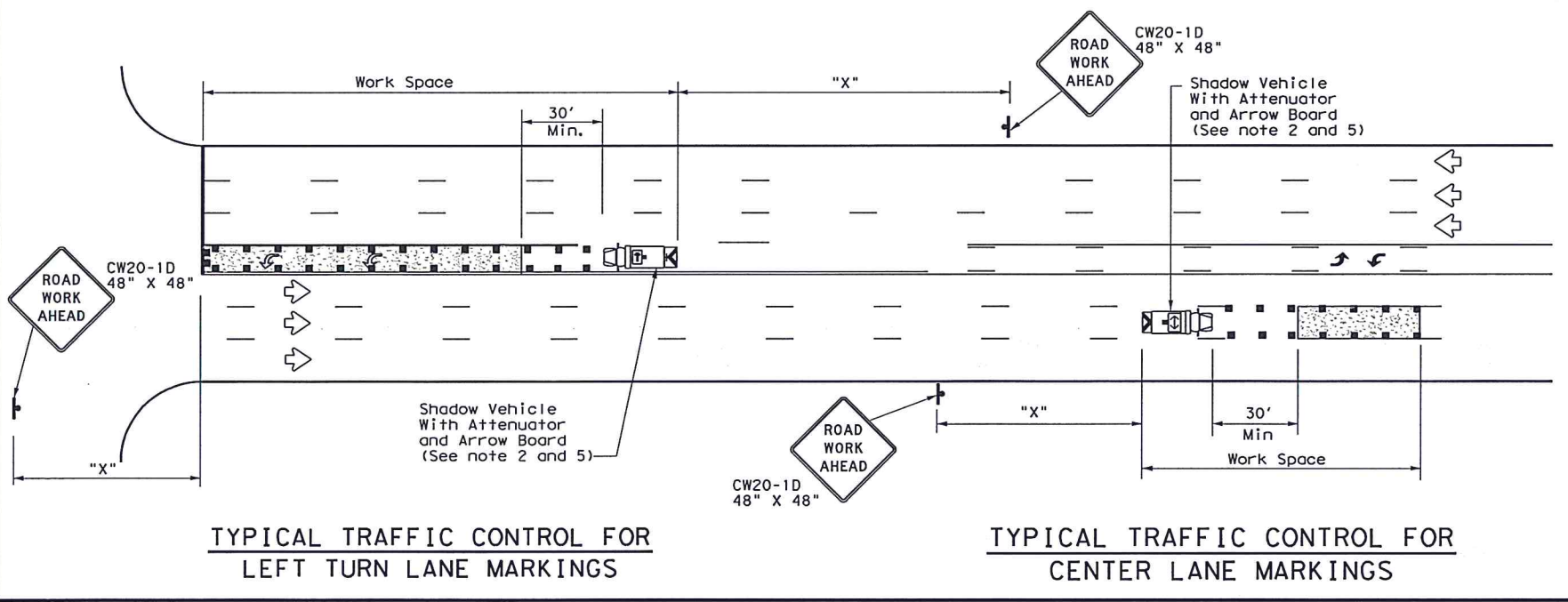
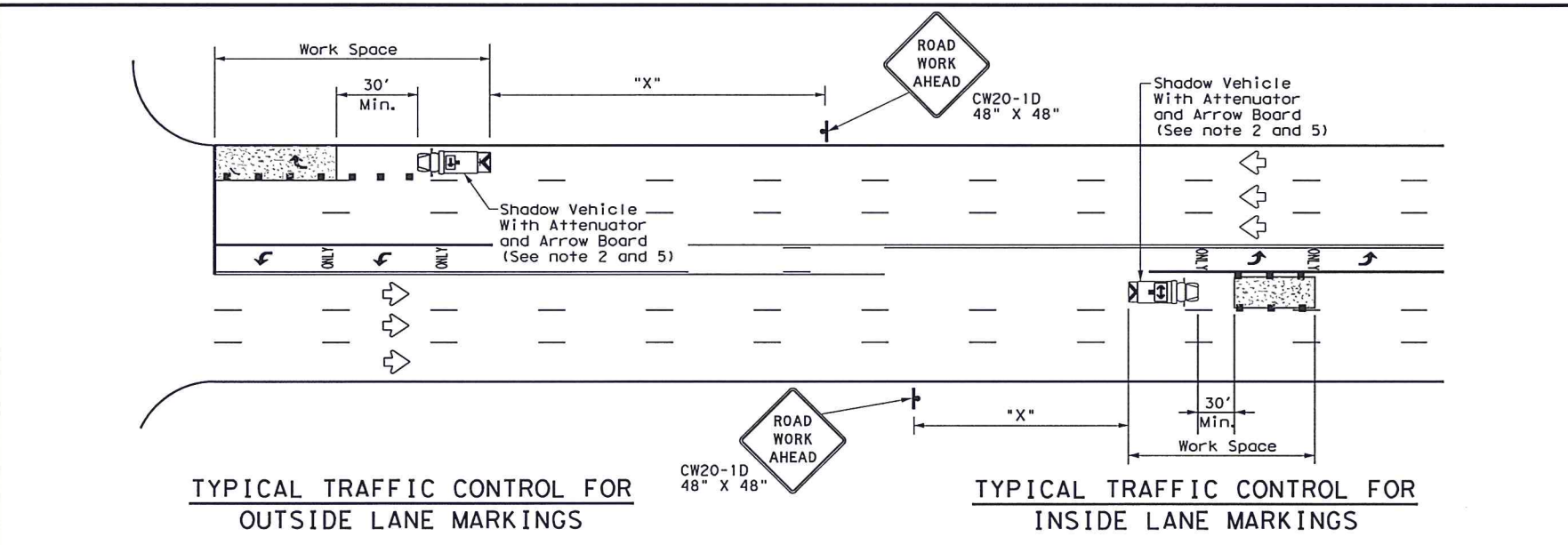
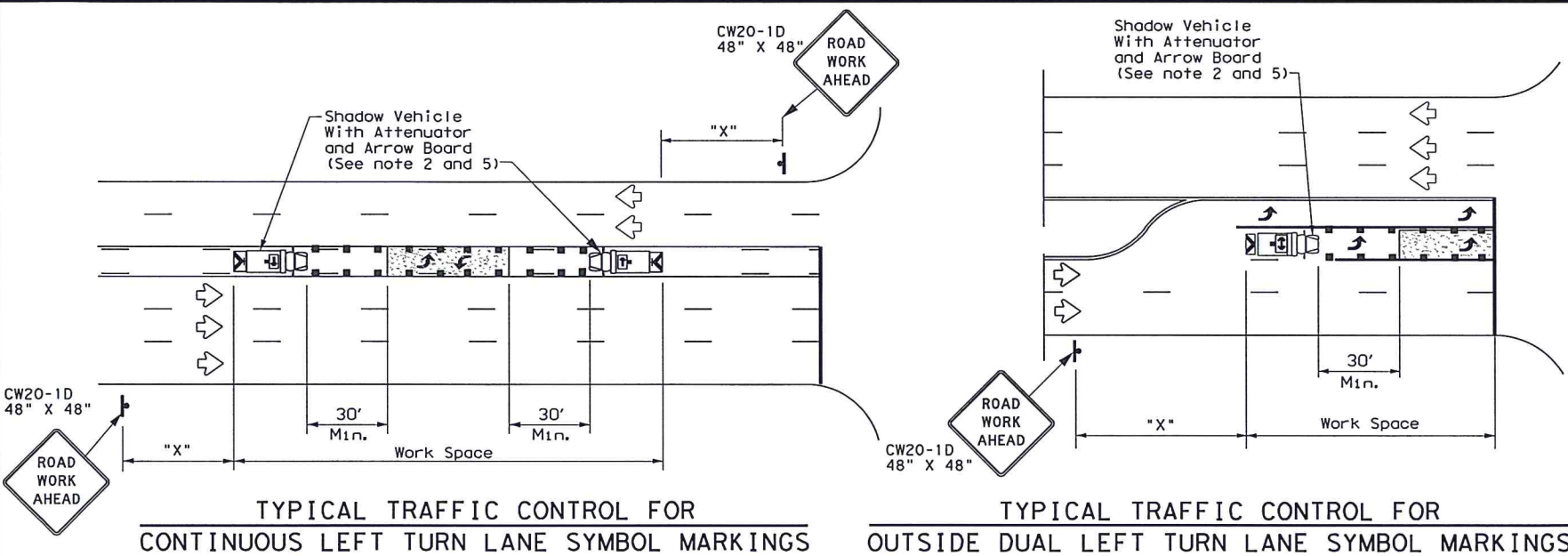


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LEGEND		
*	Trail Vehicle	ARROW BOARD DISPLAY
**	Shadow Vehicle	
***	Work Vehicle	RIGHT Directional
	Heavy Work Vehicle	LEFT Directional
	Truck Mounted Attenuator (TMA)	Double Arrow
	Traffic Flow	Channelizing Devices

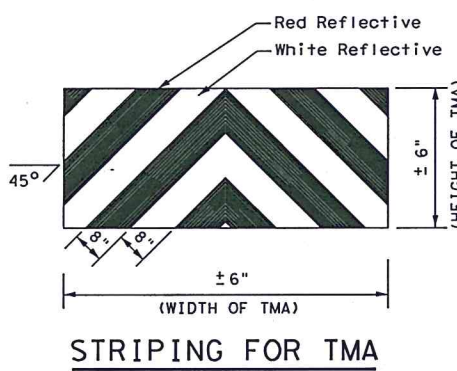
Posted Speed *	Formula	Minimum Desirable Taper Lengths **			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing "X" Distance	Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent		
30	$L = \frac{WS^2}{60}$	150'	165'	180'	30'	60'	120'	90'
35		205'	225'	245'	35'	70'	160'	120'
40		265'	295'	320'	40'	80'	240'	155'
45	L = WS	450'	495'	540'	45'	90'	320'	195'
50		500'	550'	600'	50'	100'	400'	240'
55		550'	605'	660'	55'	110'	500'	295'
60		600'	660'	720'	60'	120'	600'	350'
65		650'	715'	780'	65'	130'	700'	410'
70		700'	770'	840'	70'	140'	800'	475'
75		750'	825'	900'	75'	150'	900'	540'

\* Conventional Roads Only  
\*\* Taper lengths have been rounded off.  
L = Length of Taper (FT) W = Width of Offset (FT) S = Posted Speed (MPH)

TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### GENERAL NOTES

1. This traffic control plan is for use on conventional roads posted at 45 mph or less and is intended for mobile operations that move continuously or intermittently (stopping up to approximately 15 minutes) such as short-line striping and in-lane rumble strips. When activities are anticipated to take longer amounts of time or traffic conditions warrant, a short duration or short-term stationary traffic control plan should be used.
2. A Truck Mounted Attenuator shall be used on Shadow Vehicle. Striping on the back panel of all truck mounted attenuators shall be 8" red and white reflective sheeting placed in an inverted "V" design. Reflective sheeting shall meet or exceed the reflectivity and color requirements of departmental material specification DMS-8300, Type A.
3. All traffic control devices shall be in accordance with the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD), latest edition.
4. The use of yellow rotating beacons or strobe lights on vehicles are required. Blue high intensity rotating, flashing, oscillating or strobe lights when mounted on the drivers side of the vehicle may be operated simultaneously with the amber beacons or strobe lights.
5. Flashing arrow board shall be used on Shadow Vehicle. Flashing arrow board shall be Type B or Type C as per BC Standards. The arrow board operation shall be controlled from inside the truck.



**Texas Department of Transportation**

**Traffic Operations Division Standard**

**TRAFFIC CONTROL PLAN**  
**MOBILE OPERATIONS FOR**  
**ISOLATED WORK AREAS**  
**UNDIVIDED HIGHWAYS**  
**TCP (3-4) - 13**

FILE: tcp3-4.dgn	DW: TxDOT	CR: TxDOT	DW: TxDOT	CR: TxDOT
© TxDOT July, 2013	CONT	SECT	JOB	HIGHWAY
REVISIONS		DIST		SOUTH LAND
		COUNTY		SHEET NO.
		TOM GREEN		24

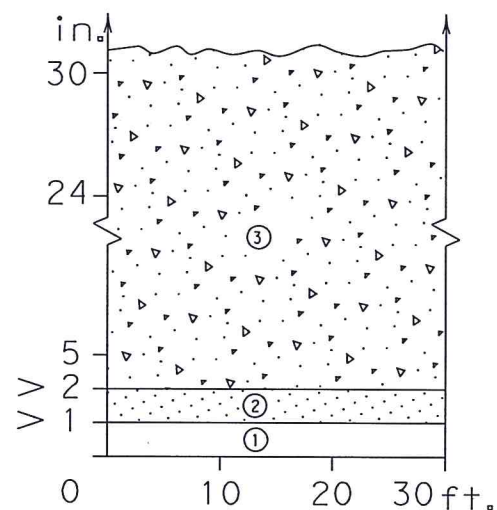


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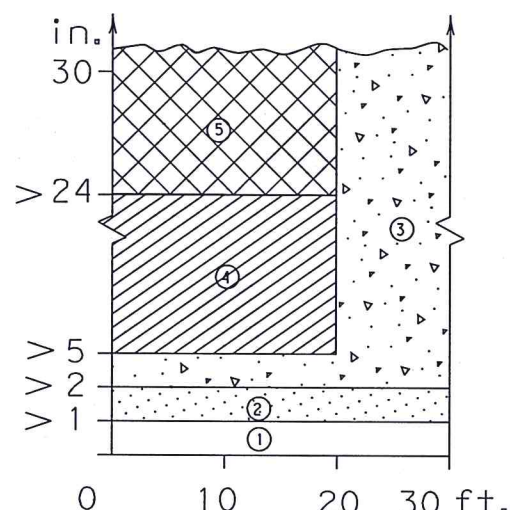
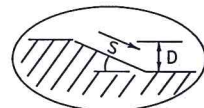
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## DEFINITION OF TREATMENT ZONES FOR VARIOUS EDGE CONDITIONS

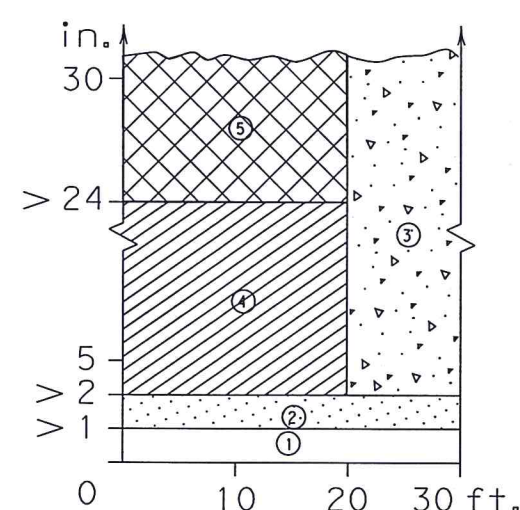
Edge Height (D) in Inches versus Lateral Clearance (Y) in Feet



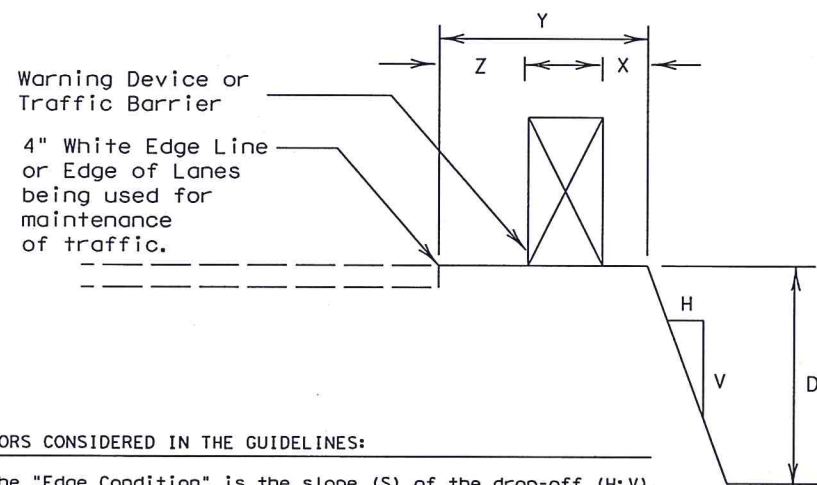
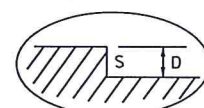
Edge Condition I  
 $S = (3:1)$  (or flatter)



Edge Condition II  
 $S = ((2.99):1)$  to  $(1:1)$



Edge Condition III  
 $S$  is steeper than  $(1:1)$



### FACTORS CONSIDERED IN THE GUIDELINES:

1. The "Edge Condition" is the slope ( $S$ ) of the drop-off ( $H:V$ ). The "Edge Height" is the depth of the drop-off " $D$ ".
2. Distance " $X$ " is to be the maximum practical under job conditions. Two feet minimum for high speed conditions. Distance " $Y$ " is the lateral clearance from edge of travel lane to edge of dropoff. Distance " $Z$ " does not have a minimum.
3. In addition to the factors considered in the guidelines, each construction zone drop-off situation should be analyzed individually, taking into account other variables, such as: traffic mix, posted speed in the construction zone, horizontal curvature, and the practicality of the treatment options.
4. The conditions for indicating the use of positive or protective barriers are given by Zone-5 and Figure-1. Traffic barriers are primarily applicable for high speed conditions. Urban areas with speeds of 30 mph or less may have a lesser need for signing, delineation, and barriers. Right-angled edges, however, with " $D$ " greater than 2 inches and located within a lateral offset of 6 feet, may indicate a higher level of treatment.
5. If the distance " $Y$ " must be less than 3 feet, the use of a positive barrier may not be feasible. In such a case, consider either: 1) narrowing the lanes to a desired 11 to 12 feet or 10 foot minimum (see CW20-8 sign), or 2) provide an edge slope such as Edge Condition I.

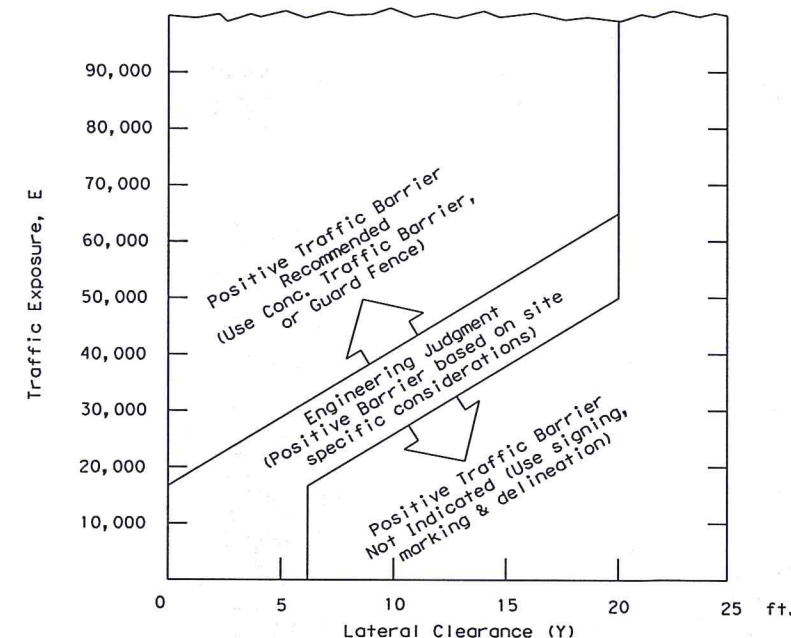
### Zone Treatment Types Guidelines:

- | Zone | Treatment Types Guidelines:   |
|------|---|
| ①    | No treatment.   |
| ②    | CW 8-11 "Uneven Lanes" signs.   |
| ③    | CW 8-9a "Shoulder Drop-Off" or CW 8-11 signs plus vertical panels.  |
| ④    | CW 8-9a or CW 8-11, signs plus drums. Where restricted space precludes the use of drums, use vertical panels. An edge fill may be provided to change the edge slope to that of the preferable Edge Condition I. |
| ⑤    | Check indications (Figure-1) for positive barrier. Where positive barrier is not indicated, the treatment shown above for Zone-4 may be used after consideration of other applicable factors.                   |

### Edge Condition Notes:

1. Edge Condition I: Most vehicles are able to traverse an edge condition with a slope rate of  $(3$  to  $1)$  or flatter. The slope must be constructed with a compacted material capable of supporting vehicles.
2. Edge Condition II: Most vehicles are able to traverse an edge condition with a slope between  $(2.99$  to  $1)$  and  $(1$  to  $1)$  so long as " $D$ " does not exceed 5 inches. Under-carriage drag on most automobiles will occur when " $D$ " exceeds 6 inches. As " $D$ " exceeds 24 inches, the possibility for rollover is greater in most vehicles.
3. Edge Condition III: When slopes are greater than  $(1$  to  $1)$  and where " $D$ " is greater than 2 inches, a more difficult control factor may exist for some vehicles, if not properly treated. For example, where " $D$ " is greater than 2 inches and up to 24 inches different types of vehicles may experience different steering control at different edge heights. Automobiles might experience more steering control differential when " $D$ " is greater than 2 inches and up to 5 inches. Trucks, particularly those with high loads, have more steering control differential when " $D$ " is greater than 5 inches and up to 24 inches. When " $D$ " exceeds 24 inches, the possibility of rollover is greater for most vehicles.
4. Milling or overlay operations that result in Edge Condition III should not be in place without appropriate warning treatments, and these conditions should not be left in place for extended periods of time.

FIGURE-1: CONDITIONS INDICATING USE OF POSITIVE BARRIER FOR ZONE 5 ( )



1  $E = ADT \times T$

Where ADT is that portion of the average daily traffic volume traveling within 20 feet (generally two adjacent lanes) of the edge dropoff condition; and, T is the duration time in years of the dropoff condition.

2 Figure-1 provides a practical approach to the use of positive barriers for the protection of vehicles from pavement drop-offs. Other factors, such as the presence of heavy machinery, construction workers, or the mix and volume of traffic may make the use of positive barriers appropriate, even when the edge condition alone may not justify the use of a barrier.

3 An approved end treatment should be provided for any positive barrier end located within a lateral offset of 20 feet from the edge of the travel lane.

These guidelines apply to temporary traffic control areas or work zones where continuous pavement edges or drop-offs exists parallel and adjacent to a lane used by traffic. The edge conditions may be present between shoulders and travel lanes, between adjacent or opposing travel lanes, or at intermediate points across the width of the paved surface. Due to the variability in construction operations, tolerances in the variables may be allowed by the engineer. These guidelines do not apply to short term operations. These guidelines do not constitute a rigid standard or policy; rather, they are guidance to be used in conjunction with engineering judgement. These guidelines may be updated on the Design Division's on-line manuals.



