INDEX OF SHEETS

STATE OF TEXAS
DEPARTMENT OF TRANSPORTATION

PLANS OF PROPOSED STATE HIGHWAY IMPROVEMENT

PROJECT NO.: C 2038-1-31

BELL COUNTY

FM 2115

	CSJ 2038-01-031		PROJECT NET	
ROADWAY:	FT= 30,184.0	MI.= 5.716	FT= 30,184.0	MI.= 5.716
BRIDGE:	FT= 140.0	MI.= 0.027	FT= 140.0	MI.= 0.027
TOTAL:	FT= 30,324.0	MI.= 5.743	FT= 30,324.0	MI.= 5.743

CSJ 2038-01-031 LIMITS: FROM IH 35 TO FM 487

FOR THE CONSTRUCTION OF RESTORATION OF EXISTING ROAD
CONSISTING OF REHABILITATE AND WIDEN SHOULDERS

DESIGN	FED.RD. DIV.NO.	PROJECT NO.		HIGHWAY NO.
GRAPHICS	6	C 2038-1-31		FM 2115
	STATE	DISTRICT	COUNTY	SHEET NO.
CHECK	TEXAS	WACO	BELL	1
	CONTROL	SECTION	JOB	
CHECK	2038	01	031	

DESIGN SPEED = 30 MPH

YEAR	ADT
2021	580
2041	890

BEGIN PROJECT
FM 2115 @ IH 35
CSJ: 2038-01-031
09+78.75

END PROJECT
FM 2115 @ FM 487
CSJ: 2038-01-031
313+02.77

EXCEPTIONS: NONE
EQUATIONS: NONE
RR CROSSINGS: NONE
SCALE: 1"=7,500'

SPECIFICATIONS ADOPTED BY THE TEXAS DEPARTMENT OF TRANSPORTATION, NOVEMBER 1, 2014 AND SPECIFICATION ITEMS LISTED AND DATED AS FOLLOWS, SHALL GOVERN ON THIS PROJECT: SPECIAL LABOR PROVISIONS FOR STATE PROJECTS (000---008).

Texas Department of Transportation

Recommended for Letting 10/24/2021
Stephen Michael Kasberg P.E.
Area Engineer

Recommended for Letting 11/22/2021
Director of Transportation Planning & Development

Approved for Letting 11/22/2021
DocuSigned by:
Stanley Swiatek
B69BD796DD564C9...

NODE

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

STATE OF TEXAS
BRADLEY MAYES
128276
LICENSED
PROFESSIONAL ENGINEER

Bradley Mayes 8/28/2021
SIGNATURE OF REGISTRANT & DATE

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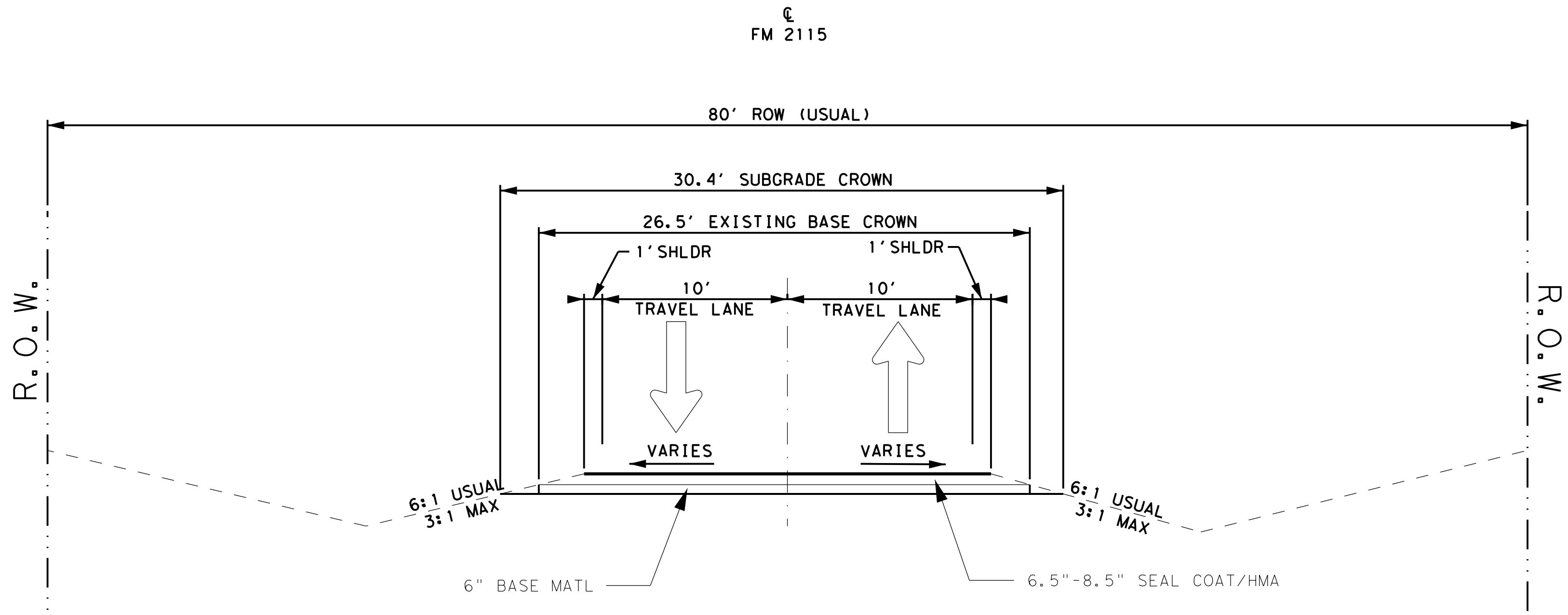
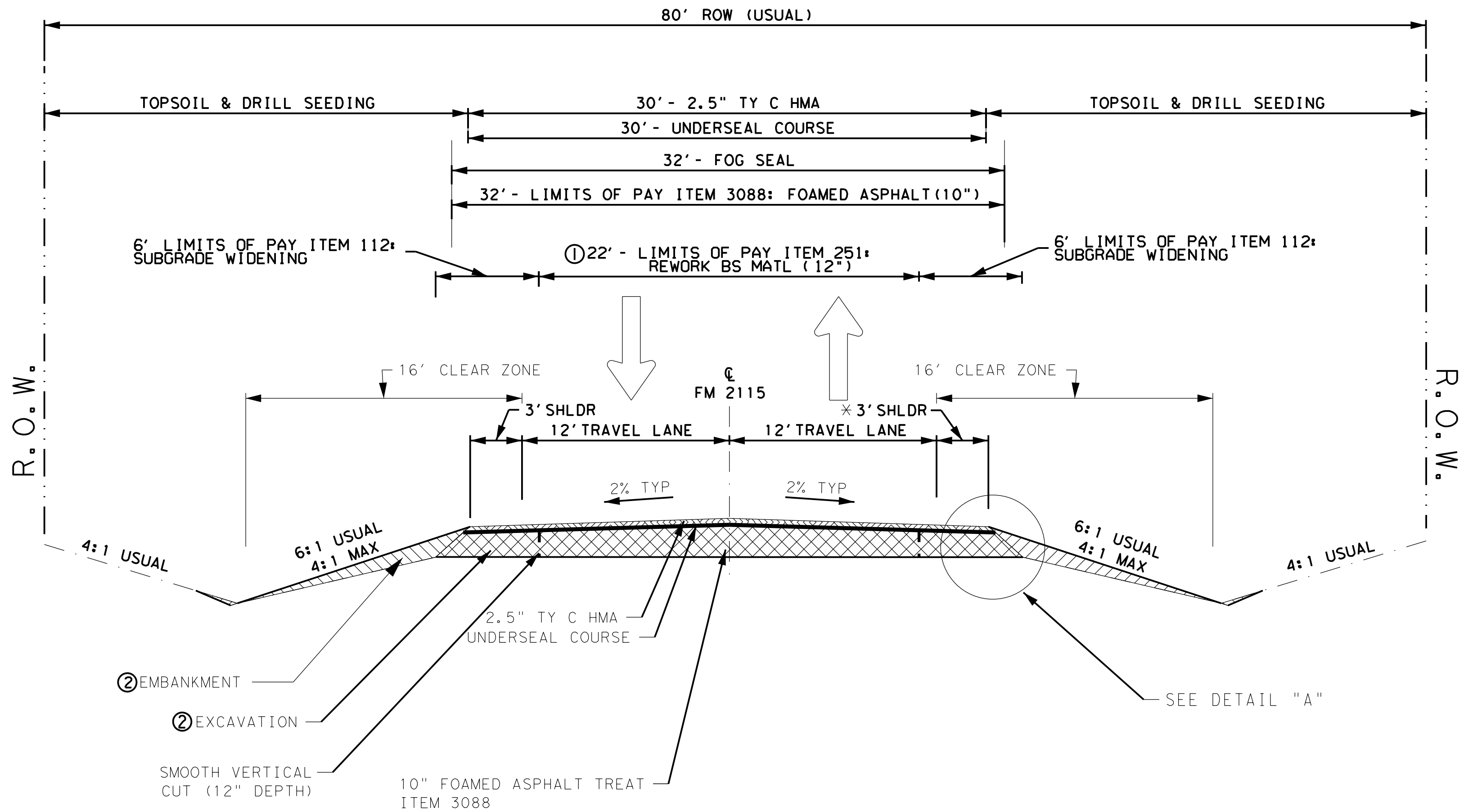
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		2



EXISTING TYPICAL SECTION

STA 10+13.07 TO STA 313+05.25



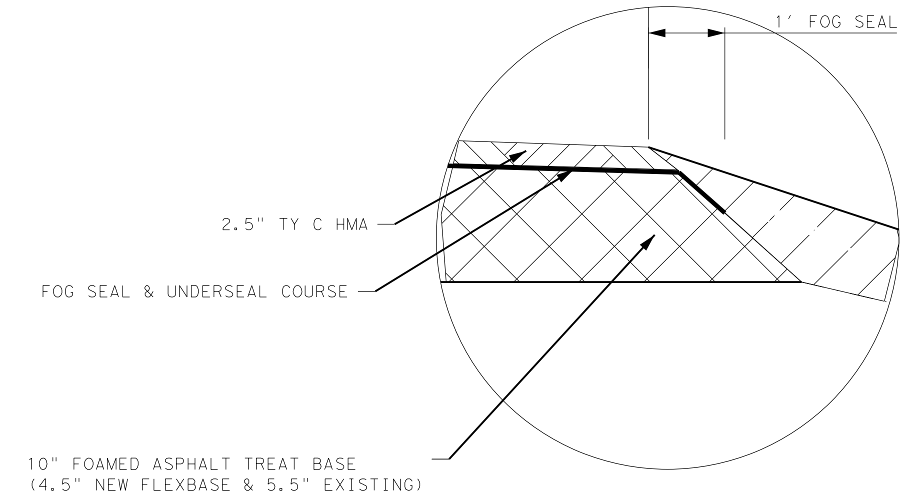
PROPOSED TYPICAL SECTION

STA 10+13.07 TO STA 313+05.25

NOTES:

① WHEN ENCOUNTERING VARYING DEPTHS OF HMA PATCHES AND SEAL COATS, PULVERIZE IN PLACE AND INCORPORATE INTO THE BASE.

② EXCAVATION AND EMBANKMENT WITHIN THE 6' OF SUBGRADE WIDENING ARE FOR CONTRACTOR'S INFORMATION ONLY. THEY ARE PAID FOR UNDER ITEM 112 "SUBGRADE WIDENING".



DETAIL "A"

* 4' SHOULDER SECTION FROM STA 24+00.00 TO STA 27+65.15 QUANTITIES IN SECTION TO BE ADJUSTED TO MATCH.

STATE OF TEXAS
BRADLEY MAYES
128276
LICENSED
PROFESSIONAL ENGINEER

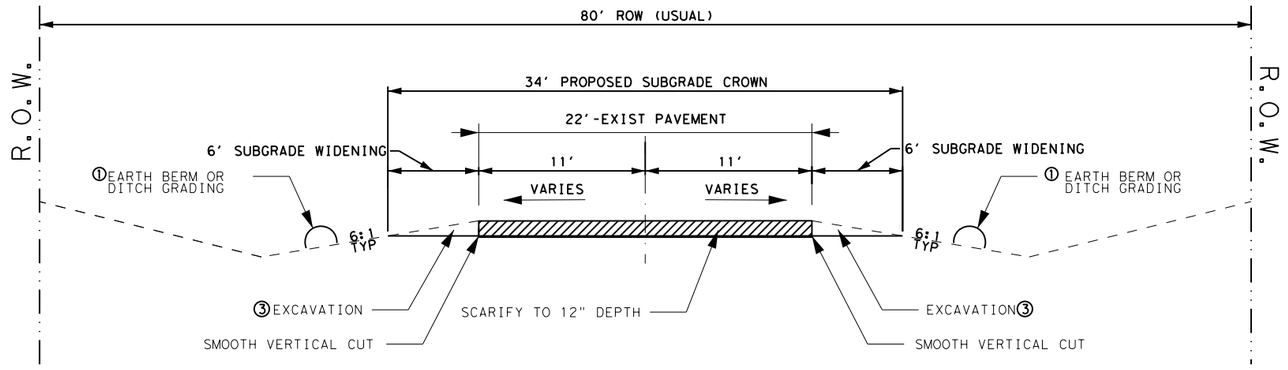
Bradley Mayes 8/28/2021

SIGNATURE OF REGISTRANT & DATE

TYPICAL SECTIONS

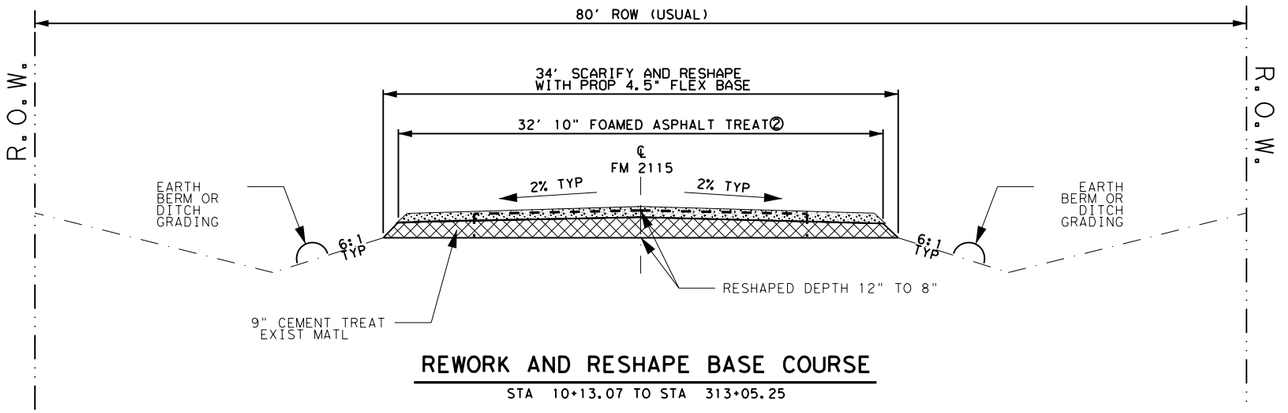
SCALE: FEET
1" = 10' HORIZ.

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		3



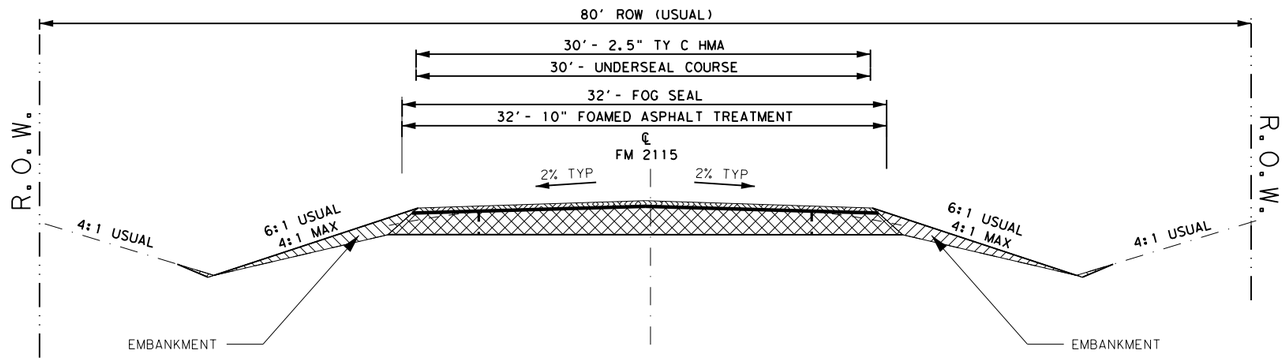
SUBGRADE WIDENING

STA 10+13.07 TO STA 313+05.25



REWORK AND RESHAPE BASE COURSE

STA 10+13.07 TO STA 313+05.25



FOAM ASPH TREAT, OVERLAY, UNDERSEAL COURSE, EMBANKMENT/EXCAVATION, BACKFILL

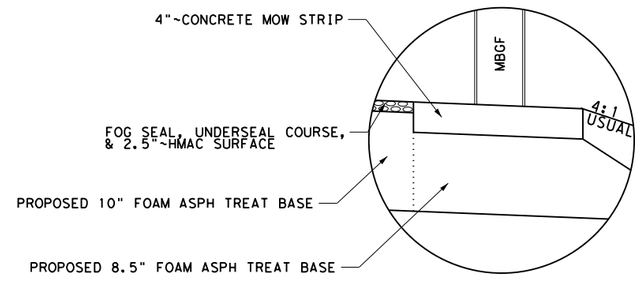
STA 10+13.07 TO STA 313+05.25

NOTES:

① FURNISHING AND PLACING TOPSOIL (4"). EXISTING TOPSOIL SHALL BE REMOVED TO A DEPTH OF 4" AND WINROWED OUTSIDE OF THE WORK AREA CREATING A BERM, AND THEN RETURNED TO SLOPES UPON COMPLETION OF ROADWAY WIDENING.

② FOAMED ASPHALT TREAT 4.5" FLEX BASE WITH THE TOP 5.5" OF EXISTING MATERIAL MIXED INTO HOMOGENEOUS STRUCTURE.

③ EXCAVATION AND EMBANKMENT WITHIN THE 6' OF SUBGRADE WIDENING ARE FOR CONTRACTOR'S INFORMATION ONLY. THEY ARE PAID FOR UNDER ITEM 112 "SUBGRADE WIDENING".



MOW STRIP DETAIL

STATE OF TEXAS
BRADLEY MAYES
128276
LICENSED
PROFESSIONAL ENGINEER

Bradley Mayes 8/28/2021

SIGNATURE OF REGISTRANT & DATE

SEQUENCE OF WORK

SCALE: 1" = 10' FEET HORIZ.

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		4

BASIS OF ESTIMATE TABLES

Table 1: Basis of Estimate for Erosion Control Items

Item	Description	Rate	Basis	Quantities
*166	FERTILIZER			
	FERTILIZER (20-10-10) (PERMANENT)	300 LBS / AC	37.3 AC	5.6 TON
	FERTILIZER (20-10-10) (TEMPORARY)	300 LBS / AC	37.3 AC	5.6 TON
168	VEGETATIVE WATERING			
	(3 APPLICATIONS - PERM)	13,100 GAL/AC/APP	37.3 AC	1,469 MG
	(3 APPLICATIONS - TEMP)	13,100 GAL/AC/APP	37.3 AC	1,469 MG

Table 2: Basis of Estimate for Base Work

Item	Description	Rate	Basis	Quantities
*216	PROOF ROLLING			
	PROOF ROLLING	8 HR /ROADBED-MILE	6 HR ROADBED-MILE	48 HR
247	FLEXIBLE BASE			
	(TY D GR 5 FNAL POS)	138 LB/CF	368,712 CF	13,656 CY *25,441 TON
315	FOG SEAL			
	FOG SEAL (SS-1)	0.10 GAL / SY	108,271 SY	10,835 GAL

* FOR CONTRACTOR'S INFORMATION ONLY

Table 3: Basis of Estimate for Foamed Asphalt Treatment

Item	Description	Rate	Basis	Quantities
3088	**FULL DEPTH RECLAMATION USING FOAMED ASPHALT (ROAD-MIXED)**			
	CEMENT (1.50%)	1.863 LB / SY / IN	108,271 SY	1,017 TON
	ASPHALT BINDER (2.50%)	3.105 LB / SY / IN	108,271 SY	1,689 TON

Table 4: Basis of Estimate for Asphalt Pavements

Item	Description	Rate	Basis	Quantities
3076	**DENSE-GRADED HOT MIX ASPHALT**			
	TY-C PG 64-22 (2.5")	110 LB / SY / IN	101,538 SY	13,965 TON

Table 5: Basis of Estimate for Interlayer Material

Item	Description	Rate	Basis	Quantities
3085	**UNDERSEAL COURSE**	**0.25 GAL / SY**	**101,538 SY**	**25,389 GAL**
	FOR CONTRACTORS INFORMATION			
	SPRAY APPLIED MEMBRANE	0.25 GAL / SY	101,538 SY	25,389 GAL
	TRAIL	0.20 GAL / SY	101,538 SY	20,308 GAL
	ASPH (AC-15P, AC-20XP, AC10-2TR, AC-12-5TR)	0.25 GAL / SY	101,538 SY	25,389 GAL
	AGGR (TY-PD GR-5 OR TY-PL GR-5) (SAC-B)	1 CY / 150 SY	101,538 SY	677 CY

GENERAL

The construction, operation and maintenance of the proposed project will be consistent with the state implementation plan as prepared by the Texas Commission on Environmental Quality.

The disturbed area for this project, as shown on the plans is 37.3 acres. However, the Total Disturbed Area (TDA) will establish the required authorization for storm water discharges. The TDA of this project will be determined by the sum of the disturbed area in all project locations in the contract, and all disturbed area on all Project-Specific Locations (PSL) located in the project limits and/or within 1 mile of the project limits. The department will obtain an authorization to discharge storm water from the Texas Commission on Environmental Quality (TCEQ) for the construction site as shown on the plans, according to the TDA of the project. The contractor will obtain any required authorization from the TCEQ for the discharge of storm water from any PSL for construction support activities on or off of the project row according to the TDA of the project. When the TDA for the project exceeds 1 acre, provide a copy of the appropriate application of permit (NOI, or Construction Site Notice) to the engineer, for any PSL located in the project limits or within 1 mile of the project limits. Follow the directives and adhere to all requirements set forth in the TCEQ, Texas Pollution Discharge Elimination System, Construction General Permit (TPDES, CGP).

Contractor questions on this project are to be emailed to the Waco District at the following address:

Bill Compton - Wacoprebid@txdot.gov, 254-867-2707, 100 S. Loop Dr., Waco, TX
Carmen Chau - Wacoprebid@txdot.gov, 254-867-2794, 100 S. Loop Dr., Waco, TX

Or Via phone or in person to the following individual(s):
Area Engineer's: Stephen Kasberg, 254-405-2684
Assistant Area Engineer's: Michael Yates, 254-346-0259

All contractor questions will be reviewed by the Area Engineer or Assistant Area Engineer. Once a response is developed, it will be posted to TxDOT's Public FTP at the following Address:
https://ftp.dot.state.tx.us/pub/txdot-info/Pre-Letting%20Responses/

All questions submitted that generate a response will be posted through this site. The site is organized by District, Project Type (Construction or Maintenance), Letting Date, CCSJ/Project Name.

Paper copies of cross-sections may be produced by using the provided .pdf file located on the above FTP Website at the bidders' expense and at copying companies. This data is for non-construction purposes only and it is the responsibility of the prospective bidder to validate the enclosed data with appropriate plans, specifications and estimate for the project(s).

GENERAL NOTES

The following standard detail sheets have been modified:

SETP-CD (MOD)

ITEM 5: CONTROL OF THE WORK

Submit all fabrication and shop drawings per TxDOT's online shop drawing submittal system and copy the Area Engineer on the email submittal, unless otherwise directed.

Where a precast or cast-in-place concrete element is shown in the plans, Contractor may submit a precast concrete alternate in accordance with "Standard Operating Procedure for Alternate Precast Proposal Submission" found online at:
https://www.txdot.gov/inside-txdot/forms-publications/consultants-contractors/publications/bridge.html#design.
Acceptance or denial of an alternate is at the sole discretion of the Department. Contractor is responsible for impacts to the project schedule and cost resulting from the use of alternates.

ITEM 6: CONTROL OF MATERIALS

References to manufacturer's trade name or catalog numbers are for the purpose of identification only and the contractor will be permitted to furnish like materials of other manufacturers provided they are of equal quality and comply with specifications for this project.

ITEM 7: LEGAL RELATIONS AND RESPONSIBILITIES

No significant traffic generator events identified.

If utilizing private property for waste disposal sites, field office sites, equipment storage sites or for any other purpose involved with this project, provide to the Engineer written proof of the property owner's approval of the use of this property. This proof may be in the form of a letter or agreement signed by the property owner or other documents acceptable to the Engineer.

Personal vehicles of the contractor's employees will not be parked within the right of way at any time including any section closed to public traffic, unless the vehicle is being utilized for construction procedures. However, the contractor's employees may park on the right of way at the sites where the contractor has his office, equipment and materials storage yard.

The contractor is alerted to the possible presence of swallows under the existing bridges or culverts. Because the migratory bird treaty act prohibits harm to swallows, their eggs or their nestlings, the contractor will not begin potentially disturbing activities on or near the bridge until the birds have abandoned any occupied nests (approximately September 1). Active nests may not be removed regardless of the date.

Prior to the swallows returning to the nests (approximately March 1), abandoned nests will be removed from the bridge. The contractor will prevent the establishment of new nests on any portion of the structure. Methods for preventing the establishment of new nests must be approved by the project Engineer. Examples of acceptable nest prevention methods are bird-deterrent netting and bird-repelling sprays and/or gels to be applied to the structure. This work will not be paid for directly, but will be subsidiary to the various bid items.

The Contractor will submit detailed site-specific plans for work in each "water of the United States" designated on the EPIC sheet. These plans must be approved by the TxDOT Engineer prior to starting any work in these areas. The plans must also describe facilities and work activities adjacent the Ordinary High-Water Marks. The plan must show actual dimensions and materials for:

- Proposed construction roads and work areas leading to or in close proximity to the Ordinary High-Water Marks
- Temporary material or equipment storage areas in close proximity to the Ordinary High-Water Marks
- Locations of proposed sediment and erosion control devices
- Identification of construction equipment and construction techniques to accomplish the work

Once this drawing and supporting information is reviewed and approved by TxDOT, all construction workers should be made aware of the limits designated on the drawings by the Contractor's supervision. Work in all waters of the US will be limited to the minimum necessary required to construct the bridge, culvert or roadway fills. Work will also include all activities needed for bridge and culvert demolitions. Working or disturbing soil in the stream channel outside the limits of the work plan will not be allowed. Orange fencing will be provided and maintained to establish the TxDOT approved boundaries in which work may be conducted between the Ordinary

High-Water Marks. Orange fencing will not be paid for but will be considered subsidiary to Item 502, “Barricades, Signs and Traffic Handling”.

Law Enforcement Personnel.
Submit charge summary and invoices using the Department forms.

Patrol vehicles must be clearly marked to correspond with the officer’s agency and equipped with appropriate lights to identify them as law enforcement. For patrol vehicles not owned by a law enforcement agency, markings will be retroreflective and legible from 100 ft. from both sides and the rear of the vehicle. Lights will be high intensity and visible from all angles.

No payment will be made for law enforcement personnel needed for moving equipment or payment for drive time to/from the event site. A minimum number of hours is not guaranteed. Payment is for work performed. If the Contractor has a field office, provide an office location for a supervisory officer when event requires a supervising officer. This work is subsidiary.

A maximum combined rate of $65 per hour for the law enforcement personnel and the patrol vehicle will be allowed. Any scheduling fee is subsidiary per Standard Specification 502.4.2.

Cancel law enforcement personnel when the event is canceled. Cancellation, minimums or “show up” fees will not be paid when cancellation is made 12 hours prior to beginning of the event. Failure to cancel within 12 hours will not be cause for payment for cancellation, minimums, or "show up" time. Payment of actual “show up” time to the event site due to cancellation will be on a case by case basis at a maximum of 2 hours per officer.

Alterations to the cancellation and maximum rate must be approved by the Engineer or pre-determined by official policy of the officers governing authority.

ITEM 8: PROSECUTION AND PROGRESS

This Project will be a Standard Workweek in accordance with Article 8.3.1.4.

Nighttime work is allowed in accordance with Article 8.3.3.

Meet weekly or at intervals as agreed upon with the engineer to notify him or her of planned work for the upcoming 3-week period.

For this project, provide a Bar Chart progress schedule.

ITEM 100: PREPARING RIGHT OF WAY

The limits of preparing right of way will be measured as shown on the SW3P layout sheets.

Remove the existing roadway delineators and object markers as shown on the plans, or as directed, during construction within the right of way. Delineator and object marker removals are subsidiary to this Item.

ITEM 110: EXCAVATION

In a cut section, when soils are encountered at subgrade depths that are unstable and are deemed unsuitable by the Engineer, undercut this material for a minimum depth of one (1.0) foot below the maximum depth as determined and replace with a material having a plasticity index less than 25 and a liquid limit of less than 50.

ITEMS 110 & 132: EXCAVATION & EMBANKMENT

Excavation and embankment for driveways, sleeper slabs, alleys and intersections will not be paid for directly, but will be considered subsidiary to these items.

In those cases where fixed features require, the governing slopes indicated herein and on the cross sections may be varied between the limits and to the extent determined.

ITEM 132: EMBANKMENT

Excavated material from the project site has not been determined to be suitable for embankment. The bidder assumes all risk for the use of excavated materials for embankment and is expected to meet all material requirements for embankment regardless of the source.

Perform Tex-106-E (Plasticity Index) by an approved laboratory on excavated soils from sources outside right of way when used in roadway embankment. Provide the test results at no expense to the department. The engineer will sample and test soils produced by the construction project for specification requirements or material sources specified in the plans.

ITEM 160: TOPSOIL

Salvage the existing topsoil from the cut/fill areas. Topsoil not stored in small windrows will be stockpiled in locations with heights no greater than four (4) feet and dumped loose from Contractor equipment. The Contractor will minimize topsoil compaction and limit equipment being driven over stockpiled topsoil.

Additional Topsoil will come from approved sources outside of the ROW. Topsoil must come from a location within six (6) inches of the natural ground surface to ensure it contains nutrients and is not sterile soil. Off ROW topsoil will contain a minimum organic content of three & one-half (3.5%) percent, based on soil test results.

ITEM 164: SEEDING FOR EROSION CONTROL

Temporary seeding mixtures (cool and warm) will also include three (3) lbs of Bermuda grass seed per acre, with all seeds being planted concurrently.

Contractor will mow or disc wheat and or oats in spring prior to vegetation going to seed.

Permanent seed mixes for both urban and rural projects including sand or clay soils in the Waco District will be bid and installed to include a minimum of one & one-half (1.5) pounds per acre Green Sprangletop seed and four (4) pounds per acre Bermudagrass seed, with other seed types also being included and quantities remaining unchanged.

ITEM 169: SOIL RETENTION BLANKETS:

Hydraulically apply Flexterra FGM, CocoFlex ET-FGM, Earth Guard or other spray applied soil retention as approved by the Engineer for erosion control on the specified slopes or areas in the construction plan. Apply as required per manufacturer's recommendations.

Use Tables under Item 164 to determine type of seeds to be used. Water for application, seeding, labor, equipment, tools, supplies, materials, fertilizer and incidentals will not be paid for directly but will be subsidiary to this Item.

ITEM 247: FLEXIBLE BASE

Construct uniform layer thickness of 6 inches, or less with the required density and moisture content.

Minimum PI is equal to three (3) for all grades, or a minimum Bar Linear Shrinkage of 2%.

RAP may be incorporated into flexbase material

ITEM 320: EQUIPMENT FOR ASPHALT CONCRETE PAVEMENT

Use a self-propelled wheel mounted MTV capable of receiving mix from the haul trucks, separate from the paver. It shall have a minimum storage capacity of approximately 25 tons. It shall be equipped with a pivoting discharge conveyor and shall completely and thoroughly remix the material prior to placement. The effectiveness of the MTV's remixing ability is subject to the approval of the Engineer. In addition, the paver shall have a surge storage insert with a minimum capacity of 20 tons.

The use of windrow pick-up equipment is allowed except on the first course of roadway material placed over the subgrade.

ITEM 400: EXCAVATION AND BACKFILL OF STRUCTURES

Aggregate for cement stabilized backfill will be coarse aggregates, GRADE 3, 4 or 5 and fine aggregate, as shown in Item 421, "Hydraulic Cement Concrete". The ratio of course aggregate to sand should not contain more than sixty percent (60%) sand unless otherwise approved.

CLASS B bedding is required if rock is encountered.

ITEM 440: REINFORCEMENT FOR CONCRETE

Fiber Reinforced Concrete (FRC) can be used as a substitute for Non-Structural Class Reinforced Concrete in Mow-Strip and Rip Rap Items. FRC may also be used for other Non-Structural Class Reinforced Concrete Items as approved.

ITEM 462: CONCRETE BOX CULVERTS AND DRAINS

Joints between pre-cast concrete box culverts will be pre-formed flexible joint sealants as described in Section 464.3.3, "Jointing".

For this contract the contractor may use either pre-cast or cast in place culvert construction.

Reshape embankment side slopes, provide embankment as required, and add topsoil to achieve a smooth uniform finish around the installation of the safety end treatments and culvert extensions as directed. Finishing and reshaping work will be subsidiary to Items 132, "Embankment", Item 162, "Sodding for Erosion Control", and Item 467, "Safety End Treatment".

Provide and install pneumatically placed concrete on the ditch bottom and side slopes between temporary terminations between old and new culverts. Pnuematically placed concrete will be placed to the height of the largest culvert on the ditch side slopes; and to a limit 10 feet outside the location of BMPs along the ditch bottom. Cement stabilized sand may be substituted for pneumatically placed concrete, with Engineer approval.

ITEM 464: REINFORCED CONCRETE PIPE

The concrete collars and the connections of pipes to existing or proposed concrete boxes or pipe will not be paid for directly but will be considered subsidiary to the various bid items.

ITEM 500: MOBILIZATION

Material On Hand (MOH) will not be used in calculating partial payments for Mobilization.

ITEM 502: BARRICADES, SIGNS, AND TRAFFIC HANDLING

The Contractor Force Account "Safety Contingency" that has been established for this project is intended to be utilized for work zone enhancements, to improve the effectiveness of the Traffic Control Plan, that could not be foreseen in the project planning and design stage. These enhancements will be mutually agreed upon by the Engineer and the Contractor's Responsible Person based on weekly or more frequent traffic management reviews on the project. The Engineer may choose to use existing bid items if it does not slow the implementation of enhancement.

Install traffic marking signs prior to sealcoat application and remove within three days after placement of traffic markings.

Access will be provided to all business and residences at all times. Where turning radii are limited during phased construction at intersections, provide all weather surfaces such as RAP or base in turning movements to accommodate and to protect the traffic from edge drop-offs. Materials, labor, maintenance and removal for these temporary accesses and radii will not be paid for directly but will be considered subsidiary to the various bid items.

A meeting between the contractor and Engineer to discuss upcoming changes in construction phasing and traffic switches is required at least fourteen (14) days prior to the phase change. Items to be discussed at this meeting include temporary signing, traffic control, pavement markings, the processes necessary for the phase change and subcontractor scheduling.

Provide written proposed lane closure information by 1:00 pm on the business day prior to the proposed closures. Do not close lanes when this requirement is not met.

When excavation is required next to a pavement lane carrying traffic and the widening is not completed by the end of the work day, backfill against the edge of the pavement with at least a 3:1 slope using an acceptable material to support vehicular traffic. Carefully remove and dispose of this material when work resumes. Backfilling pavement edges, and the materials required for the work will be subsidiary to this item.

Place barricades and signs in locations that do not obstruct the sight distance of drivers entering the highway from driveways or side streets.

The Contractor Responsible Person(s) (CRP) for Work Zone Traffic Controls will inspect and ensure any deficiencies are corrected each and every day throughout the duration of this contract. Any misaligned or damaged traffic control devices will be repaired as soon as practical after deficiency is discovered.

In addition to providing a Contractor's Responsible Person and a phone number for emergency contact, have an employee(s) available to respond on the project for emergencies and for taking corrective measures within One (1) Hour.

ITEM 504: FIELD OFFICE

Furnish one Asphalt Mix Control Laboratory (Type D) for this project.

ITEM 506: TEMPROARY EROSION, SEDIMENTATION AND ENVIRONMENTAL CONTROLS

Take all practicable precautions to prevent debris from being discharged into the Waters of Texas or a designated wetland. Install Best Management Practices before demolition begins and maintain them during the demolition. Remove any debris or construction material that escapes containment devices and are discharged into the restricted areas, before the next rain event or within 24 hours of the discharge.

If temporary construction stream crossings are allowed under a Nationwide Permit, submit in writing for approval the type and location of each temporary stream crossing. Use temporary bridges, timber mats, or other structurally sound and non-eroding material for temporary stream crossings. A temporary culvert crossing will consist of storm sewer pipes and 4- to 8-inch nominal size rock. Temporary stream crossings must not cause more than minimal changes to the hydraulic flow characteristics of the stream, increase flooding, or cause more than minimal degradation of water quality. Remove the temporary stream crossings in their entirety and return the affected areas to their pre-existing elevation. All work and materials use for temporary construction stream crossings will not be paid for directly but are subsidiary to pertinent Items.

Provide SW3P Signs. Obtain from the Engineer a copy of the project's completed TPDES Storm Water Program Construction Site Notice and Contractor Site Notice. Laminate the sheets and bond with adhesive to 36" X 36" sign blanks. Ensure the sheets remain dry. Apply Type C Blue reflective sheeting as the background and add the text "SW3P" in 5" white lettering, centered at the top. Attach the signs to approved temporary mounts and locate at each of the project limits just inside the right of way line at a readable height or as directed by the Engineer. If the sign cannot be placed outside the clear zone, it must adhere to the TMUTCD. SW3P signs, maintenance, and reposting (for replacement or as needed to ensure readability) will be subsidiary to Item 502.

Leave all right of way areas undisturbed until actual construction is to be performed in said areas.

No soil disturbing activities will begin on any section of TxDOT ROW without adequate sedimentation controls first being installed and functioning at adjacent drainage outfalls. Begin and continuously prosecute the repairs, additions and maintenance of erosion and sedimentation control devices within seven days after the Contractor receives each Form 2118, Field Inspection and Maintenance Report, from the Engineer. Failure of the Contractor to fulfill either of the above requirements places TxDOT in potential non-compliance with permit requirements and may result in withholding estimates or stopping work or both until all environmental permit requirements are fulfilled.

Concrete Washouts are required per the CGP. The Concrete Washout Area(s) structural controls must consist of temporary berms, temporary shallow pits, and/or temporary storage tanks to prevent contaminated runoff and must be lined as to prevent contamination of underlying soil. Ensure pits properly maintained including removal of concrete as not to allow over flow. The location(s) of washout area will be approved by the Engineer. When washout pits are no longer needed, they will be removed and area will be restored to original condition. This work, materials and labor will not be measured or paid for directly but will be subsidiary to Item 506, "Temporary Erosion, Sedimentation, and Environmental Controls."

Cleaning and sweeping of open roadways due to material spillage or loss from Contractor equipment or tires will be the responsibility of the Contractor at no cost to TxDOT. This work will not be charged as Item 738, “Cleaning and Sweeping Highways”. Cleaning and sweeping of roadways will be completed as directed, including multiple times per day if necessary, to maintain acceptable roadways for the traveling public and to meet environmental regulations. Construction activities will cease when material deposited on the roadway is not properly removed or when equipment is not available as needed. Adequate construction exits will be planned, constructed and maintained by the Contractor per Item 506, “Temporary Erosion, Sedimentation, and Environmental Controls”.

ITEM 510: ONE-WAY TRAFFIC CONTROL

Provide portable signals from pre-qualified manufactures on the TxDOT Work Zone Compliant List.

ITEM 540: METAL BEAM GUARD FENCE

Furnish one type of post throughout the project except as specifically noted in the plans.

Wooden block out will not be allowed.

ITEMS 542 & 544: REMOVING METAL BEAM GUARD FENCE & GUARDRAIL END TREATMENTS

W-Beam elements, steel posts and composite material blockouts will become the property of the contractor.

ITEM 544: GUARDRAIL END TREATMENTS

The use of wooden block-outs will not be allowed.

ITEM 560: MAILBOX ASSEMBLIES

Mailboxes will be kept in a position accessible to the carrier’s vehicle along the travel way except when performance of grading operations necessitates the moving of mailboxes. When grading operations necessitate the moving of mailboxes, the contractor will place them at a nearby location which will be accessible to the carrier’s vehicle. Mailboxes will be returned to a position accessible to the carrier’s vehicle along the travel way when grading operations are not in progress. This work will not be paid for directly, but will be subsidiary to Item 560, “Mailbox Assemblies”.

ITEM 585: RIDE QUALITY FOR PAVEMENT SURFACES

Use Surface Test Type A on all intersections and driveways.

Use Surface Test Type B pay adjustment schedule _2_ on the travel lanes.

Milling will not be allowed as a corrective action for excessive deviations in the surface layer.

ITEM 636: SIGNS

Verify all dimensions at the actual proposed sign location in order to maintain dimensions as shown on the Sign Mounting Details.

Stake the location of the new signs to be approved.

ITEM 644: SMALL ROADSIDE SIGN ASSEMBLIES

Bolt Clamp type will be used on Texas Triangular Slip Base System.

As practical with new construction, leave the existing sign assemblies in place until the proposed foundation, post and sign are in installed, and then remove the old sign assemblies.

Do not leave any sign foundation holes open overnight. Ensure all holes drilled are at least the minimum required depth with no loose material remaining in the hole.

Stake proposed sign locations and receive approval before installation of sign foundations.

Existing Mile Markers Signs are to be relocated to their original location(s) as they were prior to the beginning of the project.

Expanded foam foundations are not permitted.

Cut the bottom of all posts square.

For sign types which design details are not shown on these plans, fabricate according to the “STANDARD HIGHWAY SIGN DESIGNS FOR TEXAS”.

Removed material that is deemed salvageable (signs and posts) will be the property of TxDOT. Deliver salvageable material to the TxDOT Maintenance Office. Remove unsalvageable material.

The Contractor will relocate the existing double sided street name signs and furnish the post mounted brackets for the street name signs to be paid for as part of the proposed Stop Signs (R1-1). Existing street name signs will be mounted above Stop signs. If damaged while being relocated, the Contractor will furnish new double sided street name sign at their own expense.

ITEM 658: DELINEATOR AND OBJECT MARKER ASSEMBLIES

All flexible and GF2 delineators will have a tubular body.

ITEM 662: WORK ZONE PAVEMENT MARKINGS

Paint and beads may be used for non-removable pavement markings.

ITEM 666: RETROREFLECTORIZED PAVEMENT MARKINGS

The Contractor will layout the proposed striping in accordance with TxDOT Traffic Control Plan Standards and latest version Texas Manual on Uniform Traffic Control Devices (TMUTCD) and project striping layout sheets. The Engineer will verify proposed striping layout prior to the beginning of striping operations.

The Contractor will locate the beginning and ending points of No Pass Zones.

ITEM 672: RAISED PAVEMENT MARKERS

Existing raised pavement markers to be replaced will be removed at the same time that the new markers are placed (i.e. remove and replace in one operation). Existing raised pavement markers replaced by new markers will be removed in accordance with Item 677, “Eliminating Existing Pavement Markings and Markers”. Immediately fill the damaged area in the pavement due to the removal of existing markers with an approved bituminous material. This removal and backfill work will not be paid for directly, but will be subsidiary to Item 672, "Raised Pavement Markers".

ITEM 3076: DENSE-GRADED HOT-MIX ASPHALT

Design for a target Laboratory-molded density of 97.0% when using the Texas Gyratory Compactor (TGC) (Tex-204-F, Part I).

Use aggregate that meets the Surface Aggregate Classification (SAC) requirement of Class B.

Maximum stripping of 0% is required.

RAP from Contractor owned sources may be used if the RAP is fractionated.

ITEM 6001: PORTABLE CHANGEABLE MESSAGE SIGN

This project will require “full matrix” type portable changeable message signs.

Ensure that the Contractor’s Responsible Person for traffic control can revise messages within thirty (30) minutes of notification.

Furnish two (2) portable changeable message signs. The portable changeable message sign(s) will be used for all lane closures and freeway closures as shown on the traffic control plan standard sheets.

Supply portable changeable message sign(s) in accordance with the Traffic Control Plan standard sheets and Article 6f.55 of the Texas Manual on Uniform Traffic Control Devices for Streets and Highways Part VI.

ITEM 6185: TRUCK MOUNTED ATTENUATORS

The total number of truck mounted attenuators (TMA) required when utilizing the traffic control standards are shown in the tables below.

TCP 1 Series	Scenario		Required TMA	
(1-1)-18 / (1-2)-18			1	
(1-3)-18	A	B	1	2
(1-6)-18			1	

TCP 2 Series	Scenario		Required TMA	
(2-1)-18 / (2-2)-18	All		1	
(2-3)-18	A	B	1	2

TCP 3 Series	Scenario			Required TMA
(3-1)-13	All			2
(3-3)-14	A	B	D	2
	C			3
(3-4)-13	All			1, unless working inside a twltl, then 2.

Shadow vehicles equipped for truck mounted attenuators (TMA) for stationary operations will be paid for by the day and must be available for use at any time as determined by the Engineer.

Mobile operations will be paid for by the hour, per specifications. For mobile operations, payment will be made only while the TMA is in use.

For mobile operations requiring multiple TMA’s, judgement may be applied in lower speed, urban / in town traffic environments to reduce the numbers of TMA in use where the added TMA may pose a hazard for traffic entering and exiting driveways, side streets, etc.

The contractor will be responsible for determining if one or more of these operations will be ongoing at the same time to determine the total number of TMA needed for the project for those times per plan requirements. Additional TMAs used that are not specified in the plans in which the contractor expects compensation will require prior approval from the Engineer.

