FED.RD. DIV.NO.	FEDERAL AID PROJECT NO.		SHEET NO.
6	BR 2021(887),ETC.		1
STATE	STATE DIST.	COUNTY	
TEXAS	23	COMANCHE	
CONT.	SECT.	JOB	HIGHWAY NO.
0923	17	088,ETC.	CR 340,ETC.

STATE OF TEXAS
DEPARTMENT OF TRANSPORTATION

PLANS OF PROPOSED
STATE HIGHWAY IMPROVEMENT

FEDERAL AID PROJECT NO. BR 2B20(088)

CR 4981

Comanche County

FOR THE CONSTRUCTION OF BRIDGE REPLACEMENT
CONSISTING OF REPLACING BRIDGE AND APPROACHES

LIMITS: ON CR 4981 at Leon River Draw

DESIGN SPEED = MEETS OR EXCEEDS EXISTING
ADT(2013) = 50
ADT(2033) = 70
RURAL LOCAL

LENGTH OF PROJECT

ROADWAY	=	237.08 FT	= 0.045 MI.
BRIDGE	=	22.92 FT	= 0.004 MI.
TOTAL	=	260.00 FT	= 0.049 MI.

INDEX OF SHEETS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	INDEX OF SHEETS

FINAL PLANS

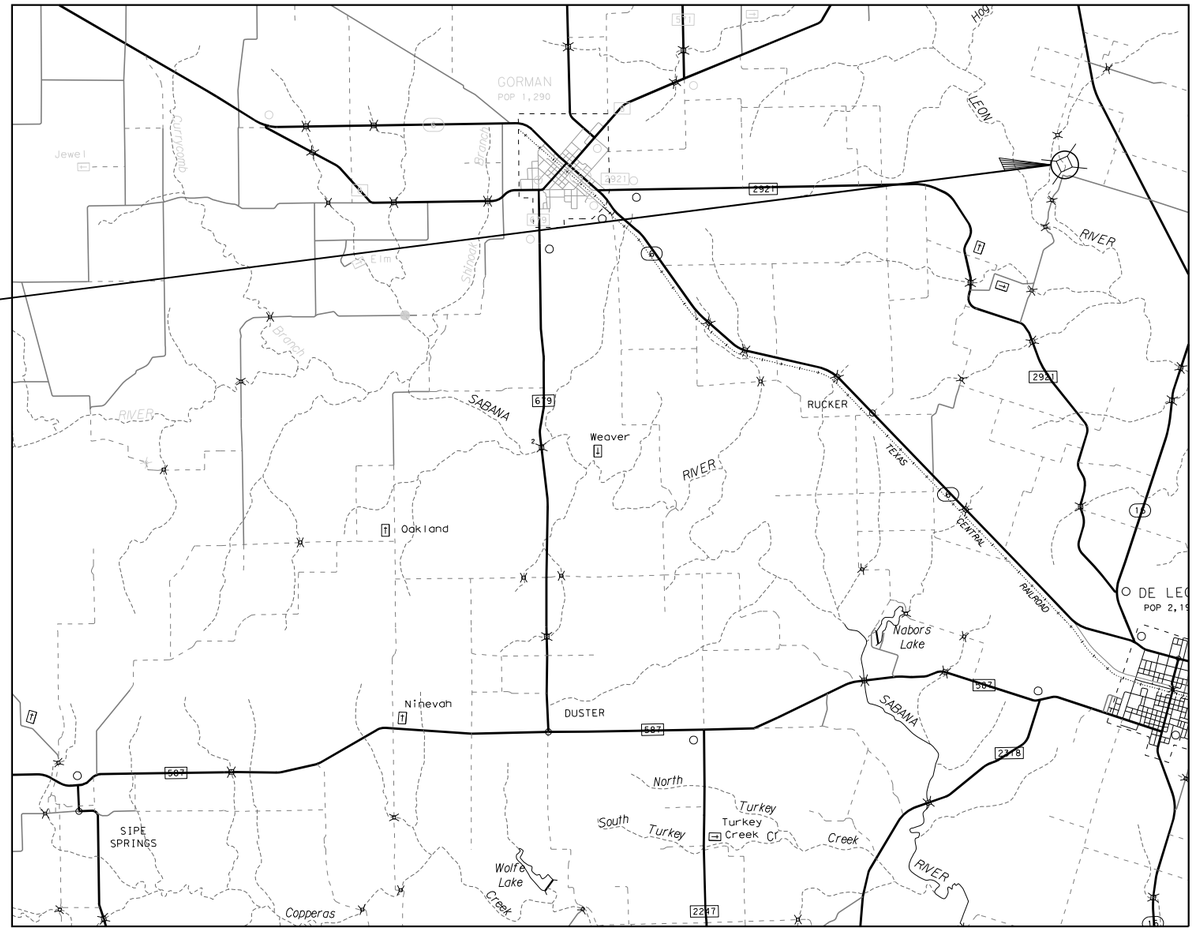
PROJECT LETTING DATE:
CONTRACTOR:
DATE CONTRACTOR BEGAN WORK:
DATE WORK WAS COMPLETED AND ACCEPTED:
FINAL CONTRACT COST:

STATE OF TEXAS
GEORGE E. TILLETT
80310
LICENSED PROFESSIONAL ENGINEER
10/22/2021

BEG PROJECT
STA 10+90
0923-17-086
END PROJECT
STA 13+50
0923-17-086

VOLUME 3

CONTRACT CSJ: 0923-17-088



SCALE 0 1 2 MILES

THE CONSTRUCTION WORK WAS PERFORMED IN ACCORDANCE WITH THE PLANS AND CONTRACT.

AREA ENGINEER, P.E. _____ DATE _____

SPECIFICATIONS ADOPTED BY THE TEXAS DEPARTMENT OF TRANSPORTATION, NOVEMBER 2014 AND SPECIFICATION ITEMS LISTED AND DATED AS FOLLOWS, SHALL GOVERN ON THIS PROJECT: REQUIRED CONTRACT PROVISIONS FOR ALL FEDERAL-AID CONSTRUCTION CONTRACTS (FORM FHWA 1273, MAY, 2012).

EQUATIONS: NONE
EXCEPTIONS: NONE
NO RAILROAD CROSSINGS - NONE ELIMINATED

REQUIRED SIGNS SHALL BE IN ACCORDANCE WITH BC (1)-21 THRU BC (12)-21 AND THE "TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES".

10/29/2021

CONCURRENCE:
DocuSigned by:
Stephanie L Davis
5B0490540F63477...
COUNTY JUDGE

Texas Department of Transportation

11/5/2021
SUBMITTED FOR LETTING:
DocuSigned by:
Dan A. Hohmann, P.E.
2E74F333C7B14AA...
DISTRICT DESIGN ENGINEER

11/5/2021
RECOMMENDED FOR LETTING:
DocuSigned by:
77D14777834646F...
DISTRICT DIRECTOR OF TRANSPORTATION
PLANNING AND DEVELOPMENT

11/5/2021
RECOMMENDED FOR LETTING:
DocuSigned by:
Elias Rmeili, P.E.
BB9FD402431A4A3...
DISTRICT ENGINEER

pw://tts-pw.bentley.com:tts-pw-01/Documents/0223.002 WA 3 - CR Brown Comanche Co/Cadd/Plan Sheets/General/CR4981_Title-01.dgn
10/22/2021 9:04

INDEX OF SHEETS

STATE OF TEXAS
GEORGE E. TILLETT
80310
LICENSED PROFESSIONAL ENGINEER

* THE STANDARD SHEETS SPECIFICALLY IDENTIFIED HAVE BEEN SELECTED BY ME OR UNDER MY RESPONSIBLE SUPERVISION AS BEING APPLICABLE TO THIS PROJECT.

George E. Tillett 10/6/2021
SIGNATURE DATE

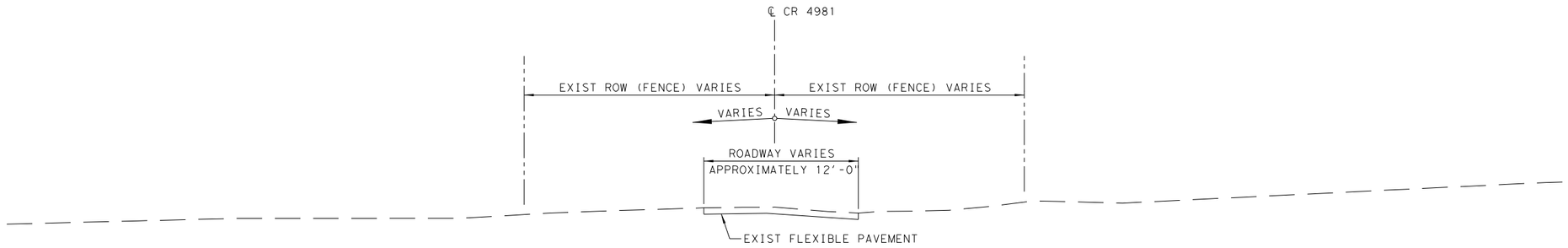
NO.	REVISION	BY	DATE

TEXAS TRANSPORTATION SOLUTIONS, INC.
Firm # F-19297

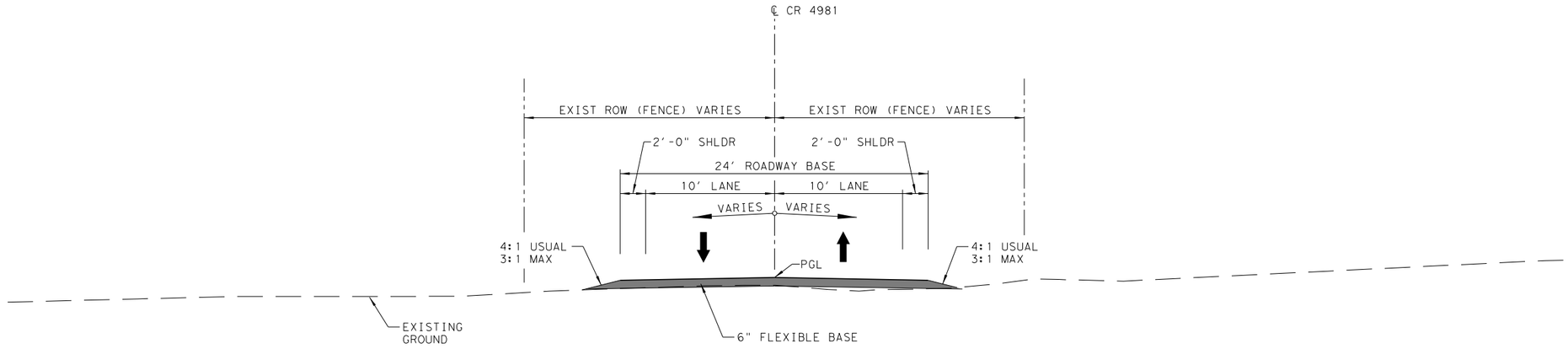
INDEX OF SHEETS
CR 4981 AT LEON RIVER DRAW-2

SHEET 1 OF 1

FED. RD DIV. No.	CONTROL No.	SECTION No.	JOB No.	HIGHWAY No.
6	0923	17	086	CR 4981
STATE	DISTRICT	COUNTY		SHEET No.
TEXAS	BWD	COMANCHE		2



EXISTING CR 4981 APPROACH ROADWAY



PROPOSED CR 4981 APPROACH ROADWAY

FROM STA 11+40.00 TO STA 12+24.54
FROM STA 12+47.46 TO STA 13+00.00

PROPOSED BRIDGE CLASS CULVERT STA 12+24.54 TO STA 12+47.46

TRANSITION FROM EXISTING WIDTH TO PROPOSED WIDTH
STA 10+90.00 TO 11+40.00
STA 13+00.00 TO 13+50.00

TRANSITION FROM EXISTING CROSS SLOPE AT STA 10+90 TO 2% CROSS SLOPE AT STA 11+40.00 (LEFT)
SEE PLAN AND PROFILE FOR INTERSECTION CROSS SLOPES (RIGHT)
TRANSITION FROM 2% CROSS SLOPE AT STA 13+00.00 TO EXISTING CROSS SLOPE AT STA 13+50.00 (LEFT AND RIGHT)

ITEM	CODE	DESCRIPTION	UNIT	QUANTITY
247	6055	FL BS (CMP IN PLC) (TYD)(GR-3)(FINAL POS)	CY	109

FL BS (CMP IN PLC) (TYD)(GR-3)(FINAL POS) EST. @ 44.4 CY/STA (TOTAL 72 CY)
ADDITIONAL FLEX BASE EST. @ 37 CY TOTAL FOR TRANS

NO.	REVISION	BY	DATE

STATE OF TEXAS
JAMES BROOKS
101002
LICENSED PROFESSIONAL ENGINEER
10/6/2021

TEXAS TRANSPORTATION SOLUTIONS, INC.
Firm #F-19297

TYPICAL SECTIONS CR 4981 AT LEON RIVER DRAW-2

SHEET 1 OF 1

FED. RD DIV. No.	CONTROL No.	SECTION No.	JOB No.	HIGHWAY No.
6	0923	17	086	CR 4981
STATE	DISTRICT	COUNTY		SHEET No.
TEXAS	BWD	COMANCHE		3

pw://tts-pw.bentley.com:tts-pw-01/Documents/0223.002 WA 3 - CR Brown Comanche Co/Cadd/Plan Sheets/Roadway/CR4981_ROW_TYP_01.dgn
10/6/2021 2:57 JamesBrooks SCRIPT: CR4981_Index.pen

ROADWAY QUANTITIES

110-6001	132-6005	164-6001	164-6009	164-6011	168-6001	169-6003	SUBSIDIARY	247-6055
EXCAVATION (ROADWAY)	EMBANKMENT (FINAL)(ORD COMP)(TY C)	BROADCAST SEED (PERM) (RURAL) (SANDY)	BROADCAST SEED (TEMP) (WARM)	BROADCAST SEED (TEMP) (COOL)	VEGETATIVE WATERING	SOIL RETENTION BLANKETS (CL 1) (TY C)	FERTILIZER	FL BS (CMP IN PLC)(TY D GR 3)(FNAL POS)
CY	CY	SY	SY	SY	MG	SY	TON	CY
119	16	145	72	72	4	300	0.01	109

ROADWAY QUANTITIES

506-6038	506-6039	506-6041	506-6043	530-6016
TEMP SEDMT CONT FENCE (INSTALL)	TEMP SEDMT CONT FENCE (REMOVE)	BIODEG EROSN CONT LOGS (INSTL) (12")	BIODEG EROSN CONT LOGS (REMOVE)	DRIVEWAYS (BASE)
LF	LF	LF	LF	SY
525	525	40	40	61

DELINEATOR & OBJECT MARKERS SUMMARY

658-6047
INSTL OM ASSM (OM-2Y)(WC)GND
EA
4

PREPARING ROW SUMMARY

LOCATION STA. - STA.	100-6002
	PREPARING ROW
	STA
10+75.00 - 13+50.00	2.6
TOTAL	2.6

FENCE SUMMARY

LOCATION STA. - STA.	552-6003	552-6008
	WIRE FENCE (TY C)	WIRE FENCE (WATER GAP)
	LF	LF
10+75.00 - 13+50.00	260	50
TOTAL	260	50

ITEM 552-6003 WILL BE USED FOR PERMANENT & TEMP FENCING: BRACES ESTIMATED @ 8 EA
THE FENCE LOCATION MUST BE APPROVED BY THE ENGINEER BEFORE BUILDING
PERMANENT FENCING TO BE LOCATED AS CLOSE TO EXISTING FENCE AS POSSIBLE UNLESS OTHERWISE DIRECTED BY THE ENGINEER

REMOVAL SUMMARY

LOCATION STA. - STA.	496-6009	658-6060
	REMOV STR (BRIDGE 0 - 99 FT LENGTH)	REMOVE DELIN & OBJECT MARKER ASSMS
	EA	EA
10+75.00 - 13+50.00	1	4
TOTAL	1	4

NO.	REVISION	BY	DATE

STATE OF TEXAS
JAMES BROOKS
101002
LICENSED PROFESSIONAL ENGINEER
10/6/2021

TEXAS TRANSPORTATION SOLUTIONS, INC.
Firm #F-19297

QUANTITY SUMMARIES
CR 4981 AT LEON
RIVER DRAW-2

SHEET 1 OF 1

FED. RD DIV. No.	CONTROL No.	SECTION No.	JOB No.	HIGHWAY No.
6	0923	17	086	CR 4981
STATE	DISTRICT	COUNTY		SHEET No.
TEXAS	BWD	COMANCHE		6

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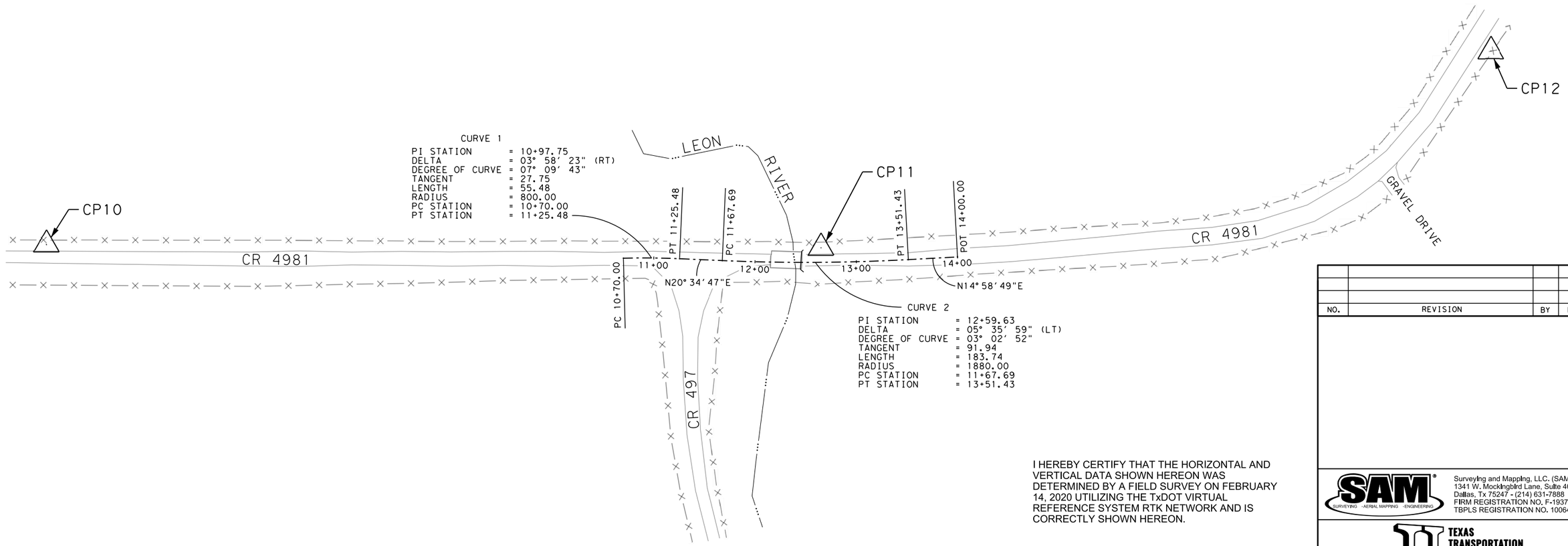
10/6/2021 2:57 JamesBrooks SCRIPT: CR4981_Index.pen

CONTROL POINTS (SURFACE COORDINATES)							
POINT	NORTH	EAST	ELEVATION	STATION	OFFSET	LT/RT	DESCRIPTION
CP10	10,771,896.960	2,845,178.762	1,242.649'	N/A	N/A	N/A	3 1/2" ALUMINUM DISK SET IN CONCRETE
CP11	10,772,622.870	2,845,418.812	1,248.287'	12+65.31	14.47'	LT	3 1/2" ALUMINUM DISK SET IN CONCRETE
CP12	10,773,311.323	2,845,439.900	1,244.119'	N/A	N/A	N/A	3 1/2" ALUMINUM DISK SET IN CONCRETE



50 0 25 50 100

GRAPHIC SCALE
1" = 100' (11"x17")
COMANCHE COUNTY, TEXAS

NOTES:

1. THE SURVEY CONTROL INFORMATION HAS BEEN ACCEPTED AND INCORPORATED INTO THIS PS&E" WHICH IS SIGNED, SEALED AND DATED BY A TEXAS PROFESSIONAL ENGINEER.

2. ALL COORDINATES SHOWN HEREON ARE BASED ON THE TEXAS COORDINATE SYSTEM, CENTRAL ZONE (4203), NORTH AMERICAN DATUM OF 1983 (2011 ADJ: EPOCH 2010.00)

3. THE VERTICAL DATUM FOR THIS PROJECT IS THE NAVD 1988 (CORS 2011), U.S. SURVEY FEET.

4. ALL COORDINATE VALUES ARE BASED UPON AN AVERAGE OF FOUR 180 EPOCH OBSERVATIONS UTILIZING THE TxDOT VRS NETWORK.

5. COORDINATES AND DISTANCES ARE U.S. SURVEY FEET. DISPLAYED IN SURFACE VALUES USING THE SURFACE ADJUSTMENT FACTOR 1.00003 (0.9999700009)

I HEREBY CERTIFY THAT THE HORIZONTAL AND VERTICAL DATA SHOWN HEREON WAS DETERMINED BY A FIELD SURVEY ON FEBRUARY 14, 2020 UTILIZING THE TxDOT VIRTUAL REFERENCE SYSTEM RTK NETWORK AND IS CORRECTLY SHOWN HEREON.

STATE OF TEXAS
REGISTERED
ERIC A. KREINER
5320
PROFESSIONAL
LAND SURVEYOR

Eric A. Kreiner
RPLS No. 5320

07/08/20
Date

NO.	REVISION	BY	DATE

Surveying and Mapping, LLC. (SAM)
1341 W. Mockingbird Lane, Suite 400W
Dallas, Tx 75247 - (214) 631-7888
FIRM REGISTRATION NO. F-1937
TBPLS REGISTRATION NO. 10064301

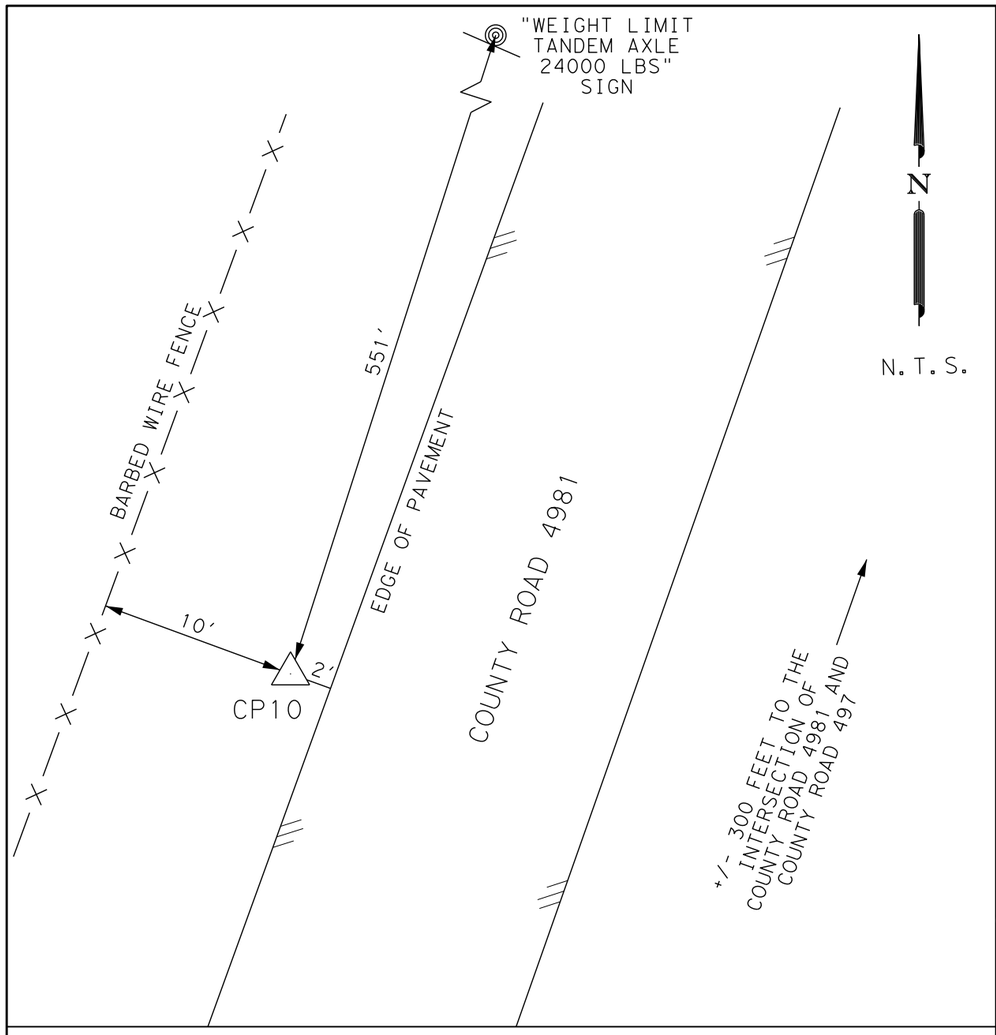
TEXAS TRANSPORTATION SOLUTIONS, INC.
Firm # F-10997

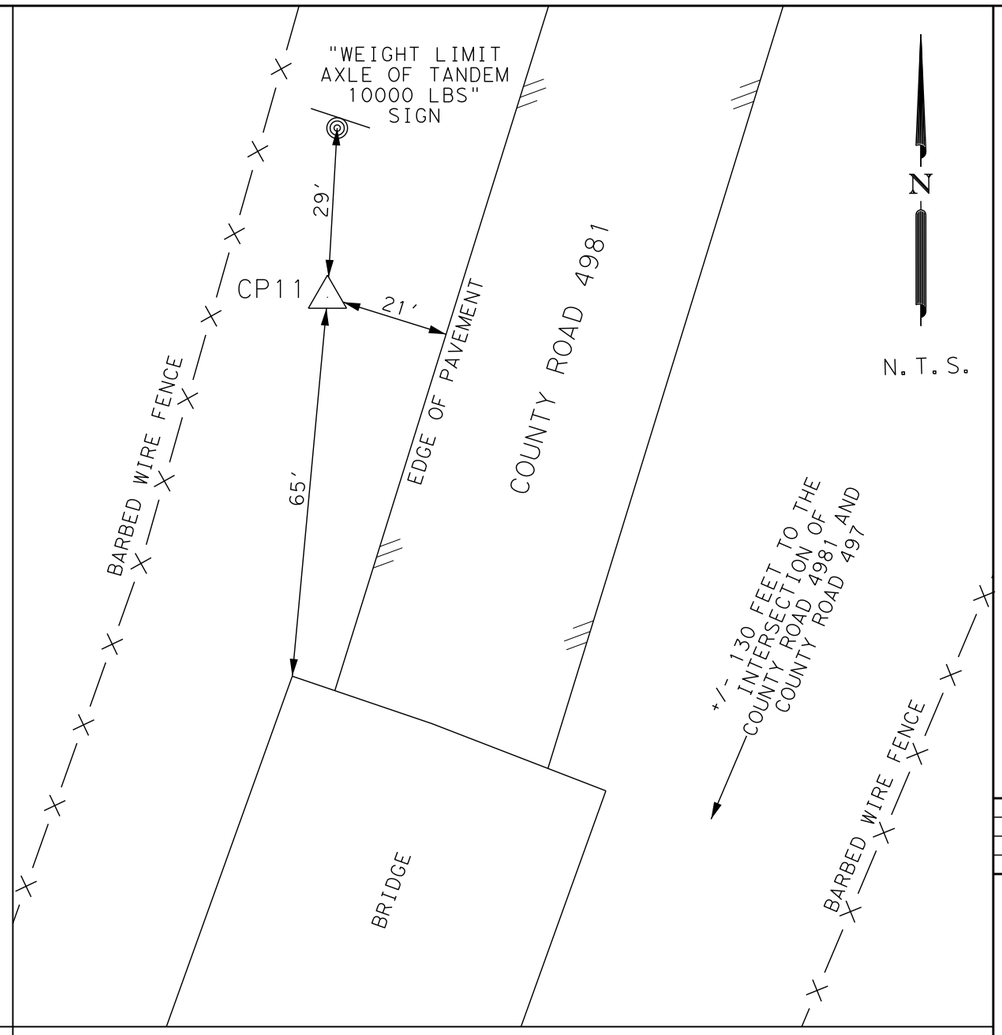
SURVEY CONTROL INDEX SHEET
CR 4981 @ LEON RIVER

1 OF 1

FED. RD DIV. No.	CONTROL No.	SECTION No.	JOB No.	HIGHWAY No.
6	0923	17	086	CR 4981
STATE	DISTRICT	COUNTY		SHEET No.
TEXAS	BWD	COMANCHE		7

CR4981 @ Leon River_Index.dgn
2020-07-08





CONTROL POINT NO. 10:
APPROXIMATE LOCATION:

3 1/2" ALUMINUM DISK SET IN CONCRETE STAMPED "CP10", +/-300 FEET SOUTH OF THE INTERSECTION OF COUNTY ROAD 4981 AND COUNTY ROAD 497, 551′ SOUTHWEST OF A "WEIGHT LIMIT TANDEM AXLE 24000 LBS" SIGN, 10′ EAST OF A BARBED WIRE FENCE AND 2′ WEST OF THE WEST EDGE OF PAVEMENT OF COUNTY ROAD 4981.

US SURVEY FEET
NAVD 88 ELEVATION= 1,242.649′
DATE SET: FEBRUARY 14, 2020
MONUMENT: 3 1/2" ALUMINUM DISK SET IN CONCRETE STAMPED "CP10"
COMANCHE COUNTY SCALE FACTOR: 1.00003
SURFACE ENGLISH CO-ORDS
NORTHING: 10,771,896.960
EASTING: 2,845,178.762
STATE PLANE ENGLISH CO-ORDS
NORTHING: 10,771,573.813
EASTING: 2,845,093.409
ELEVATIONS ARE NAVD 88 BASED UPON TXDOT VRS RTK NETWORK

CONTROL POINT NO. 11:
APPROXIMATE LOCATION:

3 1/2" ALUMINUM DISK SET IN CONCRETE STAMPED "CP11", +/- 130 FEET NORTH OF THE INTERSECTION OF COUNTY ROAD 4981 AND COUNTY ROAD 497, 65′ NORTH OF THE NORTHWEST CORNER OF THE BRIDGE DECK, 29′ SOUTH OF A "WEIGHT LIMIT AXLE OF TANDEM 10000 LBS" SIGN, AND 21′ WEST OF THE WEST EDGE OF PAVEMENT OF COUNTY ROAD 4981.

US SURVEY FEET
NAVD 88 ELEVATION= 1,248.287′
DATE SET: FEBRUARY 14,2020
MONUMENT: 3 1/2" ALUMINUM DISK SET IN CONCRETE STAMPED "CP11"
COMANCHE COUNTY SCALE FACTOR: 1.00003
SURFACE ENGLISH CO-ORDS
NORTHING: 10,772,622.870
EASTING: 2,845,418.812
STATE PLANE ENGLISH CO-ORDS
NORTHING: 10,772,299.701
EASTING: 2,845,333.452
ELEVATIONS ARE NAVD 88 BASED UPON TXDOT VRS RTK NETWORK

I HEREBY CERTIFY THAT THE HORIZONTAL AND VERTICAL DATA SHOWN HEREON WAS DETERMINED BY A FIELD SURVEY ON FEBRUARY 14, 2020 UTILIZING THE TxDOT VIRTUAL REFERENCE SYSTEM RTK NETWORK AND IS CORRECTLY SHOWN HEREON.

STATE OF TEXAS
REGISTERED
ERIC A. KREINER
5320
PROFESSIONAL
LAND SURVEYOR

07/08/20
Eric A. Kreiner Date
RPLS No. 5320

NO.	REVISION	BY	DATE

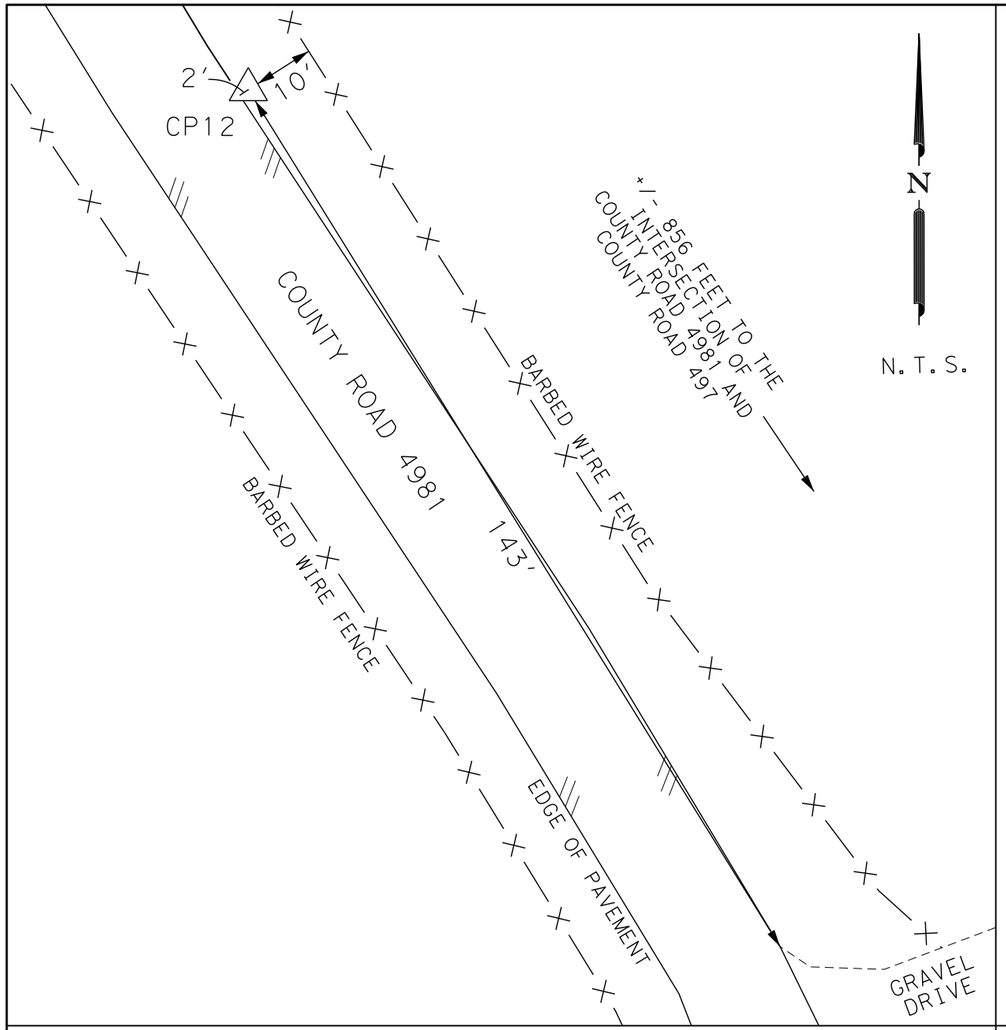
SAM SURVEYING · AERIAL MAPPING · ENGINEERING
Surveying and Mapping, LLC. (SAM)
1341 W. Mockingbird Lane, Suite 400W
Dallas, Tx 75247 • (214) 631-7888
FIRM REGISTRATION NO. F-1937
TBPLS REGISTRATION NO. 10064301

TEXAS TRANSPORTATION SOLUTIONS, INC.
Firm #F-19207

PRIMARY HORIZONTAL AND VERTICAL CONTROL CR 4981 @ LEON RIVER

FED. RD DIV. No.	CONTROL No.	SECTION No.	JOB No.	HIGHWAY No.
6	0923	17	086	CR 4981
STATE	DISTRICT	COUNTY		SHEET No.
TEXAS	BWD	COMANCHE		8

CR4981 @ Leon River_HRV.dgn
2020-07-08



CONTROL POINT NO. 12:
APPROXIMATE LOCATION:

3 1/2" ALUMINUM DISK SET IN CONCRETE STAMPED "CP12", +/- 856 FEET NORTHWEST OF THE INTERSECTION OF COUNTY ROAD 4981 AND COUNTY ROAD 497, 143' NORTHWEST OF A GRAVEL DRIVE, 10' WEST OF A BARBED WIRE FENCE, AND 2' EAST OF THE EAST EDGE OF PAVEMENT OF COUNTY ROAD 4981.

US SURVEY FEET
NAVD 88 ELEVATION= 1,244.119'
DATE SET: FEBRUARY 14, 2020
MONUMENT: 3 1/2" ALUMINUM DISK SET IN CONCRETE STAMPED "CP12"
EASTLAND COUNTY SCALE FACTOR: 1.00003
SURFACE ENGLISH CO-ORDS
NORTHING: 10,773,311.323
EASTING: 2,845,439.900
STATE PLANE ENGLISH CO-ORDS
NORTHING: 10,772,988.133
EASTING: 2,845,354.539
ELEVATIONS ARE NAVD 88 BASED UPON TXDOT VRS RTK NETWORK

I HEREBY CERTIFY THAT THE HORIZONTAL AND VERTICAL DATA SHOWN HEREON WAS DETERMINED BY A FIELD SURVEY ON FEBRUARY 14, 2020 UTILIZING THE TxDOT VIRTUAL REFERENCE SYSTEM RTK NETWORK AND IS CORRECTLY SHOWN HEREON.

STATE OF TEXAS · REGISTERED · ERIC A. KREINER · 5320 · PROFESSIONAL LAND SURVEYOR

07/08/20
Eric A. Kreiner — Date
RPLS No. 5320

NO.	REVISION	BY	DATE

Surveying and Mapping, LLC. (SAM)
1341 W. Mockingbird Lane, Suite 400W
Dallas, Tx 75247 • (214) 631-7888
FIRM REGISTRATION NO. F-1937
TBPLS REGISTRATION NO. 10064301

TEXAS TRANSPORTATION SOLUTIONS, INC.
Firm # P-10097

PRIMARY HORIZONTAL AND VERTICAL CONTROL CR 4981 @ LEON RIVER

FED. RD DIV. No.	CONTROL No.	SECTION No.	JOB No.	HIGHWAY No.
6	0923	17	086	CR 4981
STATE	DISTRICT	COUNTY		SHEET No.
TEXAS	BWD	COMANCHE		9

CR4981 @ Leon River_H&V.dgn
2020-07-08

M4-10R
48"X36"

R11-4
60"X30"

(1)

M4-10L
48"X36"

R11-4
60"X30"

(2)

M4-12T
36"X12"

M4-9R
48"X36"

(3)

M4-12T
36"X12"

M4-9L
48"X36"

(4)

M4-12T
36"X12"

M4-8
24"X12"

(5)

CW20-3D
48"x48"

(6)

CW20-3B
48"x48"

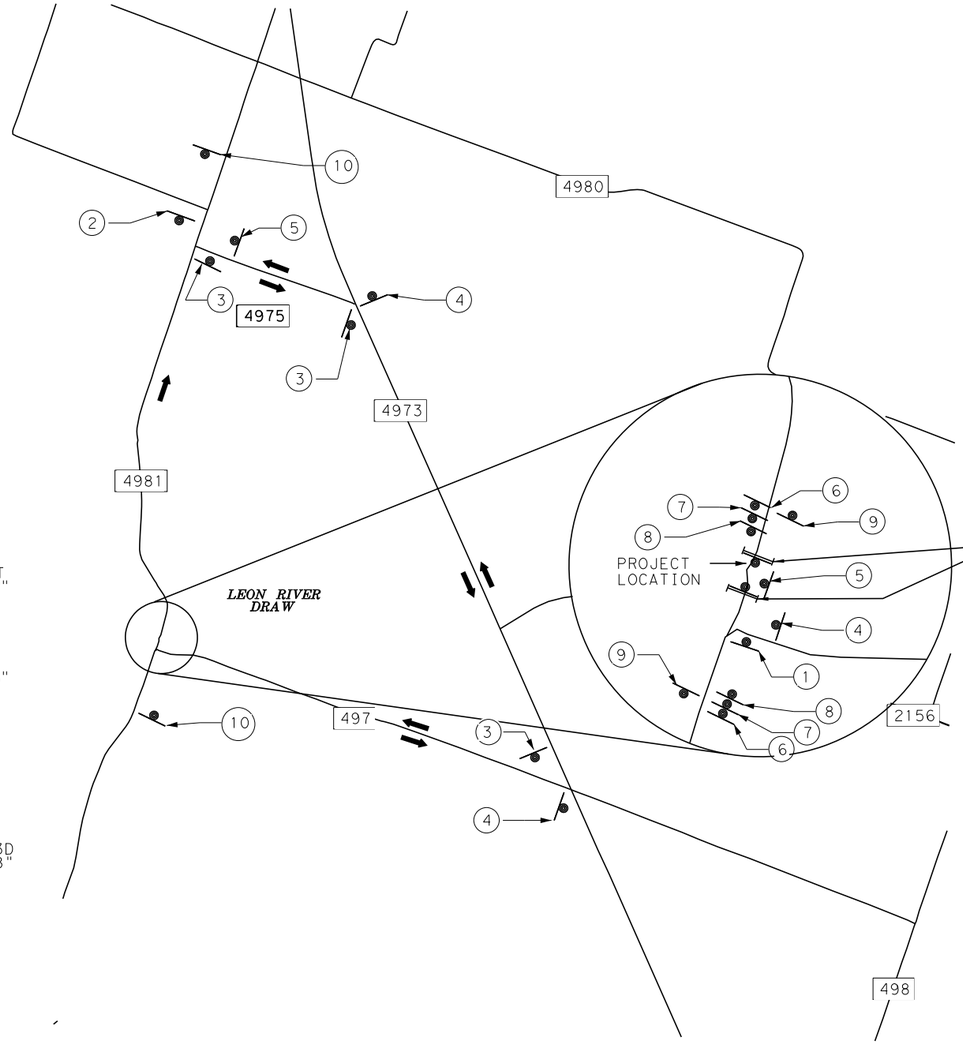
(7)

CW20-3C
48"x48"

(8)

G20-2
48"X24"

(9)



R20-3T
48"X42"

(10)

LEGEND	
SIGN	
TY III BARRICADES	

DETOUR LENGTH 4.08 MILES
ADT(2013): 50
% TRUCK: 5

G20-6T
48"X60"

R11-2
48"X30"

TYP III BARRICADE RAIL

GENERAL NOTES:

SIGNS SHALL BE PLACED IN ACCORDANCE WITH THE BARRICADE AND CONSTRUCTION STANDARDS OR AS DIRECTED BY THE ENGINEER.

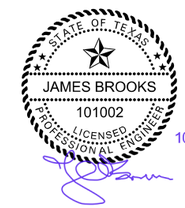
OTHER SIGNS AS DETAILED IN THE BARRICADE AND CONSTRUCTION STANDARDS AND IN THE MUTCD MAY BE USED AS REQUIRED BY THE ENGINEER IN ORDER TO PROVIDE FOR THE SAFE PASSAGE OF TRAFFIC THROUGH THE PROJECT. PAYMENT FOR ALL SUCH SIGNS, BARRICADES OR TRAFFIC CONTROL DEVICES SHALL BE CONSIDERED SUBSIDIARY TO ITEM 502 "BARRICADES, SIGNS AND TRAFFIC HANDLING."

PROVIDE ACCESS TO AND FROM DRIVEWAYS AND ALL ADJACENT PROPERTY AT ALL TIMES.

TRAFFIC CONTROL SEQUENCE
THE CONTRATOR SHALL BE REQUIRED TO SUBMIT A DETAILED SCHEDULE OF WORK TO THE AREA ENGINEER PRIOR TO THE BEGINNING OF CONSTRUCTION, WHICH GENERALLY CONFORMS TO THE FOLLOWING SEQUENCE:

1. INSTALL PROJECT LIMIT SIGNING AND BARRICADES AND SW3P PRIOR TO BEGINNING ANY OTHER WORK.
2. ALL ROAD CLOSURE SIGNING SHALL BE IN PLACE PRIOR TO ANY ACTIVITIES WHICH WILL PROHIBIT THROUGH TRAFFIC AND SHALL BE PLACED MORE THAN 24 HOURS PRIOR TO SUCH ACTIVITY.
3. COMPLETE THE CONSTRUCTION OF THE BRIDGE AND APPROACHES ACCORDING TO THE PLANS AND SPECIFICATIONS AND AS DIRECTED BY THE ENGINEER.
4. THE ROADWAY SHALL BE OPEN TO THROUGH TRAFFIC AS SOON AS DETERMINED PRACTICAL BY THE ENGINEER.
5. COMPLETE ALL OTHER WORK AS DIRECTED BY THE ENGINEER.

NO.	REVISION	BY	DATE



10/22/2021

TEXAS TRANSPORTATION SOLUTIONS, INC.
Firm #F-19207

TRAFFIC CONTROL PLAN CR 4981 AT LEON RIVER DRAW-2

SHEET 1 OF 1

FED. RD DIV. No.	CONTROL No.	SECTION No.	JOB No.	HIGHWAY No.
6	0923	17	086	CR 4981
STATE	DISTRICT	COUNTY		SHEET No.
TEXAS	BWD	COMANCHE		10

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DATE: 10/6/2021 3:00
FILE: pw://tts-pw.bentley.com:tts-pw-01/Documents/0223.002 WA 3 - CR Brown Comanche Co/Cadd/Standards/TCP/BC-21.dgn

BARRICADE AND CONSTRUCTION (BC) STANDARD SHEETS GENERAL NOTES:

1. The Barricade and Construction Standard Sheets (BC sheets) are intended to show typical examples for placement of temporary traffic control devices, construction pavement markings, and typical work zone signs. The information contained in these sheets meet or exceed the requirements shown in the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD).

2. The development and design of the Traffic Control Plan (TCP)is the responsibility of the Engineer.

3. The Contractor may propose changes to the TCP that are signed and sealed by a licensed professional engineer for approval. The Engineer may develop, sign and seal Contractor proposed changes.

4. The Contractor is responsible for installing and maintaining the traffic control devices as shown in the plans. The Contractor may not move or change the approximate location of any device without the approval of the Engineer.

5. Geometric design of lane shifts and detours should, when possible, meet the applicable design criteria contained in manuals such as the American Association of State Highway and Transportation Officials (AASHTO), "A Policy on Geometric Design of Highways and Streets," the TxDOT "Roadway Design Manual" or engineering judgment.

6. When projects abut, the Engineer(s) may omit the END ROAD WORK, TRAFFIC FINES DOUBLE, and other advance warning signs if the signing would be redundant and the work areas appear continuous to the motorists. If the adjacent project is completed first, the Contractor shall erect the necessary warning signs as shown on these sheets, the TCP sheets or as directed by the Engineer. The BEGIN ROAD WORK NEXT X MILES sign shall be revised to show appropriate work zone distance.

7. The Engineer may require duplicate warning signs on the median side of divided highways where median width will permit and traffic volumes justify the signing.

8. All signs shall be constructed in accordance with the details found in the "Standard Highway Sign Designs for Texas," latest edition. Sign details not shown in this manual shall be shown in the plans or the Engineer shall provide a detail to the Contractor before the sign is manufactured.

9. The temporary traffic control devices shown in the illustrations of the BC sheets are examples. As necessary, the Engineer will determine the most appropriate traffic control devices to be used.

10. Where highway construction or maintenance work is being undertaken, other than mobile operations as defined by the Texas Manual on Uniform Traffic Control Devices, CSJ limit signs are required. CSJ limit signs are shown on BC(2). The OBEY WARNING SIGNS STATE LAW sign, STAY ALERT TALK OR TEXT LATER and the WORK ZONE TRAFFIC FINES DOUBLE sign with plaque shall be erected in advance of the CSJ limits. The BEGIN ROAD WORK NEXT X MILES, CONTRACTOR and END ROAD WORK signs shall be erected at or near the CSJ limits. For mobile operations, CSJ limit signs are not required.

11. Traffic control devices should be in place only while work is actually in progress or a definite need exists.

12. The Engineer has the final decision on the location of all traffic control devices.

13. Inactive equipment and work vehicles, including workers' private vehicles must be parked away from travel lanes. They should be as close to the right-of-way line as possible, or located behind a barrier or guardrail, or as approved by the Engineer.

WORKER SAFETY NOTES:

1. Workers on foot who are exposed to traffic or to construction equipment within the right-of-way shall wear high-visibility safety apparel meeting the requirements of ISEA "American National Standard for High-Visibility Apparel," or equivalent revisions, and labeled as ANSI 107-2004 standard performance for Class 2 or 3 risk exposure. Class 3 garments should be considered for high traffic volume work areas or night time work.

2. Except in emergency situations, flagger stations shall be illuminated when flagging is used at night.

COMPLIANT WORKZONE TRAFFIC CONTROL DEVICES

1. Only pre-qualified products shall be used. The "Compliant Work Zone Traffic Control Devices List" (CWZTCD) describes pre-qualified products and their sources.

