EXHIBIT A

STREET DESIGN CRITERIA

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Prepared by:

Walker Partners
engineers | surveyors

823 Washington Avenue, Suite 100
Waco, TX 76701
254.714.1402

TBPE No. 8053

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1.0 INTRODUCTION

1.1 Purpose

The purpose of the City of Waco's Street Design Criteria (Criteria) is to provide minimum standards and guidelines for the design and construction of transportation infrastructure within the City and its extraterritorial jurisdiction (ETJ). These Criteria are intended to promote proven engineering and construction principles and practices to ensure safe, sustainable, and maintainable transportation facilities.

The standards set forth herein are based upon the City's historical successes and challenges melded with current-day technology. Reviews of other Texas cities' street and transportation design criteria were conducted to ensure that the City is incorporating modern industry standards into these guidelines. Finally, design manuals published by the American Association of State Highway and Transportation Officials (AASHTO), the Federal Highway Administration, and City of Waco staff have been used as reference documents in preparing this Criteria.

This Criteria is intended to be used by civil engineers employed at the City, consulting engineers retained by the City to design public transportation infrastructure, and consulting engineers designing land development projects within the City and its ETJ. The Criteria establishes fundamental guidance and minimum design standards for transportation facilities; however, the engineer of record is fully responsible for the design of these facilities and the application of the standards presented herein. Further, the Criteria is to be used in conjunction with the City's Standard Details, Standard Specifications for Construction, and City of Waco Code of Ordinances.

1.2 Application

The City of Waco's Street Design Criteria governs the planning, design, and construction of all transportation infrastructure and facilities within the City of Waco and all areas subject to its ETJ.

1.3 Authority

The City has the authority to pass ordinances regulating street design criteria through the subdivision process. These authorizations are provided in Texas Statutes which include the following:

- Home Rule Act: Article 1175;
- Subdivision: Local Government Code 212; Property Code, Section 12.002, Article 974a, Sections 1B, 4A, 9A, and 10 as added by Senate Bill 408, Section 1, Acts of the 70th Legislature.

The City has passed the following ordinances (Codes of Ordinances City of Waco, Texas) which support this Policy:

- Chapter 28 – Zoning, of the Code of Ordinances;
- Appendix B – Subdivisions.

1.4 City of Waco Master Thoroughfare Plan

The City of Waco's Master Thoroughfare Plan (Thoroughfare Plan) shall be reviewed relative to any proposed land development project.

2.0 STREET DESIGN CRITERIA

2.1 Street Classification

The City of Waco's Subdivision Ordinance provides the functional characteristics, descriptions, and definitions for each street classification. These street classifications are to be applied to all land development and street improvement projects within the City and its ETJ and are to be used as the basis for design purposes. Descriptions of the street classifications are summarized below:

A. Arterial Streets

1. Arterial Streets carry traffic from one urban area to another and serve the major activity centers of urbanized areas.

2. Arterial Streets are used for longer urban trips and carry a high portion of the total traffic with a minimum of mileage.

3. Existing and proposed Arterial Streets are designated on the Thoroughfare Plan.

B. Major and Minor Collector Streets

1. Collector Streets carry traffic from Local Streets to Arterial Streets. Collectors are broken down into two categories: Major Collectors and Minor Collectors, regardless of whether they are within a rural area or an urban area.

2. Major Collector routes are longer in length; have lower connecting driveway densities; have higher speed limits; are spaced at greater intervals; have higher annual average traffic volumes; and may have more travel lanes than their Minor Collector counterparts. Major Collectors shall include Neighborhood Collectors, Commercial Collectors, and Industrial Collectors. Major Collectors can serve both land access and traffic circulation in higher density residential, commercial, and industrial areas.

3. Minor Collectors serve both land access and traffic circulation in lower density residential and commercial/industrial areas.

C. Local Streets

1. Local Streets provide direct access to adjacent properties and distribute traffic to and from residences.

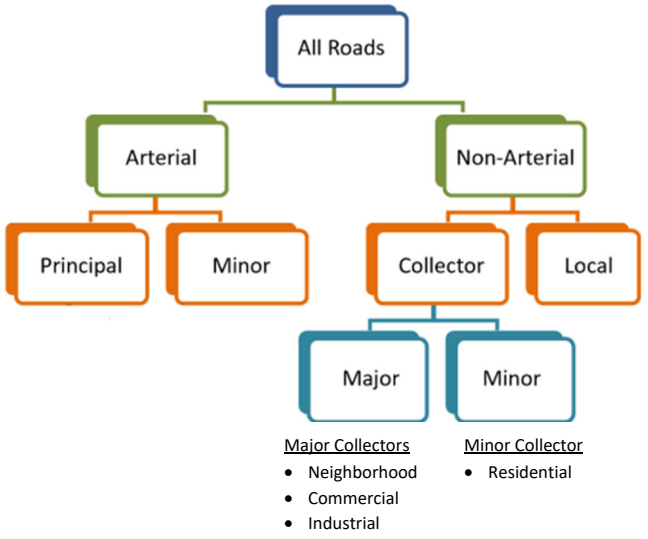
2. Local Streets are short in length and non-continuous to discourage through traffic.

3. A Local Street is used primarily for access to residential properties. Local Streets also provide secondary or minor access and circulation to community facilities (schools, parks, etc.) and other traffic generators such as commercial and industrial areas.

D. Local/Rural Residential Streets

1. Local/Rural Residential Streets designed to serve single-family homes on lots 43,560 square feet or larger, with a minimum frontage requirement of 150', are allowed to use rural street cross-sections with roadside drainage ditches. Local/Rural Street sections shall require ribbon curbs.

This classification system is consistent with the Federal Highway Administration's "Highway Functional Classification" as shown below in Figure 2-1, "Functional Classification Tree."



Source: FHWA and CDM Smith

Figure 2-1
Functional Classification Tree

2.2 Geometric Design Criteria

The minimum right-of-way widths for each street classification is prescribed in the City's Subdivision Ordinance. For collector streets (residential, commercial, and industrial), the minimum right-of-way widths are intended for those rights-of-way and street segments that do not contain turn lanes, deceleration lanes, acceleration lanes, or medians. Therefore, streets that include any of the aforementioned features will have increased right-of-way widths to accommodate such.

A. Street Widths

1. Local Streets. The width of Local Streets shall be thirty (30) feet face-of-curb to face-of-curb or thirty-one (31) feet back-of-curb to back-of-curb for standard curb and gutter. Local Streets with mountable curbs (per the Standard Details) shall be thirty-four (34) feet back-of-curb to back-of curb.

2. Local/Rural Residential Streets. The width of Local/Rural Residential Streets shall be twenty-eight (28) feet from outside edge to outside edge of the ribbon curbs.

3. Residential Collector Streets. Residential Collector Streets shall be thirty-nine (39) feet from face-of-curb to face-of-curb or forty (40) feet from back-of-curb to back-of-curb and shall consist of two (2) driving lanes.

4. Neighborhood Collector Streets. Neighborhood Collector Streets shall be forty-eight (48) feet from face-of-curb to face-of-curb or forty-nine (49) feet from back-of-curb to back-of-curb and shall consist of four (4) driving lanes, two (2) in each direction. Turn lanes, deceleration lanes, acceleration lanes, and medians will dictate greater pavement widths accordingly.

4. Commercial Collector Streets. Commercial Collector Streets shall be a minimum of forty-eight (48) feet from face-of-curb to face-of-curb or forty-nine (49) feet from back-of-curb to

back-of-curb and shall consist of four (4) driving lanes, two (2) in each direction. Turn lanes, deceleration lanes, acceleration lanes, and medians will dictate greater pavement widths accordingly.

5. Industrial Collector Streets. Industrial Collector Streets shall be a minimum of forty-eight (48) feet from face-of-curb to face-of-curb or forty-nine (49) feet from back-of-curb to back-of-curb and shall consist of four (4) driving lanes, two (2) in each direction. Turn lanes, deceleration lanes, acceleration lanes, and medians will dictate greater pavement widths accordingly.

6. Arterial Streets. Due to the unique function and characteristics of Arterial Streets, right-of-way widths, street widths, number of travel lanes, etc. shall be determined by the Director of Public Works, or Designee, or by way of an approved Traffic Impact Analysis (TIA).

B. Street Grades

1. Maximum Allowable Street Grades

The maximum allowable grades for streets within the City of Waco and its ETJ are specified in Table 2-1 as a function of street classification and design speed. Design speed is the maximum speed at which the motor vehicle can safely travel on a street based on its horizontal and vertical geometry.

Table 2-1
Maximum Street Grades

STREET CLASSIFICATION	DESIGN SPEED (MPH)	MAXIMUM GRADE (%)
Local	25	11
Local (Rural Residential)	25	11
Minor Collector (Residential)	30	10
Minor Collector (Rural)	30	8
Minor Collector (Commercial)	30	8
Major Collector (Neighborhood)	30	8
Major Collector (Commercial)	35	8
Major Collector (Industrial)	35	8
Arterial Streets	TBD*	TBD*

*Arterial Street shall be designed by a Professional Engineer registered in the State of Texas and submitted to the Director of Public Works, or Designee, for approval.

2. Minimum Allowable Street Grades

The minimum allowable street grade for all streets with standard curb and gutter, integral curb, or mountable curb shall be 0.5 percent (0.005 ft/ft); gutter grades for cul-de-sacs and “elbows” shall also be a minimum of 0.5 percent (0.005 ft/ft).

C. Vertical Curves

Parabolic vertical curves shall be used whenever the algebraic difference of the street grades (grade breaks) exceed 0.8 percent in order to effect gradual changes between different street grades. Vertical curves are either “crest” curves or “sag” curves and should result in a design that enables the driver 1) to see the road ahead; 2) to stop if necessary, within a safe distance; and 3) are adequate for drainage. The major design control for “crest” vertical curves is the provision of ample stopping sight distance for the given design speed.

For “sag” vertical curves, stopping sight distance is important at night on unlit streets with regards to the driver’s limited ability to see beyond the vehicle’s headlights. Otherwise, driver comfort is an important consideration in “sag” vertical curves where gravitational and vertical centripetal

forces act in opposite directions. Appearance is also a consideration in that a long curve is more aesthetically pleasing than a short one; however, excessively long curves should be avoided to prevent overly flat street grades flanking the low point. Gutter profile grades must be at least 0.5 percent flanking the low points of all "sag" vertical curves.

1. Vertical Curve Lengths

   Minimum lengths of crest vertical curves are based upon stopping sight distance criteria as prescribed in AASHTO's Policy on Geometric Design of Highways and Streets (AASHTO Policy) which are satisfactory from the standpoint of safety, site distance, comfort, and appearance.

   Similarly, design lengths of sag vertical curves based upon 1) headlight site distance, 2) passenger comfort, 3) appearance, and 4) drainage considerations.

   The minimum length of vertical curves shall be based upon the "minimum rate of curvature" (K) times the algebraic difference in grades (percent) as expressed in Equation 2-1.

   $$L = KA \qquad \textbf{(Equation 2-1)}$$

   Where: L = Minimum Length of Vertical Curve in feet (ft)

   K = Rate of Vertical Curvature, dimensionless

   A = Algebraic Difference in Grades, percent (%)

   The minimum K-values and design controls published in the Policy to be used for the design of vertical curves are shown in Table 2-2.

Table 2-2
Design Controls for Vertical Curves

DESIGN SPEED (MPH)	STOPPING SIGHT DISTANCE (FT)	RATE OF VERTICAL CURVATURE, K	
		K_{CREST}	K_{SAG}
25	155	12	26
30	200	19	37
35	250	29	49
40	305	44	64
45	360	61	79

Source: AASHTO Policy

D. Minimum Horizontal Centerline Radii

In accordance with the guidelines outlined in the AASHTO Policy, horizontal curvature for "low-speed urban streets" can be designed without the use of superelevation. Therefore, the typical, urban "rooftop" crown can be used throughout the horizontal curve whereby the minimum street centerline radii will be based upon design speed and side friction. Consequently, for traffic traveling along curves to the left, the normal urban street cross slope is in a "negative" superelevation.

For the determination of the minimum horizontal street centerline radii for an urban street cross-section, this Criteria will use a negative superelevation value (*e*) of two (2) percent, or -0.02. Table 2-3 summarizes the minimum radii of urban street cross sections based upon design speed.

Table 2- 3
Minimum Allowable Centerline Radii

e (%)	V_d = 25 MPH	V_d = 30 MPH	V_d = 35 MPH	V_d = 40 MPH	V_d = 45 MPH
	R (FT)	R (FT)	R (FT)	R (FT)	R (FT)
-2.0	200	333	510	762	1039

Source: AASHTO Policy

V_d = Vehicle Design Speed, mph
e = rate of street superelevation, percent
R = centerline radius of curve, feet

E. Cul-de-Sac Standards

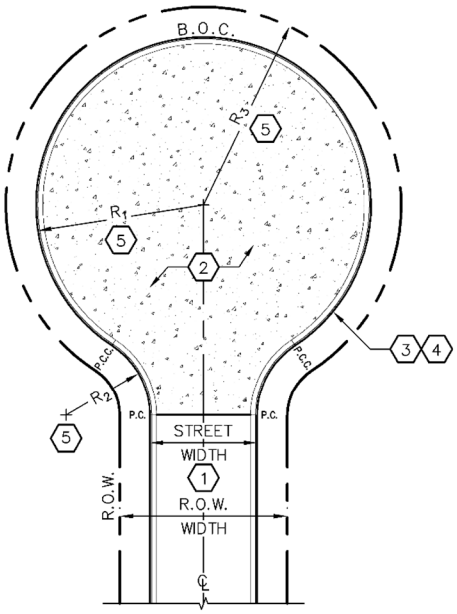
The maximum length of a cul-de-sac shall be 600 feet along the centerline from the centerline of the intersecting street to the radius point of the cul-de-sac (reference Paragraph 6.03.G.1 of the Subdivision Ordinance). The minimum radii to the face-of-curb and back-of-curb for standard curb and gutter, or to the gutterline for mountable curb, and to the right-of-way line for residential, commercial, and industrial development are depicted in Table 2-4. All cul-de-sacs shall be constructed utilizing reinforced P.C. concrete pavement as per Table 3-1.

Table 2-4
Minimum Radii for Cul-de-Sacs and Elbows

STREET TYPE	RADIUS (R_1) FROM RADIUS POINT TO		CURB RETURN RADII (R_2) AT CUL-DE-SAC THROAT (FT) TO		STREET R.O.W. RADIUS (R_3) (FT)
	F.O.C.[1]	B.O.C.[2]	F.O.C.[1]	B.O.C.[2]	
Local	49.5	50	25.5	25	60
Local (Rural Residential)	N/A	50[3]	N/A	25[3]	70
Commercial & Industrial	59.5	60	35.5	35	70

[1] F.O.C. = Face-of-Curb which is synonymous to the gutterline for mountable curb.
[2] B.O.C. = Back-of-Curb.
[3] For local/rural residential streets, radii (R_1) and (R_2) shall be from the radius point to the back of ribbon curb.

The typical layout for a cul-de-sac is shown in Figure 2-2.



KEYNOTES

1. REFER TO TABLE 2–5, "SUMMARY OF MINIMUM GEOMETRIC STREET STANDARDS."
2. REINFORCED P.C. CONCRETE PAVEMENT. REFERENCE TABLE 3–1, "MINIMUM PAVEMENT SECTIONS."
3. STANDARD CURB AND GUTTER SHALL BE USED ON CUL–DE–SACS AT THE TERMINUS OF FLEXIBLE (H.M.A.C.) PAVEMENT.
4. INTEGRAL CURB SHALL BE USED WITH RIGID (P.C. CONCRETE) PAVEMENTS WITH INTEGRAL CURB.
5. REFER TO TABLE 2–4, "MINIMUM RADII FOR CUL–DE–SACS AND ELBOWS."

B.O.C. = BACK OF CURB
P.C.C. = POINT OF COMPOUND CURVATURE
P.C. = POINT OF CURVATURE

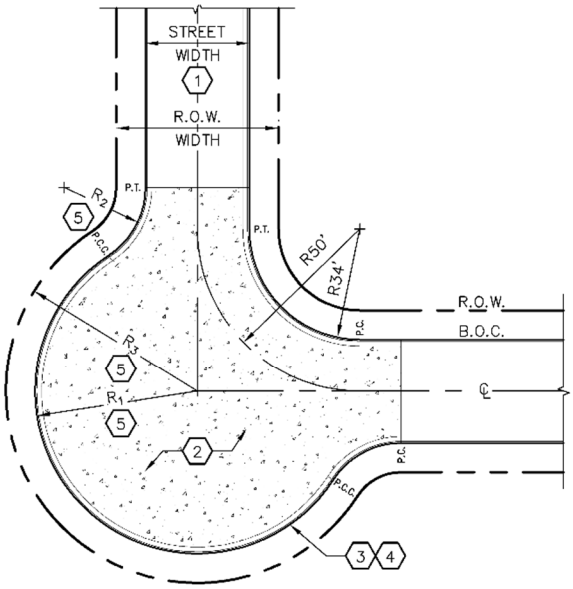
Figure 2- 2
Typical Cul-de-Sac Layout

F. Dead-End Streets

Dead-end streets are prohibited unless they meet cul-de-sac design standards outlined above, or unless the street is intended to be extended in the future and the dead end is only temporary in nature and less than 150 feet long to the boundary line of the subdivision measured from the face-of-curb of the intersecting street to the terminus of the “dead end.” Temporary shall mean no longer than five (5) years from the date of acceptance from the City of Waco.

G. “Elbow” Street Standards

Local streets with “elbows” are intended to serve low density residential areas and are not intended to carry through traffic. Elbows are required when the horizontal curvature of the street is less than the minimum allowable horizontal radius. An example of an “elbow” street layout is shown in Figure 2-3.



KEYNOTES

1. REFER TO TABLE 2–5, "SUMMARY OF MINIMUM GEOMETRIC STREET STANDARDS."
2. REINFORCED P.C. CONCRETE PAVEMENT. REFERENCE TABLE 3–1, "MINIMUM PAVEMENT SECTIONS."
3. STANDARD CURB AND GUTTER SHALL BE USED ON ELBOWS AT THE TERMINUS OF FLEXIBLE (H.M.A.C.) PAVEMENT.
4. INTEGRAL CURB SHALL BE USED WITH RIGID (P.C. CONCRETE) PAVEMENTS WITH INTEGRAL CURB.
5. REFER TO TABLE 2–4, "MINIMUM RADII FOR CUL–DE–SACS AND ELBOWS."

B.O.C. = BACK OF CURB
P.C.C. = POINT OF COMPOUND CURVATURE
P.C. = POINT OF CURVATURE
P.T. = POINT OF TANGENCY

Figure 2- 3
Typical "Elbow" Layout for Local Streets

H. Summary of Geometric Street Standards

A summary of the City of Waco's geometric street standards is shown below in Table 2-5.

Table 2-5
Summary of Minimum Geometric Street Standards

STREET CLASSIFICATION	ROW WIDTH (FT)	STREET WIDTH FOC-FOC[1] (FT)	STREET WIDTH BOC-BOC (FT)	SIDEWALK WIDTH[5] (FT)	D.U.'s[7] SERVED	AVERAGE DAILY TRAFFIC (ADT) VOLUMES	DESIGN SPEED (MPH)	MIN. CL RADIUS (FT)	MAX. GRADE (%)	MAX. DESIRED LENGTH
Local (Rural Residential)	60	N/A	32[2]	-	≤ 50	500	25	200	11	1,500 feet
Local (w/Curb & Gutter)	50[3]	30	31	5	≤ 50	500	25	200	11	1,500 feet
Minor Collector (Residential)	60	39	40	5	50-200	1,000	30	333	10	3,000 feet
Minor Collector (Rural)	80	-	32[2]	-	50-200	1,000	30	333	8	3,000 feet
Minor Collector (Commercial)	60	41	42	5-8	-	<6,000	30	333	8	1 mile
Major Collector (Neighborhood)	70	48	49	5	>200	5,000	30	333	8	2 miles
Major Collector (Commercial)	80	56	57	5-8	N/A	10,000	35	510	8	2 miles
Major Collector (Industrial)	80	56	57	6	N/A	4,000 [4]	35	510	8	2 miles
Arterial	TBD [6]	TBD [6]	TBD [6]	6	N/A	TBD [6]	TBD [6]	TBD [6]	TBD [6]	TBD [6]

[1] FOC - FOC: Face-of-Curb to Face-of-Curb. For mountable curb, FOC shall refer to the gutterline.
[2] For Rural Residential streets, "street width" shall be measured from outside edge to outside edge of ribbon curb.
[3] Right-of-way width for local streets with mountable curbs shall be widened to 54'. Mountable curbs shall be limited to Local Streets only.
[4] WB-50 Design Vehicles
[5] Sidewalk widths may need to be increased per Zoning or Overlay Districts.
[6] Shall be designed by a Professional Engineer registered in the State of Texas and submitted to the Director of Public Works, or Designee, for approval.
[7] D.U.s = Dwelling Units

I. Intersection Standards

1. General

There are three basic types of intersections: at-grade, grade separated, and interchange. The design criteria presented herein will be for at-grade intersections joining local, collector, and arterial streets.

The three basic types of at-grade intersections are the “T” intersection (three-leg intersection), the four-leg intersection, and the multi-leg intersection. The “T” intersection and four-leg intersection are the most prevalent types of intersections; however, the use of roundabouts has grown in popularity in recent years.

