SECTION 200

200. ROADWAYS

210. General Roadway Requirements

A. The standards contained in this section may be superseded for projects within Plan Districts. For such projects, refer to the relevant Plan District within the Community Development Code. Plan District boundary information is available on the City website.

B. All roadways shall meet the requirements of the *Oregon Fire Code* with City of Hillsboro Amendments and are subject to the approval of the fire code official.

210.1. Functional Classification

A. The functional classification for roads are established by the City of Hillsboro Transportation System Plan (TSP) and are as shown in Table 210.1.

Table 210.1 – Functional Classifications

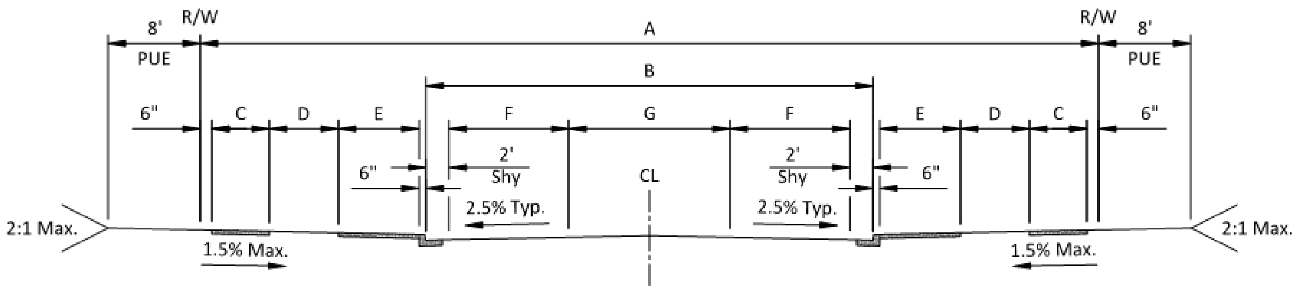
Functional Classification	Subcategory
Arterial	-
Collector	Commercial & Industrial
	Residential
Neighborhood Route	Commercial & Industrial
	Residential
Local Road	Commercial & Industrial
	Residential
Alley	-

210.2. Typical Sections

A. Standard roadway typical sections are shown by functional classification in Figures 210.1 through 210.5.

B. When required as a condition of development, half-street improvements shall include all the area between centerline and the edge of right-of-way, including the reconstruction of any existing street section not meeting the required pavement design life. See Subsection 220 for pavement design-life requirements.

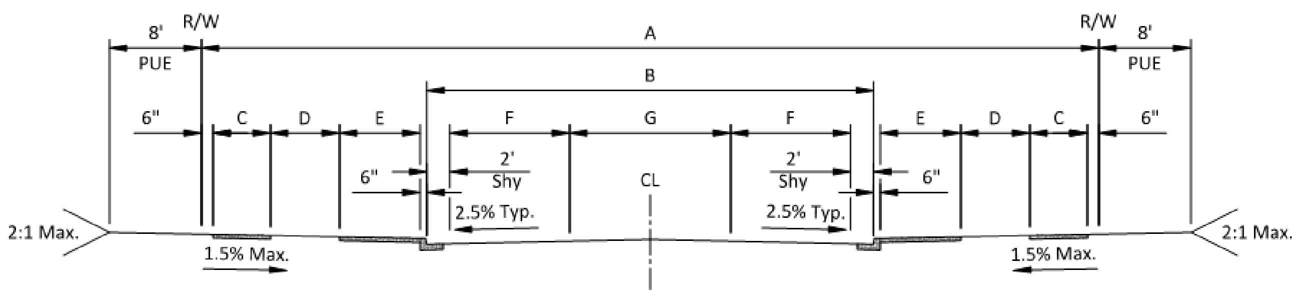
Figure 210.1 - Arterial Road Section



Number of Lanes	Right-of-Way (A)	Paved Width (B)	Sidewalk Width (C)	Landscape Strip Width (D)	Raised Cycle Track Width (E)*	Travel Lane Width (F)	Center Turn Lane (G)
2	66’	28’	5’	6’	7’	12’	-
3	80’	42’	5’	6’	7’	12’	14’
5	104’	66’	5’	6’	7’	12’	14’
7	130’	90’	6’	6’	7’	12’	14’

*For raised cycle track standards and criteria, see Subsection 230.11.B.

Figure 210.2 - Collector Road Section

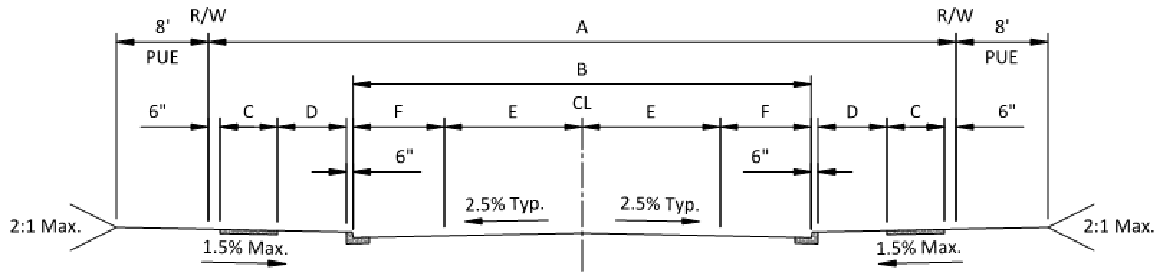


Subcategory	Number of Lanes	Right-of-Way (A)	Paved Width (B)	Sidewalk Width (C)	Landscape Strip Width (D)	Raised Cycle Track Width (E)*	Travel Lane Width (F)	Center Turn Lane (G)
Residential	2	64’	28’	5’	5’	7’	12’	-
	3	74’	38’	5’	5’	7’	11’	12’
	5	96’	60’	5’	5’	7’	11’	12’
Commercial & Industrial	2	66’	28’	5’	6’	7’	12’	-
	3	80’	42’	5’	6’	7’	12’	14’
	5	104’	66’	5’	6’	7’	12’	14’

*For raised cycle track standards and criteria, see Subsection 230.11.B.

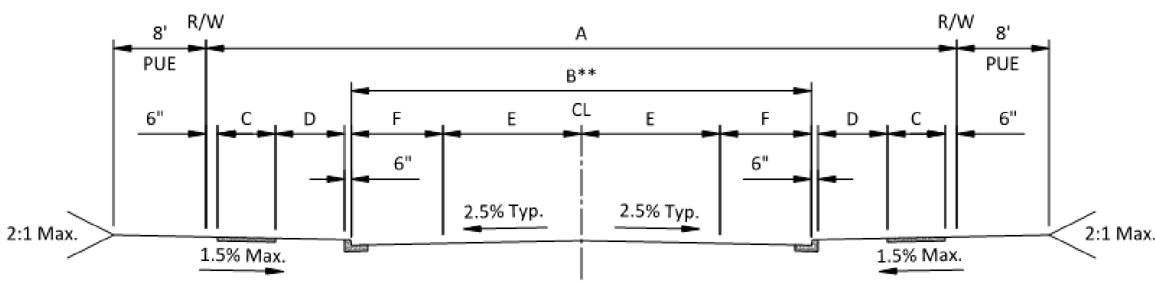
NOTE: Parking may be added if approved by City. If approved, the location of the cycle track and landscape strip shall be reversed to prevent car doors opening into the cycle track and additional R/W shall be provided.

Figure 210.3 – Neighborhood Route Section



Subcategory	Right-of-Way (A)	Paved Width (B)	Sidewalk Width (C)	Landscape Strip Width (D)	Travel Lane Width (E)	Parking Lane (F)	Parking
Commercial & Industrial	62’	40’	5’	5’	12’	8’	Both Sides
Residential	60’	36’	5’	6’	12’	6’	Both Sides

Figure 210.4 - Local Road Section



Subcategory	Right-of-Way (A)	Paved Width (B)	Sidewalk Width (C)	Landscape Strip Width (D)	Travel Lane Width (E)	Parking Lane (F)	Parking
Commercial & Industrial	62’	40’	5’	5’	12’	8’	Both sides
Residential	54’	32’	5’	5’	10’	6’	Both sides
Residential	50’	28’	5’	5’	11’	6’	One side
Residential	46’	24’	5’	5’	12’	-	None

**All roadways must meet minimum fire access requirements.

Figure 210.5 - Alley Section for Lots that Front a Public Street

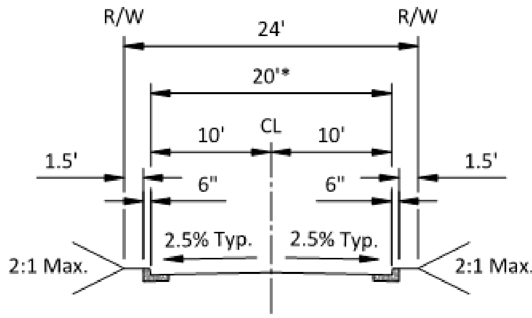
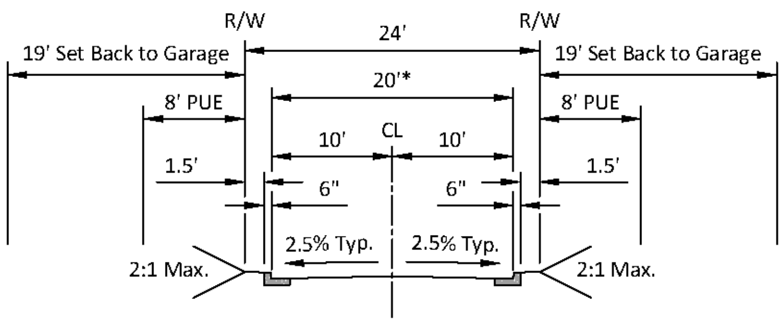


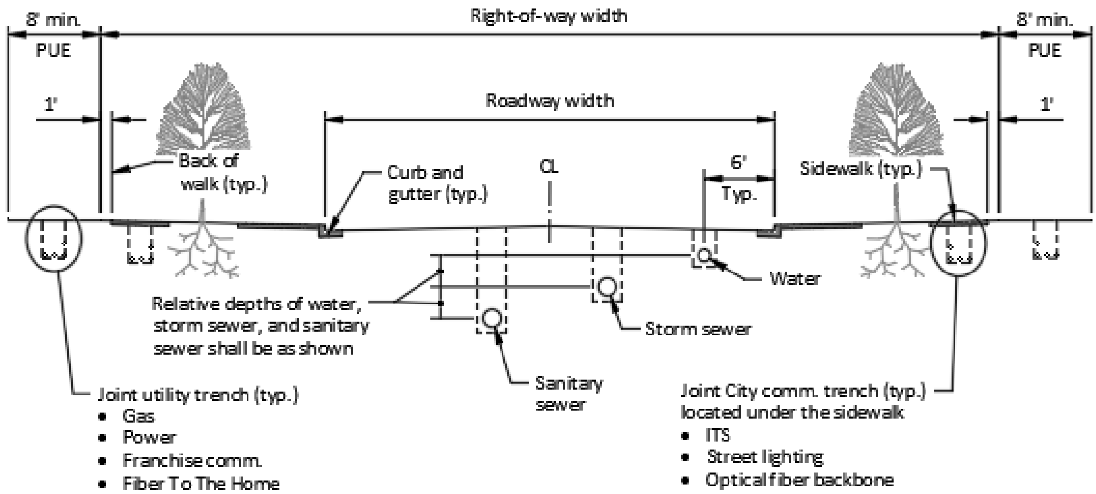
Figure 210.6 - Alley Section for Lots that Front a Green Space



*All roadways must meet minimum fire access requirements.

