

TRANSPORTATION STANDARD DRAWINGS



DENVER
**TRANSPORTATION &
INFRASTRUCTURE**

CITY AND COUNTY OF DENVER DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE

JANUARY 2026

APPROVED BY:

Signed by:

A handwritten signature in blue ink, appearing to read "James G. Potter".

James G. Potter, PE, City Engineer

Signed by:

A handwritten signature in blue ink, appearing to read "Amy J Rens".

Amy Rens, PE, PTOE, City Traffic Engineer

1/26/2026

DATE

1/27/2026

DATE

<u>Standard Drawing No.</u>	<u>Description</u>	<u>Standard Drawing No.</u>	<u>Description</u>
1.0	Index of Standard Drawings	10.0	Typical Alley Layout
1.1	Legend	10.1	Alley Cut
2.0	General Notes for Cross Sections	10.2	Alley Cut (Modified)
2.1	Local Street Cross Section	10.3	Typical Alley Cross-Section
2.2	Collector Cross Section	10.4	Alley Curb Head
2.3	Arterial Cross Section	10.5	"L" Type Alley Configurations
2.4	2 Lane Arterial Cross Section	11.0a,b,c	General Notes for Concrete Pavement and Pavement Joints
2.5	Shared Street Cross Section	11.1	Concrete Non-Roadway Joints H and Z
3.0	Standard Utility Placement with Median	11.2	Concrete Roadway Joints and Transitions A-DA
3.1	Standard Utility Placement without Median	11.3	Concrete Roadway Joints and Transitions DC-L
4.0	Curb & Gutter and Detached Sidewalk	11.4	Concrete Roadway Joints and Transitions SA-X
4.1	Curb & Gutter and Attached Sidewalk	11.5	Concrete Roadway Joint Sealants
4.2a,b	Typical Curb & Gutter Sections	11.6	Concrete Roadway Jointing at New Manholes and All Inlets
4.3	Special Use Curb & Gutter Sections	11.7	Concrete Roadway Jointing at Existing Manholes
4.4	Planter Curbs	11.8	Concrete Roadway Typical Joint Layout
4.5	Concrete Gutter Overlay	11.9	Concrete Roadway Panel Replacement
5.0	Curb Extension	11.10	Concrete Street Exploratory Holes (Potholes) Typical Repair
5.1	Truck Apron	12.0	Asphalt Patch
5.2	Median Refuge Island	12.1	Trench Patch Through Existing Gravel or Landscape Materials
5.3	Monolithic Median Curb Nose	12.2	Trench Vertical Patch (Asphalt)
5.4	Raised Crossings	12.3	Trench ("T") Patch (Concrete)
5.5a,b	Neighborhood Traffic Circle	12.4	Trench Backfill Material Requirements
5.6	Speed Cushion	12.5	Typical Asphalt Pavement Detail
6.0	Standard Residential Curb Cut	12.6	Typical Asphalt Pavement Detail Lift Thickness Criteria
6.1	Standard Commercial and Multi-Family Curb Cut	12.7	Typical Asphalt Mix Details By Traffic Use or Lift Position
6.2	Curb Cut Cross-Sections	12.8a,b	Asphalt Patching Details
6.3	Corner Clearances & Minimum Distances Between Curb Cuts	13.0	Tree Planter (Raised Curb)
7.0a,b,c	General Notes for Curb Ramps	13.1	Three Sided Tree Planter (Varied Curb)
7.1	Curb Ramp Type 1	13.2	Flush Tree Planter (Grates)
7.2a	Curb Ramp Type 2	13.3	Flush Tree Planter (Without Grates)
7.2b	Curb Ramp Type 2 Modified	14.0	Sight Triangles
7.3	Curb Ramp Type 3	14.1	Sidewalk Clear Zones
7.4	Curb Ramp Type 4	15.0	Standard Cul-de-Sac
7.5	Curb Ramp at Downtown Signalized Corner Blended Transition	16.0	Right-of-Way Survey Control-Range Points
7.6a,b	Curb Ramp Truncated Dome Placement Options		
7.7	Curb Ramp Typical Section		
7.8	Typical Sidewalk Transitions to Curb Ramp Landing		
7.9	Signal Equipment Clear Zones		
8.0	Intersection Valley Gutter		
8.1	Sidewalk Chase Drain and Tread Plate		
9.0a	Typical Concrete Bus Pullout with Detached Sidewalk		
9.0b	Typical Concrete Bus Pullout with Attached Sidewalk		
9.1	Typical Concrete Bus Pad in Asphalt Roadway		



City And County Of Denver
Transportation Standard Drawings

Index of Standard Drawings

Date:
10/24

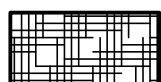
Std. Dwg.
1.0

- — — — — or  Centerline or Control Line
- or --(GB)-- or  Flowline or Grade Break (Not a joint)
- — — — — Right-of-Way Line (R.O.W)
- (A)— or —(DA)— or —(B)— Concrete Roadway – Expansion Joint per Std. Dwg. 11.2
- (H)— Non-Roadway Concrete Expansion Joint per Std. Dwg. 11.1
- (Z)— Non-Roadway Concrete Tooled or Sawed Joint per Std. Dwg. 11.1
- (C)— Concrete Roadway – Transverse Contraction Joint per Std. Dwg. 11.2
- (CA)— Concrete Roadway to Asphalt Pavement Transition per Std. Dwg. 11.2
- + + + + + (DC) + + + + + Concrete Roadway Doweled Transverse Contraction Joint per Std. Dwg. 11.3
- — — — — (E) — — — — — Concrete Roadway Longitudinal Contraction Joint per Std. Dwg. 11.3
- (L) ----- Longitudinal Construction Joint also at Curb & Gutter per Std. Dwg. 11.3
- (SA)— Sawed Appearance Joint per Std. Dwg. 11.4
- (TE)— Concrete Roadway to Existing Curb & Gutter Transition per Std. Dwg. 11.4
- × × × × (X) × × × × Concrete Roadway Mid-Panel Transverse Construction Joint per Std. Dwg. 11.4
-    Concrete Joint Sealants per Std. Dwg. 11.5

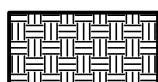
Table 1.1-1 Pedestrian Access Route (PAR) Design Elements			
Abbv.	Description	Max Design Slope	Max Field Measurement Slope
FLR	Accessible Flare Slope	9.5%	10.0%
RMP	Accessible Curb Ramp Slope	7.8%	8.3%
CXS	Accessible Cross Slope	1.5%	2.1%
CWXS	Accessible Crosswalk Slope	1.5%*	2.1%*
RNG	Accessible Running Slope	4.5%	5.0%

*See Std. Dwg. 7.0b Note 12 regarding Accessible Crosswalk Slope

ABC	Aggregate Base Course (Class 6), typically, as a stabilization material
CLSM	Controlled Low Strength Material (Std. Dwg. 12.4)
C&G	Curb & Gutter
DOTI	Dept. of Transportation and Infrastructure
FL	Flowline
HMA	Hot Mix Asphalt
PAR	Pedestrian Access Route (Compliant with FLR, RMP, CXS, CWXS, & RNG)
PCR	Point of Curb Return
TPZ	Tree Protection Zone



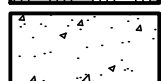
Asphalt



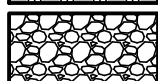
Ground/Subgrade



Dry Utility Zone



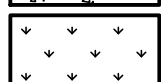
Concrete



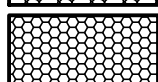
Stabilization Material,
typically ABC (Class 6)



Utility Service
Crossing Zone



Vegetation
Area/Green
Infrastructure



Detectable Warning
Surface



Irrigation or
Non-Potable
Water Use Zone



City And County Of Denver
Transportation Standard Drawings

Legend

Date:
10/24

Std. Dwg.
1.1

GENERAL NOTES FOR CROSS SECTIONS

1. These standard drawings are to be used by DOTI alongside the Complete Streets Design Standards and other DOTI Standards, Details, Manuals, Guidelines, and Engineering Policy Statements under the authority of the DOTI Rules and Regulations.
2. Cross sections depict typical mid-block conditions.
3. Curb space use depends on classification, street type, and overlay. See Complete Streets Design Standards.
4. DOTI determines where on-street parking is required. On arterials, curb space zones may be eliminated with DOTI approval such that travel lanes abut curb and gutter.
5. Gutter pans are not included in the travel lane width unless approved by DOTI.
6. Additional street width and R.O.W. may be required for certain corridors to accommodate special travel lanes, parking, and/or pedestrian, bicycle, or public transit facilities.
7. Median width may be wider for certain streets as requested by the developer and approved by DOTI. Medians will only be maintained by Denver Parks & Recreation when funding is identified and a written approval and maintenance agreement are obtained prior to median construction. Designer shall coordinate the design of the median with Denver Parks & Recreation.
8. Flush or striped medians may use the travel lane dimension.
9. Based on street type and overlay, travel lanes and curb space may be replaced with mode specific travel ways. See Complete Streets Design Standards for additional information.
10. The Sidewalk Zone includes the Pedestrian Access Route (PAR). A Frontage Zone can be added to any cross section behind the Sidewalk Zone. The Frontage Zone cannot encroach on the minimum Sidewalk Zone.
11. Where used, the Frontage Zone may be partially or fully in or out of R.O.W.. It should be located directly behind the Sidewalk Zone. For guidance on Frontage Zone requirements, consult the Complete Streets Design Standards.
12. Cross slope and Running Grade criteria are not shown on all sections. Table 2.0-1 applies to all sections.

Table 2.0-1

MAXIMUM STREET ZONE SLOPES

Sidewalk Zone	Cross Slope	CXS when the PAR is not contained within a crosswalk. CWXS when the PAR is contained within a crosswalk.
	Running Slope	RNG or adjacent street grade.
Amenity Zone/ Raised Median	Cross Slope	Pedestrian use likely: 5% or less (1.5% preferred). Pedestrian use unlikely and/or landscaped: 3:1 or less.
	Running Slope	RNG or adjacent street grade.
Travel Lane/ Flush Median/ Curb space	Cross Slope	Normally crowned with a 2% cross slope. Superelevation shall be applied as needed. Where pedestrian use of the street is anticipated, CXS.
	Running Slope	See AASHTO's A Policy on Geometric Design of Highways and Streets for guidance.

Pedestrian Access Route (PAR) Design Elements			
Abbv.	Description	Max Design Slope	Max Field Measurement Slope
FLR	Accessible Flare Slope	9.5%	10.0%
RMP	Accessible Curb Ramp Slope	7.8%	8.3%
CXS	Accessible Cross Slope	1.5%	2.1%
CWXS	Accessible Crosswalk Slope	1.5%*	2.1%*
RNG	Accessible Running Slope	4.5%	5.0%

*See Std. Dwg. 7.0b Note 12 regarding Accessible Crosswalk Slope

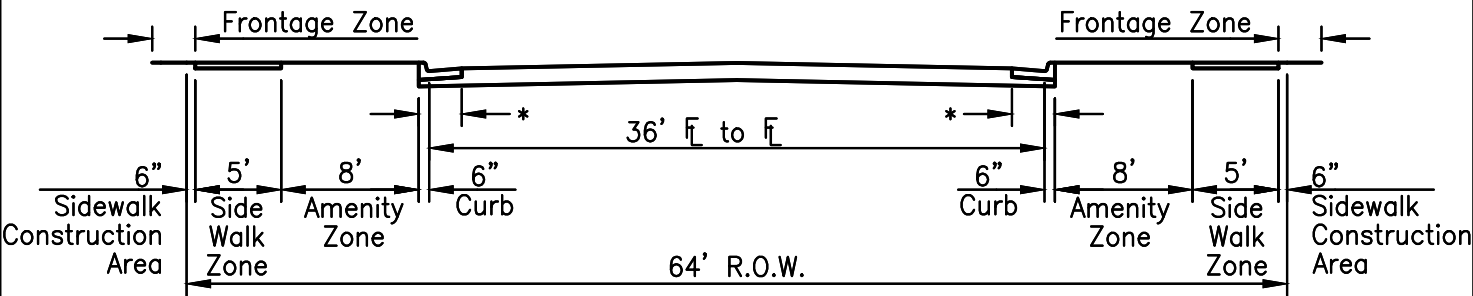


City And County Of Denver
Transportation Standard Drawings

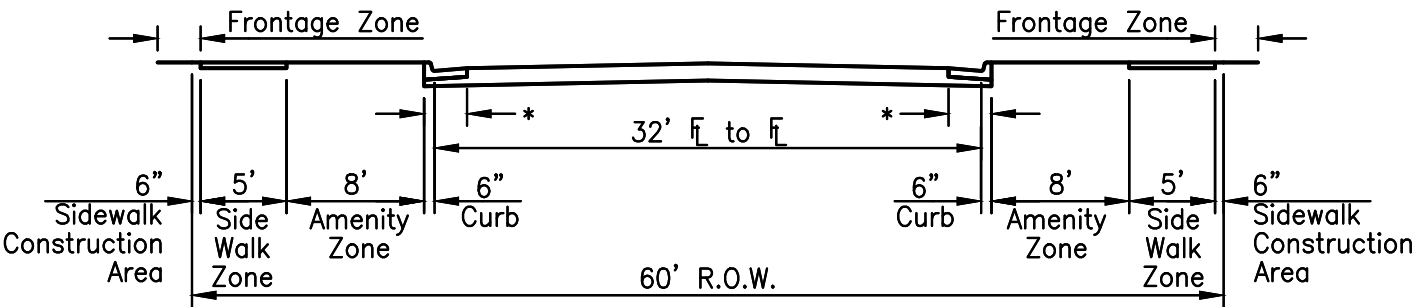
General Notes for Cross Sections

Date:
10/24

Std. Dwg.
2.0



LOCAL STREET (MID TO HIGH DENSITY)



LOCAL STREET (LOW DENSITY RESIDENTIAL)

*6" Curb and 2' Catch pan

- Notes:
- 1. Curb space use depends on context, see Complete Streets Design Standards.
 - 2. Parking generally allowed in curbspace on both sides of the street.
 - 3. R.O.W. may widen to accommodate intersection turn lanes and enhanced pedestrian, bicycle, and transit facilities. Cross section depicts typical mid-block conditions.
 - 4. At intersections, curb extensions may be required to enhance pedestrian safety.
 - 5. Density is determined through the Denver Building and Fire Code, found in Table 503.2.1 (Latest Edition), Minimum Clear Widths for Existing Fire Apparatus Access Roads. Low Density Residential section may apply only when minimum unobstructed width is 16 feet or less.
 - 6. If all of the following conditions exist, the flowline to flowline width may be decreased to 30':
 - a) Access to the adjacent land use is from the alley only
 - b) Need to accommodate only two wet utilities; and all wet utilities are no greater than 36" storm, 12" sanitary, and 16" water
 - c) No horizontal curvature
 - d) R.O.W. remains at 60' or greater
 - e) Adjacent land use is single-family or low-density multi-family residential
 - f) The decrease in width will adequately serve transportation system needs, as determined by DOTI
 - 7. Utility size and depth may require an expanded cross section. For every 12" of storm pipe size greater than 36", the R.O.W. shall widen by 1' and for every 1' of depth greater than 15 feet, the R.O.W. shall widen by 2 feet.

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Local Cross Section	Std. Dwg. 2.1

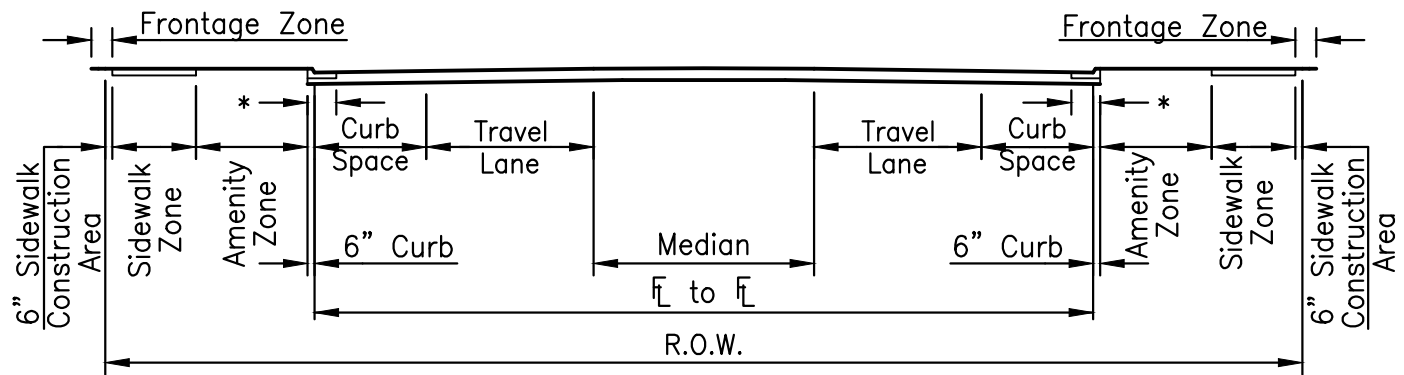


Table 2.2-1

STREET WIDTHS

Street Type	Frontage Zone (when R.O.W. is available)	Sidewalk Zone	Amenity Zone	Curb space**	Travel Lane#	Median**##	R.O.W.***		ℓ to ℓ	
							2 Lane Collector without Median	2 Lane Collector with Median	2 Lane Collector without Median	2 Lane Collector with Median
Downtown	7'	5'	8'	8'	10'	N/A	64'	N/A	36'	N/A
Main Street	7'	5'	8'	8'	10'	N/A	64'	N/A	36'	N/A
Mixed-Use	5'	5'	8'	8'	10'	10'- 18'	N/A	74'	N/A	46'
Commerical	N/A	5'	8'	8'	10'	10'- 18'	N/A	74'	N/A	46'
Industrial	N/A	5'	8'	9'	11'	N/A	68'	N/A	40'	N/A
Residential	N/A	5'	8'	8'	10'	10'- 18'	N/A	74'	N/A	46'

* 6" Curb and 2'
Catch Pan
** See Note 1
*** See Note 3
See Note 4
See Note 5

Notes:

- See Complete Streets Design Standards for additional guidance.
 - Where feasible, cross sections should match the preferred dimensions in the Complete Streets Design Standards.
 - 11' lane may be required in certain circumstances. See Complete Streets Design Standards.
 - Curb space use determined by DOTI.
- Minimum Sidewalk Zone for all Collector street types is 5'.
- R.O.W. may increase to accommodate turn lanes or street overlays as identified by the Complete Streets Design Standards or directly by DOTI. For example, a protected bike lane and additional R.O.W. may be required.
- Travel Lane width, when adjacent to curb and gutter, is exclusive of the gutter pan.
- Median may be raised with curb and gutter or flush and striped or a combination. When raised, the dimension shown is edge of gutter pan to edge of gutter pan. When striped, the dimension is to center of lane line.

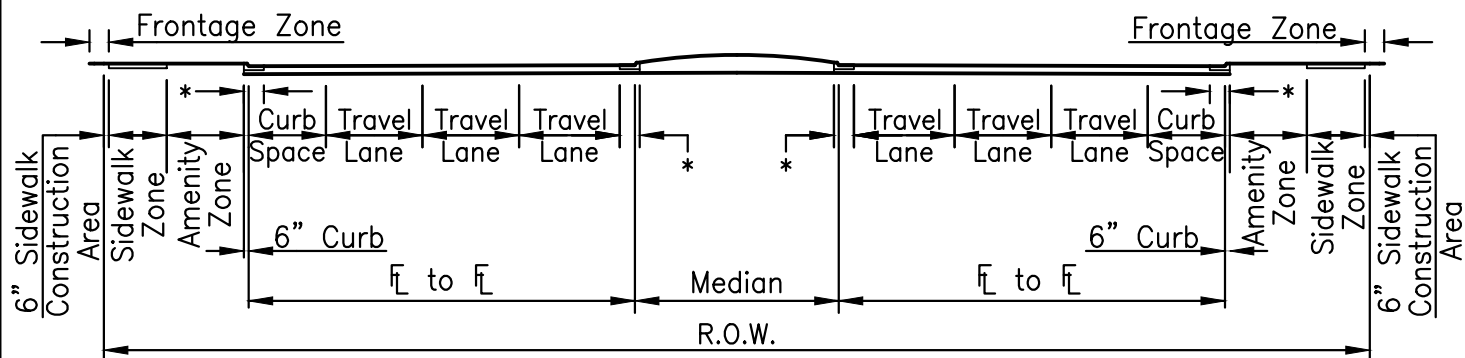


City And County Of Denver
Transportation Standard Drawings

Collector Cross Section

Date:
10/24

Std. Dwg.
2.2



STREET WIDTHS

Table 2.3-1

Street Type	Frontage Zone (when R.O.W. is available)	Sidewalk Zone	Amenity Zone	Curb space**	Travel Lane#	Median**##	R.O.W.***		ℓ to ℓ	
							4 Lane Arterial	6 Lane Arterial	4 Lane Arterial	6 Lane Arterial
Downtown	4'	8'	8'	8'	10'	N/A	90'	110'	56'	76'
Main Street	4'	8'	8'	8'	10'	N/A	90'	110'	56'	76'
Mixed-Use	2'	8'	8'	8'	10'	10'- 18'	102'	122'	29'	39'
Commerical	N/A	8'	8'	0'	10'	10'- 18'	90'	110'	23'	33'
Industrial	N/A	8'	8'	0'	11'	N/A	82'	104'	48'	70'
Residential	N/A	8'	8'	8'	10'	10'- 18'	102'	122'	29'	39'

* 6" Curb and 1' Spill pan or 2' Catch pan

** See Note 1

*** See Note 3

See Note 4

See Note 5

Notes:

- See Complete Streets Design Standards for additional guidance.
 - Where feasible, cross sections should match the preferred dimensions in the Complete Streets Design Standards.
 - 11' lane may be required in certain circumstances. See Complete Streets Design Standards.
 - Curb space use determined by DOTI.
- Minimum Sidewalk Zone for all Arterial street types is 8'.
- R.O.W. may increase to accommodate turn lanes or street overlays as identified by the Complete Streets Design Standards or directly by DOTI. For example, a protected bike lane and additional R.O.W. may be required.
- Travel Lane width, when adjacent to curb and gutter, is exclusive of the gutter pan.
- Median may be raised with curb and gutter or flush and striped or a combination. When raised, the dimension shown is edge of gutter pan to edge of gutter pan. When striped, the dimension is to center of lane line.



City And County Of Denver
Transportation Standard Drawings

Arterial Cross Section

Date:
10/24

Std. Dwg.
2.3

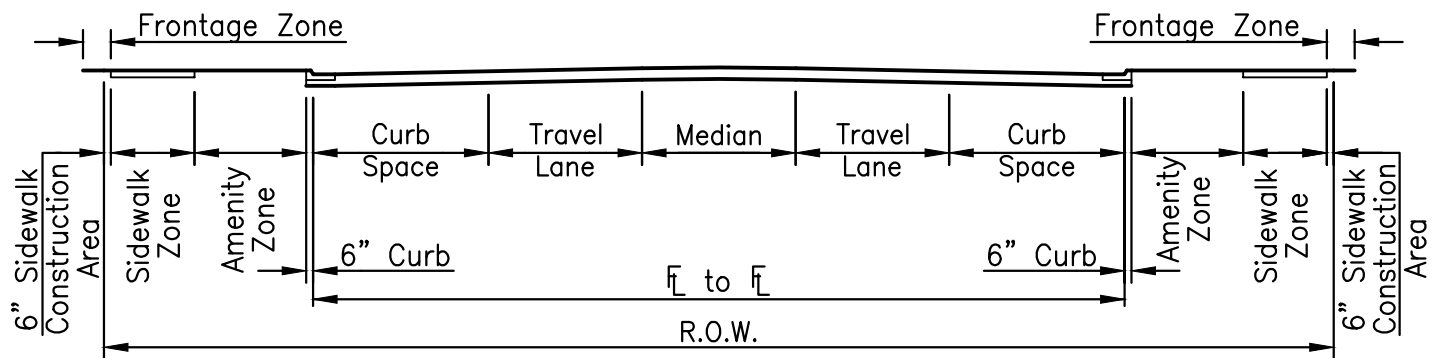


Table 2.4-1

STREET WIDTHS

Street Type	Frontage Zone (when R.O.W. is available)	Sidewalk Zone	Amenity Zone	Curb Space#	Travel Lane***	Median****	R.O.W.**	ℓ to ℓ
Downtown	4'	8'	8'	8'	10'	10'	70'	36'
Main Streets	4'	8'	8'	8'	10'	10'	70'	36'
Mixed-Use	2'	8'	8'	8'	10'	10'	70'	36'
Commerical	0'	8'	8'	8'	10'	10'	70'	36'
Industrial	0'	8'	8'	8'	11'	10'	72'	38'
Residential	0'	8'	8'	8'	10'	10'	70'	36'

* 6" Curb and 2' Catch pan

** See Note 3

*** See Note 4

**** See Notes 5 & 6

See Note 7

Notes:

- See Complete Streets Design Standards for additional guidance.
 - Where feasible, cross sections should match the preferred dimensions in the Complete Streets Design Standards.
 - 11' lane may be required in certain circumstances. See Complete Streets Design Standards.
 - Curb space use determined by DOTI.
- Minimum Sidewalk Zone for all Arterial street types is 8'.
- R.O.W. may increase to accommodate turn lanes or street overlays as identified by the Complete Streets Design Standards or directly by DOTI. For example, a protected bike lane and additional R.O.W. may be required.
- Travel Lane width, when adjacent to curb and gutter, is exclusive of the gutter pan.
- Median may be raised with curb and gutter or flush and striped or a combination. When raised, the dimension shown is edge of gutter pan to edge of gutter pan. When striped, the dimension is to center of lane line.
- Intersection turn lanes and two-way left turn lane may be required as determined by DOTI.
- The curb space use in this 2 lane arterial cross section is intended to typically be a mode-specific travelway. Where corridor overlays show a mode-specific travelway, the width of the curbspace shall reflect the modal use.

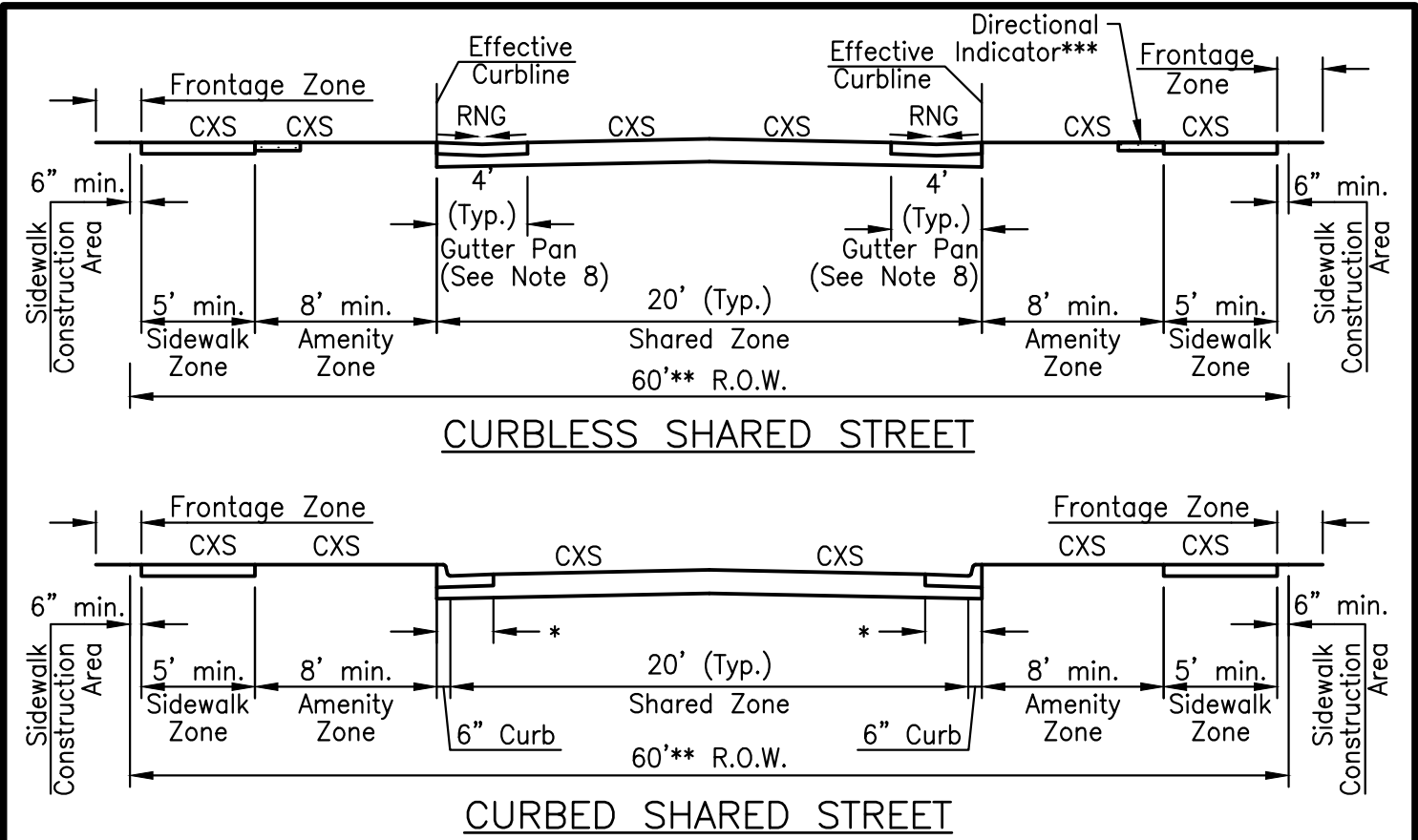


City And County Of Denver
Transportation Standard Drawings

2 Lane Arterial Cross Section

Date:
10/24

Std. Dwg.
2.4

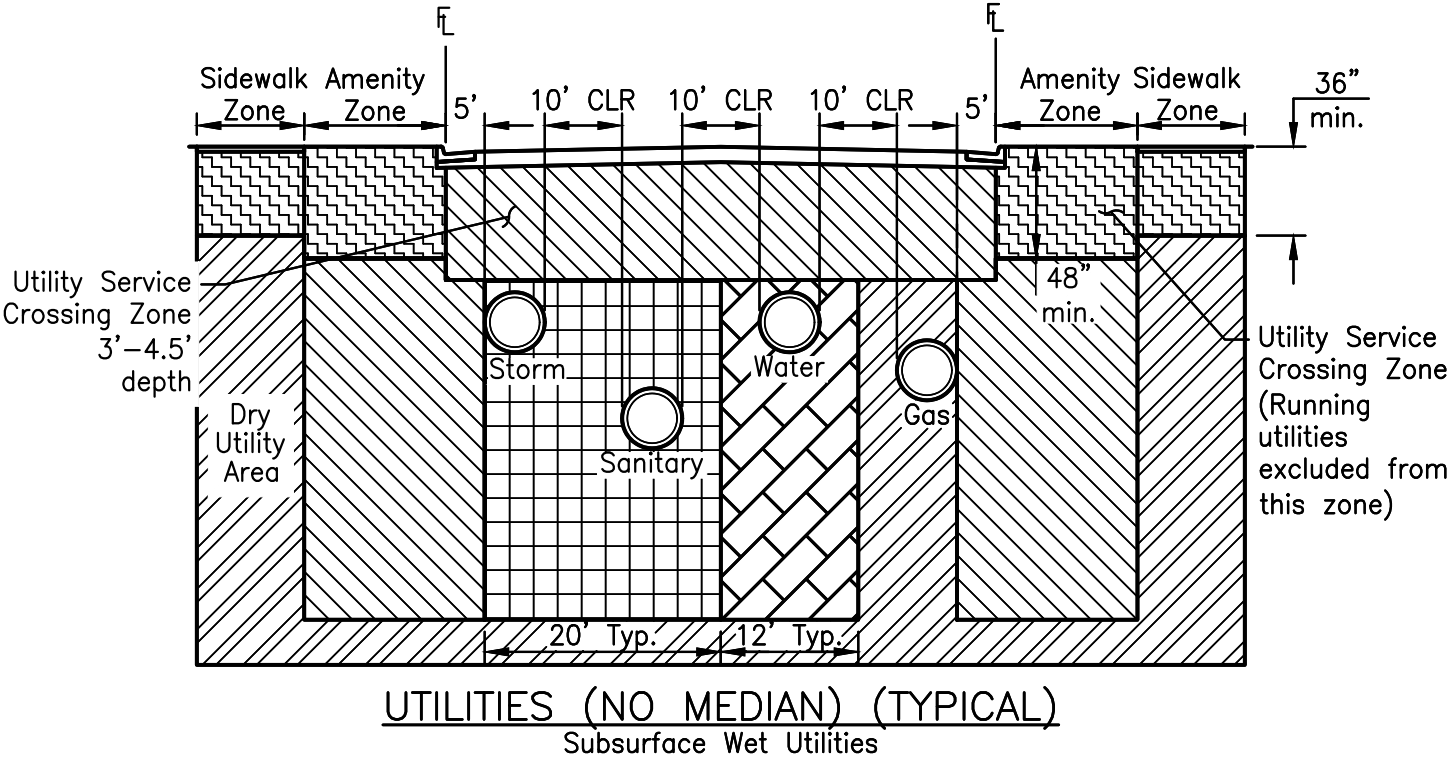


*6" Curb and 2' Catch pan
**Matches Local Street (Low Density Residential) ROW requirement. Where additional R.O.W. is available, the additional space may be added to the Amenity Zone or Sidewalk Area
***Directional indicators shall be applied throughout the corridor to provide a detectable edge to the sidewalk and to guide pedestrians to crossing points. Indicators may be omitted if the amenity zone is landscaped. At crossing points, a detectable warning surface shall be installed.

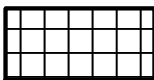
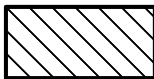
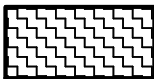
Notes:

- 1. Parking should generally be excluded from both sides of the street. Shared zone should expand to 28' if parallel parking is included on one side.
- 2. The shared zone may be decreased to 18' if a Shared Street needs to accommodate only two wet utilities and all wet utilities are no greater than 36" storm, 12" sanitary, and 16" water.
- 3. DOTI may require an increased FL-FL width when there are more than two wet utilities within the roadway.
- 4. Street Density is determined through the Denver Building and Fire Code, found in Table 503.2.1 (Latest Edition), Minimum Clear Widths for Existing Fire Apparatus Access Roads.
- 5. The Shared Zone should be as accessible as feasible considering ADA requirements for running slope, cross slope, horizontal opening, change in level, vertical clearance, and protruding object requirements.
- 6. Shared Streets should be signed to alert motorists at all street entrances of the shared zone.
- 7. Curbleless Shared Zones are preferred to promote flexibility but detectable elements must be included to assist pedestrians who are blind or with visual impairments.
- 8. Gutter pan width and slopes may vary based on ADA and drainage criteria.
- 9. A stormwater drainage system shall be designed in accordance with Chapter 7 of Denver's Storm Drainage Design and Technical Criteria Manual for allowable street flow depths. On curbleless shared streets, runoff from a minor storm shall not encroach into the PAR. In a major storm, a maximum of 1' freeboard shall be maintained from the lowest opening elevation of adjacent storm structures.
- 10. Intersection treatments may feature curb extensions, raised intersections, and/or crosswalks.
- 11. Fixed objects, including elements such as bollards, shall be a minimum of 2' away from the effective curblines and shall not reduce the clear width of the PAR to less than 48".

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Shared Street Cross Section	Std. Dwg. 2.5



LEGEND

	Dry Utility Zone		Exclusive Wastewater Utility Zone		Exclusive Water Utility Zone
	Utility Service Crossing Zone		Utility Service Crossing Zone (Running utilities excluded from this zone)		

- Notes:
- Utility maintenance holes and pull boxes shall be kept out of wheel paths and the PAR while maintaining a consistent linear path.
 - For more information and for storm utility crossings, consult the Denver Wastewater Standard Details, latest version.
 - Cross-section applies for wet utilities less than 15' deep, and maximum pipe inside diameters of: Storm 36"; Sanitary 12"; Water 16".
 - See Std. Dwg. 7.9 for signal equipment clear zones at intersections.
 - On a local or shared street, gas utilities may be placed outside of the flowline with DOTI approval. On a street with a $\overline{\text{L}}$ to $\overline{\text{L}}$ width less than 36', 3 wet utilities may not be able to be placed under the street. Non-planted amenity zones may be used for wet utilities with DOTI approval.
 - Utility poles, small cell towers, and street lights shall maintain 2' clearance from the flowline. If on-street parking is present, the minimum shall be increased to 3'.
 - Running utilities or conduit under the Sidewalk Zone shall be a minimum of 36" below finished grade. Running utilities or conduit under the amenity zone shall be a minimum of 48" below finished grade. Other than crossing service lines, it is preferred that utilities are located outside of the amenity zone and not within 5' streetside of the flowline. DOTI approval is required to place utilities within a TPZ.

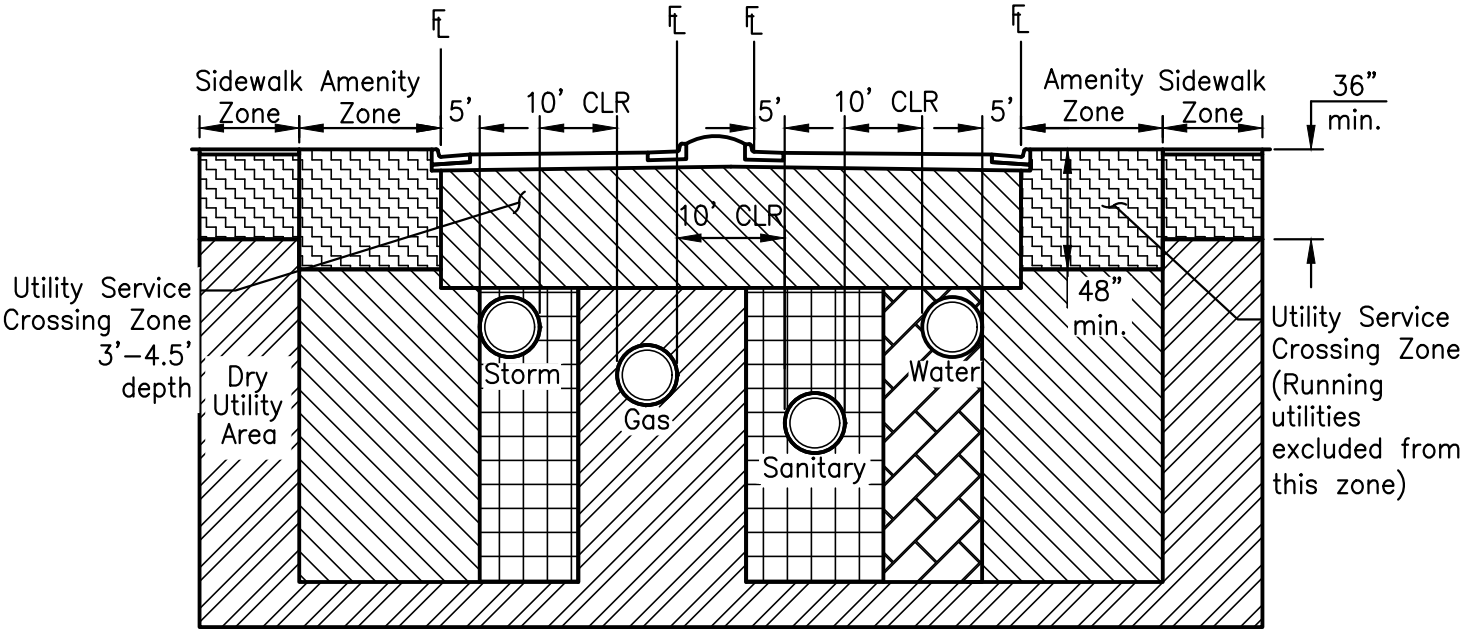


City And County Of Denver
Transportation Standard Drawings

Standard Utility Placement

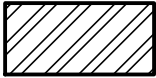
Date:
10/24

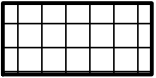
Std. Dwg.
3.0



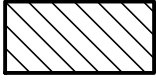
UTILITIES (MEDIAN) (TYPICAL)
Subsurface Wet Utilities

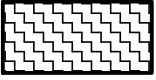
LEGEND

 Dry Utility Zone

 Exclusive Wastewater Utility Zone

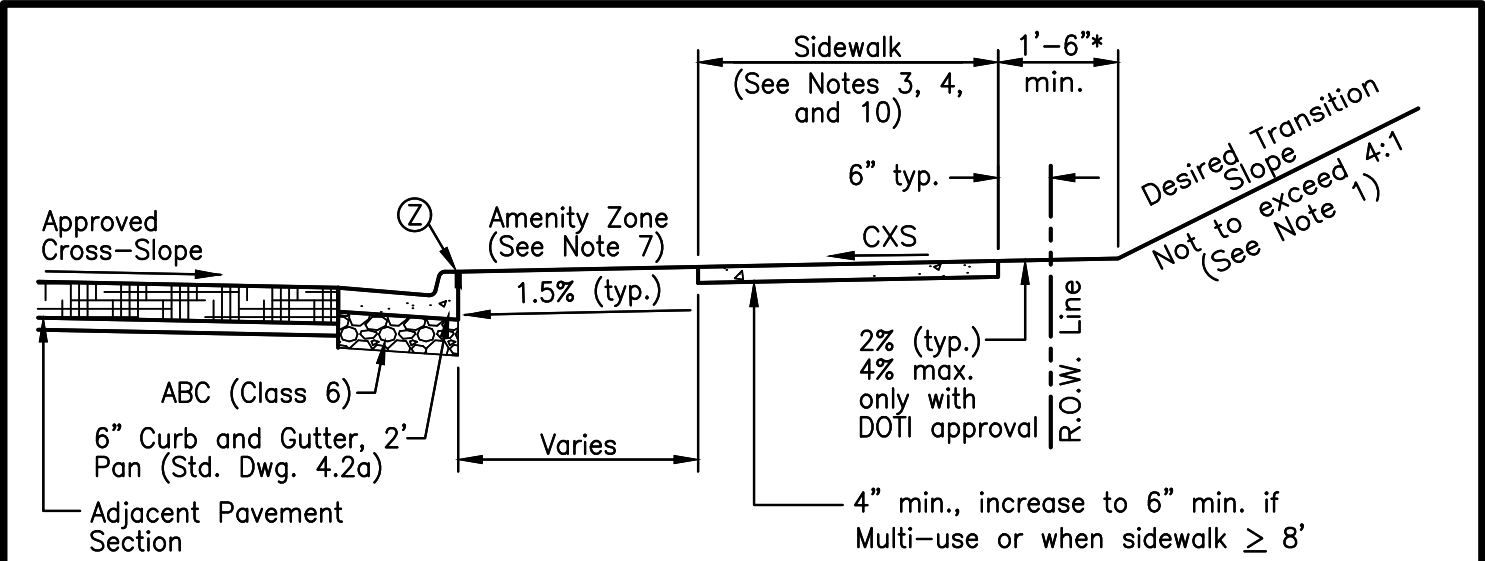
 Exclusive Water Utility Zone

 Utility Service Crossing Zone

 Utility Service Crossing Zone (Running utilities excluded from this zone)

- Notes:
- 1. Utility maintenance holes and pull boxes shall be kept out of wheel paths and the PAR while maintaining a consistent linear path.
 - 2. For more information and for storm utility crossings, consult the Denver Wastewater Standard Details, latest version.
 - 3. Cross-section applies for wet utilities less than 15' deep, and maximum pipe inside diameters of: Storm 36"; Sanitary 12"; Water 16". Additional clearance may be required for deeper or larger pipe sizes.
 - 4. Dry Utility Area may also be under a median if present.
 - 5. See Std. Dwg. 7.9 for signal equipment clear zones at intersections.
 - 6. Utility poles, small cell towers, and street lights shall maintain 2' clearance from the flowline. If on-street parking is present, the minimum shall be increased to 3'.
 - 7. Running utilities or conduit under the Sidewalk Zone shall be a minimum of 36" below finished grade. Running utilities or conduit under the amenity zone shall be a minimum of 48" below finished grade. Other than crossing service lines, it is preferred that utilities are located outside of the amenity zone and not within 5' streetside of the flowline. DOTI approval is required to place utilities within a TPZ.





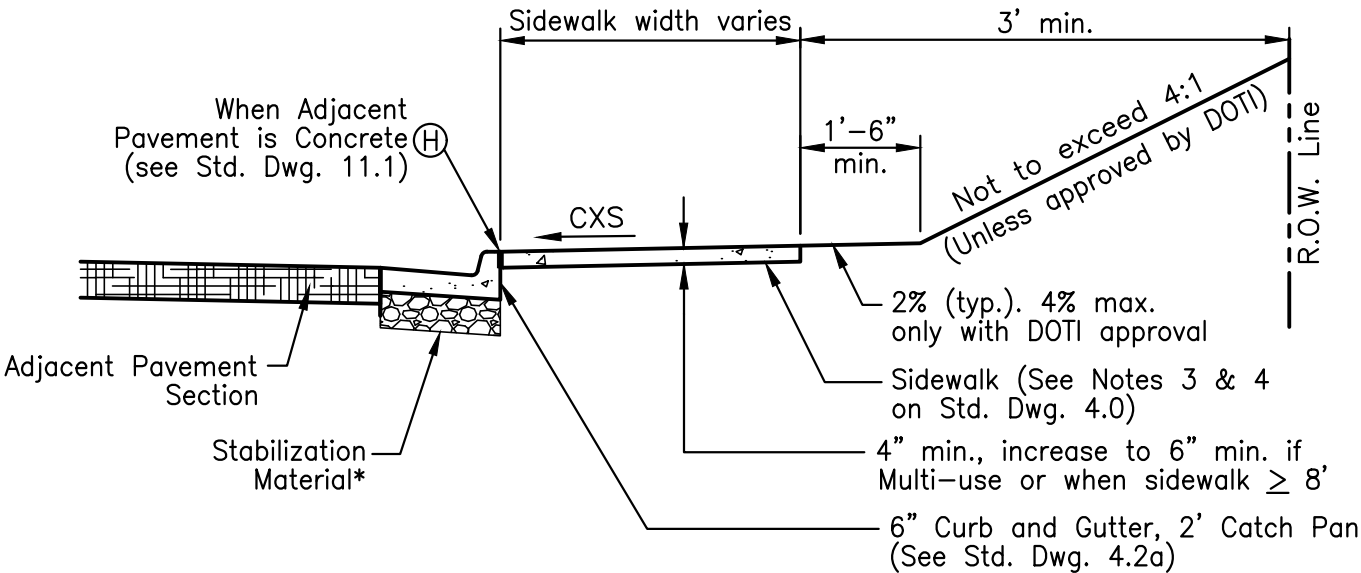
TYPICAL SECTION – CURB & GUTTER WITH DETACHED SIDEWALK

* If construction on private property is required to meet these transition dimensions, a separate agreement with owner of affected property will be required.