The design features that impact the function and safety of the at-grade intersection include the following:

- Angle of approach
- Intersection spacing and off-sets
- Radius of curvature of the curb return
- Sight distance
- Vertical alignment (pavement grades)
- Auxiliary lanes
- Traffic calming
- Intersection control

2. Intersection Geometry

Intersections involving acute angles and/or more than two streets shall be avoided. Where these conditions are unavoidable, special design considerations shall be determined and approved by the Director of Public Works, or Designee.

a. Angle of Approach. Street intersections should be designed to be perpendicular unless existing site conditions or topography prevent such. The minimum angles of intersection shall be based upon street classification as prescribed in Table 2-6.

Table 2- 6
Minimum Intersection Angle of Approach

STREET CLASSIFICATION / INTERSECTION TYPE	MINIMUM INTERSECTION ANGLE (DEGREES)
Intersections involving **Local** Streets[1]	75° (90° ± 15°)
Intersections involving **Collector**[2] Streets	80° (90° ± 10°)
Intersections involving **Arterial** Streets	85° (90° ± 5°)

[1] Alleys shall be treated as Local Streets
[2] Minor or Major Collectors

b. Intersection Spacing and Off-sets.

i. Intersection Spacing. The minimum spacing between intersections is specified in Table 2-7. (Note: all dimensions specified are from right-of-way to right-of-way).

Table 2- 7
Minimum Intersection Spacing

STREET CLASSIFICATION (MAJOR STREET)	STREET CLASSIFICATION (MINOR STREET)		
	LOCAL	COLLECTOR	ARTERIAL
Local	*200 ft.	*200 ft.	400 ft.
Collector[1]	*200 ft.	*200 ft.	400 ft.
Arterial	400 ft.	400 ft.	1200 ft.

*150-foot minimum at the entrance to subdivisions.

[1] Minor and Major Collectors

ii. Intersection Off-sets. "T" intersections in residential subdivisions are strongly recommended because studies indicate that these types of intersections are far safer than 4-legged intersections. In order for "T" intersections to function efficiently and safely, minimum off-set distances between intersections are required as follows:

- Local Street to Local Street: 150 feet centerline-to-centerline
- Local Street to Collector Street: 150 feet centerline-to-centerline
- Collector Street to Collector Street: 200 feet centerline-to-centerline
- All Street Classifications to Arterial Street: 350 feet centerline to centerline, or as determined via Traffic Impact Analysis

c. Horizontal Alignment within the Intersection. The horizontal approach to an intersection shall be tangent for a minimum length as prescribed in Table 2.8.

Table 2-8
Minimum Horizontal Approach Geometry

FUNCTIONAL CLASSIFICATION	MINIMUM HORIZONTAL TANGENT LENGTH OF APPROACHING STREET (FEET)	
	LOCAL	COLLECTOR
Local	50	50
Minor Collector (Residential/Commercial)	50	50
Major Collector (Neighborhood/Commercial/Industrial)	50	75
Arterial	75	75

d. Vertical Alignment within the Intersection. Proper vertical alignment of the street profiles at intersections should consist of mild grades to provide a smooth transition through the intersection and to meet the pedestrian accessibility "cross-slope" requirements as prescribed by the U.S. Access Board's (proposed) Public Rights-of-Way Accessibility Guidelines.

The design speed and corresponding maximum grades for the major street at any intersection shall be maintained through the intersection and corresponding "landings" unless there is a proposed pedestrian access route across the major street, in which case the cross-slope of the major street shall be two percent (2%) maximum. The minor street shall have a maximum grade of two percent (2%) for proposed pedestrian access routes. The minimum "landing" lengths for approaching and departing pedestrian accessible intersections shall be equal to the minimum curb return radii specified in Table 2-9.

e. Radius of Curvature of Curb Returns. For Local Streets in residential neighborhoods, pedestrian safety is paramount and low design speeds are preferred, and therefore short radii curb returns are desirable. For Collector Streets and streets in commercial and industrial areas, pavement widths are wider and curb radii are longer to accommodate larger design vehicles and to eliminate the need for the vehicle to encroach into other lanes during the turning movement. The minimum curb return radii are specified in Table 2-9 based upon the functional classification of the street; however, when designing curb returns at intersections, the design engineer should consider the largest vehicles that will use the street. Minimum turning radii for multiple vehicle types are provided in the Policy and computer software such as AUTOTURN can be used as a design tool to simulate vehicle turning movements.

Right-of-way corner clips are required to accommodate the prescribed curb return radii and to provide an obstruction-free approach sight "triangle" at the intersection as described in the subsequent section.

Table 2-9
Curb Return Radii Criteria

INTERSECTION TYPE	MINIMUM CURB RETURN RADIUS (FEET)	RIGHT-OF-WAY, CORNER CLIP (FEET)
Local[1] to Local	20	10.5 ft. x 10.5 ft.
Local[1] to Minor Collector (Residential)	20	10.5 ft. x 10.5 ft.
Minor Collector (Residential) to Minor Collector (Residential)	25	15 ft. x 15 ft.
Minor Collector (Commercial) to Minor Collector (Commercial)	30	21 ft. x 21 ft.
Major Collector (Neighborhood) to Major Collector (Neighborhood)	30	19.5 ft. x 19.5 ft.
Major Collector (Commercial/Industrial) to Major Collector (Commercial/Industrial)	30	18.5 ft. x 18.5 ft.
Major Collector (Commercial/Industrial) to Arterial	30	18.5 ft. x 18.5 ft.

[1] Alleys shall be treated as Local streets.

Figures 2-4 through 2-10 on the following pages depict the prescribed corner clips for each type of intersection.

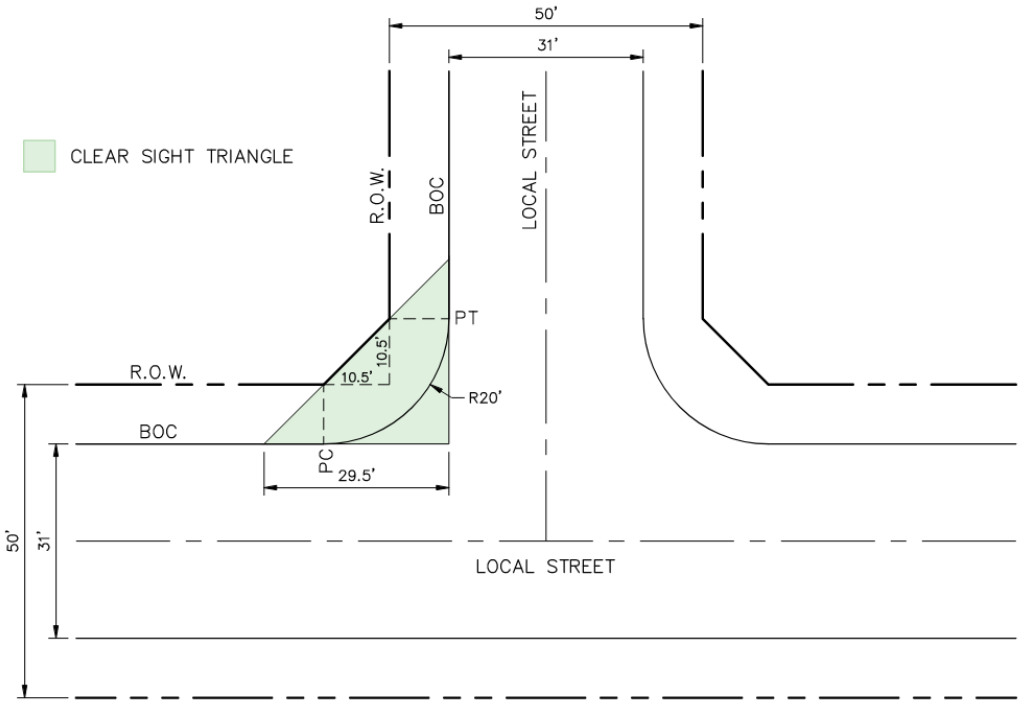


Figure 2- 4
Local Street to Local Street Intersection

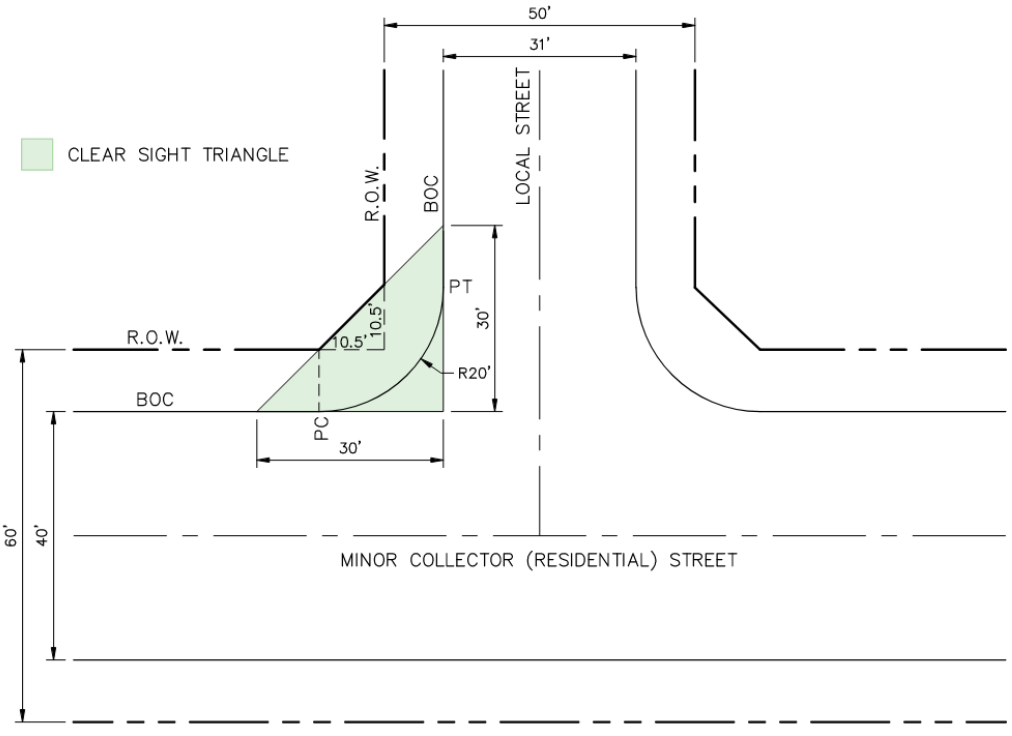


Figure 2- 5
Local Street to Minor Collector (Residential) Street Intersection

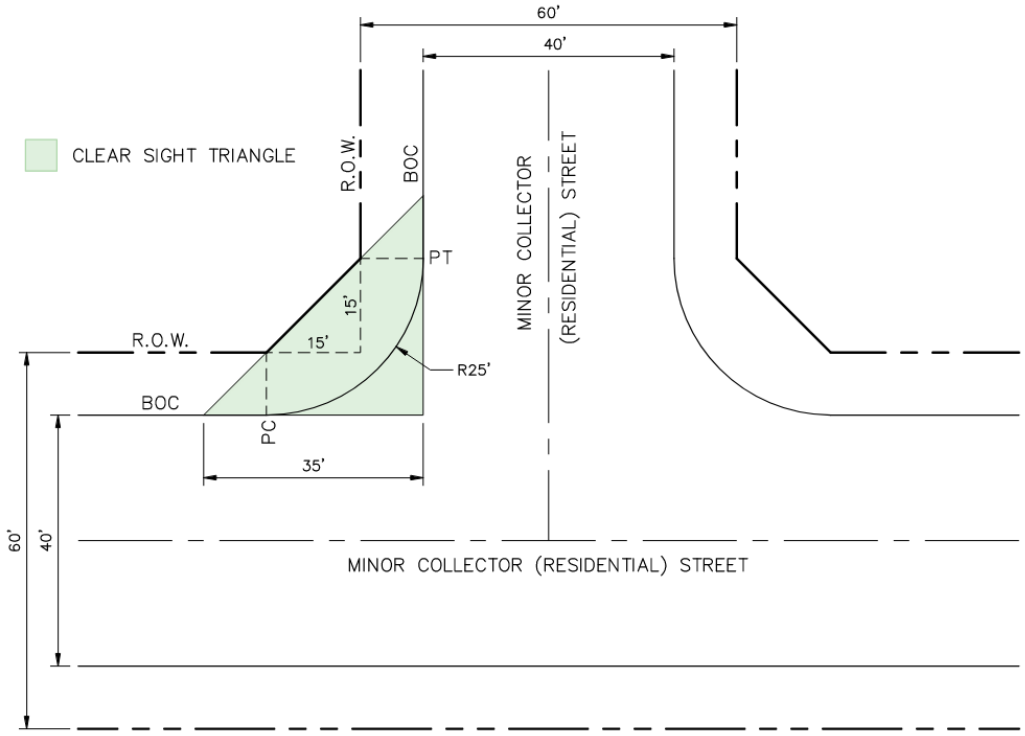


Figure 2-6
Minor Collector (Residential) Street to Minor Collector (Residential) Street Intersection

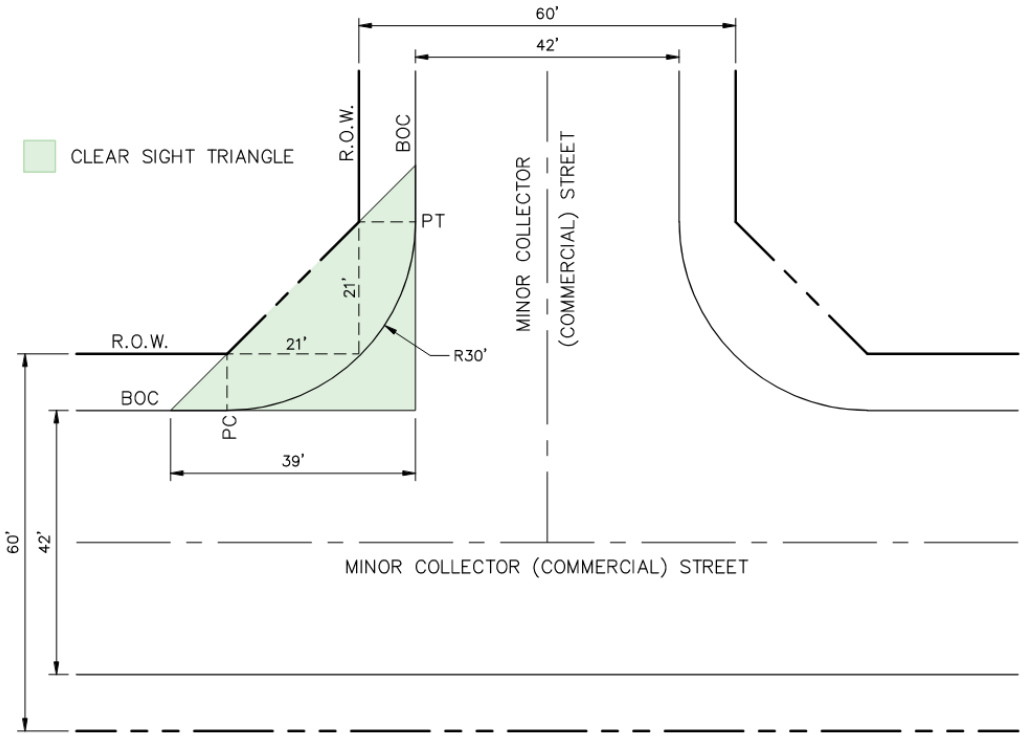


Figure 2-7
Minor Collector (Commercial) Street to Minor Collector (Commercial) Street Intersection

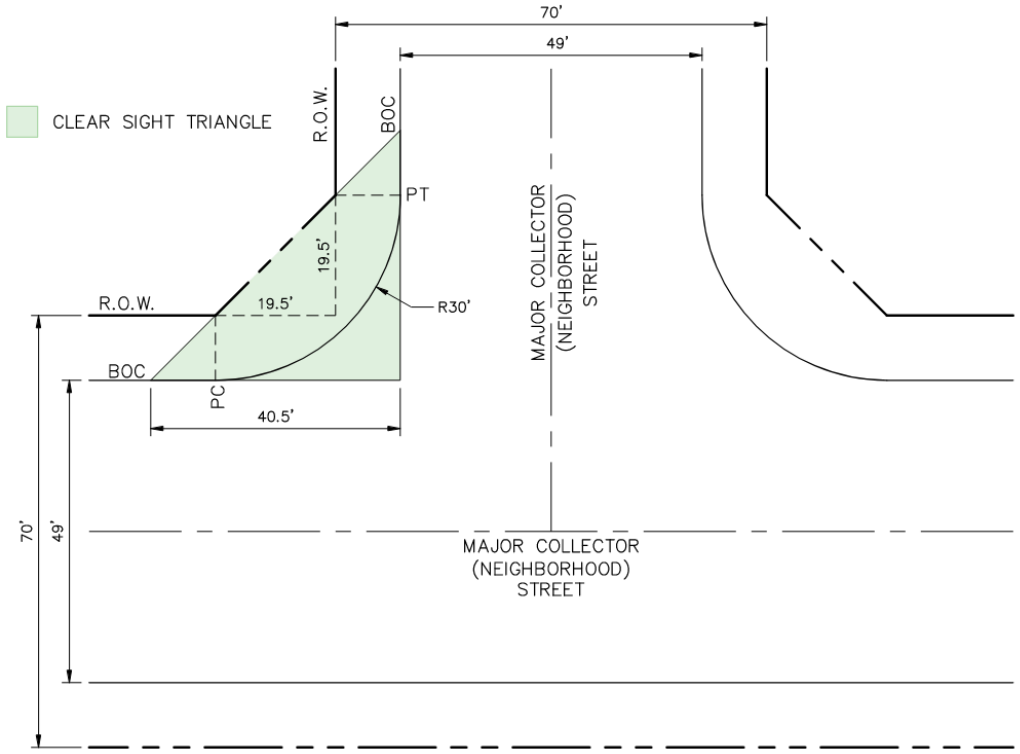


Figure 2-8
Major Collector (Neighborhood) Street to Major Collector (Neighborhood) Street Intersection

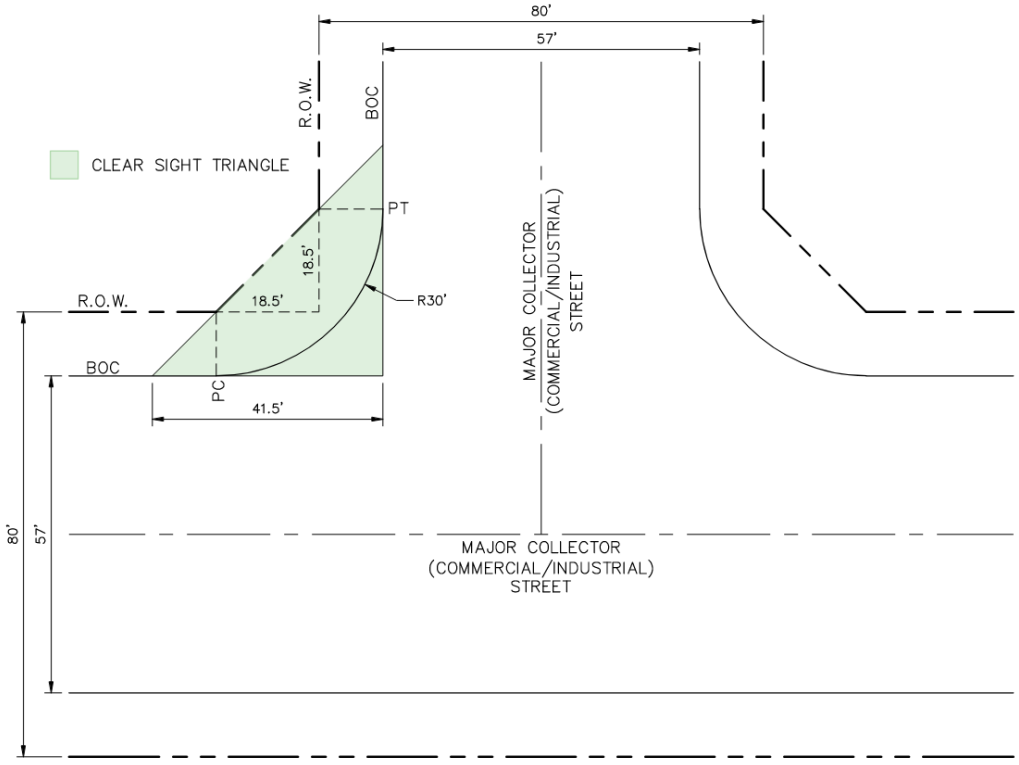


Figure 2-9
Major Collector (Commercial/Industrial) Street to Major Collector (Commercial/Industrial) Street Intersection

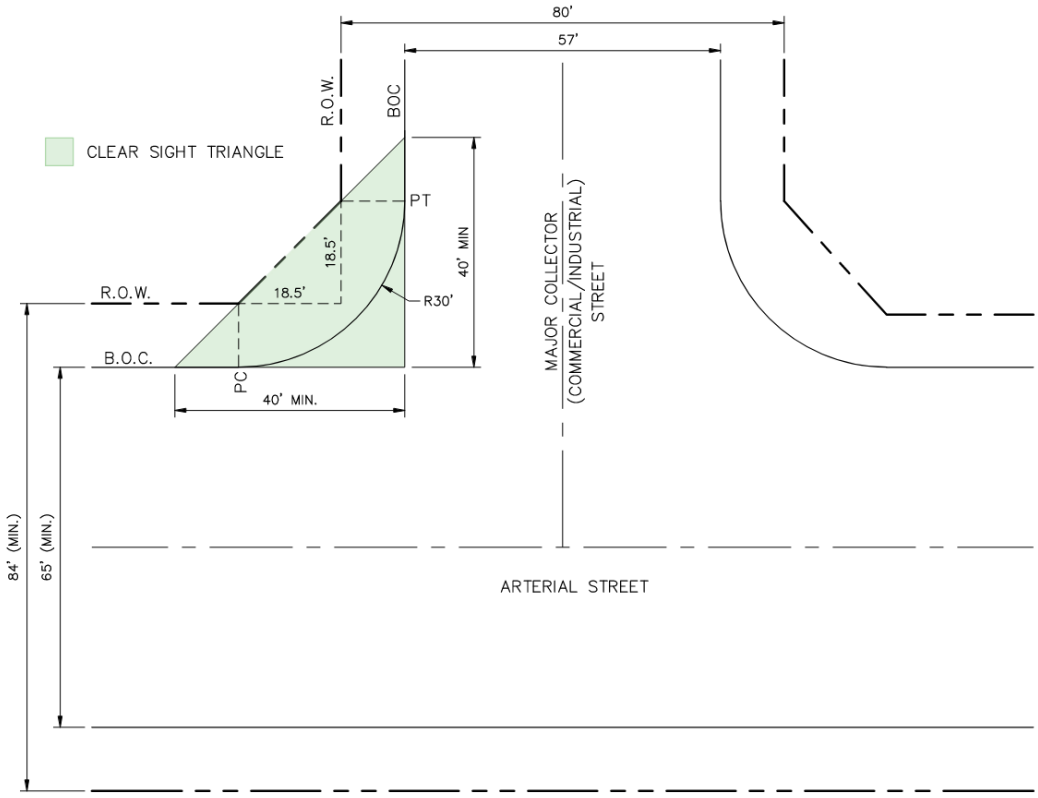


Figure 2-10
Major Collector (Commercial/Industrial) Street to Arterial Street Intersection

3. Intersection Sight Distance

   Intersection sight distance for an at-grade intersection is subject to the type of traffic control at the intersection, or where no traffic control devices are present, by the rules of the road. At an intersection where no traffic control devices are present, a basic rule of the road would require the vehicle on the left to yield to the vehicle on the right if they arrive at approximately the same time. Sight distance is provided at intersections to let drivers identify the presence of potentially conflicting vehicles and to be able to stop or adjust their speed, as appropriate, to avoid intersection collision. The driver of a vehicle approaching an intersection should have an unobstructed view of the entire intersection, including any traffic control devices. Likewise, sufficient distances along the major street shall be provided to permit the driver to anticipate and avoid potential collisions. To enhance traffic operations, intersection sight distances that exceed stopping sight distances are desirable along the major street.