2. Work zone traffic control devices shall be compliant with the Manual for Assessing safety Hardware (MASH).

THE DOCUMENTS BELOW CAN BE FOUND ON-LINE AT http://www.txdot.gov
COMPLIANT WORK ZONE TRAFFIC CONTROL DEVICES LIST (CWZTCD)
DEPARTMENTAL MATERIAL SPECIFICATIONS (DMS)
MATERIAL PRODUCER LIST (MPL)
ROADWAY DESIGN MANUAL - SEE "MANUALS (ONLINE MANUALS)"
STANDARD HIGHWAY SIGN DESIGNS FOR TEXAS (SHSD)
TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (TMUTCD)
TRAFFIC ENGINEERING STANDARD SHEETS

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION GENERAL NOTES AND REQUIREMENTS

BC(1)-21

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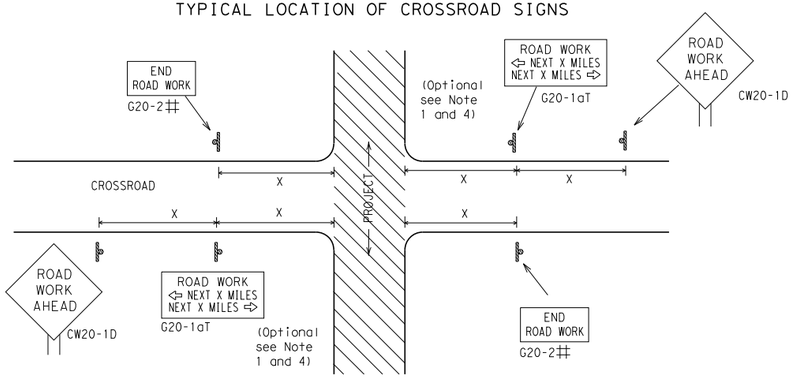
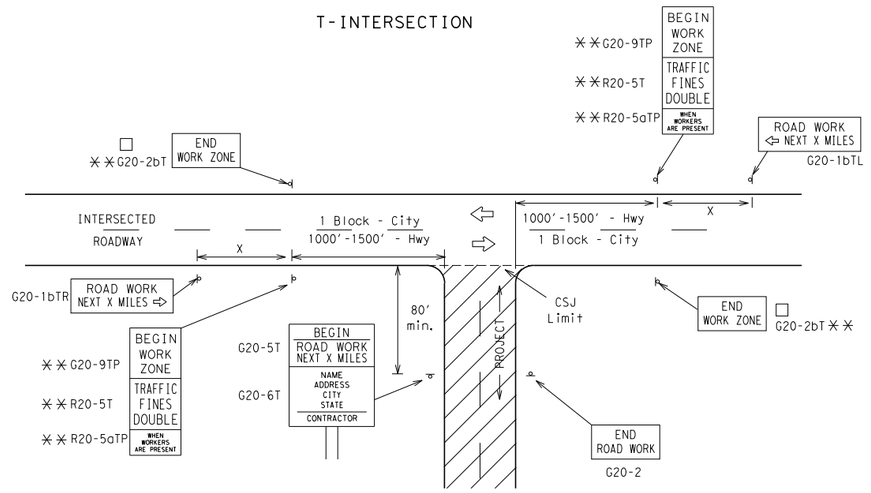
TYPICAL LOCATION OF CROSSROAD SIGNS



May be mounted on back of "ROAD WORK AHEAD"(CW20-1D) sign with approval of Engineer. (See note 2 below)

1. The typical minimum signing on a crossroad approach should be a "ROAD WORK AHEAD" (CW20-1D)sign and a (G20-2) "END ROAD WORK" sign, unless noted otherwise in plans.
2. The Engineer may use the reduced size 36" x 36" ROAD WORK AHEAD (CW20-1D) sign mounted back to back with the reduced size 36" x 18" "END ROAD WORK"(G20-2) sign on low volume crossroads (see Note 4 under "Typical Construction Warning Sign Size and Spacing"). See the "Standard Highway Sign Designs for Texas" manual for sign details. The Engineer may omit the advance warning signs on low volume crossroads. The Engineer will determine whether a road is low volume as per TMUTCD Part 5. This information shall be shown in the plans.
3. Based on existing field conditions, the Engineer/Inspector may require additional signs such as FLAGGER AHEAD, LOOSE GRAVEL, or other appropriate signs. When additional signs are required, these signs will be considered part of the minimum requirements. The Engineer/Inspector will determine the proper location and spacing of any sign not shown on the BC sheets, Traffic Control Plan sheets or the Work Zone Standard Sheets.
4. The "ROAD WORK NEXT X MILES"(G20-1aT)sign shall be required at high volume crossroads to advise motorists of the length of construction in either direction from the intersection. The Engineer will determine whether a roadway is considered high volume.
5. Additional traffic control devices may be shown elsewhere in the plans for higher volume crossroads.
6. When work occurs in the intersection area, appropriate traffic control devices, as shown elsewhere in the plans or as determined by the Engineer/Inspector, shall be in place.

T-INTERSECTION



CSJ LIMITS AT T-INTERSECTION

1. The Engineer will determine the types and location of any additional traffic control devices, such as a flagger and accompanying signs, or other signs, that should be used when work is being performed at or near an intersection.
2. If construction closes the road at a T-intersection, the Contractor shall place the "CONTRACTOR NAME"(G20-6T) sign behind the Type 3 Barricades for the road closure (see BC(10) also). The "ROAD WORK NEXT X MILES" left arrow(G20-1bTL) and "ROAD WORK NEXT X MILES" right arrow (G20-1bTR)" signs shall be replaced by the detour signing called for in the plans.

TYPICAL CONSTRUCTION WARNING SIGN SIZE AND SPACING[1,5,6]

SIZE

Sign Number or Series	Conventional Road	Expressway/ Freeway
CW20[4] CW21 CW22 CW23 CW25	48" x 48"	48" x 48"
CW1, CW2, CW7, CW8, CW9, CW11, CW14	36" x 36"	48" x 48"
CW3, CW4, CW5, CW6, CW8-3, CW10, CW12	48" x 48"	48" x 48"

SPACING

Posted Speed	Sign △ Spacing "X"
MPH	Feet (Apprx.)
30	120
35	160
40	240
45	320
50	400
55	500[2]
60	600[2]
65	700[2]
70	800[2]
75	900[2]
80	1000[2]
✳	✳[3]

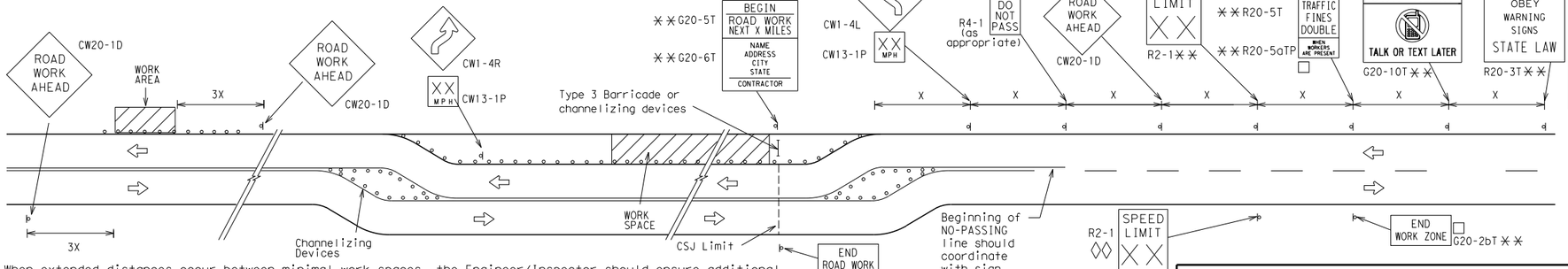
✳ For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

△ Minimum distance from work area to first Advance Warning sign nearest the work area and/or distance between each additional sign.

GENERAL NOTES

1. Special or larger size signs may be used as necessary.
2. Distance between signs should be increased as required to have 1500 feet advance warning.
3. Distance between signs should be increased as required to have 1/2 mile or more advance warning.
4. 36" x 36" "ROAD WORK AHEAD" (CW20-1D)signs may be used on low volume crossroads at the discretion of the Engineer as per TMUTCD Part 5. See Note 2 under "Typical Location of Crossroad Signs".
5. Only diamond shaped warning sign sizes are indicated.
6. See sign size listing in "TMUTCD", Sign Appendix or the "Standard Highway Sign Designs for Texas" manual for complete list of available sign design sizes.

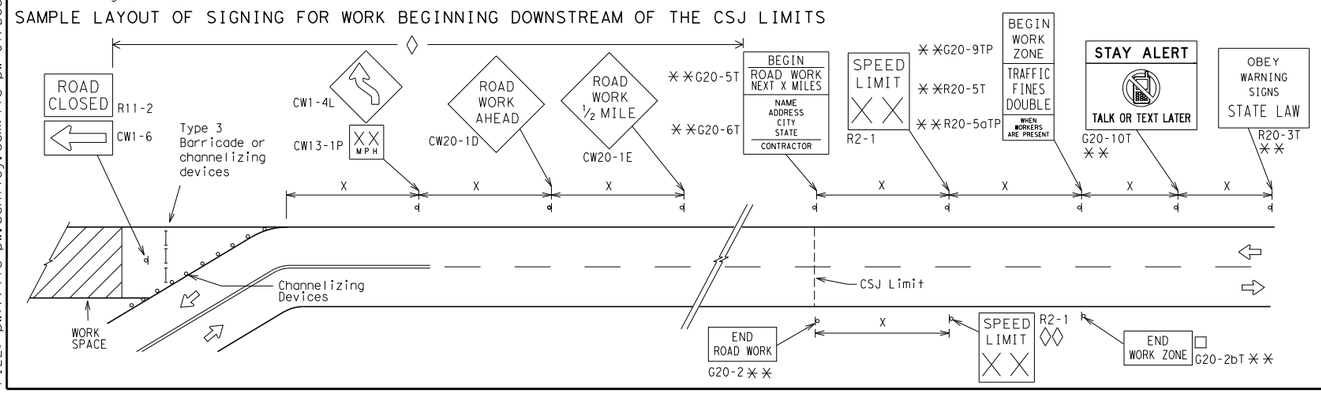
WORK AREAS IN MULTIPLE LOCATIONS WITHIN CSJ LIMITS



When extended distances occur between minimal work spaces, the Engineer/Inspector should ensure additional "ROAD WORK AHEAD"(CW20-1D)signs are placed in advance of these work areas to remind drivers they are still within the project limits. See the applicable TCP sheets for exact location and spacing of signs and channelizing devices.

SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING AT THE CSJ LIMITS

SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING DOWNSTREAM OF THE CSJ LIMITS



NOTES

The Contractor shall determine the appropriate distance to be placed on the G20-1 series signs and "BEGIN ROAD WORK NEXT X MILES"(G20-5T)sign for each specific project. This distance shall replace the "X" and shall be rounded to the nearest whole mile with the approval of the Engineer. No decimals shall be used.

□ The "BEGIN WORK ZONE"(G20-9TP) and "END WORK ZONE" (G20-2bT) shall be used as shown on the sample layout when advance signs are required outside the CSJ Limits. They inform the motorist of entering or leaving a part of the work zone lying outside the CSJ Limits where traffic fines may double if workers are present.

✳✳ CSJ limit signing is required for highway construction and maintenance work, with the exception of mobile operations.

◊ Area for placement of "ROAD WORK AHEAD" (CW20-1D)sign and other signs or devices as called for on the Traffic Control Plan.

◊◊ Contractor will install a regulatory speed limit sign at the end of the work zone.

LEGEND	
⊢⊣	Type 3 Barricade
○ ○ ○	Channelizing Devices
▬	Sign
X	See Typical Construction Warning Sign Size and Spacing chart or the TMUTCD for sign spacing requirements.

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PROJECT LIMIT

BC(2)-21

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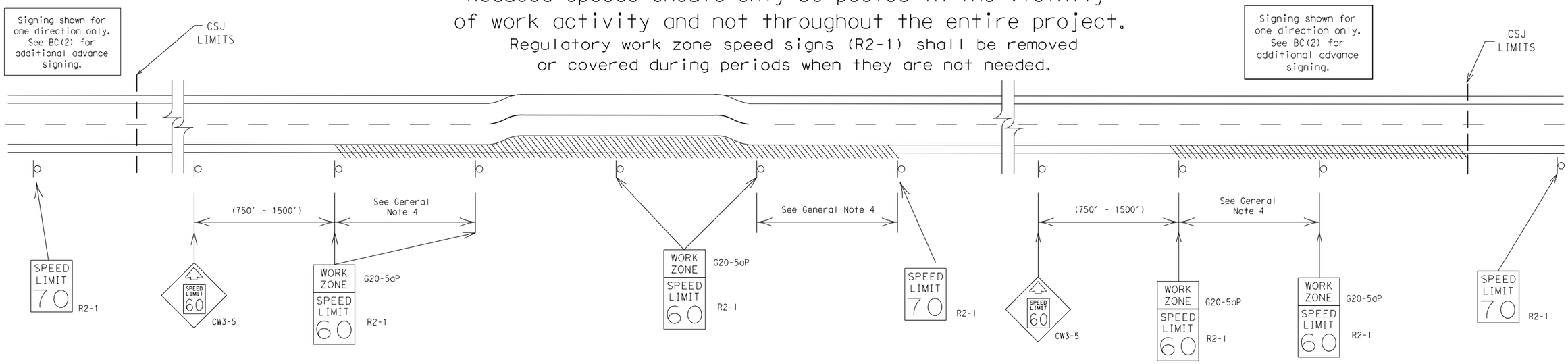
TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

Work zone speed limits shall be regulatory, established in accordance with the "Procedures for Establishing Speed Zones," and approved by the Texas Transportation Commission, or by City Ordinance when within Incorporated City Limits.

Reduced speeds should only be posted in the vicinity of work activity and not throughout the entire project.

Regulatory work zone speed signs (R2-1) shall be removed or covered during periods when they are not needed.



GUIDANCE FOR USE:

LONG/INTERMEDIATE TERM WORK ZONE SPEED LIMITS

This type of work zone speed limit should be included on the design of the traffic control plans when restricted geometrics with a lower design speed are present in the work zone and modification of the geometrics to a higher design speed is not feasible.

Long/Intermediate Term Work Zone Speed Limit signs, when approved as described above, should be posted and visible to the motorist when work activity is present. Work activity may also be defined as a change in the roadway that requires a reduced speed for motorists to safely negotiate the work area, including:

a) rough road or damaged pavement surface
b) substantial alteration of roadway geometrics (diversions)
c) construction detours
d) grade
e) width
f) other conditions readily apparent to the driver

As long as any of these conditions exist, the work zone speed limit signs should remain in place.

SHORT TERM WORK ZONE SPEED LIMITS

This type of work zone speed limit may be included on the design of the traffic control plans when workers or equipment are not behind concrete barrier, when work activity is within 10 feet of the traveled way or actually in the traveled way.

Short Term Work Zone Speed Limit signs should be posted and visible to the motorists only when work activity is present. When work activity is not present, signs shall be removed or covered.
(See Removing or Covering on BC(4)).

GENERAL NOTES

1. Regulatory work zone speed limits should be used only for sections of construction projects where speed control is of major importance.
2. Regulatory work zone speed limit signs shall be placed on supports at a 7 foot minimum mounting height.
3. Speed zone signs are illustrated for one direction of travel and are normally posted for each direction of travel.
4. Frequency of work zone speed limit signs should be:
   40 mph and greater 0.2 to 2 miles
   35 mph and less 0.2 to 1 mile
5. Regulatory speed limit signs shall have black legend and border on a white reflective background (See "Reflective Sheeting" on BC(4)).
6. Fabrication, erection and maintenance of the"ADVANCE SPEED LIMIT"(CW3-5)sign, "WORK ZONE"(G20-5aP) plaque and the "SPEED LIMIT"(R2-1)signs shall not be paid for directly, but shall be considered subsidiary to Item 502.
7. Turning signs from view, laying signs over or down will not be allowed, unless as otherwise noted under "REMOVING OR COVERING" on BC(4).
8. Techniques that may help reduce traffic speeds include but are not limited to:
   A. Law enforcement.
   B. Flagger stationed next to sign.
   C. Portable changeable message sign (PCMS).
   D. Low-power (drone) radar transmitter.
   E. Speed monitor trailers or signs.
9. Speeds shown on details above are for illustration only. Work Zone Speed Limits should only be posted as approved for each project.
10. For more specific guidance concerning the type of work, work zone conditions and factors impacting allowable regulatory construction speed zone reduction see TxDOT form #1204 in the TxDOT e-form system.

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT

BC(3)-21

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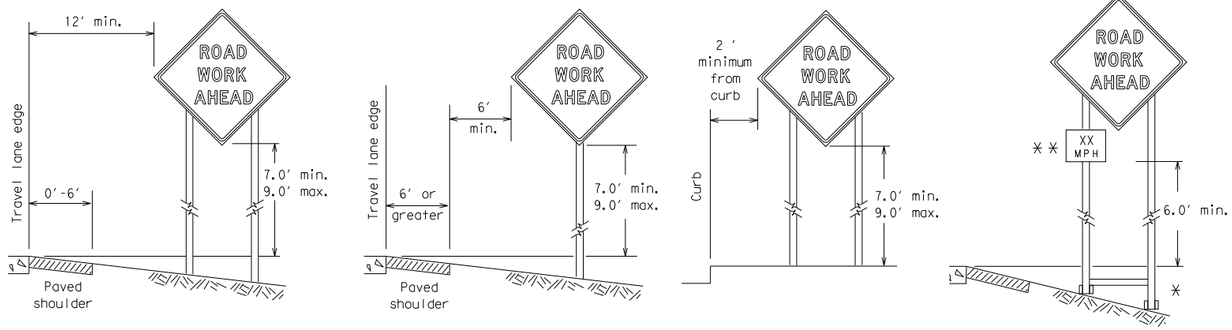
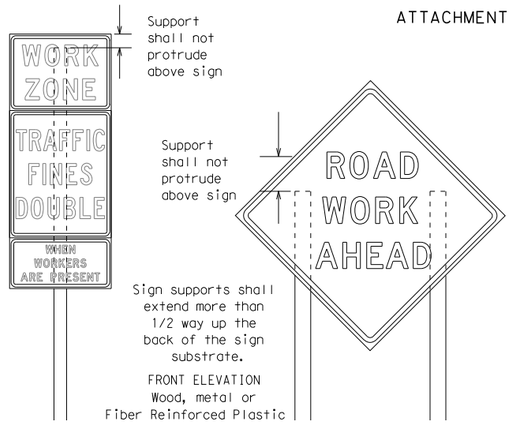
TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS

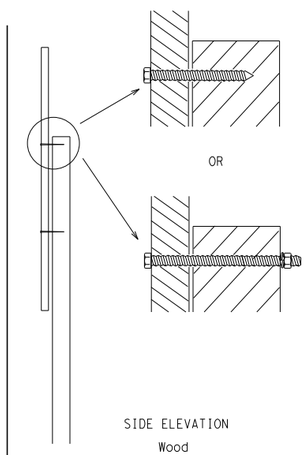


⚹ When placing skid supports on unlevel ground, the leg post lengths must be adjusted so the sign appears straight and plumb. Objects shall NOT be placed under skids as a means of leveling.

⚹⚹ When plaques are placed on dual-leg supports, they should be attached to the upright nearest the travel lane. Supplemental plaques (advisory or distance) should not cover the surface of the parent sign.

ATTACHMENT FOR SIGN SUPPORTS





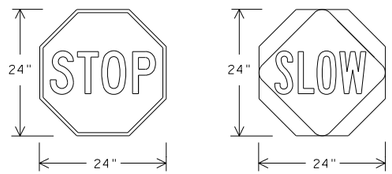
Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

Nails shall NOT be allowed. Each sign shall be attached directly to the sign support. Multiple signs shall not be joined or spliced by any means. Wood supports shall not be extended or repaired by splicing or other means.

Splicing embedded perforated square metal tubing in order to extend post height will only be allowed when the splice is made using four bolts, two above and two below the spice point. Splice must be located entirely behind the sign substrate, not near the base of the support. Splice insert lengths should be at least 5 times nominal post size, centered on the splice and of at least the same gauge material.

STOP/SLOW PADDLES

1. STOP/SLOW paddles are the primary method to control traffic by flaggers. The STOP/SLOW paddle size should be 24" x 24".
2. STOP/SLOW paddles shall be retroreflectorized when used at night.
3. STOP/SLOW paddles may be attached to a staff with a minimum length of 6' to the bottom of the sign.
4. Any lights incorporated into the STOP or SLOW paddle faces shall only be as specifically described in Section 6E.03 Hand Signaling Devices in the TMUTCD.



SHEETING REQUIREMENTS (WHEN USED AT NIGHT)		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	RED	TYPE B OR C SHEETING
BACKGROUND	ORANGE	TYPE B_{FL} OR C_{FL} SHEETING
LEGEND & BORDER	WHITE	TYPE B OR C SHEETING
LEGEND & BORDER	BLACK	ACRYLIC NON-REFLECTIVE FILM

CONTRACTOR REQUIREMENTS FOR MAINTAINING PERMANENT SIGNS WITHIN THE PROJECT LIMITS

1. Permanent signs are used to give notice of traffic laws or regulations, call attention to conditions that are potentially hazardous to traffic operations, show route designations, destinations, directions, distances, services, points of interest, and other geographical, recreational, specific service (LOGO), or cultural information. Drivers proceeding through a work zone need the same, if not better route guidance as normally installed on a roadway without construction.
2. When permanent regulatory or warning signs conflict with work zone conditions, remove or cover the permanent signs until the permanent sign message matches the roadway condition. For details for covering large guide signs see the TS-CD standard.
3. When existing permanent signs are moved and relocated due to construction purposes, they shall be visible to motorists at all times.
4. If existing signs are to be relocated on their original supports, they shall be installed on crashworthy bases as shown on the SMD Standard sheets. The signs shall meet the required mounting heights shown on the BC Sheets or the SMD Standards. This work should be paid for under the appropriate pay item for relocating existing signs.
5. If permanent signs are to be removed and relocated using temporary supports, the Contractor shall use crashworthy supports as shown on the BC standard sheets, TLRS standard sheets or the CWZTCD list. The signs shall meet the required mounting heights shown on the BC, or the SMD standard sheets during construction. This work should be paid for under the appropriate pay item for relocating existing signs.
6. Any sign or traffic control device that is struck or damaged by the Contractor or his/her construction equipment shall be replaced as soon as possible by the Contractor to ensure proper guidance for the motorists. This will be subsidiary to Item 502.

GENERAL NOTES FOR WORK ZONE SIGNS

1. Contractor shall install and maintain signs in a straight and plumb condition and/or as directed by the Engineer.
2. Wooden sign posts shall be painted white.
3. Barricades shall NOT be used as sign supports.
4. All signs shall be installed in accordance with the plans or as directed by the Engineer. Signs shall be used to regulate, warn, and guide the traveling public safely through the work zone.
5. The Contractor may furnish either the sign design shown in the plans or in the "Standard Highway Sign Designs for Texas" (SHSD). The Engineer/Inspector may require the Contractor to furnish other work zone signs that are shown in the TMUTCD but may have been omitted from the plans. Any variation in the plans shall be documented by written agreement between the Engineer and the Contractor's Responsible Person. All changes must be documented in writing before being implemented. This can include documenting the changes in the Inspector's TxDOT diary and having both the Inspector and Contractor initial and date the agreed upon changes.
6. The Contractor shall furnish sign supports listed in the "Compliant Work Zone Traffic Control Device List" (CWZTCD) for small roadside signs. Supports for temporary large roadside signs shall meet the requirements detailed on the Temporary Large Roadside Signs (TLRS) standard sheets. The Contractor shall install the sign support in accordance with the manufacturer's recommendations. If there is a question regarding installation procedures, the Contractor shall furnish the Engineer a copy of the manufacturer's installation recommendations so the Engineer can verify the correct procedures are being followed.
7. The Contractor is responsible for installing signs on approved supports and replacing signs with damaged or cracked substrates and/or damaged or marred reflective sheeting as directed by the Engineer/Inspector.
8. 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 inch.
9. The Contractor shall replace damaged wood posts. New or damaged wood sign posts shall not be spliced.

DURATION OF WORK (as defined by the "Texas Manual on Uniform Traffic Control Devices" Part 6)

1. The types of sign supports, sign mounting height, the size of signs, and the type of sign substrates can vary based on the type of work being performed. The Engineer is responsible for selecting the appropriate size sign for the type of work being performed. The Contractor is responsible for ensuring the sign support, sign mounting height and substrate meets manufacturer's recommendations in regard to crashworthiness and duration of work requirements.
   a. Long-term stationary - work that occupies a location more than 3 days.
   b. Intermediate-term stationary - work that occupies a location more than one daylight period up to 3 days, or nighttime work lasting more than one hour.
   c. Short-term stationary - daytime work that occupies a location for more than 1 hour in a single daylight period.
   d. Short, duration - work that occupies a location up to 1 hour.
   e. Mobile - work that moves continuously or intermittently (stopping for up to approximately 15 minutes.)

SIGN MOUNTING HEIGHT

1. The bottom of Long-term/Intermediate-term signs shall be at least 7 feet, but not more than 9 feet, above the paved surface, except as shown for supplemental plaques mounted below other signs.
2. The bottom of Short-term/Short Duration signs shall be a minimum of 1 foot above the pavement surface but no more than 2 feet above the ground.
3. Long-term/Intermediate-term Signs may be used in lieu of Short-term/Short Duration signing.
4. Short-term/Short Duration signs shall be used only during daylight and shall be removed at the end of the workday or raised to appropriate Long-term/Intermediate sign height.
5. Regulatory signs shall be mounted at least 7 feet, but not more than 9 feet, above the paved surface regardless of work duration.

SIZE OF SIGNS

1. The Contractor shall furnish the sign sizes shown on BC (2) unless otherwise shown in the plans or as directed by the Engineer.

SIGN SUBSTRATES

1. The Contractor shall ensure the sign substrate is installed in accordance with the manufacturer's recommendations for the type of sign support that is being used. The CWZTCD lists each substrate that can be used on the different types and models of sign supports.
2. "Mesh" type materials are NOT an approved sign substrate, regardless of the tightness of the weave.
3. All wooden individual sign panels fabricated from 2 or more pieces shall have one or more plywood cleat, 1/2" thick by 6" wide, fastened to the back of the sign and extending fully across the sign. The cleat shall be attached to the back of the sign using wood screws that do not penetrate the face of the sign panel. The screws shall be placed on both sides of the splice and spaced at 6" centers. The Engineer may approve other methods of splicing the sign face.

REFLECTIVE SHEETING

1. All signs shall be retroreflective and constructed of sheeting meeting the color and retro-reflectivity requirements of DMS-8300 for rigid signs or DMS-8310 for roll-up signs. The web address for DMS specifications is shown on BC(1).
2. White sheeting, meeting the requirements of DMS-8300 Type A, shall be used for signs with a white background.
3. Orange sheeting, meeting the requirements of DMS-8300 Type B_{FL} or Type C_{FL}, shall be used for rigid signs with orange backgrounds.

SIGN LETTERS

1. All sign letters and numbers shall be clear, and open rounded type uppercase alphabet letters as approved by the Federal Highway Administration (FHWA) and as published in the "Standard Highway Sign Design for Texas" manual. Signs, letters and numbers shall be of first class workmanship in accordance with Department Standards and Specifications.

REMOVING OR COVERING

1. When sign messages may be confusing or do not apply, the signs shall be removed or completely covered.
2. Long-term stationary or intermediate stationary signs installed on square metal tubing may be turned away from traffic 90 degrees when the sign message is not applicable. This technique may not be used for signs installed in the median of divided highways or near any intersections where the sign may be seen from approaching traffic.
3. Signs installed on wooden skids shall not be turned at 90 degree angles to the roadway. These signs should be removed or completely covered when not required.
4. 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.
5. Burlap shall NOT be used to cover signs.
6. Duct tape or other adhesive material shall NOT be affixed to a sign face.
7. Signs and anchor stubs shall be removed and holes backfilled upon completion of work.

SIGN SUPPORT WEIGHTS

1. Where sign supports require the use of weights to keep from turning over, the use of sandbags with dry, cohesionless sand should be used.
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 shall 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.

FLAGS ON SIGNS

1. Flags may be used to draw attention to warning signs. When used, the flag shall be 16 inches square or larger and shall be orange or fluorescent red-orange in color. Flags shall not be allowed to cover any portion of the sign face.

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES

BC(4)-21

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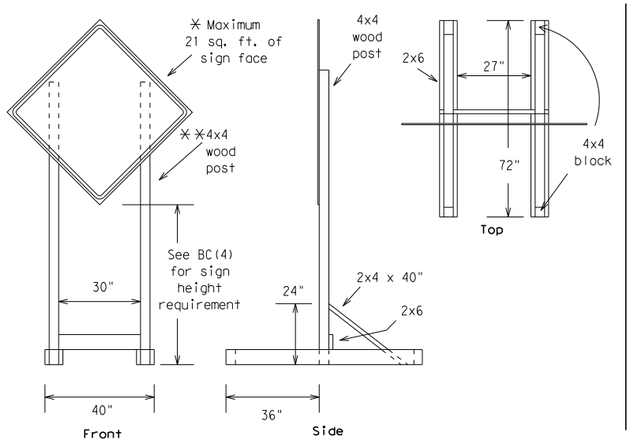
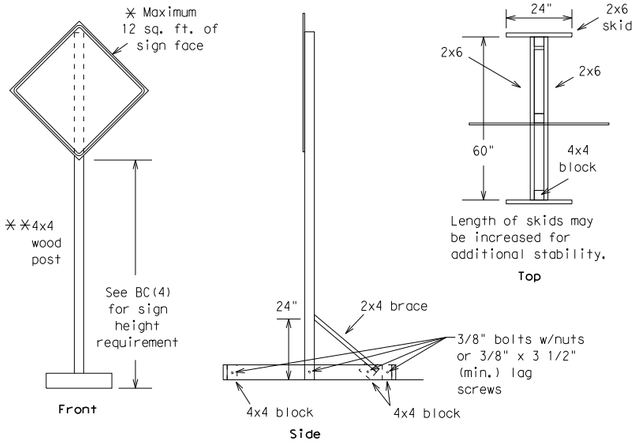
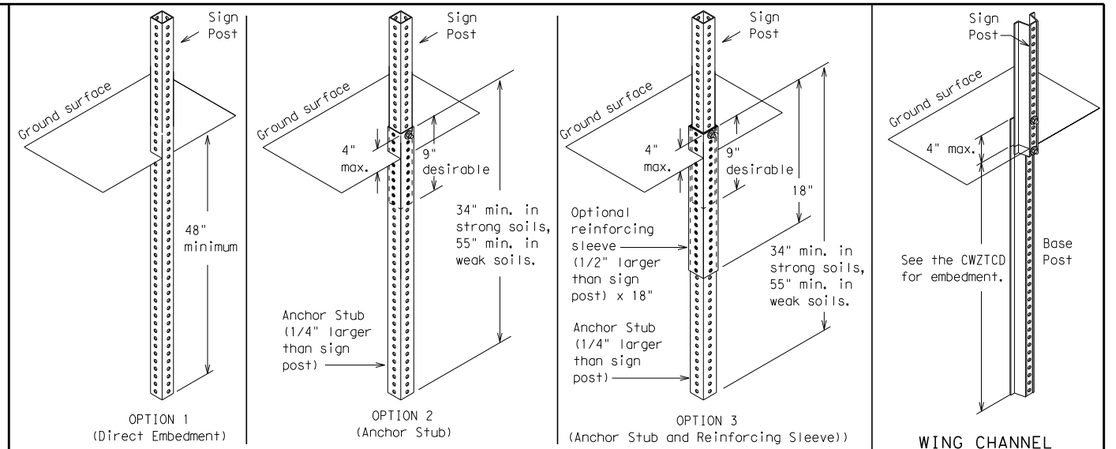




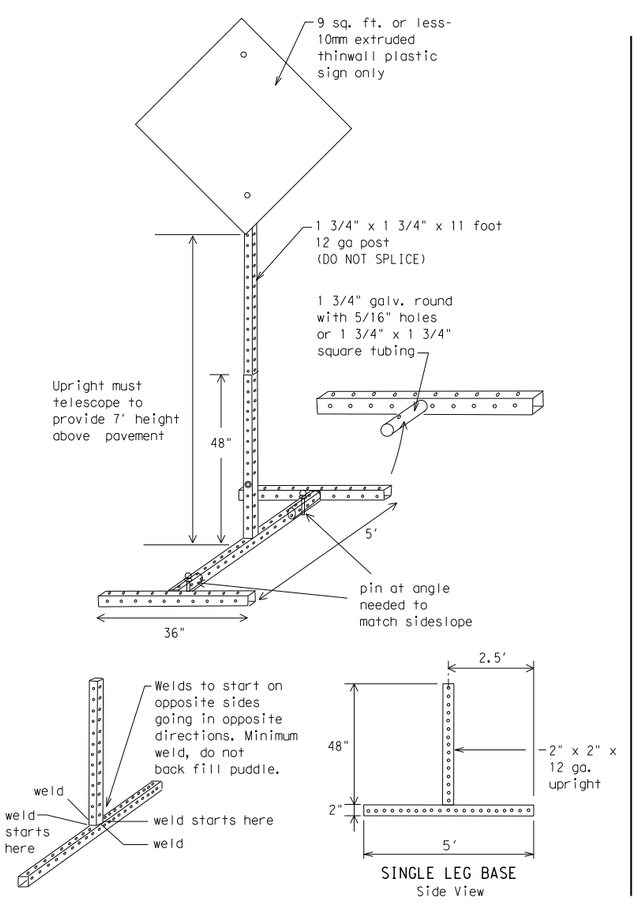
SKID MOUNTED WOOD SIGN SUPPORTS

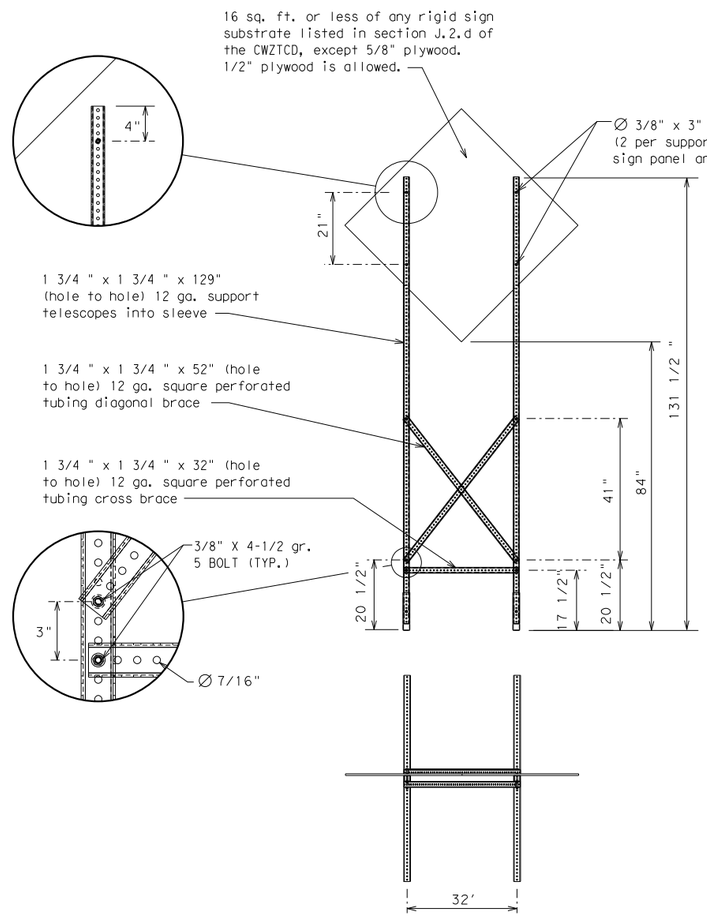
✳ LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS

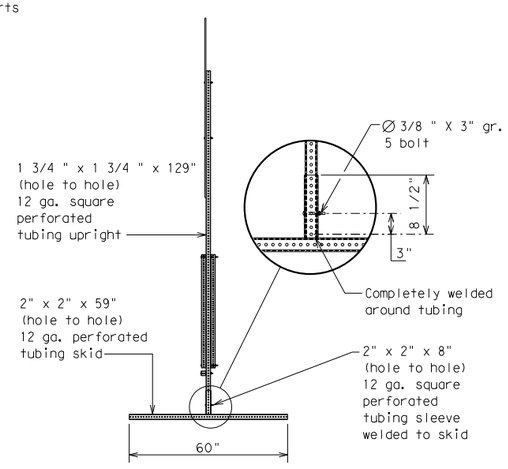


GROUND MOUNTED SIGN SUPPORTS

Refer to the CWZTCD and the manufacturer's installation procedure for each type sign support.
The maximum sign square footage shall adhere to the manufacturer's recommendation.
Two post installations can be used for larger signs.







SKID MOUNTED PERFORATED SQUARE STEEL TUBING SIGN SUPPORTS

✳ LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS

WEDGE ANCHORS

Both steel and plastic Wedge Anchor Systems as shown on the SMD Standard Sheets may be used as temporary sign supports for signs up to 10 square feet of sign face. They may be set in concrete or in sturdy soils if approved by the Engineer. (See web address for "Traffic Engineering Standard Sheets" on BC(1)).

OTHER DESIGNS

MORE DETAILS OF APPROVED LONG/INTERMEDIATE AND SHORT TERM SUPPORTS CAN BE FOUND ON THE CWZTCD LIST. SEE BC(1) FOR WEBSITE LOCATION.

GENERAL NOTES

1. Nails may be used in the assembly of wooden sign supports, but 3/8" bolts with nuts or 3/8" x 3 1/2" lag screws must be used on every joint for final connection.
2. No more than 2 sign posts shall be placed within a 7 ft. circle, except for specific materials noted on the CWZTCD List.
3. When project is completed, all sign supports and foundations shall be removed from the project site. This will be considered subsidiary to Item 502.

✳ See BC(4) for definition of "Work Duration."

✳✳ Wood sign posts MUST be one piece. Splicing will NOT be allowed. Posts shall be painted white.

☐ See the CWZTCD for the type of sign substrate that can be used for each approved sign support.

Texas Department of Transportation — Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT

BC(5)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0923	17	086	CR 4981
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	BWD	COMANCHE		15

DATE: 10/6/2021 3:00
FILE: pw://tts-pw.bentley.com:tts-pw-01/Documents/0223.002 WA 3 - CR Brown Comanche Co/Cadd/Standards/TCP/BC-21.dgn

WHEN NOT IN USE, REMOVE THE PCMS FROM THE RIGHT-OF-WAY OR PLACE THE PCMS BEHIND BARRIER OR GUARDRAIL WITH SIGN PANEL TURNED PARALLEL TO TRAFFIC

PORTABLE CHANGEABLE MESSAGE SIGNS

1. The Engineer/Inspector shall approve all messages used on portable changeable message signs (PCMS).
2. Messages on PCMS should contain no more than 8 words (about four to eight characters per word), not including simple words such as "TO," "FOR," "AT," etc.
3. Messages should consist of a single phase, or two phases that alternate. Three-phase messages are not allowed. Each phase of the message should convey a single thought, and must be understood by itself.
4. Use the word "EXIT" to refer to an exit ramp on a freeway; i.e., "EXIT CLOSED." Do not use the term "RAMP."
5. Always use the route or interstate designation (IH, US, SH, FM) along with the number when referring to a roadway.
6. When in use, the bottom of a stationary PCMS message panel should be a minimum 7 feet above the roadway, where possible.
7. The message term "WEEKEND" should be used only if the work is to start on Saturday morning and end by Sunday evening at midnight. Actual days and hours of work should be displayed on the PCMS if work is to begin on Friday evening and/or continue into Monday morning.
8. The Engineer/Inspector may select one of two options which are available for displaying a two-phase message on a PCMS. Each phase may be displayed for either four seconds each or for three seconds each.
9. Do not "flash" messages or words included in a message. The message should be steady burn or continuous while displayed.
10. Do not present redundant information on a two-phase message; i.e., keeping two lines of the message the same and changing the third line.
11. Do not use the word "Danger" in message.
12. Do not display the message "LANES SHIFT LEFT" or "LANES SHIFT RIGHT" on a PCMS. Drivers do not understand the message.
13. Do not display messages that scroll horizontally or vertically across the face of the sign.
14. The following table lists abbreviated words and two-word phrases that are acceptable for use on a PCMS. Both words in a phrase must be displayed together. Words or phrases not on this list should not be abbreviated, unless shown in the TMUTCD.
15. PCMS character height should be at least 18 inches for trailer mounted units. They should be visible from at least 1/2 (.5) mile and the text should be legible from at least 600 feet at night and 800 feet in daylight. Truck mounted units must have a character height of 10 inches and must be legible from at least 400 feet.
16. Each line of text should be centered on the message board rather than left or right justified.
17. If disabled, the PCMS should default to an illegible display that will not alarm motorists and will only be used to alert workers that the PCMS has malfunctioned. A pattern such as a series of horizontal solid bars is appropriate.

WORD OR PHRASE	ABBREVIATION
Access Road	ACCS RD
Alternate	ALT
Avenue	AVE
Best Route	BEST RTE
Boulevard	BLVD
Bridge	BRDG
Cannot	CANT
Center	CTR
Construction Ahead	CONST AHD
CROSSING	XING
Detour Route	DETOUR RTE
Do Not	DONT
East	E
Eastbound	(route) E
Emergency	EMER
Emergency Vehicle	EMER VEH
Entrance, Enter	ENT
Express Lane	EXP LN
Expressway	EXPWY
XXXX Feet	XXXX FT
Fog Ahead	FOG AHD
Freeway	FRWY, FWY
Freeway Blocked	FWY BLKD
Friday	FRI
Hazardous Driving	HAZ DRIVING
Hazardous Material	HAZMAT
High-Occupancy	HOV
Vehicle Highway	HWY
Hour(s)	HR, HRS
Information	INFO
It Is	ITS
Junction	JCT
Left	LFT
Left Lane	LFT LN
Lane Closed	LN CLOSED
Lower Level	LWR LEVEL
Maintenance	MAINT

WORD OR PHRASE	ABBREVIATION
Major	MAJ
Miles	MI
Miles Per Hour	MPH
Minor	MNR
Monday	MON
Normal	NORM
North	N
Northbound	(route) N
Parking	PKING
Road	RD
Right Lane	RT LN
Saturday	SAT
Service Road	SERV RD
Shoulder	SHLDR
Slippery	SLIP
South	S
Southbound	(route) S
Speed	SPD
Street	ST
Sunday	SUN
Telephone	PHONE
Temporary	TEMP
Thursday	THURS
To Downtown	TO DWNTN
Traffic	TRAF
Travelers	TRVLRS
Tuesday	TUES
Time Minutes	TIME MIN
Upper Level	UPR LEVEL
Vehicles (s)	VEH, VEHS
Warning	WARN
Wednesday	WED
Weight Limit	WT LIMIT
West	W
Westbound	(route) W
Wet Pavement	WET PVMT
Will Not	WONT

Roadway designation # IH-number, US-number, SH-number, FM-number

RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

(The Engineer may approve other messages not specifically covered here.)

Phase 1: Condition Lists

Road/Lane/Ramp Closure List

- FREEWAY CLOSED X MILE
- FRONTAGE ROAD CLOSED
- ROAD CLOSED AT SH XXX
- SHOULDER CLOSED XXX FT
- ROAD CLSD AT FM XXXX
- RIGHT LN CLOSED XXX FT
- RIGHT X LANES CLOSED
- RIGHT X LANES OPEN
- CENTER LANE CLOSED
- DAYTIME LANE CLOSURES
- NIGHT LANE CLOSURES
- I-XX SOUTH EXIT CLOSED
- VARIOUS LANES CLOSED
- EXIT XXX CLOSED X MILE
- EXIT CLOSED
- RIGHT LN TO BE CLOSED
- MALL DRIVEWAY CLOSED
- X LANES CLOSED TUE - FRI
- XXXXXXXX BLVD CLOSED

Other Condition List

- ROADWORK XXX FT
- ROAD REPAIRS XXXX FT
- FLAGGER XXXX FT
- LANE NARROWS XXXX FT
- RIGHT LN NARROWS XXXX FT
- TWO-WAY TRAFFIC XX MILE
- MERGING TRAFFIC XXXX FT
- CONST TRAFFIC XXX FT
- LOOSE GRAVEL XXXX FT
- UNEVEN LANES XXXX FT
- DETOUR X MILE
- ROUGH ROAD XXXX FT
- ROADWORK PAST SH XXXX
- ROADWORK NEXT FRI-SUN
- BUMP XXXX FT
- US XXX EXIT X MILES
- TRAFFIC SIGNAL XXXX FT
- LANES SHIFT *

* LANES SHIFT in Phase 1 must be used with STAY IN LANE in Phase 2.

Phase 2: Possible Component Lists

Action to Take/Effect on Travel List

- MERGE RIGHT
- FORM X LINES RIGHT
- DETOUR NEXT X EXITS
- USE XXXXX RD EXIT
- USE EXIT XXX
- USE EXIT I-XX NORTH
- STAY ON US XXX SOUTH
- USE I-XX E TO I-XX N
- TRUCKS USE US XXX N
- WATCH FOR TRUCKS
- WATCH FOR TRUCKS
- EXPECT DELAYS
- EXPECT DELAYS
- PREPARE TO STOP
- REDUCE SPEED XXX FT
- END SHOULDER USE
- USE OTHER ROUTES
- WATCH FOR WORKERS
- STAY IN LANE *

* LANES SHIFT in Phase 1 must be used with STAY IN LANE in Phase 2.

Location List

- AT FM XXXX
- BEFORE RAILROAD CROSSING
- NEXT X MILES
- PAST US XXX EXIT
- XXXXXXX TO XXXXXXX
- US XXX TO FM XXXX

Warning List

- SPEED LIMIT XX MPH
- MAXIMUM SPEED XX MPH
- MINIMUM SPEED XX MPH
- ADVISORY SPEED XX MPH
- RIGHT LANE EXIT
- USE CAUTION
- DRIVE SAFELY
- DRIVE WITH CARE

** Advance Notice List

- TUE-FRI XX AM- X PM
- APR XX-XX X PM-X AM
- BEGINS MONDAY
- BEGINS MAY XX
- MAY X-X XX PM - XX AM
- NEXT FRI-SUN
- XX AM TO XX PM
- NEXT TUE AUG XX
- TONIGHT XX PM- XX AM

** See Application Guidelines Note 6.

APPLICATION GUIDELINES

1. Only 1 or 2 phases are to be used on a PCMS.
2. The 1st phase (or both) should be selected from the "Road/Lane/Ramp Closure List" and the "Other Condition List".
3. A 2nd phase can be selected from the "Action to Take/Effect on Travel, Location, General Warning, or Advance Notice Phase Lists".
4. A Location Phase is necessary only if a distance or location is not included in the first phase selected.
5. If two PCMS are used in sequence, they must be separated by a minimum of 1000 ft. Each PCMS shall be limited to two phases, and should be understandable by themselves.
6. For advance notice, when the current date is within seven days of the actual work date, calendar days should be replaced with days of the week. Advance notification should typically be for no more than one week prior to the work.

WORDING ALTERNATIVES

1. The words RIGHT, LEFT and ALL can be interchanged as appropriate.
2. Roadway designations IH, US, SH, FM and LP can be interchanged as appropriate.
3. EAST, WEST, NORTH and SOUTH (or abbreviations E, W, N and S) can be interchanged as appropriate.
4. Highway names and numbers replaced as appropriate.
5. ROAD, HIGHWAY and FREEWAY can be interchanged as needed.
6. AHEAD may be used instead of distances if necessary.
7. FT and MI, MILE and MILES interchanged as appropriate.
8. AT, BEFORE and PAST interchanged as needed.
9. Distances or AHEAD can be eliminated from the message if a location phase is used.

PCMS SIGNS WITHIN THE R.O.W. SHALL BE BEHIND GUARDRAIL OR CONCRETE BARRIER OR SHALL HAVE A MINIMUM OF FOUR (4) PLASTIC DRUMS PLACED PERPENDICULAR TO TRAFFIC ON THE UPSTREAM SIDE OF THE PCMS, WHEN EXPOSED TO ONE DIRECTION OF TRAFFIC. WHEN EXPOSED TO TWO WAY TRAFFIC, THE FOUR DRUMS SHOULD BE PLACED WITH ONE DRUM AT EACH OF THE FOUR CORNERS OF THE UNIT.

FULL MATRIX PCMS SIGNS

1. When Full Matrix PCMS signs are used, the character height and legibility/visibility requirements shall be maintained as listed in Note 15 under "PORTABLE CHANGEABLE MESSAGE SIGNS" above.
2. When symbol signs, such as the "Flagger Symbol"(CW20-7) are represented graphically on the Full Matrix PCMS sign and, with the approval of the Engineer, it shall maintain the legibility/visibility requirement listed above.
3. When symbol signs are represented graphically on the Full Matrix PCMS, they shall only supplement the use of the static sign represented, and shall not substitute for, or replace that sign.
4. A full matrix PCMS may be used to simulate a flashing arrow board provided it meets the visibility, flash rate and dimming requirements on BC(7), for the same size arrow.

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

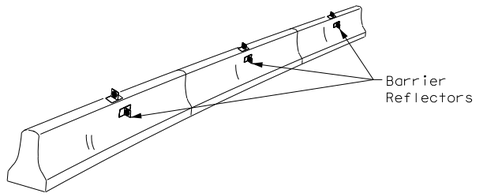
BC(6)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0923	17	086	CR 4981
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	BWD	COMANCHE		16

100

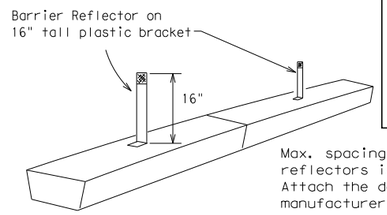
DATE: 10/6/2021 3:00
FILE: pw://tts-pw.bentley.com:tts-pw-01/Documents/0223.002 WA 3 - CR Brown Comanche Co/Cadd/Standards/TCP/BC-21.dgn

1. Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
2. Color of Barrier Reflectors shall be as specified in the TMUTCD. The cost of the reflectors shall be considered subsidiary to Item 512.



CONCRETE TRAFFIC BARRIER (CTB)

3. Where traffic is on one side of the CTB, two (2) Barrier Reflectors shall be mounted in approximately the midsection of each section of CTB. An alternate mounting location is uniformly spaced at one end of each CTB. This will allow for attachment of a barrier grapple without damaging the reflector. The Barrier Reflector mounted on the side of the CTB shall be located directly below the reflector mounted on top of the barrier, as shown in the detail above.
4. Where CTB separates two-way traffic, three barrier reflectors shall be mounted on each section of CTB. The reflector unit on top shall have two yellow reflective faces (Bi-Directional)while the reflectors on each side of the barrier shall have one yellow reflective face, as shown in the detail above.
5. When CTB separates traffic traveling in the same direction, no barrier reflectors will be required on top of the CTB.
6. Barrier Reflector units shall be yellow or white in color to match the edgeline being supplemented.
7. Maximum spacing of Barrier Reflectors is forty (40) feet.
8. Pavement markers or temporary flexible-reflective roadway marker tabs shall NOT be used as CTB delineation.
9. Attachment of Barrier Reflectors to CTB shall be per manufacturer's recommendations.
10. Missing or damaged Barrier Reflectors shall be replaced as directed by the Engineer.
11. Single slope barriers shall be delineated as shown on the above detail.

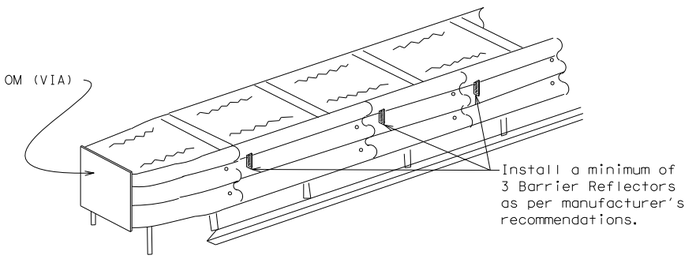


Max. spacing of barrier reflectors is 20 feet. Attach the delineators as per manufacturer's recommendations.

LOW PROFILE CONCRETE BARRIER (LPCB)

LOW PROFILE CONCRETE BARRIER (LPCB) USED IN WORK ZONES

LPCB is approved for use in work zone locations, where the posted speed is 45mph, or less. See Roadway Standard Sheet LPCB.

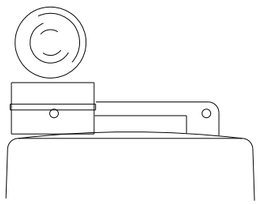


DELINEATION OF END TREATMENTS

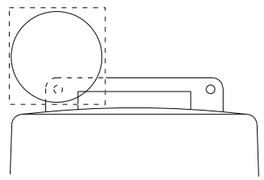
END TREATMENTS FOR CTB'S USED IN WORK ZONES

End treatments used on CTB's in work zones shall meet the apppropriate crashworthy standards as defined in the Manual for Assessing Safety Hardware (MASH). Refer to the CWZTCD List for approved end treatments and manufacturers.