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 2038-01-031 **DISTRICT** Waco **COUNTY** Bell
HIGHWAY FM 2115

				CONTROL SECTION JOB	2038-01-031		TOTAL EST.	TOTAL FINAL
				PROJECT ID	A00004449			
				COUNTY	Bell			
				HIGHWAY	FM 2115			
ALT	BID CODE	DESCRIPTION	UNIT		EST.	FINAL		
	100-6002	PREPARING ROW	STA		15.000		15.000	
	104-6054	REMOVING CONCRETE(MOW STRIP)	LF		753.000		753.000	
	110-6001	EXCAVATION (ROADWAY)	CY		7,472.000		7,472.000	
	112-6001	SUBGRADE WIDENING (ORD COMP)	STA		305.000		305.000	
	132-6004	EMBANKMENT (FINAL)(DENS CONT)(TY B)	CY		18,351.000		18,351.000	
	160-6003	FURNISHING AND PLACING TOPSOIL (4")	SY		180,418.000		180,418.000	
	164-6035	DRILL SEEDING (PERM) (RURAL) (CLAY)	SY		180,418.000		180,418.000	
	164-6051	DRILL SEED (TEMP)(WARM OR COOL)	SY		180,418.000		180,418.000	
	168-6001	VEGETATIVE WATERING	MG		2,937.000		2,937.000	
	169-6001	SOIL RETENTION BLANKETS (CL 1) (TY A)	SY		2,500.000		2,500.000	
	216-6001	PROOF ROLLING	HR		48.000		48.000	
	247-6393	FL BS (RDWY DEL)(TY D GR 5)(FNAL POS)	CY		13,656.000		13,656.000	
	251-6273	REWORK BS MTL (TY C)(12")(ORD COMP)	SY		74,050.000		74,050.000	
	315-6001	FOG SEAL (SS-1)	GAL		10,835.000		10,835.000	
	400-6005	CEM STABIL BKFL	CY		451.000		451.000	
	400-6006	CUT & RESTORING PAV	SY		336.000		336.000	
	402-6001	TRENCH EXCAVATION PROTECTION	LF		221.000		221.000	
	403-6001	TEMPORARY SPL SHORING	SF		5,782.000		5,782.000	
	432-6002	RIPRAP (CONC)(5 IN)	CY		275.000		275.000	
	432-6033	RIPRAP (STONE PROTECTION)(18 IN)	CY		446.000		446.000	
	432-6045	RIPRAP (MOW STRIP)(4 IN)	CY		198.000		198.000	
	462-6007	CONC BOX CULV (5 FT X 3 FT)	LF		104.000		104.000	
	462-6010	CONC BOX CULV (6 FT X 3 FT)	LF		136.000		136.000	
	462-6051	CONC BOX CULV (5 FT X 3 FT)(EXTEND)	LF		60.000		60.000	
	462-6060	CONC BOX CULV (7 FT X 5 FT)(EXTEND)	LF		39.000		39.000	
	462-6065	CONC BOX CULV (8 FT X 6 FT)(EXTEND)	LF		94.000		94.000	
	462-6077	CONC BOX CULV (10 FT X 9 FT)(EXTEND)	LF		28.000		28.000	
	464-6005	RC PIPE (CL III)(24 IN)	LF		310.000		310.000	
	464-6007	RC PIPE (CL III)(30 IN)	LF		300.000		300.000	
	464-6008	RC PIPE (CL III)(36 IN)	LF		261.000		261.000	
	466-6097	HEADWALL (CH - PW - 0) (DIA= 24 IN)	EA		3.000		3.000	
	466-6099	HEADWALL (CH - PW - 0) (DIA= 30 IN)	EA		2.000		2.000	
	466-6101	HEADWALL (CH - PW - 0) (DIA= 36 IN)	EA		1.000		1.000	
	466-6171	WINGWALL (PW - 1) (HW=10 FT)	EA		1.000		1.000	
	466-6172	WINGWALL (PW - 1) (HW=11 FT)	EA		1.000		1.000	
	466-6174	WINGWALL (PW - 1) (HW=13 FT)	EA		2.000		2.000	
	466-6179	WINGWALL (PW - 1) (HW=4 FT)	EA		1.000		1.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 2038-01-031 **DISTRICT** Waco **COUNTY** Bell
HIGHWAY FM 2115

			CONTROL SECTION JOB		**2038-01-031**	TOTAL EST.	TOTAL FINAL
			PROJECT ID		**A00004449**		
			COUNTY		**Bell**		
			HIGHWAY		**FM 2115**		
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	466-6180	WINGWALL (PW - 1) (HW=5 FT)	EA	1.000		1.000	
	466-6181	WINGWALL (PW - 1) (HW=6 FT)	EA	1.000		1.000	
	466-6182	WINGWALL (PW - 1) (HW=7 FT)	EA	2.000		2.000	
	466-6184	WINGWALL (PW - 1) (HW=9 FT)	EA	3.000		3.000	
	467-6177	SET (TY I)(S= 5 FT)(HW= 4 FT)(4:1) (C)	EA	4.000		4.000	
	467-6363	SET (TY II) (18 IN) (RCP) (6: 1) (P)	EA	60.000		60.000	
	467-6390	SET (TY II) (24 IN) (RCP) (4: 1) (C)	EA	6.000		6.000	
	467-6395	SET (TY II) (24 IN) (RCP) (6: 1) (P)	EA	16.000		16.000	
	467-6419	SET (TY II) (30 IN) (RCP) (4: 1) (C)	EA	9.000		9.000	
	467-6422	SET (TY II) (30 IN) (RCP) (6: 1) (C)	EA	1.000		1.000	
	467-6423	SET (TY II) (30 IN) (RCP) (6: 1) (P)	EA	14.000		14.000	
	467-6450	SET (TY II) (36 IN) (RCP) (4: 1) (C)	EA	7.000		7.000	
	496-6007	REMOV STR (PIPE)	LF	2,310.000		2,310.000	
	500-6001	MOBILIZATION	LS	1.000		1.000	
	502-6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	7.000		7.000	
	506-6002	ROCK FILTER DAMS (INSTALL) (TY 2)	LF	810.000		810.000	
	506-6011	ROCK FILTER DAMS (REMOVE)	LF	810.000		810.000	
	506-6021	CONSTRUCTION EXITS (INSTALL) (TY 2)	SY	1,780.000		1,780.000	
	506-6024	CONSTRUCTION EXITS (REMOVE)	SY	1,780.000		1,780.000	
	506-6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	8,687.000		8,687.000	
	506-6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	8,687.000		8,687.000	
	510-6003	ONE-WAY TRAF CONT (PORT TRAF SIG)	MO	7.000		7.000	
	530-6002	INTERSECTIONS (ACP)	SY	2,404.000		2,404.000	
	530-6004	DRIVEWAYS (CONC)	SY	397.000		397.000	
	530-6005	DRIVEWAYS (ACP)	SY	4,994.000		4,994.000	
	533-6002	RUMBLE STRIPS (CENTERLINE)	LF	30,292.000		30,292.000	
	540-6002	MTL W-BEAM GD FEN (STEEL POST)	LF	2,287.500		2,287.500	
	540-6016	DOWNSTREAM ANCHOR TERMINAL SECTION	EA	1.000		1.000	
	542-6001	REMOVE METAL BEAM GUARD FENCE	LF	612.500		612.500	
	544-6001	GUARDRAIL END TREATMENT (INSTALL)	EA	19.000		19.000	
	544-6003	GUARDRAIL END TREATMENT (REMOVE)	EA	4.000		4.000	
	552-6001	WIRE FENCE (TY A)	LF	201.000		201.000	
	552-6003	WIRE FENCE (TY C)	LF	133.000		133.000	
	560-6001	MAILBOX INSTALL-S (TWG-POST) TY 1	EA	18.000		18.000	
	560-6002	MAILBOX INSTALL-D (TWG-POST) TY 1	EA	6.000		6.000	
	560-6003	MAILBOX INSTALL-M (TWG-POST) TY 1	EA	5.000		5.000	
	644-6060	IN SM RD SN SUP&AM TYTWT(1)WS(P)	EA	37.000		37.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 2038-01-031 **DISTRICT** Waco **COUNTY** Bell
HIGHWAY FM 2115

			CONTROL SECTION JOB		**2038-01-031**	TOTAL EST.	TOTAL FINAL
			PROJECT ID		**A00004449**		
			COUNTY		**Bell**		
			HIGHWAY		**FM 2115**		
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	644-6076	REMOVE SM RD SN SUP&AM	EA	37.000		37.000	
	644-6080	RELOCATE SM RD SN SUP & AM TY TEMP	EA	37.000		37.000	
	658-6016	INSTL DEL ASSM (D-SW)SZ (BRF)GF1 (BI)	EA	31.000		31.000	
	658-6100	INSTL OM ASSM (OM-2Z)(WFLX)GND(BI)	EA	20.000		20.000	
	662-6032	WK ZN PAV MRK NON-REMOV (Y)4"(BRK)	LF	4,457.000		4,457.000	
	662-6034	WK ZN PAV MRK NON-REMOV (Y)4"(SLD)	LF	39,323.000		39,323.000	
	662-6111	WK ZN PAV MRK SHT TERM (TAB)TY Y-2	EA	3,310.000		3,310.000	
	666-6048	REFL PAV MRK TY I (W)24"(SLD)(100MIL)	LF	72.000		72.000	
	666-6303	RE PM W/RET REQ TY I (W)4"(SLD)(100MIL)	LF	60,783.000		60,783.000	
	666-6312	RE PM W/RET REQ TY I (Y)4"(BRK)(100MIL)	LF	4,457.000		4,457.000	
	666-6315	RE PM W/RET REQ TY I (Y)4"(SLD)(100MIL)	LF	39,323.000		39,323.000	
	672-6009	REFL PAV MRKR TY II-A-A	EA	724.000		724.000	
	3076-6017	D-GR HMA TY-C SAC-B PG64-22	TON	13,962.000		13,962.000	
	3085-6001	UNDERSEAL COURSE	GAL	25,389.000		25,389.000	
	3088-6001	CEMENT	TON	1,017.000		1,017.000	
	3088-6002	ASPHALT BINDER (PG 64-22)	TON	1,689.000		1,689.000	
	3088-6005	FOAMED ASPHALT TREAT (10")(DC)	SY	108,271.000		108,271.000	
	6001-6001	PORTABLE CHANGEABLE MESSAGE SIGN	DAY	60.000		60.000	
	6001-6002	PORTABLE CHANGEABLE MESSAGE SIGN	EA	2.000		2.000	
	6185-6002	TMA (STATIONARY)	DAY	24.000		24.000	
	6185-6003	TMA (MOBILE OPERATION)	HR	312.000		312.000	
	18	SAFETY CONTINGENCY: CONTRACTOR FORCE ACCOUNT WORK (PARTICIPATING)	LS	1.000		1.000	
		EROSION CONTROL MAINTENANCE: CONTRACTOR FORCE ACCOUNT WORK (PART)	LS	1.000		1.000	
1A	464-6003	RC PIPE (CL III)(18 IN)	LF	968.000		968.000	
2A	464-6085	RC PIPE (CL III) (24 IN) (ALT)	LF	280.000		280.000	
3A	464-6086	RC PIPE (CL III) (30 IN) (ALT)	LF	168.000		168.000	
3	4122-6008	THERMOPLASTIC PIPE(30 IN)(PP)(TYPE III)	LF	168.000		168.000	
2	4122-6010	THERMOPLASTIC PIPE(24 IN)(PP)(TYPE III)	LF	280.000		280.000	
1	4122-6014	THERMOPLASTIC PIPE(18 IN)(PP)(TYPE III)	LF	968.000		968.000	

SUMMARY OF ROADWAY ITEMS

LOCATION	110 6001	112 6001	132 6004	216 6001	247 6393	251 6273	315 6001	3076 6017	3085 6001	3088 6001	3088 6002	3088 6005
	EXCAVATION (ROADWAY)	SUBGRADE WIDENING (ORD COMP)	EMBANKMENT (FINAL) (DENS CONT) (TY B)	PROOF ROLLING	FL BS (RDWY DEL) (TY D GR 5) (FNAL POS)	REWORK BS MTL (TY C) (12") (O RD COMP)	FOG SEAL (SS-1)	D-GR HMA TY-C SAC-B PG64-22	UNDERSEAL COURSE	CEMENT	ASPHALT BINDER (PG64-22)	FOAMED ASPHALT TREAT (10") (DC)
	CY	STA	CY	HR	CY	SY	GAL	TON	GAL	TON	TON	SY
BEGIN - 30+00	361	21	1889	3.2	944	4858	725	936	1701	68	113	7245
30+00 - 50+00	450	20	1396	3.2	889	4889	712	917	1667	67	111	7112
50+00 - 70+00	651	20	583	3.2	904	4889	716	923	1678	67	112	7156
70+00 - 90+00	586	20	1568	3.2	912	4889	718	926	1684	67	112	7178
90+00 - 110+00	442	20	1361	3.2	889	4889	712	917	1667	67	111	7112
110+00 - 130+00	353	20	999	3.2	889	4889	712	917	1667	67	111	7112
130+00 - 150+00	552	20	711	3.2	919	4889	720	929	1689	68	112	7200
150+00 - 170+00	496	20	846	3.2	912	4889	718	926	1684	67	112	7178
170+00 - 190+00	502	20	1600	3.2	912	4889	718	926	1684	67	112	7178
190+00 - 210+00	398	20	1537	3.2	889	4889	712	917	1667	67	111	7112
210+00 - 230+00	489	20	1076	3.2	897	4889	714	920	1673	67	111	7134
230+00 - 250+00	548	20	989	3.2	889	4889	712	917	1667	67	111	7112
250+00 - 270+00	567	20	916	3.2	897	4889	714	920	1673	67	111	7134
270+00 - 290+00	430	20	1892	3.2	889	4889	712	917	1667	67	111	7112
290+00 - END	647	24	988	3.2	1025	5635	820	1057	1921	77	128	8196
PROJECT TOTALS	**7472**	**305**	**18351**	**48**	**13656**	**74050**	**10835**	**13965**	**25389**	**1017**	**1689**	**108271**

SUMMARY OF EROSION CONTROL ITEMS

LOCATION	100 6002	160 6003	164 6035	164 6051	168 6001	169 6001	506 6002	506 6011	506 6021	506 6024	506 6038	506 6039
	PREPARING ROW	FURNISHING AND PLACING TOPSOIL (4")	DRILL SEEDING (PERM) (RURAL) (CLAY)	DRILL SEED (TEMP) (WARM OR COOL)	VEGETATIVE WATERING	SOIL RETENTION BLANKETS (CL 1) (TY A)	ROCK FILTER DAMS (INSTALL) (TY 2)	ROCK FILTER DAMS (REMOVE)	CONSTRUCTION EXITS (INSTALL) (TY 2)	CONSTRUCTION EXITS (REMOVE)	TEMP SEDMT CONT FENCE (INSTALL)	TEMP SEDMT CONT FENCE (REMOVE)
	STA	SY	SY	SY	MG	SY	LF	LF	SY	SY	LF	LF
SHEET 1 OF 15	3	10444	10444	10444	170		50	50	445	445	948	948
SHEET 2 OF 15	1	10674	10674	10674	174		110	110			388	388
SHEET 3 OF 15	1	10844	10844	10844	177		50	50			318	318
SHEET 4 OF 15	2	10578	10578	10578	172		50	50			548	548
SHEET 5 OF 15		10944	10944	10944	178		50	50	445	445	168	168
SHEET 6 OF 15		10944	10944	10944	178		50	50			168	168
SHEET 7 OF 15	1	10778	10778	10778	176		50	50			168	168
SHEET 8 OF 15	1	10912	10912	10912	178		50	50			373	373
SHEET 9 OF 15	3	10578	10578	10578	172		50	50			708	708
SHEET 10 OF 15	1	10982	10982	10982	179		50	50	445	445	368	368
SHEET 11 OF 15		18100	18100	18100	294		50	50			1340	1340
SHEET 12 OF 15		10918	10918	10918	178		50	50			328	328
SHEET 13 OF 15		10944	10944	10944	178		50	50			328	328
SHEET 14 OF 15	2	10578	10578	10578	172		50	50			368	368
SHEET 15 OF 15		22200	22200	22200	361		50	50	445	445	2168	2168
PROJECT TOTALS	**15**	**180418**	**180418**	**180418**	**2937**	**2500***	**810**	**810**	**1780**	**1780**	**8687**	**8687**

* TO BE USED AS DIRECTED

CONSOLIDATED SUMMARIES

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		7

SUMMARY OF WORKZONE TRAFFIC CONTROL ITEMS

LOCATION	510 6003	662 6032	662 6034	662 6111	6001 6001	6001 6002	6185 6002	6185 6003
	ONE-WAY TRAF CONT (PORT TRAF SIG)	WK ZN PAV MRK NON-REMOV (Y)4"(BRK)	WK ZN PAV MRK NON-REMOV (Y)4"(SLD)	WK ZN PAV MRK SHT TERM (TAB)TY Y-2	PORTABLE CHANGEABLE MESSAGE SIGN	PORTABLE CHANGEABLE MESSAGE SIGN	TMA (STATIONARY)	TMA (MOBILE OPERATION)
	MO	LF	LF	EA	DAY	EA	DAY	HR
BEGIN - 30+00			4084	205				
30+00 - 50+00			4000	200				
50+00 - 70+00		470	2210	252				
70+00 - 90+00		452	2195	246				
90+00 - 110+00		355	2518	233				
110+00 - 130+00			3780	189				
130+00 - 150+00		90	3456	200				
150+00 - 170+00		385	2463	239				
170+00 - 190+00		825	1000	298				
190+00 - 210+00		500	290	165				
210+00 - 230+00		170	3330	218				
230+00 - 250+00		340	2262	216				
250+00 - 270+00		500	1168	209				
270+00 - 290+00		370	2159	219				
290+00 - END			4408	221				
PROJECT TOTALS	**7•**	**4457**	**39323**	**3310**	**60•**	**2•**	**24•**	**312•**

• TO BE USED AS DIRECTED

SUMMARY OF SIGNING ITEMS

LOCATION	644 6060	644 6076	644 6080
	IN SM RD SN SUP&AM TYTWT(1)WS(P)	REMOVE SM RD SN SUP&AM	RELOCATE SM RD SN SUP & AM TY TEMP
	EA	EA	EA
SHEET 1 OF 15	2	2	2
SHEET 2 OF 15	8	8	8
SHEET 3 OF 15	3	3	3
SHEET 4 OF 15	1	1	1
SHEET 5 OF 15	3	3	3
SHEET 6 OF 15	2	2	2
SHEET 7 OF 15	2	2	2
SHEET 8 OF 15			
SHEET 9 OF 15			
SHEET 10 OF 15	1	1	1
SHEET 11 OF 15	3	3	3
SHEET 12 OF 15	2	2	2
SHEET 13 OF 15	1	1	1
SHEET 14 OF 15			
SHEET 15 OF 15	9	9	9
PROJECT TOTALS	**37**	**37**	**37**

SUMMARY OF MBGF ITEMS

LOCATION	104 6054	432 6045	540 6002	540 6016	542 6001	544 6001	544 6003	658 6016	658 6100
	REMOVING CONCRETE (MOW STRIP)	RIPRAP (MOW STRIP)(4 IN)	MTL W-BEAM GD FEN (STEEL POST)	DOWNSTREAM ANCHOR TERMINAL SECTION	REMOVE METAL BEAM GUARD FENCE	GUARDRAIL END TREATMENT (INSTALL)	GUARDRAIL END TREATMENT (REMOVE)	INSTL DEL ASSM (D-SW)SZ (BRF)GF1 (BI)	INSTL OM ASSM (OM-2Z)(WFL X)GND(BI)
	LF	CY	LF	EA	LF	EA	EA	EA	EA
Culvert 1- NORTHBOUND									1
Culvert 1- SOUTHBOUND									1
Culvert 2- NORTHBOUND		19	225			2		3	
Culvert 2- SOUTHBOUND		12	237.5	1		1		3	
Culvert 3- NORTHBOUND		21	250			2		3	
Culvert 3- SOUTHBOUND		14	150			2		3	
Culvert 4- NORTHBOUND									1
Culvert 4- SOUTHBOUND									1
Culvert 5- NORTHBOUND		13	87.5			2		3	
Culvert 5- SOUTHBOUND		20	225			2		3	
Culvert 6- NORTHBOUND									1
Culvert 6- SOUTHBOUND									1
Culvert 7- NORTHBOUND									1
Culvert 7- SOUTHBOUND									1
Culvert 8- NORTHBOUND									1
Culvert 8- SOUTHBOUND									1
Culvert 9- NORTHBOUND		23	250			2		3	
Culvert 9- SOUTHBOUND		23	250			2		3	
Culvert 10- NORTHBOUND									1
Culvert 10- SOUTHBOUND									1
Culvert 11- NORTHBOUND									1
Culvert 11- SOUTHBOUND									1
Culvert 12- NORTHBOUND									1
Culvert 12- SOUTHBOUND									1
Culvert 13- NORTHBOUND									1
Culvert 13- SOUTHBOUND									1
Culvert 14- NORTHBOUND									1
Culvert 14- SOUTHBOUND									1
Culvert 15- NORTHBOUND	445	26	325		375	2	2	4	
Culvert 15- SOUTHBOUND	308	27	287.5		237.5	2	2	3	
PROJECT TOTALS	**753**	**198**	**2287.5**	**1**	**612.5**	**19**	**4**	**31**	**20**

SUMMARY OF PAVEMENT MARKING ITEMS

LOCATION	533 6002	666 6048	666 6303	666 6312	666 6315	672 6009
	RUMBLE STRIPS (CENTERLINE)	REFL PAV MRK TY I (W)24"(SLD)(100MIL)	RE PM W/RET REQ TY I (W)4"(SLD) (100MIL)	RE PM W/RET REQ TY I (Y)4"(BRK) (100MIL)	RE PM W/RET REQ TY I (Y)4"(SLD) (100MIL)	REFL PAV MRKR TY II-A-A
	LF	LF	LF	LF	LF	EA
SHEET 1 OF 15	1987		4084		4084	52
SHEET 2 OF 15	2000		4000		4000	50
SHEET 3 OF 15	2000		4000	470	2210	52
SHEET 4 OF 15	2000		4000	452	2195	51
SHEET 5 OF 15	2000	8	3925	355	2518	50
SHEET 6 OF 15	2000	16	4390		3780	48
SHEET 7 OF 15	2000		4127	90	3456	48
SHEET 8 OF 15	2000		4000	385	2463	51
SHEET 9 OF 15	2000		3954	825	1000	54
SHEET 10 OF 15	2000		3977	500	290	29
SHEET 11 OF 15	2000	18	3915	170	3330	51
SHEET 12 OF 15	2000		4000	340	2262	46
SHEET 13 OF 15	2000		4000	500	1168	40
SHEET 14 OF 15	2000		4000	370	2159	46
SHEET 15 OF 15	2305	30	4411		4408	56
PROJECT TOTALS	**30292**	**72**	**60783**	**4457**	**39323**	**724**

CONSOLIDATED SUMMARIES

SHEET 2 OF 5

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		8

SUMMARY OF DRIVEWAYS AND INTERSECTIONS																ALT BID				
LOCATION/STATION (LT/RT)		EXIST DRWY TYPE	DR/INT	ITEM				104	105	247	310	316	316	3076	464	464	464	467	467
				BID CODE				(1)	(1)	(1)	(1)	(1)	(1)	(1)	6003	6085	6086	6363	6395
				WIDTH	LENGTH	R-1	R-2	REMOVING CONC (DRIVEWAYS)	REMOVING STAB BASE AND ASPH PAV (2")	FL BS (CMP IN PLC) (TY D GR 4) (FINAL POS)	PRIME COAT (MC -30 OR AE-P)	AGGR (TY-D GR-5 OR TY-L	ASPH (CRS-2)	HMAC D-GR HMA TY-C SAC-B PG 64-22	RC PIPE (CL III) (18 IN)	RC PIPE (CL III) (24 IN) (ALT)	RC PIPE (CL III) (30 IN) (ALT)	SET (TY II) (18 IN) (RCP) (6:1) (P)	SET (TY II) (24 IN) (RCP) (6:1) (P)
				FT	FT	FT	FT	SY	SY	CY	GAL	CY	GAL	TON	LF	LF	LF	EA	EA
10+81.26	LT	ASPHALT	D	16	26	15	15		57	6.4	12	0.4	14.3	6.3	40			2	
15+41.02	RT	GRAVEL	D	18	30	37	16		99	11.0	20	0.7	24.7	10.9					
16+62.72	RT	GRAVEL	D	16	32	36	28		107	11.9	22	0.8	26.7	11.8					
18+70.56	RT	GRAVEL	D	16	54	33	23		135	15.0	27	0.9	33.7	14.9					
21+39.26	RT	GRAVEL	D	16	43	23	23		102	11.3	21	0.7	25.5	11.2					
22+55.06	RT	GRAVEL	D	18	54	16	16		121	13.4	25	0.9	30.1	13.3					
24+00.00	RT	GRAVEL	D	16	25	27	27		80	8.9	16	0.6	19.9	8.8					
26+20.89	LT	GRAVEL	D	16	25	27	27		80	8.9	16	0.6	19.9	8.8		32			2
27+69.00	RT	GRAVEL	D	18	38	27	27		111	12.4	23	0.8	27.7	12.2			24		
38+51.28	RT	GRAVEL	D	16	23	25	50		116	12.9	24	0.8	28.9	12.7		56			2
43+00.00	RT	GRAVEL	D	20	29	55	18		145	16.1	29	1.0	36.1	15.9					
47+35.48	LT	GRAVEL	D	20	25	18	18		72	7.9	15	0.5	17.8	7.9	32			2	
52+18.33	LT	GRAVEL	D	19	25	18	18		69	7.6	14	0.5	17.1	7.6	32			2	
60+92.30	LT	GRAVEL	D	17	25	18	18		63	7.0	13	0.5	15.7	6.9	24			2	
64+61.60	LT	GRAVEL	D	16	24	37	33		102	11.3	21	0.7	25.4	11.2					
67+57.24	LT	CONCR	D	21	27	37	27	114		12.6	23	0.8	28.3	12.5	32			2	
72+53.60	LT	GRAVEL	D	18	25	26	22		78	8.7	16	0.6	19.5	8.6					
73+62.48	LT	GRAVEL	D	18	25	25	15		71	7.9	15	0.5	17.6	7.8					
78+00.00	LT	CONCR	D	26	25	42	42	157		17.4	32	1.1	39.1	17.2		24			2
83+86.32	RT	GRAVEL	D	16	25	15	15		56	6.2	12	0.4	13.8	6.1	24			2	
86+36.61	LT	CONCR	D	18	25	16	16	63		7.0	13	0.5	15.6	6.9		32			2
91+57.88	LT	GRAVEL	D	18	25	16	16		63	7.0	13	0.5	15.6	6.9		32			2
HACKBERRY RD. 105+14.22	LT	ASPHALT	I	17	105				199	33.1	40	1.4	49.6	21.9	32			2	
HACKBERRY RD. 117+93.20	LT	ASPHALT	I	17	93				176	29.3	36	1.2	44.0	19.4					
HACKBERRY RD. 120+54.86	RT	ASPHALT	I	21	163				381	63.4	77	2.6	95.1	41.9	32			2	
HACKBERRY RD. 134+69.02	RT	ASPHALT	I	21	81				189	31.5	38	1.3	47.3	20.8	56			2	
135+95.61	RT	CONCR	D	18	25	16	16	63		7.0	13	0.5	15.6	6.9	32			2	
137+29.12	RT	GRAVEL	D	18	25	16	16		63	7.0	13	0.5	15.6	6.9	32			2	
138+76.12	RT	GRAVEL	D	18	25	16	16		63	7.0	13	0.5	15.6	6.9	24			2	
142+87.77	RT	GRAVEL	D	16	25	16	16		57	6.3	12	0.4	14.2	6.3	24			2	
145+60.00	RT	GRASS	D	16	26	16	16		59	6.5	12	0.4	14.7	6.5	24			2	
152+07.84	RT	GRASS	D	18	26	16	16		65	7.2	13	0.5	16.1	7.1	32			2	
155+59.46	RT	GRAVEL	D	16	25	16	16		57	6.3	12	0.4	14.2	6.3	24			2	
159+40.80	LT	GRAVEL	D	16	25	16	16		57	6.3	12	0.4	14.2	6.3					
161+79.39	LT	GRAVEL	D	16	25	16	16		57	6.3	12	0.4	14.2	6.3	32			2	
164+18.04	LT	GRAVEL	D	16	25	16	16		57	6.3	12	0.4	14.2	6.3	32			2	
167+00.00	LT	ASPHALT	D	16	25	32	16		75	8.4	15	0.5	18.8	8.3	24			2	
170+18.25	LT	GRAVEL	D	18	25	32	16		81	9.0	17	0.6	20.2	8.9	32			2	
173+12.72	LT	GRAVEL	D	20	25	31	27		96	10.7	20	0.7	24.0	10.6	40			2	
173+54.29	RT	GRAVEL	D	16	25	16	16		57	6.3	12	0.4	14.2	6.3	24			2	
178+26.44	LT	GRAVEL	D	16	27	31	16		78	8.6	16	0.6	19.3	8.5		32			2
186+48.20	RT	GRASS	D	16	25	16	16		57	6.3	12	0.4	14.2	6.3		24			2
188+44.61	LT	GRAVEL	D	16	25	27	39		99	10.9	20	0.7	24.6	10.8					
HARE 189+88.34	RT	GRAVEL	I	24	26	18	36		108	18.0	22	0.8	27.0	11.9					
194+78.00	LT	GRAVEL	D	16	25	16	16		57	6.3	12	0.4	14.2	6.3			96		
194+78.39	RT	GRAVEL	D	16	25	17	25		67	7.4	14	0.5	16.6	7.3			48		
LINDEMANN 213+07.70	LT	ASPHALT	I	20	78	42	67		323	53.8	65	2.2	80.7	35.5	64			2	
214+23.98	RT	GRAVEL	D	16	25	21	24		69	7.7	14	0.5	17.2	7.6	32			2	
216+90.35	RT	GRAVEL	D	18	25	18	28		77	8.5	16	0.6	19.2	8.5	32			2	
226+14.94	RT	GRAVEL	D	16	125	21	20		243	27.0	49	1.7	60.6	26.7	24			2	
239+73.25	LT	GRAVEL	D	30	26	63	63		276	30.7	56	1.9	69.0	30.4					
240+43.08	RT	GRAVEL	D	22	26	15	15		75	8.3	15	0.5	18.6	8.2	56			2	
240+78.06	RT	GRAVEL	D	16	26	15	15		57	6.4	12	0.4	14.3	6.3					
251+95.89	RT	GRAVEL	D	16	25	16	16		57	6.3	12	0.4	14.2	6.3	32			2	
264+21.81	RT	GRAVEL	D	16	25	17	17		59	6.5	12	0.4	14.6	6.5	48			4	
277+19.78	LT	GRAVEL	D	45	33	60	60		337	37.5	68	2.3	84.2	37.1					
288+59.55	LT	GRAVEL	D	16	49	34	87		296	32.8	60	2.0	73.8	32.5					
291+33.89	LT	GRAVEL	D	20	208				463	51.4	93	3.1	115.6	50.9					
293+82.20	RT	GRAVEL	D	16	25	15	15		56	6.2	12	0.4	13.8	6.1					
HARALD CLARK 309+58.73	LT	ASPHALT	I	28	46	15	192		1028	171.3	206	6.9	256.9	113.1		48			2
CSJ: 2038-01-031 SHEET TOTAL									7398	998.60	1587.00	54.6	1943.4	857.1	968	280	168	60	16

(1) - FOR CONTRACTORS INFORMATION ONLY

CONSOLIDATED SUMMARIES

SHEET 3 OF 5

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	9

SUMMARY OF DRIVEWAYS AND INTERSECTIONS															MAIN BID		
LOCATION/STATION (LT/RT)		EXIST DRWY TYPE	DR/ INT	ITEM				467	496	530	530	530	560	560	560	4122	4122	4122
				BID CODE				6423	6007	6002	6004	6005	6001	6002	6003	6008	6010	6014
				WIDTH	LENGTH	R-1	R-2	SET (TY II) (30 IN) (RCP) (6:1) (P)	REMOV STR (PIPE)	INTERSECTIONS (ACP)	DRIVEWAYS (CONC)	DRIVEWAYS (ACP)	MAILBOX INSTALL-S (TWG-POST) TY 1	MAILBOX INSTALL-D (TWG-POST) TY 1	MAILBOX INSTALL-M (TWG-POST) TY 1	THERMOPLASTIC PIPE (30 IN) (PP) (TYPE III)	THERMOPLASTIC PIPE (24 IN) (PP) (TYPE III)	THERMOPLASTIC PIPE (18 IN) (PP) (TYPE III)
				FT	FT	FT	FT	EA	LF	SY	SY	SY	EA	EA	EA	LF	LF	LF
10+81.26	LT	ASPHALT	D	16	26	15	15		34			57	1					40
15+41.02	RT	GRAVEL	D	18	30	37	16					99		2				
16+62.72	RT	GRAVEL	D	16	32	36	28					107	1					
18+70.56	RT	GRAVEL	D	16	54	33	23					135	1					
21+39.26	RT	GRAVEL	D	16	43	23	23					102		1				
22+55.06	RT	GRAVEL	D	18	54	16	16					121	1					
24+00.00	RT	GRAVEL	D	16	25	27	27					80			1			
26+20.89	LT	GRAVEL	D	16	25	27	27		32			80					32	
27+69.00	RT	GRAVEL	D	18	38	27	27	2	23			111		1		24		
38+51.28	RT	GRAVEL	D	16	23	25	50		54			116					56	
43+00.00	RT	GRAVEL	D	20	29	55	18					145			2			
47+35.48	LT	GRAVEL	D	20	25	18	18		28			72						32
52+18.33	LT	GRAVEL	D	19	25	18	18		28			69						32
60+92.30	LT	GRAVEL	D	17	25	18	18		22			63						24
64+61.60	LT	GRAVEL	D	16	24	37	33					102	1					
67+57.24	LT	CONCR	D	21	27	37	27		28		114		1					32
72+53.60	LT	GRAVEL	D	18	25	26	22					78						
73+62.48	LT	GRAVEL	D	18	25	25	15					71	1					
78+00.00	LT	CONCR	D	26	25	42	42		24		157		1				24	
83+86.32	RT	GRAVEL	D	16	25	15	15		23			56						24
86+36.61	LT	CONCR	D	18	25	16	16		27		63		1		1		32	
91+57.88	LT	GRAVEL	D	18	25	16	16		32			63					32	
HACKBERRY RD. 105+14.22	LT	ASPHALT	I	17	105				32	199								32
HACKBERRY RD. 117+93.20	LT	ASPHALT	I	17	93					176								
HACKBERRY RD. 120+54.86	RT	ASPHALT	I	21	163				32	381								32
HACKBERRY RD. 134+69.02	RT	ASPHALT	I	21	81				52	189								56
135+95.61	RT	CONCR	D	18	25	16	16		27		63		1					32
137+29.12	RT	GRAVEL	D	18	25	16	16		31			63		1				32
138+76.12	RT	GRAVEL	D	18	25	16	16		23			63	1					24
142+87.77	RT	GRAVEL	D	16	25	16	16		23			57	1					24
145+60.00	RT	GRASS	D	16	26	16	16					59						24
152+07.84	RT	GRASS	D	18	26	16	16		25			65						32
155+59.46	RT	GRAVEL	D	16	25	16	16		17			57	1					24
159+40.80	LT	GRAVEL	D	16	25	16	16					57						
161+79.39	LT	GRAVEL	D	16	25	16	16					57						32
164+18.04	LT	GRAVEL	D	16	25	16	16		27			57		1				32
167+00.00	LT	ASPHALT	D	16	25	32	16		21			75	1					24
170+18.25	LT	GRAVEL	D	18	25	32	16		32			81						32
173+12.72	LT	GRAVEL	D	20	25	31	27		38			96			1			40
173+54.29	RT	GRAVEL	D	16	25	16	16		20			57						24
178+26.44	LT	GRAVEL	D	16	27	31	16		28			78	1				32	
186+48.20	RT	GRASS	D	16	25	16	16		21			57					24	
188+44.61	LT	GRAVEL	D	16	25	27	39					99	1					
HARE 189+88.34	RT	GRAVEL	I	24	26	18	36			108								
194+78.00	LT	GRAVEL	D	16	25	16	16	8	68			57				96		
194+78.39	RT	GRAVEL	D	16	25	17	25	4	40			67				48		
LINDEMANN 213+07.70	LT	ASPHALT	I	20	78	42	67		60	323								64
214+23.98	RT	GRAVEL	D	16	25	21	24		30			69						32
216+90.35	RT	GRAVEL	D	18	25	18	28		30			77						32
226+14.94	RT	GRAVEL	D	16	125	21	20		20			243	1					24
239+73.25	LT	GRAVEL	D	30	26	63	63					276						
240+43.08	RT	GRAVEL	D	22	26	15	15		54			75						56
240+78.06	RT	GRAVEL	D	16	26	15	15					57						
251+95.89	RT	GRAVEL	D	16	25	16	16		26			57	1					32
264+21.81	RT	GRAVEL	D	16	25	17	17		42			59						48
277+19.78	LT	GRAVEL	D	45	33	60	60					337						
288+59.55	LT	GRAVEL	D	16	49	34	87					296						
291+33.89	LT	GRAVEL	D	20	208							463						
293+82.20	RT	GRAVEL	D	16	25	15	15					56						
HARALD CLARK 309+58.73	LT	ASPHALT	I	28	46	15	192		48	1028							48	
CSJ: 2038-01-031 SHEET TOTAL								14	1222	2404	397	4994	18	6	5	168	280	968

(1) - FOR CONTRACTORS INFORMATION ONLY

CONSOLIDATED SUMMARIES

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		10

SUMMARY OF DRAINAGE ITEMS

LOCATION	400 6005	400 6006	402 6001	403 6001	432 6002	432 6033	462 6007	462 6010	462 6051	462 6060	462 6065	462 6077	464 6005	464 6007	464 6008	466 6097	466 6099
	CEM STABIL BKFL	CUT & RESTORING PAV	TRENCH EXCAVATION PROTECTION	TEMPORARY SPL SHORING	RIPRAP (CONC) (5 IN)	RIPRAP (STONE PROTECTION) (18 IN)	CONC BOX CULV (5 FT X 3 FT)	CONC BOX CULV (6 FT X 3 FT)	CONC BOX CULV (5 FT X 3 FT) (EXTEND)	CONC BOX CULV (7 FT X 5 FT) (EXTEND)	CONC BOX CULV (8 FT X 6 FT) (EXTEND)	CONC BOX CULV (10 FT X 9 FT) (EXTEND)	RC PIPE (CL III) (24 IN)	RC PIPE (CL III) (30 IN)	RC PIPE (CL III) (36 IN)	HEADWALL (CH - PW - 0) (DIA= 24 IN)	HEADWALL (CH - PW - 0) (DIA= 30 IN)
	CY	SY	LF	SF	CY	CY	LF	LF	LF	LF	LF	LF	LF	LF	LF	EA	EA
CULVERT 1	59	17	27		3	10							60			2	
CULVERT 2 09-0-140-2038-01-001	7			1955	20	75						28					
CULVERT 3 09-0-140-2038-01-002	3			1119	38						56						
CULVERT 4	42	31	25		2										96		
CULVERT 5 09-0-140-2038-01-003				658	35					39							
CULVERT 6	42	51	30		2		104										
CULVERT 7	47	41	38												165		
CULVERT 8	23	18			3									56			1
CULVERT 9 09-0-140-2038-01-004				726		135			60								
CULVERT 10	30	26											88				
CULVERT 11	59	49	28		6	12								192			
CULVERT 12	60	59	35		7			136									
CULVERT 13	26	18	25											52			1
CULVERT 14	35	26	13			4							162			1	
CULVERT 15 09-0-140-2038-01-005	4			1324	33						38						
NON-BRIDGE CLASS PROJECT TOTALS	423	336	221		23	26	104	136					310	300	261	3	2
PROJECT TOTALS	**437**	**336**	**221**	**5782**	**149**	**236**	**104**	**136**	**60**	**39**	**94**	**28**	**310**	**300**	**261**	**3**	**2**

SUMMARY OF DRAINAGE ITEMS

LOCATION	466 6101	466 6171	466 6172	466 6174	466 6179	466 6180	466 6181	466 6182	466 6184	467 6177	467 6390	467 6419	467 6422	467 6450	496 6007	552 6001	552 6003
	HEADWALL (CH - PW - 0) (DIA= 36 IN)	WINGWALL (PW - 1) (HW=10 FT)	WINGWALL (PW - 1) (HW=11 FT)	WINGWALL (PW - 1) (HW=13 FT)	WINGWALL (PW - 1) (HW=4 FT)	WINGWALL (PW - 1) (HW=5 FT)	WINGWALL (PW - 1) (HW=6 FT)	WINGWALL (PW - 1) (HW=7 FT)	WINGWALL (PW - 1) (HW=9 FT)	SET (TY I) (S= 5 FT) (HW= 4 FT) (4:1) (C)	SET (TY II) (24 IN) (RCP) (4: 1) (C)	SET (TY II) (30 IN) (RCP) (4: 1) (C)	SET (TY II) (30 IN) (RCP) (6: 1) (C)	SET (TY II) (36 IN) (RCP) (4: 1) (C)	REMOV STR (PIPE)	WIRE FENCE (TY A)	WIRE FENCE (TY C)
	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	LF	LF	LF
CULVERT 1															45		
CULVERT 2 09-0-140-2038-01-001				2													
CULVERT 3 09-0-140-2038-01-002			1						1								133
CULVERT 4														4	70		
CULVERT 5 09-0-140-2038-01-003								1	1								
CULVERT 6										4					205		
CULVERT 7	1													3	123		
CULVERT 8												1			41		
CULVERT 9 09-0-140-2038-01-004							1	1									
CULVERT 10											4				76		
CULVERT 11												8			144		
CULVERT 12					1	1									265		
CULVERT 13													1		37		
CULVERT 14											2				82		
CULVERT 15 09-0-140-2038-01-005		1							1							201	
NON-BRIDGE CLASS PROJECT TOTALS	1				1	1				4	6	9	1	7	1088		
PROJECT TOTALS	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**2**	**3**	**4**	**6**	**9**	**1**	**7**	**1088**	**201**	**133**

CONSOLIDATED SUMMARIES

SHEET 5 OF 5

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		11

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SUMMARY OF SIGN REMOVALS AND RELOCATIONS				644-6076	644-6080
CSJ	SHEET	SIGN NO.	DESCRIPTION	REMOVE SM RD SN SUP & AM (EA)	RELOCATE SM RD SN SUP & AM TY TEMP (EA)
2038-01-031	1 OF 15	1	SOUTH	1	1
			FM 2115		
		2	WINDING ROAD LEFT	1	1
			ADVISORY SPEED 45 MPH		
	2 of 15	1	SCHOOL BUS STOP AHEAD	1	1
		2	CHEVRON RIGHT	1	1
			CHEVRON LEFT		
		3	CHEVRON RIGHT	1	1
			CHEVRON LEFT		
		4	CHEVRON RIGHT	1	1
			CHEVRON LEFT		
		5	CHEVRON RIGHT	1	1
			CHEVRON LEFT		
		6	CHEVRON RIGHT	1	1
			CHEVRON LEFT		
		7	CHEVRON RIGHT	1	1
			CHEVRON LEFT		
		8	CHEVRON RIGHT	1	1
			CHEVRON LEFT		
	3 of 15	1	CHEVRON RIGHT	1	1
			CHEVRON LEFT		
		2	WINDING ROAD LEFT	1	1
			ADVISORY SPEED 45 MPH		
		3	HORIZ CURVE RIGHT	1	1
			ADVISORY SPEED 50 MPH		
	4 of 15	1	HORIZ CURVE LEFT	1	1
			ADVISORY SPEED 50 MPH		
	5 of 15	1	REVERSE CURVE RIGHT	1	1
			ADVISORY SPEED 50 MPH		
		2	STOP	1	1
		3	FM 2115	1	1
			ARROW - ANGLED UP RIGHT		
	6 of 15	1	STOP	1	1
		2	STOP	1	1
	7 of 15	1	STOP	1	1
		2	REVERSE CURVE RIGHT	1	1
			ADVISORY SPEED 50 MPH		
	10 of 15	1	STOP	1	1
	11 OF 15	1	REVERSE CURVE RIGHT	1	1
			ADVISORY SPEED 50 MPH		
		2	STOP	1	1
		3	SCHOOL BUS STOP AHEAD	1	1
	12 OF 15	1	SCHOOL BUS STOP AHEAD	1	1
		2	REVERSE CURVE RIGHT	1	1
			ADVISORY SPEED 50 MPH		
	13 OF 15	1	WINDING ROAD LEFT	1	1
			ADVISORY SPEED 50 MPH		
	15 OF 15	1	STOP AHEAD	1	1
		2	<- Bartlett Jarrell ->	1	1
		3	SPEED LIMIT (SPEED)	1	1
		4	WINDING ROAD LEFT	1	1
			ADVISORY SPEED 50 MPH		
		5	STOP	1	1
		6	PROPERTY OF THE STATE	1	1
			SUB-LOC #6		
		7	WEIGHT LIMIT/GROSS (WEIGHT) LBS	1	1
		8	STOP	1	1
		9	FM 2115	1	1
			ARROW - HORIZ. STRGHT		
PROJECT TOTALS				37 (EA)	37 (EA)

SUMMARY OF SIGN RELOCATES & REMOVALS

DW: TxDOT
CK: TxDOT
DW: TxDOT
CK: TxDOT

DIST	COUNTY	CONT	SECT	JOB	HIGHWAY
WAC	BELL	2038	01	031	FM 2115

SHEET NO. 12

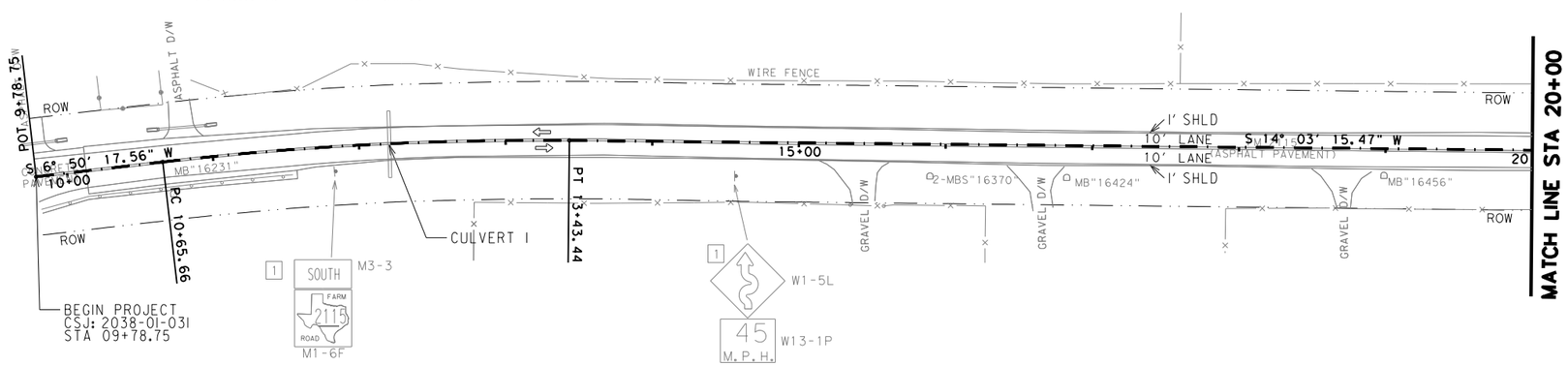
18

NOTES:

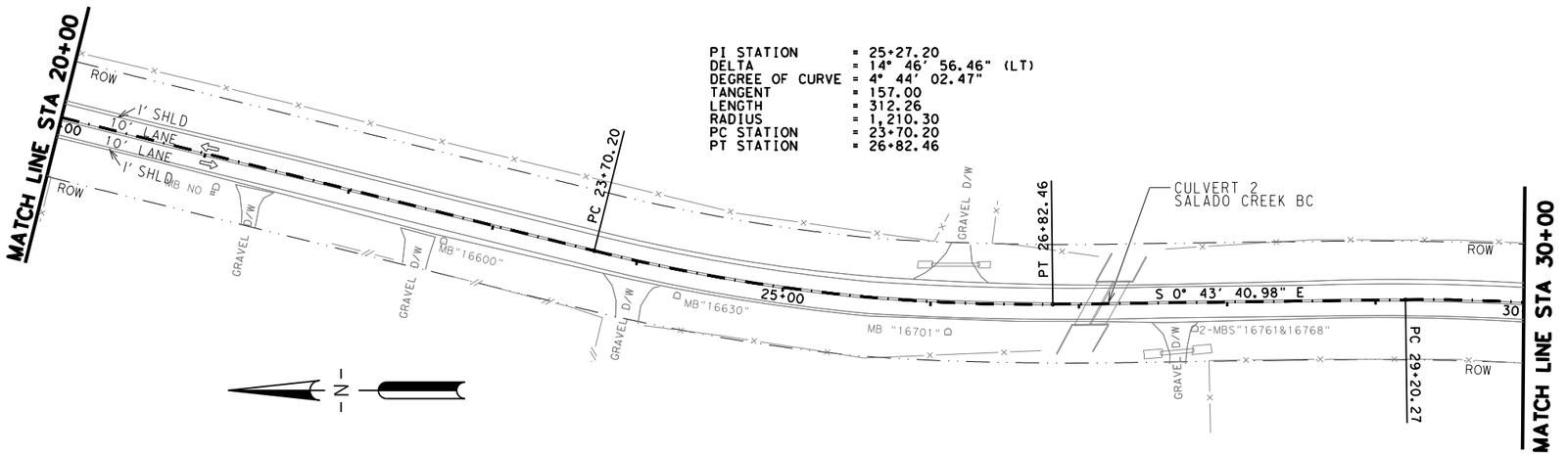
1. RELOCATE EXISTING SIGN SUPPORT AND ASSEMBLY DURING CONSTRUCTION. REMOVAL AFTER CONSTRUCTION IS SUBSIDIARY.