Notes:

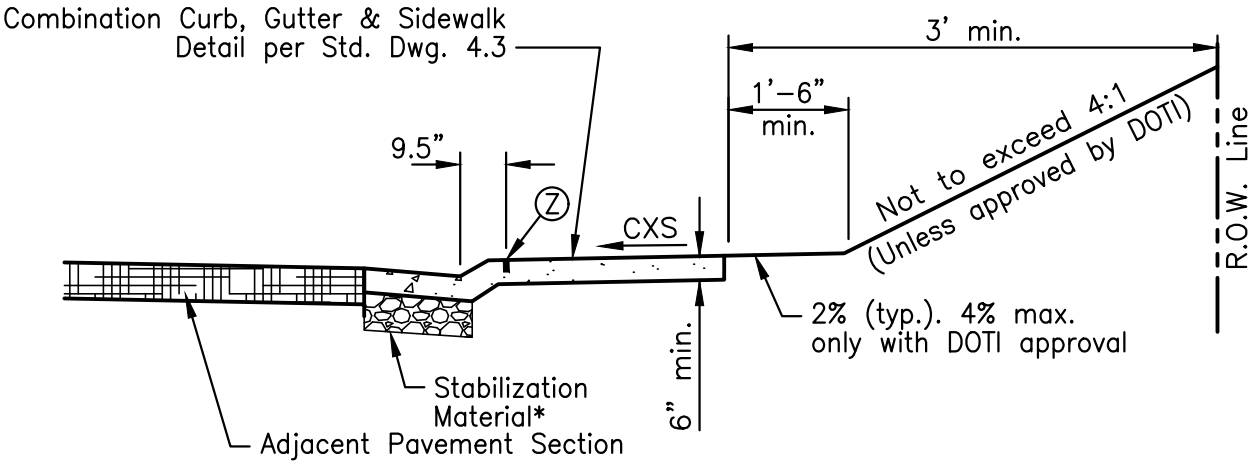
- 1. Side slope may exceed 4:1 only with the approval of DOTI.
- 2. Proposed variations from minimum dimensions shall be approved by DOTI in writing.
- 3. Tree grates cannot be used as part of the PAR.
- 4. Sidewalk Materials: The sidewalk material shall be concrete except as noted herein. For limited sidewalk replacement work, such as replacing several sidewalk panels for a utility trench, the replacement sidewalk material may match the existing sidewalk material when approved by DOTI. Sandstone may only be used for limited replacement sidewalk material under the following conditions as approved by DOTI:
 - a) No horizontal or vertical gaps or joints larger than 0.25" are allowed. Joints should be filled with sand. Vertical changes in level between 0.25" and 0.5" shall be beveled with a slope not steeper than 1:2.
 - b) Sandstone must be at least 2.5" thick by 5' long (minimum) by 2' wide (minimum). Driving surfaces should be at least 4" thick. May use two layers to achieve this thickness.
 - c) Sandstone must be set on a minimum 2" thick sand base under fitted with a rot resistant geotextile fabric. DOTI may require a drainage system for some installations. Drainage systems, when required, must be able to support HS-20 loading.
 - d) Sandstone should only be used on streets with a running slope less than or equal to 5%. Sandstone sidewalk on steeper slopes may not meet accessible route slip resistance criteria.
- 5. Refer to Std. Dwg. 11.0c and 12.0 for patching and saw cut details.
- 6. Placement of empty 3" schedule 40 PVC conduit is required behind the back of curb along the entire project/property frontage when warranted by the traffic operations Conduit Engineer (720)865-4000 for future street lights, signals, etc. These conduits shall meet the depth requirements specified on Std. Dwg. 3.0 and 3.1.
- 7. Landscaping and/or Landscape Fencing shall not be placed in a manner that impacts the PAR, impedes pedestrian movements, impacts the safe and efficient use and operation of the R.O.W., and/or blocks or covers access to utilities, existing trees, or facilities as solely determined by DOTI.
- 8. Landscape/amenity material shall be contained to the landscape/amenity area.
- 9. Any new Trees shall placed in accordance with Std. Dwg. 14.0 to provide adequate sight lines. Mulch shall be per Office of the City Forester.
- 10. If bricks were approved by DOTI for use within the sidewalk, they shall be wet-set or mortared to a 4 inch thick concrete base layer (or sub-walk). If brick sidewalk is designed as part of a permeable system, DOTI must approve a foundation system for new or retrofit brick systems.
- 11. When adjacent to land managed by Denver Parks & Recreation, the amenity zone and sidewalk may drain towards this adjacent land if approved by DOTI.

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Curb & Gutter and Detached Sidewalk	Std. Dwg. 4.0



TYPICAL SECTION-6" CURB & GUTTER WITH ATTACHED SIDEWALK

This section is only for use to repair existing sections of attached sidewalk or with DOTI approval for amenity zone to be reduced to 0' width.



TYPICAL SECTION-COMBINATION CURB, GUTTER, & SIDEWALK

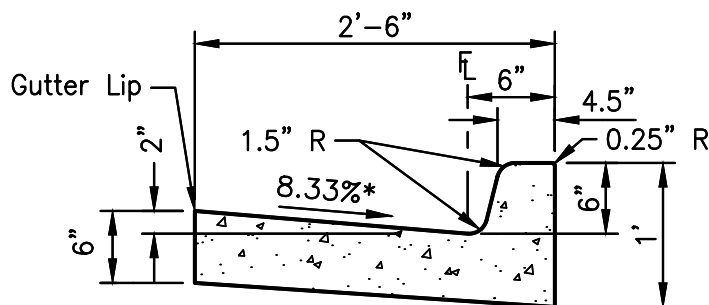
This section is only for use to repair existing sections of combination curb, gutter and sidewalk.

*Typically ABC (Class 6)

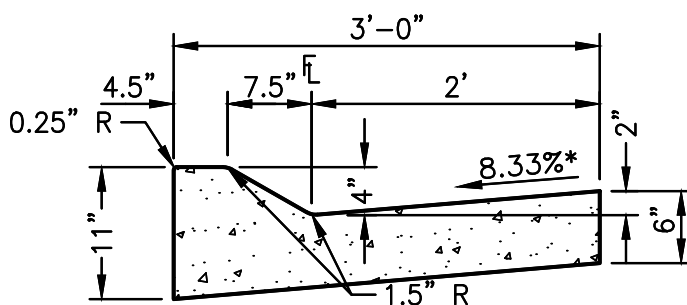
Pedestrian Access Route (PAR) Design Elements			
Abbv.	Description	Max Design Slope	Max Field Measurement Slope
FLR	Accessible Flare Slope	9.5%	10.0%
RMP	Accessible Curb Ramp Slope	7.8%	8.3%
CXS	Accessible Cross Slope	1.5%	2.1%
CWXS	Accessible Crosswalk Slope	1.5%*	2.1%*
RNG	Accessible Running Slope	4.5%	5.0%

*See Std. Dwg. 7.0b Note 12 regarding Accessible Crosswalk Slope

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Curb & Gutter and Attached Sidewalk	Std. Dwg. 4.1

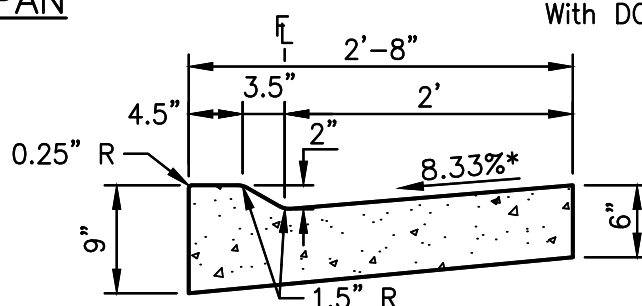


6" CURB AND GUTTER-2'
CATCH PAN



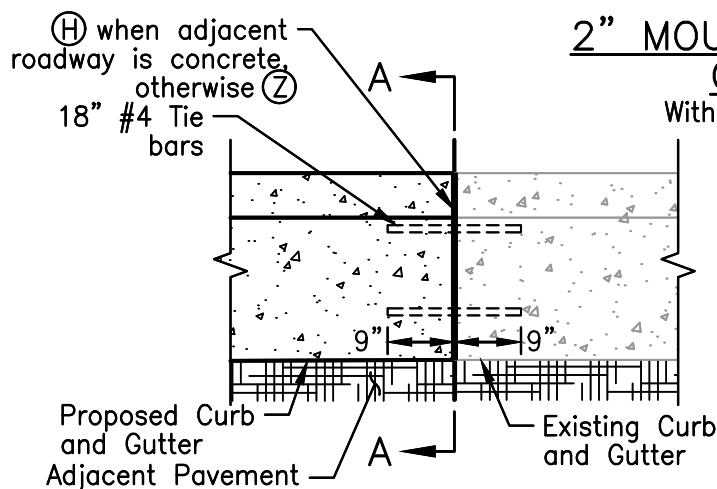
4" MOUNTABLE CURB-2'
CATCH PAN

With DOTI approval only



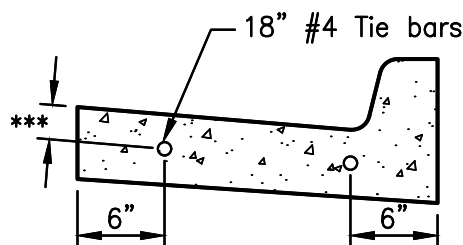
2" MOUNTABLE CURB-2'
CATCH PAN

With DOTI approval only



TYPICAL TIE BAR LOCATION

2' Catch Pan shown. Other Gutter and Curb and Gutter sections similar.

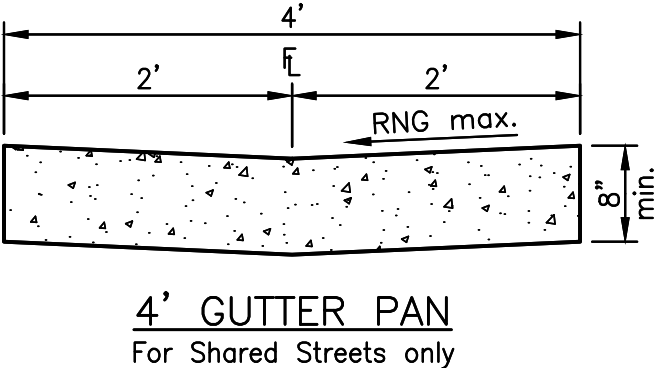
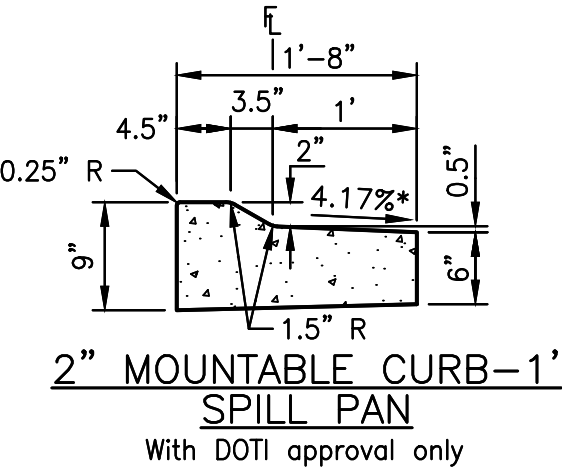
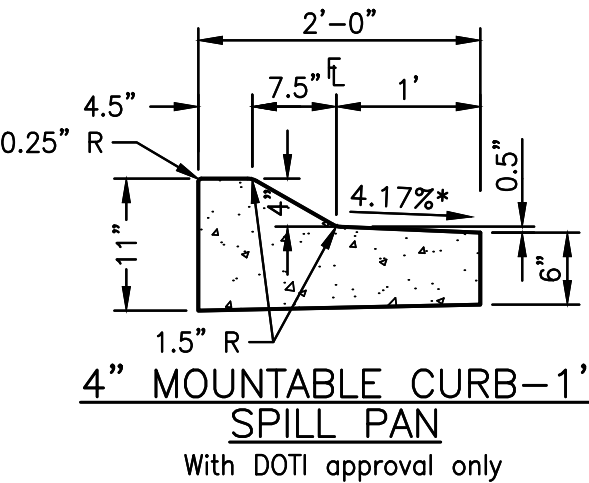
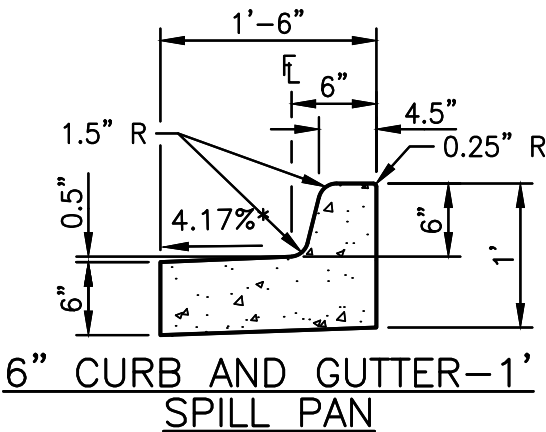


SECTION A-A

***Tie bars shall be centered vertically within the proposed gutter pan

Note:

1. Curb and gutter section lengths shall be 10' long typical and adjusted in length so that adjacent concrete pavement joint lines will continue through the curb and gutter. Maximum length of any curb and gutter section is 12'.
2. Refer to Std. Dwg. 11.9 for additional information on how concrete panel replacement affects curb and gutter.
3. Gutters must transition at all Curb Ramps per Std. Dwg. 7.0-7.9. An 8.33% catch pan or 4.17% spill pan is required in all cases, including concrete streets, except at curb ramps and curb ramp transitions where max slope shall be RNG.
4. $\frac{3}{4}$ " preformed expansion joint material to be placed between sections at or near the PCR at every concrete street intersection. Expansion joints shall be placed between C&G sections where an asphalt street abuts a concrete street.
5. Typical 6" curb height may vary between 4" and 9" depending on the adjacent use without additional reinforcing. Where parking is adjacent to curb, 6" is the max height.
6. Curb and gutter pan depth shall be installed to match the adjoining pavement section or the depth of patching to be installed. In a transit overlay, gutter pan thickness shall be 8" min.



*See Note 3

- Note:
1. Curb and gutter section lengths shall be 10' long typical and adjusted in length so that adjacent concrete pavement joint lines will continue through the curb and gutter. Maximum length of any curb and gutter section is 12'.
 2. Refer to Std. Dwg. 11.9 for additional information on how concrete panel replacement affects curb and gutter.
 3. Gutters must transition at all Curb Ramps per Std. Dwgs. 7.0-7.9. An 8.33% catch pan or 4.17% spill pan is required in all cases, including concrete streets, except at curb ramps and curb ramp transitions where max slope shall be RNG.
 4. 3/4" preformed expansion joint material to be placed between sections at or near the PCR at every concrete street intersection. Expansion joints shall be placed between C&G sections where an asphalt street abuts a concrete street.
 5. Typical 6" curb height may vary between 4" and 9" depending on the adjacent use without additional reinforcing. Where parking is adjacent to curb, 6" is the max height.
 6. Curb and gutter pan depth shall be installed to match the adjoining pavement section or the depth of patching to be installed. In a transit overlay, gutter pan thickness shall be 8" min.
 7. 4" gutter pan is detailed for use as a travelway edge delineation and storm conveyance on a shared street. This detail is not intended for use as a drainage cross pan. Gutter pan width and slopes may vary based on ADA and drainage criteria.

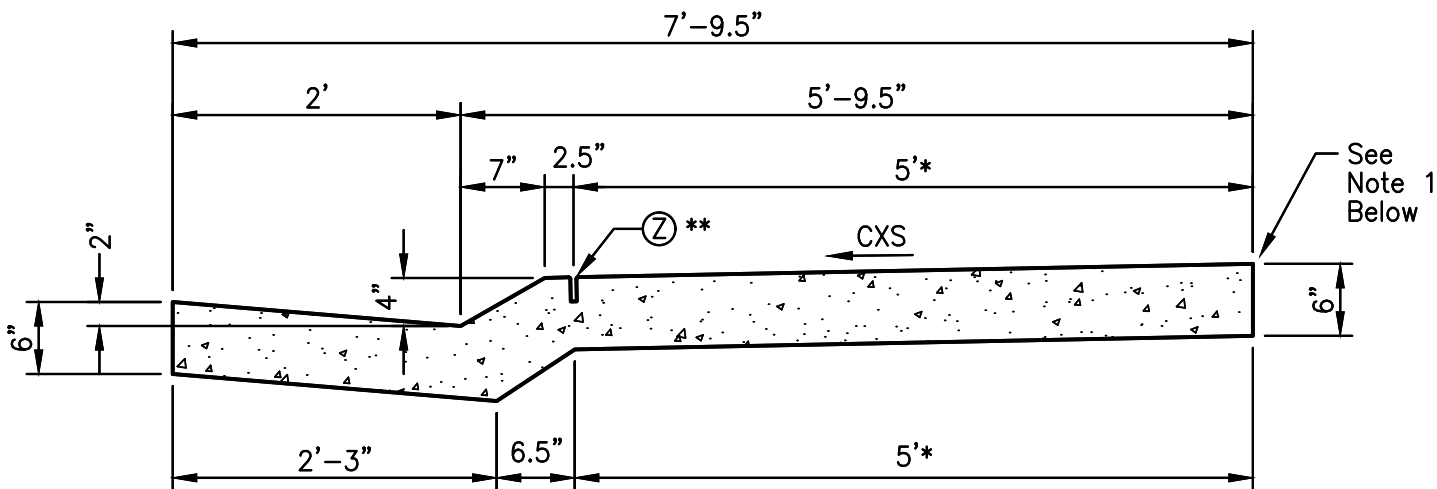


City And County Of Denver
Transportation Standard Drawings

Typical Curb & Gutter Sections

Date:
10/24

Std. Dwg.
4.2b



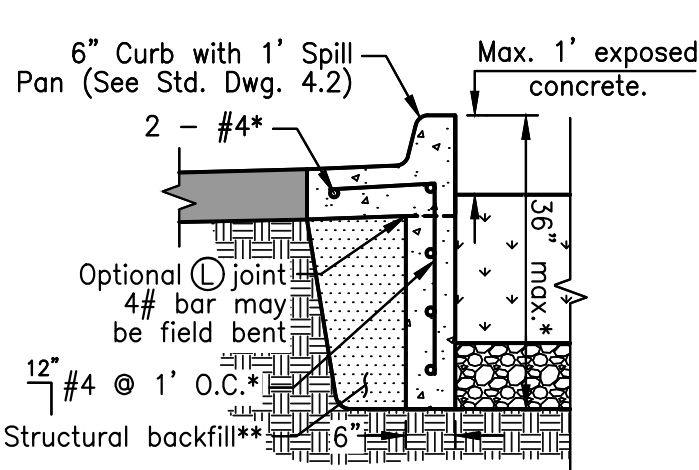
*Match existing width on repair projects under 50' in length only (3' absolute minimum width).
**This joint is also the sawcut point for sidewalk repairs.

REPAIRING COMBINATION CURB, GUTTER AND SIDEWALK (5')

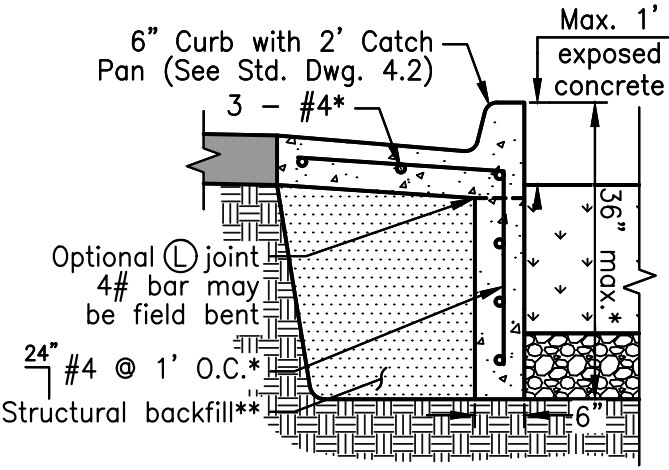
This section is only for use to repair existing sections of combination curb, gutter and sidewalk.

- Notes:
1. Apply  (at C&G) joint wherever DOTI has approved attaching new 6" thick sidewalk to the outside edge of any existing combination curb, gutter and sidewalk.

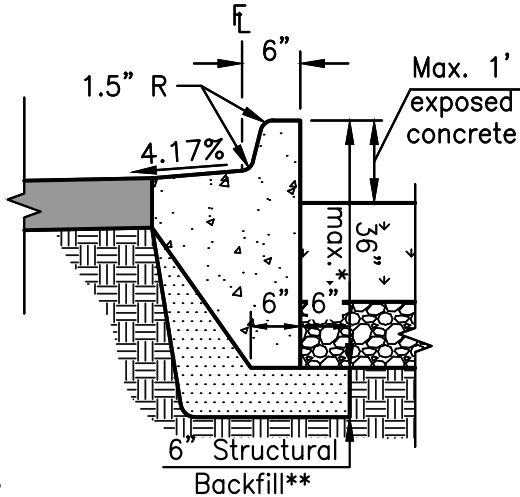
	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Special Use Curb & Gutter Sections	Std. Dwg. 4.3



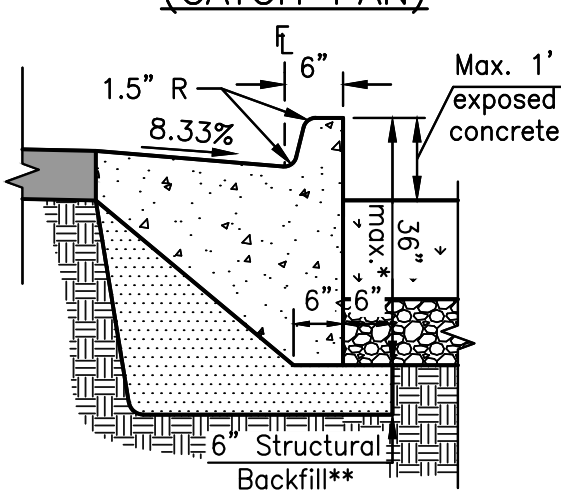
PLANTER CURB TYPE 1 (SPILL PAN)



PLANTER CURB TYPE 1 (CATCH PAN)



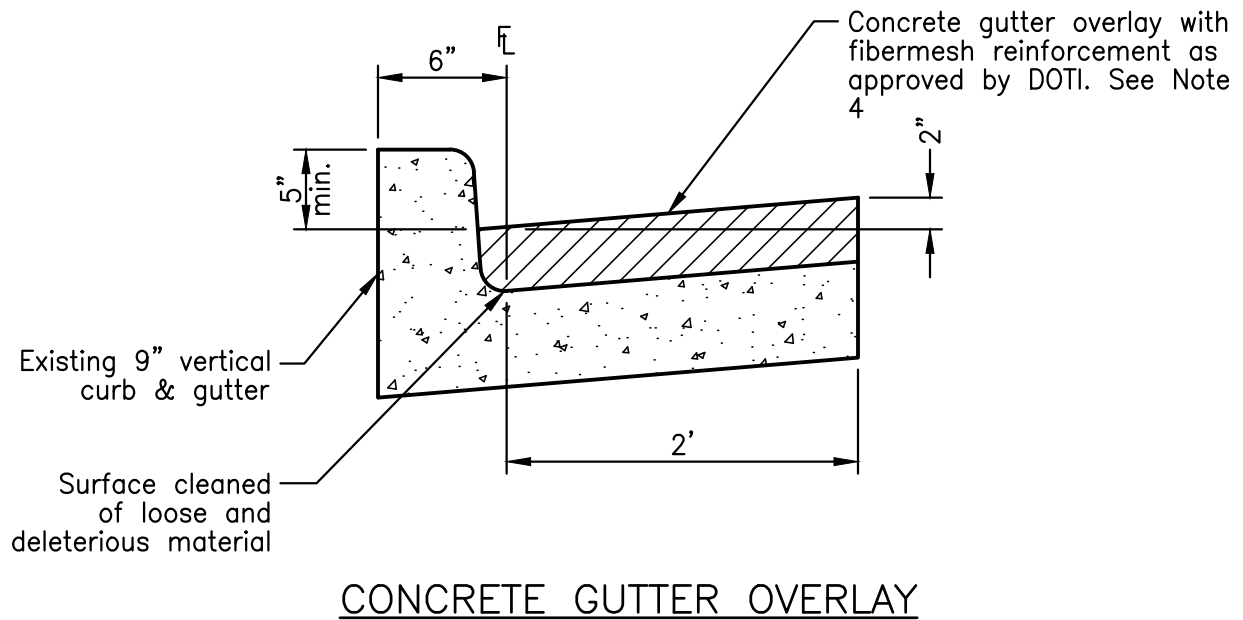
PLANTER CURB TYPE 2 (SPILL PAN)



PLANTER CURB TYPE 2 (CATCH PAN)

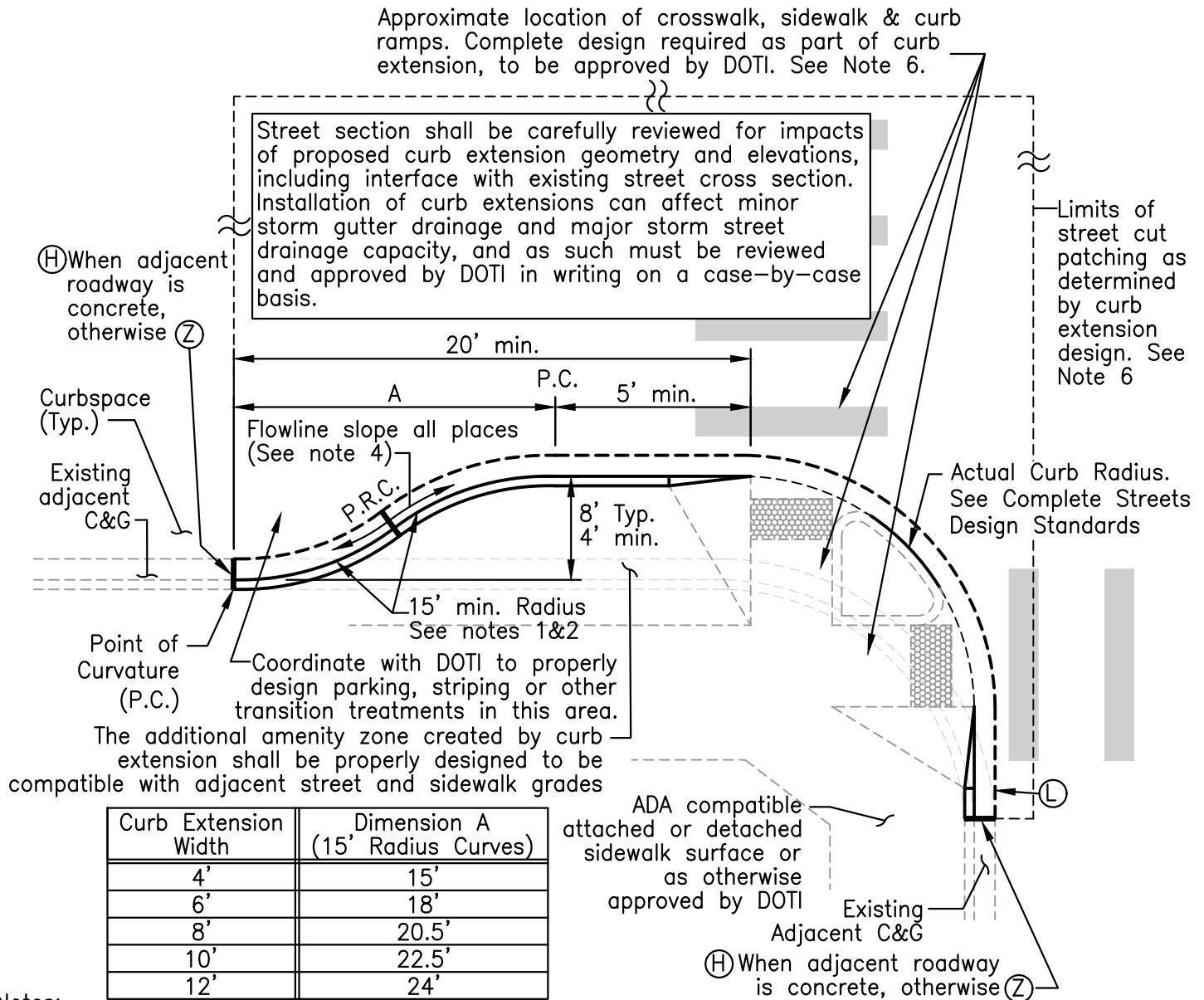
*See Note 1
**See Note 3

- Note:
1. A structural engineer, with input from a geotechnical engineer, shall design wall dimensions, reinforcing, any foundation components such as footings or bottom slab, and subgrade/bedding/backfill specifications when walls are taller than 36".
 2. $\frac{3}{4}$ " preformed expansion joint material to be placed between sections of Planter Curb and Standard 6" curb per Std. Dwg. 4.2a.
 3. Structural backfill shall consist of CDOT Class 1 Structural Backfill or Aggregate Base Course (Class 6). Structural backfill shall be used up to the limits of excavation under existing asphalt and placed and compacted in 6" max lifts. Any material that spills from under the existing roadway shall be replaced with structural backfill and compacted. If base course or earthwork spillage results in more than 12" of existing pavement to overhang unsupported, the pavement shall be sawcut to the limit of undisturbed base course, removed, and replaced in kind.
 4. Typical reinforcing shown. Planter Curb 1 and Planter Curb 2 may be used up to 36" height in typical soils.
 5. All reinforcing shall have a minimum 2" clear cover.
 6. Reinforcing steel shall be Grade 60.
 7. 4" wide openings in the curb head or 2" inset drain pipes may be included to convey storm flows. See Std. Dwg. 13.0 and 13.1 for additional details. Openings in the curb head must be formed and may not be chipped or sawn out.
 8. Planter Curbs shall not be used when adjacent to on-street parking.
 9. Curb dimensions that are not shown shall match Std. Dwg. 4.2a and 4.2b.



- Notes:
- 1. For limited use with existing 9" curb and gutter only, and only with approval of DOTI. Not for new construction.
 - 2. Transitions to existing concrete gutters (or to asphalt flowline when in gutter overlay) on either side of a concrete gutter overlay shall be carefully evaluated to identify future project impacts and ensure that drainage is preserved.
 - 3. All transitions shall be approved by DOTI.
 - 4. Concrete for gutter overlay shall meet the requirements of MGPEC (Municipal Government Pavement Engineers Council) Item 30.

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Concrete Gutter Overlay	Std. Dwg. 4.5



Notes:

- Where length of curb extension is desired to be as short as possible, the curb extension radius closest to the traffic lane (near edge) may be reduced to 12'. This radius can be reduced to 10' with DOTI approval.
- The reverse curves at each end of the parking pocket shall be tangent to each other, and each curve shall be tangent with the curbline continuing in each direction.
- The length of the extension is measured as 20' from the edge of curb ramp (if directional, as shown. Ignore flares or curb heads) or from the PC of the curb if the curb ramp is diagonal. Any reduction in this length shall be approved by DOTI.
- Curb extension design shall provide positive 0.7% preferred, 0.5% min, drainage slope at all points along new bulb-out flowline. New inlets and storm drain may be required.
- If there is an existing or proposed bus stop or driveway at the corner, the length of the extension should be lengthened to accommodate the full length of the bus stop/driveway according to RTD criteria.
- Limits of street cut and patching shall be set to ensure that the PAR within the street (including the crosswalk) is not adversely affected by causing any PAR design elements to be exceeded. In some cases, reconstruction of entire street from curb to curb may be required.
- Curb extensions provide additional amenity zone space. See Complete Streets Design Standards for additional information.

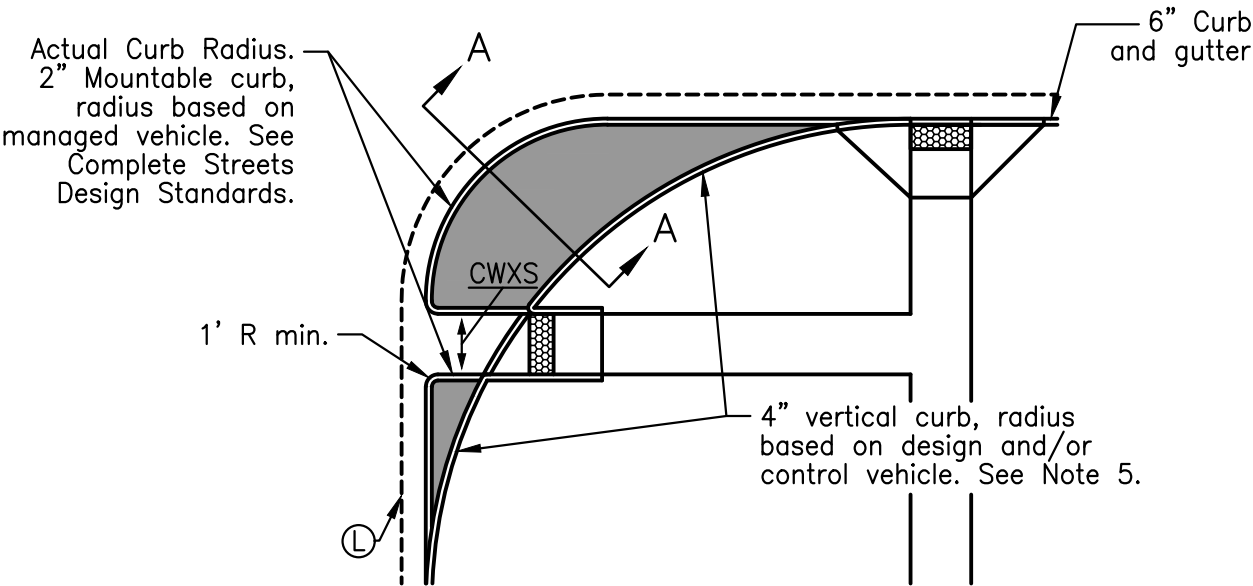


City And County Of Denver
Transportation Standard Drawings

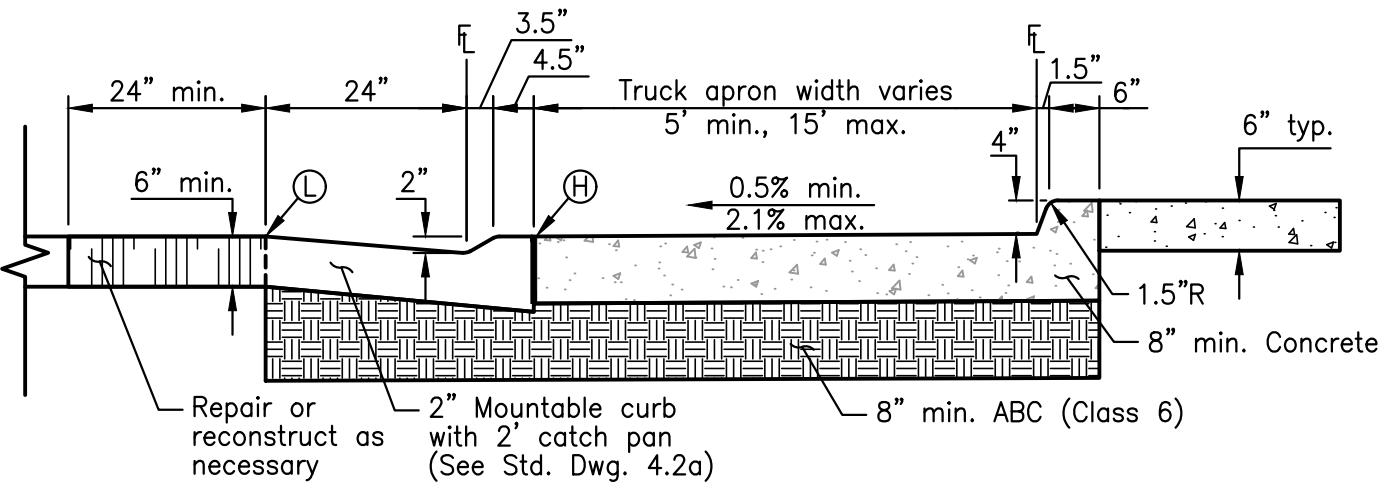
Curb Extension

Date:
10/24

Std. Dwg.
5.0

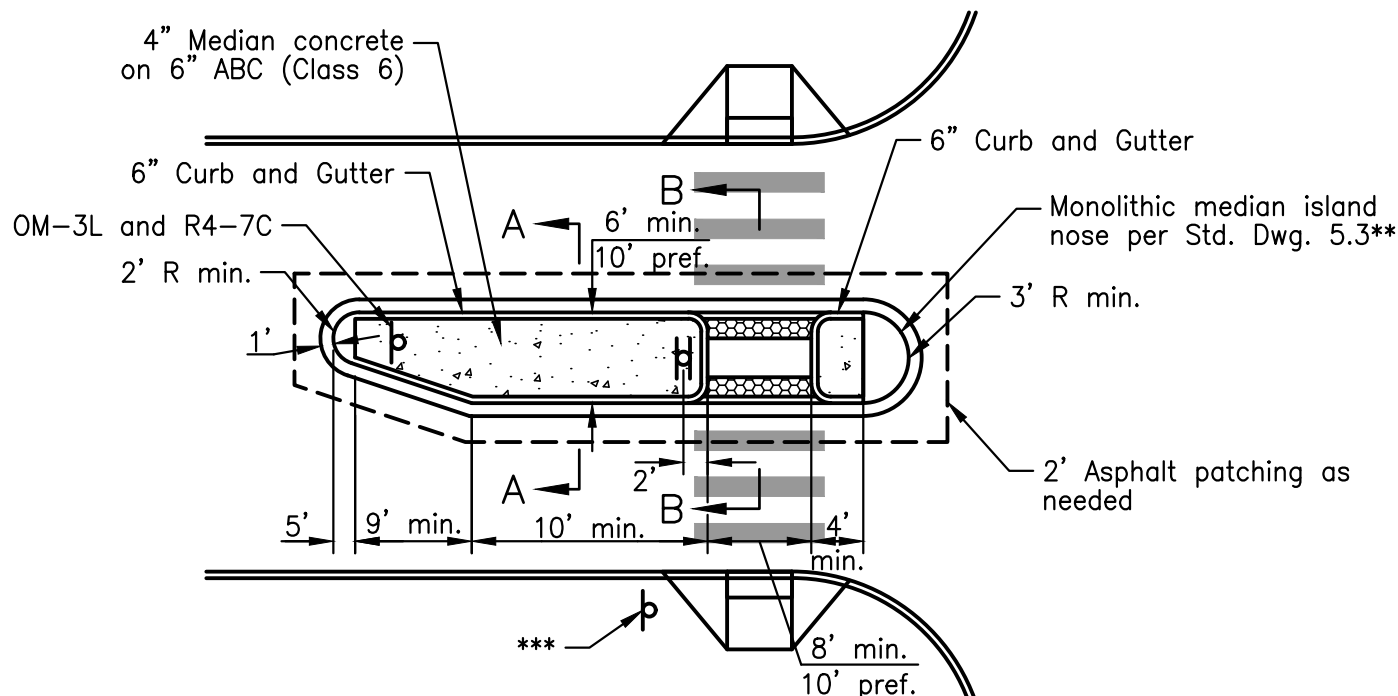


MULTI-RADIUS TRUCK APRON

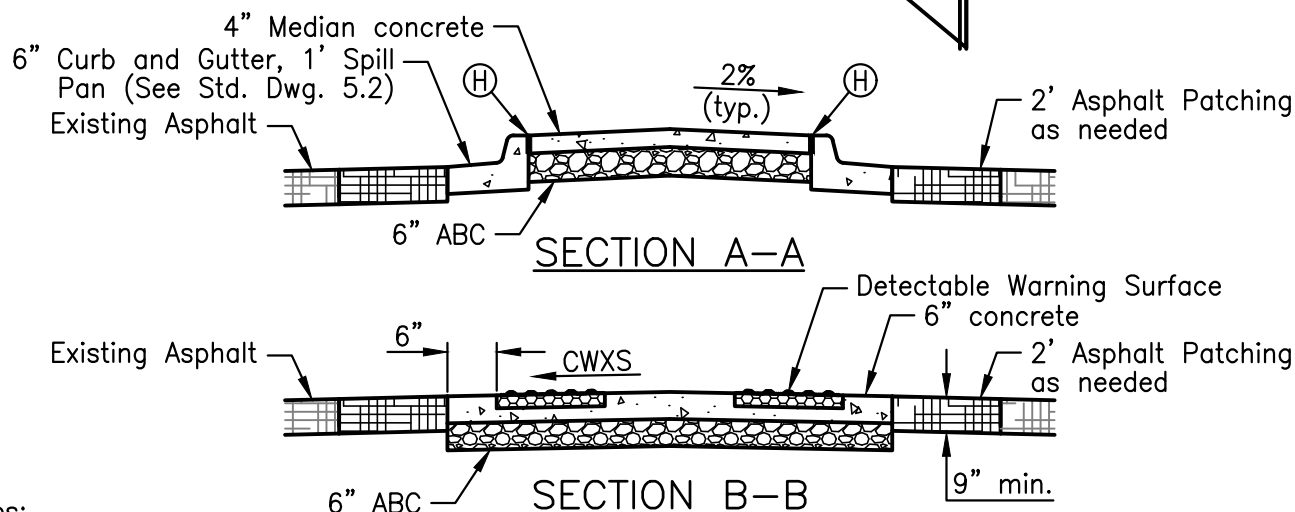


SECTION A-A

- Notes:
1. Size and shape of corner treatments are dependant on intersection characteristics.
 2. Concrete material in truck apron shall be colored and/or textured to discourage use by the managed vehicle, but allow use by the design and control vehicles.
 3. Radius of apron must be within 5'-15' of normal radius.
 4. Truck apron must use a 2" mountable curb.
 5. If not adjacent to pedestrian route, a 4" mountable curb may be used in lieu of a 4" vertical curb.
 6. This detail may be used to reduce turning speed for vehicles where a smaller radius cannot be provided due to regular use by larger vehicles. Corner islands, curb extensions, and tighter radii are preferred.
 7. Curb Ramps are to be designed per Section 7.
 8. Inlets shall not be placed along truck apron unless approved by the PM. Coordinate slopes and low points so that inlets may be placed prior to the apron.
 9. Street section shall be carefully reviewed for impacts to storm water routing. Installation shall consider any new low points as a sump and shall provide inlet(s) as described in the Denver Storm Drainage Design and Technical Criteria.



- * Any lane taper shall meet MUTCD requirements based on design speed
- ** Median nose may be excluded with DOTI approval
- *** Refer to Denver's Uncontrolled Pedestrian Crossing Guidelines for signing and striping



Notes:

1. Within median pedestrian refuge, no slope shall exceed 1.5% in any direction, inclusive of the detectable warning surface areas and the space between. See Std. Dwg. 7.0b Note 12.
2. Install 4" PVC sockets for signage.
3. Begin median nose at 2' setback from continuation of flowlines across side street as shown.
4. Pedestrian refuge width shall match the median width. The minimum width is 6'. The minimum opening length is 6' (10' if multi-use path).
5. Detectable warning surfaces shall be included on both sides of the median to inform users of the roadway.
6. Refer to MUTCD and Denver's Traffic Signal, Sign and Pavement Marking Standards for guidance on signing and striping.
7. For a midblock median refuge island, mirror the approach side (non-intersection side). In siting a midblock pedestrian refuge, consider existing lighting, addition of improved crossing signage and signalization. See Complete Streets Design Standards for additional information.