BARRIER REFLECTORS FOR CONCRETE TRAFFIC BARRIER AND ATTENUATORS



Type C Warning Light or approved substitute mounted on a drum adjacent to the travel way.



Warning reflector may be round or square.Must have a yellow reflective surface area of at least 30 square inches

WARNING LIGHTS

1. Warning lights shall meet the requirements of the TMUTCD.
2. Warning lights shall NOT be installed on barricades.
3. Type A-Low Intensity Flashing Warning Lights are commonly used with drums. They are intended to warn of or mark a potentially hazardous area. Their use shall be as indicated on this sheet and/or other sheets of the plans by the designation "FL". The Type A Warning Lights shall not be used with signs manufactured with Type B_{FL} or C_{FL} Sheeting meeting the requirements of Departmental Material Specification DMS-8300.
4. Type-C and Type D 360 degree Steady Burn Lights are intended to be used in a series for delineation to supplement other traffic control devices. Their use shall be as indicated on this sheet and/or other sheets of the plans by the designation "SB".
5. The Engineer/Inspector or the plans shall specify the location and type of warning lights to be installed on the traffic control devices.
6. When required by the Engineer, the Contractor shall furnish a copy of the warning lights certification. The warning light manufacturer will certify the warning lights meet the requirements of the latest ITE Purchase Specifications for Flashing and Steady-Burn Warning Lights.
7. When used to delineate curves, Type-C and Type D Steady Burn Lights should only be placed on the outside of the curve, not the inside.
8. The location of warning lights and warning reflectors on drums shall be as shown elsewhere in the plans.

WARNING LIGHTS MOUNTED ON PLASTIC DRUMS

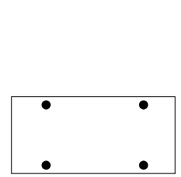
1. Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
2. Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
3. A series of sequential flashing warning lights placed on channelizing devices to form a merging taper may be used for delineation. If used, the successive flashing of the sequential warning lights should occur from the beginning of the taper to the end of the merging taper in order to identify the desired vehicle path. The rate of flashing for each light shall be 65 flashes per minute, plus or minus 10 flashes.
4. Type C and D steady-burn warning lights are intended to be used in a series to delineate the edge of the travel lane on detours, on lane changes, on lane closures, and on other similar conditions.
5. Type A, Type C and Type D warning lights shall be installed at locations as detailed on other sheets in the plans.
6. Warning lights shall not be installed on a drum that has a sign, chevron or vertical panel.
7. The maximum spacing for warning lights on drums should be identical to the channelizing device spacing.

WARNING REFLECTORS MOUNTED ON PLASTIC DRUMS AS A SUBSTITUTE FOR TYPE C (STEADY BURN) WARNING LIGHTS

1. A warning reflector or approved substitute may be mounted on a plastic drum as a substitute for a Type C, steady burn warning light at the discretion of the Contractor unless otherwise noted in the plans.
2. The warning reflector shall be yellow in color and shall be manufactured using a sign substrate approved for use with plastic drums listed on the CWZTCD.
3. The warning reflector shall have a minimum retroreflective surface area (one-side) of 30 square inches.
4. Round reflectors shall be fully reflectorized, including the area where attached to the drum.
5. Square substrates must have a minimum of 30 square inches of reflectorized sheeting. They do not have to be reflectorized where it attaches to the drum.
6. The side of the warning reflector facing approaching traffic shall have sheeting meeting the color and retroreflectivity requirements for DMS 8300-Type B or Type C.
7. When used near two-way traffic, both sides of the warning reflector shall be reflectorized.
8. The warning reflector should be mounted on the side of the handle nearest approaching traffic.
9. The maximum spacing for warning reflectors should be identical to the channelizing device spacing requirements.

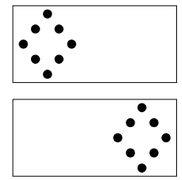
Arrow Boards may be located behind channelizing devices in place for a shoulder taper or merging taper, otherwise they shall be delineated with four (4) channelizing devices placed perpendicular to traffic on the upstream side of traffic.

1. The Flashing Arrow Board should be used for all lane closures on multi-lane roadways, or slow moving maintenance or construction activities on the travel lanes.
2. Flashing Arrow Boards should not be used on two-lane, two-way roadways, detours, diversions or work on shoulders unless the "CAUTION" display (see detail below) is used.
3. The Engineer/Inspector shall choose all appropriate signs, barricades and/or other traffic control devices that should be used in conjunction with the Flashing Arrow Board.
4. The Flashing Arrow Board should be able to display the following symbols:

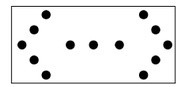


4 CORNER CAUTION

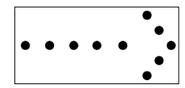
OR



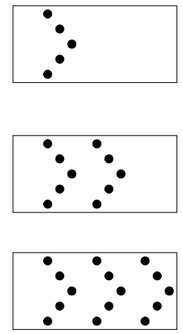
ALTERNATING DIAMOND CAUTION



DOUBLE ARROW



RIGHT/LEFT ARROW
(right arrow shown; left is similar)



RIGHT/LEFT SEQUENTIAL CHEVRON
(right chevron shown; left is similar)

5. The "CAUTION" display consists of four corner lamps flashing simultaneously, or the Alternating Diamond Caution mode as shown.
6. The straight line caution display is NOT ALLOWED.
7. The Flashing Arrow Board shall be capable of minimum 50 percent dimming from rated lamp voltage. The flashing rate of the lamps shall not be less than 25 nor more than 40 flashes per minute.
8. Minimum lamp "on time" shall be approximately 50 percent for the flashing arrow and equal intervals of 25 percent for each sequential phase of the flashing chevron.
9. The sequential arrow display is NOT ALLOWED.
10. The flashing arrow display is the TxDOT standard; however, the sequential chevron display may be used during daylight operations.
11. The Flashing Arrow Board shall be mounted on a vehicle, trailer or other suitable support.
12. A Flashing Arrow Board SHALL NOT BE USED to laterally shift traffic.
13. A full matrix PCMS may be used to simulate a Flashing Arrow Board provided it meets visibility, flash rate and dimming requirements on this sheet for the same size arrow.
14. Minimum mounting height of trailer mounted Arrow Boards should be 7 feet from roadway to bottom of panel.

REQUIREMENTS			
TYPE	MINIMUM SIZE	MINIMUM NUMBER OF PANEL LAMPS	MINIMUM VISIBILITY DISTANCE
B	30 x 60	13	3/4 mile
C	48 x 96	15	1 mile

ATTENTION

Flashing Arrow Boards shall be equipped with automatic dimming devices.

WHEN NOT IN USE, REMOVE THE ARROW BOARD FROM THE RIGHT-OF-WAY OR PLACE THE ARROW BOARD BEHIND CONCRETE TRAFFIC BARRIER OR GUARDRAIL.

FLASHING ARROW BOARDS

TRUCK-MOUNTED ATTENUATORS

1. Truck-mounted attenuators (TMA) used on TxDOT facilities must meet the requirements outlined in the Manual for Assessing Safety Hardware (MASH).
2. Refer to the CWZTCD for the requirements of Level 2 or Level 3 TMAs.
3. Refer to the CWZTCD for a list of approved TMAs.
4. TMAs are required on freeways unless otherwise noted in the plans.
5. A TMA should be used anytime that it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the work performance.
6. The only reason a TMA should not be required is when a work area is spread down the roadway and the work crew is an extended distance from the TMA.

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION ARROW PANEL, REFLECTORS, WARNING LIGHTS & ATTENUATOR

BC(7)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0923	17	086	CR 4981
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	BWD	COMANCHE		17

101

DATE: 10/6/2021 3:00
FILE: pw://tts-pw.bentley.com:tts-pw-01/Documents/0223.002 WA 3 - CR Brown Comanche Co/Cadd/Standards/TCP/BC-21.dgn

GENERAL NOTES

1. For long term stationary work zones on freeways, drums shall be used as the primary channelizing device.
2. For intermediate term stationary work zones on freeways, drums should be used as the primary channelizing device but may be replaced in tangent sections by vertical panels, or 42" two-piece cones. In tangent sections, one-piece cones may be used with the approval of the Engineer but only if personnel are present on the project at all times to maintain the cones in proper position and location.
3. For short term stationary work zones on freeways, drums are the preferred channelizing device but may be replaced in tapers, transitions and tangent sections by vertical panels, two-piece cones or one-piece cones as approved by the Engineer.
4. Drums and all related items shall comply with the requirements of the current version of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) and the "Compliant Work Zone Traffic Control Devices List" (CWZTCD).
5. Drums, bases, and related materials shall exhibit good workmanship and shall be free from objectionable marks or defects that would adversely affect their appearance or serviceability.
6. The Contractor shall have a maximum of 24 hours to replace any plastic drums identified for replacement by the Engineer/Inspector. The replacement device must be an approved device.

GENERAL DESIGN REQUIREMENTS

Pre-qualified plastic drums shall meet the following requirements:

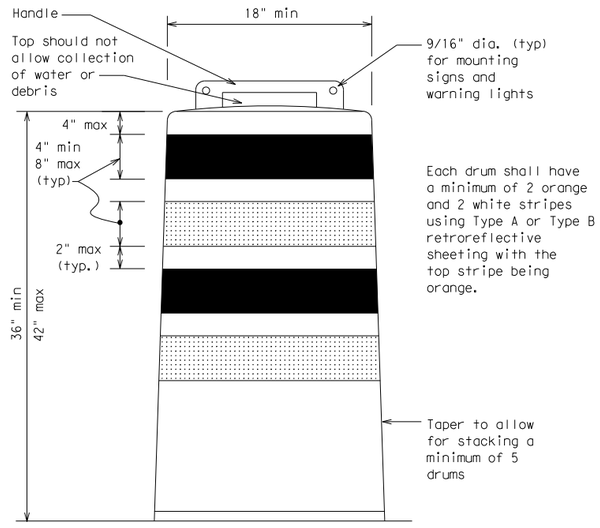
1. Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
2. The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents accidental separation due to normal handling and/or air turbulence created by passing vehicles.
3. Plastic drums shall be constructed of lightweight flexible, and deformable materials. The Contractor shall NOT use metal drums or single piece plastic drums as channelization devices or sign supports.
4. Drums shall present a profile that is a minimum of 18 inches in width at the 36 inch height when viewed from any direction. The height of drum unit (body installed on base) shall be a minimum of 36 inches and a maximum of 42 inches.
5. The top of the drum shall have a built-in handle for easy pickup and shall be designed to drain water and not collect debris. The handle shall have a minimum of two widely spaced 9/16 inch diameter holes to allow attachment of a warning light, warning reflector unit or approved compliant sign.
6. The exterior of the drum body shall have a minimum of four alternating orange and white retroreflective circumferential stripes not less than 4 inches nor greater than 8 inches in width. Any non-reflectorized space between any two adjacent stripes shall not exceed 2 inches in width.
7. Bases shall have a maximum width of 36 inches, a maximum height of 4 inches, and a minimum of two footholds of sufficient size to allow base to be held down while separating the drum body from the base.
8. Plastic drums shall be constructed of ultra-violet stabilized, orange, high-density polyethylene (HDPE) or other approved material.
9. Drum body shall have a maximum unballasted weight of 11 lbs.
10. Drum and base shall be marked with manufacturer's name and model number.

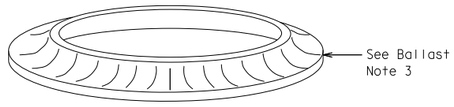
RETROREFLECTIVE SHEETING

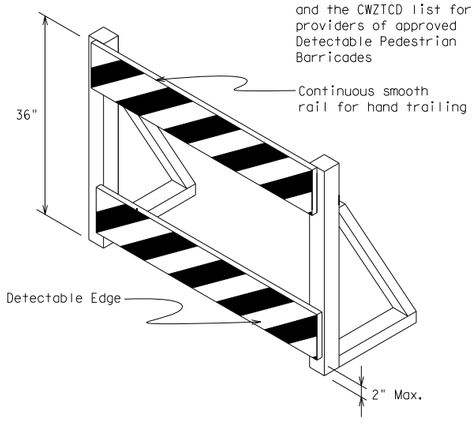
1. The stripes used on drums shall be constructed of sheeting meeting the color and retroreflectivity requirements of Departmental Materials Specification DMS-8300, "Sign Face Materials." Type A or Type B reflective sheeting shall be supplied unless otherwise specified in the plans.
2. The sheeting shall be suitable for use on and shall adhere to the drum surface such that, upon vehicular impact, the sheeting shall remain adhered in-place and exhibit no delaminating, cracking, or loss of retroreflectivity other than that loss due to abrasion of the sheeting surface.

BALLAST

1. Unballasted bases shall be large enough to hold up to 50 lbs. of sand. This base, when filled with the ballast material, should weigh between 35 lbs (minimum) and 50 lbs (maximum). The ballast may be sand in one to three sandbags separate from the base, sand in a sand-filled plastic base, or other ballasting devices as approved by the Engineer. Stacking of sandbags will be allowed, however height of sandbags above pavement surface may not exceed 12 inches.
2. Bases with built-in ballast shall weigh between 40 lbs. and 50 lbs. Built-in ballast can be constructed of an integral crumb rubber base or a solid rubber base.
3. Recycled truck tire sidewalls may be used for ballast on drums approved for this type of ballast on the CWZTCD list.
4. The ballast shall not be heavy objects, water, or any material that would become hazardous to motorists, pedestrians, or workers when the drum is struck by a vehicle.
5. When used in regions susceptible to freezing, drums shall have drainage holes in the bottoms so that water will not collect and freeze becoming a hazard when struck by a vehicle.
6. Ballast shall not be placed on top of drums.
7. Adhesives may be used to secure base of drums to pavement.

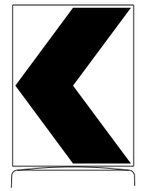




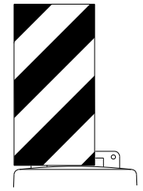


DETECTABLE PEDESTRIAN BARRICADES

1. When existing pedestrian facilities are disrupted, closed, or relocated in a TTC zone, the temporary facilities shall be detectable and include accessibility features consistent with the features present in the existing pedestrian facility. Refer to WZ(BTS-2) for Pedestrian Control requirements for Sidewalk Diversions, Sidewalk Detours and Crosswalk Closures.
2. Where pedestrians with visual disabilities normally use the closed sidewalk, a Detectable Pedestrian Barricade shall be placed across the full width of the closed sidewalk instead of a Type 3 Barricade.
3. Detectable pedestrian barricades similar to the one pictured above, longitudinal channelizing devices, some concrete barriers, and wood or chain link fencing with a continuous detectable edging can satisfactorily delineate a pedestrian path.
4. Tape, rope, or plastic chain strung between devices are not detectable, do not comply with the design standards in the "Americans with Disabilities Act Accessibility Guidelines (ADAAG)" and should not be used as a control for pedestrian movements.
5. Warning lights shall not be attached to detectable pedestrian barricades.
6. Detectable pedestrian barricades should use 8" nominal barricade rails as shown on BC(10) provided that the top rail provides a smooth continuous rail suitable for hand trailing with no splinters, burrs, or sharp edges.



18" x 24" Sign
(Maximum Sign Dimension)
Chevron CW1-8, Opposing Traffic Lane Divider, Driveway sign D70a, Keep Right R4 series or other signs as approved by Engineer



12" x 24"
Vertical Panel
mount with diagonals sloping down towards travel way

Plywood, Aluminum or Metal sign substrates shall NOT be used on plastic drums

SIGNS, CHEVRONS, AND VERTICAL PANELS MOUNTED ON PLASTIC DRUMS

1. Signs used on plastic drums shall be manufactured using substrates listed on the CWZTCD.
2. Chevrons and other work zone signs with an orange background shall be manufactured with Type B_{FL} or Type C_{FL} Orange sheeting meeting the color and retroreflectivity requirements of DMS-8300, "Sign Face Material," unless otherwise specified in the plans.
3. Vertical Panels shall be manufactured with orange and white sheeting meeting the requirements of DMS-8300 Type A or Type B. Diagonal stripes on Vertical Panels shall slope down toward the intended traveled lane.
4. Other sign messages (text or symbolic) may be used as approved by the Engineer. Sign dimensions shall not exceed 18 inches in width or 24 inches in height, except for the R9 series signs discussed in note 8 below.
5. Signs shall be installed using a 1/2 inch bolt (nominal) and nut, two washers, and one locking washer for each connection.
6. Mounting bolts and nuts shall be fully engaged and adequately torqued. Bolts should not extend more than 1/2 inch beyond nuts.
7. Chevrons may be placed on drums on the outside of curves, on merging tapers or on shifting tapers. When used in these locations, they may be placed on every drum or spaced not more than on every third drum. A minimum of three (3) should be used at each location called for in the plans.
8. R9-9, R9-10, R9-11 and R9-11a Sidewalk Closed signs which are 24 inches wide may be mounted on plastic drums, with approval of the Engineer.

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(8)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-03 8-14 9-07 5-21 7-13	0923	17	086	CR 4981
	DIST	COUNTY		SHEET NO.
	BWD	COMANCHE		18

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DATE: 10/6/2021 3:00
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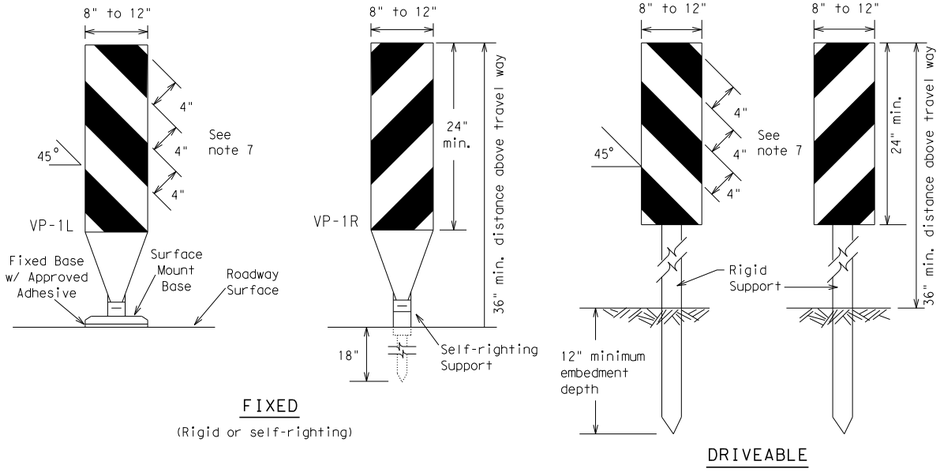
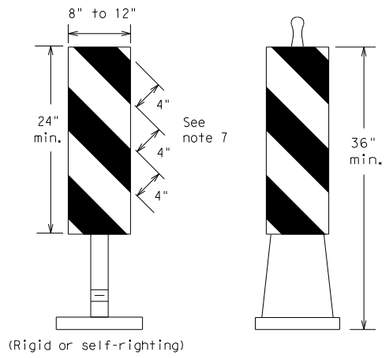


FIXED
(Rigid or self-righting)

DRIVEABLE

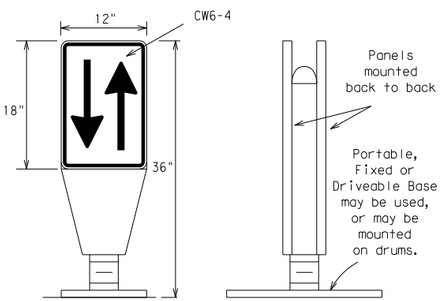


(Rigid or self-righting)

PORTABLE

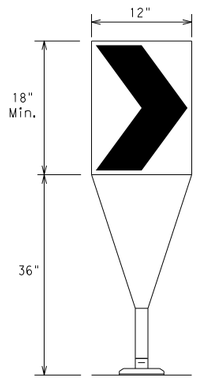
1. Vertical Panels (VP's) are normally used to channelize traffic or divide opposing lanes of traffic.
2. VP's may be used in daytime or nighttime situations. They may be used at the edge of shoulder drop-offs and other areas such as lane transitions where positive daytime and nighttime delineation is required. The Engineer/Inspector shall refer to the Roadway Design Manual for additional requirements on the use VP's for drop-offs.
3. VP's should be mounted back to back if used at the edge of cuts adjacent to two-way two lane roadways. Stripes are to be reflective orange and reflective white and should always slope downward toward the travel lane.
4. VP's used on expressways and freeways or other high speed roadways, may have more than 270 square inches of retroreflective area facing traffic.
5. Self-righting supports are available with portable base. See "Compliant Work Zone Traffic Control Devices List" (CWZTCD).
6. Sheeting for the VP's shall be retroreflective Type A or Type B conforming to Departmental Material Specification DMS-8300, unless noted otherwise.
7. Where the height of reflective material on the vertical panel is 36 inches or greater, a panel stripe of 6 inches shall be used.

VERTICAL PANELS (VPs)



1. Opposing Traffic Lane Dividers (OTLD) are delineation devices designed to convert a normal one-way roadway section to two-way operation. OTLD's are used on temporary centerlines. The upward and downward arrows on the sign's face indicate the direction of traffic on either side of the divider. The base is secured to the pavement with an adhesive or rubber weight to minimize movement caused by a vehicle impact or wind gust.
2. The OTLD may be used in combination with 42" cones or VPs.
3. Spacing between the OTLD shall not exceed 500 feet. 42" cones or VPs placed between the OTLD's should not exceed 100 foot spacing.
4. The OTLD shall be orange with a black non-reflective legend. Sheeting for the OTLD shall be retroreflective Type B_{FL} or Type C_{FL} conforming to Departmental Material Specification DMS-8300, unless noted otherwise. The legend shall meet the requirements of DMS-8300.

OPPOSING TRAFFIC LANE DIVIDERS (OTLD)



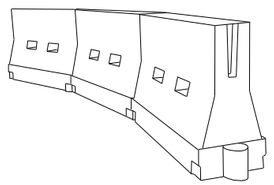
Fixed Base w/ Approved Adhesive (Driveable Base, or Flexible Support can be used)

1. The chevron shall be a vertical rectangle with a minimum size of 12 by 18 inches.
2. Chevrons are intended to give notice of a sharp change of alignment with the direction of travel and provide additional emphasis and guidance for vehicle operators with regard to changes in horizontal alignment of the roadway.
3. Chevrons, when used, shall be erected on the outside of a sharp curve or turn, or on the far side of an intersection. They shall be in line with and at right angles to approaching traffic. Spacing should be such that the motorist always has three in view, until the change in alignment eliminates its need.
4. To be effective, the chevron should be visible for at least 500 feet.
5. Chevrons shall be orange with a black nonreflective legend. Sheeting for the chevron shall be retroreflective Type B_{FL} or Type C_{FL} conforming to Departmental Material Specification DMS-8300, unless noted otherwise. The legend shall meet the requirements of DMS-8300.
6. For Long Term Stationary use on tapers or transitions on freeways and divided highways, self-righting chevrons may be used to supplement plastic drums but not to replace plastic drums.

CHEVRONS

GENERAL NOTES

1. Work Zone channelizing devices illustrated on this sheet may be installed in close proximity to traffic and are suitable for use on high or low speed roadways. The Engineer/Inspector shall ensure that spacing and placement is uniform and in accordance with the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD).
2. Channelizing devices shown on this sheet may have a driveable, fixed or portable base. The requirement for self-righting channelizing devices must be specified in the General Notes or other plan sheets.
3. Channelizing devices on self-righting supports should be used in work zone areas where channelizing devices are frequently impacted by errant vehicles or vehicle related wind gusts making alignment of the channelizing devices difficult to maintain. Locations of these devices shall be detailed elsewhere in the plans. These devices shall conform to the TMUTCD and the "Compliant Work Zone Traffic Control Devices List" (CWZTCD).
4. The Contractor shall maintain devices in a clean condition and replace damaged, nonreflective, faded, or broken devices and bases as required by the Engineer/Inspector. The Contractor shall be required to maintain proper device spacing and alignment.
5. Portable bases shall be fabricated from virgin and/or recycled rubber. The portable bases shall weigh a minimum of 30 lbs.
6. Pavement surfaces shall be prepared in a manner that ensures proper bonding between the adhesives, the fixed mount bases and the pavement surface. Adhesives shall be prepared and applied according to the manufacturer's recommendations.
7. The installation and removal of channelizing devices shall not cause detrimental effects to the final pavement surfaces, including pavement surface discoloration or surface integrity. Driveable bases shall not be permitted on final pavement surfaces. The Engineer/Inspector shall approve all application and removal procedures of fixed bases.



LONGITUDINAL CHANNELIZING DEVICES (LCD)

1. LCDs are crashworthy, lightweight, deformable devices that are highly visible, have good target value and can be connected together. They are not designed to contain or redirect a vehicle on impact.
2. LCDs may be used instead of a line of cones or drums.
3. LCDs shall be placed in accordance to application and installation requirements specific to the device, and used only when shown on the CWZTCD list.
4. LCDs should not be used to provide positive protection for obstacles, pedestrians or workers.
5. LCDs shall be supplemented with retroreflective delineation as required for temporary barriers on BC(7) when placed roughly parallel to the travel lanes.
6. LCDs used as barricades placed perpendicular to traffic should have at least one row of reflective sheeting meeting the requirements for barricade rails as shown on BC(10). Place reflective sheeting near the top of the LCD along the full length of the device.

WATER BALLASTED SYSTEMS USED AS BARRIERS

1. Water ballasted systems used as barriers shall not be used solely to channelize road users, but also to protect the work space per the appropriate Manual for Assessing Safety Hardware (MASH) crashworthiness requirements based on roadway speed and barrier application.
2. Water ballasted systems used to channelize vehicular traffic shall be supplemented with retroreflective delineation or channelizing devices to improve daytime/nighttime visibility. They may also be supplemented with pavement markings.
3. Water ballasted systems used as barriers shall be placed in accordance to application and installation requirements specific to the device, and used only when shown on the CWZTCD list.
4. Water ballasted systems used as barriers should not be used for a merging taper except in low speed (less than 45 MPH) urban areas. When used on a taper in a low speed urban area, the taper shall be delineated and the taper length should be designed to optimize road user operations considering the available geometric conditions.
5. When water ballasted systems used as barriers have blunt ends exposed to traffic, they should be attenuated as per manufacturer recommendations or flared to a point outside the clear zone.

If used to channelize pedestrians, longitudinal channelizing devices or water ballasted systems must have a continuous detectable bottom for users of long canes and the top of the unit shall not be less than 32 inches in height.

HOLLOW OR WATER BALLASTED SYSTEMS USED AS LONGITUDINAL CHANNELIZING DEVICES OR BARRIERS

Posted Speed	Formula	Minimum Desirable Taper Lengths ✳✳			Suggested Maximum Spacing of Channelizing Devices	
		10′ Offset	11′ Offset	12′ Offset	On a Taper	On a Tangent
30	$L=\frac{WS^2}{60}$	150′	165′	180′	30′	60′
35		205′	225′	245′	35′	70′
40		265′	295′	320′	40′	80′
45	L = WS	450′	495′	540′	45′	90′
50		500′	550′	600′	50′	100′
55		550′	605′	660′	55′	110′
60		600′	660′	720′	60′	120′
65		650′	715′	780′	65′	130′
70		700′	770′	840′	70′	140′
75		750′	825′	900′	75′	150′
80		800′	880′	960′	80′	160′

✳✳Taper lengths have been rounded off.
L=Length of Taper (FT.) W=Width of Offset (FT.)
S=Posted Speed (MPH)

SUGGESTED MAXIMUM SPACING OF CHANNELIZING DEVICES AND MINIMUM DESIRABLE TAPER LENGTHS

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(9)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0923	17	086	CR 4981
9-07 8-14	DIST	COUNTY		SHEET NO.
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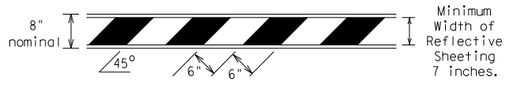
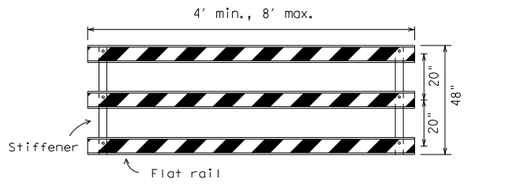
TYPE 3 BARRICADES

1. Refer to the Compliant Work Zone Traffic Control Devices List (CWZTCD) for details of the Type 3 Barricades and a list of all materials used in the construction of Type 3 Barricades.
2. Type 3 Barricades shall be used at each end of construction projects closed to all traffic.
3. Barricades extending across a roadway should have stripes that slope downward in the direction toward which traffic must turn in detouring. When both right and left turns are provided, the chevron striping may slope downward in both directions from the center of the barricade. Where no turns are provided at a closed road, striping should slope downward in both directions toward the center of roadway.
4. Striping of rails, for the right side of the roadway, should slope downward to the left. For the left side of the roadway, striping should slope downward to the right.
5. Identification markings may be shown only on the back of the barricade rails. The maximum height of letters and/or company logos used for identification shall be 1".
6. Barricades shall not be placed parallel to traffic unless an adequate clear zone is provided.
7. Warning lights shall NOT be installed on barricades.
8. Where barricades require the use of weights to keep from turning over, the use of sandbags with dry, cohesionless sand is recommended. The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight. Sand bags shall not be stacked in a manner that covers any portion of a barricade rails reflective sheeting. Rock, concrete, iron, steel or other solid objects will NOT be permitted. Sandbags should weigh a minimum of 35 lbs and a maximum of 50 lbs. Sandbags shall be made of a durable material that tears upon vehicular impact. Rubber (such as tire inner tubes) shall not be used for sandbags. Sandbags shall only be placed along or upon the base supports of the device and shall not be suspended above ground level or hung with rope, wire, chains or other fasteners.
9. Sheeting for barricades shall be retroreflective Type A or Type B conforming to Departmental Material Specification DMS-8300 unless otherwise noted.

Barricades shall NOT be used as a sign support.



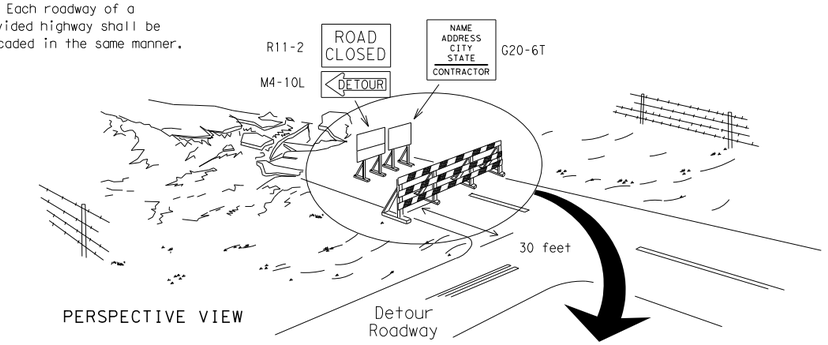
TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



Stiffener may be inside or outside of support, but no more than 2 stiffeners shall be allowed on one barricade.

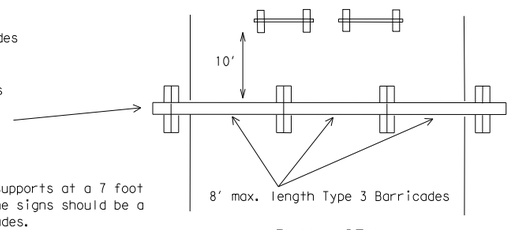
TYPICAL PANEL DETAIL
FOR SKID OR POST TYPE BARRICADES

Each roadway of a divided highway shall be barricaded in the same manner.



PERSPECTIVE VIEW

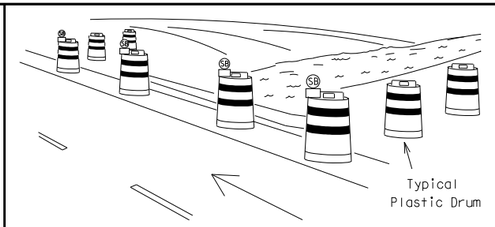
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic.
Barricade striping should slant downward in the direction of detour.



PLAN VIEW

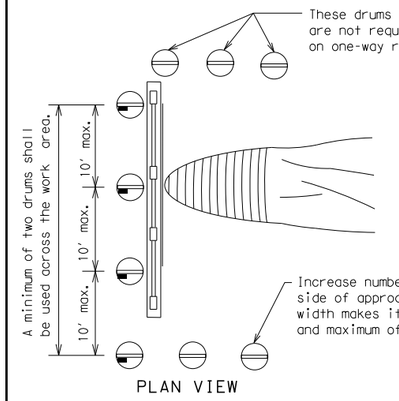
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION



PERSPECTIVE VIEW

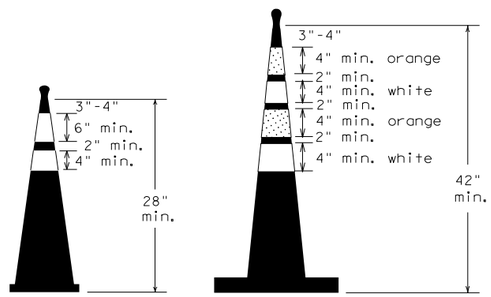
1. Where positive redirectional capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder width is greater than 12 feet, steady-burn lights may be omitted if drums are used.
5. Drums must extend the length of the culvert widening.



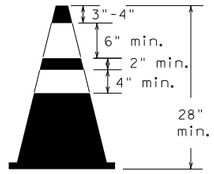
PLAN VIEW

LEGEND	
	Plastic drum
	Plastic drum with steady burn light or yellow warning reflector
SB	Steady burn warning light or yellow warning reflector

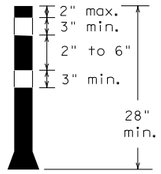
CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS



Two-Piece cones



One-Piece cones

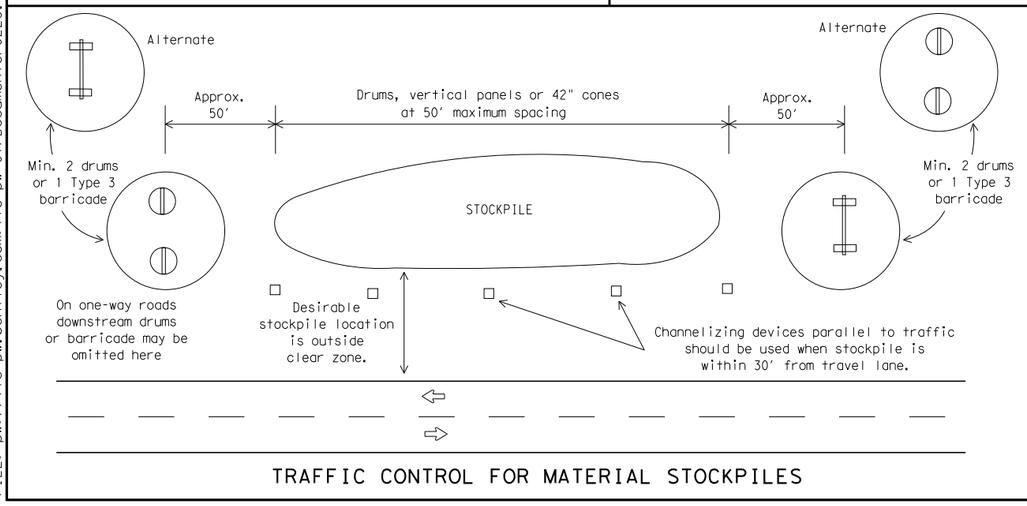


Tubular Marker

28" Cones shall have a minimum weight of 9 1/2 lbs.

42" 2-piece cones shall have a minimum weight of 30 lbs. including base.

1. Traffic cones and tubular markers shall be predominantly orange, and meet the height and weight requirements shown above.
2. One-piece cones have the body and base of the cone molded in one consolidated unit. Two-piece cones have a cone shaped body and a separate rubber base, or ballast, that is added to keep the device upright and in place.
3. Two-piece cones may have a handle or loop extending up to 8" above the minimum height shown, in order to aid in retrieving the device.
4. Cones or tubular markers shall have white or white and orange reflective bands as shown above. The reflective bands shall have a smooth, sealed outer surface and meet the requirements of Departmental Material Specification DMS-8300 Type A or Type B.
5. 28" cones and tubular markers are generally suitable for short duration and short-term stationary work as defined on BC(4). These should not be used for intermediate-term or long-term stationary work unless personnel is on-site to maintain them in their proper upright position.
6. 42" two-piece cones, vertical panels or drums are suitable for all work zone durations.
7. Cones or tubular markers used on each project should be of the same size and shape.



TRAFFIC CONTROL FOR MATERIAL STOCKPILES

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(10)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0923	17	086	CR 4981
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	BWD	COMANCHE		20

DATE: 10/6/2021 3:00
FILE: pw://tts-pw.bentley.com:tts-pw-01/Documents/0223.002 WA 3 - CR Brown Comanche Co/Cadd/Standards/TCP/BC-21.dgn

WORK ZONE PAVEMENT MARKINGS

GENERAL

1. The Contractor shall be responsible for maintaining work zone and existing pavement markings, in accordance with the standard specifications and special provisions, on all roadways open to traffic within the CSJ limits unless otherwise stated in the plans.
2. Color, patterns and dimensions shall be in conformance with the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD).
3. Additional supplemental pavement marking details may be found in the plans or specifications.
4. Pavement markings shall be installed in accordance with the TMUTCD and as shown on the plans.
5. When short term markings are required on the plans, short term markings shall conform with the TMUTCD, the plans and details as shown on the Standard Plan Sheet WZ(STPM).
6. When standard pavement markings are not in place and the roadway is opened to traffic, DO NOT PASS signs shall be erected to mark the beginning of the sections where passing is prohibited and PASS WITH CARE signs at the beginning of sections where passing is permitted.
7. All work zone pavement markings shall be installed in accordance with Item 662, "Work Zone Pavement Markings."

RAISED PAVEMENT MARKERS

1. Raised pavement markers are to be placed according to the patterns on BC(12).
2. All raised pavement markers used for work zone markings shall meet the requirements of Item 672, "RAISED PAVEMENT MARKERS" and Departmental Material Specification DMS-4200 or DMS-4300.

PREFABRICATED PAVEMENT MARKINGS

1. Removable prefabricated pavement markings shall meet the requirements of DMS-8241.
2. Non-removable prefabricated pavement markings (foil back) shall meet the requirements of DMS-8240.

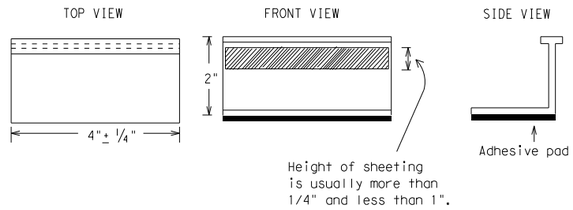
MAINTAINING WORK ZONE PAVEMENT MARKINGS

1. The Contractor will be responsible for maintaining work zone pavement markings within the work limits.
2. Work zone pavement markings shall be inspected in accordance with the frequency and reporting requirements of work zone traffic control device inspections as required by Form 599.
3. The markings should provide a visible reference for a minimum distance of 300 feet during normal daylight hours and 160 feet when illuminated by automobile low-beam headlights at night, unless sight distance is restricted by roadway geometrics.
4. Markings failing to meet this criteria within the first 30 days after placement shall be replaced at the expense of the Contractor as per Specification Item 662.

REMOVAL OF PAVEMENT MARKINGS

1. Pavement markings that are no longer applicable, could create confusion or direct a motorist toward or into the closed portion of the roadway shall be removed or obliterated before the roadway is opened to traffic.
2. The above shall not apply to detours in place for less than three days, where flaggers and/or sufficient channelizing devices are used in lieu of markings to outline the detour route.
3. Pavement markings shall be removed to the fullest extent possible, so as not to leave a discernable marking. This shall be by any method approved by TxDOT Specification Item 677 for "Eliminating Existing Pavement Markings and Markers".
4. The removal of pavement markings may require resurfacing or seal coating portions of the roadway as described in Item 677.
5. Subject to the approval of the Engineer, any method that proves to be successful on a particular type pavement may be used.
6. Blast cleaning may be used but will not be required unless specifically shown in the plans.
7. Over-painting of the markings SHALL NOT BE permitted.
8. Removal of raised pavement markers shall be as directed by the Engineer.
9. Removal of existing pavement markings and markers will be paid for directly in accordance with Item 677, "ELIMINATING EXISTING PAVEMENT MARKINGS AND MARKERS," unless otherwise stated in the plans.
10. Black-out marking tape may be used to cover conflicting existing markings for periods less than two weeks when approved by the Engineer.

Temporary Flexible-Reflective Roadway Marker Tabs



STAPLES OR NAILS SHALL NOT BE USED TO SECURE TEMPORARY FLEXIBLE-REFLECTIVE ROADWAY MARKER TABS TO THE PAVEMENT SURFACE

1. Temporary flexible-reflective roadway marker tabs used as guidemarks shall meet the requirements of DMS-8242.
2. Tabs detailed on this sheet are to be inspected and accepted by the Engineer or designated representative. Sampling and testing is not normally required, however at the option of the Engineer, either "A" or "B" below may be imposed to assure quality before placement on the roadway.
   A. Select five (5) or more tabs at random from each lot or shipment and submit to the Construction Division, Materials and Pavement Section to determine specification compliance.
   B. Select five (5) tabs and perform the following test. Affix five (5) tabs at 24 inch intervals on an asphaltic pavement in a straight line. Using a medium size passenger vehicle or pickup, run over the markers with the front and rear tires at a speed of 35 to 40 miles per hour, four (4) times in each direction. No more than one (1) out of the five (5) reflective surfaces shall be lost or displaced as a result of this test.
3. Small design variances may be noted between tab manufacturers.
4. See Standard Sheet WZ(STPM) for tab placement on new pavements. See Standard Sheet TCP(7-1) for tab placement on seal coat work.

RAISED PAVEMENT MARKERS USED AS GUIDEMARKS

1. Raised pavement markers used as guidemarks shall be from the approved product list, and meet the requirements of DMS-4200.
2. All temporary construction raised pavement markers provided on a project shall be of the same manufacturer.
3. Adhesive for guidemarks shall be bituminous material hot applied or butyl rubber pad for all surfaces, or thermoplastic for concrete surfaces.

Guidemarks shall be designated as:
YELLOW - (two amber reflective surfaces with yellow body).
WHITE - (one silver reflective surface with white body).

DEPARTMENTAL MATERIAL SPECIFICATIONS	
PAVEMENT MARKERS (REFLECTORIZED)	DMS-4200
TRAFFIC BUTTONS	DMS-4300
EPOXY AND ADHESIVES	DMS-6100
BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS	DMS-6130
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240
TEMPORARY REMOVABLE, PREFABRICATED PAVEMENT MARKINGS	DMS-8241
TEMPORARY FLEXIBLE, REFLECTIVE ROADWAY MARKER TABS	DMS-8242

A list of prequalified reflective raised pavement markers, non-reflective traffic buttons, roadway marker tabs and other pavement markings can be found at the Material Producer List web address shown on BC(1).

Texas Department of Transportation — Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

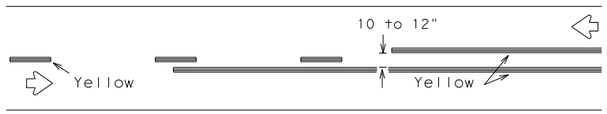
BC(11)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS 2-98 9-07 5-21 1-02 7-13 11-02 8-14	0923	17	086	CR 4981
	DIST	COUNTY		SHEET NO.
	BWD	COMANCHE		21

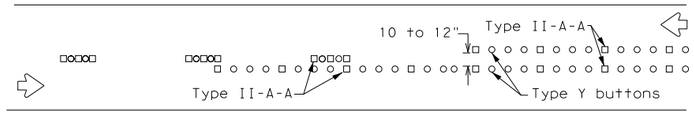
105

DATE: 10/6/2021 3:00
FILE: pw://tts-pw.bentley.com:tts-pw-01/Documents/0223.002 WA 3 - CR Brown Comanche Co/Cadd/Standards/TCP/BC-21.dgn

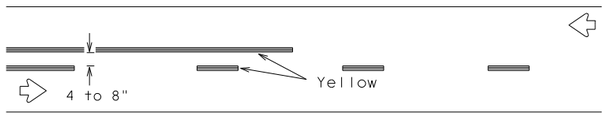
PAVEMENT MARKING PATTERNS



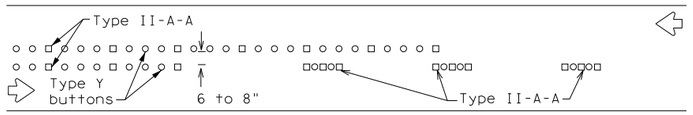
REFLECTORIZED PAVEMENT MARKINGS - PATTERN A



RAISED PAVEMENT MARKERS - PATTERN A



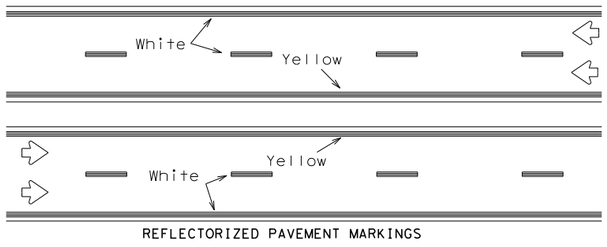
REFLECTORIZED PAVEMENT MARKINGS - PATTERN B



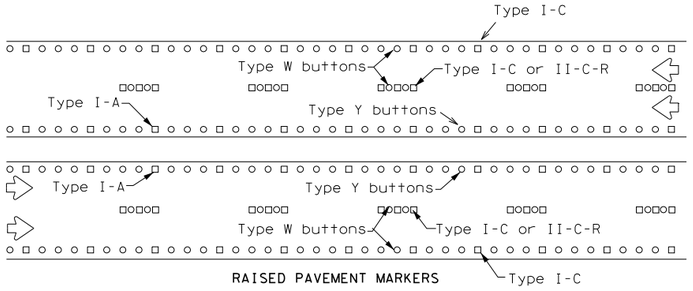
RAISED PAVEMENT MARKERS - PATTERN B

Pattern A is the TXDOT Standard, however Pattern B may be used if approved by the Engineer.
Prefabricated markings may be substituted for reflectorized pavement markings.

CENTER LINE & NO-PASSING ZONE BARRIER LINES FOR TWO-LANE, TWO-WAY HIGHWAYS



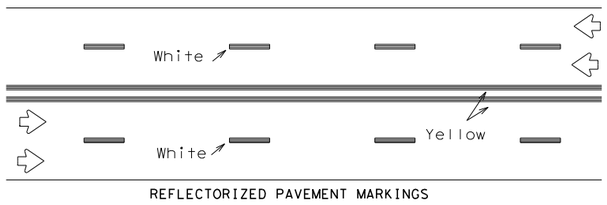
REFLECTORIZED PAVEMENT MARKINGS



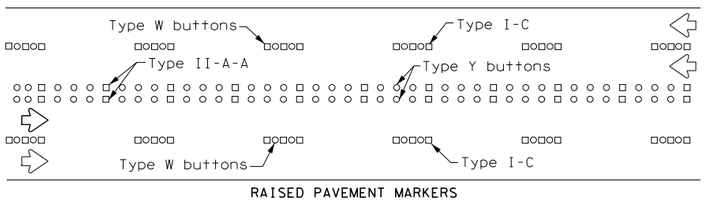
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

EDGE & LANE LINES FOR DIVIDED HIGHWAY



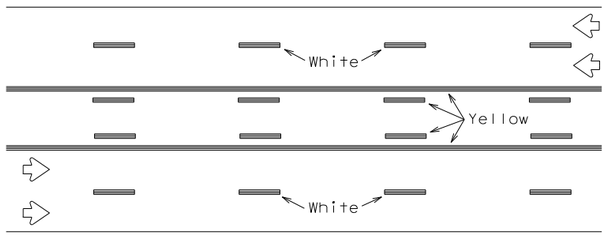
REFLECTORIZED PAVEMENT MARKINGS



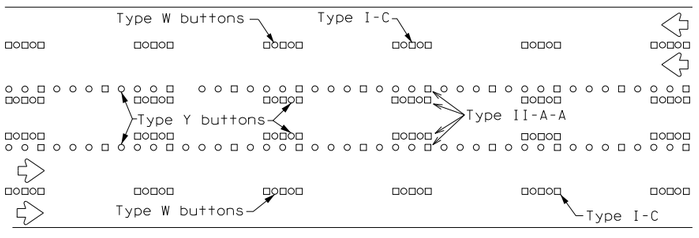
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS



RAISED PAVEMENT MARKERS

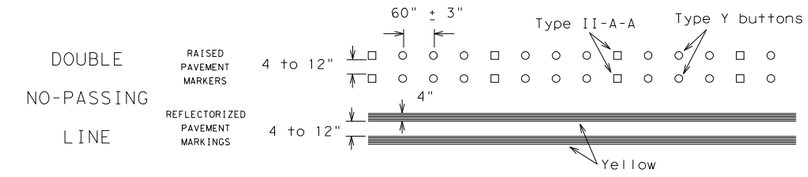
Prefabricated markings may be substituted for reflectorized pavement markings.

TWO-WAY LEFT TURN LANE

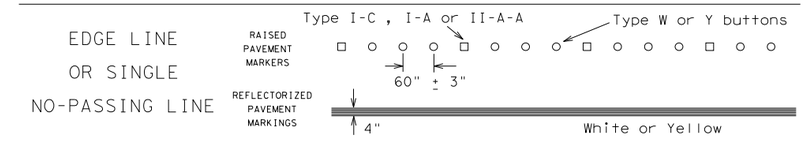
STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS

SOLID LINES

DOUBLE NO-PASSING LINE

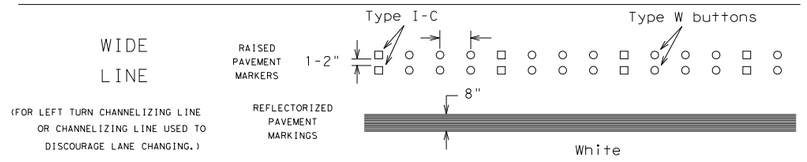


EDGE LINE OR SINGLE NO-PASSING LINE



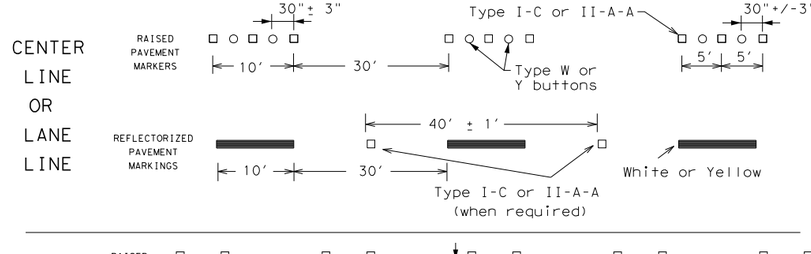
WIDE LINE

(FOR LEFT TURN CHANNELIZING LINE OR CHANNELIZING LINE USED TO DISCOURAGE LANE CHANGING.)