2. RELOCATE EXISTING STREET NAME SIGN AND PROVIDE A POST MOUNTED BRACKET AFTER CONSTRUCTION. THIS MATERIAL AND WORK WILL BE SUBSIDIARY TO THE NEW STOP SIGN ASSEMBLY.

PI STATION = 12+04.73
DELTA = 7° 12' 57.92" (RT)
DEGREE OF CURVE = 2° 35' 52.18"
TANGENT = 139.07
LENGTH = 277.77
RADIUS = 2,205.53
PC STATION = 10+65.66
PT STATION = 13+43.44



PI STATION = 25+27.20
DELTA = 14° 46' 56.46" (LT)
DEGREE OF CURVE = 4° 44' 02.47"
TANGENT = 157.00
LENGTH = 312.26
RADIUS = 1,210.30
PC STATION = 23+70.20
PT STATION = 26+82.46



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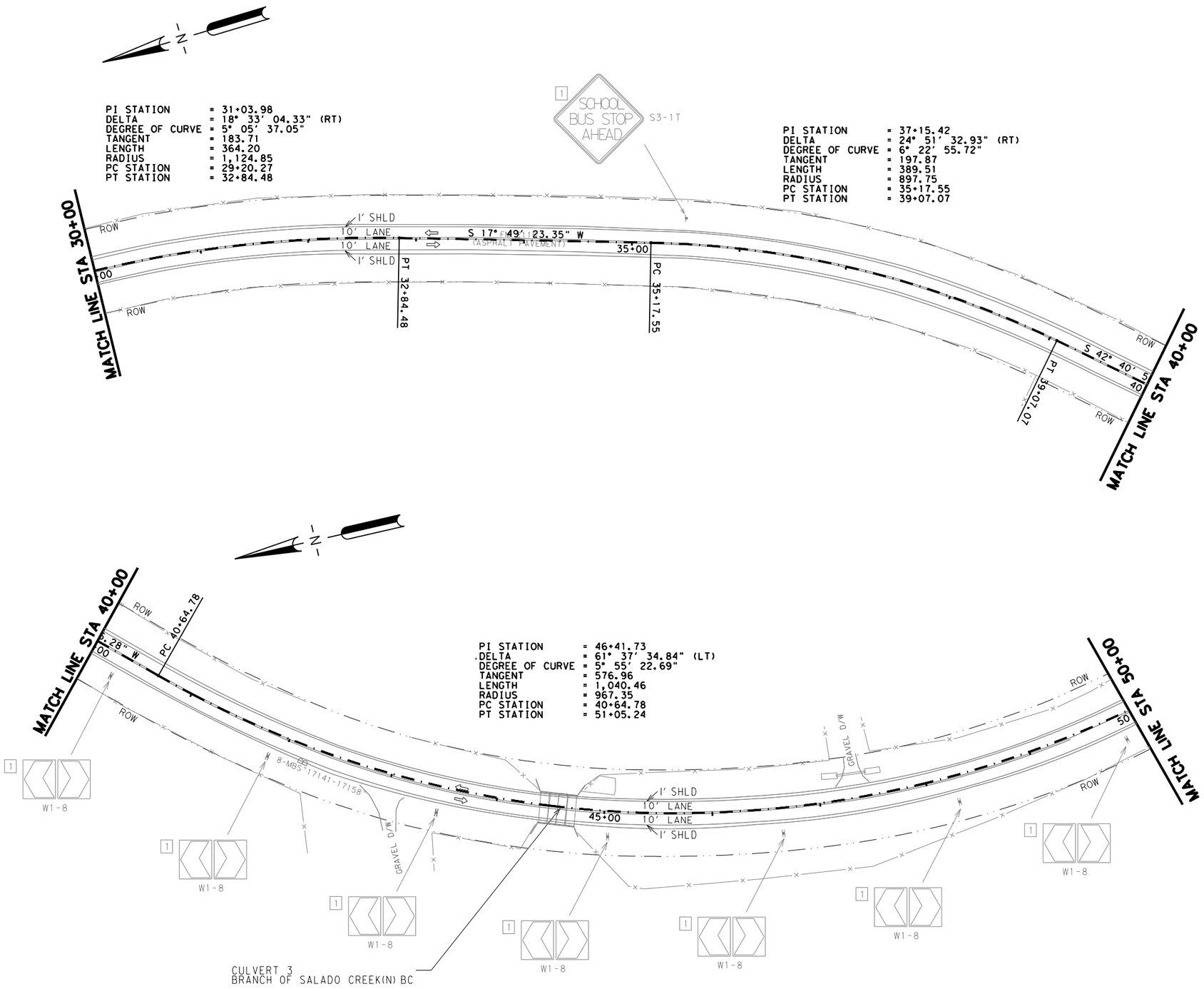
EXISTING PROJECT LAYOUTS

SCALE: 1" = 100' HORIZ. FEET

SHEET 10F 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		13



NOTES:

1. RELOCATE EXISTING SIGN SUPPORT AND ASSEMBLY DURING CONSTRUCTION. REMOVAL AFTER CONSTRUCTION IS SUBSIDIARY.

2. RELOCATE EXISTING STREET NAME SIGN AND PROVIDE A POST MOUNTED BRACKET AFTER CONSTRUCTION. THIS MATERIAL AND WORK WILL BE SUBSIDIARY TO THE NEW STOP SIGN ASSEMBLY.

STATE OF TEXAS
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Bradley Mayes 8/28/2021
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EXISTING PROJECT LAYOUTS

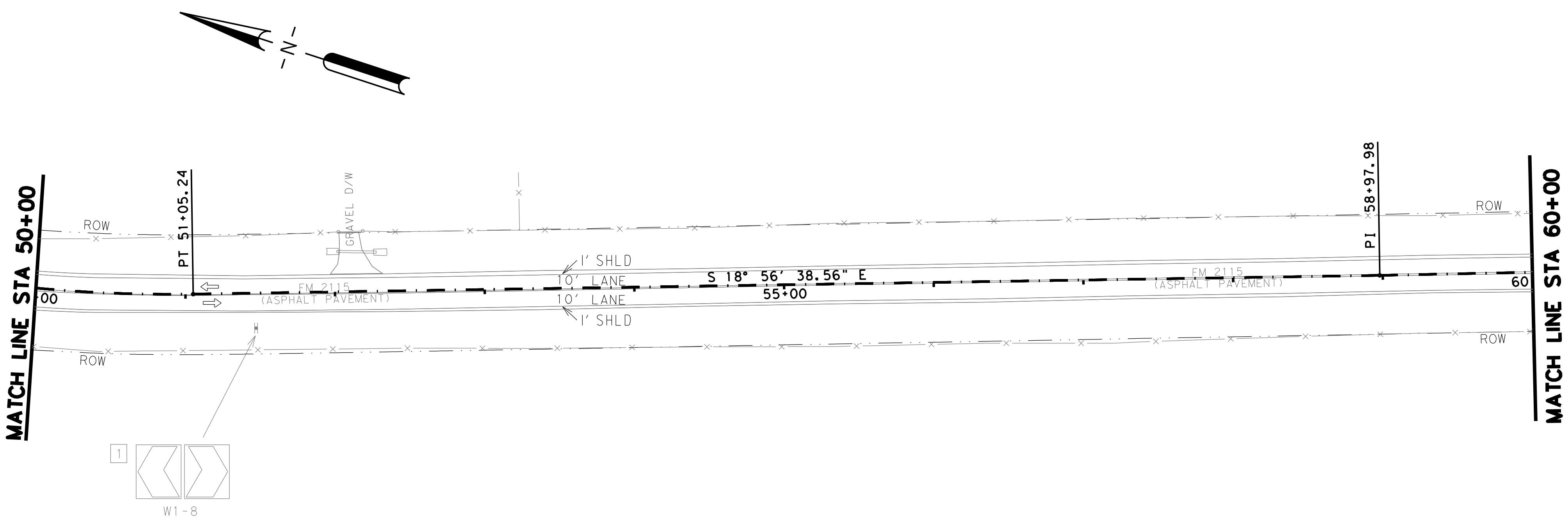
SCALE: 1" = 100' HORIZ. FEET

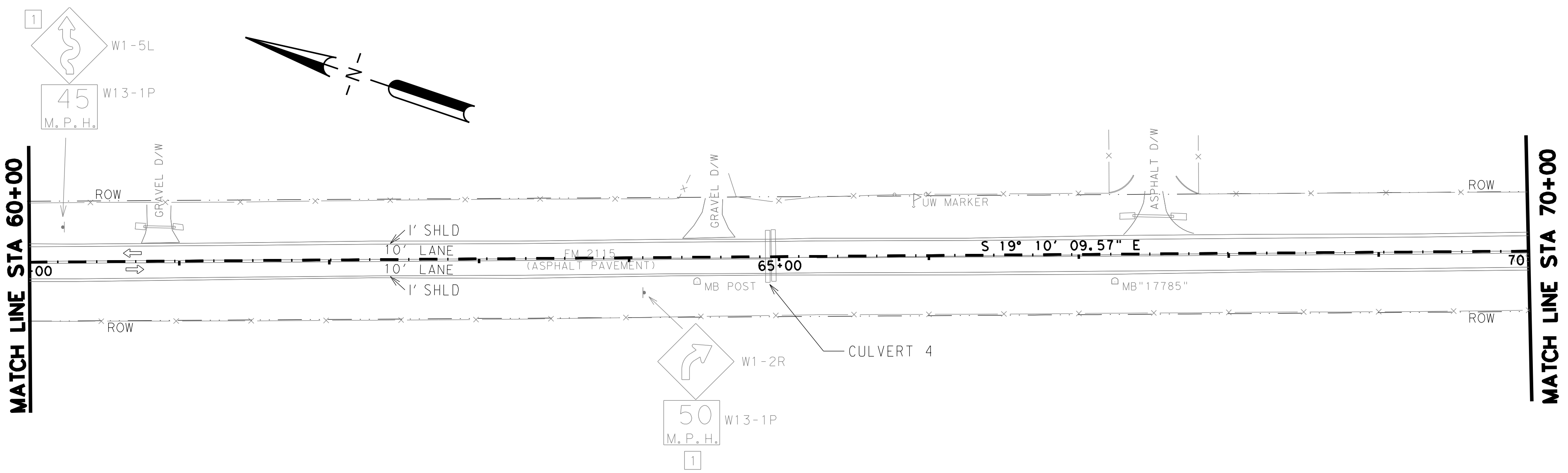
CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		14

NOTES:

1. RELOCATE EXISTING SIGN SUPPORT AND ASSEMBLY DURING CONSTRUCTION. REMOVAL AFTER CONSTRUCTION IS SUBSIDIARY.

2. RELOCATE EXISTING STREET NAME SIGN AND PROVIDE A POST MOUNTED BRACKET AFTER CONSTRUCTION. THIS MATERIAL AND WORK WILL BE SUBSIDIARY TO THE NEW STOP SIGN ASSEMBLY.





STATE OF TEXAS
BRADLEY MAYES
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8/28/2021

SIGNATURE OF REGISTRANT & DATE

EXISTING PROJECT LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 3 OF 15

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		15

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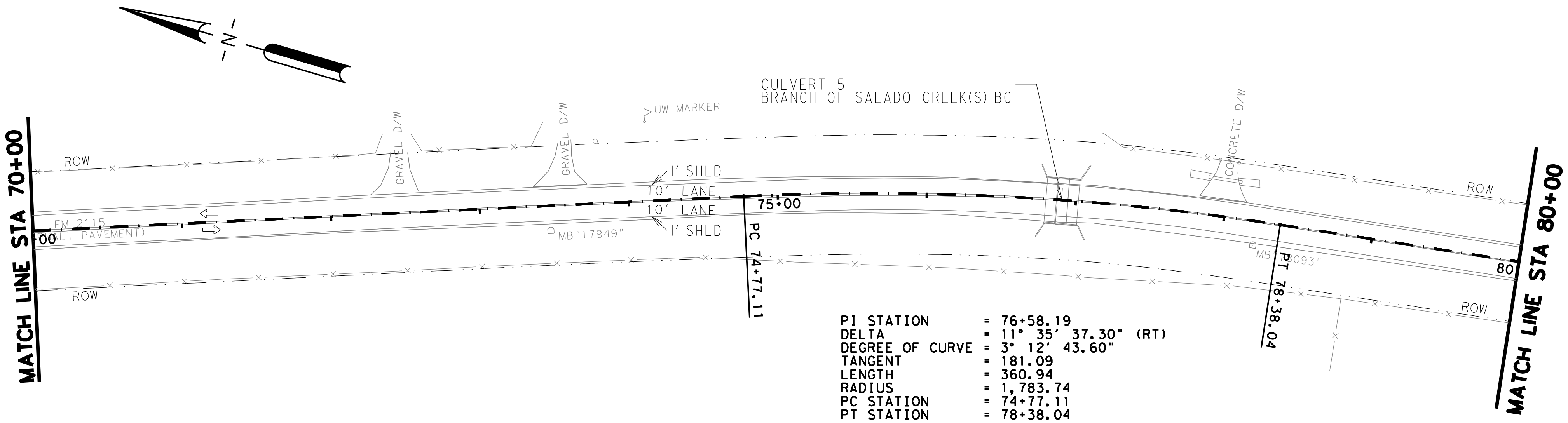
NODE

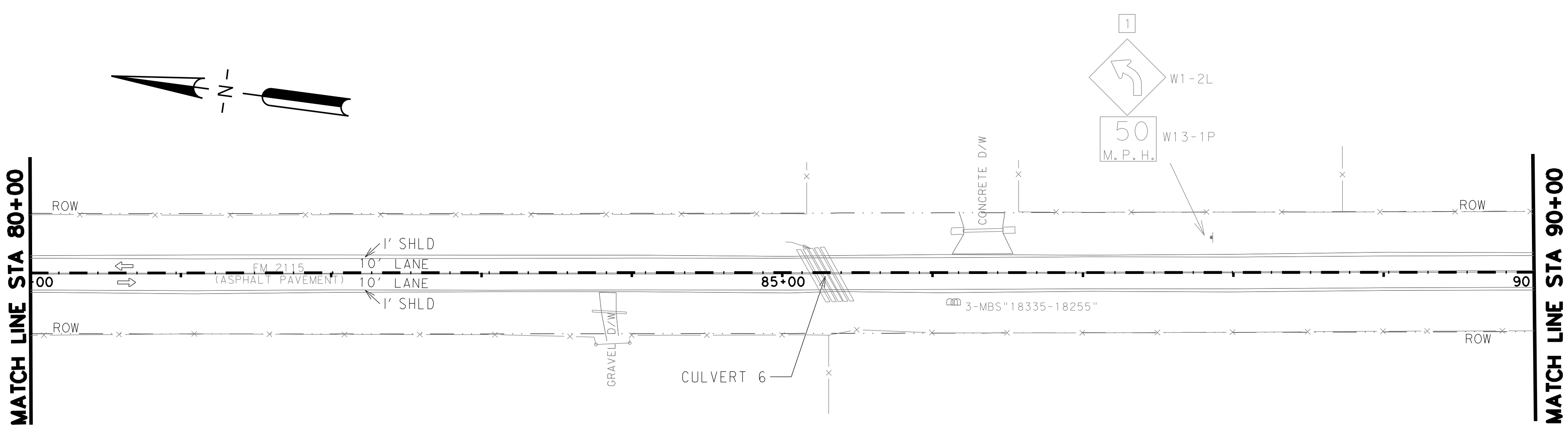
NOTES:

1. RELOCATE EXISTING SIGN SUPPORT AND ASSEMBLY DURING CONSTRUCTION. REMOVAL AFTER CONSTRUCTION IS SUBSIDIARY.

2. RELOCATE EXISTING STREET NAME SIGN AND PROVIDE A POST MOUNTED BRACKET AFTER CONSTRUCTION. THIS MATERIAL AND WORK WILL BE SUBSIDIARY TO THE NEW STOP SIGN ASSEMBLY.



PI STATION	= 76+58.19
DELTA	= 11° 35' 37.30" (RT)
DEGREE OF CURVE	= 3° 12' 43.60"
TANGENT	= 181.09
LENGTH	= 360.94
RADIUS	= 1,783.74
PC STATION	= 74+77.11
PT STATION	= 78+38.04



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EXISTING PROJECT LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 4 OF 15

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		16

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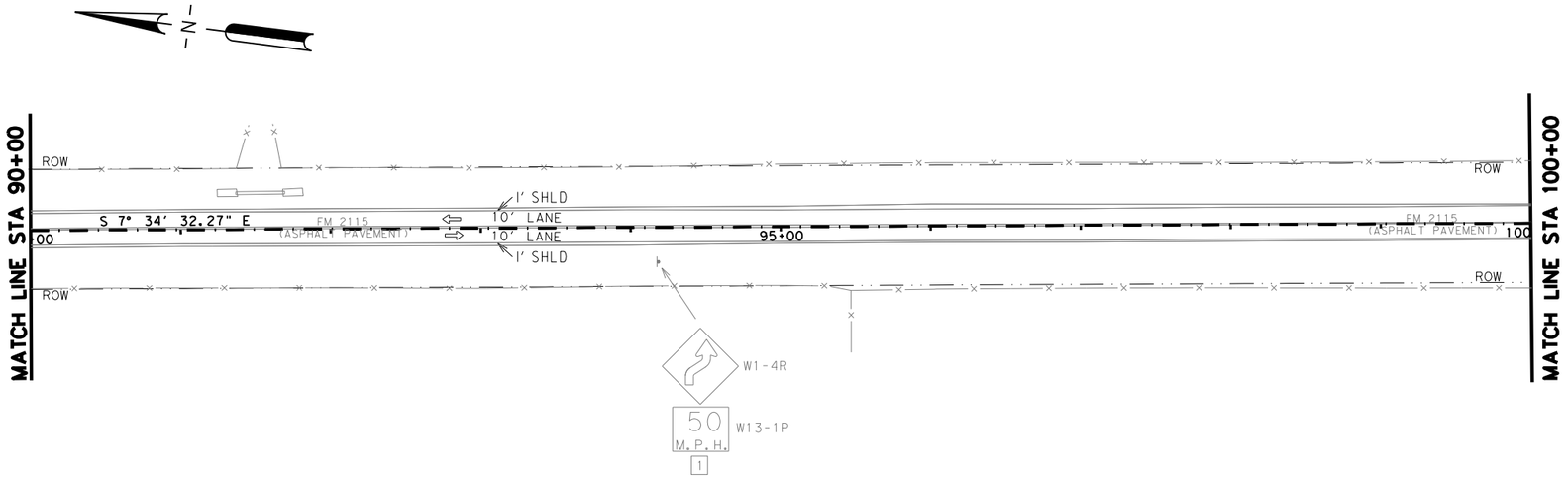
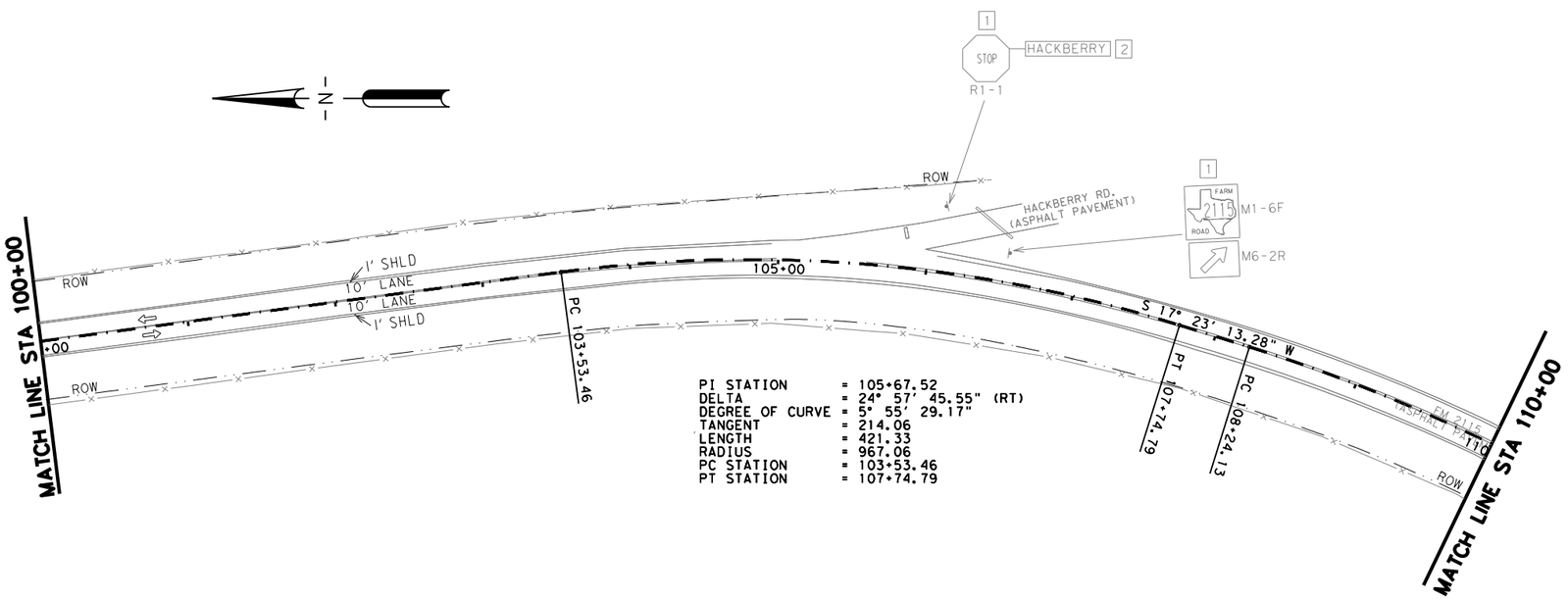
NODE

NOTES:

1. RELOCATE EXISTING SIGN SUPPORT AND ASSEMBLY DURING CONSTRUCTION. REMOVAL AFTER CONSTRUCTION IS SUBSIDIARY.

2. RELOCATE EXISTING STREET NAME SIGN AND PROVIDE A POST MOUNTED BRACKET AFTER CONSTRUCTION. THIS MATERIAL AND WORK WILL BE SUBSIDIARY TO THE NEW STOP SIGN ASSEMBLY.





PI STATION	= 105+67.52
DELTA	= 24° 57' 45.55" (RT)
DEGREE OF CURVE	= 5° 55' 29.17"
TANGENT	= 214.06
LENGTH	= 421.33
RADIUS	= 967.06
PC STATION	= 103+53.46
PT STATION	= 107+74.79

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SIGNATURE OF REGISTRANT & DATE

EXISTING PROJECT LAYOUTS

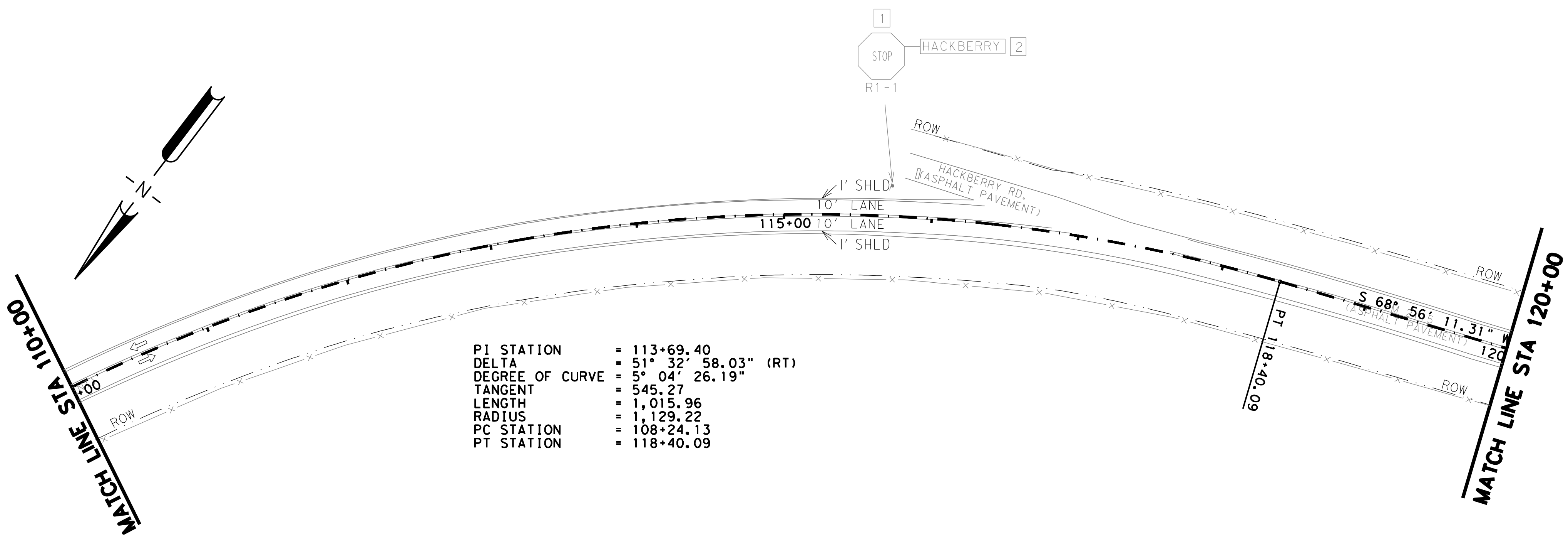
SCALE: 1" = 100' HORIZ. FEET

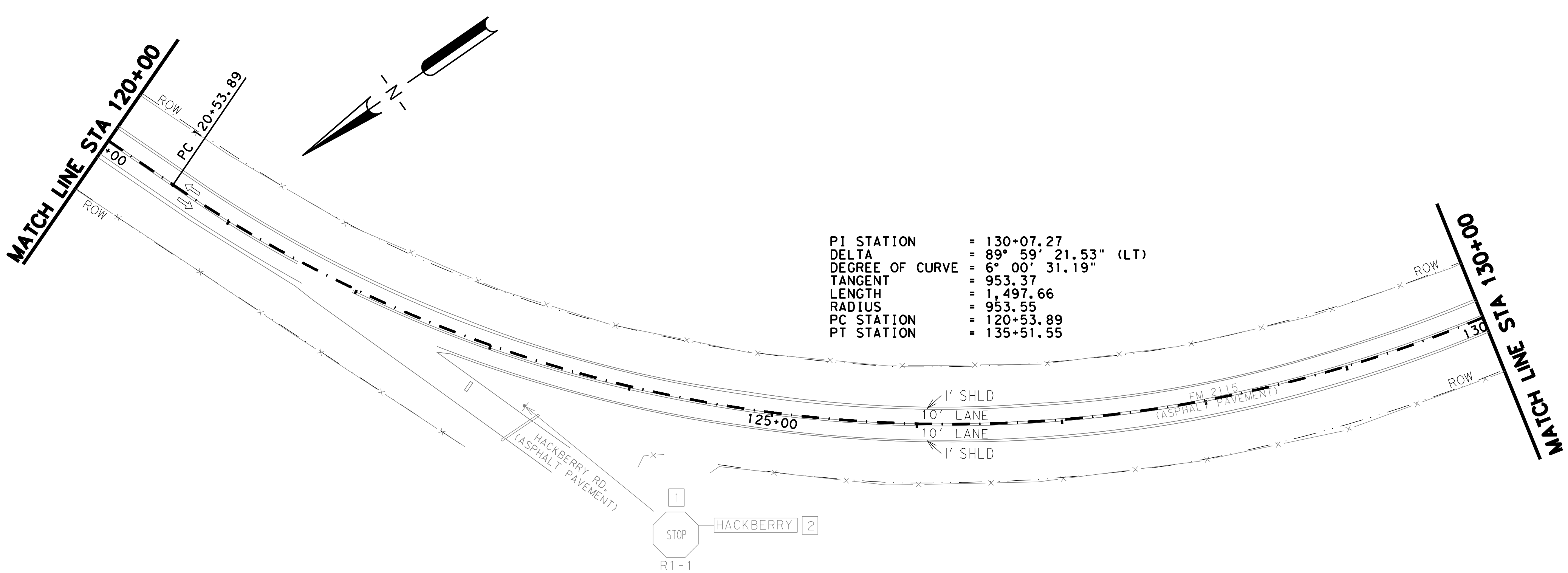
CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		17

NOTES:

1. RELOCATE EXISTING SIGN SUPPORT AND ASSEMBLY DURING CONSTRUCTION. REMOVAL AFTER CONSTRUCTION IS SUBSIDIARY.

2. RELOCATE EXISTING STREET NAME SIGN AND PROVIDE A POST MOUNTED BRACKET AFTER CONSTRUCTION. THIS MATERIAL AND WORK WILL BE SUBSIDIARY TO THE NEW STOP SIGN ASSEMBLY.





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EXISTING PROJECT LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 6 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	18

NODE

NOTES:

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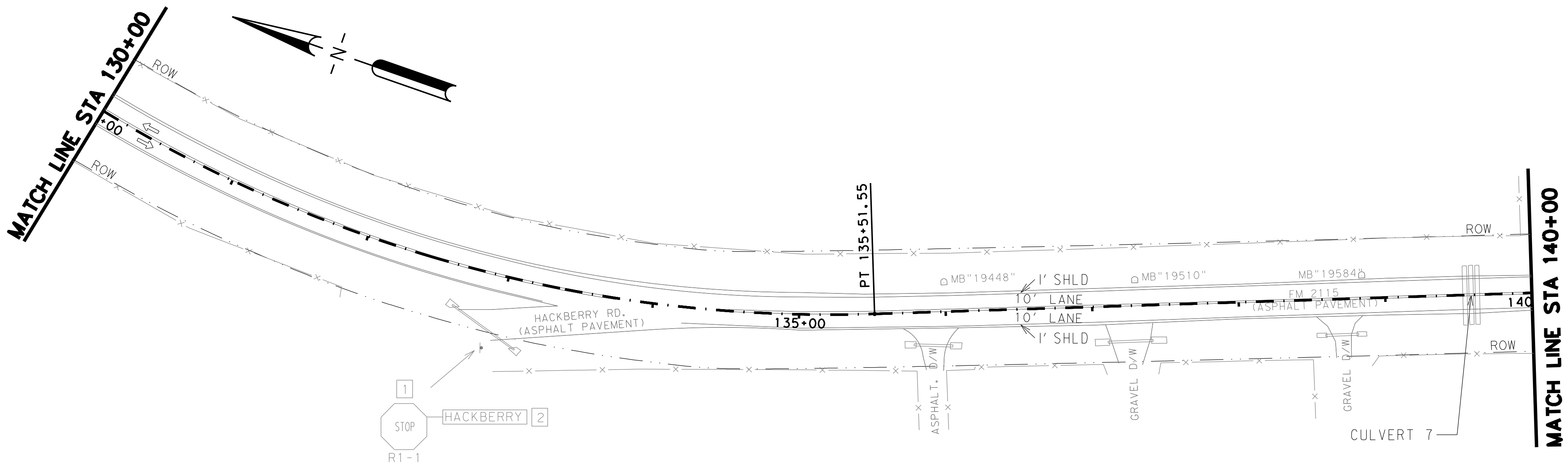

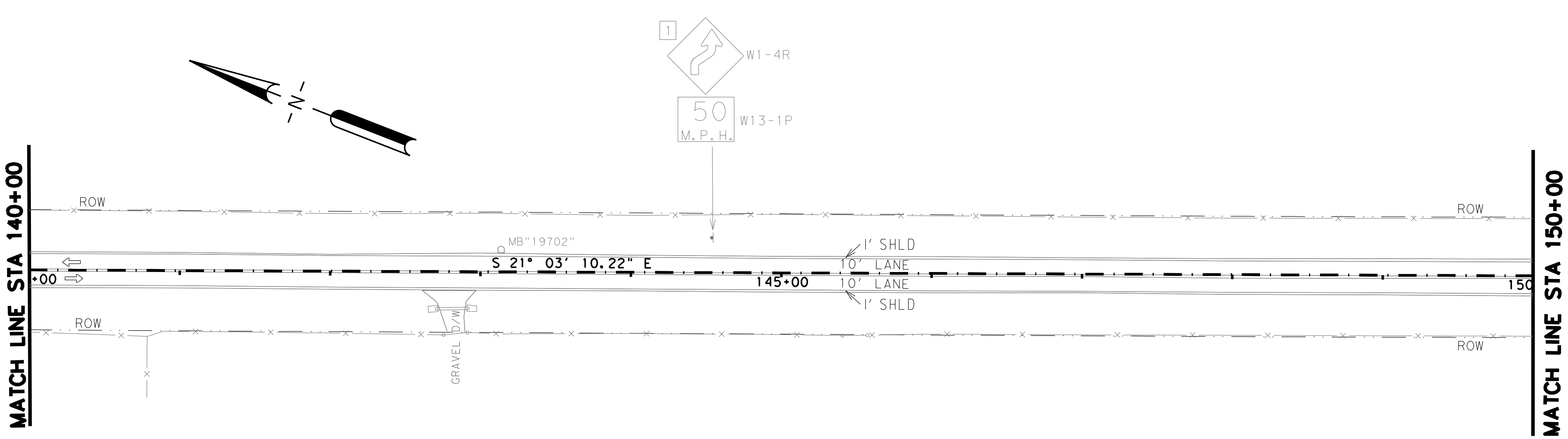

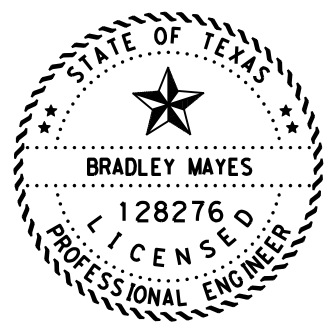

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EXISTING PROJECT LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 7 OF 15

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		19

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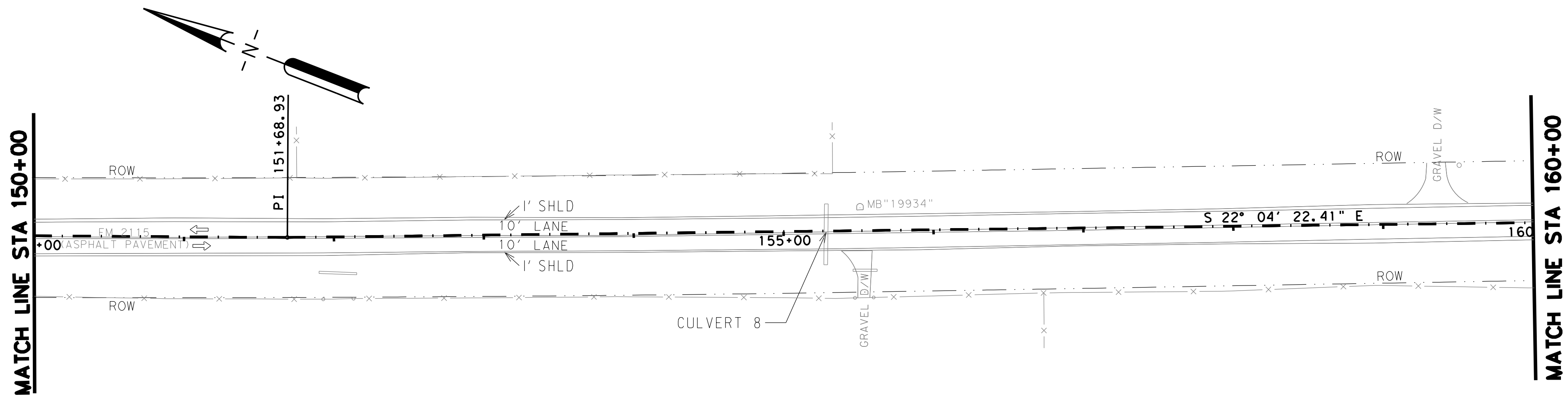

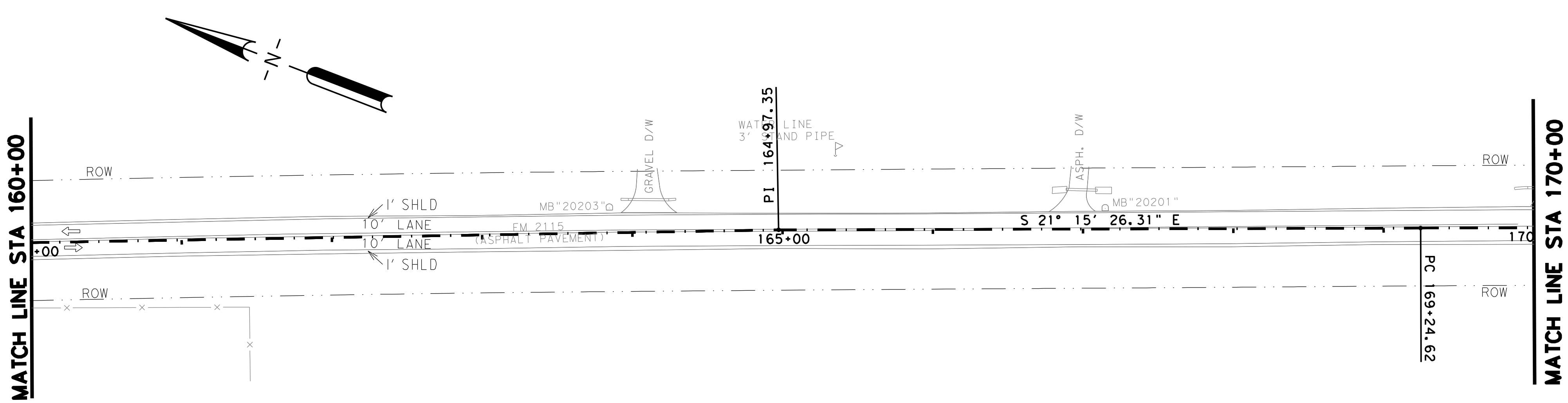

NOTES:

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2. RELOCATE EXISTING STREET NAME SIGN AND PROVIDE A POST MOUNTED BRACKET AFTER CONSTRUCTION. THIS MATERIAL AND WORK WILL BE SUBSIDIARY TO THE NEW STOP SIGN ASSEMBLY.

STATE OF TEXAS
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EXISTING PROJECT LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 8 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	20

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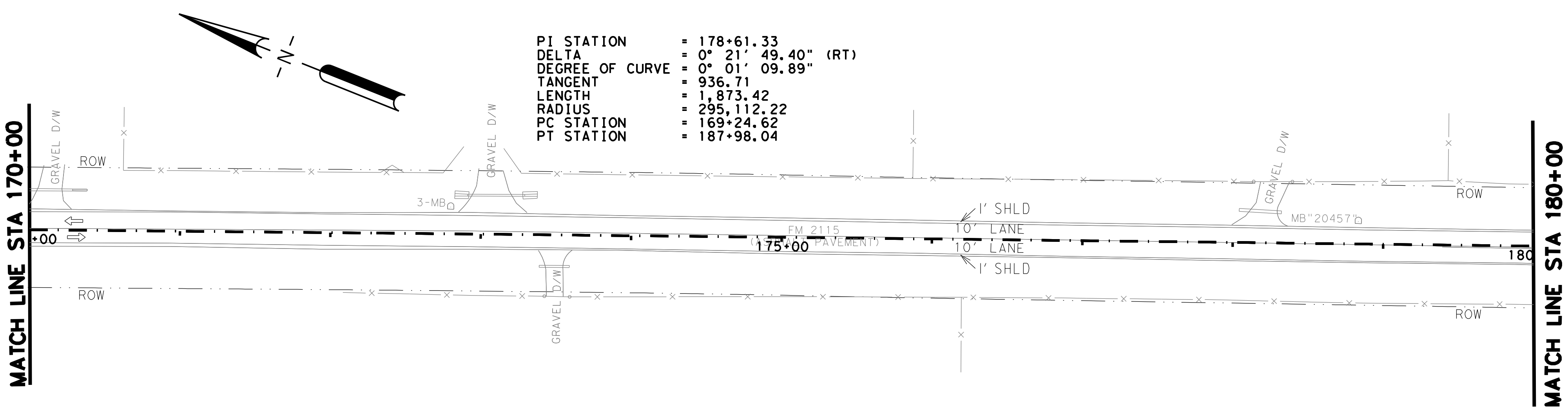
NODE

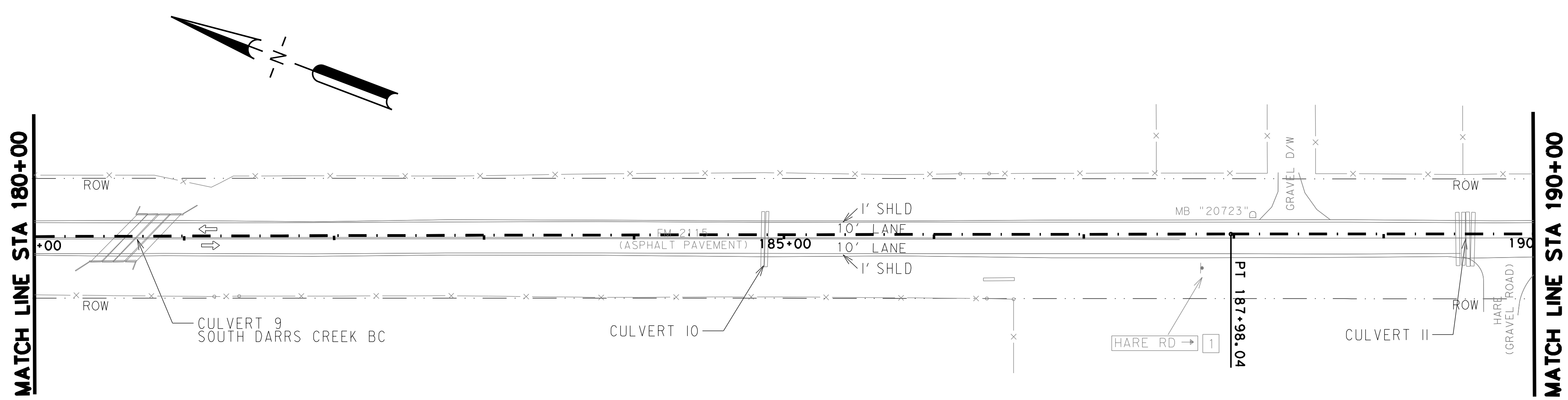
NOTES:

1. RELOCATE EXISTING SIGN SUPPORT AND ASSEMBLY DURING CONSTRUCTION. REMOVAL AFTER CONSTRUCTION IS SUBSIDIARY.

2. RELOCATE EXISTING STREET NAME SIGN AND PROVIDE A POST MOUNTED BRACKET AFTER CONSTRUCTION. THIS MATERIAL AND WORK WILL BE SUBSIDIARY TO THE NEW STOP SIGN ASSEMBLY.

PI STATION	= 178+61.33
DELTA	= 0° 21' 49.40" (RT)
DEGREE OF CURVE	= 0° 01' 09.89"
TANGENT	= 936.71
LENGTH	= 1,873.42
RADIUS	= 295,112.22
PC STATION	= 169+24.62
PT STATION	= 187+98.04





BRADLEY MAYES
128276
STATE OF TEXAS
LICENSED
PROFESSIONAL ENGINEER

Bradley Mayes 8/28/2021

SIGNATURE OF REGISTRANT & DATE

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EXISTING PROJECT LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 9 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	21

pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\2038010314 - Design\Plan Sets\02 Roadway\FM 2115 EXISTING PROJECT LAYOUTS.dgn

NODE

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NOTES:

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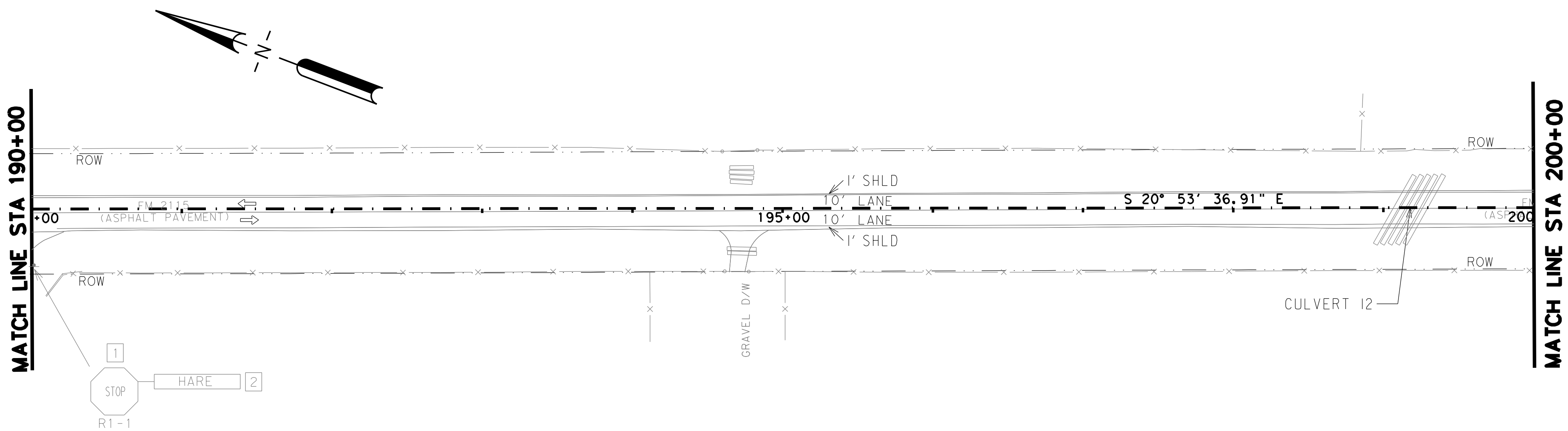
2. RELOCATE EXISTING STREET NAME SIGN AND PROVIDE A POST MOUNTED BRACKET AFTER CONSTRUCTION. THIS MATERIAL AND WORK WILL BE SUBSIDIARY TO THE NEW STOP SIGN ASSEMBLY.