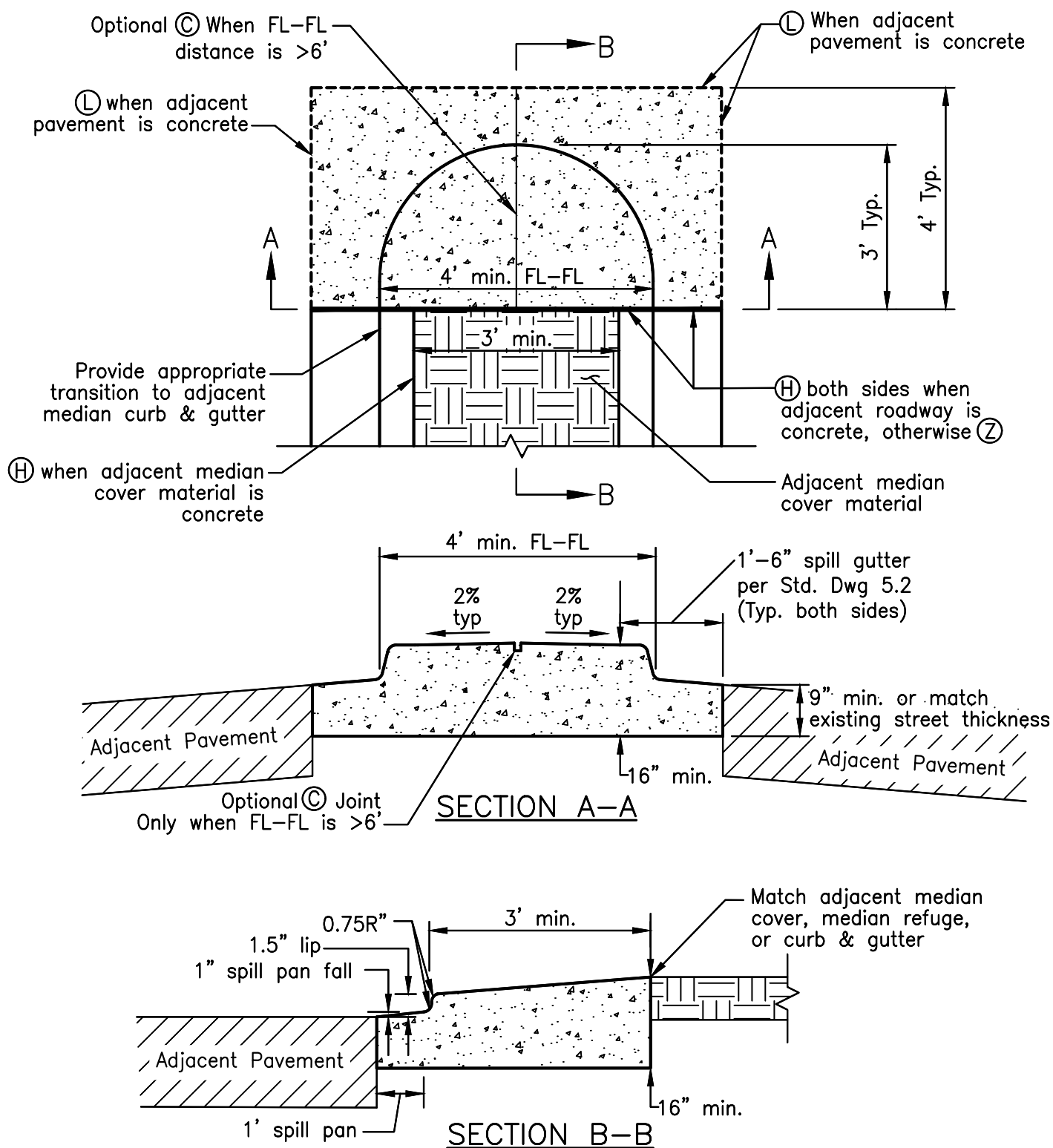


City And County Of Denver
Transportation Standard Drawings

Median Refuge Island

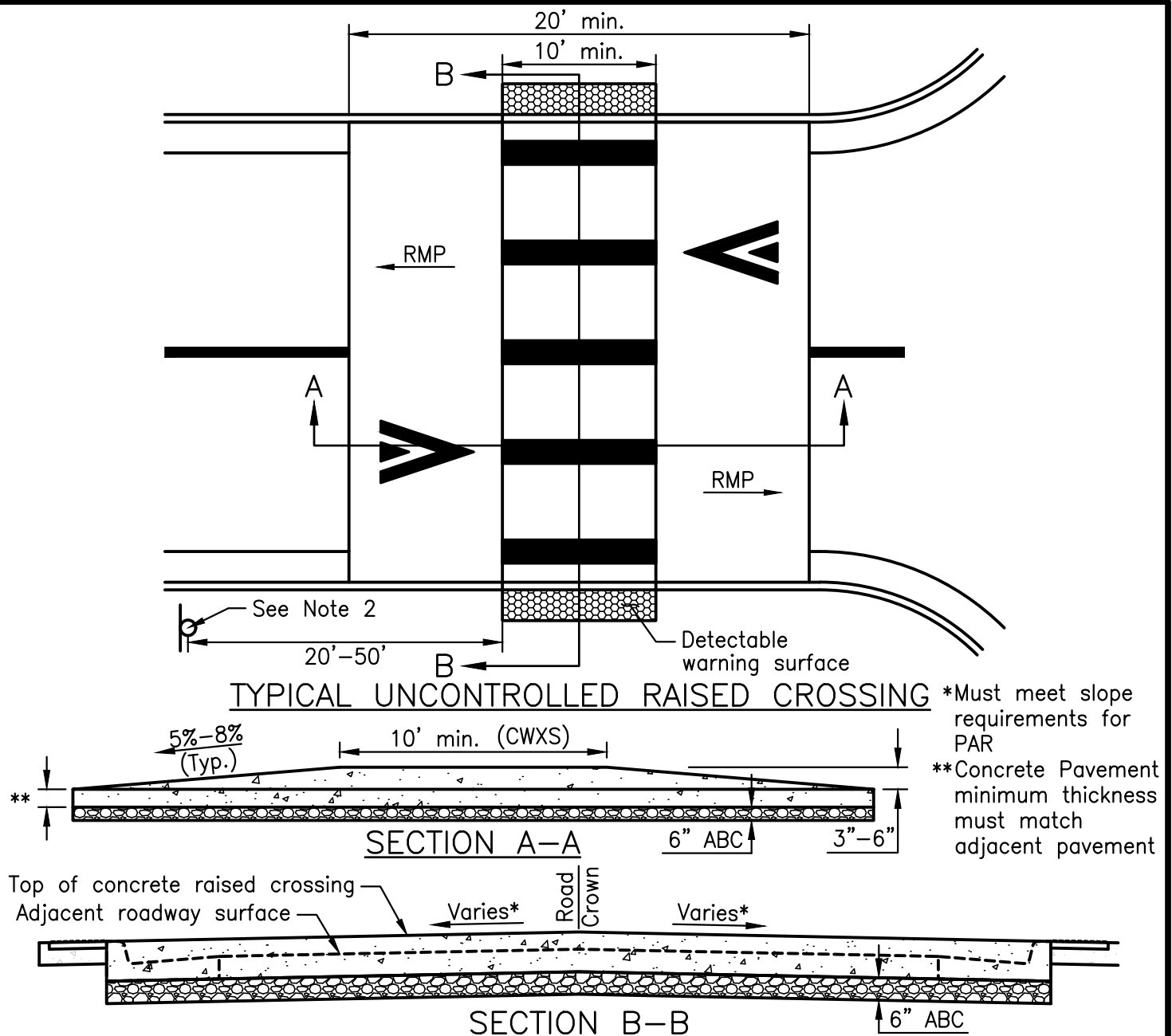
Date:
10/24

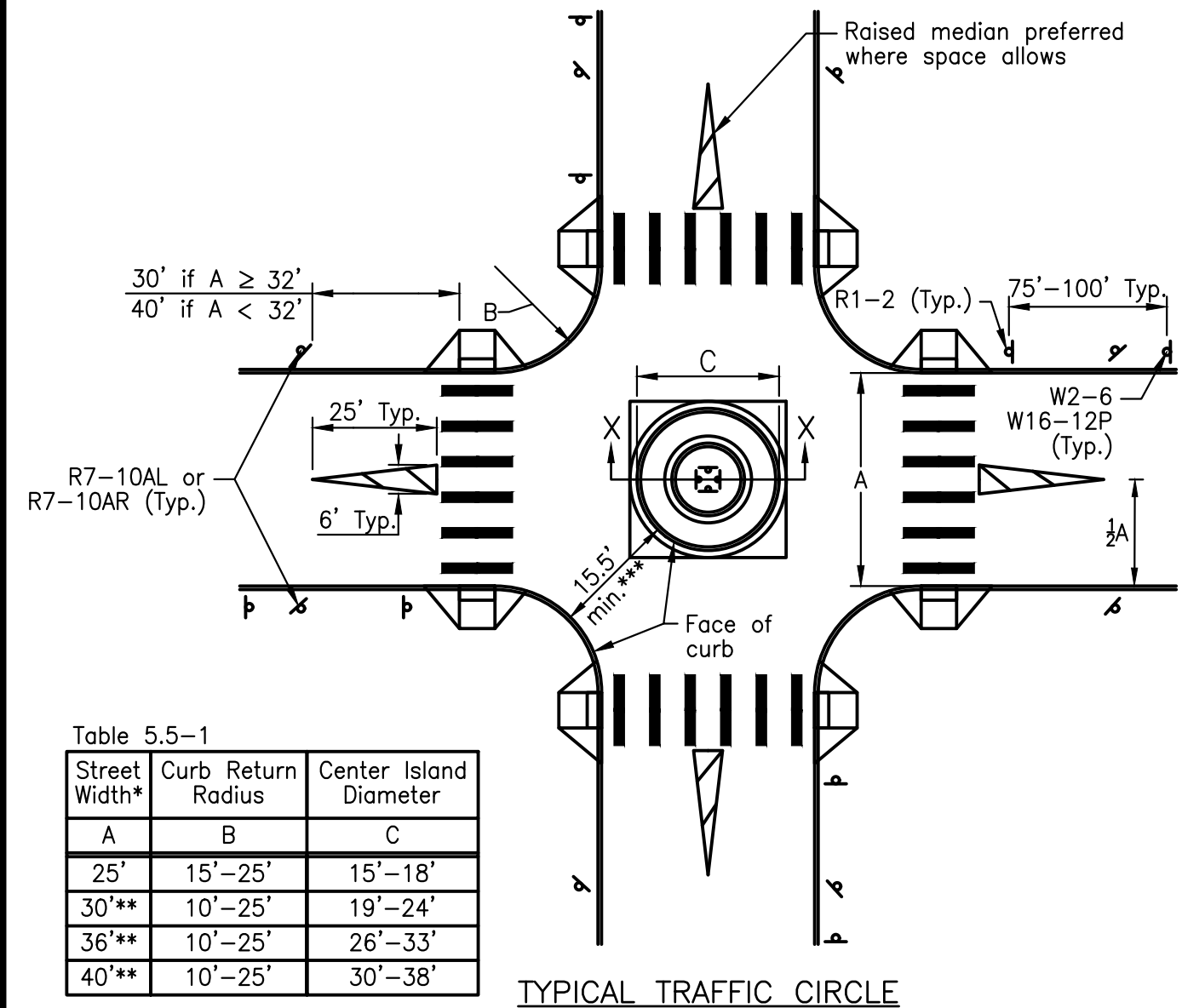
Std. Dwg.
5.2



Notes:

1. Median nose shall be poured monolithically with curb and gutter transition.
2. Curb height at median nose may be adjusted with approval by DOTI.





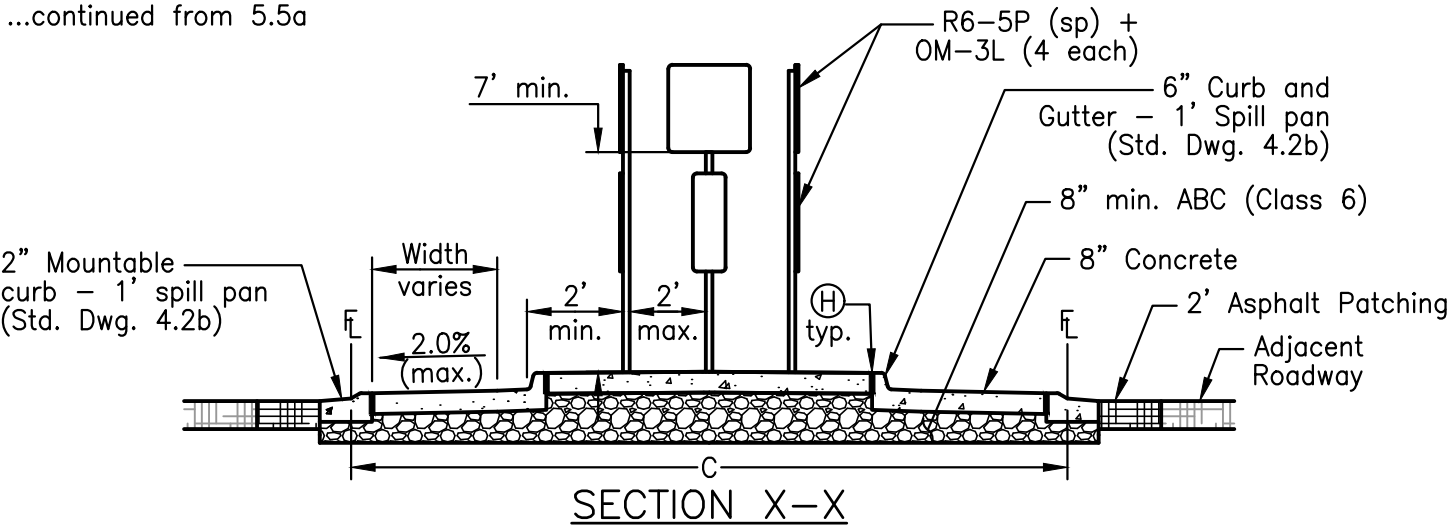
*Where the intersecting streets have differing widths, or where the intersecting streets are offset, an oval-shaped center island can be used; curb extensions may also be used to narrow one of the intersecting streets.

**On streets wide enough to accommodate parking, designers may need to add curb extension treatments to enforce horizontal deflection of the approach vehicular path. This is especially critical when parking utilization is low.

***The area between the apex of the curb and the traffic circle shall be designed to a maximum slope of 5%. In retrofit situations, the slope shall be a maximum of 10%.

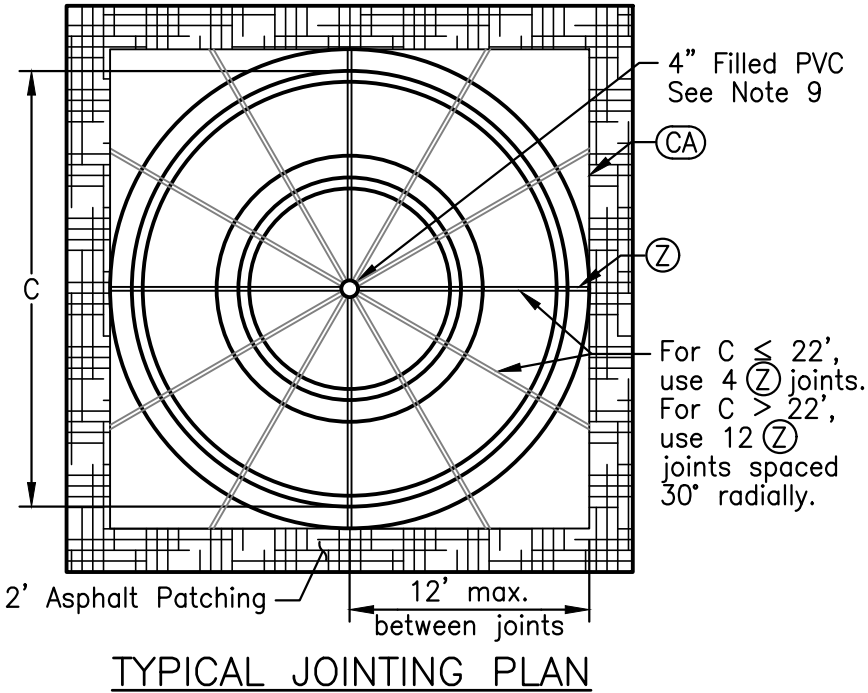
Continued on 5.5b...

...continued from 5.5a



Notes:

1. Traffic circles shall not be installed where the parallel design vehicle path encroaches into the centerline of a valley gutter.
2. Traffic circles shall not be installed with diagonal pedestrian curb ramps
3. Truck aprons should be applied appropriately given the design and control vehicles selected for the larger street.
4. A 15.5' clearance from intersection corner to traffic circle shall be maintained at a minimum. Design and control vehicles shall be able to complete left turns, right turns, and through movements through the intersection if they are permitted for normal traffic. U-turns may be omitted for analysis. If a corner inlet is present, increase clearance from intersection corners to edge of traffic circle by 2 feet, as the inlet gutter or pan is not a drivable surface.
5. Street section shall be carefully reviewed for impacts to storm water routing. Installation shall consider any new low points as a sump and shall provide inlet(s) as described in the Denver Storm Drainage Design and Technical Criteria.
6. If a traffic circle serves a bike route, see Denver's Bikeway Design Manual (Latest Edition) for additional guidance.
7. All local traffic circles shall be reviewed by Denver Fire Department prior to installation.
8. Traffic circles may be landscaped with DOTI approval. Plantings shall follow DOTI height restrictions and maintenance requirements.
9. Where joints meet at an acute angle and at the center of the circle, a 4" PVC pipe shall be installed as a termination core to prevent cracking. The inside of the PVC pipe shall be coated with bond breaker and filled with non-shrink grout.

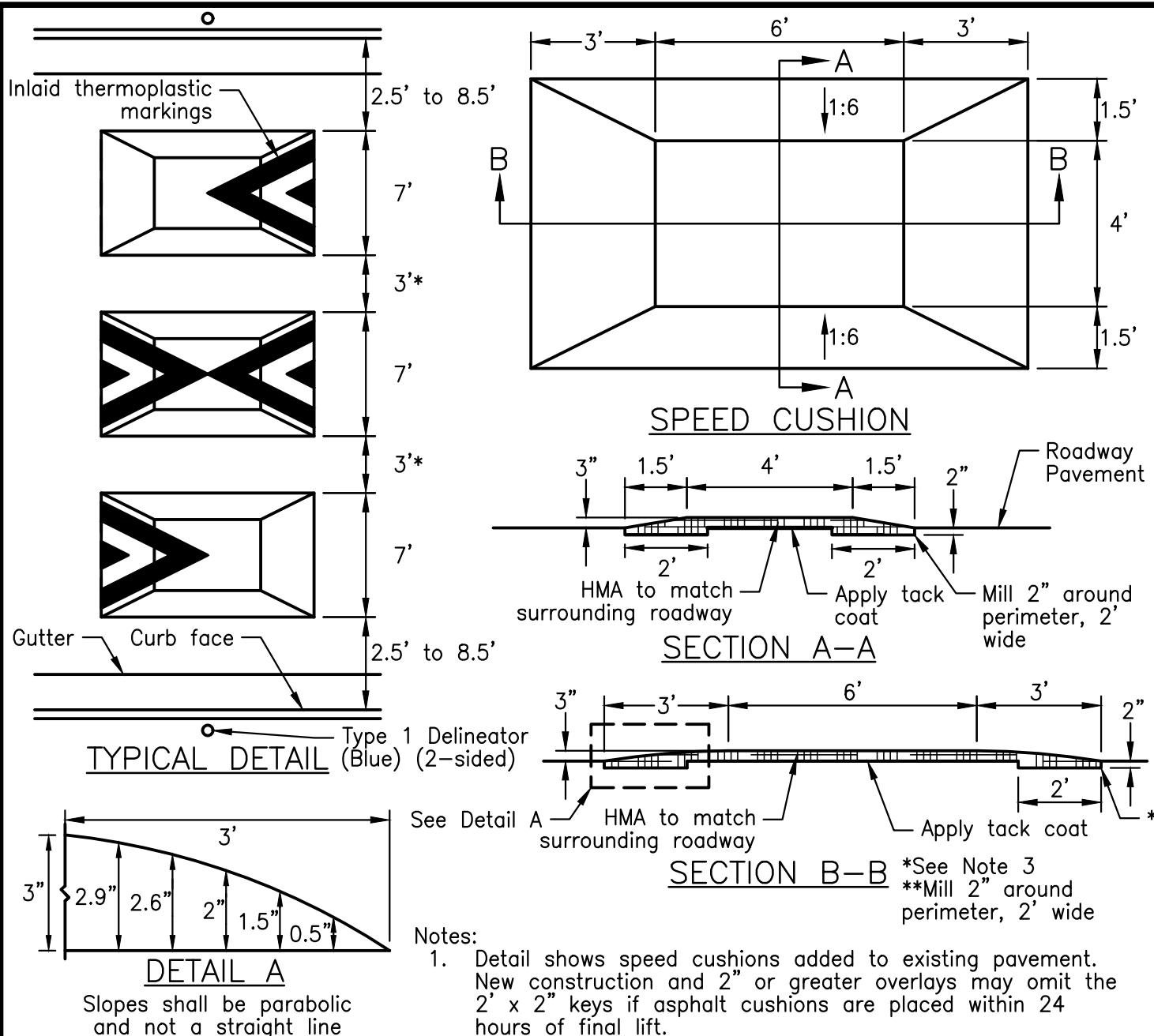


City And County Of Denver
Transportation Standard Drawings

Neighborhood Traffic Circle

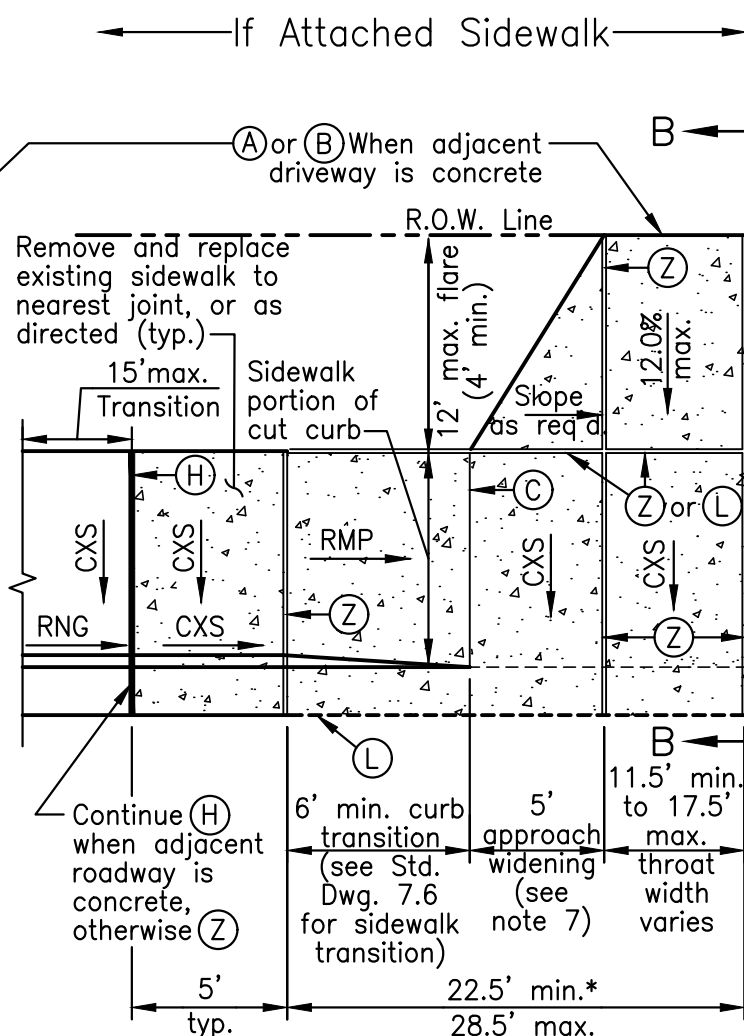
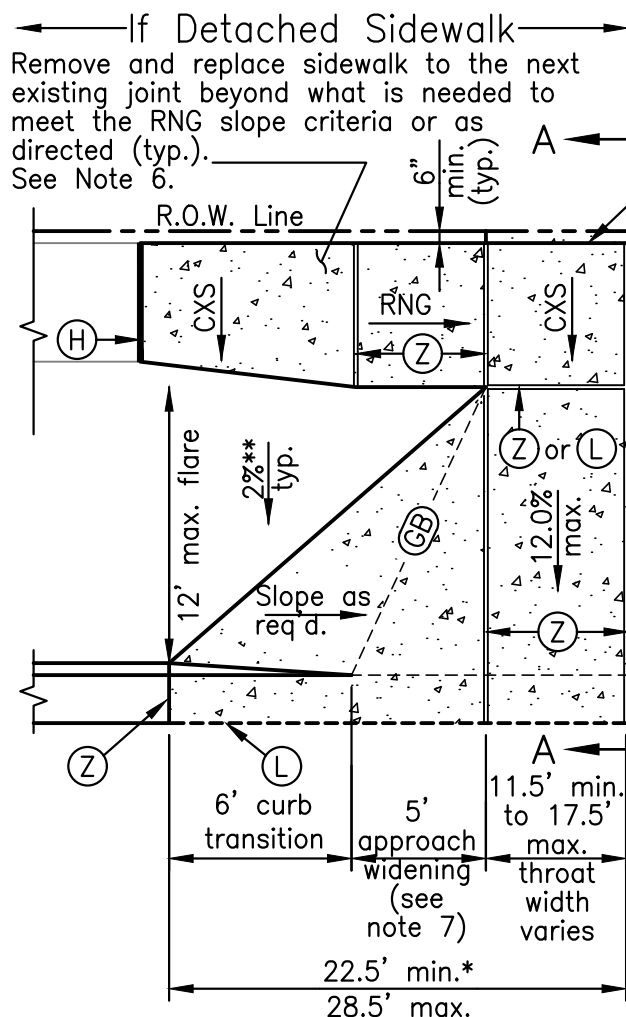
Date:
10/24

Std. Dwg.
5.5b



Notes:

- Detail shows speed cushions added to existing pavement. New construction and 2" or greater overlays may omit the 2' x 2" keys if asphalt cushions are placed within 24 hours of final lift.
- Detail for use on asphalt roadways only.
- If curb-to-curb width is less than 32', decrease the distance between speed cushions from 3' to 2'.
- Speed cushions shall not be placed over manholes, water valves, other utility appurtenances, or over survey monuments.
- Speed cushions shall not be installed within 20' of a driveway or curb cut or within 100' of an intersection without DOTI approval.
- W17-1 signs shall be installed 20' to 50' advance of speed cushions.
- Speed cushions are to be constructed between 3" and 3.5" in height. If constructed outside of this range, contractors will be required to make corrections. Because some settlement is normal, it is preferable for the initial height to be mid-range.
- Speed cushions shall be installed with SX(75) PG 64-22 unless otherwise approved by DOTI. Tack coat shall be applied prior to application of asphalt.
- Asphalt application shall include sealant at the edges.



*Widths beyond min./max. dimensions shown must be approved by DOTI.

**Or match existing grade

Notes:

STANDARD COMMERCIAL & MULTI-FAMILY CURB CUT

1. Apply asphalt patch requirements in Std. Dwg. 12.0 when driveway is installed adjacent to existing asphalt street.
2. Additional tooled joints may be required to provide definition of sidewalk or driving surfaces or to control the location of cracking.
3. On-site parking stalls that back into the driveway aisle shall be located a minimum of 10' from the R.O.W. line, measured to the nearest point of the parking space.
4. Any garage door or gate shall be located a minimum of 20' from the R.O.W. line and/or back of sidewalk, whichever is closer. A garage door or gate located at an exit only may be located at the R.O.W. line only by specific written permission of DOTI.
5. The sidewalk portions of the curb cut shall match the width and alignment of the approaching sidewalk, with a minimum width of 5' and a cross-slope of CXS toward the flowline.
6. The adjacent sidewalk shall extend up to 15' from driveway curb cut in order to meet RNG and CXS compliant slopes. See Std. Dwg. 7.7 for transition panel guidance.
7. Narrower approach widening widths due to site constraints must be approved by DOTI.
8. If a driveway is signalized, or includes stop or yield devices, the intersecting PAR shall be marked with a detectable warning surface.
9. Contact Office of the City Forester at (720)913-0651 prior to performing any work within the TPZ of existing R.O.W. trees.

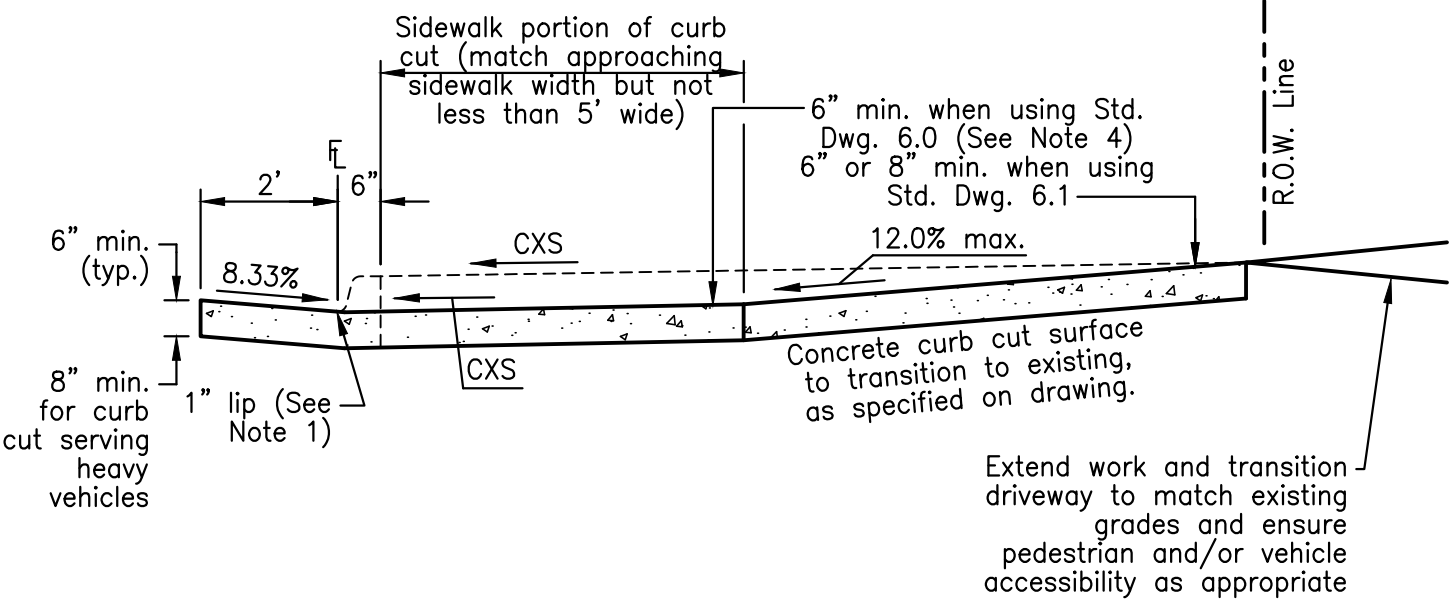
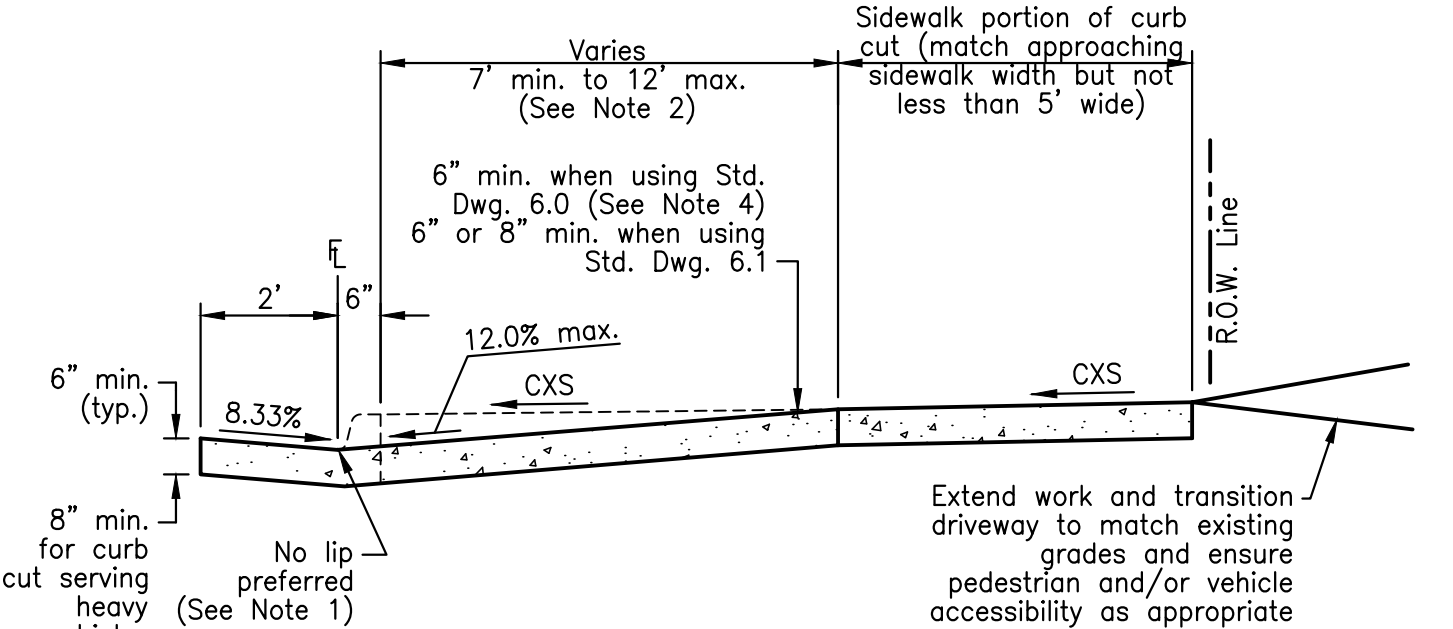


City And County Of Denver
Transportation Standard Drawings

Standard Commercial and
Multi-Family Curb Cut

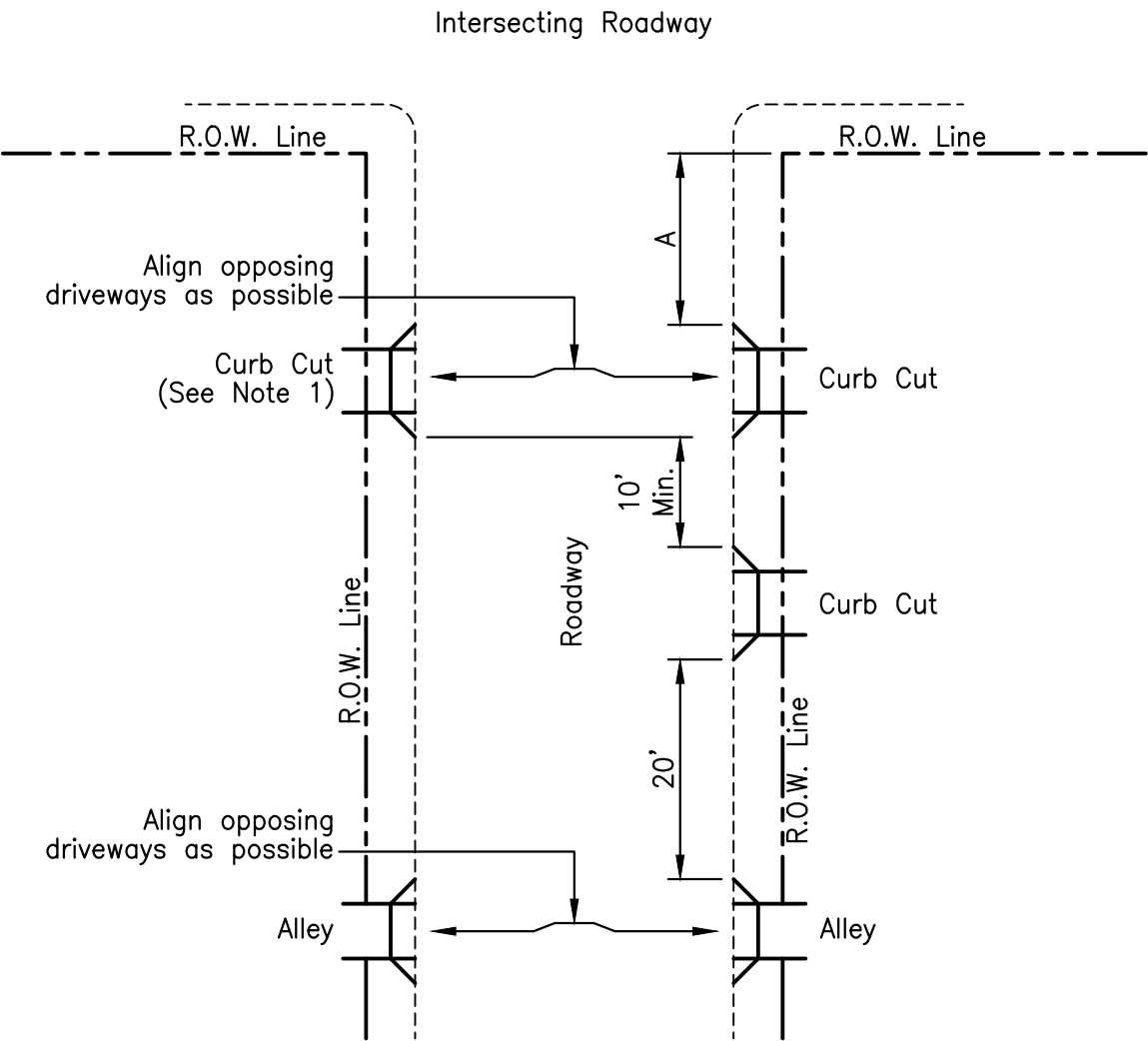
Date:
10/24

Std. Dwg.
6.1



- Notes:
- 1. When maintaining maximum 12% driveway running grade is difficult or to prevent ponding, a 1" lip (1.5" maximum allowed) with 0.125" R at flowline may be installed.
 - 2. When this dimension is less than 7', a special detail must be developed to show how the approaching sidewalk will transition to the lower curb cut.
 - 3. Concrete curb cuts require fibermesh reinforcement at minimum 1.5 pounds per cubic yard.
 - 4. Driveways expected to service any heavy, non-passenger truck traffic shall provide 8" thick concrete at all places.
 - 7. Contact Office of City Forestry at (720)913-0651 prior to performing any work within the TPZ of existing R.O.W. trees.

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Curb Cut Cross-Sections	Std. Dwg. 6.2



Roadway Classification	Corner Clearance 'A' (min. in feet)
Arterial	100
Collector	75
Local/Shared	20/40 (See Note 2)

Notes:

- 1. If placing a new curb cut on the side of a street opposite an existing driveway, the new curb cut shall directly align with an existing driveway or maintain a minimum 10' of separation between flares.
- 2. On local roads, corner clearance is 40' when the intersecting roadway is an arterial and 20' for all other classes of intersecting roadways.
- 3. Additional corner spacing may be required at signalized intersections to keep curb cut clear of required turn lanes.
- 4. All new curb cuts must be specifically approved in writing by DOTI.
- 5. Contact Office of the City Forester at (720)913-0651 prior to performing any work within the TPZ of existing R.O.W. trees.

GENERAL NOTES FOR CURB RAMPS

1. The following Curb Ramp types are general representations and many require modifications to fit actual field conditions. Most applications within the City are retrofit situations where one or more constraints such as limited R.O.W., significant grade differences, and drainage concerns must be taken into account in locating the Curb Ramp. Design resources are available within the City to assist with the proper selection and application of ramp types to maintain applicable Standards.
 - Type 1 Curb Ramps are for use in areas where the sidewalk is set back from the street, and pedestrian access from the side of the ramp is not likely to occur because the approach area is covered by landscaping or an obstacle is present.
 - Type 2 Curb Ramps are for use where pedestrian access can occur from both sides of the ramp. Modified Type 2 ramps are for use in retrofit situations wherever there are existing obstructions or inadequate R.O.W.
 - Type 3 Curb Ramps are for use where sidewalk is attached on one side, detached or adjacent to a fixed obstruction (per Std. Dwg. 7.3) on the other, and pedestrian access can occur from only one side.
 - Type 4 Curb Ramps are for use when there are existing obstructions or there is not sufficient room in the R.O.W. to construct a Type 1, 2, or 3 Ramp, including the landing at the top of the ramp and a PAR around the top of the ramp.
 - Downtown Signalized Corner Blended Transitions are for use where the entire radius is depressed to eliminate use of teardrop islands between ramps only with DOTI approval.

Consult with DOTI for procedures and standards to follow for curb ramps located in Denver Landmark Districts, abutting Denver Landmark Districts, or for districts and structures listed in the National Register of Historic Places.
2. Refer to the most current version of the City and County of Denver "Sidewalk and Curb Ramp Construction Rules and Regulations" and "Curb Ramp Installation and Replacement Policy and Procedures" for additional design parameters.
3. Curb Ramps shall be positioned as directionally as possible to align with opposing curb ramps. Placement of diagonal or mid-block Curb Ramps must be approved in writing by DOTI.
4. Grade breaks at the top and bottom of curb ramp runs shall be flush and perpendicular to the direction of the curb ramp and per Std. Dwg. 7.6a-b.
5. The design preference is for directional curb ramps on all road classifications.
6. For each Curb Ramp installation, a transition panel may be required to facilitate proper transitions between proposed work adhering to slope requirements and existing facilities. Per Std. Dwg. 7.7, for ramps less than 15' long, CXS and RNG must be met. If CXS and/or RNG cannot be met within 15', the ramp length shall be 15' long and CXS and RNG may exceed their prescribed values, and CXS and RNG shall warp at a consistent rate along the ramp.
7. Curb Ramps shall match approaching clear sidewalk width, or 5' minimum, whichever is greater. Curb Ramp throat width shall not exceed 8' unless serving a multi-use path, for which the throat width shall not exceed 12' unless otherwise approved by DOTI.
8. Curb ramps adjacent to all city owned and/or Parks-maintained areas including, but not limited to, parks, recreation centers, libraries, and buildings shall be installed with a minimum ramp width of 6' or the width of the adjacent PAR, whichever is greater. For Parks-maintained locations that serve multi-use trails, the curb ramp shall be extended to match the trail width up to 10' wide with no approval required and 12' wide with DOTI approval.
9. Contact Office of City Forester at prior to performing any work within the TPZ of existing R.O.W. trees.
10. The design cross-slope of the Curb Ramp surface shall be 1.5% max (CXS). Where curb ramps are being constructed on existing streets with running grades greater than 2.1%, the cross-slope of the curb ramp shall match the roadway's flowline slope at the flowline and transition at 0.5%/ft maximum to 1.5% maximum where the top of the curb ramp meets the landing or turning space.

Continued on 7.0b...



City And County Of Denver
Transportation Standard Drawings

General Notes for Curb Ramps

Date:
10/24

Std. Dwg.
7.0a

GENERAL NOTES FOR CURB RAMPS

...continued from 7.0a

11. The 'slope' of the gutter in front of a curb ramp shall be RNG. For a standard 2' gutter pan, this results in a maximum gutter depth of no more than 1.2". To transition from the standard 2" gutter depth to an accessible 1.2" depth in front of the ramp, warp the gutter lip in a 2' to 6' curb & gutter section adjacent to the curb ramp, as shown on each standard curb ramp drawing.
12. The Accessible Crosswalk Slope (CWXS) defines the maximum cross slope of the PAR when it is contained within a crosswalk. Where a PAR is contained within a crosswalk at a yield or stop controlled intersection, the cross slope of the PAR shall be 1:48 (2.1%) maximum. Where a PAR is contained within a crosswalk at an uncontrolled approach, the cross slope of the PAR shall be 5.0% maximum. The cross slope of a PAR within a midblock crosswalk or a crosswalk at a roundabout shall not exceed the street grade. Where roadway superelevation exceeds 5.0% at the location of a crosswalk, the grade of the PAR may match but not exceed the adjacent superelevation. The above mentioned slopes shall be considered the maximum field measurement slope, and therefore the maximum design slope shall be 0.5% less.
13. A level (CXS) landing area, 5' typical by the width of the ramp throat, shall be required at the top of each Curb Ramp or when a turning movement is required to access an adjacent PAR. Slopes shall be designed to CXS directions shown on each detail. The level landing area shall in no cases be less than 4' in any direction. Landings must be provided with or without adjacent sidewalks.
14. Location of a properly designed and located curb ramp shall take precedence over location of a drainage structure or existing obstacle, to the maximum extent feasible. When the effort required to remove, and/or relocate drainage structures or other obstacles exceeds maximum extent feasible, it shall be acceptable to reposition the curb ramp or close the PAR and/or crosswalk at that location, if approved by DOTI in writing.
14. All Curb Ramps shall be constructed with detectable warning surfaces. Detectable warning surfaces shall be installed across the full width of the ramp (excluding any flared sides), and set so that the closest point or points are 6" from grade break at bottom of the ramp (flowline) or from the edge of pavement where there is no curb.
15. Detectable warning surfaces shall be brick red, tile red, black when noted, or other equivalent color as approved by DOTI to provide color contrast visually with adjacent walking surfaces, either light-on-dark or dark-on-light, with the adjoining ramp or accessible surface. When adjoining sidewalk is flagstone, or when retrofitting detectable warning surfaces within red concrete, the detectable warning surface shall be black in color to provide required contrast. Concrete for curb ramp construction shall never be stained or have color added.
16. A sample of the detectable warning surface shall be submitted to, and approved by DOTI prior to construction. Detectable warning surfaces shall meet ADA requirements and have non-slip tops. The surfaces are to be wet set into concrete. Integral anchors may be used if resetting is needed. Where a concrete border is required for proper installation of a detectable warning surface, a concrete border not exceeding 2" shall be permitted on all sides of the detectable warning surface. Detectable warning surfaces set in a sand or other non-cementitious bed will not be allowed unless approved by DOTI. Detectable warning surfaces may not be stamped into wet concrete. Brick shall not be used for detectable warning surfaces unless specifically approved in writing by DOTI.

Continued on 7.0c...



City And County Of Denver
Transportation Standard Drawings

General Notes for Curb Ramps

Date:
10/24

Std. Dwg.
7.0b

GENERAL NOTES FOR CURB RAMPS

...continued from 7.0b

17. Detectable warning surfaces fabricated from non-cementitious material (composite, plastic, etc.) with hollow undersides may not be cut unless approved by DOTI and the manufacturer. If embedment ribs are present, any proposed cuts must be at and along an embedment rib-line, so whole sections to embedment ribs are set into wet concrete. Any section without embedment ribs shall be cut off and discarded. If solid cementitious or other non-hollow detectable warning surfaces are cut, the location of the cuts should be positioned to minimize cutting through domes. If domes are cut, the remaining partial domes must be ground off completely. Placement of small cut triangles of detectable warning surfaces to fill gaps, corners, etc. is not allowed. When detectable warning surfaces are cut to fit, center-to-center spacing measured between domes adjacent to cut edges shall be no more than twice the normal spacing between domes not adjacent to cut edges.
18. Detectable warning surfaces for curb ramps adjacent to all city owned and/or Parks-maintained facilities including, but not limited to, parks, recreation centers, libraries, and buildings shall be constructed using cast iron materials in lieu of materials described in Std. Dwg. 7.0b, note 17.
19. Concrete for curb ramps requires fibermesh reinforcement at minimum 1.5 pounds per cubic yard. Concrete for curb ramps shall meet the requirements of MGPEC (Municipal Government Pavement Engineers Council) Item 30.
20. At the bottom of any curb ramp at the intersection of RMP and RNG, the change in grade shall not exceed 13.3%.
21. Accessible Flare Slopes (FLR) shall be measured parallel to the adjacent curb line.
22. Any required transition between vertical and mountable curb adjacent to ramps should occur in a maximum of 10'.
23. Pay limits of all ramps are comprised of all area shown with concrete hatching on the applicable details, unless otherwise noted.
24. Coordinate with DOTI if additional R.O.W. is required to ensure that the curb ramp, including top landing and flares do not extend onto private property.