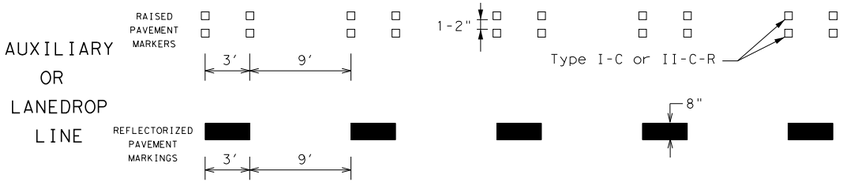


BROKEN LINES

CENTER LINE OR LANE LINE

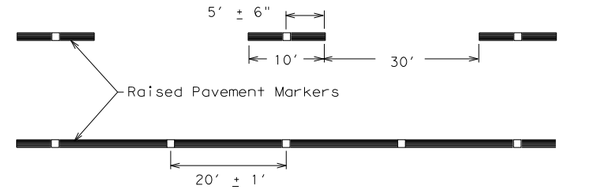


AUXILIARY OR LANEDROP LINE



REMOVABLE MARKINGS WITH RAISED PAVEMENT MARKERS

If raised pavement markers are used to supplement REMOVABLE markings, the markers shall be applied to the top of the tape at the approximate mid length of tape used for broken lines or at 20 foot spacing for solid lines. This allows an easier removal of raised pavement markers and tape.



Centerline only - not to be used on edge lines

Raised pavement markers used as standard pavement markings shall be from the approved products list and meet the requirements of Item 672 "RAISED PAVEMENT MARKERS."

Texas Department of Transportation

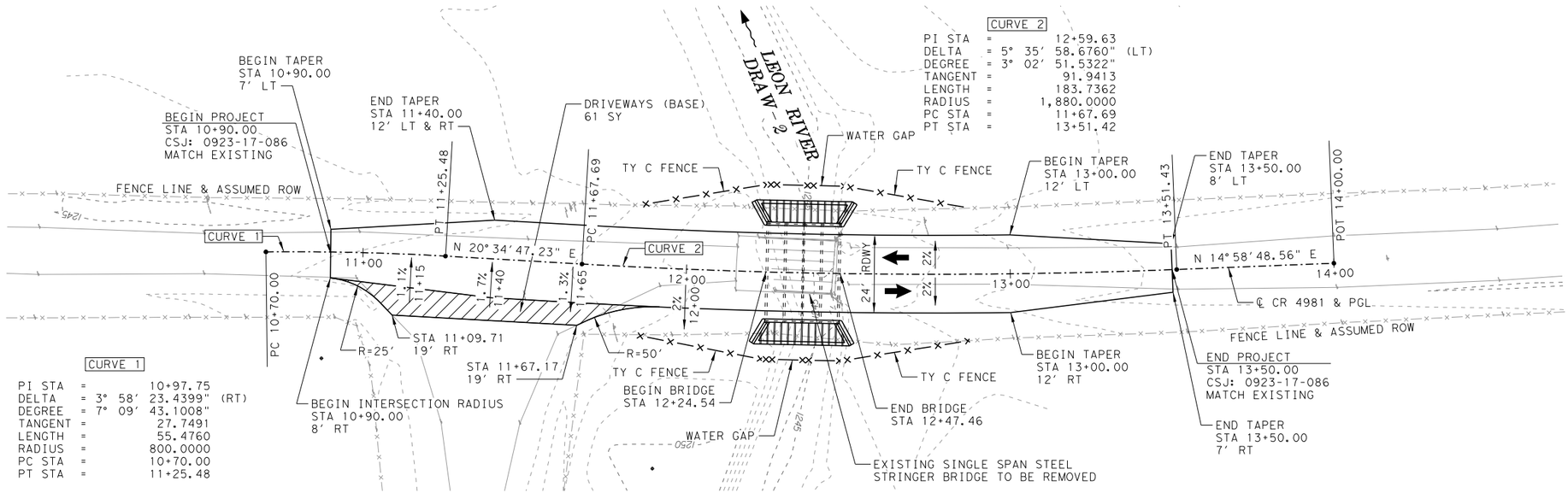
Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

BC(12)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS 1-97 9-07 5-21 2-98 7-13 11-02 8-14	0923	17	086	CR 4981
	DIST	COUNTY		SHEET NO.
	BWD	COMANCHE		22

106



CURVE 1

PI STA	=	10+97.75
DELTA	=	3° 58' 23.4399" (RT)
DEGREE	=	7° 09' 43.1008"
TANGENT	=	27.7491
LENGTH	=	55.4760
RADIUS	=	800.0000
PC STA	=	10+70.00
PT STA	=	11+25.48

CURVE 2

PI STA	=	12+59.63
DELTA	=	5° 35' 58.6760" (LT)
DEGREE	=	3° 02' 51.5322"
TANGENT	=	91.9413
LENGTH	=	183.7362
RADIUS	=	1,880.0000
PC STA	=	11+67.69
PT STA	=	13+51.42

0 20 40

SCALE: 1" = 40'

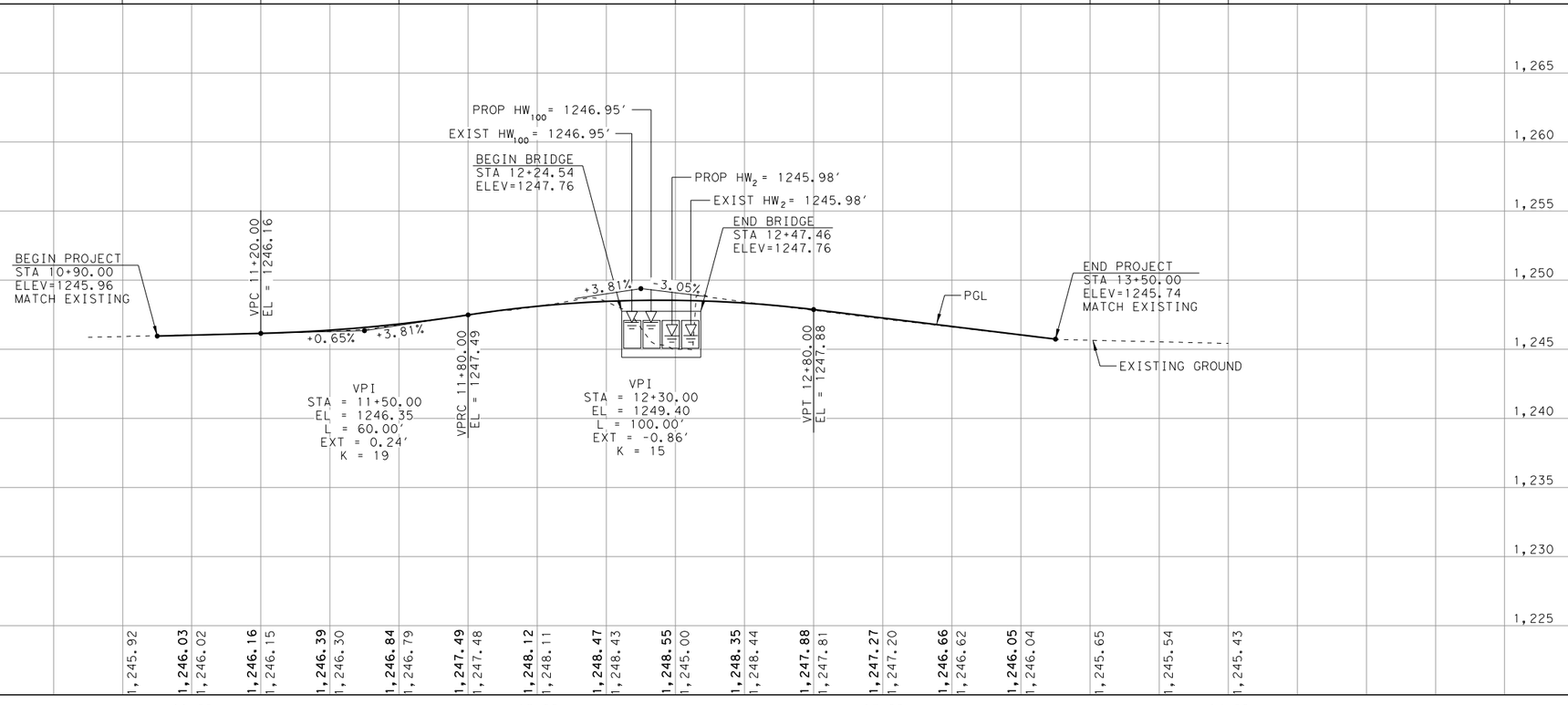
LEGEND

- DIRECTION OF TRAFFIC
- DIRECTION OF FLOW
- MBGF
- WIRE FENCE (TY C) (PERMANENT)
- WIRE FENCE (WATER GAP) (PERMANENT)

NOTE: TYPE C FENCE TO BE LOCATED AS CLOSE TO EXISTING FENCE AS POSSIBLE UNLESS DIRECTED BY THE ENGINEER.

100' OF TEMP TYPE C FENCE PLACED AS DIRECTED BY THE ENGINEER.

0	0	1	3	4	7	1	EST	UNIT	DESCRIPTION
23	36	10	2	5	27	16	119	CY	EMBANK (FINAL)(ORD COMP)(TY C)
								CY	EXCAV (RDWY)



NO.	REVISION	BY	DATE

STATE OF TEXAS
JAMES BROOKS
101002
LICENSED
PROFESSIONAL ENGINEER
7/30/2020

TEXAS TRANSPORTATION SOLUTIONS, INC.
Firm #F-19297

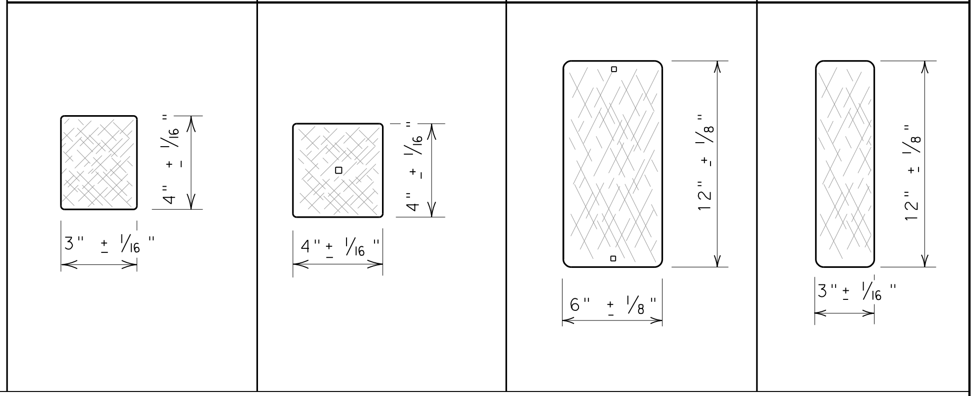
PLAN AND PROFILE CR 4981 AT LEON RIVER DRAW-2

SHEET 1 OF 1

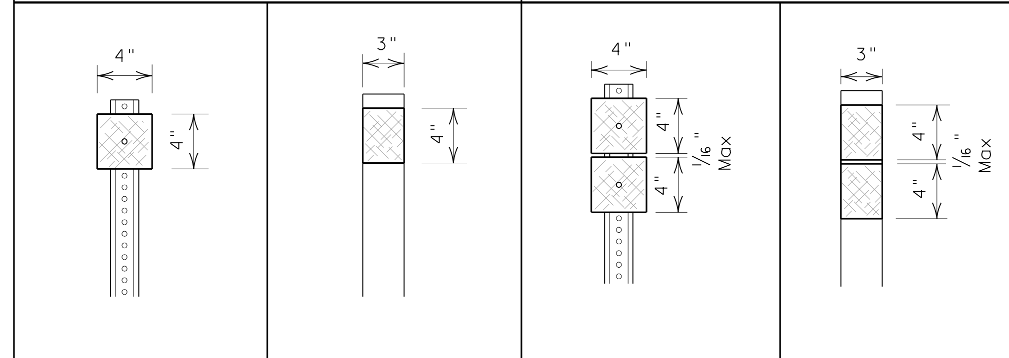
FED. RD DIV. No.	CONTROL No.	SECTION No.	JOB No.	HIGHWAY No.
6	0923	17	086	CR 4981
STATE	DISTRICT	COUNTY		SHEET No.
TEXAS	BWD	COMANCHE		23

pw://tts-pw.bentley.com:tts-pw-01/Documents/0223.002/Cadd/Plan Sheets/Roadway/CR4981_RDW_PP_01.dgn
7/30/2020 6:45 Joel2timerman SCRIPT: CR4981_Index.pen

REFLECTOR UNIT SIZES FOR DELINEATORS AND OBJECT MARKERS

	SIZE 1	SIZE 2	SIZE 3	SIZE 4
DEVICE				
SHEETING	Yellow, White or Red Type B or C reflective sheeting			
NOTE	1. Size 1 and 4 - Direct applied reflective sheeting for use on flexible post (flx). 2. Size 2 and 3 - For use on wing channel (wc) post only. Use approved metal, plastic or fiberglass backplate with 17/64" mounting holes.			

DELINEATORS

	SINGLE		DOUBLE	
DEVICE				
	1-Size 2 reflector unit	1-Size 1 reflector unit	2-Size 2 reflector units	2-Size 1 reflector units
SHEETING	Yellow, White or Red Type B or C Reflective Sheeting			
POST TYPE	WC	YFLX, WFLX	WC	YFLX, WFLX
MOUNT TYPE	GND	GND, SRF	GND	GND, SRF

D & OM DESCRIPTIVE CODES

INSTL DEL ASSM (D-XX)SZ X (XXXX)XXX(XX)

NUMBER OF REFLECTORS
- S = Single
- D = Double

COLOR OF REFLECTORS
- W = White
- Y = Yellow
- R = Red

REFLECTOR UNIT SIZE
- 1 or 2

TYPE OF POST OR DELINEATOR
- WC = Wing Channel Post
- YFLX = Yellow Flexible Post
- WFLX = White Flexible Post
- BRF = Barrier Reflector

TYPE OF MOUNT
- GND = Embedded (drivable or set in concrete)
- CTB = Concrete Barrier Mount
- GF1 or GF2 = Guard Fence Attachment
- SRF = Surface Mount

DIRECTION
- If Required
- BI = Bi-Directional
- BR = Bi-Directional with red on back

INSTL OM ASSM (OM-XX) (XXXX)XXX(XX)

TYPE OF OBJECT MARKER
- 1, 2, 3, or 4

NUMBER OF REFLECTORS OR DIRECTION
- X = 3-Size 2 reflector units (Type 2 only)
- Y = 1-Size 3 reflector unit (Type 2 only)
- Z = 3-Size 1 or 1-Size 4 reflector unit(s)(Type 2 only)
- L = Left Side (Type 3 Object Marker only)
- R = Right Side (Type 3 Object Marker only)
- C = Center (Type 3 Object Marker only)

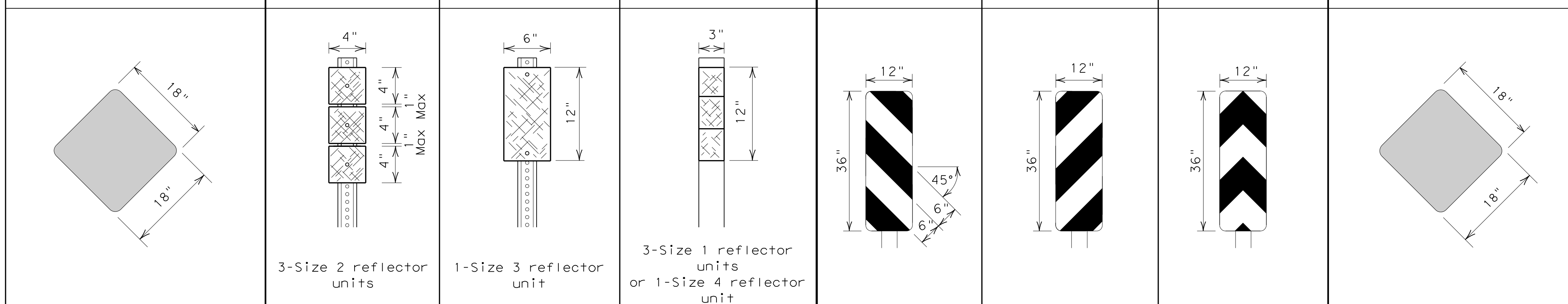
TYPE OF POST
- WC = Wing Channel Post
- WFLX = White Flexible Post
- TWT = Thin Walled Tubing

TYPE OF MOUNT
- GND = Embedded (drivable)
- SRF = Surface Mount
- WAS = Wedge Anchor Steel
- WAP = Wedge Anchor Plastic

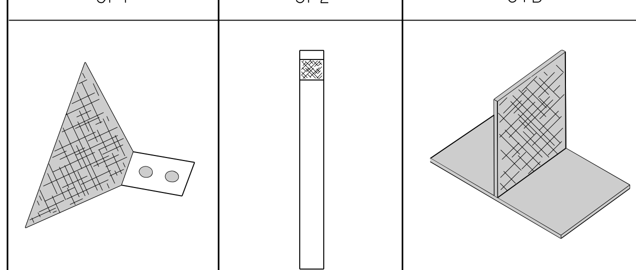
DIRECTION
- If Required
- BI = Bi-Directional

DEPARTMENTAL MATERIAL SPECIFICATIONS	
FLEXIBLE DELINEATOR & OBJECT MARKER POSTS (EMBEDDED & SURFACE MOUNT TYPES)	DMS-4400
SIGN FACE MATERIALS	DMS-8300
DELINEATORS, OBJECT MARKERS AND BARRIER REFLECTORS	DMS-8600

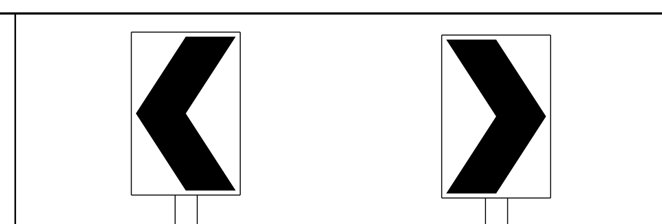
OBJECT MARKERS

	Type 1 (OM-1)	Type 2 (OM-2)			Type 3 (OM-3)			Type 4 (OM-4)
	OM-1	OM-2X	OM-2Y	OM-2Z	OM-3L	OM-3R	OM-3C	OM-4
DEVICE								
		3-Size 2 reflector units	1-Size 3 reflector unit	3-Size 1 reflector units or 1-Size 4 reflector unit				
SHEETING	Yellow-Type B_{FL} or C_{FL} Sheeting	Yellow - Type B or C Sheeting			Alternating acrylic black and retroflective yellow - Type B_{FL} or C_{FL} Sheeting			Red -Type B_{FL} or C_{FL} Sheeting
POST TYPE	TWT	WC	WC	WFLX	TWT			TWT
MOUNT TYPE	WAS, WAP	GND	GND	GND, SRF	WAS, WAP			WAS, WAP

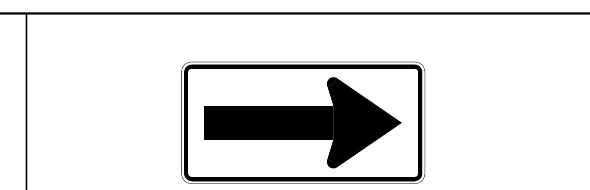
BARRIER REFLECTORS (BRF)

	GF1	GF2	CTB
DEVICE			
	1. Barrier reflectors shall meet the requirements of DMS 8600. 2. Approved Barrier Reflectors are listed on the "Barrier Reflectors" Material Producer List at: www.txdot.gov.		
SHEETING	Yellow, White, Red		
NOTE	1. Reflective sheeting shall have a minimum dimension of 3 inches and minimum surface area of 9 square inches.		

CHEVRONS

DEVICE	 W1-8			
SIZE (W x L)	18"x 24" (Conventional)	24"x 30" (Conventional Oversize)	30"x 36" (Expressway)	36" x 48" (Freeway)
MOUNTING HEIGHT	4'-0" or 7'-0"		7'-0" Only	

ONE DIRECTION LARGE ARROW

DEVICE	 W1-6	
SIZE (W x L)	48" x 24" (Conventional)	60" x 30" (Expressway & Freeway)
MOUNTING HEIGHT	7'-0"	

NOTE

1. CHEVRON (W1-8) signs and ONE DIRECTION LARGE ARROW (W1-6) Signs shall be installed per Sign Mounting Details (SMD) Standard Sheets and paid under Item 644 (Small Roadside Sign Assemblies).
2. When there is a need to increase conspicuity, the Texas version of the ONE DIRECTION LARGE ARROW sign (W1-9T) may be used instead of the ONE DIRECTION LARGE ARROW (W1-6).

NOTE:

Delineator and object marker substrates and sign substrates shall be 0.080" Aluminum sign blank to conform to ASTM B-209 Alloy 6061-T6 or approved alternative.

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER MATERIAL DESCRIPTION

D & OM(1)-20

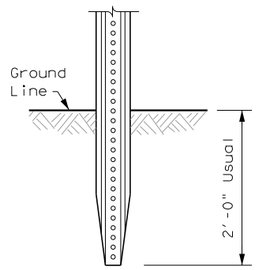
FILE: dom1-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
©TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS 10-09 3-15 4-10 7-20	0923	17	086	CR 4981
	DIST		COUNTY	SHEET NO.
	BWD		COMANCHE	24

20A

POST TYPE AND SUPPORT FOUNDATION DETAILS

WING CHANNEL (WC)

GND

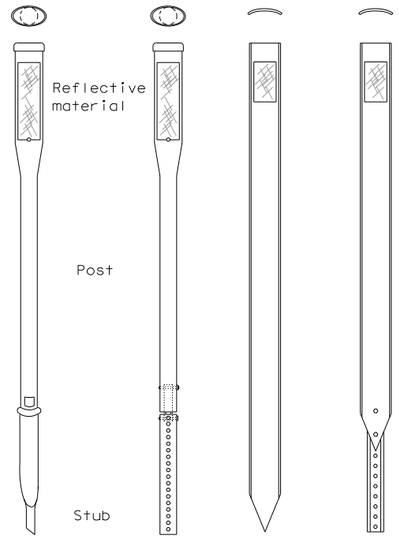


NOTES

1. Embedded Wing Channel (WC) post option may be used for Type 2 Object Markers and Delineators only.
2. 1.12 lbs/ft steel per ASTM A 1011 SS Gr. 50, or ASTM A499.

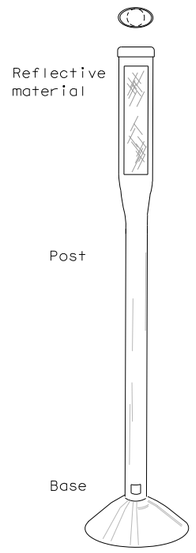
FLEXIBLE POSTS (YFLX, WFLX)

GND



EMBEDDED

SRF



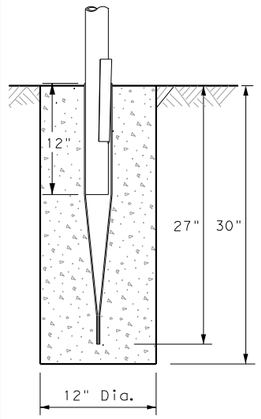
SURFACE MOUNT

NOTES

1. See "Flexible Delineator and Object Marker Posts" Material Producer List for approved devices.
2. Install per manufacturer's recommendations.
3. Post length may vary to meet field conditions.
4. When using yellow delineators with flexible posts to separate opposing direction of travel, such as centerline or median use, the flexible posts shall be yellow.

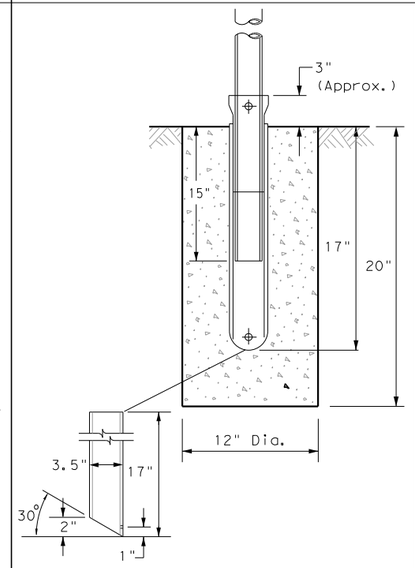
WEDGE ANCHOR SYSTEMS

WAS



STEEL

WAP



PLASTIC

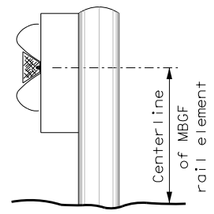
NOTE

1. Install per manufacturer's recommendations.

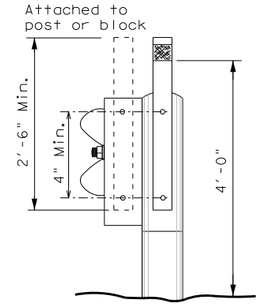
TYPE OF BARRIER MOUNTS

GUARD FENCE ATTACHMENT

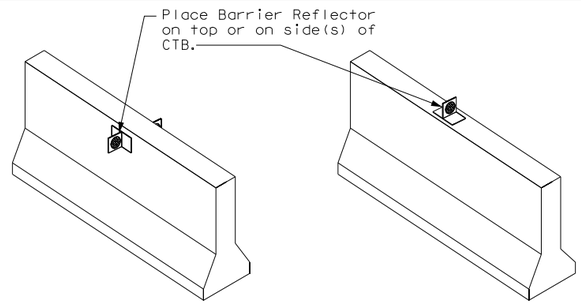
GF1



GF2



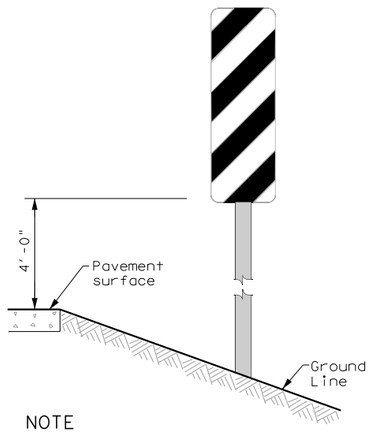
CONCRETE TRAFFIC BARRIER (CTB)



GENERAL NOTES

1. Place delineators on a section of roadway at a consistent distance from the edge of pavement.
2. Where a restriction prevents consistent placement from the pavement edge, place the affected object markers in line with the innermost edge of the obstruction.
3. When Type 2 object markers and delineators are more than 8'-0" from the edge of the pavement, it may not be possible to maintain a height of approximately 4'-0". If this is the case, place the object marker or delineator as close to the desired height as possible.
4. Install all delineators, object markers and barrier reflectors in accordance with the manufacturer's recommendation.
5. Barrier reflectors should be installed a minimum of 18 inches above the edge of the pavement surface.
6. Diagonal stripes on Type 3 object markers shall slope down toward the intended travel lane.

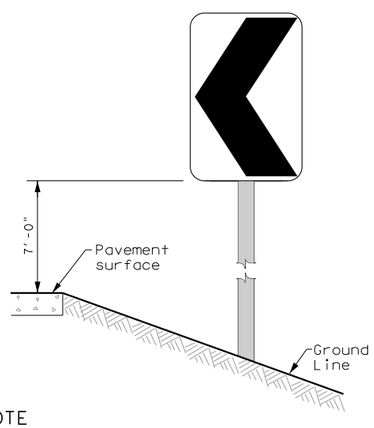
TYPES 1, 3, AND 4 OBJECT MARKERS AND CHEVRONS



NOTE

Mounting at 4 feet to the bottom of the chevron is permitted for chevrons that will not exceed a height of 6'-6" to the top of the chevron (sizes 24" x 30" and smaller)

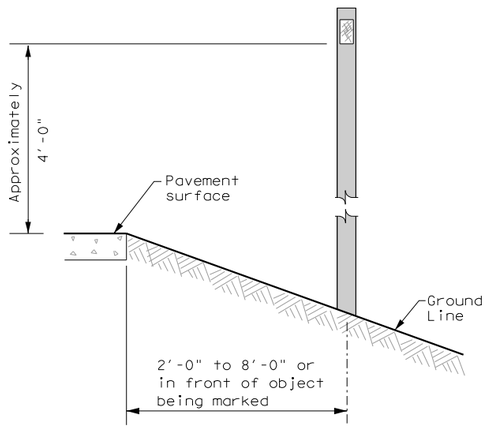
CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN



NOTE

Chevrons 30" x 36" and larger shall be mounted at a height of 7' to the bottom of the chevron. Chevron sign and ONE DIRECTION LARGE ARROW sign (W1-9T) shall be installed per SMD standard sheets and paid under item 644.

DELINEATORS AND TYPE 2 OBJECT MARKERS



See general notes 1, 2 and 3.

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER INSTALLATION

D & OM(2)-20

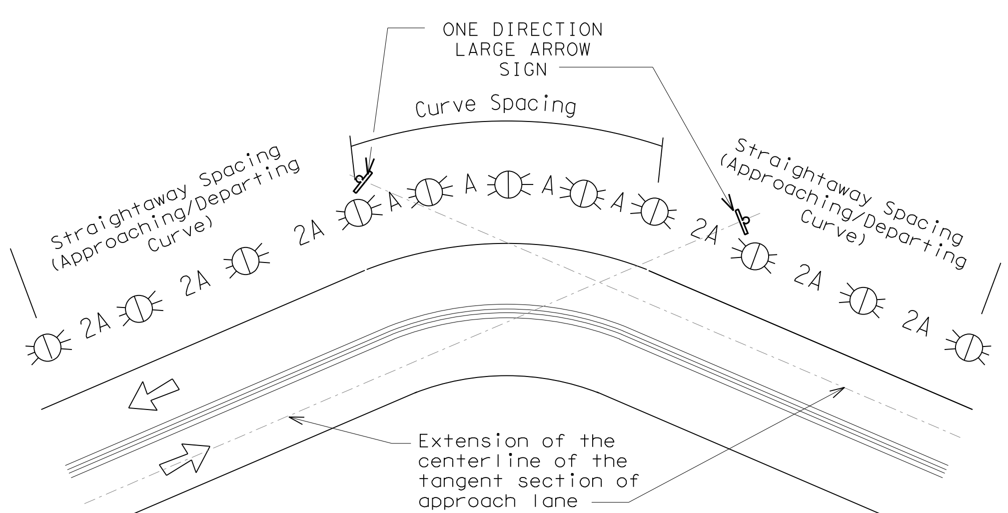
FILE: dom2-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
©TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0923	17	086	CR 4981
10-09 3-15	DIST	COUNTY		SHEET NO.
4-10 7-20	BWD	COMANCHE		25
20B				

DATE: 10/6/2021 3:05
FILE: pw://tts-pw.bentley.com:tts-pw-01/Documents/0223.002 WA 3 - CR Brown Comanche ... Standards/Roadway/D&OM(3)-20.dgn

MINIMUM WARNING DEVICES AT CURVES WITH ADVISORY SPEEDS

Amount by which Advisory Speed is less than Posted Speed	Curve Advisory Speed: Turn (30 MPH or less)	Curve Advisory Speed: Curve (35 MPH or more)
5 MPH & 10 MPH	• RPMs	• RPMs
15 MPH & 20 MPH	• RPMs and One Direction Large Arrow sign	• RPMs and Chevrons; or • RPMs and One Direction Large Arrow sign where geometric conditions or roadside obstacles prevent the installation of chevrons.
25 MPH & more	• RPMs and Chevrons; or • RPMs and One Direction Large Arrow sign where geometric conditions or roadside obstacles prevent the installation of chevrons	• RPMs and Chevrons

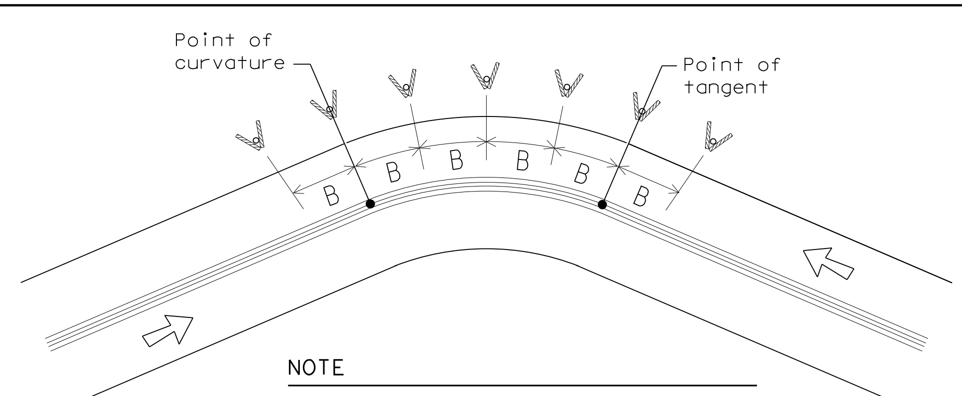
SUGGESTED SPACING FOR DELINEATORS ON HORIZONTAL CURVES



NOTE

ONE DIRECTION LARGE ARROW (W1-6) sign should be located at approximately and perpendicular to the extension of the centerline of the tangent section of approach lane.

SUGGESTED SPACING FOR CHEVRONS ON HORIZONTAL CURVES



NOTE

At least one chevron pair is installed beyond the point of tangent in tangent section.

DELINEATOR AND CHEVRON SPACING

WHEN DEGREE OF CURVE OR RADIUS IS KNOWN

Degree of Curve	FEET: Radius of Curve	FEET: Spacing in Curve	FEET: Spacing in Straightaway	FEET: Chevron Spacing in Curve
		A	2A	B
1	5730	225	450	——
2	2865	160	320	——
3	1910	130	260	200
4	1433	110	220	160
5	1146	100	200	160
6	955	90	180	160
7	819	85	170	160
8	716	75	150	160
9	637	75	150	120
10	573	70	140	120
11	521	65	130	120
12	478	60	120	120
13	441	60	120	120
14	409	55	110	80
15	382	55	110	80
16	358	55	110	80
19	302	50	100	80
23	249	40	80	80
29	198	35	70	40
38	151	30	60	40
57	101	20	40	40

Curve delineator approach and departure spacing should include 3 delineators spaced at 2A. This spacing should be used during design preparation or when the degree of curve is known.

DELINEATOR AND CHEVRON SPACING

WHEN DEGREE OF CURVE OR RADIUS IS NOT KNOWN

Advisory Speed (MPH)	Spacing in Curve	Spacing in Straightaway	Chevron Spacing in Curve
	A	2xA	B
65	130	260	200
60	110	220	160
55	100	200	160
50	85	170	160
45	75	150	120
40	70	140	120
35	60	120	120
30	55	110	80
25	50	100	80
20	40	80	80
15	35	70	40

If the degree of curve is not known, delineator spacing may be determined based on the Advisory Speed of the curve. Use the delineator curve spacing for each Advisory Speed (MPH).

DELINEATOR AND OBJECT MARKER APPLICATION AND SPACING

CONDITION	REQUIRED TREATMENT	MINIMUM SPACING
Frwy./Exp. Tangent	RPMs	See PM-series and FPM-series standard sheets
Frwy./Exp. Curve	Single delineators on right side	See delineator spacing table
Frwy/Exp.Ramp	Single delineators on at least one side of ramp (should be on outside of curves) (see Detail 3 on D&OM(4))	100 feet on ramp tangents Use delineator spacing table for ramp curves ("straightway spacing" does not apply to ramp curves)
Acceleration/Deceleration Lane	Double delineators (see Detail 3 on D&OM(4))	100 feet (See Detail 3 on D & OM (4))
Truck Escape Ramp	Single red delineators on both sides	50 feet
Bridge Rail (steel or concrete)and Metal Beam Guard Fence	Bi-Directional Delineators when undivided with one lane each direction Single Delineators when multiple lanes each direction	Equal spacing (100'max) but not less than 3 delineators
Concrete Traffic Barrier (CTB) or Steel Traffic Barrier	Barrier reflectors matching the color of the edge line	Equal spacing 100' max
Cable Barrier	Reflectors matching the color of the edge line	Every 5th cable barrier post (up to 100'max)
Guard Rail Terminus/Impact Head	Divided highway - Object marker on approach end Undivided 2-lane highways - Object marker on approach and departure end	Requires reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end See D & OM (5) and D & OM (6)
Bridges with no Approach Rail	Type 3 Object Marker (OM-3) at end of rail and 3 single delineators approaching rail	See D & OM(5)
Reduced Width Approaches to Bridge Rail	Type 2 and Type 3 Object Markers (OM-3) and 3 single delineators approaching bridge	Requires reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end See D & OM (5)
Culverts without MBGF	Type 2 Object Markers	See Detail 2 on D & OM(4)
Crossovers	Double yellow delineators and RPMs	See Detail 1 on D & OM (4)
Pavement Narrowing (lane merge) on Freeways/Expressway	Single delineators adjacent to affected lane for full length of transition	100 feet

NOTES

1. Unless indicated otherwise, the delineator or barrier reflector color shall conform to the color of the pavement edge line on the side of the road where the delineators or barrier reflectors are placed.
2. Barrier reflectors may be used to replace required delineators.
3. Single red delineators may be mounted on the back side of delineator posts for wrong way driver applications

LEGEND

Symbol	Description
	Bi-directional Delineator
	Delineator
	Sign

Texas Department of Transportation — Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

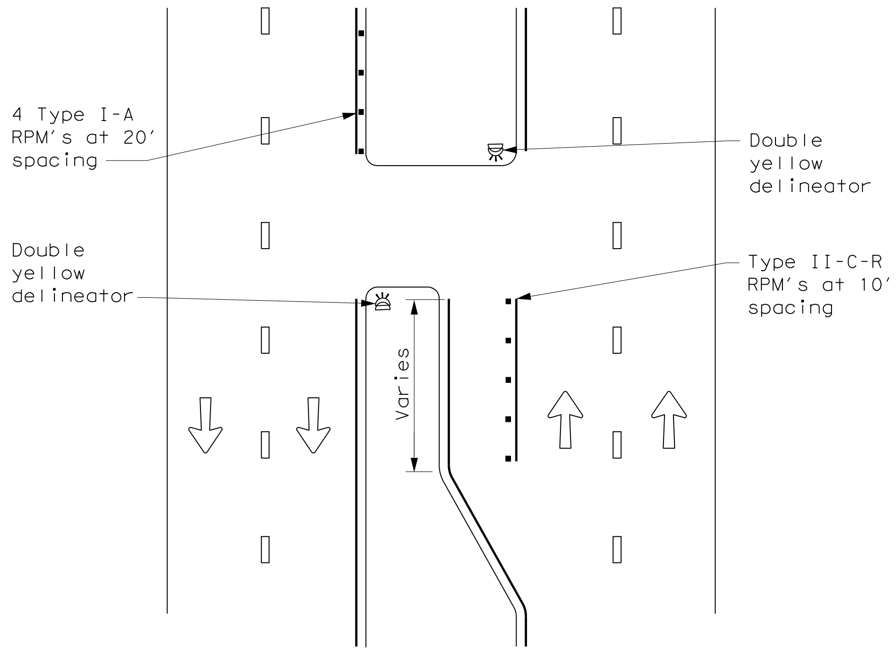
D & OM(3)-20

FILE: dom3-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT August 2004	CONT 0923	SECT 17	JOB 086	HIGHWAY CR 4981
REVISIONS 3-15 8-15 8-15 7-20	DIST BWD	COUNTY COMANCHE		SHEET NO. 26

20C

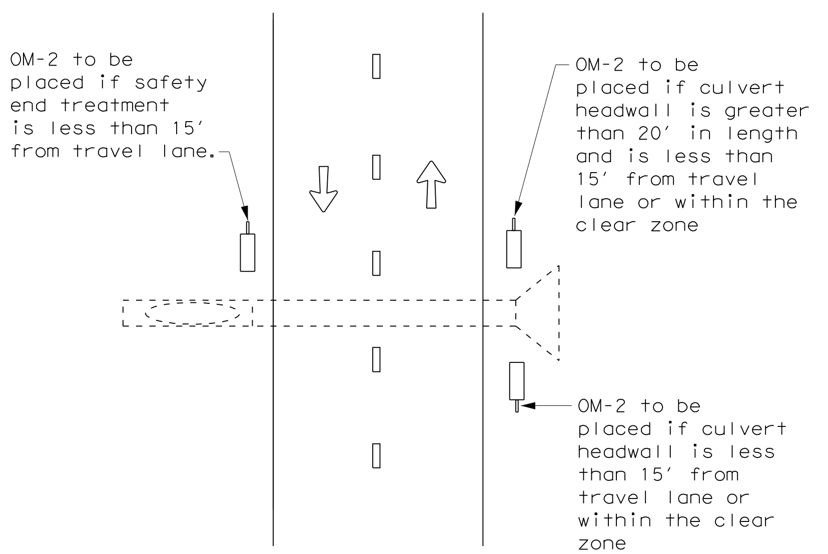
DATE: 10/6/2021 3:05
FILE: pw://tts-pw.bentley.com:tts-pw-01/Documents/0223.002 WA 3 - CR Brown

CROSSOVERS



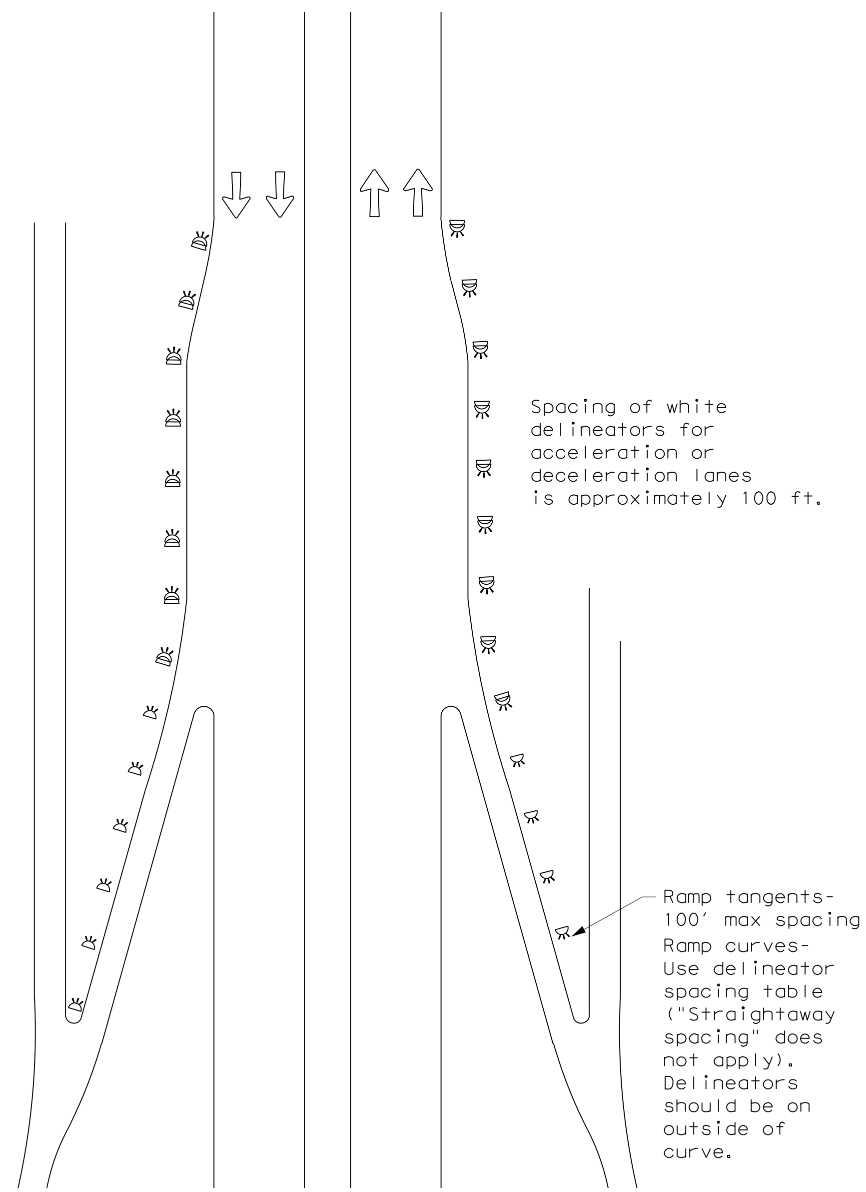
DETAIL 1

FOR CULVERTS WITHOUT MBGF



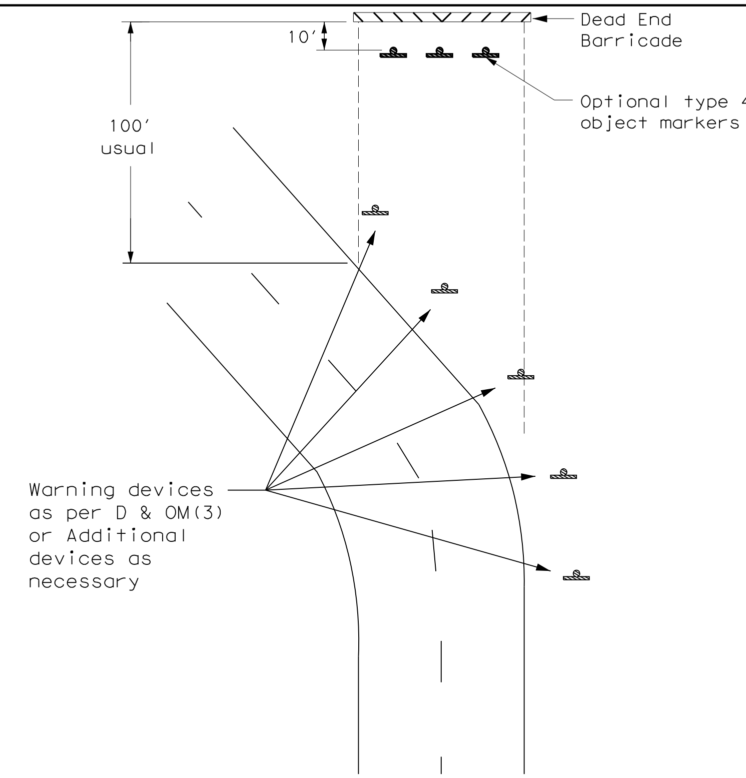
DETAIL 2

FREEWAY DELINEATION FOR RAMPS AND ACCELERATION/DECELERATION LANES



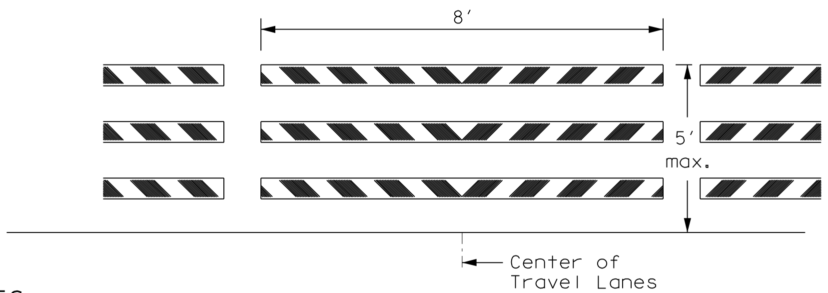
DETAIL 3

TYPICAL APPLICATION OF DEAD END BARRICADE



DETAIL 4

TYPICAL DEAD END BARRICADE INSTALLATION



NOTES

1. Barricade striping shall be red and white reflective sheeting for all permanent road closures.
2. Barricade striping is red and white sloping toward the center of the roadway.
3. Type 3 Barricade Supports should be anchored to soil or pavement as described in compliant Work Zone Traffic Control Devices List, section D.2.f and D.2.g.