   Clear sight triangles are specified areas at intersection approach legs and corners that should be kept clear of obstructions that might block a driver's view of potential conflicts. The dimensions of the legs of the sight triangles depend on the design speeds of the intersecting streets and the type of traffic control used at the intersection. Two types of clear sight triangles are considered in intersection design: approach site triangles and departure sight triangles.

   This Criteria prescribes design guidelines for the approach sight triangle for the most common type of intersections associated with land development projects whereby the driver/vehicle on the minor street comes to a stop before entering or departing into the major street. The corner clips prescribed in Table 2-9, above, provide the right-of-way necessary for the "approach"

sight triangle. There shall be no obstruction greater than 2.5 feet above the street gutter at any point within the triangle.

The geometry of a clear approach sight triangle is such that when the driver of a vehicle without the right-of-way sees a vehicle that has the right-of-way on an intersection approach, the driver of that potentially conflicting vehicle can also see the first vehicle.

Figure 2-11 illustrates departure sight triangles necessary for a stopped driver on a minor street approach to enter or cross the major street.

For most land development projects, the most typical type of traffic control is the stop control. The vehicle on the minor street is required to completely stop, ensure that movement through the intersection, either entering the intersection street or crossing it, can be safely done without colliding with oncoming traffic, and then proceed.

The driver on the minor street must have an unobstructed view for a sufficient distance in order to ensure the movement through the intersection can be safely accomplished. This sufficient sight distance depends on the speed of the oncoming vehicles and some nominal perception-reaction time representative of most drivers as well as the physical conditions of the intersection. The three types of movements for the stopped vehicle are outlined below:

1. *Case 1: Left turn from the minor street*. The stopped vehicle can turn left onto the major street, which requires clearing traffic from both directions.
2. *Case 2: Right turn from the minor street*. The stopped vehicle can turn right, which requires clearing traffic coming from the driver's left.
3. *Case 3: Crossing maneuver from the minor street*. The vehicle can proceed through the intersection, continuing along the minor street (four-legged intersections only). This requires that the vehicle clear traffic approaching from either direction of the major street and also vehicles turning left from the opposite direction on the minor street.

The vertex (decision point) of the "departure" site triangle on the minor street and the corresponding assumed location of the driver's eye should be 18 feet from the edge of the major street traveled way. The distance from a vehicle travelling along the major street and the driver on the minor street is illustrated by the dimension "*a*" in Figure 2-9. According to the AASHTO Policy, this assumed location of the driver's eye is 3.5 feet above the surface of the intersecting street.

For left turns from the minor street, "departure" sight triangles for traffic approaching from the right or the left shall be provided from the minor street to the major street for all stop-controlled approaches. The lengths of the legs of the "departure" sight triangle along the major street in each direction (legs b_1 and b_2 in Figure 2-11) is prescribed in Tables 2-10 and 2-11, respectively, based upon the design speed of the major street.

For right turns from the minor street, a "departure" sight triangle for traffic approaching from the left as shown in Figure 2-11 shall be provided for right turns from the minor street to the major street. The sight distance length of leg b_1 is shown in Table 2-11.

The "departure" sight triangles for left and right turns onto the major street, as described for Cases 1 and 2 will also provide adequate sight distance for minor street vehicles to cross the major street.

All intersections shall have clear sight triangles which meet the criteria for both the “approach” and “departure” minimum visibility distances. For conditions whereby the right-of-way “corner clips” do not satisfy the “departure” sight triangle requirements, then a “sight visibility easement” dedication will be required beyond the “corner clips.”

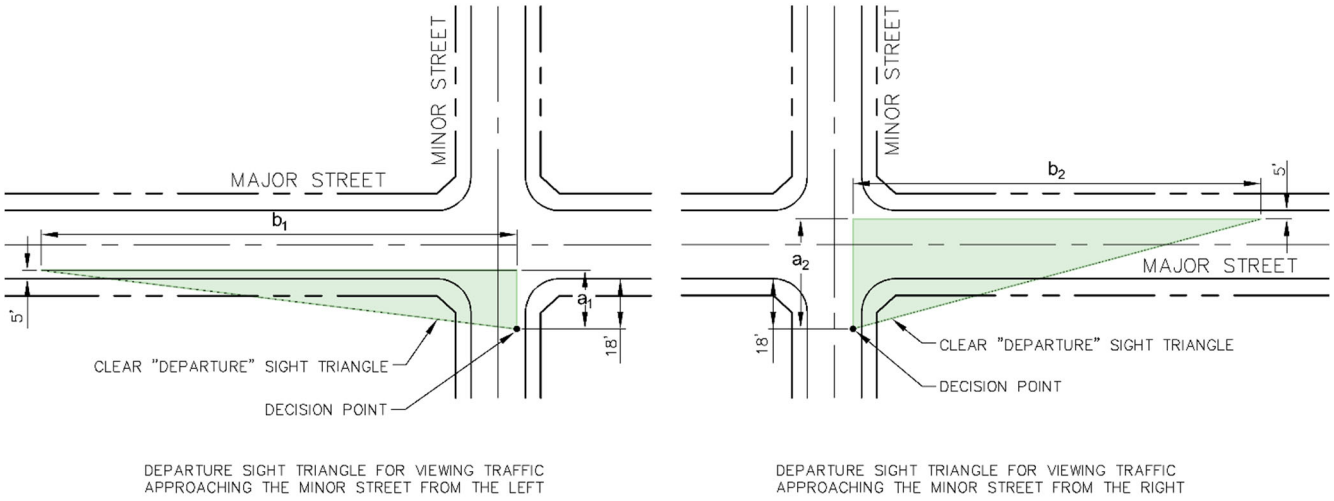


Figure 2-11
Departure Sight Triangles (Stop-Controlled)

Table 2-10
Design Intersection Sight Distance (“b_1”) – Case 1: Left Turn from Stop for Traffic Approaching from the Left

DESIGN SPEED (MPH)	STOPPING SIGHT DISTANCE (FT)	INTERSECTION SIGHT DISTANCE FOR PASSENGER CARS DESIGN “b_1” (FT)
25	155	280
30	200	335
35	250	390
40	305	445
45	360	500

Note: intersection sight distance is shown for a stopped passenger car to turn left onto a two-lane street with no median.

Table 2-11
Design Intersection Sight Distance (“b_2”) – Case 2: Right Turn from Stop for Traffic Approaching from the Right

DESIGN SPEED (MPH)	STOPPING SIGHT DISTANCE (FT)	INTERSECTION SIGHT DISTANCE FOR PASSENGER CARS DESIGN “b_2” (FT)
25	155	240
30	200	290
35	250	335
40	305	385
45	360	430

Note: intersection sight distance is shown for a stopped passenger car to turn right onto or to cross a two-lane street with no median.

4. Valley Gutters

   Valley gutters may be placed at the following intersection locations for stormwater conveyance:

   - Local Street to Local Street intersections
   - On the Local Street for Local Street to Collector (Residential) Street intersections

   At the approval of the Director of Public Works, or Designee, valley gutters may be placed at the following intersection locations for stormwater conveyance:

   - On the secondary Residential Collector Street for Collector (Residential) Street to Collector (Residential) Street intersections
   - On the secondary Commercial/Industrial Collector Street for Collector (Commercial/Industrial) Street to Collector (Industrial/Collector) Street intersections
   - On the minor street of an Arterial Street intersection

   Valley gutters shall be designed in accordance with the City of Waco's Stormwater Design Criteria and Standard Details.

5. Fillets

   Concrete fillets shall be constructed for all H.M.A.C. pavement intersections other than Arterial Streets.

6. Turn Lane Standards

   Turning movement requirements at street intersections shall be based upon an approved Traffic Impact Analysis (TIA) or as determined by the Director of Public Works, or Designee. When turn lanes are required, the minimum geometric standards shall be in accordance with Tables 2-12 and 2-13 and with Figures 2-12 and 2-13. Additional consideration will be made for unique traffic movements such as excessive tractor-trailer traffic, extended length transport vehicle movements, unusually high traffic volumes, etc.

Table 2-12
Minimum Left-Turn Lane Geometric Standards

STREET CLASSIFICATION	LANE WIDTH (FT)	STORAGE LENGTH, L_1 (FT)	TRANSITION (TAPER) LENGTH, L_2 (FT)	ADDITIONAL R.O.W. REQUIRED (FT)
Minor Collector (Residential)	12	60	100	16
Minor Collector (Commercial)	12	150	100	16
Major Collector (Neighborhood/Commercial/Industrial)	12	150	100	16
Arterial	12	TBD [1]	TBD [1]	TBD [1]

[1] Shall be designed by a Professional Engineer registered in the State of Texas and submitted to the Director of Public Works, or Designee, for approval.

Table 2-13
Minimum Right-Turn Lane Geometric Standards

STREET CLASSIFICATION	LANE WIDTH (FT)	STORAGE LENGTH, L_1 (FT)	TRANSITION (TAPER) LENGTH, L_2 (FT)	ADDITIONAL R.O.W. REQUIRED (FT)
Minor Collector (Residential)	12	100	100	16
Minor Collector (Commercial)	12	150	150	16
Major Collector (Neighborhood/Commercial/Industrial)	12	150	150	16
Arterial	12	TBD [1]	TBD [1]	16

[1] Shall be designed by a Professional Engineer registered in the State of Texas and submitted to the Director of Public Works, or Designee, for approval.

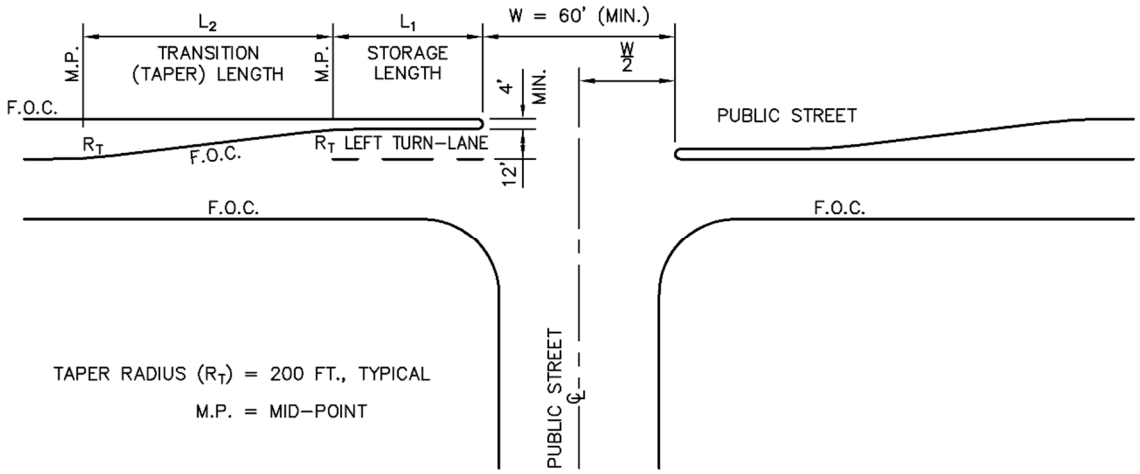


Figure 2-12
Left Turn-Lane Schematic

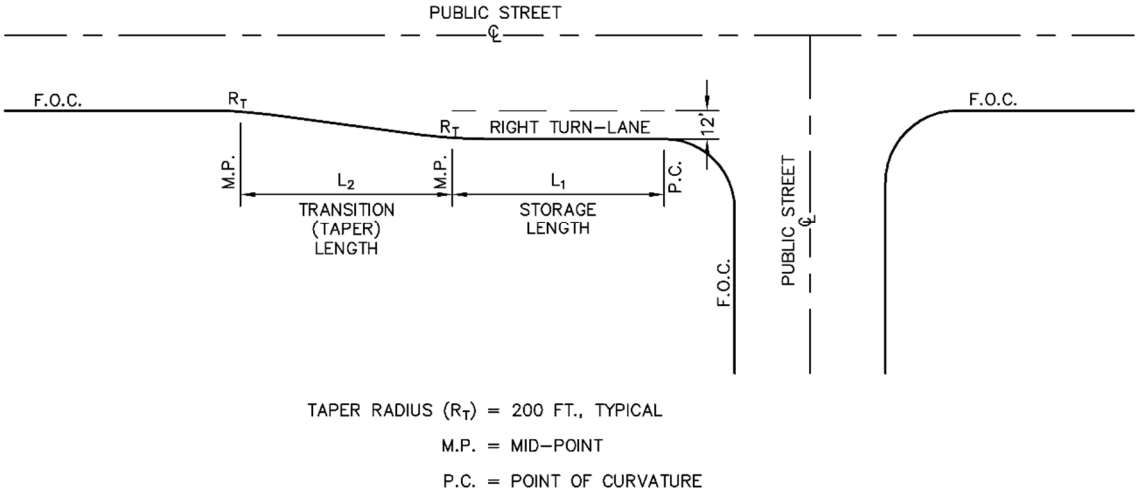


Figure 2-13
Right Turn-Lane Schematic

7. Roundabout Standards

   Roundabouts shall be constructed in accordance with the U.S. Department of Transportation; Federal Highway Administration; Publication No. FHWA-RD-00-067; Roundabouts: An Informational Guide (nacto.org).

3.0 PAVEMENT DESIGN STANDARDS

3.1 General

The primary factors which influence the performance of street pavements include the subgrade upon which the pavement is constructed, the strength and quality of the materials used to construct the pavement, the quality of construction, and the vehicular type and amount of traffic using the facility.

This section covers the minimum structural pavement design standards for each classification of street except for Arterial Streets. Arterial Streets are so unique and traffic-specific, that such streets are to be designed on a case-by-case basis. The pavement designs specified in this Criteria are to be considered as “minimums” and are based upon industry-standard accepted design procedures prescribed by AASHTO coupled with over sixty years of documented construction practices. Constructability, sustainability, performance, and engineering economics are the core principles of these standards. The theoretical design life assumed for both the flexible and rigid pavement sections used throughout this Criteria is 50 years.

3.2 Geotechnical Engineering Report

A. General

A Geotechnical Engineering Report shall be prepared, signed, and sealed by a Professional Engineer, registered in the State of Texas, specializing in the field of geotechnical engineering, and licensed in the State of Texas, which at a minimum shall identify the geologic formations and soil types encountered within the project limits for street improvements. The cost of the geotechnical engineering report shall be borne by the developer and shall include, at a minimum, the following:

- 10-foot deep (minimum) boreholes, or 3 feet into rock, whichever occurs first, every 1000 feet along the centerline of the proposed street alignment unless the variability of the soil conditions require more. Greater boring depths may be required in areas of unfavorable soil conditions or in areas of significant cuts and fills;
- Soil classification(s) for subgrade soils;
- Plasticity Index (P.I.) of subgrade soils;
- Groundwater conditions, including seasonal changes in groundwater tables and soil moisture conditions;
- Soluble sulfate tests in geological formations in which sulfates are suspected (i.e., South Bosque, Lake Waco, Del Rio (Grayson), and Taylor (Ozan));
- Lime stabilization of subgrade recommendations;
- Identification of problematic site conditions that require site-specific geotechnical engineering solutions (e.g., very high P.I.s of subgrade soils, sulfates, deep cuts or fills, escarpment, unique features such as old stock tanks, etc.)

B. Lime Stabilized Subgrade Requirement

If the in-situ street subgrade soils classify as Clay (CL or CH) per the Unified Soil Classification System and have a plasticity index (PI) greater than 20, then the subgrade soil shall be lime stabilized in accordance with Table 3-1 and the City of Waco’s Standard Details and Standard Specifications for Construction.

3.3 Minimum Pavement Sections

The minimum structural sections for both flexible and rigid pavements for street subgrade soils with low, moderate, and high P.I.s are specified in Table 3-1 for each street classification. The Engineer of Record, in consultation and coordination with the Geotechnical Engineer, is responsible for ensuring that these minimum standards meet the design requirements for the specific site conditions of the project. Further geotechnical engineering analyses may be required if problematic soil conditions are encountered (e.g., very high P.I.s of subgrade soils, the presence of soluble sulfates; alluvium soils; groundwater; escarpment; old stock tanks; deep cuts or fills; etc.) or unique/unusual vehicular or truck traffic volumes are anticipated.

Table 3-1
Minimum Pavement Sections

STREET CLASSIFICATION	P.I. OF SUBGRADE	FLEXIBLE PAVEMENT SECTION (HMAC)			RIGID PAVEMENT SECTION (P.C. CONCRETE)		
		HMAC	BASE	SUBGRADE	P.C. CONCRETE	BASE	SUBGRADE
Local	P.I. ≤ 20	2" Type D	9" CTB (3.5" + 5.5")	Compacted[3]	5"	4" CTB[1,2]	Compacted
Local	20 < P.I. < 40	2" Type D	5.5" CTB	6" LSS	5"	-	6" LSS
Local	P.I. ≥ 40	2" Type D	9" CTB (3.5" + 5.5")	6" LSS	5"	-	8" LSS
Residential/Neighborhood Collector	P.I. ≤ 20	2" Type D	10" CTB (4" + 6")	Compacted	6"	4" CTB[1,2]	Compacted
Residential/Neighborhood Collector	20 < P.I. < 40	2" Type D	6" CTB	8" LSS	6"	-	6" LSS
Residential/Neighborhood Collector	P.I. ≥ 40	2" Type D	10" CTB (4" + 6")	8" LSS	6"	-	8" LSS
Commercial Collector[5]	P.I. ≤ 20	2" Type D	11" CTB (4" + 7")	Compacted	7"	4" CTB[1,2]	Compacted
Commercial Collector[5]	20 < P.I. < 40	2" Type D	7" CTB	8" LSS	7"	-	6" LSS
Commercial Collector[5]	P.I. ≥ 40	2" Type D	11" CTB (4" + 7")	8" LSS	7"	-	8" LSS
Industrial Collector	P.I. ≤ 20	3" Type C	12" CTB (7" + 5")	Compacted	8"	4" CTB[1,2]	Compacted
Industrial Collector	20 < P.I. < 40	3" Type C	9" CTB (4" + 5")	8" LSS	8"	-	6" LSS
Industrial Collector	P.I. ≥ 40	3" Type C	11" CTB (6" + 5")	8" LSS	8"	-	8" LSS

[1] Alternate: 4" Recycled Crushed Concrete (TxDOT Standard Specifications for Construction Item 247 Flexible Base Type D, Grade 1-2, excluding Type A materials, with a minimum P.I. of four)
[2] Bond Breaker consisting of 10 mil. polyethylene between CTB and P.C. Concrete Pavement
[3] Compacted subgrade shall have a uniform density of not less than 95% of the maximum density per ASTM D698 per City of Waco's Standard Specifications for Construction.
[4] Alternate: 3.5" Recycled Crushed Concrete (TxDOT Standard Specifications for Construction Item 247 Flexible Base Type D, Grade 1-2, excluding Type A materials, with a minimum P.I. of four) may be substituted for 3.5" CTB Sub-base
[5] Minor and Major Commercial Collectors

When the geotechnical engineering report identifies that the subgrade soils must be stabilized with lime, then the subgrade shall be stabilized with a minimum of seven percent (7%) of lime per dry weight of subgrade soil in accordance with the City of Waco's Standard Specifications for Construction. The actual rate of lime used for subgrade stabilization may be greater than 7% as determined after street "rough" cutting operations are complete and lime series testing of the subgrade is conducted.

All Arterial Street pavement shall be reinforced concrete and shall be designed by a Registered Professional Engineer registered in the State of Texas, and submitted to the Director of Public Works, or Designee, for review and approval.