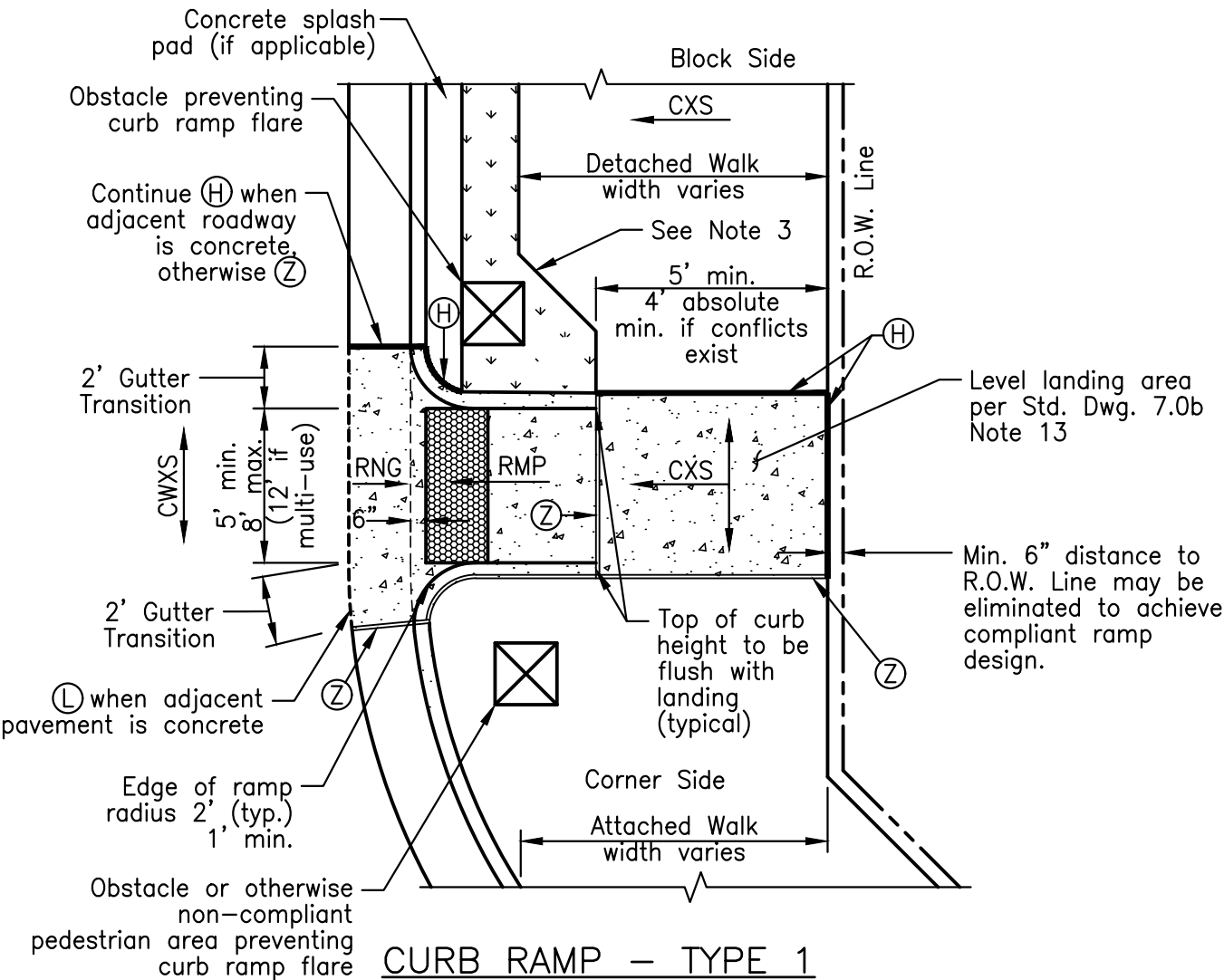


City And County Of Denver
Transportation Standard Drawings

General Notes for Curb Ramps

Date:
10/24

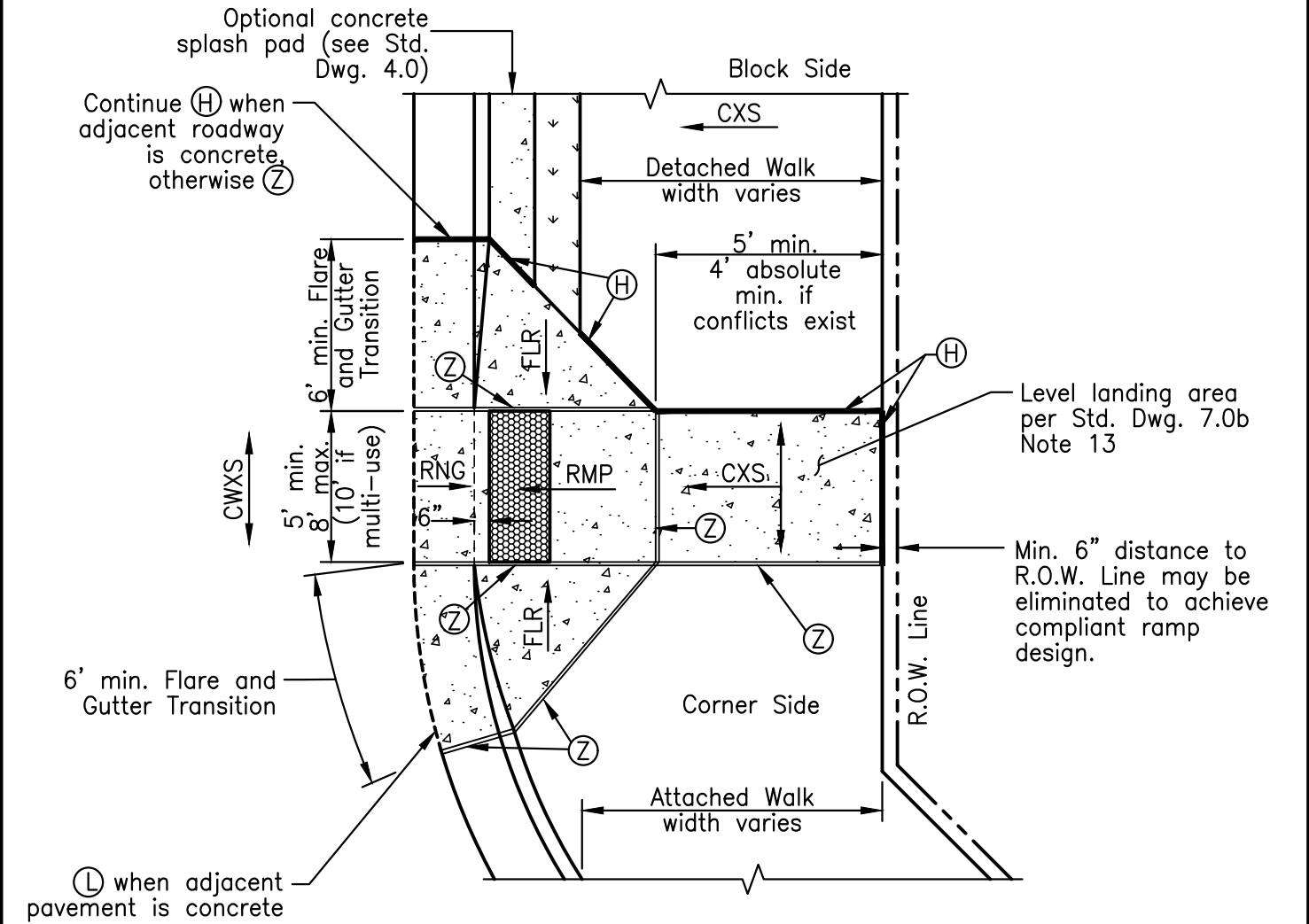
Std. Dwg.
7.0c



- Notes:
1. Type 1 Curb Ramps shall be used where there is insufficient room for FLR slopes on both sides of the curb ramp.
 2. Typical Curb Ramp installations shall consist of two curb ramps at each corner, each positioned to cross its leg of the intersection to a receiving curb ramp. A single curb ramp placed diagonally may not be used in new construction.
 3. Adjacent landscaping/planted strips should transition to the back of Type 1 Curb Ramps. Alternatively, the curb ramp may be shortened such that its back matches the width of the landscaping, but not so much that a 12:1 maximum slope is exceeded.
 4. Contact Office of City Forester at (720)913-0651 prior to performing any work within the TPZ of existing R.O.W. trees.

Pedestrian Access Route (PAR) Design Elements			
Abbv.	Description	Max Design Slope	Max Field Measurement Slope
FLR	Accessible Flare Slope	9.5%	10.0%
RMP	Accessible Curb Ramp Slope	7.8%	8.3%
CXS	Accessible Cross Slope	1.5%	2.1%
CWXS	Accessible Crosswalk Slope	1.5%*	2.1%*
RNG	Accessible Running Slope	4.5%	5.0%

*See Std. Dwg. 7.0b Note 12 regarding Accessible Crosswalk Slope

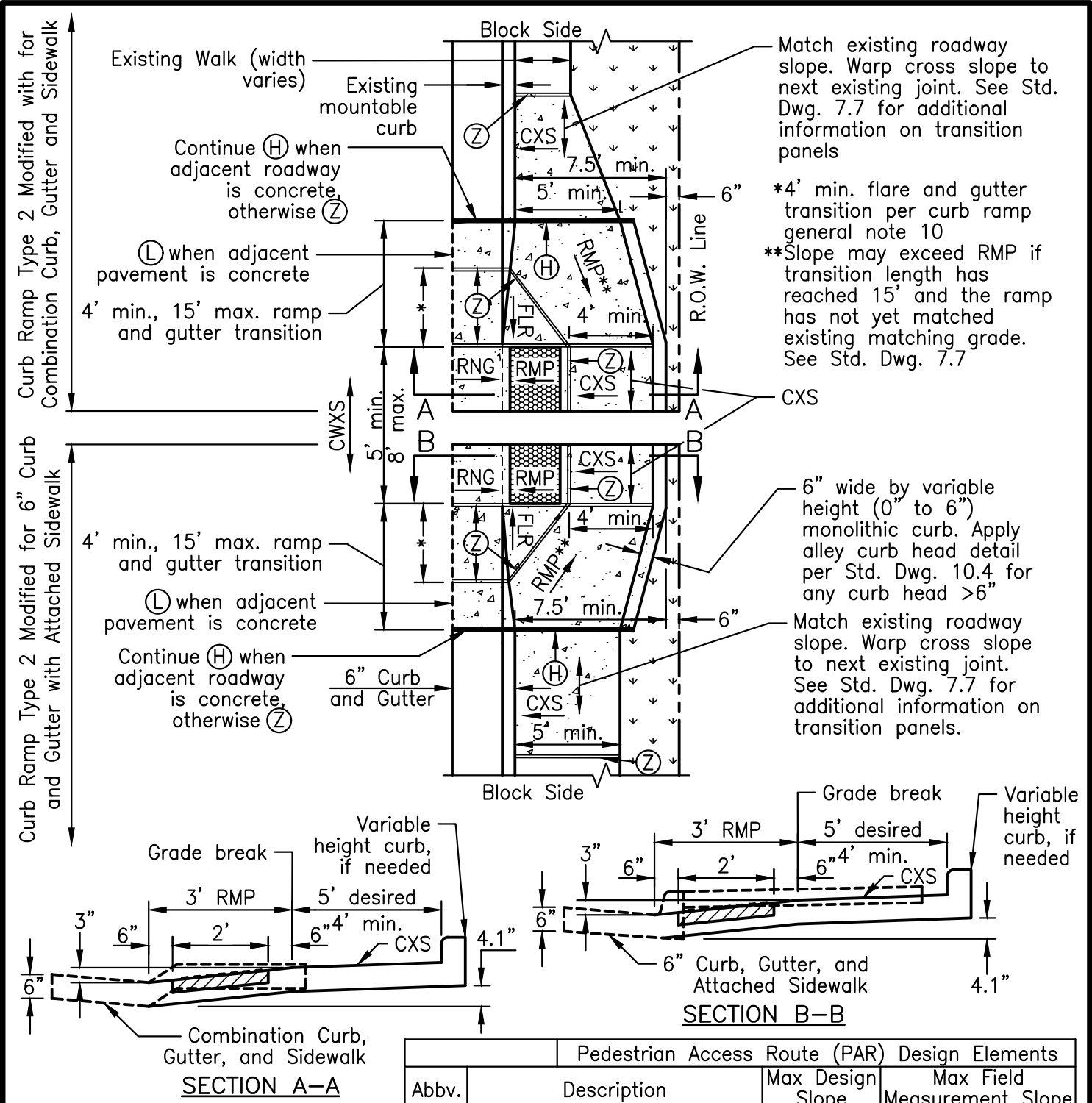


CURB RAMP – TYPE 2

- Notes:
1. A Type 2 Curb Ramp shall be used where there is sufficient room for FLR slopes as depicted on this Std. Dwg., on both sides of the curb ramp.
 2. Typical Curb Ramp installations shall consist of two curb ramps at each corner, each positioned to cross its leg of the intersection to a receiving curb ramp. A single curb ramp placed diagonally should not be used in new construction.
 3. Contact Office of City Forester at (720)913-0651 prior to performing any work within the TPZ of existing R.O.W. trees.

		Pedestrian Access Route (PAR) Design Elements	
Abbv.	Description	Max Design Slope	Max Field Measurement Slope
FLR	Accessible Flare Slope	9.5%	10.0%
RMP	Accessible Curb Ramp Slope	7.8%	8.3%
CXS	Accessible Cross Slope	1.5%	2.1%
CWXS	Accessible Crosswalk Slope	1.5%*	2.1%*
RNG	Accessible Running Slope	4.5%	5.0%

*See Std. Dwg. 7.0b Note 12 regarding Accessible Crosswalk Slope



Notes:
1. All grade breaks should be aligned with (H) or (Z) joints.

Pedestrian Access Route (PAR) Design Elements			
Abbv.	Description	Max Design Slope	Max Field Measurement Slope
FLR	Accessible Flare Slope	9.5%	10.0%
RMP	Accessible Curb Ramp Slope	7.8%	8.3%
CXS	Accessible Cross Slope	1.5%	2.1%
CWXS	Accessible Crosswalk Slope	1.5%*	2.1%*
RNG	Accessible Running Slope	4.5%	5.0%

*See Std. Dwg. 7.0b Note 12 regarding Accessible Crosswalk Slope

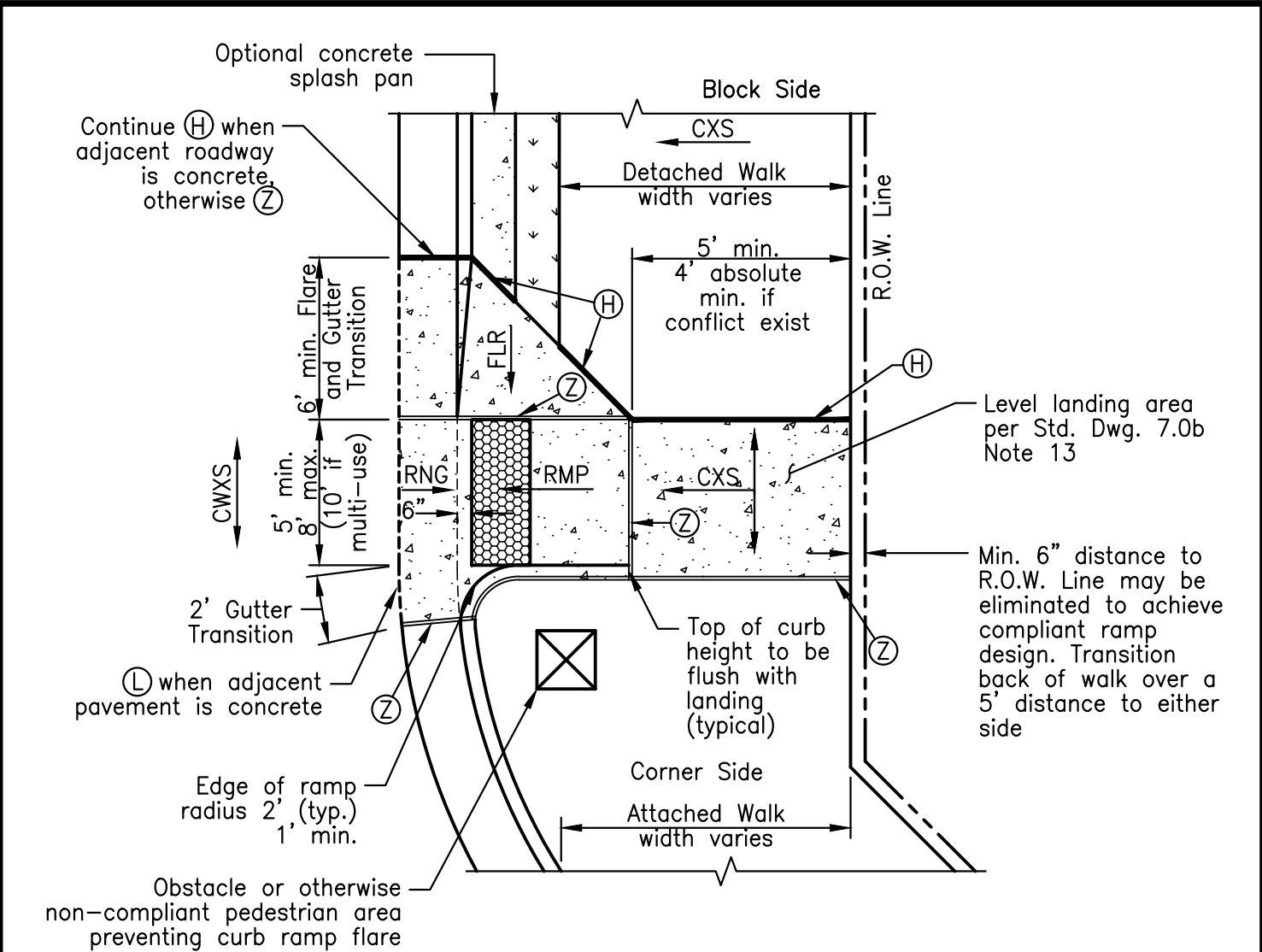


City And County Of Denver
Transportation Standard Drawings

Curb Ramp Type 2 Modified

Date:
10/24

Std. Dwg.
7.2b



CURB RAMP - TYPE 3

- Notes:
1. A Type 3 Curb Ramp shall be used where there is insufficient room for a compliant flare on one side of the curb ramp.
 2. Typical Curb Ramp installations shall consist of two curb ramps at each corner, each positioned to cross its leg of the intersection to a receiving curb ramp. A single curb ramp placed diagonally may not be used in new construction.
 3. Contact Office of City Forester at (720)913-0651 prior to performing any work within the TPZ of existing R.O.W. trees.

		Pedestrian Access Route (PAR) Design Elements	
Abbv.	Description	Max Design Slope	Max Field Measurement Slope
FLR	Accessible Flare Slope	9.5%	10.0%
RMP	Accessible Curb Ramp Slope	7.8%	8.3%
CXS	Accessible Cross Slope	1.5%	2.1%
CWXS	Accessible Crosswalk Slope	1.5%*	2.1%*
RNG	Accessible Running Slope	4.5%	5.0%

*See Std. Dwg. 7.0b Note 12 regarding Accessible Crosswalk Slope

Notes:

- | | | | | |
|---|---|----------------------------|------------------|-----------------------------|
| <p>1. A Type 4 Curb Ramp may be used in retrofit situations wherever there are existing obstructions or inadequate R.O.W. width at the intersection of existing residential streets to provide a Type 1, 2, or 3 Curb Ramp.</p> <p>2. Typical Curb Ramp installations shall consist of two curb ramps at each corner, each positioned to cross its leg of the intersection to a receiving curb ramp.</p> <p>3. Any proposed single curb ramp placed diagonally at a corner will only be considered in retrofit situations at the intersection of existing residential streets, and must specifically be approved by DOTI in writing.</p> <p>4. Contact Office of City Forester at (720)913-0651 prior to performing any work within the drip line of existing R.O.W. trees.</p> | Pedestrian Access Route (PAR) Design Elements | | | |
| | Abbv. | Description | Max Design Slope | Max Field Measurement Slope |
| | FLR | Accessible Flare Slope | 9.5% | 10.0% |
| | RMP | Accessible Curb Ramp Slope | 7.8% | 8.3% |
| | CXS | Accessible Cross Slope | 1.5% | 2.1% |
| | CWXS | Accessible Crosswalk Slope | 1.5%* | 2.1%* |
| | RNG | Accessible Running Slope | 4.5% | 5.0% |

		Pedestrian Access Route (PAR)	Design Elements	
Abbv.	Description	Max Design Slope	Max Field Measurement Slope	
FLR	Accessible Flare Slope	9.5%	10.0%	
RMP	Accessible Curb Ramp Slope	7.8%	8.3%	
CXS	Accessible Cross Slope	1.5%	2.1%	
CWXS	Accessible Crosswalk Slope	1.5%*	2.1%*	
RNG	Accessible Running Slope	4.5%	5.0%	

*See Std. Dwg. 7.0b Note 12 regarding Accessible Crosswalk Slope

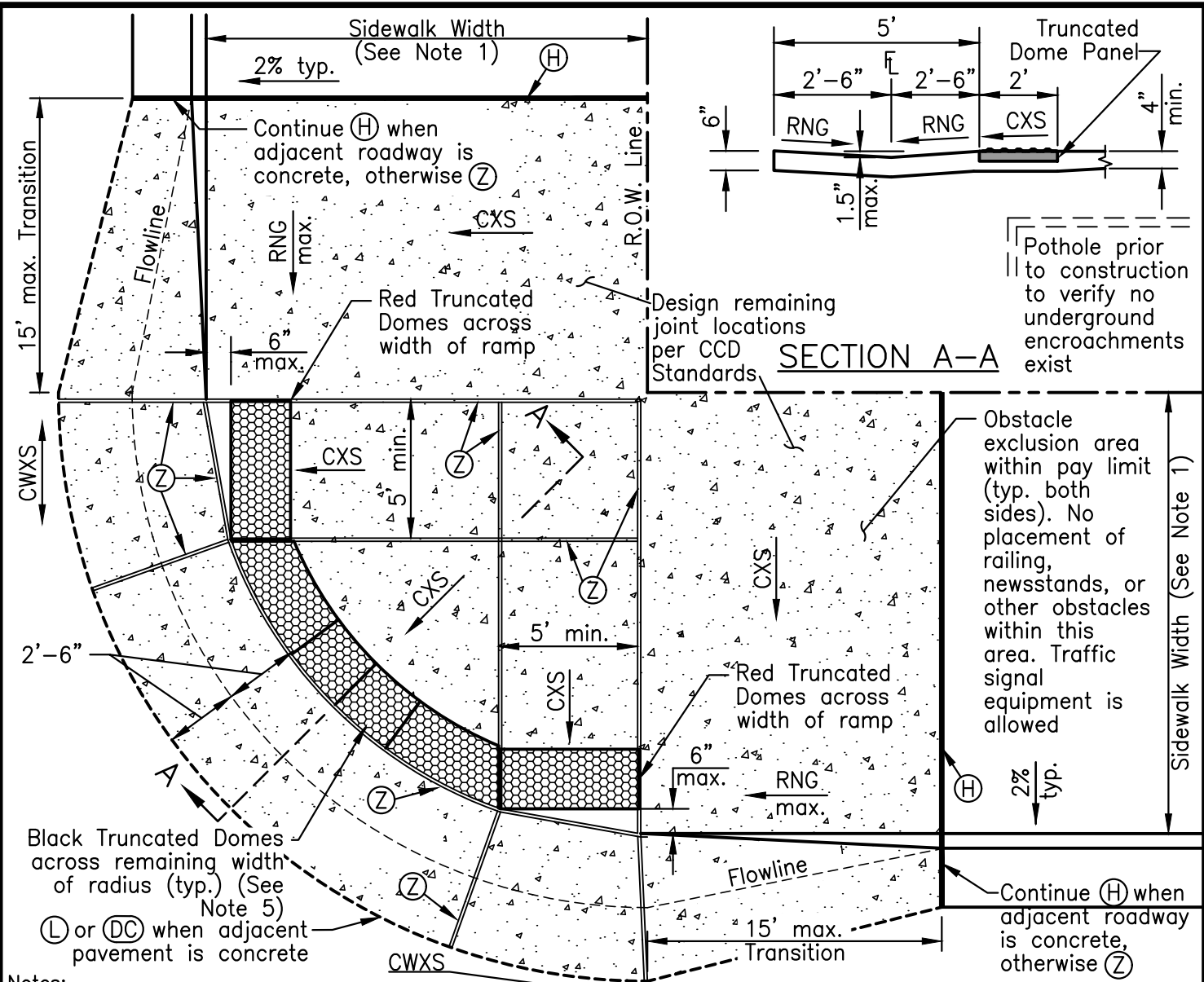


City And County Of Denver
Transportation Standard Drawings

Curb Ramp Type 4

Date:
10/24

Std. Dwg.
7.4



- Notes:
- 1. If existing sidewalk widths are different, match the smallest width, to 5' minimum.
 - 2. For construction adjacent to existing asphalt streets, refer to Std. Dwg. 12.0.
 - 3. Slopes shown as typical on section A-A may be adjusted if necessary to fit existing conditions, but must meet RNG slope in all situations.
 - 4. Radial black truncated dome panels shall be placed edge to edge so that there is no gap between each panel. Panels may be trimmed to fit flush against other panels and construction joints. The use of panels that are less than 2' wide must be approved by DOTI.
 - 5. Black truncated dome panels proposed in cast iron material shall be asphalt-dipped for black color. Black truncated dome panels proposed for approval by DOTI in all other materials shall be ultraviolet and weather/wear resistant to maintain long-term color contrast.
 - 6. All truncated dome panels proposed for placement at the same corner shall be made of uniform material. Therefore, when cast iron panels are used, red panels shall also be placed in cast iron.

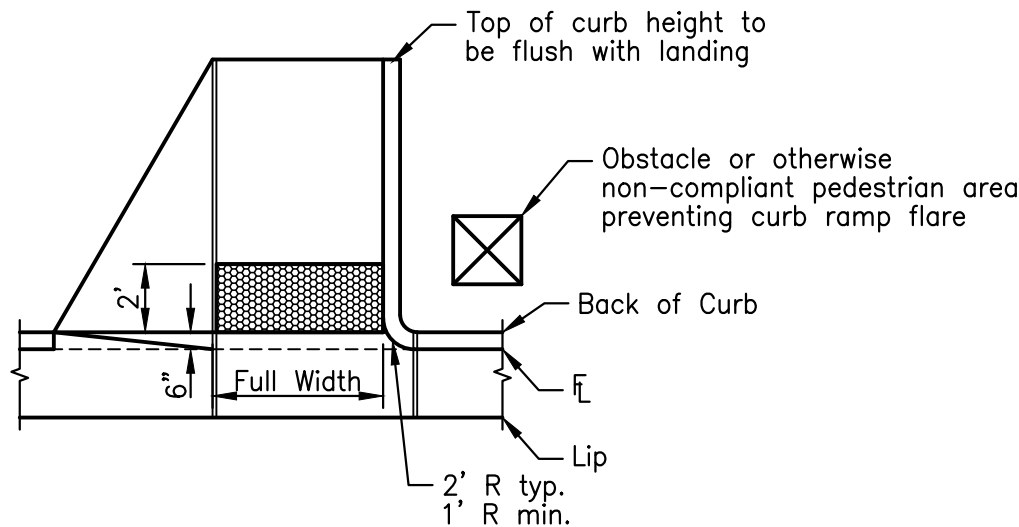
Pedestrian Access Route (PAR) Design Elements			
Abbv.	Description	Max Design Slope	Max Field Measurement Slope
FLR	Accessible Flare Slope	9.5%	10.0%
RMP	Accessible Curb Ramp Slope	7.8%	8.3%
CXS	Accessible Cross Slope	1.5%	2.1%
CWXS	Accessible Crosswalk Slope	1.5%*	2.1%*
RNG	Accessible Running Slope	4.5%	5.0%

*See Std. Dwg. 7.0b Note 12 regarding Accessible Crosswalk Slope



City and County of Denver
Transportation Standards & Details
Curb Ramp at Downtown Signalized
Corner Blended Transition

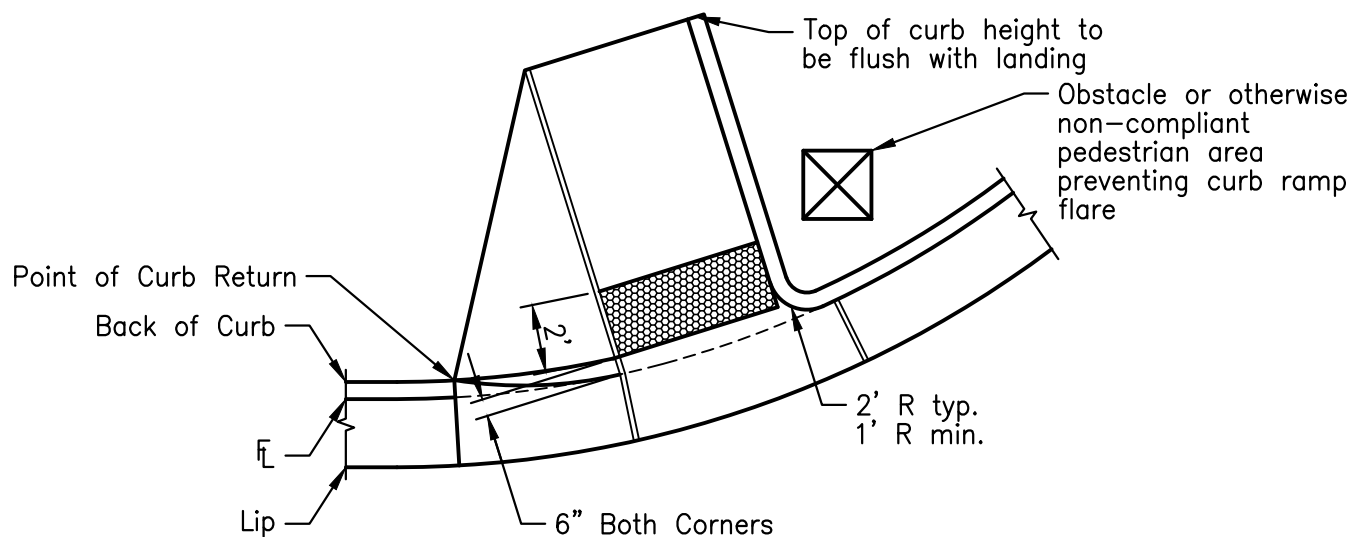
Date:
10/24
Std. Dwg.
7.5



OPTION 1

Apply when edge of curb ramp closest to intersection is located either at or outside of corner Point of Curb Return

>> IF CANNOT INSTALL, MOVE TO OPTION 2 <<

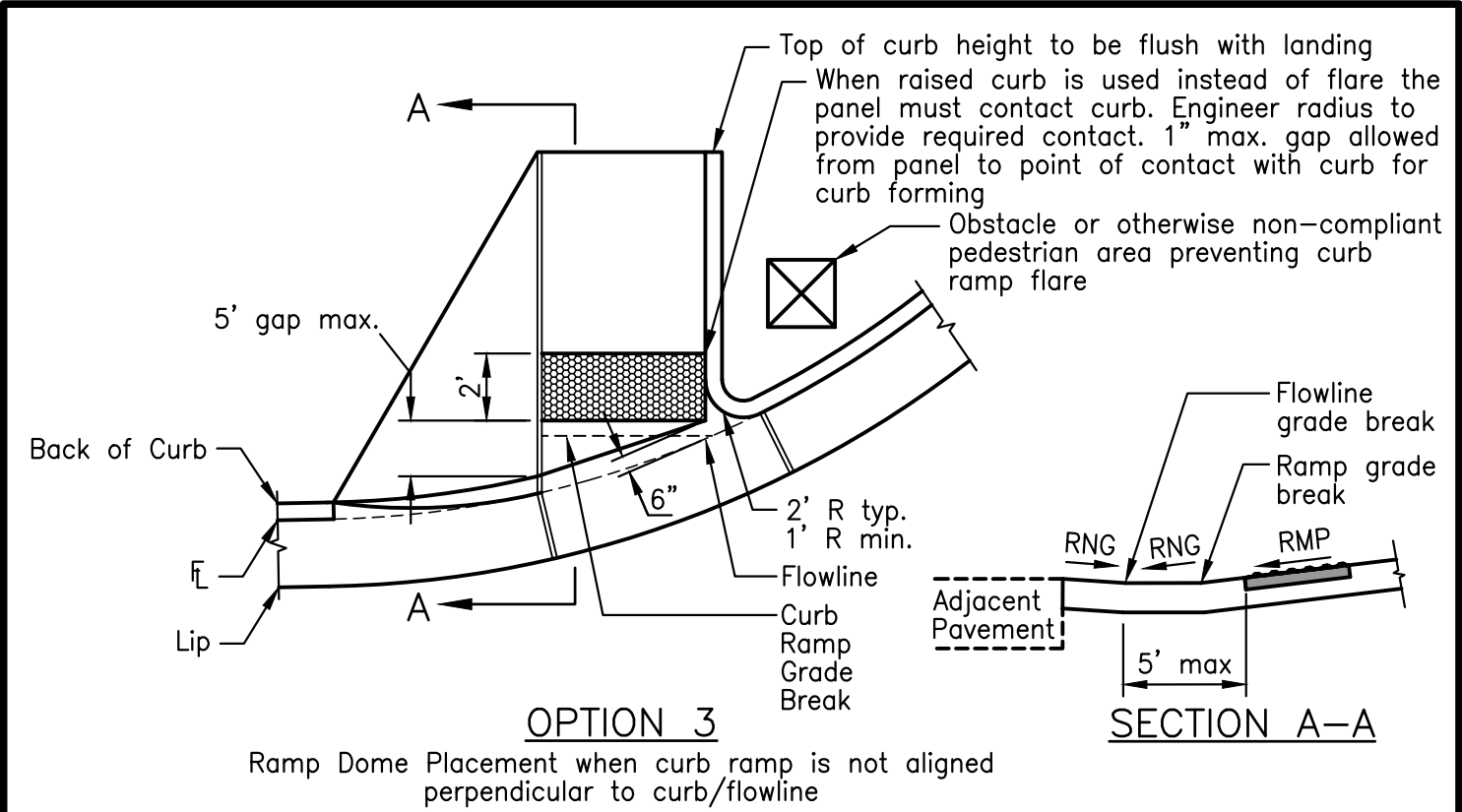


OPTION 2

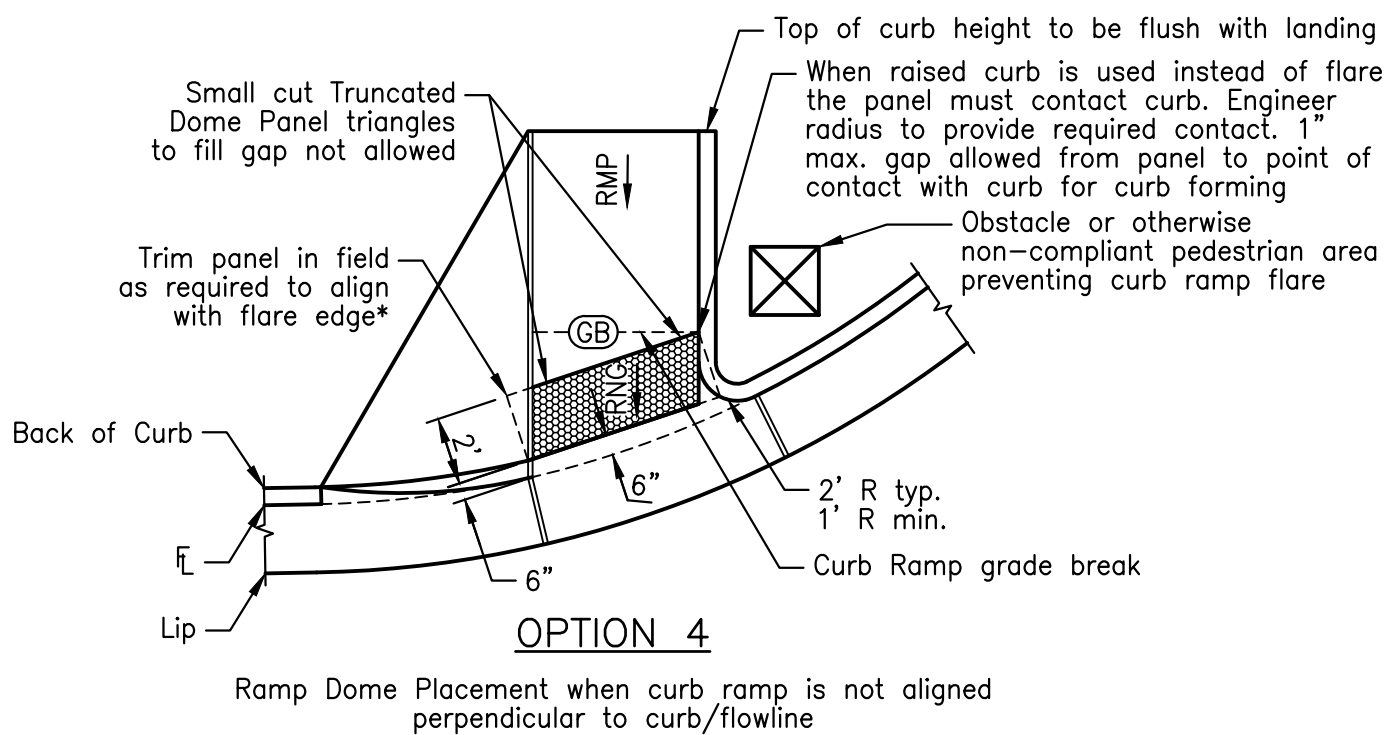
Apply when inside edge of curb ramp closest to intersection is located either at or Inside of corner Point of Curb Return

>> IF CANNOT INSTALL, MOVE TO OPTION 3 <<

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Curb Ramp Truncated Dome Placement Options	Std. Dwg. 7.6a

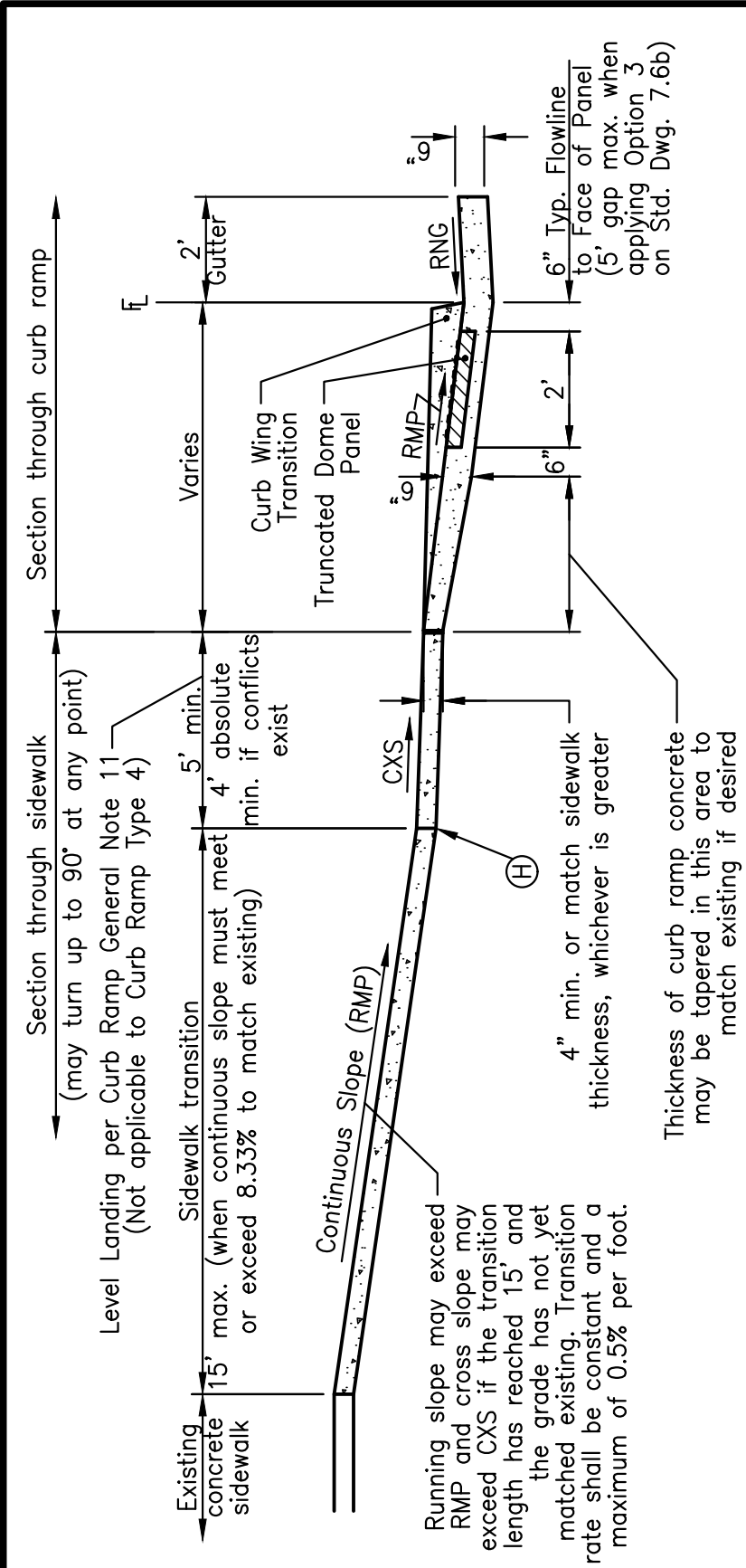


>> IF CANNOT INSTALL, MOVE TO OPTION 4 <<



*Refer to note 17 on Std. Dwg. 7.0b

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Curb Ramp Truncated Dome Placement Options	Std. Dwg. 7.6b



TYPICAL CURB RAMP CROSS-SECTION

- Notes:
- 1. Contact Office of City Forestry at (720)913-0651 prior to performing any work within the TPZ of existing R.O.W. trees.
 - 2. Transitional segments may be used to connect new or altered pedestrian access routes to existing pedestrian circulation paths, and the differences between adjacent surface characteristics shall be minimized to provide a smooth transition. Transition sidewalk width and cross slope at a consistent rate from standard to existing.

Pedestrian Access Route (PAR)		Design Elements	
Abbv.	Description	Max Design Slope	Max Field Measurement Slope
FLR	Accessible Flare Slope	9.5%	10.0%
RMP	Accessible Curb Ramp Slope	7.8%	8.3%
CXS	Accessible Cross Slope	1.5%	2.1%
CWXS	Accessible Crosswalk Slope	1.5%*	2.1%*
RNG	Accessible Running Slope	4.5%	5.0%

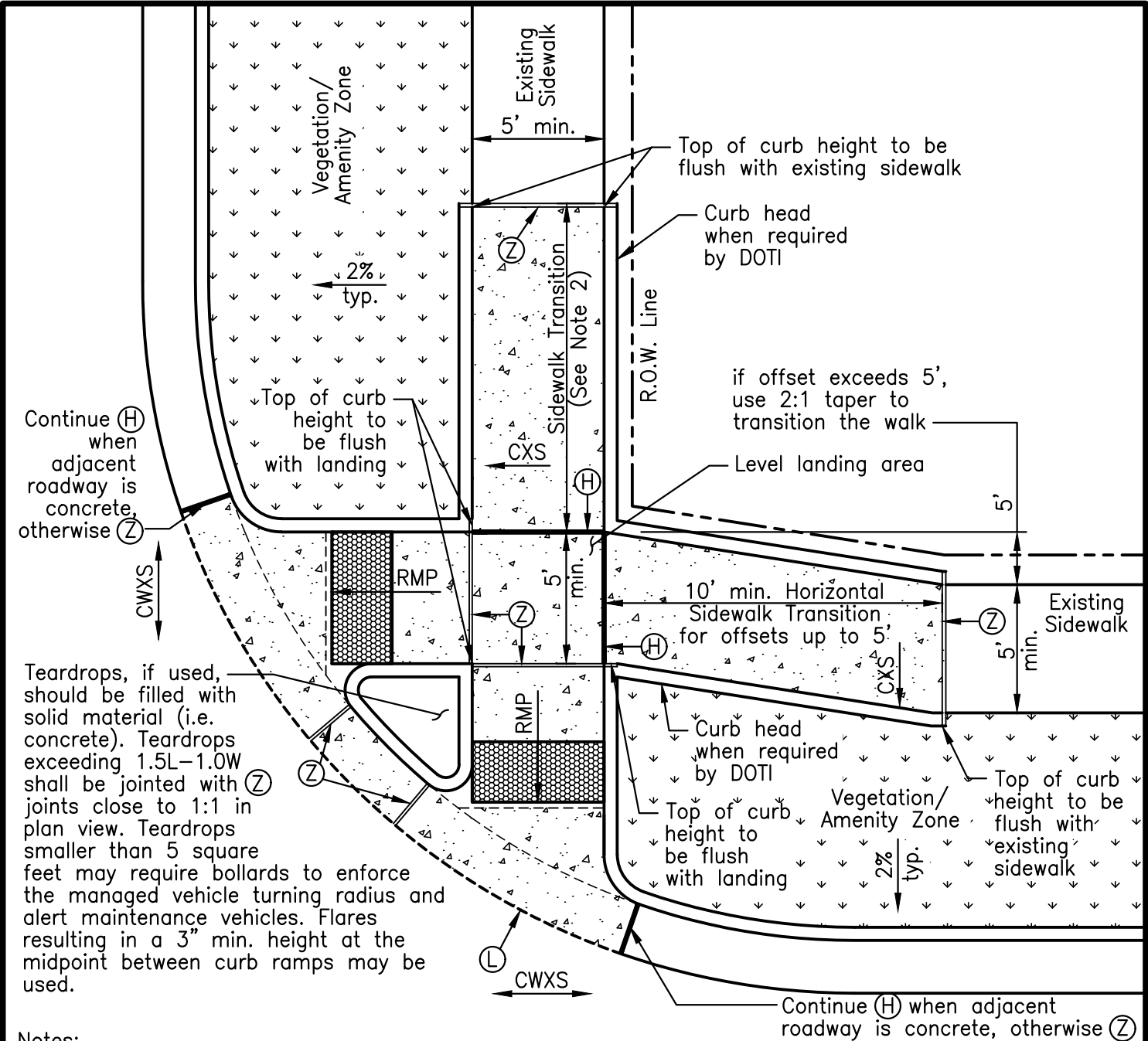
*See Std. Dwg. 7.0b Note 12 regarding Accessible Crosswalk Slope



City And County Of Denver
Transportation Standard Drawings

Curb Ramp Typical Section

Date:
10/24
Std. Dwg.
7.7



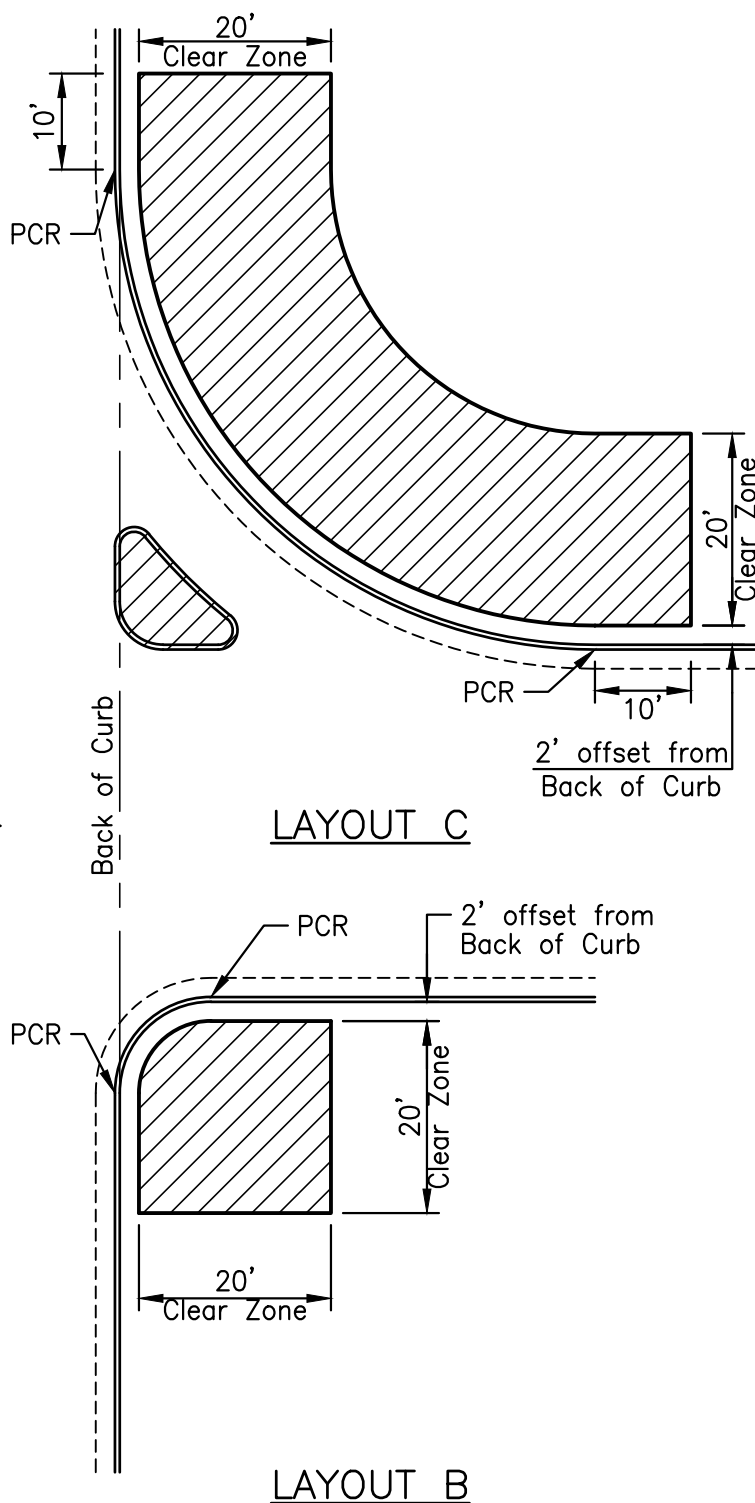
Notes:

- 1. To allow required curb ramp length to meet maximum allowed slopes, sidewalks leading up to curb ramps may be offset as shown.
- 2. Sidewalk transition length need not exceed 15'. See Std. Dwg. 7.7 for additional information.
- 3. Complete jointing details are not included on this drawing.
- 4. Curb ramps, landing area, and sidewalk transition must be poured monolithically or connected with tie bars. Tie bars shall not be used to connect curb ramp sections to sidewalk.