09/23/2016

Texas Department of Transportation  
Traffic Operations Division

## TREATMENT FOR VARIOUS EDGE CONDITIONS

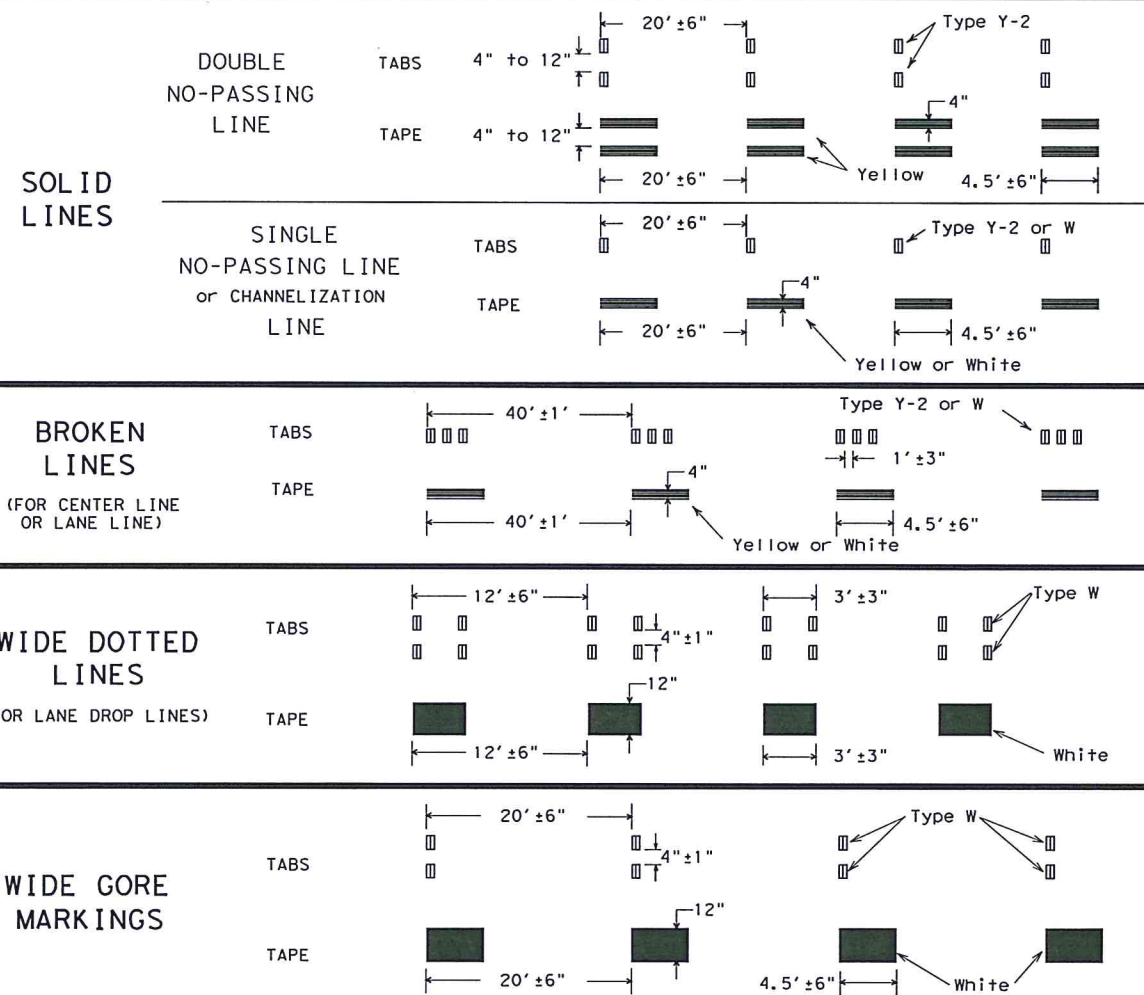
© TxDOT August 2000	DN: TXDOT	CK: TXDOT	DN: TXDOT	CK: TXDOT
REVISIONS	CONT	SECT	JOB	HIGHWAY
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08-01 correct typos	DIST	COUNTY		SHEET NO.
		TOM GREEN		25



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## WORK ZONE SHORT TERM PAVEMENT MARKINGS DETAILS



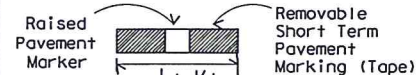
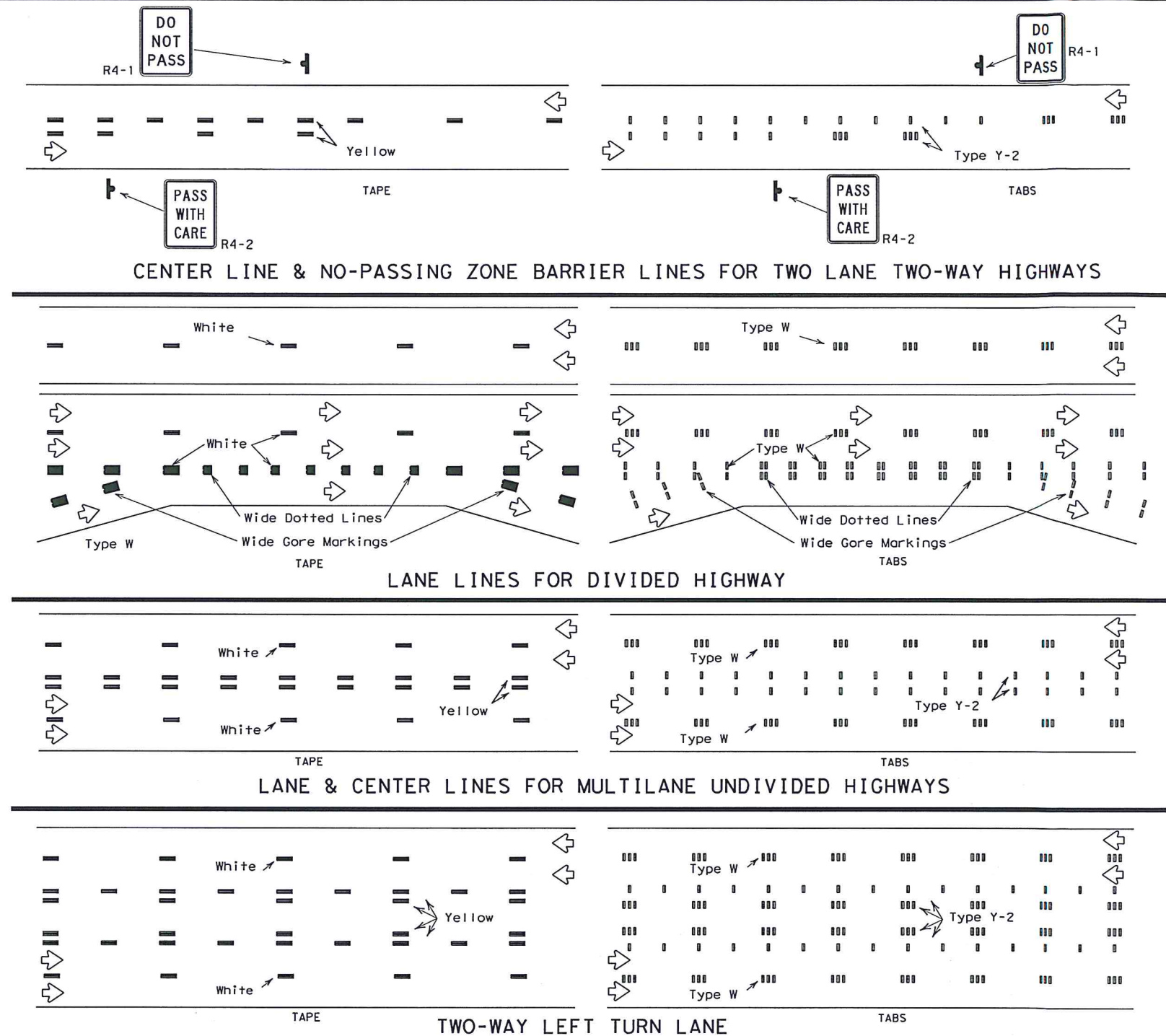
### NOTES:

- Short term pavement markings may be prefabricated markings (stick down tape) or temporary flexible-reflective roadway marker tabs unless otherwise specified elsewhere in plans.
- Short term pavement markings shall NOT be used to simulate edge lines.
- Dimensions indicated on this sheet are typical and approximate. Variations in size and height may occur between markers or devices made by manufacturers, by as much as 1/4 inch, unless otherwise noted.
- Temporary flexible-reflective roadway marker tabs will require normal maintenance replacement when used on roadways with an ADT per lane of up to 7500 vehicles with no more than 10% truck mix. When roadways exceed these values, additional maintenance replacement of devices should be planned.
- No segment of roadway open to traffic shall remain without permanent pavement markings for a period greater than 14 calendar days. The Contractor will be responsible for maintaining short term pavement markings until permanent pavement markings are in place. When the Contractor is responsible for placement of permanent pavement markings, no segment of roadway shall remain without permanent pavement markings for a period greater than 14 calendar days unless weather conditions prohibit placement. Permanent pavement markings shall be placed as soon as weather permits.
- For two lane, two-way roadways, DO NOT PASS signs shall be erected to mark the beginning of sections where passing is prohibited and PASS WITH CARE signs shall be erected to mark the beginning of sections where passing is permitted. Signs shall be in accordance with the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) and may be used to indicate the limits of no-passing zones for up to 14 calendar days. Permanent pavement markings should then be placed.
- For low volume two lane, two-way roadways of 4000 ADT or less, no-passing lines may be omitted when approved by the Engineer. DO NOT PASS and PASS WITH CARE signs shall be erected (see note 6).
- For exit gores where a lane is being dropped place wide gore markings or retroreflective channelizing devices to guide motorist through the exit. If channelizing devices are to be used it should be noted elsewhere in the plans. One piece cones are not allowed for this purpose.

### TEMPORARY FLEXIBLE, REFLECTIVE ROADWAY MARKER TABS (TABS)

- Temporary flexible-reflective roadway marker tabs detailed on this sheet will be designated Type Y-2 (two amber reflective surfaces with yellow body); Type Y (one amber reflective surface with yellow body); and Type W (one white or silver reflective surface with white body). Additional details may be found on BC(11).
- Tabs shall meet requirements of Departmental Material Specification DMS-8242.
- When dry, tabs shall be visible for a minimum distance of 200 feet during normal daylight hours and when illuminated by automobile low-beam head light at night, unless sight distance is restricted by roadway geometrics.
- No two consecutive tabs nor four tabs per 1000 feet of line shall be missing or fail to meet the visual performance requirements of Note 3.

## WORK ZONE SHORT TERM PAVEMENT MARKINGS PATTERNS



If raised pavement markers are used to supplement REMOVABLE short term markings, the markers shall be applied to the top of the tape at the approximate mid length of the tape. This allows an easier removal of raised markers and tape.

### PREFABRICATED PAVEMENT MARKINGS

- Temporary Removable Prefabricated Pavement Markings shall meet the requirements of DMS-8241.
- Non-removable Prefabricated Pavement Markings shall meet the requirements of either DMS-8240 "Permanent Prefabricated Pavement Markings" or DMS-8243 "Temporary Construction-Grade Prefabricated Pavement Markings."

### RAISED PAVEMENT MARKERS

- All raised pavement markers used for work zone markings shall meet the requirements of Item 672, "RAISED PAVEMENT MARKERS" and DMS-4200.

### DEPARTMENTAL MATERIAL SPECIFICATIONS (DMS) & MATERIAL PRODUCER LISTS (MPL)

- DMSs referenced above can be found along with embedded links to their respective MPLs at the following website:  
[http://www.txdot.gov/business/contractors\\_consultants/material\\_specifications/default.htm](http://www.txdot.gov/business/contractors_consultants/material_specifications/default.htm)



## WORK ZONE SHORT TERM PAVEMENT MARKINGS

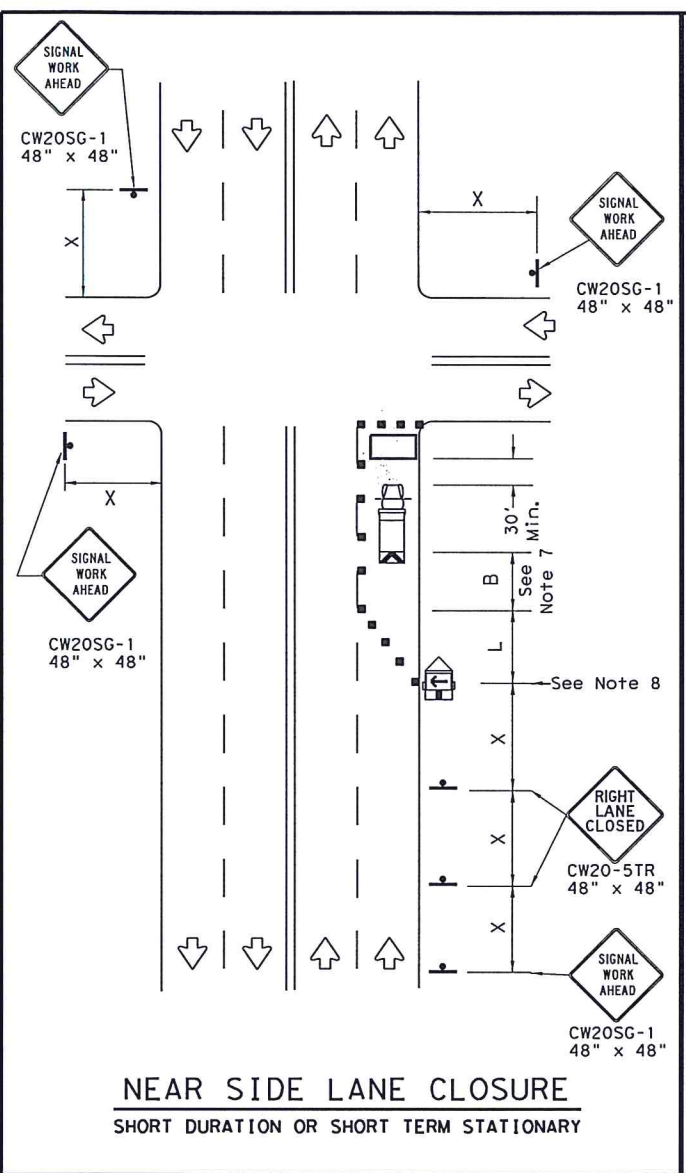
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3-03		DIST	COUNTY	SHEET NO.
7-13			TOM GREEN	26

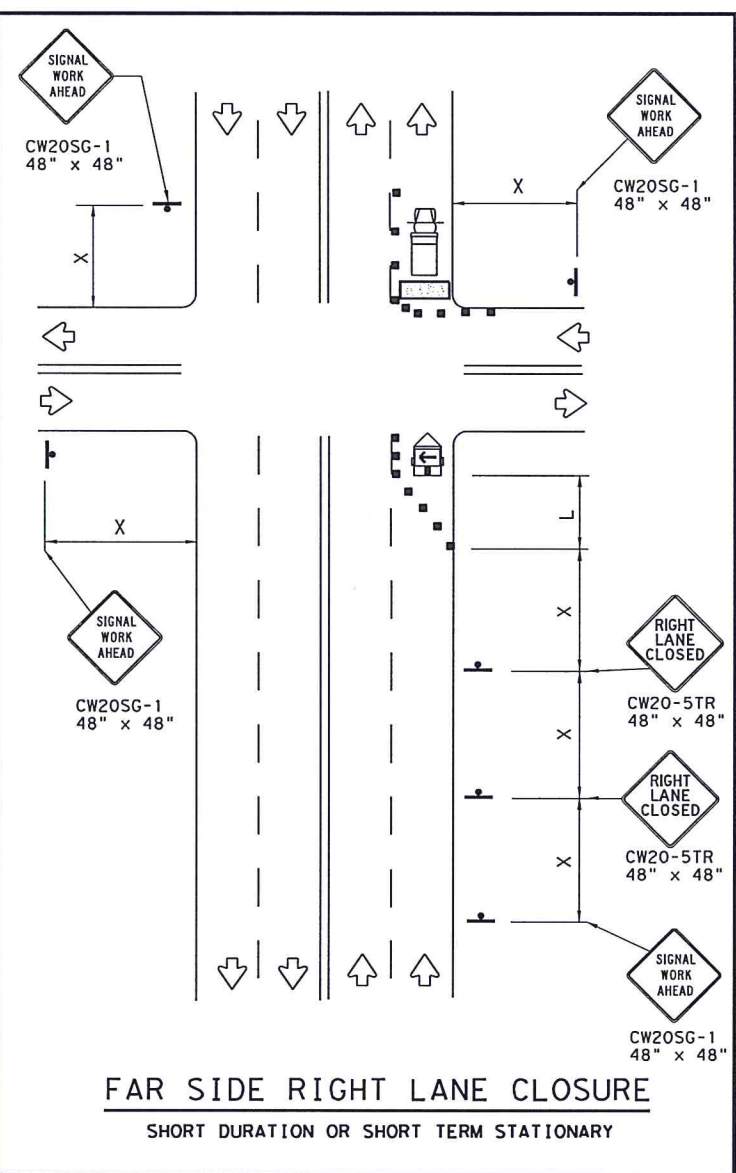


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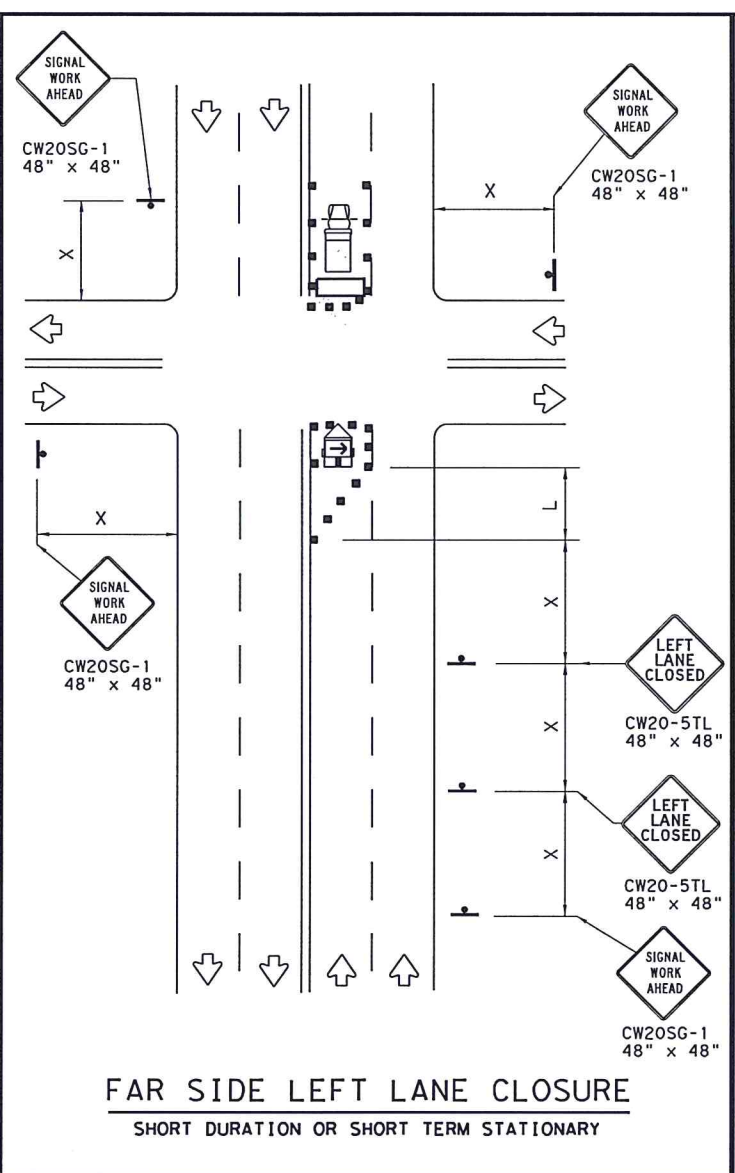
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NEAR SIDE LANE CLOSURE  
SHORT DURATION OR SHORT TERM STATIONARY



FAR SIDE RIGHT LANE CLOSURE  
SHORT DURATION OR SHORT TERM STATIONARY



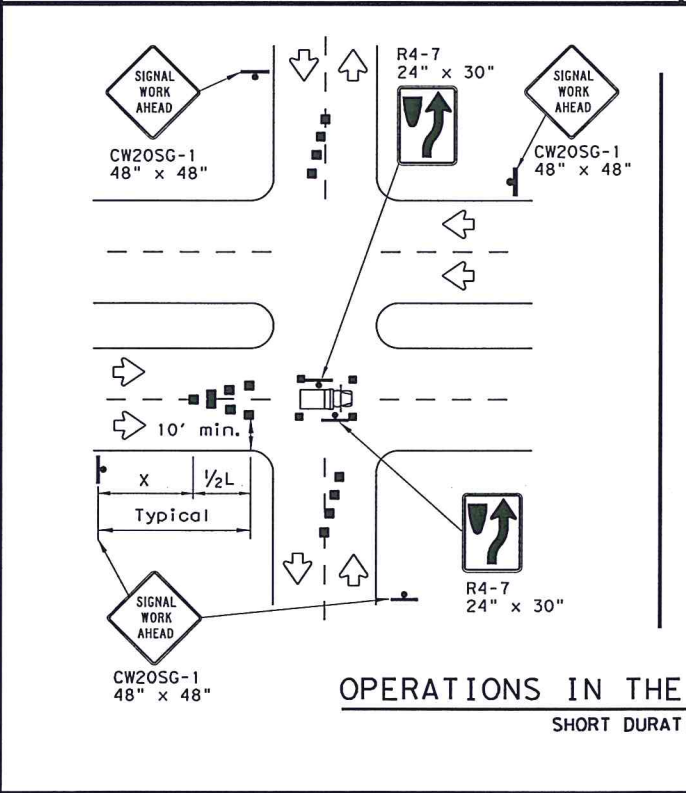
FAR SIDE LEFT LANE CLOSURE  
SHORT DURATION OR SHORT TERM STATIONARY

LEGEND			
	Type 3 Barricade		Channelizing Devices
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)
	Trailer Mounted Flashing Arrow Board		Portable Changeable Message Sign (PCMS)
	Sign		Traffic Flow
	Flag		Flagger

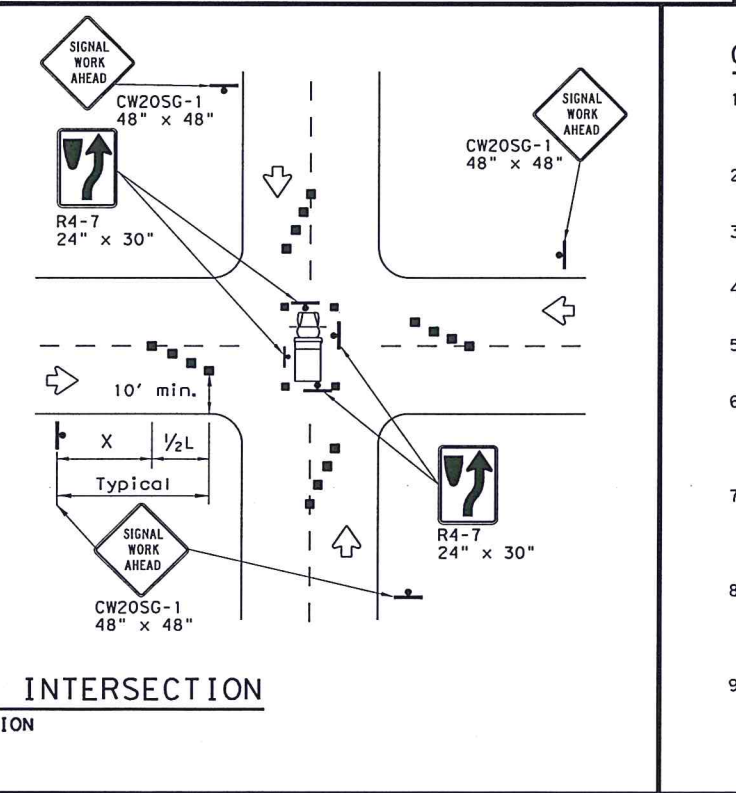
Posted Speed *	Formula	Minimum Desirable Taper Lengths **			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing "X" Distance	Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent		
30	$L = \frac{WS^2}{60}$	150'	165'	180'	30'	60'	120'	90'
35		205'	225'	245'	35'	70'	160'	120'
40		265'	295'	320'	40'	80'	240'	155'
45	L = WS	450'	495'	540'	45'	90'	320'	195'
50		500'	550'	600'	50'	100'	400'	240'
55		550'	605'	660'	55'	110'	500'	295'
60		600'	660'	720'	60'	120'	600'	350'
65		650'	715'	780'	65'	130'	700'	410'
70		700'	770'	840'	70'	140'	800'	475'
75		750'	825'	900'	75'	150'	900'	540'

\* Conventional Roads Only  
\*\* Taper lengths have been rounded off.  
L=Length of Taper (FT) W=Width of Offset (FT) S=Posted Speed (MPH)

WORKERS IN BUCKET TRUCKS SHALL NOT WORK ABOVE OPEN LANES OF TRAFFIC.



OPERATIONS IN THE INTERSECTION  
SHORT DURATION



GENERAL NOTES

- The minimum size channelizing device is the 28" cone. 42" Two-piece cones, drums, vertical panels or barricades will be required when the device must be left unattended at night.
- Obstructions or hazards at the work area shall be clearly marked and delineated at all times.
- Flaggers and Flagger Symbol (CW20-7) signs may be required according to field conditions.
- Vehicles parked in roadway shall be equipped with at least two high intensity rotating, flashing, oscillating or strobe type lights.
- High level warning devices (flag trees) may be used at corners of the vehicle.
- When work operations are performed on existing signals, the signals may be placed in flashing red mode when approved by the engineer. If existing signals do not have power, All-Way Stop (R1-1 and R1-3P) signs may be implemented when approved by the engineer.
- For Short-Term Stationary work the buffer space "B" from the above table should be used if field conditions permit. For Short Duration (less than 1 hour) any buffer space provided will enhance the safety of the setup.
- The arrow board at this location may be omitted for Short Duration work if the work vehicle has an arrow board in operation. As an option, the arrow board may be placed at the end of the taper in the closed lane if space is not available at the beginning of the taper.
- Signs and devices for the NEAR SIDE LANE CLOSURE may be altered for a left lane closure by using a LEFT LANE CLOSED (CW20-5TL) and adding channelizing devices on the centerline to protect the work space from opposing traffic.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC SIGNAL WORK  
TYPICAL DETAILS

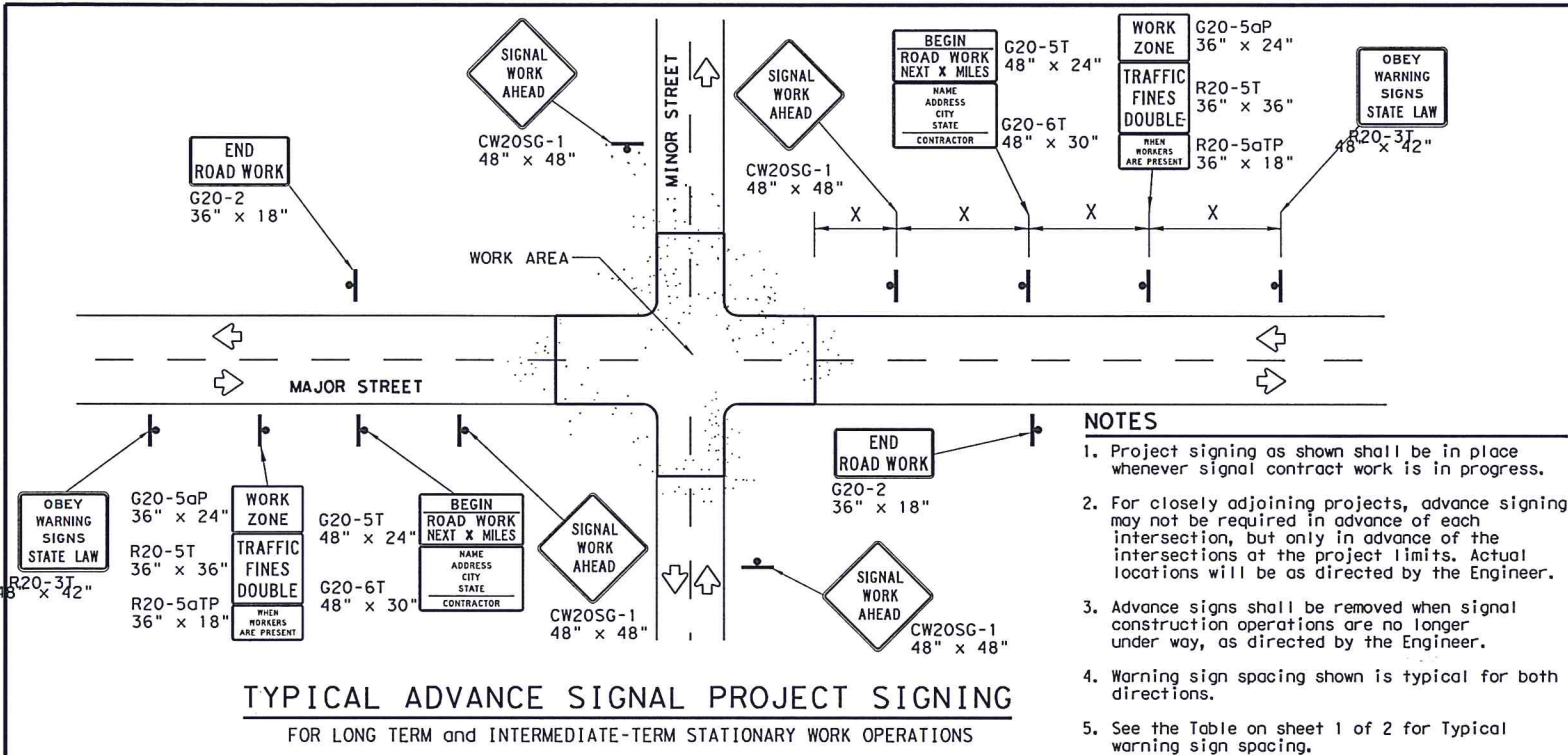
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4-98 3-03		TOM GREEN		27



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- NOTES**
1. Project signing as shown shall be in place whenever signal contract work is in progress.
  2. For closely adjoining projects, advance signing may not be required in advance of each intersection, but only in advance of the intersections at the project limits. Actual locations will be as directed by the Engineer.
  3. Advance signs shall be removed when signal construction operations are no longer under way, as directed by the Engineer.
  4. Warning sign spacing shown is typical for both directions.
  5. See the Table on sheet 1 of 2 for Typical warning sign spacing.