3.4 Street Cross-Sections

"Typical" pavement sections for both flexible and rigid pavements for each street classification can be found in Appendices A and B. Street cross-sections for each street classification depicting utility assignments, water and wastewater mains, fire hydrant and valve locations, sidewalk locations, parkway grading guidelines, etc. can be found in Appendix C.

Flexible pavement sections with hot-mix asphaltic concrete pavement for the surface course shall have a "rooftop" crown as depicted in the street cross-sections found in Appendix C. Likewise, rigid pavement sections consisting of Portland Cement concrete pavement shall also have a "rooftop" crown as depicted in Appendix C - Street Cross-Sections.

3.5 Inspection, Material Testing, and Construction Staking

A. Inspection

The City of Waco shall provide inspection services during construction. The developer shall pay the Inspection Fee in accordance with the Fee Rate Schedule to the City of Waco prior to issuance of the Notice to Proceed and commencement of construction.

B. Material Testing

1. Material testing of all subgrade, base, surface courses, concrete, etc. shall be performed in accordance with the Standard Specifications for Construction.
2. The developer shall pay for all material testing required for public improvements within public right-of-way.
3. All material testing shall be performed by a geotechnical engineering firm registered with the Texas Board of Professional Engineers and Land Surveyors.

C. Construction Staking

Construction staking shall be performed under the supervision of a Registered Professional Land Surveyor or licensed Professional Engineer for all public street, drainage, water, and wastewater improvements constructed within public rights-of-way or easements. Typical construction staking tasks associated with land development projects include, at a minimum the following:

- Street "Rough-Cut" grading
- Right-of-way staking
- Sanitary sewer mains, manholes, and clean-outs
- Storm drains, inlets, junction boxes, channels, and stormwater facilities
- Waterlines and fire hydrants
- Curb and gutter
- Electrical conduit crossings

"Cut" sheets, signed, and sealed by the Engineer of Record, shall be submitted to the City prior to the construction of each phase of each improvement. In general, the sequence of construction staking, and the information provided for the Contractor shall be as outlined in Table 3-2.

Table 3-2
Construction Staking Requirements

1. "ROUGH CUT"
The centerline of each street will be staked by the engineer at 50-foot intervals and "cut" sheets will be issued. The contractor will transfer any grades as required to complete rough cut grading of the entire right-of-way. No further construction staking will be performed until all of the right-of-way is graded to the subgrade lines and grades as shown on the plans.
2. RIGHT-OF-WAY
The right-of-way shall be staked by the Engineer at all property corners, points of curvature (PC's), and points of tangency (PT's). The contractor will preserve and protect these stakes because they will be final stakes for the waterline and dry utilities.
3. SANITARY SEWER
Sanitary sewer mains and manholes will be staked by the Engineer in accordance with the City of Waco's Standard Specifications for Construction, "Special Provisions," and "cut" sheets will be issued accordingly. Sanitary sewer services will not be staked, but will be constructed at the locations shown on the plans.
4. STORM DRAIN
Storm drains, inlets, manholes, and junction boxes (only) will be staked by the Engineer in accordance with the City of Waco's Standard Specifications for Construction, "Special Provisions," and "cut" sheets will be issued accordingly. "Cut" sheets will be issued for each structure.
5. WATERLINE
The contractor will utilize the right-of-way stakes for horizontal alignment purposes. No additional construction staking will be performed for the waterline. The Engineer will stake the fire hydrants, horizontal bends, and vertical bends. "Cut" sheets will be issued for the fire hydrants and bends. Water services and valves will not be staked by the Engineer, but will be constructed at the locations shown on the plans.
6. CURB AND GUTTER
The Engineer will set line and grade stakes in accordance with the City of Waco's Standard Specifications for Construction, "Special Provisions." "Cut" sheets will be issued by the Engineer for both curbs of the proposed street.
7. ELECTRICAL CONDUIT CROSSINGS
The Engineer shall provide electrical conduit staking at street crossing locations only.
8. DRY UTILITIES
Dry utilities will be constructed utilizing the right-of-way stakes described in 2, above.
9. VERTICAL CONTROL
The Engineer will provide temporary benchmarks for construction purposes.

4.0 DRIVE APPROACH AND ACCESS DESIGN CRITERIA

4.1 Purpose

This drive approach and access design criteria for new site developments is intended to promote a standard of excellence for development in the City of Waco which will contribute to long-term public safety and protection of private investment.

4.2 Visibility Standards for Access onto Public Streets

Clear sight triangles shall be provided at all drive approaches accessing a public street. Within these clear sight triangles there shall be no fences, walls, signs, hedges, landscaping, trees, or structures of any kind which could obstruct the view of the driver trying to enter onto the public street. The design criteria prescribed in Section 2.2 (I)(2) and (3) for "Intersection Street Design" for public streets applies to all multi-family, commercial, industrial, and institutional driveways accessing Collector and Arterial streets. Figure 2-9, "Departure Sight Triangles," shall be used to establish the clear departure sight triangles. Obstruction-free, clear "Approach Sight Triangles" for all multi-family, commercial, industrial, and institutional driveways shall be designed and constructed as shown in Table 4-1 and Figure 4-1.

Table 4-1
Approach Site Triangle Distances

INTERSECTION STREET CLASSIFICATION	DISTANCE	
	X (FT)	Y (FT)
Minor Collector (Residential)	30	30
Major Collector (Neighborhood/Commercial/Industrial)	35	35
Arterial	40	40

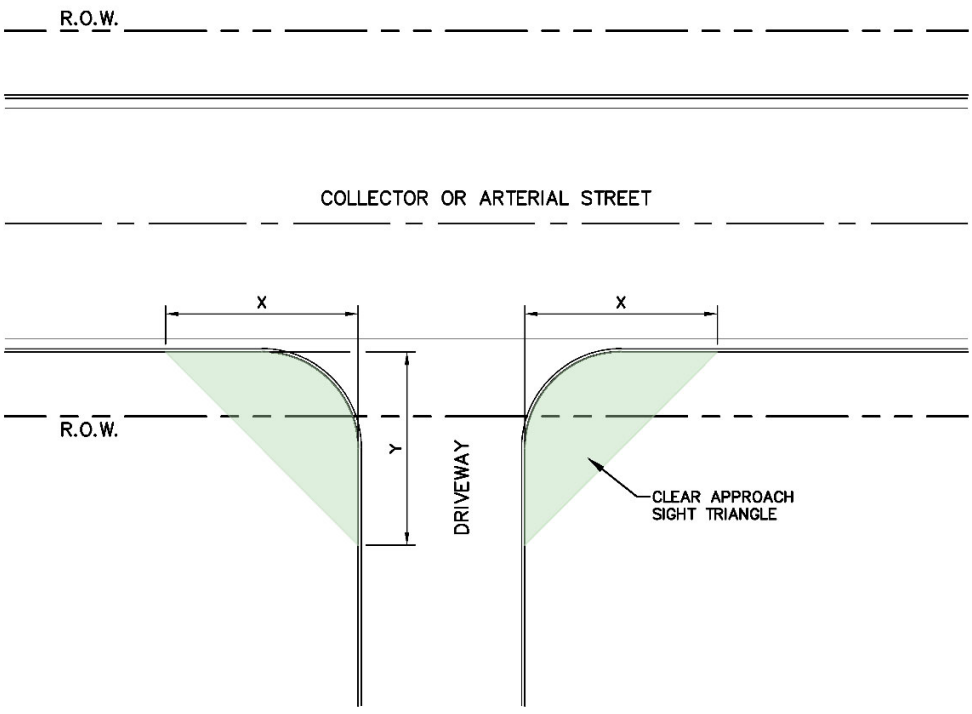


Figure 4-1
Approach Site Triangles at Driveway

If public parking is proposed or exists within the public right-of-way then those parked vehicles must be considered in the sight distance design for the driveway(s).

A. Residential Driveway Standards

Residential driveway standards apply to single-family and two-family residential land uses. Under normal circumstances, one (1) driveway is permitted for each residential lot, and these standards are intended for local streets only. Residential lots on arterial streets are subject to commercial driveway standards. Exceptions may be permitted for each residential lot, corner lots, and circle driveways.

The edge of a driveway shall be located no closer than the Curb Radius, R_1, (as prescribed in Table 4-2) to the property line, without an encroachment agreement with the adjacent homeowner. The minimum Residential Driveway Standards are depicted in Table 4-2, and a schematic layout with these standards is shown in Figure 4-2.

Table 4-2
Minimum Residential Driveway Standards

DRIVEWAY TYPE	DRIVEWAY WIDTH	CURB RADIUS	DRIVEWAY TO CORNER LENGTH	LENGTH BETWEEN DRIVEWAYS	DISTANCE FROM DRIVEWAY TO SIDE PROPERTY LINE
	X	R_1	L_1	L_2	L_3
Single Driveway	10’ Min[1] 12’ Max	4’ Min 15’ Max	30’ Min	8’ Min	≥ R1
Double Driveway	20’ Min 24’ Max[2]	4’ Min 15’ Max	30’ Min	8’ Min	≥ R1

[1] 20’ minimum for two-family residential driveways.
[2] For 3 car garages facing the street, driveway width may be 36’ Max.

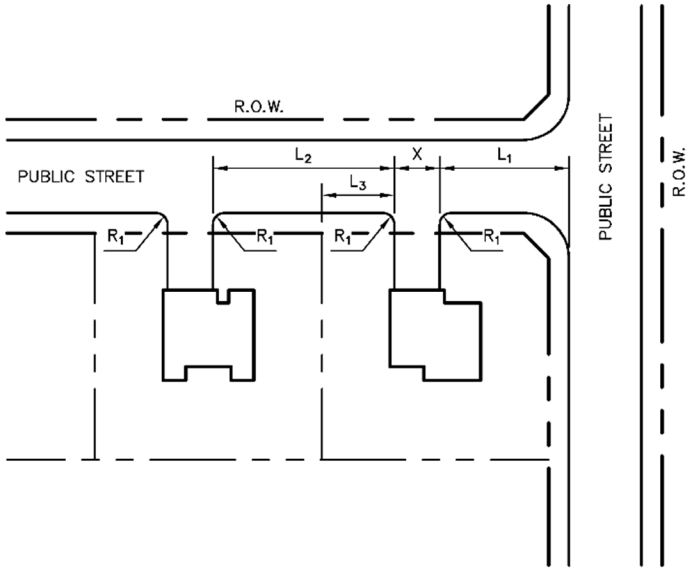


Figure 4- 2
Schematic for Residential Driveway Standards

B. Commercial Driveway Standards

Commercial driveway standards apply to all land uses including office and multi-family residential. The location and design of all driveway openings shall meet the standards contained in this section and shall be submitted for approval to the Director of Public Works, or Designee.

Multiple driveway openings for a single development shall not exceed forty (40) percent of the property frontage as measured at the street curbline. This distance shall include the curb radius on the driveway.

Deceleration lanes may be required by the Director of Public Works, or Designee for driveways on arterial and collector streets. Requirements for these lanes may be anticipated where the additional lane is needed to avoid disrupting traffic flow on the street. Refer to Table 4-3.

Table 4-3
Deceleration Lane Standards

PUBLIC STREET SPEED LIMIT (MPH)	MINIMUM STORAGE LENGTH L_1 (FT)	MINIMUM TRANSITION LENGTH L_2 (FT)	MINIMUM CURB RADIUS R_1 (FT)	TRANSITION (TAPER) RADIUS R_2 (FT)
30	100	100	15	200
35	150	150	15	200
≥ 40	TBD*	TBD*	15	200

* Shall be designed by a Professional Engineer registered in the State of Texas and by way of an approved TIA and submitted to the Director of Public Works, or Designee, for approval.

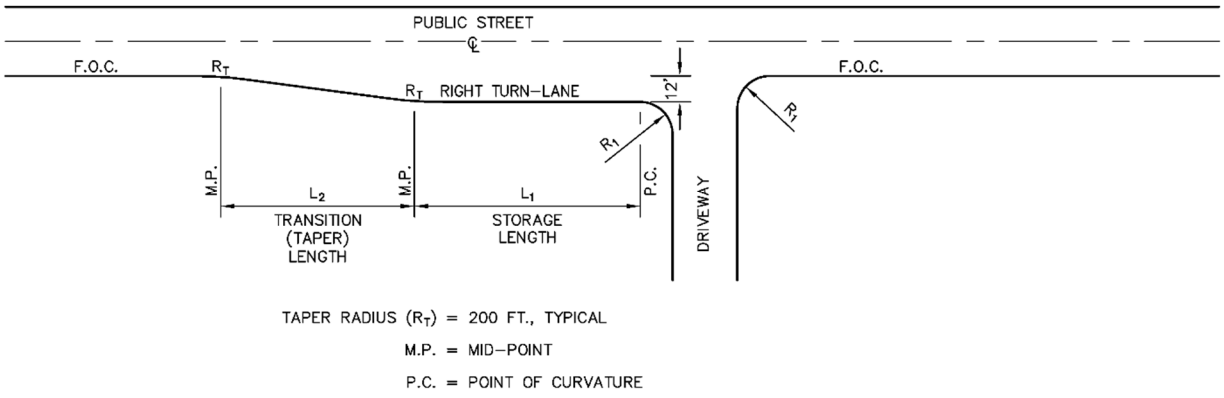


Figure 4- 3
Deceleration Lane Schematic

Waco's quality of urban development is aggressively promoted in newly developing areas by encouraging joint access and limiting the number of driveways in a given development frontage.

Driveway access to existing major streets may be restricted or prohibited where new driveways would create or worsen traffic problems.

Where severe physical restrictions exist and where such restrictions would effectively prohibit access to a property under development, the Director of Public Works, or Designee may waive one or more of the requirements contained herein. However, no driveway will be permitted when undue safety hazards to the motoring public could result.

The rise in a drive approach from the gutter line to the back of the apron shall be six inches, making the driveway slope in the first ten feet from the gutterline 5 percent. The slope may rise an additional 5 percent or fall a maximum of 6 percent in the second ten feet. These standards shall apply unless unusual conditions exist, and permission is obtained from Engineering Services of the City of Waco.

Where planned adjacent to another property, the driveway opening shall be set off the property line by a distance equal to the required curb radius. Adherence to this requirement should not significantly change the angle of intersection between the driveway and street from ninety (90) degrees. Refer to Table 4-4.

Table 4-4
Commercial Driveway Standards (Multiple Driveways)

STREET TYPE	ARTERIAL	COLLECTOR	LOCAL	CBD[1]
Driveway Width, X	30' Min. 42' Max.[2]	24' Min. 42' Max.[2]		
Curb Radius, R_1	10' Min.			
Interior Curb Radius, R_2	25’ Min.			
Driveway to Corner Length, L_1	120' Min.	60' Min.	35' Min.	40’ Min.
Length Between Driveways, L_2	40' Min.	40' Min.	40' Min.	40’ Min.

[1] Central Business District
[2] Divided driveway with raised medians will be reviewed on a case-by-case basis.

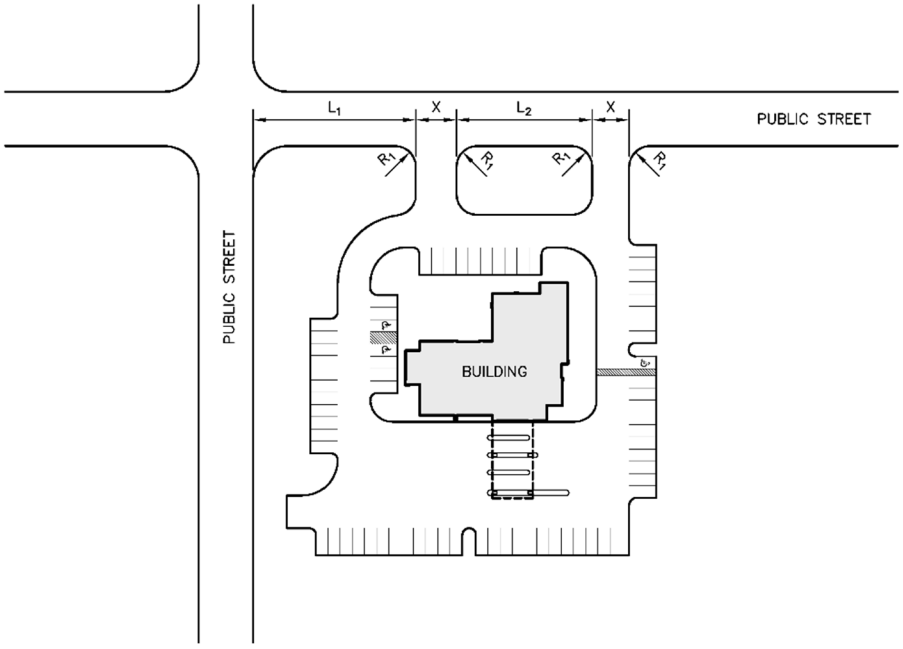


Figure 4-4
Schematic for Commercial Driveway Standards

Driveways may be required to be shared among adjacent property owners with appropriate recorded ingress/egress and cross parking agreements. Driveways serving major trip generators will be required to have raised barrier curb to prevent internal circulation from crossing the driveway close to the street intersection.

C. Industrial Driveway Standards

Industrial driveway standards apply to land uses within designated industrial districts. These standards may also be applied to other land uses with industrial or commercial zoning where frequent use by large wheelbase or semi-trucks is anticipated. The design of internal circulation elements must consider the operational characteristics of large wheelbase trucks and semi-trailers as well as parking and loading requirements. Refer to the chart below.

- Commercial driveway width and curb radii standards shall apply to driveways anticipated to accommodate passenger vehicles and smaller trucks only.
- Industrial driveways shall be located and designed in such a way that all maneuvering space to loading areas or docks is provided on-site, so as to discourage backing from the street. The location and design of all industrial driveway openings shall meet the standards contained in this section and shall be approved by the Director of Public Works, or Designee.

Table 4-5
Industrial Driveway Standards

STREET TYPE	ARTERIAL	COLLECTOR
Driveway Width, X_1	30' Min. 50' Max.	30' Min. 50' Max.
Curb Radius, R_1	15' Min. 25' Typ.	10' Min. 25' Typ.
Driveway to Corner Length, L_1	120' Min.	60' Min.
Length Between Driveways, L_2	40' Min.	40' Min.

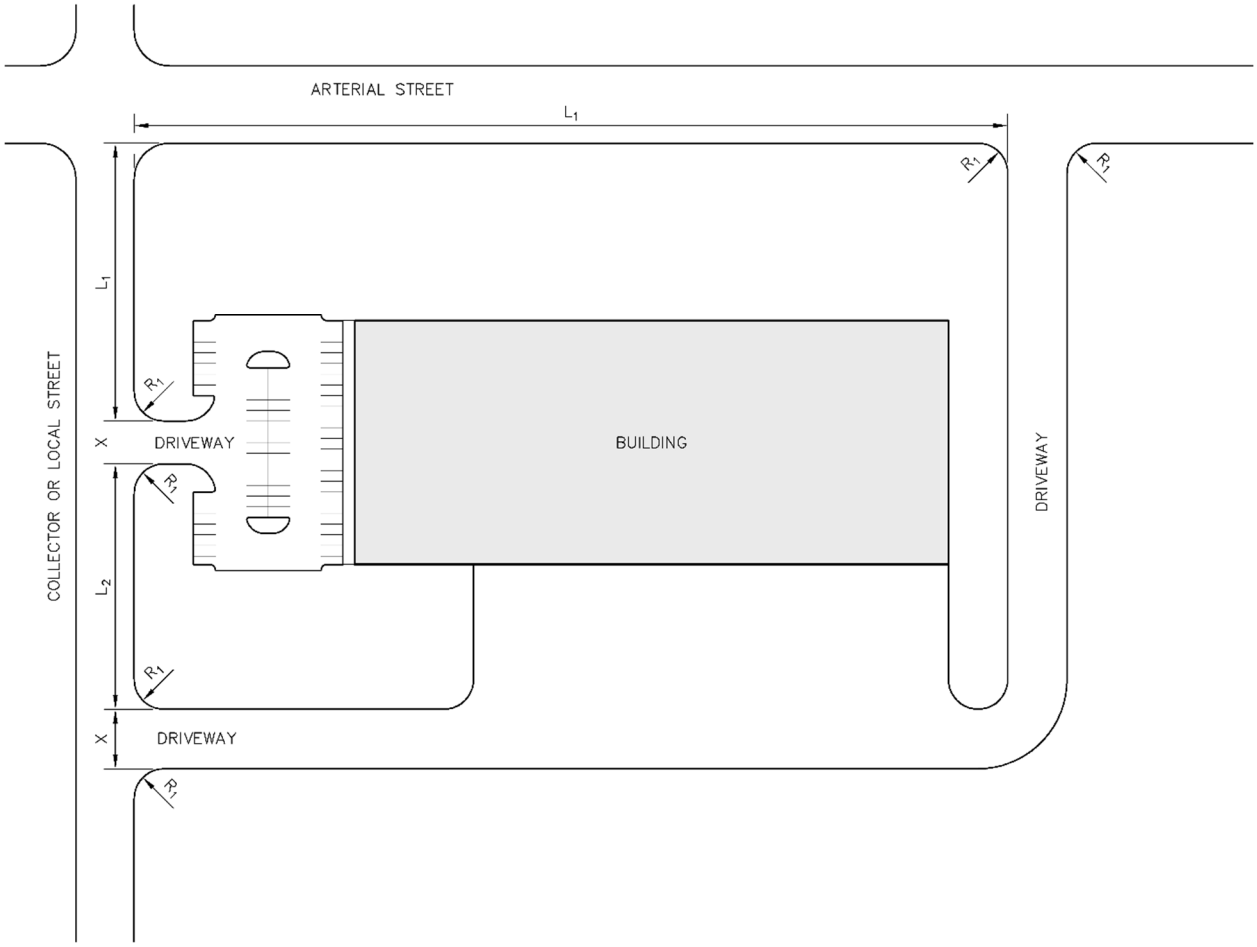


Figure 4-5
Industrial Driveway Schematic

D. Alley Access

The use of alleys by the public for access to off-street parking is permissible under certain conditions. Alley intersections shall meet the minimum City sight distance requirements for street intersections and shall meet the following requirements:

- The alley shall meet the horizontal and vertical criteria at intersections as prescribed for local streets.
- Existing utilities are relocated as required.
- Ingress, egress, and loading provisions meet the Solid Waste refuse pick-up requirements.
- The alley is paved with reinforced concrete by the developer according to City's Standard Specifications for Construction. Such paving shall be required for the full width of the development plus any additional paving needed to provide a continuous paved accessway to a nearby City street.
- If the alley is approved for use as a direct access to head-in parking, two additional conditions must be satisfied:

1) The total number of parking spaces provided must equal or exceed the number required by the City of Waco Zoning Ordinance, and
2) The minimum aisle width for the alley head-in parking is thirty feet.