Pedestrian Access Route (PAR) Design Elements			
Abbv.	Description	Max Design Slope	Max Field Measurement Slope
FLR	Accessible Flare Slope	9.5%	10.0%
RMP	Accessible Curb Ramp Slope	7.8%	8.3%
CXS	Accessible Cross Slope	1.5%	2.1%
CWXS	Accessible Crosswalk Slope	1.5%*	2.1%*
RNG	Accessible Running Slope	4.5%	5.0%

*See Std. Dwg. 7.0b Note 12 regarding Accessible Crosswalk Slope

Diagram illustrating a street corner layout (LAYOUT A) showing a 20' x 20' clear zone, a 2' offset from the back of the curb, and a 10' wide curb. The diagram is labeled "LAYOUT A".



1. When the flowline radius is greater than 22'-6", use Layout A.
2. When the flowline radius is 22'-6" or less, use Layout B.
3. The clear zone does not apply outside of R.O.W.
4. Underground utilities may be allowed to proceed in a straight line through these Clear Zones if no signals exist or are planned for the intersection and with approval by DOTI.

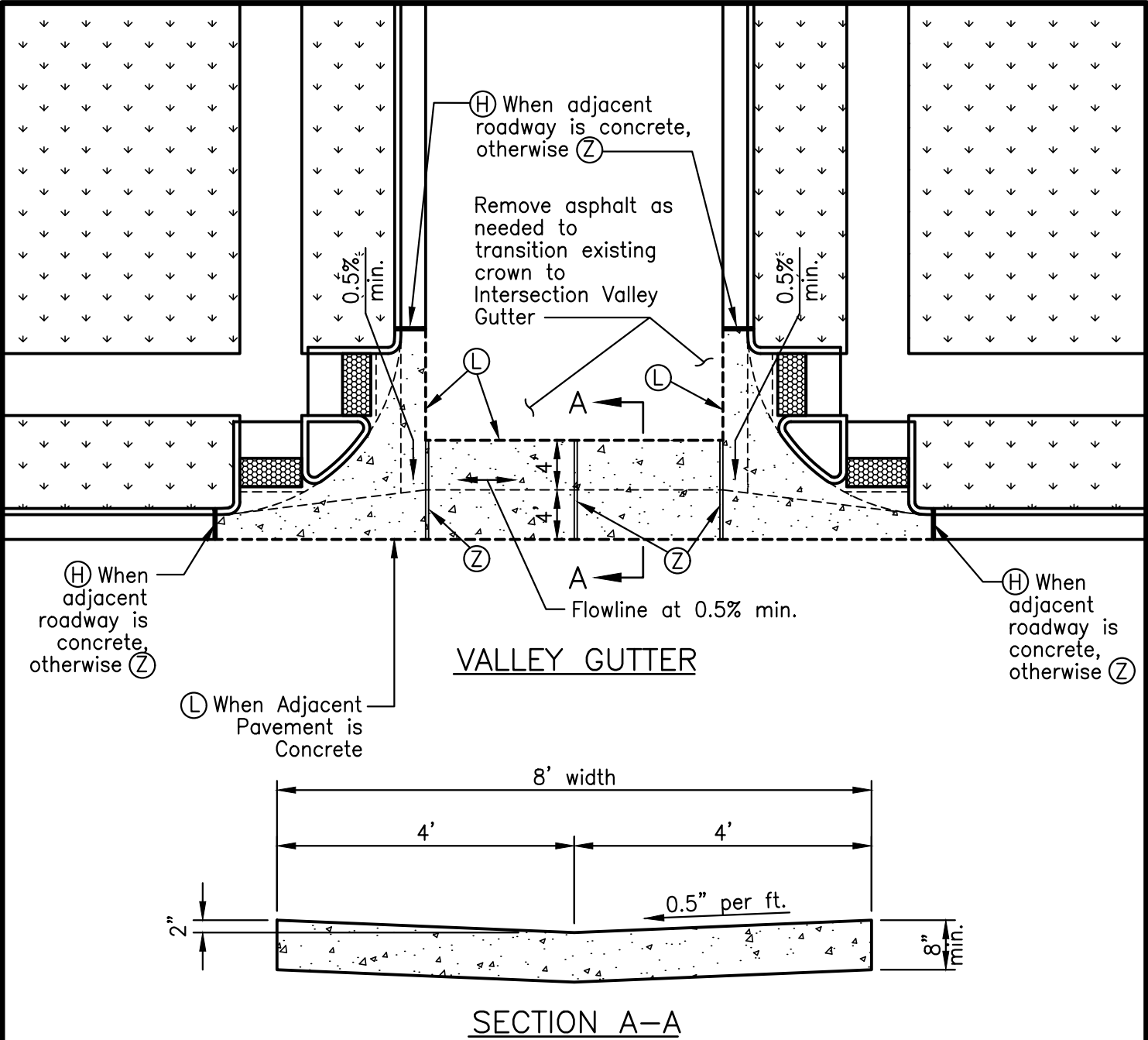


City And County Of Denver
Transportation Standard Drawings

Signal Equipment Clear Zone

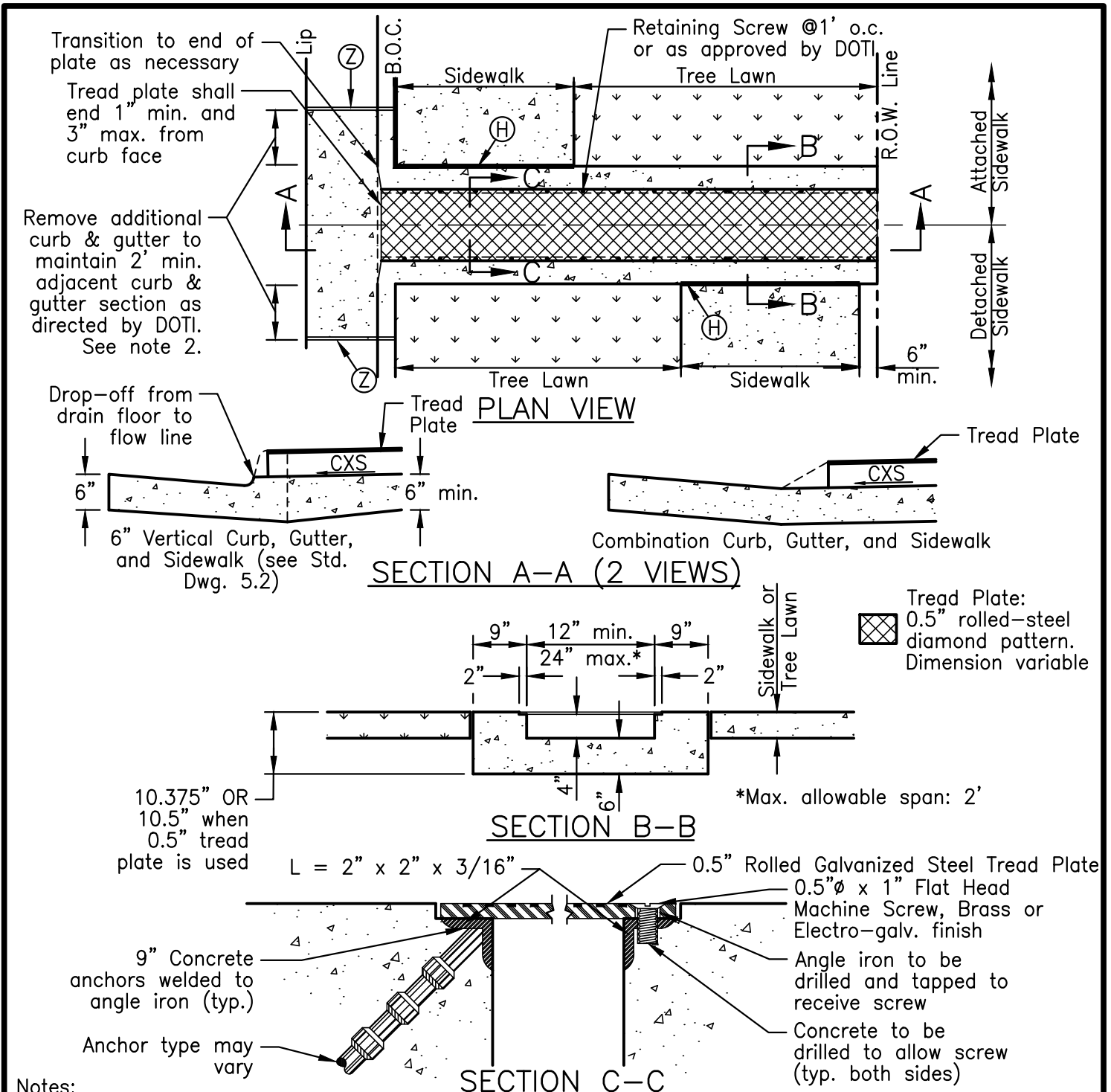
Date:
10/24

Std. Dwg.
7.9



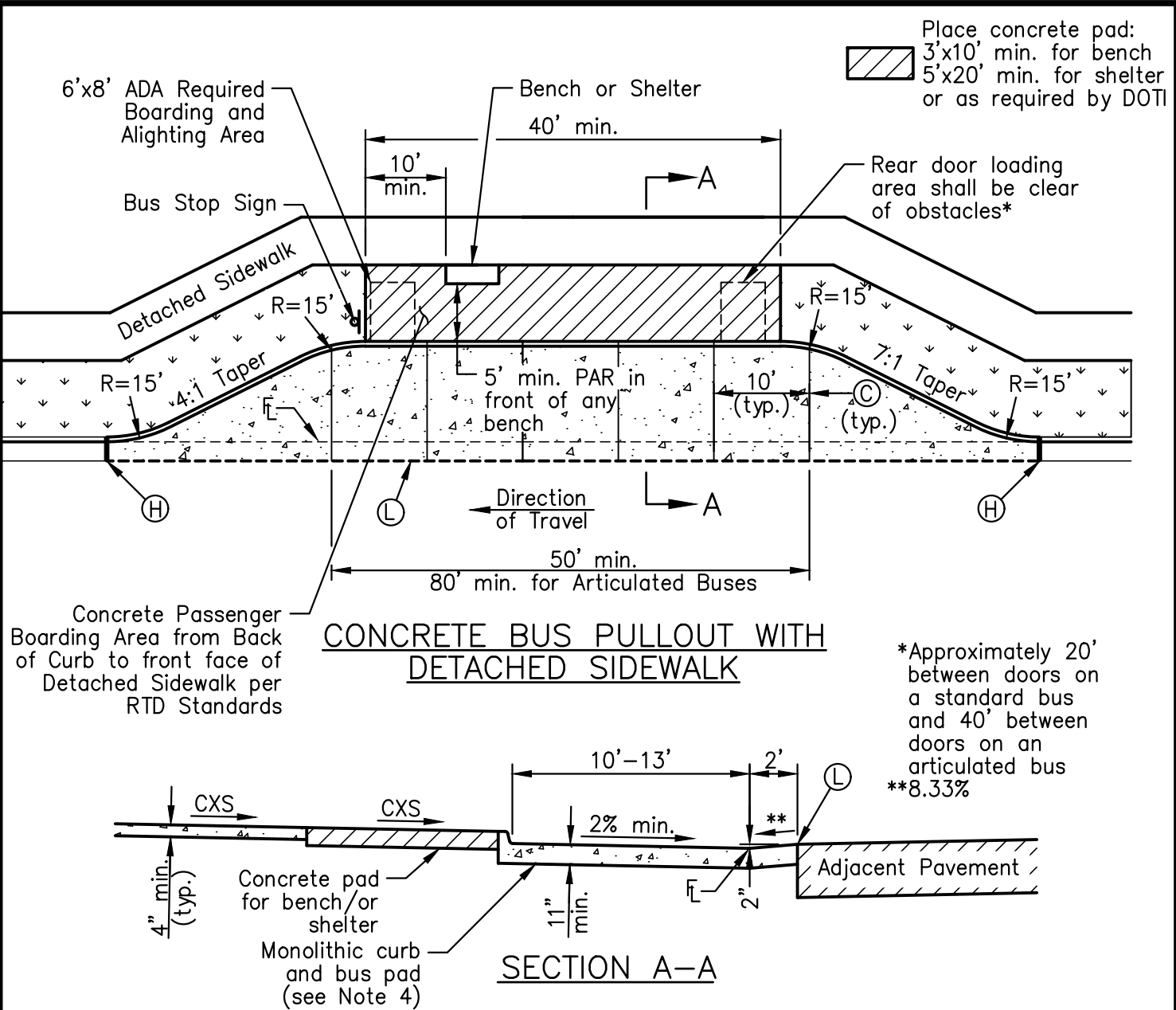
- Notes:
1. This Standard Drawing shall only be used for the replacement of existing Intersection Valley Gutters, or where existing street grades necessitate their use. Intersection Valley Gutters should not be used in areas of new street construction. Intersection Valley Gutters may not cross arterial, collector, or streets with bike lanes without approval of DOTI.
 2. Intersection valley gutters may only be placed when approved in writing by DOTI.
 3. Valley gutter cross-pan requires fibermesh reinforcement at minimum 1.5 pounds per cubic yard.
 4. Valley gutters should not be used at signalized intersections or without a stop sign unless approved by DOTI. If applied in these situations, a reduced cross pan slope may be considered.

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Intersection Valley Gutter	Std. Dwg. 8.0



Notes:

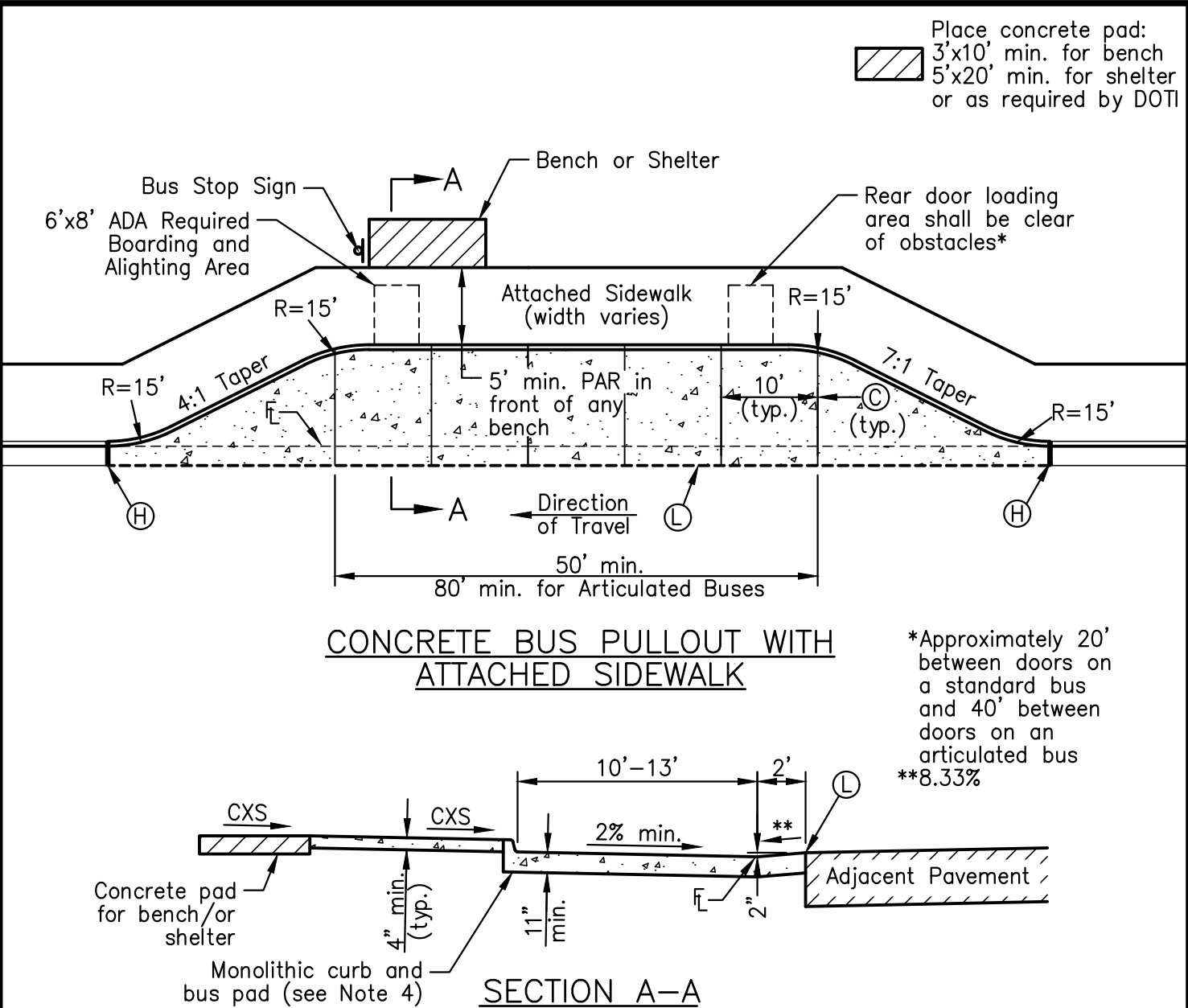
1. Chase and cover plate run perpendicularly from Property Line to flowline unless approved by DOTI and shall only be constructed with approval from DOTI.
2. Chase and curb & gutter to be placed monolithically. Sidewalk to be placed separately.
3. Contact Office of the City Forester at (720)913-0651 prior to performing any work within the TPZ of existing R.O.W. trees.
4. Sidewalk Chase Drain and Tread Plate is not approved for use as an inlet to green infrastructure.
5. Chase drains shall be designed to handle the desired flow. In addition, a larger span may dictate a thicker plate be used.
6. Tread plates that fall within the PAR shall meet ADA horizontal opening and change in level requirements.



Notes:

1. Length of bus pullout pad may vary to fit site conditions or as otherwise required by RTD standards.
2. All projects that have a bus stop adjacent must provide a concrete bus pad or bus pullout, and a passenger boarding area or shelter pad. The passenger boarding area or passenger shelter pad shall be located in the R.O.W. or appropriate easement. The shelter pad, passenger boarding area, and bench shall be installed and maintained by the land owner directly adjacent, unless otherwise approved by DOTI.
3. Concrete bus pullout requires fibermesh reinforcement at minimum 1.5 pounds per cubic yard.
4. Monolithic curb and bus pad shall be transitioned a minimum of 4' to match standard 6" curb and gutter.
5. Contact Office of City Forester at (720)913-0651 prior to performing any work within the TPZ of existing R.O.W. trees.
6. All boarding areas must connect to an accessible curb ramp (typically at nearest corner). In alterations, boarding and alighting areas and boarding platforms shall be connected to existing pedestrian circulation paths by a PAR.
7. No raised obstructions shall be located within 10' of anticipated door locations.

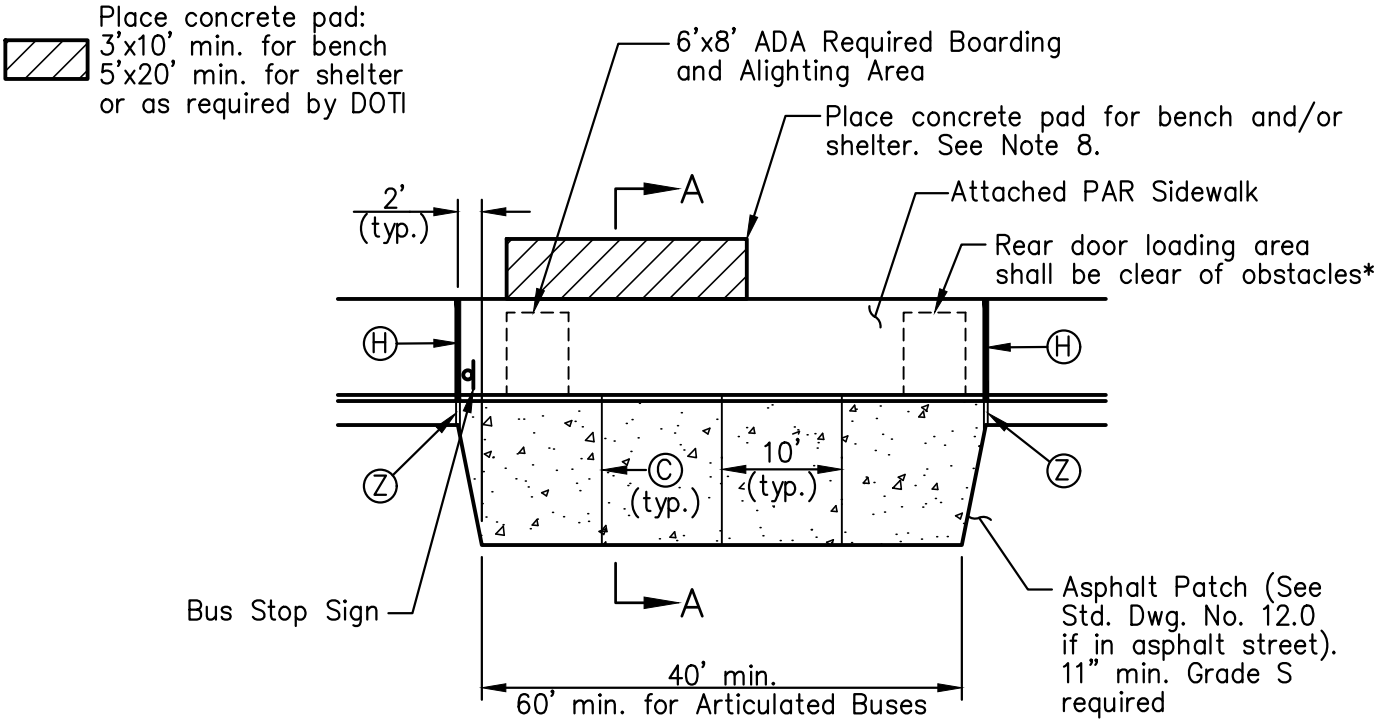
	City And County Of Denver Transportation Standard Drawings Typical Concrete Bus Pullout with Detached Sidewalk	Date: 10/24 Std. Dwg. 9.0a
--	--	--



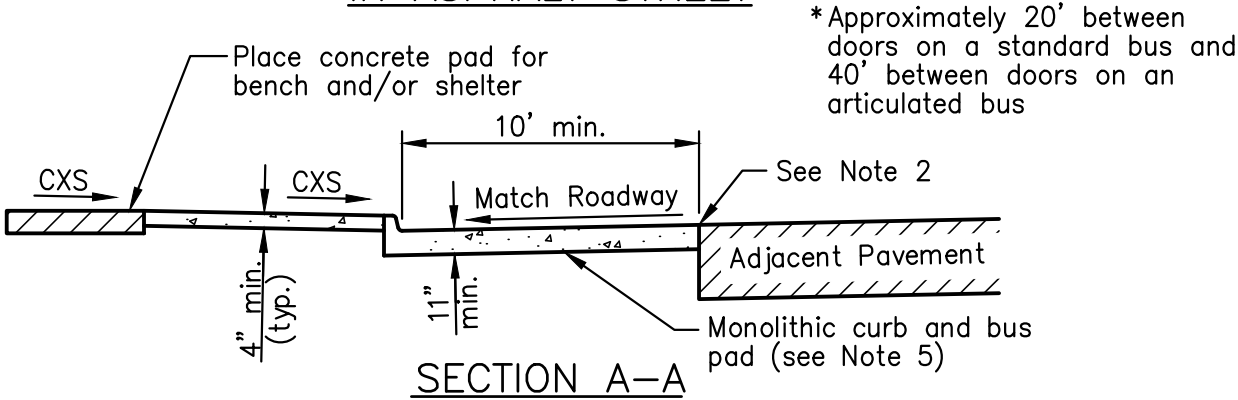
Notes:

1. Length of bus pullout pad may vary to fit site conditions or as otherwise required by RTD standards.
2. All projects that have a bus stop adjacent must provide a concrete bus pad or bus pullout, and a passenger boarding area or shelter pad. The passenger boarding area or passenger shelter pad shall be located in the R.O.W. or appropriate easement. The shelter pad, passenger boarding area, and bench shall be installed and maintained by the land owner directly adjacent, unless otherwise approved by DOTI.
3. Concrete bus pullout requires fibermesh reinforcement at minimum 1.5 pounds per cubic yard.
4. Monolithic curb and bus pad shall be transitioned a minimum of 4' to match standard 6" curb and gutter.
5. Contact Office of City Forester at (720)913-0651 prior to performing any work within the TPZ of existing R.O.W. trees.
6. All boarding areas must connect to an accessible curb ramp (typically at nearest corner). In alterations, boarding and alighting areas and boarding platforms shall be connected to existing pedestrian circulation paths by a PAR.
7. No raised obstructions shall be located within 10' of anticipated door locations.

	City And County Of Denver Transportation Standard Drawings Typical Concrete Bus Pullout with Attached Sidewalk	Date: 10/24 Std. Dwg. 9.0b
--	---	-------------------------------------



**CONCRETE BUS PAD
IN ASPHALT STREET**



- Notes:
1. Length of bus pullout pad may vary to fit site conditions or as otherwise required by RTD Standards.
 2. Edge of concrete bus pad shall be designed outside of travel lane wheel path.
 3. All projects that have a bus stop adjacent must provide a concrete bus pad or bus pullout, and a passenger boarding area or shelter pad. The passenger boarding area or passenger shelter pad shall be located in the R.O.W. or appropriate easement. The shelter pad, passenger boarding area, and bench shall be installed and maintained by the land owner directly adjacent, unless otherwise approved by DOTI.
 4. Concrete bus pads require fibermesh reinforcement at minimum 1.5 pounds per cubic yard.
 5. Monolithic curb and bus pad shall be transitioned a minimum of 4' to match standard 6" curb and gutter.
 6. No raised obstructions shall be placed within 10' of anticipated door locations.
 7. Where seating is provided within transit shelters, the clear space (30" x 48") shall be located either at one end of the seat or so as to not overlap the area 18 inches from the front edge of the seat.
 8. Contact Office of City Forester at (720)913-0651 prior to performing any work within the TPZ of existing R.O.W. trees.

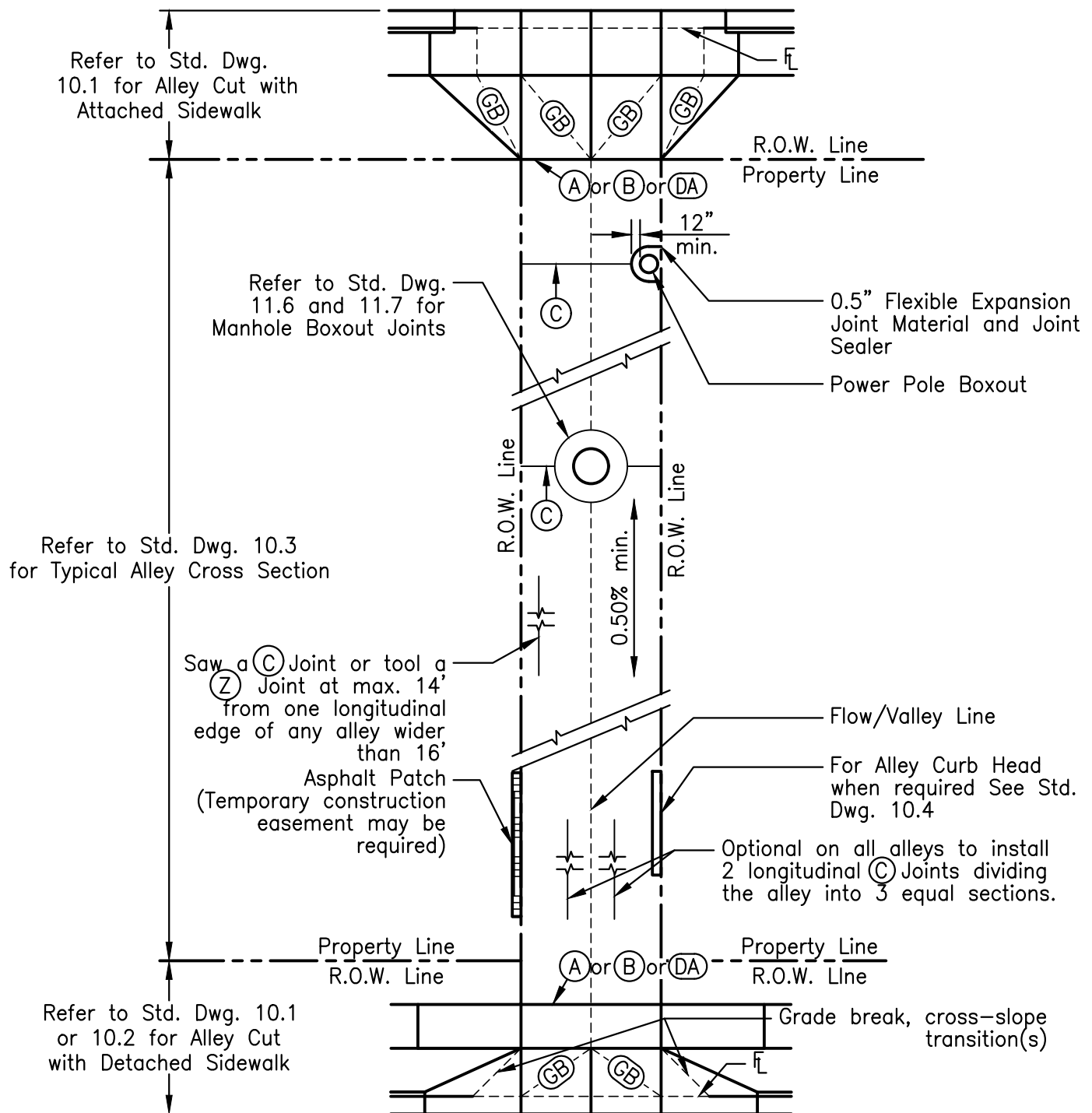


City And County Of Denver
Transportation Standard Drawings

Typical Concrete Bus Pad in
Asphalt Roadway

Date:
10/24

Std. Dwg.
9.1



Notes:

- 0.75" Sealed Expansion Joint shall be placed at those locations where alley changes direction ("T" or "L" shaped alleys) and where adjacent to abutting buildings.
- Traverse Contraction Joints (C) shall be spaced at a maximum of 12' intervals and placed at manholes, poles, and ends of curb head or as directed by DOTI. (see Std. Dwg. 11.8).
- Jointing plan for alley construction shall be approved by DOTI.
- Dead-end alleys are not allowed.
- Requests for any new alleys must be approved by DOTI.
- No Parking signage is not typically merited in alleyways. See Std. Dwg. 14.0 for pedestrian sight triangle requirement.

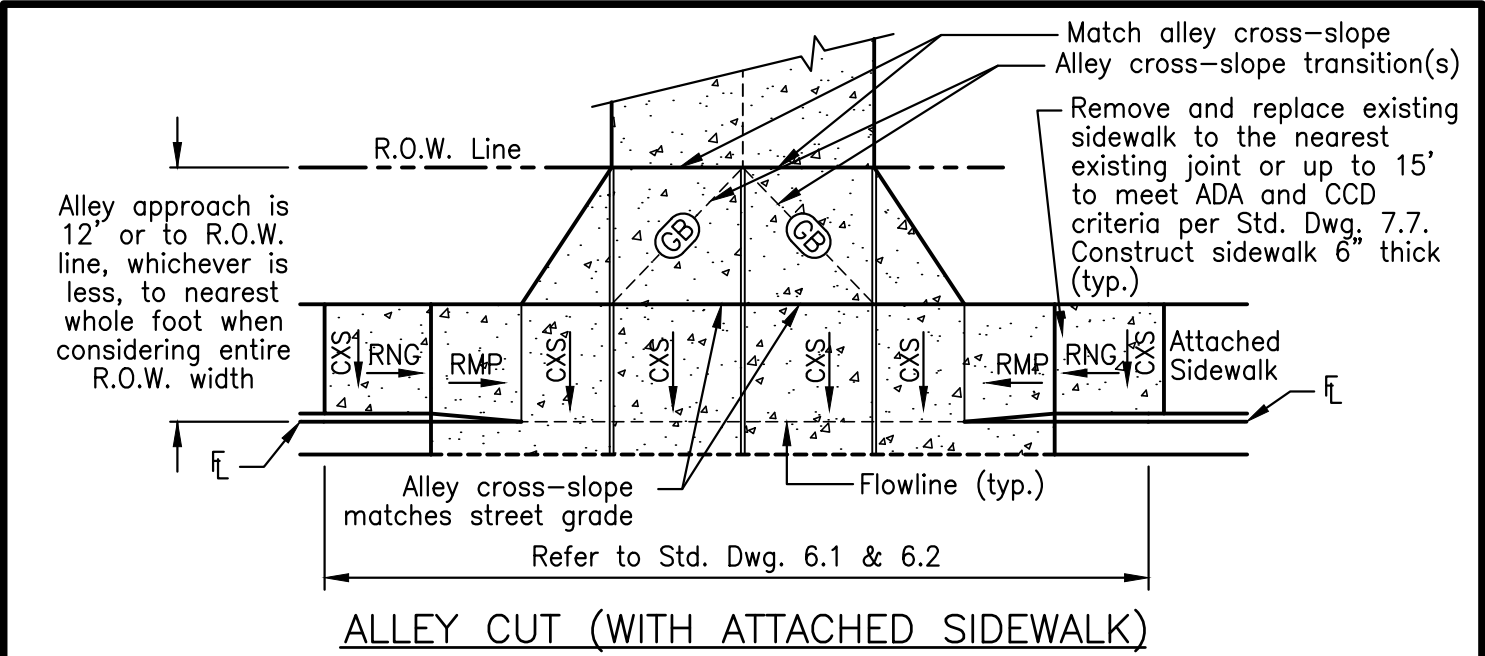


City And County Of Denver
Transportation Standard Drawings

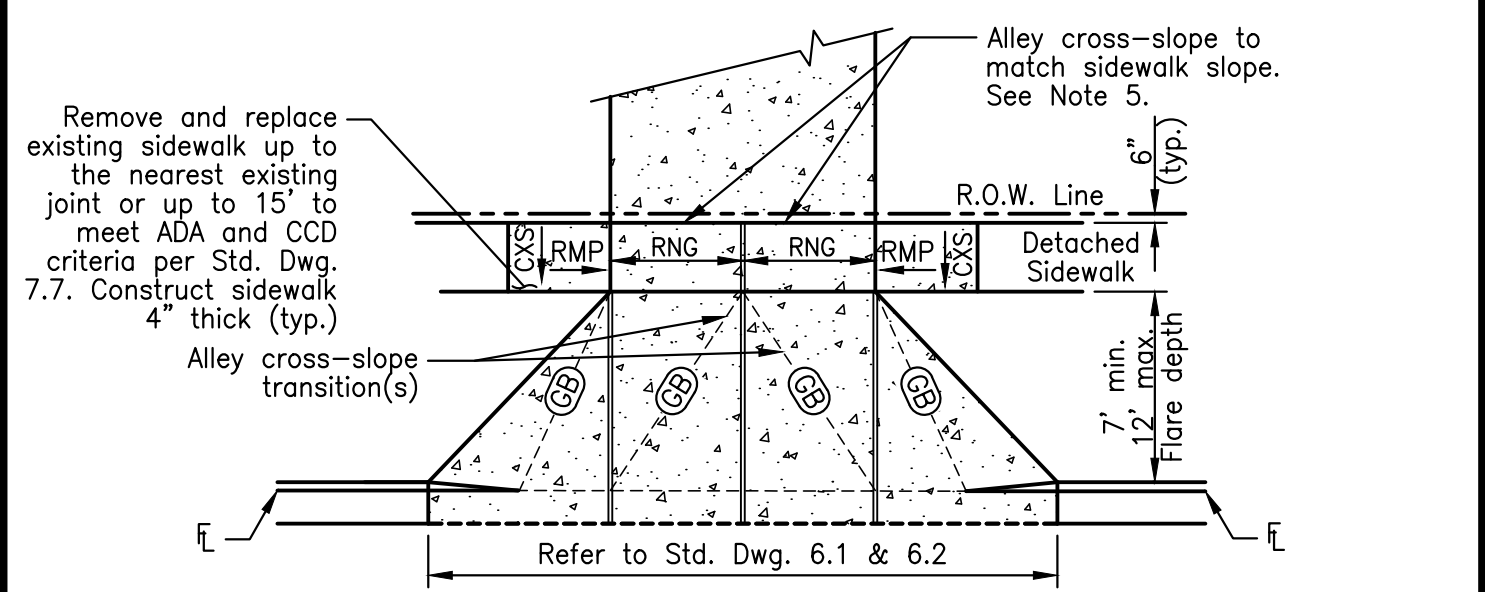
Typical Alley Layout

Date:
10/24

Std. Dwg.
10.0



ALLEY CUT (WITH ATTACHED SIDEWALK)

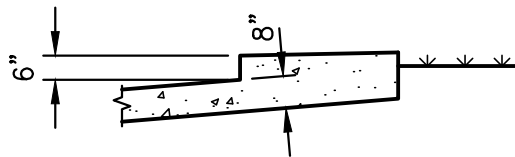
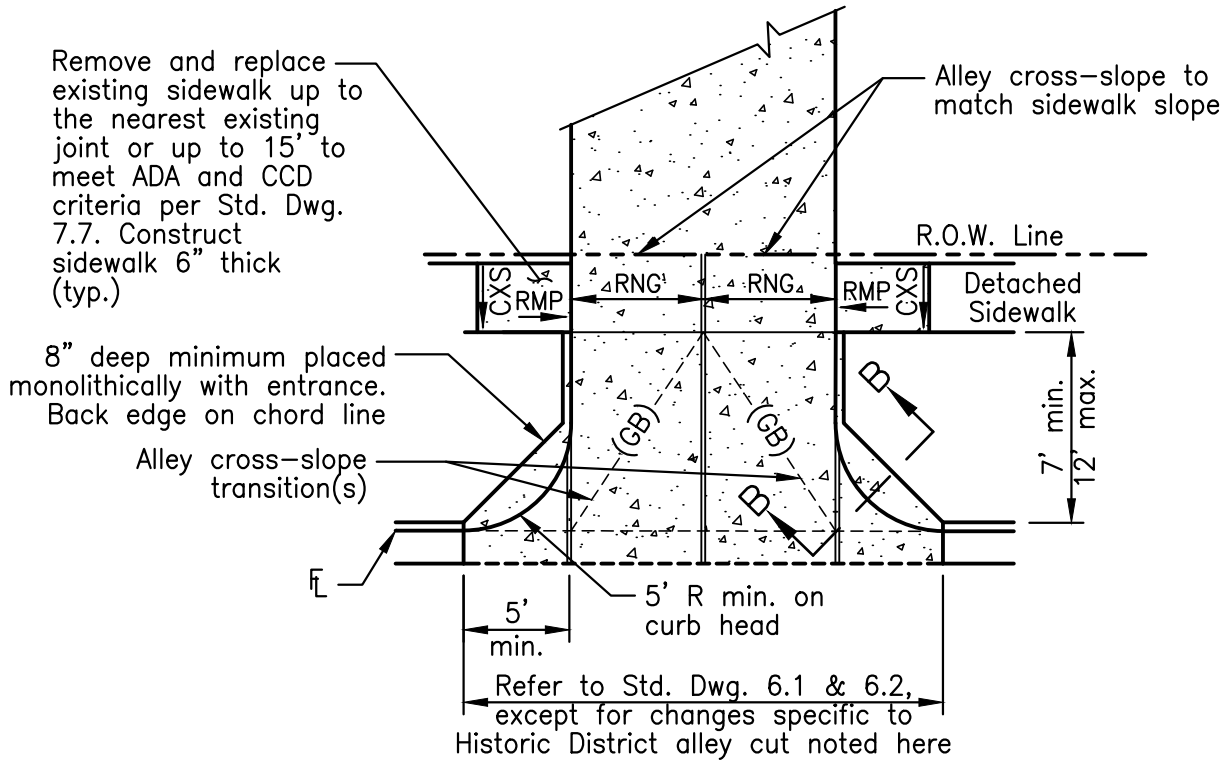


ALLEY CUT (WITH DETACHED SIDEWALK)

- Notes:
- 1. Refer to Std. Dwg. 6.1 and 6.2 for additional slope, joint, transition and cross section details.
 - 2. Alley, sidewalks that cross the alley, and alley approach concrete thickness shall be 8" minimum.
 - 3. Approach widening may be modified for areas with adjacent curb cuts only with approval of DOTI.
 - 4. Site conditions may require replacement of the adjacent sidewalk outside alley limits in order to meet alley grades.

Pedestrian Access Route (PAR) Design Elements			
Abbv.	Description	Max Design Slope	Max Field Measurement Slope
FLR	Accessible Flare Slope	9.5%	10.0%
RMP	Accessible Curb Ramp Slope	7.8%	8.3%
CXS	Accessible Cross Slope	1.5%	2.1%
CWXS	Accessible Crosswalk Slope	1.5%*	2.1%*
RNG	Accessible Running Slope	4.5%	5.0%

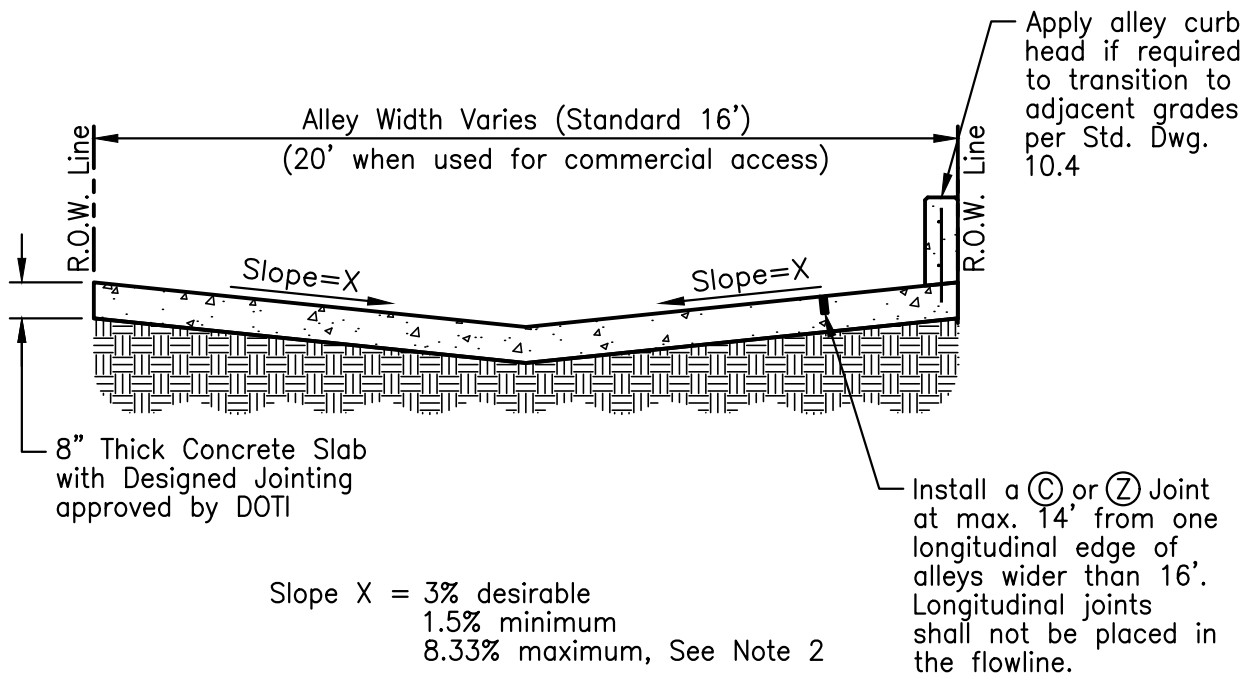
*See Std. Dwg. 7.0b Note 12 regarding Accessible Crosswalk Slope



- Notes:
- 1. Any sidewalk sections remaining or replaced must be larger than 4'x4'.
 - 2. Alley, sidewalks that cross the alley, and alley approach concrete paving thickness shall be 8" minimum.
 - 3. Approach widening may be modified for areas with adjacent curb cuts only with approval of DOTI.
 - 4. Site conditions may require replacement of the adjacent sidewalk outside alley limits in order to meet alley grades.
 - 5. This detail is for use if there is an existing obstruction within the typical flare area that cannot be relocated as approved by DOTI.