C. Standard utility locations are shown in Figure 210.7.

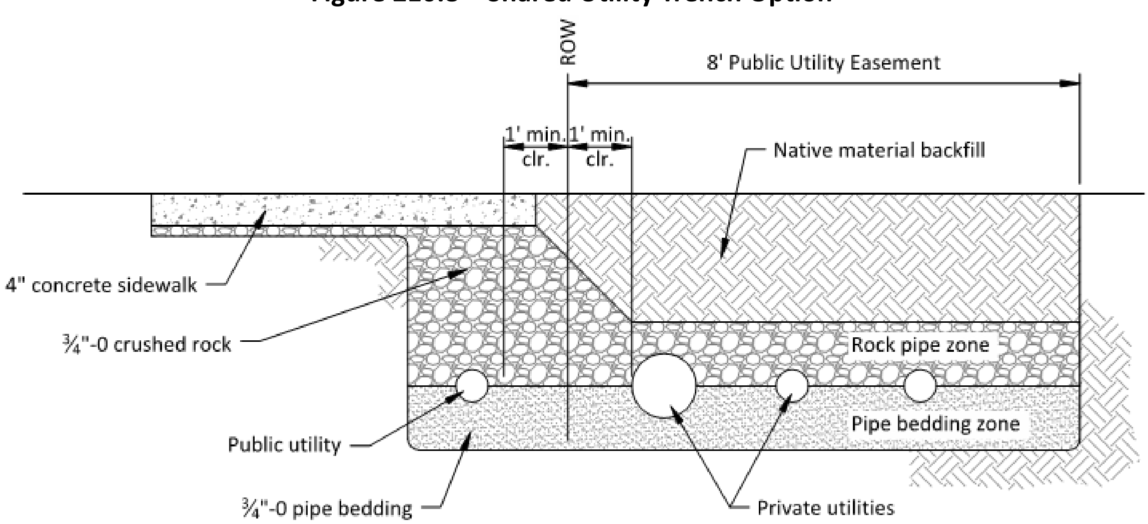
Figure 210.7 – Standard Utility Locations



Notes

1. Sanitary sewer and storm sewer shall be located per Clean Water Services (CWS) standards.
2. Manholes shall not be placed in the vehicle wheel-path. See Subsection 410.E.6.
3. Maintain minimum required separations between sanitary sewer and water per CWS regulations and OAR 333-061-0050.
4. The placement and depths of gas, power, cable, and other dry utilities located within the Public Utility Easement (PUE) shall be per Oregon Utilities Coordinating Council (OUCC) standards.
5. See CWS Std. Drg. No. 590 for trench backfill details. For all trenches with paved areas, use Class "B" backfill. For all trenches within unpaved areas, use Class "A" backfill.
6. Water lines shall be placed on the South and East sides of the roadway. Gas and electric lines shall be placed on the North and West sides.
7. All above ground utilities shall meet roadway clear zone requirements.
8. Optical fiber conduit and cable shall be placed in the joint utility trench (in the PUE) in Fiber To The Home (FTTH) applications. It shall be placed in the joint communications and street lighting trench (in the ROW) within corridors specified in the City's Transportation Communications Plan. See Subsection 360.1.
9. See Subsection 230.10.A.3 and Std. Drg. No. 350-2 for requirements concerning utility placement within sidewalks.
10. See Subsection 130 for easement requirements.
11. See COH Std. Drg. No. 250-2 for pavement restoration details.

Figure 210.8 – Shared Utility Trench Option



D. The joint utility trench (containing gas, power, and franchise communications) may be combined with the joint City communications trench (containing ITS, street lighting, and optical fiber backbone) as shown in Figure 210.8.

210.3. Channelization/Intersections

A. The TSP identifies the required number of lanes for each street. Additional lanes may be required at intersections in excess of the minimum street standards shown in the TSP and the typical sections shown herein. Additional right-of-way may be required to accommodate the increased number of lanes at intersections.

B. Where traffic signals exist or are anticipated for installation within five years, additional right-of-way shall be provided to accommodate signal poles and equipment clear of the sidewalk.

C. See Subsection 230.5 for intersection design standards.

210.4. Design Speed

A. Design speeds are as shown in Table 210.2.

Table 210.2 – Design Speeds

Functional Classification	Design Speed
Arterial	45 mph
Collector	35 mph
Neighborhood Route	25 mph
Local Road	25 mph
Alley	15 mph

210.5. Roundabouts

A. Roundabouts shall be designed according to the guidelines presented in *NCHRP Report 1043: Guide for Roundabouts*.

220. Pavement Design and Construction

A. Pavement materials and construction work must comply with the current *Oregon Standard Specifications for Construction*. Abbreviations and terms used within this section are as defined or used in the ODOT standard specifications unless otherwise defined.

B. Pavement materials for each new roadway classification shall be as shown in Table 220.1.

Table 220.1 – Pavement Materials

Functional Classification	Subcategory	Pavement Material
Arterial	-	Concrete
Collector	Commercial & Industrial	Concrete
	Residential	Asphalt
Neighborhood Route	Commercial & Industrial	Concrete
	Residential	Asphalt
Local Road	Commercial & Industrial	Asphalt
	Residential	Asphalt
Alley	-	Asphalt

220.1. Designed Pavement Sections

A. Pavement design period

1. **New pavement**: 40 years.

2. **Rehabilitation**: 20 years.

3. **Widening**: 20 years, plus 20 year rehabilitation of existing pavement.

4. **Reconstruction**: 40 years.

5. Design period may be conditioned in the land use decision. If unsure, contact transportation planning.

B. Pavement designs shall be developed using the following:

1. **Asphalt concrete**: AASHTO *Guide for Design of Pavement Structures* (AASHTO Guide) and the design guidelines of the latest ODOT *Pavement Design Guide* (ODOT Guide).

2. **Portland cement concrete**: 1998 *Supplement for Rigid Pavement Design* (AASHTO Supplement) or the StreetPave™ design software by the American Concrete Pavement Association (ACPA).

C. Pavement designs shall be developed and documented by an engineering report prepared and stamped by an Oregon registered Professional Engineer experienced in pavement design. The report must include specific pavement design recommendations for materials and construction. Additionally, the report must include sufficient design documentation regarding site conditions, design assumptions and design parameters to allow for independent peer review of the design recommendations. The engineering report shall address considerations for year round construction. Recommendations for both summer and winter construction shall be included.

D. Field testing of pavement construction work shall follow the procedures and testing schedule listed in the latest edition of the *ODOT Manual of Field Test Procedures* (MFTP) for the applicable type of work.

220.2. Subgrade Evaluation

A. Conduct sufficient soil explorations (at least one per 500-feet of roadway and at least two total) to visually classify the soils within three feet below the planned subgrade surface. Conduct laboratory testing on samples of the subgrade soils including determination of moisture content, Atterberg Limits as necessary for soil classification, moisture-density relationship by standard Proctor compaction and subgrade support values for the in situ subgrade and compacted subgrade.

B. Subgrade support values for design of flexible pavement (resilient modulus) and rigid pavement (modulus of subgrade reaction or k-value) shall be estimated by one or more of the following methods:

1. Estimate in situ subgrade support values by back calculation of Falling Weight Deflectometer (FWD) deflections measured on paved or aggregate surfaced areas within the project limits. FWD testing shall be conducted in accordance with ASTM D 4694 and D 4695. The FWD must have been reference calibrated at a FHWA/SHRP Regional Calibration Center within 12 months preceding the testing. Back calculate the elastic modulus of the subgrade soil for flexible pavement design in accordance with the back calculation procedures described in the AASHTO Guide or other procedures meeting the guidelines of ASTM D 5858. Use the modulus correction factors given in the ODOT Guide to convert back calculated elastic moduli into equivalent saturated laboratory resilient moduli. Back calculate the dynamic k-value of the subgrade for rigid pavement design in accordance with the back calculation procedures described in the AASHTO Supplement and correct the dynamic k-value to static k-value using a factor of 0.5.

2. Estimate in situ subgrade support values by measuring subgrade soil penetration resistance using the dynamic cone penetrometer (DCP) in accordance with ASTM D 6951. Estimate the subgrade resilient modulus for flexible pavement design from DCP Index (mm/blow) using the correlation given in the ODOT Guide. Use the modulus correction factors given in the ODOT Guide to convert DCP determined resilient moduli into equivalent saturated laboratory resilient moduli. Estimate subgrade static k-value for rigid pavement design from DCP Penetration Rate (inches/blow) using the correlation given in the AASHTO Supplement.

3. Determine in situ resilient modulus by laboratory testing of push tube samples of subgrade soil. Conduct the resilient modulus testing using the ODOT testing protocol. Evaluate resilient modulus at a deviator stress of 6 psi without confining pressure.

4. Determine the resilient modulus of compacted subgrade by testing laboratory compacted subgrade soil. Compact the subgrade sample to 95% of standard Proctor maximum dry density at moisture content of 1 to 2 percentage points above standard Proctor optimum

moisture content. Conduct the resilient modulus testing using the ODOT testing protocol. Evaluate resilient modulus at a deviator stress of 6 psi without confining pressure.

5. Estimate the k-value of compacted subgrade by CBR testing of a laboratory compacted subgrade soil. Compact the subgrade sample to 95% of standard Proctor maximum dry density at moisture content of 1 to 2 percentage points above standard Proctor optimum moisture content. Conduct the CBR testing in accordance with ASTM D 1883 using surcharge weight equivalent to the proposed pavement section. Estimate the static k-value from the CBR value using the correlation given in the AASHTO Supplement.

6. In lieu of testing to establish subgrade support values, presumptive design values of 3,000 psi for resilient modulus and 50 pci for k-value may be used.

220.3. Traffic Loading Analysis

A. The pavement design traffic loading is the total number of Equivalent 18-kip Single Axle Load (ESAL) repetitions that the pavement is expected to experience during the design period. Traffic engineering analysis shall be conducted to estimate existing and/or projected average daily traffic volumes, percentage of heavy vehicles, distribution of heavy vehicle volumes according to the Federal Highway Administration (FHWA) axle classifications and projected growth rate in heavy vehicle volumes during the design period.

B. Daily heavy vehicle volumes shall be multiplied by the conversion factors shown below in Table 220.2 to calculate annual ESAL repetitions for each heavy vehicle. The cumulative ESAL repetitions from all heavy vehicles during the design period shall be calculated taking into account the expected annual growth in heavy vehicle volumes. The minimum traffic loading for pavement design shall be 50,000 ESAL repetitions.

Table 220.2 – Annual ESAL Conversion Factors

FHWA Classification	Daily Vehicle Volume to Annual ESAL Repetitions Conversion Factors	
	Flexible Pavement	Rigid Pavement
Weight restricted buses, school buses	246	269
2-axle Transit Buses	780	1170
Articulated Transit Buses	1550	2320
5	104	99
6	284	417
7	757	1199
8	253	277
9	466	715
10	561	912
11	603	606
12	546	663
13	1037	1660

C. The presumptive traffic loadings shown below in Table 220.3 may be used as design values in lieu of a detailed traffic analysis.

Table 220.3 – Presumptive Traffic Loadings

Functional Classification	Flexible Pavement 40-yr ESAL Repetitions	Rigid Pavement 40-yr ESAL Repetitions
Local Residential & Neighborhood Route (note)	50,000	70,000
Commercial/Industrial	1,000,000	1,600,000
Collector	4,000,000	6,000,000
Arterial	8,000,000	13,000,000

Note: Use Commercial/Industrial Functional Classification traffic loadings if street will be used by a Tri-Met bus line or similar shuttle buses.

D. The traffic loading for circulatory lanes within roundabouts should be 1.5 to 2 times the highest traffic loading on the approach lanes to account for the combined loading from the approaches.

E. If using StreetPave™ load spectrum traffic analysis is required. Use site specific total truck traffic with the default typical traffic category corresponding to the road type. For transit bus routes, default to major arterial traffic category.