5.0 PEDESTRIAN ACCESSIBILITY STANDARDS

All sidewalks shall be designed and constructed in accordance with the requirements of Americans with Disabilities Act, Public Right-of-Way Accessibility Guidelines (PROWAG), Texas Department of Licensing and Regulations, City of Waco Code of Ordinances, City of Waco Standard Specifications, City of Waco Standard Details, or other guides as approved by the Director of Public Works, or Designee.

6.0 BICYCLE FACILITIES STANDARDS

The following documents shall be used in the design of on-street bicycle facilities: AASHTO's Guide for the Development of Bicycle Facilities, NACTO's Urban Bikeway Design Guide, Texas Manual on Uniform Traffic Control Devices (TMUTCD), and/or other guides as approved by Director of Public Works, or Designee, such as but not limited to FHWA Separated Bike Lane Planning and Design Guide, FHWA Achieving Multimodal Networks, FHWA Accessible Shared Streets, FHWA Measuring Multimodal Network Connectivity.

7.0 STREET LIGHT POLICY

[Left Blank Intentionally]

8.0 TRAFFIC IMPACT ANALYSIS GUIDELINES

[Left Blank Intentionally]

GLOSSARY

APPLICANT - A developer or an agent acting on a developer's behalf

COMPREHENSIVE PLAN - The City of Waco's (adopted) Comprehensive Plan

DEVELOPMENT - Proposed development, which includes its physical characteristics and its use

ITE - Institute of Transportation Engineers

PLAN COMMISSION - City Plan Commission

TRAFFIC IMPACTS - Impacts that traffic generated, by a development, will have on the (1) operational and physical characteristics of the transportation system that is adjacent to and/or surrounding the development and (2) neighborhoods that are abutting or adjacent to the development.

TRAFFIC IMPACT ANALYSIS (TIA) - A study which assesses traffic impacts. The study's range of detail and complexity depends on the type, size, and location of a development.

TRB - Transportation Research Board

TRANSPORTATION SYSTEM - An assemblage of components for the movement of people and goods, which includes travel ways (e.g., roadways, railways, bicycle paths), intersections, operational devices (e.g., traffic signals, lights), parking areas, and transport services (e.g., mass transit).

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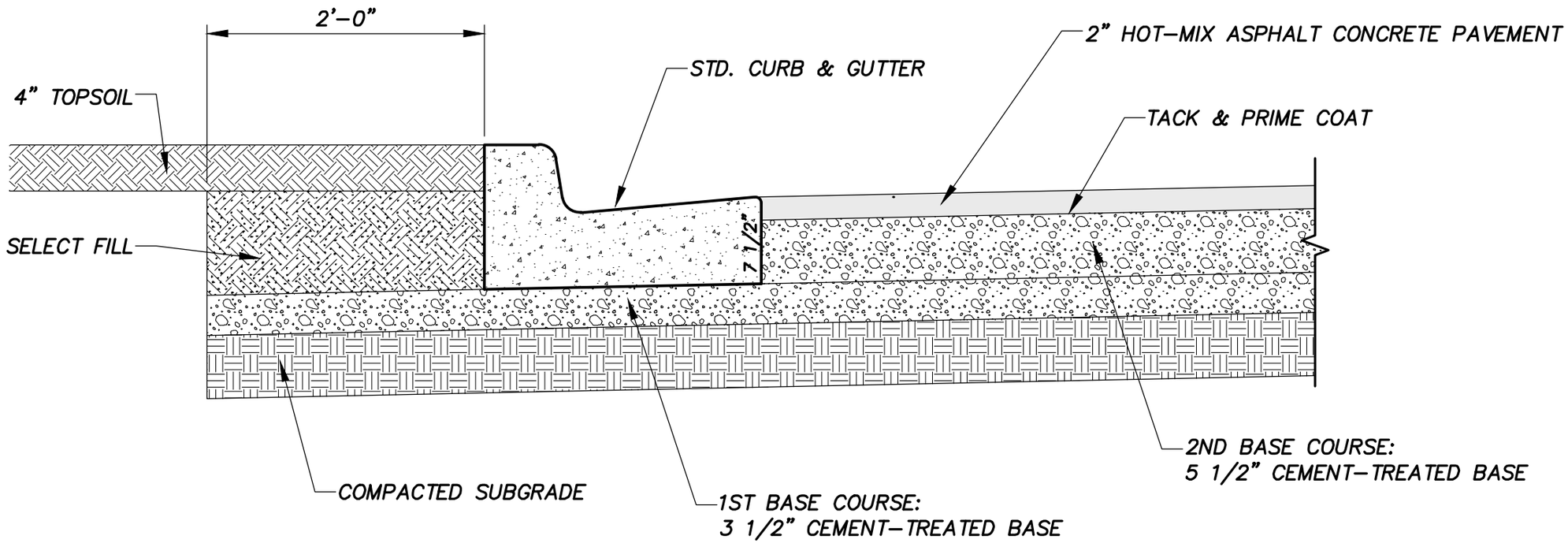
U.S. Department of Transportation, Federal Highway Administration, *Roundabouts: An Informational Guide (nacto.org)*, Publication No. FHWA-RD-00-067.

A "TYPICAL" FLEXIBLE PAVEMENT SECTIONS

APPENDIX

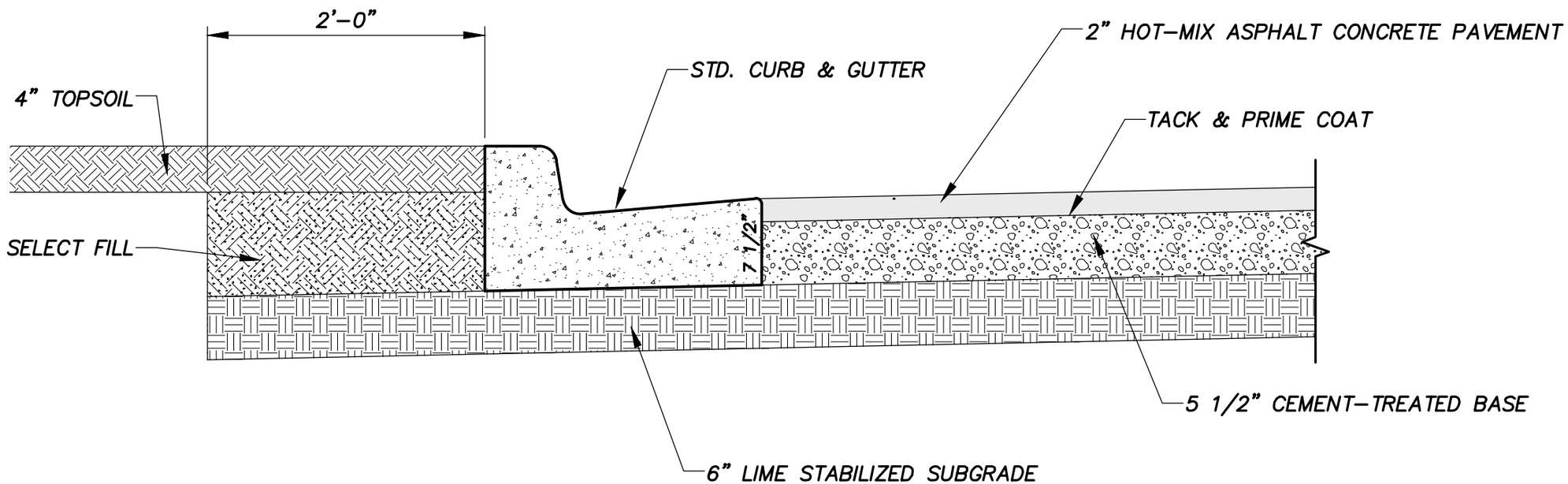


L1 (F)

TYPICAL FLEXIBLE PAVEMENT SECTION: LOCAL STREET (P.I. ≤ 20)

SCALE:

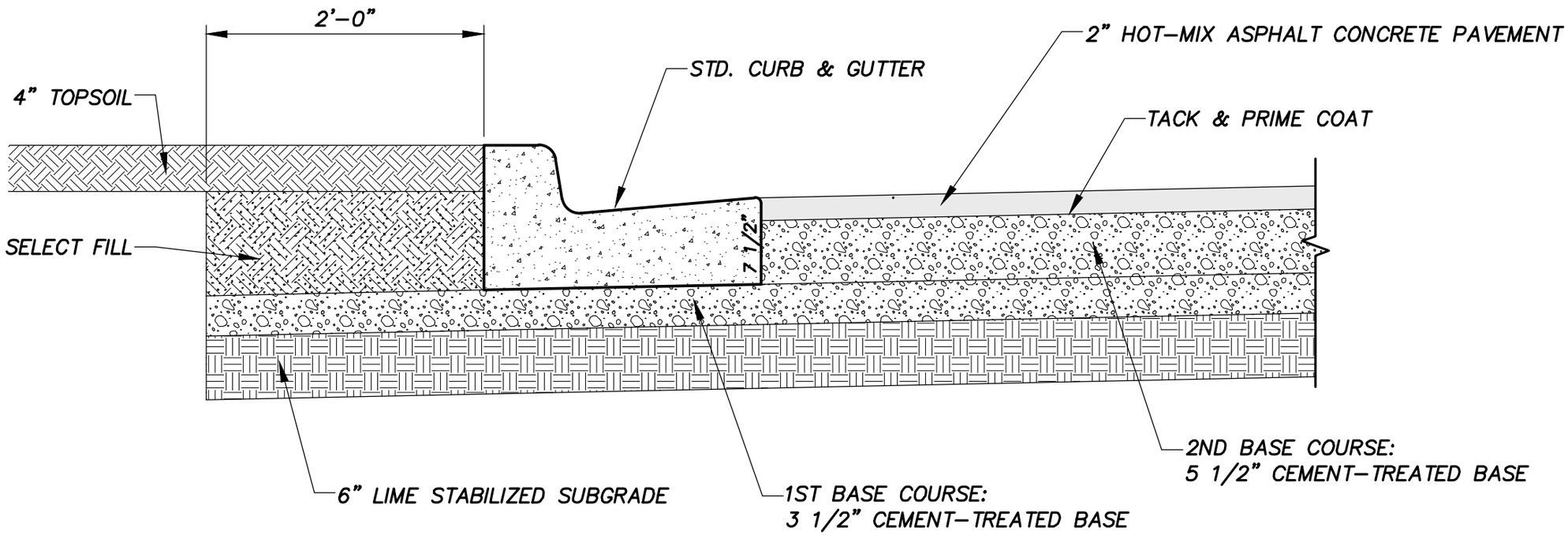
0 1 2 3



L2 (F) TYPICAL RIGID PAVEMENT SECTION: LOCAL STREET (20 < P.I. < 40)

SCALE:

0 1 2 3

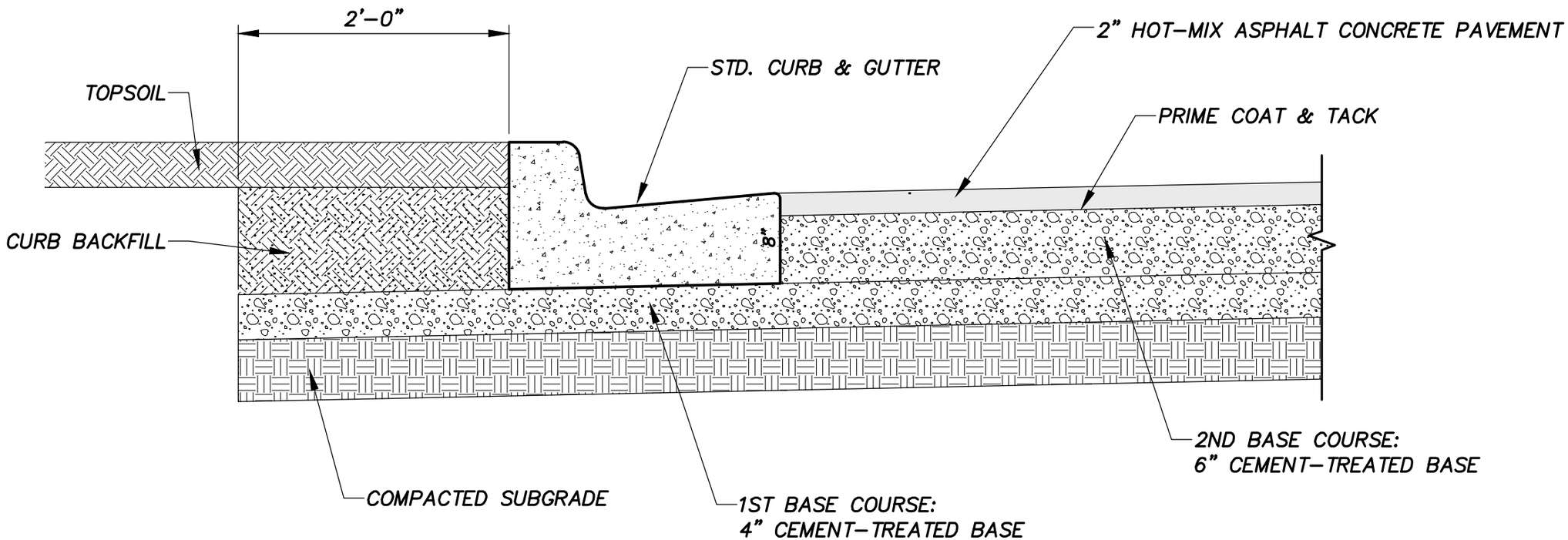


L3 (F)

TYPICAL FLEXIBLE PAVEMENT SECTION: LOCAL STREET (P.I. ≥ 40)

SCALE:

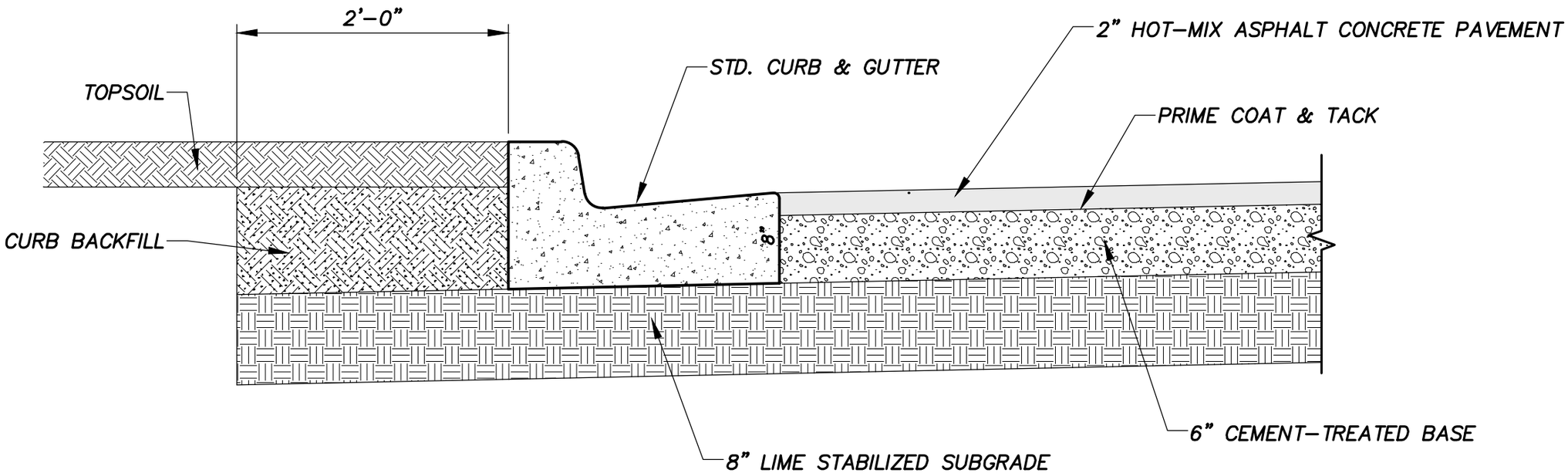
0 1 2 3



R/NC1(F) TYPICAL FLEXIBLE PAVEMENT SECTION: RESIDENTIAL/NEIGHBORHOOD COLLECTOR STREET (P.I. < 20)

0 1 2 3

GRAPHIC SCALE (FEET)



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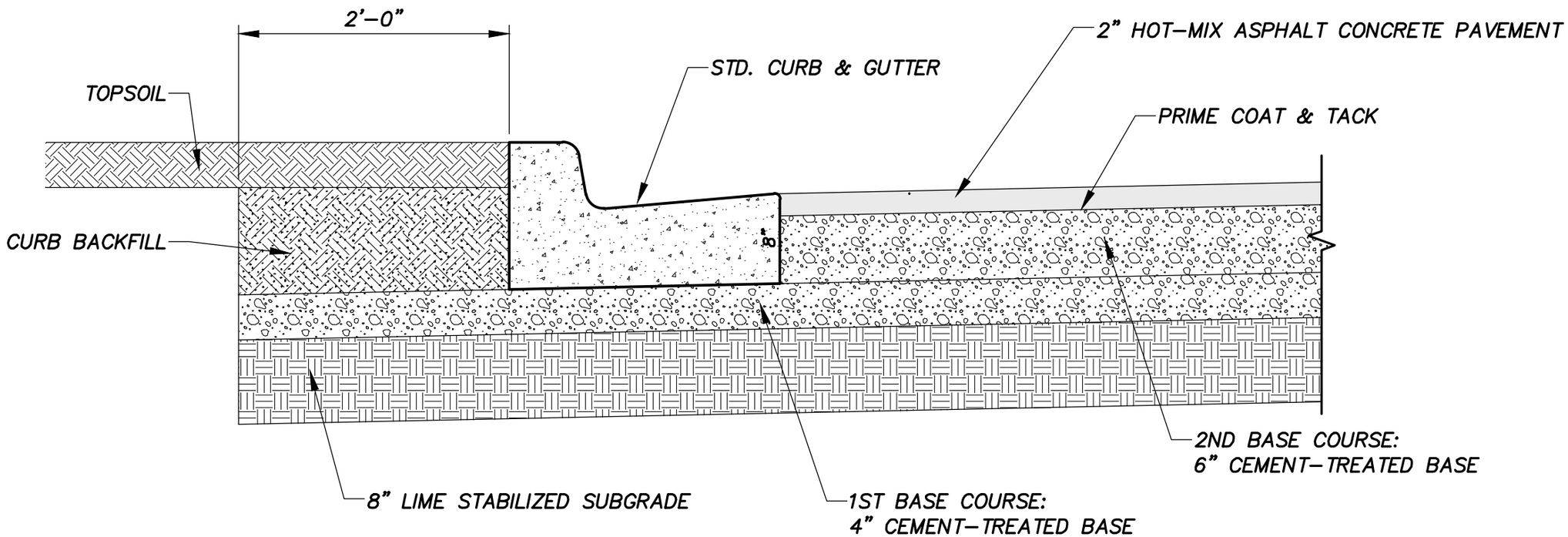

R/NC3(F) TYPICAL FLEXIBLE PAVEMENT SECTION: RESIDENTIAL/NEIGHBORHOOD COLLECTOR STREET (P.I. > 40)

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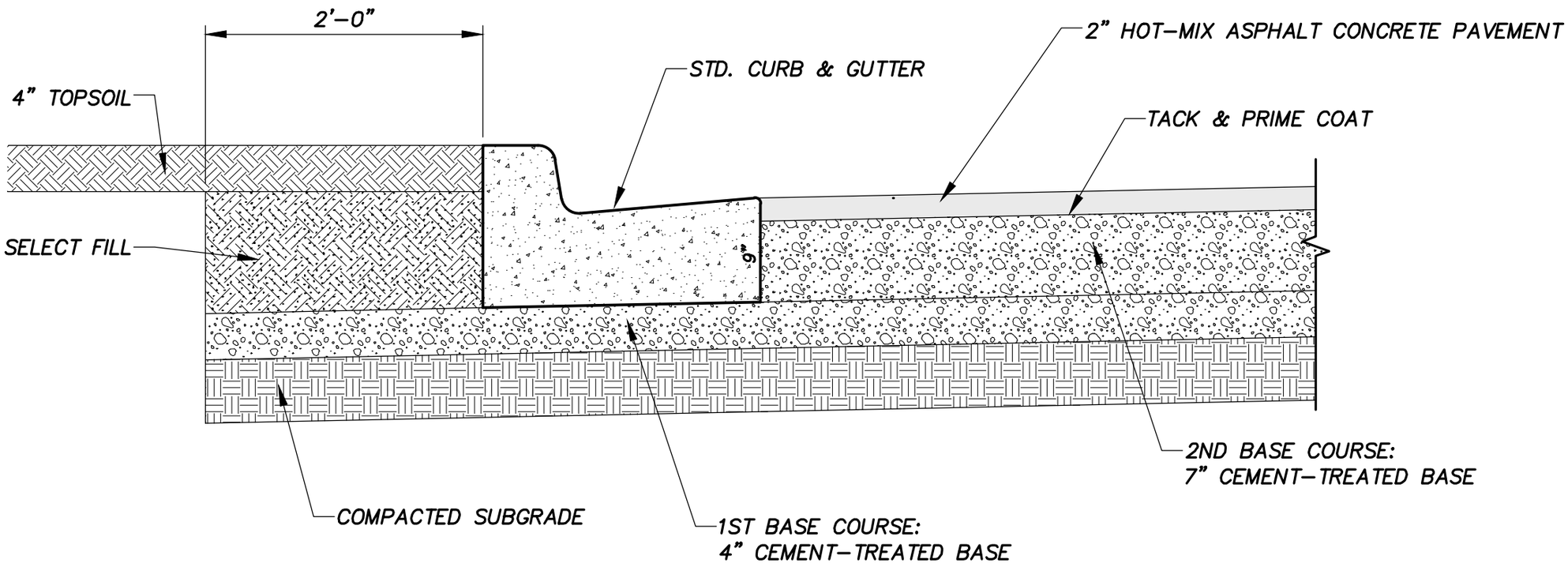
GRAPHIC SCALE (FEET)