		Pedestrian Access Route (PAR) Design Elements	
Abbv.	Description	Max Design Slope	Max Field Measurement Slope
FLR	Accessible Flare Slope	9.5%	10.0%
RMP	Accessible Curb Ramp Slope	7.8%	8.3%
CXS	Accessible Cross Slope	1.5%	2.1%
CWXS	Accessible Crosswalk Slope	1.5%*	2.1%*
RNG	Accessible Running Slope	4.5%	5.0%

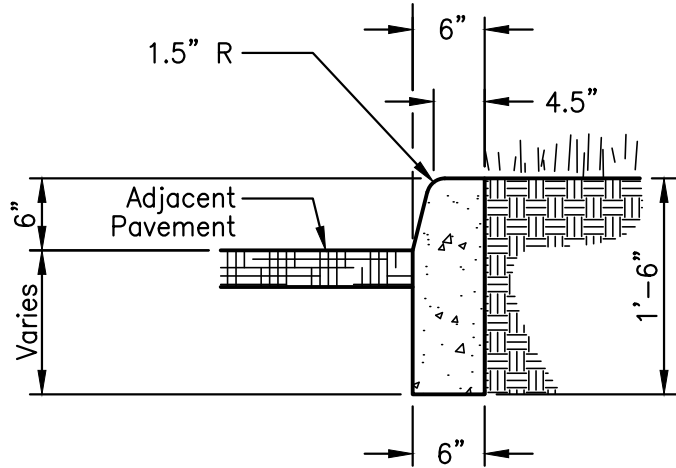
*See Std. Dwg. 7.0b Note 12 regarding Accessible Crosswalk Slope



TYPICAL ALLEY CROSS-SECTION

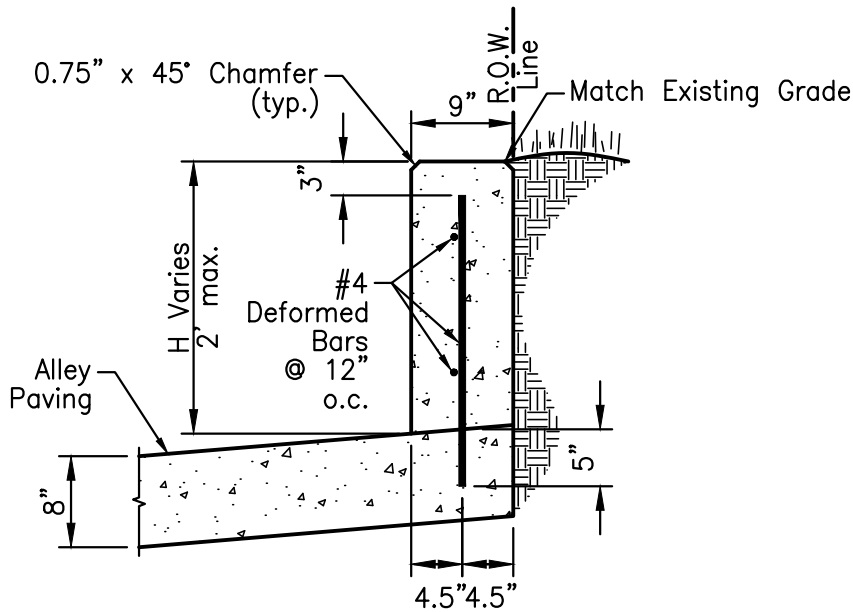
- Notes:
- 1. Minimum longitudinal grade for a typical alley is 0.5%.
 - 2. At the alley center flowline, the change in grade shall not exceed 13.3%

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Typical Alley Cross-Section	Std. Dwg. 10.3



6" CURB HEAD

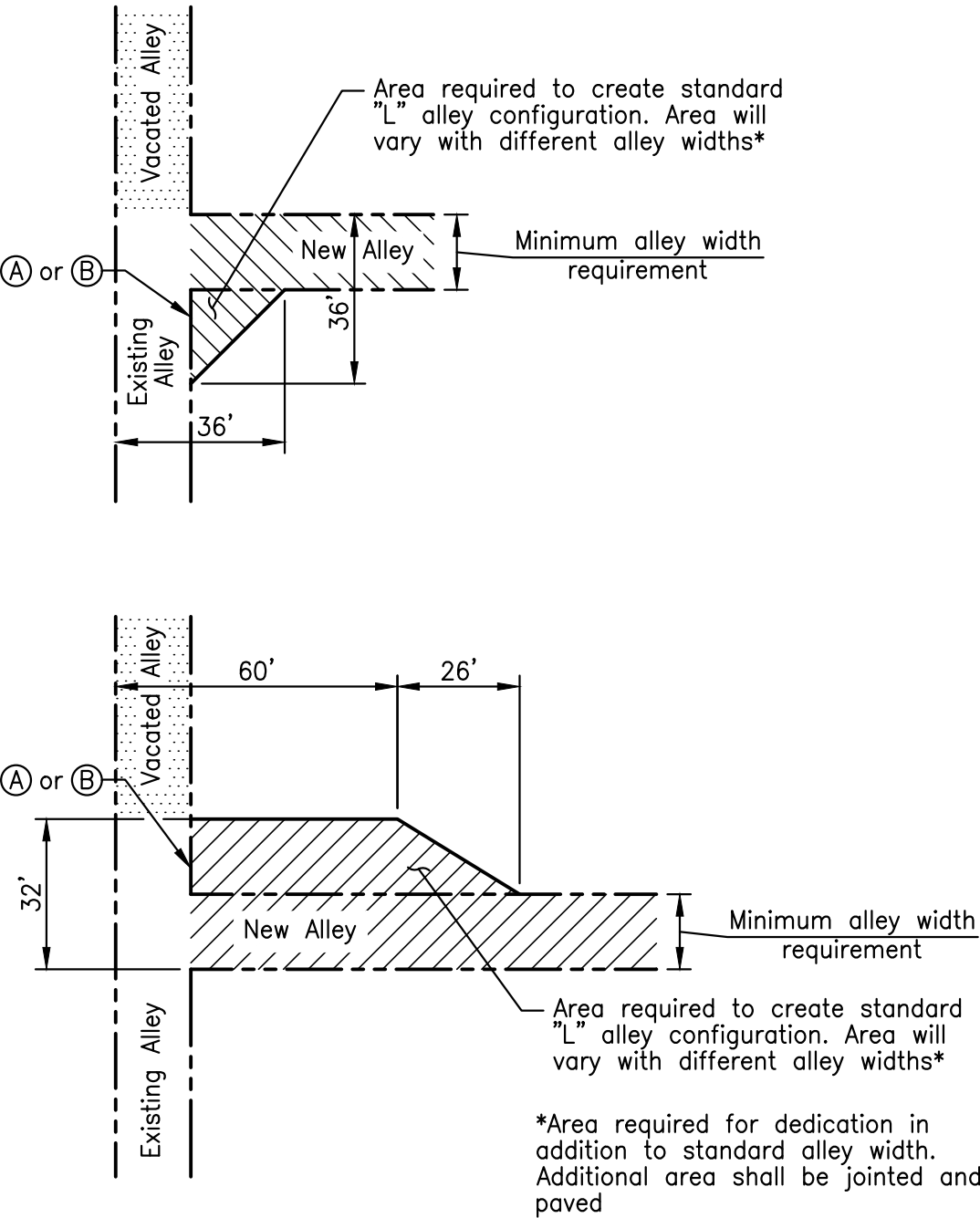
- Notes:
- 1. This section is only for use with DOTI approval.
 - 2. When adjacent to existing asphalt paving, a minimum 2' wide asphalt patch is required per Std. Dwg. 12.0 when installing new curb head.
 - 3. Larger curb head sections may be required by DOTI.



ALLEY CURB HEAD

- Notes:
- 1. Alley curb Head is to be poured separately from alley at locations as determined by DOTI.
 - 2. Place No. 4 Deformed Bars at 12" on-center as directed by DOTI.
 - 3. If the curb height is 6" or less no rebar is required.
 - 4. For H greater than 2' a retaining wall design is required.
 - 5. Jointing should be consistent with alley pavement joints.
 - 6. This detail is for use by City projects when adjacent property grades cannot be reasonably transitioned to meet proposed alley grades. Any curb head taller than 2', shall be designed and planned outside the R.O.W.

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Curb Heads	Std. Dwg. 10.4



"L" TYPE ALLEY CONFIGURATIONS

 DENVER TRANSPORTATION & INFRASTRUCTURE	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	"L" Type Alley Configurations	Std. Dwg. 10.5

General Notes

- G-1) All concrete pavement and associated curb & gutter shall be placed on CDOT Class 6 ABC or equivalent recycled concrete ABC, unless the existing subgrade materials are similar. Base shall be moisture conditioned, compacted, proof-rolled, final shaped, and re-compacted to allow the required thicknesses to be placed.
- G-2) Any concrete road that carries heavy traffic loads (1,000,000 ESALS or greater) shall apply (DC) Joints
- G-3) When within 100' of Railroad Track Centerline, concrete pavement for the entire roadway width shall be required for a minimum of 100' on either side of the Railroad Track centerline or 2' beyond Separator Medians, if any. Panels adjacent to tracks, bearing on ballast and/or aggregate base with separator geotextile, shall be reinforced with minimum 3 each full strength rebar (use tie bar size and spacing in table Std. Dwg. 11.0b) longitudinally, with one transverse bar at each end and middle, 2" clear, placed at depth T/2. Also use dowels per (DC) joints to adjacent panels.
- G-4) All Concrete placed in the public ROW shall be reinforced with fibers meeting ASTM C1116 and dosed at a minimum of 1.5 lbs. per cubic yard, or as otherwise specified.
- G-5) Concrete shall attain a minimum field compressive strength of 2,500 psi before being opened to traffic as determined by maturity meters.

Design Layout

- DL-1) Transverse Joints are across traffic direction, Longitudinal Joints are with traffic direction. Traverse Contraction Joint spacing should not exceed 15 feet nor 150% of the Longitudinal Joint spacing.
- DL-2) Construction Joint locations are dependent on manhole locations, traffic control constraints, and contractor's placement sequence. All features must be shown on joint plans.
- DL-3) For new construction, all transverse joints ((A), (B), (C), (DA), and (DC)) shall be continuous across the pavement and curb and gutter. Construct transverse joints perpendicular to the centerline of pavement and extend the sawed joint through the curb and gutter. Gutter sections do not require dowels. Curb and gutter section should be designed to match the intended panel joint layout. New panels shall have no more than 2 sides with an (E) joint.
- DL-4) If the contractor proposes variations from this standard or the project has unusual or irregular conditions not discovered herein, a pavement joint layout shall be prepared for approval by DOTI.
- DL-5) Longitudinal joints shall coincide with edge of lane markings, if possible, and have a maximum spacing of 13' or 14' to back of curb if monolithic without extra joint. All longitudinal joints shall be tied. Lane widths over 13' require special design.
- DL-6) The contractor shall use a circular blockout at new manholes and other roadway appurtenances of similar or larger sizes. Small appurtenances, such as valves, monument boxes, and existing manholes do not require a blockout, but do require a bond breaker and flexible expansion joint material. Unless otherwise directed, the blockout may be eliminated at new manholes if Removable CLSM is used for backfill around the manhole collar from manhole base to paving subgrade where soil compaction equipment cannot reach.
- DL-7) Full panel replacement may be required at new curb cuts to concrete streets if the (Z) joints of the driveway surfaces do not line up with the (C) or (DC) joints of street pavement. Selected (L) joint tie bars may be eliminated between drive pan and pavement. Use (L) joints on longitudinal tie-ins along street direction.
- DL-8) Minimum width of concrete lane widening is 18" using (L) joint. Special jointing and reinforcing plans are required when transverse to longitudinal spacing is >1.33 or <0.75. Full panel length rebar is required when these panel size ratios are exceeded. Use minimum #4 epoxy coated rebar spaced per table on Std. Dwg. 11.0b for tie bars, 2" clear at ends, placed at depth T/2.

Continued on 11.0b...



City And County Of Denver
Transportation Standard Drawings

General Notes for Concrete
Pavement and Joints

Date:
10/24

Std. Dwg.
11.0a

...continued from 11.0a

Reinforcing Size Table

Pavement Thickness T (in)	Tie Bar Size Grade 40 (deformed)	Dowel Bar Dia (in) Grade 60 (smooth)
$T < 8$	No. 4	1.00
$8 \leq T \leq 10$	No. 5	1.25
$10 < T \leq 15$	No. 6	1.50

Minimum Tie Bar and Dowel Bar Spacing

Joint Type	Tie Bars deformed, 30" long		Dowel Bars smooth, 18" long	
	on center	from edge	on center	from edge
DA	N/A	N/A	12"	12"
DC	N/A	N/A	12"	12"
E	30"	15"	N/A	N/A
L	30"	15"	N/A	N/A
X	12"	12"	N/A	N/A

Reinforcing

- R-1) Tie bars shall conform to AASHTO M284 grade 40, epoxy coated, and deformed. Dowel bars shall conform to AASHTO M255 grade 60 for core material, and AASHTO M254 for epoxy coating the smooth bars. Dowel bars shall be wiped with form oil, but not dripping, just prior to concrete placement to prevent concrete bonding.
- R-2) Tie and dowel bars shall be normally started half the required spacing from a panel edge. Tie bars shall be kept at least 6" clear of any dowel bar. Tie bars may be slightly bent to follow this rule. Dowel bars shall be spaced the full width across intersections and merged traffic lanes. Straight traffic lane sections shall have a minimum of 4 dowels in each wheel path, and 5 in the wheel path adjacent to any shoulder or gutter.
- R-3) Dowel placement tolerances to be inspected and adjusted before concrete placement (refer to CDOT M-412-1 for graphical definition of terms and CDOT Specification 412.13(b)2) shall be:
- Vertical Translation $< 1.0"$, Horizontal Translation $< 2.0"$ when spacing bars from edge panels.
 - Longitudinal (End) Shift (equal bar length in each panel) $< 2.1"$
 - Horizontal and Vertical Rotational Alignment (ends not parallel with pavement surface) $< 0.5"$

Expansion Joint (A), (B), (DA) Maximum Spacing by Adjacent Concrete Temperature at Placement

Placing New Concrete Against Existing Concrete at This Temperature (°F)	The 2 Each at $\frac{3}{4}"$ Expansion Joints at PCR is OK for this PCR to PCR Spacing of	Add a Mid-block Joint with $\frac{1}{2}"$ Material for Maximum PCR to PCR Spacing of	OR	Add a Mid-block Joint with $\frac{3}{4}"$ Material for Maximum PCR to PCR Spacing of
40 to 59	425 feet	575 feet		650 feet
60 to 79	650 feet	875 feet		975 feet
80 and above	1300 feet	1750 feet		1950 feet

Continued on 11.0c...



City And County Of Denver
Transportation Standard Drawings

General Notes for Concrete
Pavement and Joints

Date:
10/24

Std. Dwg.
11.0b

...continued from 11.0b

Expansion Joint

- EXP-1) When PCR to PCR distance is more than table (Dwg. 11.0b), then additional joints at mid-block are required for longer block intervals between intersecting streets. Expansion joints also required when concrete intersects concrete.
- EXP-2) Any sidewalk, concrete street or median including attached curb & gutter shall have expansion joints meeting this criteria, depending on ADJACENT existing concrete temperature at placement time.
- EXP-3) Any sidewalk, concrete street or median including attached curb & gutter TOUCHING AT ANY ANGLE to any concrete street, sidewalk, median, curb & gutter or valley gutter shall meet the same spacing criteria.
- EXP-4) When new work meets existing, and the existing is deficient in expansion joint width; the connection shall be an expansion joint with total width meeting this criteria.
- EXP-5) Medians and planter boxes shall honor the expansion and contraction movement of this joint.
- EXP-6) Use (CA) transition joint at concrete asphalt surface.

Saw and Seal

- SS-1) All sawn joints shall be to a minimum depth of T/4 when no reinforcing steel is used, and not less than T/3 when tie bars or dowel bars are used. T is pavement thickness; T/4 is 25% of thickness, T/3 is 33% of thickness.
- SS-2) If a sawed appearance joint is desired inside regular panels, it shall be no more than 0.5" deep. This appearance joint is designated (SA).
- SS-3) Take reasonable measures during saw cutting and joint cleaning to prevent particulate matter from becoming airborne and to prevent the discharge of particulate matter beyond the property from which the emissions originate. The measures must be effective in the control of fugitive particulate emissions and runoffs at all times on the project site, including periods of inactivity.
- SS-4) Immediately after sawing, joints shall be cleaned by pressurized water jet or other approved method. Joints shall also be cleaned and dried with sandblasting and compressed air just ahead (100' or less) of placing backer rod material and joint sealant. Joint cleaning methods shall be contained or vacuumed to prevent fugitive dust and runoff. DOTI may require other methods of joint cleaning if necessary.

Patching

- P-1) Notes for Panel Replacements or rework for Trench Patches when ideal situations do not apply:
 - a) Full panel replacement to normal joint lines is required.
 - b) For establishing transverse joints, maintain the existing joint gap on existing adjoining panels at the time of panel replacement. Remove any gap filling material in the new joint before new joints are sealed. Use expansion caps or deeper hole, the same as the gap width on the poured end of dowels to allow future movement of the entire length of joint across all lanes.
 - c) Consult DOTI Inspector Dept. for advice on special situations. Use of bond breakers, eliminating selected tie bars for offset joints or narrow panels, use of predicted crack mitigation techniques, added panel replacements, or special reinforcing for narrow or skinny panels may be advised or required.
 - d) The Contractor's warranty obligation shall not be waived if CCD conveys any advice or directive for non-standard situations.
- P-2) Any patches in concrete flatwork outside the roadway shall include recompaction per Concrete Note G-1 including a 6" layer of aggregate base course prior to placing concrete.

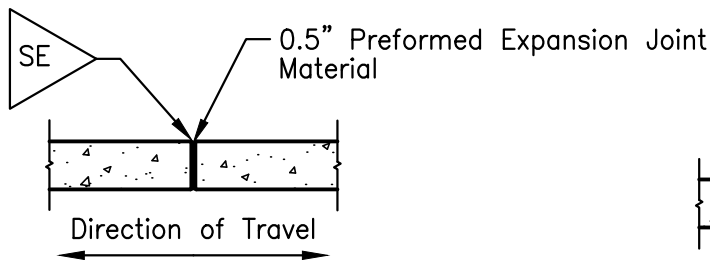


City And County Of Denver
Transportation Standard Drawings

General Notes for Concrete
Pavement and Joints

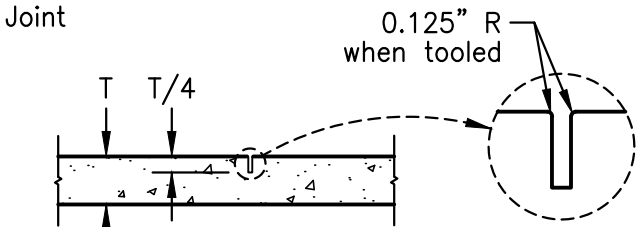
Date:
10/24

Std. Dwg.
11.0c



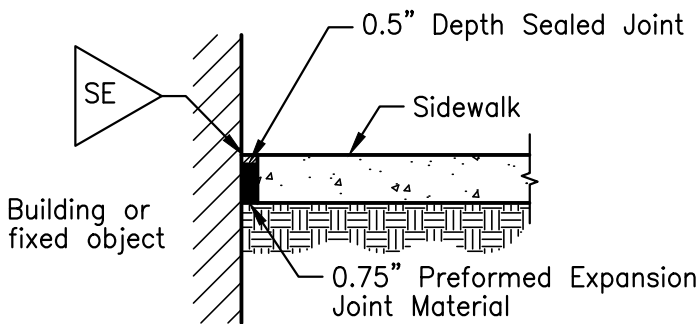
H NON-ROADWAY EXPANSION JOINT

All concrete panels with an adjacent **H** joint shall be generally square and shall not exceed 1.5L:1W shape. Triangular panels should not have any angles less than 30 degrees.



Z NON-ROADWAY CONCRETE TOOLED OR SAWED JOINT

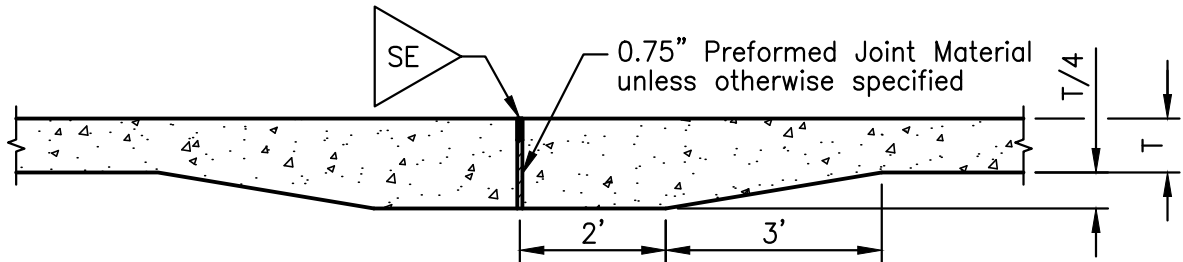
Note that **Z** Joints in multi-use paths must be sawed. Sidewalk joints may be either tooled or sawed.



EXPANSION JOINT BETWEEN SIDEWALK AND BUILDINGS AND FIXED OBJECTS

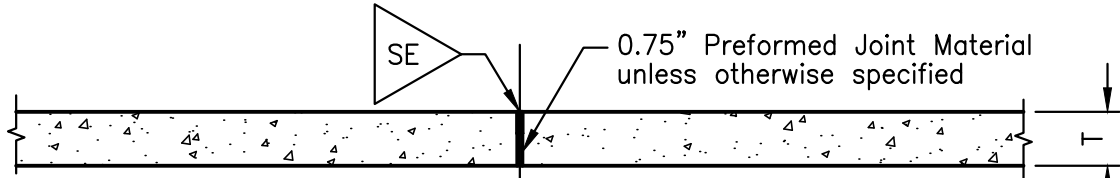
- Notes:
- Joint spacing for concrete curb & gutter and sidewalk:
 - 10' - Combination curb, gutter, and sidewalk
 - 10' - Curb & gutter, curb head, or mountable curb
 - 5' - Attached sidewalksDetached sidewalk joint spacing shall be equal to the width of the detached sidewalk.
 - For sidewalks, expansion joints shall be provided every 100' to 120' and shall extend the full depth of the concrete walk. May be lengthened for curve walks with approval of Public Works.
 - H** joints shall be installed between new sidewalk and existing concrete slabs, inlets, fire hydrants, poles, and other fixed objects.
 - Expansion joint material between curb and sidewalk is required when sidewalk abuts back of curb on concrete streets.
 - These details and notes do not apply to bike paths - See Parks & Recreation Standards.
 - Minimum widening of sidewalks shall be 18". Apply **L** joint between existing and proposed sidewalk concrete.

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Concrete Non-Roadway Joints H & Z	Std. Dwg. 11.1



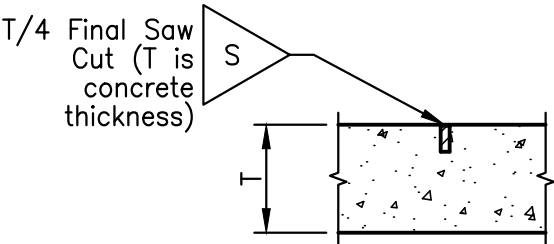
(A) CONCRETE ROADWAY EXPANSION JOINT (WITH THICKENED EDGE)

For pavements requiring smooth dowel bars in transverse joints
(Any (A) Joint may be replaced with a (DA) Joint; Apply (CA) whenever adjacent pavement is asphalt)



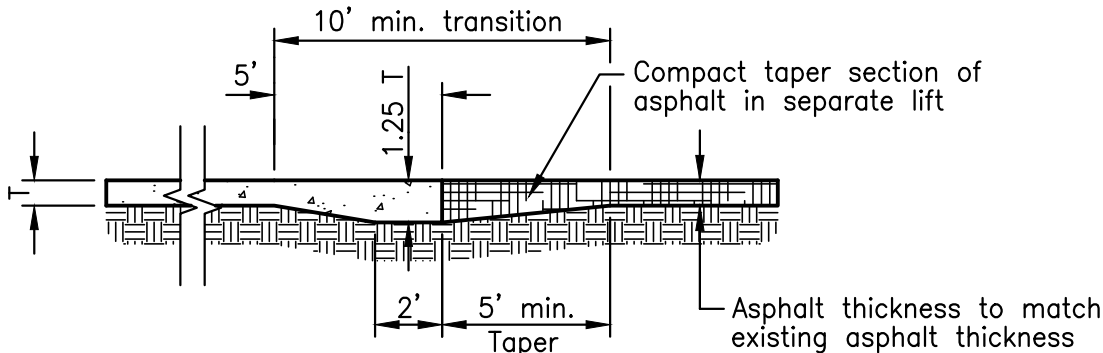
(B) CONCRETE ROADWAY EXPANSION JOINT (WITHOUT THICKENED EDGE)

For lower traffic situations or when new concrete is abutting existing concrete

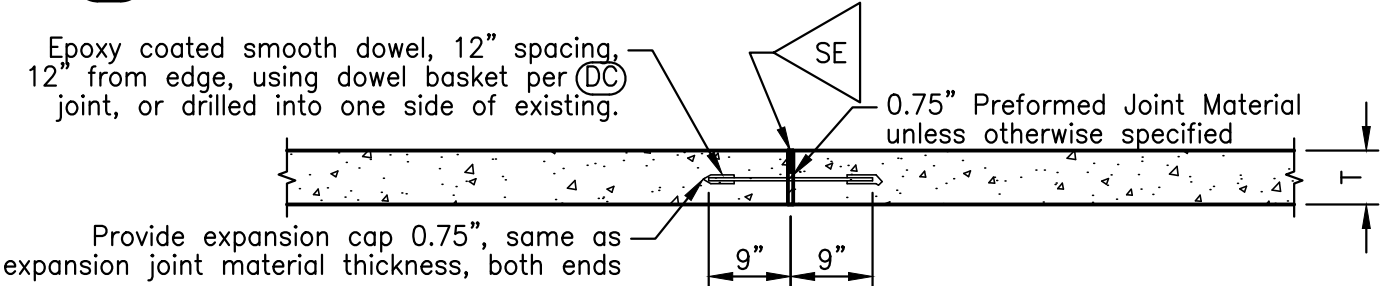


(C) CONCRETE ROADWAY SAWED TRANSVERSE CONTRACTION JOINT

For use in applications where ESALS are less than 1,000,000



(CA) CONCRETE ROADWAY TO ASPHALT PAVEMENT TRANSITION



(DA) CONCRETE ROADWAY DOWELED EXPANSION JOINT

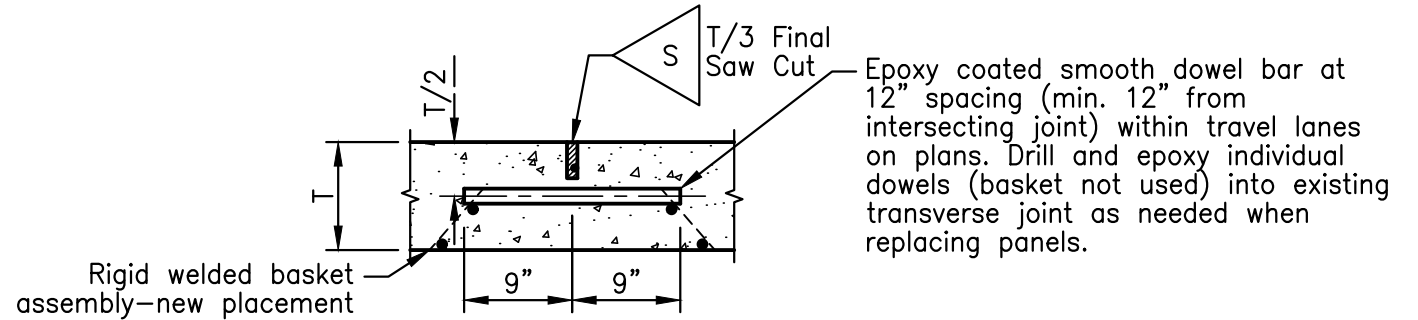


City And County Of Denver
Transportation Standard Drawings

Concrete Roadway Joints and
Transitions A-DA

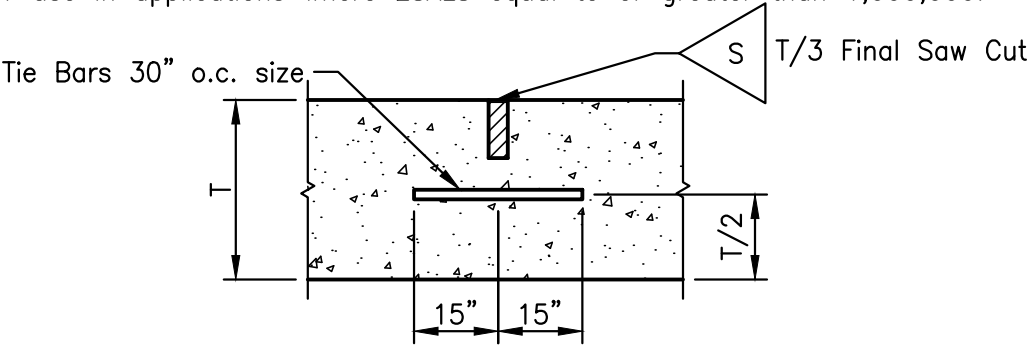
Date:
10/24

Std. Dwg.
11.2



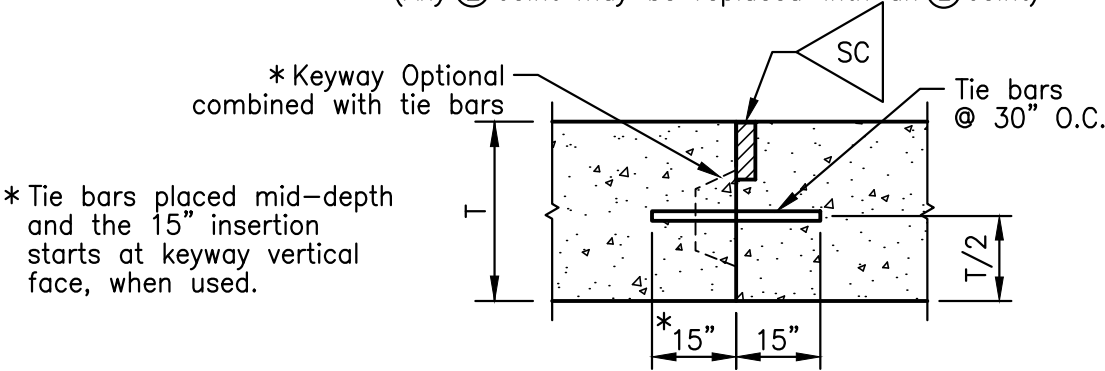
(DC) CONCRETE ROADWAY DOWELED TRANSVERSE CONTRACTION JOINT

For use in applications where ESALS equal to or greater than 1,000,000.



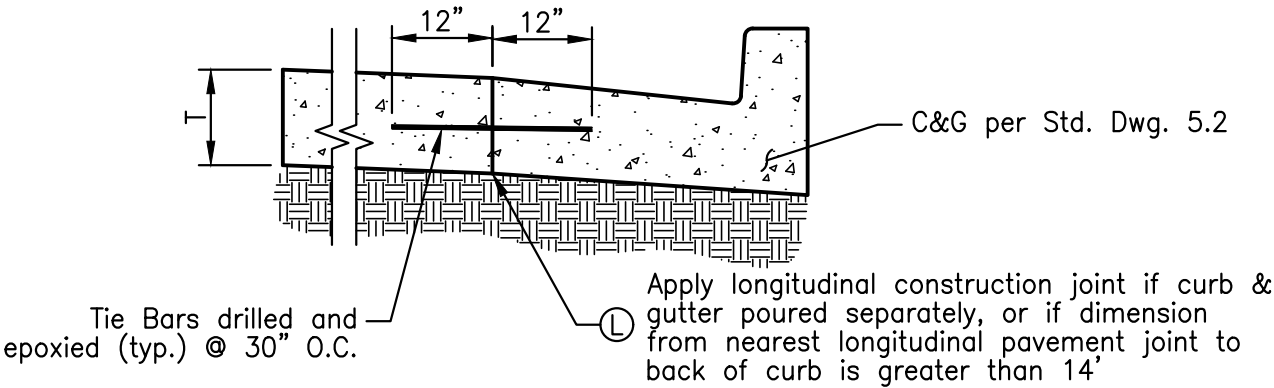
(E) CONCRETE ROADWAY LONGITUDINAL CONTRACTION JOINT

(Any (E) Joint may be replaced with an (L) Joint)



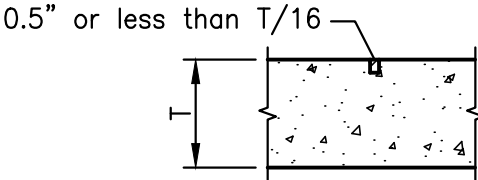
(L) CONCRETE ROADWAY LONGITUDINAL CONSTRUCTION JOINT

Equivalent to CDOT's L joint; Not for use when adjacent pavement is asphalt

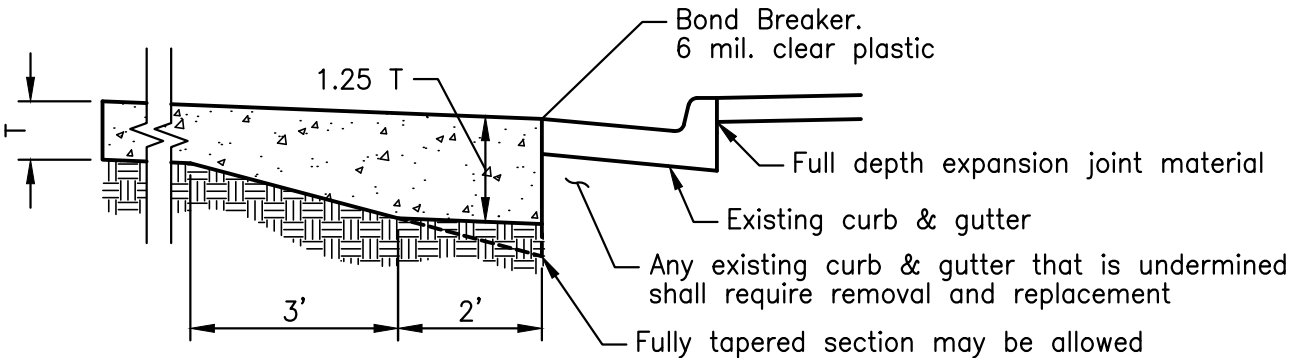


(L) (at C&G) CONCRETE ROADWAY TO CURB AND GUTTER JOINT

 DENVER TRANSPORTATION & INFRASTRUCTURE	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Concrete Roadway Joints and Transitions DC-L	Std. Dwg. 11.3

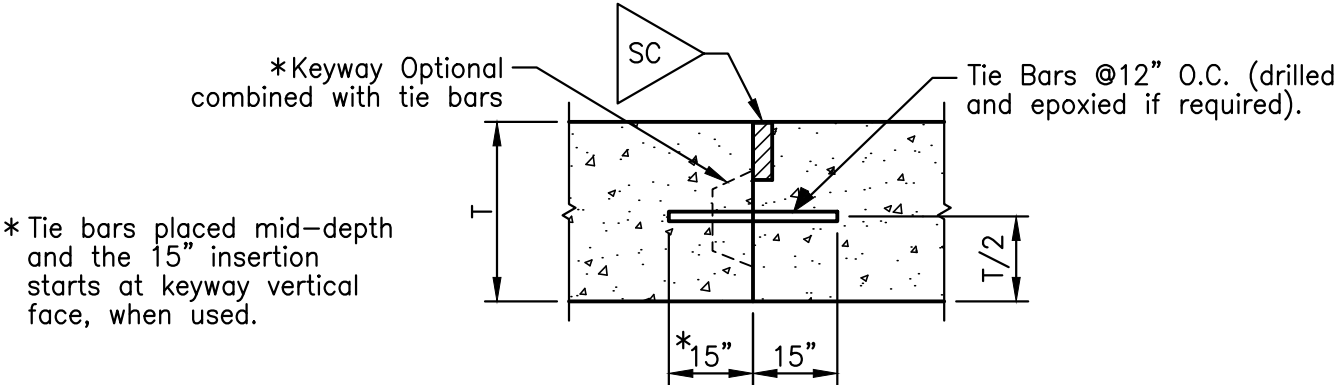


(SA) CONCRETE ROADWAY SAWED APPEARANCE JOINT

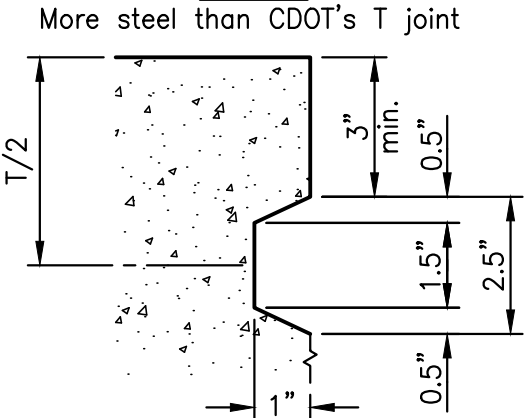


(TE) CONCRETE ROADWAY TO EXISTING CURB AND GUTTER TRANSITION

No tie-bars required for short sections. Extra precautions are needed to obtain suitable compaction due to hand work



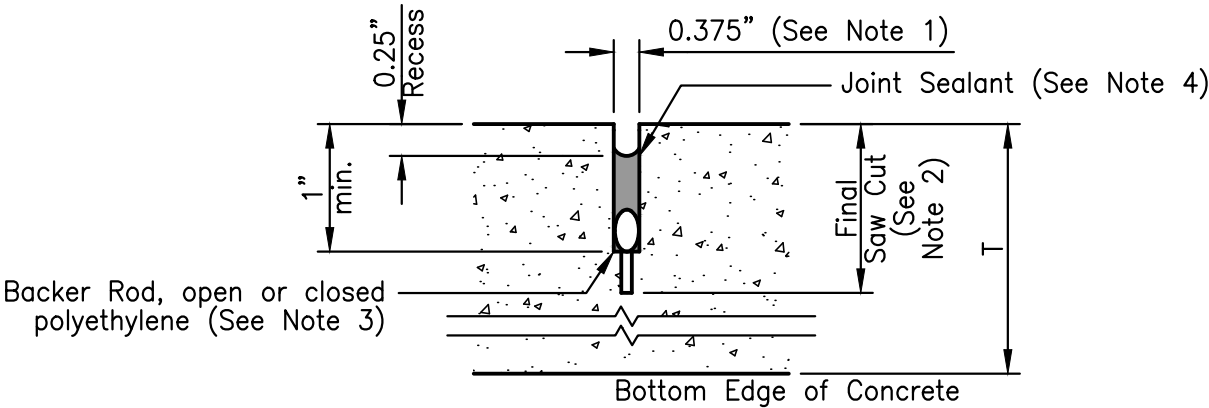
(X) CONCRETE ROADWAY MID PANEL TRANSVERSE CONSTRUCTION JOINT



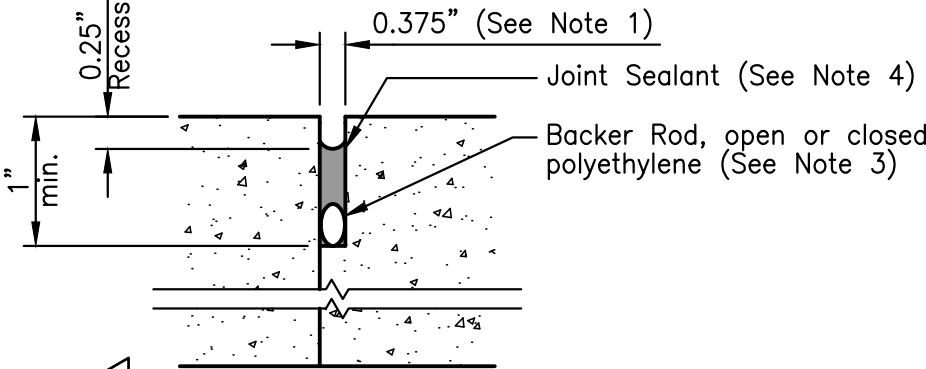
OPTIONAL ADDED KEYWAY DETAIL TO (X) OR (L)

Only when T ≥ 9". Form only female keyway

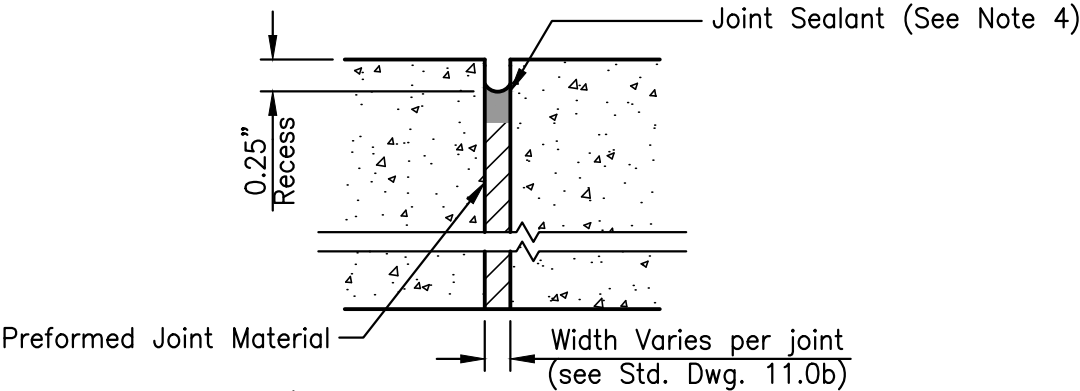
	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Concrete Roadway Joints and Transitions SA-X	Std. Dwg. 11.4



S SEAL AT SAWED JOINT



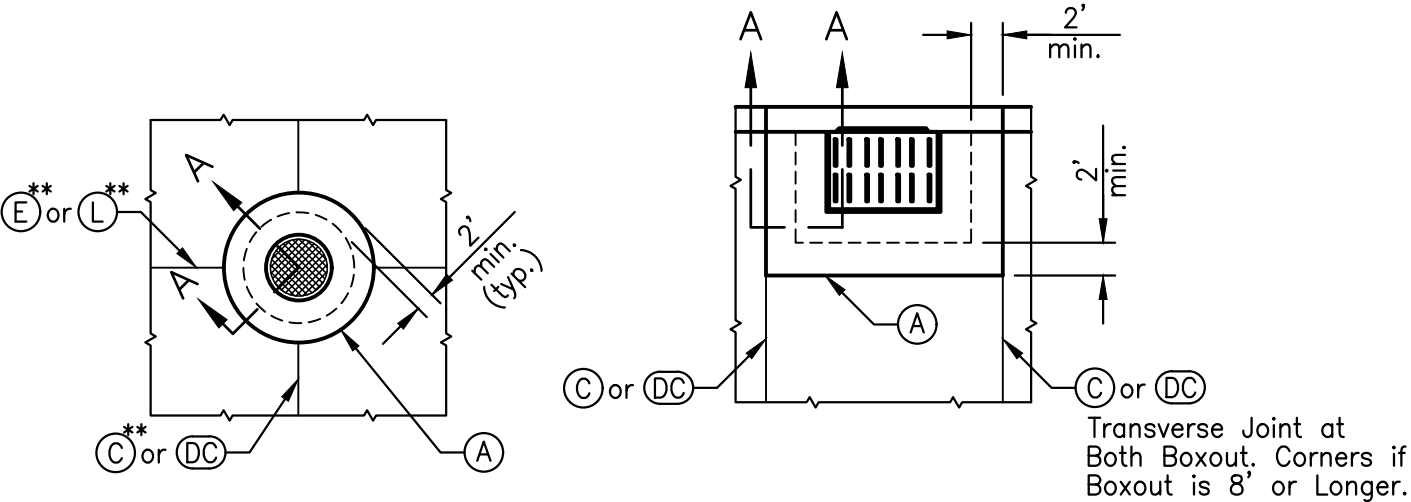
SC SEAL AT CONSTRUCTION JOINT



SE SEAL AT EXPANSION JOINT

- Notes:
- 1. Saw and seal width may be 0.1875" (3/16") maximum for new paving areas. Width may be 0.375" (3/8") maximum when matching existing appearance.
 - 2. The final saw cut depth when no steel is present is T/4. The final saw cut depth when steel is present (tie or dowel bars) is T/3. T is the concrete thickness.
 - 3. Uninstalled backer rod diameter shall be twice the saw and seal width.
 - 4. Joint sealant thickness should be equal to saw width. Joint sealant shall be approved silicone sealant, rated for streets or highways.

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Concrete Joint Sealants	Std. Dwg. 11.5

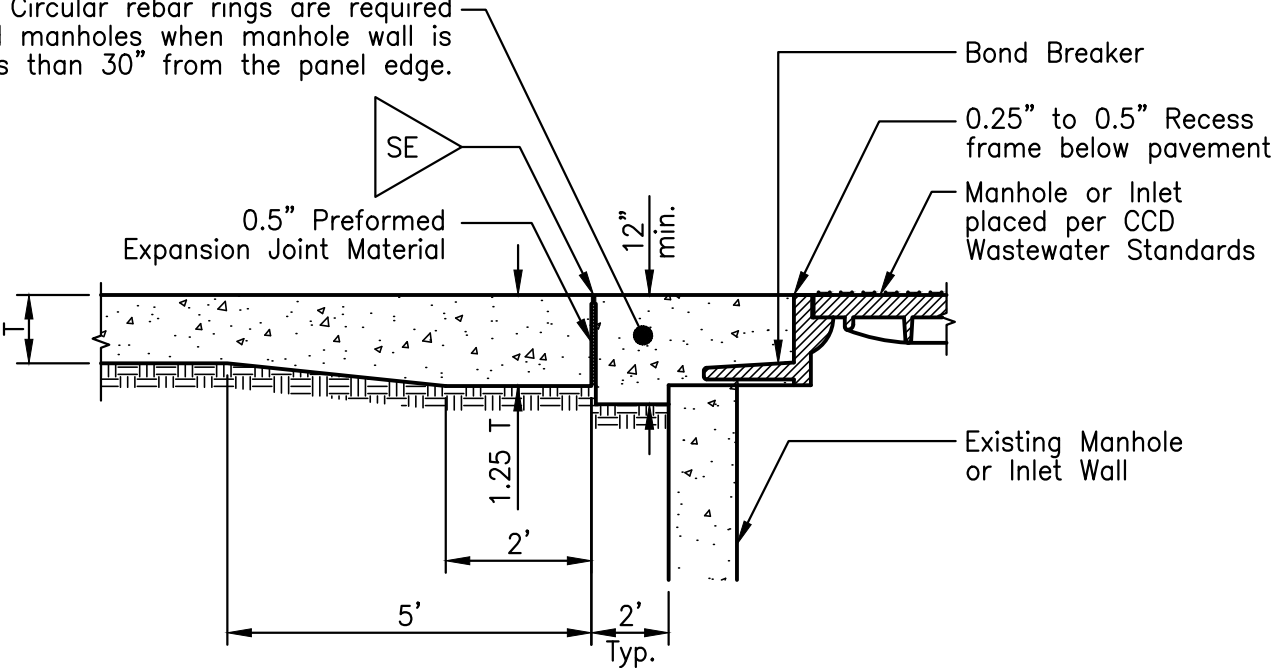


CIRCULAR BLOCKOUT AT
NEW MANHOLE*

BOXOUT AT INLET

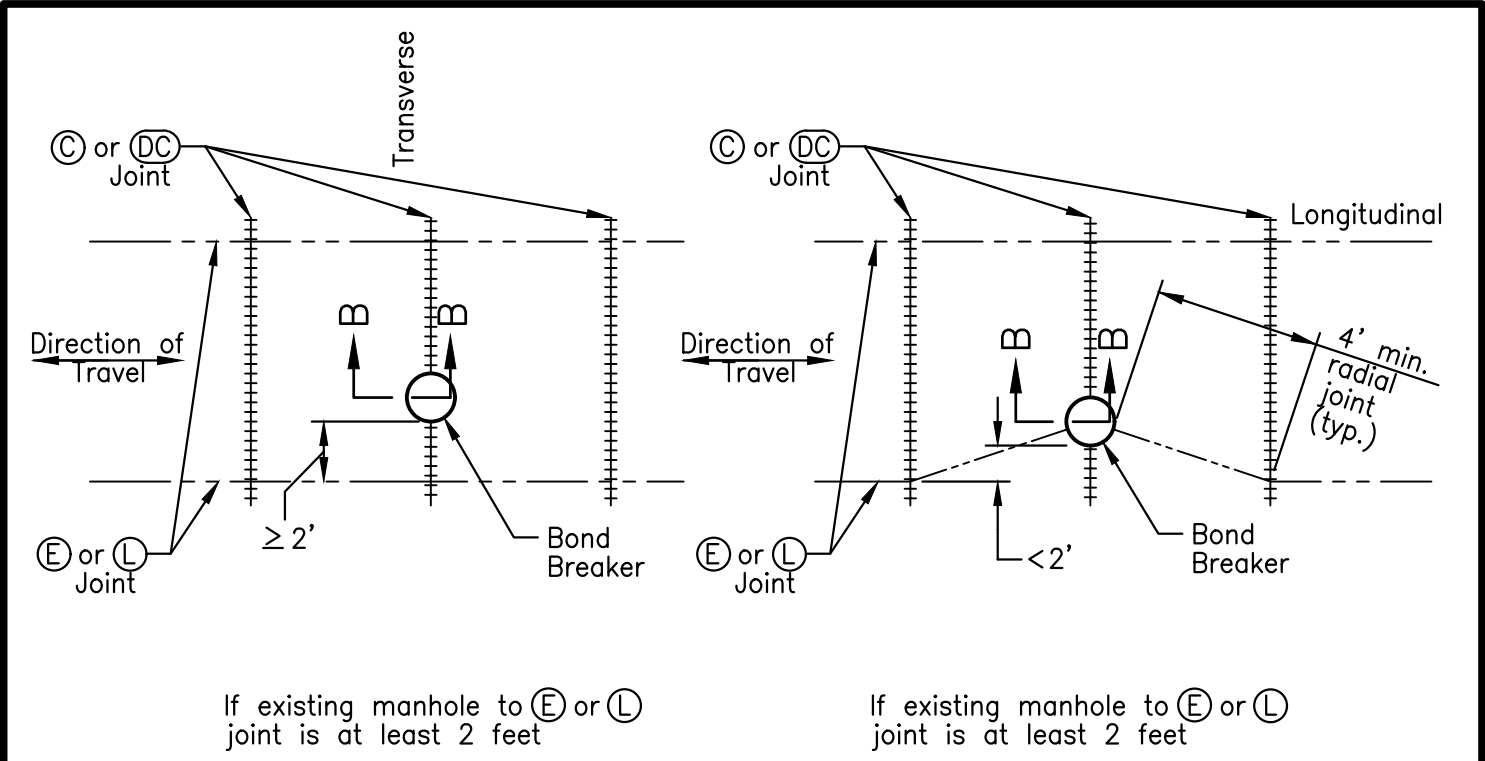
- * Unless otherwise directed, the circular blockout may be eliminated if Removable CLSM is used for the entire backfill around the manhole collar.
- ** Joints must line up with other Joints and not dead-end or tee at panel sides. Transverse joint spacing shall be adjusted to align at the diameter, or pass at least 4' from the blockout. Use skewed longitudinal joints when the joints are within 2' of the blockout.