220.4. Flexible Pavement Thickness Design Criteria

A. Use the design parameter values shown below in Table 220.4 for flexible pavement design.

Table 220.4 – Flexible Pavement Design Parameter Values

Parameter	Design Value
Design Reliability Level:	90% arterial, collector, commercial, and bus routes 80% Local residential and neighborhood routes
Initial Serviceability, Po:	4.2
Terminal Serviceability, Pt:	2.5
Standard Deviation:	0.50
New Asphalt Concrete Layer Coefficient:	0.42
New Aggregate Base Layer Coefficient:	0.10
New Aggregate Base Resilient Modulus, psi:	20,000
New Aggregate Base Drainage Coefficient:	1.0
New Aggregate Subbase Layer Coefficient:	0.08
New Aggregate Subbase Resilient Modulus, psi:	11,200
New Aggregate Subbase Drainage Coefficient:	1.0

B. The pavement section shall be designed using the Layered Design Analysis method described in Section 3.1.5 of Part II of the 1993 AASHTO Guide. The calculated pavement thickness should be rounded to the nearest 0.5-inch.

C. The minimum roadway AC section thickness shall be 5 inches consisting of a 3-inch thick base lift and 2-inch thick wearing course. Multi-use pathways shall have a minimum AC section thickness of 3-inches placed in a single lift.

D. The minimum thickness of aggregate base shall be 8-inches. Geotechnical Engineer to provide analysis of rock section's suitability to support construction traffic. Analysis should take into account construction time of year. Plant mixing is required for all aggregate.

E. Full depth reclamation with cement can be included provided laboratory testing and design is provided in the engineering report. Layer coefficient shall be 0.16 where at least 50 percent, by weight, of existing material to be treated is granular, otherwise layer coefficient shall be considered equal to aggregate subbase (0.08).

F. The asphalt concrete should be ½- or ¾- inch dense ACP according to ODOT 00744. A request can be made for low nominal maximum aggregate size for thin lift paving.

G. Minimum and maximum lift thicknesses are 2.0 and 3.0 inches, respectively for ½- and ¾- inch dense ACP.

H. Compact asphalt concrete to a minimum of 91% of moving average maximum density (MAMD) for the base lift and 92% of MAMD for all subsequent lifts.

I. For typical ACP, binder should be PG 64-22. However the binder grade should be adjusted depending on aggregate gradation, traffic levels, and the amount of recycled asphalt material. Binder grade discussion and reasoning must be submitted in the engineering report.

220.5. Rigid Pavement Thickness Design Criteria

A. AASHTO Supplement Design requirements

1. Use the design parameter values shown below in Table 220.5 for rigid pavement design by the AASHTO Supplement procedures and Table 220.6 for rigid pavement design with the StreetPave™ system.

2. The minimum PCC slab thickness shall be 6 inches. Streets with transit or shuttle bus traffic shall have minimum PCC slab thickness of 8 inches.

3. The minimum thickness of aggregate base shall be 4 inches. Geotechnical Engineer to provide analysis of rock section's suitability to support construction traffic. Analysis should take into account construction time of year. Plant mixing is required for all aggregate.

4. The slab thickness design shall take into account the slab edge support condition as defined within the AASHTO Supplement and/or StreetPave™.

5. For AASHTO Supplement design, if the transverse joints are un-dowelled, the tensile stress at the top of the slab needs to be checked for axle loading near the transverse joint (joint loading). Dowels are required if the tensile stress for joint loading exceeds the tensile stress calculated at the bottom of the slab for the mid-slab loading case (as used for the slab thickness design).

6. For AASHTO supplement design, estimate the magnitude of joint faulting at the end of the design period for dowelled or un-dowelled joints using the predicative models. Adjustment to the design is required if the predicted faulting magnitude exceeds the critical values given in Table 28 of the 1998 Supplement. Potential adjustments include use of dowels or increase in dowel diameter, use of treated base material and use of subsurface drains to improve drainage conditions.

7. For StreetPave™ design, default setting should be "No" under macro fibers. If macro fibers are proposed, project specific test results must be provided using the ASTM C1609 test method with an analysis showing a maximum residual strength of 15 percent.

8. Requirements under ODOT 00756.60 must be met or concrete shall achieve a minimum compressive strength of 3800 psi prior to opening to traffic. If the time frame designated for opening traffic is less than 72 hours after concrete placement, provide Class HES4000 – 1 ½ concrete designed to attain a minimum average compressive strength of 3,000 psi prior to allowing traffic on the concrete. Otherwise furnish Class 4000 – 1 ½ paving concrete.

9. Concrete must meet the requirements of the concrete embodied carbon threshold in section 170.6.1 and provide GWP analysis with mix design.

Table 220.5 – Rigid Pavement Design Parameter Values (AASHTO supplement)

Parameter	Design Value
Design Reliability Level:	90% arterial, collector, commercial, and bus routes 80% Local residential and neighborhood routes
Initial Serviceability, Po:	4.5
Terminal Serviceability, Pt:	2.5
Standard Deviation:	0.40
28-day Flexural Strength, psi:	600
Modulus of Elasticity of Concrete, psi:	3,600,000
Modulus of Elasticity of Base Material, psi	Median value from Table 14 of AASHTO Supplement for the base type
Drainage coefficient for faulting analysis:	0.80
Poisson's Ratio of PCC:	0.15
Edge Support Adjustment Factor:	As recommended in AASHTO Supplement for type of edge support
Friction Coefficient between Slab and Base	Median value from Table 14 of AASHTO Supplement for the base type
Mean Annual Wind Speed, mph:	7.9
Mean Annual Temperature °F:	53.6
Mean Annual Precipitation, inches:	36.3
Moisture Gradient & Construction Temperature Differential in Slab:	1 °F per inch of slab thickness
Mean Annual Freezing Index:	33 degree (F) days
Annual Temperature Range °F:	46.6
Number of Days with Maximum Temperature above 90 °F:	10.8

Table 220.6 – Rigid Pavement Design Parameter Values (StreetPave™)

Parameter	Design Value
Design Reliability Level	90% arterial, collector, commercial, and bus routes 80% Local residential and neighborhood routes
Terminal Serviceability	2.5
28-day Flexural Strength, psi	600
Modulus of Elasticity of Concrete, psi	3,600,000
Slabs Cracked	10%
Drainage coefficient for faulting analysis	0.80
Poisson's Ratio of PCC	0.15
Edge Support	Design dependent. Exception required for untied support
Macro fibers in concrete	Default to No. Maximum of 15% residual if approved by City

220.6. Rigid Pavement Jointing Design Criteria

A. The Design Engineer shall provide a jointing plan in the project plans showing the construction joints and transverse and longitudinal joints in the concrete pavement to control cracking. The jointing plan shall show to scale at a minimum: manholes, valve boxes, inlets, joint layouts, dowels, tie bars and other required reinforcement and joint details including sawing depths.

B. Joint layout shall be designed in accordance with American Concrete Pavement Association (ACPA) recommendations and the criteria described herein. The Design Engineer shall avoid or minimize: joints that intersect another joint or the pavement edge at an angle of less than 60-degrees, interior corners (L-shaped slabs), slabs less than 1-foot wide, odd shapes (keep slabs rectangular, trapezoidal or triangular). Utility fixtures shall be isolated from the slab by box-outs with isolation joints in accordance with Std. Drg. No. 220-2. Coordinate the joint layout with fixture locations so that the joints are centered on the box-outs or coincide with the isolation joints around the box-outs.

C. Gutter joints shall be aligned with the transverse joints on the adjoining slab unless an isolation joint is placed between the gutter and the slab. Note that if the gutter is isolated from the slab by a butt type joint, then an edge support factor of 1.0 shall be used in the slab thickness design.

D. Longitudinal joints shall coincide with lane lanes. Note that on streets with an odd number of lanes this will require an offset crown. Spacing between longitudinal joints shall not exceed 15 feet or 24x slab thickness on unbound base or 21x slab thickness on stabilized base.

E. Transverse contraction joints shall be spaced at relatively equal intervals and shall be close to the same spacing as the longitudinal joints so that the panels are relatively square. The ratio of the maximum to minimum slab dimensions (aspect ratio) formed by joints shall not exceed 1.25. Spacing between transverse joints shall not exceed 15-feet or 24x slab thickness on unbound base or 21x slab thickness on stabilized base. If the aspect ratio cannot be met, a reinforcement grid shall be installed as shown on Std. Drg. Nos. 220-1 and 250-3.

F. Joint construction, dowel bar installation and tie bar installation shall conform to the details shown on Std. Drg. Nos. 220-1 and 250-3.

1. Transverse joints (sawed or construction) in plain concrete pavement slabs 7 inch thick or greater shall be dowelled. All joints within intersections shall be dowelled when dowels are needed on the transverse joints in one of the approach lanes. Plate dowels will not be allowed. Dowel installation shall be per ODOT 00756.43(a).

2. All joints shall be sealed with joint sealant listed on the ODOT QPL placed in a joint reservoir sized in accordance with the recommendations of the joint sealant manufacturer (typically the reservoir width should be twice the sealant depth for silicone sealant). The sealant shall be supported by a backer rod of the size and material recommended by the joint sealant manufacturer. The top of the sealant shall be recessed below the slab surface by 1/8 to 3/8-inch.

220.7. Structural Rehabilitation Design

A. Pavement coring shall be performed at representative locations to determine the thickness and composition of the pavement materials and evaluate cracking depth, investigate cracking mode (top-down or bottom-up) and investigate for moisture induced damage (asphalt stripping damage). Investigation shall also include a visual survey of pavement distress.

B. Field investigation shall include falling weight deflectometer (FWD) testing of existing pavement to determine structural condition and remaining structural life for Commercial/Industrial, Collector, and Arterial street sections.

1. FWD testing conducted in accordance with ASTM D 4694 and D 4695. The FWD must have been calibrated within 12 months preceding the testing. Investigation shall also include a visual survey of pavement distress.

2. The FWD test data shall be analyzed to delineate analysis units representing segments having distinctly different structural characteristics.

3. The in situ resilient modulus of the subgrade and the effective structural number of the existing pavement structure shall be estimated from back-calculation analysis of the FWD test data using the back-calculation analysis procedure described in the AASHTO Guide or other procedures meeting the guidelines of ASTM D 5858.

C. Resilient modulus analysis for residential street sections should be one of the options listed under 220.2B. Additionally, residential effective structural analysis should be layered based on the suggested coefficients listed in Table 5.2 of the AASHTO guide.

D. Design for structural rehabilitation of existing pavement shall be accomplished using the procedures described in Part III of the AASHTO Guide and the rehabilitation design guidelines in the ODOT Guide. The rehabilitation recommendations shall include consideration to measures for mitigation of reflective cracking.

220.8. Subgrade Evaluation

A. The Design Engineer shall evaluate the laboratory soils test data to determine if subgrade compaction is feasible including consideration of moisture conditions during construction and whether the compacted subgrade will support construction activities and traffic.

B. If subgrade compaction is deemed feasible, the pavement section shall be designed based on the subgrade support values determined from the laboratory tests of compacted subgrade. Compaction of the subgrade shall be accomplished in accordance with the procedures and compaction criteria given in ODOT 00330.43 including deflection testing according to ODOT TM 158. Subgrade separation geotextile shall be placed over the compacted subgrade prior to placing aggregate base.

C. If subgrade compaction is not deemed feasible, the subgrade shall be stabilized by one of the following methods:

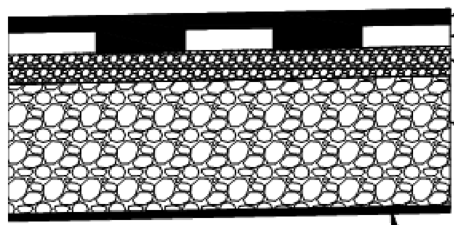
1. Conduct subgrade stabilization in accordance with ODOT 00331. Use aggregate bases conforming to section 2630. Use of geosynthetic reinforced aggregate backfill is allowed. Include subgrade separation geotextile placed directly over the subgrade to prevent infiltration of subgrade fines into the aggregate backfill.