DETAIL 5

LEGEND

Symbol	Description
	Bidirectional Delineator
	Delineator
	OM-3
	Barricade
	Sign
	OM-2
	Double Delineator

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

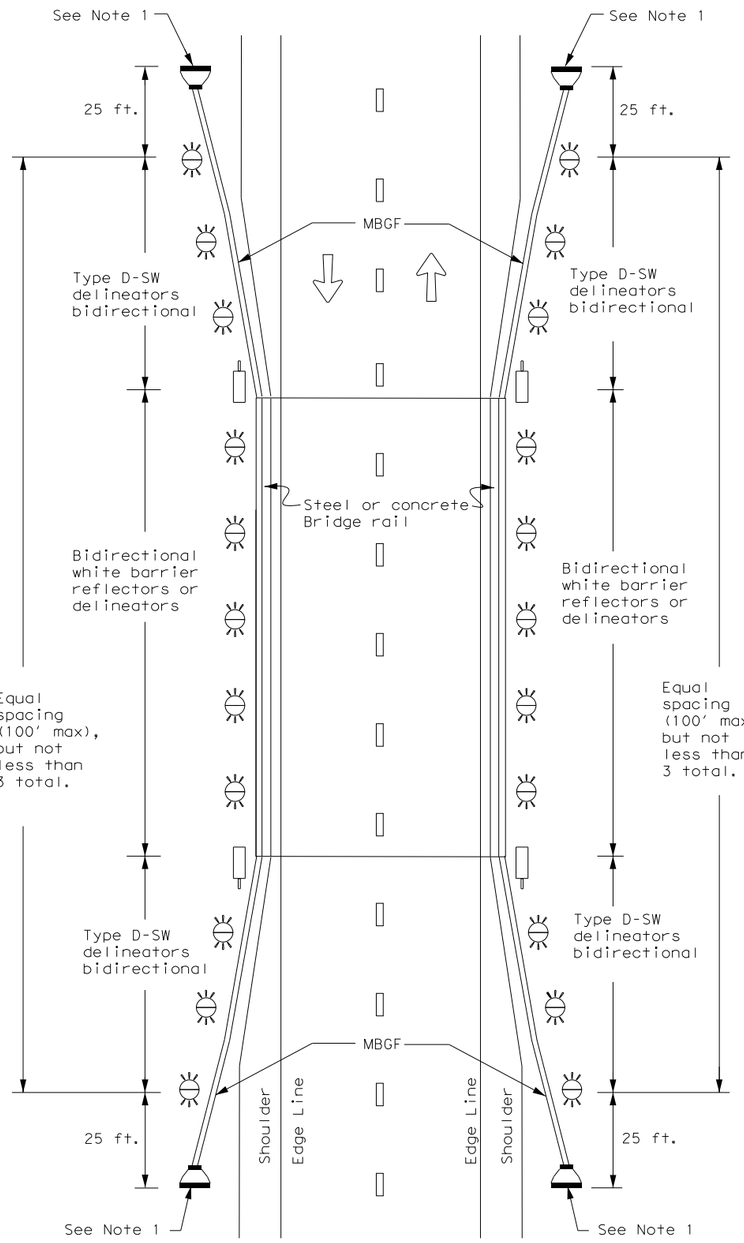
D & OM(4)-20

FILE: dom4-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
©TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS 3-15 7-20	0923	17	086	CR 4981
	DIST		COUNTY	SHEET NO.
	BWD		COMANCHE	27

20D

DATE: 10/6/2021 3:06
FILE: pw://tts-pw.bentley.com:tts-pw-01/Documents/0223.002 WA 3 - CR Brown Comanche/dgn/dom5-20.dgn

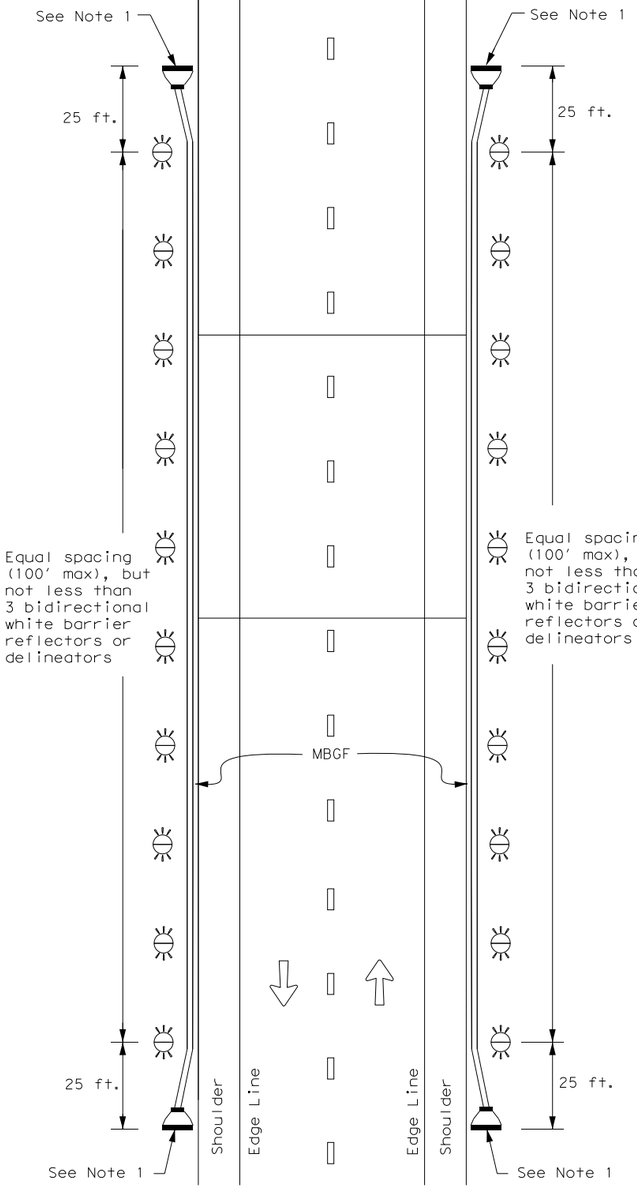
TWO-WAY, TWO LANE ROADWAY WITH REDUCED WIDTH APPROACH RAIL



NOTE:

1. Terminal ends require reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end.

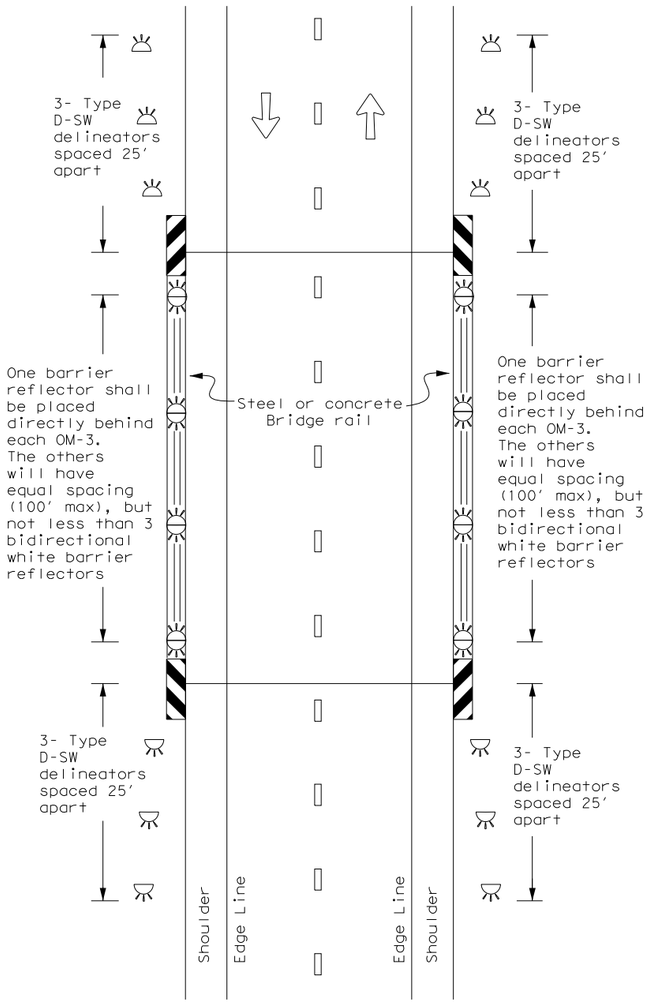
TWO-WAY, TWO LANE ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



NOTE:

1. Terminal ends require reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3) in front of the terminal end.

TWO-WAY, TWO LANE ROADWAY BRIDGE WITH NO APPROACH RAIL



LEGEND

	Bidirectional Delineator
	Delineator
	OM-3
	OM-2
	Terminal End
	Traffic Flow

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

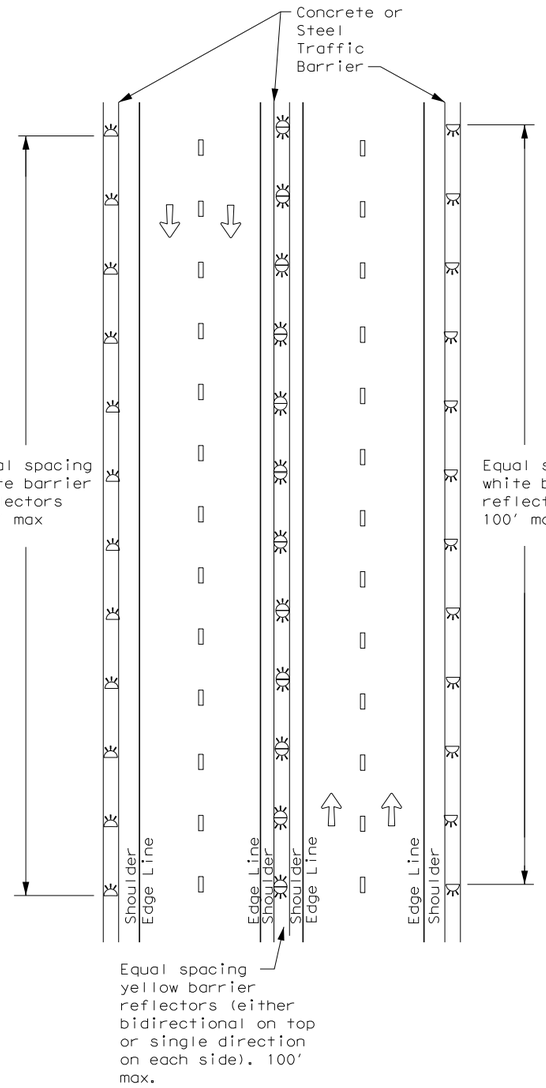
D & OM(5)-20

FILE: dom5-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT August 2015	CONT	SECT	JOB	HIGHWAY
REVISIONS	0923	17	086	CR 4981
7-20	DIST	COUNTY		SHEET NO.
	BWD	COMANCHE		28

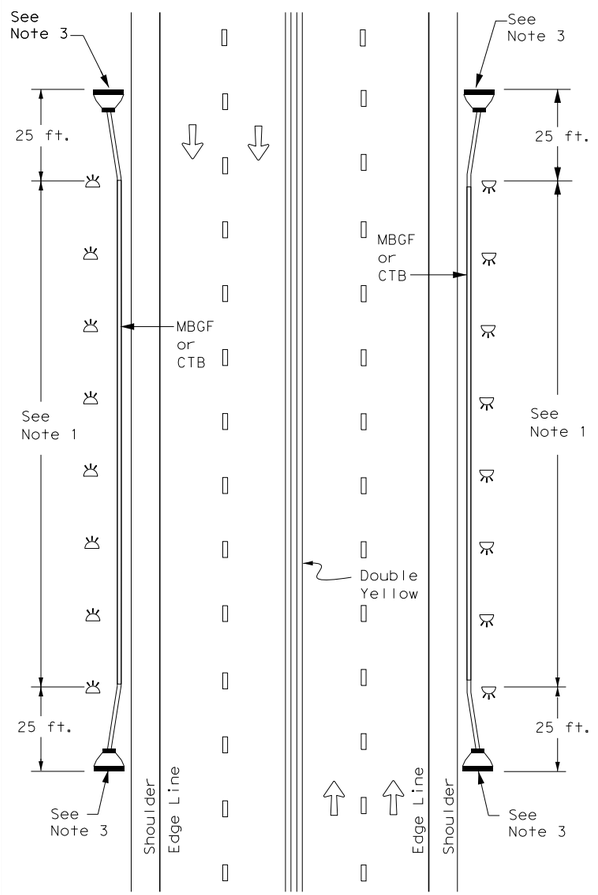
20E

DATE: 10/6/2021 3:06
FILE: pw://ts-pw.bentley.com:ts-pw-01/Documents/0223.002 WA 3 - CR Brown - comanche 0/dgn/dom6-20.dgn

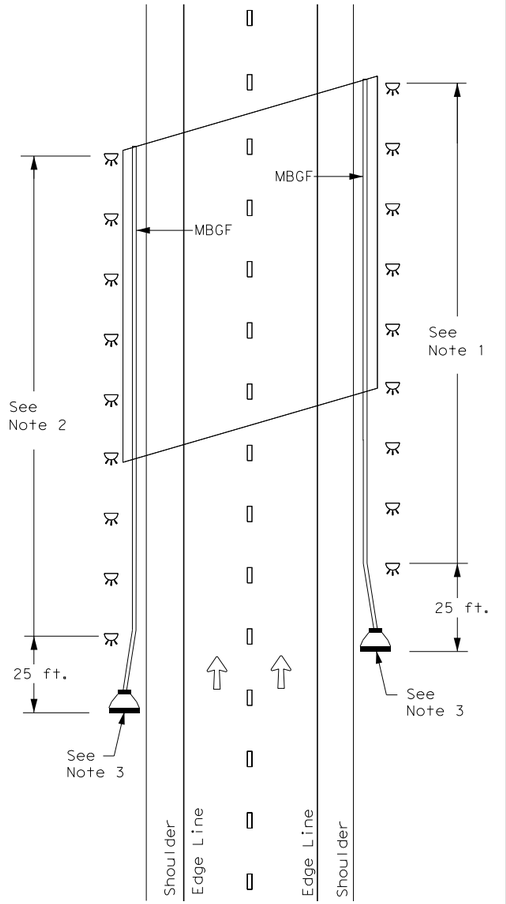
CONTINUOUS CONCRETE OR STEEL BARRIER



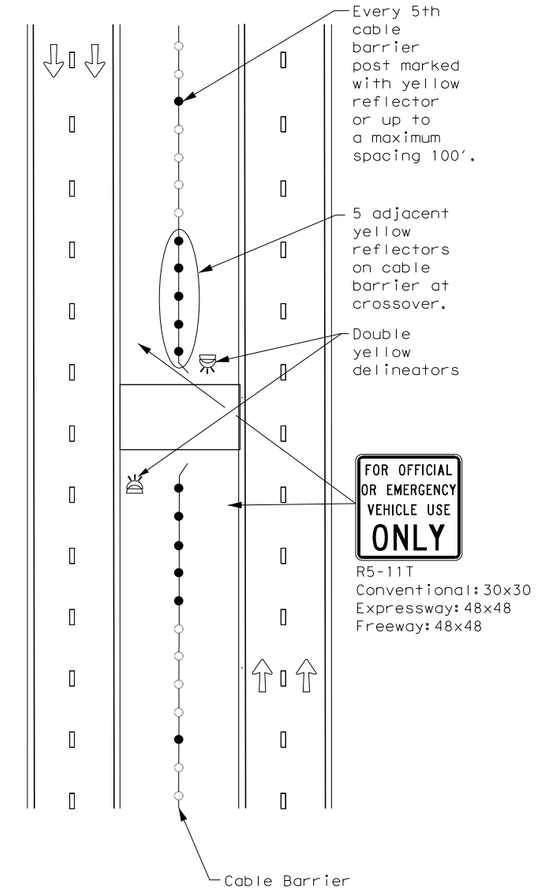
MULTI-LANE UNDIVIDED, TWO-WAY ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



DIVIDED ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



EMERGENCY CROSSOVER



NOTES

1. Equal spacing (100′ max), but not less than 3 single directional white barrier reflectors or delineators. On Continuos Barrier, equal spacing (100′ max.)
2. Equal spacing (100′ max), but not less than 3 single directional yellow barrier reflectors or delineators.
3. Terminal ends require reflective sheeting provided by manufacturer per D & OM (VIA) or a Type 3 Object Marker (OM-3)in front of the terminal end.

LEGEND

	Bidirectional Delineator
	Delineator
	OM-3
	OM-2
	Terminal End
	Traffic Flow

Texas Department of Transportation

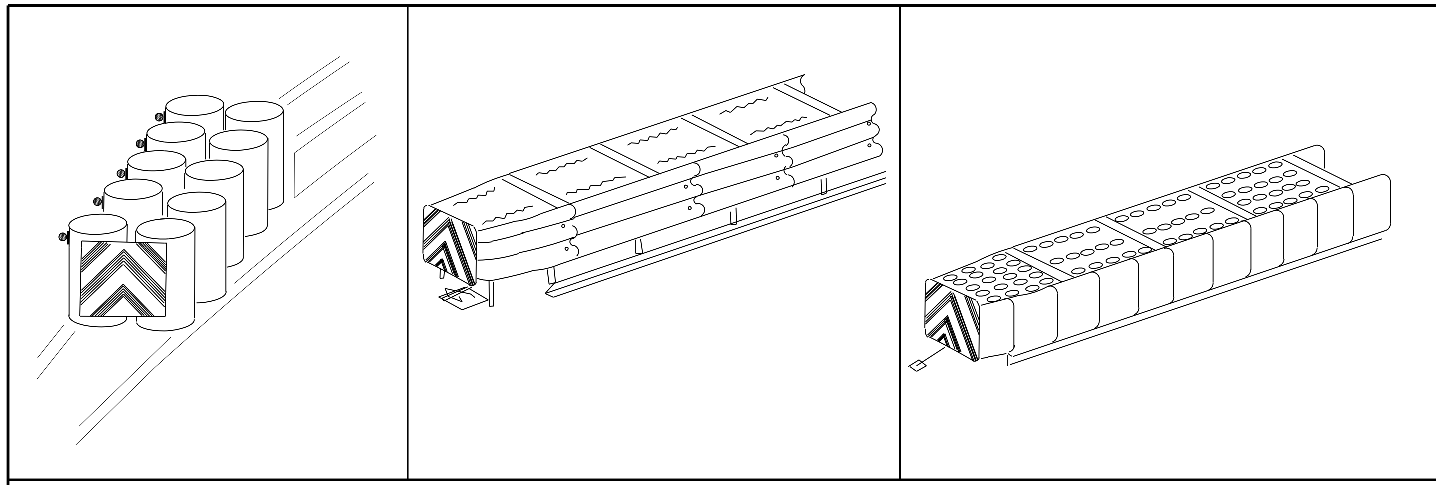
Traffic Safety Division Standard

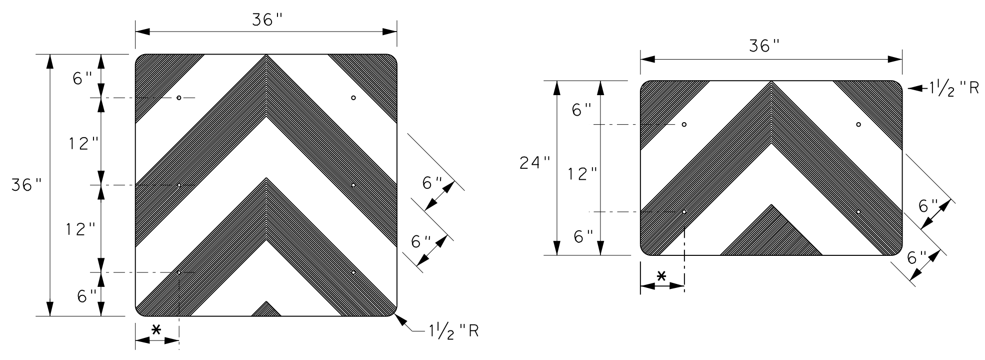
DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

D & OM(6)-20

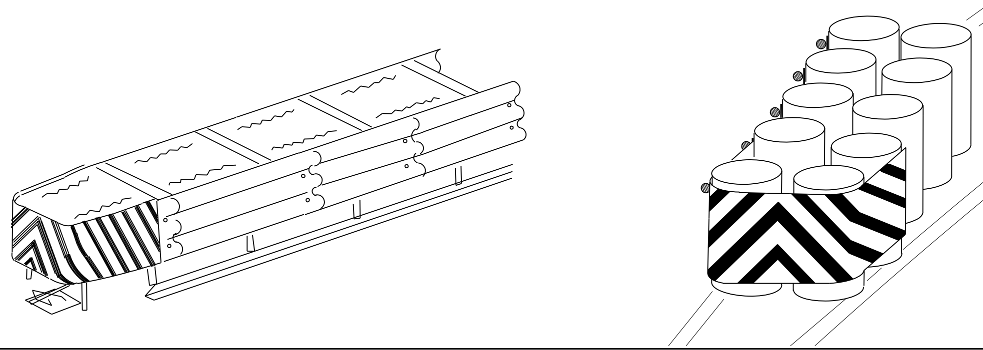
FILE: dom6-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT August 2015	CONT	SECT	JOB	HIGHWAY
REVISIONS	0923	17	086	CR 4981
7-20	DIST	COUNTY		SHEET NO.
	BWD	COMANCHE		29

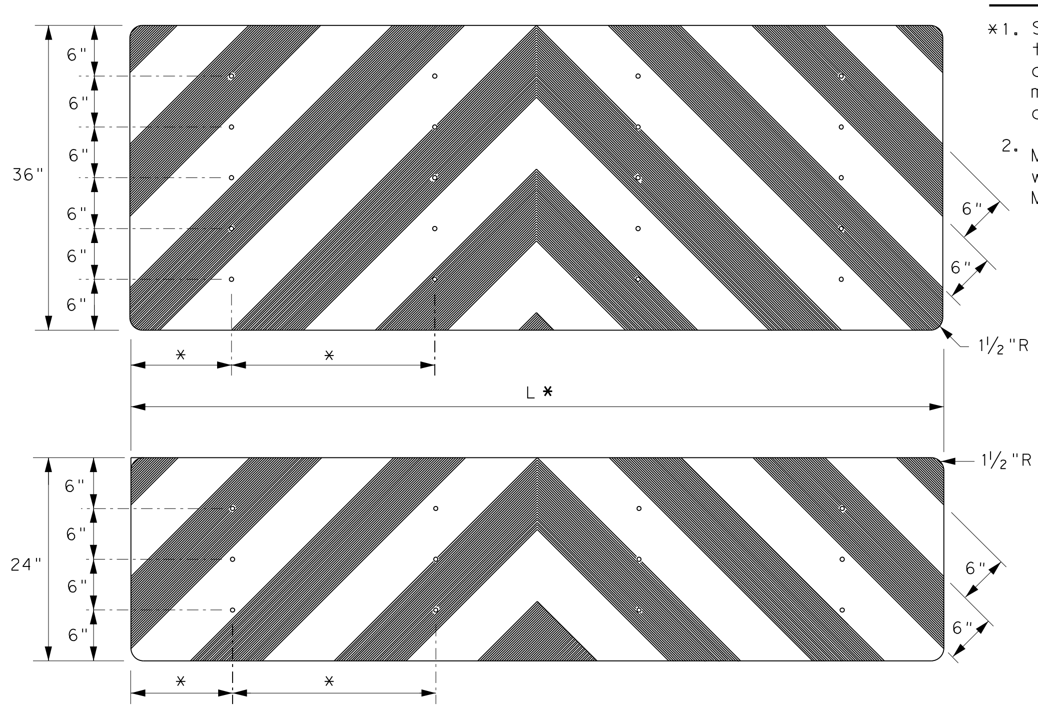
20F





* Adjust to fit attenuator per manufacturer's recommendation, or as directed by the Engineer

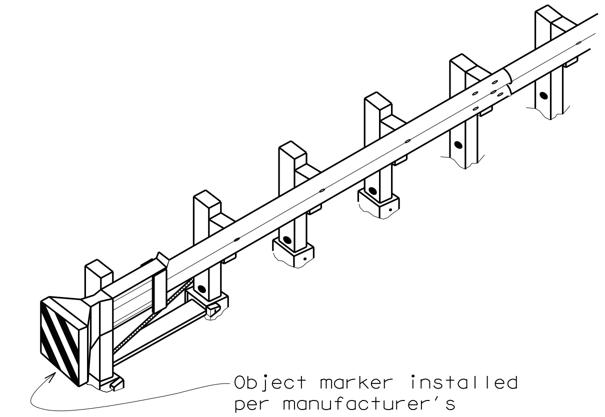


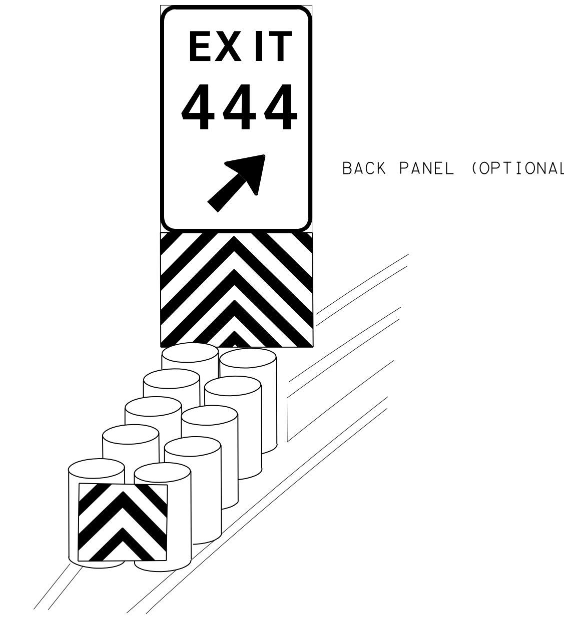


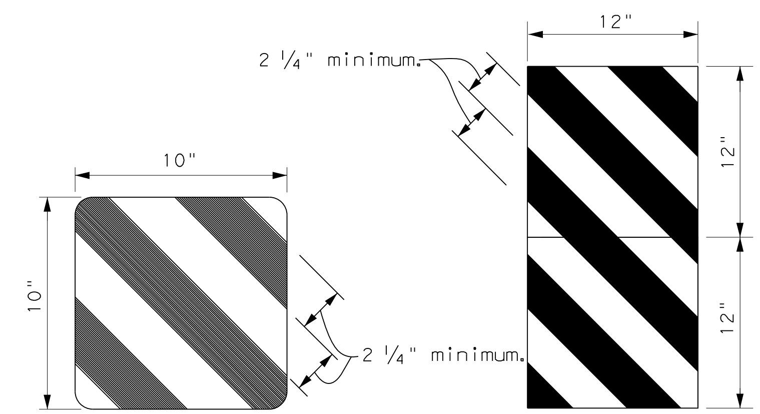
NOTES

*1. Spacing should be adjusted to attach through centerline of drum, per attenuator manufacturers recommendation, or as directed by the Engineer.

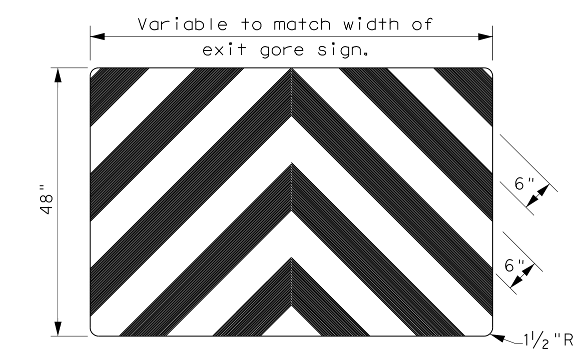
2. Mounting should be flush with top of attenuator. Minimum size 96" x 24".







OBJECT MARKERS SMALLER THAN 3 FT^2



NOTES

1. Object Markers shall conform to the Texas MUTCD and meet the color and reflectivity requirement of Department Material Specification DMS 8300. Background shall be yellow reflective sheeting (Type B or C) and Chevron shall be black.

2. Object Markers may be fabricated from adhesive backed reflective sheeting applied directly to guardrail end treatment, or applied directly to an "end cap" as per the manufacturer's recommendation. Direct applied sheeting shall provide a smooth surface and have no wrinkles, air bubbles, cuts or tears. A radius at the corners is not required for direct applied sheeting.

3. Object Marker size may be reduced to fit smaller devices. Width of alternating black and yellow stripes are typically 6". Object Markers smaller than 3ft may have reduced width stripes of a minimum of 2 1/4".

4. Pop rivets, screws, or nuts and bolts may be used to attach object markers and reflectors. Holes, slots or other openings may be cut or drilled through object markers to allow cable or other attachments.

5. Object Marker at nose of attenuator is subsidiary to the attenuator.

6. See D & OM (1-4) for required barrier reflectors.

Texas Department of Transportation — Traffic Safety Division Standard

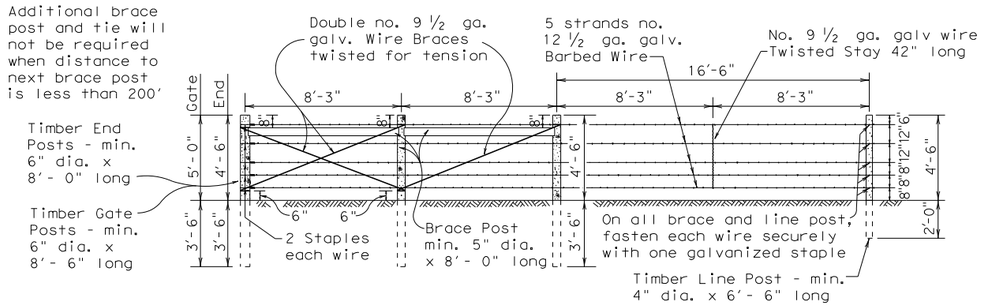
DELINEATOR & OBJECT MARKER FOR VEHICLE IMPACT ATTENUATORS

D & OM(VIA)-20

FILE: domvia20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT		
© TxDOT December 1989	CONT	SECT	JOB	HIGHWAY		
REVISIONS	0923	17	086	CR 4981		
4-92 8-04 / 8-95 3-15 / 4-98 7-20	DIST	COUNTY	SHEET NO.			
	BWD	COMANCHE	30			

20G

DATE: 10/6/2021 3:06
FILE: pw://tts-pw.bentley.com:tts-pw-01/Documents/0223.002 WA 3 - CR Brown ...

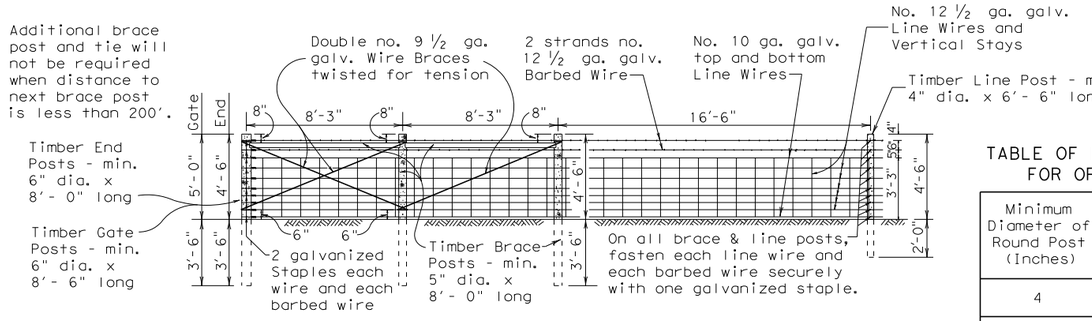


SECTION GALVANIZED BARBED WIRE FENCE WITH WOOD POSTS

Bracing Detail Used at Ends and Gates

TYPE "A" FENCE

(See General Note 6)



SECTION GALVANIZED WOVEN WIRE FENCE WITH WOOD POSTS

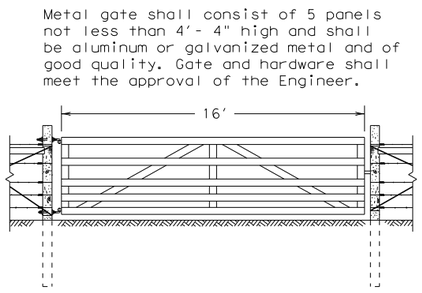
Bracing Detail Used at Ends and Gates

TYPE "B" FENCE

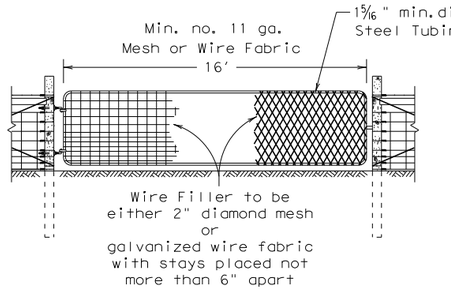
(See General Note 6)

TABLE OF EQUIVALENT SIZES FOR OPTIONAL SHAPE

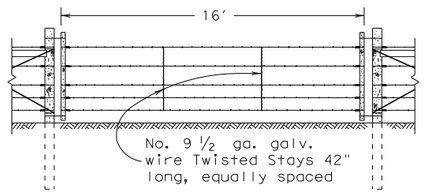
Minimum Diameter of Round Post (Inches)	Minimum Equivalent Dimension for Each Side of Square Post (Inches)
4	3 ½
5	4 ½
6	5 ¼



DETAIL TYPE 1 GATE



DETAIL TYPE 2 GATE

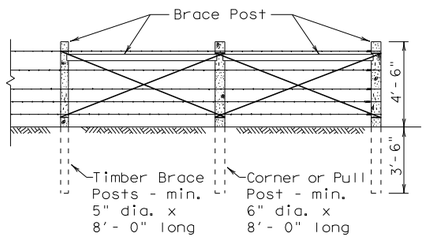


DETAIL TYPE 3 GATE

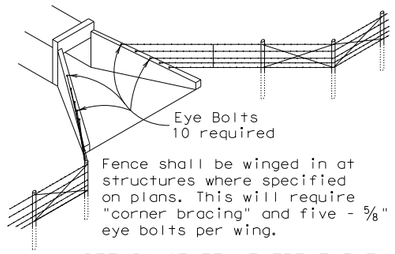
GENERAL NOTES

1. Any high point which interferes with the placing of wire mesh shall be excavated to provide 2" clearance.
2. Latches for Type 1 and Type 2 gates shall be good commercial quality and design latches of the spring, fork or chain type. All latches shall be suitable for the gate and shall be approved by the Engineer.
3. Hinges for Type 2 gates shall be commercial design approved by the Engineer suitable for post and gate.
4. Concrete shall be of the design and consistency approved by the Engineer and shall contain not less than 4 sacks of cement per cubic yard. Concrete footings are to be crowned at the top to shed water.
5. If rock is encountered at a depth less than the embedded depth required, a 15" or larger diameter hole shall be drilled for the post and the post shall be set in concrete. If rock is encountered at a depth of 1'- 6" or more below the ground surface, the hole shall be drilled to the required depth. If rock is encountered at a depth less than 1'- 6" below the ground surface, the holes shall be drilled a minimum of 2'- 0" into the rock or to the depth whichever is the lesser depth.
6. Barbed Wire shall be in accordance with ASTM A 121 (Class 1) Design designation 12-2-4-1 4R or 12-2-5-1 4R, or as approved by the Engineer.

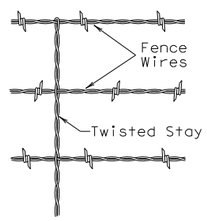
   Woven Wire Fence (Type B) shall be in accordance with ASTM A 116 (Class 1) No. 12-1/2 Grade 60 (See Table 1 ASTM A 116) to the height and design shown on the plans, or as approved by the Engineer.
7. The location of gates and corner posts will be as indicated elsewhere on these plans.
8. Square wood posts may be used in lieu of round posts provided minimum equivalent size requirements, as shown are met. All wood posts shall be in accordance with Item 552, "Wire Fence."



CORNER OR PULL POST ASSEMBLY

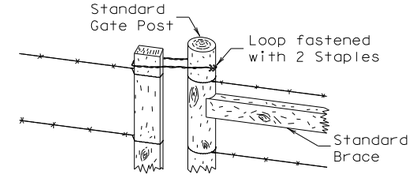


DETAIL OF FENCE TREATMENT AT STRUCTURES



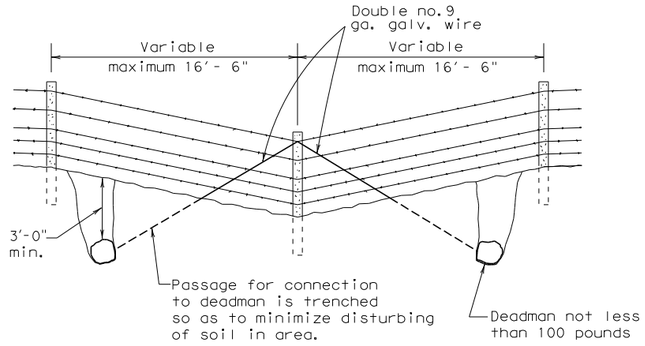
DETAIL OF STAY

(Barbed wire fence)



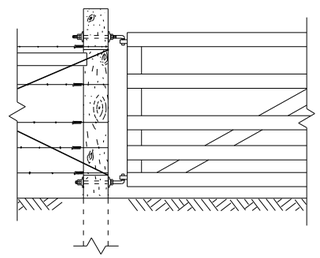
Loop to be made from two strands twisted no. 9 ½ ga. galv. smooth wire, and to be securely fastened to gate post with two galv. staples.

DETAIL FASTENER TYPE 3 GATE

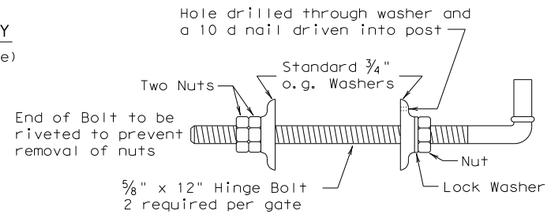


DETAIL OF FENCE SAG

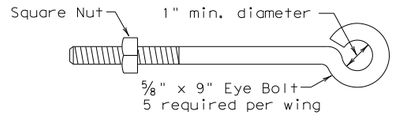
(Single Line Connection)



DETAIL SHOWING INSTALLATION OF HINGES OF TYPE 1 & 2 GATE



DETAIL OF GATE HINGE BOLT ASSEMBLY



DETAIL OF EYE BOLT

Texas Department of Transportation

Design Division Standard

BARBED WIRE AND WOVEN WIRE FENCE

(WOOD POSTS)

WF(1)-10

FILE: wf110.dgn	DN: TxDOT	CK: AM	DW: VP	CK:
© TxDOT 1994	CONT	SECT	JOB	HIGHWAY
REVISIONS	0923	17	086	CR 4981
	DIST	COUNTY		SHEET NO.
	BWD	COMANCHE		31

DATE: 7/30/2020
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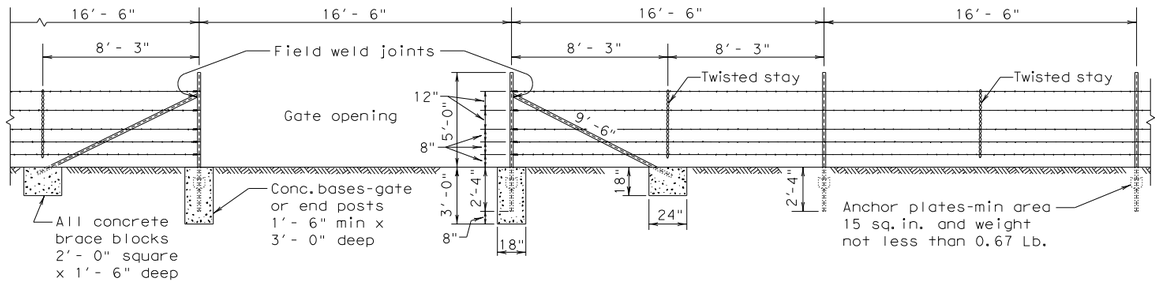


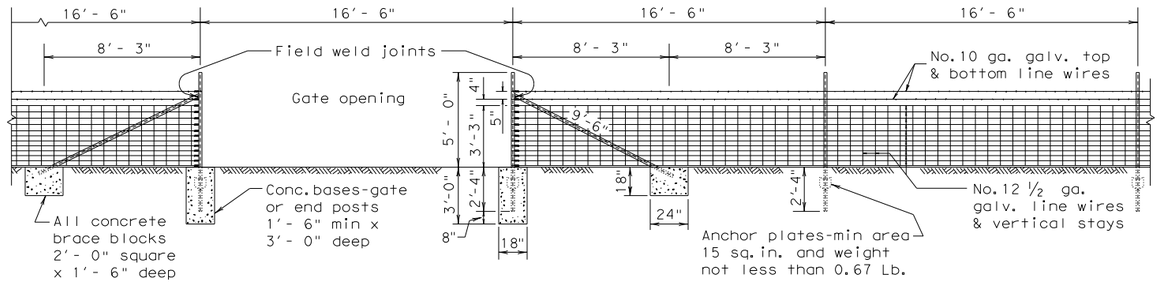
SECTION GALVANIZED BARBED WIRE FENCE WITH METAL POSTS

BRACING DETAIL USED AT ENDS AND GATES

TYPE "C" FENCE

(See General Note 8)

Note:
For Steel pipe and T-Post requirements. (See General Notes 6 & 7)

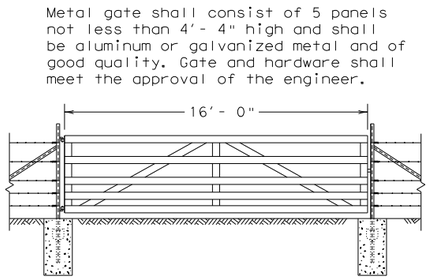


SECTION GALVANIZED WOVEN WIRE FENCE WITH METAL POSTS

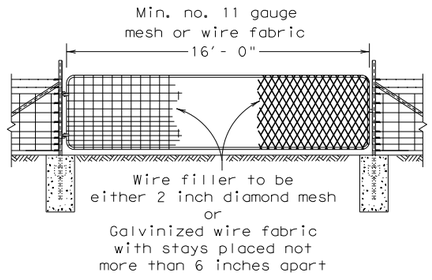
BRACING DETAIL USED AT ENDS AND GATES

TYPE "D" FENCE

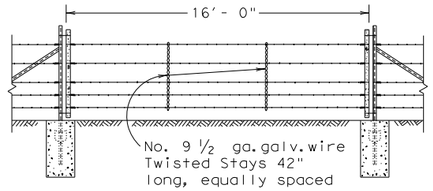
(See General Note 8)



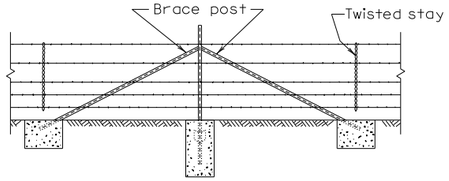
DETAIL TYPE 1 GATE



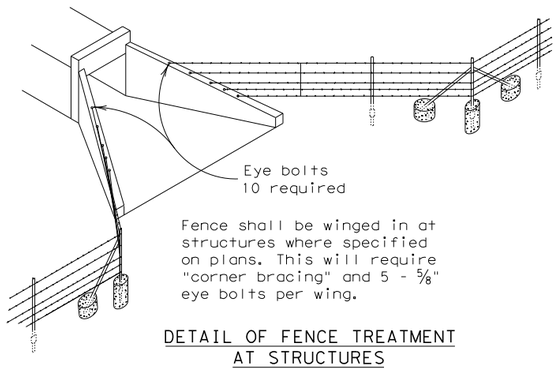
DETAIL TYPE 2 GATE



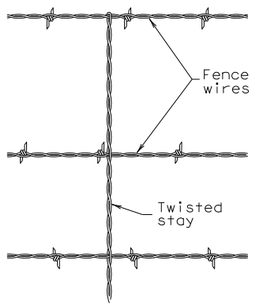
DETAIL TYPE 3 GATE



CORNER OR PULL POST ASSEMBLY

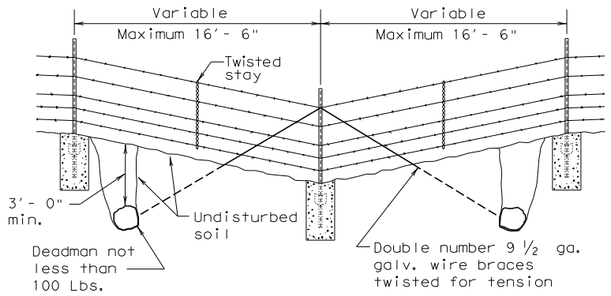


DETAIL OF FENCE TREATMENT AT STRUCTURES

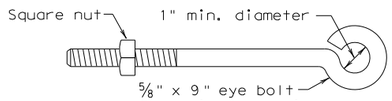


DETAIL OF STAY

(Barbed Wire Fence)



DETAIL OF FENCE SAG



DETAIL OF EYE BOLT

GENERAL NOTES

1. Any high point which interferes with the placing of wire mesh shall be excavated to provide a 2 inch clearance.
2. Latches for Type 1 and Type 2 gates shall be good commercial quality and design latch of the spring, fork or chain type. All latches shall be suitable to the gate and shall be approved by the Engineer.
3. Hinges for Type 2 gates shall be a commercial design approved by the Engineer suitable for post and gate.
4. Concrete shall be of the design and consistency approved by the Engineer and shall contain not less than 4 sacks of cement per cubic yard. Concrete footings are to be crowned at the top to shed water.
5. Steel anchor plates shall be of a design and thickness sufficient to prevent turning of the post in firm soil.
6. Steel pipe end posts, corner and pull posts shall be a minimum of 2" Std. pipe (2.375" O.D., 0.154" wall thickness) with a 1¼" Std. pipe brace (1.660" O.D., 0.140" wall thickness), with a 2"x2"x1/4" angle, or other as approved by the Engineer. Fasteners for securing barbed wire or woven wire fence to metal posts shall be a minimum of 11 gauge galvanized steel wire. Tubular posts shall be fitted with water malleable iron caps.
7. If Steel pipe is used for posts and braces, use standard pipe in accordance with ASTM A 53, Class B or A 501. For T-Posts use steel that meets ASTM A 702. Metal line posts shall be not less than 6′-6" in length and shall weigh not less than (1.33 lbs./lin.ft.). These Items shall be in accordance with Item 552, "Wire Fence."
8. Barbed Wire shall be in accordance with ASTM A 121, Class 1 Design designation 12-2-4-1 4R or 12-2-5-1 4R, or as approved by the Engineer.

   Woven Wire Fence (Type D) shall be in accordance with ASTM A 116, Class 1 No. 12-1/2 Grade 60 (See Table 1 ASTM A 116) to the height and design shown on the plans, or as approved by the Engineer.
9. The location of gates and corner posts will be as indicated elsewhere in these plans.

Texas Department of Transportation

Design Division Standard

BARBED WIRE AND WOVEN WIRE FENCE (STEEL POSTS)

WF(2)-10

FILE: wf210.dgn	DN: TxDOT	CK: AM	DW: VP	CK:
© TxDOT 1996	CONT	SECT	JOB	HIGHWAY
REVISIONS	0923	17	086	CR 4981
	DIST	COUNTY		SHEET NO.
	BWD	COMANCHE		32

DATE: 7/30/2020
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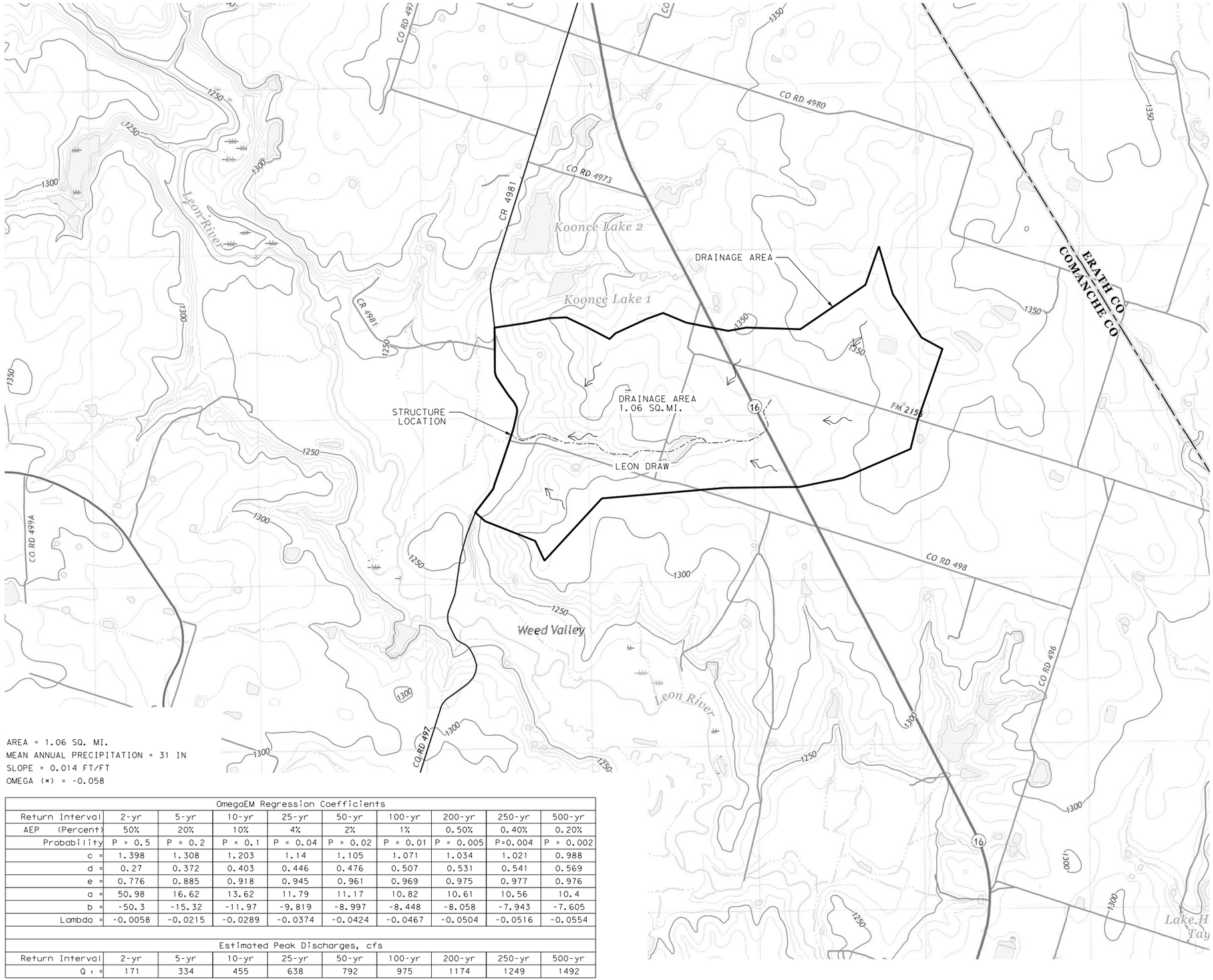


N

0 1000 2000

SCALE: 1" = 2000'

AREA = 1.06 SQ. MI.
MEAN ANNUAL PRECIPITATION = 31 IN
SLOPE = 0.014 FT/FT
OMEGA (*) = -0.058

OmegaEM Regression Coefficients									
Return Interval	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr	250-yr	500-yr
AEP (Percent)	50%	20%	10%	4%	2%	1%	0.50%	0.40%	0.20%
Probability	P = 0.5	P = 0.2	P = 0.1	P = 0.04	P = 0.02	P = 0.01	P = 0.005	P=0.004	P = 0.002
c =	1.398	1.308	1.203	1.14	1.105	1.071	1.034	1.021	0.988
d =	0.27	0.372	0.403	0.446	0.476	0.507	0.531	0.541	0.569
e =	0.776	0.885	0.918	0.945	0.961	0.969	0.975	0.977	0.976
a =	50.98	16.62	13.62	11.79	11.17	10.82	10.61	10.56	10.4
b =	-50.3	-15.32	-11.97	-9.819	-8.997	-8.448	-8.058	-7.943	-7.605
Lambda =	-0.0058	-0.0215	-0.0289	-0.0374	-0.0424	-0.0467	-0.0504	-0.0516	-0.0554
Estimated Peak Discharges, cfs									
Return Interval	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr	250-yr	500-yr
Q T =	171	334	455	638	792	975	1174	1249	1492

NO.	REVISION	BY	DATE

STATE OF TEXAS
ELIZABETH M. GASTON
114280
LICENSED
PROFESSIONAL ENGINEER

E. Gaston 7/31/2020

FIRM REGISTRATION NO. F-230

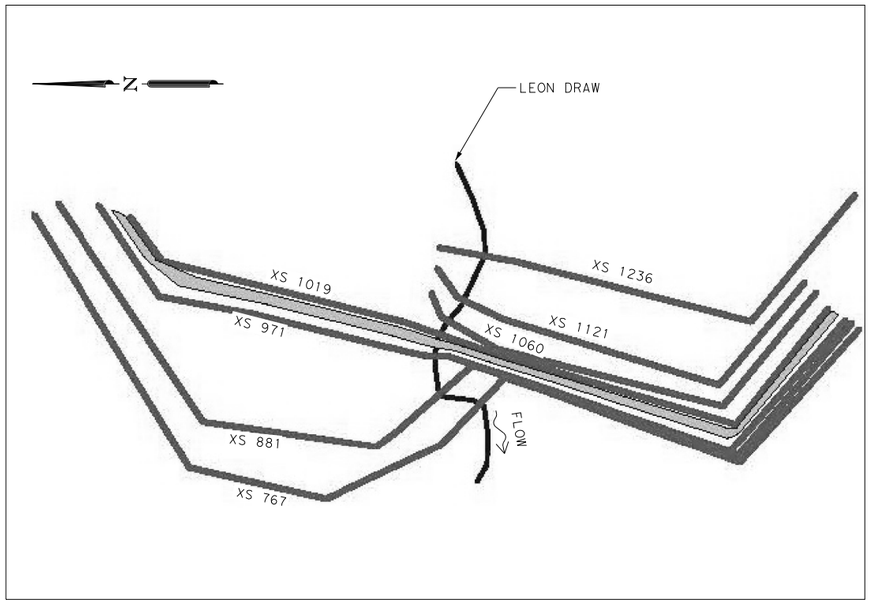
tnp

TEXAS TRANSPORTATION SOLUTIONS, INC.
Firm #F-19297

DRAINAGE AREA MAP
CR 4981
AT LEON DRAW

SHEET 1 OF 1

FED. RD DIV. No.	CONTROL No.	SECTION No.	JOB No.	HIGHWAY No.
6	0923	17	086	CR 4981
STATE	DISTRICT	COUNTY		SHEET No.
TEXAS	BWD	COMANCHE		33



CROSS SECTION LAYOUT
N.T.S.