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LENGTH	=	380.69
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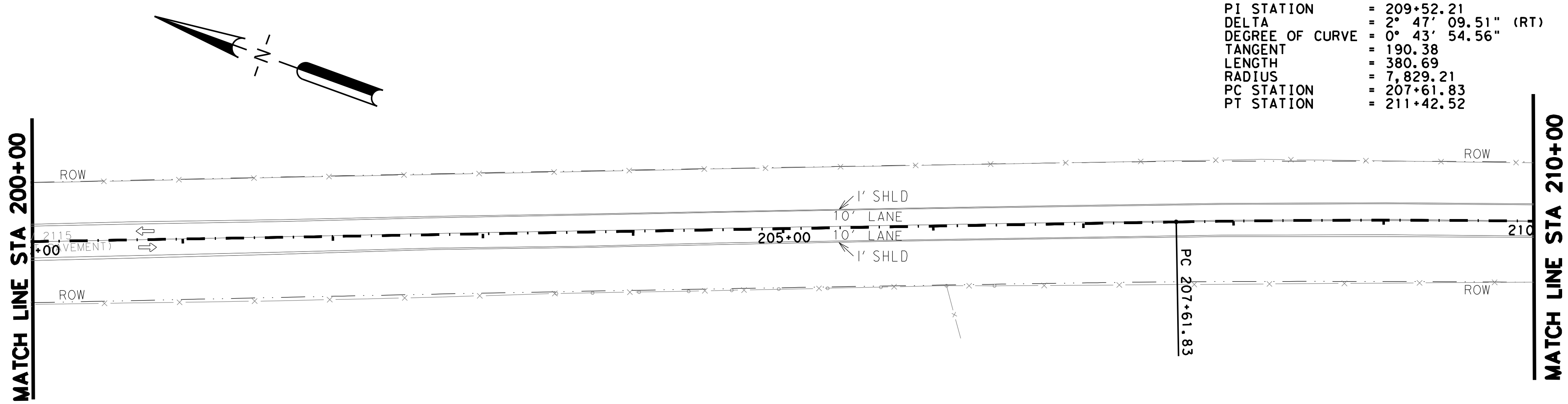
PC STATION	=	207+61.83
PT STATION	=	211+42.52



STATE OF TEXAS
BRADLEY MAYES
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Bradley Mayes 8/28/2021

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EXISTING PROJECT LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 10 OF 15

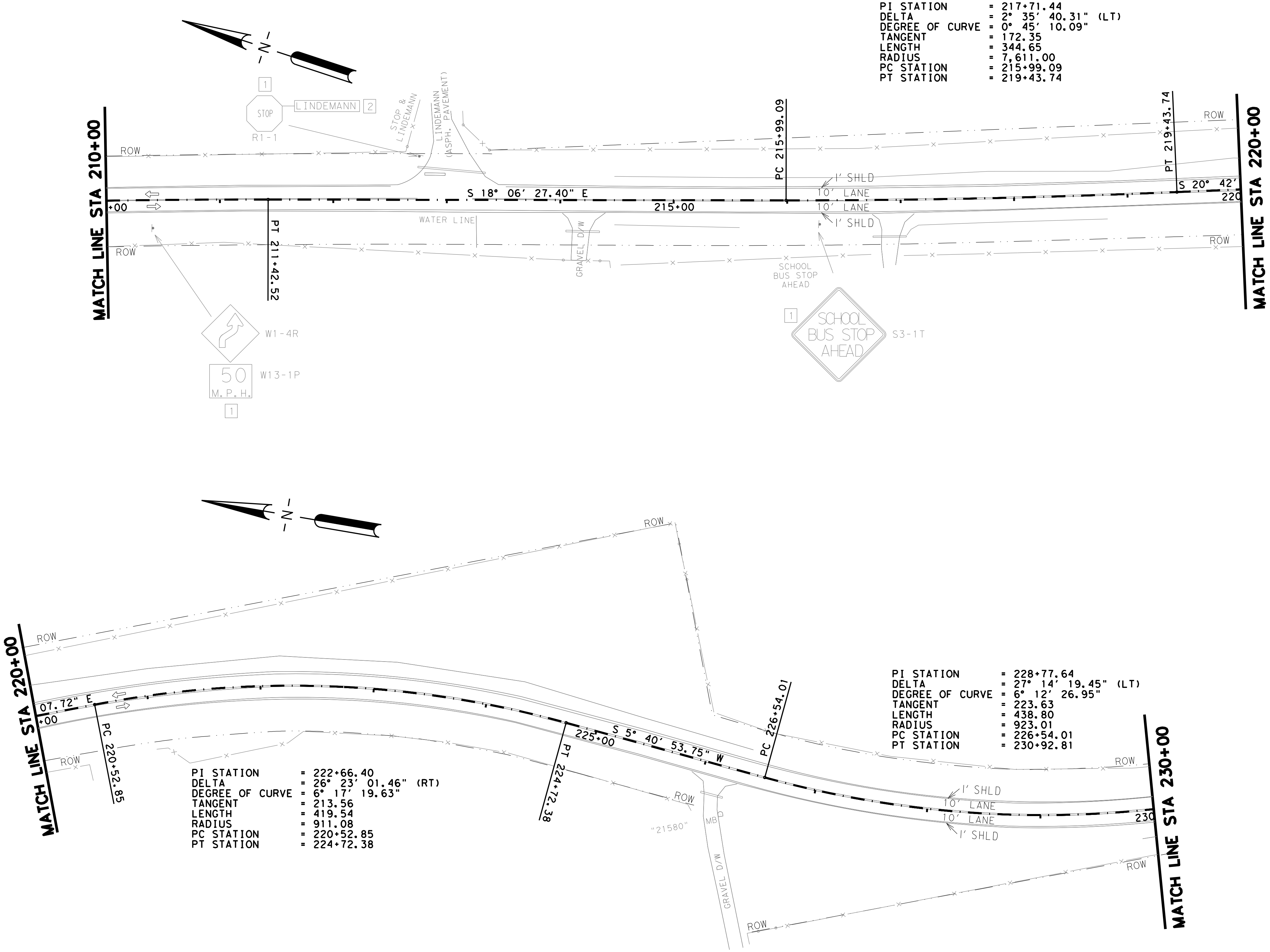
CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		22

NODE

NOTES:

1. RELOCATE EXISTING SIGN SUPPORT AND ASSEMBLY DURING CONSTRUCTION. REMOVAL AFTER CONSTRUCTION IS SUBSIDIARY.

2. RELOCATE EXISTING STREET NAME SIGN AND PROVIDE A POST MOUNTED BRACKET AFTER CONSTRUCTION. THIS MATERIAL AND WORK WILL BE SUBSIDIARY TO THE NEW STOP SIGN ASSEMBLY.



STATE OF TEXAS
BRADLEY MAYES
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PROFESSIONAL ENGINEER

Bradley Mayes 8/28/2021

SIGNATURE OF REGISTRANT & DATE

EXISTING PROJECT LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 11 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		23

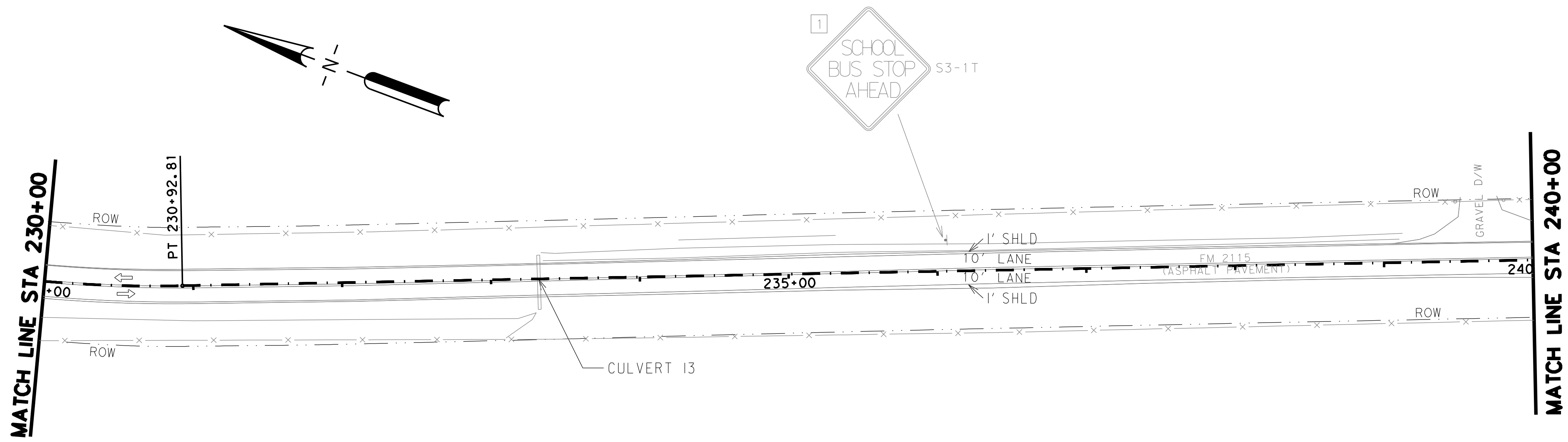
pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\2038010314 - Design\Plan Sets\02 Roadway\FM 2115 EXISTING PROJECT LAYOUTS.dgn

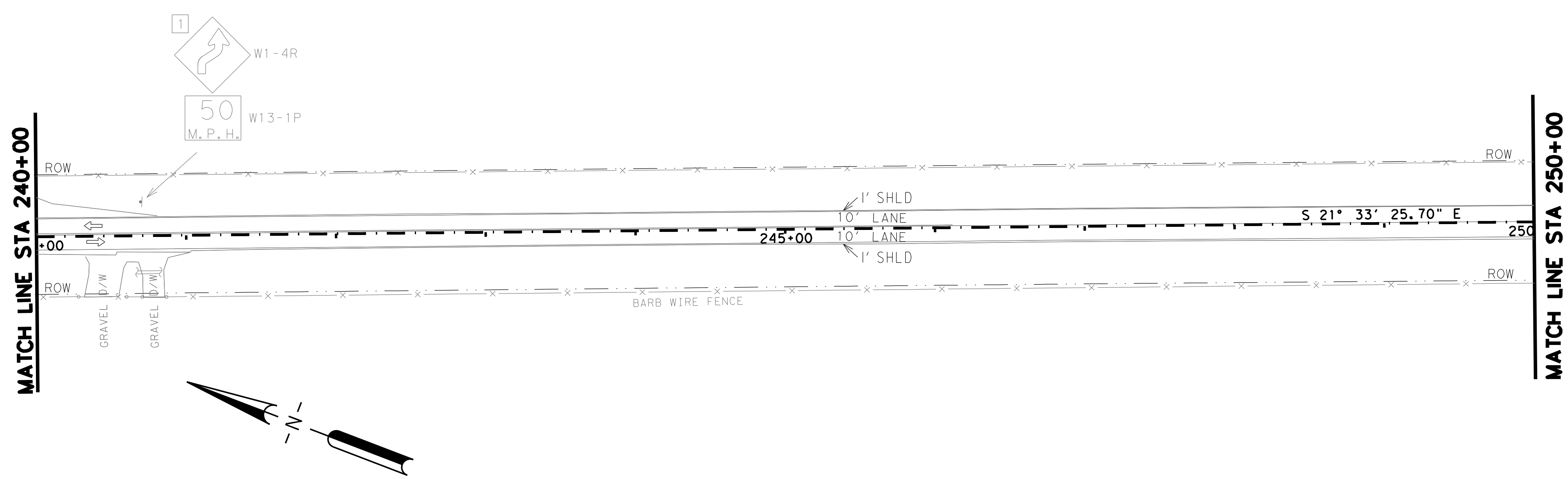
NODE

NOTES:

1. RELOCATE EXISTING SIGN SUPPORT AND ASSEMBLY DURING CONSTRUCTION. REMOVAL AFTER CONSTRUCTION IS SUBSIDIARY.

2. RELOCATE EXISTING STREET NAME SIGN AND PROVIDE A POST MOUNTED BRACKET AFTER CONSTRUCTION. THIS MATERIAL AND WORK WILL BE SUBSIDIARY TO THE NEW STOP SIGN ASSEMBLY.





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Bradley Mayes 8/28/2021

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EXISTING PROJECT LAYOUTS

SCALE: FEET 1" = 100' HORIZ.

SHEET 12 OF 15

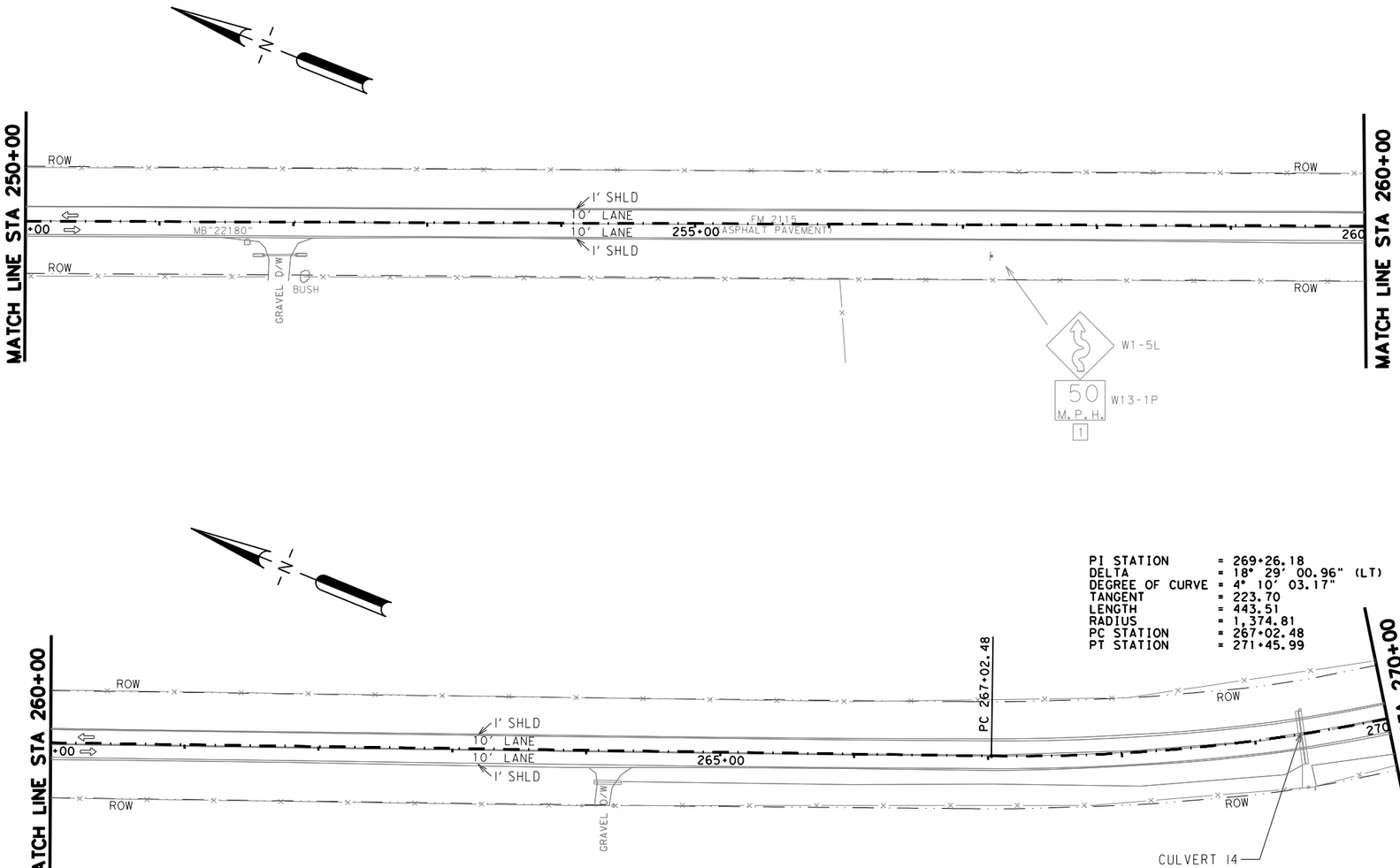
CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	24

NODE

NOTES:

1. RELOCATE EXISTING SIGN SUPPORT AND ASSEMBLY DURING CONSTRUCTION. REMOVAL AFTER CONSTRUCTION IS SUBSIDIARY.

2. RELOCATE EXISTING STREET NAME SIGN AND PROVIDE A POST MOUNTED BRACKET AFTER CONSTRUCTION. THIS MATERIAL AND WORK WILL BE SUBSIDIARY TO THE NEW STOP SIGN ASSEMBLY.



PI STATION = 269+26.18
DELTA = 18° 29' 00.96" (LT)
DEGREE OF CURVE = 4° 10' 03.17"
TANGENT = 223.70
LENGTH = 443.51
RADIUS = 1,374.81
PC STATION = 267+02.48
PT STATION = 271+45.99

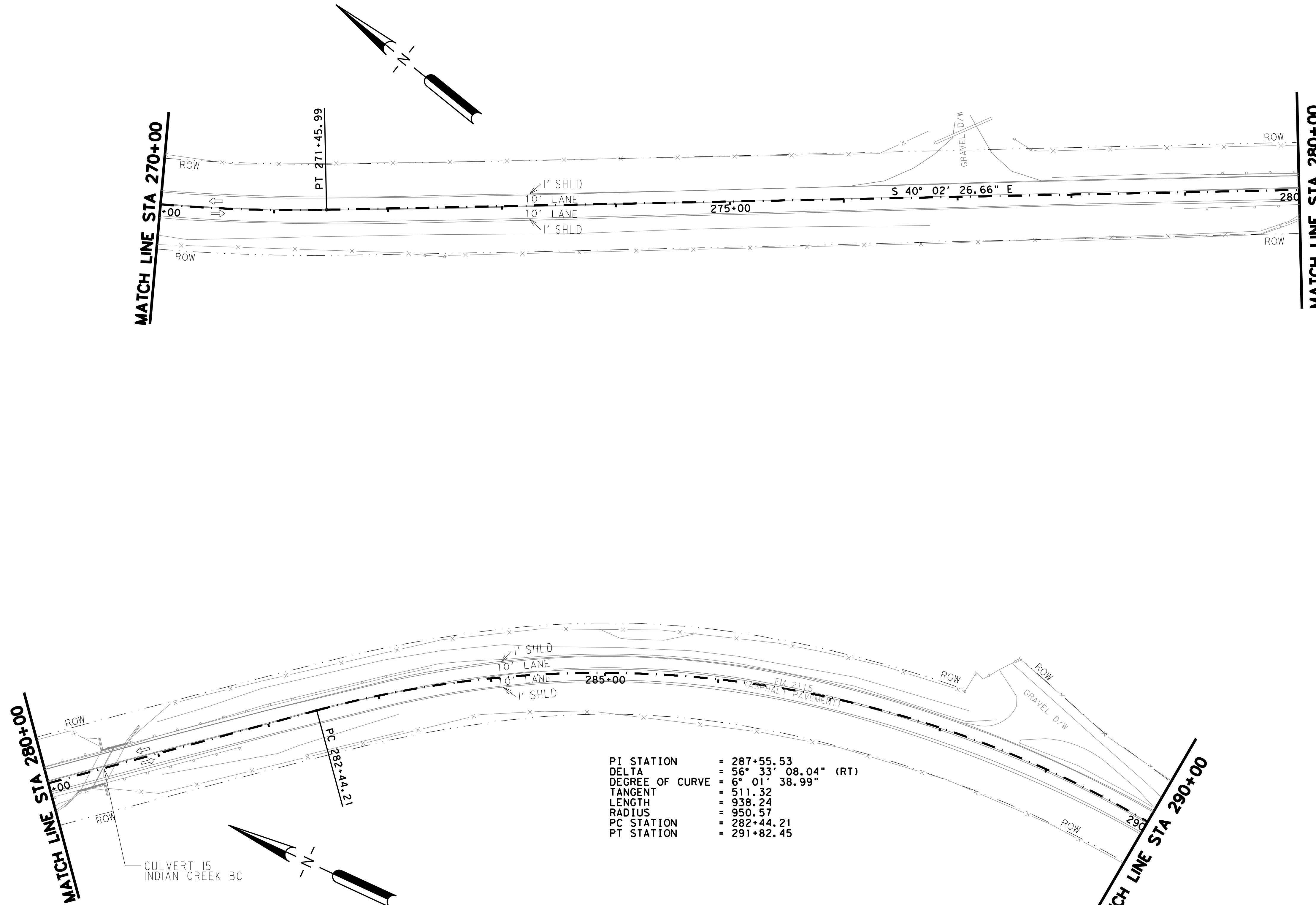
STATE OF TEXAS
BRADLEY MAYES
128276
LICENSED
PROFESSIONAL ENGINEER

Bradley Mayes 8/28/2021
SIGNATURE OF REGISTRANT & DATE

EXISTING PROJECT LAYOUTS

SCALE: 1" = 100' HORIZ. FEET

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		25



NOTES:

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LICENSED PROFESSIONAL ENGINEER

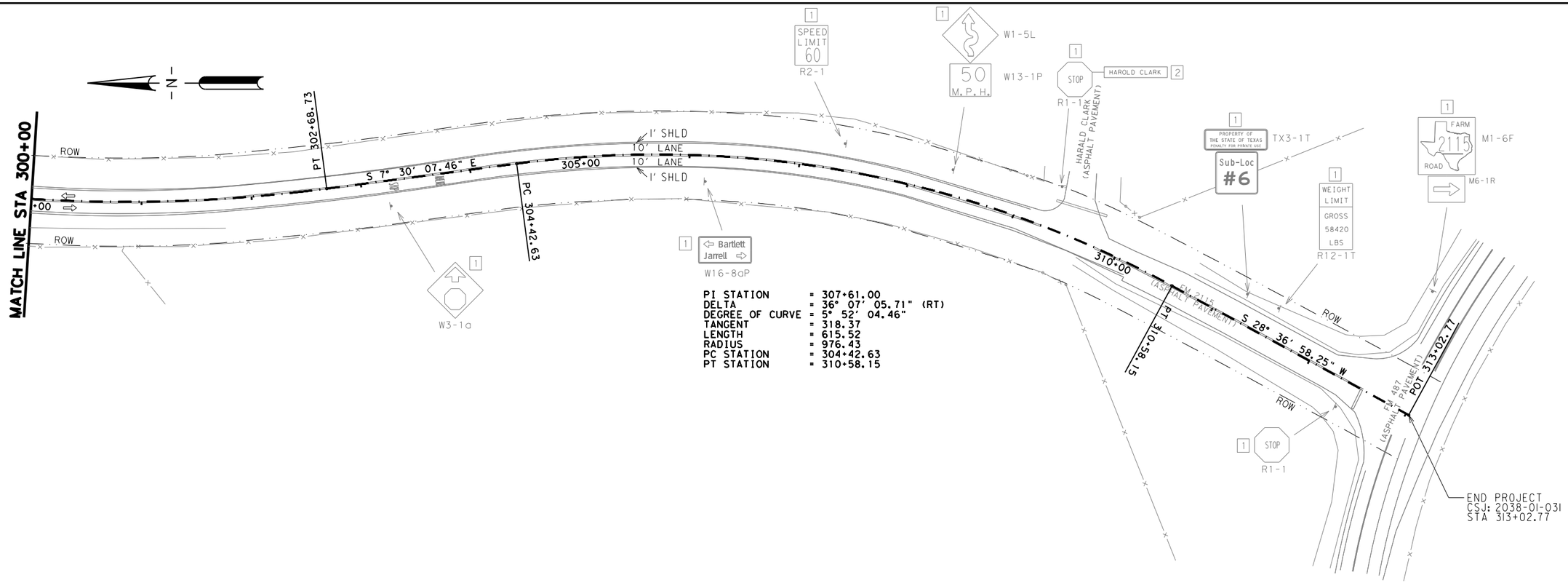
8/28/2021
SIGNATURE OF REGISTRANT & DATE

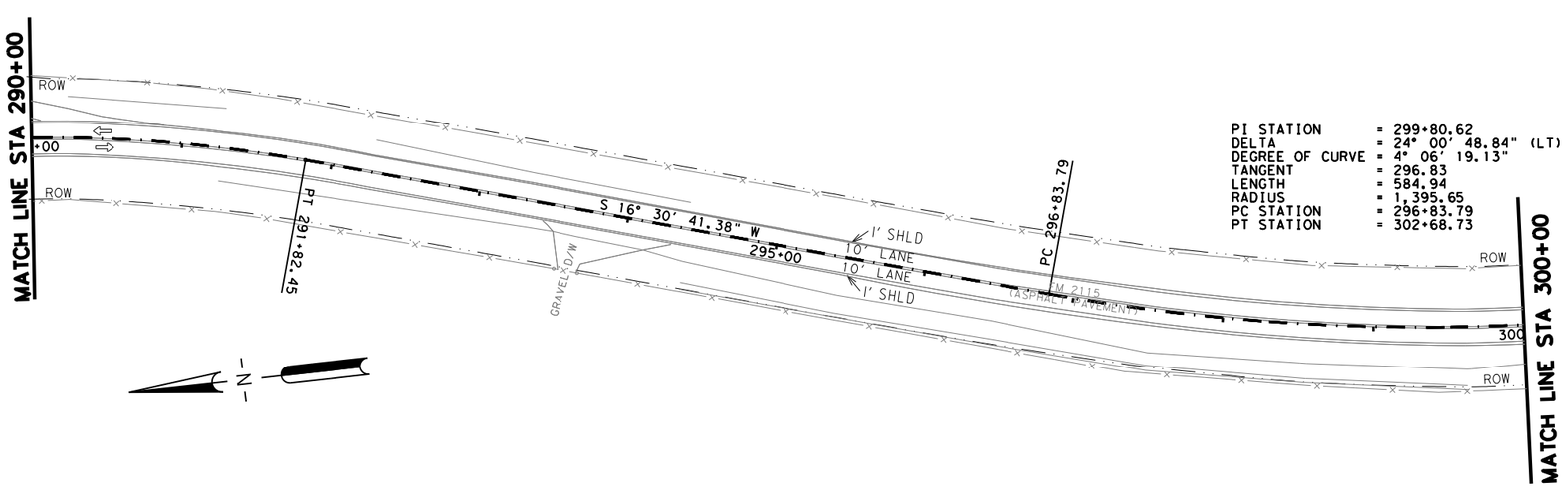
EXISTING PROJECT LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 14 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	26





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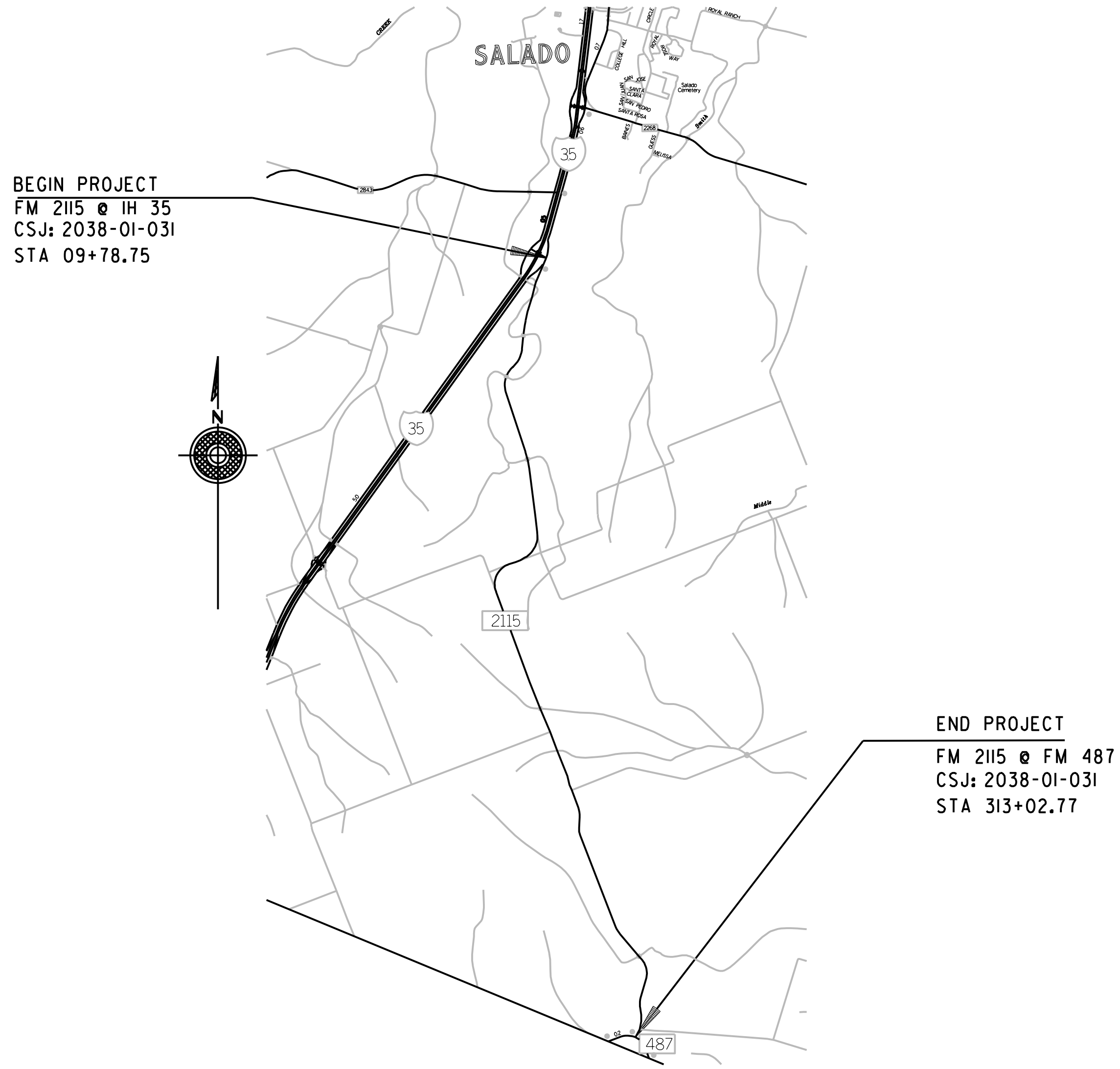
Bradley Mayes 8/28/2021
SIGNATURE OF REGISTRANT & DATE

EXISTING PROJECT LAYOUTS

SCALE: 1" = 100' HORIZ. FEET

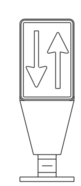
SHEET 15 OF 15

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		27



VICINITY MAP

1. SIGNS G20-1T WITH PLAQE OR G20-5T, G20-6, G20-2a, G20-2b, CW20-1D, R20-3, R20-5, G20-9T AND R20-5 PLAQUE WILL BE REQUIRED AT PROJECT LIMITS.
2. CW20-1D AND G20-2a WILL BE REQUIRED AT ALL CROSSROADS.
3. G20-1a WILL BE REQUIRED AT ALL MAJOR CROSSROADS.



2 WAY VERTICAL PANELS WILL BE REQUIRED TO SIMULATE CENTERLINE.

SIGNAGE LEGEND

G20-1T W/ PLAQUE OR G20-5T	48X18	BEGIN ROAD WORK NEXT X MILES
	48X24	BEGIN ROAD WORK NEXT X MILES
G20-6	48X30	NAME, ADDRESS, CITY, STATE, CONTRACTOR
G20-9T	36X30	BEGIN WORK ZONE
G20-2b	36X18	END WORK ZONE
R20-3	48X42	OBEY WARNING SIGNS STATE LAW
G20-1a	72X36	ROAD WORK NEXT X MILES
CW20-1D	48X48	ROAD WORK AHEAD
R20-5	36X36	TRAFFIC FINES DOUBLE
R20-5 PLAQUE	36X18	WHEN WORKERS ARE PRESENT
G20-2a	48X24	END ROAD WORK

NOTES:

1. ALL TRAFFIC CONTROL DEVICES WILL CONFORM WITH THE TEXAS "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS" (TMUTCD), AND WILL BE MAINTAINED AS DIRECTED. ADDITIONAL GUIDELINES FOR TRAFFIC CONTROL DEVICES MAY BE FOUND IN THE TMUTCD.
2. FOR CHANNELING DEVICE PLACEMENT AND SPACING FOR ALL PHASES, REFER TO THE TCP STANDARDS.

GENERAL

A. INSTALL ALL SIGNS, BARRICADES AND TRAFFIC CONTROL DEVICES AS SHOWN AND IN ACCORDANCE WITH THE STANDARD BC SHEETS AND AS DIRECTED.

B. ADDITIONAL SIGNS, BARRICADES OR TRAFFIC CONTROL DEVICES OTHER THAN THOSE SPECIFIED MAY BE REQUIRED FOR THE SAFE MOVEMENT OF TRAFFIC THROUGH THE PROJECT. PAYMENT FOR ALL SUCH SIGNS, BARRICADES OR TRAFFIC CONTROL DEVICES WILL BE CONSIDERED SUBSIDIARY TO THE ITEM "BARRICADES, SIGNS AND TRAFFIC HANDLING".

C. WORK SITES SHOULD BE CAREFULLY MONITORED TO ENSURE THAT TRAFFIC CONTROL MEASURES ARE OPERATING EFFECTIVELY AND THAT ALL DEVICES USED ARE CLEARLY VISIBLE, CLEAN AND IN GOOD REPAIR.

D. THE CONTRACTOR WILL PROVIDE SAFE ACCESS TO AND FROM ALL PRIVATE PROPERTY AT ALL TIMES AND IN ALL WEATHER CONDITIONS.

E. THE CONTRACTOR WILL BE REQUIRED TO SUBMIT A DETAILED SCHEDULE OF WORK PRIOR TO THE BEGINNING OF CONSTRUCTION WHICH GENERALLY CONFORMS TO THE SEQUENCE SHOWN ON THE TCP SEQUENCE OF OPERATION BELOW.

F. COMPLETE ALL WORK ON PROJECT AS SHOWN ON THE VARIOUS PLAN SHEETS AND IN COMPLIANCE WITH THE GENERAL NOTES OF THIS CONTRACT.

G. ANY REQUEST TO ALTER THE SEQUENCE OF OPERATION OR TRAFFIC CONTROL PLAN WILL BE SUBMITTED TO THE ENGINEER FOR HIS WRITTEN APPROVAL.

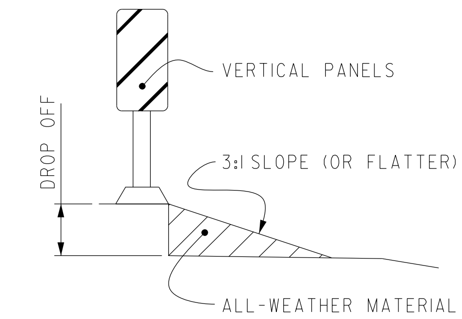
SEQUENCE OF CONSTRUCTION

A. SCHEDULE PROPOSED WORK IN ONLY ONE WORK AREA AT A TIME. THERE WILL BE NO WORK PERFORMED IN MORE THAN ONE WORK AREA AT A TIME.

B. FINISH PROPOSED WORK IN EACH WORK AREA BEFORE PROCEEDING TO PERFORM WORK IN ANOTHER WORK AREA. AT A MINIMUM, ALL SAFETY END TREATMENT FOR SIDE ROAD AND CROSS DRAINAGE CULVERTS WILL BE COMPLETE AND IN PLACE. OBTAIN APPROVAL BEFORE PROCEEDING TO BEGIN WORK IN ANOTHER WORK AREA.

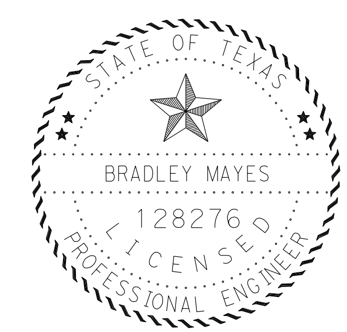
C. THE CONTRACTOR WILL BE REQUIRED TO SUBMIT A DETAILED SCHEDULE OF WORK TO THE AREA ENGINEER PRIOR TO THE BEGINNING OF CONSTRUCTION, WHICH GENERALLY CONFORMS TO THE FOLLOWING SEQUENCE:

1. INSTALL PROJECT LIMIT SIGNING AND BARRICADES PRIOR TO ANY OTHER WORK.
2. INSTALL REQUIRED TEMPORARY EROSION CONTROL DEVICES.
3. EXTEND CROSS DRAINAGE STRUCTURES ON THE WIDENING SIDE.
4. PLACE WORK ZONE PAVEMENT MARKINGS.
5. CONSTRUCT MBGF, RIPRAP IMPROVEMENTS, DRIVEWAYS, AND BASE WIDENING OPERATIONS SO THAT PAVEMENT DROP-OFFS CONFORM TO THE "PAVEMENT EDGE DROP-OFF DETAIL" BEFORE THE END OF EACH DAY'S OPERATION, UNLESS OTHERWISE DIRECTED.
6. CONSTRUCT FOAMED ASPHALT TREATMENT, THEN COVER WITH FOG SEAL.
7. PLACE WORK ZONE PAVEMENT MARKINGS.
8. THE CONTRACTOR MAY OPEN A WIDENED SECTION ONCE CONSTRUCTION IS COMPLETE, PROVIDED THAT SIGNING AND STRIPING HAS BEEN PLACED AND APPROVED.
9. PLACE PERMANENT VEGETATIVE MEASURES.
10. REMOVE TEMPORARY TRAFFIC CONTROL DEVICES.
11. COMPLETE UNDERSEAL & OVERLAY OVER ENTIRE WIDTH OF ROADWAY.
12. PLACE TABS ON OVERLAY.
13. INSTALL RUMBLE STRIPS.
14. PLACE REMAINING PERMANENT SIGNING AND STRIPING AS INDICATED ON THE SIGNING AND STRIPING LAYOUTS.
15. CLEAN UP PROJECT, REMOVE TEMPORARY EROSION CONTROL DEVICES AND PROJECT BARRICADES.



PAV EDGE DROP-OFF DETAIL

1. LESS THAN 2 INCHES: CW 8-11 SIGNS ARE REQUIRED.
2. GREATER THAN 2 INCHES: VERTICAL PANELS AND EITHER CW 8-9a OR CW 8-11 SIGNS ARE REQUIRED.
3. THE SAFETY SLOPE WILL BE CONSTRUCTED WITH AN ALL- WEATHER MATERIAL SUCH AS RAP, WHICH IS CLEAN AND FREE OF DEBRIS AND LARGE ROCKS.



Bradley Mayes 8/28/2021
SIGNATURE OF REGISTRANT & DATE

SEQUENCE OF CONSTRUCTION

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	28

pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\203801031\4 - Design\Plan Sheets\TCP\FM 2115 SEQUENCE OF OPERATION.dgn
NODE

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FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\203801314 - Design\Plan Set\2. TCP\Standards\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

SHEET 1 OF 12

Texas Department of Transportation | Traffic Safety Division Standard

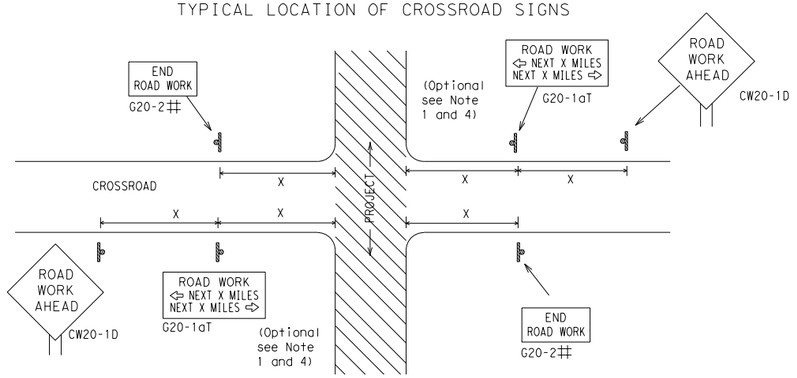
BARRICADE AND CONSTRUCTION GENERAL NOTES AND REQUIREMENTS

BC(1)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
4-03 7-13	DIST	COUNTY		SHEET NO.
9-07 8-14	WAC	BELL		29
5-10 5-21				

DATE: 8/28/2021 5:36:43 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\2038010314 - Design Plan Set 2. TCP\Standards\bc-21.dgn

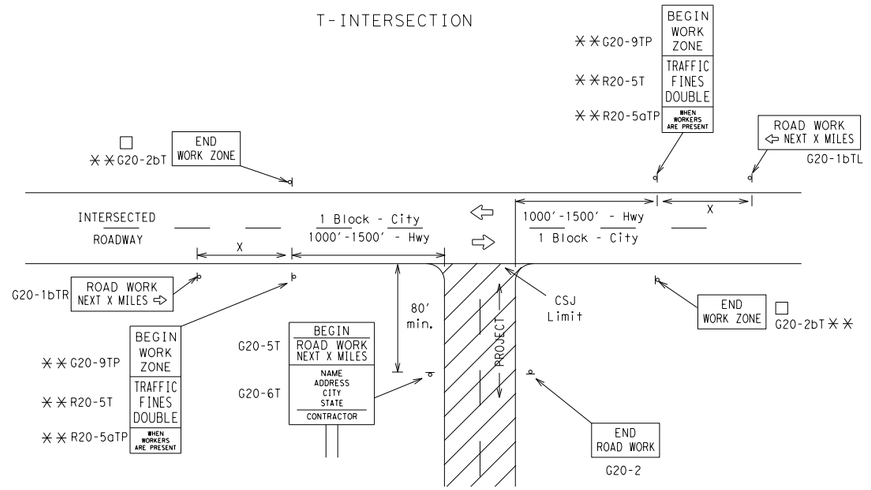
TYPICAL LOCATION OF CROSSROAD SIGNS



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.

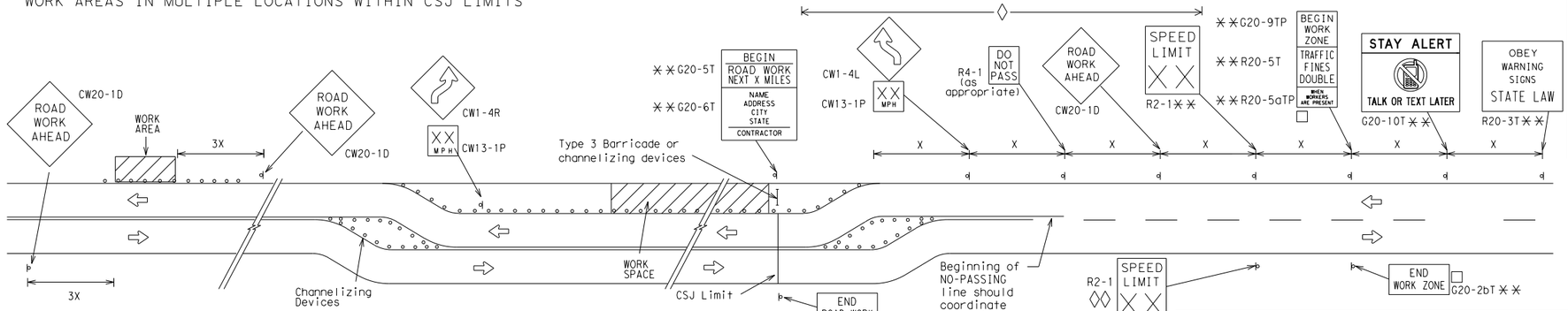
△ Minimum distance from work area to first Advance Warning sign nearest the work area and/or distance between each additional sign.

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.