#### GENERAL NOTES FOR WORK ZONE SIGNS

1. Signs shall be installed and maintained in a straight and plumb condition.
2. Wooden sign posts shall be painted white.
3. Barricades shall NOT be used as sign supports.
4. Nails shall NOT be used to attach signs to any support.
5. All signs shall be installed in accordance with the plans or as directed by the Engineer.
6. The Contractor shall furnish the sign design shown in the plans or in the "Standard Highway Sign Designs for Texas" (SHSD).
7. The Contractor shall furnish sign supports and substrates listed in the "Compliant Work Zone Traffic Control Device List" (CWZTCD), installed as per the manufacturer's recommendations.
8. Temporary signs that have damaged or cracked substrates and/or damaged or marred reflective sheeting shall be replaced as directed by the Engineer.
9. Identification markings may be shown only on the back of the sign substrate. The maximum height of letters and/or company logos used for identification shall be 1".
10. Damaged wood posts shall be replaced. Splicing wood posts will not be allowed.

#### DURATION OF WORK

1. Work zone durations are defined in Part 6, Section 6G.02 of the Texas Manual on Uniform Traffic Control Devices (TMUTCD).

#### SIGN MOUNTING HEIGHT

1. Sign height of Long-term/Intermediate-term warning signs shall be as shown on Figure 6F-1 of the TMUTCD.
2. Sign height of Short-term/Short Duration warning signs shall be as shown on Figure 6F-2 of the TMUTCD.
3. Regulatory signs shall be mounted at least 7 feet, but not more than 9 feet, above the paved surface regardless of work duration.

#### REMOVING OR COVERING

1. When sign messages may be confusing or do not apply, the signs shall be removed or completely covered, unless otherwise approved by the Engineer.
2. When signs are covered, the material used shall be opaque, such as heavy mil black plastic, or other materials which will cover the entire sign face and maintain their opaque properties under automobile headlights at night without damaging the sign sheeting. Burlap, or heavy materials such as plywood or aluminum shall not be used to cover signs.
3. Duct tape or other adhesive material shall NOT be affixed to a sign face.
4. Signs and anchor stubs shall be removed and holes back filled upon completion of the work.

#### REFLECTIVE SHEETING

1. All signs shall be retroreflective and constructed of sheeting meeting the requirements of the DMS and color usage table shown on this sheet.

#### SIGN SUPPORT WEIGHTS

1. Weights used to keep signs from turning over should be sandbags filled with dry, cohesionless material.
2. The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight.
3. Rock, concrete, iron, steel or other solid objects will not be permitted for use as sign support weights.
4. Sandbags should weigh a minimum of 35 lbs and a maximum of 50 lbs.
5. Sandbags shall be made of a durable material that tears upon vehicular impact. Rubber, such as tire inner tubes, shall not be used.
6. Rubber ballasts designed for channelizing devices should not be used for ballast on portable sign supports. Sign supports designed and manufactured with rubber bases may be used when shown on the CWZTCD list.
7. Sandbags shall only be placed along or laid over the base supports of the traffic control device and shall not be suspended above ground level or hung with rope, wire, chains or other fasteners. Sandbags shall be placed along the length of the skids to weigh down the sign support.
8. Sandbags shall NOT be placed under the skid and shall not be used to level sign supports placed on slopes.

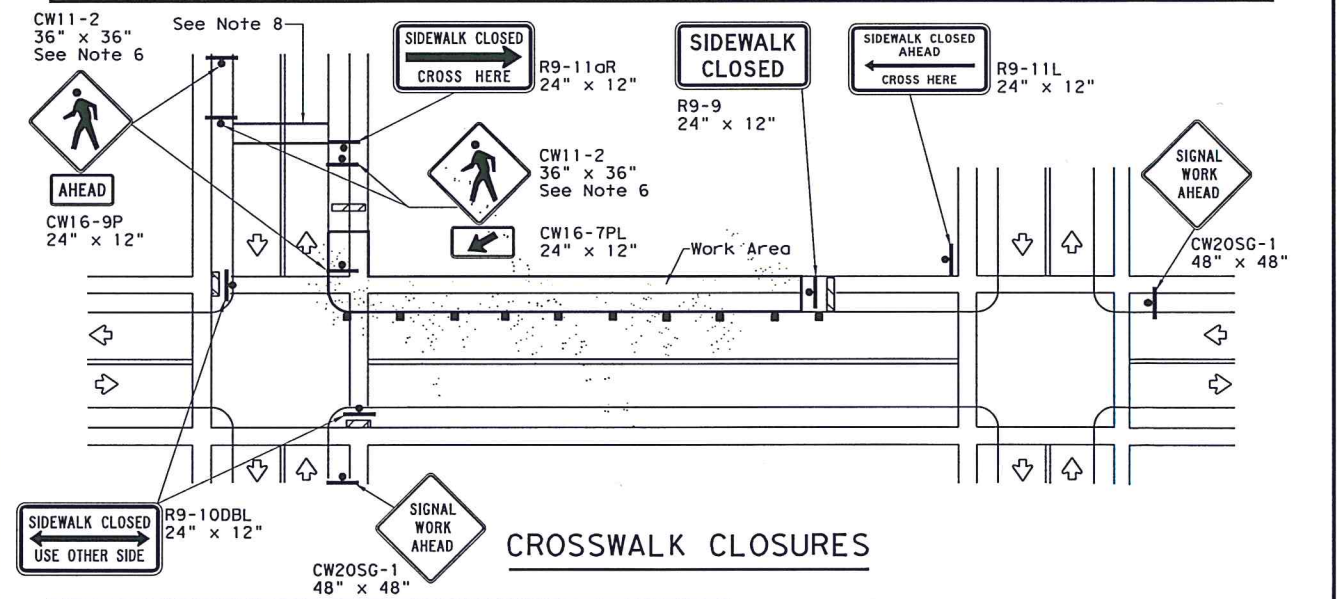
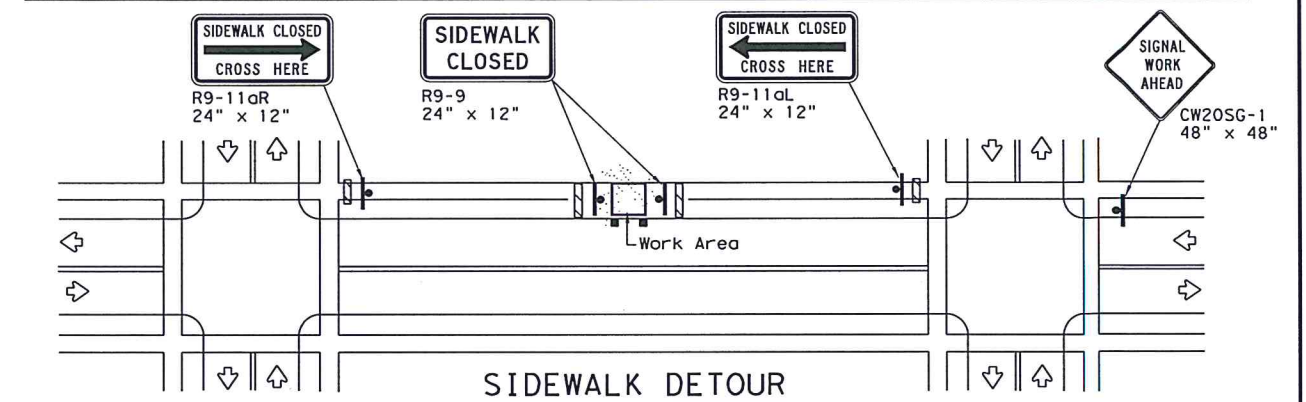
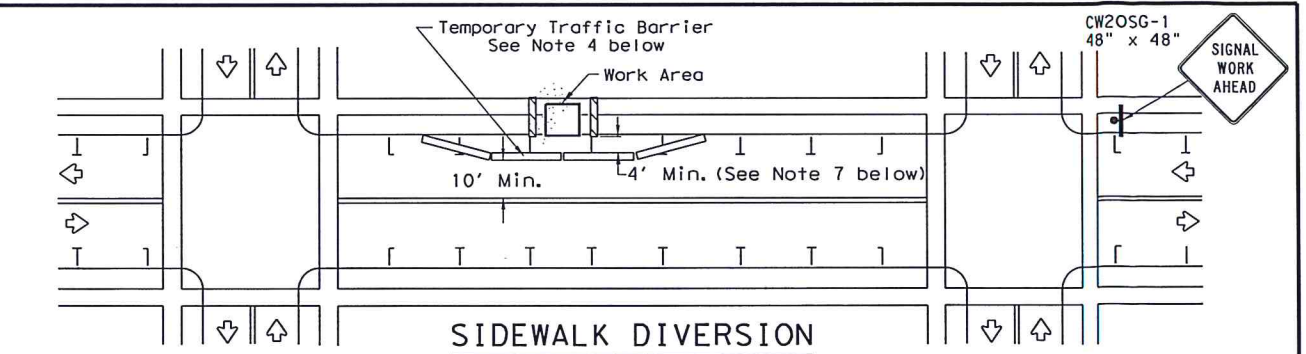
LEGEND	
	Sign
	Channelizing Devices
	Type 3 Barricade

#### DEPARTMENTAL MATERIAL SPECIFICATIONS

SIGN FACE MATERIALS	DMS-8300
FLEXIBLE ROLL-UP REFLECTIVE SIGNS	DMS-8310

COLOR	USAGE	SHEETING MATERIAL
ORANGE	BACKGROUND	TYPE B <sub>FL</sub> OR TYPE C <sub>FL</sub> SHEETING
WHITE	BACKGROUND	TYPE A SHEETING
BLACK	LEGEND & BORDERS	ACRYLIC NON-REFLECTIVE SHEETING

Only pre-qualified products shall be used. A copy of the "Compliant Work Zone Traffic Control Devices List" (CWZTCD) describes pre-qualified products and their sources and may be found at the following web address:  
[http://www.txdot.gov/txdot\\_library/publications/construction.htm](http://www.txdot.gov/txdot_library/publications/construction.htm)



#### PEDESTRIAN CONTROL

1. Holes, trenches or other hazards shall be adequately protected by covering, delineating or surrounding the hazard with orange plastic pedestrian fencing or longitudinal channelizing devices, or as directed by the Engineer.
2. "CROSSWALK CLOSURES" as detailed above will require the Engineer's approval prior to installation.
3. R9 series signs shown may be placed on supports detailed on the BC standards or CWZTCD list, or when fabricated from approved lightweight plastic substrates, they may be mounted on top of a plastic drum at or near the location shown.
4. For speeds less than 45 mph longitudinal channelizing devices may be used instead of traffic barriers when approved by the Engineer. Attenuation of blunt ends and installation of water filled devices shall be as per BC(9) and manufacturer's recommendations.
5. Location of devices are for general guidance. Actual device spacing and location must be field adjusted to meet actual conditions.
6. Where pedestrians with visual disabilities normally use the closed sidewalk Detectable Pedestrian Barricades should be used instead of the Type 3 Barricades shown.
7. The width of existing sidewalk should be maintained if practical.
8. Pavement markings for mid-block crosswalks shall be paid for under the appropriate bid items.
9. When crosswalks or other pedestrian facilities are closed or relocated, temporary facilities shall be detectable and shall include accessibility features consistent with the features present in the existing pedestrian facility.

SHEET 2 OF 2

Texas Department of Transportation

Traffic Operations Division Standard

## TRAFFIC SIGNAL WORK BARRICADES AND SIGNS

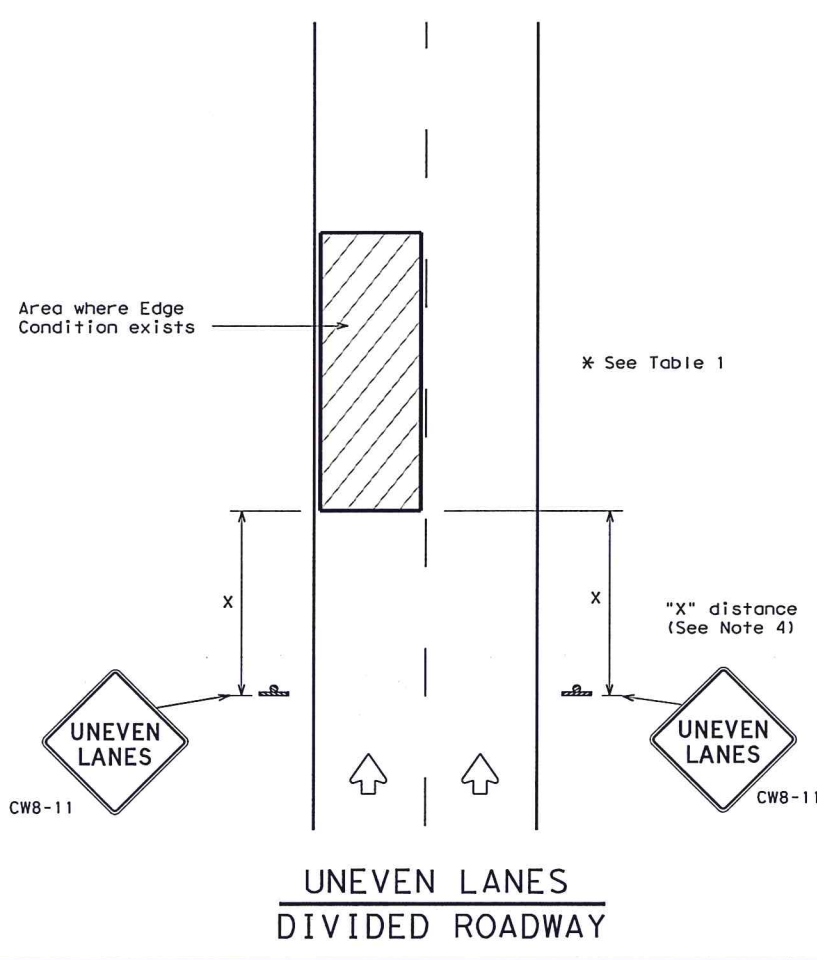
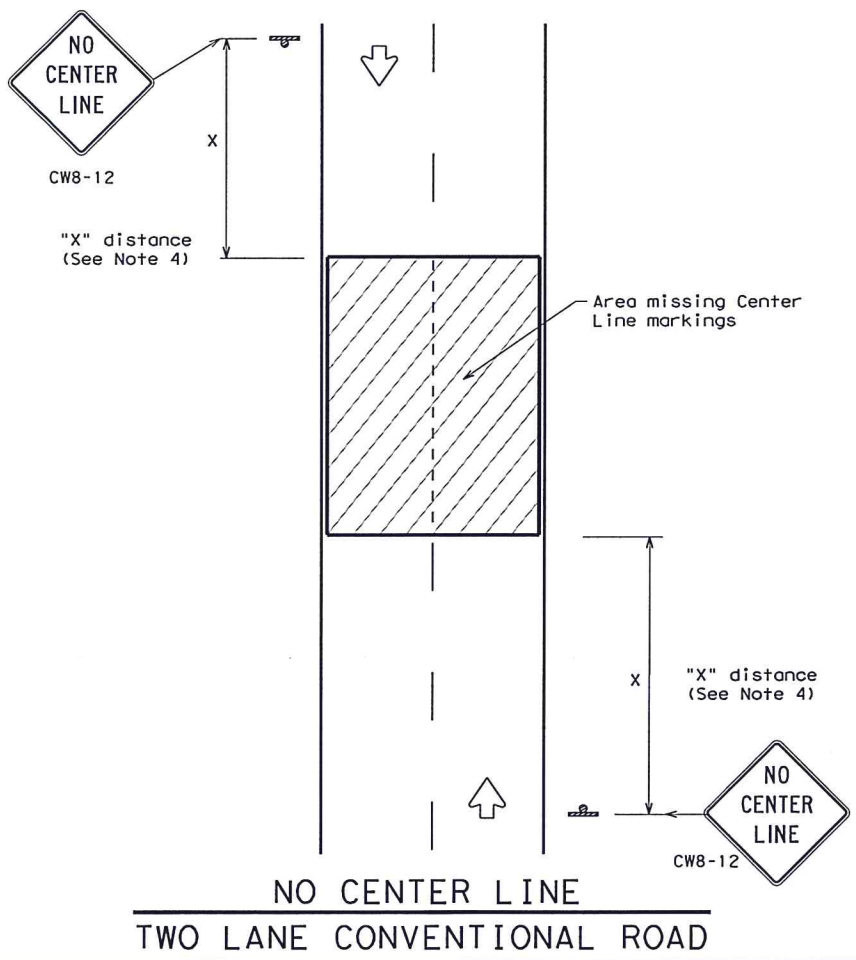
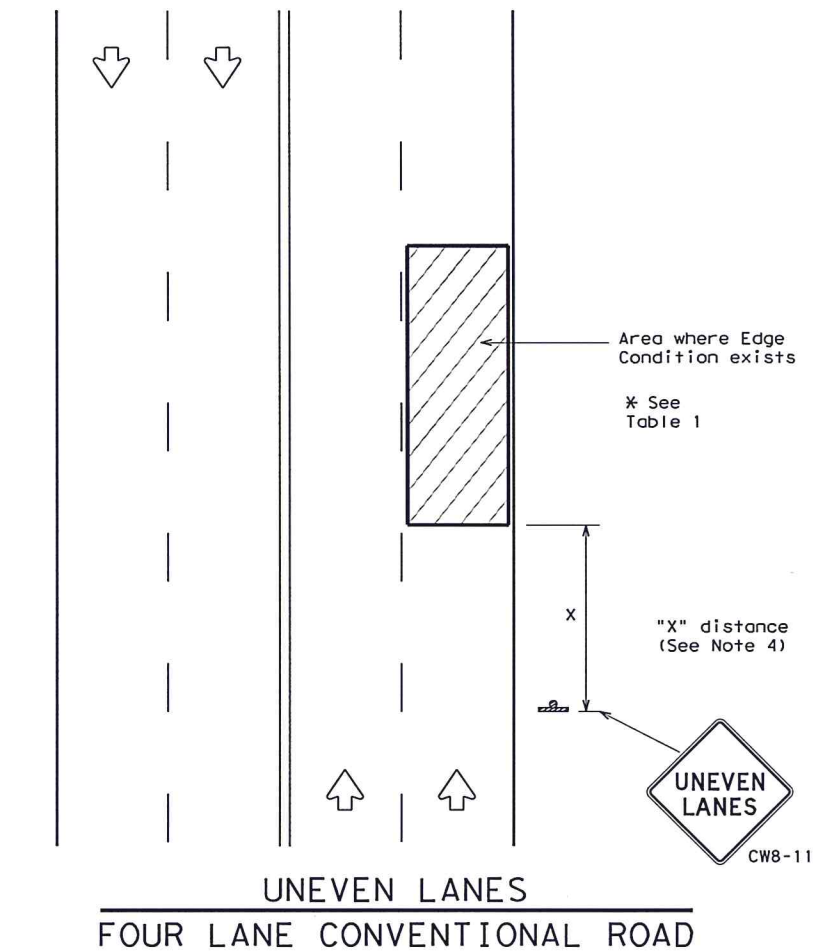
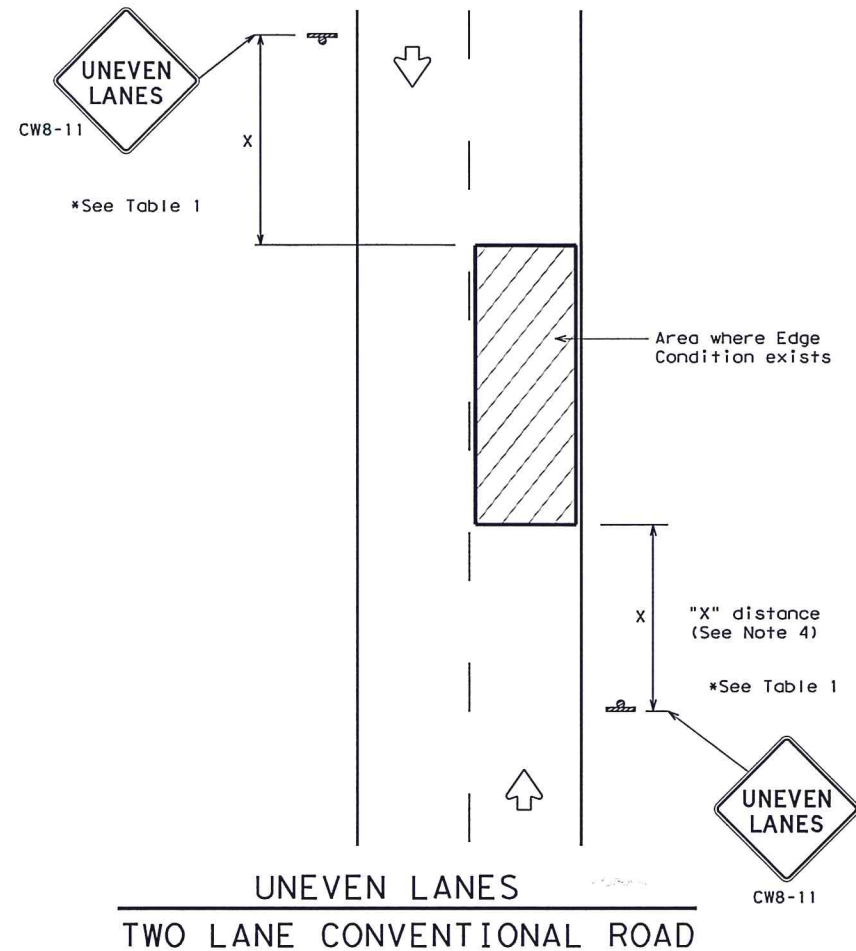
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© TxDOT	April 1992	CONT:	SECT	JOB:	HIGHWAY:				
REVISIONS				SOUTHLAND					
2-98	10-99	7-13	DIST:	COUNTY:	SHEET NO.				
4-98	3-03			TOM GREEN	28				



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DEPARTMENTAL MATERIAL SPECIFICATIONS	
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240
TEMPORARY (REMOVABLE) PREFABRICATED PAVEMENT MARKINGS	DMS-8241
SIGN FACE MATERIALS	DMS-8300

COLOR	USAGE	SHEETING MATERIAL
ORANGE	BACKGROUND	TYPE B <sub>FL</sub> OR TYPE C <sub>FL</sub> SHEETING
BLACK	LEGEND & BORDERS	ACRYLIC NON-REFLECTIVE SHEETING


#### GENERAL NOTES

- If spalling or holes occur, ROUGH ROAD (CW8-8) signs should be placed in advance of the condition and be repeated every two miles where the condition persists.
- UNEVEN LANES (CW8-11) signs shall be installed in advance of the condition and repeated every mile. Signs installed along the uneven lane condition may be supplemented with the NEXT XX MILES (CW7-3aP) plaque or Advisory Speed (CW13-1P) plaque.
- NO CENTER LINE (CW8-12) signs and temporary pavement markings as per the WZ(STPM) standard shall be installed if yellow centerlines separating two way traffic are obscured or obliterated. Repeat NO CENTER LINE signs every two miles where the center line markings are not in place. The signs and markings shall remain in place until permanent pavement markings are installed.
- Signs shall be spaced at the distances recommended as per BC standards.
- Additional signs may be required as directed by the Engineer. Signs shall remain in place until final surface is applied. Signs shall be considered subsidiary to Item 502 "BARRICADES, SIGNS AND TRAFFIC HANDLING."
- Signs shall be fabricated and mounted on supports as shown on the BC standards and/or listed on the "Compliant Work Zone Traffic Control Devices" list.
- Short term markings shall not be used to simulate edge lines.
- All signs shall be constructed in accordance with the details found in the "Standard Highway Sign Designs for Texas," latest edition.

TABLE 1		
Edge Condition	Edge Height (D)	* Warning Devices
①	Less than or equal to: 1 1/4" (maximum-planing) 1 1/2" (typical-overlay)	Sign: CW8-11
②	Less than or equal to 3"	Sign: CW8-11
③	Distance "D" may be a maximum of 3" if uneven lanes with edge condition 2 or 3 are open to traffic after work operations cease. Uneven lanes should not be open to traffic when "D" is greater than 3".	

TRAFFIC CONTROL DURING PLANING,  
OVERLAY AND LEVELING OPERATIONS  
ARE SHOWN ELSEWHERE IN THE PLANS.