2. Treat the subgrade with Portland cement in accordance with ODOT 00344 including the compaction criteria given in ODOT 00344.45. Determine the cement treatment rate to achieve a 7 day compressive strength of at least 200 psi as determined by ASTM D 1633 Method A on specimens compacted to 95% of maximum dry density at optimum water content as determined by ASTM D 558. Portland cement content greater than 8 percent requires City approval.

220.9. Standard Pavement Sections

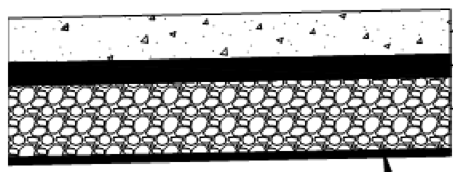
A. The pavement designs shown in Figures 220.1 and 220.2 may be used as alternatives to preparing a project-specific design.

Figure 220.1 - Standard Asphalt Concrete (AC) Pavement Section



Functional Classification	Subcategory	Thickness (inches)				AC Mix Design Level
		AC Wearing Course (Note 3)	AC Base Course (Note 3)	Aggregate Base Course (Note 4)	Aggregate Sub Base Course (Note 5)	
Collector	Residential	2.0	8.0	8.0	12.0	3
Neighborhood Route	Residential	2.0	3.0	4.0	12.0	2
Local Road	Commercial & Industrial	2.0	6.0	6.0	12.0	3
	Residential	2.0	3.0	4.0	12.0	2
Alley	-	2.0	2.0	4.0	10.0	2
Multi-Use Path	-	2.0	2.0	4.0	10.0	2

Figure 220.2 - Standard Portland Cement Concrete (PCC) Pavement Section



Functional Classification	Subcategory	Thickness (inches)		
		PCC Slab (Note 6, 7)	AC Base Course (Note 3)	Aggregate Base Course (Note 4)
Arterial	-	10.0	4.0	10.0
Collector	Commercial & Industrial	9.0	4.0	10.0
Neighborhood Route	Commercial & Industrial	9.0	4.0	10.0

NOTES TO FIGURES 220.1 AND 220.2:

1. These standard pavement sections are based on conservative design criteria including anticipated traffic and construction vehicle loading under poor soil conditions. These assumptions may not be representative of typical conditions for many locations.

2. For Local Roads, use the Commercial & Industrial pavement section if a transit bus line or similar shuttle buses will use the street.

3. Use ½ inch dense ACP, PG 64-22. Place in two 2-inch lifts.

4. Use ¾"-0 or 1"-0 dense graded base aggregate meeting the requirements of ODOT 00641. Thickness may need to be increased to 12 inches or more for constructability in areas of soft or wet subgrade. Geotechnically designed wet weather sections that are less than the minimum prescribed city standard wet weather section shall require subgrade testing. Subgrade testing shall be done to reflect the assumed conditions by the geotechnical design and report for compliance.

5. Use 1½"-0 dense graded aggregate meeting the requirements of ODOT 00331.

6. Use Class 4000, 1½" paving concrete.

7. Use epoxy coated, 1.25-inch diameter by 18-inch long smooth circular steel dowel bars at 12-inch spacing along all transverse joints. Bars should be coated with a bond breaker to be approved by the Engineer.

230. Roadway Design

A. All roadways shall be designed in accordance with the guidance provided in the current edition of *A Policy on Geometric Design of Highways and Streets*, except as modified by this section.

230.1. Horizontal Alignment

A. Centerline alignment of improvements should be parallel to the centerline of right-of-way.

B. Horizontal curves shall meet the minimum radius requirements shown in Table 230.1.

C. Reversing horizontal curves shall be separated by at least 50 feet of tangent (100 feet on Arterials).

D. Horizontal curves shall be designed using a maximum superelevation rate of 4 percent (e_{max}=4%). See Subsection 230.4 for superelevation standards.

Table 230.1 – Minimum Curve Radii

Design Speed (MPH)	Friction Factor (F)	Minimum Curve Radius (ft.) for Various Cross Slopes			
		(e) – 2.5%	(e) 0%*	(e) 2.5%*	(e) 4%*
15	0.330	50	45	45	40
20	0.300	100	90	85	80
25	0.252	185	165	150	145
30	0.221	305	275	245	230
35	0.197	475	415	370	345
40	0.178	700	600	525	490
45	0.163	980	830	720	665

*Use of superelevation requires City approval.

230.2. Horizontal Transitions

A. Street width transitions shall be designed according to Figure 230.1.

B. For street width transitions from a wider width to a narrower width, the length of transition taper shall be determined as follows:

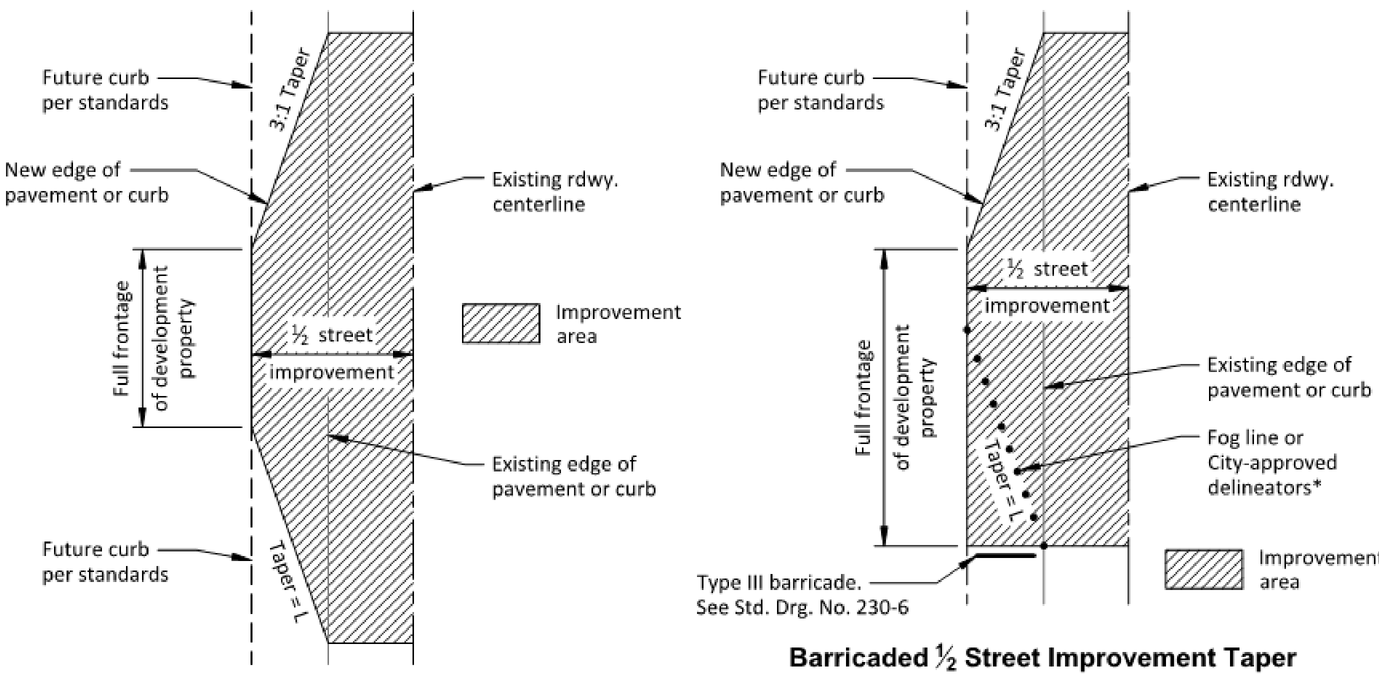
$$L = S \times W \qquad (\text{if } S \geq 45)$$

$$L = \frac{W \times (S)^2}{60} \qquad (\text{if } S < 45)$$

L = minimum length of taper (feet)
S = design speed (MPH)
W = shift distance (feet)

C. Street width transitions from a narrower width to a wider width shall be designed with a 3:1 minimum taper.

Figure 230.1 – Street Width Transitions



Standard ½ Street Improvement Taper

Barricaded ½ Street Improvement Taper

*Maximum spacing of delineators shall be the numerical value of the design speed (for example 35' spacing for 35 mph)

230.3. Vertical Alignment (Profiles)

A. Vertical alignments shall meet the following requirements:

1. Minimum street grades shall be 0.5 percent.
2. Grade changes of 1 percent or more shall be accomplished with vertical curves.
3. Minimum vertical curve length is 25 feet.
4. Grade breaks shall be separated by a minimum of 50 feet.

B. When new streets are built adjacent to or crossing drainage ways, the finish grade shall be designed a minimum of 1 foot above the 100-year flood plain as identified in the most current National Flood Insurance Rate Maps (FIRM) and the Flood Insurance Study.

C. Vertical curves shall conform to the values found in Table 230.2.

Table 230.2 – Design Control for Crest and Sag Vertical Curves

Design Speed (MPH)	Minimum Rate of Vertical Curvature (K)	
	Crest	Sag*
15	3	10
20	7	17
25	12	26
30	19	37
35	29	49
40	44	64
45	61	79

*Values are for roadways where street lighting is not present. The City may accept a lower K value for sag vertical curves if the roadway design includes lighting. The Engineer shall provide calculations for sag curve K values based on lighting.

D. Drainage affects the design of vertical curves on curbed roadways, as a level point may occur at the crest or sag. All vertical curves shall be sharp enough so that a minimum grade of 0.30 percent is provided within 50 feet of the level point.

230.4. Cross-slope and Superelevation

A. Roadway cross-slope shall be no less than 2 percent and no greater than 4 percent.

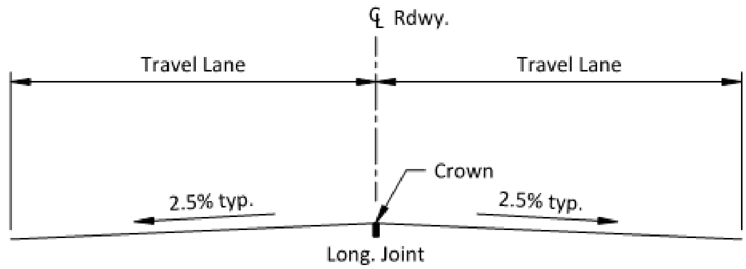
B. The use of superelevations is subject to approval by the City.

C. Stormwater runoff from outside the right-of-way shall be controlled to prevent concentrated crossflow in superelevated roadway sections.

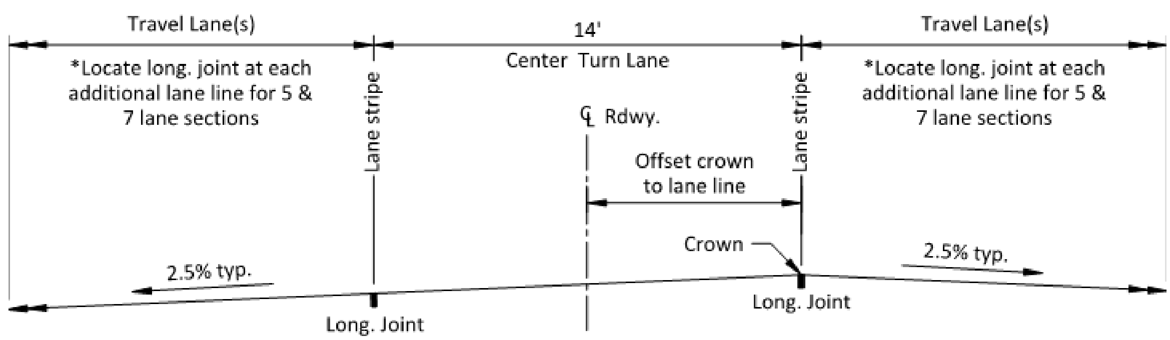
D. Street grades, intersections, and superelevation transitions shall be designed to prevent concentrations of stormwater from flowing across the travel lanes.