CC1 (F)

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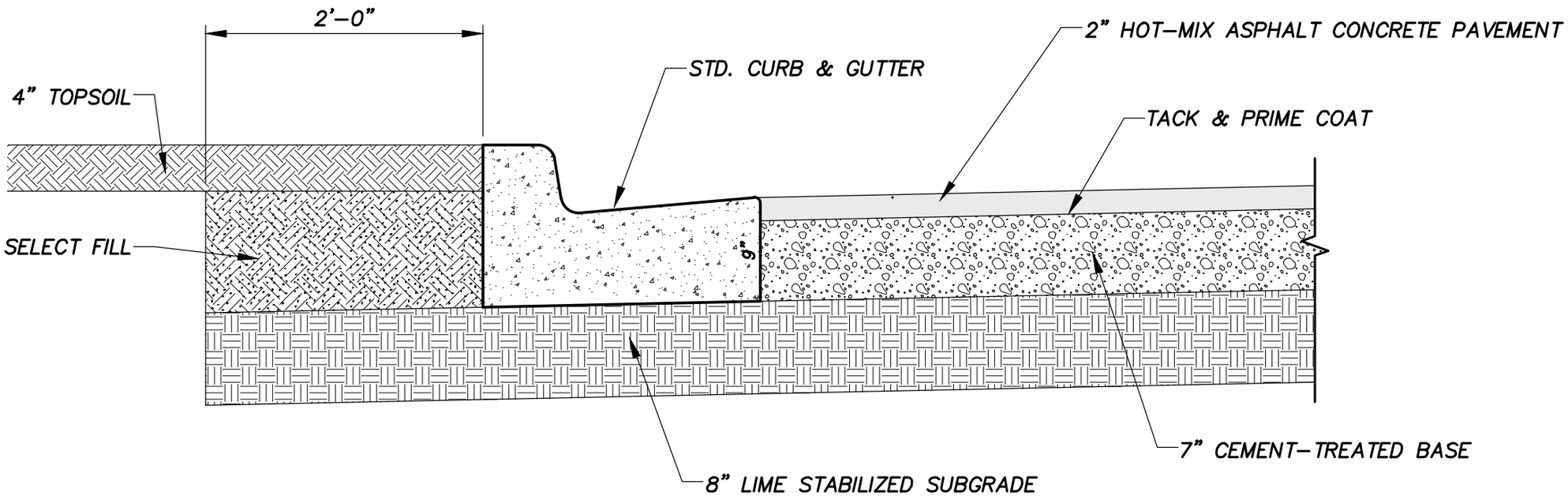
SCALE:

0 1 2 3



CC2(F)

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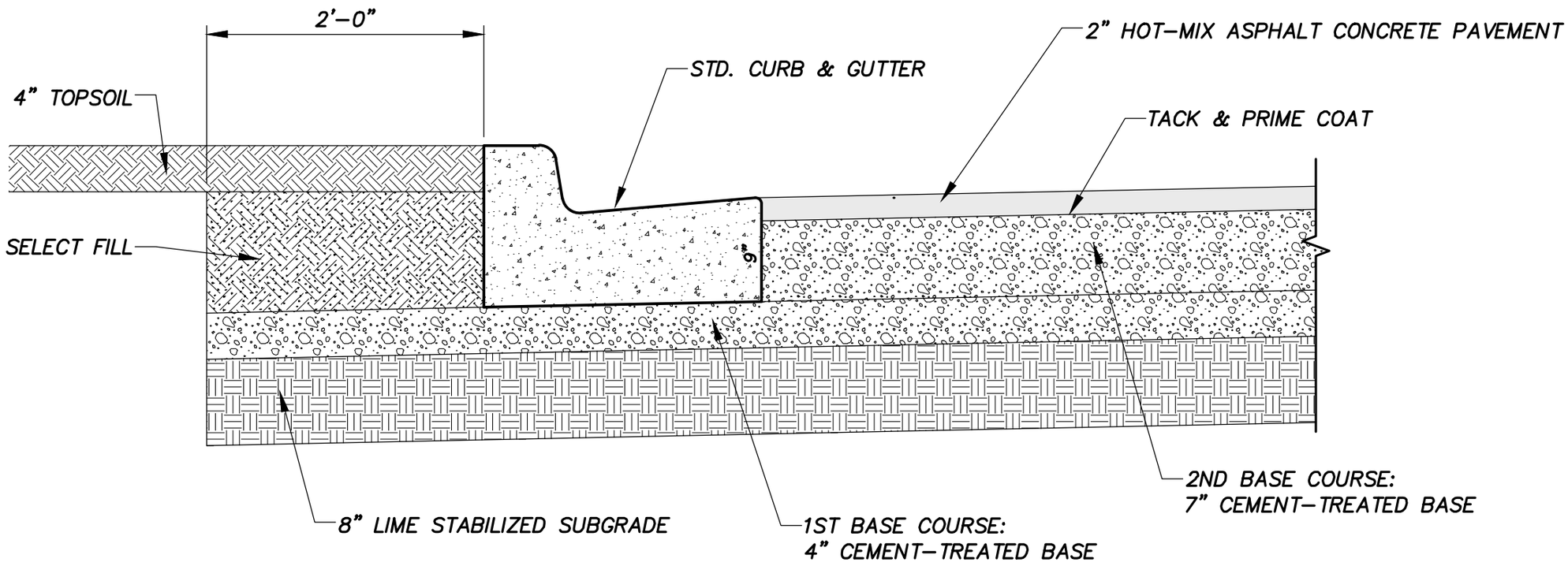

CC3 (F)

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SCALE:

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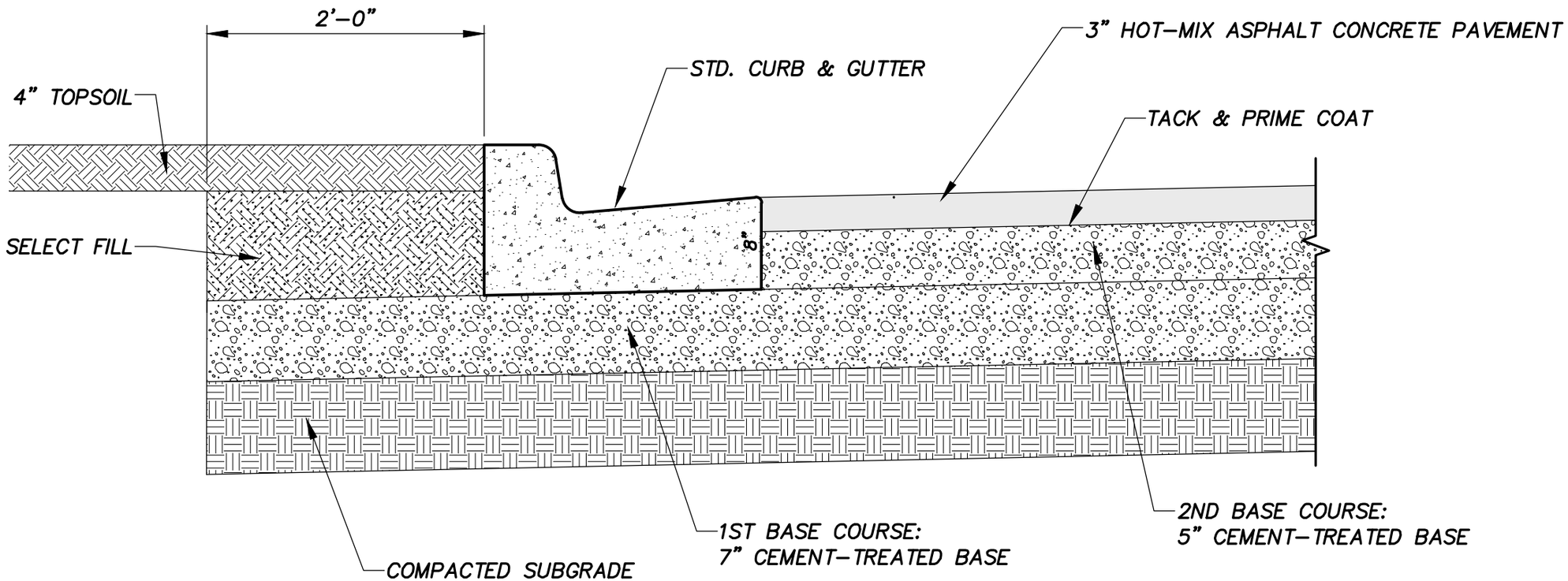

IC1 (F)

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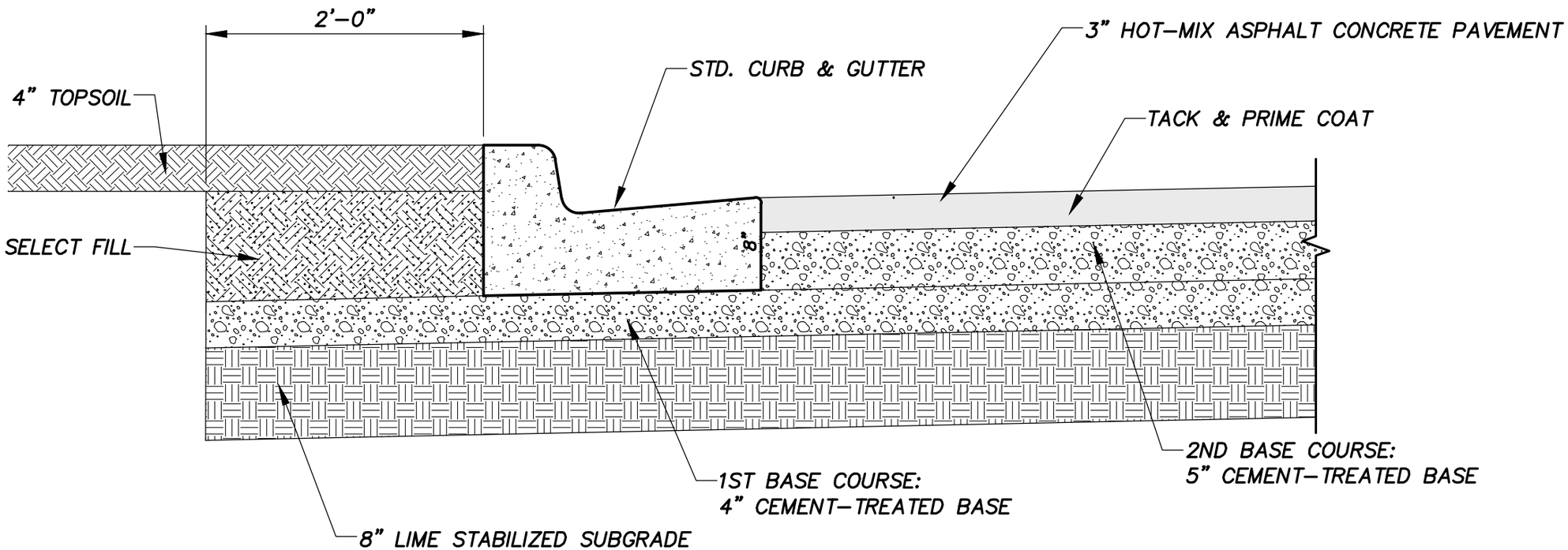
SCALE:

0 1 2 3



IC2 (F)

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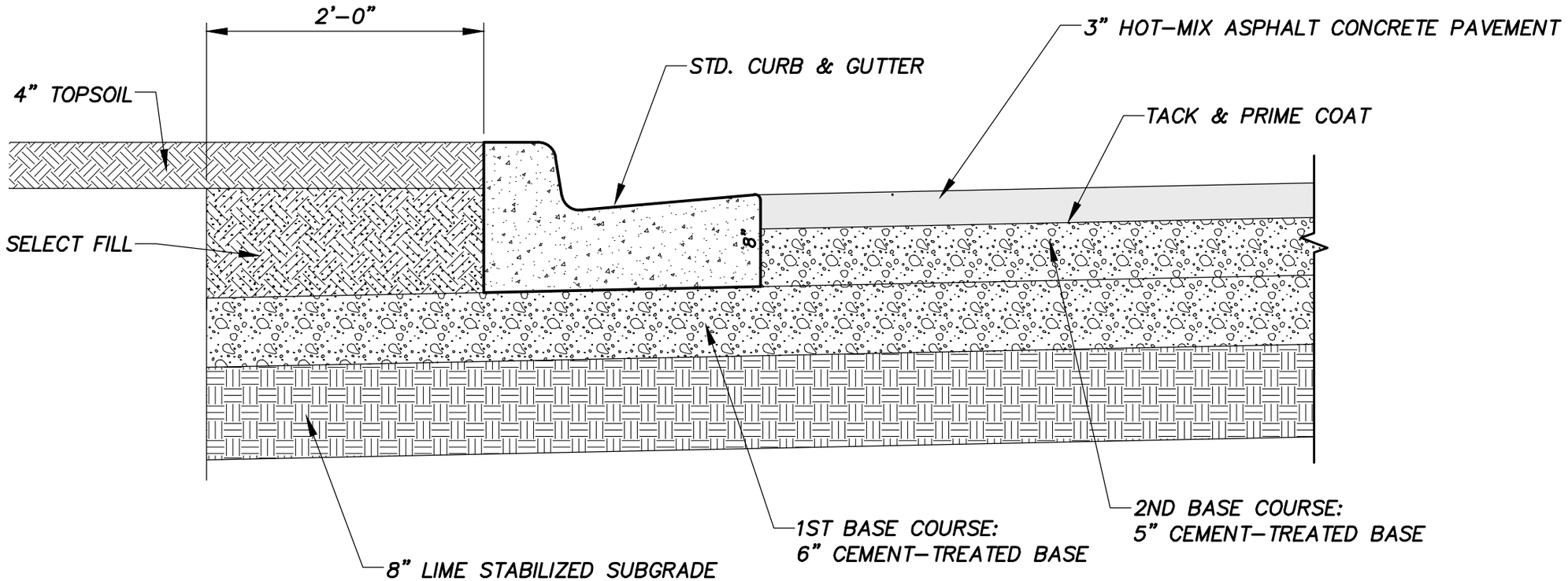


IC3 (F)

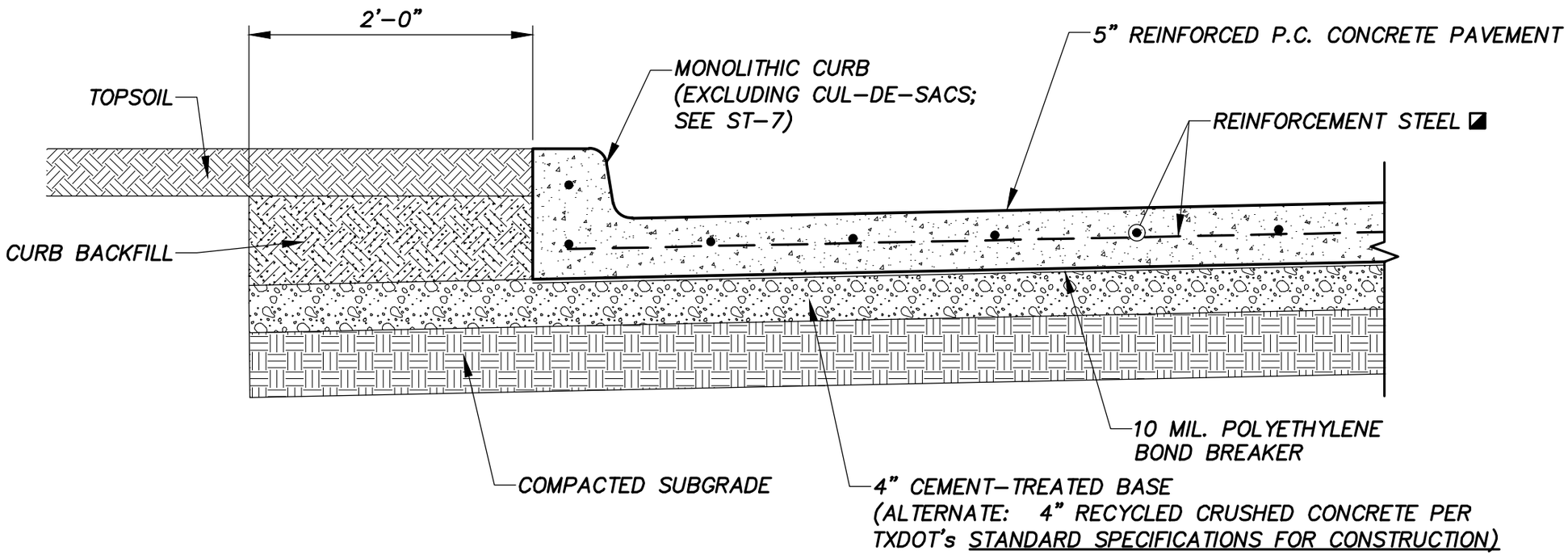
TYPICAL FLEXIBLE PAVEMENT SECTION: INDUSTRIAL COLLECTOR STREET (P.I. ≥ 40)

SCALE:

0 1 2 3

B "TYPICAL" RIGID PAVEMENT SECTIONS

APPENDIX



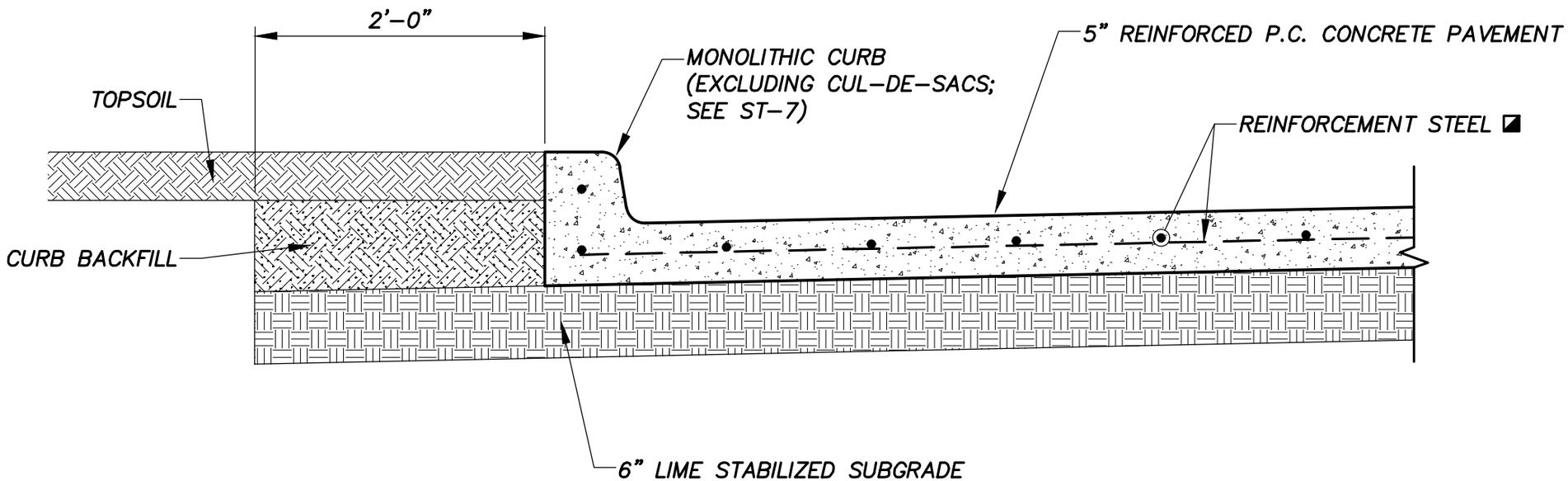
◪ ALL REINFORCEMENT STEEL SHALL BE NO. 4's @ 12" CENTER-TO-CENTER EACH WAY

L1 (R)

TYPICAL RIGID PAVEMENT SECTION: LOCAL STREET (P.I. ≤ 20)

0 1 2 3

GRAPHIC SCALE (FEET)