MINIMUM WARNING SIGN SIZE	
Conventional roads	36" x 36"
Freeways/expressways, divided roadways	48" x 48"

**Texas Department of Transportation**

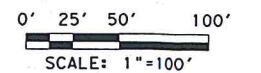
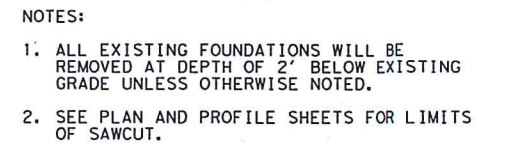
**Traffic Operations Division Standard**

**SIGNING FOR  
UNEVEN LANES**

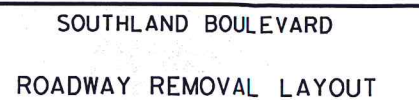
**WZ (UL) - 13**

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© TxDOT April 1992	CONT	SECT	JOB	HIGHWAY
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8-95 2-98 7-13	DIST	COUNTY		SHEET NO.
1-97 3-03		TOM GREEN		29

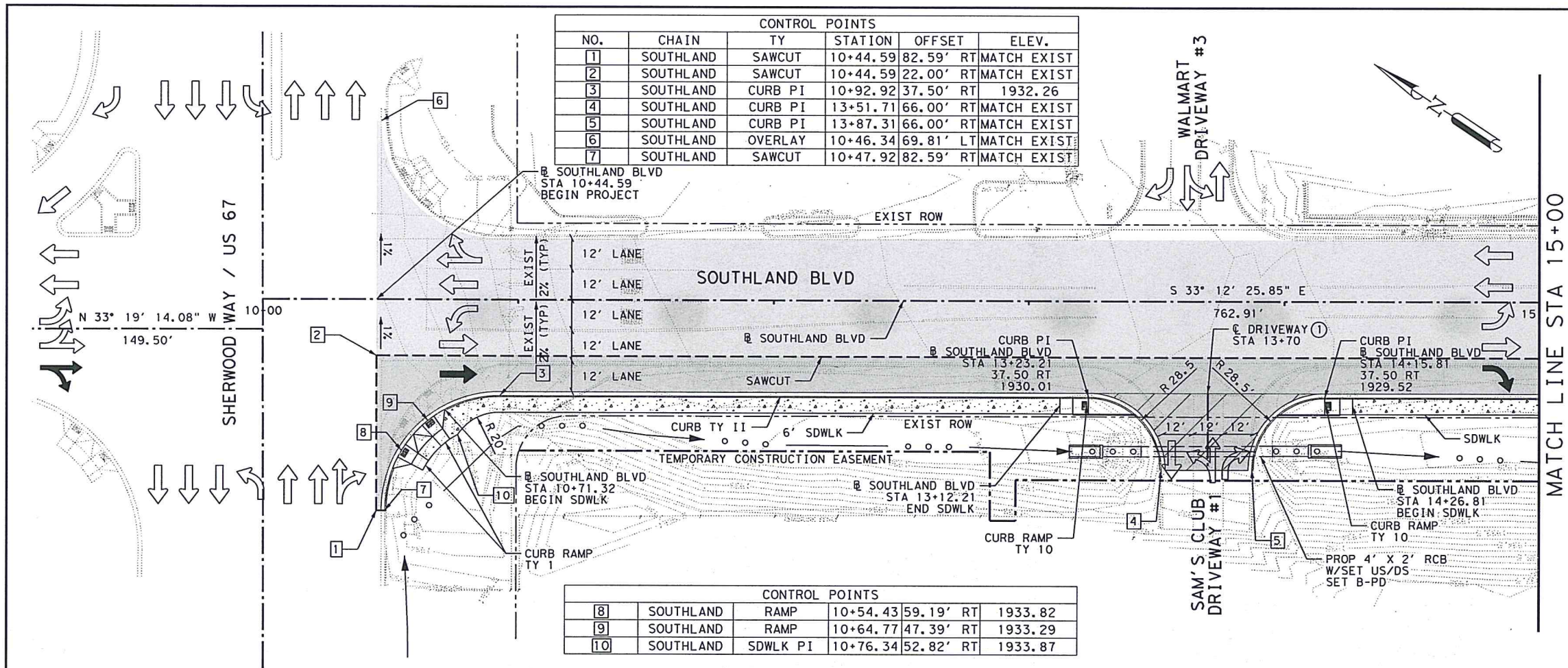




**LJA Engineering, Inc.**   
FRN-F-1386





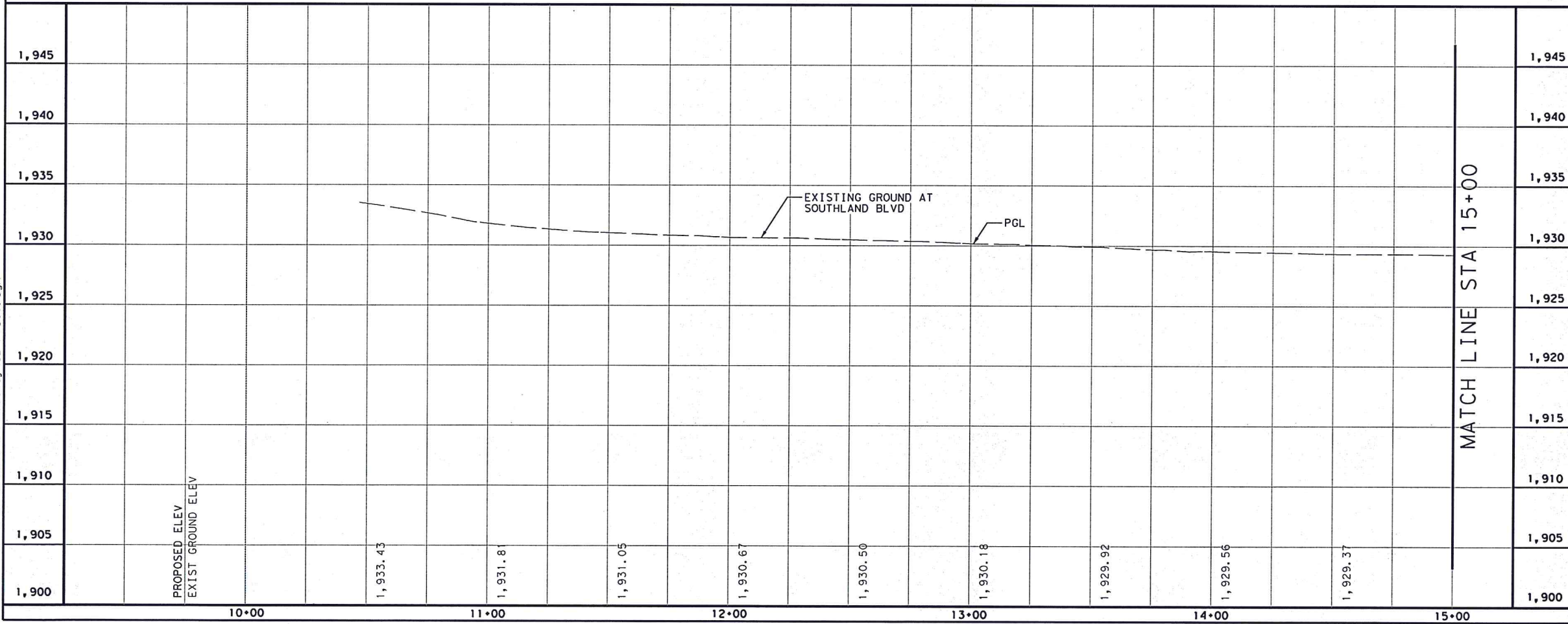


**LEGEND**

- PROPOSED TRAFFIC DIRECTION ARROW
- EXISTING TRAFFIC DIRECTION ARROW
- PROPOSED FULL DEPTH PAVEMENT
- PROPOSED CONC. DRIVEWAY
- PROPOSED SIDEWALK
- PROPOSED OVERLAY/INLAY
- HORIZONTAL CURVE (XXX-X)
- SAWCUT
- DRIVEWAY NUMBER (X)

**NOTES:**

- ALL CALLOUTS ARE TO FACE OF CURB UNLESS OTHERWISE NOTED
- REFER TO DRAINAGE SHEETS
- REFER TO DRIVEWAY DETAILS FOR CULVERT INFORMATION



09/23/2016

STATE OF TEXAS  
MICHAEL C. COYLE  
95634  
LICENSED PROFESSIONAL ENGINEER

0' 25' 50'  
SCALE: 1"=50'- HORZ  
1"=10'- VERT

REV. NO.	DATE	DESCRIPTION	BY

**LJA Engineering, Inc.**  
FRN - F-1386

THE CITY OF SAN ANGELO  
TEXAS

**SOUTHLAND BOULEVARD  
INTERSECTION  
PLAN AND PROFILE**

SHEET 1 OF 2

31

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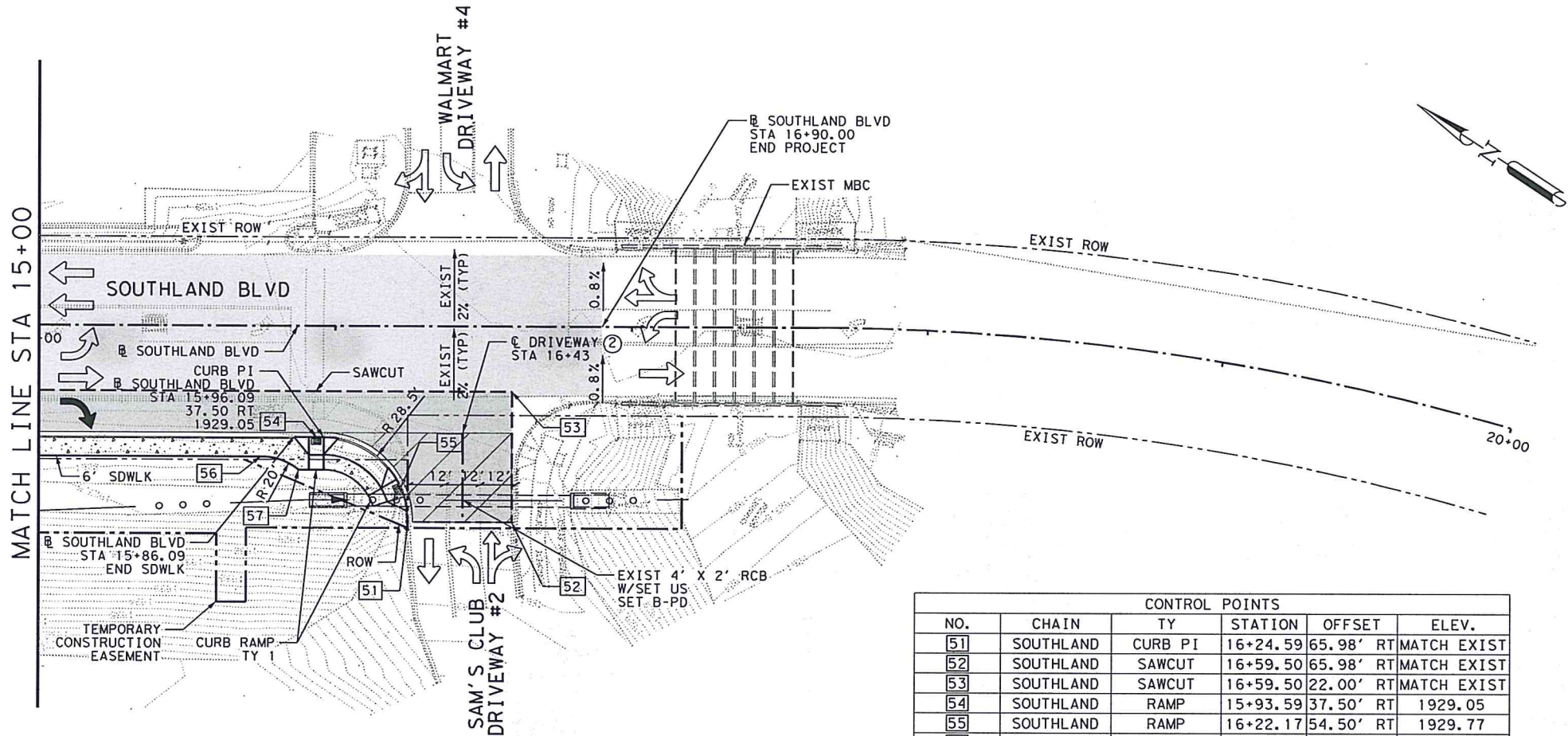


LEGEND

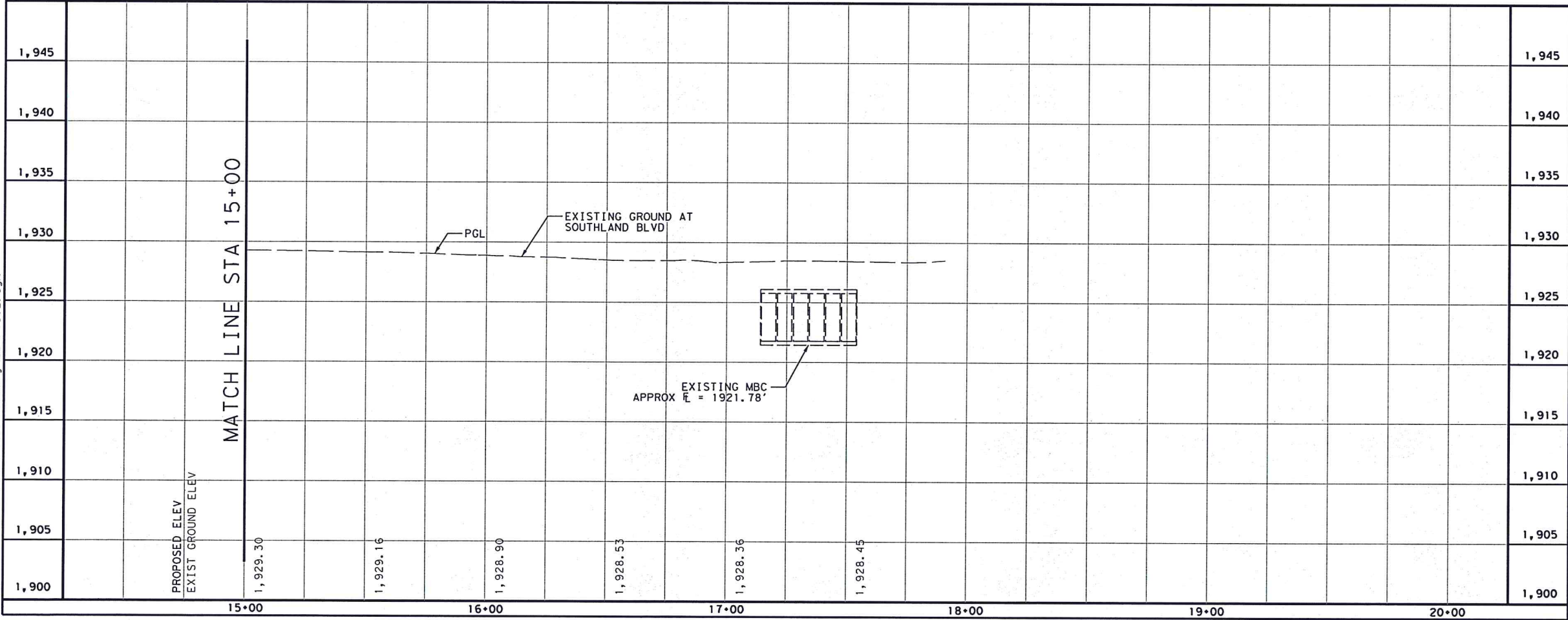
- PROPOSED TRAFFIC DIRECTION ARROW
- EXISTING TRAFFIC DIRECTION ARROW
- PROPOSED FULL DEPTH PAVEMENT
- PROPOSED CONC. DRIVEWAY
- PROPOSED SIDEWALK
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- DRIVEWAY NUMBER

NOTES:

- 1. ALL CALLOUTS ARE TO FACE OF CURB UNLESS OTHERWISE NOTED
- 2. REFER TO DRAINAGE SHEETS
- 3. REFER TO DRIVEWAY DETAILS FOR CULVERT INFORMATION



CONTROL POINTS						
NO.	CHAIN	TY	STATION	OFFSET		ELEV.
51	SOUTHLAND	CURB PI	16+24.59	65.98'	RT	MATCH EXIST
52	SOUTHLAND	SAWCUT	16+59.50	65.98'	RT	MATCH EXIST
53	SOUTHLAND	SAWCUT	16+59.50	22.00'	RT	MATCH EXIST
54	SOUTHLAND	RAMP	15+93.59	37.50'	RT	1929.05
55	SOUTHLAND	RAMP	16+22.17	54.50'	RT	1929.77
56	SOUTHLAND	SDWLK PI	15+75.00	44.00'	RT	1929.71
57	SOUTHLAND	SDWLK PI	15+87.64	48.50'	RT	1929.63



0' 25' 50'  
SCALE: 1"=50'- HORZ  
1"=10'- VERT

REV. NO. DATE DESCRIPTION BY  
**LJA Engineering, Inc.**  
FRN - F-1386



SOUTHLAND BOULEVARD  
INTERSECTION  
PLAN AND PROFILE

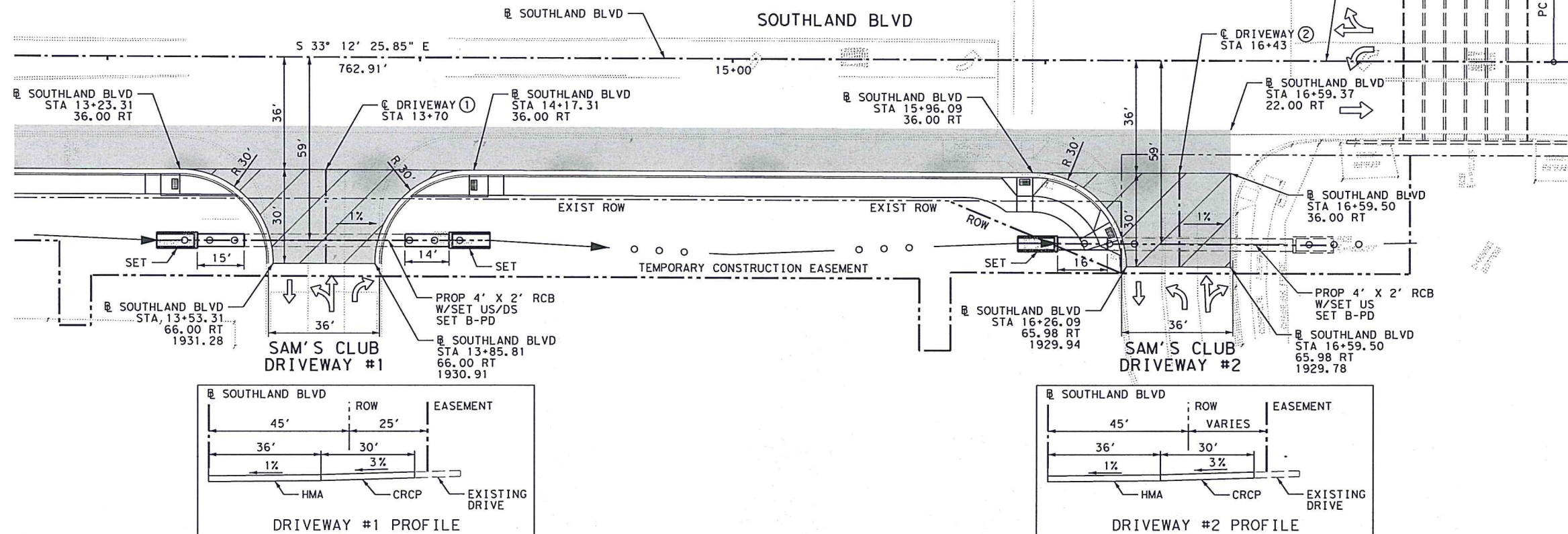
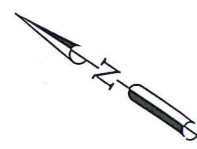


Proposed Driveway 1			
Frequency	2 YR	25 YR	100 YR
D.A. =	99.49	99.49	99.49
Q =	13.50	62.89	76.09
TW =	1927.28	1928.27	1928.56
HW =	1928.11	1929.13	1929.34

Proposed Driveway 2			
Frequency	2 YR	25 YR	100 YR
D.A. =	114.18	114.18	114.18
Q =	16.50	75.72	94.65
TW =	1926.70	1927.31	1927.52
HW =	1927.09	1928.27	1928.56

## LEGEND

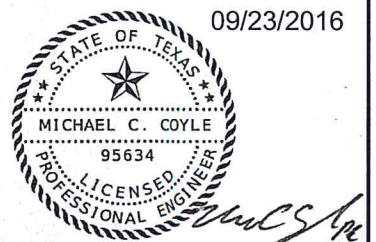
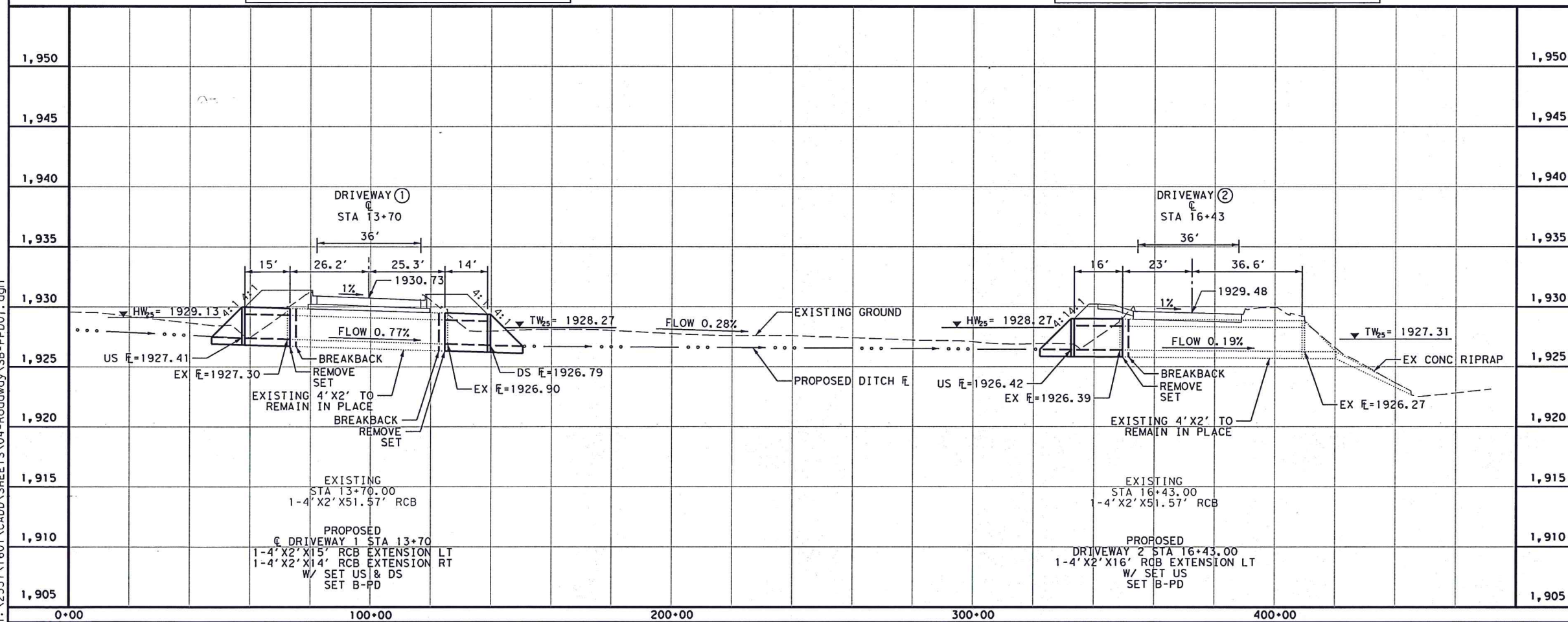
- PROPOSED FULL DEPTH PAVEMENT  
 PROPOSED CONC. DRIVEWAY  
 DRIVEWAY NUMBER



## NOTES:

1. COLLAR DETAIL SHALL BE APPROVED BY INSPECTOR BEFORE CONSTRUCTION OF CULVERT EXTENSIONS.

9/23/2016  
T: \\2357\\1601\\CADD\\SHEETS\\04-Roadway\\SB-PPD01.dgn



0' 10' 20' 40'  
SCALE: 1"=40'- HORZ  
1"=10'- VERT

REV. NO. DATE DESCRIPTION BY

**LJA Engineering, Inc.**  
FRN - F-1386

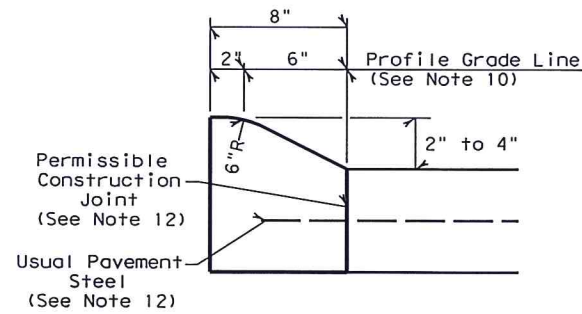


**SOUTHLAND BOULEVARD**  
**DRIVEWAY DETAILS**

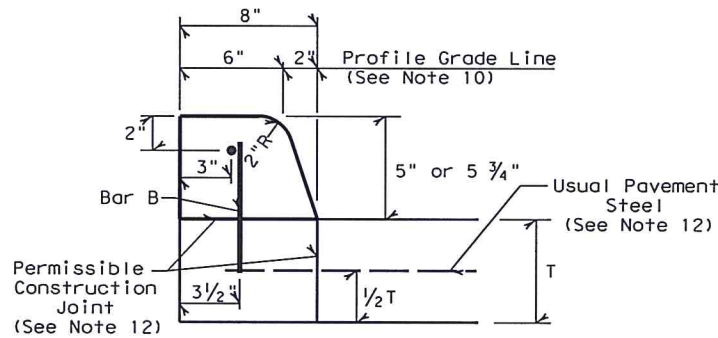


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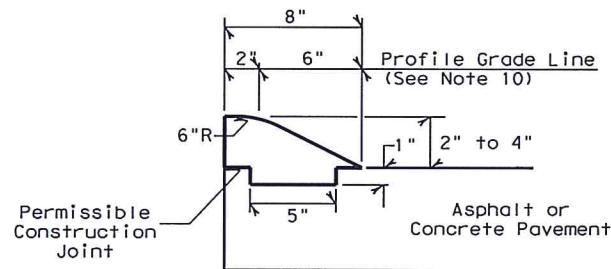
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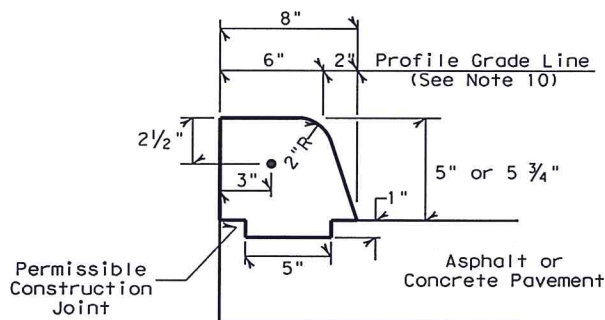
TYPE I CURB (MONOLITHIC)  
2" - 4" HEIGHT



