6.8**	**9.2**	**37.3**	**43.7**
⊠	**T-6**	**19.00**	**0.02**			**0.0**	**4.2**	**2.9**	**5.5**	**8.0**	**39.6**	**39.8**

PROJECT **Delaware Municipal Airport** PROJECT NO. **W-14-127**

GRADATION CURVES

Resource International Inc.

APPENDIX VI

PHOTOGRAPHS OF PAVEMENT CORES

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

Pavement Core Data Summary

PROJECT	Delaware Municipal Airport
LOCATION	Delaware, Ohio
JOB No.	W-14-127
BORING/CORE No.	RP-1
DATE CORE OBTAINED	9/30/2014

Core Composition

Core Number	Lift Thickness (in.)	Asphalt: P401 Surface Mix	Asphalt: P401 Intermediate Mix	Asphalt: P401 Base Mix	P501 Concrete	Aggregate/Granular Base	Other			
RP-1	1.25	✓								
	2.75		✓							
	18.00					✓				

Comments/Remarks

- A few air voids evident at the bottom of the P-401 surface lift
- Some cracking of aggregate evident in the Intermediate lift.

Total Pavement Thickness =	4.00 in.	Total Asphalt Thickness =	4.00 in.	Total Concrete Thickness =	0.00 in.	Total Base Thickness =	18.00 in.

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

Pavement Core Data Summary

PROJECT	Delaware Municipal Airport
LOCATION	Delaware, Ohio
JOB No.	W-14-127
BORING/CORE No.	RP-2
DATE CORE OBTAINED	9/30/2014

Core Composition

Core Number	Lift Thickness (in.)	Asphalt: P401 Surface Mix	Asphalt: P401 Intermediate Mix	Asphalt: P401 Base Mix	P501 Concrete	Aggregate/Granular Base	Other			
RP-2	1.75	✓								
	2.75		✓							
	18.00					✓				

Comments/Remarks

- Some air voids evident at the bottom of the P-401 surface lift as well as throughout the remainder of the lift.
- Some minor aggregate cracking in the intermediate lift

Total Pavement Thickness =	4.50 in.	Total Asphalt Thickness =	4.50 in.	Total Concrete Thickness =	0.00 in.	Total Base Thickness =	18.00 in.

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

Pavement Core Data Summary

PROJECT	Delaware Municipal Airport
LOCATION	Delaware, Ohio
JOB No.	W-14-127
BORING/CORE No.	RP-3
DATE CORE OBTAINED	9/30/2014

Core Composition

Core Number	Lift Thickness (in.)	Asphalt: P401 Surface Mix	Asphalt: P401 Intermediate Mix	Asphalt: P401 Base Mix	P501 Concrete	Aggregate/Granular Base	Other			
RP-3	1.50	✓								
	2.50		✓							
	17.00					✓				

Comments/Remarks

- A few minor air voids evident throughout the core, otherwise core is in good shape.

Total Pavement Thickness =	4.00 in.	Total Asphalt Thickness =	4.00 in.	Total Concrete Thickness =	0.00 in.	Total Base Thickness =	17.00 in.

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

Pavement Core Data Summary

PROJECT	Delaware Municipal Airport
LOCATION	Delaware, Ohio
JOB No.	W-14-127
BORING/CORE No.	RP-4
DATE CORE OBTAINED	9/30/2014

Core Composition

Core Number	Lift Thickness (in.)	Asphalt: P401 Surface Mix	Asphalt: P401 Intermediate Mix	Asphalt: P401 Base Mix	P501 Concrete	Aggregate/Granular Base	Other			
RP-4	1.50	✓								
	2.50		✓							
	19.00					✓				

Comments/Remarks

- Some air voids evident at the bottom of the P-401 surface lift as well as some throughout the remainder of the core.

Total Pavement Thickness =	4.00 in.	Total Asphalt Thickness =	4.00 in.	Total Concrete Thickness =	0.00 in.	Total Base Thickness =	19.00 in.

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

Pavement Core Data Summary

PROJECT	Delaware Municipal Airport
LOCATION	Delaware, Ohio
JOB No.	W-14-127
BORING/CORE No.	TP-1
DATE CORE OBTAINED	9/30/2014

Core Composition

Core Number	Lift Thickness (in.)	Asphalt: P401 Surface Mix	Asphalt: P401 Intermediate Mix	Asphalt: P401 Base Mix	P501 Concrete	Aggregate/Granular Base	Other			
TP-1	2.00	✓								
	2.00		✓							
	14.00					✓				

Comments/Remarks

- Numerous air voids evident in both lifts of the P-401 asphalt.

Total Pavement Thickness =	4.00	in.	Total Asphalt Thickness =	4.00	in.	Total Concrete Thickness =	0.00	in.	Total Base Thickness =	14.00	in.

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

Pavement Core Data Summary

PROJECT	Delaware Municipal Airport
LOCATION	Delaware, Ohio
JOB No.	W-14-127
BORING/CORE No.	TP-2
DATE CORE OBTAINED	9/30/2014

Core Composition

Core Number	Lift Thickness (in.)	Asphalt: P401 Surface Mix	Asphalt: P401 Intermediate Mix	Asphalt: P401 Base Mix	P501 Concrete	Aggregate/Granular Base	Other			
TP-2	2.00	✓								
	2.50		✓							
	13.00					✓				

Comments/Remarks

- Some air voids evident through out the P-401 surface lift of the asphalt.

Total Pavement Thickness =	4.50 in.	Total Asphalt Thickness =	4.50 in.	Total Concrete Thickness =	0.00 in.	Total Base Thickness =	13.00 in.

SAMPLE EROSION CONTROL REPORT

SAMPLE INSPECTION REPORT

PERMIT NO. _____

PROJECT NO. _____

EROSION CONTROL INSPECTION REPORT

Date: _____

Name: _____ Firm: _____

Title: _____

Rain Event – 24 hour total _____ as reported by _____

Observations: _____

_____

_____

_____

Erosion and sediment control measures are/are not in compliance with the Storm Water Pollution Prevention Plan.

Action needed: _____

_____

_____

_____

The following erosion and sediment control measures would increase the efficiency of the Storm Water Pollution Prevention Plan: _____

_____

_____

_____

Superintendent's Signature:_____