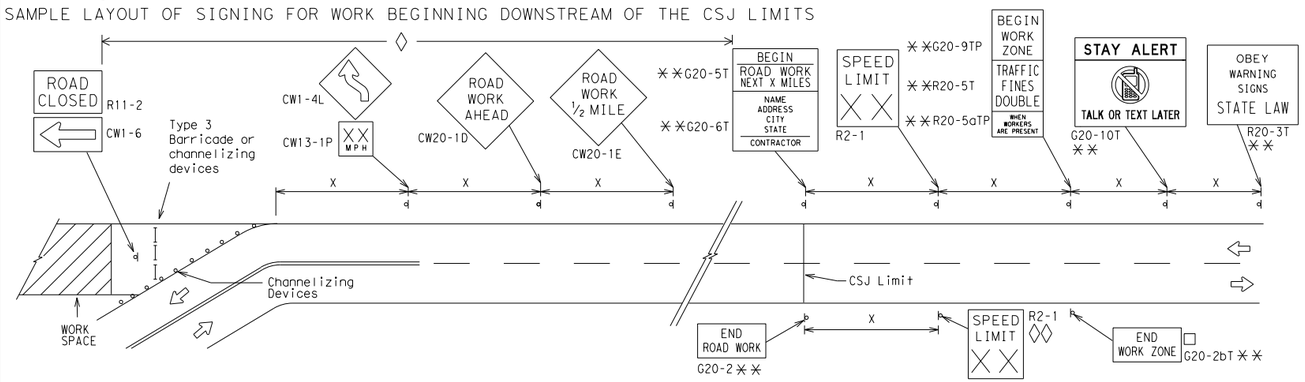
WORK AREAS IN MULTIPLE LOCATIONS WITHIN CSJ LIMITS

SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING AT THE 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 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

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	WAC	BELL		30

DATE: 8/28/2021 5:36:44 PM
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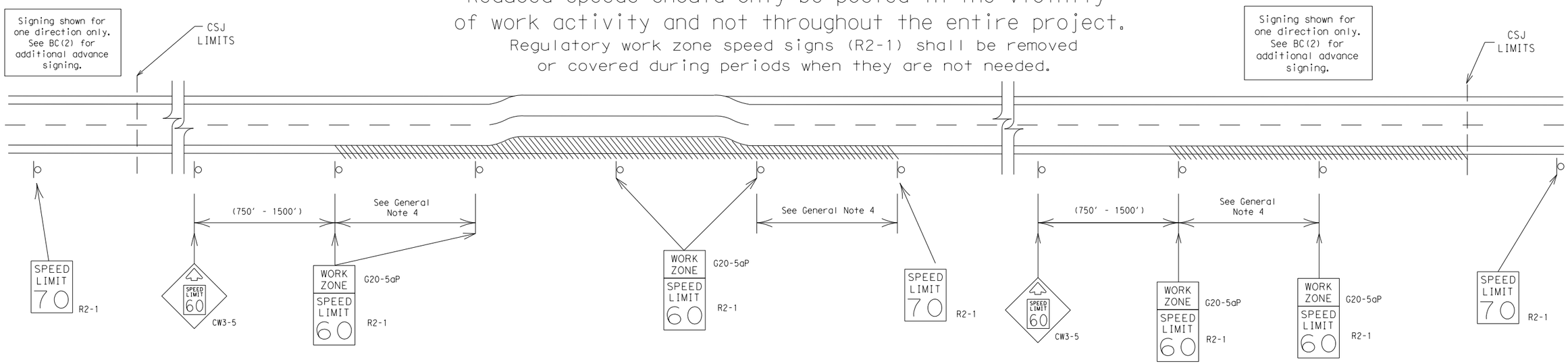
TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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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9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	WAC	BELL		31

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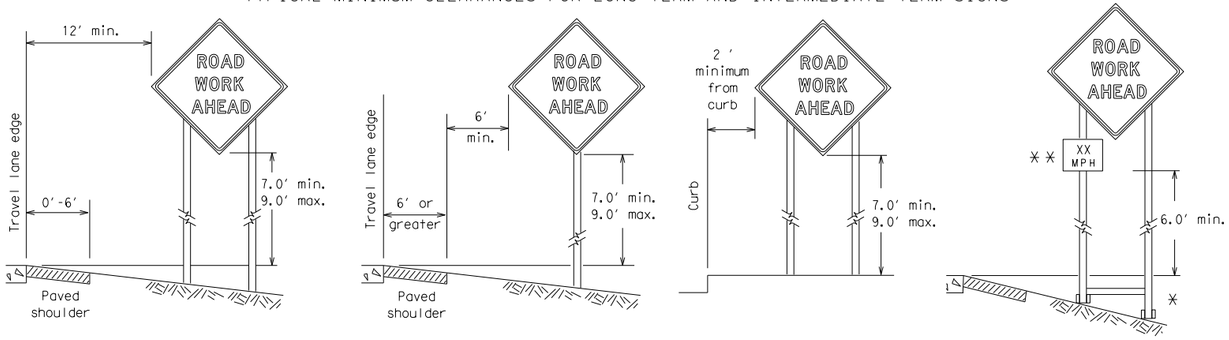
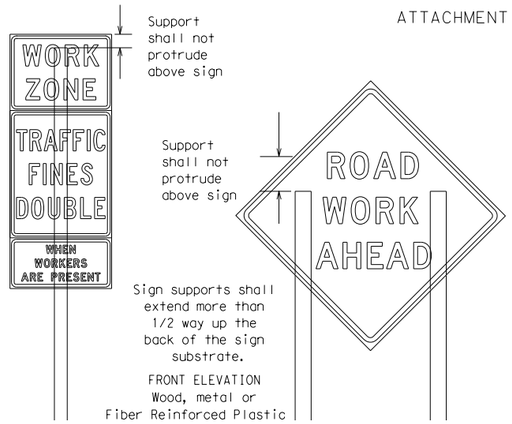
TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS

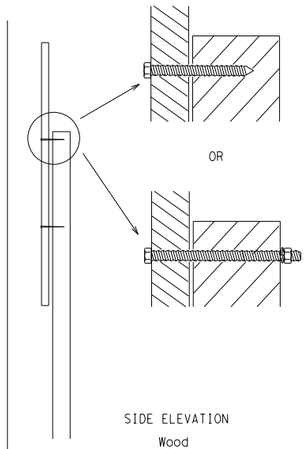


⚹ When placing skid supports on unlevel ground, the leg post lengths must be adjusted so the sign appears straight and plumb. Objects shall NOT be placed under skids as a means of leveling.

⚹⚹ 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





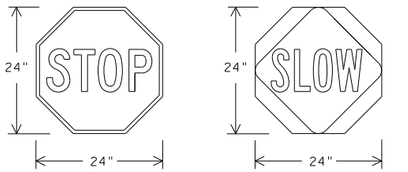
Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

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

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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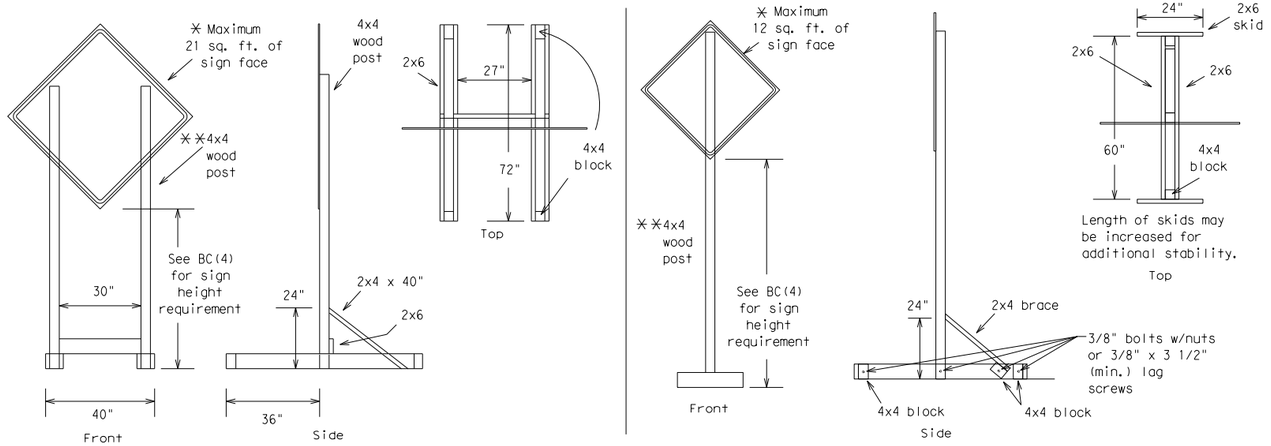
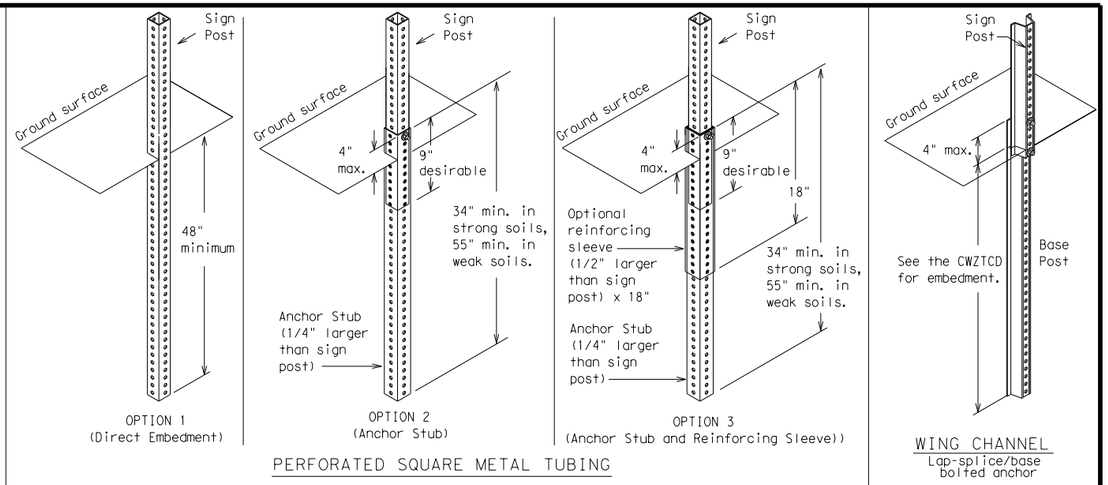


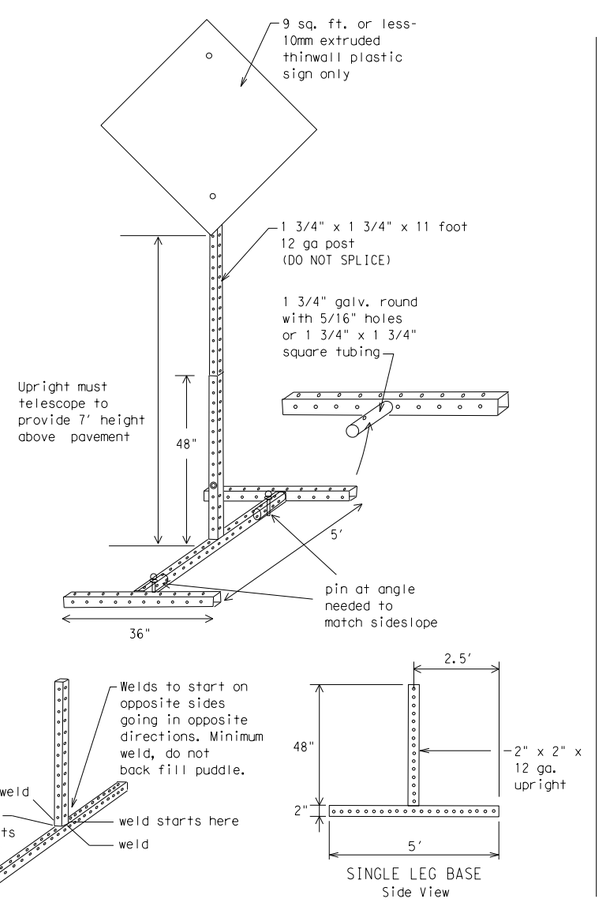
SKID MOUNTED WOOD SIGN SUPPORTS

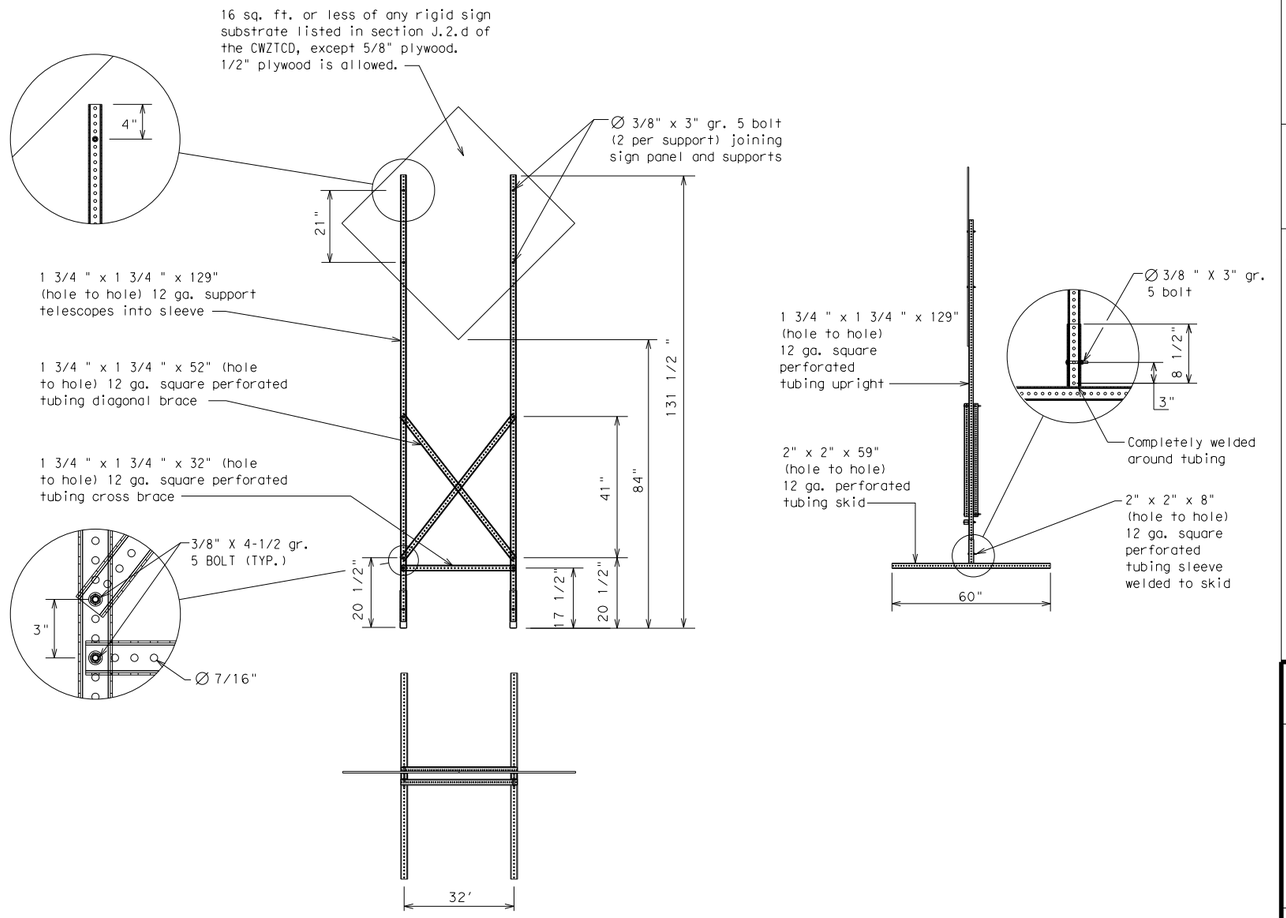
* LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS



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

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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 *	

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

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

** 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		2038	01	031	FM 2115
9-07 8-14		DIST	COUNTY		SHEET NO.
7-13 5-21		WAC	BELL		34

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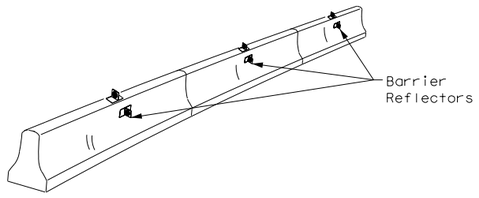
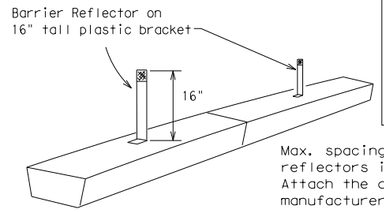
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\203801031\4 - Design\Plan Set\2. TCP\Standards\bc-21.dgn

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.

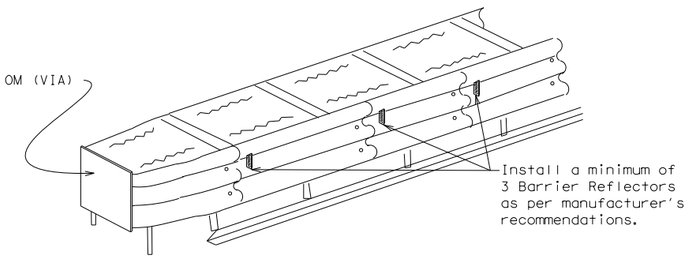


Max. spacing of barrier reflectors is 20 feet. Attach the delineators as per manufacturer's recommendations.

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.

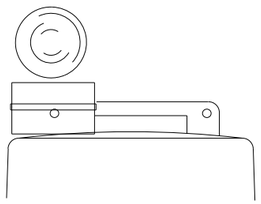


DELINEATION OF END TREATMENTS

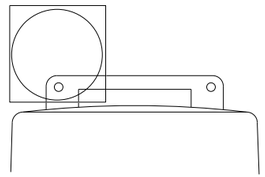
END TREATMENTS FOR CTB'S USED IN WORK ZONES

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

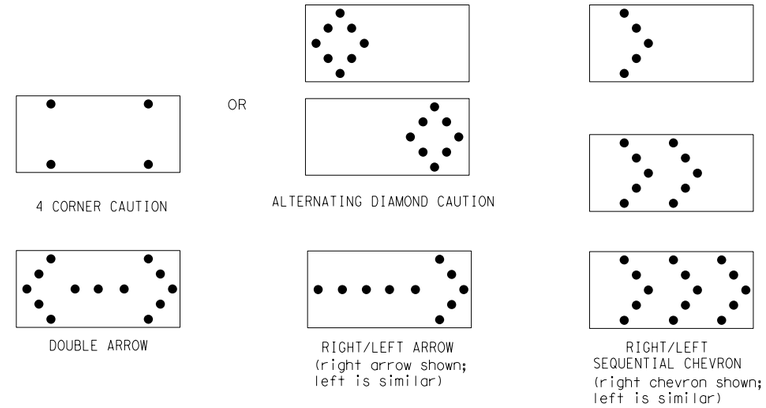
1. Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
2. Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
3. A series of sequential flashing warning lights placed on channelizing 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

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	2038	01	031	FM 2115
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	WAC	BELL		35

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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:

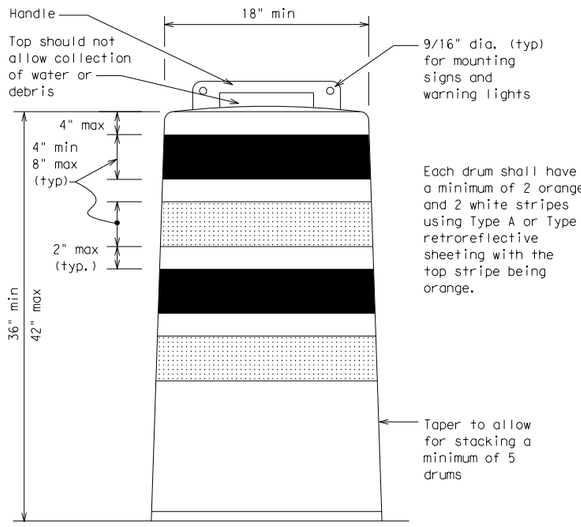
1. Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
2. The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents 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.

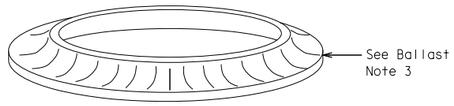
RETROREFLECTIVE SHEETING

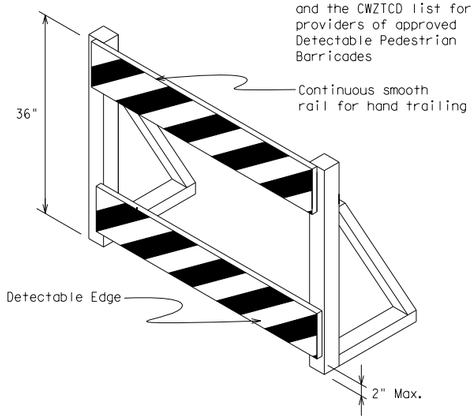
1. The stripes used on drums shall be constructed of sheeting meeting the color and retroreflectivity requirements of Departmental Materials Specification DMS-8300, "Sign Face Materials." Type A or Type B reflective sheeting shall be supplied unless otherwise specified in the plans.
2. The sheeting shall 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.

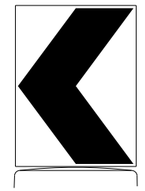




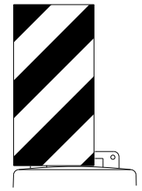


DETECTABLE PEDESTRIAN BARRICADES

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

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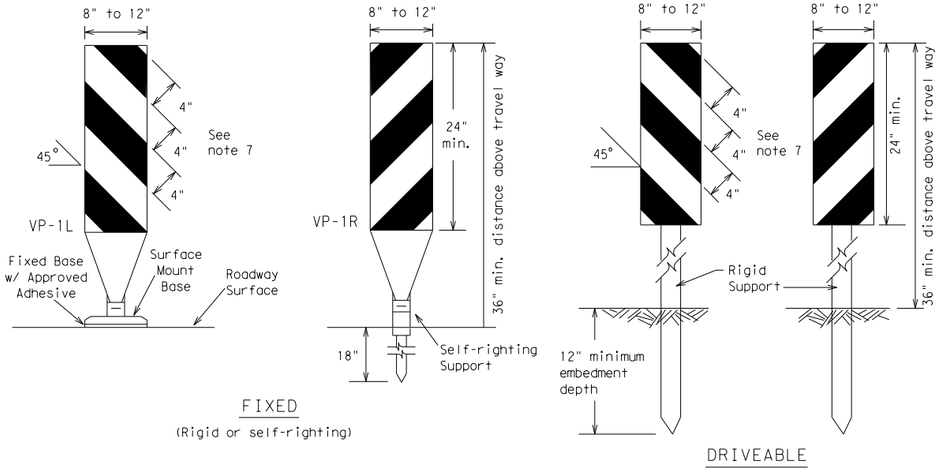
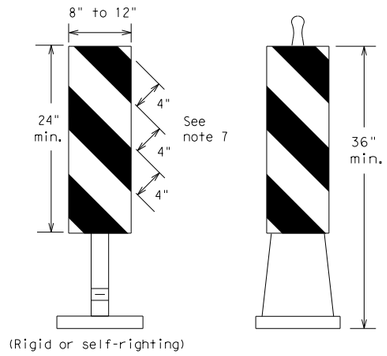


FIXED
(Rigid or self-righting)

DRIVEABLE

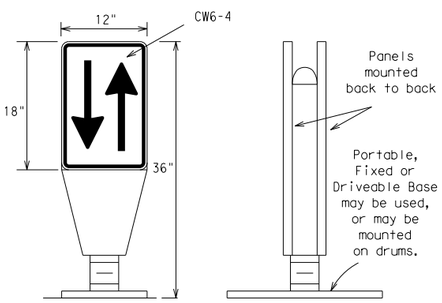


(Rigid or self-righting)

PORTABLE

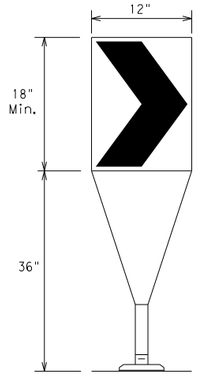
1. Vertical Panels (VP's) are normally used to channelize traffic or divide opposing lanes of traffic.
2. VP's may be used in daytime or nighttime situations. They may be used at the edge of shoulder drop-offs and other areas such as lane transitions where positive daytime and nighttime delineation is 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)



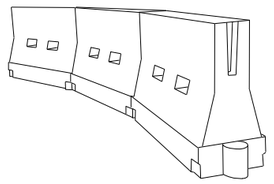
Fixed Base w/ Approved Adhesive (Driveable Base, or Flexible Support can be used)

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 ** 10' Offset	11' Offset	12' Offset	Suggested Maximum Spacing of Channelizing Devices 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

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BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(9)-21

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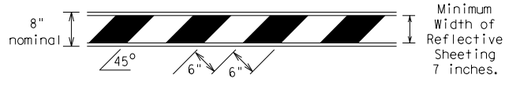
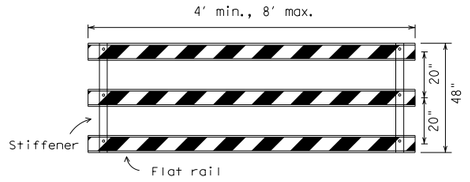
TYPE 3 BARRICADES

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.



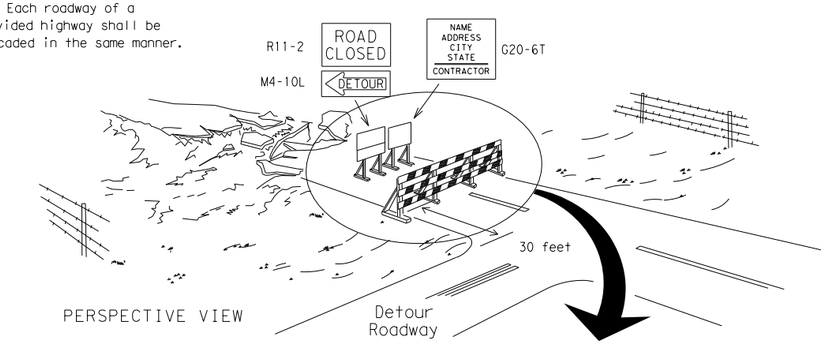
TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



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

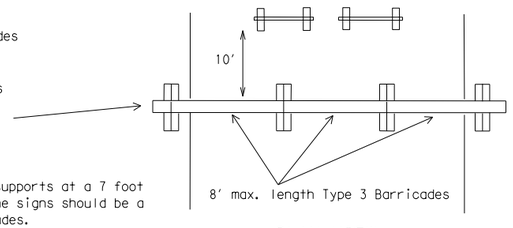
Each roadway of a divided highway shall be barricaded in the same manner.



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.

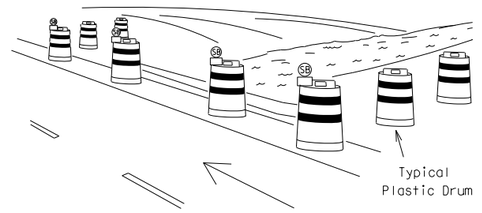
Barricade striping should slant downward in the direction of detour.



PLAN VIEW

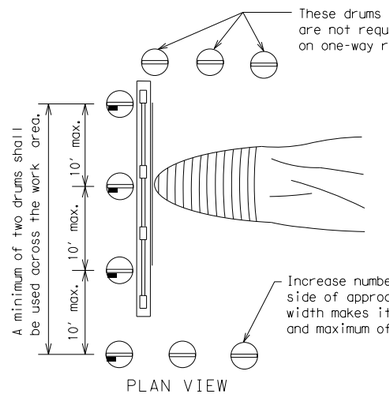
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION



PERSPECTIVE VIEW

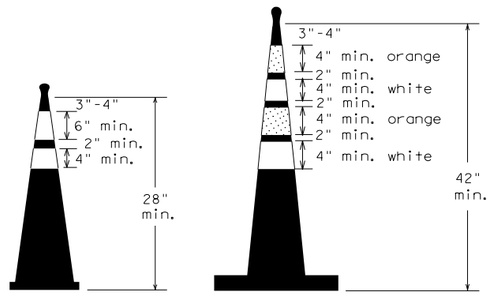
1. Where positive redirectional capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder 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

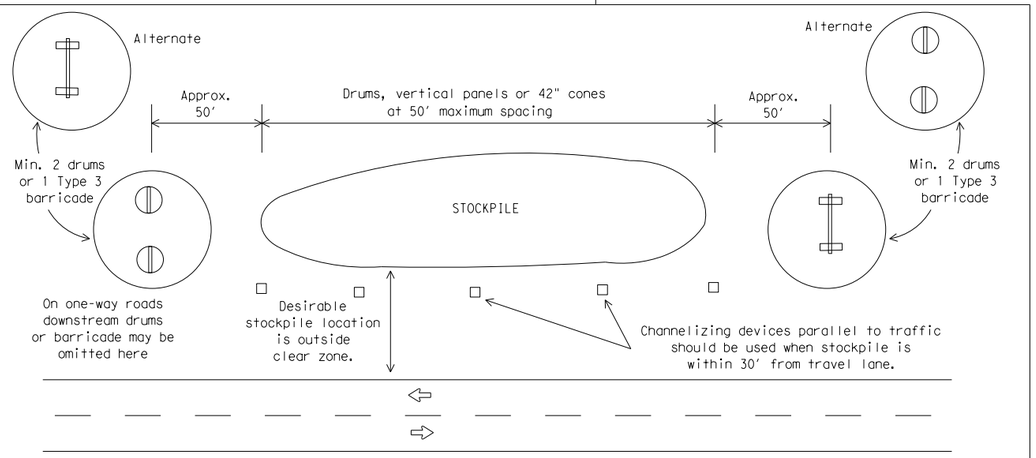
CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS



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

SHEET 10 OF 12

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(10)-21

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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.

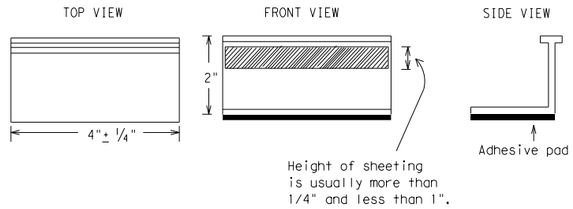
MAINTAINING WORK ZONE PAVEMENT MARKINGS

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).

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BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

BC(11)-21

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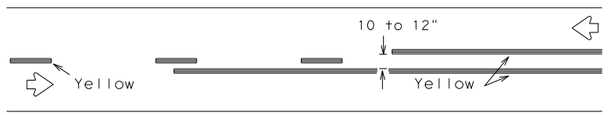
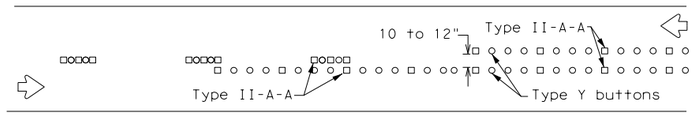
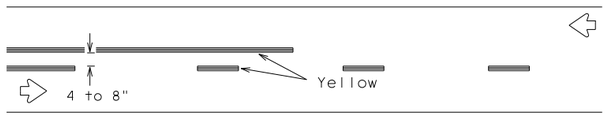
PAVEMENT MARKING PATTERNS



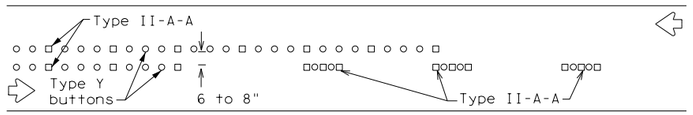
REFLECTORIZED PAVEMENT MARKINGS - PATTERN A



RAISED PAVEMENT MARKERS - PATTERN A



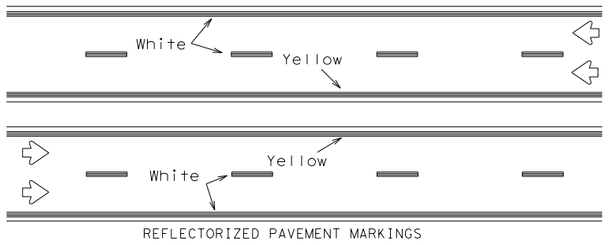
REFLECTORIZED PAVEMENT MARKINGS - PATTERN B



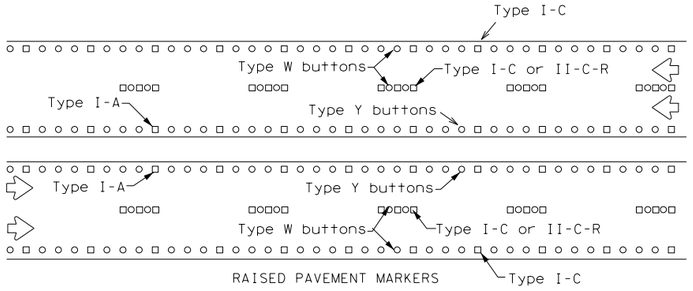
RAISED PAVEMENT MARKERS - PATTERN B

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



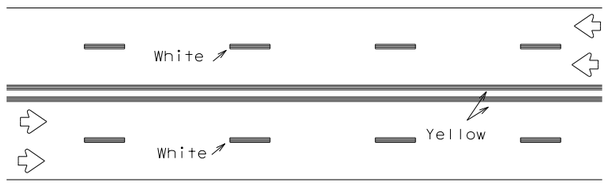
REFLECTORIZED PAVEMENT MARKINGS



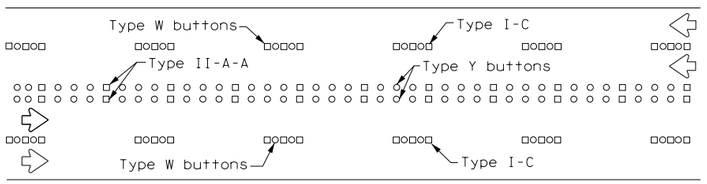
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

EDGE & LANE LINES FOR DIVIDED HIGHWAY



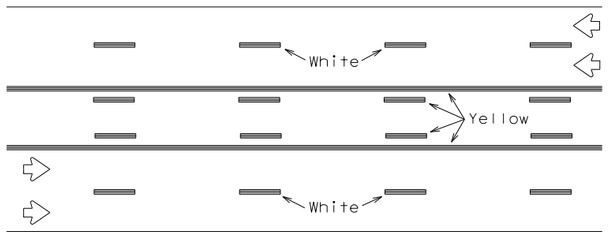
REFLECTORIZED PAVEMENT MARKINGS



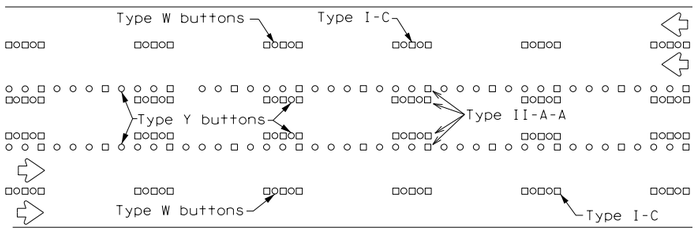
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS



RAISED PAVEMENT MARKERS

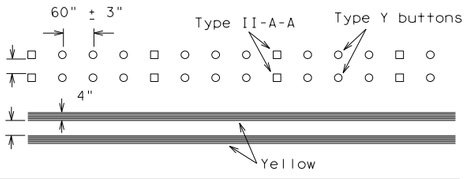
Prefabricated markings may be substituted for reflectorized pavement markings.

TWO-WAY LEFT TURN LANE

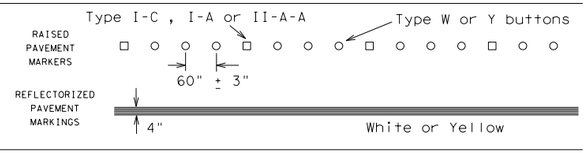
STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS

SOLID LINES

DOUBLE NO-PASSING LINE

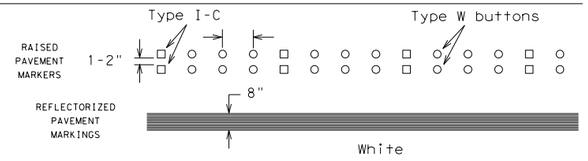


EDGE LINE OR SINGLE NO-PASSING LINE



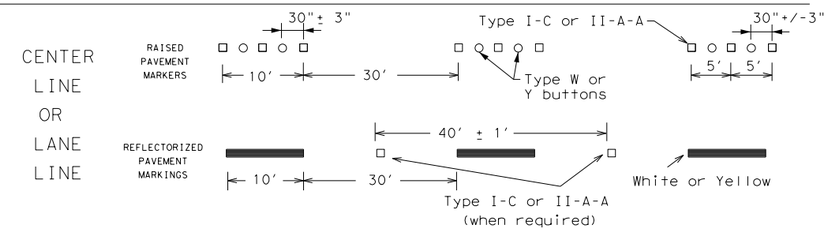
WIDE LINE

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

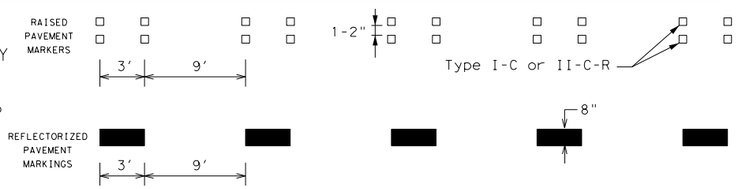


BROKEN LINES

CENTER LINE OR LANE LINE

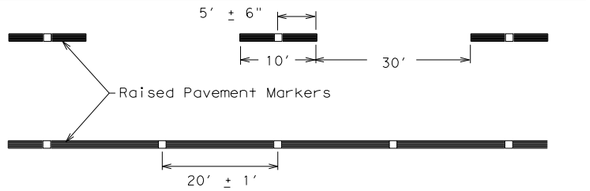


AUXILIARY OR LANEDROP LINE



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."

SHEET 12 OF 12

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	2038	01	031	FM 2115
2-98 7-13	DIST	COUNTY		SHEET NO.
11-02 8-14	WAC	BELL		40

106

DATE: 8/28/2021 5:36:53 PM
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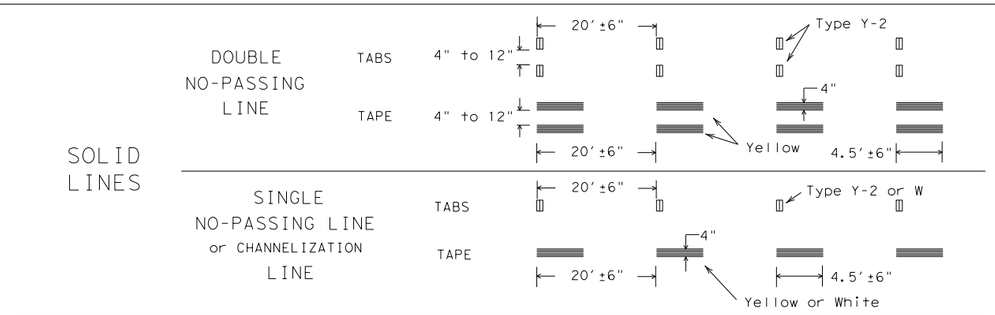
WORK ZONE SHORT TERM PAVEMENT MARKINGS DETAILS



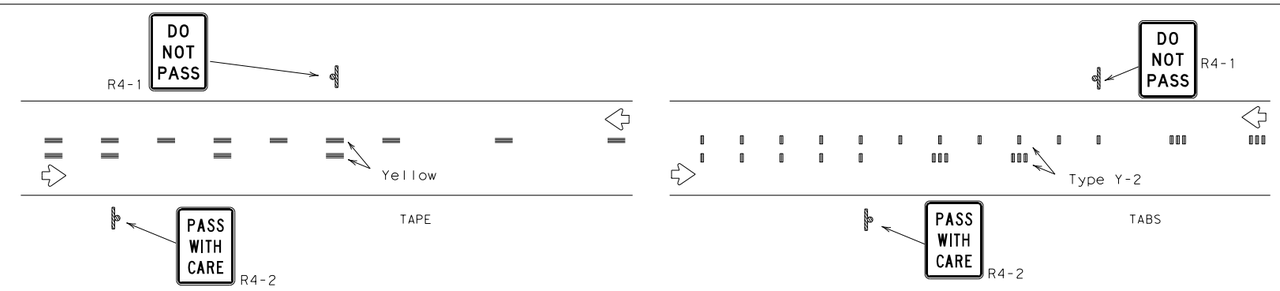
NOTES:

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

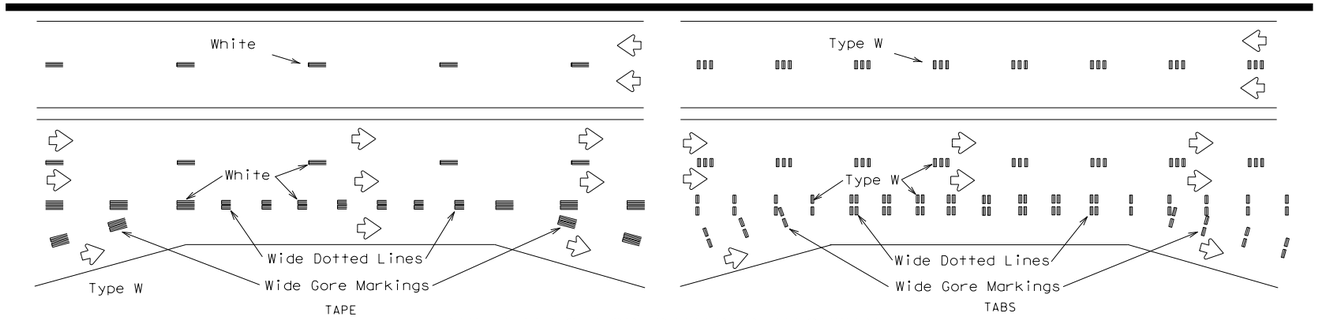
TEMPORARY FLEXIBLE, REFLECTIVE ROADWAY MARKER TABS (TABS)

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

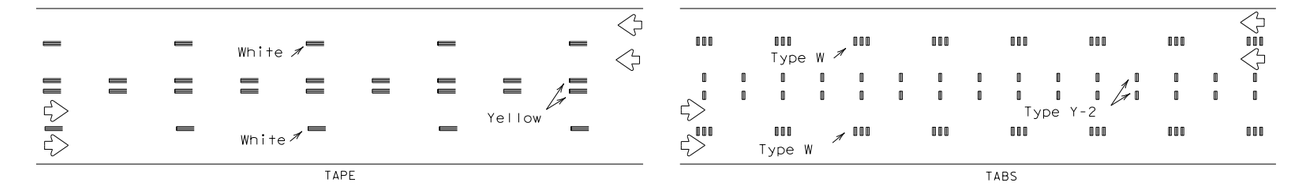
WORK ZONE SHORT TERM PAVEMENT MARKINGS PATTERNS



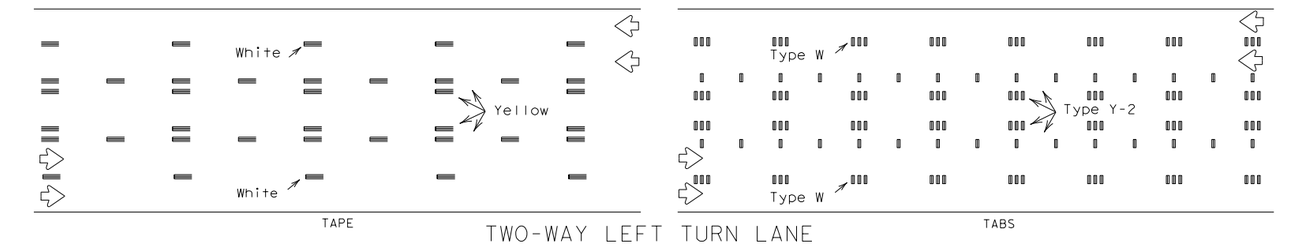
CENTER LINE & NO-PASSING ZONE BARRIER LINES FOR TWO LANE TWO-WAY HIGHWAYS



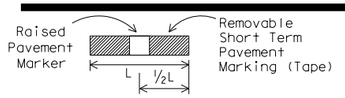
LANE LINES FOR DIVIDED HIGHWAY



LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



TWO-WAY LEFT TURN LANE



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

PREFABRICATED PAVEMENT MARKINGS

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

RAISED PAVEMENT MARKERS

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

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

1. DMSs referenced above can be found along with embedded links to their respective MPLs at the following website:
   http://www.txdot.gov/business/contractors_consultants/material_specifications/default.htm

Texas Department of Transportation

Traffic Operations Division Standard

WORK ZONE SHORT TERM PAVEMENT MARKINGS

WZ(STPM)-13

FILE:	wzstpm-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT	April 1992	CONT	SECT	JOB	HIGHWAY
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3-03		WAC	BELL		41
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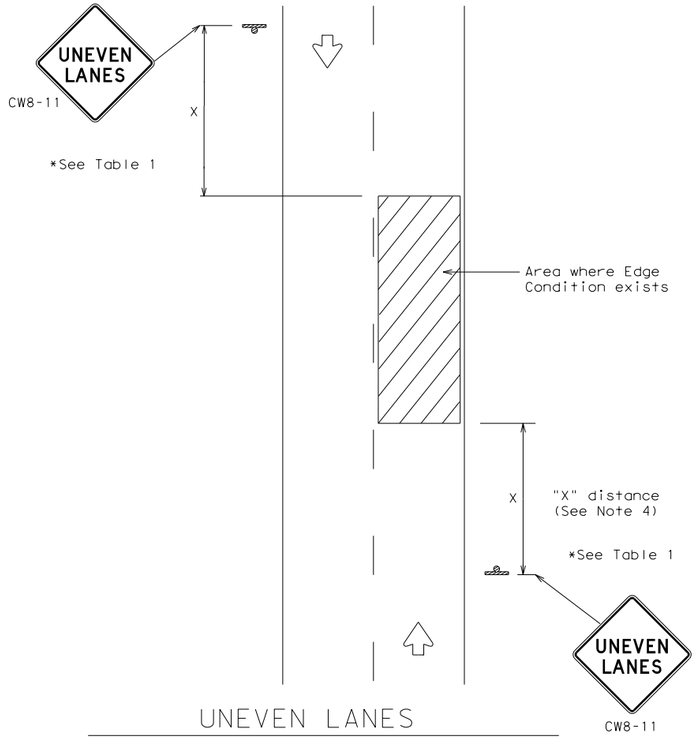
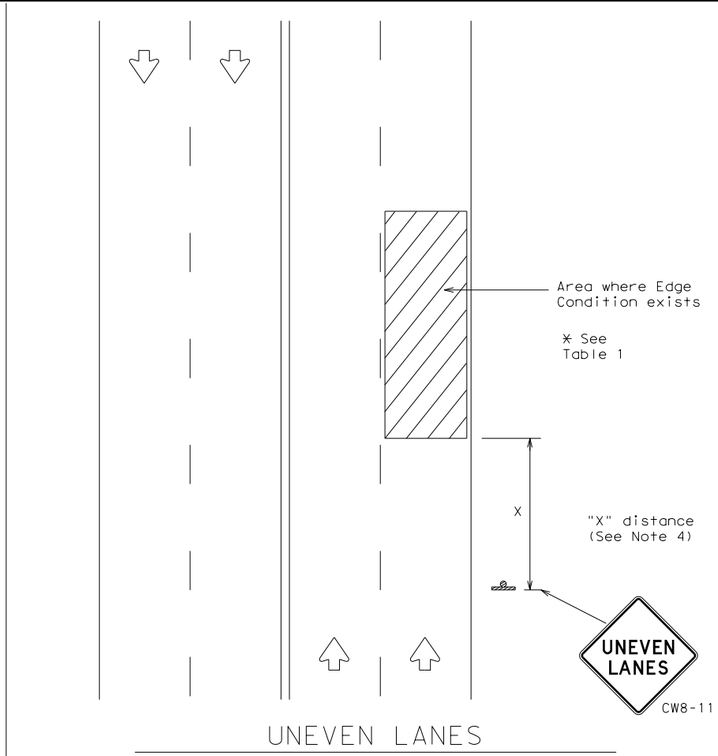
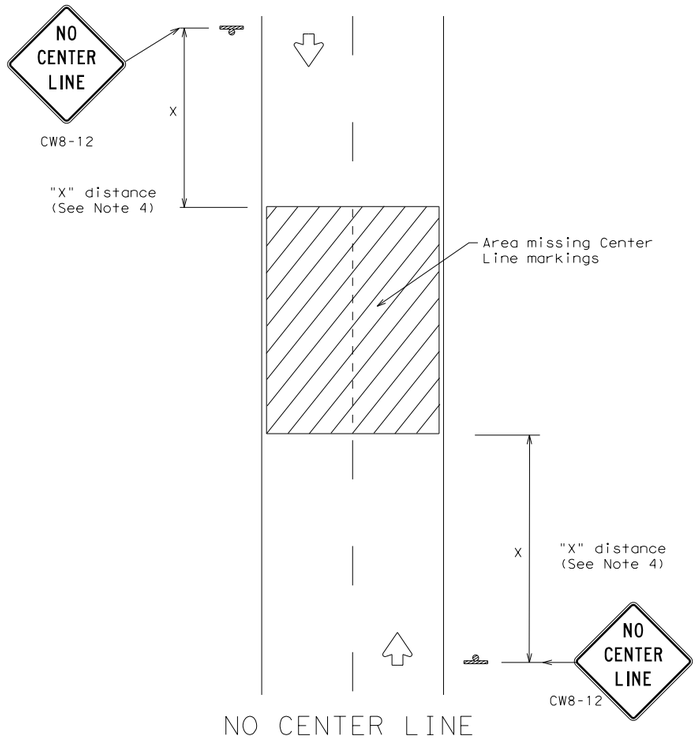


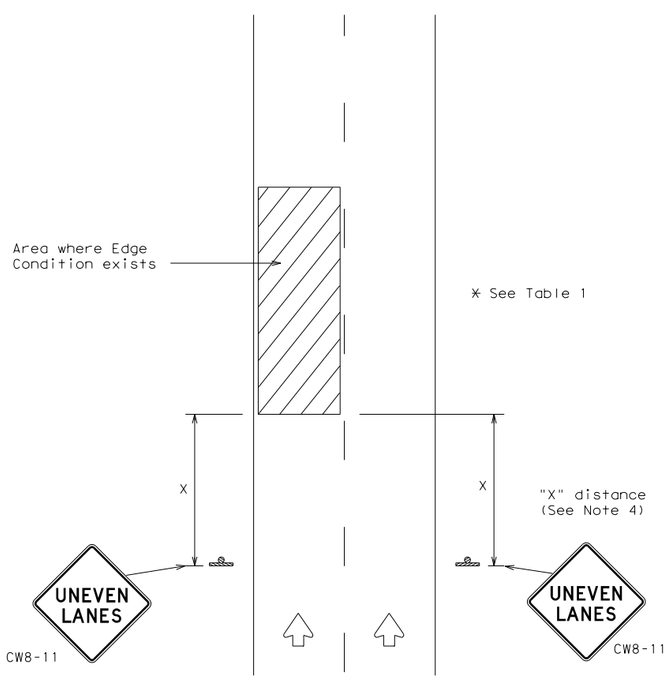
UNEVEN LANES
TWO LANE CONVENTIONAL ROAD



UNEVEN LANES
FOUR LANE CONVENTIONAL ROAD



NO CENTER LINE
TWO LANE CONVENTIONAL ROAD



UNEVEN LANES
DIVIDED ROADWAY

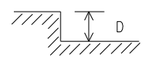
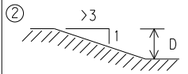
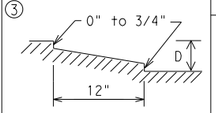
DEPARTMENTAL MATERIAL SPECIFICATIONS	
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240
TEMPORARY (REMOVABLE) PREFABRICATED PAVEMENT MARKINGS	DMS-8241
SIGN FACE MATERIALS	DMS-8300

COLOR	USAGE	SHEETING MATERIAL
ORANGE	BACKGROUND	TYPE B_{FL} OR TYPE C_{FL} SHEETING
BLACK	LEGEND & BORDERS	ACRYLIC NON-REFLECTIVE SHEETING

GENERAL NOTES

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

TABLE 1

Edge Condition	Edge Height (D)	* Warning Devices
① 	Less than or equal to: 1¼" (maximum-planing) 1½" (typical-overlay)	Sign: CW8-11
	Distance "D" may be a maximum of 1 1/4 " for planing operations and 2" for overlay operations if uneven lanes with edge condition 1 are open to traffic after work operations cease.	
② 	Less than or equal to 3"	Sign: CW8-11
③  Notched Wedge Joint	Distance "D" may be a maximum of 3" if uneven lanes with edge condition 2 or 3 are open to traffic after work operations cease. Uneven lanes should not be open to traffic when "D" is greater than 3".	

