CITY OF DELAWARE OHIO

Chapter 7: Roadway Design

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For the purpose of design, right of way and pavement width design values are specified for various capacities for each functional classification type of roadway. The basic design elements for arterial, collector and local streets are shown respectively. Wherever possible, the recommended pavement and right of way widths should be adhered to. However, it is understood that the right of way in already established City areas may continue to be less due to constraints such as existing structures or other geographical and or physical limitations. Minimum pavement widths can be utilized under special or restrictive conditions. It should be noted that local and collector roadways without curb and sidewalk are permitted in industrial areas only and require approval by the City.

The information contained in this section is intended to be utilized as guideline to acceptable roadway design within the City of Delaware and should not be construed as a substitute for other governing design standards and regulations such as the Ohio Department of Transportation Location & Design Manuals and the Ohio Manual of Uniform Traffic Control Devices (OMUTCD). For the purpose of roadway design within the City of Delaware, the designer shall follow ODOT CMS most current edition for all highway material item specifications with the exception of Items 604, 608, 609 and 901 where the City of Columbus Construction Materials Specifications (COC CMS) and/or the City of Delaware (COD) specifications are to be followed.

1. Arterial Street Design Requirements

The following table identifies the design parameter for Arterial Streets.

Table 7-1:
Design Parameters for Arterial Streets

	Minor Arterial		**Major Arterial**	
ADT	3,500 – 10,000		> 10,000	
Number of Lanes	2-Lane	3-Lane	4-Lane	5-Lane
Street Width (Back/Curb to Back/Curb) (FT)	40	40	52	64
Pavement Width (FT)	36	36	48	60
Lane Width (FT)	14	12	12	12
Right of Way Width (FT)	100	100	100	120
Parking Requirements	Parking is typically prohibited for new arterial construction			
Note: The design of arterial streets shall be in conformance with the current edition of the Ohio Department of Transportation's Location & Design Manual Vol. 1.				

2. Collector and Local Street Design Requirements

A. The length of a block for Local Street shall not exceed 1200ft.
B. A minimum 100-ft tangent section of pavement is required between reverse curves.
C. Public streets shall have a normal crown cross-section with 24-inch combination curb and gutter. Straight, 18-inch curb may be substituted on private streets. Approval for substitution shall be made on a case-by-case basis.
D. Sidewalks are required on both sides of public streets unless exempted by the City.
E. Sidewalks are to be 5ft wide and constructed of concrete. A combination bike/pedestrian path shall be 8ft in width and constructed with an asphalt surface.
F. Bike paths and sidewalks wider than 5ft generally require the establishment of an access easement adjacent to the proposed right of way.

G. Tree lawns shall be sloped at ¼-in per foot towards the street.
H. A temporary "Tee" turn-a-round constructed per City Standard Drawing is required at the end of any stub street that services 2 or more lots.
I. Reference City of Delaware Standards for Typical Street Sections and Curb Details.
J. Collector street design parameters are identified in the following table:

Table 7-2:
Design Parameters for Collector Streets

ADT	1,500 – 3,500
Street Width (Back/Curb to Back/Curb) (FT)	40
Pavement Width (FT)	36
Right of Way Width (FT)	70
Design Speed (MPH)	30 - 40
Minimum CL Radius (FT)	350
Minimum Turning Radius (FT)	5
Min/Max Street Grade (%)	0.5/4.0
Minimum "K" Crest Curve	44
Minimum "K" Sag Curve	64
Tree lawn Width (FT)	10
Parking Requirements	Parking is permitted where collector streets serve a primarily residential area however may be restricted where dedicated turn lanes are required near intersections