Circular rebar rings are required around manholes when manhole wall is less than 30" from the panel edge.



SECTION A-A BLOCKOUT/BOXOUT

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Concrete Roadway Jointing at New Manholes and All Inlets	Std. Dwg. 11.6



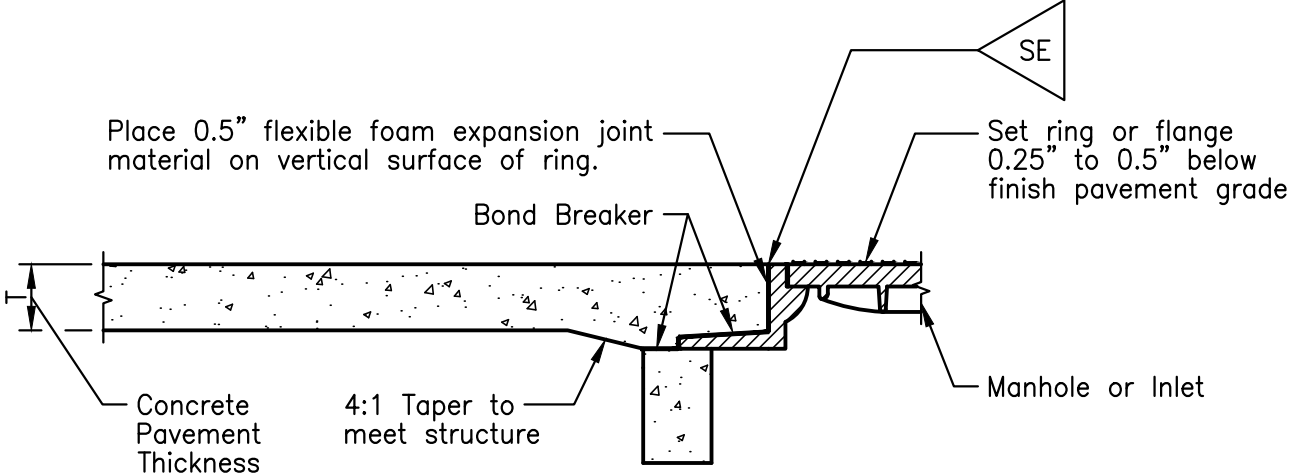
Note: Adjust (C) or (DC) to hit on diameter of manhole or pass at least 4' from the blackout.

EXISTING MANHOLE

When distance to nearest longitudinal joint is greater than or equal to 2'

EXISTING MANHOLE

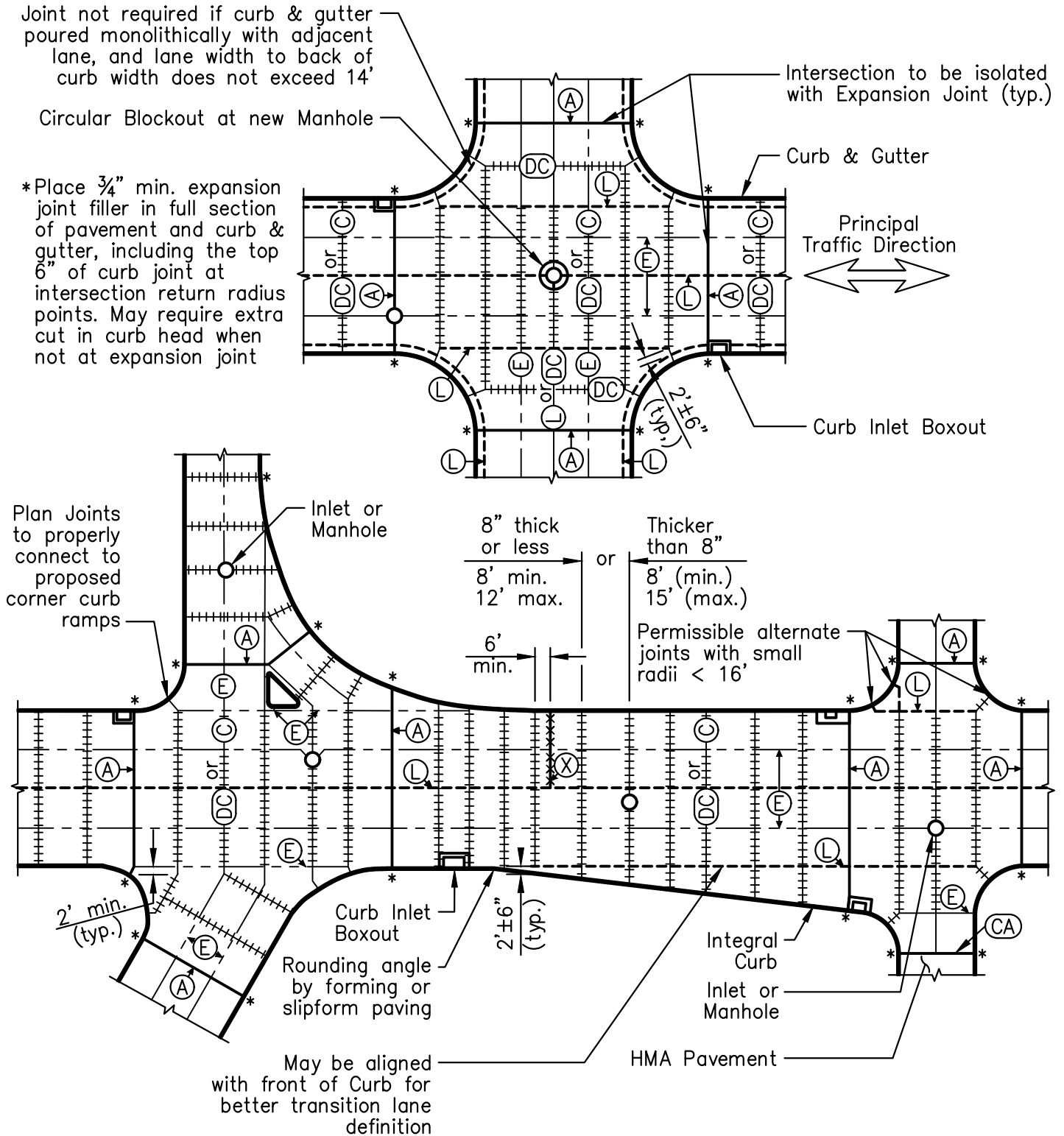
When distance to nearest longitudinal joint is less than 2'

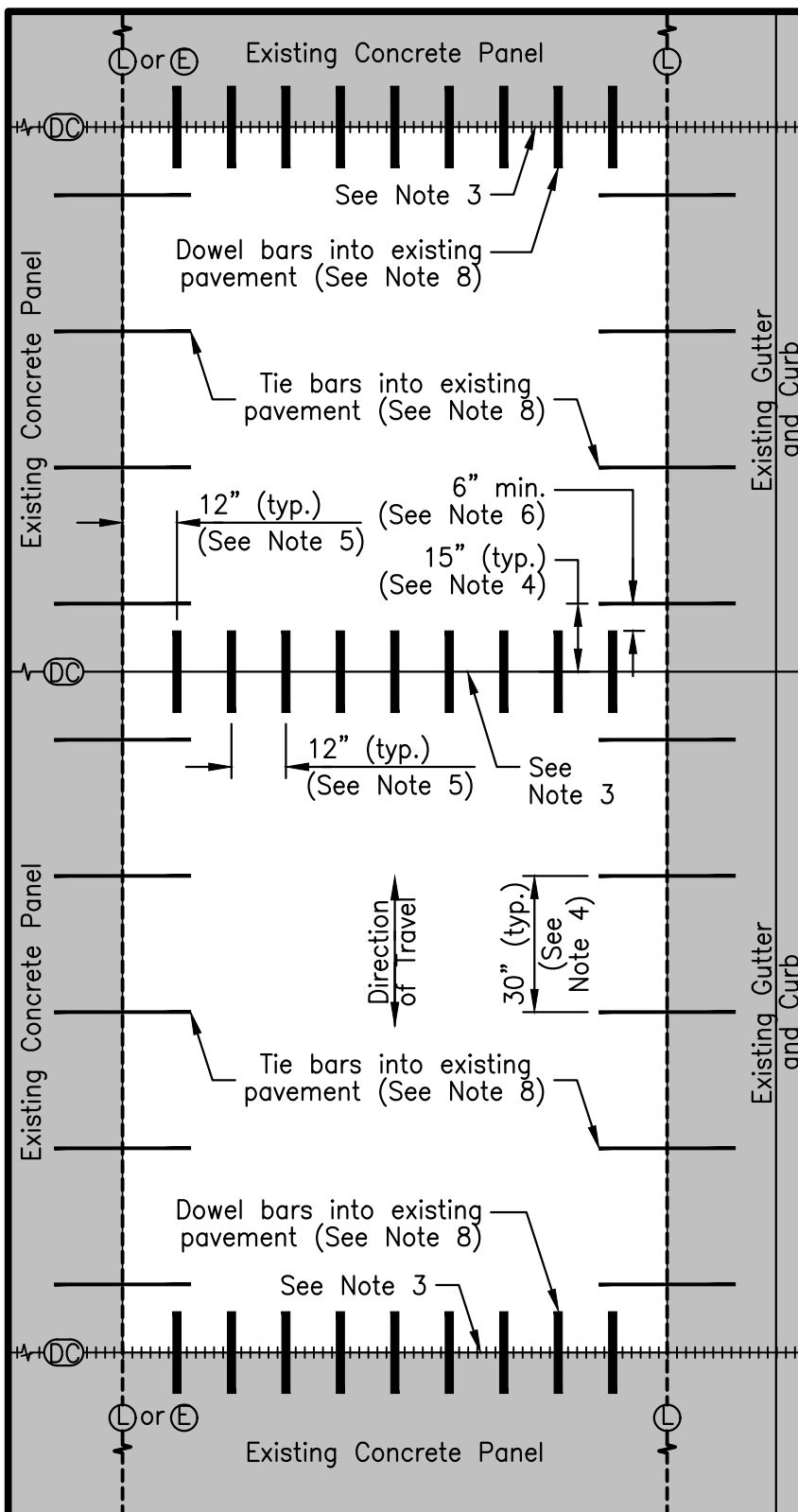


SECTION B-B

- Notes:
1. Bond Breaker shall be composed of plastic sheet, building paper, or other approved material to prevent bonding.
 2. The sides of all valve boxes, pipes, manhole ring or flange, and objects penetrating a placement shall be wrapped full depth with sealant backer material (Type 2 compressible foam sheets) meeting ASTM D 5249.

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Concrete Roadway Jointing at Existing Manholes	Std. Dwg. 11.7





Notes:

1. All saw cuts shall be straight and follow existing panel joint lines. Contractor should use full slot cut to relieve pressure and minimize damage to surrounding panels during panel removals. Contractor shall replace any panels damaged during their activities. Consult City Inspector for alternate instruction when existing joints do not line up.
2. Subgrade preparation shall be completed to meet compaction and proofroll specifications. The surface shall be smooth and flat including areas under tie and dowel bars. Add 4" Class 6 Aggregate Base Course meeting moisture and compaction specifications if subgrade is not sand or gravel.
3. Re-establish any existing expansion joints (A or DA) in transverse joints with full-depth expansion joint material. Match existing saw cut width of surrounding panels.
4. All steel is placed at mid-depth of thickness (T/2).
5. Use (DC) joints even if dowels did not previously exist in transverse joints.
6. Minimum clearance between tie bars and dowel bars is 6". Tie bars may be bent horizontally to achieve clearance.
7. Tie bar spacing may be adjusted to keep 15" clear from any non-ideal panel lines and gutter pan lines. Do not drill in tie bars if panel is <30" long or near any existing cracks.
8. Drill larger than dowel or tie bar and epoxy bars into existing concrete per supplier instructions. Eliminate tie bars in the shortest section of adjoining panels when joint lines do not align.
9. Exposed end of dowel bars shall be lightly oiled or greased. Tie bars used and exposed shall be clean, rust free, and not oiled or greased.
10. Repeat layout on the left for multiple lane replacement.

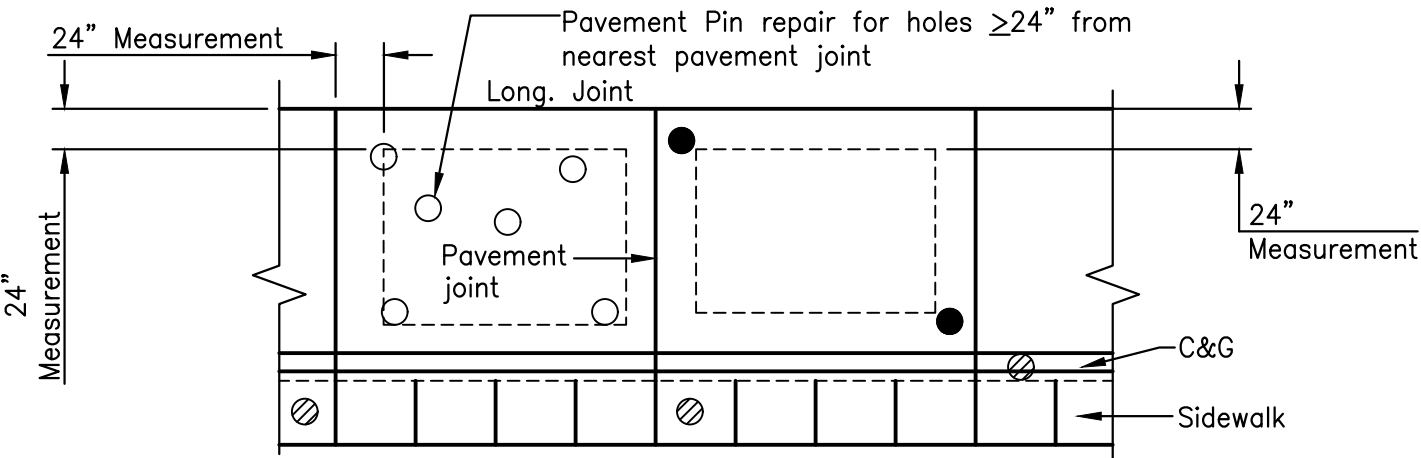


City And County Of Denver
Transportation Standard Drawings

Concrete Roadway Panel
Replacement

Date:
10/24

Std. Dwg.
11.9



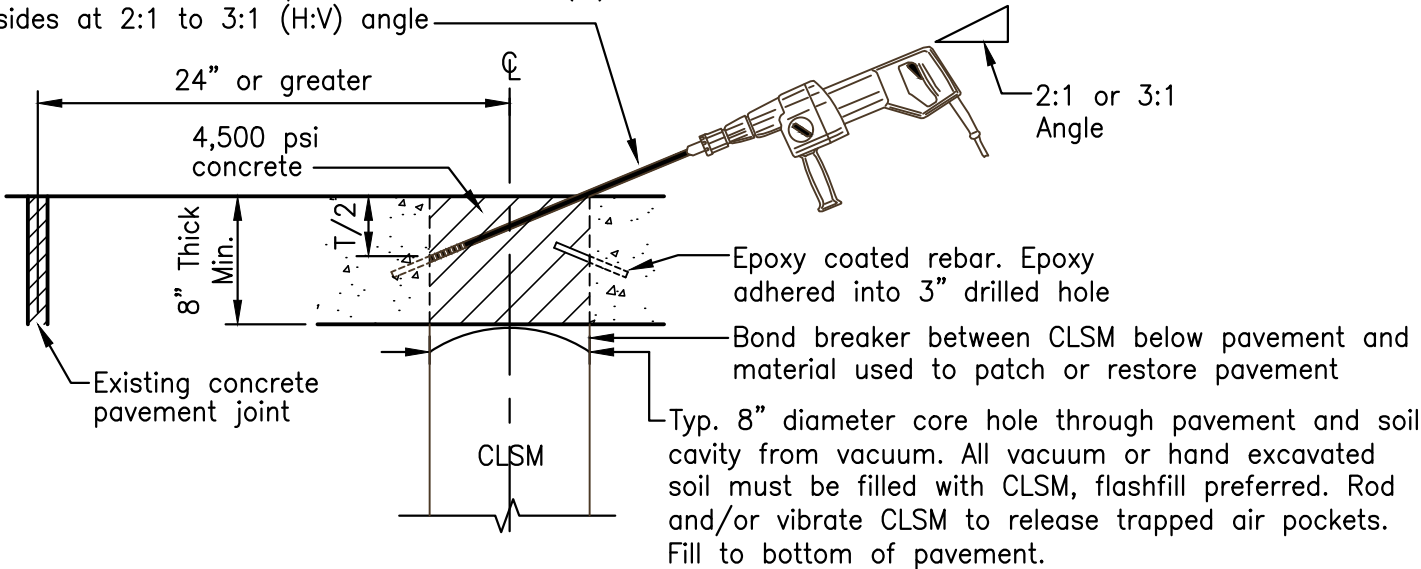
Exploratory Hole Legend

- Exploratory holes located 24" or greater from nearest concrete pavement joint. Perform Pin Repair per detail below. Up to 6 holes of this type allowed before full panel replacement is required. Existing holes are counted as part of total. Holes shall be spaced no closer than two diameters apart with no more than two holes in a straight line.
- Exploratory holes located less than 24" from nearest concrete pavement joint. Backfill of this type of hole shall be CLSM topped with non-shrink grout in pavement section. Do not use pin repair. Up to 2 holes of this type allowed before full panel replacement is required. Total count of existing plus current holes will be used.
- ⊗ Any exploratory hole placed in concrete surfaces outside of street paving requires full concrete panel replacement to nearest joint(s). No patching or partial panel removal/replacement allowed.

Pin Repair Detail

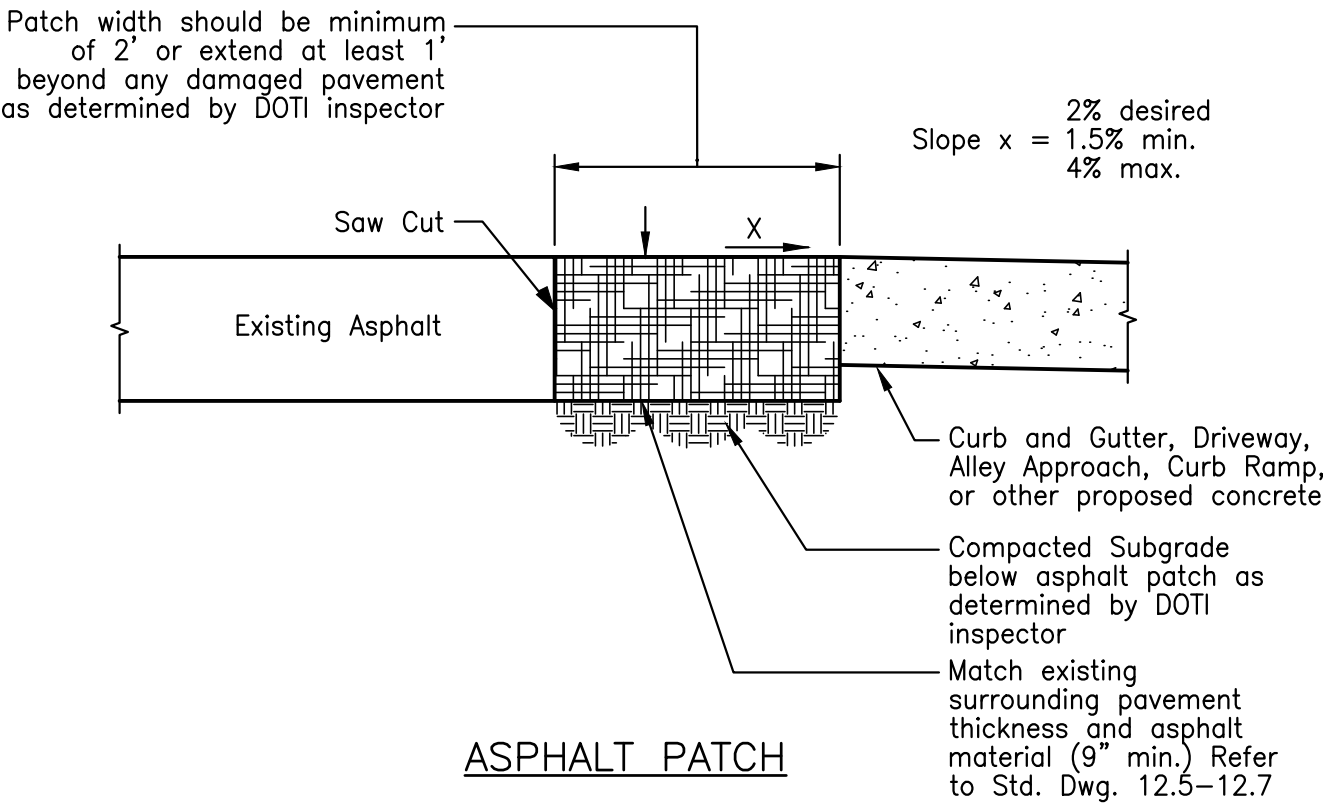
Perform when exploratory hole is 24" or greater from concrete pavement joint line

Install 3 tie bar pins (6" long #4 epoxy coated deformed tie bars) spaced apart at $\frac{1}{3}$ or $\frac{1}{4}$ of circle. Drill $\frac{5}{8}$ " diameter holes 3" deep. Select widest dimensions for drilling. Start drill about 1" above pavement thickness ($\frac{T}{2}$). Drill 3" into sides at 2:1 to 3:1 (H:V) angle



City And County Of Denver
Transportation Standard Drawings
Concrete Street Exploratory Holes
(Potholes) Typical Repair

Date:
10/24
Std. Dwg.
11.10



Notes:

1. Larger patch section is required on new streets or streets that have undergone recent pavement work.
 - a.) Patches into streets of LESS than 32 square feet, shall be patched using the method of infra-red heating into surrounding asphalt, adding rejuvenator liquid, mixing it with new and old asphalt, and re-compaction.
 - b.) Patches into streets of GREATER than 32 square feet, shall be patched using the "T" patch method. Refer to Std. Dwg. 12.2.
 - c.) When any single project or contractor makes 5 or more patches within any single 300' section of street, then the street shall be milled and overlaid at minimum of full lane (stripe to stripe or centerline/crown to curb and gutter) width, or more to cover all previous cuts. Mill and overlay shall start and stop at least 10 feet outside of the total of all cuts. All such paving shall be minimum 10 feet wide with self propelled paver with grade controls.
2. Any asphalt patch more than 10' long, or more than one lane wide, may trigger reconstruction of more of the existing street. When required, street reconstruction shall be per Std. Dwgs. 12.5-12.7 and Std. Dwgs. 12.8a-12.8b.
3. Avoid saw cuts, including potholing, in the existing or future planned wheel paths.
4. Lane edges (joints between paving passes) shall follow the traffic striped lanes as much as practicable. Lane edge joints shall not be in a wheel path. They should stagger previous edge by a minimum of 6" to avoid stacked edges.
5. Where existing cross-slope is steeper than 4%, patch cross-slope may be allowed to match, with approval of DOTI.
6. Where multiple excavations are needed within a street, they shall be combined into a single cohesive patch. Patches shall extend to the curb and gutter or edge of the roadway and up to the nearest lane for all patches. In the case that a new patch overlaps an existing patch, the new patch shall be expanded to include the existing patch limits so no overlapping of patches exists.
7. Exploratory holes (potholes) shall be backfilled in accordance with Std. Dwg. 12.4 to 9" below the surface or the asphalt thickness, whichever is greater. The cap shall be constructed with a durable material approved by DOTI. The cap shall be constructed so the permanent surface is flush with the existing pavement. Potholes shall be permanently restored within 48 hours.

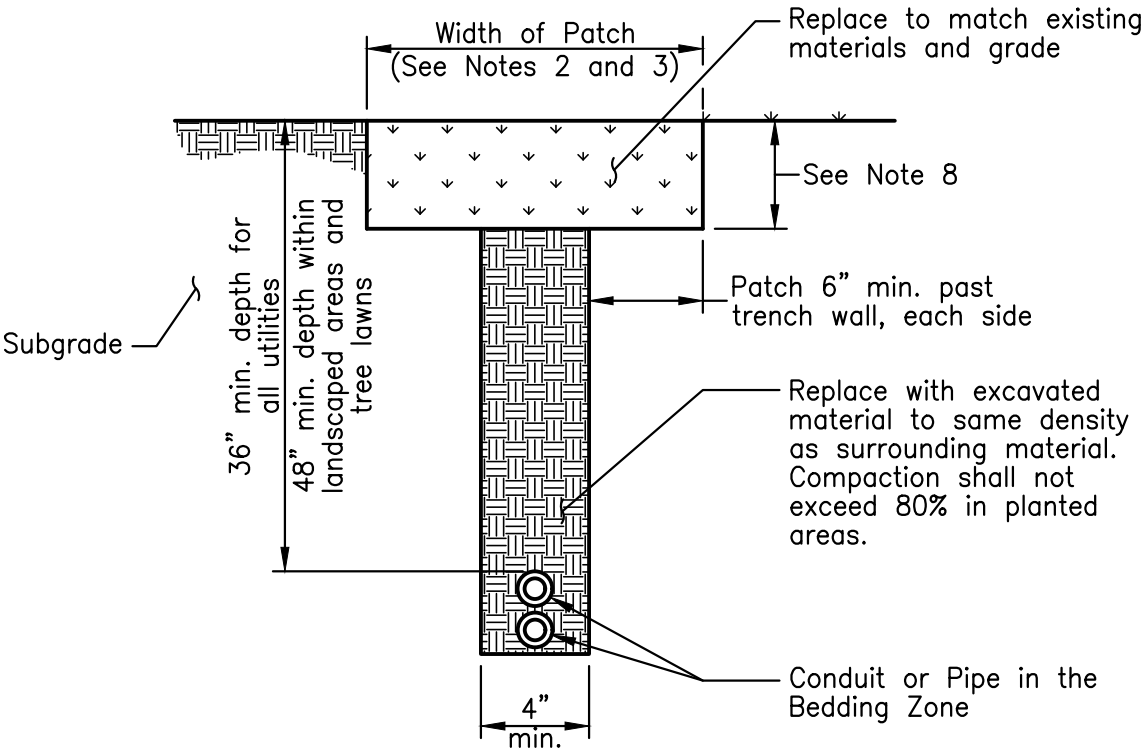


City And County Of Denver
Transportation Standard Drawings

Asphalt Patch

Date:
10/24

Std. Dwg.
12.0



*See Note 8

TRENCH PATCH THROUGH EXISTING GRAVEL OR LANDSCAPING

Notes:

1. Wherever possible, conduit or cable shall be installed by boring, driving, or any other acceptable trenchless means. Open cutting shall be used only under special circumstances and only with approval of DOTI.
2. Minimum width and type of restoration to be determined by DOTI Inspector, based on contractor's pre-activity photos, to match pre-existing conditions.
3. Sod replacement shall be a minimum of 18" in width. Seed is allowed in native landscape areas only and shall not be used in existing turf areas.
4. Any hardscape (concrete or pavers) should be replaced in full panels or pavers of the same type, color, and size as before.
5. The Contractor shall obtain a Temporary Construction Access Permit (TCAP) for any work or occupancy of Park land, this includes but is not limited to: designated city parks, parkways, open space, trails, and bike paths. Information and application can be found at: <https://www.denvergov.org/Government/Agencies-Departments-Offices/Parks-Recreation/Planning-Development/Construction-Access-Permits>
6. Any trenching within the TPZ of existing R.O.W. trees must be approved by the Office of City Forester prior to commencement of construction activities. Utility installation under the canopy of existing trees shall be bored unless conditions warrant alternate technique.
7. Any pavers or bricks displaced in trenching shall be replaced better or equal to existing on recompact subgrade and with either a 3" thick sand setting course or set into wet concrete to match the existing condition.
8. If area is sodded or seeded, fill with 6" minimum topsoil and apply sod or seed. If surrounding area is gravel, fill with 4" minimum gravel to match existing materials and grade.

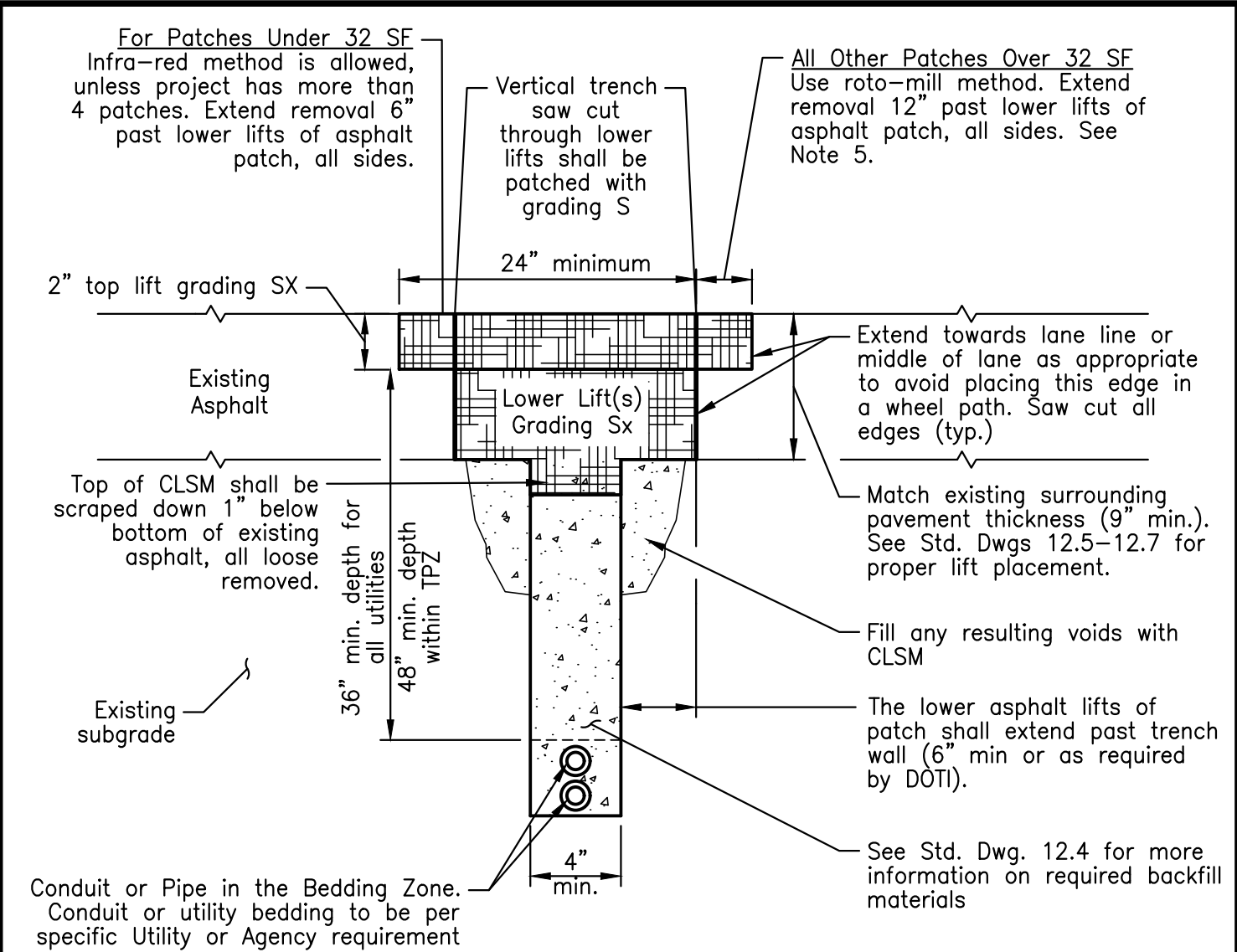


City And County Of Denver
Transportation Standard Drawings

Trench Patch Through Existing
Gravel or Landscape Materials

Date:
10/24

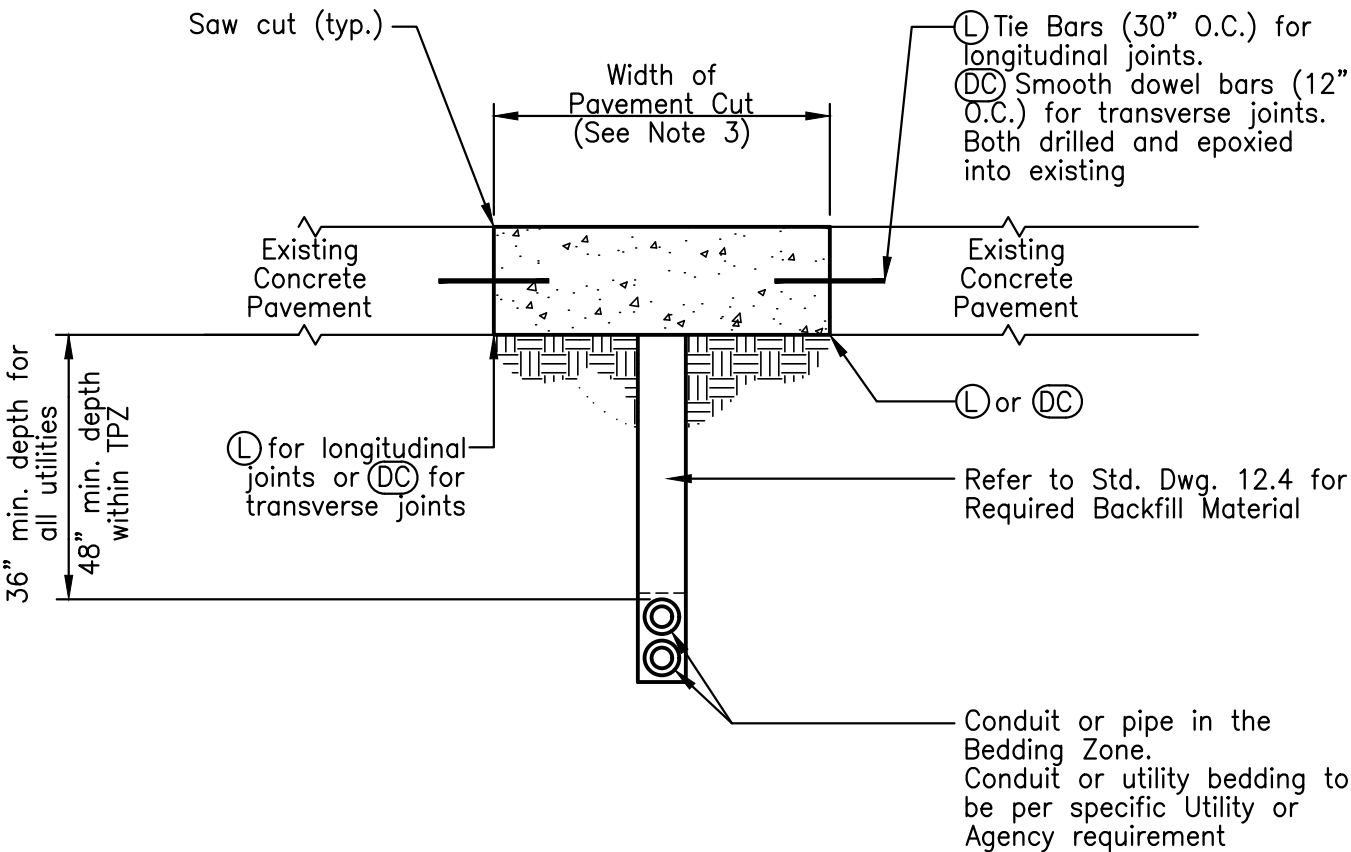
Std. Dwg.
12.1



TRENCH PATCH (ASPHALT)
Utility Excavation or Bore Access Hole

- Notes:
1. This detail shall be applied for any patch or trench within an asphalt street. See Std. Dwg. 12.8a-12.8b for asphalt restoration scenarios.
 2. Wherever possible, conduit or cable shall be installed by boring, driving, or any other acceptable trenchless means. Open cutting shall be used only under special circumstances and only with approval of DOTI.
 3. Removable CLSM layer thickness of Flow-Fill not to exceed 3' at a time, and bleed water shall be pushed off surface before another layer can be added. Flash-Fill may be placed full height thickness at one time.
 4. Pipe or conduit shall be protected from floating when using CLSM. Use plastic wrapping to avoid Flash Fill from adhering to other conduits or pipes.
 5. Streets in which any single project results in 5 or more total patches per street will be required to mill and overlay entire patched area of the street using lane lines as a point of overlay edge.
 6. Apply tack coat to all exposed walls of existing asphalt that will not receive patching by infra-red.
 7. Machine patches shall be used for patches greater than 150'.
 8. Asphalt used to patch SMA streets shall use either PG 64-28 or PG 76-28 binder.
 9. For exploratory pothole replacement, see Std. Dwg. 11-10.

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Trench Vertical Patch (Asphalt)	Std. Dwg. 12.2



TRENCH PATCH (CONCRETE)

- Notes:
- 1. Wherever possible conduit or cable shall be installed by boring, driving, or any other acceptable means under concrete units. Open cutting shall be used only under special circumstances and only with approval of DOTI.
 - 2. This Standard Drawing applies to all concrete streets and alleys. Full panel replacements are required for sidewalks, curb, gutters, and driveways.
 - 3. Full panel replacement is required when cutting or trenching into any concrete pavement.
 - 4. A construction joint (L) shall be used to tie the concrete patch to both existing concrete longitudinal joints. A doweled contraction joint (DC) shall be used at the connection into existing transverse joints. Continue existing transverse joint lines across pavement, duplicate transverse joints as (DC) joints.
 - 5. The limits of concrete patching shall be perpendicular or parallel to the centerline of the street. Skewed panel replacement over trenches is not permitted.
 - 6. Restoration of the 5' x 5' service cut in alley when the joints are more than 4 feet from existing joints, may use tie bars on all 4 sides of cut, drilled and epoxied at 18" O.C., and 9" deep into existing sides. When cut joints are less than 4 feet from existing joints, expand cut to the existing joint. Use dowels at existing transverse joint. See details for bar sizes from Std. Dwg. 11.0b.

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Trench ("T") Patch (Concrete)	Std. Dwg. 12.3

Backfill Materials Required per Cut or Trench Class

Reference the DOTI Rules and Regulations Governing Street Cuts and Roadway Excavation specifications, current version.

Cut or Trench Class	Cut or Trench Size or Structure	Backfill Materials and Method Before Test
1	Less than 150 square feet of surface cut (includes potholes for utility locates and any subsurface exploratory or monitor wells) OR for patches up to 36" wide. No minimum length OR within 4 feet of structure, manhole or vault	Method A=> use Removable CLSM
2 & 3	Greater than 150 square feet of surface cut, AND Greater than 36 inches wide	Method A=> use Removable CLSM OR Method B=> approved excavated soil or import moisture adjusted and compacted**

Method A: Requirements for Removable Controlled Low Strength Material (CLSM)

CLSM is required for Class 1 cuts or trenches, and optional for Class 2 cuts or trenches. CLSM shall be easily removable and air entrained, shall consist of an approved mix design using either flow-fill (cement and aggregate based) or flash-fill (flyash based). Both types are required to meet Removability Modulus of less than 1.5, and require different ranges of air entrainment, per MGPEC Item 19 Specifications.

	Air Entrainment	28 day compressive strength	Flowability by Slump or Spread	Construction Criteria
Flow-Fill (normal Removeable CLSM)	6.0% min. (test by pressure method or unit weight method)	50 psi minimum to 150 psi maximum	Slump (C143) 7" to 10"	Limit 3 feet thick. Between placements, push water OFF surface before adding more.

OR

Flash-Fill (fast set Removeable CLSM)	Permanent 15.0% min. (test by unit weight method)	50 psi minimum to 300 psi maximum	Spread (D6103) 8" min., or Slump (C143, one lift, no rodding) 7" to 10"	Protect from bonding to conduits, pipes, or pavement openings.
---------------------------------------	---	-----------------------------------	---	--

*CLSM drier than these slump levels shall be treated as imported in Method B, and must be compacted.

Method B: Approved Reuse of Excavated Materials or Import

Requirements for Reuse of Excavated Materials in Trench Backfill: materials shall be free of organics, trash, hazardous materials, rock or bedrock more than 3" diameter, high clay content (Plasticity Index (PI) shall be no more than 20), and soft or wet materials.

**Refer to the specific Utility or Agency Specifications or Standards for pipe bedding and backfill material and construction requirements for lift thickness, moisture, and compaction. Compaction must be verified by tests. See criteria in Rules & Regulations for Street Cuts or as approved by DOTI.

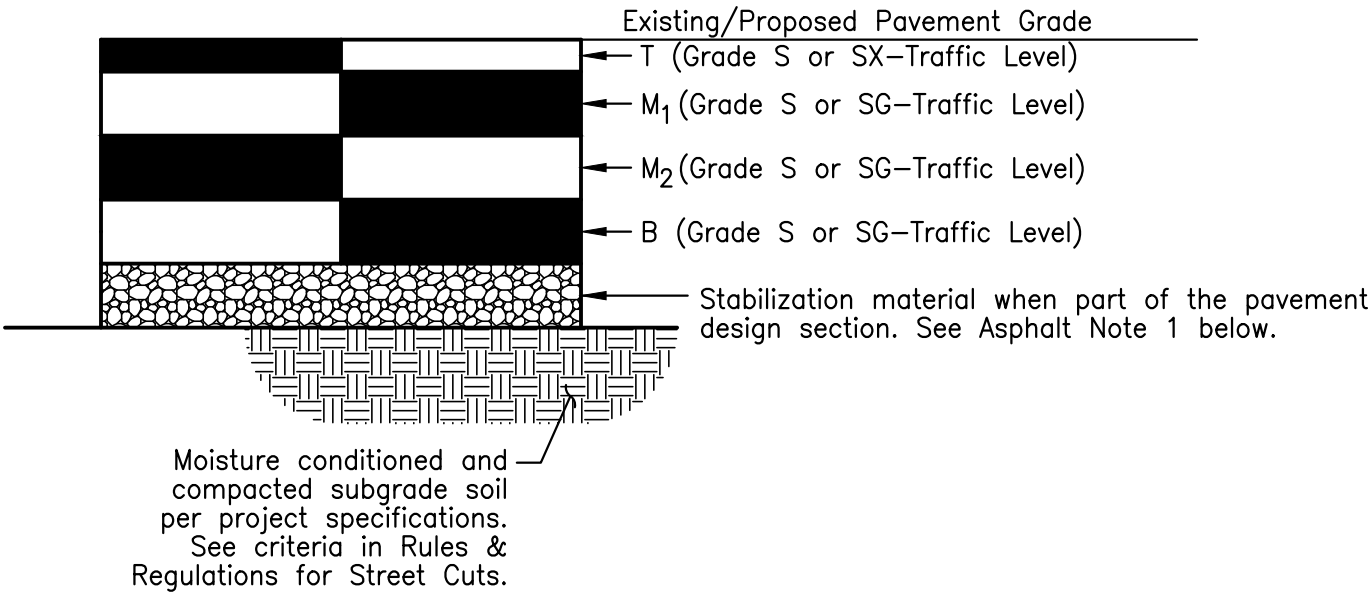


City And County Of Denver
Transportation Standard Drawings

Trench Backfill Material
Requirements

Date:
10/24

Std. Dwg.
12.4



TYPICAL ASPHALT LAYER DETAIL – HOT MIX ASPHALT (HMA)

New Roadway Notes

- 1. A pavement design prepared by a qualified Geotechnical Engineer shall be submitted for new roadways to be constructed, or as otherwise required by DOTI. Pavement designs shall conform to either MGPEC or current CDOT M–E Pavement Design Manual and shall be stamped by a Professional Engineer licensed in Colorado. Thickness Designs for arterial or industrial roads shall be designed by the current CDOT M–E Pavement Design Manual.
- 2. Table 12.6–2 on Std. Dwg. 12.6 shall be applied for design of constructed lift thickness.

Existing Roadway Reconstruction Notes

- 1. A pavement design prepared by a qualified Geotechnical Engineer may be submitted for existing roadways to be reconstructed, in lieu of minimum requirements shown on Table 12.7–1 on Std. Dwg. 12.7. If prepared, pavement designs shall meet the requirements for new roadways.

Asphalt Notes:

- 1. For full depth reconstruction, asphalt thickness shown on Std. Dwg. 12.7 as full depth. An equivalent asphalt over base composite section may be used when subgrade soils are low–swelling. See MGPEC Pavement Design Standards. Aggregate base course (ABC) may be substituted 4" ABC for 1" asphalt up to 12" ABC of full depth asphalt per the pavement design. The minimum local road pavement section is 5" HMA over 6" ABC. The minimum collector or arterial pavement section is 9" HMA over 12" ABC.
- 2. Tack coat shall be applied between each asphalt layer unless the engineer determines the existing exposed layer is adequately sticky without a tack coat.
- 3. All asphalt to meet MGPEC Item 20 specifications. When an existing street in good condition needs (lowering) less than 12 inches in elevation and for less than 650 feet in length, it may reconstructed with a minimum thickness matching existing adjacent asphalt and base course. Contact Dept. ROW Inspector for assessment of existing condition approval.

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Typical Asphalt Pavement Detail	Std. Dwg. 12.5

LIFT THICKNESS BASED UPON MIX GRADING

Table 12.6-1

Mix Grading (nominal size)	Absolute Minimum Lift Thickness (3 x nominal size)	Recommended Lift Thickness (4 x nominal size)	Maximum Lift Thickness is limited by compaction equipment and crew's ability
SX (1/2")	1.5"	2.0"	3.0"
S (3/4")	2.3" → use 2.5"	3.0"	4.0"
SG (1")	3.0" → use 3.5"	4.0"	5.0"

COMBINATIONS OF LIFT THICKNESSES TO ACHIEVE THE FULL DEPTH SECTION WITH HEAVY MAIN LINE PAVING EQUIPMENT

Table 12.6-2

Full Depth HMA	Top Lift (T)	Bottom Lift (B)	or	Top Lift (T)	Upper Mid-Lift (M ₁)	Lower Mid-Lift (M ₂)	Bottom Lift (B)
6.0	2.0	4.0	or	3.0	N/A	N/A	3.0
6.5	2.5	4.0	or	3.0	N/A	N/A	3.5
7.0	3.0	4.0		2.5	N/A	N/A	4.5*
7.5	3.0	4.5*		3.0	N/A	N/A	4.5*
8.0	3.0	5.0*		2.0	3.0	N/A	3.0
9.0	N/A	N/A		2.0	3.0	N/A	4.0
10.0	N/A	N/A		2.0	4.0	N/A	4.0
11.0	N/A	N/A		3.0	4.0	N/A	4.0
12.0	N/A	N/A		3.0	3.0	3.0	3.0
13.0	N/A	N/A		3.0	3.0	3.0	4.0
14.0	N/A	N/A		3.0	3.0	4.0	4.0
15.0	N/A	N/A		3.0	4.0	4.0	5.0*

Note: For 0.5" increments add or subtract 0.5" to a lift

*Indicates SG grading mix shall be used at these thicknesses in lieu of S grading, based on contractor's ability to achieve compaction.