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

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

Texas Department of Transportation

Traffic Operations Division Standard

SIGNING FOR UNEVEN LANES

WZ(UL)-13

FILE: wzul-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT April 1992	CONT	SECT	JOB	HIGHWAY
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8-95 2-98 7-13	DIST	COUNTY		SHEET NO.
1-97 3-03	WAC	BELL		42

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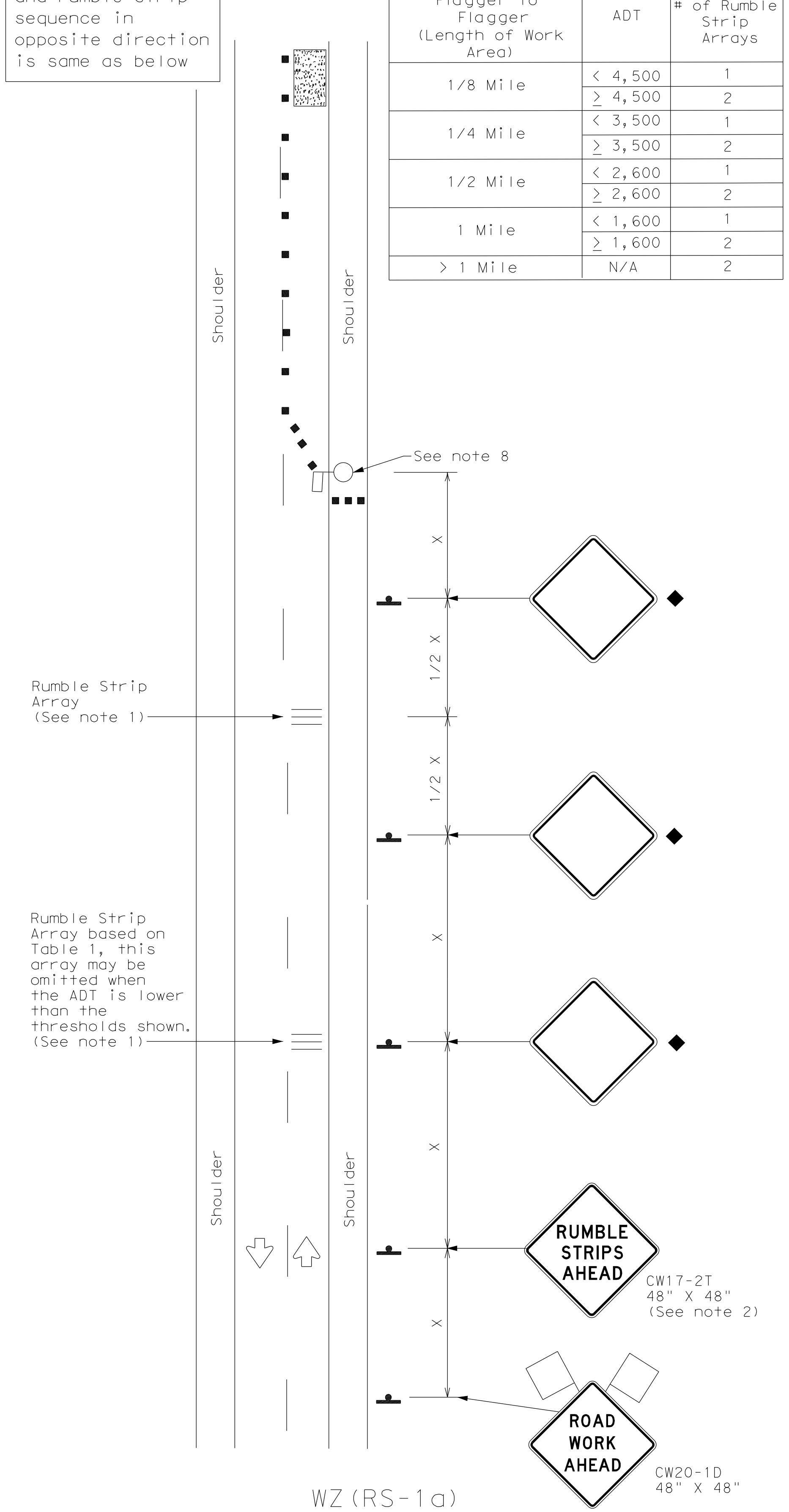
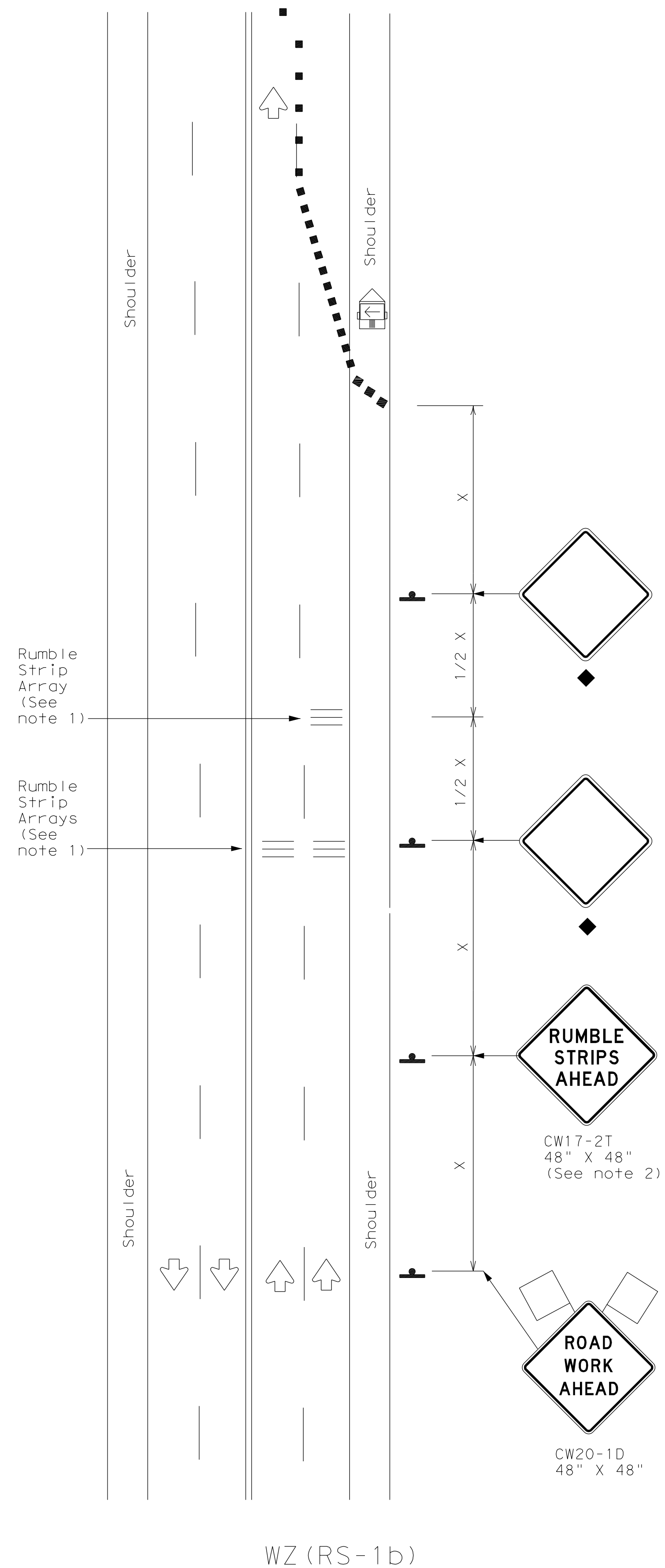
Warning sign and rumble strip sequence in opposite direction is same as below

TABLE 1		
Flagger to Flagger (Length of Work Area)	ADT	# of Rumble Strip Arrays
1/8 Mile	< 4,500	1
	≥ 4,500	2
1/4 Mile	< 3,500	1
	≥ 3,500	2
1/2 Mile	< 2,600	1
	≥ 2,600	2
1 Mile	< 1,600	1
	≥ 1,600	2
> 1 Mile	N/A	2



WZ(RS-1a)
75 mph or Less

RUMBLE STRIPS ON ONE-LANE TWO-WAY APPLICATION



WZ(RS-1b)
75 mph or Less

RUMBLE STRIPS FOR LANE CLOSURE ON CONVENTIONAL ROADWAY

GENERAL NOTES

1. Each Rumble Strip Array should consist of three rumble strips spaced center to center at the spacing shown in Table 2, placed transverse across the lane at locations shown.
2. The CW17-2T "RUMBLE STRIPS AHEAD" sign should be located after the CW20-1D "ROAD WORK AHEAD sign and spaced as shown. If traffic is observed to be queuing, or is expected to queue beyond the Rumble Strips, the CW17-2T sign and the first Rumble Strip Array may be located upstream of the CW20-1D sign as necessary to provide needed warning.
3. Temporary Rumble Strips will be considered subsidiary to Item 502, and shall be a product listed on the Compliant Work Zone Traffic Control Devices.
4. Removal of the Temporary Rumble Strips should be accomplished before removing the advance warning signs.
5. Temporary Rumble Strips should not be used on horizontal curves, loose gravel, soft or bleeding asphalt, heavily rutted pavements or unpaved surfaces.
6. Temporary Rumble Strips shall be installed and maintained as per manufacturer's recommendations.
7. This standard sheet shall be used in conjunction with other appropriate TCP standard, TMUTCD typical application or project specific detail for the project.
8. The one-lane two-way application may utilize a flagger, an AFAD or a portable traffic signal.
9. Temporary Rumble Strips may be used on freeways or expressways based on engineering judgment.

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

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

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

TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
	✓	✓		

◆ Signs are for illustrative purposes only. Signs required may vary depending on the TCP, TMUTCD Typical Application, or project specific details for the project.

TABLE 2	
Speed	Approximate distance between strips in an Array
≤ 40 MPH	10'
> 40 MPH & ≤ 55 MPH	15'
> 55 MPH	20'

Texas Department of Transportation
Traffic Operations Division Standard

TEMPORARY RUMBLE STRIPS

WZ(RS)-16

FILE: wzrs16.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2012	CONT 2038	SECT 01	JOB 031	HIGHWAY FM 2115
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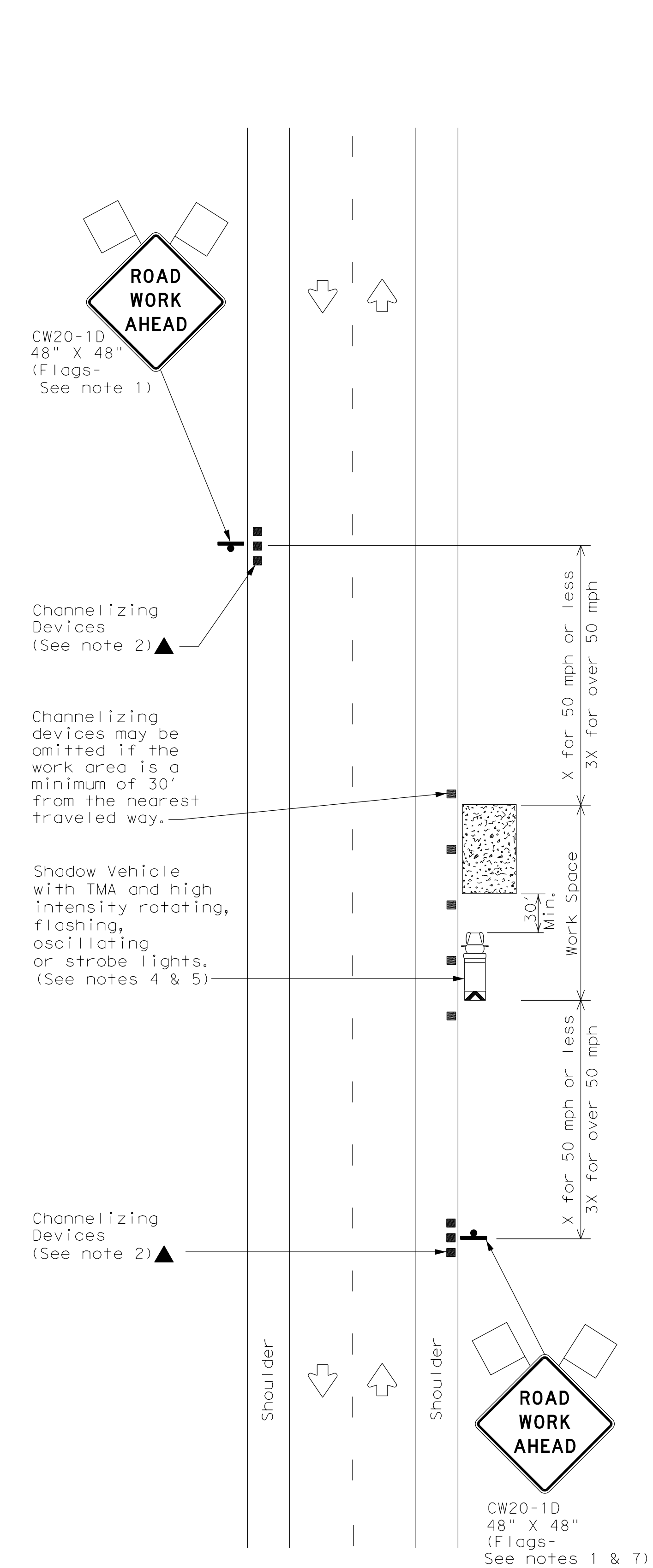
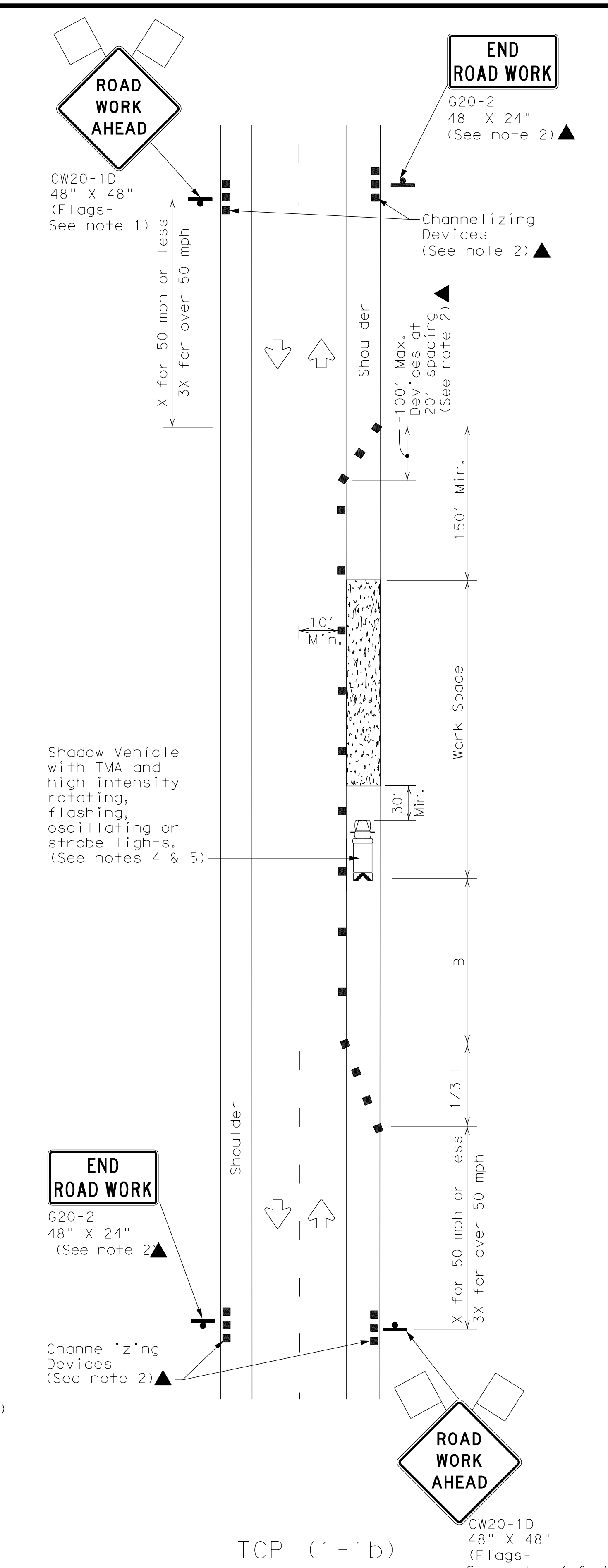


TCP (1-1a)

WORK SPACE NEAR SHOULDER

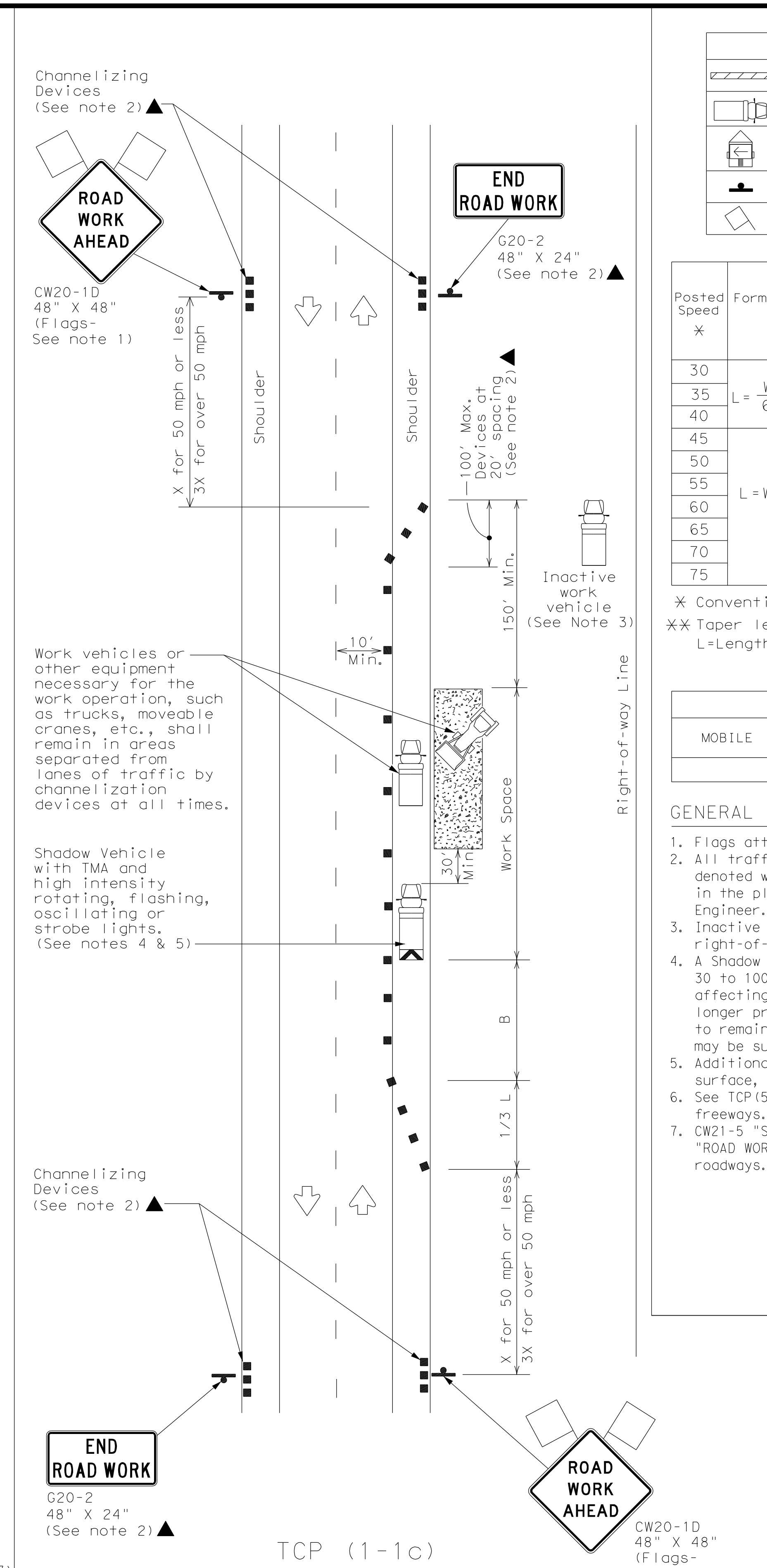
Conventional Roads



TCP (1-1b)

WORK SPACE ON SHOULDER

Conventional Roads



TCP (1-1c)

WORK VEHICLES ON SHOULDER

Conventional Roads

LEGEND

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

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

* Conventional Roads Only

** Taper lengths have been rounded off.

L=Length of Taper(FT) W=Width of Offset(FT) S=Posted Speed(MPH)

TYPICAL USAGE

MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
	✓	✓		

GENERAL NOTES

1. Flags attached to signs where shown are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
3. Inactive work vehicles or other equipment should be parked near the right-of-way line and not parked on the paved shoulder.
4. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
5. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect wider work spaces.
6. See TCP(5-1)for shoulder work on divided highways, expressways and freeways.
7. CW21-5 "SHOULDER WORK" signs may be used in place of CW20-1D "ROAD WORK AHEAD" signs for shoulder work on conventional roadways.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN CONVENTIONAL ROAD SHOULDER WORK

TCP(1-1)-18

FILE: tcp1-1-18.dgn	DN:	CK:	DW:	CK:
©TxDOT December 1985	CONT 2038	SECT 01	JOB 031	HIGHWAY FM 2115
REVISIONS 2-94 4-98 8-95 2-12 1-97 2-18	DIST WAC		COUNTY BELL	SHEET NO. 44

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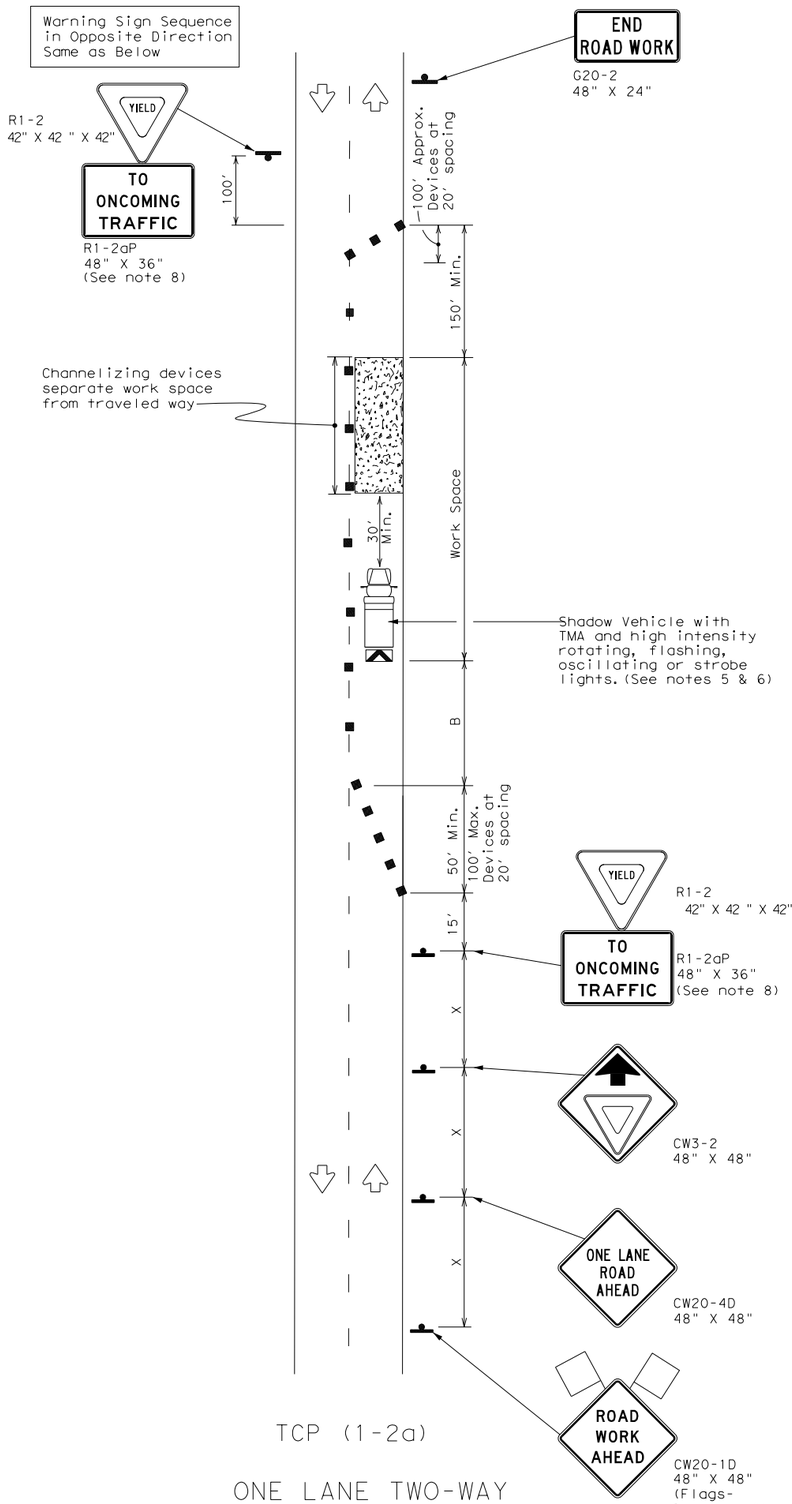
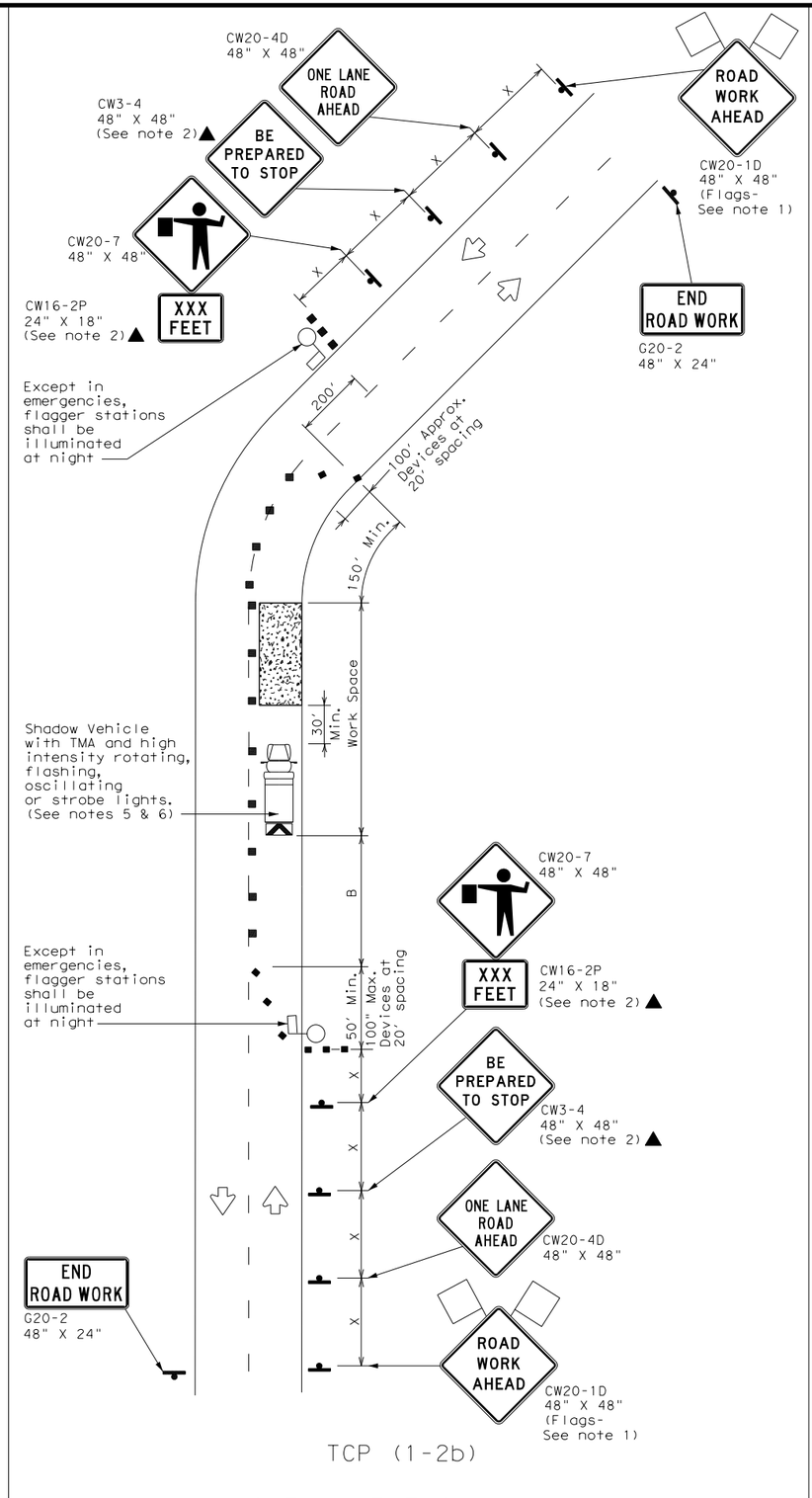


TCP (1-2a)

ONE LANE TWO-WAY CONTROL WITH YIELD SIGNS

(Less than 2000 ADT - See note 7)



TCP (1-2b)

ONE LANE TWO-WAY CONTROL WITH FLAGGERS

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

Posted Speed *	Formula	Minimum Desirable Taper Lengths ** 10' Offset	11' Offset	12' Offset	Suggested Maximum Spacing of Channelizing Devices On a Taper	On a Tangent	Minimum Sign Spacing "X" Distance	Suggested Longitudinal Buffer Space "B"	Stopping Sight Distance
30	$L=\frac{WS^2}{60}$	150'	165'	180'	30'	60'	120'	90'	200'
35		205'	225'	245'	35'	70'	160'	120'	250'
40		265'	295'	320'	40'	80'	240'	155'	305'
45	L=WS	450'	495'	540'	45'	90'	320'	195'	360'
50		500'	550'	600'	50'	100'	400'	240'	425'
55		550'	605'	660'	55'	110'	500'	295'	495'
60		600'	660'	720'	60'	120'	600'	350'	570'
65		650'	715'	780'	65'	130'	700'	410'	645'
70		700'	770'	840'	70'	140'	800'	475'	730'
75		750'	825'	900'	75'	150'	900'	540'	820'

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

TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
	✓	✓		

GENERAL NOTES

1. Flags attached to signs where shown are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
3. The CW3-4 "BE PREPARED TO STOP" sign may be installed after the CW20-4D "ONE LANE ROAD AHEAD" sign, but proper sign spacing shall be maintained.
4. Sign spacing may be increased or an additional CW20-1D "ROAD WORK AHEAD" sign may be used if advance warning ahead of the flagger or R1-2 "YIELD" sign is less than 1500 feet.
5. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
6. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect wider work spaces.

TCP (1-2a)

7. R1-2 "YIELD" sign traffic control may be used on projects with approaches that have adequate sight distance. For projects in urban areas, work spaces should be no longer than one half city block. In rural areas on roadways with less than 2000 ADT, work spaces should be no longer than 400 feet.
8. R1-2 "YIELD" sign with R1-2aP "TO ONCOMING TRAFFIC" plaque shall be placed on a support at a 7 foot minimum mounting height.

TCP (1-2b)

9. Flaggers should use two-way radios or other methods of communication to control traffic.
10. Length of work space should be based on the ability of flaggers to communicate.
11. If the work space is located near a horizontal or vertical curve, the buffer distances should be increased in order to maintain adequate stopping sight distance to the flagger and a queue of stopped vehicles (see table above).
12. Channelizing devices on the center-line may be omitted when a pilot car is leading traffic and approved by the Engineer.
13. Flaggers should use 24" STOP/SLOW paddles to control traffic. Flags should be limited to emergency situations.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN ONE-LANE TWO-WAY TRAFFIC CONTROL

TCP(1-2)-18

FILE: tcp1-2-18.dgn	DN:	CK:	DW:	CK:
©TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-90 4-98	2038	01	031	FM 2115
2-94 2-12	DIST	COUNTY		SHEET NO.
1-97 2-18	WAC	BELL		45

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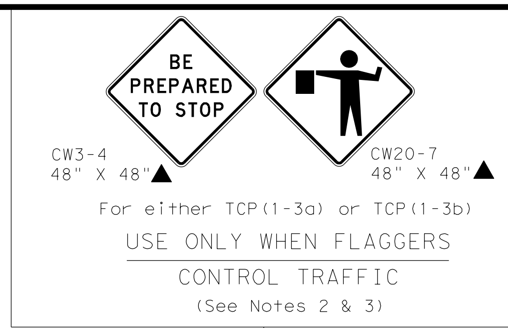
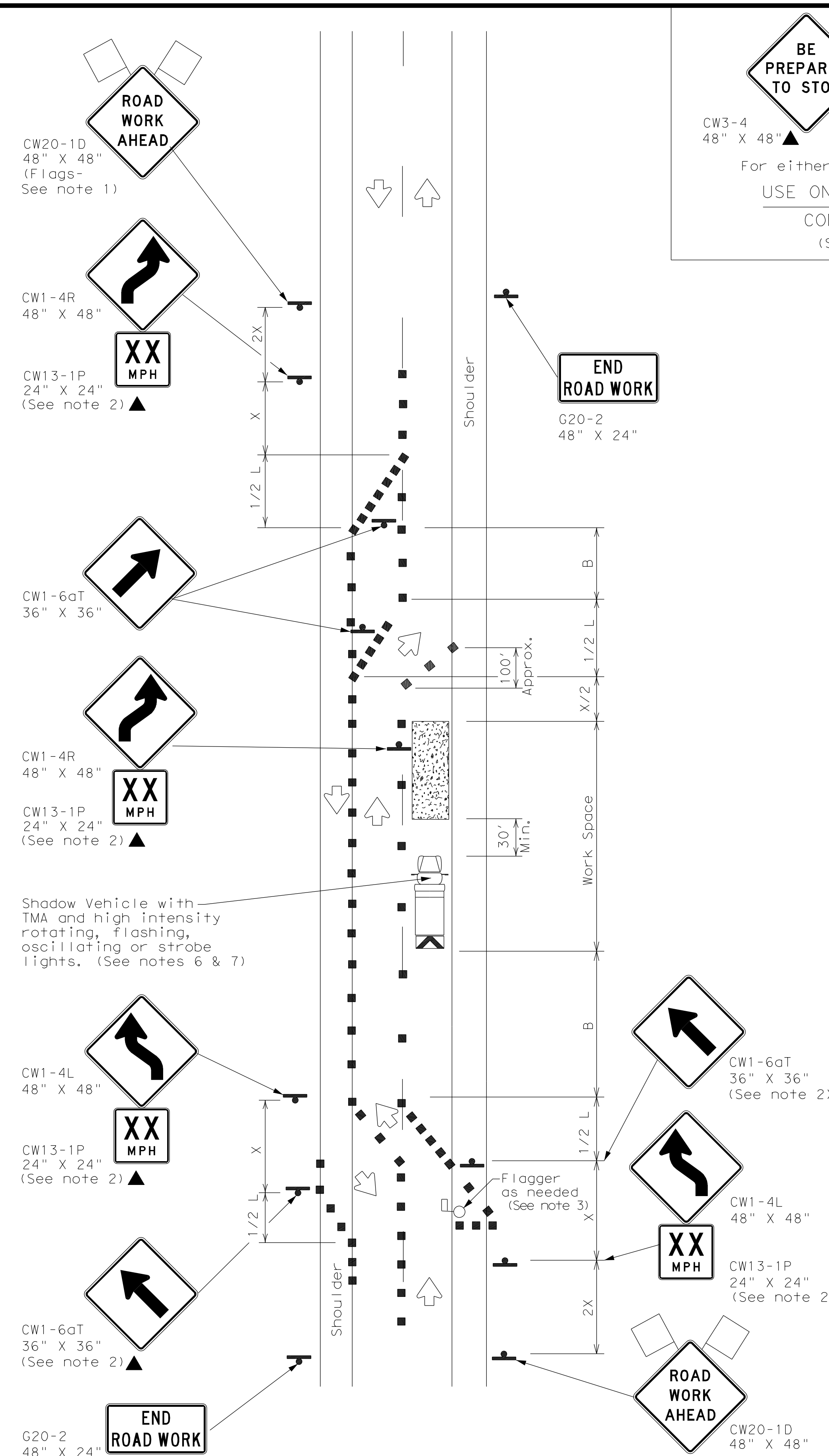
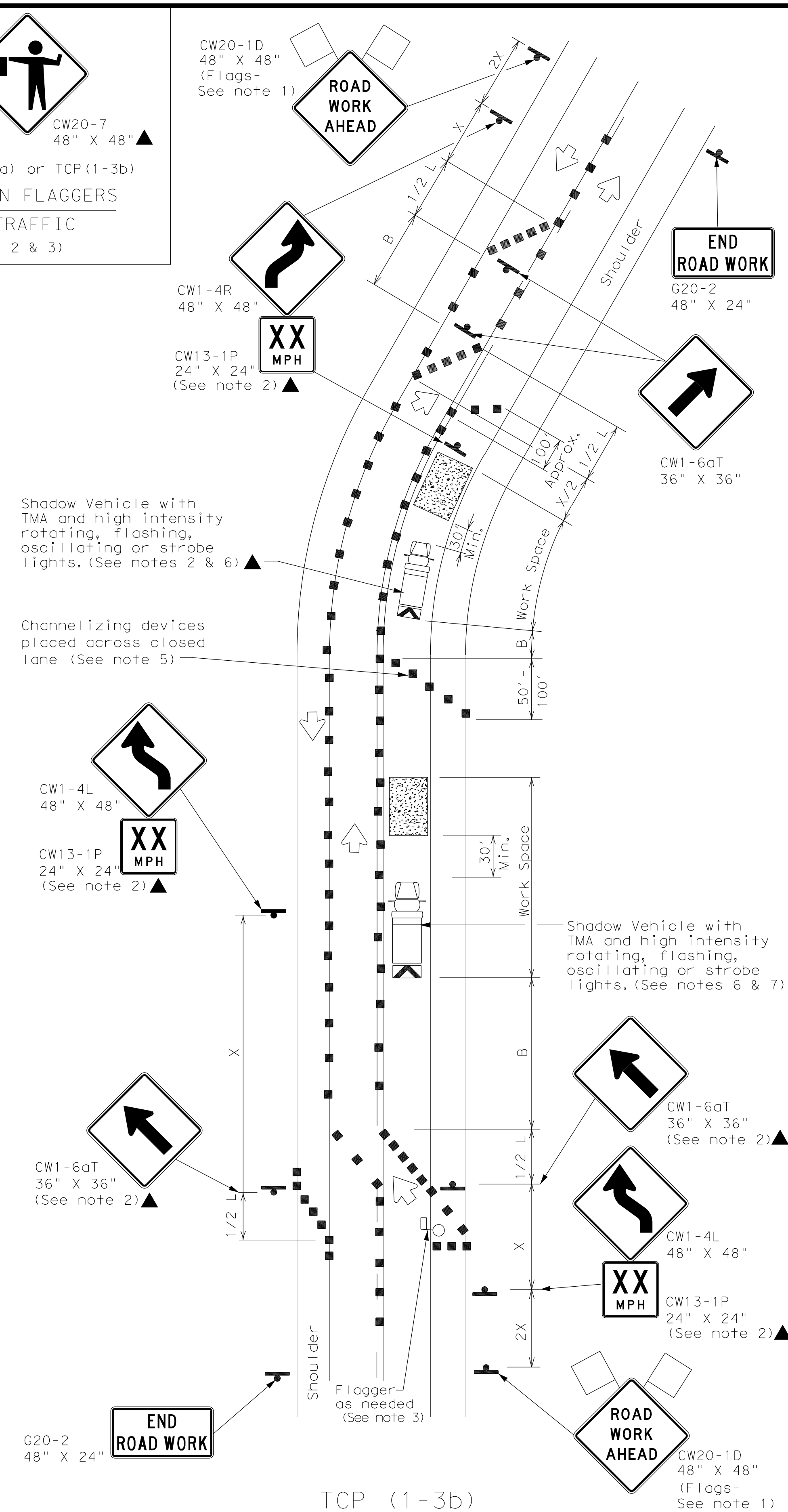




TCP (1-3a)
2-LANE ROADWAY WITH PAVED SHOULDERS

ONE LANE CLOSED
ADEQUATE FIELD OF VIEW



TCP (1-3b)
2-LANE ROADWAY WITH PAVED SHOULDERS

ONE LANE CLOSED
INADEQUATE FIELD OF VIEW

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

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

* Conventional Roads Only

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

TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
	✓	✓		

GENERAL NOTES

1. Flags attached to signs where shown are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
3. Flagger control should NOT be used unless roadway conditions or heavy traffic volume require additional emphasis to safely control traffic. Additional flaggers may be positioned in advance of traffic queues to alert traffic to reduce speed.
4. DO NOT PASS, PASS WITH CARE and construction regulatory speed zone signs may be installed downstream of the ROAD WORK AHEAD signs.
5. When the work zone is made up of several work spaces, channelizing devices should be placed laterally across the closed lane to re-emphasize closure. Laterally placed channelizing devices should be repeated every 500 to 1000 feet in urban areas and every 1/4 to 1/2 mile in rural areas.
6. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
7. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect wider work spaces.
8. Where traffic is directed over a yellow centerline, channelizing devices which separate two-way traffic should be spaced on tapers at 20', or 15' if posted speed are 35 mph or slower, and for tangent sections, at 1/2S where S is the speed in mph. This tighter device spacing is intended for the area of conflicting markings not the entire work zone.