K. Local street design parameters are identified in the following table:

Table 7-3:
Design Parameters for Local Streets

	Primary	**Secondary**	**Cul de Sac**	**Alley**
ADT	500 – 1,500	0-500	0-250	N/A
Street Width (Back/Curb to Back/Curb)(FT)	36	32	32	16
Pavement Width (FT)	32	28	R=54.5	16
Right of Way Width (FT)	62	58	R=67.5	32
Design Speed (MPH)	30	30	30	15
Minimum CL Radius (FT)	275	225	125	125
Minimum Turning Radius (FT)	20	20	20	20
Min/Max Street Grade (%)	0.5/4.0	0.5/6.0	0.5/6.0	0.5/6.0
Minimum "K" Crest Curve	19	19	19	
Minimum "K" Sag Curve	37	37	37	
Tree Lawn Width (FT)	8	8	8	N/A
Parking Requirements	Permitted	Permitted, one side only	Permitted	Not Permitted

3. Cul-de-sac Design Requirements

A. Maximum length (L) is 700ft measured from the center of bulb to the centerline of the intersecting street.
B. Paved radius is 40ft measured to the back of curb. (54.5ft for L > 250ft)
C. ROW radius is 53ft allowing for an 8-ft tree lawn and 5ft sidewalk. (67.5ft for L > 250ft)
D. Interior islands on larger cul-de-sacs require prior approval of the City Fire Chief
E. Interior Island radius is 25.5ft measured to back of curb.
F. Slope for inside of island is 2% minimum to 8% maximum to curb.
G. Islands shall be constructed with 24" mountable curb.
H. Parking is prohibited against the center island.
I. Island landscaping and maintenance shall be the responsibility of the HOA.
J. Island shall be landscaped with grass and trees as required by City.

4. Alley Design Requirements

A. All alleys are to be constructed in public right of way or a public access easement.
B. Alleys less than 16ft wide must be posted as "One Way."
C. Minimum distance from edge of alley pavement to any structure is 8 ft.
D. Curbs are not required on alleys except at the ends of alley where the intersecting street radius return ends.
E. Inverted crown pavement section in alleys is acceptable and requires continuous centerline underdrain and storm sewer collection.

5. Curb Ramps & Crosswalks Design Requirements

A. Curb ramps are required in all directions at intersecting street corners.
B. Curb ramps are to be designed utilizing the most current ADAAG requirements, in addition to City of Delaware standards.
C. The width of a curb ramp shall be as wide as the width of adjacent sidewalk, but never less than five feet.
D. Mid-block pedestrian crossings are only permitted as approved by the City and must be appropriately signed and striped per City of Delaware Crosswalk Installation and Enhancement Design Guide.

6. Industrial Roadway Design Requirements

Roadways in designated industrial areas shall be designated by the City as "Industrial Pavement" and designed to the following criteria:

A. The minimum pavement width is 28ft with two 12-ft lanes and 2ft paved shoulders.
B. Ditch drainage sections are permitted but not required.
C. No parking permitted on either side of the roadway
D. 50ft turning radii are required at all intersections.
E. Heavy pavement section is required as per the required pavement composition.

7. Private Streets, Parking Lots & Driveways Design Requirements

A. Private streets shall be constructed to the public street standards except as permitted under this section.
B. The minimum pavement width for two-way traffic shall be 20ft; 28ft if parking is permitted on only one side of the street, opposite the water main/hydrants.