HEC-RAS RIVER: LEON DRAW REACH: LEON DRAW

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
LEON DRAW	1236	2-yr	EXIST V1.1	171	1245.93	1248.01	1248.01	1248.57	0.014574	6.07	31.38	35.37	0.93
LEON DRAW	1236	2-yr	PROP V5	171	1245.93	1248.01	1248.01	1248.57	0.014574	6.07	31.38	35.37	0.93
LEON DRAW	1236	100-yr	EXIST V1.1	975	1245.93	1249.88	1249.88	1250.14	0.006243	5.77	377.28	691.42	0.66
LEON DRAW	1236	100-yr	PROP V5	975	1245.93	1249.88	1249.88	1250.14	0.006243	5.77	377.28	691.42	0.66
LEON DRAW	1121	2-yr	EXIST V1.1	171	1244.84	1247.42	1246.69	1247.64	0.003963	3.98	55.08	73.04	0.49
LEON DRAW	1121	2-yr	PROP V5	171	1244.84	1247.42	1246.69	1247.64	0.003963	3.98	55.08	73.04	0.49
LEON DRAW	1121	100-yr	EXIST V1.1	975	1244.84	1248.48	1248.48	1248.74	0.00794	5.97	327.13	444.02	0.71
LEON DRAW	1121	100-yr	PROP V5	975	1244.84	1248.48	1248.48	1248.74	0.00794	5.97	327.13	444.02	0.71
LEON DRAW	1060	2-yr	EXIST V1.1	171	1244.79	1246.66	1246.66	1247.19	0.014854	5.92	31.31	39.59	0.93
LEON DRAW	1060	2-yr	PROP V5	171	1244.79	1246.66	1246.66	1247.19	0.014854	5.92	31.31	39.59	0.93
LEON DRAW	1060	100-yr	EXIST V1.1	975	1244.79	1247.80	1247.80	1248.11	0.012766	6.17	275.26	394.10	0.89
LEON DRAW	1060	100-yr	PROP V5	975	1244.79	1247.80	1247.80	1248.11	0.012766	6.17	275.26	394.10	0.89
LEON DRAW	1022	2-yr	EXIST V1.1	171	1244.97	1245.98	1244.25	1245.98	0.00002	0.15	946.67	881.48	0.03
LEON DRAW	1022	2-yr	PROP V5	171	1244.97	1245.98	1244.25	1245.98	0.00002	0.15	946.67	881.48	0.03
LEON DRAW	1022	100-yr	EXIST V1.1	975	1244.97	1246.95	1244.85	1246.96	0.000087	0.47	1989.69	1282.94	0.07
LEON DRAW	1022	100-yr	PROP V5	975	1244.97	1246.95	1244.85	1246.96	0.000087	0.47	1989.85	1282.98	0.07
LEON DRAW	1000			Mult Open									
LEON DRAW	971	2-yr	EXIST V1.1	171	1244.86	1245.98		1245.98	0.000007	0.09	1475.64	1176.79	0.02
LEON DRAW	971	2-yr	PROP V5	171	1244.86	1245.98		1245.98	0.000007	0.09	1475.64	1176.79	0.02
LEON DRAW	971	100-yr	EXIST V1.1	975	1244.86	1246.95		1246.95	0.000037	0.30	2753.26	1494.19	0.05
LEON DRAW	971	100-yr	PROP V5	975	1244.86	1246.95		1246.95	0.000037	0.30	2753.26	1494.19	0.05
LEON DRAW	881	2-yr	EXIST V1.1	171	1244.44	1245.97		1245.98	0.000734	1.05	273.08	556.32	0.20
LEON DRAW	881	2-yr	PROP V5	171	1244.44	1245.97		1245.98	0.000734	1.05	273.08	556.32	0.20
LEON DRAW	881	100-yr	EXIST V1.1	975	1244.44	1246.92		1246.94	0.00068	1.30	1028.12	1028.94	0.20
LEON DRAW	881	100-yr	PROP V5	975	1244.44	1246.92		1246.94	0.00068	1.30	1028.12	1028.94	0.20
LEON DRAW	767	2-yr	EXIST V1.1	171	1243.59	1245.89	1245.47	1245.90	0.000788	1.41	241.92	507.42	0.22
LEON DRAW	767	2-yr	PROP V5	171	1243.59	1245.89	1245.47	1245.90	0.000788	1.41	241.92	507.42	0.22
LEON DRAW	767	100-yr	EXIST V1.1	975	1243.59	1246.84	1246.03	1246.86	0.000787	1.92	1004.28	1093.50	0.23
LEON DRAW	767	100-yr	PROP V5	975	1243.59	1246.84	1246.03	1246.86	0.000787	1.92	1004.28	1093.50	0.23

RIVER: LEON DRAW PROFILE: 2-YR OPEN #2: CULVERT #1
REACH: LEON DRAW RS: 1000 PLAN: PROP. V5

PLAN: PROP.V5	LEWIS CREEK	LEWIS CREEK	RS: 1000	CULV GROUP:	CULVERT #1
Q CULV GROUP (CFS)	0.95	CULV FULL LEN (FT)			
# BARRELS	4	CULV VEL US (FT/S)	0.05		
Q BARREL (CFS)	0.24	CULV VEL DS (FT/S)	0.05		
E.G. US. (FT)	1245.98	CULV INV EL UP (FT)	1245.11		
W.S. US. (FT)	1245.98	CULV INV EL DN (FT)	1245.07		
E.G. DS (FT)	1245.98	CULV FRCTN LS (FT)	0		
W.S. DS (FT)	1245.98	CULV EXIT LOSS (FT)	0		
DELTA EG (FT)	0	CULV ENTR LOSS (FT)	0		
DELTA WS (FT)	0	Q WEIR (CFS)			
E.G. IC (FT)	1245.17	WEIR STA LFT (FT)			
E.G. OC (FT)	1245.98	WEIR STA RGT (FT)			
CULVERT CONTROL	Outlet	WEIR SUBMERG			
CULV WS INLET (FT)	1245.98	WEIR MAX DEPTH (FT)			
CULV WS OUTLET (FT)	1245.98	WEIR AVG DEPTH (FT)			
CULV NML DEPTH (FT)	0.06	WEIR FLOW AREA (SQ FT)			
CULV CRT DEPTH (FT)	0.04	MIN EL WEIR FLOW (FT)	1248.58		

RIVER: LEON DRAW PROFILE: 100-YR OPEN #2: CULVERT #1
REACH: LEON DRAW RS: 1000 PLAN: PROP. V5

PLAN: PROP.V5	LEWIS CREEK	LEWIS CREEK	RS: 1000	CULV GROUP:	CULVERT #1
Q CULV GROUP (CFS)	4.99	CULV FULL LEN (FT)			
# BARRELS	4	CULV VEL US (FT/S)	0.14		
Q BARREL (CFS)	1.25	CULV VEL DS (FT/S)	0.13		
E.G. US. (FT)	1246.95	CULV INV EL UP (FT)	1245.11		
W.S. US. (FT)	1246.95	CULV INV EL DN (FT)	1245.07		
E.G. DS (FT)	1246.95	CULV FRCTN LS (FT)	0		
W.S. DS (FT)	1246.95	CULV EXIT LOSS (FT)	0		
DELTA EG (FT)	0	CULV ENTR LOSS (FT)	0		
DELTA WS (FT)	0	Q WEIR (CFS)			
E.G. IC (FT)	1245.3	WEIR STA LFT (FT)			
E.G. OC (FT)	1246.95	WEIR STA RGT (FT)			
CULVERT CONTROL	Outlet	WEIR SUBMERG			
CULV WS INLET (FT)	1246.95	WEIR MAX DEPTH (FT)			
CULV WS OUTLET (FT)	1246.95	WEIR AVG DEPTH (FT)			
CULV NML DEPTH (FT)	0.17	WEIR FLOW AREA (SQ FT)			
CULV CRT DEPTH (FT)	0.12	MIN EL WEIR FLOW (FT)	1248.58		

NOTES:

1. WATER SURFACE ELEVATION COMPUTED USING HEC-RAS VERSION 5.0.7.
2. THE TAILWATER WAS DETERMINED USING NORMAL DEPTH COMPUTATION WITH A SLOPE OF 0.000787 FT/FT.
3. THIS CROSSING IS LOCATED IN AN UNMAPPED FEMA AREA.
4. FLOODPLAIN ADMINISTRATOR COORDINATION ON JULY 10, 2020.
5. NO INSURABLE STRUCTURES ARE WITHIN THE VICINITY OF THE PROJECT.
6. PROPOSED BRIDGE 2 YEAR DISCHARGE: 171 CFS
   INSIDE TOP OF CULVERT = 1247.11
   FREEBOARD = 1.13 FT
   PERCENT OF FLOW OVERTOPPING ROAD = 99.4%
7. PROPOSED BRIDGE 100 YEAR DISCHARGE: 975 CFS
   INSIDE TOP OF CULVERT = 1247.11
   FREEBOARD = 0.16 FT
   PERCENT OF FLOW OVERTOPPING ROAD = 99.5%

NO.	REVISION	BY	DATE

STATE OF TEXAS
ELIZABETH M. GASTON
114280
LICENSED
PROFESSIONAL ENGINEER
7/31/2020

FIRM REGISTRATION NO. F-230

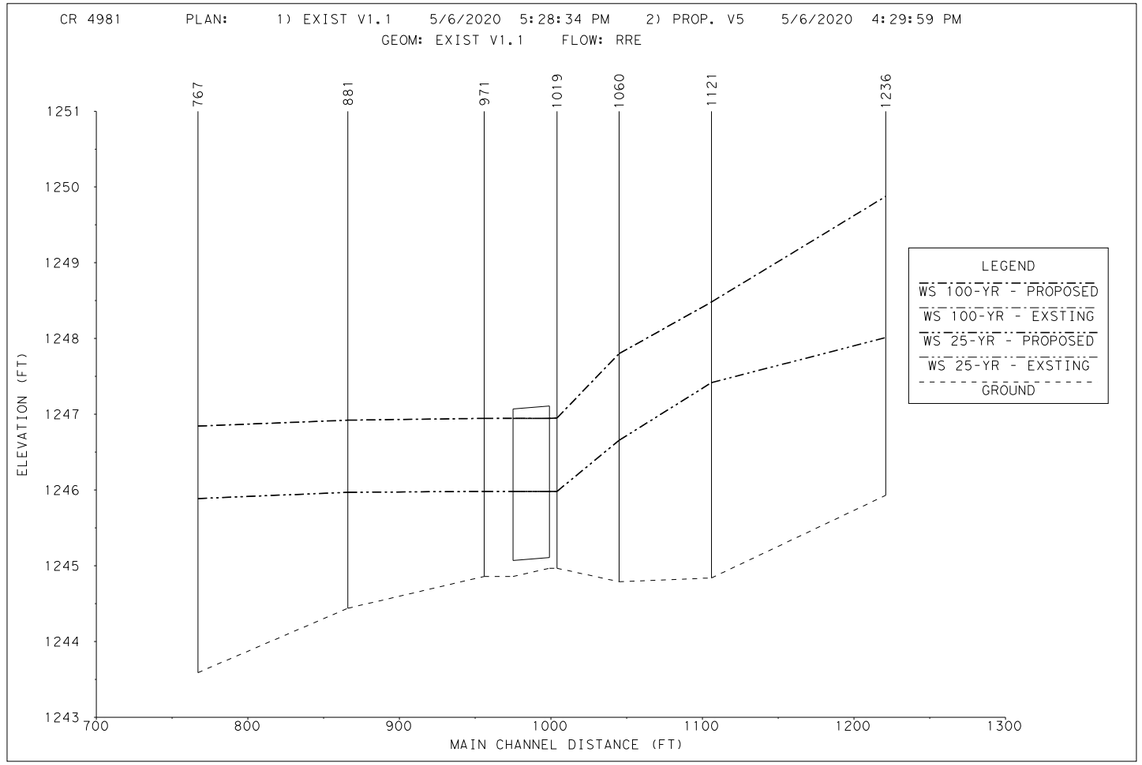
tnp

TEXAS TRANSPORTATION SOLUTIONS, INC.
Firm #F-19297

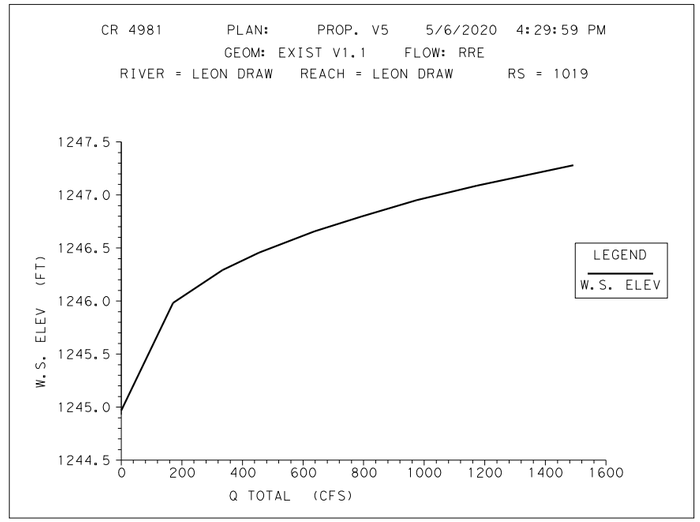
HYDRAULIC DATA
CR 4981
AT LEON DRAW

SHEET 1 OF 2

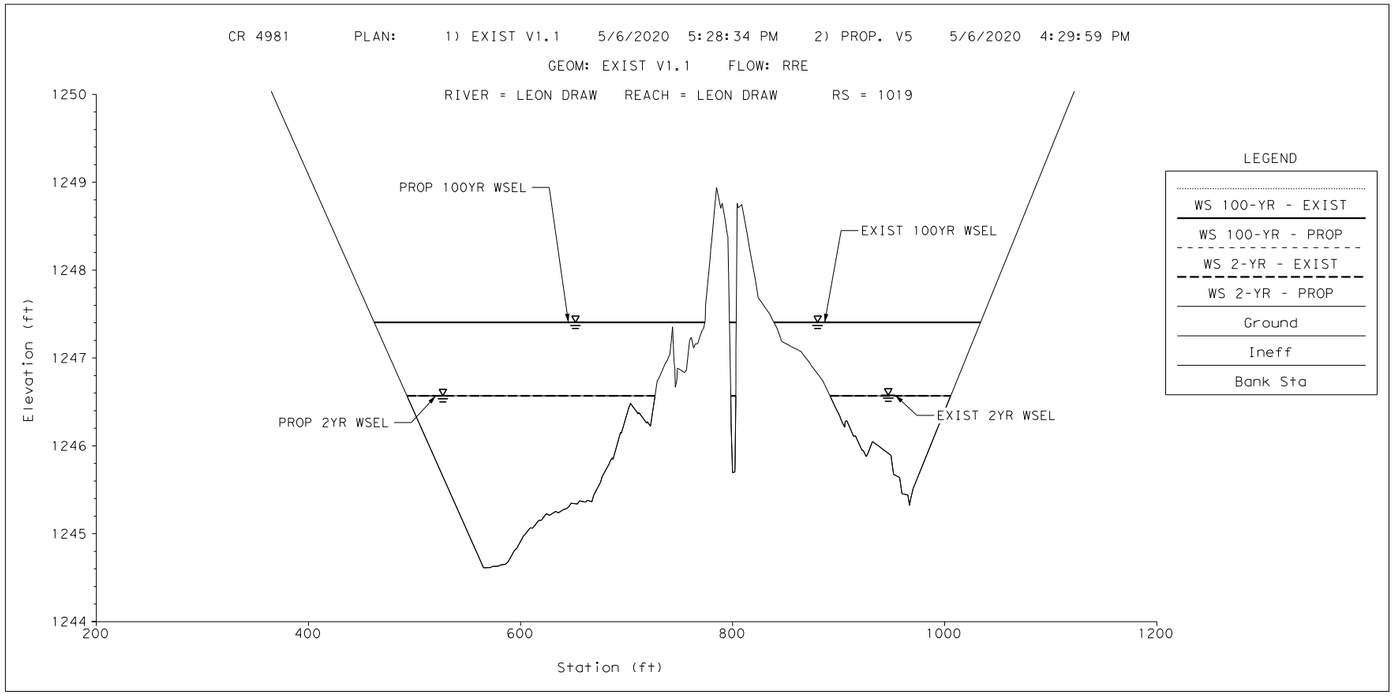
FED. RD DIV. No.	CONTROL No.	SECTION No.	JOB No.	HIGHWAY No.
6	0923	17	086	CR 4981
STATE	DISTRICT	COUNTY		SHEET No.
TEXAS	BWD	COMANCHE		34



HEC-RAS PROFILE OUTPUT



HEC-RAS RATING CURVE



HEC-RAS CROSS SECTION OUTPUT

NOTES:

1. WATER SURFACE ELEVATION COMPUTED USING HEC-RAS VERSION 5.0.7.
2. THE TAILWATER WAS DETERMINED USING NORMAL DEPTH COMPUTATION WITH A SLOPE OF 0.000787 FT/FT.
3. THIS CROSSING IS LOCATED IN AN UNMAPPED FEMA AREA.
4. FLOODPLAIN ADMINISTRATOR COORDINATION ON JULY 10, 2020.
5. NO INSURABLE STRUCTURES ARE WITHIN THE VICINITY OF THE PROJECT.
6. PROPOSED BRIDGE 2 YEAR DISCHARGE: 171 CFS
   INSIDE TOP OF CULVERT = 1247.11
   FREEBOARD = 1.13 FT
   PERCENT OF FLOW OVERTOPPING ROAD = 99.4%
7. PROPOSED BRIDGE 100 YEAR DISCHARGE: 975 CFS
   INSIDE TOP OF CULVERT = 1247.11
   FREEBOARD = 0.16 FT
   PERCENT OF FLOW OVERTOPPING ROAD = 99.5%

NO.	REVISION	BY	DATE

STATE OF TEXAS
ELIZABETH M. GASTON
114280
LICENSED
PROFESSIONAL ENGINEER
E. Gaston
7/31/2020

FIRM REGISTRATION NO. F-230

tnp

TEXAS TRANSPORTATION SOLUTIONS, INC.
Firm #F-19297

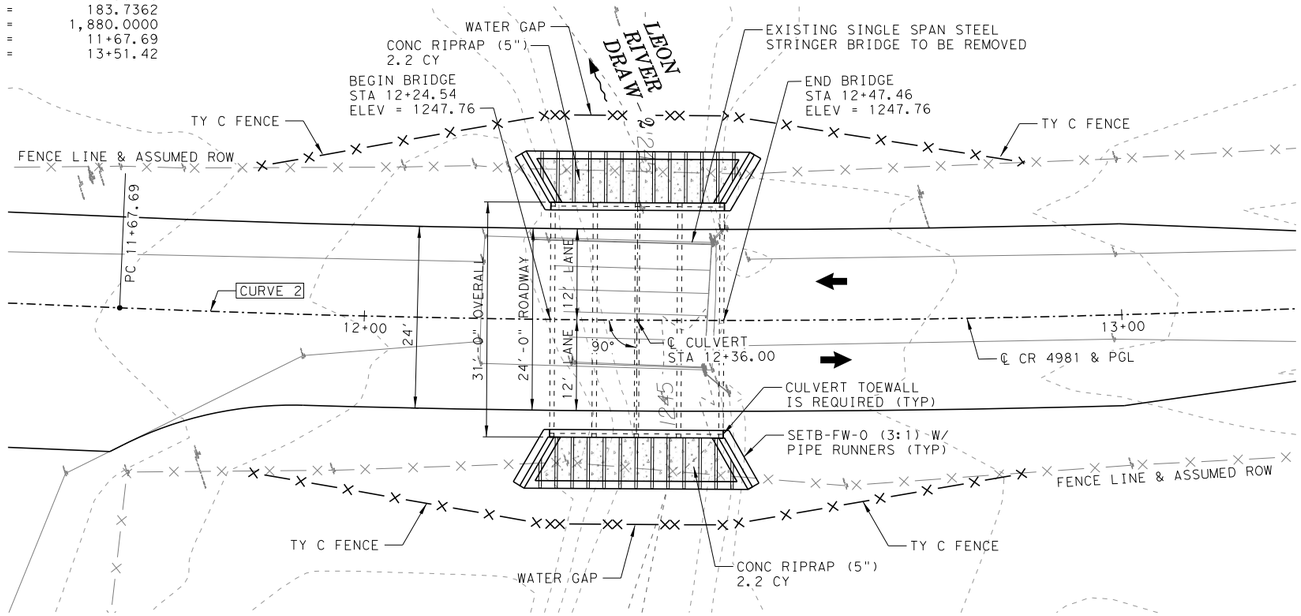
HYDRAULIC DATA
CR 4981
AT LEON DRAW

SHEET 2 OF 2

FED. RD DIV. No.	CONTROL No.	SECTION No.	JOB No.	HIGHWAY No.
6	0923	17	086	CR 4981
STATE	DISTRICT	COUNTY		SHEET No.
TEXAS	BWD	COMANCHE		35

CURVE 2

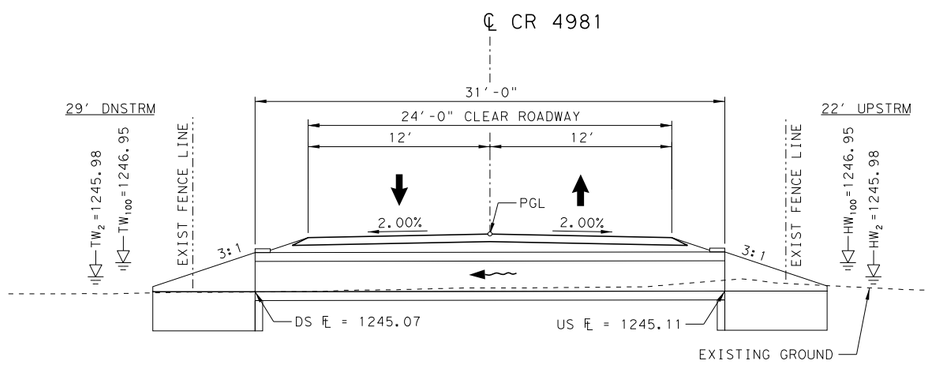
PI STA = 12+59.63
DELTA = 5° 35′ 58.6760" (LT)
DEGREE = 3° 02′ 51.5322"
TANGENT = 91.9413
LENGTH = 183.7362
RADIUS = 1,880.0000
PC STA = 11+67.69
PT STA = 13+51.42



PLAN

0 10 20
SCALE: 1" = 20′

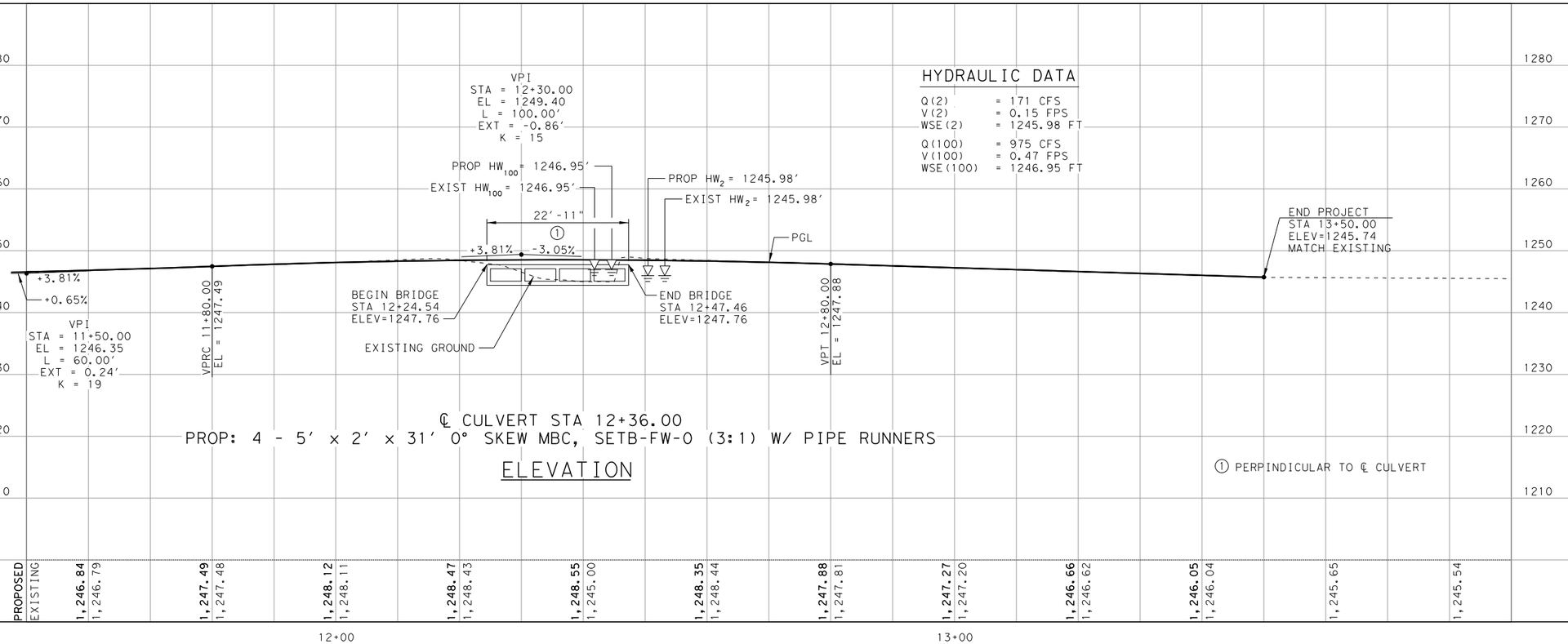
ITEM	DESCRIPTION	UNIT	QUANTITY
420 6051	CL C CONC (CULV)	CY	42
432 6002	RIPRAP (CONC)(5 IN)	CY	5
467 6171	SET (TY I)(S= 5 FT)(HW= 3 FT)(3:1) (C)	EA	8



TYPICAL SECTION

EXISTING BRIDGE:
SINGLE STEEL STRINGER SPAN
ON FLARED WING ABUTMENTS

DESIGN SPEED: MOE
AADT(2017): 50
AADT(2033): 70
FUNCTION CLASS: RURAL LOCAL
EXISTING NBI: 23-047-0-AA02-84-004
PROPOSED NBI: 23-047-0-AA02-84-007



℄ CULVERT STA 12+36.00
PROP: 4 - 5′ x 2′ x 31′ 0° SKEW MBC, SETB-FW-0 (3:1) W/ PIPE RUNNERS

ELEVATION

HYDRAULIC DATA

Q(2) = 171 CFS
V(2) = 0.15 FPS
WSE(2) = 1245.98 FT

Q(100) = 975 CFS
V(100) = 0.47 FPS
WSE(100) = 1246.95 FT

① PERPINDICULAR TO ℄ CULVERT

NO.	REVISION	BY	DATE

STATE OF TEXAS
JAMES BROOKS
101002
LICENSED PROFESSIONAL ENGINEER
7/30/2020

TEXAS TRANSPORTATION SOLUTIONS, INC.
Firm #F-19207

CULVERT LAYOUT CR 4981 AT LEON RIVER DRAW-2

SHEET 1 OF 1

FED. RD DIV. No.	CONTROL No.	SECTION No.	JOB No.	HIGHWAY No.
6	0923	17	086	CR 4981
STATE	DISTRICT	COUNTY		SHEET No.
TEXAS	BWD	COMANCHE		36

pw://tts-pw.bentley.com:tts-pw-01/Documents/0223.002/Cadd/Plan Sheets/Roadway/CR4981_CULV_LAYOUT_01.dgn
Joel Zimmerman 6:48
SCRIPT: CR4981_Index.pen
7/30/2020

Culvert Station and/or Creek Name followed by applicable end (Lt, Rt or Both)	Description of Box Culvert No. Spans ~ Span X Height	Max Fill Height (Ft)	Applicable Box Culvert Standard (4)	Applicable Wingwall or End Treatment Standard	Skew Angle (0°,15°, 30° or 45°)	Side Slope or Channel Slope Ratio (SL:1)	T Culvert Top Slab Thickness (In)	U Culvert Wall Thickness (In)	C Estimated Curb Height (Ft)	Hw (1) Height of Wingwall (Ft)	A Curb to End of Wingwall (Ft)	B Offset of End of Wingwall (Ft)	Lw Length of Longest Wingwall (Ft)	Ltw Culvert Toewall Length (Ft)	Atw Anchor Toewall Length (Ft)	Riprap Apron (CY)	Class (2) "C" Conc (Curb) (CY)	Class (3) "C" Conc (Wingwall) (CY)	Total Wingwall Area (SF)
CR 4981 AT LEON RIVER DRAW-2 (Both)	4 ~ 5' X 2'	1'	MC-5-20	SETB-FW-0	0	3:1	8"	7"	0.250	2.667	7.000	4.041	8.083	22.917	29.833	4.4	0.4	10.0	N/A

NOTES:
Skew = 0° on SW-0, FW-0, SETB-CD, SETB-SW-0, and SETB-FW-0 standard sheets;
30° maximum for safety end treatment

SL:1 = Horizontal : 1 Vertical
- Side slope at culvert for flared or straight wingwalls.
- Channel slope for parallel wingwalls.
- Slope must be 3:1 or flatter for safety end treatments.

T = Box culvert top slab thickness. Dimension can be found on the applicable box culvert standard sheet.

U = Box culvert wall thickness. Dimension can be found on the applicable box culvert standard sheet.

C = Curb height

See applicable wing or end treatment standard sheets for calculations of Hw, A, B, Lw, Ltw, Atw, and Total Wingwall Area.

Hw = Height of wingwall

A = Distance from face of curb to end of wingwall (not applicable to parallel or straight wingwalls)

B = Offset of end of wingwall (not applicable to parallel or straight wingwalls)

Lw = Length of longest wingwall.

Ltw = Length of culvert toewall (not applicable when using riprap apron)

Atw = Length of anchor toewall (applicable to safety end treatment only)
Total Wingwall Area = Wingwall area in sq. ft. for two wingwalls (one structure end) if Lt or Rt. Area for four wingwalls (two structure ends) if Both.

(1) Round the wall heights shown to the nearest foot for bidding purposes.

(2) Concrete volume shown is for box culvert curb only. For curbs using the Box Culvert Rail Mounting Details (RAC) standard sheet quantities shown must be increased by a factor of 2.25. If Class S concrete is required for the top slab of the culvert, also provide Class S concrete for the curb. Curb concrete is considered part of the Box Culvert for payment.

(3) Concrete volume shown is total of wings, footings, culvert toewall (if any), anchor toewalls (if any) and wingwall toewalls. Riprap aprons, culverts, and curb quantities are not included.

(4) Regardless of the type of culvert shown on this sheet, the Contractor has the option of furnishing cast-in-place or precast culverts unless otherwise shown elsewhere on the plans. If the Contractor elects to provide culverts of a different type than those shown on this sheet, it is the Contractor's responsibility to make the necessary adjustments to the dimensions and quantities shown.

STATE OF TEXAS
JAMES BROOKS
101002
LICENSED PROFESSIONAL ENGINEER
10/6/2021

Texas Department of Transportation | Bridge Division Standard

BOX CULVERT SUPPLEMENT
WINGS AND END TREATMENTS

BCS

FILE: bcsstde1-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT 0923	SECT 17	JOB 086	HIGHWAY CR 4981
REVISIONS	DIST BWD	COUNTY COMANCHE		SHEET NO. 37

DATE: 10/6/2021 2:48
FILE: pw://tts-pw.bentley.com:tts-pw-01/Documents/0223.002 WA 3 - CR Brown

DATE: 7/30/2020 6:49
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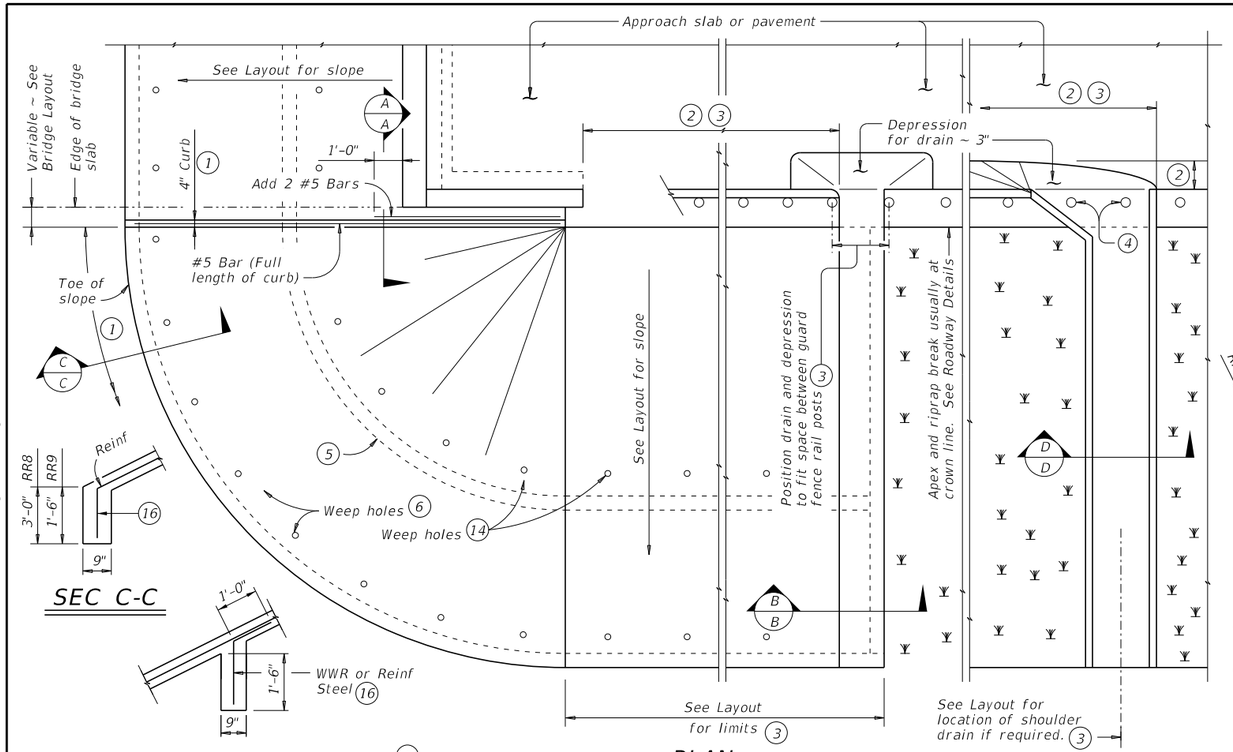
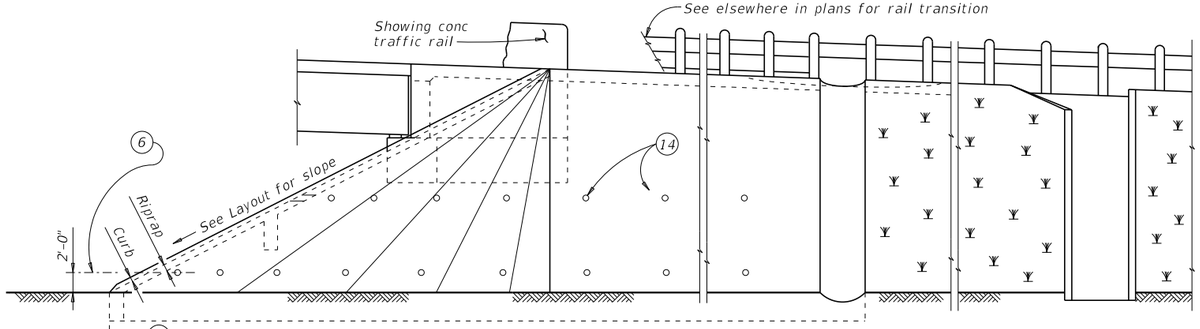


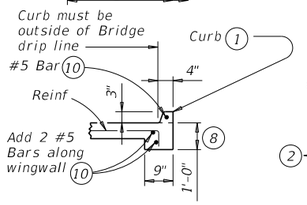
PLAN

SEC C-C

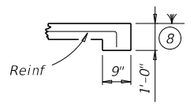
INTERMEDIATE TOEWALL (5)



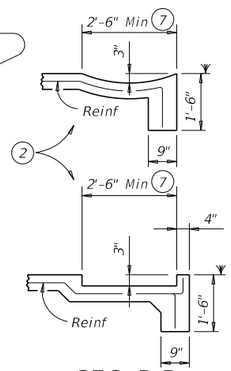
ELEVATION



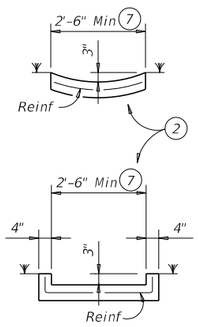
SEC A-A



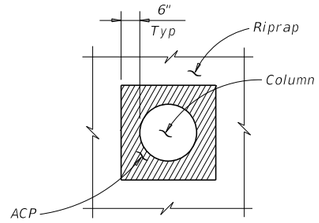
SEC B-B
(No drain)



SEC B-B
(Shoulder drain integral with riprap)

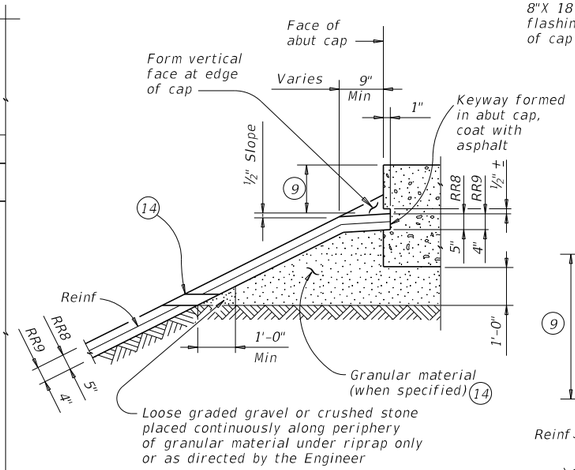


SEC D-D
(Shoulder drain)

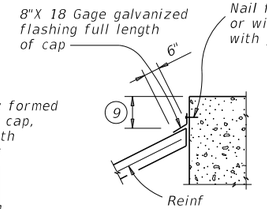


Riprap blockout to be filled with ACP. (Subsidiary to riprap)

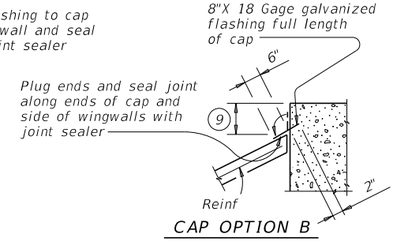
RIPRAP DETAIL AT COLUMNS
(As directed by the Engineer)



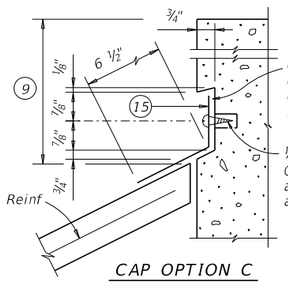
SHOWING KEYWAY OPTION



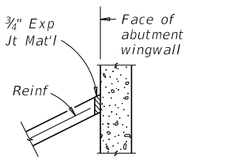
CAP OPTION A



CAP OPTION B

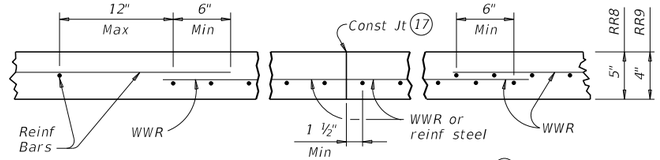


CAP OPTION C



SECT THRU RIPRAP AT WINGWALL (12)

SECTIONS THRU RIPRAP AT CAP (11)



REINFORCEMENT DETAILS (13)

See General Notes for optional synthetic fiber reinforcement.

1. When riprap is shown extended around header on layout, extend slab and toewall as shown and eliminate 4" curb.
2. Limits and configuration of drains and depressions are as shown elsewhere in plans or as directed by the Engineer.
3. Location of shoulder drain must consider limitations imposed by rail transition. Do not locate shoulder drains at expansion joints between approach slab and concrete pavement.
4. See details elsewhere in plans for installation of guard fence posts through concrete riprap.
5. Provide intermediate toewall only when designated elsewhere in the plans or included in the specifications.
6. Provide lower level of 2" Dia weep holes at 10' c-c backed by 1 CF packet of gravel and galvanized hardware cloth at all locations unless directed by the Engineer to eliminate.
7. Use wider or other drain configurations if shown elsewhere in plans or if directed by the Engineer.
8. Wall extension may be reduced or modified if approved by the Engineer. Increase wall extension to 1'-6" whenever the optional intermediate toewall is called for in the plans.
9. Top of cap to top of riprap dimension varies as directed by the Engineer. Should be 9" Min for beam/slab type bridges and 1'-6" for slab span, box beam, or slab beam bridges.
10. #5 bars shown are required even when synthetic fiber reinforcing option is selected.
11. Provide sealing option for joint between the face of cap and riprap as designated by the Engineer or as shown elsewhere on plans.
12. Flashing (shown in Cap Option A) may be used at wingwall in addition to Exp Jt Mat'l if shown on plans or directed by the Engineer.
13. Provide #3 reinforcing bars at 18" Spa c-c. Provide Welded Wire Reinforcement (WWR) as 6x6-D2.9xD2.9 or D3xD3. Combinations of WWR and reinforcing bars may be used if both are permitted. Use lap splices of a minimum 6 inches, measured from the transverse wire of WWR, and the ends of reinforcing bars.
14. If granular material is specified, provide upper level of 2" Dia weep holes at 10' c-c backed by galvanized hardware cloth.
15. 8" x 18 Gage Galv Sheet Metal
16. Provide WWR or #3 bars, with 1'-0" extension into slope.
17. WWR or reinforcing steel is continuous through riprap construction joints. Provide WWR or reinforcing steel that extends 1'-1" minimum into adjacent riprap on each side of construction joint even if synthetic reinforcing fiber is utilized.

FOR CONTRACTOR'S INFORMATION ONLY:
5" of RR8 = 0.015 CY/SF
4" of RR9 = 0.012 CY/SF
#3 Reinf at 18" c-c = 0.501 Lbs/SF
6x6-D3xD3 = 0.408 Lbs/SF

GENERAL NOTES:

Provide Class "B" concrete (f'c = 2,000 psi) unless noted elsewhere in plans.

Provide Grade 60 reinforcing steel.

Provide deformed welded wire reinforcement (WWR) meeting ASTM A1064, unless otherwise shown.

Provide reinforcing bars, deformed WWR, or any suitable combination of both types for riprap reinforcing, unless specified elsewhere in the plans.

Optionally synthetic fibers may be used if approved by the Engineer. Provide synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) in lieu of steel reinforcing in riprap concrete.

Install construction joints or grooved joints extending the full slant slope height at intervals of approximately 20 feet unless otherwise directed by the Engineer.

Hardware cloth, loose grade stone behind weep holes, flashing, or other sealing material are subsidiary to the bid item "Riprap".

See Layout for limits of riprap.

RR8 is to be used on stream crossings.

RR9 is to be used on other embankments.

Texas Department of Transportation

Bridge Division Standard

CONCRETE RIPRAP AND SHOULDER DRAINS
EMBANKMENTS AT BRIDGE ENDS (TYPES RR8 & RR9)

CRR

FILE: crrstde1-19.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0923	17	086	CR 4981
	DIST	COUNTY		SHEET NO.
	BWD	COMANCHE		38

DATE: 7/30/2020 6:49
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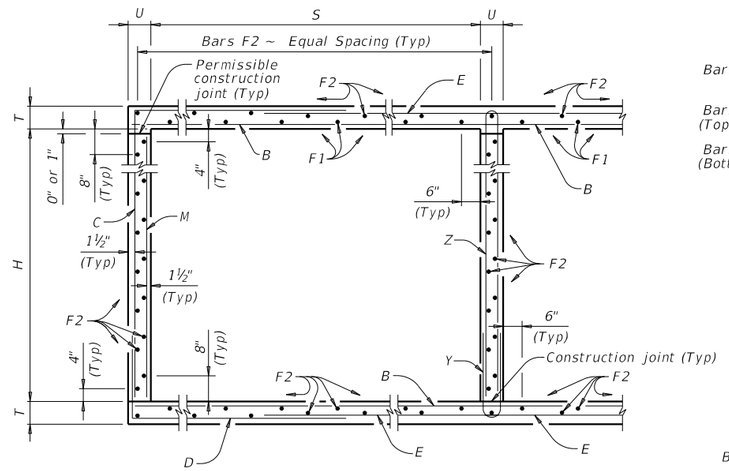
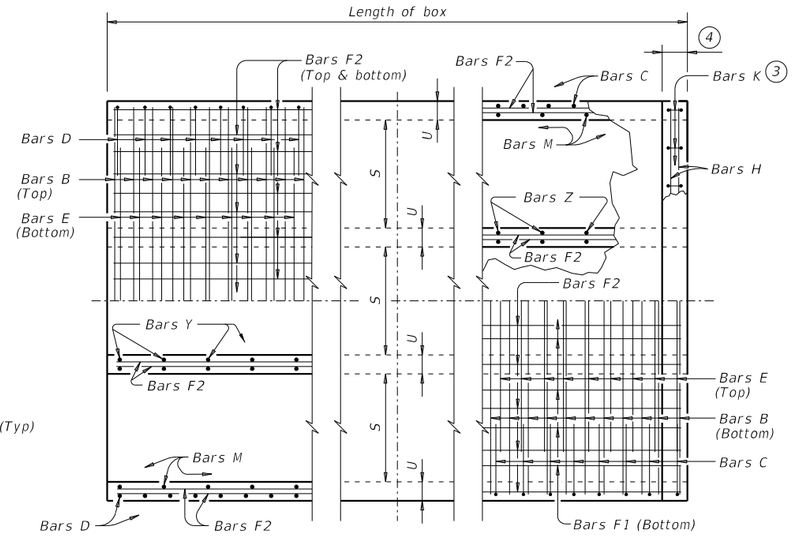


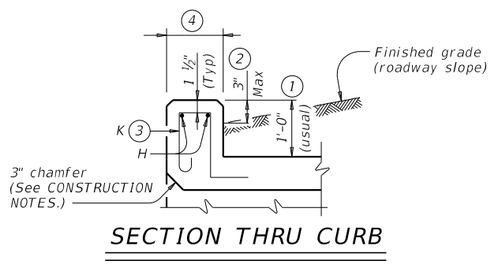
TYPICAL SECTION



BOTTOM SLAB

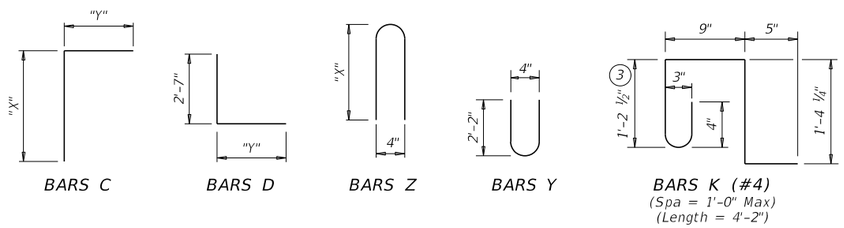
TOP SLAB

PART PLANS



SECTION THRU CURB

TABLE OF BAR DIMENSIONS		
H	"X"	"Y"
2'-0"	2'-6 ½"	3'-8 ½"
3'-0"	3'-6 ½"	3'-8 ½"
4'-0"	4'-6 ½"	3'-8 ½"
5'-0"	5'-6 ½"	3'-8 ½"



1. 0" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail or curbs taller than 1'-0", refer to the Extended Curb Details (ECD) standard sheet. For structures with T631 or T631LS bridge rail, refer to the Mounting Details for T631 & T631LS Rails (T631-CM) standard sheet. Refer to the Rail Anchorage Curb (RAC) standard sheet for structures with bridge rail other than T631 or T631LS.

2. For vehicle safety, the following requirements must be met:
   - For structures without bridge rail, construct curbs no more than 3" above finished grade.
   - For structures with bridge rail, construct curbs flush with finished grade.

   Reduce curb heights, 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'-3" when the Rail Anchorage Curb (RAC) standard sheet is referred to elsewhere in the plans.

The Contractor may replace Bars B, C, D, E, F1, F2, M, Y, and/or Z with deformed welded wire reinforcement (WWR) meeting the requirements of ASTM A1064. 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. The lap length required for WWR is never less than the lap length required for uncoated #4 bars.

Example conversion: Replacing No. 6 Gr 60 at 6" Spacing with WWR
Required WWR = (0.44 sq. in. per 0.5 ft.) x (60 ksi / 70 ksi) = 0.755 sq. in. per ft.
If D30.6 wire is used to meet the 0.755 sq. in. per ft. requirement in this example, the required spacing = (0.306 sq. in.) / (0.755 sq. in. per ft.) x (12 in. per ft.) = 4.86" Max spacing. Required lap length for the provided D30.6 wire is 2'-1" (the same minimum lap length required for uncoated #5 bars, as listed under MATERIAL NOTES).

CONSTRUCTION NOTES:

Do not use permanent forms.

Chamfer the bottom edge of the top slab 3" at the entrance.

Optionally, raise construction joints shown at the flow line by a maximum of 6". If this option is taken, Bars M may be cut off or raised, Bars C and D may be reversed, and Bars Y and Z may be reversed.

MATERIAL NOTES:

Provide Grade 60 reinforcing steel.

Provide galvanized reinforcing steel if required elsewhere in the plans.

Provide Class C concrete (f'c = 3,600 psi) for culvert barrel and curb, with the following exceptions: provide Class S concrete (f'c = 4,000 psi) for top slabs of:
- culverts with overlay,
- culverts with 1-to-2 course surface treatment, or
- culverts with the top slab as the final riding surface.

Provide bar laps, where required, as follows:
- Uncoated or galvanized ~ #4 = 1'-8" Min
- Uncoated or galvanized ~ #5 = 2'-1" Min
- Uncoated or galvanized ~ #6 = 2'-6" Min

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications for the range of fill heights shown.

See the Multiple Box Culverts Cast-In-Place Miscellaneous Detail (MC-MD) standard sheet for details pertaining to skewed ends, angle sections, and lengthening.

Cover dimensions are clear dimensions, unless noted otherwise.
Reinforcing bar dimensions shown are out-to-out of bar.