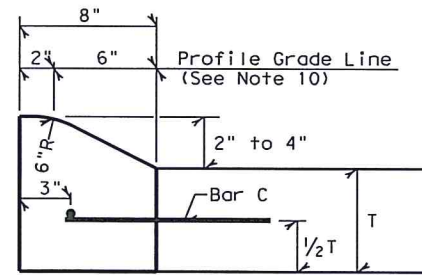
TYPE II CURB (MONOLITHIC)  
5" - 5 3/4" HEIGHT



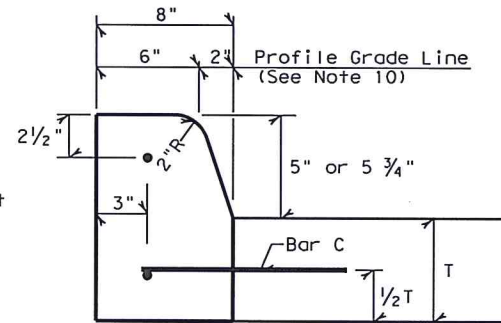
TYPE III CURB (KEYED)  
2" - 4" HEIGHT



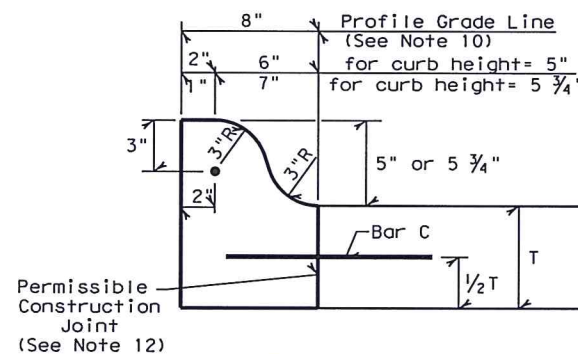
TYPE IV CURB (KEYED)  
5" - 5 3/4" HEIGHT



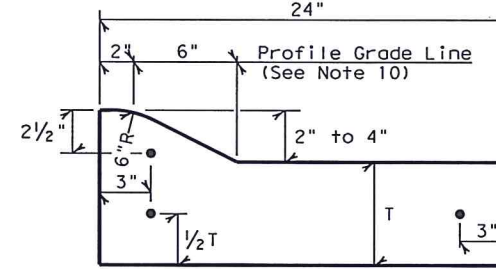
TYPE I CURB  
2" - 4" HEIGHT



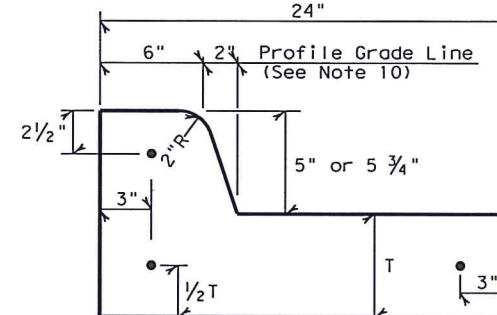
TYPE II CURB  
5" - 5 3/4" HEIGHT



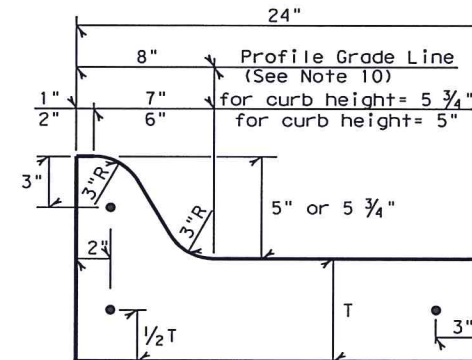
TYPE IIa CURB  
5" - 5 3/4" HEIGHT



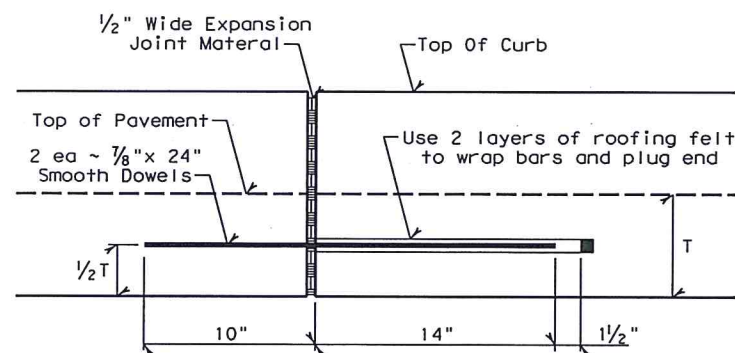
TYPE I CURB AND GUTTER  
2" - 4" HEIGHT



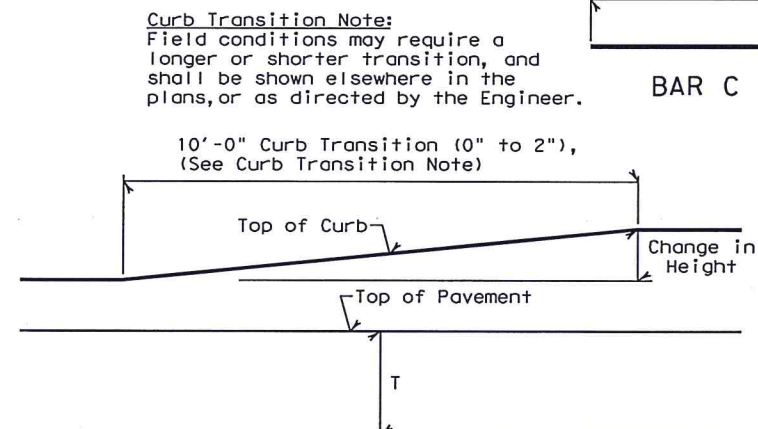
TYPE II CURB AND GUTTER  
5" - 5 3/4" HEIGHT



TYPE IIa CURB AND GUTTER  
5" - 5 3/4" HEIGHT



EXPANSION JOINT DETAIL



CURB TRANSITION


Note: To be paid for as Highest Curb

### General Notes

1. All materials and construction shall be in accordance with Item 529, "Concrete Curb, Gutter, and Combined Curb and Gutter."
2. Concrete shall be Class A.
3. When reinforcing bars are used, they shall be No.4 unless otherwise shown. The use of synthetic fiber in lieu of steel reinforcing is acceptable, provided the fiber producer is on the Department Producer List (MPL), maintained by TxDOT, Construction Division.
4. Round exposed sharp edges with a rounding tool, to a minimum radius of 1/4 inch.
5. All existing curbs and driveways to be removed shall be sawed or removed at existing joints.
6. Where concrete curb is placed on existing concrete pavement, the pavement shall be drilled and the reinforcing bars grouted in place.
7. Expansion and contraction joints shall be constructed to match pavement joints in all curbs and curb and gutter adjacent to jointed concrete pavement. Where placement of curb or curb and gutter is not adjacent to concrete pavement, expansion joints shall be provided at structures, curb returns at streets, and at locations directed by The Engineer.
8. Vertical and horizontal dowel bars and transverse reinforcing bars shall be placed at four feet C-C.
9. Dimension 'T' shown is the thickness of concrete pavement. When curb is installed adjacent to flexible pavement dimension 'T' is 8" maximum.
10. Usual profile grade line. Refer to typical sections and plan-profile sheets for exact locations.
11. One-half inch expansion joint material shall be provided where curb or curb and gutter is adjacent to sidewalk or riprap.
12. When vertical permissible construction joints are used, resulting in a longitudinal construction joint in the pavement, the longitudinal pavement steel shall be placed in accordance with pavement details shown elsewhere in the plans for longitudinal construction joints. Reinforcing steel for curb section shall then conform to that required for concrete curb.

Varies  
BAR B

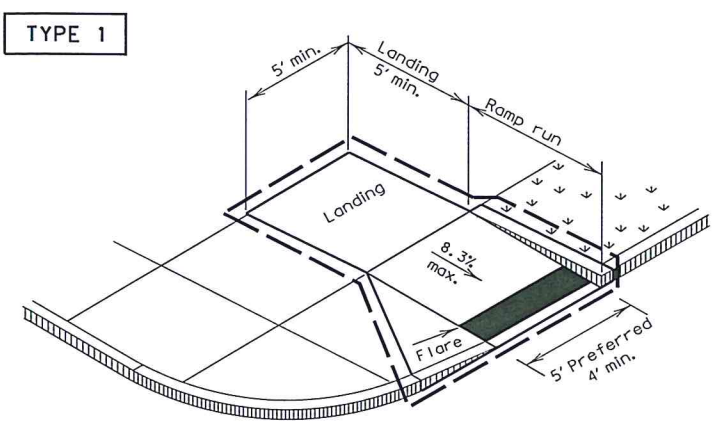
12"  
BAR C

				Design Division Standard	
CONCRETE CURB AND CURB AND GUTTER CCCG-12					
FILE: cccg12.dgn		DW: TxDOT		CK: AM	DW: VP
© TxDOT: 1995		CONT	SECT	JOB	
REVISIONS				HIGHWAY	
UPDATED 2012 - VP		DIST	COUNTY		SHEET NO.
		TOM GREEN		34	

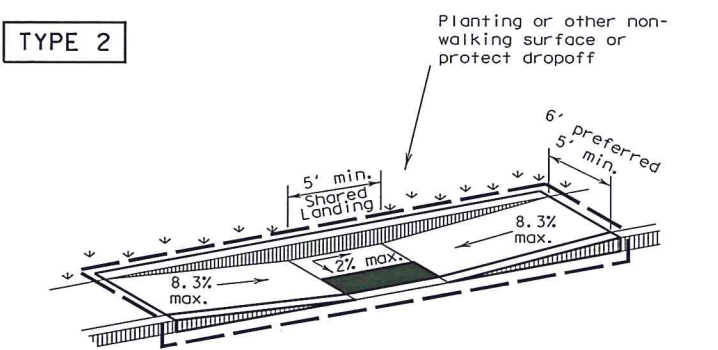


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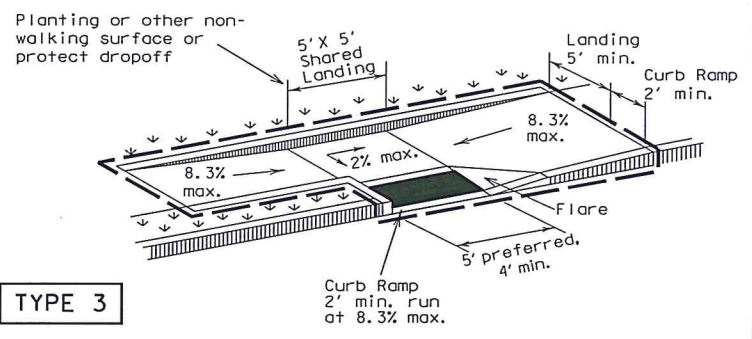
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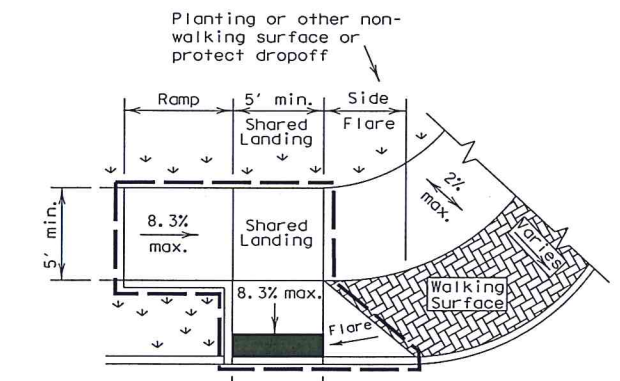
PERPENDICULAR CURB RAMP



PARALLEL CURB RAMP  
(Use only where water will not pond in the landing.)

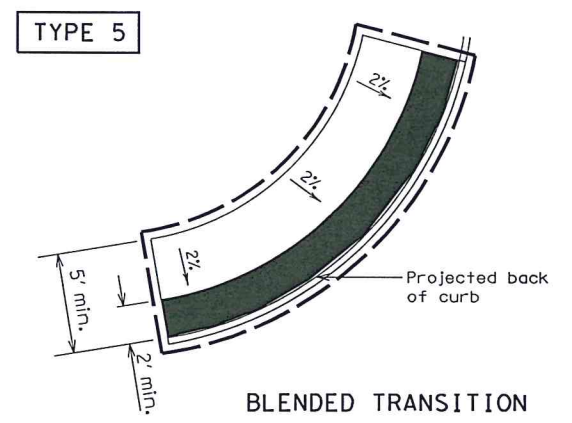


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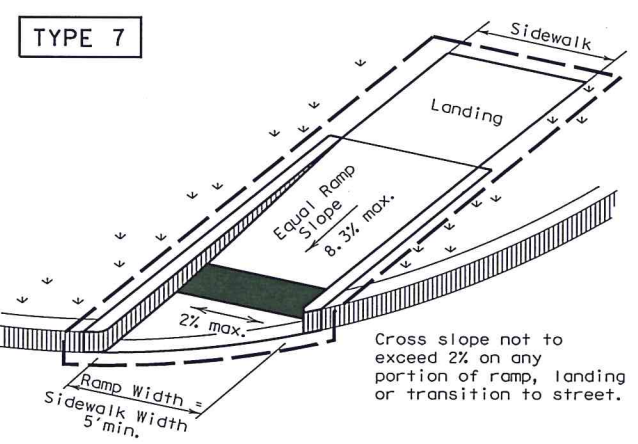


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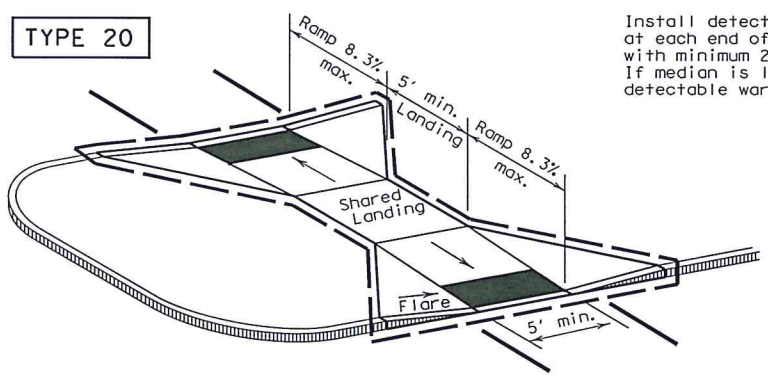
COMBINATION CURB RAMPS



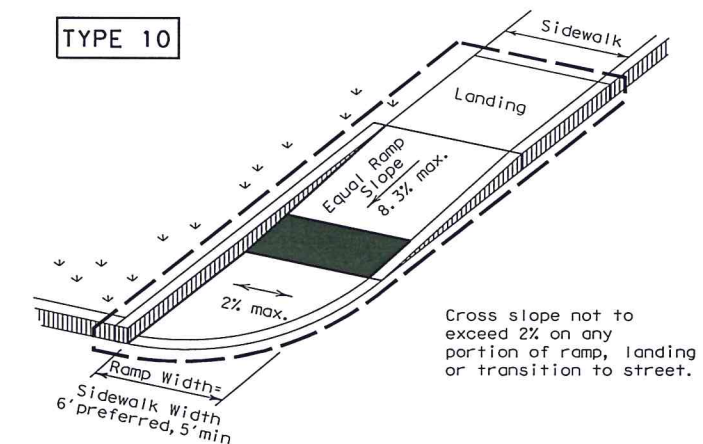
BLENDED TRANSITION



(Sidewalk set back from curb)

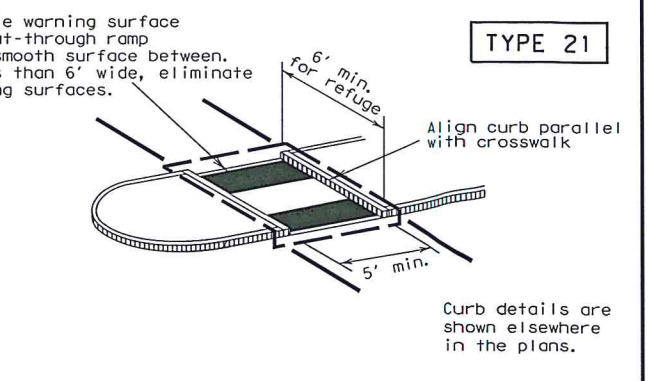


CURB RAMPS AT MEDIAN ISLANDS

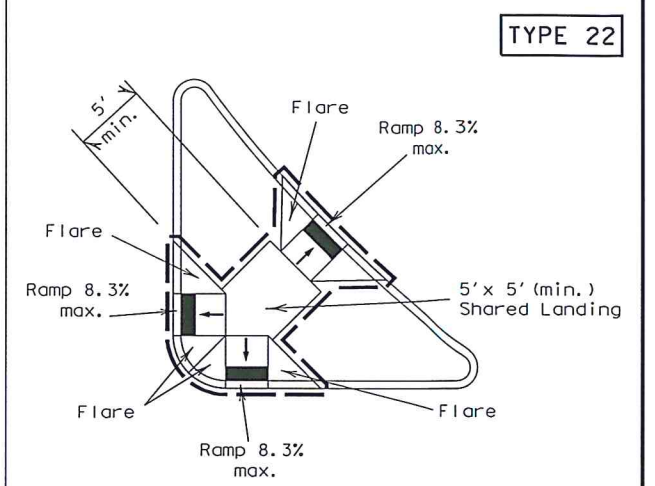


(Sidewalk adjacent to curb)

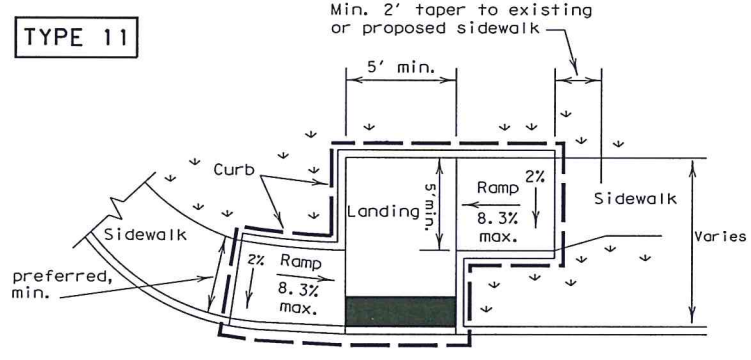
DIRECTIONAL RAMPS WITHIN RADIUS



Curb details are shown elsewhere in the plans.



COMBINATION ISLAND RAMPS



OFFSET PARALLEL CURB RAMP

NOTES / LEGEND:

See General Notes on sheet 2 of 4 for more information.

Denotes planting or non-walking surface not part of pedestrian circulation path.

— Ramp Limits of Payment

■ Detectable Warning Surface

PEDESTRIAN FACILITIES  
CURB RAMPS

PED-12A

FILE: ped12a.dgn	DN: TxDOT	CK: RM	DN: TxDOT	CK: VP
© TxDOT March 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS				
VP June 13, 2012	DIST	COUNTY		SOUTHLAND
		TOM GREEN		35



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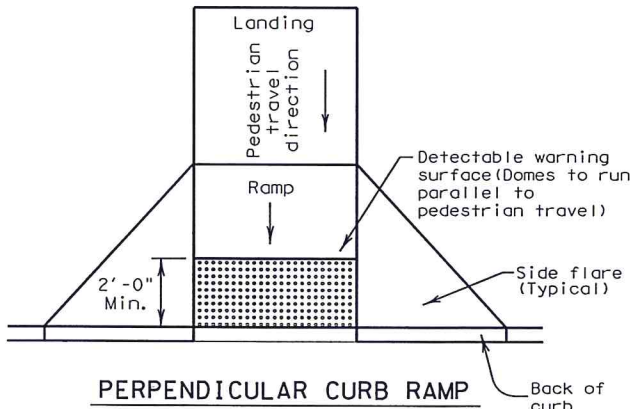
General Notes

Curb Ramps

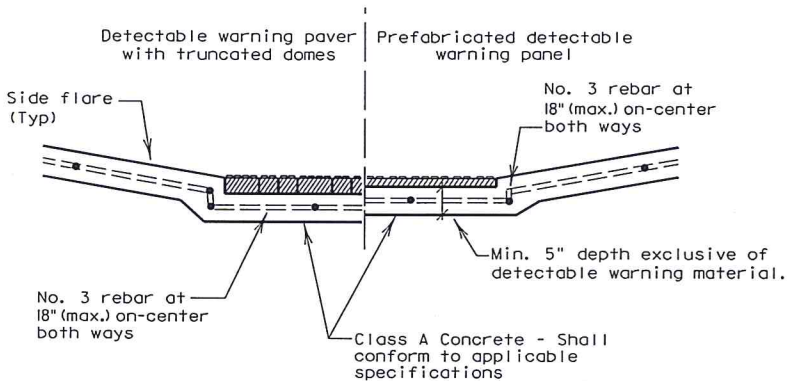
1. Install a curb ramp or blended transition at each pedestrian street crossing.
2. All slopes shown are maximum allowable. Lesser slopes that will still drain properly should be used. Adjust curb ramp length or grade of approach sidewalks as directed.
3. The minimum sidewalk width is 5'. Where the sidewalk is adjacent to the back of curb, a 6' sidewalk width is desirable. Where a 5' sidewalk cannot be provided due to site constraints, sidewalk width may be reduced to 4' for short distances. 5'x 5' passing areas at intervals not to exceed 200' are required.
4. Landings shall be 5'x 5' minimum with a maximum 2% slope in any direction.
5. Maneuvering space at the bottom of curb ramps shall be a minimum of 4'x 4' wholly contained within the crosswalk and wholly outside the parallel vehicular travel path.
6. Maximum allowable cross slope on sidewalk and curb ramp surfaces is 2%.
7. Provide flared sides where the pedestrian circulation path crosses the curb ramp. Flared sides shall be sloped at 10% maximum, measured parallel to the curb. Returned curbs may be used only where pedestrians would not normally walk across the ramp, either because the adjacent surface is planted, substantially obstructed, or otherwise protected.
8. Additional information on curb ramp location, design, light reflective value and texture may be found in the current edition of the Texas Accessibility Standards (TAS) and 16 TAC 68.102.
9. To serve as a pedestrian refuge area, the median should be a minimum of 6' wide, measured from back of curbs. Medians should be designed to provide accessible passage over or through them.
10. Small channelization islands, which do not provide a minimum 5'x 5' landing at the top of curb ramps, shall be cut through level with the surface of the street.
11. Crosswalk dimensions, crosswalk markings and stop bar locations shall be as shown elsewhere in the plans. At intersections where crosswalk markings are not required, curb ramps shall align with theoretical crosswalks unless otherwise directed.
12. Handrails are not required on curb ramps. Provide curb ramps wherever on accessible route crosses (penetrates) a curb.
13. Curb ramps and landings shall be constructed and paid for in accordance with Item 531 "Sidewalks".
14. Place concrete at a minimum depth of 5" for ramps, flares and landings, unless otherwise directed.
15. Provide a smooth transition where the curb ramps connect to the street.
16. Curbs shown on sheet 1 within the limits of payment are considered part of the curb ramp for payment, whether it is concrete curb, gutter, or combined curb and gutter.
17. Existing features that comply with TAS may remain in place unless otherwise shown on the plans.

Detectable Warning Material

18. Curb ramps must contain a detectable warning surface that consists of raised truncated domes complying with Section 705 of the TAS. The surface must contrast visually with adjoining surfaces, including side flares. Furnish and install an approved cast-in-place dark brown or dark red detectable warning surface material adjacent to uncolored concrete, unless specified elsewhere in the plans.
19. Detectable Warning Materials must meet TxDOT Departmental Materials Specification DMS 4350 and be listed on the Material Producer List. Install products in accordance with manufacturer's specifications.
20. Detectable warning surfaces must be slip resistant and not allow water to accumulate.
21. Detectable warning surfaces shall be a minimum of 24" in depth in the direction of pedestrian travel, and extend the full width of the curb ramp or landing where the pedestrian access route enters the street.
22. Detectable warning surfaces shall be located so that the edge nearest the curb line is at the back of curb. Align the rows of domes to be perpendicular to the grade break between the ramp run and the street. Detectable warning surfaces may be curved along the corner radius.
23. Shaded areas on Sheet 1 of 4 indicate the approximate location for the detectable warning surface for each curb ramp type.

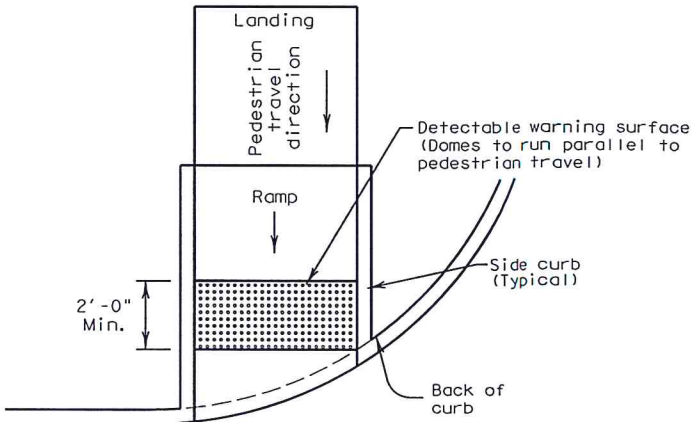


PERPENDICULAR CURB RAMP  
Typical placement of detectable warning surface on sloping ramp run.



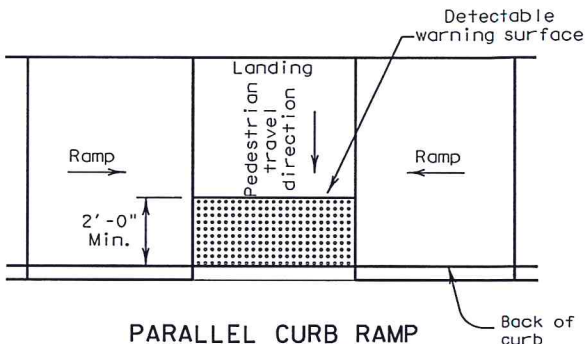
SECTION: CURB RAMP AT DETECTABLE WARNING

DETECTABLE WARNINGS



DIRECTIONAL CURB RAMP

Typical placement of detectable warning surface on sloping ramp run.