C. The minimum pavement width for an uncurbed private alley or one-way street is 12ft edge to edge of pavement.
D. In parking entrances and areas, curbing is required along all driveway entrances, travel lanes, parking lot pavement edges, and around all free-standing traffic or landscape islands. Curbing is not required around small landscape islands abutting a building.
E. Curbing maybe partially eliminated with City approval, as necessary to provide sheet flow storm drainage to meet an approved storm water management plan
F. Parking areas abutting a sidewalk shall be separated by a combination curb/sidewalk, or by a curb and tree lawn configuration. The tree lawn shall be a minimum of 3ft wide. If no tree lawn is present, then the walk must be at least 6ft wide to account for vehicle overhang. Parking blocks shall be installed in all uncurbed parking stalls.
G. The finished grade behind curb shall match the top of curb elevation.
H. Curbing in public right-of-way is to be combination curb/gutter or 18-in straight curb. Extruded concrete curbing is permitted along the perimeter of private parking lots, parking islands and at the end of parking stalls provided the curb is continuously backed by grade to the top of the curb. The curb shall be 7.5-in in height and shall be Class C, 4000 psi mix with fiber reinforcement or continuous rebar reinforcement. The top course of asphalt shall be placed after the curb is installed to aid in anchoring the curb leaving a 6-inch reveal.
I. Inverted crown pavement sections in alleys are acceptable and shall be designed per the City Standard Drawings with 3/16-inch per foot minimum cross-slope. Perforated drain tile shall be installed along the centerline of the pavement and shall outlet directly to a storm sewer collection system.
J. The maximum algebraic difference in the slopes of pavement on either side of a sump or catch basin shall be less than 2.5%.
K. Private streets and alleys shall be constructed to the public street pavement composition standard.
L. Commercial parking lots should be paved with a minimum of 4.0-inch of asphalt over 6-inches of compacted granular base. Areas subject to heavy vehicles loads shall be constructed with 6-inches of asphalt over 6-inches of stone base.
M. All trench backfill and cover requirements for public streets shall apply to private streets and/or parking lots when utilities are located within paved areas.
N. Individual commercial and business driveway approaches shall be constructed of concrete per the City Standard Drawings. At the direction of the City, private streets or high volume commercial or business driveways serving multiple tenants shall tie to the existing public street intersection with a flexible pavement section equivalent to the intersecting public street pavement section.
O. The location of dumpster pads is subject to the access requirements of the City and approval by the Public Works Director. Dumpster pads must be constructed to City Standard Drawings if City refuse service is desired.
P. See the Stormwater Management Section for limitations on ponding in paved areas
Q. Parking lot drive aisles must be a minimum of 24-ft wide.
R. Parking stalls must be a minimum of 9-ft by 19-ft.
S. All parking stalls, painted islands, and internal pavement markings must be striped in white paint unless otherwise required by ADAAG or Ohio Manual of Uniform Traffic Control Devices requirements.
T. Commercial properties and/or multi-family residences utilizing City of Delaware Refuse Services shall design for and provide dumpster pads per City standards.
U. All driveways shall not exceed 8% slope.

8. Intersection Design Requirements

A. Left Turn Lanes

Left turn lanes and all components associated with left turn lanes shall be designed per the most current edition of the Ohio Department of Transportation Location & Design Manual (ODOT L&D), Volume 1-Roadway Design, Section 400. This includes but is not limited to the design of: the approach, departure, or diverging tapers, turn lane length, and storage length.

B. Islands

An island is an area between traffic lanes used to direct and control vehicular movements, divide opposing or same direction of traffic streams, or provide pedestrian refuge. Islands shall be designed per the most current edition of the Ohio Department of Transportation Location & Design Manual (ODOT L&D), Volume 1-RoadwayDesign, Section 400.

Curbed islands are required in the City of Delaware. A 100 sq. ft. is preferred, however no less than a 75 sq. ft curbed islands will be typically permitted. All curbed islands shall have a mountable curb and concrete surface.

C. Intersection Angles

Intersection angles are typically designed to intersect at 90 degrees, which may require minor realignment of existing streets. In no case should the angle of intersection be less than 70 degrees. The crossroad alignment should be as close to perpendicular as practicable.

D. Intersection Alignment

Combinations of pavement cross slopes and profile grades may produce unacceptable grade breaks on through intersections. This is especially true where a new roadway intersects an existing divided roadway. A centerline profile of a proposed new cross street centerline should be developed in order to analyze the bifurcation through the intersection. The profile through the intersection should be designed to meet the design speed of the crossroad. Since the grade break across a normal crowned pavement is 1.9% or greater, it should be noted that the crown of the through street must be flattened. This will allow the vehicles on the cross street to pass through the intersection without significantly adjusting their speed.