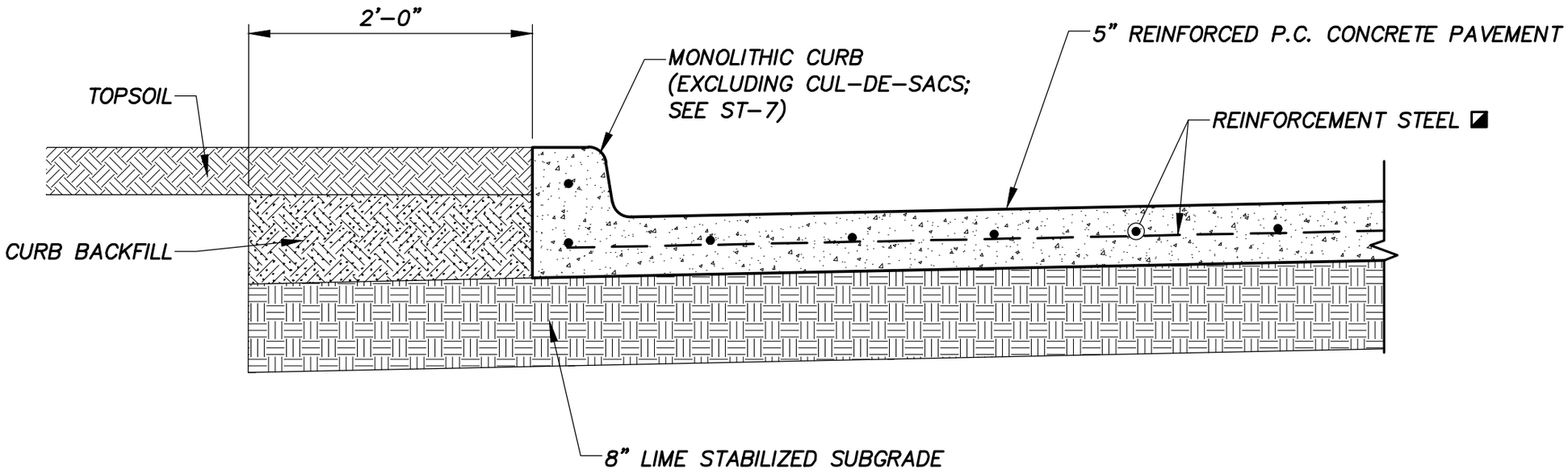


◪ ALL REINFORCEMENT STEEL SHALL BE NO. 4's @ 12" CENTER–TO–CENTER EACH WAY

L2(R) TYPICAL RIGID PAVEMENT SECTION: LOCAL STREET (20 < P.I. < 40)

0 1 2 3

GRAPHIC SCALE (FEET)

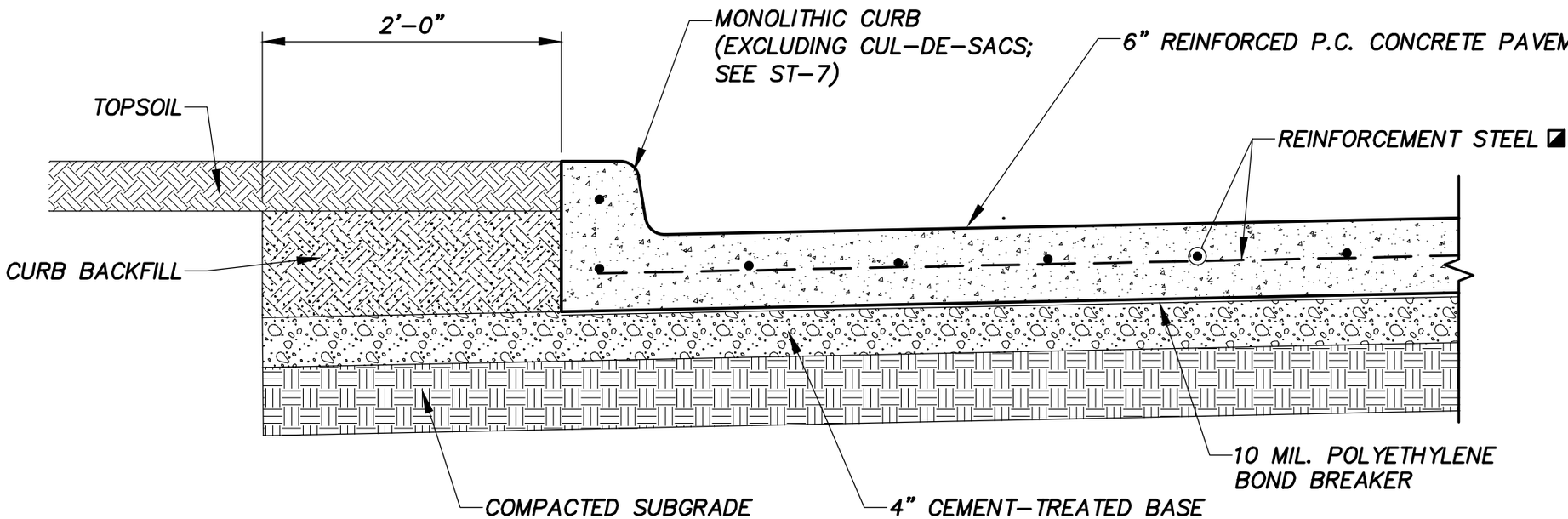


◪ ALL REINFORCEMENT STEEL SHALL BE NO. 4's @ 12" CENTER–TO–CENTER EACH WAY

L3(R) TYPICAL RIGID PAVEMENT SECTION: LOCAL STREET (P.I. ≥ 40)

0 1 2 3

GRAPHIC SCALE (FEET)

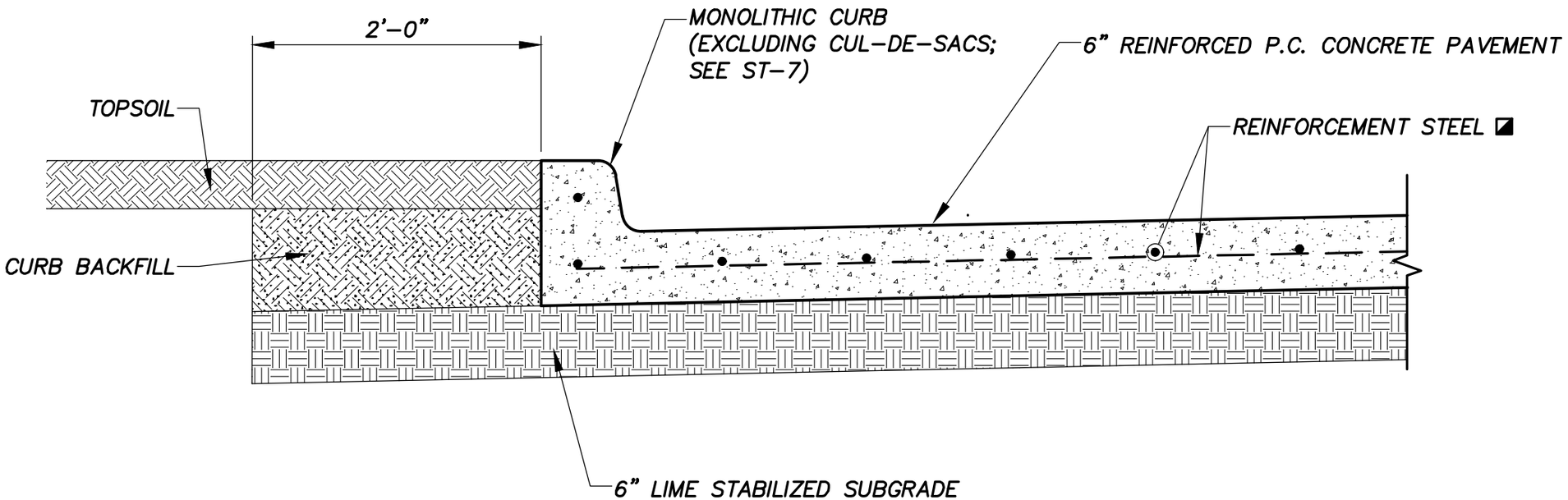


◪ ALL REINFORCEMENT STEEL SHALL BE NO. 4's @ 12" CENTER–TO–CENTER EACH WAY

R/NC1(R) TYPICAL RIGID PAVEMENT SECTION: RESIDENTIAL/NEIGHBORHOOD COLLECTOR STREET (P.I. < 20)

0 1 2 3

GRAPHIC SCALE (FEET)



◪ ALL REINFORCEMENT STEEL SHALL BE NO. 4's @ 12" CENTER–TO–CENTER EACH WAY

R/NC2 (R) TYPICAL RIGID PAVEMENT SECTION: RESIDENTIAL/NEIGHBORHOOD COLLECTOR STREET (20 < P.I. < 40)

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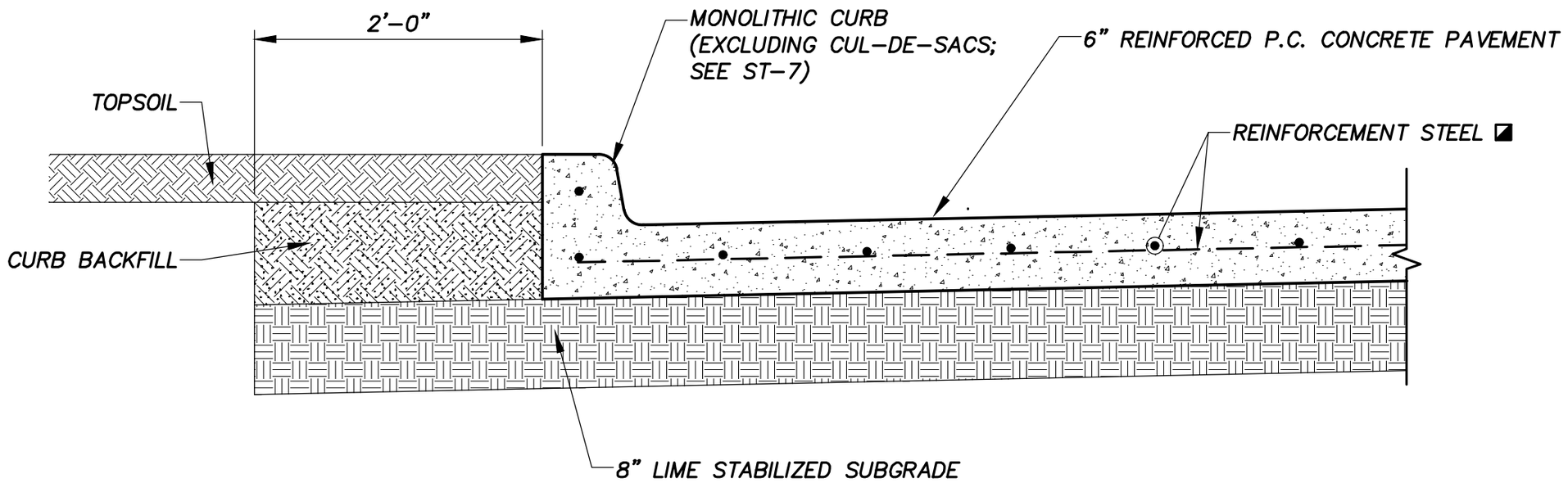
GRAPHIC SCALE (FEET)



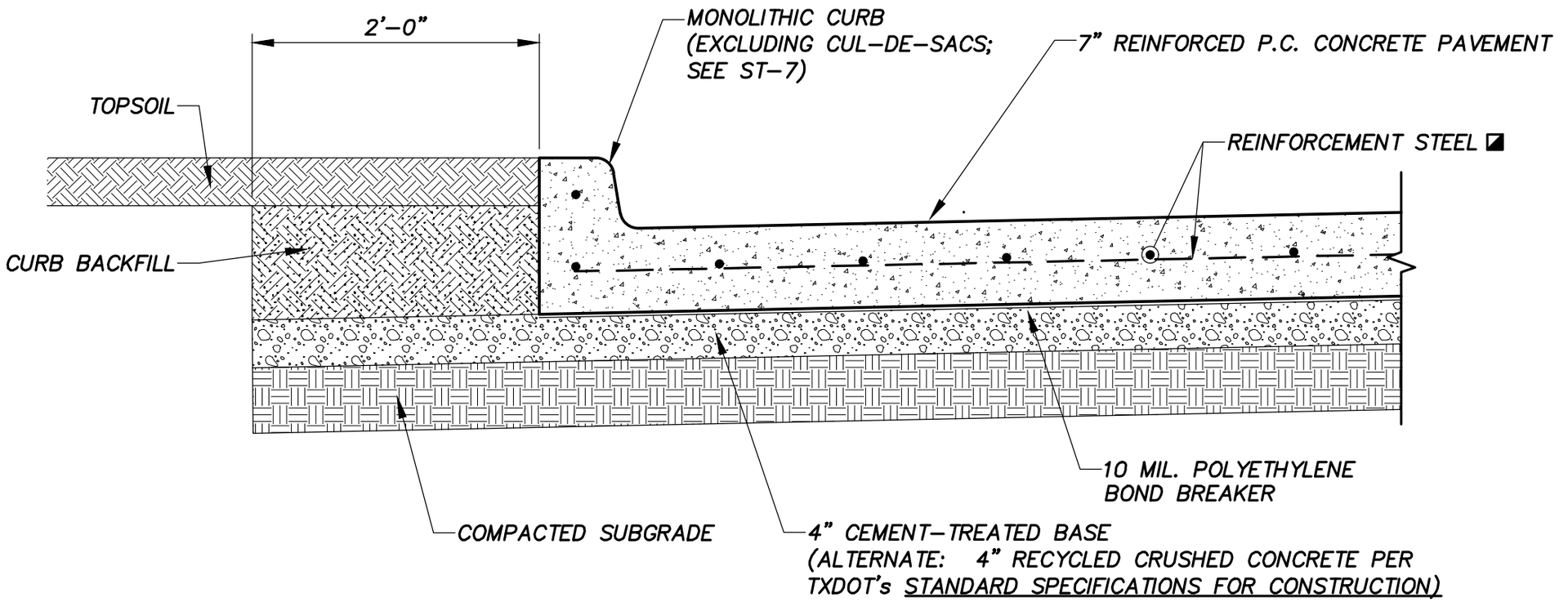
◪ ALL REINFORCEMENT STEEL SHALL BE NO. 4's @ 12" CENTER–TO–CENTER EACH WAY

R/NC3(R)

TYPICAL RIGID PAVEMENT SECTION: RESIDENTIAL/NEIGHBORHOOD COLLECTOR STREET (P.I. > 40)

0 1 2 3

GRAPHIC SCALE (FEET)



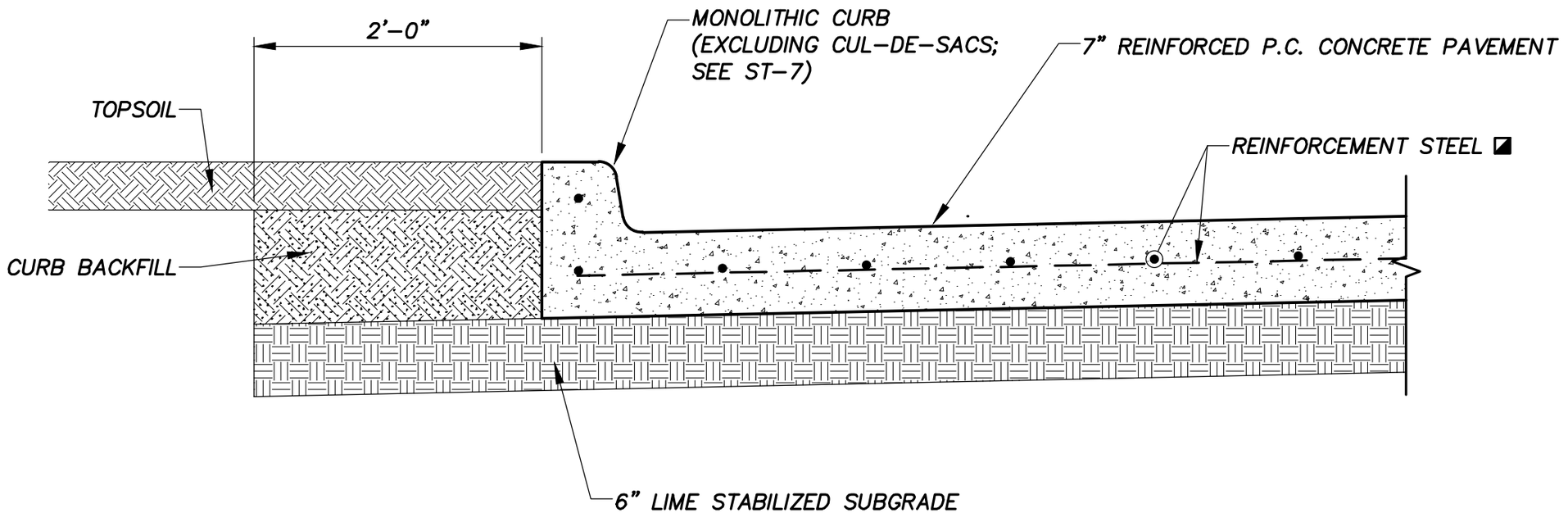
◪ ALL REINFORCEMENT STEEL SHALL BE NO. 4's @ 12" CENTER-TO-CENTER EACH WAY

CC1(R)

TYPICAL RIGID PAVEMENT SECTION: COMMERCIAL COLLECTOR STREET (P.I. ≤ 20)

0 1 2 3

GRAPHIC SCALE (FEET)



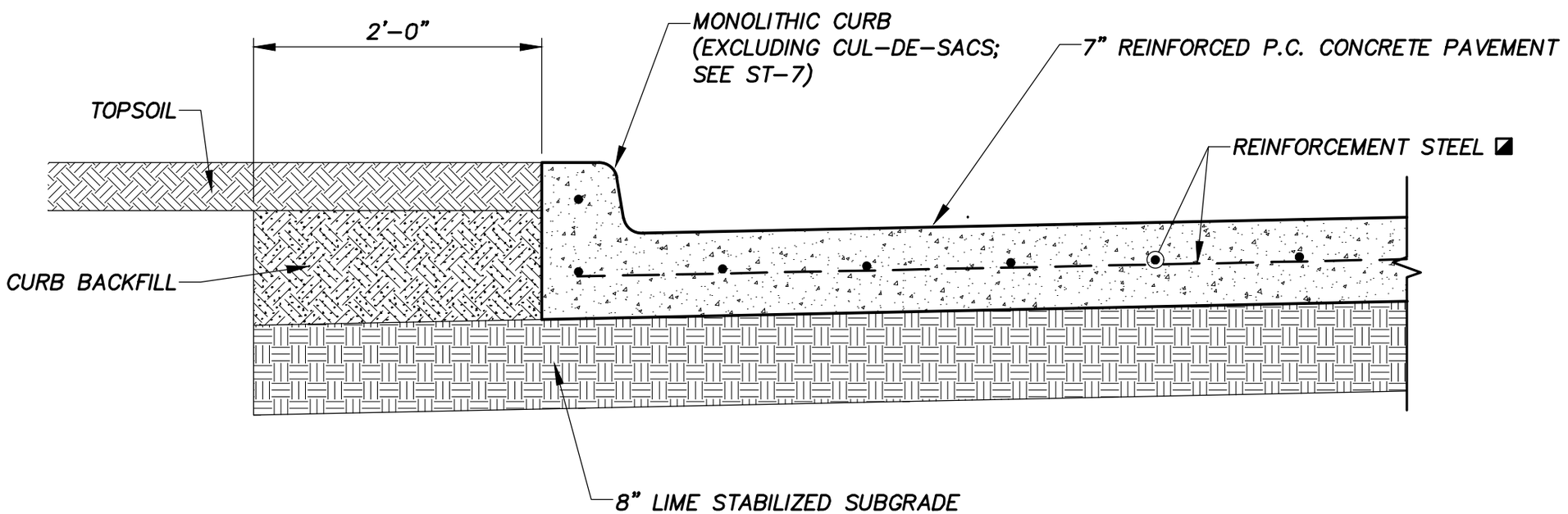
◪ ALL REINFORCEMENT STEEL SHALL BE NO. 4's @ 12" CENTER–TO–CENTER EACH WAY

CC2(R)

TYPICAL RIGID PAVEMENT SECTION: COMMERCIAL COLLECTOR STREET (20 < P.I. < 40)

0 1 2 3

GRAPHIC SCALE (FEET)

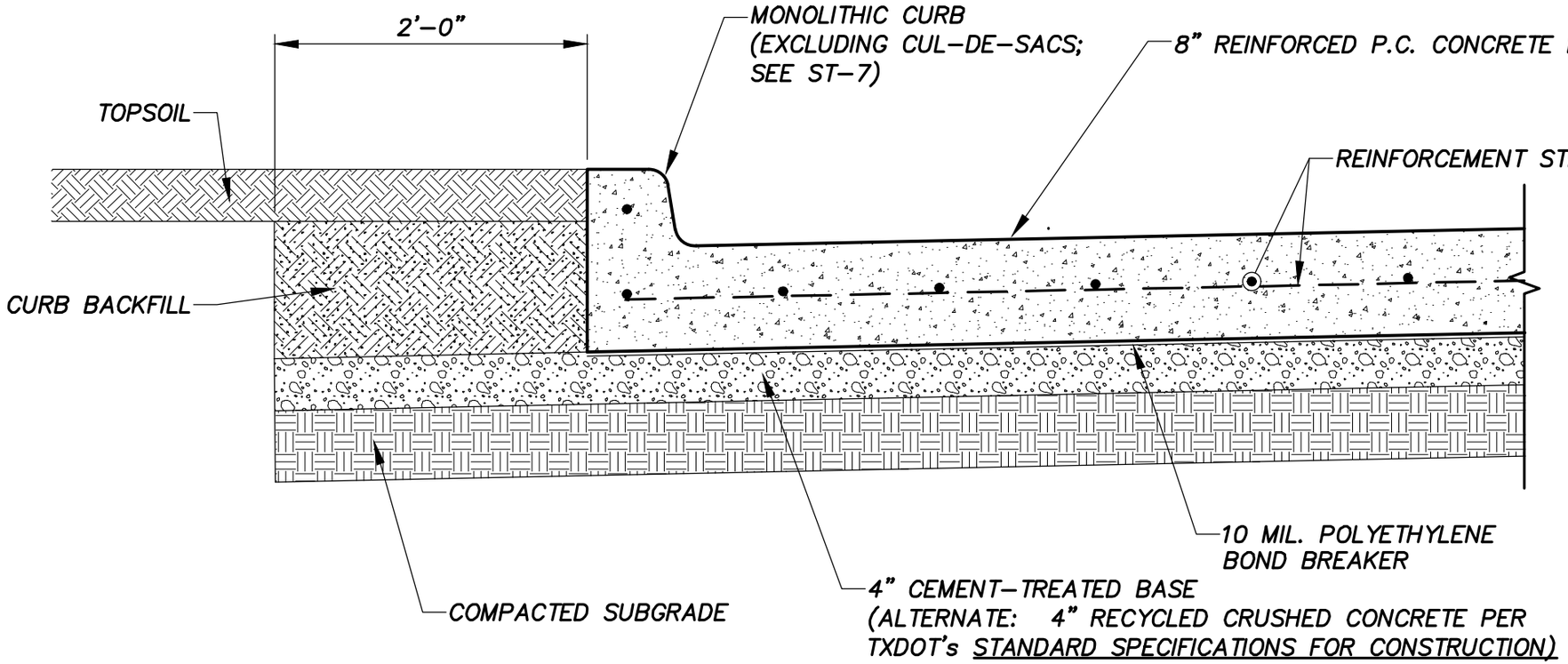


◪ ALL REINFORCEMENT STEEL SHALL BE NO. 4's @ 12" CENTER-TO-CENTER EACH WAY

CC3 (R) TYPICAL RIGID PAVEMENT SECTION: COMMERCIAL COLLECTOR STREET (P.I. ≥ 40)