Texas Department of Transportation — Traffic Operations Division Standard

TRAFFIC CONTROL PLAN
TRAFFIC SHIFTS ON
TWO LANE ROADS

TCP(1-3)-18

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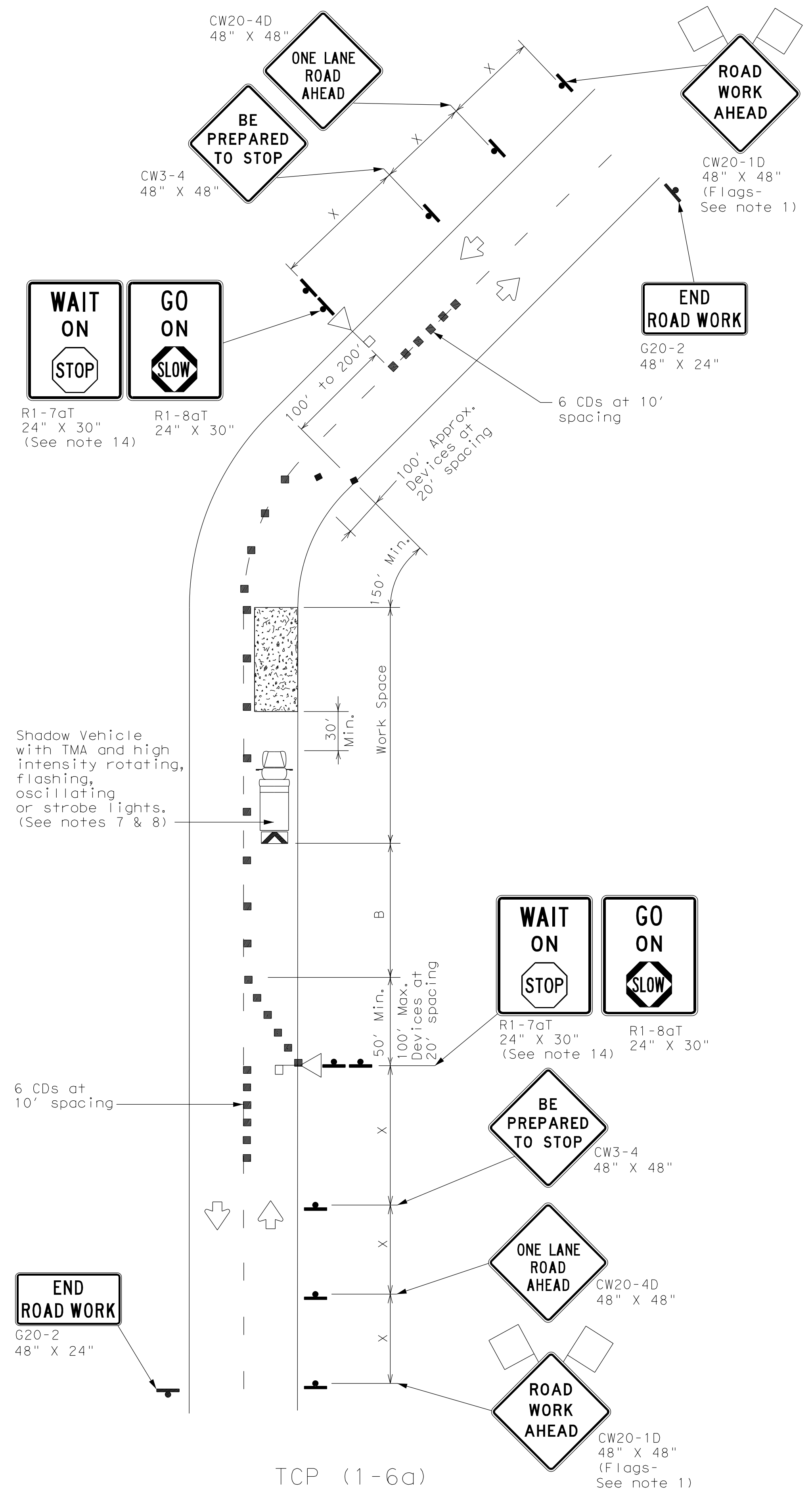
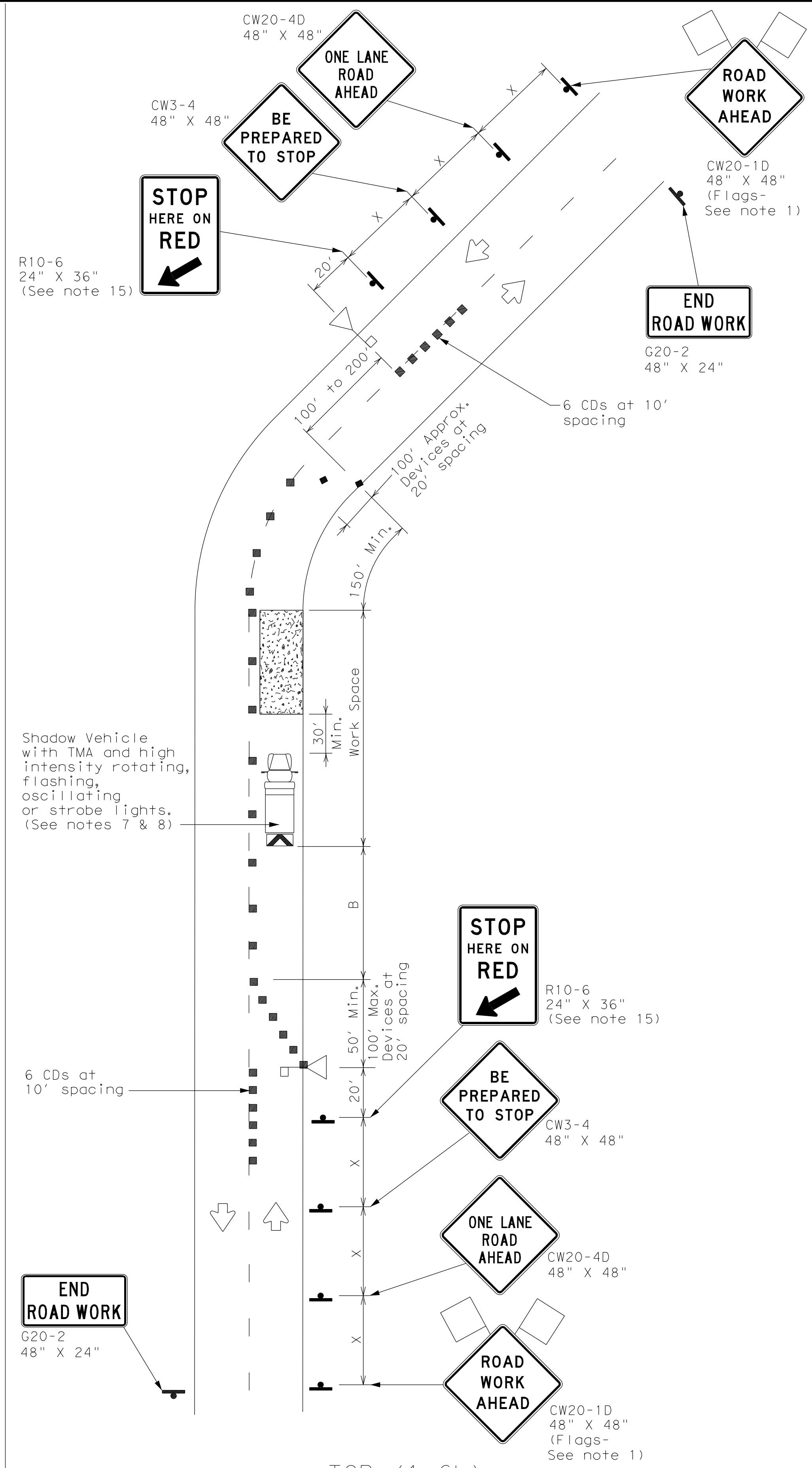
©TxDOT December 1985	CONT 2038	SECT 01	JOB 031	HIGHWAY FM 2115
REVISIONS 2-94 4-98 8-95 2-12 1-97 2-18	DIST WAC		COUNTY BELL	SHEET NO. 46



TCP (1-6a)

ONE LANE TWO-WAY CONTROL WITH STOP/SLOW AFADs



TCP (1-6b)

ONE LANE TWO-WAY CONTROL WITH RED/YELLOW LENS AFADs

LEGEND

(symbol)	Type 3 Barricade	(symbol)	Channelizing Devices (CDs)
(symbol)	Heavy Work Vehicle	(symbol)	Truck Mounted Attenuator (TMA)
(symbol)	Automated Flagger Assistance Device (AFAD)	(symbol)	Portable Changeable Message Sign (PCMS)
(symbol)	Sign	(symbol)	Traffic Flow
(symbol)	Flag	(symbol)	Flagger

Posted Speed *	Formula	Minimum Desirable Taper Lengths **			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing "X" Distance	Suggested Longitudinal Buffer Space "B"	Stopping Sight Distance
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent			
30	$L = \frac{WS^2}{60}$	150'	165'	180'	30'	60'	120'	90'	200'
35		205'	225'	245'	35'	70'	160'	120'	250'
40		265'	295'	320'	40'	80'	240'	155'	305'
45	$L = WS$	450'	495'	540'	45'	90'	320'	195'	360'
50		500'	550'	600'	50'	100'	400'	240'	425'
55		550'	605'	660'	55'	110'	500'	295'	495'
60		600'	660'	720'	60'	120'	600'	350'	570'
65		650'	715'	780'	65'	130'	700'	410'	645'
70		700'	770'	840'	70'	140'	800'	475'	730'
75		750'	825'	900'	75'	150'	900'	540'	820'

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

TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
	✓	✓		

GENERAL NOTES

1. Flags attached to signs where shown are REQUIRED.
2. AFADs shall only be used in situations where there is one lane of approaching traffic in the direction to be controlled.
3. Adequate stopping sight distance must be provided to each AFAD location for approaching traffic. (See table above).
4. Each AFAD shall be operated by a qualified/certified flagger. Flaggers operating AFADs shall not leave them unattended while they are in use.
5. One flagger may operate two AFADs only when the flagger has an unobstructed view of both AFADs and of the approaching traffic in both directions.
6. When pilot cars are used, a flagger controlling traffic shall be located on each approach. AFADs shall not be operated by the pilot car operator.
7. All AFADs shall be equipped with gate arms with an orange or fluorescent red-orange flag attached to the end of the gate arm. The flag shall be a minimum of 16" square.
8. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
9. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect wider work spaces.
10. Flaggers should use two-way radios or other methods of communication to control traffic.
11. Length of work space should be based on the ability of flaggers to communicate.
12. If the work space is located near a horizontal or vertical curve, the buffer distances should be increased in order to maintain stopping sight distance to the AFAD.
13. Channelizing devices on the center line may be omitted when a pilot car is leading traffic and approved by the Engineer.
14. The R1-7aT "WAIT ON STOP" sign and the R1-8aT "GO ON SLOW" sign shall be installed at the AFAD location on separate supports or they may be fabricated as one 48" x 30" sign. They shall not obscure the face of the STOP/SLOW AFAD.
15. The R10-6 "STOP HERE ON RED" arrow sign shall be offset so as not to obscure the lenses of the AFAD.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN AUTOMATED FLAGGER ASSISTANCE DEVICES (AFADS)

TCP(1-6)-18

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©TxDOT February 2012	CONT	SECT	JOB	HIGHWAY
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	WAC		BELL	47

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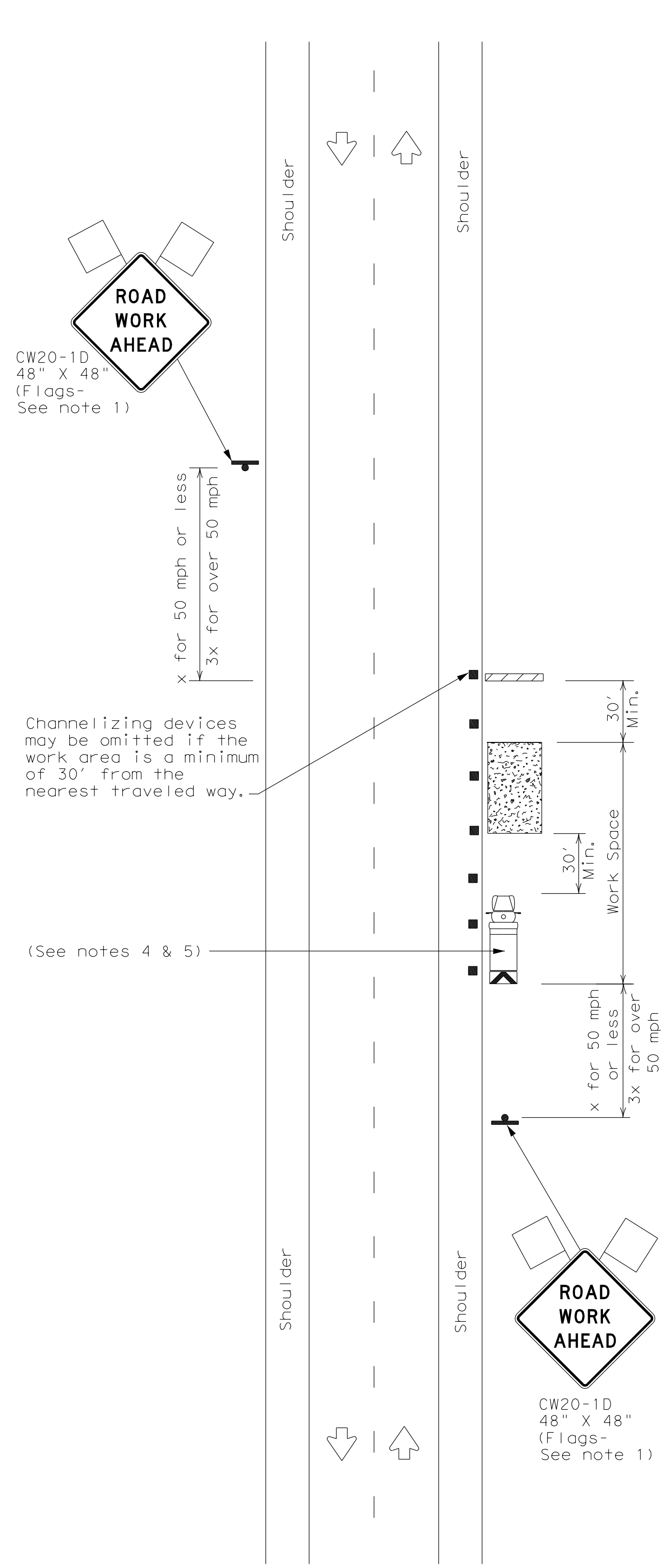
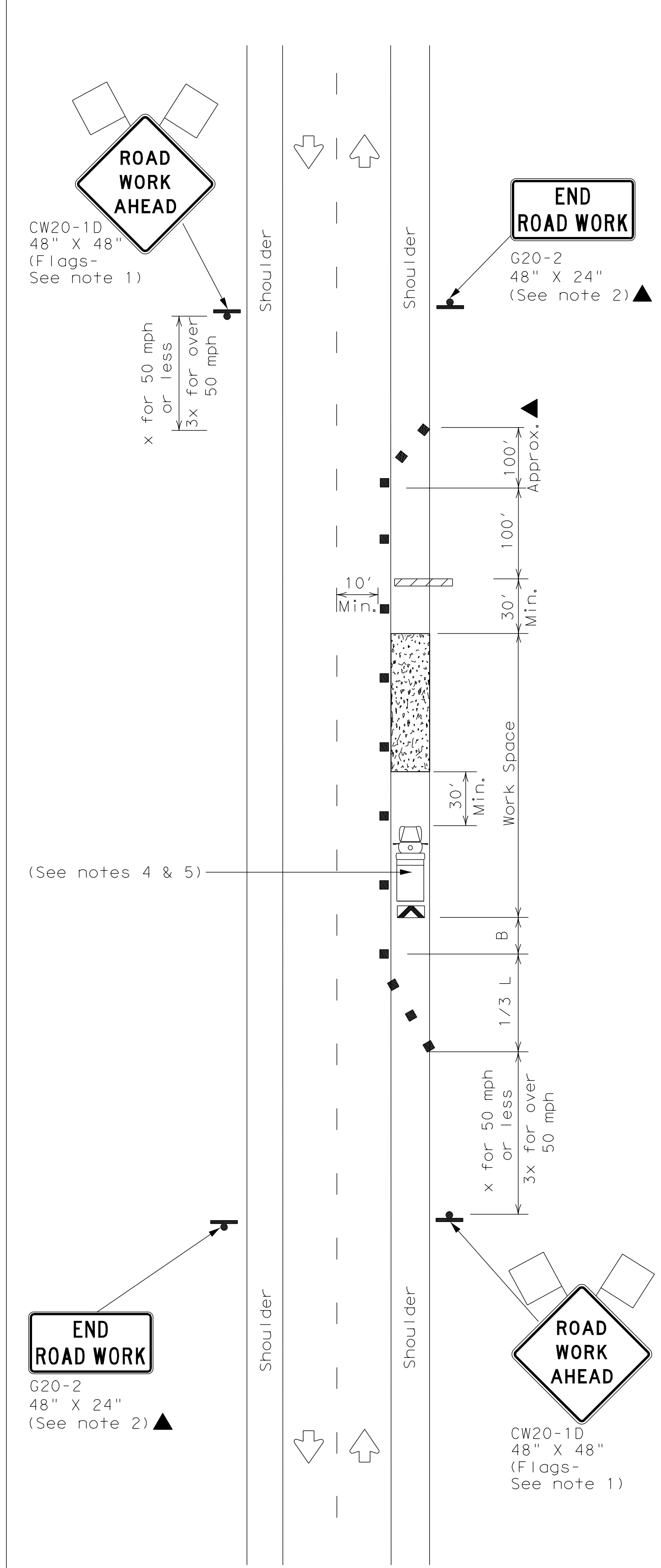


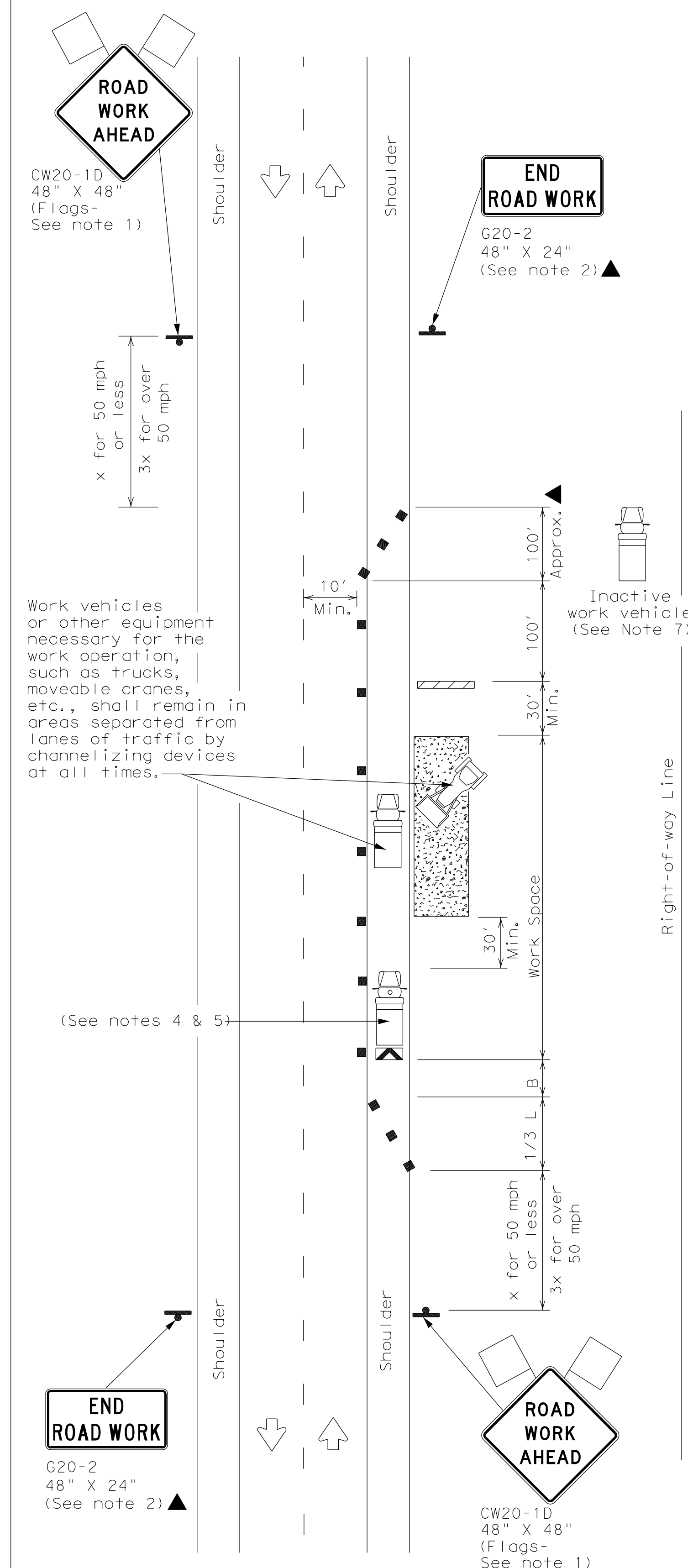
TCP (2-1a)

WORK SPACE NEAR SHOULDER
Conventional Roads



TCP (2-1b)

WORK SPACE ON SHOULDER
Conventional Roads



TCP (2-1c)

WORK VEHICLES ON SHOULDER
Conventional Roads

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

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

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

TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
	✓	✓	✓	✓

GENERAL NOTES

1. Flags attached to signs where shown, are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated in the plans, or for routine maintenance work, when approved by the Engineer.
3. Stockpiled material should be placed a minimum of 30 feet from nearest traveled way.
4. Shadow Vehicle with TMA and high intensity rotating, flashing, oscillating or strobe lights. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
5. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect a wider work space.
6. See TCP(5-1) for shoulder work on divided highways, expressways and freeways.
7. Inactive work vehicles or other equipment should be parked near the right-of-way line and not parked on the paved shoulder.
8. CW21-5 "SHOULDER WORK" signs may be used in place of CW20-1D "ROAD WORK AHEAD" signs for shoulder work on conventional roadways.

Texas Department of Transportation
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN CONVENTIONAL ROAD SHOULDER WORK

TCP(2-1)-18

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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS 2-94 4-98 8-95 2-12 1-97 2-18	2038	01	031	FM 2115
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	WAC		BELL	48

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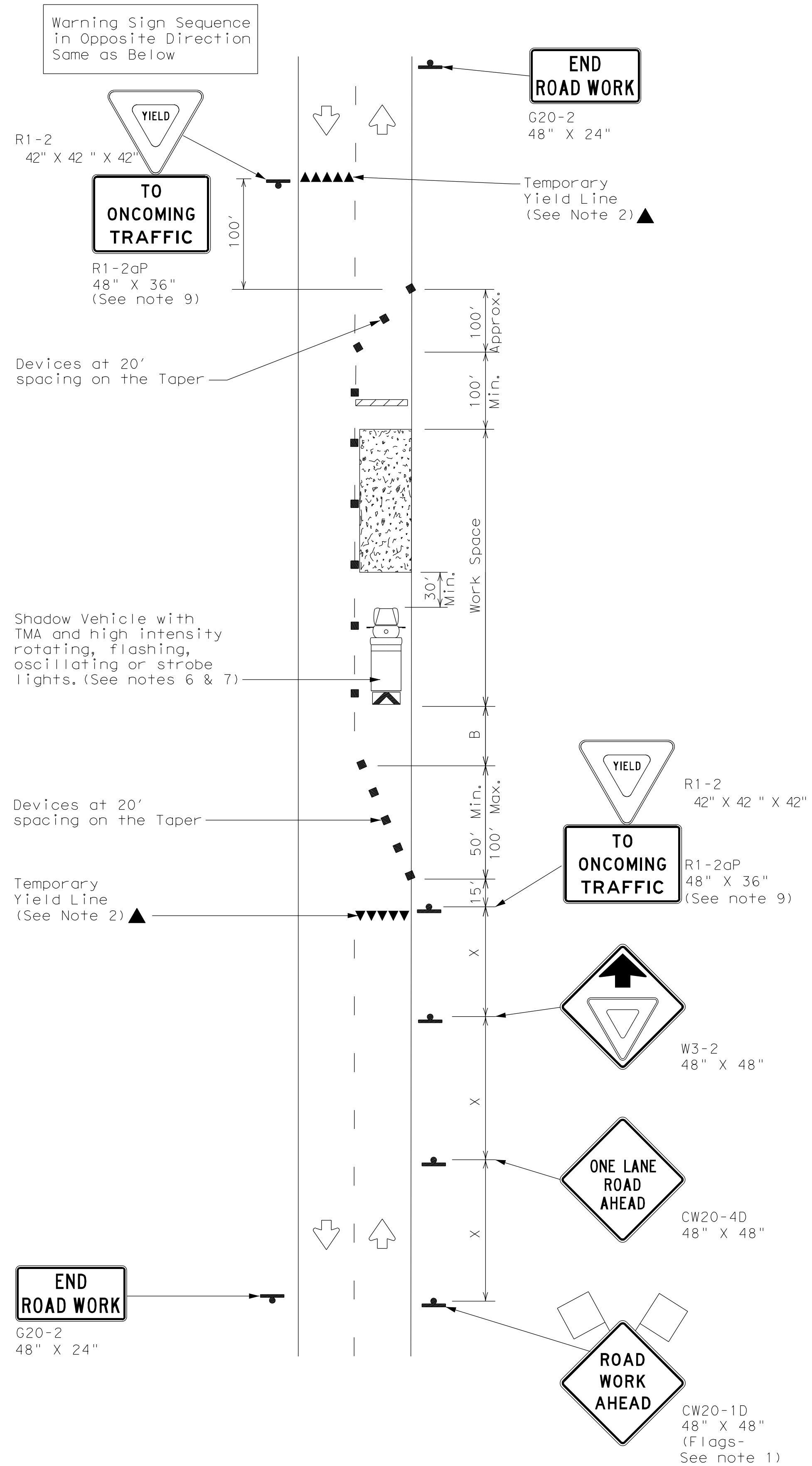


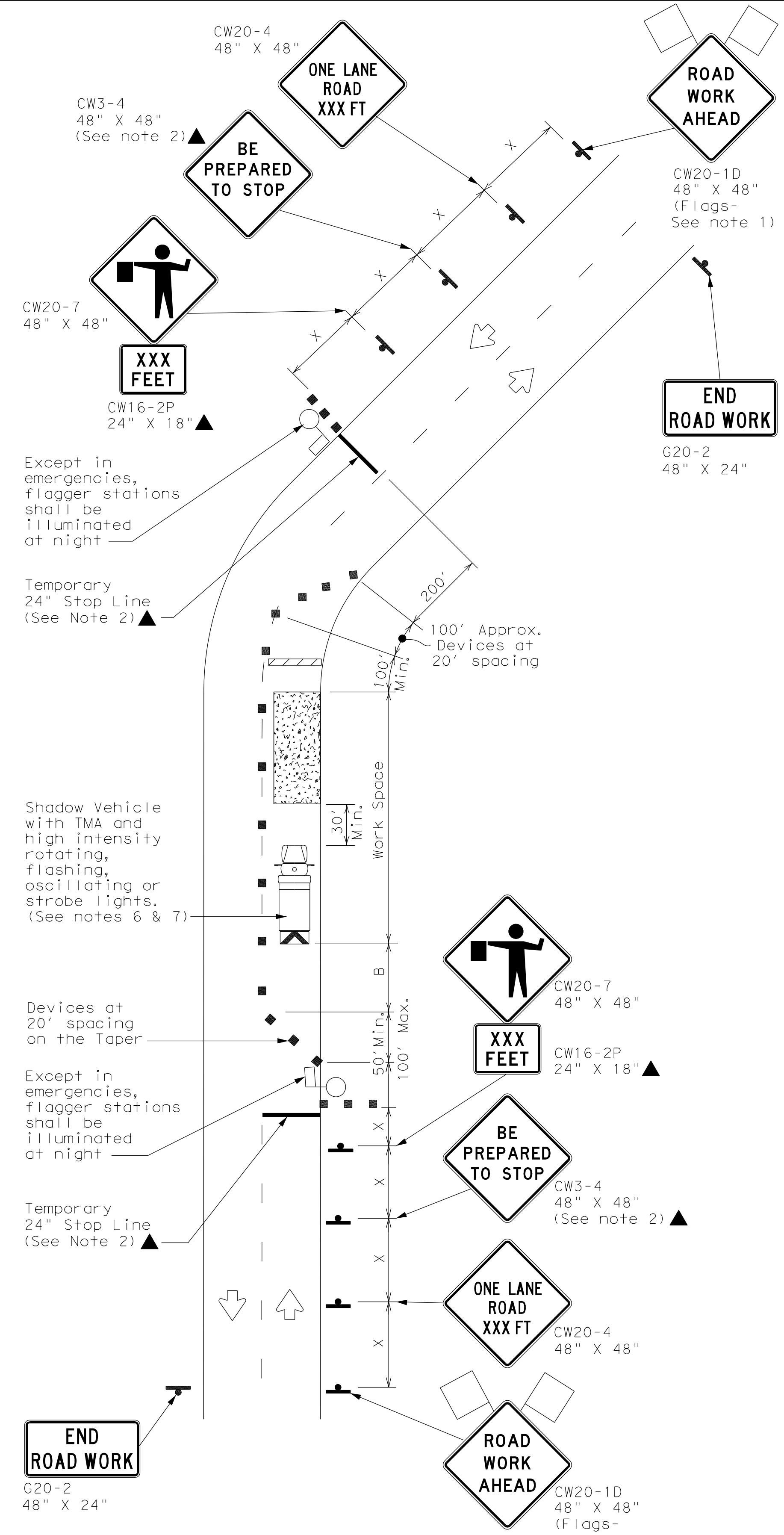
TCP (2-2a)

2-LANE ROADWAY WITHOUT PAVED SHOULDERS

ONE LANE TWO-WAY

CONTROL WITH YIELD SIGNS

(Less than 2000 ADT - See Note 9)



TCP (2-2b)

2-LANE ROADWAY WITHOUT PAVED SHOULDERS

ONE LANE TWO-WAY

CONTROL WITH FLAGGERS

LEGEND

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

Posted Speed ✻	Formula	Minimum Desirable Taper Lengths ✻✻			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing "X" Distance	Suggested Longitudinal Buffer Space "B"	Stopping Sight Distance
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent			
30	$L = \frac{WS^2}{60}$	150'	165'	180'	30'	60'	120'	90'	200'
35		205'	225'	245'	35'	70'	160'	120'	250'
40		265'	295'	320'	40'	80'	240'	155'	305'
45	L = WS	450'	495'	540'	45'	90'	320'	195'	360'
50		500'	550'	600'	50'	100'	400'	240'	425'
55		550'	605'	660'	55'	110'	500'	295'	495'
60		600'	660'	720'	60'	120'	600'	350'	570'
65		650'	715'	780'	65'	130'	700'	410'	645'
70		700'	770'	840'	70'	140'	800'	475'	730'
75		750'	825'	900'	75'	150'	900'	540'	820'

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

TYPICAL USAGE

MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
	✓	✓	✓	

GENERAL NOTES

1. Flags attached to signs where shown, are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
3. The CW3-4 "BE PREPARED TO STOP" sign may be installed after the CW20-4 "ONE LANE ROAD XXX FT" sign, but proper sign spacing shall be maintained.
4. Flaggers should use two-way radios or other methods of communication to control traffic.
5. Length of work space should be based on the ability of flaggers to communicate.
6. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
7. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect a wider work space.

TCP (2-2a)

8. The R1-2 "YIELD" sign traffic control may be used on projects with approaches that have adequate sight distance. For projects in urban areas, work space should be no longer than one half city block. In rural areas, roadways with less than 2000 ADT, work space should be no longer than 400 feet.
9. The R1-2aP "YIELD TO ONCOMING TRAFFIC" sign shall be placed on a support at a 7 foot minimum mounting height.

TCP (2-2b)

10. Channelizing devices on the center line may be omitted when a pilot car is leading traffic and approved by the Engineer.
11. If the work space is located near a horizontal or vertical curve, the buffer distances should be increased in order to maintain stopping sight distance to the flagger and a queue of stopped vehicles. (See table above).
12. Flaggers should use 24" STOP/SLOW paddles to control traffic. Flags should be limited to emergency situtations.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN ONE-LANE TWO-WAY TRAFFIC CONTROL

TCP(2-2)-18

FILE: tcp2-2-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
8-95 3-03	DIST		COUNTY	SHEET NO.
1-97 2-12 4-98 2-18	WAC		BELL	49

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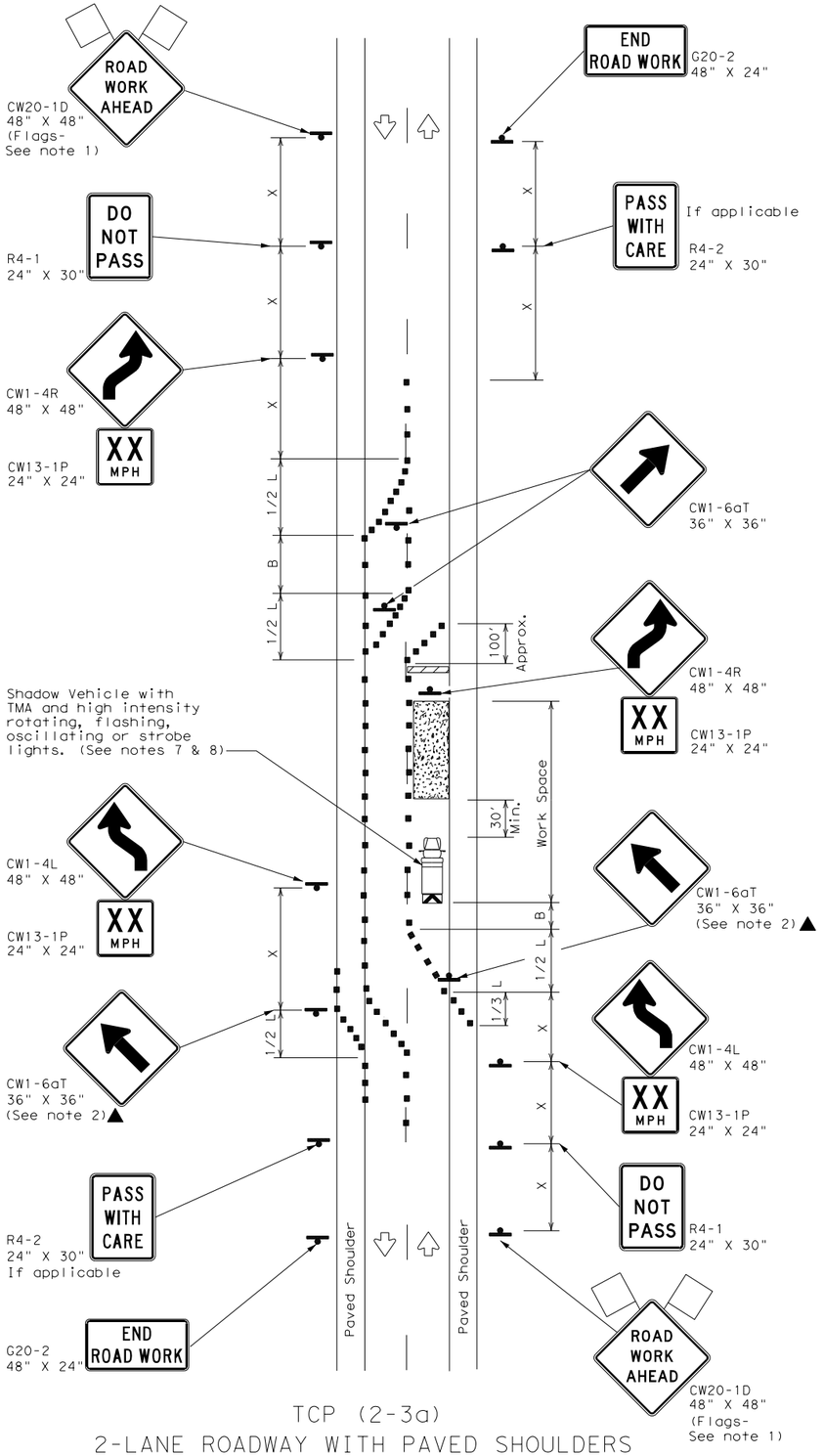
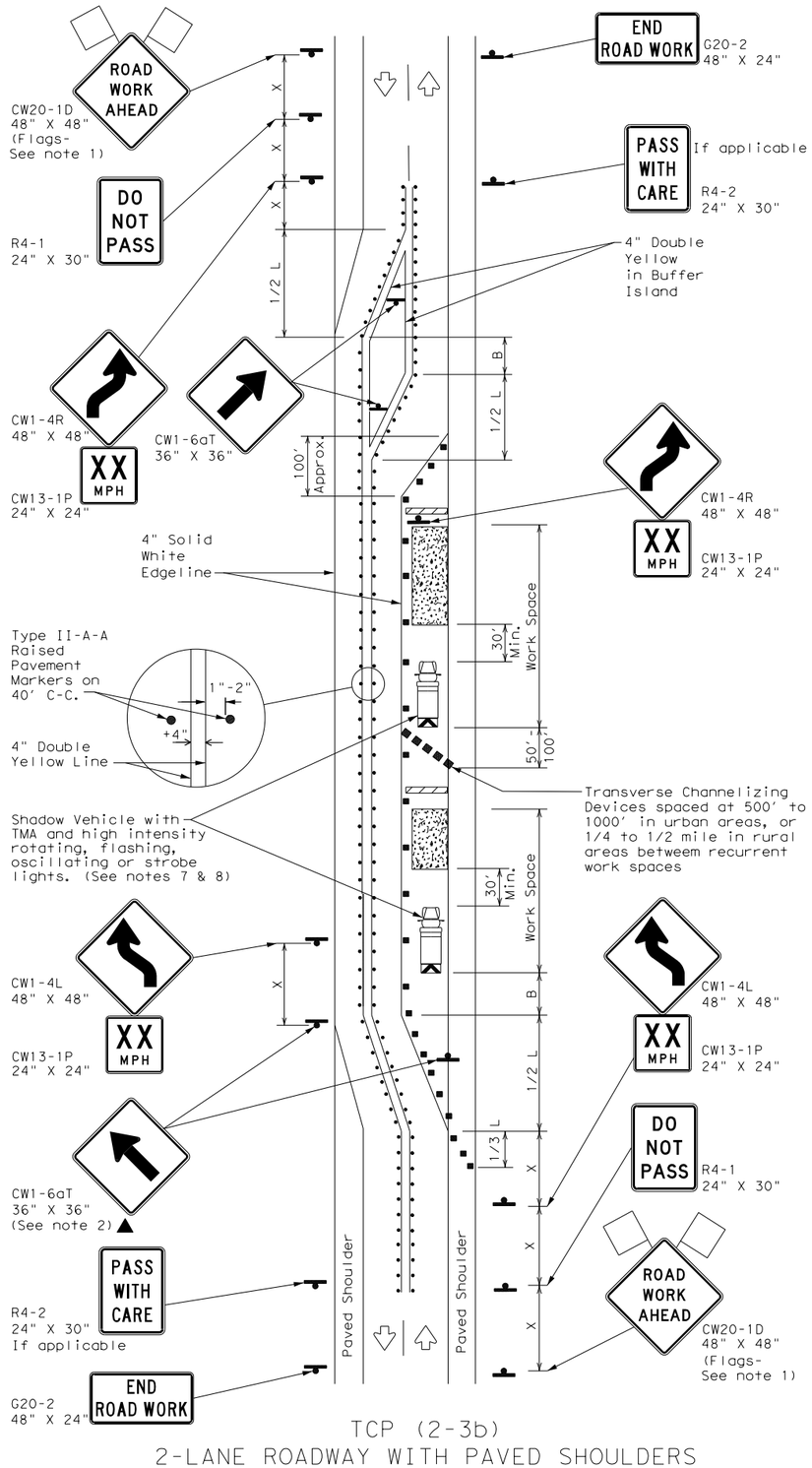


TCP (2-3a)
2-LANE ROADWAY WITH PAVED SHOULDERS
ONE LANE CLOSED
ADEQUATE FIELD OF VIEW



TCP (2-3b)
2-LANE ROADWAY WITH PAVED SHOULDERS
ONE LANE CLOSED
INADEQUATE FIELD OF VIEW

LEGEND			
	Type 3 Barricade		Channelizing Devices
	Heavy Work Vehicle		Truck Mounted Attenuator (TMA)
	Trailer Mounted Flashing Arrow Board		Raised Pavement Markers Ty II-AA
	Sign		Traffic Flow
	Flag		Flagger

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

* Conventional Roads Only

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

TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
				TCP(2-3b)ONLY
			✓	✓

GENERAL NOTES

1. Flags attached to signs where shown, are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
3. When work space will be in place less than three days existing pavement markings may remain in place. Channelizing devices shall be used to separate traffic.
4. Flagger control should NOT be used unless roadway conditions or heavy traffic volume require additional emphasis to safely control traffic. Flagger should be positioned at end of traffic queue.
5. The R4-1 "DO NOT PASS," R4-2 " PASS WITH CARE" and construction regulatory speed zone signs may be installed within CW20-1D "ROAD WORK AHEAD" signs. Proper spacing of signs shall be maintained.
6. Conflicting pavement marking shall be removed for long term projects.
7. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted.
8. Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect a wider work space.

TCP (2-3a)

9. Conflicting pavement markings shall be removed for long-term projects. For shorter durations where traffic is directed over a yellow centerline, channelizing devices which separate two-way traffic should be spaced on tapers at 20' or 15' if posted speeds are 35 mph or slower, and for tangent sections, at 1/2(S) where S is the speed in mph. This tighter device spacing is intended for the area of the conflicting markings, not the entire work zone.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN TRAFFIC SHIFTS ON TWO-LANE ROADS

TCP(2-3)-18

FILE: tcp(2-3)-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS 8-95 3-03 1-97 2-12 4-98 2-18	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		50

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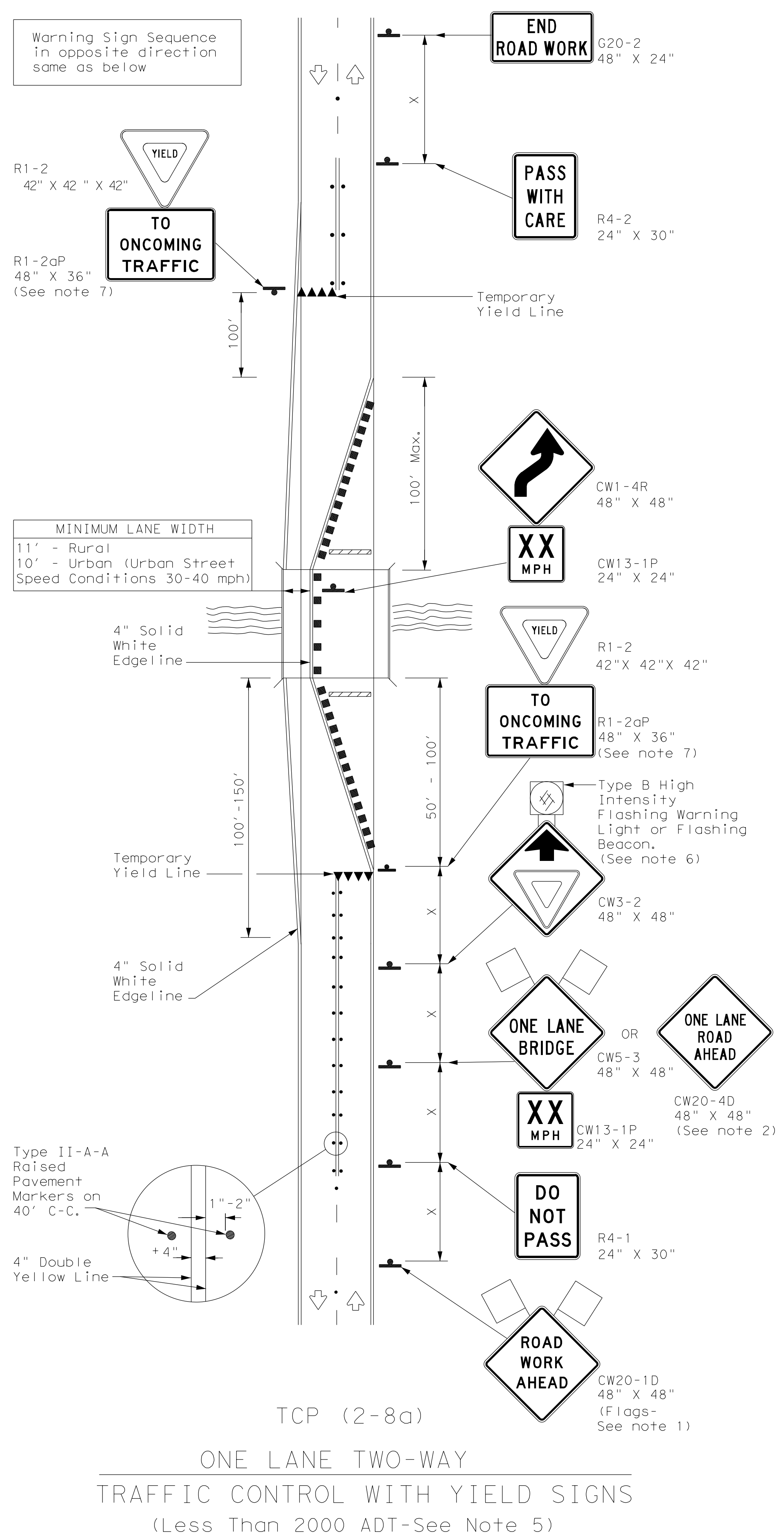

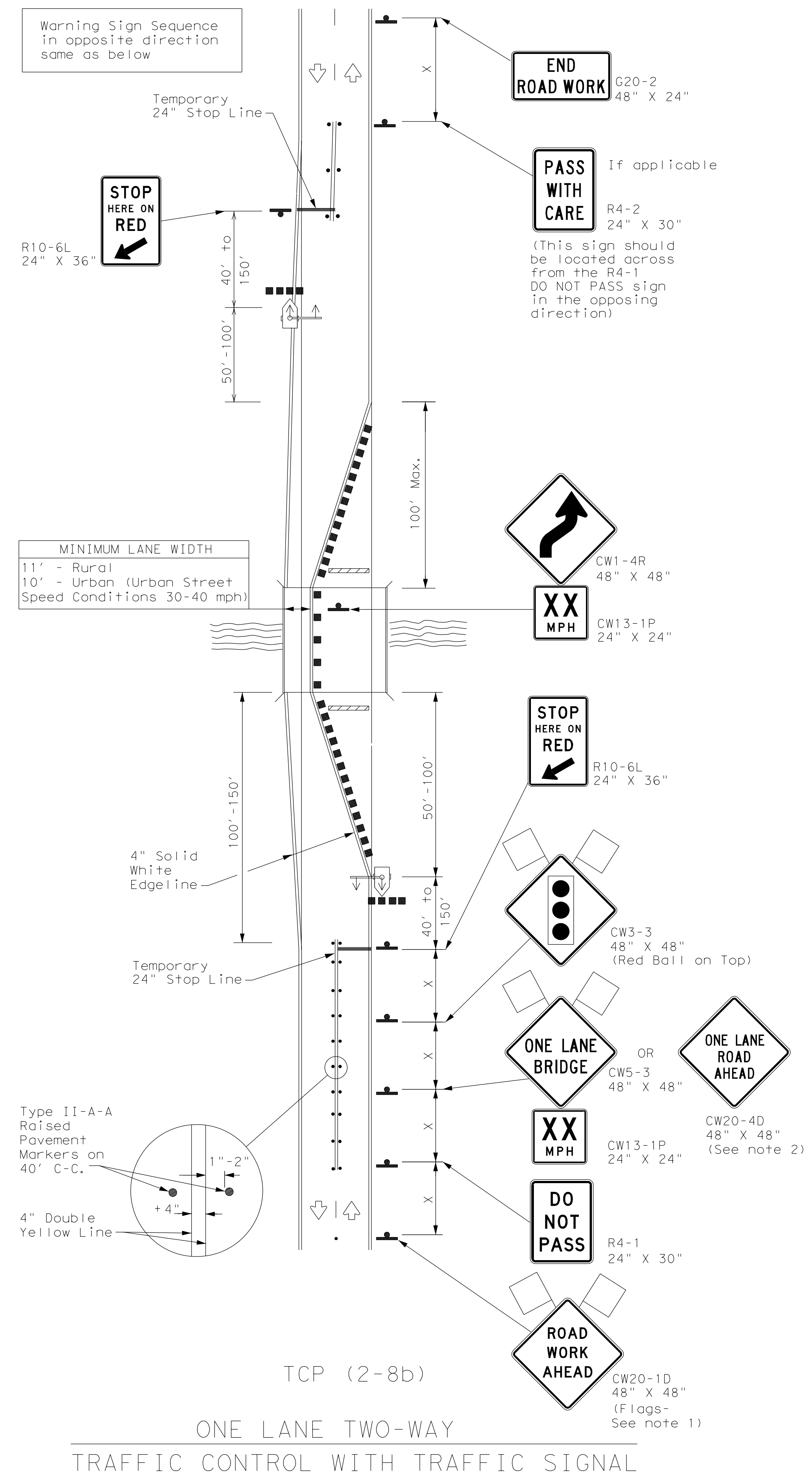

LEGEND

	Type 3 Barricade		Channelizing Devices
	Sign		Traffic Flow
	Flag		Flagger
	Raised Pavement Markers Ty II-AA		Temporary or Portable Traffic Signal

Posted Speed *	Formula	Minimum Desirable Taper Lengths **			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing "X" Distance	Suggested Longitudinal Buffer Space "B"	Stopping Sight Distance
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent			
30	$L = \frac{WS^2}{60}$	150'	165'	180'	30'	60'	120'	90'	200'
35		205'	225'	245'	35'	70'	160'	120'	250'
40		265'	295'	320'	40'	80'	240'	155'	305'
45	L = WS	450'	495'	540'	45'	90'	320'	195'	360'
50		500'	550'	600'	50'	100'	400'	240'	425'
55		550'	605'	660'	55'	110'	500'	295'	495'
60		600'	660'	720'	60'	120'	600'	350'	570'
65		650'	715'	780'	65'	130'	700'	410'	645'
70		700'	770'	840'	70'	140'	800'	475'	730'
75		750'	825'	900'	75'	150'	900'	540'	820'

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

TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
			✓	✓

GENERAL NOTES

1. Flags attached to signs where shown are REQUIRED.
2. When this TCP is used at a location which does not involve a bridge, a 48" x 48" CW20-4D "ONE LANE ROAD AHEAD" signs should be used in lieu of the CW5-3 "ONE LANE BRIDGE" signs. The CW13-1P Advisory Speed Plaque is required with either warning sign.
3. Raised pavement markers shall be placed 40 feet c-c on centerline between DO NOT PASS signs and stop or yield lines.
4. For intermediate term situations, when it is not feasible to remove and restore pavement markings, the channelization must be made dominant by using a very close spacing. This is especially important in locations of conflicting information, such as where traffic is directed over a double yellow centerline. In such locations a maximum channelizing device spacing of 20 feet is recommended. The 20 foot channelizing device spacing recommendation is intended for the area of conflicting information and not the entire work zone.