The maximum allowable grade break through an intersection without constructing a vertical curve and/or flattening the crown of the through road is speed dependent, reference the most current edition of the Ohio Department of Transportation Location & Design Manual (ODOT L&D), Volume 1-Roadway Design, Section 200, for the maximum change in vertical alignment (break in grade) permitted without using a vertical curve.

9. Pavement Section Composition

Pavement section composition shall be as shown on the City of Delaware Standard Details for Pavement Sections, both for flexible and composite pavement (refer to the RDWD series of standard drawings).

A. Asphalt binder grade PG 76-22M may be specified by the City for use in roadways subject to significantly high truck loadings.

10. Alternate Pavement Designs

For the design of new arterial and industrial highway pavement sections, alternative pavement design criteria may be used in determining minimum pavement composition and thickness. Such criteria and methodologies shall be submitted in advance to the City for approval. All pavement materials and construction shall conform to the ODOT CMS (latest edition), unless the City determines that additional requirements are needed for a particular project.

11. Pavement Markings & Signage

All pavement markings for public and private sites are to comply with Ohio Manual of Uniform Traffic Control Devices requirements, or as further specified by this manual. All pavement markings within commercial or industrial development parking areas shall be completed in white paint unless otherwise required by ADAAG or Ohio Manual of Uniform Traffic Control Devices requirements.

If “No Parking” zones are required, they should be specified on the same side of the street as the fire hydrants. Approaches to intersections or major entry ways may require “No Parking” zones on both sides of the street. No Parking signs adjacent to an intersection must include the text “From Here to Corner”, and must have one arrow pointing towards the intersection. All pavement markings on public roadways are to conform to Item 644 Thermoplastic pavement markings. Temporary painted marking are permitted in cold weather, but they must be replaced with permanent thermoplastic markings before the roadway will be accepted.

12. Maintenance of Traffic (MOT)

A detailed Maintenance of Traffic Plan (MOT) is required for all construction activities within the public right-of-ways. The MOT plan is required as part of the plan set for major road improvements and widening projects but can be submitted separately by a contractor in advance of construction activities or in conjunction with the required Public Way permit.

Construction plans shall include the note “*The Maintenance of Traffic plan is the responsibility of the contractor. A Maintenance of Traffic Plan must be submitted at the time of the Pre-Construction Meeting and be approved by the City in advance of any construction activities within the public right of way.*” MOT plans should be prepared in compliance with OMUTCD, , current edition. Additional MOT plans and permitting may be required for projects within Delaware County, Townships, or ODOT jurisdictions.

13. Emergency Vehicle Access

In accordance with City of Delaware Codified Ordinances, Part 15, all streets (including but not limited to arterial, collector, local, private, alleys, and emergency access drives) shall:

A. be designed and constructed with a sufficient width to provide adequate access for emergency vehicles
B. have a minimum clearance of fourteen feet for all overhead obstructions.

Please reference the Infrastructure Design Guide, Appendix E: Ladder Truck Turning Performance Analysis for the specifications and apparatus turning radius requirements.

14. Roundabouts

Roundabouts shall be designed per the most current edition of the Ohio Department of Transportation Location & Design Manual (ODOT L&D), Volume 1-Roadway Design, Section 400, the OMUTCD for signage and pavement markings, and City of Delaware Standard Details.

Roundabouts in the City of Delaware shall be designed using the RODEL Software System or other pre-approved software. The decision to install a roundabout must be approved by the Public Works Department at the planning stage of the project.

For additional information, see the most current edition of Federal Highway Administration's Roundabouts: An Informational Guide (NCHRP Report 672).

15. Traffic Calming Features

Traffic calming features, including but not limited to median islands, intersection or mid-block bump outs, curb extensions, etc., shall be provided and installed by a project on any public street as determined by the Public Works Department/City Engineer. All traffic calming features shall be in conformance with the City of Delaware Traffic Calming Manual and designed on the engineering plan set.