E. On PCC roadways with an odd number of lanes, the crown shall be offset to a lane line to prevent locating a joint in the middle of a traffic lane. See Figure 230.2.

Figure 230.2 – Offset Crown on Concrete Roadways



2 Lane Roadways



3, 5 and 7 Lane Roadways

230.5. Intersections

A. The interior angle at intersecting streets shall be as near to 90 degrees as possible and shall be no less than 75 degrees. A straight horizontal alignment (no curves, no angle points) shall be used through the intersection and for a minimum of 25 feet on each side of the intersecting right-of-way centerlines.

B. At stop-controlled intersections, the crown of the major (higher classification) street shall continue through the intersection. The cross-slope of the minor street shall flatten to match the longitudinal grade of the major street. A grade break of 5 percent or less may be allowed in the profile of the minor street as it crosses the crown of the major street. At intersections where both streets have the same functional classification, the City will either determine the controlling roadway or require the intersection be designed according to Subsection 230.5.C.

C. At signalized intersections, and at intersections which may be signalized in the future, the cross-slope of the major roadway shall be such that the profiles of both roadways meet all the requirements of Subsection 230.3 through the intersection.

D. Roadways intersected by streets not constructed to full standards shall be designed to match both the present and future vertical alignments of the intersecting street. The requirements of this manual shall be met for both present and future conditions.

E. Minimum curb radii at intersections are shown in Table 230.3. The right-of-way radii at intersections shall be sufficient to maintain at least the same right-of-way to curb distance as the lower classified street.

F. Curb ramps shall be provided for all directions at each corner of every intersection. See Subsection 230.10 for curb ramp standards.

G. Maximum intersection spacing (block length) shall be 1,000 feet for Arterials and 400 feet for Collectors.

Table 230.3 – Minimum Curb Radii at Intersections

Functional Classification	Minimum Curb Radius (ft.)	
	Residential	Commercial & Industrial
Arterial	40	40
Collector	30	40
Neighborhood Route	25	40
Local Road	25	40
Alley	25	-

NOTES TO TABLE 230.3:

1. If streets with different functional classifications intersect, use the larger radius.
2. If an on-street parking, bike lane , and/or cycle track exists, then the curb radius shown may be reduced by five feet.
3. Based on project-specific factors, the City may require a truck turning analysis to determine the curb radius. In such cases, the required radius may be larger than what is shown.

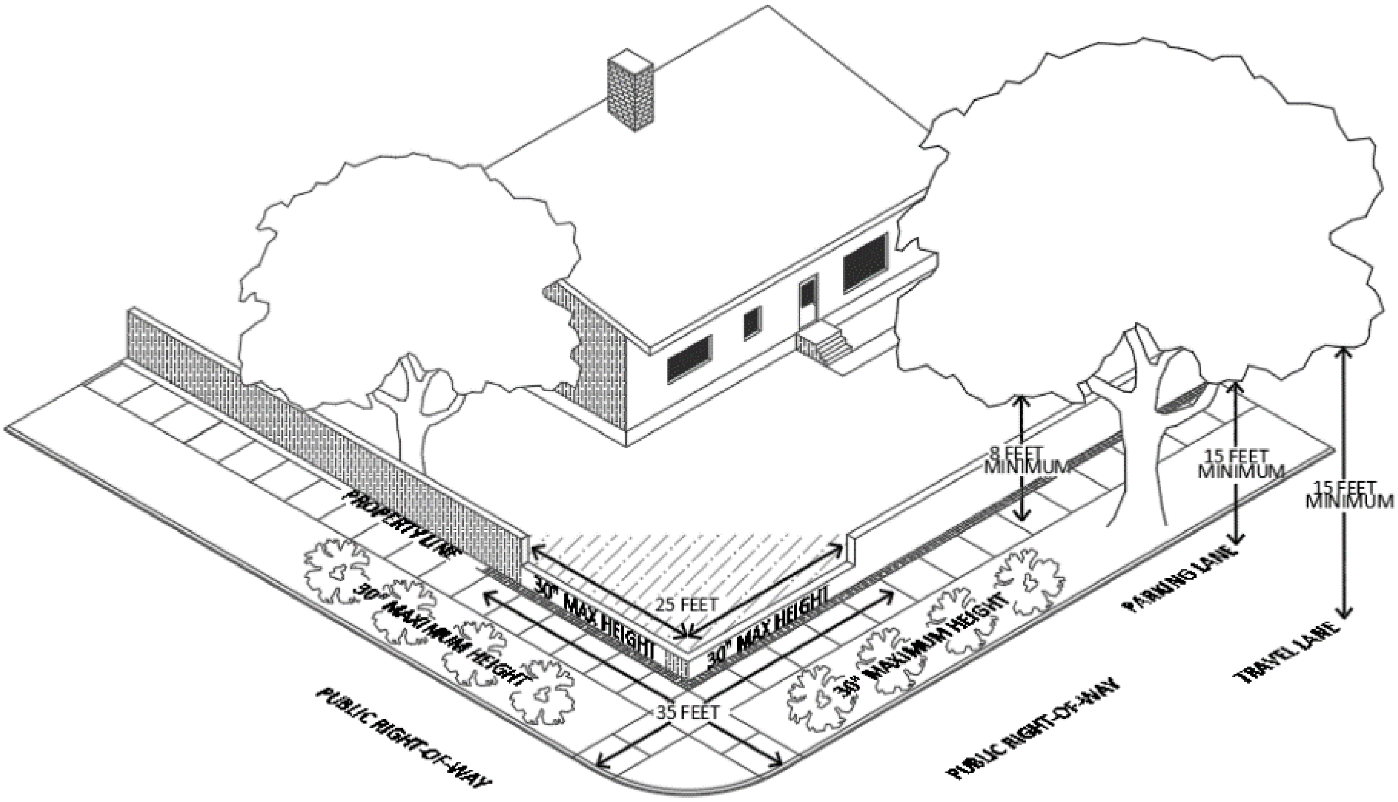
230.5.1. Visibility at Intersections (Sight Distance)

A. The Engineer shall evaluate safe intersection sight distance using the principles and methods recommended by AASHTO. This policy shall apply to the design of new streets and driveways, and to the placement of any object located within or behind the public right-of-way.

B. No object taller than 30 inches, or plant capable of growing taller than 30 inches, shall be placed within a sight clearance area. Poles, tree trunks, and similar objects less than 12 inches in diameter may be allowed in the sight clearance area if it can be shown that such obstructions do not prevent the continuous view of the vehicle approaching on the intersecting street.

C. Where new development occurs, sight distance requirement areas shall be shown on the plat and construction plans as Permanent Vision Clearance Easements.

Figure 230.3 Intersection Sight Clearance Area



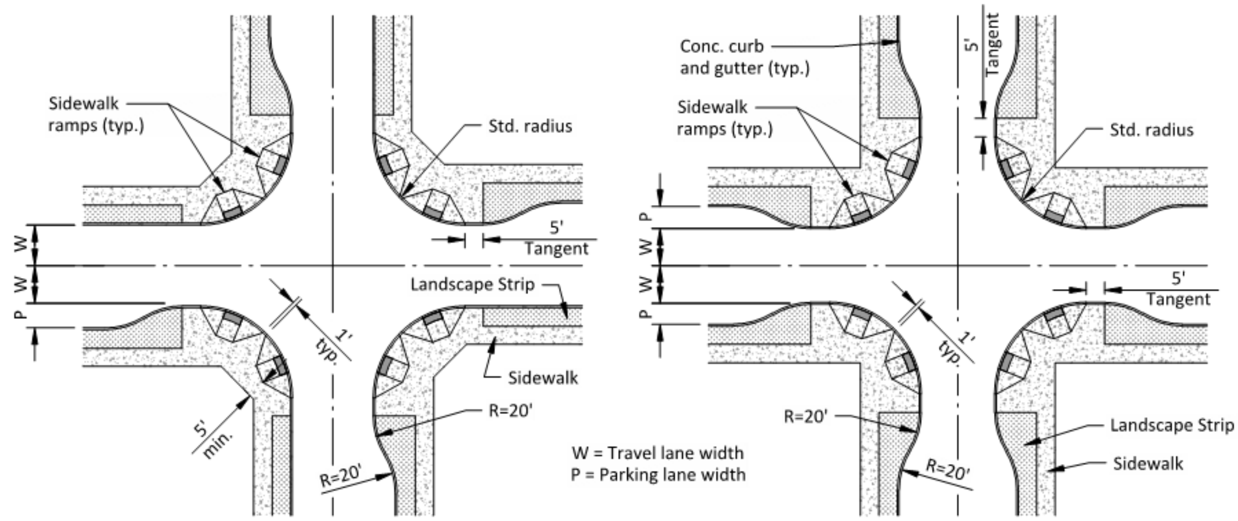
NOTES TO FIGURE 230.3:

1. 8 foot minimum vertical clear zone over entire width of sidewalk.
2. 15 foot minimum vertical clear zone over entire parking lane (when applicable).
3. 15 foot minimum vertical clear zone over entire travel lane.
4. Clear zone triangles be per AASHTO sight distance requirements at intersections for alleys.

230.5.2. Curb Extensions (Bulb-outs)

A. Curb extensions (bulb-outs) shall meet the requirements shown in Figure 230.4.

Figure 230.4 - Curb Extensions (Bulb-outs)



Parking on One Side

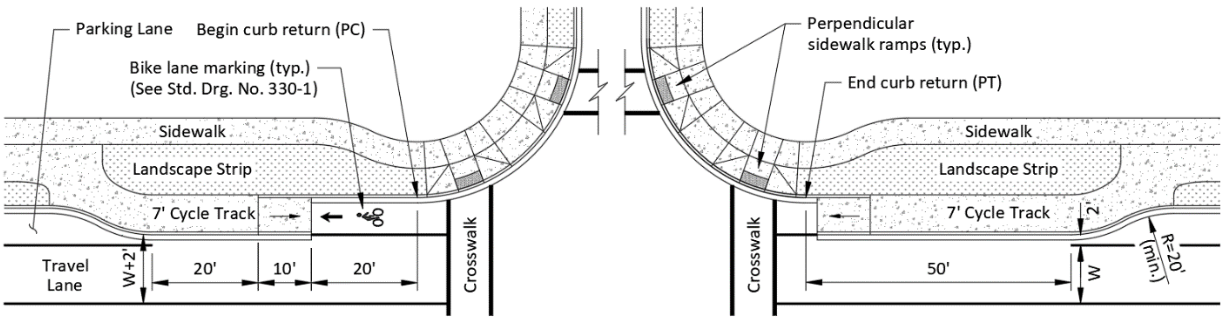
Parking on Both Sides

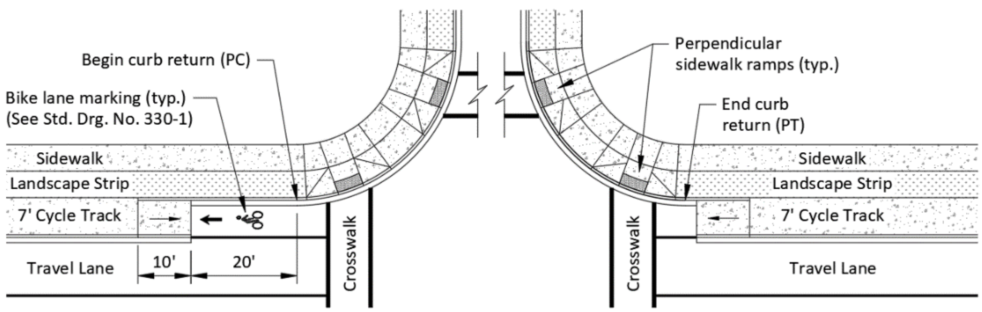
230.5.3. Raised Cycle Track Transitions

A. Raised cycle track transitions shall meet the requirements shown in Figure 230.5.

B. For raised cycle track standards and criteria, see Subsection 230.11.B.

Figure 230.5 – Raised Cycle Track Transitions





230.6. Driveways

A. Driveways are not permitted on streets with an existing or proposed non-access reserve strip.

B. All driveways shall have a minimum width of 9 feet. The maximum width of driveways shall be 30 feet for residential, and 50 feet for commercial and industrial.