PARALLEL CURB RAMP

Typical placement of detectable warning surface on landing at street edge.

Detectable Warning Pavers

24. Furnish detectable warning paver units meeting all requirements of ASTM C-936, C-33. Lay in a two by two unit basket weave pattern or as directed.
25. Lay full-size units first followed by closure units consisting of at least 25 percent of a full unit. Cut detectable warning paver units using a power saw.

Sidewalks

26. Provide clear ground space at operable parts, including pedestrian push buttons. Operable parts shall be placed within one or more reach ranges specified in TAS 308.
27. Place traffic signal or illumination poles, ground boxes, controller boxes, signs, drainage facilities and other items so as not to obstruct the pedestrian access route or clear ground space.
28. Street grades and cross slopes shall be as shown elsewhere in the plans.
29. Changes in level greater than 1/4 inch are not permitted.
30. The least possible grade should be used to maximize accessibility. The running slope of sidewalks and crosswalks within the public right of way may follow the grade of the parallel roadway. Where a continuous grade greater than 5% must be provided, handrails may be desirable to improve accessibility. Handrails may also be needed to protect pedestrians from potentially hazardous conditions. If provided, handrails shall comply with TAS 505.
31. Handrail extensions shall not protrude into the usable landing area or into intersecting pedestrian routes.
32. Driveways and turnouts shall be constructed and paid for in accordance with Item "Intersections, Driveways and Turnouts". Sidewalks shall be constructed and paid for in accordance with Item, "Sidewalks".
33. Sidewalk details are shown elsewhere in the plans.

SHEET 2 OF 4



PEDESTRIAN FACILITIES  
CURB RAMPS

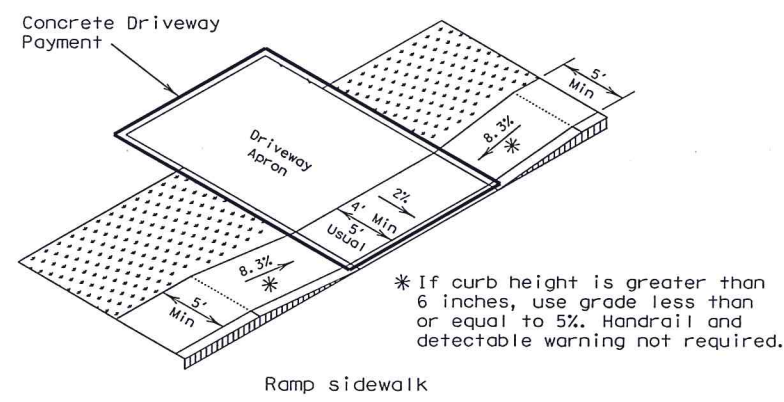
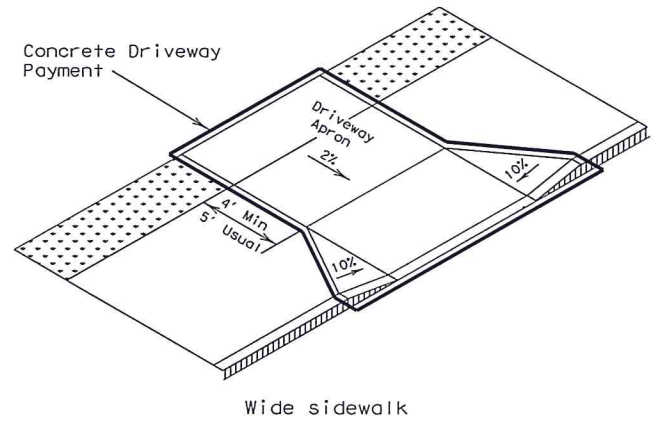
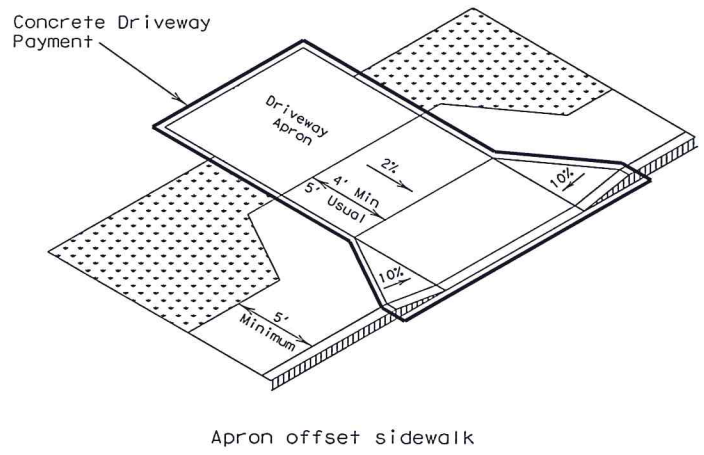
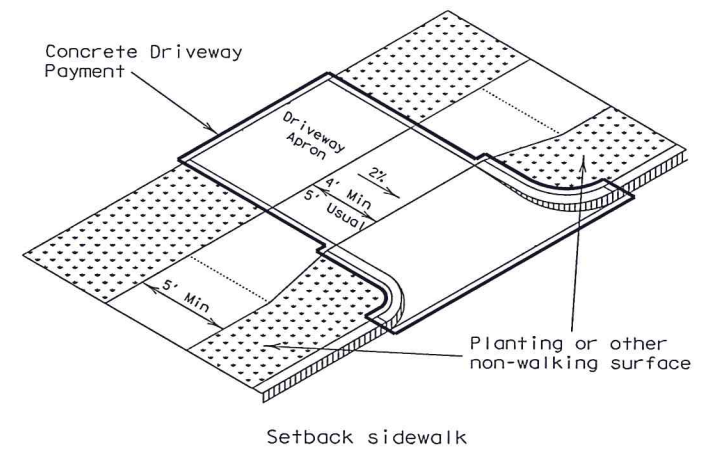
PED-12A

FILE: ped12a.dgn	DN: TxDOT	CR: RM	DN: TxDOT	CR: VP
© TxDOT March 2002	CONT	SECT	JOB	HIGHWAY
REVIEWS				SOUTHLAND
VP June 13, 2012	DIST	COUNTY		SHEET NO.
		TOM GREEN		36



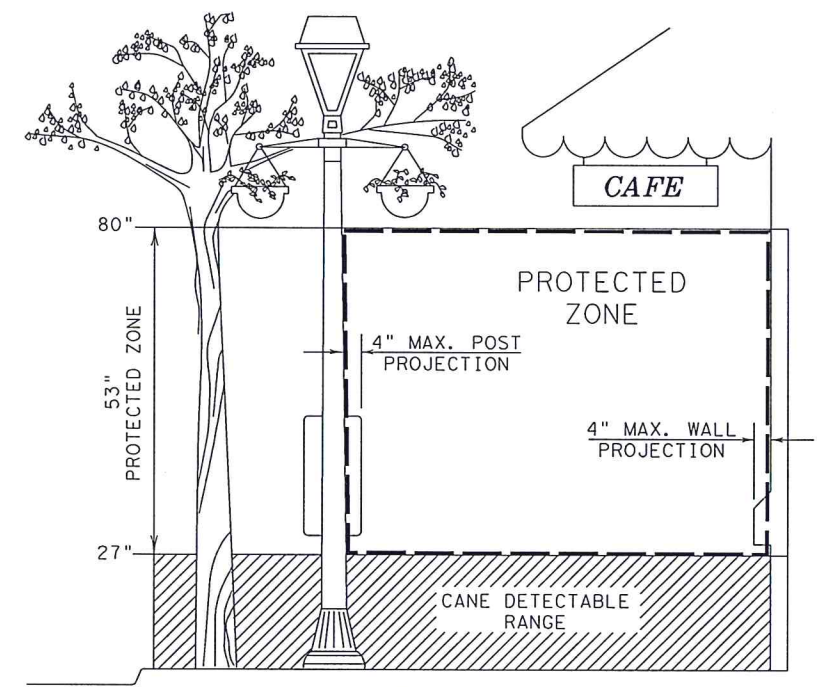
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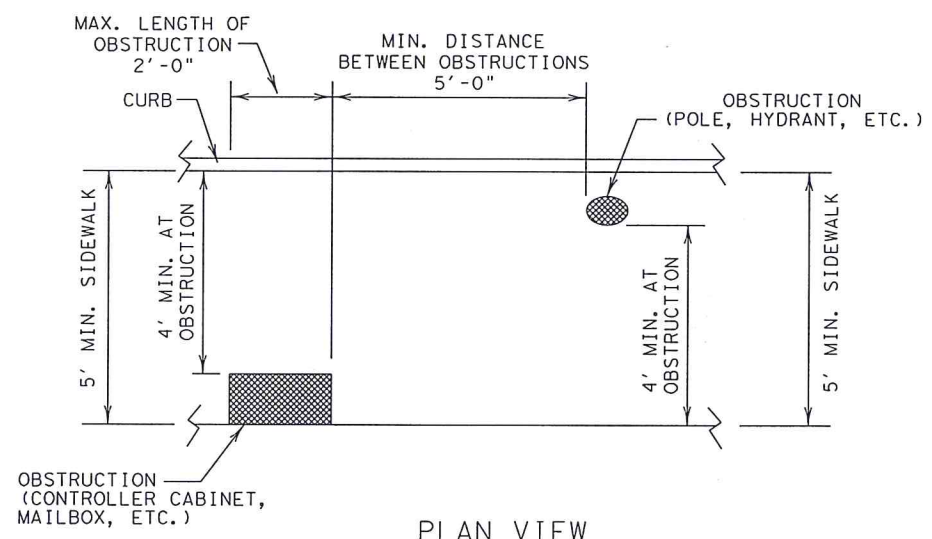
SIDEWALK TREATMENT AT DRIVEWAYS

\* If curb height is greater than 6 inches, use grade less than or equal to 5%. Handrail and detectable warning not required.



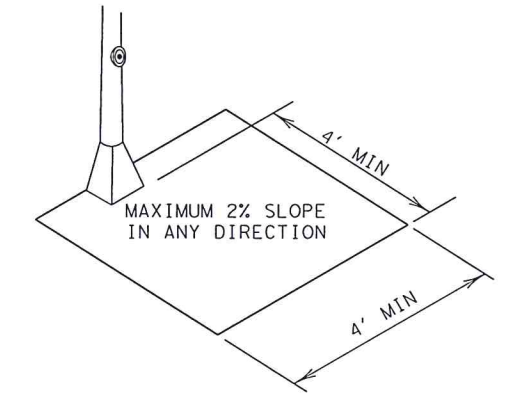
PROTECTED ZONE

In pedestrian circulation area, maximum 4" projection for post or wall mounted objects between 27" and 80" above the surface.

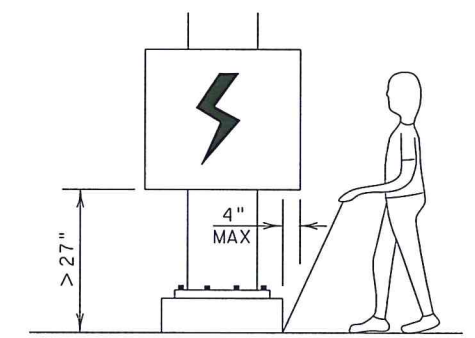


PLAN VIEW  
PLACEMENT OF STREET FIXTURES

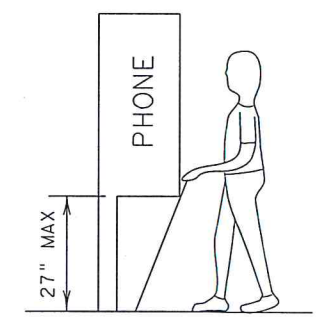
(ITEMS NOT INTENDED FOR PUBLIC USE. MINIMUM 4' x 4' CLEAR GROUND SPACE REQUIRED AT PUBLIC USE FIXTURES.)



CLEAR GROUND SPACE ADJACENT TO PEDESTRIAN PUSH BUTTON




When an obstruction of a height greater than 27" from the surface would create a protrusion of more than 4" into the pedestrian circulation area, construct additional curb or foundation at the bottom to provide a maximum 4" overhang.



Protruding objects of a height  $\leq 27"$  are detectable by cane and do not require additional treatment.

DETECTION BARRIER FOR VERTICAL CLEARANCE < 80"



Texas Department of Transportation

Design Division Standard

PEDESTRIAN FACILITIES  
CURB RAMPS

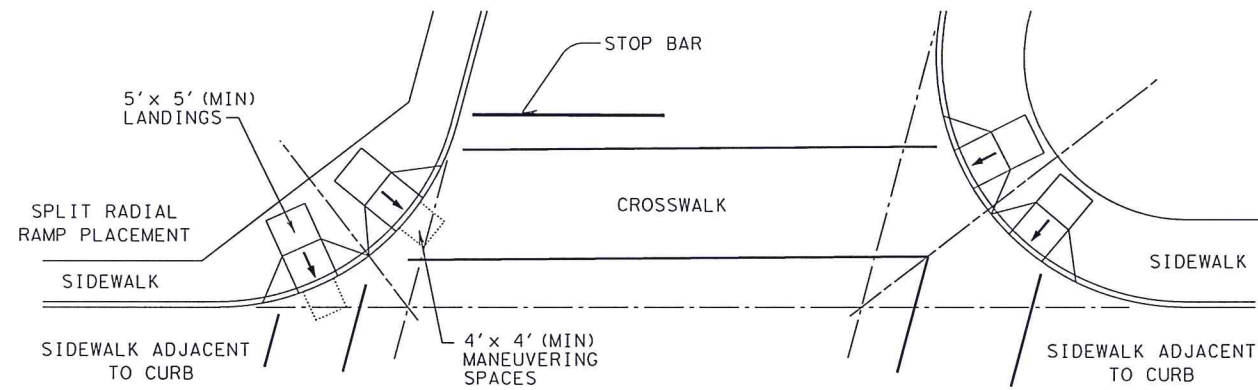
PED-12A

FILE: ped12a.dgn	DN: TxDOT	CR: RM	DN: TxDOT	CR: VP
© TxDOT March 2002	CONT	SECT	JOB	HIGHWAY
VP June 13, 2012	DIST	COUNTY	SHEET NO.	
		TOM GREEN	37	

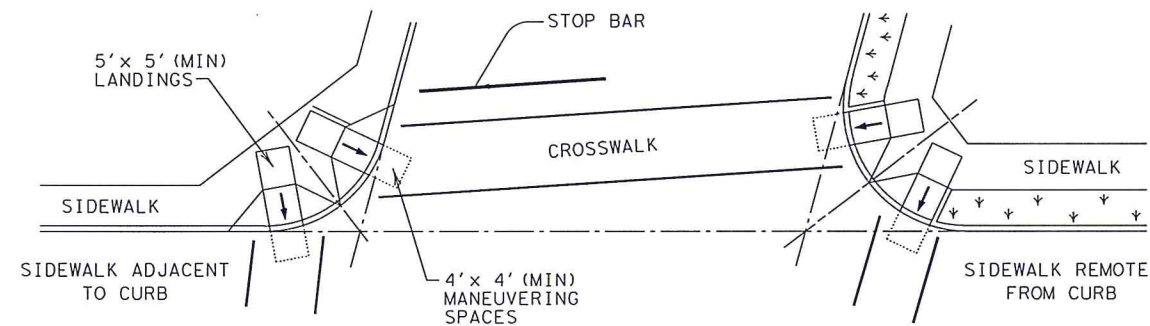


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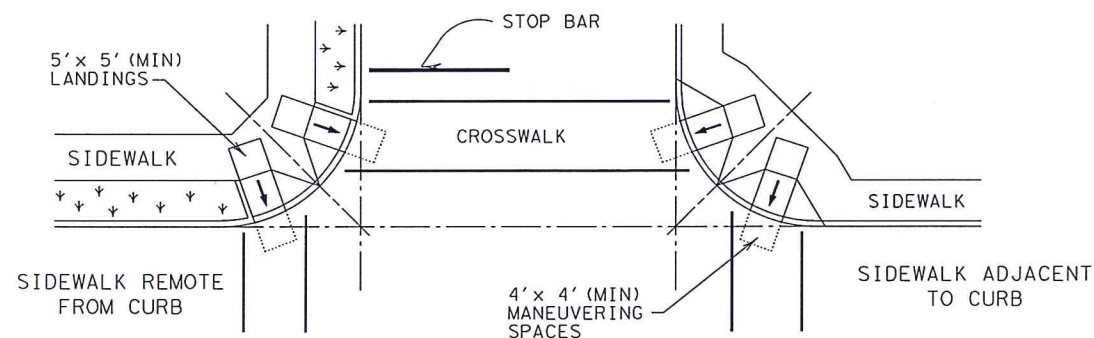
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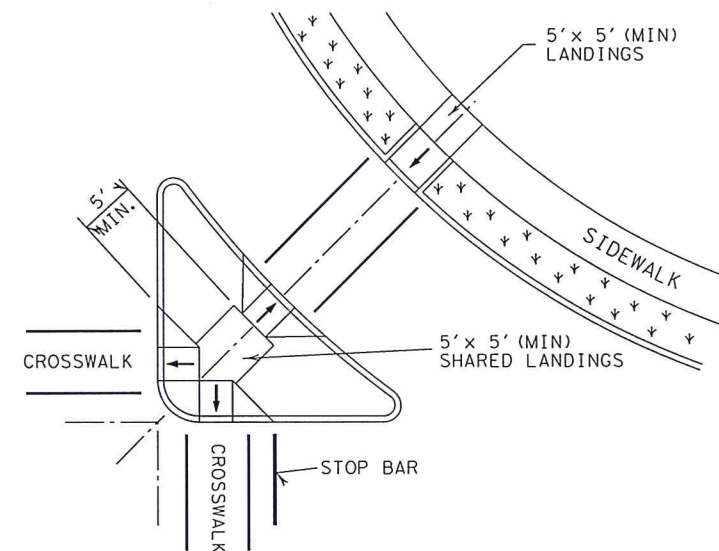
SKewed INTERSECTION WITH "LARGE" RADIUS



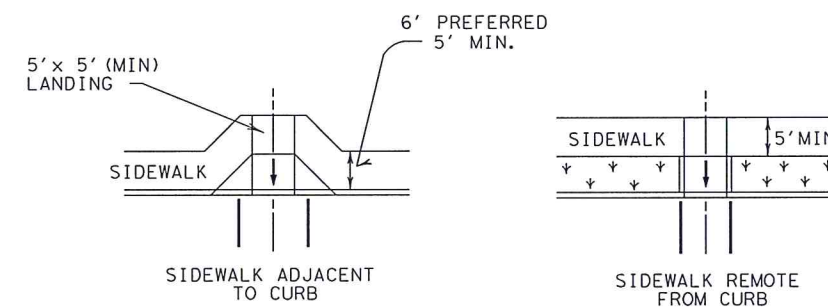
SKewed INTERSECTION WITH "SMALL" RADIUS



NORMAL INTERSECTION WITH "SMALL" RADIUS



AT INTERSECTION  
W/FREE RIGHT TURN & ISLAND



MID-BLOCK PLACEMENT  
PERPENDICULAR RAMPS

TYPICAL CROSSING LAYOUTS

SHEET 4 OF 4

Texas Department of Transportation

Design  
Division  
Standard

# PEDESTRIAN FACILITIES CURB RAMPS

## PED-12A

FILE: ped12a.dgn

DN: TxDOT

CR: RM

DN: TxDOT

CR: VP

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CONT

SECT

JOB

HIGHWAY

REVISIONS

SOUTHLAND

VP June 13, 2012

DIST

COUNTY

SHEET NO.

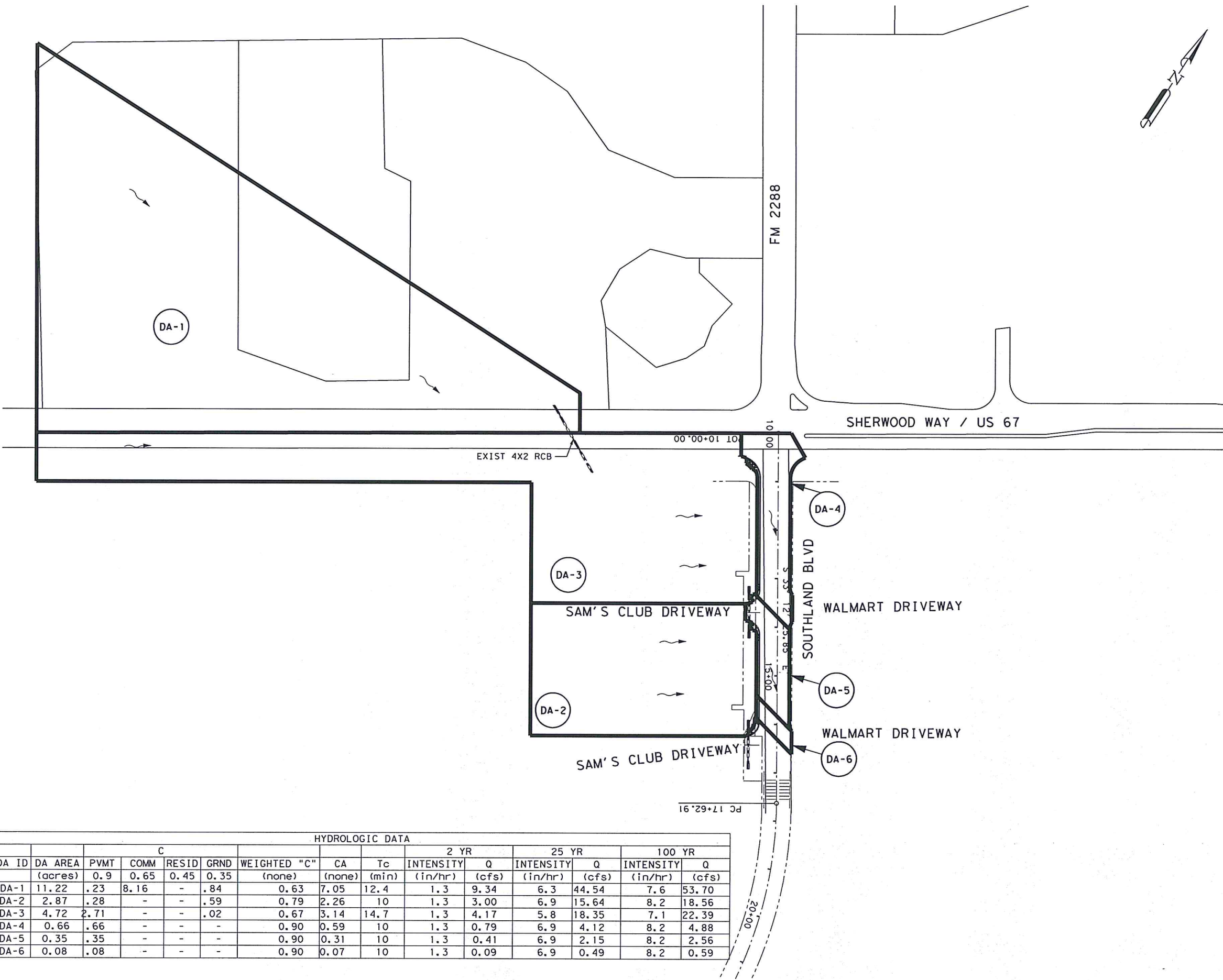
TOM GREEN

38



LEGEND

- DIRECTION OF FLOW
- SUB DRAINAGE BOUNDARY
- DRAINAGE AREA ID



09/23/2016

SCALE: 1"=200'

REV. NO.	DATE	DESCRIPTION	BY

**LJA Engineering, Inc.**

FRN - F-1386

**SOUTHLAND BOULEVARD**

**OVERALL DRAINAGE AREA MAP**

SHEET 1 OF 1

39

11:08:30 AM 9/23/2016 T:\2357\1601\CADD\SHEET\S06-Drainage\SB-DDA01.dgn

HYDROLOGIC DATA														
C														
DA ID	DA AREA	PVMT	COMM	RESID	GRND	WEIGHTED "C"	CA	Tc	2 YR		25 YR		100 YR	
	(acres)	0.9	0.65	0.45	0.35	(none)	(none)	(min)	INTENSITY	Q	INTENSITY	Q	INTENSITY	Q
									(in/hr)	(cfs)	(in/hr)	(cfs)	(in/hr)	(cfs)
DA-1	11.22	.23	8.16	-	.84	0.63	7.05	12.4	1.3	9.34	6.3	44.54	7.6	53.70
DA-2	2.87	.28	-	-	.59	0.79	2.26	10	1.3	3.00	6.9	15.64	8.2	18.56
DA-3	4.72	2.71	-	-	.02	0.67	3.14	14.7	1.3	4.17	5.8	18.35	7.1	22.39
DA-4	0.66	.66	-	-	-	0.90	0.59	10	1.3	0.79	6.9	4.12	8.2	4.88
DA-5	0.35	.35	-	-	-	0.90	0.31	10	1.3	0.41	6.9	2.15	8.2	2.56
DA-6	0.08	.08	-	-	-	0.90	0.07	10	1.3	0.09	6.9	0.49	8.2	0.59