0 1 2 3

GRAPHIC SCALE (FEET)



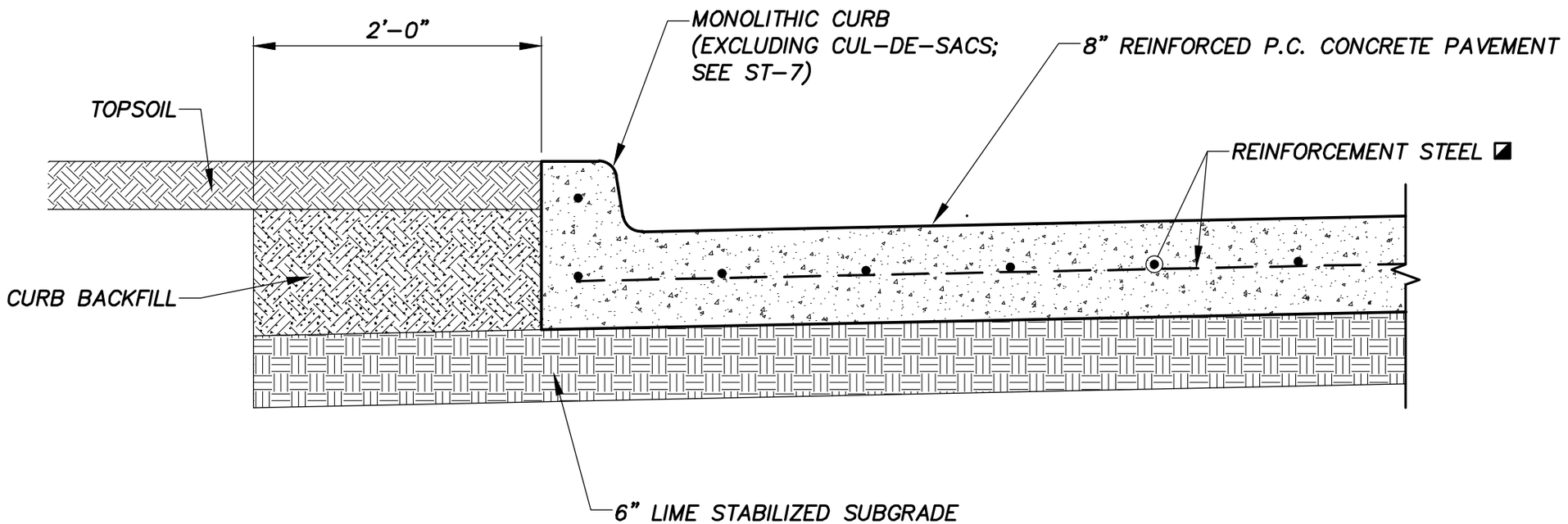
◪ ALL REINFORCEMENT STEEL SHALL BE NO. 4's @ 12" CENTER-TO-CENTER EACH WAY

IC1 (R)

TYPICAL RIGID PAVEMENT SECTION: INDUSTRIAL COLLECTOR STREET (P.I. ≤ 20)

0 1 2 3

GRAPHIC SCALE (FEET)



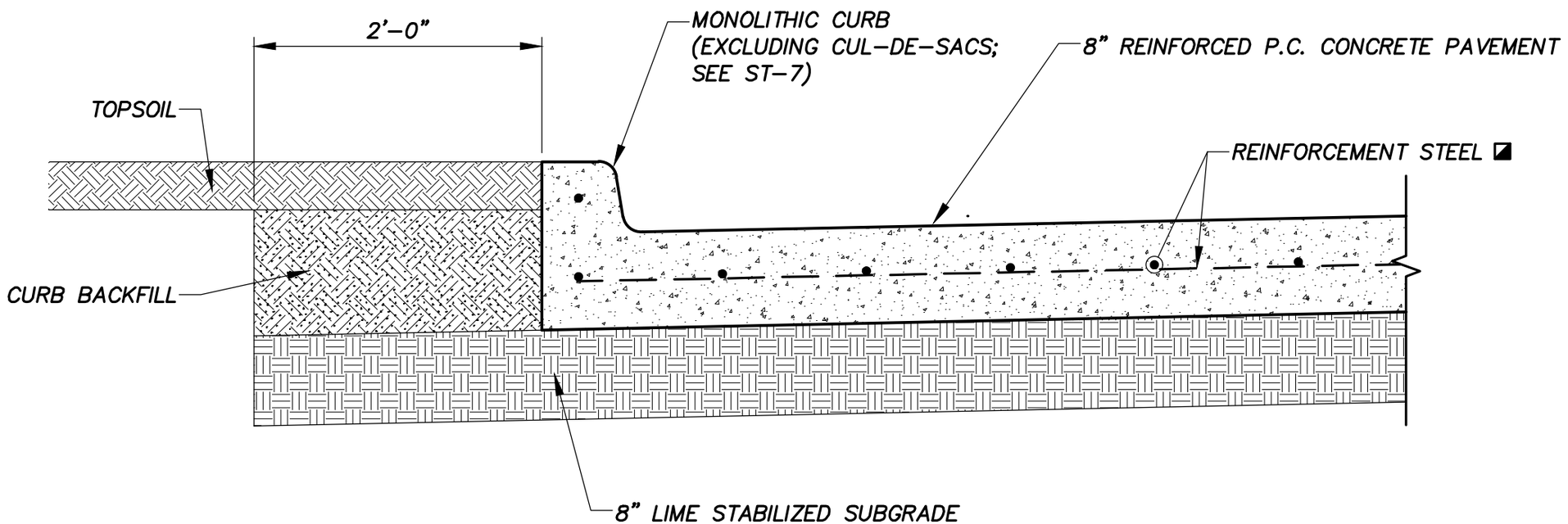
◪ ALL REINFORCEMENT STEEL SHALL BE NO. 4's @ 12" CENTER–TO–CENTER EACH WAY

IC2 (R)

TYPICAL RIGID PAVEMENT SECTION: INDUSTRIAL COLLECTOR STREET (20 < P.I. < 40)

0 1 2 3

GRAPHIC SCALE (FEET)



◪ ALL REINFORCEMENT STEEL SHALL BE NO. 4's @ 12" CENTER–TO–CENTER EACH WAY

IC3 (R)

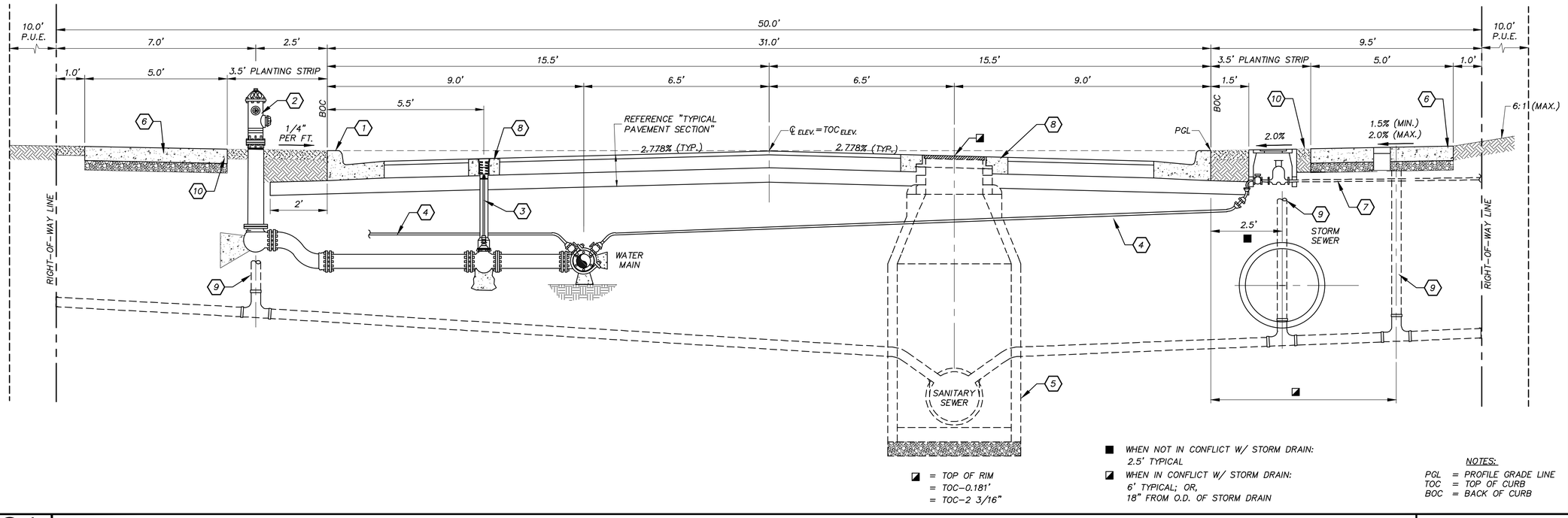
TYPICAL RIGID PAVEMENT SECTION: INDUSTRIAL COLLECTOR STREET (P.I. ≥ 40)

0 1 2 3

GRAPHIC SCALE (FEET)

C STREET CROSS-SECTIONS

APPENDIX



■ WHEN NOT IN CONFLICT W/ STORM DRAIN: 2.5' TYPICAL

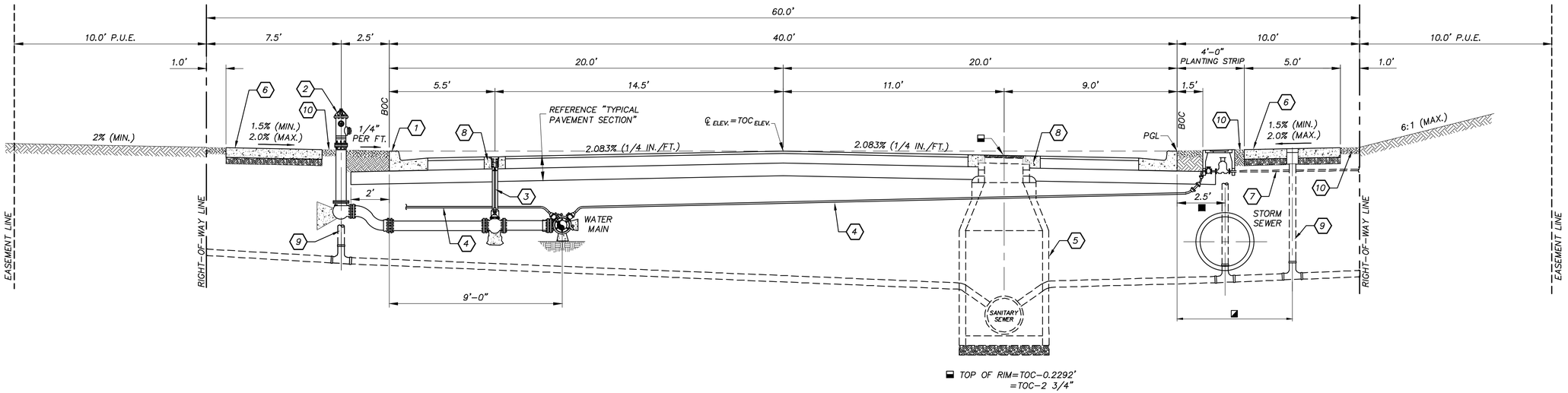
◪ WHEN IN CONFLICT W/ STORM DRAIN: 6' TYPICAL; OR, 18" FROM O.D. OF STORM DRAIN

◪ = TOP OF RIM = TOC–0.181' = TOC–2 3/16"

NOTES:
PGL = PROFILE GRADE LINE
TOC = TOP OF CURB
BOC = BACK OF CURB

G1 LOCAL STREET AND RIGHT-OF-WAY CROSS-SECTION WITH UTILITY ASSIGNMENTS

0 1 2 4



▬ TOP OF RIM=TOC–0.2292' =TOC–2 3/4"

■ WHEN NOT IN CONFLICT W/ STORM DRAIN: 2.5' TYPICAL

◪ WHEN IN CONFLICT W/ STORM DRAIN: 6' TYPICAL; OR, 18" FROM O.D. OF STORM DRAIN

NOTES:
PGL = PROFILE GRADE LINE
TOC = TOP OF CURB
BOC = BACK OF CURB

A1 MINOR COLLECTOR (RESIDENTIAL) STREET AND R.O.W. CROSS SECTION WITH UTILITY ASSIGNMENTS

0 1.5 3 6
GRAPHIC SCALE (FEET)

KEY NOTES

1. STANDARD CURB & GUTTER
2. FIRE HYDRANT
3. VALVE BOX & EXTENSION INSTALLATION
4. RESIDENTIAL WATER SERVICE
5. PRECAST CONCRETE WASTEWATER MANHOLE
6. REINFORCED CONCRETE SIDEWALK
7. YARD LINE
8. CONCRETE PAD/DIAMOND
9. SANITARY SEWER SERVICE W/ CLEANOUT BOX & COVER
10. 4" TOPSOIL W/SOLID BLOCK SOD OR BERMUDA SEED W/ GREEN CURLEX BLANKET

GENERAL NOTES

1. REFER TO THE CITY OF WACO'S MANUAL OF STANDARD DETAILS FOR "TYPICAL PAVEMENT SECTIONS" AND STREET, DRAINAGE, WATER, AND SANITARY SEWER STANDARD DETAILS.

REV.	DESCRIPTION	DATE

Walker Partners engineers ★ surveyors
T.B.P.E. Registration No. 8053

CITY OF WACO

STREET STANDARDS

LOCAL AND MINOR COLLECTOR (RESIDENTIAL) STREETS AND RIGHTS-OF-WAY CROSS-SECTIONS WITH UTILITY ASSIGNMENTS

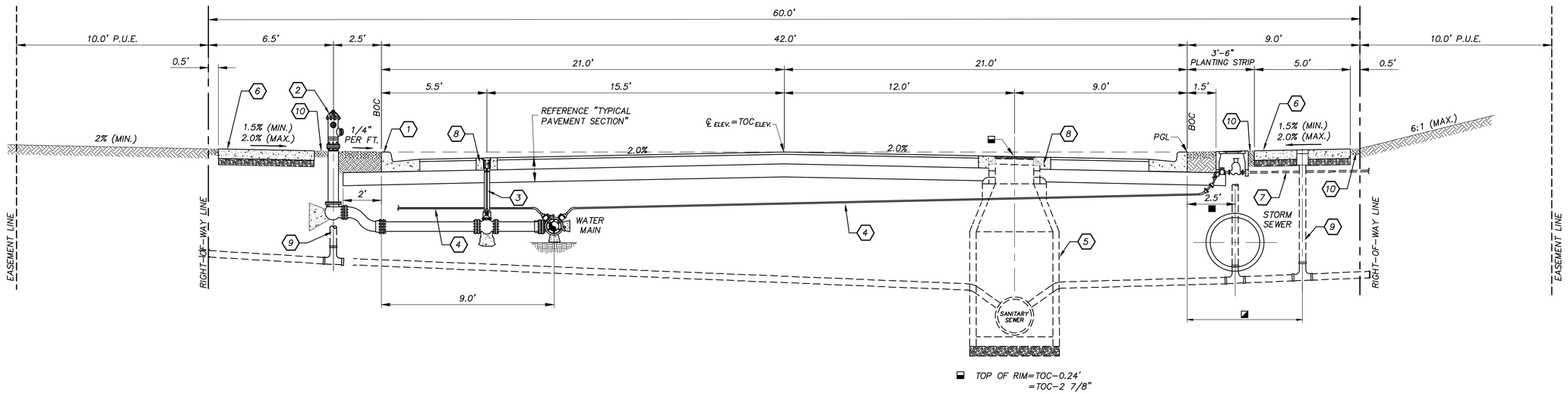
1-13-2025 DATE
GEORGE E. WALKER, JR.

STATE OF TEXAS
GEORGE E. WALKER, JR.
65360
REGISTERED PROFESSIONAL ENGINEER

PM	GEW
DESIGNED	GEW
DRAFTED	ARC
CHECKED	GEW
PROJECT NO.	WP

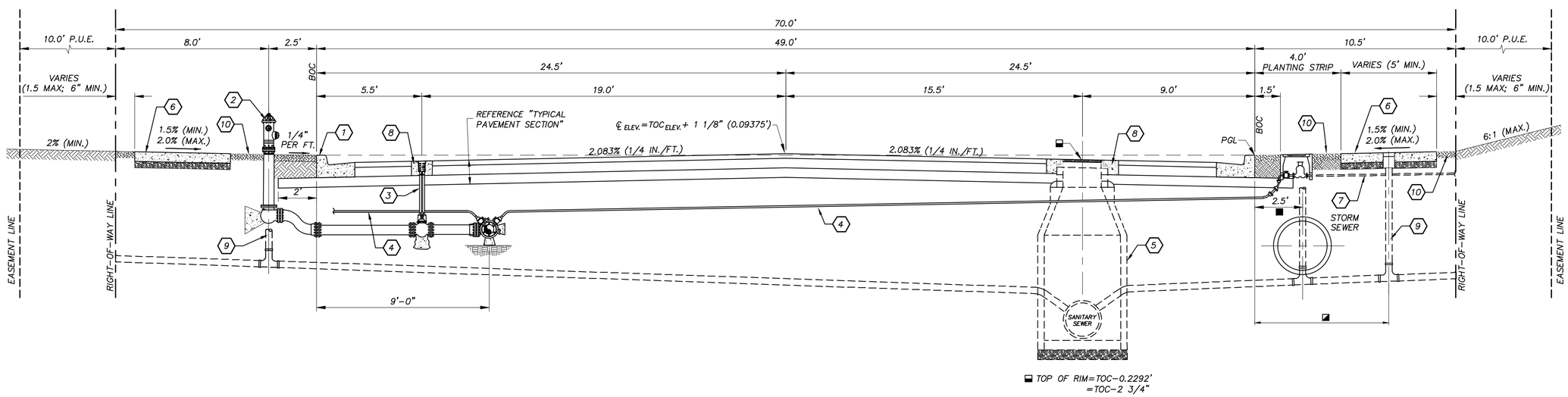
DRAWING NO. 2000

G:\PROJECTS\1-032262 ENGINEERING\2.0 CAD\DIVISION 2000 - STREET SECTIONS TO WACO 12-20-21.DWG, 32' SECTION, 1/13/2025 1:37:32 PM, achilds



G1 MINOR COLLECTOR (COMMERCIAL) STREET AND R.O.W. CROSS SECTION WITH UTILITY ASSIGNMENTS

GRAPHIC SCALE (FEET): 0, 1.5, 3, 6



A1 MAJOR COLLECTOR (NEIGHBORHOOD) STREET AND R.O.W. CROSS SECTION WITH UTILITY ASSIGNMENTS

GRAPHIC SCALE (FEET): 0, 1.5, 3, 6

KEY NOTES

1. STANDARD CURB & GUTTER
2. FIRE HYDRANT
3. VALVE BOX & EXTENSION INSTALLATION
4. WATER SERVICE
5. PRECAST CONCRETE WASTEWATER MANHOLE
6. REINFORCED CONCRETE SIDEWALK
7. YARD LINE
8. CONCRETE PAD/DIAMOND
9. SANITARY SEWER SERVICE W/ CLEANOUT BOX & COVER
10. 4" TOPSOIL W/SOLID BLOCK SOD OR BERMUDA SEED W/ GREEN CURLEX BLANKET

REV.	DESCRIPTION	DATE

Walker Partners engineers ★ surveyors
T.B.P.E. Registration No. 8053

CITY OF WACO

STREET STANDARDS

COLLECTOR STREETS AND RIGHTS-OF-WAY CROSS-SECTION WITH UTILITY ASSIGNMENTS

1-13-2025 DATE

GEORGE E. WALKER, JR.

STATE OF TEXAS
GEORGE E. WALKER, JR.
65360
REGISTERED PROFESSIONAL ENGINEER

PM	GEW
DESIGNED	GEW
DRAFTED	ARC
CHECKED	GEW
PROJECT NO.	WP

DRAWING NO. 2001

G:\PROJECTS\1-032262 ENGINEERING\2.0 CAD\DIVISION 2000 - STREET SECTIONS TO WACO 12-20-21.DWG, 40' AND 49' SECTIONS, 1/13/2025 1:37:19 PM, achilds