C. There shall be a minimum 25 feet long full-height curb between driveways on the same lot and a minimum 2 feet long full-height curb between adjacent driveways on separate lots.

D. Concentrated surface runoff from industrial or commercial sites is not allowed to flow over sidewalks and pedestrian routes onto a public roadway.

E. Driveways shall meet intersection sight distance requirements. See Subsection 230.5.1.

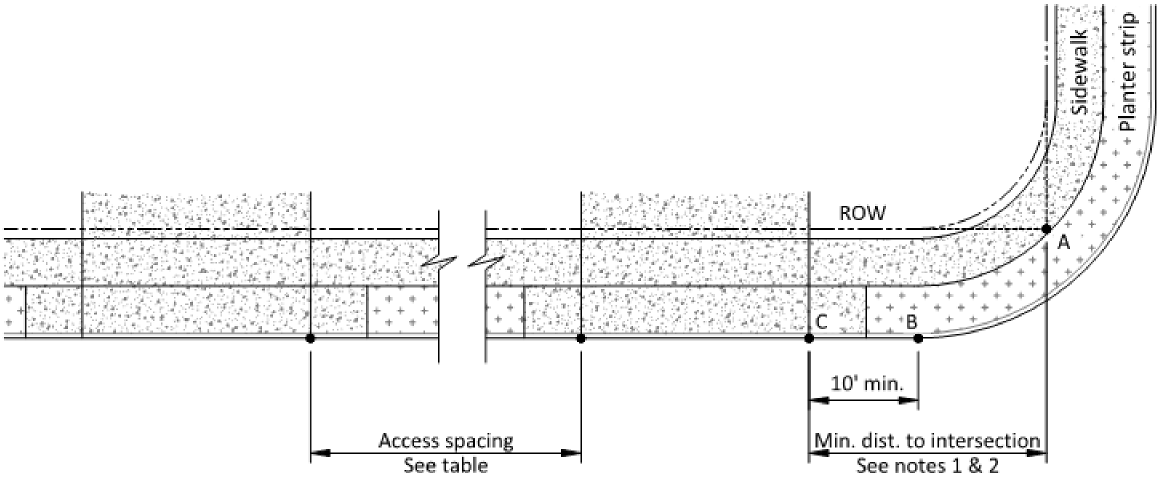
F. New single-family residential driveway shall have no direct access to a Collector or Arterial unless there is no other alternative.

G. On Collectors and Arterials, limit the number of access points by using shared driveways where possible.

H. Driveway spacing shall meet the requirements shown in Figure 230.6.

I. Driveway slopes shall meet the requirements shown in Figure 230.7.

Figure 230.6 - Driveway Spacing



Functional Classification	Min. Spacing
Arterial	600 ft
Collector	300 ft
Neighborhood Route	See Subsection 230.6.C.
Local Road	See Subsection 230.6.C.
Alley	See Subsection 230.6.C.

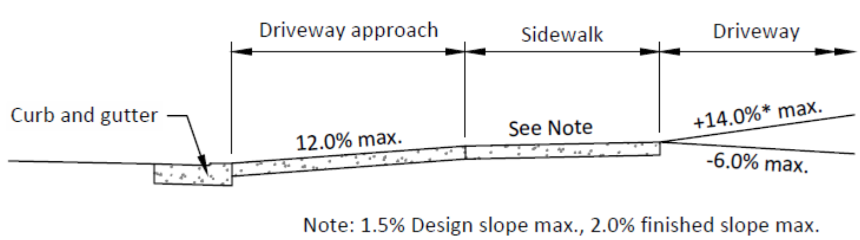
NOTES TO FIGURE 230.6:

1. The edge of driveway (Point C) shall be located no less than 100 feet from the point of intersection (Point A) of right-of-way lines at intersection with Collector or Arterial.

2. The edge of driveway (Point C) shall be located no less than 25 feet from the point of intersection (Point A) of right-of-way lines at intersection with Local Road.

3. The edge of driveway (Point C) shall be located no less than 10 feet from the point of curvature of the curb (Point B) adjacent to any intersection.

Figure 230.7 - Driveway Slopes



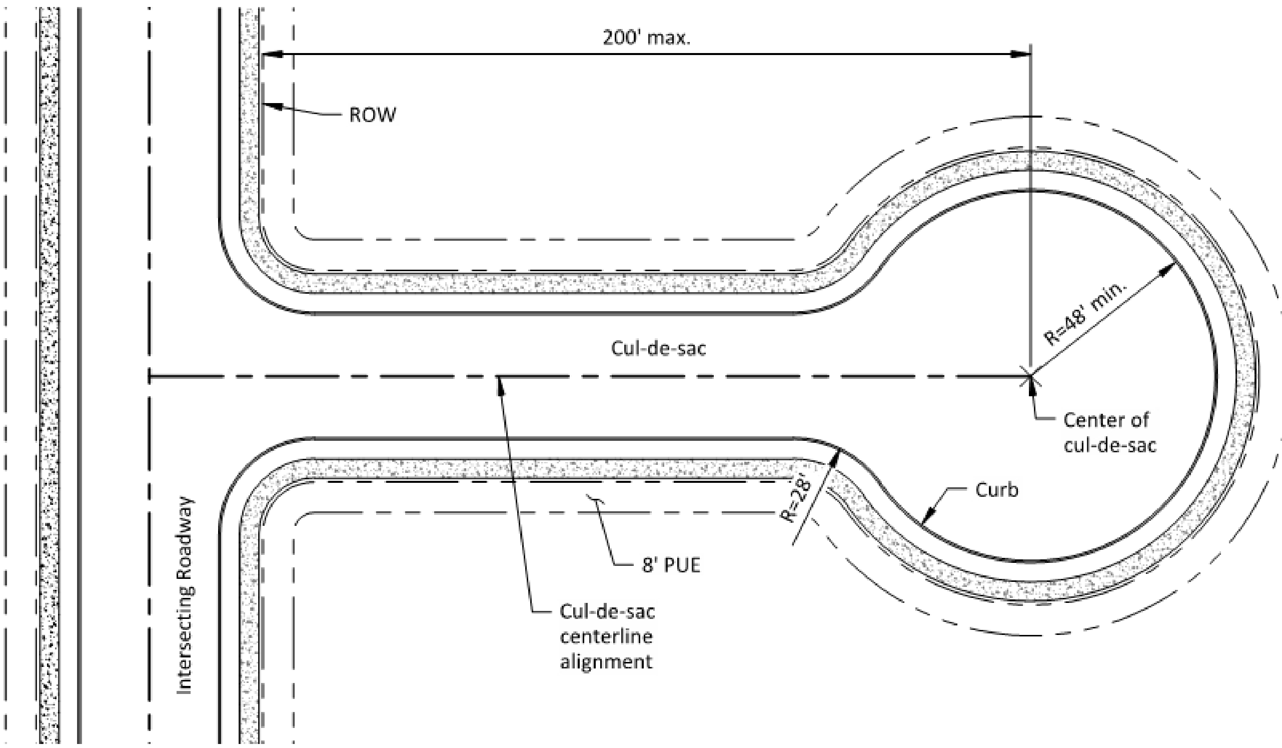
*10% max. where required for fire access.

230.7. Cul-de-sacs, Eyebrow Corners, and Turnarounds

A. Cul-de-sacs shall meet the requirements shown in Figure 230.8.

B. Eyebrow corners shall meet the requirements shown in Figure 230.9.

Figure 230.8 - Standard Cul-de-sac

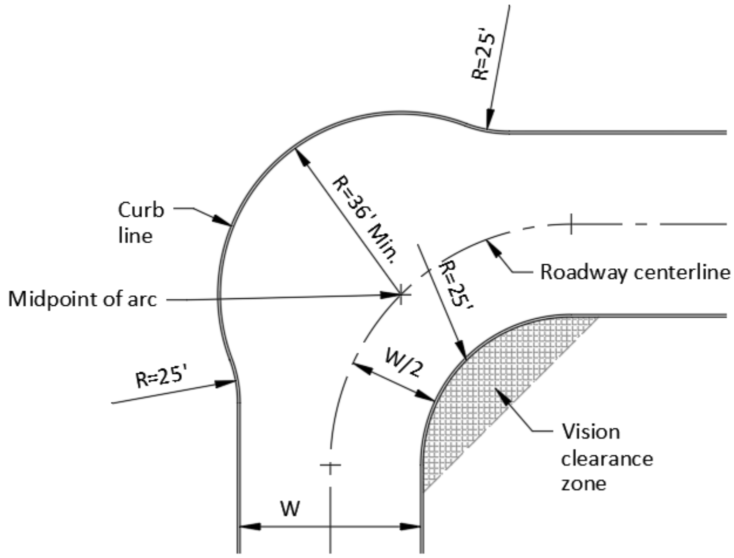


NOTES TO FIGURE 230.8:

1. Cul-de-sacs are only allowed on Local Roads.

2. Sidewalk, landscape strip, ROW, and easement widths shall remain consistent around the full perimeter of the cul-de-sac and shall be in accordance with Subsection 210.2.

Figure 230.9 - Standard Eyebrow Corner



NOTES TO FIGURE 230.9:

1. Eyebrow corners may be used only on Local Roads where expected ADT will not exceed 500 vehicles per day.
2. Eyebrow corner geometry shall be evaluated on the basis of turning requirements for the Fire Department vehicles.
3. Eyebrow corners shall meet AASHTO requirements for minimum stopping sight distance.

C. Turnaround geometry shall be evaluated on the basis of turning requirements for the Fire Department vehicles. Turnaround geometry details must be in accordance with Oregon Fire Code with City of Hillsboro amendments. Turnarounds are only allowed on Local Roads.

230.8. Raised Medians

A. The style and design of the raised median shall be site-specific and is subject to City approval. Use of raised median(s) will require a predesign meeting with the COH to determine the design requirements and conditions to apply to medians.

B. The raised median shall be safe for the design speed.

C. Raised medians shall be set back at least 2 feet from the travel way on both sides for roadways with speeds of 35 MPH or higher. For speeds less than 35 MPH, a 1 foot set back shall be used.