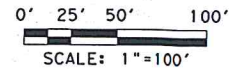
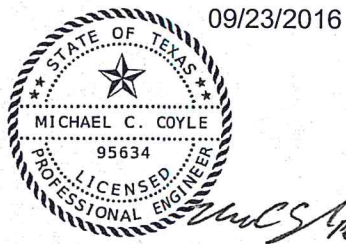
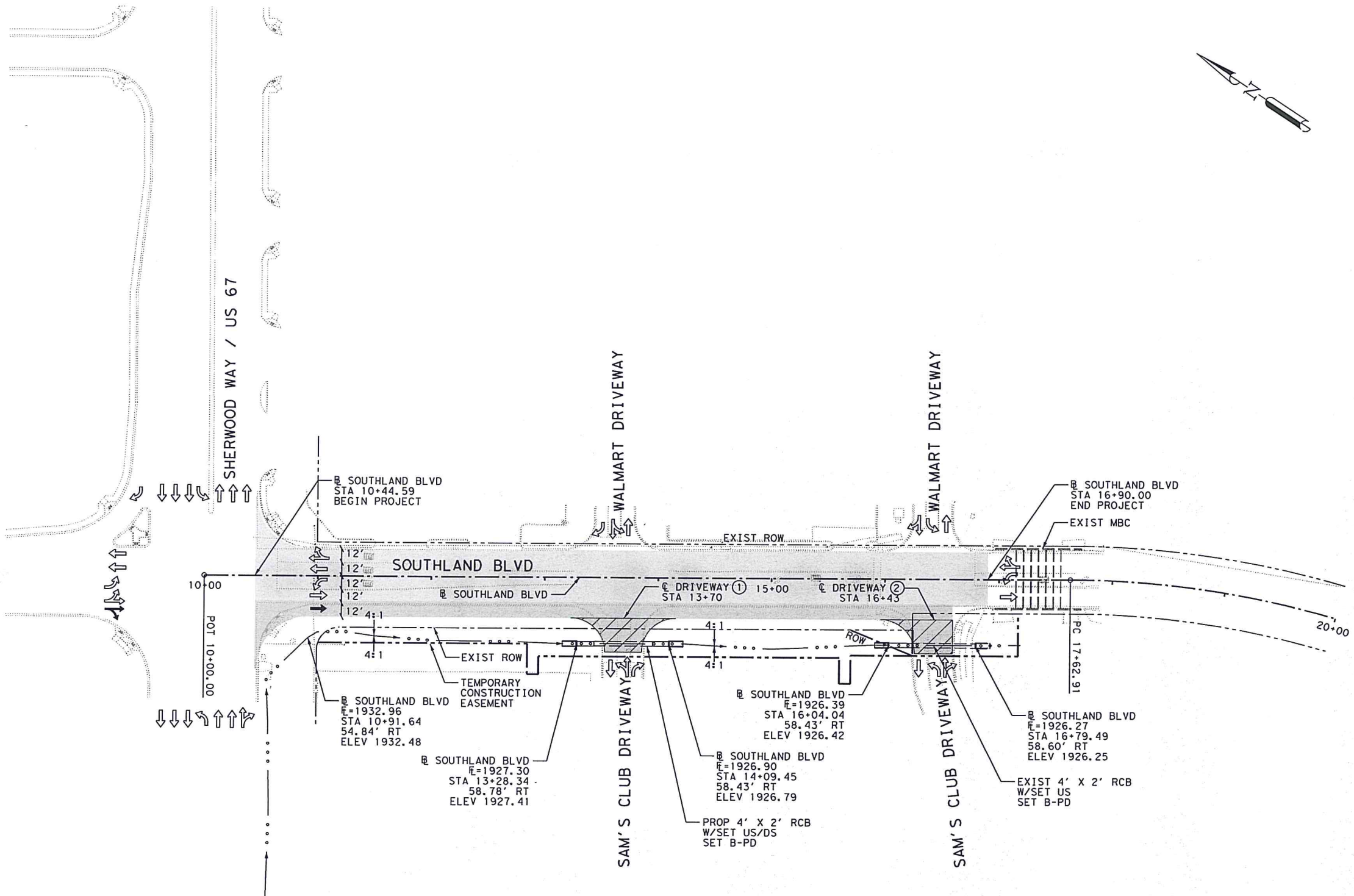


LEGEND

- DIRECTION OF FLOW
- DITCH
- PROP STORM SEWER
- EXIST STORM SEWER

NOTES:

- 1. PIPE LENGTHS SHOWN IN PROFILE ARE CENTER OF STRUCTURES. LENGTHS SHOWN ON SUMMARY OF STORM SEWER QUANTITIES ARE CALCULATED PAY LENGTHS.
- 2. CONTRACTOR TO VERIFY LOCATION OF EXISTING STORM SEWER AND ADJUST PROPOSED TIE-IN LOCATIONS AS DIRECTED BY THE ENGINEER.
- 3. REFER TO DRIVEWAY DETAILS SHEET FOR MORE INFORMATION.



REV. NO.	DATE	DESCRIPTION	BY

**LJA Engineering, Inc.**  
FRN - F-1386

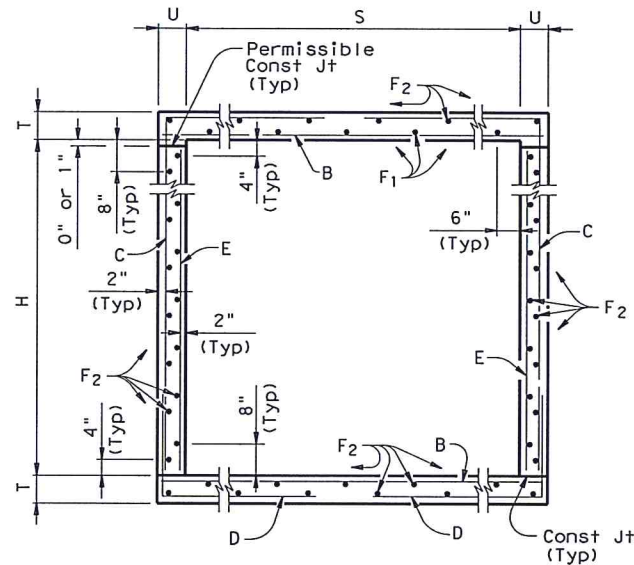


**SOUTHLAND BOULEVARD**  
**DRAINAGE PLAN**

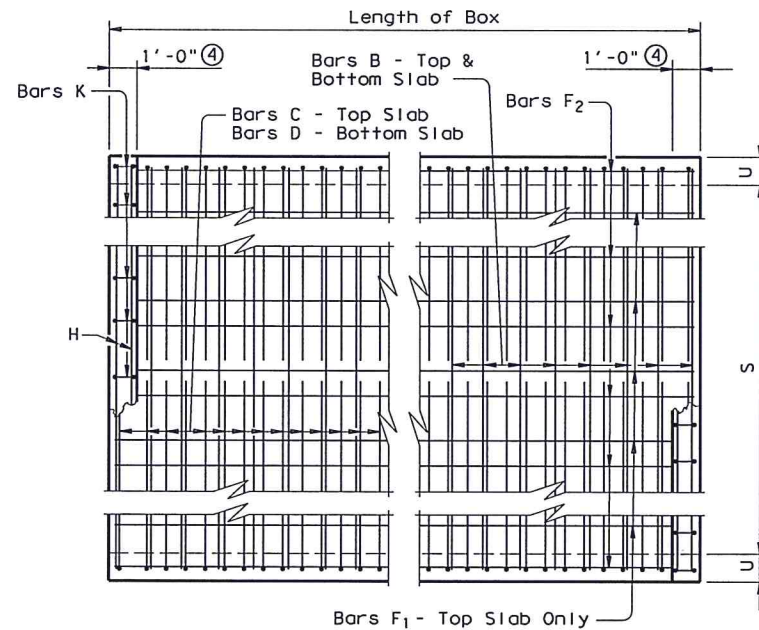


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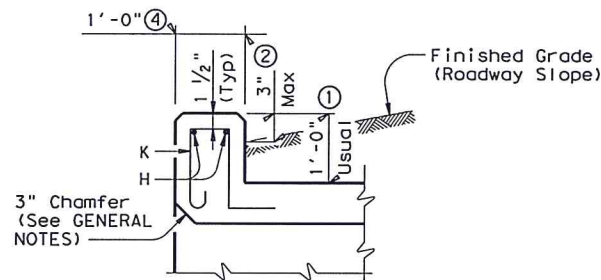
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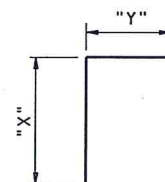
TYPICAL SECTION



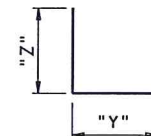
PLAN OF REINF STEEL



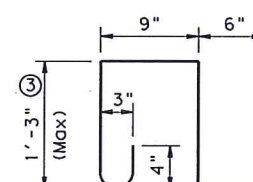
SECTION THRU CURB



BARS C



BARS D



BARS K ~ #4  
(Spa = 1'-0" Max)  
(Length = 4'-3")

- ① 0" min to 5'-0" max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail, bicycle rail or curbs taller than 1'-0", refer to ECD standard. For structures with T6 bridge rail, refer to T6-CM standard. For structures with traffic rail, other than T6, refer to RAC standard.
- ② For vehicle safety, the following requirements must be met:
  - For structures without bridge rail, curbs shall project no more than 3" above finished grade.
  - For structures with bridge rail, curbs shall be flush with finished grade.Curb heights shall be reduced, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
- ③ For curbs less than 1'-0" high, tilt bars K or reduce bar height as necessary to maintain cover. For curbs less than 3" high, bars K may be omitted.
- ④ 1'-0" typical. 2'-0" when RAC standard is referred to elsewhere in the plans.

Deformed welded wire reinforcement (WWR) meeting the requirements of ASTM A1064 may be used to replace conventional reinforcement shown at the Contractor's option. The area of required reinforcement may be reduced by the ratio of 60 ksi / 70 ksi. Spacing of WWR is limited to 4" Min and 18" Max. When required, provide lap splices in the WWR of the same length required for the equivalent bar size, rounded up for wire sizes between conventional bar sizes.

Example Conversion: Replacement of No. 6 Gr 60 at 6" Spacing with WWR.  
WWR required = (0.44 sq in/ 0.5') x (60 ksi/70 ksi) = 0.754 sq in/ft.  
If D30.6 wire is used to meet the 0.754 sq in/ft requirement in this example, the required spacing = (0.306 sq in/ 0.754 sq in/ft) x 12 in/ft = 4.87" Max spacing.  
Required lap length for the provided D30.6 wire is 2'-2" (Lap required for uncoated No. 5 bars, as shown in Item 440).

**GENERAL NOTES:**

Designed according to AASHTO LRFD Specifications.  
Designed to the maximum fill height shown.  
All reinforcing steel shall be Grade 60.  
All concrete shall be Class "C" with these exceptions: use Class "S" for top slabs of culverts with overlay, with 1-to-2 course surface treatment, or with the top slab as the final riding surface.  
Class "C" concrete shall have a minimum compressive strength of 3,600 psi. Class "S" concrete shall have a minimum compressive strength of 4,000 psi.  
The use of permanent forms is not allowed.  
The bottom edge of the top slab shall be chamfered 3" at the entrance.  
Reinforcing bars shall be adjusted to provide a minimum of 1 1/4" clear cover.  
Construction joints shown at the flow line may be raised a maximum of 6" at the Contractor's option.  
If this option is used, Bars E may be cut off or raised, and Bars C and D may be reversed.  
See standard SCC-MD for skewed ends, angle sections and lengthening details.

HL93 LOADING

SHEET 1 OF 2

		Bridge Division Standard	
<b>SINGLE BOX CULVERTS CAST-IN-PLACE 0' TO 30' FILL</b>			
<b>SCC-3 &amp; 4</b>			
FILE: sc34ste.dgn	DN: GAF	CK: LHW	DR: BWH/TxDOT
©TxDOT February 2010	CONT	SECT	JOB
REVISIONS		HIGHWAY	
10-12: Added WWR		DIST	COUNTY
		SHEET NO.	
		TOM GREEN	
		41	



**DISCLAIMER:**

11:08:36 AM

Deformed welded wire reinforcement (WWR) meeting the requirements of ASTM A1064 may be used to replace conventional reinforcement shown at the Contractor's option. The area of required reinforcement may be reduced by the ratio of 60 ksi / 70 ksi. Spacing of WWR is limited to 2" Min and 18" Max. When required, provide lap splices in the WWR of the same length required for the equivalent bar size, rounded up for wire sizes between conventional bar sizes.

Example Conversion: Replacement of No. 6 Gr 60 at 6" Spacing with WWR.

WWR required =  $(0.44 \text{ sq in/ } 0.5') \times (60 \text{ ksi}/70 \text{ ksi}) = 0.754 \text{ sq in/ft.}$

If D30.6 wire is used to meet the 0.754 sq in/ft requirement in this example, the required spacing =  $(0.306 \text{ sq in/ } 0.754 \text{ sq in/ft}) \times 12 \text{ in/ft} = 4.87''$

Max spacing.

Required lap length for the provided D30.6 wire is 2'-2" (Lap required for uncoated No. 5 bars, as shown in Item 440).

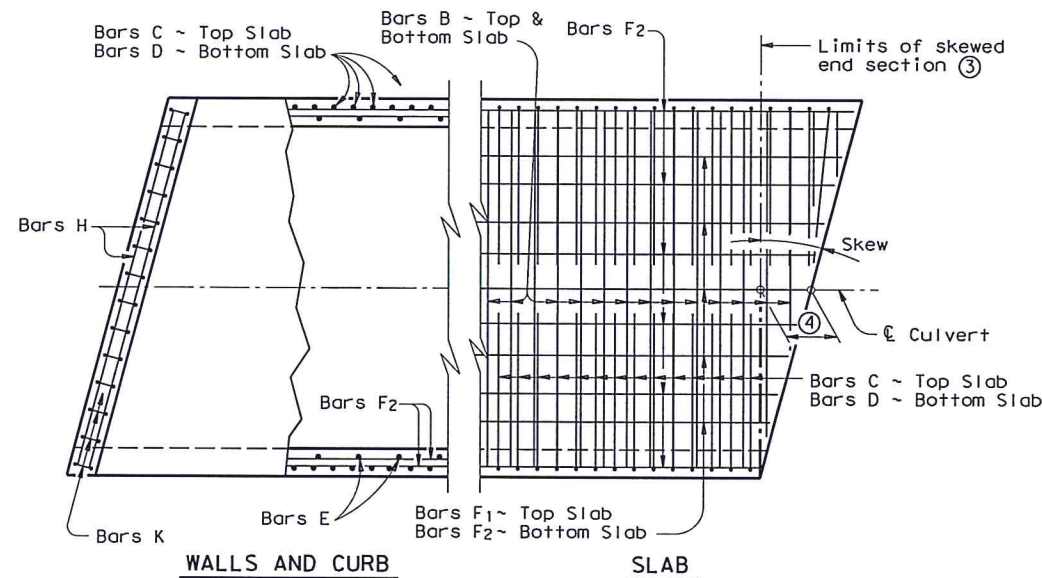
SCC-3 & 4

FILE: scc34sle.dgn		DN: GAF		CK: LWW		DW: BWH/TxDOT		CK: GAF	
©TxDOT February 2010		CONT	SECT	JOB			HIGHWAY		
REVISIONS							SOUTHLAND		
10-12: Added VINR		DIST		COUNTY			SHEET NO.		
				TOM GREEN			42		



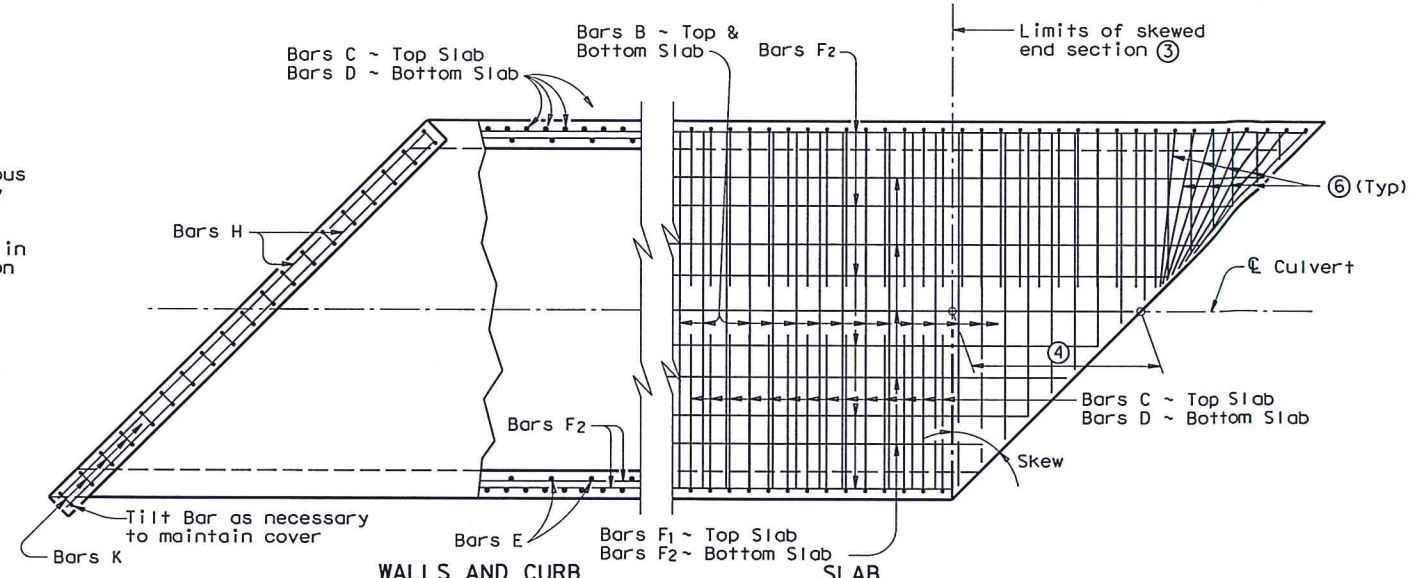
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DATE: 9/23/2016 11:08:37 AM  
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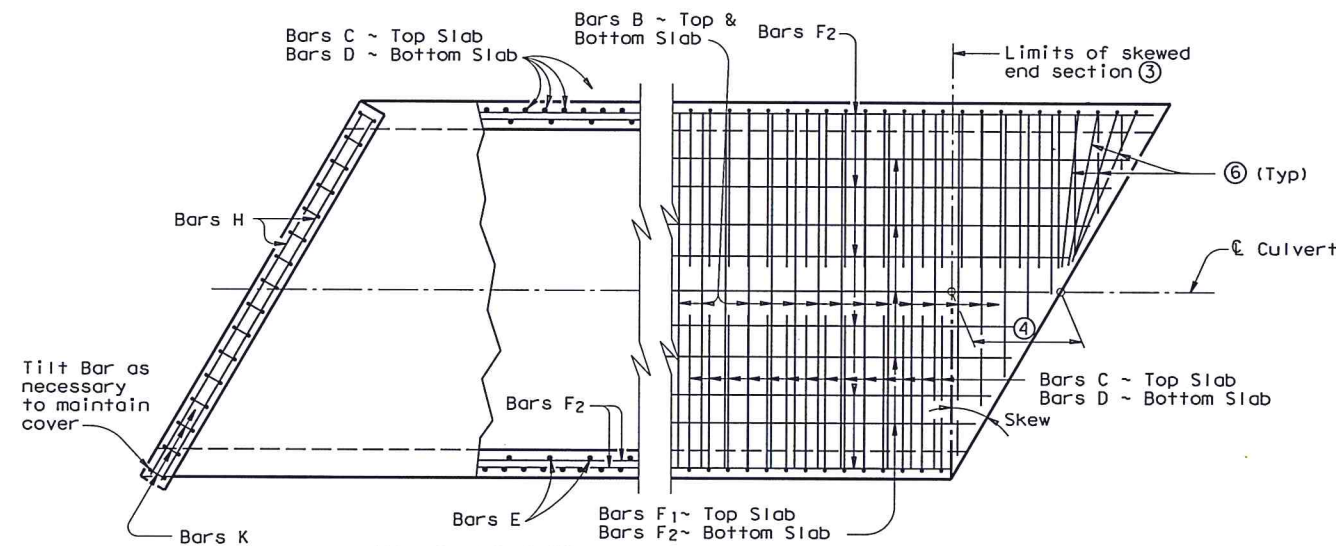


PLAN OF SKEWED ENDS ~ FROM 0° TO 15°

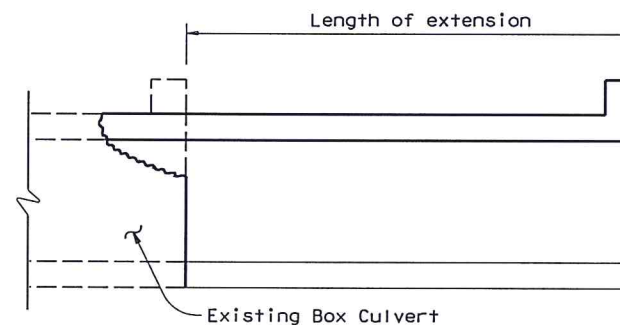
- ② When the spacing between Bars B becomes less than half of the normal spacing, bars shall be cut to avoid fouling
- ③ The length of Bars B and E will vary in the skewed end sections [One half of overall width] x [Tan of the skew angle]
- ④ Bars F1 and F2 shall be continuous through the angle section. They shall be bent to remain parallel to the walls of the Box Culvert.
- ⑤ When necessary to avoid fouling in acute corners, the slab extension leg of Bars C and Bars D may be shortened to a minimum of 1'-6" for skews of 30° and 45°.
- ⑥ For skews of 15° or less, the contractor has the option of placing Bars B, C and D parallel to the skewed end while maintaining spacing along centerline box. Lengths of Bars B shown on the standards shall be increased to accommodate the skew.



PLAN OF SKEWED ENDS ~ OVER 30° TO 45°



PLAN OF SKEWED ENDS ~ OVER 15° TO 30°

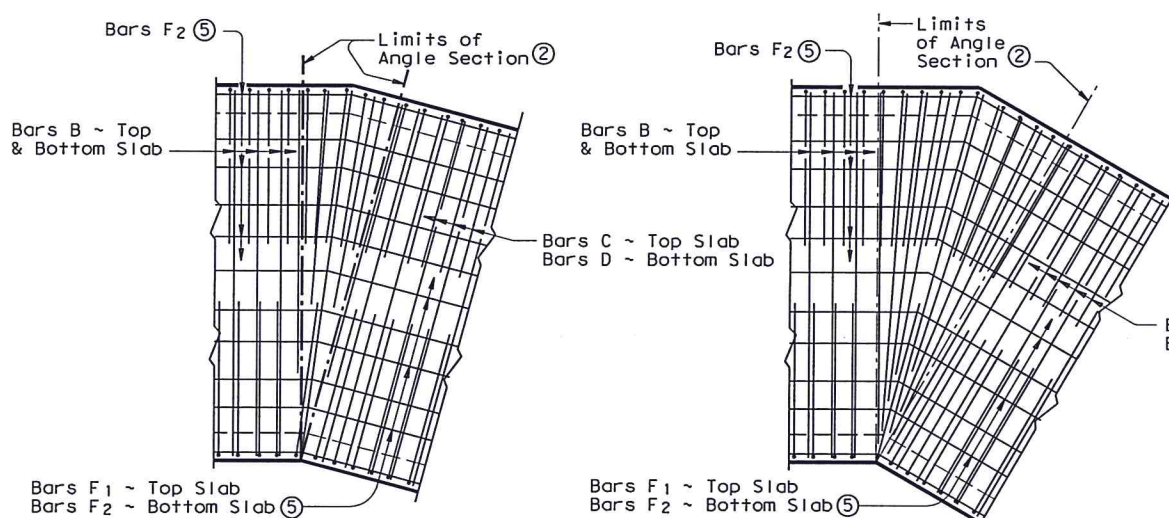


LENGTHENING DETAIL

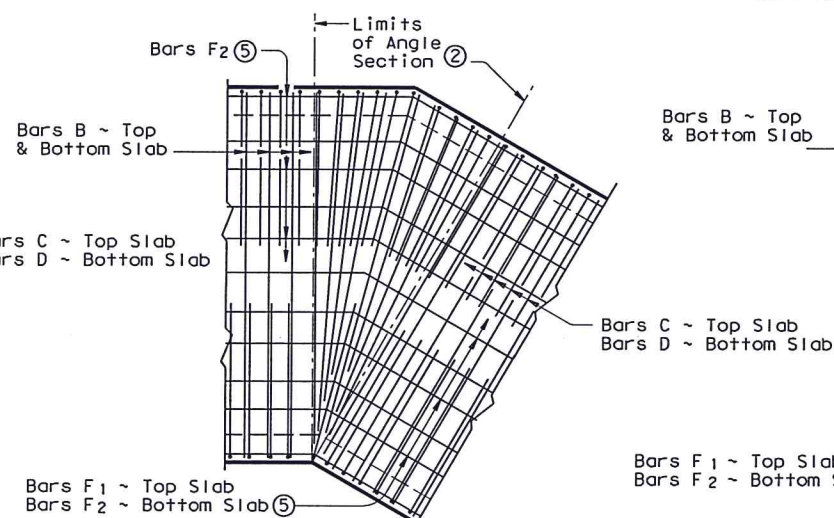
- ① For box culverts with less than 2'-0" of fill, the top slab shall be broken back to provide a minimum 1'-10" lap of the existing longitudinal bars with the longitudinal bars in the extension. If the depth of fill is 2'-0" or greater, the top slab shall be broken back to provide a 1'-0" minimum embedment of existing longitudinal reinforcing into the extension. Alternatively, if the fill height is greater than 2'-0", the existing curb may be left in place and 2'-0" long #6 bars shall be drilled and grouted 1'-0" into the existing top slab at 1'-6" center to center spacing. Wings and apron shall be broken back as necessary to install the extension. Exposed wingwall and apron reinforcing may be removed or cleaned and included in the extension. When lengthening existing box culverts with dimensions different than current standard dimensions, horizontal and vertical transitions shall be formed as directed by the Engineer. Bottom slabs shall match to maintain an uninterrupted flow line. Existing and new reinforcing shall be field bent into transition maintaining specified cover requirements.