HL93 LOADING

SHEET 1 OF 2

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE
5'-0" SPAN
0' TO 20' FILL

MC-5-20

FILE: mc520ste-20.dgn	DN: TBE	CK: BMP	DN: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0923	17	086	CR 4981
	DIST	COUNTY		SHEET NO.
	BWD	COMANCHE		39

NUMBER OF SPANS	SECTION DIMENSIONS				BILLS OF REINFORCING STEEL (For Box Length = 40 feet)																														QUANTITIES					
					Bars B					Bars C & D							Bars E					Bars F1 ~ #4				Bars F2 ~ #4				Bars M ~ #4				Bars Y & Z ~ #4								Bars H 4 ~ #4		Bars K		Per Foot of Barrel		Curb		Total	
	S	H	T	U	No.	Size	Spa	Length	Wt	No.	Size	Spa	Bars C Length	Bars C Wt	Bars D Length	Bars D Wt	No.	Size	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Bars Y Length	Bars Y Wt	Bars Z Length	Bars Z Wt	Length	Wt	No.	Wt	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)
2	5'-0"	2'-0"	8"	7"	108	#5	9"	11'-6"	1,295	108	#5	9"	6'-3"	704	6'-4"	713	108	#5	9"	8'-8"	976	8	18"	39'-9"	212	38	18"	39'-9"	1,009	108	9"	2'-0"	144	54	9"	4'-7"	165	5'-3"	189	11'-6"	31	26	72	0.710	135.2	0.9	103	29.3	5,510
3	5'-0"	2'-0"	8"	7"	108	#5	9"	17'-1"	1,924	108	#5	9"	6'-3"	704	6'-4"	713	108	#5	9"	14'-3"	1,605	12	18"	39'-9"	319	54	18"	39'-9"	1,434	108	9"	2'-0"	144	108	9"	4'-7"	331	5'-3"	379	17'-1"	46	38	106	1.029	188.8	1.3	152	42.4	7,705
4	5'-0"	2'-0"	8"	7"	108	#5	9"	22'-8"	2,553	108	#5	9"	6'-3"	704	6'-4"	713	108	#5	9"	19'-10"	2,234	16	18"	39'-9"	425	70	18"	39'-9"	1,859	108	9"	2'-0"	144	162	9"	4'-7"	496	5'-3"	568	22'-8"	61	48	134	1.348	242.4	1.7	195	55.6	9,891
5	5'-0"	2'-0"	8"	7"	108	#5	9"	28'-3"	3,182	108	#5	9"	6'-3"	704	6'-4"	713	108	#5	9"	25'-5"	2,863	20	18"	39'-9"	531	86	18"	39'-9"	2,284	108	9"	2'-0"	144	216	9"	4'-7"	661	5'-3"	758	28'-3"	75	60	167	1.667	296.0	2.1	242	68.8	12,082
6	5'-0"	2'-0"	8"	7"	108	#5	9"	33'-10"	3,811	108	#5	9"	6'-3"	704	6'-4"	713	108	#5	9"	31'-0"	3,492	24	18"	39'-9"	637	102	18"	39'-9"	2,708	108	9"	2'-0"	144	270	9"	4'-7"	827	5'-3"	947	33'-10"	90	70	195	1.986	349.6	2.5	285	82.0	14,268
2	5'-0"	3'-0"	8"	7"	108	#6	9"	11'-6"	1,865	108	#5	9"	7'-3"	817	6'-4"	713	108	#5	9"	8'-8"	976	8	18"	39'-9"	212	44	18"	39'-9"	1,168	108	9"	3'-0"	216	54	9"	4'-7"	165	7'-3"	262	11'-6"	31	26	72	0.775	159.9	0.9	103	31.9	6,497
3	5'-0"	3'-0"	8"	7"	108	#6	9"	17'-1"	2,771	108	#5	9"	7'-3"	817	6'-4"	713	108	#5	9"	14'-3"	1,605	12	18"	39'-9"	319	62	18"	39'-9"	1,646	108	9"	3'-0"	216	108	9"	4'-7"	331	7'-3"	523	17'-1"	46	38	106	1.115	223.5	1.3	152	45.9	9,093
4	5'-0"	3'-0"	8"	7"	108	#6	9"	22'-8"	3,677	108	#5	9"	7'-3"	817	6'-4"	713	108	#5	9"	19'-10"	2,234	16	18"	39'-9"	425	80	18"	39'-9"	2,124	108	9"	3'-0"	216	162	9"	4'-7"	496	7'-3"	785	22'-8"	61	48	134	1.456	287.2	1.7	195	59.9	11,682
5	5'-0"	3'-0"	8"	7"	108	#6	9"	28'-3"	4,583	108	#5	9"	7'-3"	817	6'-4"	713	108	#5	9"	25'-5"	2,863	20	18"	39'-9"	531	98	18"	39'-9"	2,602	108	9"	3'-0"	216	216	9"	4'-7"	661	7'-3"	1,046	28'-3"	75	60	167	1.796	350.8	2.1	242	73.9	14,274
6	5'-0"	3'-0"	8"	7"	108	#6	9"	33'-10"	5,488	108	#5	9"	7'-3"	817	6'-4"	713	108	#5	9"	31'-0"	3,492	24	18"	39'-9"	637	116	18"	39'-9"	3,080	108	9"	3'-0"	216	270	9"	4'-7"	827	7'-3"	1,308	33'-10"	90	70	195	2.137	414.5	2.5	285	88.0	16,863
2	5'-0"	4'-0"	8"	7"	108	#6	9"	11'-6"	1,865	108	#5	9"	8'-3"	929	6'-4"	713	108	#5	9"	8'-8"	976	8	18"	39'-9"	212	44	18"	39'-9"	1,168	108	9"	4'-0"	289	54	9"	4'-7"	165	9'-3"	334	11'-6"	31	26	72	0.840	166.3	0.9	103	34.5	6,754
3	5'-0"	4'-0"	8"	7"	108	#6	9"	17'-1"	2,771	108	#5	9"	8'-3"	929	6'-4"	713	108	#5	9"	14'-3"	1,605	12	18"	39'-9"	319	62	18"	39'-9"	1,646	108	9"	4'-0"	289	108	9"	4'-7"	331	9'-3"	667	17'-1"	46	38	106	1.202	231.8	1.3	152	49.4	9,422
4	5'-0"	4'-0"	8"	7"	108	#6	9"	22'-8"	3,677	108	#5	9"	8'-3"	929	6'-4"	713	108	#5	9"	19'-10"	2,234	16	18"	39'-9"	425	80	18"	39'-9"	2,124	108	9"	4'-0"	289	162	9"	4'-7"	496	9'-3"	1,001	22'-8"	61	48	134	1.564	297.2	1.7	195	64.3	12,083
5	5'-0"	4'-0"	8"	7"	108	#6	9"	28'-3"	4,583	108	#5	9"	8'-3"	929	6'-4"	713	108	#5	9"	25'-5"	2,863	20	18"	39'-9"	531	98	18"	39'-9"	2,602	108	9"	4'-0"	289	216	9"	4'-7"	661	9'-3"	1,335	28'-3"	75	60	167	1.926	362.7	2.1	242	79.1	14,748
6	5'-0"	4'-0"	8"	7"	108	#6	9"	33'-10"	5,488	108	#5	9"	8'-3"	929	6'-4"	713	108	#5	9"	31'-0"	3,492	24	18"	39'-9"	637	116	18"	39'-9"	3,080	108	9"	4'-0"	289	270	9"	4'-7"	827	9'-3"	1,668	33'-10"	90	70	195	2.288	428.1	2.5	285	94.0	17,408
2	5'-0"	5'-0"	8"	7"	108	#6	9"	11'-6"	1,865	108	#5	9"	9'-3"	1,042	6'-4"	713	108	#5	9"	8'-8"	976	8	18"	39'-9"	212	50	18"	39'-9"	1,328	108	9"	5'-0"	361	54	9"	4'-7"	165	11'-3"	406	11'-6"	31	26	72	0.904	176.7	0.9	103	37.0	7,171
3	5'-0"	5'-0"	8"	7"	108	#6	9"	17'-1"	2,771	108	#5	9"	9'-3"	1,042	6'-4"	713	108	#5	9"	14'-3"	1,605	12	18"	39'-9"	319	70	18"	39'-9"	1,859	108	9"	5'-0"	361	108	9"	4'-7"	331	11'-3"	812	17'-1"	46	38	106	1.288	245.3	1.3	152	52.8	9,965
4	5'-0"	5'-0"	8"	7"	108	#6	9"	22'-8"	3,677	108	#5	9"	9'-3"	1,042	6'-4"	713	108	#5	9"	19'-10"	2,234	16	18"	39'-9"	425	90	18"	39'-9"	2,390	108	9"	5'-0"	361	162	9"	4'-7"	496	11'-3"	1,217	22'-8"	61	48	134	1.672	313.9	1.7	195	68.6	12,750
5	5'-0"	5'-0"	8"	7"	108	#6	9"	28'-3"	4,583	108	#5	9"	9'-3"	1,042	6'-4"	713	108	#5	9"	25'-5"	2,863	20	18"	39'-9"	531	110	18"	39'-9"	2,921	108	9"	5'-0"	361	216	9"	4'-7"	661	11'-3"	1,623	28'-3"	75	60	167	2.056	382.5	2.1	242	84.3	15,540
6	5'-0"	5'-0"	8"	7"	108	#6	9"	33'-10"	5,488	108	#5	9"	9'-3"	1,042	6'-4"	713	108	#5	9"	31'-0"	3,492	24	18"	39'-9"	637	130	18"	39'-9"	3,452	108	9"	5'-0"	361	270	9"	4'-7"	827	11'-3"	2,029	33'-10"	90	70	195	2.439	451.0	2.5	285	100.1	18,326

HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE

5'-0" SPAN

0' TO 20' FILL

MC-5-20

FILE: mc520ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0923	17	086	CR 4981
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	BWD	COMANCHE		40

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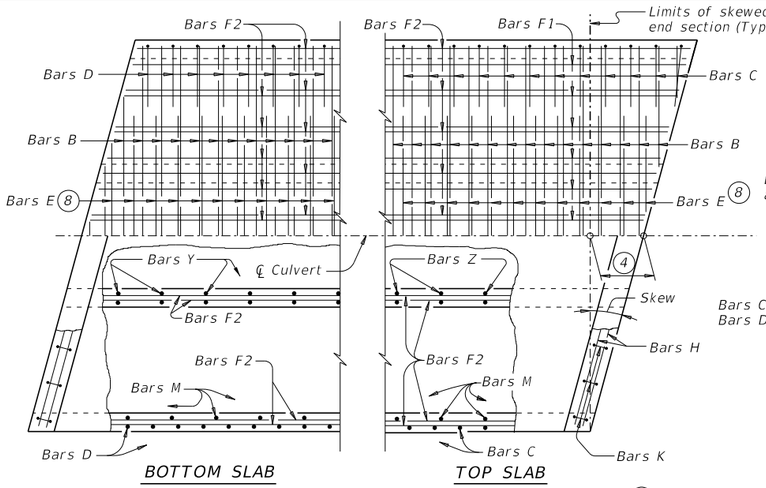
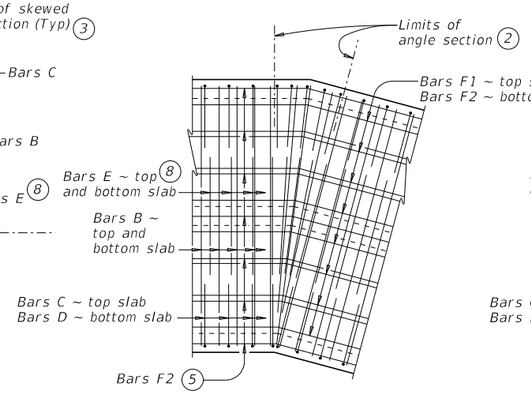
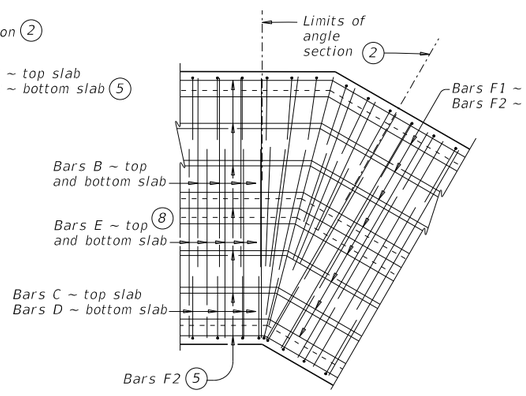


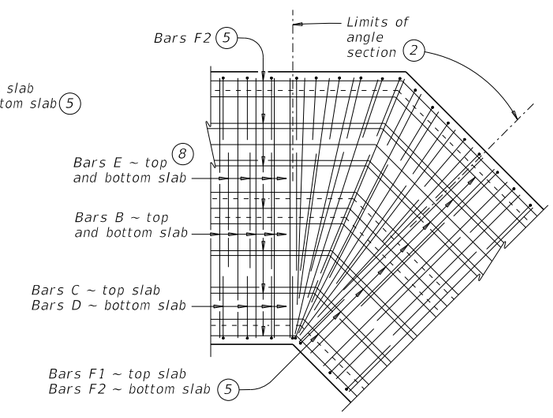
PLAN OF SKEWED ENDS ~ FROM 0° TO 15° 7



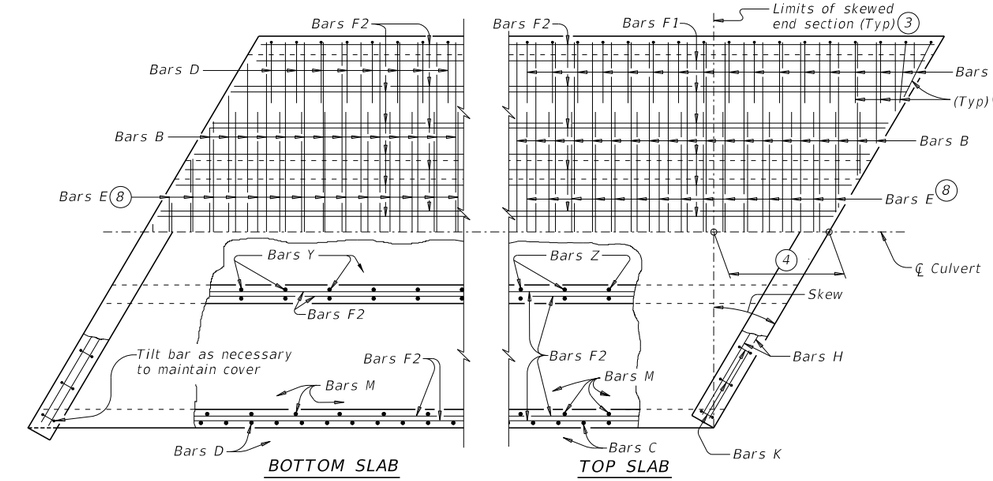
PLAN OF ANGLE SECTION ~ FROM 0° TO 15°



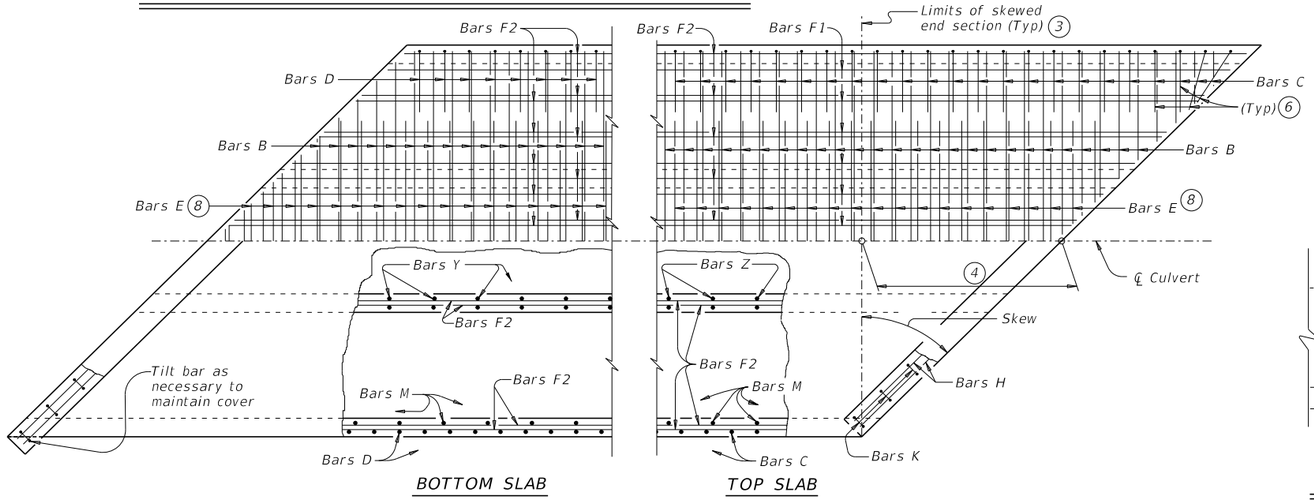
PLAN OF ANGLE SECTION ~ OVER 15° TO 30°



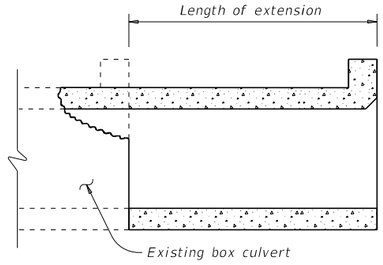
PLAN OF ANGLE SECTION ~ OVER 30° TO 45°



PLAN OF SKEWED ENDS ~ OVER 15° TO 30°



PLAN OF SKEWED ENDS ~ OVER 30° TO 45°



LENGTHENING DETAIL 1

1. For skewed box culverts with less than 2'-0" of fill, break back the top slab to provide a 1'-10" minimum lap of the existing longitudinal bars with the longitudinal bars in the extension.
   For non-skewed box culverts with less than 2'-0" of fill and for skewed or non-skewed culverts with a fill depth of 2'-0" or greater, break back the top slab to provide a 1'-10" minimum lap of the existing longitudinal bars with the longitudinal bars in the extension. Alternatively, if the box is non-skewed, embed #6 anchor bars with a Type III, Class C, D, E, or F anchor adhesive into the existing walls, top and bottom slab at 1'-6" center-to-center spacing. Minimum embedment depth is 8". Anchor adhesive chosen must be able to achieve a basic bond strength in tension, Nba, of 26.4 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use. Anchor installation, including hole size, drilling, and clean out, must be in accordance with Item 450, "Railing." Test adhesive anchors in accordance with Item 450.3.3, "Tests." Test 3 anchors per 100 anchors installed.
   Break back wings and apron as necessary to install the extension. Clean and extend the exposed wingwall and apron reinforcing into the extension. When lengthening existing box culverts with dimensions different than current standard dimensions, form horizontal and vertical transitions as directed by the Engineer. Match bottom slabs to maintain an uninterrupted flow line. Field bend existing and new reinforcing into transitions and maintain specified cover requirements. For top slabs of culverts with overlay, with 1-to-2 course surface treatment, or with the top slab as the final riding surface, adjust the "H" dimension to provide a smooth riding surface.
2. When the spacing between Bars B or Bars E becomes less than half of the normal spacing, cut bars to avoid conflict.
3. The length of Bars B and Bars E will vary in the skewed end sections.
4. [One half of overall width] x [tangent of the skew angle]
5. Place Bars F1 and F2 continuously through the angle section. Bend Bars F1 and F2 to remain parallel to the walls of the box culvert.
6. When necessary to avoid conflict in acute corners, shorten the slab extension leg of Bars C and Bars D to a minimum of 1'-6" for skews of 30° thru 45°.
7. At the Contractor's option, for skews of 15° or less, place Bars B, C, D, and E parallel to the skewed end while maintaining spacing along centerline of box. Increase lengths of Bars B and Bars E shown on the Multiple Box Culverts Cast-In-Place (MC) standard sheets to accommodate the skew.
8. Extend Bars E as shown on the MC standard sheet for direct traffic culverts.

CONSTRUCTION NOTES:

Do not use permanent forms.
When required, lap Bars H 1'-8" for uncoated or galvanized bars.
Provide a minimum of 1 ½" clear cover.

MATERIAL NOTES:

Provide Grade 60 reinforcing steel.
Provide galvanized reinforcing steel, if required elsewhere in the plans.
Provide Class C concrete (f'c = 3,600 psi) with these exceptions: provide Class S concrete (f'c = 4,000 psi) for top slabs of culverts with overlay, with 1-to-2 course surface treatment, or with the top slab as the final riding surface.

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.
Refer to Multiple Box Culverts Cast-in-Place (MC) standard sheets for details of straight sections of culvert.
For skewed sections and angle sections, refer to Multiple Box Culverts Cast-in-Place (MC) standard sheets 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 Multiple Box Culverts Cast-In-Place (MC) standard sheets by the cosine of the skew angle.

Cover dimensions are clear dimensions, unless noted otherwise.

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE MISCELLANEOUS DETAILS

MC-MD

FILE: mcmdste-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0923	17	086	CR 4981
	DIST	COUNTY		SHEET NO.
	BWD	COMANCHE		41

DATE: 7/30/2020 6:49
FILE: pw://tts-pw.bentley.com:tts-pw-01/Documents/0223.002/Cadd/Standards/SFT/SETB-FW-0.dgn

TABLE OF DIMENSIONS AND REINFORCING STEEL
(Wings for One Structure End)

Dimensions					Variable Reinforcing				Estimated Quantities per ft of wing length (Two~Wings) (3)	
					Bars J1		Bars J2			
Maximum Wingwall Height Hw (9)	W	X	Y	Z	Size	Spa	Size	Spa	Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	33.73	0.248
3'-0"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	37.07	0.261
3'-6"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	37.74	0.273
4'-0"	2'- 5"	1'- 0"	9"	7"	#4	1'-0"	#4	1'-0"	38.41	0.285
4'-6"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	41.75	0.330
5'-0"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	45.09	0.343
5'-6"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	45.75	0.355
6'-0"	3'- 2"	1'- 6"	1'- 0"	7"	#4	1'-0"	#4	1'-0"	46.42	0.367
7'-0"	3'- 8"	1'- 9"	1'- 3"	7"	#4	1'-0"	#4	1'-0"	52.77	0.414
8'-0"	4'- 2"	2'- 0"	1'- 6"	8"	#5	1'-0"	#4	1'-0"	60.19	0.486
9'-0"	4'- 8"	2'- 3"	1'- 9"	8"	#4	6"	#4	6"	81.49	0.535
10'-0"	5'- 2"	2'- 6"	2'- 0"	8"	#5	6"	#4	6"	97.25	0.584
11'-0"	5'- 8"	2'- 9"	2'- 3"	8"	#6	6"	#5	6"	133.65	0.634
12'-0"	6'- 2"	3'- 0"	2'- 6"	9"	#7	6"	#5	6"	162.29	0.721

TABLE OF WING WALL REINFORCING (Two~Wings)

Bar	Size	No.	Spa
D	#5	~	1'-0"
E	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	4	~
M	#4	4	~
P	#4	~	1'-0"
R	#5	6	~
V	#4	~	1'-0"

TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES

Bar	Size	No.	Spa
L	#4	~	1'-6"
Q	#4	1	~
Reinf (Lb/Ft)			2.45
Conc (CY/Ft)			0.037

TABLE OF ESTIMATED ANCHOR TOEWALL QUANTITIES

Bar	Size	No.	Spa
K	#4	~	1'-0"
N	#5	6	~
OL	#4	6	~
Reinf (Lb/Ft)			9.82
Conc (CY/Ft)			0.074

(1) Extend Bars P 3'-0" Min into bottom slab of box culvert.

(2) Adjust to fit as necessary to maintain 1 1#2" clear cover and 4" Min between bars.

(3) Quantities shown are based on an average wing height for two wings (one structure end). To determine total quantities for two wings multiply the tabulated values by Lw.

(4) Recommended values of slope are: 3:1, 4:1, and 6:1. Provide 3:1 or flatter slope.

(5) When shown elsewhere on the plans, construct 5" deep concrete riprap. Payment for riprap is as required by Item 432, "Riprap". Unless otherwise shown on the plans or directed by the Engineer, extend construction joints or grooved joints, oriented in the direction of flow, across the full distance of the riprap, at intervals of approximately 20'. When such riprap is provided, the culvert toewall shown in SECTION B-B is not required.

(6) At Contractor's option, end the culvert toewall flush with wingwall toewall. Adjust reinforcing as needed.

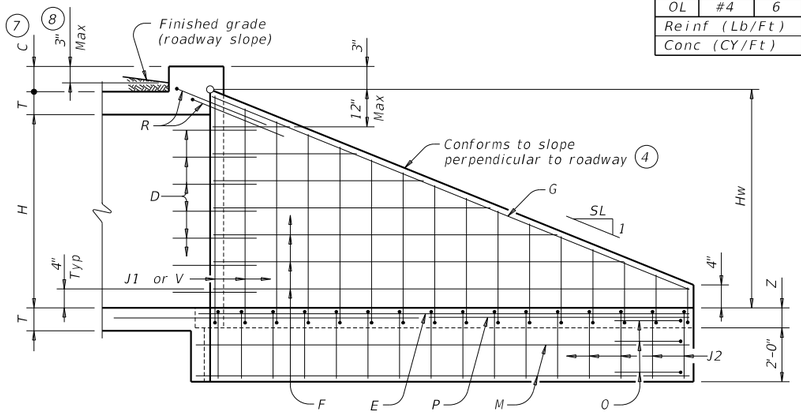
(7) 3" Min to 5'-0" Max. Estimated curb heights are shown elsewhere in the plans. For structures without railing and curbs taller than 1'-0", refer to the Extend Curb Details (ECD) standard sheet.

(8) For vehicle safety, reduce curb heights, if necessary, to provide a maximum 3" projection above finished grade. No changes will be made in quantities and no additional compensation will be allowed for this work.

(9) See Table of Maximum Wing Heights for various slopes. Height is limited based on a 33'-6" maximum safety pipe runner length.

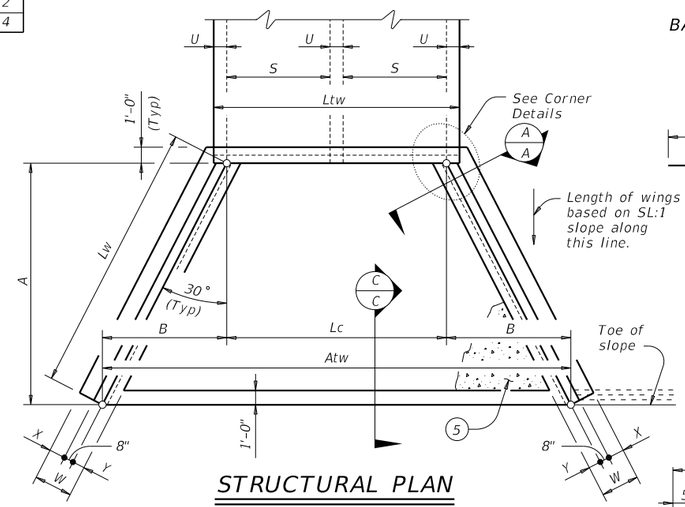
TABLE OF MAXIMUM WING HEIGHTS (9)

Side Slope	Hw Max
3:1	11'- 5"
4:1	8'-10"
6:1	6'- 1"



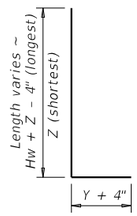
INSIDE ELEVATION OF WINGWALL

(Showing reinforcing. Culvert and culvert toewall reinforcing not shown for clarity.)

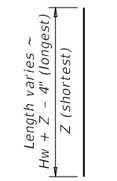


STRUCTURAL PLAN

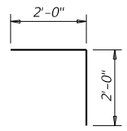
(Showing dimensions.)



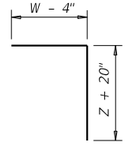
BARS J1



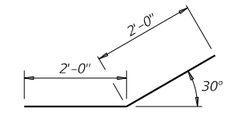
BARS V



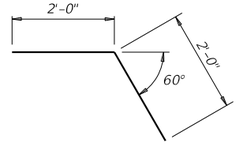
BARS L



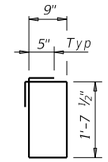
BARS J2



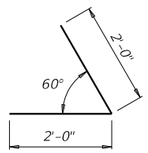
BARS D



BARS R



BARS K
(Length = 5'-5")



BARS OL

WING DIMENSION CALCULATIONS:

Hw = H + T + C - 0.250' (9)
A = (Hw - 0.333') (SL)
B = (A) (tan (30°))
Lw = (A) ÷ cos (30°))

For cast-in-place culverts:
Ltw = (N) (S) + (N + 1) (U)
For precast culverts:
Ltw = (N) (2U + S) + (N - 1) (0.500')

Lc = (Ltw) - (2U)
Atw = (Lc) + (2B)
Total Wingwall Area (two wings ~ SF) = (Hw + 0.333') (Lw)

Hw = Height of wingwall (feet)
Atw = Anchor toewall length (feet)
Lw = Length of wingwall (feet)
N = Number of culvert barrels
SL:1 = Side slope ratio (horizontal : 1 vertical)
Ltw = Culvert toewall length (feet)
Lc = Culvert curb between wings (feet)

See applicable box culvert standard for H, S, T, and U values.
See Table of Maximum Wall Heights for limits on Hw.

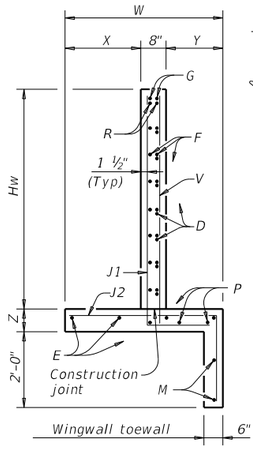
MATERIAL NOTES:

Provide Grade 60 reinforcing steel.
Provide galvanized reinforcing steel if required elsewhere in the plans.
Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.
Provide Class "C" concrete (f`c = 3,600 psi).
Adjust reinforcing as necessary to provide a minimum clear cover of 1 ½".
Provide pipe runners and anchor pipes meeting the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 Gr B, or API 5LX52.
Provide ASTM A307 bolts and nuts.
Provide ASTM A36 steel plates.
Galvanize all steel components, except reinforcing unless required elsewhere in the plans, after fabrication.
Repair galvanizing damaged during transport or construction in accordance with the Item 445, "Galvanizing".
For optional adhesive anchors, install adhesive anchorages in accordance with the manufacturer's instructions including hole size, drilling equipment and method, hole cleaning equipment and method, mixing and dispensing adhesive, and anchor insertion. Do not alter the manufacturer's mixing nozzle or dispenser. Provide anchorage rods that are clean and free of grease, oil, or any other foreign material. Demonstrate hole cleaning method to the Engineer for approval and continue the approved process for all anchorage locations. Test adhesive anchors in accordance with Item 450.3.3, "Tests." Test 3 anchors per 100 anchors installed.

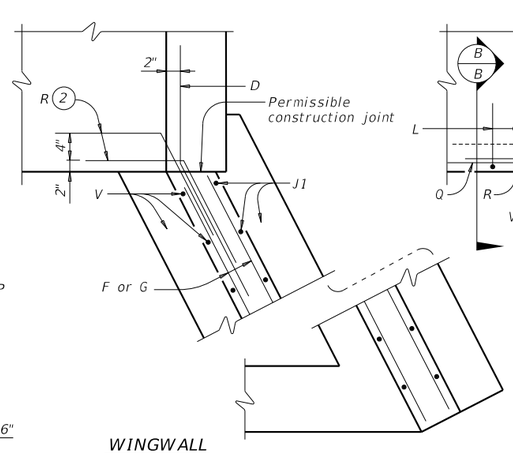
GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design 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 pipe runners.
Pipe runners are designed for a traversing load of 1,800 pounds at yield as recommended by Research Report 280-1, "Safety Treatment of Roadside Cross-Drainage Structures", Texas Transportation Institute, March 1981.
When structure is founded on solid rock, depth of toewalls for culverts and wingwalls may be reduced or eliminated as directed by the Engineer.
All bolts, nuts, washers, brackets, angles, and pipe runners are considered parts of the safety end treatment for payment.
The quantities for pipe runners, reinforcing steel, and concrete, resulting from the formulas given herein are for Contractor's information only.
See the Box Culvert Supplement (BCS) standard sheet for additional dimensions and information.

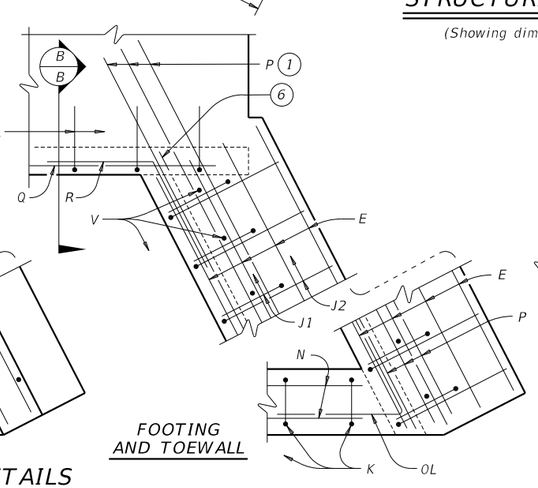
Cover dimensions are clear dimensions, unless noted otherwise.
Reinforcing dimensions are out-to-out of bars.



SECTION A-A



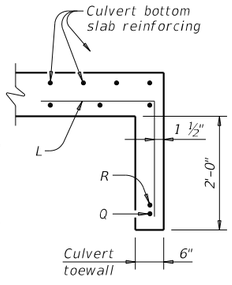
WINGWALL



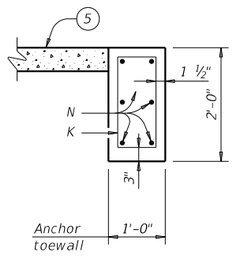
FOOTING AND TOEWALL

CORNER DETAILS

(Culvert and culvert toewall reinforcing not shown for clarity.)



SECTION B-B (5)



SECTION C-C

SHEET 1 OF 3

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 0° SKEW BOX CULVERTS
TYPE I ~ CROSS DRAINAGE

SETB-FW-0

FILE: setbf0se-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0923	17	086	CR 4981
	DIST	COUNTY		SHEET NO.
	BWD	COMANCHE		42

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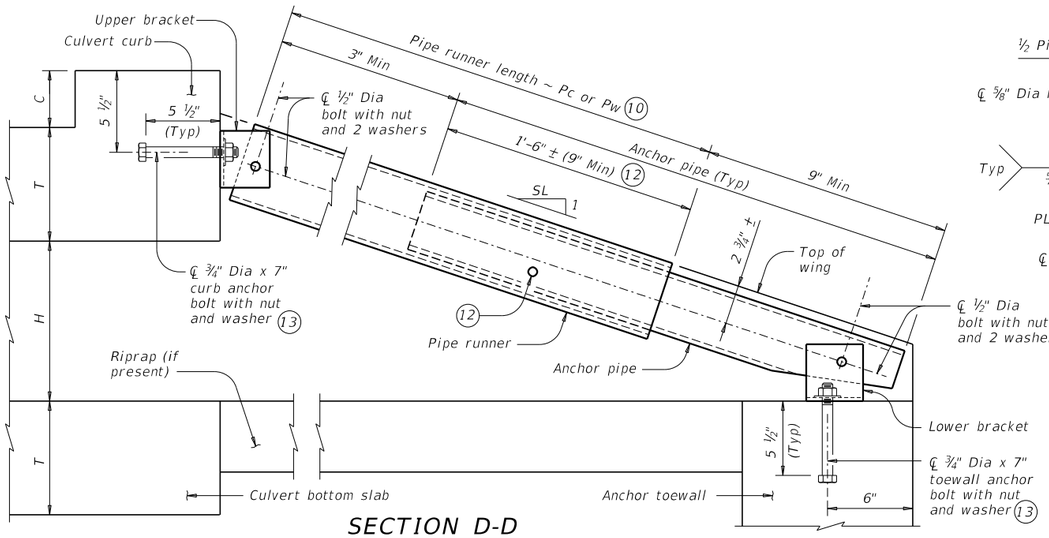
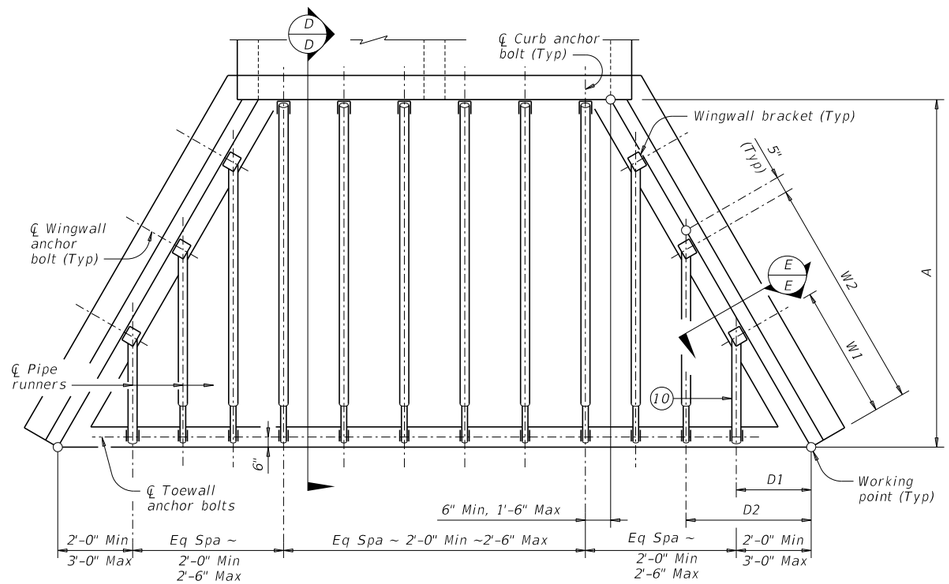
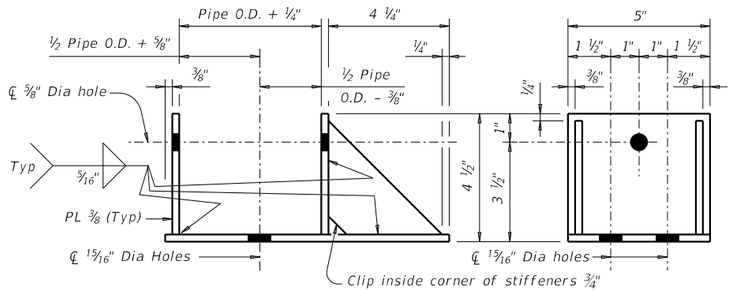


SECTION D-D

(Showing curb pipe runner. Except for upper bracket, wingwall pipe runners are similar.)

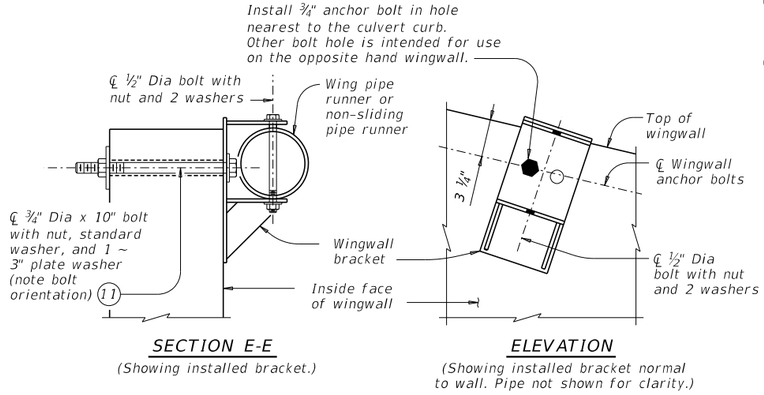


PIPE RUNNER PLAN



ELEVATION

SIDE VIEW



SECTION E-E

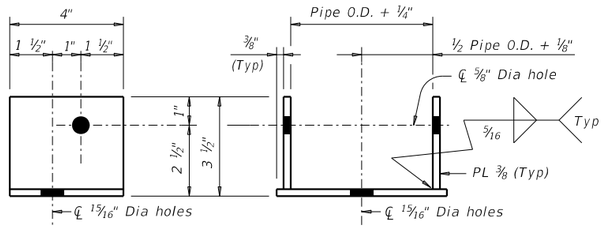
(Showing installed bracket.)

ELEVATION

(Showing installed bracket normal to wall. Pipe not shown for clarity.)

Note: Match wingwall bracket to the upper curb bracket size.

WINGWALL BRACKET DETAILS



SIDE VIEW

ELEVATION

Note: Match upper and lower brackets, except for the brackets used with non-sliding pipe runners, to the required pipe diameters as shown in the table.

UPPER AND LOWER BRACKET DETAILS

MAXIMUM PIPE RUNNER LENGTHS AND REQUIRED PIPE RUNNER SIZES

Maximum Pipe Runner Length (Pc or Pw)	Required Pipe Runner Size			Required Anchor Pipe Size		
	Pipe Size	Pipe O.D.	Pipe I.D.	Pipe Size	Pipe O.D.	Pipe I.D.
9'-4"	3" STD	3.500"	3.068"	2" STD	2.375"	2.067"
19'-0"	4" STD	4.500"	4.026"	3" STD	3.500"	3.068"
33'-6"	5" STD	5.563"	5.047"	4" STD	4.500"	4.026"

(10) If pipe runner length (Pw) is 1'-9" or less replace the normal pipe runner and anchor pipe with a single non-sliding pipe runner. See Non-Sliding Pipe Runner Details for additional information.

(11) At Contractor's option, ⅞" diameter hole may be formed or cored drilled. Percussion drilling is not permitted. Adjust placement of reinforcing steel as necessary to avoid bolt holes.

(12) After installation of pipe runner, use the ½" inspection hole to ensure that the lap of the anchor pipe with the pipe runner is adequate.

(13) At Contractor's option, an adhesive anchor may be used. Provide ¾" Dia adhesive anchors that meet the requirements of ASTM A307 Gr A fully threaded rods. Embed threaded rods into curb, wingwalls, and toewall using a Type III, Class C, D, E, or F anchor adhesive. Minimum embedment depth is 5 ½". Provide anchor adhesive able to achieve a basic bond strength in tension, Nba, of 20 kips. Submit signed and sealed calculations or the manufacturer's published literature showing the proposed anchor adhesive's ability to develop this load to the Engineer for approval prior to use.

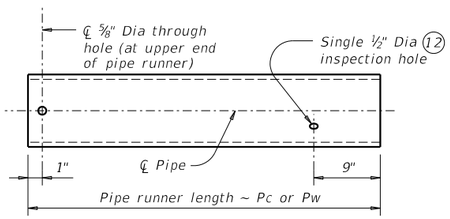
PIPE RUNNER DIMENSION CALCULATIONS:

Wn = (2.000) (Dn) - (0.416')
Pwn = (Dn) (K2) - (2.063')
Pw1 Non-Sliding Pipe Runner (If required) = (D1) (K2) - (0.563')
Pc = (A) (K1) - (1.688')

Wn = Distance from working point to centerline anchor bolt measured along bottom inside face of wing (feet)
Dn = Distance from working point to centerline pipe runner measured along outside face of anchor toewall (feet)
Pw = Wingwall pipe runner length (feet)
Pc = Curb pipe runner length (feet)
K = Constant values for use in formulas

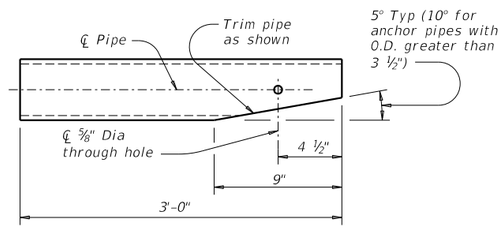
Slope SL:1	K1		K2
3:1	~ 1.054	~	1.826
4:1	~ 1.031	~	1.785
6:1	~ 1.014	~	1.756

n = Wing pipe runner number

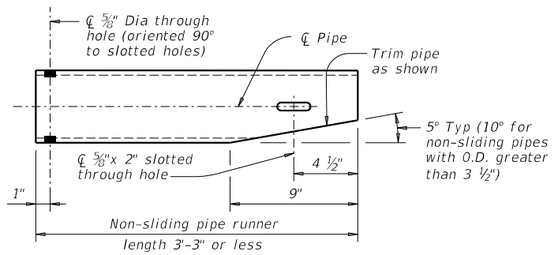


Note: Pipe diameter required for curb pipe runner is also used for wingwall pipe runner.

PIPE RUNNER DETAILS



ANCHOR PIPE DETAILS



Note: Pipe size is the same as required for curb pipe runner. Adjust the corresponding lower bracket accordingly.

NON-SLIDING PIPE RUNNER DETAILS

Texas Department of Transportation

Bridge Division Standard

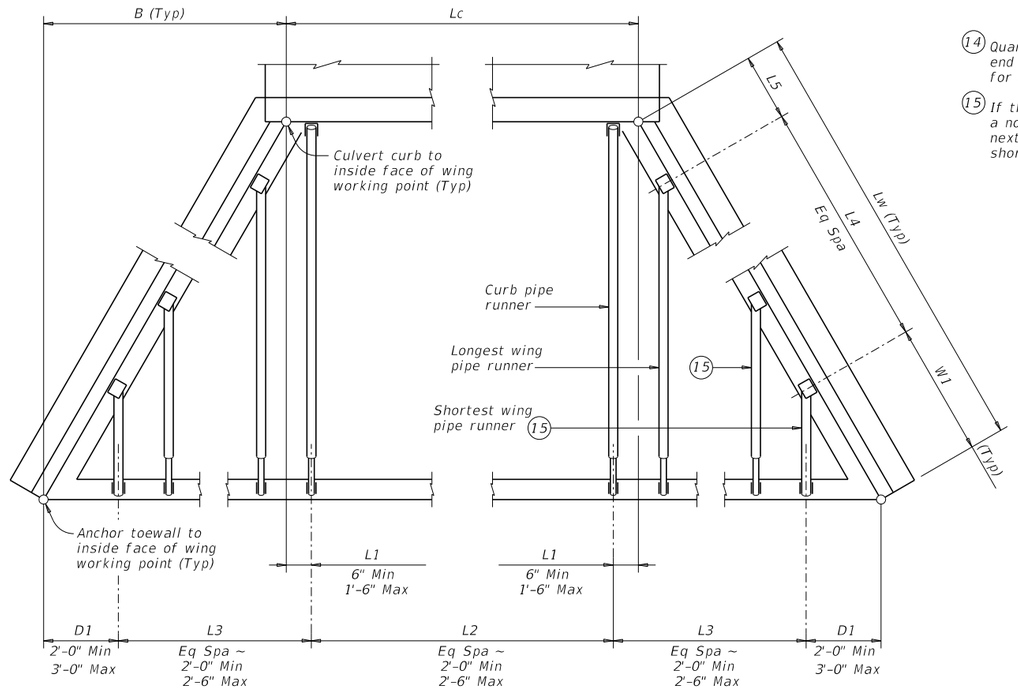
SAFETY END TREATMENT WITH FLARED WINGS

FOR 0° SKEW BOX CULVERTS
TYPE I ~ CROSS DRAINAGE

SETB-FW-0

FILE: setbf0se-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0923	17	086	CR 4981
	DIST	COUNTY		SHEET NO.
	BWD	COMANCHE		43

Culvert Station and/or Creek name followed by applicable end (Lt, Rt or Both) (14)	Lc (Ft)	L1 (Ft)	L2			D1 (Ft)	L3			W1 (Ft)	L4			L5 (Ft)	Curb Pipe Runner (Pc)		Longest Wing Pipe Runner (Pw) (Ft)	Shortest Wing Pipe Runner (Pw) (Ft)	Non-Sliding Wing Pipe Runner (if applicable) (Ft)	Curb, Wing, and/or Non-Sliding Pipe Runners		3'-0" Anchor Pipe	
			No. Spa	Spa at (Ft)	Overall Length (Ft)		No. Spa	Spa at (Ft)	Overall Length (Ft)		No. Spa	Spa at (Ft)	Overall Length (Ft)		No.	Length (Ft)				Size (3",4" or 5")	Total Length (14) (Ft)	Size (2",3" or 4")	Total Length (14) (Ft)



PIPE RUNNER LAYOUT

(14) Quantities shown are for one structure end if Lt or Rt. Quantities shown are for two structure ends if Both.

(15) If the outermost wing pipe runner is a non-sliding pipe runner, consider the next outermost wing pipe runner as the shortest.

SPECIAL NOTE:

This tabular sheet is to be filled out by the culvert specifier and provides information for the construction details and quantities of pipe runners.

An Excel 2010 spreadsheet to assist in completing this table can be downloaded from the Bridge Standards (English) web page on the TxDOT web site. The completed sheet must be signed, sealed, and dated by a licensed Professional Engineer.

Note that the tabular quantities are given for estimating purposes only. It is likely that these quantities will change due to field conditions. Therefore, all dimensions must be verified by the Contractor in the field prior to fabrication of the safety end treatment components.

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SHEET 3 OF 3

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 0° SKEW BOX CULVERTS TYPE I ~ CROSS DRAINAGE

SETB-FW-0

FILE: setbf0se-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0923	17	086	CR 4981
	DIST	COUNTY		SHEET NO.
	BWD	COMANCHE		44

UPDATED 6/22/2017

During the planning phase of project development the following environmental permits, issues, and commitments have been developed during coordination with resource agencies, local governmental entities, and the general public. Any change orders and/or deviations from the final design must be reported to the Engineer prior to the commencement of construction activities, as additional environmental clearances may be required.

I. Clean Water Act, Sec. 402 Texas Pollutant Discharge Elimination System

(Addresses CGP and MS4 Storm Water requirements for the project.)

(In the event that the Contractor implements a PSL on or within one mile of the project, a SIte Notice and/or a NOI will apply.)

☐ No Action Required ☑ Required Action

Action No. 1

The project disturbs less than one acre of surface area. The contractor is responsible for the PSL as defined in the Standard Specifications for construction and Maintenance of Highways, Street, and Bridges (2014 Edition, Section 7.7.6, Page 42). The total disturbed acreage is the combined acreage to be disturbed on the project and the contractor's PSL.

The EPIC must be updated if the disturbed area increases to one or more acres during the course of construction (refer to following sections). It may become necessary to post a site notice and/or NOI for the project and/or PSL.

Commitment No. 1

Refer to the SW3P Plan Sheet, BMPs and Detail. It will address sweeping, chemical storage, sanitary waste, and all other management practices.

MS4 operators that receives discharge from the project: -N/A-

II. Clean Water Act, Section 401 and 404 Compliance

(Addresses Nationwide Permits, Individual Permits, and Wetlands.)

(Filling, dredging, or excavating in any water bodies, rivers, creeks, streams, wetlands, or wet area is prohibited unless specified in the USACE permit and approved by the Engineer.)

(When temporary fill is implemented, only stated TxDOT standards will be used unless written authorization for an alternative is obtained from the Engineer. No equipment is allowed in any stream channel below the Ordinary High Water Mark except on temporary stream crossings or drill pads.)