D. Street lighting shall be sufficient to provide illumination of the raised median.

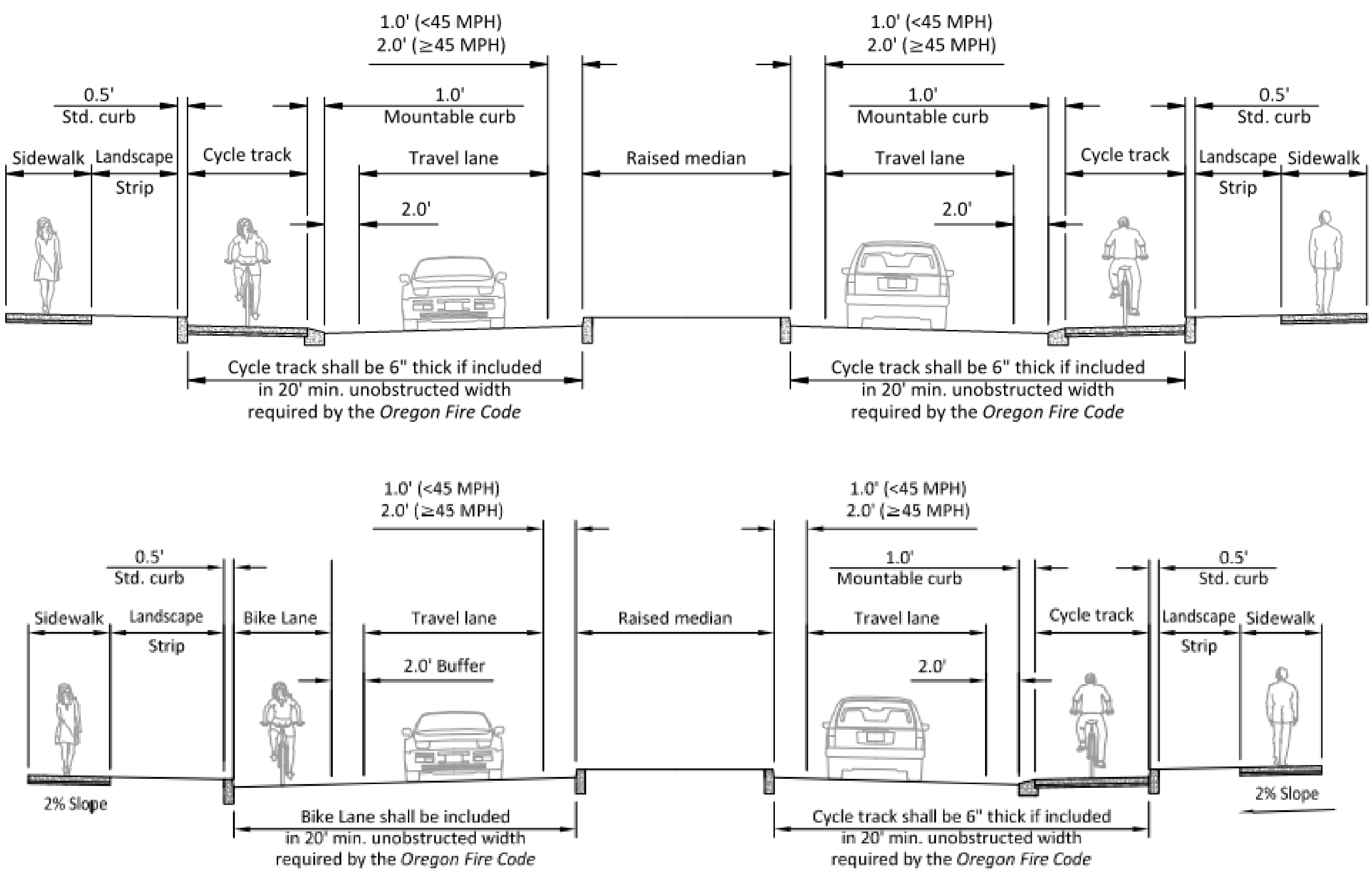
E. Objects in the median, such as trees, shrubs, signs, and light poles, shall not physically or visually interfere with vehicle or pedestrian traffic.

F. Concrete raised medians on concrete streets shall be constructed in accordance with ODOT standard drawing RD705. The pavement panel shall extend under the median and the median shall be placed on top of the pavement panel.

G. Raised medians containing vegetation require a private maintenance agreement between the City and the Developer/Owner.

H. An unobstructed width of not less than 20 feet (26 feet where the adjacent property requires the Fire Department to use an aerial apparatus) is required per the Oregon Fire Code. Street design shall include mountable curbs and 6" thick concrete cycle tracks when the cycle track is included in the unobstructed width.

Figure 230.10 - Typical Roadway Section with Cycle Track and Raised Median



Typical Roadway Section with Cycle Track and Raised Median

I. Continuous raised medians greater than 550 feet shall have an unobstructed median cut through no less than 50 feet in length. The median cut through length(s) shall be included in the continuous raised median length. These median cut through(s) shall:

1. Be installed approximately every 600 feet and located/adjusted to be consistent with intersections or accesses designated within the Transportation System Plan (TSP) and Community Development Code.

2. Conditions where a median is required for a single lane facility that does not provide width for a cycle track or bike lane shall provide an unobstructed median cut through length no less than 50 feet and shall be installed at 300 foot intervals that are consistent with the TSP and Community Development Code.

3. Be located as close as possible to fire hydrant locations when possible.

4. If a median location is in conflict with the TSP or Community Development Code, the median cut through may be relocated and approved by both City of Hillsboro Public Work Traffic Engineering Section and City of Hillsboro Fire Department.

230.9. Curbs

A. All streets shall include standard curb and gutter on both sides.

B. Mountable curbs may be allowed under the following conditions, and as approved by the City.

1. The street is a residential Local Road; and

2. The frontages of the lots are 45 feet or less; and

3. A storm sewer lateral is provided to each lot in lieu of a curb drain; and

4. The mountable curb is proposed at the time of land use application and is approved as part of the process.

C. When new curb is being constructed, a stamp shall be impressed on the top of the curb to mark where each water, sanitary, storm, or private irrigation line crosses. Impressions shall be 2 inches high and shall accurately locate the service directly below the stamp. The impression for a water line shall be the letter “W”, for a sanitary line it shall be the letter “S”, for a storm line it shall be the letter “D”, and for an irrigation line it shall be the letters “IR”. A note shall be placed on the approved construction plans indicating this requirement.

230.10. Pedestrian Access Routes

A. Sidewalks

1. Sidewalks shall be at least 5 feet wide and separated from the curb by a landscape strip as indicated in Subsection 210.2 and Std. Drg. No. 230-4.

2. Where clustered mailboxes, transit shelters, benches, or any other objects are within a sidewalk, the walk shall be widened to provide clearance equal to ADA minimum requirements. See Std. Drg. No. 230-5.

3. Sidewalks should be kept free of utility structures and other encroachments by locating such structures behind the sidewalk, in the landscape strip, or in the PUE. If a utility structure must be located in the sidewalk, it shall be installed flush with the sidewalk and have a non-skid walking surface rated for pedestrian traffic and meeting the requirements listed in PROWAG.

4. Maximum designed cross-slope shall be 1.5 percent, finished maximum slope shall be 2.0%.

5. Sidewalks locations where crossing is prohibited must ensure that there is no crosswalk or curb ramp, and that the pedestrian access route is separated from the roadway. Crosswalk Closed signs may be required.

B. Curb Ramps

1. Curb ramps shall be a minimum of 5 feet in width and be designed and constructed in accordance with Title III of the Americans with Disabilities Act of 1990 (ADA) and the *Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way* (PROWAG).

2. All existing curb ramps abutting a street overlay or pavement reconstruction project shall be brought into compliance with ADA and PROWAG requirements for curb ramps.

3. Curb ramps located within marked (striped) crossings shall be wholly within the crossing, excluding the flared wings.

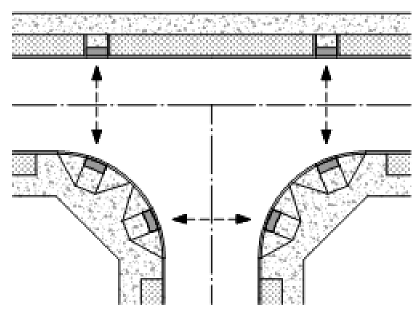
4. Two directional curb ramps shall be provided at each street corner.

5. At Tee intersections, the “cross-bar” of the tee shall have two crossings equipped with curb ramps. All Tee intersections shall have at least six curb ramps, with two curb ramps on each corner of the intersection. See Figure 230.11.

6. See ODOT RD 900 series of standard drawings for curb ramp details.

7. Maximum designed ramp slope shall be 7.5 percent, finished maximum slope shall be 8.3 percent. All curb ramps shall be graded to drain toward the roadway.

Figure 230.11 – Curb Ramps at Tee Intersections



8. For curb ramp plan requirements, see Subsection 120.3.8.

C. Detectable Warning Surfaces

1. Detectable warning surfaces (truncated domes) shall be black.

2. Where a detectable warning surface is wet set, provide 1 inch to 2 inch wide concrete border on all sides of detectable warning surface tile.

D. Crosswalks

1. Crosswalk locations shall meet the requirements in ORS 801.220.

2. Marked crosswalks shall be provided at crossings that are protected by a traffic signal. Marked crosswalks may be provided at other locations only when approved by the City.

3. Pedestrian access routes through Medians and Pedestrian Refuge Islands within a crosswalk shall be a minimum of 60 inches wide. If a shared use path crosses through a Median or Pedestrian Refuge Island, the clear width of the pedestrian access route shall

be a minimum of 60 inches or the at least as wide as the crosswalk, whichever is greater.

4. Where a pedestrian access route is contained within a crosswalk, the grade of the pedestrian access route shall be 5.0% maximum.

5. The maximum cross slope of a crosswalk at a stop controlled intersection is 2.0%

6. The maximum cross slope of a crosswalk that is at a non-stopped controlled intersection is 5.0%.

7. The maximum cross slope of a crosswalk at a mid-block intersection shall not exceed the slope of the roadway.

230.11. Bicycle Facilities

A. Bicycle facilities shall be provided in accordance Section 200 based on the typical sections per the roadway functional classification or as directed by conditions of approval.

B. Raised Cycle Tracks

1. Raised cycle tracks shall be 7 feet wide (not including curb) and have a designed cross-slope of no more than 1.5 percent. Finished maximum slope shall be 2.0 percent. See Std. Drg. No. 230-4.

2. Minimum spacing between potential conflict points, such as driveways, alleys, and at grade street crossings, shall be 200 feet.

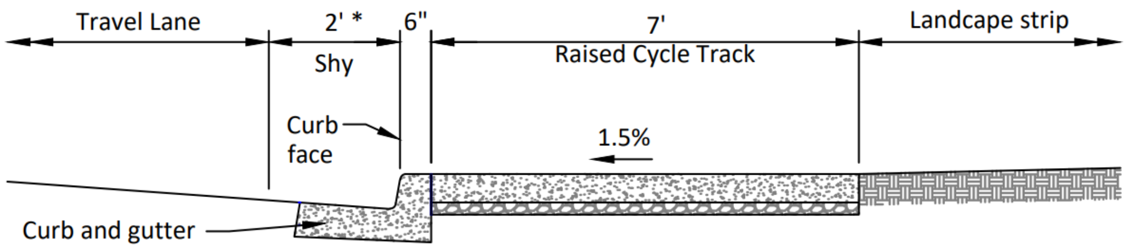
C. Buffered Bike Lanes and Bike Lanes

1. Subject to City approval, a buffered bike lane or bike lane alternative design may be used in place of the standard raised cycle track when warranted by site-specific constraints. See Figure 230.12.

2. Buffered bike lanes shall be a minimum 5 feet wide with an additional 2 foot wide buffer and have a designed cross-slope that matches the proposed roadway. See Std. Drg. 330-1 for guidance on buffered bike lane line markings.

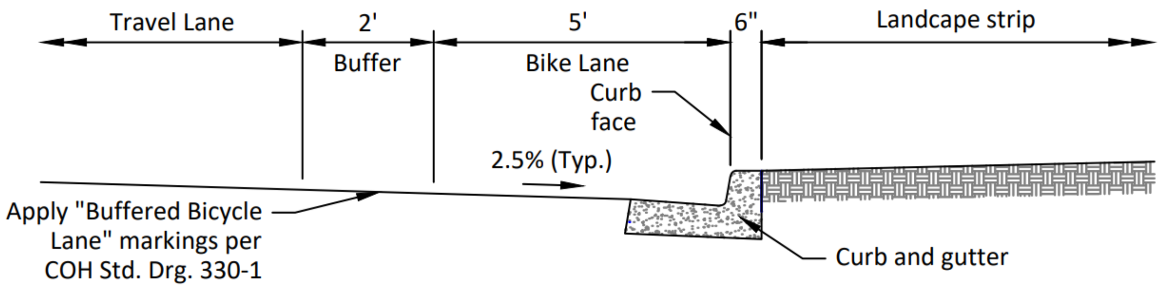
3. Bike lanes shall be a minimum 6 feet wide and have a designed cross-slope that matches the proposed roadway. See Std. Drg. No. 330-1 for guidance on bike lane line markings.