#### GENERAL NOTES:

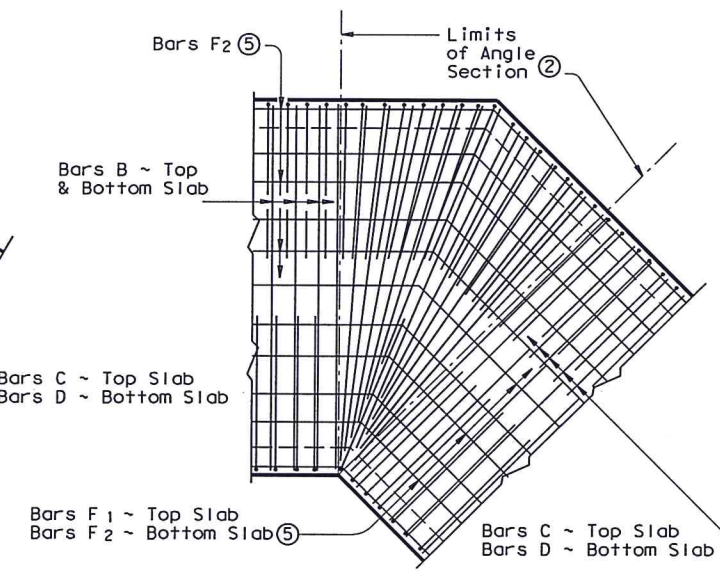
- Designed according to AASHTO LRFD Specifications.
- All reinforcing steel shall be Grade 60.
- All concrete shall be Class "C" with these exceptions: use Class "S" for top slabs of culverts with overlay, with 1-to-2 course surface treatment, or with the top slab as the final riding surface.
- Class "C" concrete shall have a minimum compressive strength of 3,600 psi. Class "S" concrete shall have a minimum compressive strength of 4,000 psi.
- The use of permanent forms is not allowed.
- Refer to Single Box Culverts Cast-in-Place standard for details of straight sections of culvert. For skewed sections and angle sections refer to Single Box Culverts Cast-in-Place standard for slab and wall dimensions, bar sizes, maximum bar spacing, and any other details not shown. For Skewed ends with curbs, adjust length of Bars H, number of Bars K, curb concrete volume and reinforcing steel weight by dividing the values shown on the culvert standards by the cosine of the skew angle.
- Laps for Bars H, when required, shall be 1'-9" for uncoated bars and 2'-7" for epoxy coated.



PLAN OF ANGLE SECTION ~ FROM 0° TO 15°




PLAN OF ANGLE SECTION ~ OVER 15° TO 30°



PLAN OF ANGLE SECTION ~ OVER 30° TO 45°

HL93 LOADING



Texas Department of Transportation

Bridge Division Standard

SINGLE BOX CULVERTS

CAST-IN-PLACE

MISCELLANEOUS DETAILS

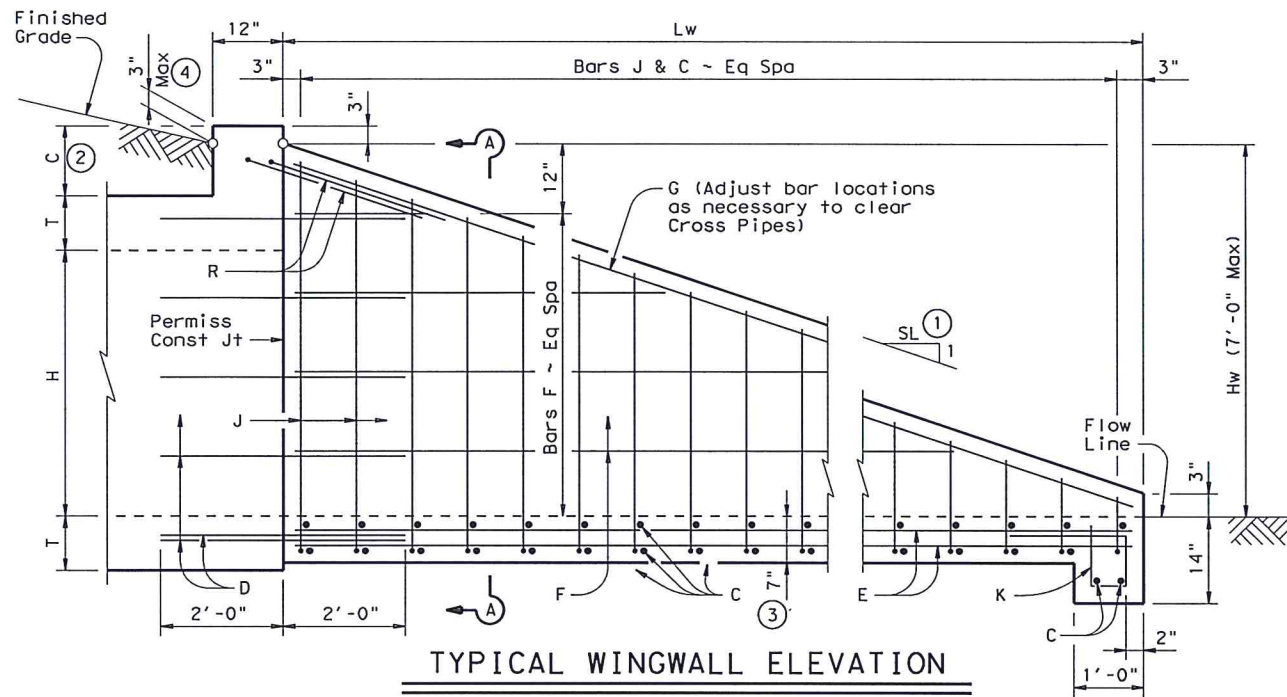
SCC-MD

FILE: sccmdste.dgn	DW: GAF	CK: UNW	DW: BWI/TxDOT	CK: GAF
©TxDOT February 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS				SOUTHLAND
	DIST	COUNTY		SHEET NO.
		TOM GREEN		43

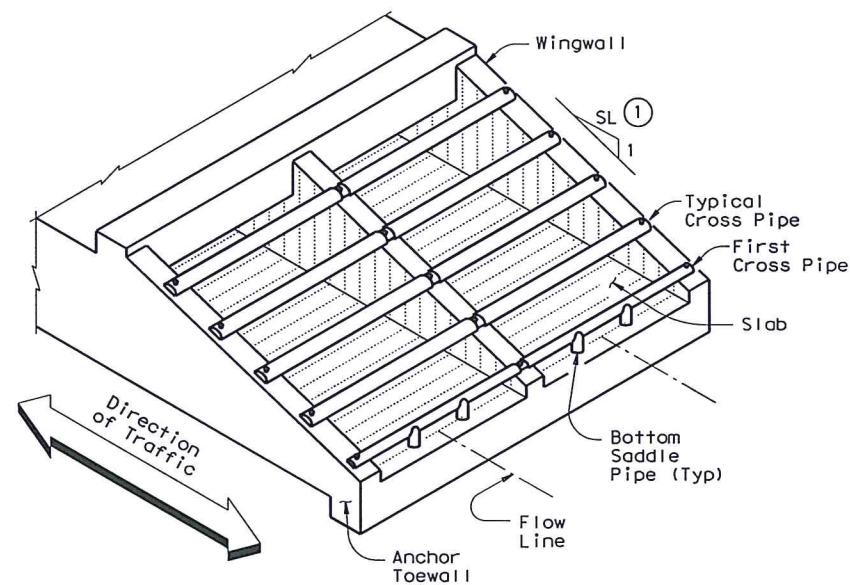


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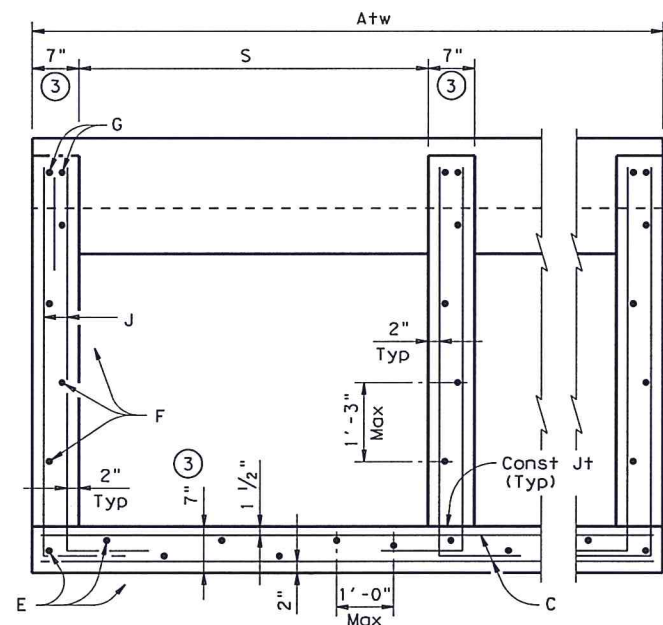


(Cross Pipes not shown for clarity)



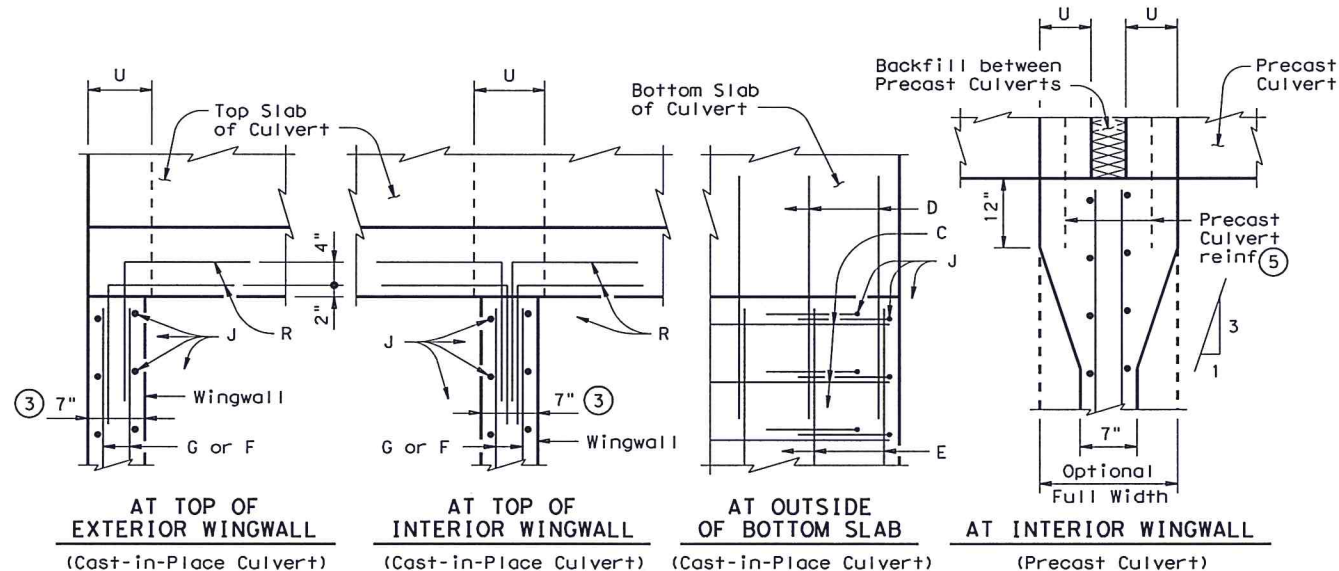
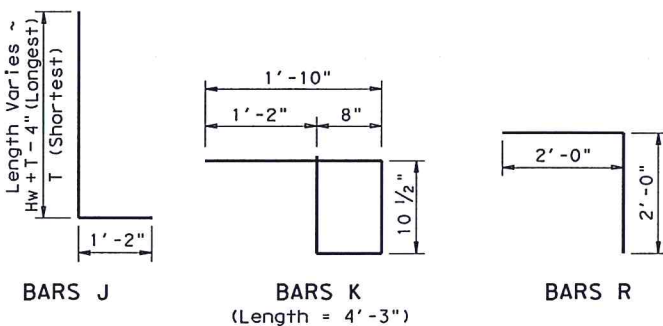
### ISOMETRIC VIEW OF TYPICAL INSTALLATION

(Showing Bolted Anchor Option)



### SECTION A-A

(Showing typical Wingwall and Wing Slab reinforcing)  
(Pipe Runners not shown for clarity)



### PLAN VIEWS OF CORNER DETAILS

TABLE OF REINFORCING BAR SIZES & SPACING		
Bar	Size	Spacing
C	#4	10" Max
D	#4	match F & E
E	#4	1'-0" Max
F	#4	1'-3" Max
G	#6	Shown
J	#4	10" Max
K	#4	1'-0" Max
R	#4	Shown

- Slope will be 6:1 or flatter.
- 0" min to 5'-0" max. Estimated curb heights are shown elsewhere in the plans. For structures without railing and curbs taller than 1'-0", refer to ECD standard.
- Wingwall and slab thicknesses may be the same as the adjacent culvert wall and slab thicknesses (7" Minimum). If thicknesses greater than the minimum (7") are used, no changes will be made in quantities and no additional compensation will be allowed.
- For vehicle safety, curbs shall project no more than 3" above finished grade. Curb heights shall be reduced, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
- For Culverts with C = 0", the precast culvert reinforcing may extend 1'-0" minimum into Wingwall. Wingwall Bars D and R may be omitted. Otherwise, refer to the "Wingwall Connection Detail" on the SCP-MD standard.

Formulas: (All values are in Feet)  
 $Hw = H + T + C - 0.250'$   
 $Lw = (Hw - 0.250') (SL)$   
For Cast-in-place culverts:  
 $Atw = (N) (S) + (N+1) (U)$   
For Precast culverts:  
 $Atw = (N) (2U+S) + (N-1) (0.500')$   
Total Wingwall Area (S.F.)  
 $= (0.5) (Hw + 0.250') (Lw) (N+1)$   
Total Concrete Volume (C.Y.)  
 $= [(Wingwall Area) (0.583') + (Lw) (Atw) (0.583') + (Atw) (1.000') (1.167' - 0.583')] \div (27)$   
Total Reinforcing (Lbs)  
 $= (1.55) (Lw) (Atw) + (4.43) (Atw) + (K) (Hw) (N+1) (\sqrt{Lw})$

C = Height of Curb above top of Top Slab  
Hw = Height of Wingwall  
K = Constant Value for use in formulas  
Slope SL:1 K  
6:1 ~ 10.41  
Atw = Anchor Toewall Length  
Lw = Length of Wingwall  
N = Number of Culvert Barrels  
S = Clear Span of each Barrel  
SL:1 = Side Slope Ratio (Horizontal : 1 Vertical)  
See applicable box culvert standard for H, S, T, and U values.

**GENERAL NOTES:**  
Designed according to AASHTO LRFD Specifications.  
The Safety End Treatments shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the Cross Pipes.  
Cross Pipes are designed for a traversing load of 10,000 pounds at yield as recommended by Research Report 280-2F, "Safety Treatment of Roadside Parallel-Drainage Structures", Texas Transportation Institute, March 1981.  
All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.  
All reinforcing steel shall be Grade 60. All reinforcing shall be adjusted as necessary to provide a minimum clear cover of 1 1/4".  
The quantities for concrete, reinforcing steel, and Cross Pipes resulting from the formulas given herein are for Contractor's information only.  
Cross Pipes, Sleeve Pipes, and Saddle Pipes shall conform to the requirements of ASTM A53 (Type E or S, Grade B), ASTM A500 (Grade B), or API 5LX52.  
Bolts and nuts shall conform to ASTM A307. All steel components, except the concrete reinforcing, shall be galvanized after fabrication. Galvanizing damaged during transport or construction shall be repaired in accordance with the specifications.  
See BCS standard sheet for additional dimensions and information.  
Alternate design drawings bearing the seal of a professional engineer will be acceptable for precast construction of the Safety End Treatments.

SHEET 1 OF 2

Texas Department of Transportation

Bridge Division Standard

## SAFETY END TREATMENT

FOR BOX CULVERTS  
(MAXIMUM Hw = 7'-0")  
TYPE I ~ PARALLEL DRAINAGE

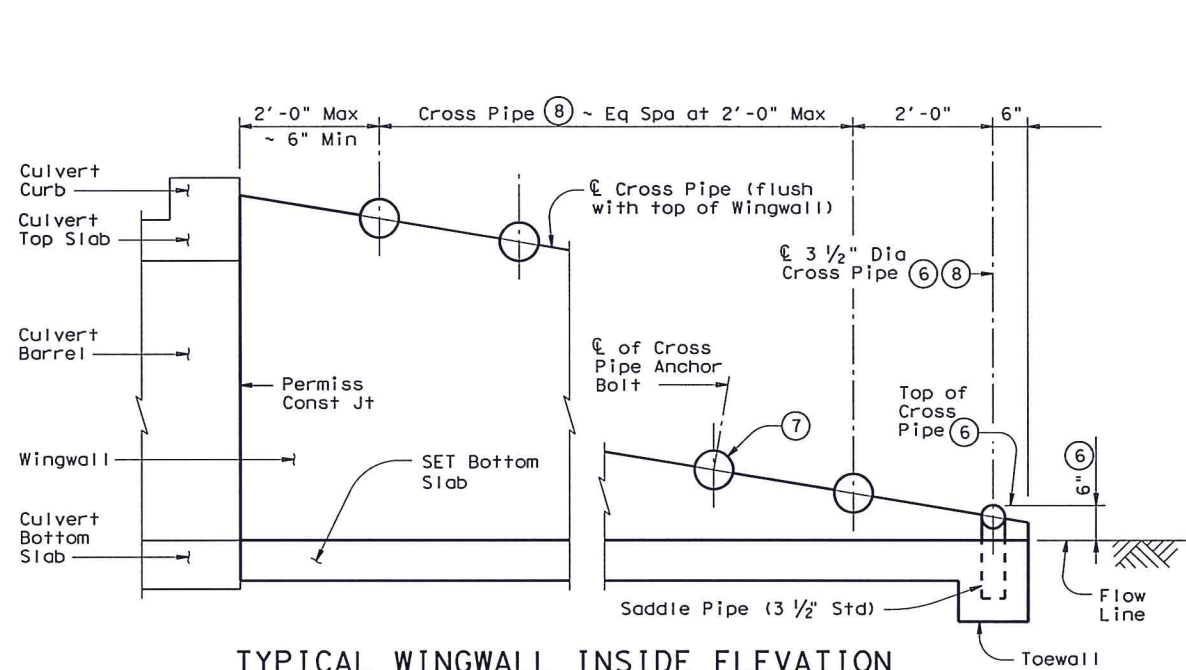
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REVISIONS				SOUTHLAND
	DIST		COUNTY	SHEET NO.
			TOM GREEN	44



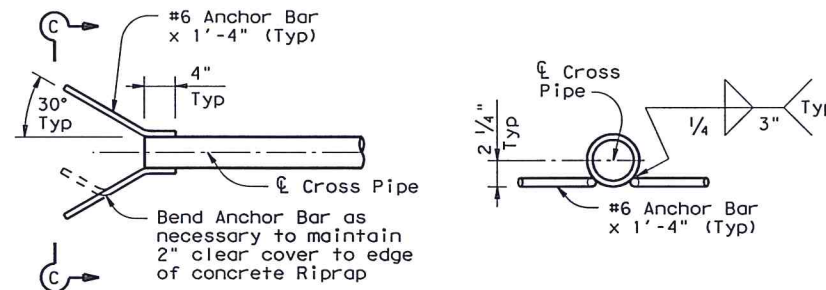
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TYPICAL WINGWALL INSIDE ELEVATION

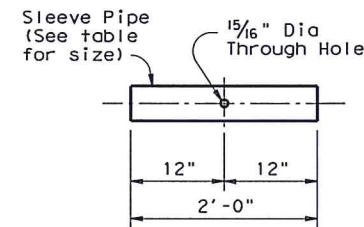
(Showing installation of Cross Pipes)



PART PLAN

SECTION C-C

OPTIONAL ANCHOR BAR DETAILS

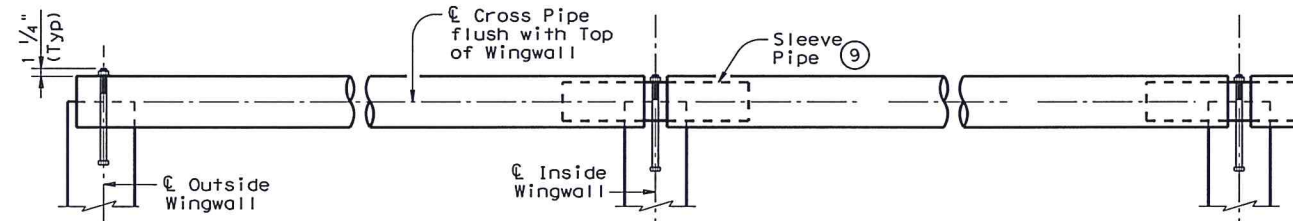
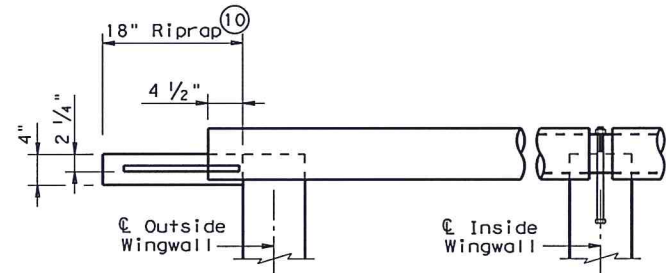


SLEEVE PIPE DETAILS (9)

REQUIRED PIPE SIZES (8)		
Culvert Span Sizes	Cross Pipe Size	Sleeve Pipe Size (9)
First Pipe	3 1/2" STD	2 1/2" STD
30" to 42"	4" STD	3" STD
48" to 72"	5" STD	4" STD
78" to 120"	6" STD	5" STD

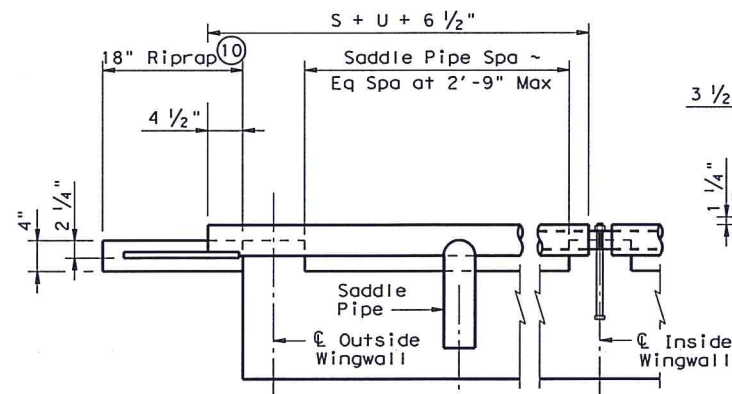
STANDARD PIPE SIZES		
Pipe Size	Pipe O.D.	Pipe I.D.
2 1/2" STD	2.875"	2.469"
3" STD	3.500"	3.068"
3 1/2" STD	4.000"	3.548"
4" STD	4.500"	4.026"
5" STD	5.563"	5.047"
6" STD	6.625"	6.065"

- The proper installation of the first Cross Pipe is critical for vehicle safety. The top of the first Cross Pipe must be placed at no more than 6" above the flow line.
- The third Cross Pipe from the bottom of the Culvert shall always be installed using a bolted connection. Care shall be taken to ensure that concrete does not flow into this Cross Pipe so as to permit disassembly of the bolted connection to allow cleanout access.
- Cross Pipes and Sleeve Pipes (if required) shall be as shown in the REQUIRED PIPE SIZES table. Saddle Pipes for the 3 1/2" first Cross Pipe shall also be 3 1/2".
- At Contractor's option, the Cross Pipe may be continuous across the Inside Wingwalls. If such option is selected, the Sleeve Pipe shall be omitted and a 15/16" diameter through hole made in the Cross Pipe to accept the anchor bolt at the centerline of each Interior Wingwall.
- Riprap will be required when using the optional Anchor Bar details and shall be included in the Price Bid for Safety End Treatment. Such Riprap shall be concrete Riprap in accordance with Item 432, "Riprap".

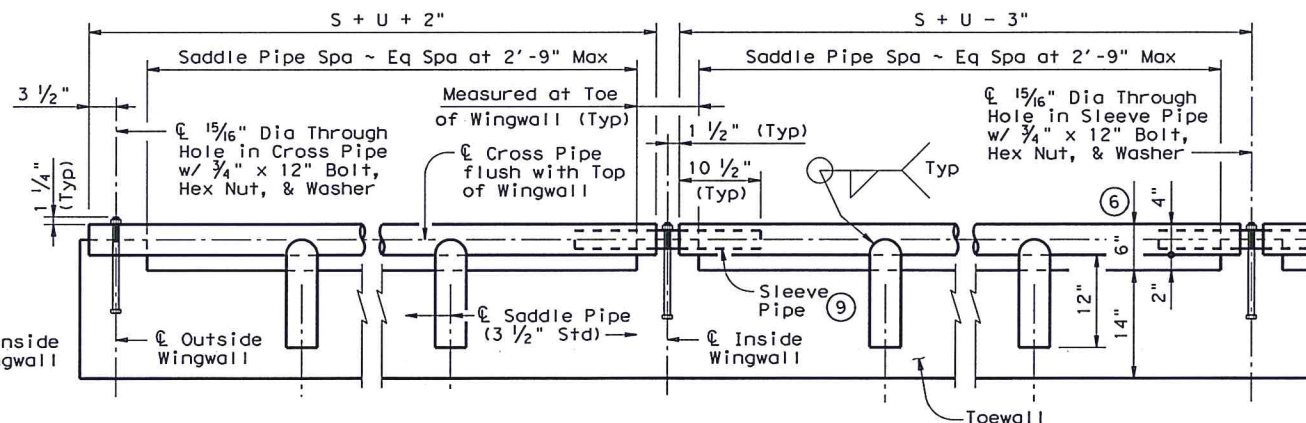


SECTION THROUGH INSTALLATION OF TYPICAL FULL CROSS PIPE

(Anchor details and dimensions are similar to those shown below in SECTION THROUGH INSTALLATION OF 3 1/2" FIRST CROSS PIPE detail.)



OUTSIDE CULVERT BARREL WITH OPTIONAL ANCHOR BARS & RIPRAP



SECTION THROUGH INSTALLATION OF 3 1/2" FIRST CROSS PIPE

OUTSIDE CULVERT BARREL WITH BOLTED ANCHOR

INSIDE CULVERT BARREL

CROSS PIPE INSTALLATION DETAILS

SHEET 2 OF 2



SAFETY END TREATMENT  
FOR BOX CULVERTS  
(MAXIMUM HW = 7'-0")  
TYPE I ~ PARALLEL DRAINAGE

SETB-PD

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REVISIONS				
	DIST	COUNTY		SOUTHLAND
		TOM GREEN		45