☐ No Action Required ☑ 404 Permit and 401 Certification Required

Permit	Required Action	Waters of the US	App. Plan Sheet(s)
NWP #14	Adher to permit and associated conditions	Leon River Draw	SW3P Layout

Best Management Practices for applicable 401 General Conditions:

General Condition 12 - Categories I and II BMPs required

Category I (Erosion Control)

- ☑ Temporary Vegetation
- ☐ Mulch
- ☐ Interceptor Swale
- ☐ Erosion Control Compost
- ☑ Compost Filter Berms and Socks
- ☐ Blankets, Matting
- ☐ Sod
- ☐ Diversion Dike
- ☐ Mulch Filter Berms and Socks
- ☐ Compost Blankets

Category II (Sedimentation Control)

- ☐ Sand Bag Berm
- ☑ Silt Fence
- ☐ Triangular Filter Dike
- ☐ Stone Outlet Sediment Traps
- ☐ Erosion Control Compost
- ☐ Compost Filter Berms and Socks
- ☑ Rock Berm
- ☐ Hay Bale Dike
- ☐ Brush Berms
- ☐ Sediment Basins
- ☐ Mulch Filter Berms and Socks

General Condition 25 - Category III BMPs required

Category III (Post-Construction TSS Control)

- ☐ Retention/Irrigation
- ☐ Extended Detention Basin
- ☑ Vegetative Filter Strips
- ☐ Grassy Swales
- ☐ Erosion Control Compost
- ☐ Compost Filter Berms and Socks
- ☐ Constructed Wetlands
- ☐ Wet Basins
- ☐ Vegetation-Lined Ditches
- ☐ Sand Filter Systems
- ☐ Mulch filter Berms and Socks
- ☐ Sedimentation Chambers

Prepared by ********** $TIME$
DATE: $DATE$
FILE: $FILE$

III. Cultural Resources

(Addresses any special circumstances associated with cultural resources, such as archeological or historic sites.)

(Upon discovery of archeological artifacts (bones, burnt rock, flint, pottery, etc.;cease work in the immediate area and contact the Engineer immediately.)

☑ No Action Required ☐ Required Action

Action No.	Station (Rt/Lt)	Commitment
1.	---	---

IV. Vegetation Resources

(Addresses any special circumstances associated with vegetation, such as large trees to be avoided, or mitigation that will occur as part of the project.)

☐ No Action Required ☑ Required Action

Action No.	Station (Rt/Lt)	Commitment
1.	All	Avoid non-mow locations for stockpiles and equipment parking/storage.
2.	Project Limits	Preserve native vegetation to the extent practical. Contractor must adhere to Construction Specification Requirements Specs 162, 164, 192, 193, 506, 730, 751, 752 in order to comply with requirements for invasive species, beneficial landscaping, and tree/brush removal commitments.

V. Federal Listed, Proposed, Threatened, Endangered Species, Critical Habitat, State Listed Species, Candidate Species, and Migratory Bird Treaty Act (MBTA)

(Addresses any special habitat that may need to be avoided, lists any threatened or endangered species where habitat was observed and might be impacted within the project area, and lists any precautions such as nesting seasons for migratory birds.)

☐ No Action Required ☑ Required Action

Species Potentially within Project Area & Description — Habitat Description

The Contractor is to be aware that if bats or active bird nests are identified during construction; they are to stop work and contact The Brownwood District Environmental Coordinator, Andrew Chisholm, 325) 643-0442. When choosing locations for storing equipment or placing other Project Specific Locations (PSLs), burrows should be avoided as these may contain species of concern. Any species entering the work area shall be left alone and allowed to leave the construction area unharmed.

The Migratory Bird Treaty Act of 1918 states that it is unlawful to kill, capture, collect, possess, buy, sell, trade, or transport any migratory bird, nest, young, feather, or egg in part or in whole, without a federal permit issued in accordance within the Act's policies and regulations. Migration patterns would not be affected by the proposed project. The contractor will remove all old migratory bird nests from any structure where work would be done from September 1 through the end of February. In addition, the contractor will be prepared to prevent migratory birds from building nests between March 1 and August 31, per the Environmental Permits, Issues, and Commitments (EPIC) plans. In the event that migratory birds are encountered on-site during project construction, adverse impacts on protected birds, active nests, eggs, and/or young shall be avoided.

VI. Hazardous Material or Contamination Issues

(Addresses any previously identified high risk sites associated with hazardous materials that may be encountered during construction.)

Comply with the Hazard Communication Act (the Act) for personnel who will be working with hazardous materials by conducting safety meetings prior to beginning construction and making workers aware of potential hazards in the workplace. Ensure that all workers are provided with personal protective equipment appropriate for any hazardous materials used.

Obtain and keep on-site Material Safety Data Sheets (MSDS) for all hazardous products used on the project, which may include, but are not limited to the following categories: Paints, acids, solvents, asphalt products, chemical additives, fuels and concrete curing compounds or additives. Provide protected storage, off bare ground and covered, for products which may be hazardous. Maintain product labelling as required by the Act.

Maintain an adequate supply of on-site spill response materials, as indicated in the MSDS. In the event of a spill, take actions to mitigate the spill as indicated in the MSDS, in accordance with safe work practices, and contact the District Spill Coordinator immediately. The Contractor shall be responsible for the proper containment and cleanup of all product spills.

Contractor will follow all applicable storage and management requirements for liquid oil products, liquid petroleum products, and other chemical liquids as per 40 CFR 112 (a.k.a. SPCC) and/or TCEQ Construction General Permit for storm water management.

Contact the Engineer if any of the following are detected:
- Dead or distressed vegetation (not identified as normal)
- Trash piles, drums, canisters, barrels, etc.
- Undesirable smells/odors
- Underground storage tanks
- Evidence of leaching or seepage of substances
- Any other evidence indicating possible hazardous materials or contamination discovered on-site

---

Does the project involve any bridge class structure rehabilitation or replacements (bridge class structure not including box culverts)?

☑ Yes ☐ No

If "No", then no further action is required.
If "Yes", then TxDOT is responsible for completing an asbestos assessment/inspection.
Are the results of the asbestos inspection positive (is asbestos present)?

☐ Yes ☑ No

If "Yes", then TxDOT must retain a Texas Department of State Health Services (DSHS) licensed asbestos consultant to assist with the notification, develop abatement/mitigation procedures, and perform management activities as necessary. The notification form to DSHS must be postmarked at least 10 working days prior to scheduled abatement and/or demolition.

If "No", then TxDOT is still required to notify DSHS 10 working days prior to any scheduled demolition.

In either case, the Contractor is responsible for providing the date(s) for abatement activities and/or demolition with careful coordination between the Engineer and asbestos consultant in order to minimize construction delays and subsequent claims.

Bridges on this project may contain Lead-Containing Paint (LCP) or other items that contain lead. The location of (LCP) is identified in the General Notes. Item 6.10.1.2 in the 2014 TxDOT Standard Specifications shall be utilized for this project.

VII. Other Environmental Issues

(Addresses any other environmental issues that may not have been covered in other sections.)

☑ No Action Required ☐ Required Action

Action No.	Station (Rt/Lt)	Commitment
1.	---	---

LIST OF ABBREVIATIONS

BMP: Best Management Practice
CGP: Construction General Permit
DSHS: Texas Department of State Health Services
FEMA: Federal Emergency Management Agency
FHWA: Federal Highway Administration
MOA: Memorandum of Agreement
MOU: Memorandum of Understanding
MS4: Municipal Separate Stormwater Sewer System
MBTA: Migratory Bird Treaty Act
NOI: Notice of Intent
NOT: Notice of Termination
NWP: Nationwide Permit
SPCC: Spill Prevention Control and Countermeasure
SW3P: Storm Water Pollution Prevention Plan
PCN: Pre-Construction Notification
PSL: Project Specific Location
TCEQ: Texas Commission on Environmental Quality
TPDES: Texas Pollutant Discharge Elimination System
TPWD: Texas Parks and Wildlife Department
TxDOT: Texas Department of Transportation
T&E: Threatened and Endangered Species
USACE: U.S. Army Corp of Engineers
USFWS: U.S. Fish and Wildlife Service

ENVIRONMENTAL PERMITS, ISSUES, AND COMMITMENTS (EPIC) LESS THAN 1 ACRE

Texas Department of Transportation
BROWNWOOD DISTRICT

CONT	SECT	JOB	HIGHWAY
0923	17	086	CR 4981
DIST	COUNTY		SHEET NO.
BWD	COMANCHE		45

SITE DESCRIPTION

PROJECT LIMITS:

CSJ 0923-17-086 CR 4981 at Leon River Draw-2

Latitude = 32.21083
Longitude = -98.55937

LOCATION MAPS:

Refer to title sheet for project location map.

PROJECT DESCRIPTION:

CSJ 0923-17-086
For the construction of: Replacement of bridge consisting of: Replace bridge and approaches

MAJOR SOIL DISTURBING ACTIVITIES:

The major soil disturbing activities for this project will consist of preparation of R.O.W., removing existing strutcture, excavation work, embankment work for the construction of the bridge and roadway, and placement and removal of erosion controls.

TOTAL PROJECT AREA:	0.21AC
TOTAL AREA TO BE DISTURBED:	0.18 AC

EXISTING CONDITION OF SOIL & VEGETATIVE COVER AND % OF EXISTING VEGETATIVE COVER:

CSJ 0923-17-086
Surrounding land is used as pasture range and 90% of the R.O.W. vegetative cover is predominantly comprised of various native grasses and wild flowers.

NAME OF RECEIVING WATERS:

CSJ 0923-17-086
Runoff from project flows into Leon River Draw-2.

EROSION AND SEDIMENT CONTROLS

OTHER EROSION AND SEDIMENT CONTROLS:

MAINTENANCE:
All erosion controls will be maintained in good working order. If a repair is necessary, it will be made at the earliest possible date, but no later than seven (7) calendar days after the ground has dried sufficiently to prevent further damage from equipment. The areas around creeks and drainage ways shall have priority over other areas on the project site.

INSPECTION:
An inspection will be performed by a TxDOT inspector at least once every seven (7) calendar days. An inspection and maintenance report will be made per each inspection. Stormwater controls will be modified as directed by the Engineer based on these reports.

WASTE MATERIALS:
Any waste materials generated during construction will be disposed of in accordance with existing federal, state, and local laws.

HAZARDOUS WASTE (INCLUDING SPILL REPORTING):
At a minimum, any products in the following categories are considered to be hazardous: Fuels, Lubricating products, Asphalt products, or Concrete curing compounds and any additives. In the event of a spill which may be hazardous, clean-up will be done in accordance with federal, state, and local regulations.

SANITARY WASIE:
Sanitary waste from portable units will be collected by a licensed sanitary waste management contractor.

OFF SITE VEHICLE TRACKING AND DUST CONTROL:

- __X__ DUST CONTROL (OFF SITE) AS NEEDED - PER ENGINEER
- ____ HAUL ROADS DAMPENED FOR DUST CONTROL
- ____ LOADED HAUL TRUCKS TO BE COVERED WITH TARPAULIN
- ____ EXCESS DIRT ON ROAD REMOVED DAILY
- ____ STABILIZED CONSTRUCTION ENTRANCE

REMARKS:
Disposal areas, stockpiles, and haul roads shall be constructed in a manner that will minimize and control the amount of sediment that may enter receiving waters. Disposal areas shall not be located in any wetland, water body or stream bed. Construction staging area and vehicle maintenance area shall be constructed by the contractor in a manner to minimize the runoff pollutants. All waterways shall be cleared as soon as practicable of temporary embankment, temporary bridges, matting, false work, piling, debris or other obstructions placed during construction operations that are not a part of the finished work.

For off R.O.W. facilities the contractor shall comply with TCEQ requirements.

The contractor is responsible for ensuring that all subcontractors are aware of and comply with all components of the SW3P per Item 506.

Furnish one SW3P permit posting sign and sign support as detailed on the SW3P Sheet. Install this sign in a location selected by the Engineer. The sign and support should be removed upon completion of the project and is the property of the Contractor. The purchase of the sign and support, installation, relocation(s) if determined necessary by the Engineer and removal at project end shall be subsidiary to Item 506.

Sedimentation Basins - Since the area disturbed is less than 10 acres per drainage area; a sedimentation basin is not required.

Best Management Practices:

Erosion	*Sedimentation*	*Post-Construction TSS*
■ Temporary Vegetation	■ Silt Fence	■ Vegetative Filter Strips
☐ Blankets/Matting	☐ Rock Berm	☐ Retention/Irrigation Systems
☐ Mulch	☐ Triangular Filter Dike	☐ Extended Detention Basin
☐ Sodding	☐ Sand Bag Berm	☐ Constructed Wetlands
☐ Interceptor Swale	☐ Straw Bale Dike	☐ Wet Basin
☐ Diversion Dike	☐ Brush Berms	☐ Erosion Control Compost
☐ Erosion Control Compost	☐ Erosion Control Compost	☐ Mulch Filter Berm and Socks
☐ Mulch Filter Berm and Socks	☐ Mulch Filter Berm and Socks	☐ Compost Filter Berm and Socks
■ Compost Filter Berm and Socks	☐ Compost Filter Berm and Socks	☐ Vegetation Lined Ditches
	☐ Stone Outlet Sediment Traps	☐ Sand Filter Systems
	☐ Sediment Basins	

NARRATIVE - SEQUENCE OF CONSTRUCTION (STORM WATER MANAGEMENT) ACTIVITIES:

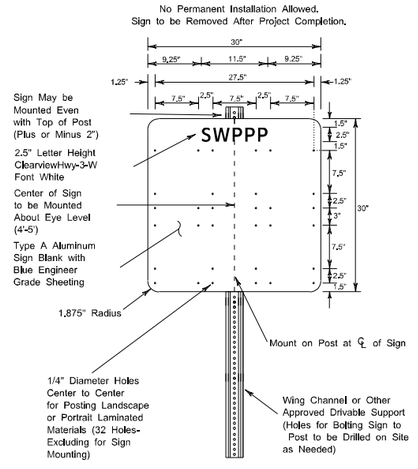
The order of activities will be as follows:

1. Preserve existing vegetative cover as much as possible.
2. Install temporary sediment control fencing and other items as shown on plans prior to any soil disturbing activities.
3. Perform bridge work, roadway work, and perform any necessary excavation, embankment and grading, temporary seeding, and signage.
4. Place permanent seeding as shown in the plans and as directed by the Engineer.

STORM WATER MANAGEMENT:

Storm water will be carried by side road ditches which will empty into the various natural runoff channels.

STORM WATER POLLUTION PREVENTION PLAN PERMIT POSTING

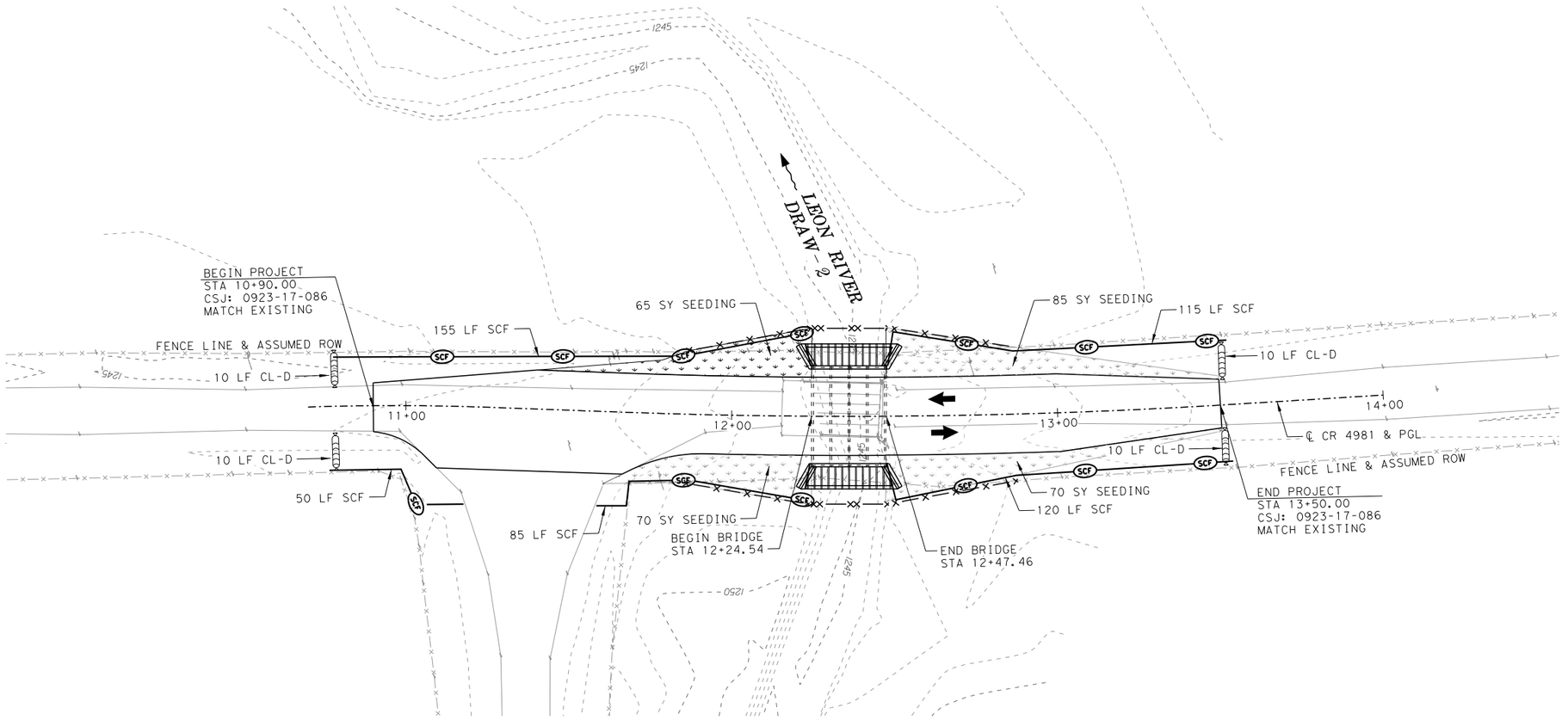


Texas Department of Transportation
Brownwood District Office
2495 Highway 183 North
Brownwood Texas, 76802

STATE OF TEXAS
JAMES BROOKS
101002
LICENSED PROFESSIONAL ENGINEER
7/30/2020

CR 4981 BROWNWOOD DIST. STORM WATER POLLUTION PREVENTION PLAN

DATE: 7/30/2020 6:50
FILE: pw://ts-pw.bentley.com:ts-pw-01/Documents/0223.002/Cadd/Plan Sheets/ESCP/CR4981_SW3P-01.DGN



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SCALE: 1" = 40'

N

LEGEND

- SCF — SEDIMENT CONTROL FENCE
- TEMP EROSION CONTROL LOG
- DIRECTION OF FLOW

NOTE:

SOIL RETENTION BLANKETS SHALL BE PLACED ALONG V-DITCHES. SEE CROSS SECTIONS FOR DITCH LOCATIONS.

ITEM	DESCRIPTION	UNIT	QUANTITY
164-6001	BROADCAST SEED (PERM) (RURAL) (SANDY)	SY	145
164-6009	BROADCAST SEED (TEMP) (WARM)	SY	72
164-6011	BROADCAST SEED (TEMP) (COOL)	SY	72
168-6001	VEGETATIVE WATERING	MG	4
SUBSIDIARY	FERTILIZER	TON	0.01
169-6003	SOIL RETENTION BLANKETS (CL 1) (TY C)	SY	300
506-6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	525
506-6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	525
506-6041	BIODEG EROSN CONT LOGS (INSTL) (12")	LF	40
506-6043	BIODEG EROSN CONT LOGS (REMOVE)	LF	40

NO.	REVISION	BY	DATE

STATE OF TEXAS
JAMES BROOKS
101002
LICENSED PROFESSIONAL ENGINEER
10/6/2021

TEXAS TRANSPORTATION SOLUTIONS, INC.
Firm #F-19297

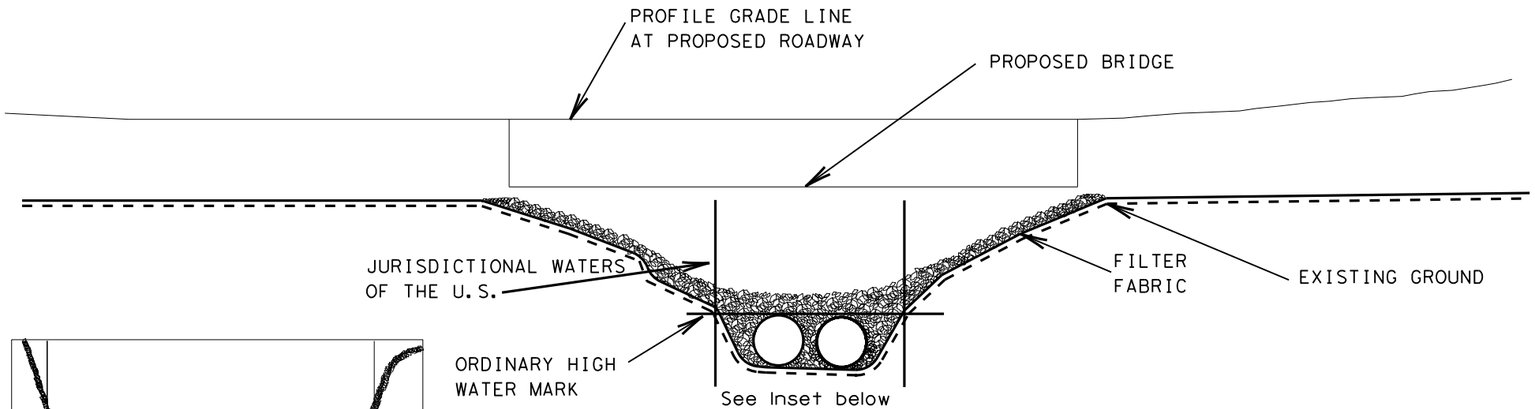
SW3P LAYOUT
CR 4981 AT
LEON RIVER DRAW-2

SHEET 1 OF 1

FED. RD DIV. No.	CONTROL No.	SECTION No.	JOB No.	HIGHWAY No.
6	0923	17	086	CR 4981
STATE	DISTRICT	COUNTY		SHEET No.
TEXAS	BWD	COMANCHE		47

pw://tts-pw.bentley.com:tts-pw-01/Documents/0223.002 WA 3 - CR Brown Comanche Co/Cadd/Plan Sheets/ESCP/CR4981_SW3P_LAYOUT-01.dgn
10/6/2021 3:10 JamesBrooks SCRIPT: CR4981_Index.pen

TEMPORARY CROSSING



CAPACITY OF CULVERT(S) SHALL BE ADEQUATE TO CONVEY THE LOW FLOW OF WATER

Note: Temporary crossing will not be paid for directly but will be considered subsidiary to pertinent items.

DRAWING NOT TO SCALE

STATE OF TEXAS
DAN A. HOHMANN
97588
LICENSED
PROFESSIONAL ENGINEER

Dan A Hohmann P.E.

11/29/21

CR 4981
TEMP CROSSING
DETAIL
0923-17-086

CONT	SECT	JOB	HIGHWAY
0923	17	086	CR 4981
DIST	COUNTY		SHEET NO.
BWD	COMANCHE		48

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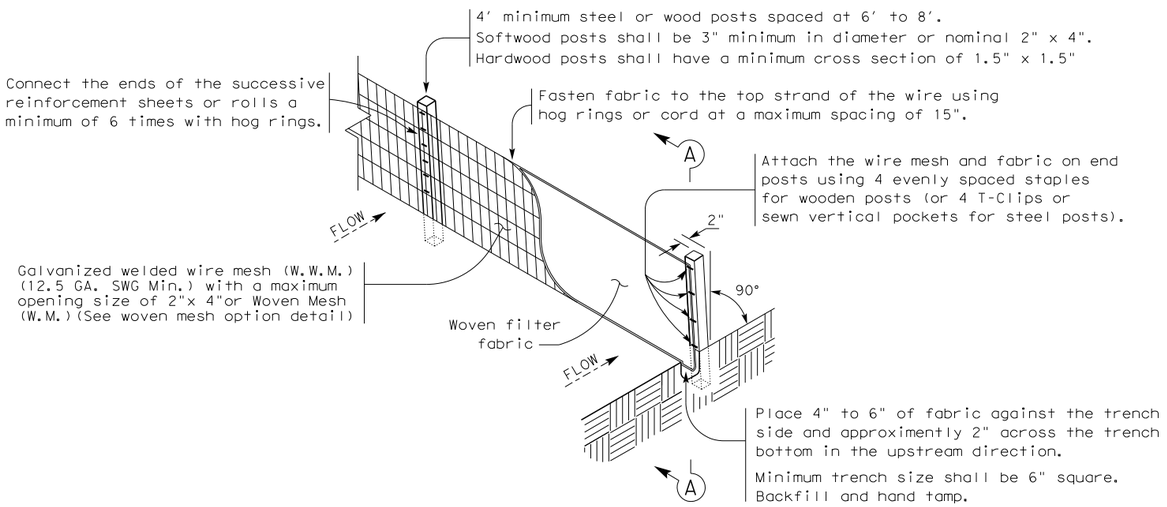
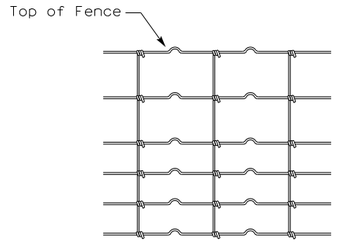
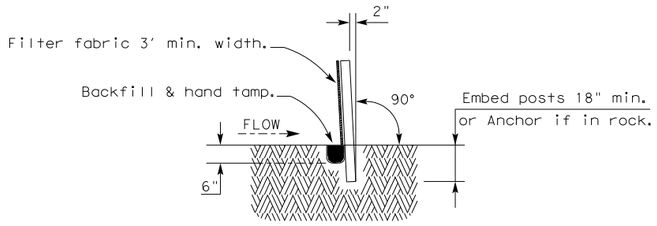
FILE: $FILE$



TEMPORARY SEDIMENT CONTROL FENCE

SCF





SECTION A-A

HINGE JOINT KNOT WOVEN MESH (OPTION) DETAIL

Galvanized hinge joint knot woven mesh (12.5 GA.SWG Min.) requires a minimum of five horizontal wires spaced at a maximum of 12 inches apart and all vertical wires spaced at a maximum of 12 inches apart.

SEDIMENT CONTROL FENCE USAGE GUIDELINES

A sediment control fence may be constructed near the downstream perimeter of a disturbed area along a contour to intercept sediment from overland runoff. A 2 year storm frequency may be used to calculate the flow rate to be filtered.

Sediment control fence should be sized to filter a maximum flow through rate of 100 GPM/FT^2. Sediment control fence is not recommended to control erosion from a drainage area larger than 2 acres.

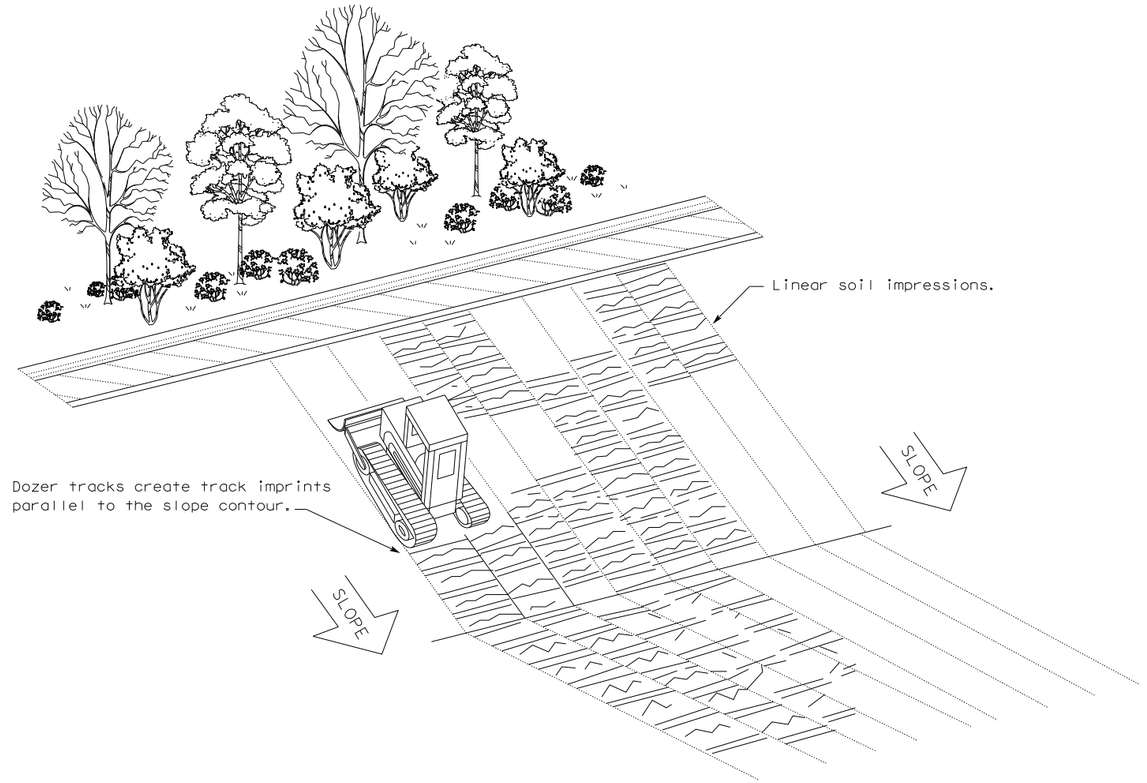
LEGEND

Sediment Control Fence

SCF

GENERAL NOTES

1. Vertical tracking is required on projects where soil distributing activities have occurred unless otherwise approved.
2. Perform vertical tracking on slopes to temporarily stabilize soil.
3. Provide equipment with a track undercarriage capable of producing linear soil impressions measuring a minimum of 12" in length by 2" to 4" in width by 1/2" to 2" in depth.
4. Do not exceed 12" between track impressions.
5. Install continous linear track impressions where the minimum 12" length impressions are perpendicular to the slope or direction of water flow.



VERTICAL TRACKING

Texas Department of Transportation

Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

FENCE & VERTICAL TRACKING

EC(1)-16

FILE: ec116	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	0923	17	086	CR 4981
	DIST	COUNTY		SHEET NO.
	BWD	COMANCHE		49

7/30/2020
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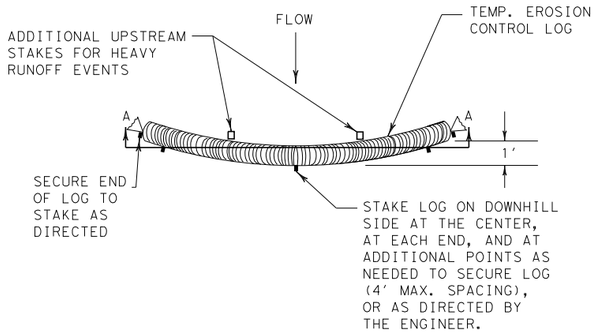
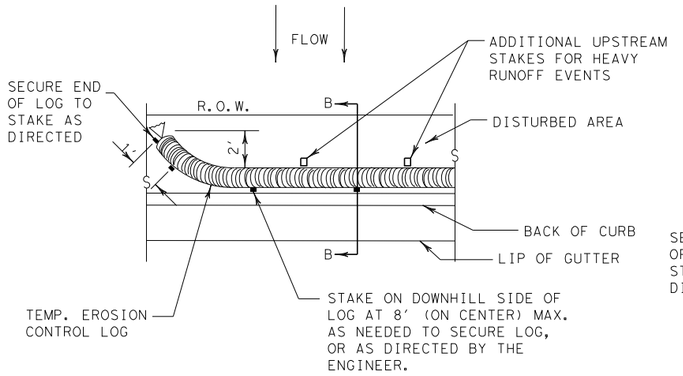


PLAN VIEW



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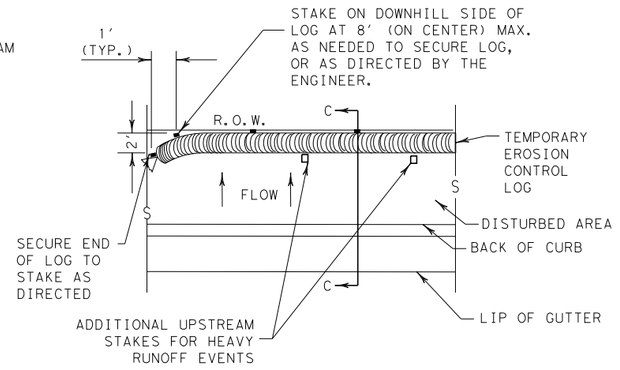
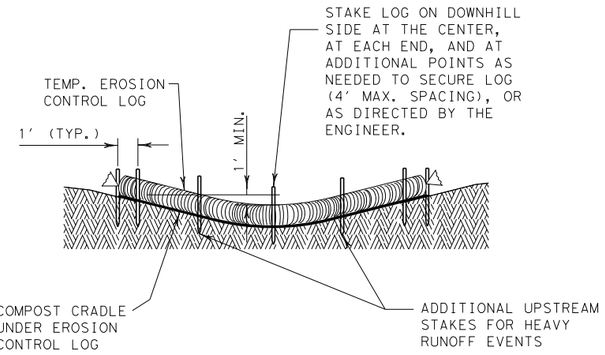


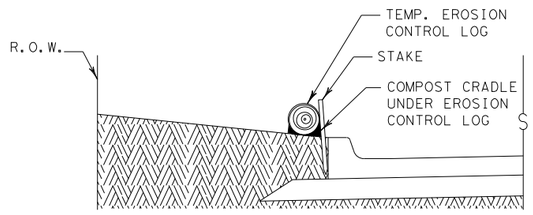
PLAN VIEW



SECTION A-A

EROSION CONTROL LOG DAM

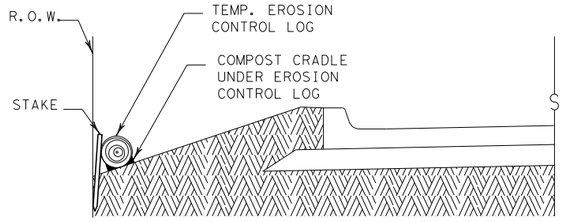
CL-D



SECTION B-B

EROSION CONTROL LOG AT BACK OF CURB

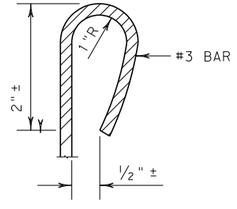
CL-BOC



SECTION C-C

EROSION CONTROL LOG AT EDGE OF RIGHT-OF-WAY

CL-ROW



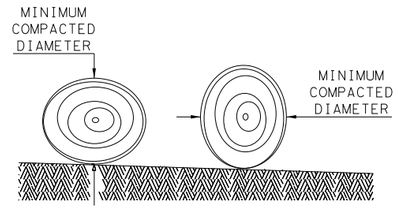
REBAR STAKE DETAIL

LEGEND

- CL-D — EROSION CONTROL LOG DAM
- CL-BOC — EROSION CONTROL LOG AT BACK OF CURB
- CL-ROW — EROSION CONTROL LOG AT EDGE OF RIGHT-OF-WAY
- CL-SST — EROSION CONTROL LOGS ON SLOPES STAKE AND TRENCHING ANCHORING
- CL-SSL — EROSION CONTROL LOGS ON SLOPES STAKE AND LASHING ANCHORING
- CL-DI — EROSION CONTROL LOG AT DROP INLET
- CL-CI — EROSION CONTROL LOG AT CURB INLET
- CL-GI — EROSION CONTROL LOG AT CURB & GRATE INLET

GENERAL NOTES:

1. EROSION CONTROL LOGS SHALL BE INSTALLED IN ACCORDANCE WITH MANFACTURER'S RECOMMENDATIONS, OR AS DIRECTED BY THE ENGINEER.
2. LENGTHS OF EROSION CONTROL LOGS SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND AS REQUIRED FOR THE PURPOSE INTENDED.
3. UNLESS OTHERWISE DIRECTED, USE BIODEGRADABLE OR PHOTODEGRADABLE CONTAINMENT MESH ONLY WHERE LOG WILL REMAIN IN PLACE AS PART OF A VEGETATIVE SYSTEM. FOR TEMPORARY INSTALLATIONS, USE RECYCLABLE CONTAINMENT MESH.
4. FILL LOGS WITH SUFFICIENT FILTER MATERIAL TO ACHIEVE THE MINIMUM COMPACTED DIAMETER SPECIFIED IN THE PLANS WITHOUT EXCESSIVE DEFORMATION.
5. STAKES SHALL BE 2" X 2" WOOD OR #3 REBAR, 2'-4' LONG, EMBEDDED SUCH THAT 2" PROTRUDES ABOVE LOG, OR AS DIRECTED BY THE ENGINEER.
6. DO NOT PLACE STAKES THROUGH CONTAINMENT MESH.
7. COMPOST CRADLE MATERIAL IS INCIDENTAL & WILL NOT BE PAID FOR SEPARATELY.
8. SANDBAGS USED AS ANCHORS SHALL BE PLACED ON TOP OF LOGS & SHALL BE OF SUFFICIENT SIZE TO HOLD LOGS IN PLACE.
9. TURN THE ENDS OF EACH ROW OF LOGS UPSLOPE TO PREVENT RUNOFF FROM FLOWING AROUND THE LOG.
10. FOR HEAVY RUNOFF EVENTS, ADDITIONAL UPSTREAM STAKES MAY BE NECESSARY TO KEEP LOG FROM FOLDING IN ON ITSELF.



DIAMETER MEASUREMENTS OF EROSION CONTROL LOGS SPECIFIED IN PLANS

SEDIMENT BASIN & TRAP USAGE GUIDELINES

An erosion control log sediment trap may be used to filter sediment out of runoff draining from an unstabilized area.

Log Traps: The drainage area for a sediment trap should not exceed 5 acres. The trap capacity should be 1800 CF/Acre (0.5" over the drainage area).

Control logs should be placed in the following locations:

1. Within drainage ditches spaced as needed or min. 500' on center
2. Immediately preceding ditch inlets or drain inlets
3. Just before the drainage enters a water course
4. Just before the drainage leaves the right of way
5. Just before the drainage leaves the construction limits where drainage flows away from the project.

The logs should be cleaned when the sediment has accumulated to a depth of 1/2 the log diameter.

Cleaning and removal of accumulated sediment deposits is incidental and will not be paid for separately.

Texas Department of Transportation

Design Division Standard

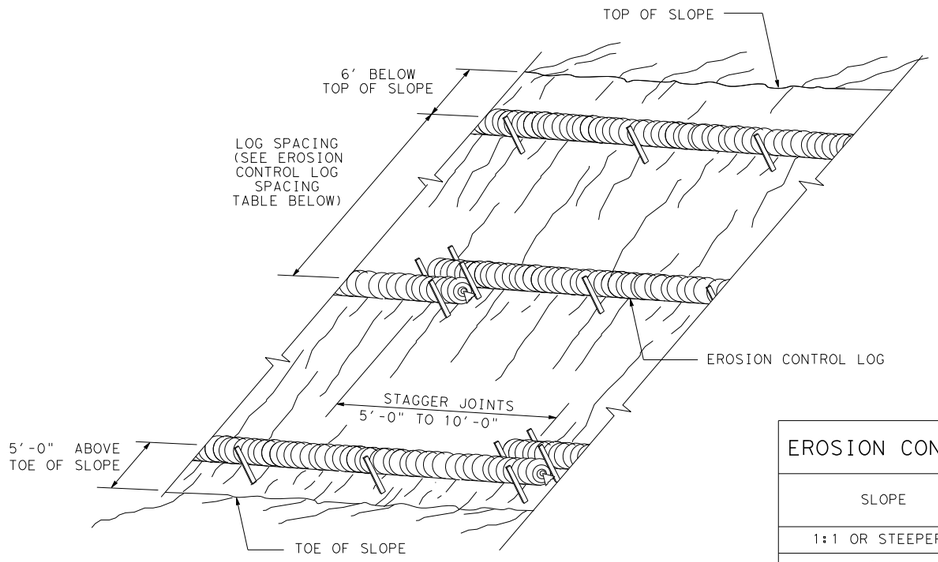
TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

EROSION CONTROL LOG

EC(9)-16

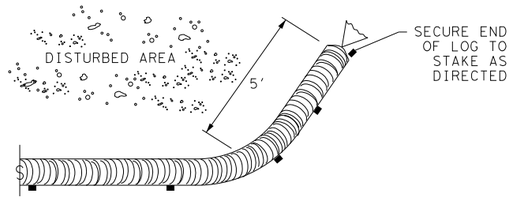
FILE: ec916	DN: TxDOT		CK: KM		DW: LS/PT		CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB		HIGHWAY		
REVISIONS	0923	17	086		CR 4981		
	DIST	COUNTY				SHEET NO.	
	BWD	COMANCHE				50	

DATE: 7/30/2020
FILE: pw://tts-pw.bentley.com:tts-pw-01/Documents/0223.002/Cadd/Standards/ESCP/EC(9)-16.dgn



EROSION CONTROL LOGS ON SLOPES
STAKE AND TRENCHING ANCHORING

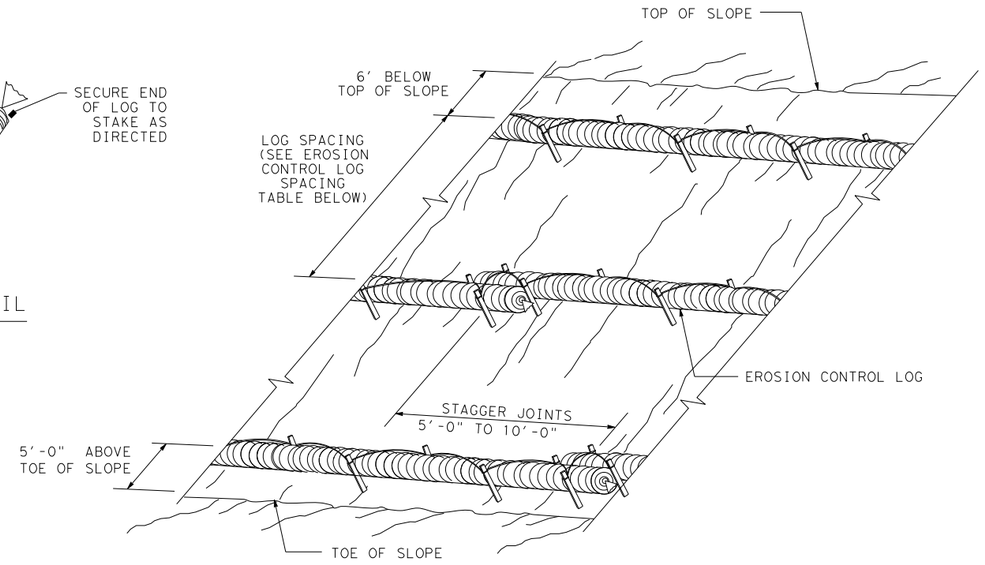
CL-SST



END SECTION RAP DETAIL

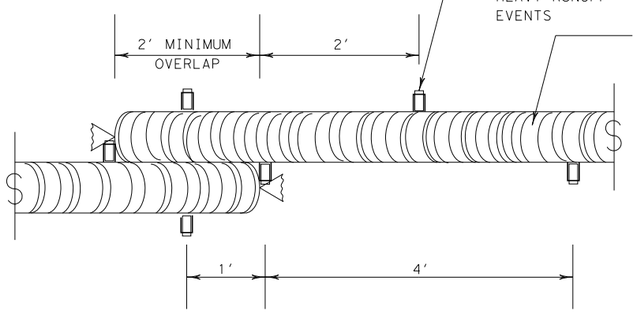
EROSION CONTROL LOG SPACING TABLE				
SLOPE	LOG DIAMETER			
	6"	8"	12"	18"
1:1 OR STEEPER	5'	10'	15'	20'
2:1	10'	20'	30'	40'
3:1	15'	30'	45'	60'
4:1 OR FLATTER	20'	40'	60'	80'

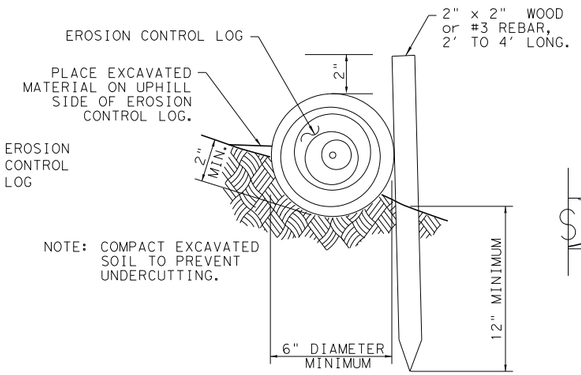
* ADJUSTMENTS CAN BE MADE FOR SOIL TYPE:
SOFT, LOAMY SOILS-ADJUST ROWS CLOSER TOGETHER;
HARD, ROCKY SOILS- ADJUST ROWS FARTHER APART



EROSION CONTROL LOGS ON SLOPES
STAKE AND LASHING ANCHORING

CL-SSL

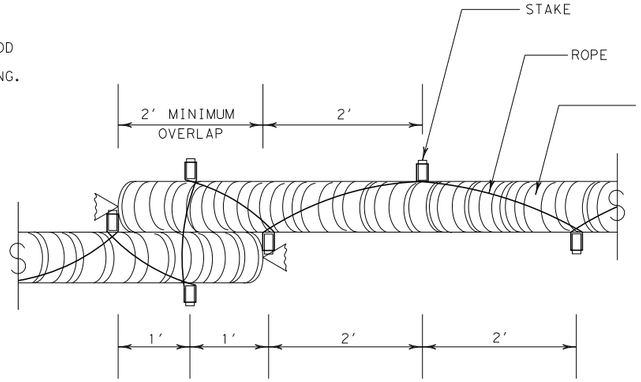




STAKE AND TRENCHING ANCHORING DETAIL

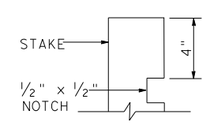
CL-SST

TRENCH DEPTH TABLE	
LOG DIAMETER	DEPTH
6"	2"
8"	3"
12"	4"
18"	5"

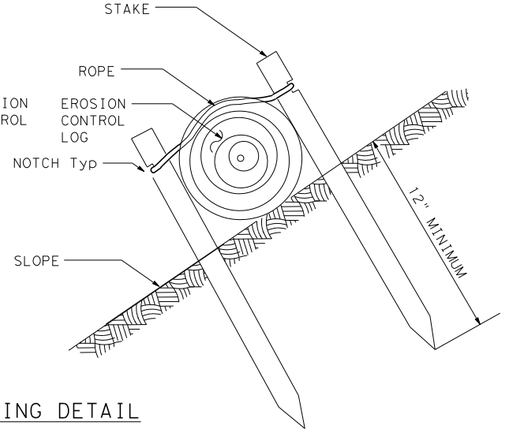


STAKE AND LASHING ANCHORING DETAIL

CL-SSL



STAKE NOTCH DETAIL



Texas Department of Transportation | Design Division Standard

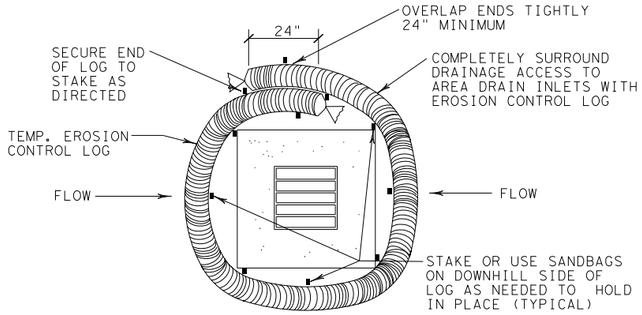
TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

EROSION CONTROL LOG

EC(9)-16

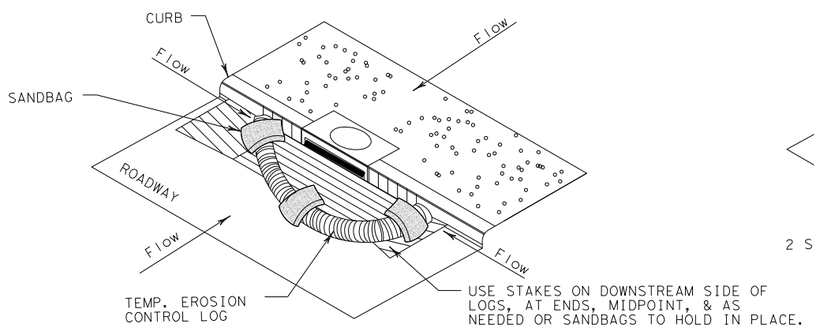
FILE: ec116	DN: TxDOT	CK: KM	DW: LS/PT	CK: LS	
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0923	17	086	CR 4981	
	DIST	COUNTY		SHEET NO.	
	BWD	COMANCHE		51	

DATE: 7/30/2020
FILE: pw://tts-pw.bentley.com:tts-pw-01/Documents/0223.002/Cadd/Standards/ESCP/EC(9)-16.dgn



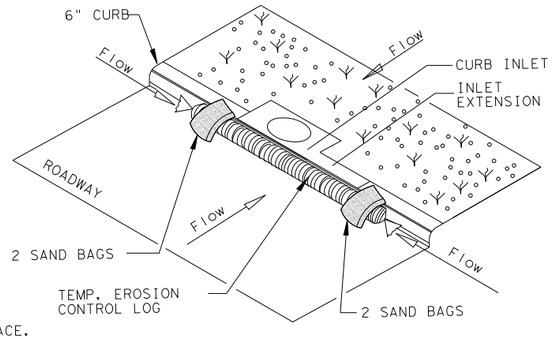
EROSION CONTROL LOG AT DROP INLET

CL-DI



EROSION CONTROL LOG AT CURB INLET

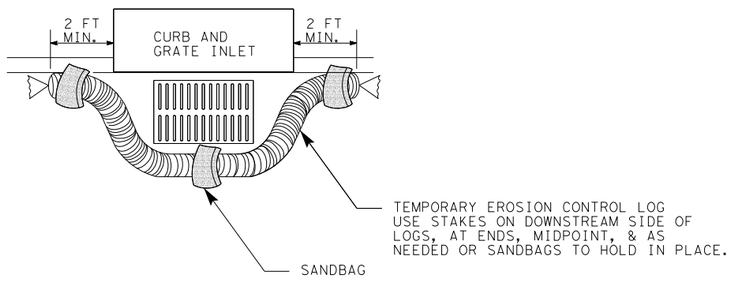
CL-CI



EROSION CONTROL LOG AT CURB INLET

CL-CI

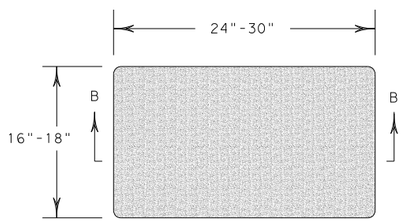
NOTE:
EROSION CONTROL LOGS USED AT CURB INLETS SHOULD ONLY BE USED IF THEY WILL NOT IMPEDE TRAFFIC OR FLOOD THE ROADWAY OR WHEN THE STORM SEWER SYSTEM IS NOT FULLY FUNCTIONAL.



EROSION CONTROL LOG AT CURB & GRADE INLET

CL-GI

SECTION B-B



SANDBAG DETAIL

SHEET 3 OF 3

Texas Department of Transportation

Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

EROSION CONTROL LOG

EC(9)-16

FILE: ec916	DN: TxDOT	CK: KM	DW: LS/PT	CK: LS		
© TxDOT: JULY 2016	CONT	SECT	JOB		HIGHWAY	
REVISIONS	0923	17	086		CR 4981	
	DIST	COUNTY			SHEET NO.	
	BWD	COMANCHE			52	