Figure 230.12 – Buffered Bike Lane or Bike Lane Alternative Design



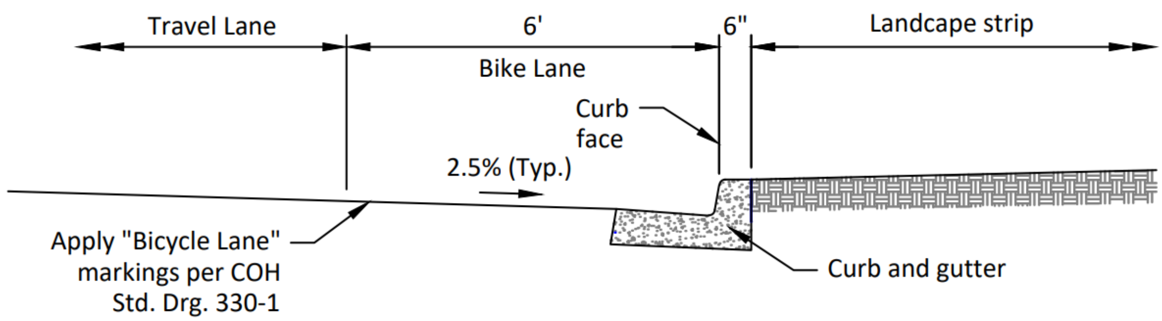
*Eliminate 2' shy dimension when located adjacent to on street parking

Standard Design
Raised Cycle Track



Note:
Buffered bike lane alternative may only be used with prior City approval and the Engineer must demonstrate its necessity.

Alternative Design
Buffered Bike Lane



Note:
Standard bike lane alternative may only be used with prior City approval and the Engineer must demonstrate its necessity.

Alternative Design
Standard Bike Lane

230.12. Grading

A. Collectors and Arterials shall have a maximum 2 percent upward grading to 1 foot behind the sidewalk, and no slope steeper than 6:1 beyond. All public utility easements outside right-of-way shall have maximum slope of 5:1.

B. If side-slope grading is needed beyond the right-of-way and public utility easements to catch the existing grade, a slope easement is required.

C. Retaining walls may be used if side-slopes are greater than the 2:1 requirement in the subsections above or where slope stability is a problem. If side-slopes are to be maintained (mowed) by the City, a maximum of 3:1 slope will be required. Retaining walls shall be constructed to a height where the side-slope is no more than 2:1. Retaining walls must meet vision clearance requirements as identified in Subsection 230.5 and meet all State of Oregon Building Code requirements. A permit will be required from the City's Building Department for retaining and landscape walls 4 feet or higher.

230.13. Stub Streets and Stub Alleys

A. Stub streets and stub alleys (stubs) should only be used where future extensions are planned. An interim turnaround shall be constructed when stubs exceed 50 feet in length and require maintenance access for utilities and street sweepers. Stubs requiring fire, garbage, or local delivery access may be subject to additional requirements. Stubs shall be barricaded and signed per Std. Drg. Nos. 230-6 and 230-7.

240. Transit Stops and Shelters

240.1. General

A. All transit stops, shelters, and associated appurtenances shall be designed and constructed in accordance with the *Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way* (PROWAG).

B. Placement of waste receptacles, signs, seating, or any other appurtenance shall not infringe upon an ADA area or the pedestrian access route as defined by R302 of PROWAG. It must not compromise direct access between the ADA waiting area and the ADA Landing area or access between either ADA area and the sidewalk.

C. Any installation of transit stops, shelters, or associated appurtenances requires issuance of a ROW permit through Public Works.

D. Prior to installation, transit stops, shelters, and associated appurtenances must be evaluated for adequate sight distance by an Engineer.

240.2. ADA Landing Area

A. ADA landing areas shall provide a minimum clear length of 8 feet, measured perpendicular to the curb, and a minimum clear width of 5 feet, measured parallel to the roadway.

B. Where transit stops serve vehicles with more than one car, ADA landing areas serving each car shall comply with this section.

C. Where rear door ADA landing areas are provided, they shall comply with this section.

D. Parallel to the roadway, the grade of ADA landing areas shall be the same as the roadway. Perpendicular to the roadway, the designed grade of ADA landing areas shall be 1.5 percent or less.

E. ADA landing areas shall be connected to streets, sidewalks, or pedestrian circulation paths by ADA accessible pedestrian access routes.

240.3. Clearances

A. All transit stops shall met the standard clearance requirements shown in Table 240.1

Table 240.1 – Transit Stop Standard Clearance Requirements

Description	Requirement
Sidewalk Clearance	Minimum of 5' of sidewalk clearance.
Accessible Pathway	Minimum 5' wide paths between shelter and any utility object.
Road Clearance	2.5' minimum clearance between shelter and edge of curb.
ADA Landing Area	See Subsection 240.2

240.4. Transit Shelters

A. Transit shelter placement and orientation shall provide the following:

1. 5 feet of pedestrian pass-by, including clearance between poles, hydrants and other obstacles.
2. ADA landing area adjacent to bus stop sign and outside of shelter.
3. Clear pathway from the ADA waiting area inside the shelter to the ADA landing area.
4. Clear pathway from the rear door landing area to the pedestrian access route.
5. Interior lighting at the shelter for passenger visibility and security.

B. Transit shelters shall meet the clearance requirements shown in Table 240.2.

Table 240.2 – Transit Shelter Clearance Requirements

Description	Requirement
ADA Waiting Areas in Shelters	A minimum of 2.5’ x 4.0’ space must be kept clear for mandatory waiting area to accommodate mobility devices.
Visibility	Shelter must not block motorist’s or pedestrian’s line of sight.
Building Clearance	Minimum 12 inches from buildings, fences, and other structures to the bus shelter in order to allow room for maintenance.
Relation to Bus Stop	Shelter shall be within 25 feet of the ADA landing Area.
Sight Distance	The shelter shall be placed so that the passengers waiting in the shelter can see approaching vehicles.

240.5. Seating

A. Benches or seats shall not be placed closer than 3.5 feet from the curb, or 6 feet from the curb when a travel lane exists immediately adjacent to the curb.

B. Clearance requirements for shelters apply to seating.

C. Orient seating towards the roadway or in the direction of approaching traffic.

D. Furniture shall be bolted to the sidewalk using stainless steel drop-in anchors sized according to the furniture manufacturer’s recommendations.

240.6. Pavement Requirements

A. Any damage to the sidewalk surface resulting from transit stop related furniture (even in the event of an automobile collision) is the responsibility of the transit authority to repair.

B. Sidewalk repairs must be completed according to Subsection 230.10.

C. In roadway areas where buses start, stop, or turn, or along roadways with high bus volumes, the following requirements shall be met:

1. On roads carrying more than 150 buses per day, concrete pavement shall be used.
2. A reinforced concrete pad shall be provided at high-volume bus stops and bus pullouts.

240.7. Standard Transit Stop Configurations

A. Standard transit stop configurations are shown in Figures 240.1 through 240.3.

Figure 240.1 - Curb-tight Sidewalk with Bus Shelter

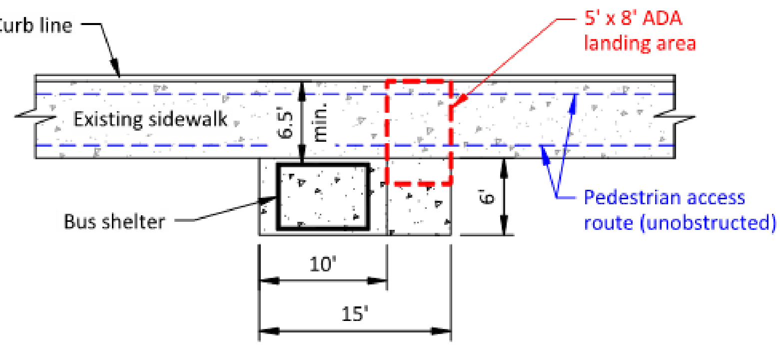


Figure 240.2 - Separated Sidewalk with Rear Door Landing Area

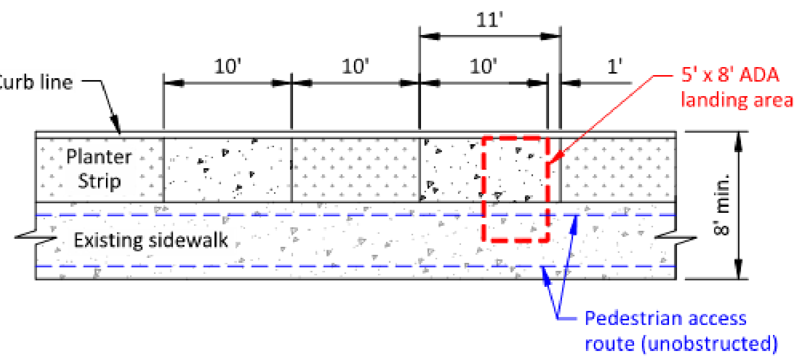
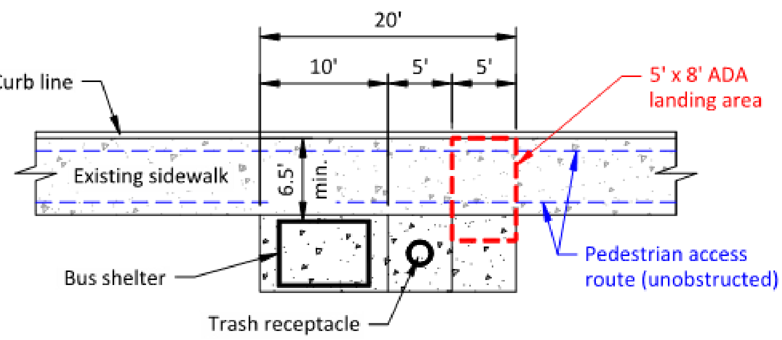


Figure 240.3 - Curb-Tight Sidewalk with Shelter and Waste Receptacle



250. Roadway Repairs

A. Street cuts are not allowed on new streets or streets overlaid within the last 5 years unless approved by the city. See Std. Drg. No. 250-1.

B. Asphalt street cuts and pavement restoration shall comply with Std. Drg. No. 250-2.

C. Portland cement concrete (PCC) repair shall comply with Std. Drg. No. 250-3.

D. Temporary steel plating shall comply with Std. Drg. No. 250-4.

E. Temporary pavement patching shall meet the following requirements:

1. Pavement restoration shall be as required by this section and the approved plans. After the trench has been backfilled, the pavement may be patched temporarily. Pavement repairs made in emergency situations will be considered temporary and must be restored in accordance with the requirements for permanent pavement restoration. AC pavement shall conform to the standards outlined in Subsection 220.

2. Permanent replacement of pavement, curb-and-gutter, sidewalk and driveway cuts shall be completed within 5 working days from the completion of the utility work.

3. Hot mix temporary trench patching shall be in place at the end of every workday.

4. Cold mix asphalt shall only be used when hot mix is not available. The compacted thickness of cold mix asphalt shall be at least 2 inches. The contractor shall monitor the patch and maintain a smooth driving surface by promptly correcting any irregularities in the pavement surface that deviate from the proper street grade or cross-section by plus or minus ¼ inch or more. If the temporary patch is not monitored and maintained, or if the temporary patch creates unsafe driving conditions, the City may complete a permanent repair at the contractor's expense.