Note:

- Contractor must select proper compaction equipment and techniques to achieve required compaction in all cases. Compaction specification is 92% to 96% of Rice Value (maximum theoretical density).



City And County Of Denver
Transportation Standard Drawings

Typical Asphalt Pavement Detail
Lift Thickness Criteria

Date:
10/24

Std. Dwg.
12.6

DEFAULT ASPHALT PAVEMENT DESIGN CRITERIA AND MINIMUM THICKNESS BY ROADWAY

Table 12.7-1 CLASSIFICATION FOR RECONSTRUCTION OF EXISTING STREETS

	Traffic Level					
	Residential	Collector		Heavy Collector (Truck or Bus Route)	Arterial	Industrial
Design Lane ESALS Minimum, unless designer performs a vehicle classification per MGPEC Pavement Design Standards	70,000 + 80 x num. of new dwelling units to be constructed	100,000**	500,000***	3,000,000	5,000,000	Must perform MGPEC Pavement Design
Minimum total full depth asphalt section (T+M+B) without MGPEC compliant geotechnical or pavement thickness design*	7.0"	7.5"***	10.0"***	13.5"	14.5"	14.5" or per pavement design

* Or match existing, whichever is greater

** Local, shared street, residential collector, and mixed-use collector

*** Collector with added commercial uses or has RTD bus route, or takes commercial traffic

Table 12.7-2 REQUIRED ASPHALT MATERIALS-BY LIFT

		Traffic Level				
		Residential <100,000 ESALs	Collector	Heavy Collector (Truck or Bus Route)	Arterial	Industrial
Top Lift (T)	Asphalt Mix Grading (nominal size)	SX (1/2")	SX (1/2")	SX (1/2")	SX (1/2")	SX (1/2"), or S (3/4") by permission of DOTI
	Mix Design Gyration Compaction Effort Level	N=75	N=75	N=100	N=100	N=100 or N=125 (from design)
	Asphalt Binder Grade (PG hh-II)	PG 58-28	*PG 58-28 with low traffic **PG 64-22 with high traffic	PG 64-22	PG 76-28 (polymer modified), if available. Use PG 64-22 if not.	PG 64-22 or by design
Lower Lifts (M ₁) (M ₂) (B)	Asphalt Mix Grading (nominal size)	S (3/4") or SG (1.0") Note: 1	S (3/4") or SG (1.0") Note: 1	S (3/4") or SG (1.0") Note: 1	S (3/4") or SG (1.0") Note: 1	S (3/4") or SG (1.0") Note: 1
	Mix Design Gyration Compaction Effort Level	N=75	N=75	N=100	N=100	N=100 or N=125
	Asphalt Binder Grade (PG hh-II)	Same as for top lift	Same as for top lift	PG 64-22 Note: 2	PG 64-22 Note: 2	PG 64-22 Note: 2

* PG 58-28 if no buses, no commercial use

** PG 64-22 if has RTD bus route or takes commercial traffic

Notes:

- Grading SG may be allowed based upon ability of paving operation to obtain required percent of Rice compaction, proper lift thickness, and sufficient length of paving. Not to be used when hand placement or moving is necessary that would result in segregation.
- A one-grade softer binder may be allowed on lower lifts to meet "Perpetual Pavement" designs.

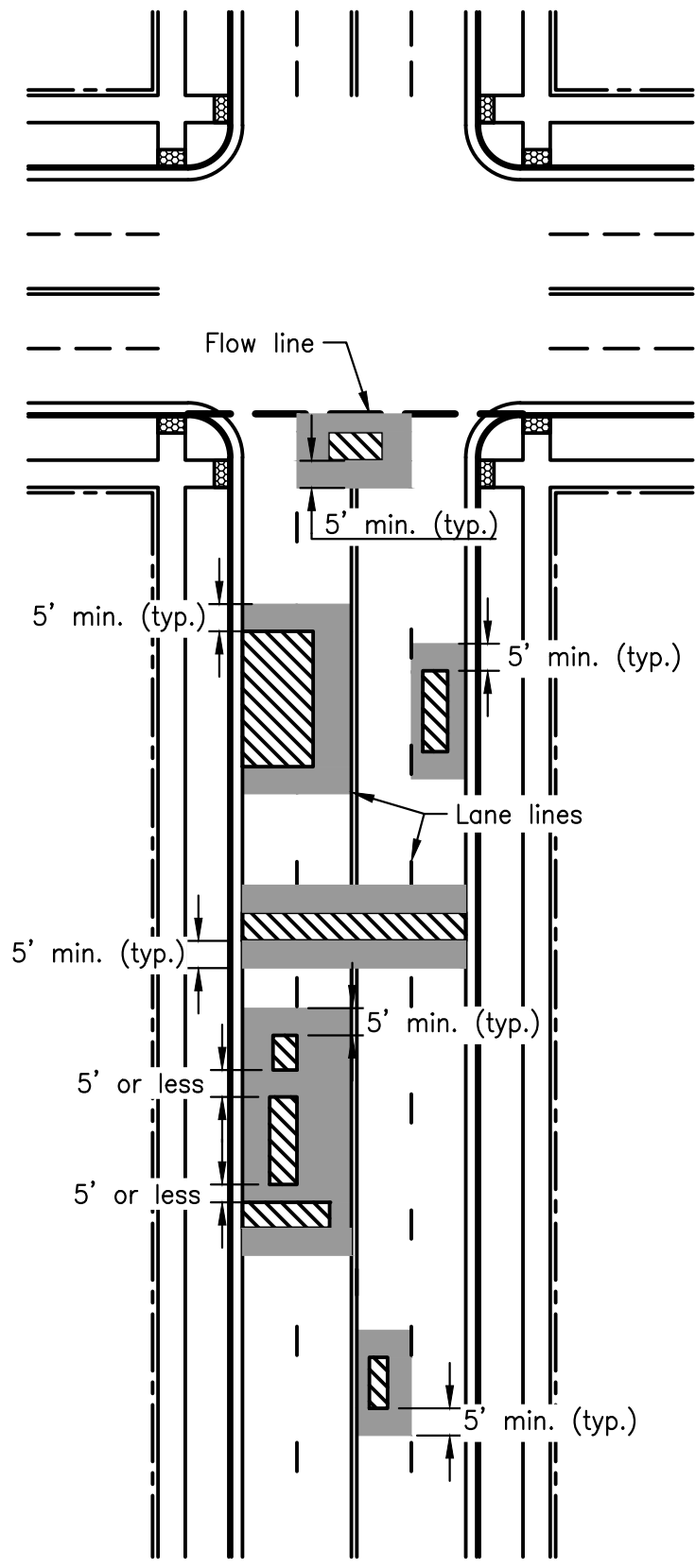


City And County Of Denver
Transportation Standard Drawings

Typical Asphalt Mix Details by
Traffic Use or Lift Position

Date:
10/24

Std. Dwg.
12.7



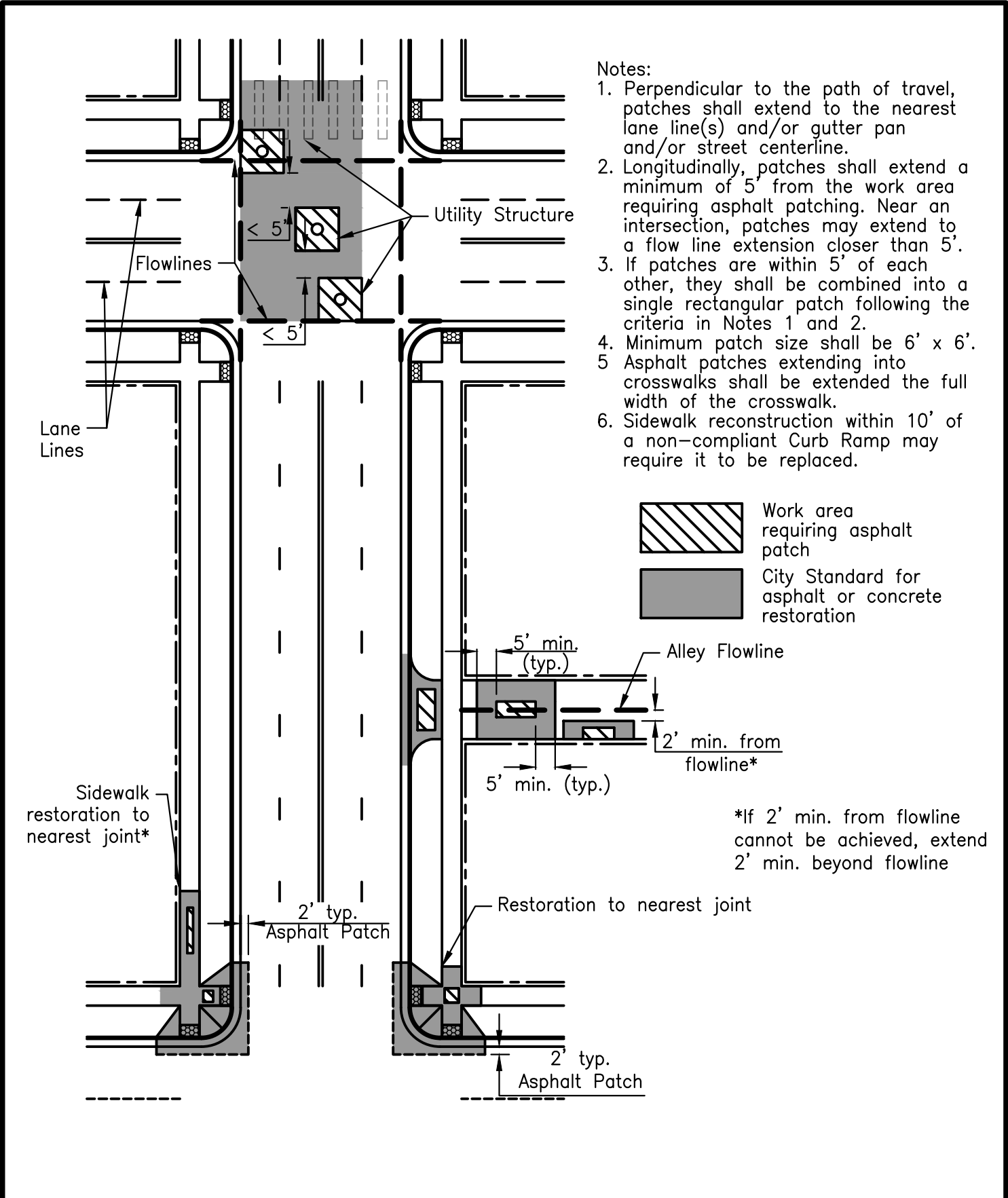
- Notes:
1. Perpendicular to the path of travel, patches shall extend to the nearest lane line(s) and/or gutter pan and/or street centerline.
 2. Longitudinally, patches shall extend a minimum of 5' from the work area requiring asphalt patching. Near an intersection, patches may extend to a flow line extension closer than 5'.
 3. If patches are within 5' of each other, they shall be combined into a single rectangular patch following the criteria in Notes 1 and 2.
 4. Minimum patch size shall be 6' x 6'.
 5. Patches in mode specific travel ways must adhere to the same requirements shown.



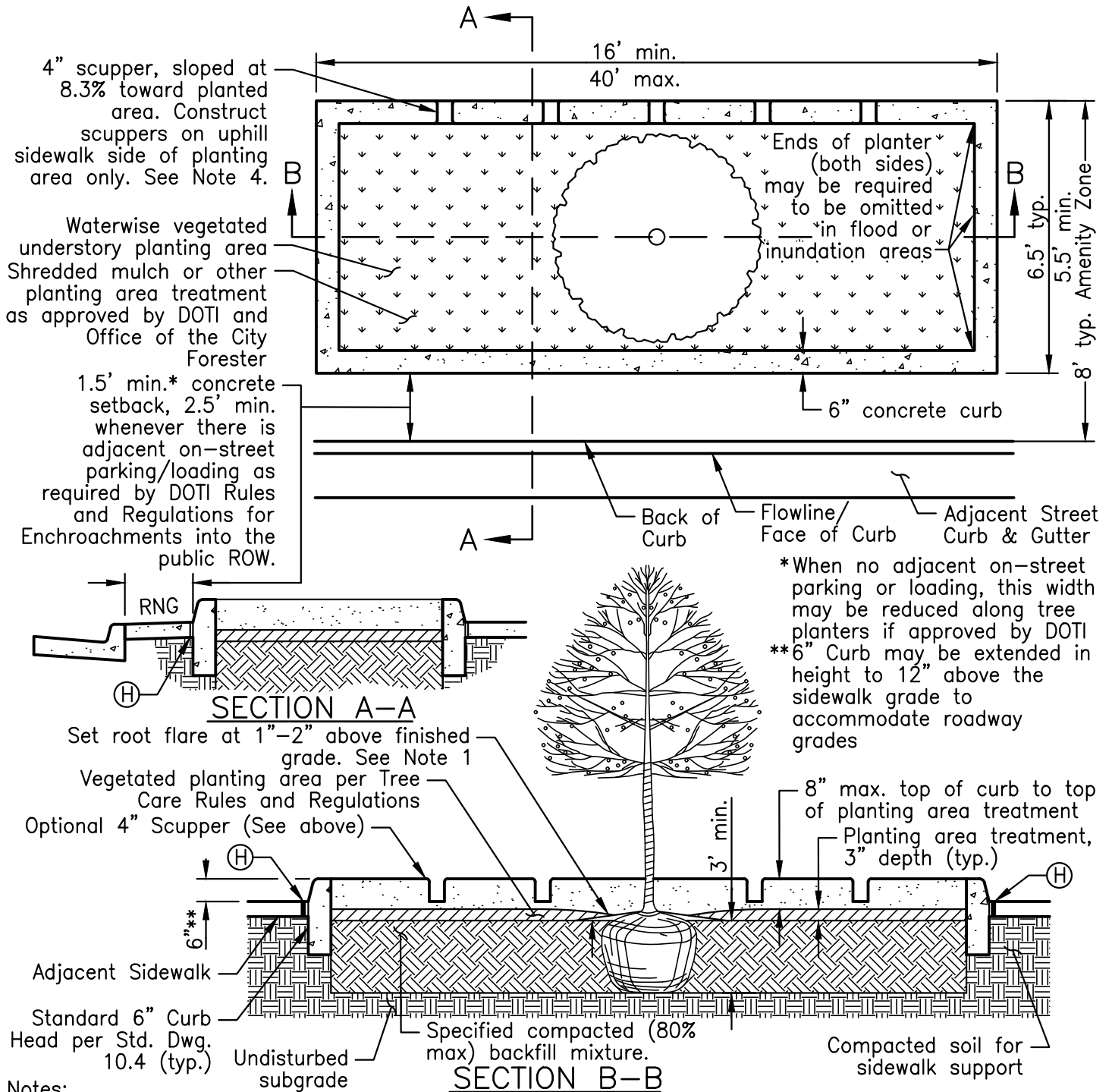
Work area requiring asphalt patch



City Standard for asphalt restoration

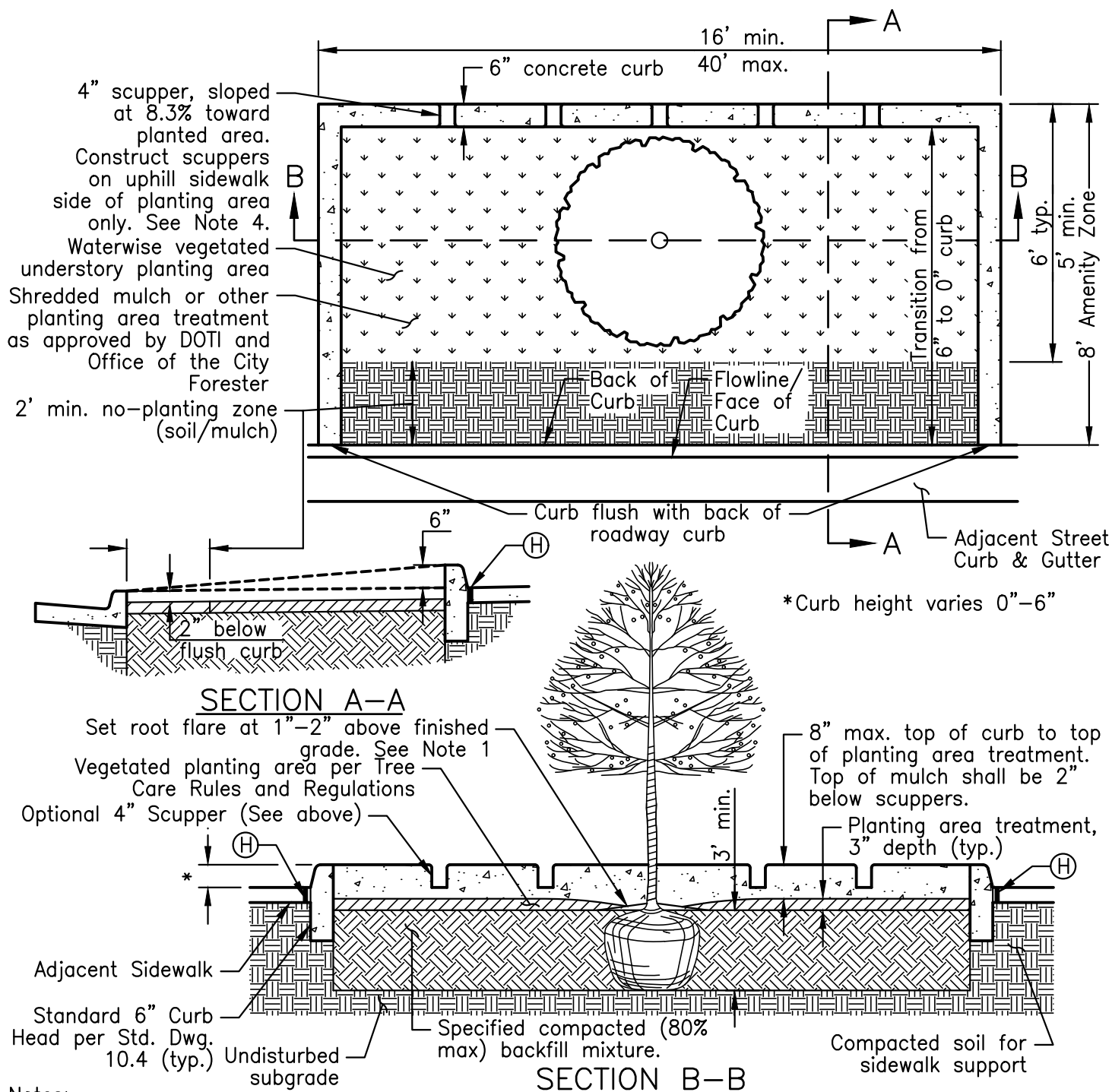


 DENVER TRANSPORTATION & INFRASTRUCTURE	City And County Of Denver Transportation Standard Drawings Asphalt, Sidewalk, Curb Ramp, and Alley Patching Details	Date: 10/24 Std. Dwg. 12.8b
--	--	--------------------------------------



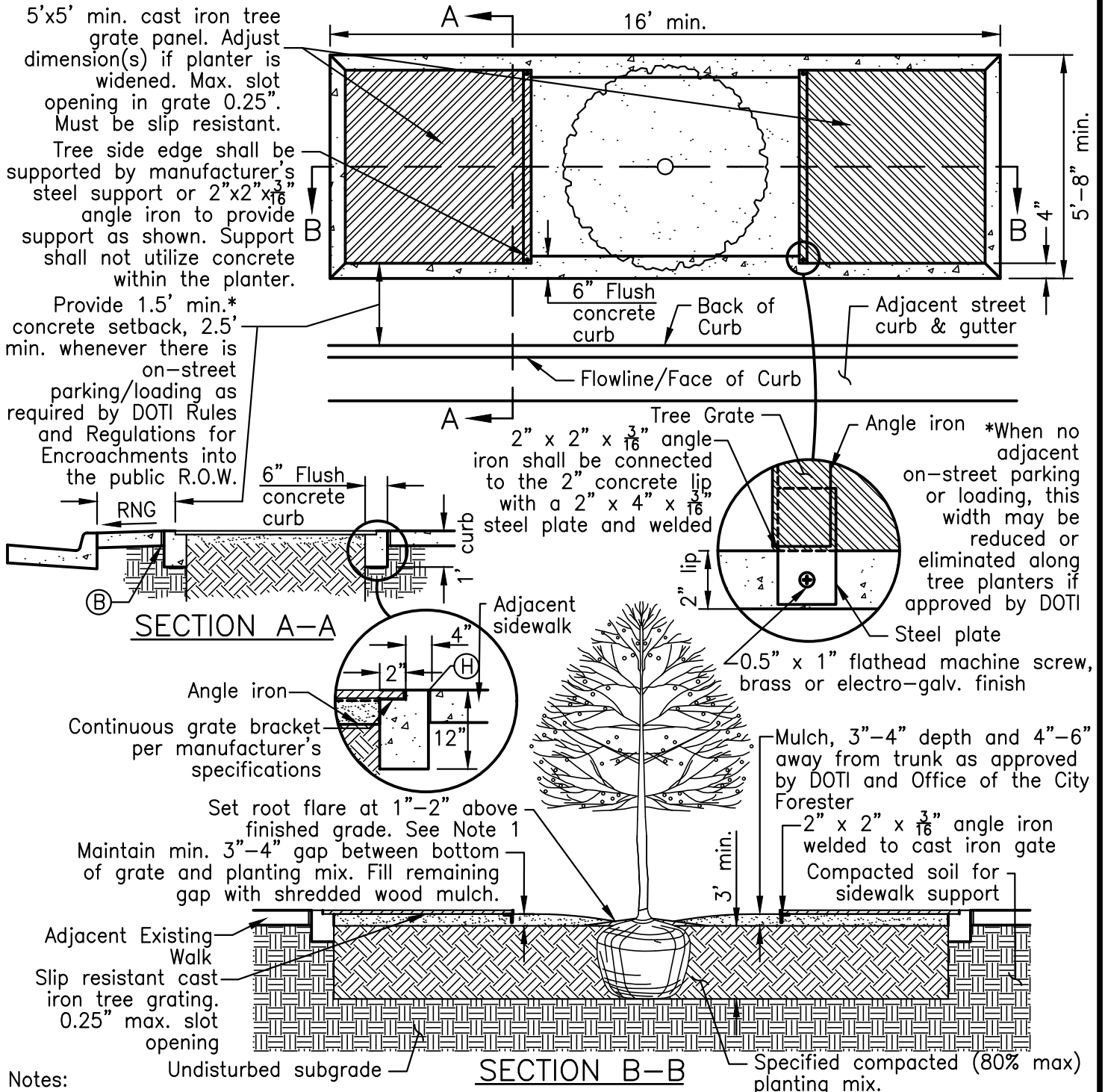
Notes:

1. Tree planting per Tree Care Rules and Regulations and Tree Planting Details. Soil volume requirements should be considered in planter layout.
2. For all new installations, automatic irrigation system shall be provided in open planting area.
3. Concrete jointing and scoring outside open planting area shall be coordinated with DOTI field staff.
4. 4" scuppers must be formed and corners must be chamfered or rounded. These scuppers may be replaced with 3" inset drain pipes.
5. Electrical components may be added to Tree Planter in accordance with Encroachment Rules and Regulations. No free-standing electrical outlets are permitted within a Tree Planter.
6. Trees shall be placed per Tree Care Rules and Regulations, Tree Planting Details, and sight distance requirements on Std. Dwg. 14.0.



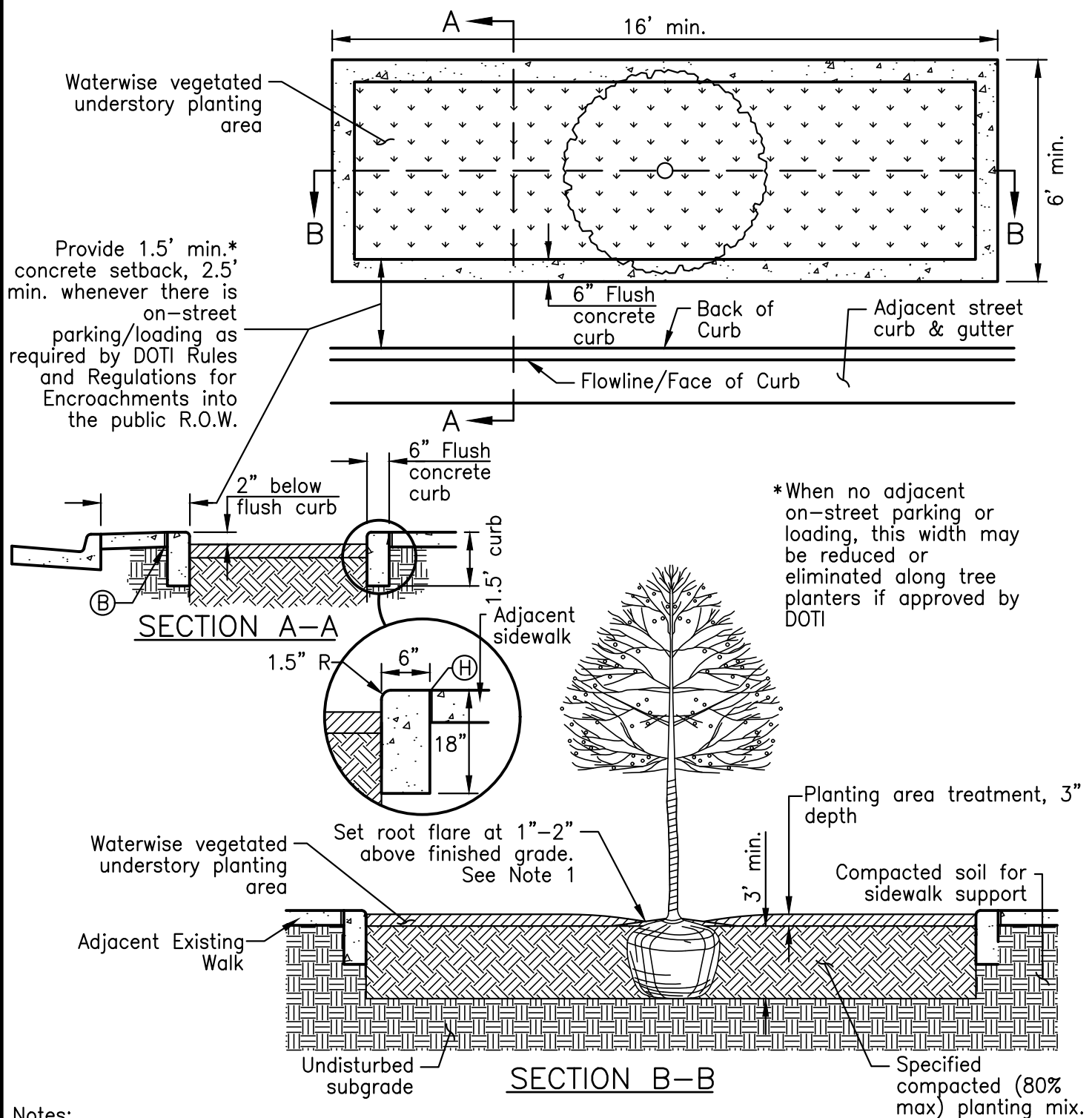
Notes:

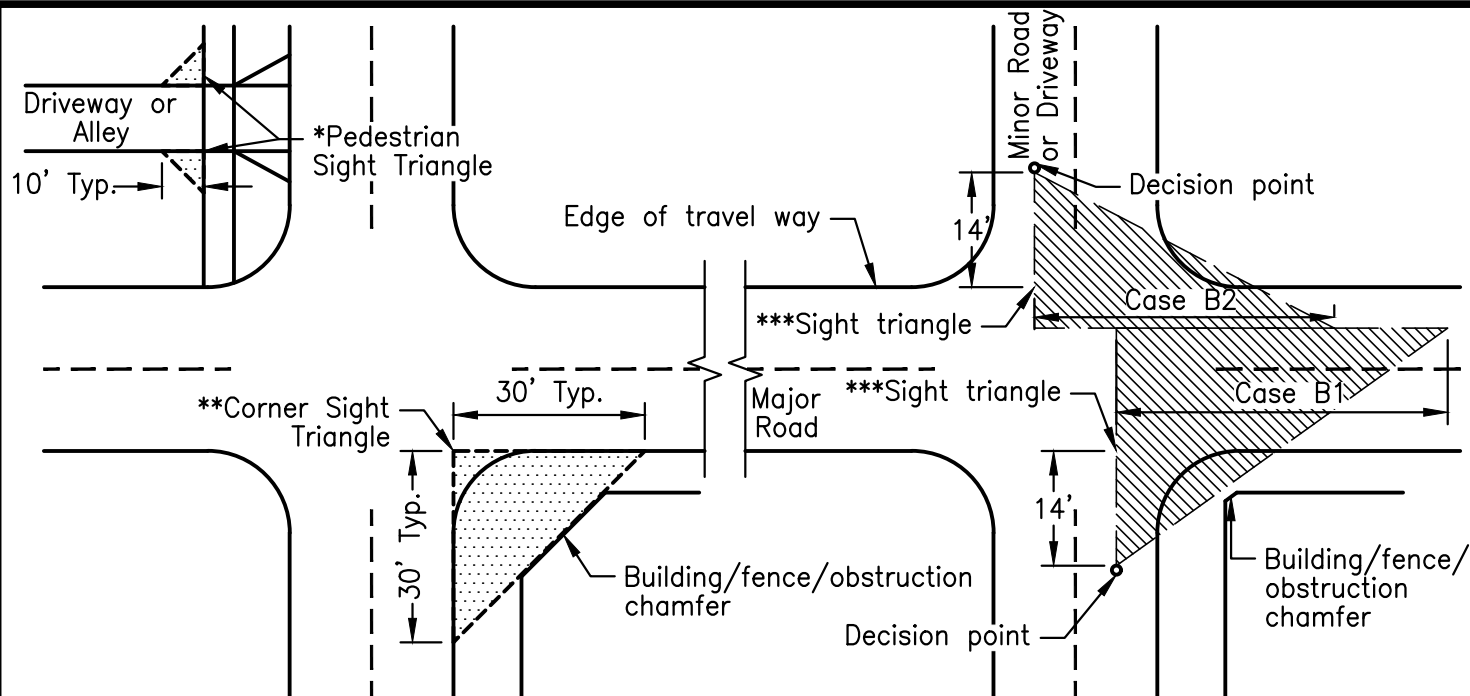
1. Tree planting per Tree Care Rules and Regulations and Tree Planting Details. Soil volume requirements should be considered in planter layout.
2. For all new installations, automatic irrigation system shall be provided in open planting area.
3. Concrete jointing and scoring outside open planting area shall be coordinated with DOTI field staff.
4. 4" scuppers must be formed and corners must be chamfered or rounded. These scuppers may be replaced with 3" inset drain pipes.
5. Electrical components may be added to Tree Planter in accordance with Encroachment Rules and Regulations. No free-standing electrical outlets are permitted within a Tree Planter.
6. Trees shall be placed per Tree Care Rules and Regulations, Tree Planting Details, and sight distance requirements on Std. Dwg. 14.0.



Notes:

1. Tree planting per Tree Care Rules and Regulations and Tree Planting Details. Soil volume requirements should be considered in planter layout.
2. For all new installations, automatic irrigation system shall be provided in open planting area.
3. Concrete jointing and scoring outside open planting area shall be coordinated with DOTI field staff.
4. Electrical components may be added to Tree Planter in accordance with Encroachment Rules and Regulations. No free-standing electrical outlets are permitted within a Tree Planter.
5. Trees shall be placed per Tree Care Rules and Regulations, Tree Planting Details, and sight distance requirements on Std. Dwg. 14.0.
6. Grates are preferred to Raised Curb where pedestrian activity is high and a hardscaped amenity zone is provided. Any holes needed in the grate for parking meters or signs shall be approved by DOTI.





SIGHT TRIANGLES

INTERSECTION SIGHT DISTANCE

Table 28.0-1

Sight Triangles	
Type	Restriction
10'x10' Pedestrian*	No items wider than 18" and taller than 30" may be located within this triangle.
30'x30' Corner**	No items taller than 30" may be located within this triangle. Traffic control devices, and equipment exempt.
AASHTO Roadway***	No items wider than 18" and taller than 30" may be located within this triangle. Street trees, traffic control devices, bicycle racks, and equipment exempted.

Table 28.0-2

AASHTO Case B - Intersections with Stop Control on the minor road*		
Design Speed (mph)	Left Turn from Stop (AASHTO Case B1)	Right Turn from Stop (AASHTO Case B2)
15	170'	145'
20	225'	195'
25	280'	240'
30	335'	290'
35	390'	335'
40	445'	385'
45	500'	430'
50	555'	480'

*Located at each side of a driveway and alley. Placed at back of sidewalk and edge of drive aisle/alley.

**Located at each quadrant of two intersecting public streets. Placed along flow-line of both roadways.

***Located at each driveway, alley, and intersection per AASHTO standards for "Departure triangles." Place decision point 14' from edge of traveled way. If on-street parking is available (unmarked), assume 8' parking width and place the decision point 10' behind the flow-line.

Notes:

1. A clear sight triangle is the space which shall be kept free of obstructions that may block an approaching driver's view of any potentially conflicting users.
2. The assumed distance to the driver's eye is 14' from edge of traveled way.
3. Intersection sight distance assumes street grades of 3% or less with no medians. If grades exceed 3%, then recalculate time gap per AASHTO.
4. For intersections with Traffic Signal Control or All-Way Stop Control, refer to AASHTO Case D and Case E, respectively. For right turns on a red signal, use AASHTO Case B2.



City And County Of Denver
Transportation Standard Drawings

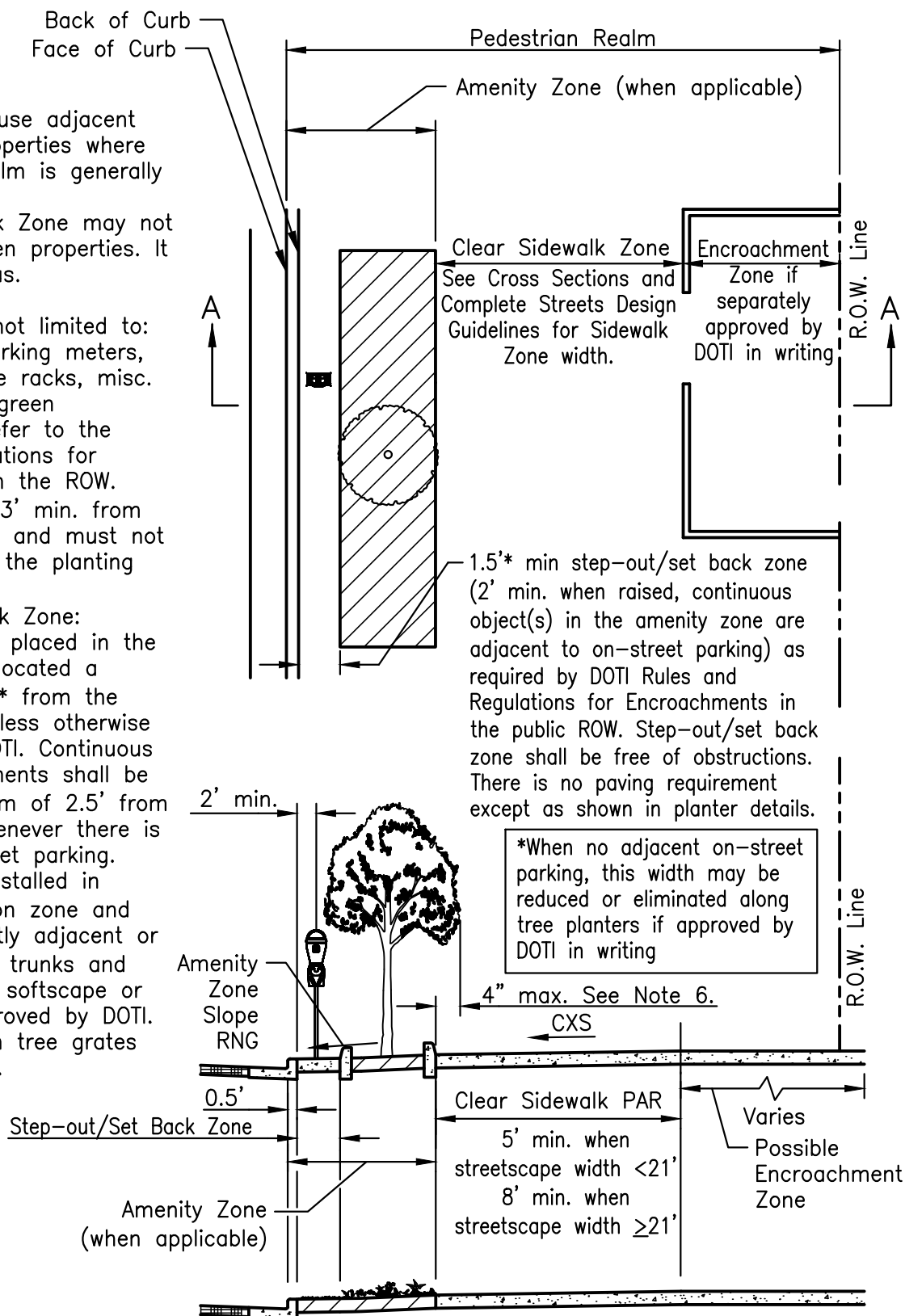
Sight Triangles

Date:
10/24

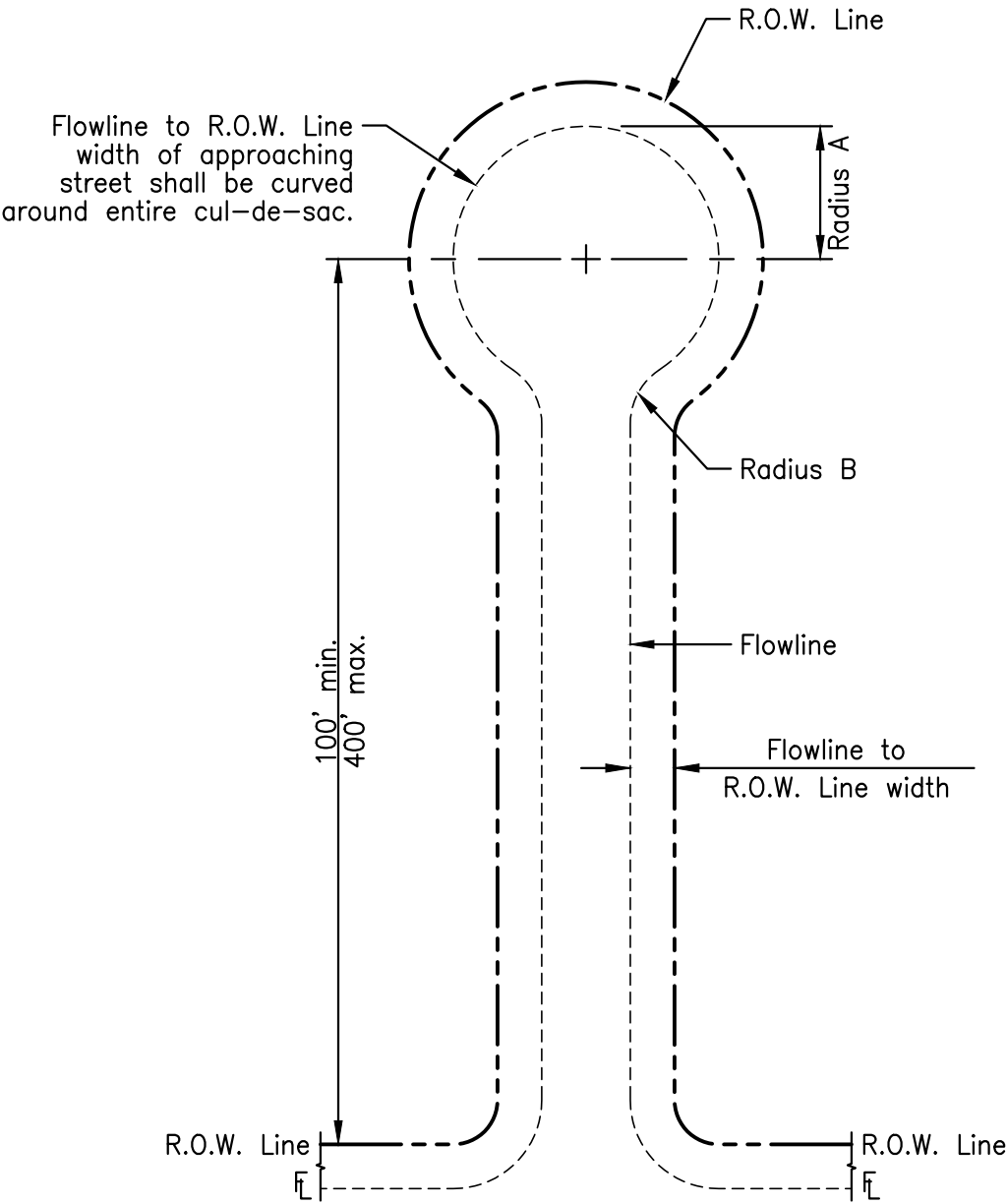
Std. Dwg.
14.0

Notes:

1. This detail is for use adjacent to commercial properties where the pedestrian realm is generally hardscaped.
2. The Clear Sidewalk Zone may not be reduced between properties. It must be continuous.
3. Amenity zone:
 - Can include, but not limited to: planting area, parking meters, bus shelters, bike racks, misc. street furniture, green infrastructure. Refer to the Rules and Regulations for Encroachments in the ROW.
 - Space bike racks 3' min. from the edge of tree and must not be placed within the planting area.
4. Step-out/Set Back Zone:
 - Any encroachment placed in the R.O.W. must be located a minimum of 1.5'* from the face of curb, unless otherwise approved by DOTI. Continuous raised encroachments shall be placed a minimum of 2.5' from face of curb whenever there is adjacent on-street parking.
5. Meters shall be installed in step-out/separation zone and shall not be directly adjacent or within 36" of tree trunks and may be placed in softscape or hardscape as approved by DOTI. Installation through tree grates should be avoided.
6. Objects such as tree limbs with leading edges more than 27" and less than 80" above the walking surface shall extend into the PAR no more than 4".



SECTION A-A



STANDARD CUL-DE-SAC
Only allowed on local streets

Street Type	Radius	
	A	B
Residential*	45'	25'
All other Street Types**	57'	30'

*Based on SU-30 and Denver Fire Truck turning radii

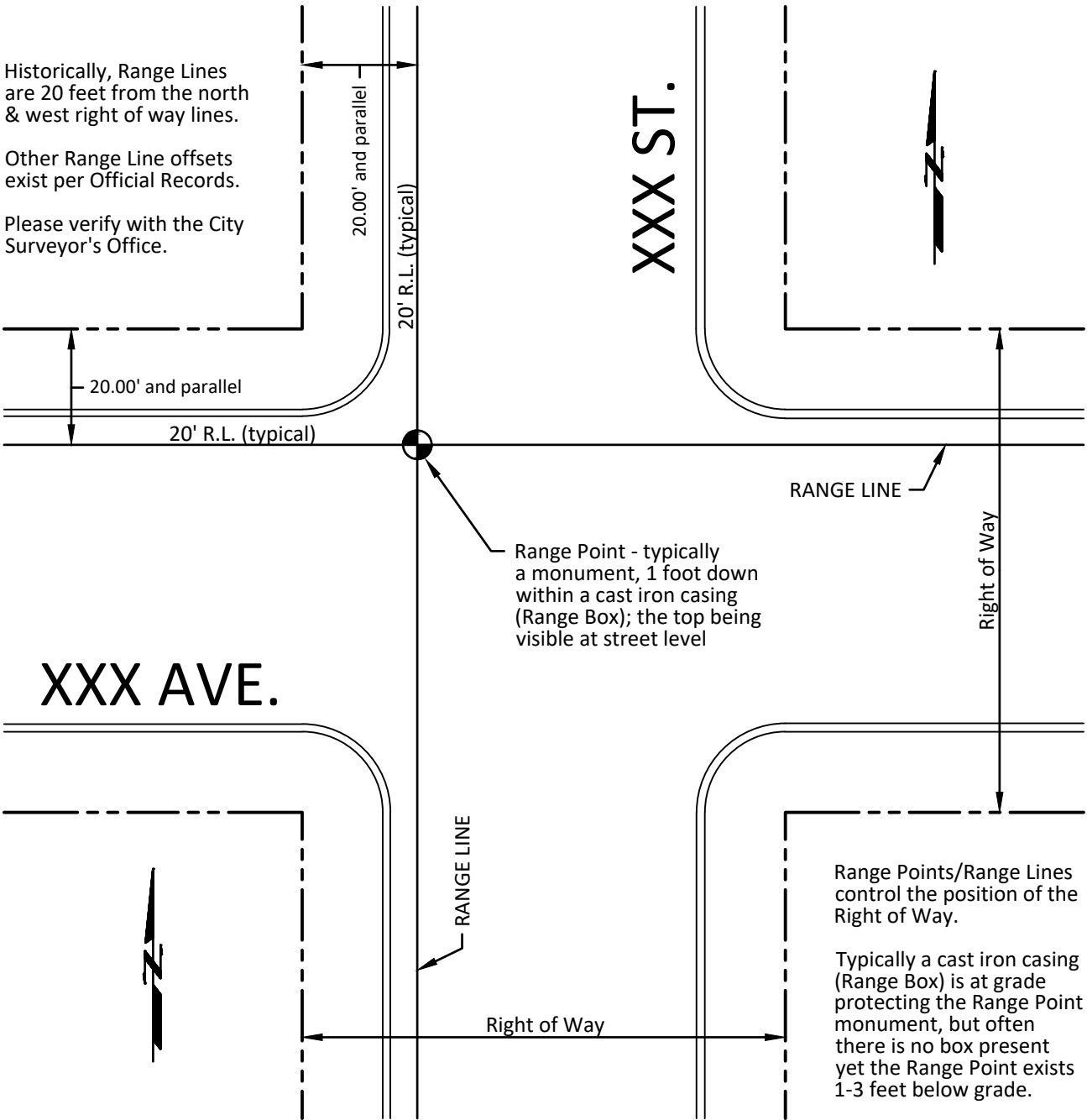
**Use Industrial dimensions if any adjacent property is zoned industrial

Notes:

- 1. New cul-de-sacs must be approved by DOTI.
- 2. R.O.W. Line may vary based on specific site conditions.
- 3. Hammer-head turnarounds are not permitted on public roadways.

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Standard Cul-de-Sac	Std. Dwg. 15.0

RANGE POINTS ARE SURVEY MONUMENTATIONS USED TO PERMANENTLY ESTABLISH AND PRESERVE THE PUBLIC RIGHTS OF WAY IN THE CITY AND COUNTY OF DENVER.
THIS PRACTICE HAS BEEN IN EFFECT IN THE CITY SINCE THE LATE 1800s.
SEE ORDINANCE 41 SERIES 1886.



Note that all existing range points shall be protected and preserved.
If any range point is disturbed by any activity, it shall be properly restored per Range Point Guidelines, found at:
<https://www.denvergov.org/survey>

	City And County Of Denver Transportation Standard Drawings	Date: 10/24
	Right-of-Way Survey Control **Range Points**	Std. Dwg. 16.0