TCP (2-8a)

5. Traffic control by CW3-2 "YIELD AHEAD" symbol signs for one lane two-way traffic control operations should be limited to work spaces less than 400 feet long and roadways with less than 2000 ADT. Otherwise, portable traffic signals should be used.
6. If power is available, a flashing beacon should be attached to the CW3-2 "YIELD AHEAD" symbol sign for emphasis.
7. The R1-2 "YIELD" and R1-2aP "TO ONCOMING TRAFFIC" signs and other regulatory signs shall be installed at 7 foot minimum mounting height.

TCP (2-8b)

8. A list of approved Portable Traffic Signals can be found in the "Compliant Work Zone Traffic Control Devices" list.
9. Portable traffic signals should be located to provide adequate stopping sight distance for approaching motorist (See table above).

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN LONG TERM ONE-LANE TWO-WAY CONTROL

TCP(2-8)-18

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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
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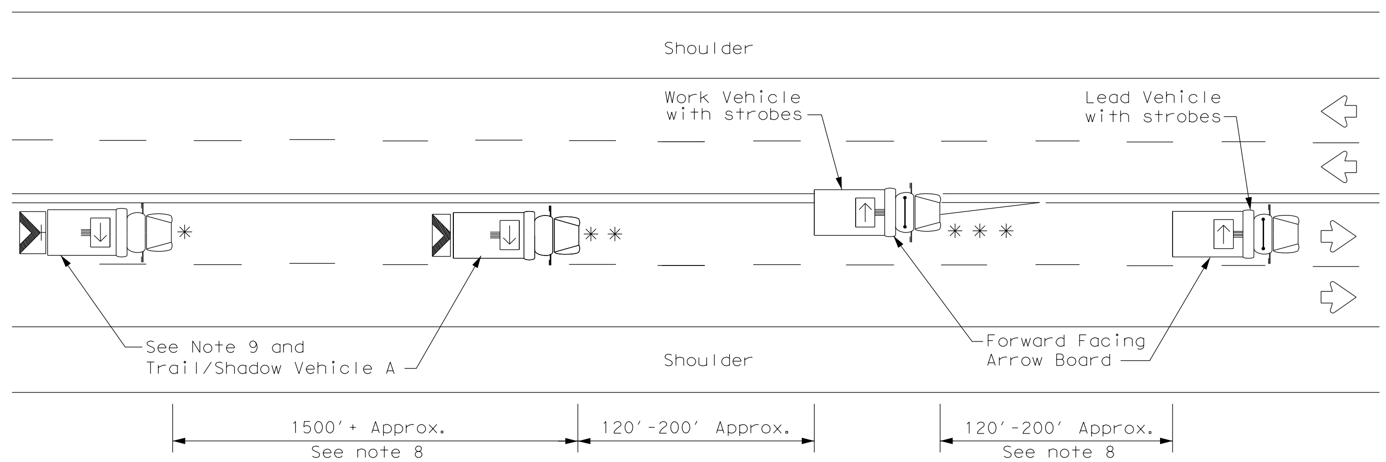
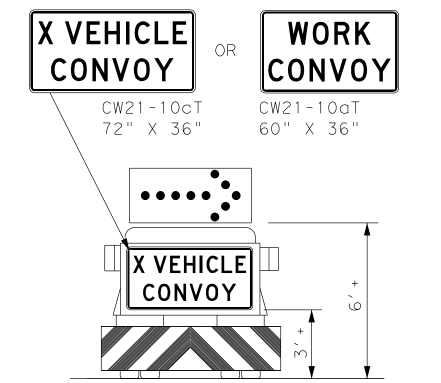


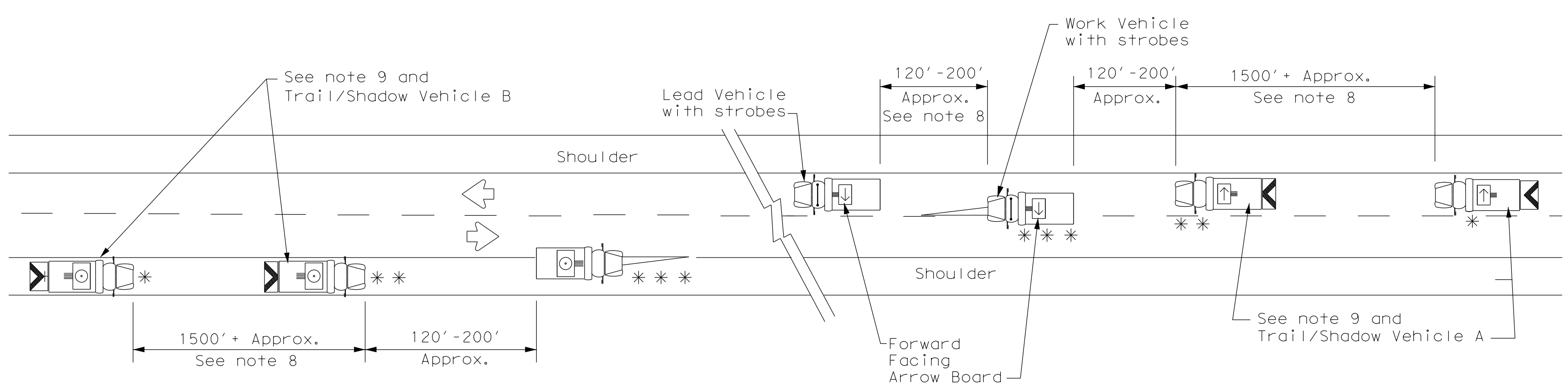
TCP (3-1a)

UNDIVIDED MULTILANE ROADWAY



TRAIL/SHADOW VEHICLE A

with RIGHT Directional display Flashing Arrow Board

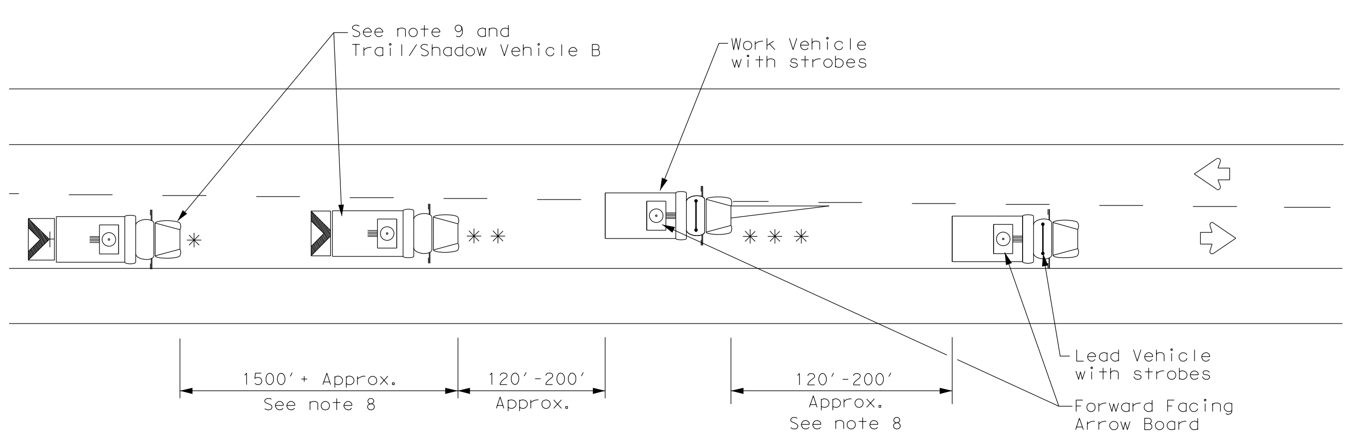


WORK ON SHOULDER

WORK ON TRAVEL LANE

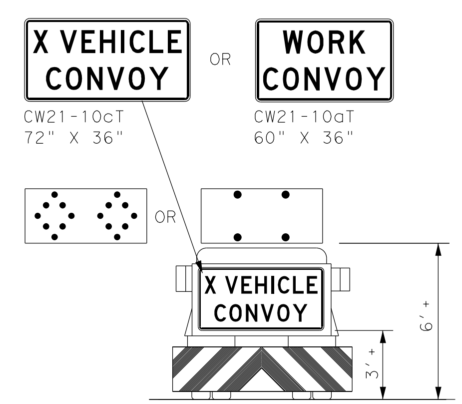
TCP (3-1b)

TWO-WAY ROADWAY WITH PAVED SHOULDERS



TCP (3-1c)

TWO-WAY ROADWAY WITHOUT PAVED SHOULDERS



TRAIL/SHADOW VEHICLE B

with Flashing Arrow Board in CAUTION display

LEGEND

Symbol	Description	Symbol	ARROW BOARD DISPLAY
*	Trail Vehicle		
* *	Shadow Vehicle		
* * *	Work Vehicle		RIGHT Directional
	Heavy Work Vehicle		LEFT Directional
	Truck Mounted Attenuator (TMA)		Double Arrow
	Traffic Flow		CAUTION (Alternating Diamond or 4 Corner Flash)

TYPICAL USAGE

MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
✓				

GENERAL NOTES

1. TRAIL, SHADOW, and LEAD vehicles shall be equipped with arrow boards as illustrated. When a LEAD vehicle is not used the WORK vehicle must be equipped with an arrow board. The Engineer will determine if the LEAD VEHICLE and/or TRAIL VEHICLE are required based on prevailing roadway conditions, traffic volume, and sight distance restrictions.

2. The use of amber high intensity rotating, flashing, oscillating, or strobe lights on vehicles are required. Blue high intensity rotating, flashing, oscillating or strobe lights when mounted on the driver's side of the vehicle may be operated simultaneously with the amber beacons or strobe lights.

3. The use of truck mounted attenuators (TMA) on the SHADOW VEHICLE and TRAIL VEHICLE are required.

4. Reflective sheeting on the rear of the TMA shall meet or exceed the reflectivity and color requirements of DEPARTMENTAL MATERIAL SPECIFICATION DMS 8300, Type A.

5. Flashing arrow boards shall be Type B or Type C as per the Barricade and Construction (BC) standards. The board shall be controlled from inside the vehicle.

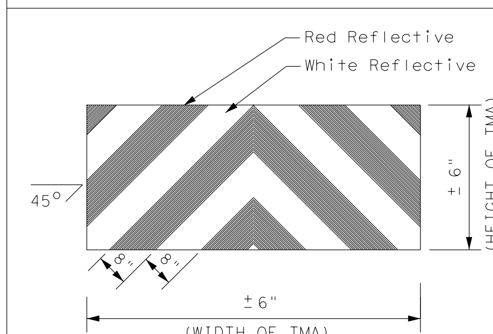
6. Each vehicle shall have two-way radio communication capability.

7. When work convoys must change lanes, the TRAIL VEHICLE should change lanes first to shadow the other convoy vehicles.

8. Vehicle spacing between the TRAIL VEHICLE and the SHADOW VEHICLE will vary depending on sight distance restrictions. Motorists approaching the work convoy should be able to see the TRAIL VEHICLE in time to slow down and/or change lanes as they approach the TRAIL VEHICLE. Vehicle spacing between the WORK VEHICLE and SHADOW VEHICLE and vehicle spacing between WORK VEHICLE and LEAD VEHICLE may vary according to terrain, work activity and other factors.

9. "X VEHICLE CONVOY" (CW21-10cT) or "WORK CONVOY" (CW21-10aT) signs shall be used on TRAIL VEHICLES and SHADOW VEHICLES as shown. As an option 48" X 48" diamond shaped "WORK CONVOY"(CW21-10T) or "X VEHICLE CONVOY" (CW21-10bT) signs may be used where adequate mounting space exists. When used, the X VEHICLE CONVOY sign shall have the number of the convoy vehicles displayed on the sign in the number designation "X" location. The "X VEHICLE CONVOY" sign shall not be used on the SHADOW VEHICLE if a TRAIL VEHICLE is used.

10. On two-lane two-way roadways, the work and protection vehicles should pull over periodically to allow motor vehicle traffic to pass. If motorists are not allowed to pass the work convoy, a "DO NOT PASS" (R4-1) sign should be placed on the back of the rearmost protection vehicle.



STRIPING FOR TMA

Texas Department of Transportation — Traffic Operations Division Standard

TRAFFIC CONTROL PLAN MOBILE OPERATIONS UNDIVIDED HIGHWAYS

TCP(3-1)-13

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©TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS 2-94 4-98 8-95 7-13 1-97	2038	01	031	FM 2115
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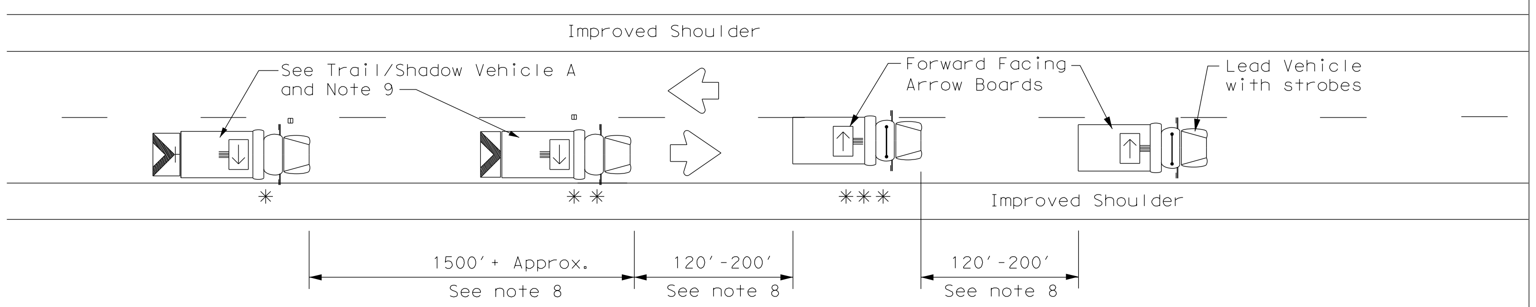
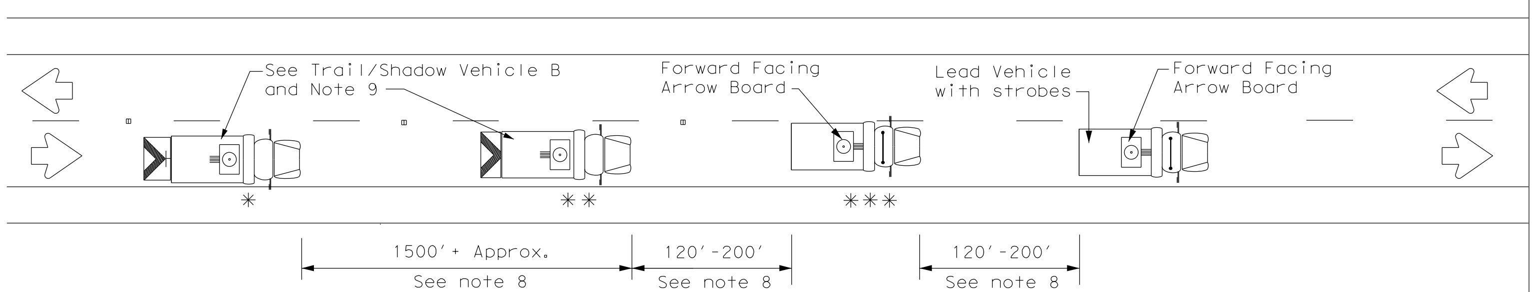


TCP (3-3a)

TWO LANE HIGHWAY WITH PAVED SHOULDERS

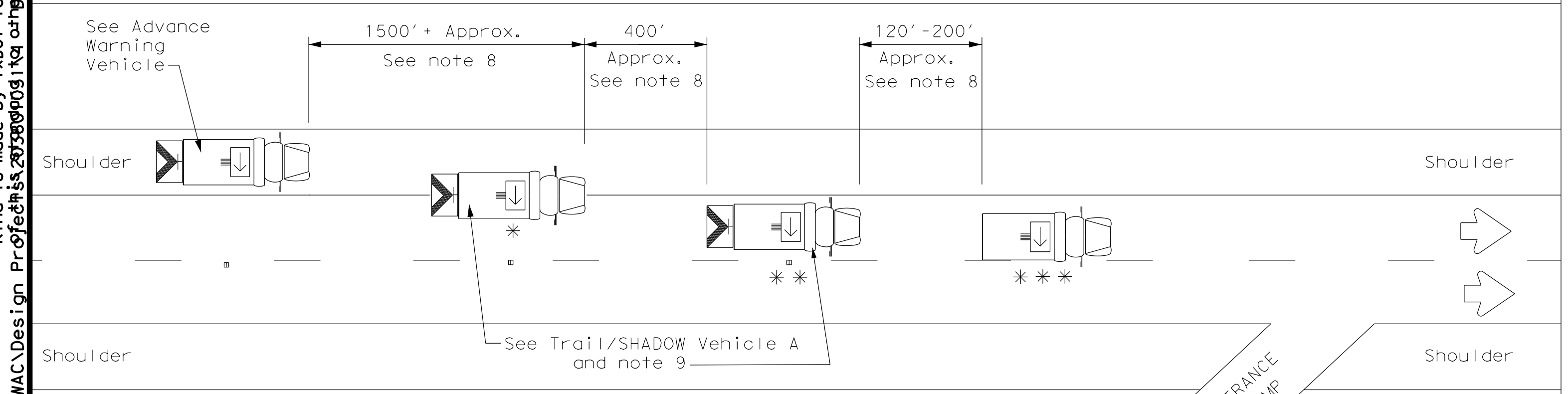
(WORK ON TRAVEL LANE)



TCP (3-3b)

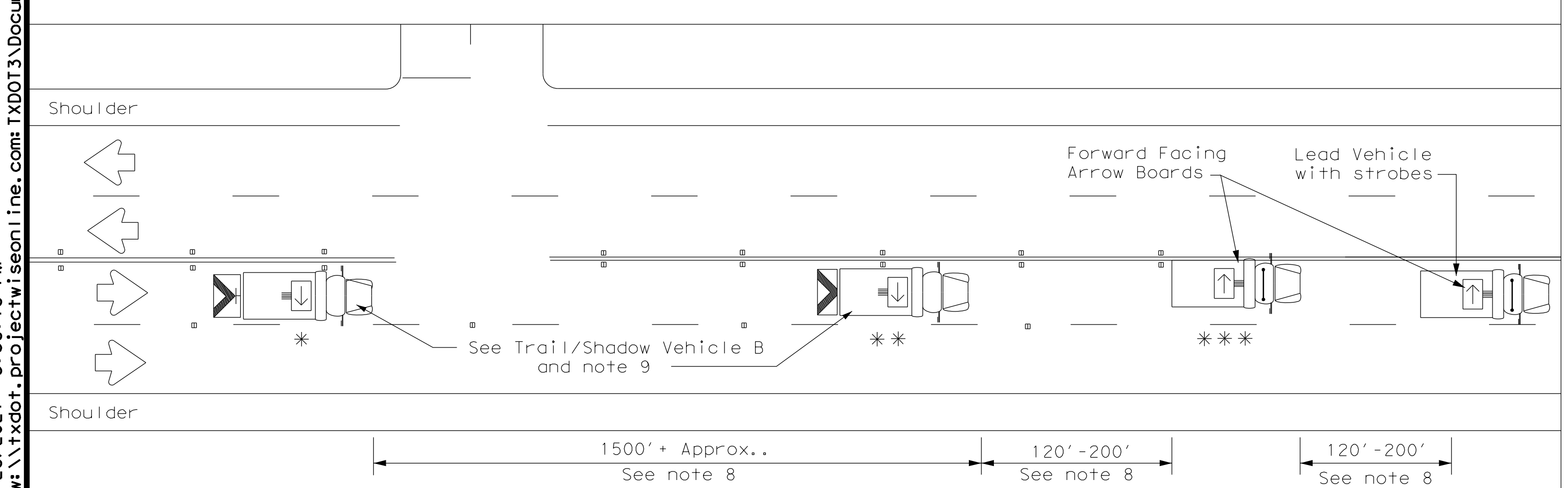
TWO LANE HIGHWAY WITHOUT PAVED SHOULDERS

(WORK ON TRAVEL LANE)



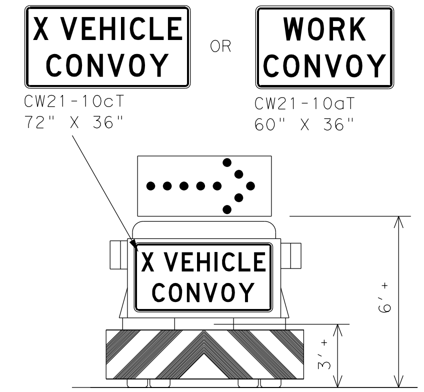
TCP (3-3c)

DIVIDED MULTILANE HIGHWAY



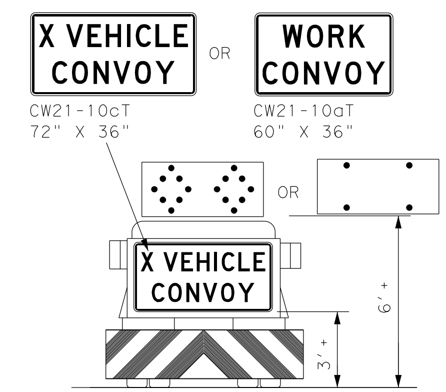
TCP (3-3d)

UNDIVIDED MULTILANE HIGHWAY



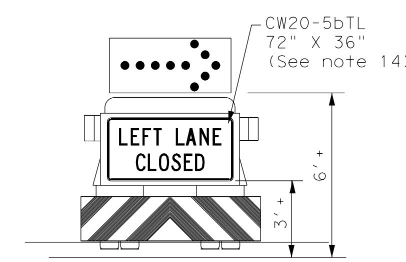
TRAIL/SHADOW VEHICLE A

with RIGHT Directional display Flashing Arrow Board

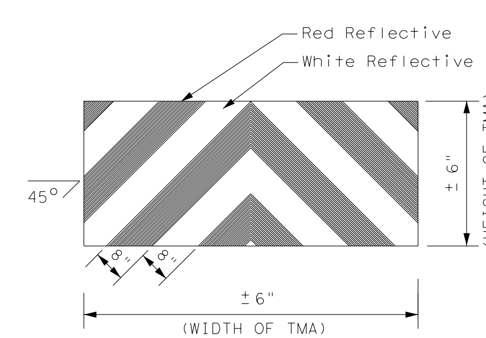


TRAIL/SHADOW VEHICLE B

with Flashing Arrow Board in Caution Mode



ADVANCE WARNING VEHICLE



STRIPING FOR TMA

LEGEND

*	Trail Vehicle	ARROW BOARD DISPLAY	
**	Shadow Vehicle		
***	Work Vehicle	[→]	RIGHT Directional
[vehicle symbol]	Heavy Work Vehicle	[←]	LEFT Directional
[TMA symbol]	Truck Mounted Attenuator (TMA)	[↔]	Double Arrow
[arrow symbol]	Traffic Flow	[⊙]	CAUTION (Alternating Diamond or 4 Corner Flash)

TYPICAL USAGE

MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
✓				

GENERAL NOTES

1. TRAIL, SHADOW, and LEAD vehicles shall be equipped with arrow boards as illustrated. When a LEAD vehicle is not used on two way roads the WORK vehicle must have an arrow board. For divided roadways, the arrow board on the WORK vehicle is optional based on the type of work being performed. The Engineer will determine if the LEAD vehicle and/or TRAIL vehicle are required based on prevailing roadway conditions, traffic volume, and sight distance restrictions.
2. The use of amber high intensity rotating, flashing, oscillating, or strobe lights on vehicles are required. Blue high intensity rotating, flashing, oscillating, or strobe lights when mounted on the driver's side of the vehicle may be operated simultaneously with the amber beacons or strobe lights.
3. The use of truck mounted attenuators (TMA) on the SHADOW VEHICLE, ADVANCE WARNING and TRAIL VEHICLE are required.
4. Reflective sheeting on the rear of the TMA shall meet or exceed the reflectivity and color requirements of DEPARTMENTAL MATERIAL SPECIFICATION DMS 8300, Type A.
5. Flashing arrow boards shall be Type B or Type C as per the Barricade and Construction (BC) standards. The board shall be controlled from inside the vehicle.
6. Each vehicle shall have two-way radio communication capability.
7. When work convoys must change lanes, the TRAIL VEHICLE should change lanes first to shadow the other convoy vehicles.
8. Vehicle spacing between the TRAIL VEHICLE and the SHADOW VEHICLE will vary depending on sight distance restrictions. Motorists approaching the convoy should be able to see the TRAIL VEHICLE in time to slow down and/or change lanes as they approach the TRAIL VEHICLE. Vehicle spacing between the WORK VEHICLE and SHADOW VEHICLE and vehicle spacing between WORK VEHICLE and LEAD VEHICLE may vary according to terrain, work activity and other factors.
9. X VEHICLE CONVOY (CW21-10cT) or WORK CONVOY (CW21-10aT) signs shall be used on TRAIL VEHICLES and SHADOW VEHICLES as shown. As an option 48" x 48" diamond shaped WORK CONVOY (CW21-10T) or X VEHICLE CONVOY (CW21-10bT) signs may be used where adequate mounting space exists. When used, the X VEHICLE CONVOY sign shall have the number of the convoy vehicles displayed on the sign in the number designation "X" location. The X VEHICLE CONVOY sign shall not be used on the SHADOW VEHICLE if a TRAIL VEHICLE is used.
10. For divided highways with two or three lanes in one direction, the appropriate LEFT LANE CLOSED (CW20-5bTL), RIGHT LANE CLOSED (CW20-5bTR), or CENTER LANE CLOSED (CW20-5dT) sign should be used on the Advance Warning Vehicle. As an option, a portable changeable message sign (PCMS) or truck mounted changeable message sign (TMCMS) with a minimum character height of 12", and displaying the same legend may be substituted for these signs. An appropriate directional arrow display, simulating the size and legibility of the flashing arrow board may be used in the second phase of the PCMS/TMCMS message. When this is done, the arrow board will not be required on the Advance Warning Vehicle.
11. A double arrow shall not be displayed on the arrow board on the Advance Warning Vehicle.
12. For divided highways with three or four lanes in each direction, use TCP(3-2).
13. Standard diamond shape versions of the CW20-5 series signs may be used as an option if the rectangular signs shown are not available.
14. The Advance Warning Vehicle may straddle the edgeline when Shoulder width makes it necessary.
15. On two-lane two-way roadways, the work and protection vehicles should pull over periodically to allow motor vehicle traffic to pass. If motorists are not allowed to pass the work convoy, a DO NOT PASS (R4-1) sign should be placed on the back of the rearmost protection vehicle.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN MOBILE OPERATIONS RAISED PAVEMENT MARKER INSTALLATION/ REMOVAL

TCP(3-3)-14

FILE: tcp3-3.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT	
©TxDOT September 1987	CONT	SECT	JOB	HIGHWAY	
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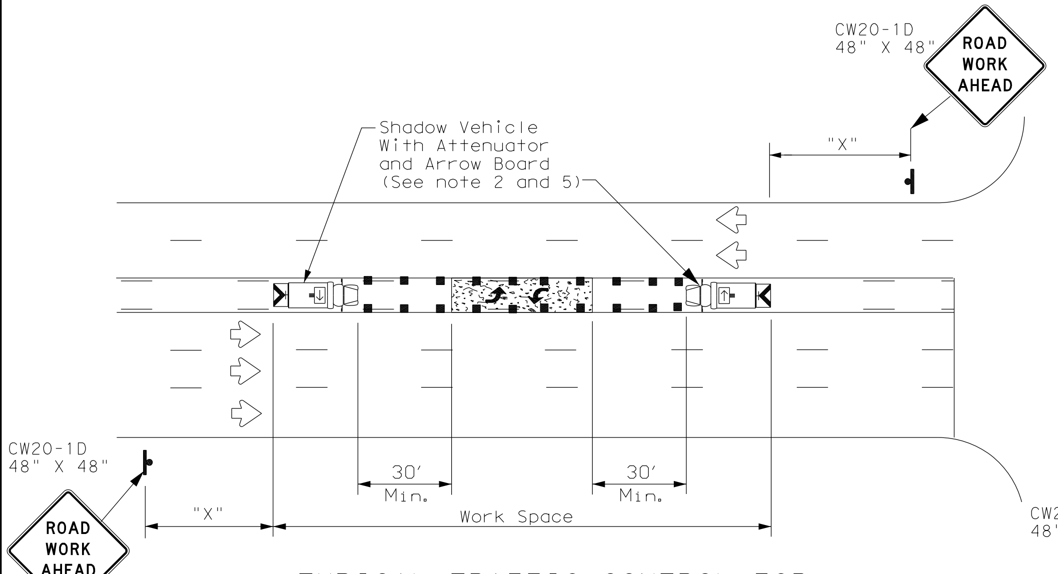
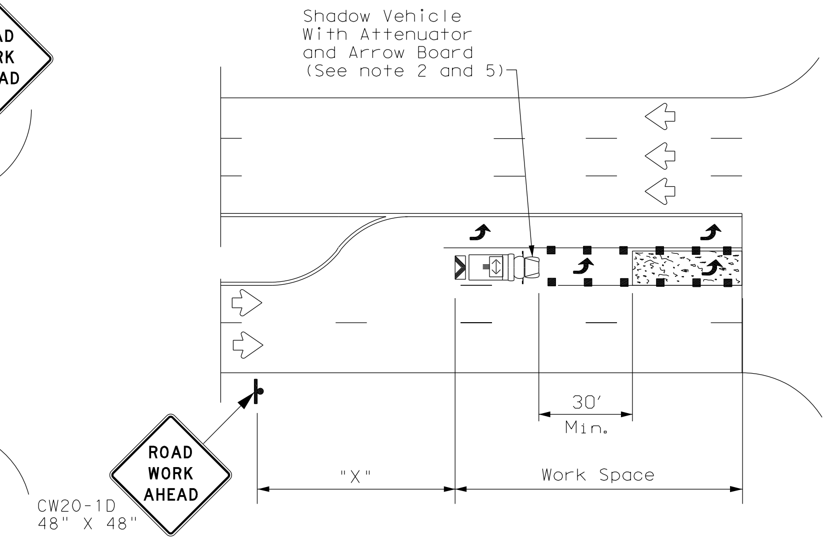
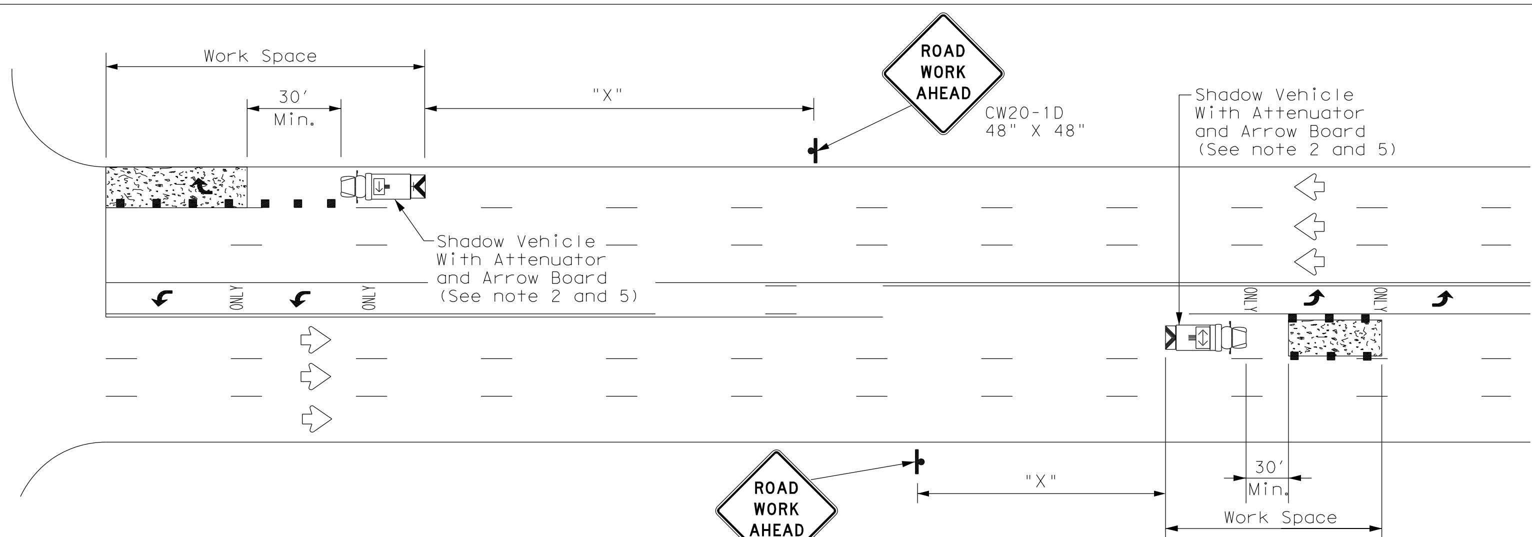
2-94 4-98	DIST		COUNTY	SHEET NO.	
8-95 7-13	WAC		BELL	53	
1-97 7-14					



TYPICAL TRAFFIC CONTROL FOR
CONTINUOUS LEFT TURN LANE SYMBOL MARKINGS

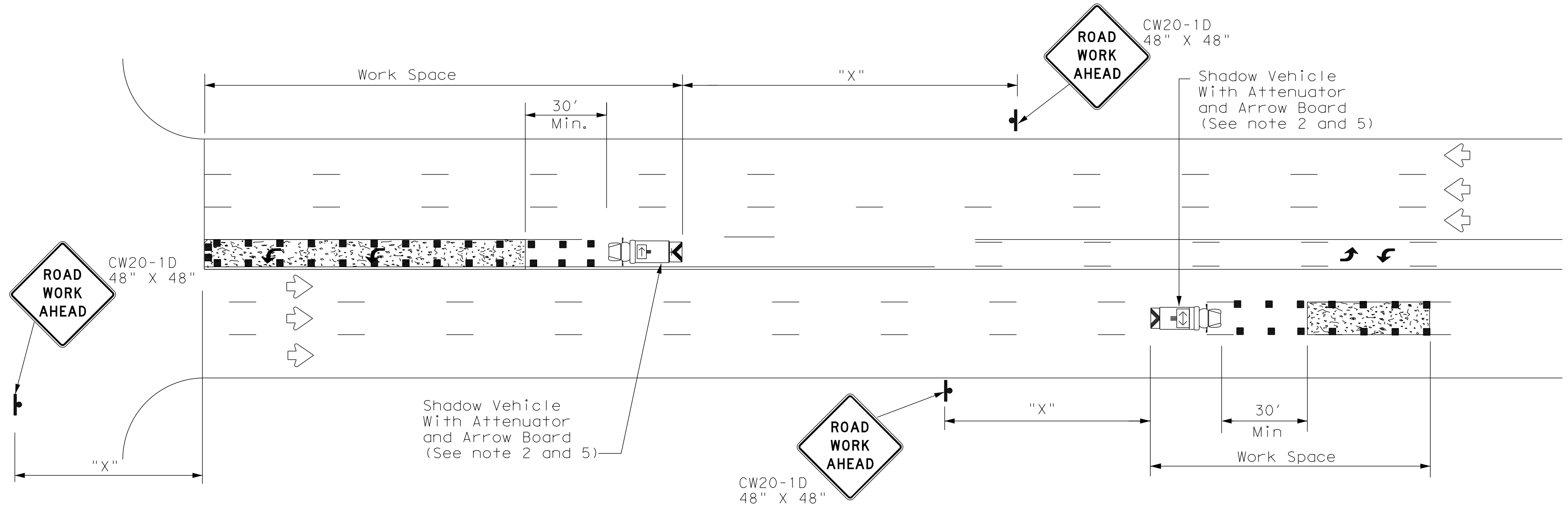


TYPICAL TRAFFIC CONTROL FOR
OUTSIDE DUAL LEFT TURN LANE SYMBOL MARKINGS



TYPICAL TRAFFIC CONTROL FOR
OUTSIDE LANE MARKINGS

TYPICAL TRAFFIC CONTROL FOR
INSIDE LANE MARKINGS



TYPICAL TRAFFIC CONTROL FOR
LEFT TURN LANE MARKINGS

TYPICAL TRAFFIC CONTROL FOR
CENTER LANE MARKINGS

LEGEND

Symbol	Description	Symbol	Arrow Board Display
✳	Trail Vehicle		ARROW BOARD DISPLAY
✳✳	Shadow Vehicle		
✳✳✳	Work Vehicle		RIGHT Directional
	Heavy Work Vehicle		LEFT Directional
	Truck Mounted Attenuator (TMA)		Double Arrow
	Traffic Flow	■ ■ ■	Channelizing Devices

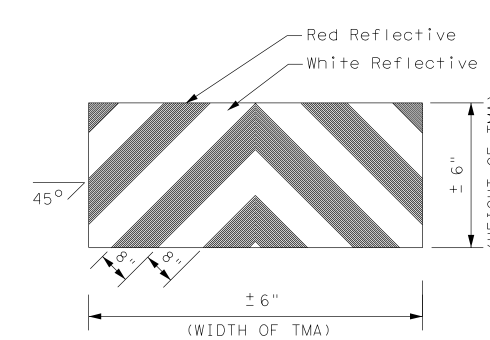
Posted Speed ✳	Formula	Minimum Desirable Taper Lengths ✳✳			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing "X" Distance	Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent		
30	$L = \frac{WS^2}{60}$	150'	165'	180'	30'	60'	120'	90'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

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

TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
✓				

GENERAL NOTES

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



STRIPING FOR TMA

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN MOBILE OPERATIONS FOR ISOLATED WORK AREAS UNDIVIDED HIGHWAYS

TCP(3-4)-13

FILE: tcp3-4.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT July, 2013	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST		COUNTY	SHEET NO.
	WAC		BELL	54

178

DATE: 8/28/2021 5:38:24 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\2038-01-031 ...

DATE: 8/26/2021 5:38:30 PM
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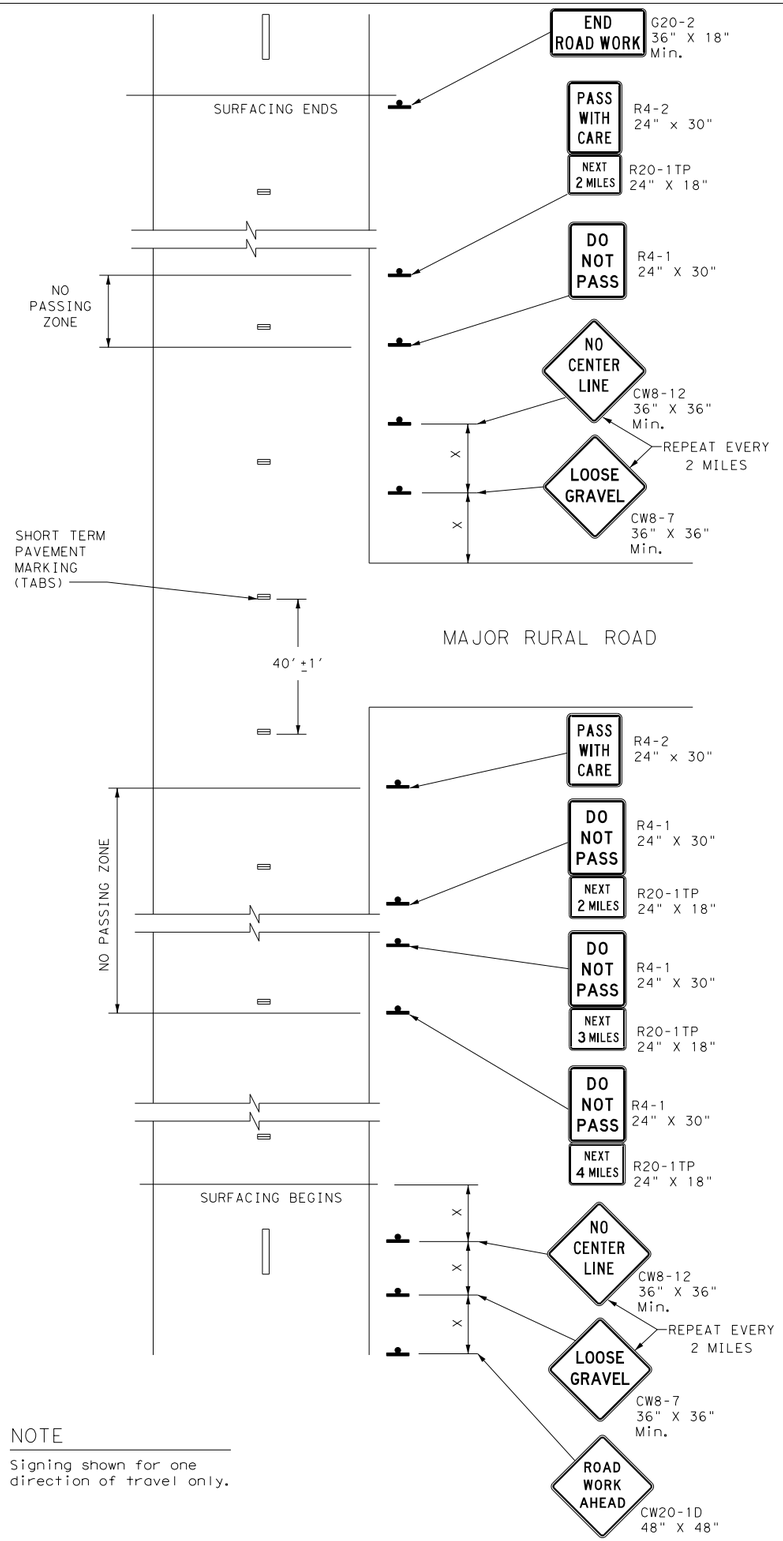
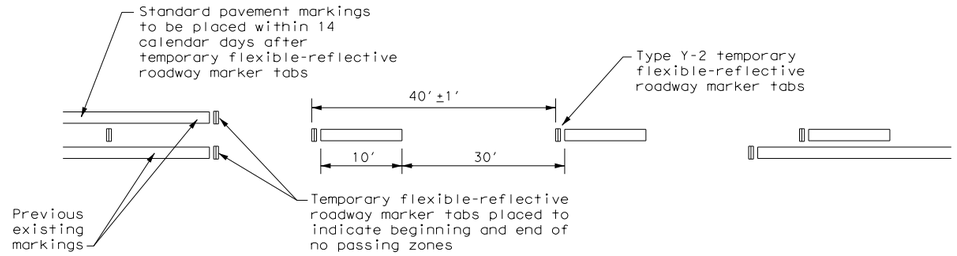


NOTE

Signing shown for one direction of travel only.

NO PASSING ZONES ON TWO-LANE TWO-WAY ROADS



TABS ON CENTERLINES OF TWO-LANE TWO-WAY ROADS

For seal coat, micro-surface or similar operations

"DO NOT PASS" SIGN (R4-1) and NO-PASSING ZONES

A. Prior to the beginning of construction, all currently striped no-passing zones shall be signed with the DO NOT PASS (R4-1) signs and PASS WITH CARE (R4-2) signs placed at the beginning and end of each zone for each direction of travel except as otherwise provided herein. Signs marking these individual no-passing zones need not be covered prior to construction if the signs supplement the existing pavement markings.

B. At the discretion of the Engineer, in areas of numerous no-passing zones, several zones may be combined as a single zone. If passing is to be prohibited over one or more lengthy sections, a DO NOT PASS sign and a NEXT XX MILES (R20-1TP) plaque may be used at the beginning of such zones. The DO NOT PASS sign and the NEXT XX MILES plaque should be repeated every mile to the end of the no-passing zone. In areas where there is considerable distance between no-passing zones, the end of the no-passing zone may be signed with a PASS WITH CARE sign and a NEXT XX MILES plaque.

C. Depending on traffic volumes and length of sections, it may be desirable to prohibit passing throughout the project to prevent damage to windshield and lights. The DO NOT PASS sign and NEXT XX MILES plaque should be used and repeated as often as necessary for this purpose. Where several existing zones are to be combined into one individual no-passing zone, the sign at the beginning of the zone should be covered until the surfacing operation has passed this location so as not to have the DO NOT PASS sign conflict with the existing pavement markings. Also, unless one days operation completes the entire length of such combined zones, appropriate DO NOT PASS and PASS WITH CARE signs should be placed at the beginning and end of the no-passing zones where the surfacing operation has stopped for the day.

D. R4-1 and R4-2 are to remain in place until standard pavement markings are installed.

"NO CENTER LINE" SIGN (CW8-12)

A. Center line markings are yellow pavement markings that delineate the separation of travel lanes that have opposite directions of travel on a roadway. Divided highways do not typically have center line markings.

B. At the time construction activity obliterates the existing center line markings(low volume roads may not have an existing centerline), a NO CENTER LINE (CW8-12) sign should be erected at the beginning of the work area, at approximately 2 mile intervals within the work area, beyond major intersections and other locations deemed necessary by the Engineer.

C. The NO CENTER LINE signs are to remain in place until standard pavement markings are installed.

"LOOSE GRAVEL" SIGN (CW8-7)

A. When construction begins, a LOOSE GRAVEL (CW8-7) sign should be erected at each end of the work area and repeated at intervals of approximately 2 miles in rural areas and closer in urban areas.

B. The LOOSE GRAVEL signs are to remain in place until the condition no longer exists.

PAVEMENT MARKINGS

A. Temporary markings for surfacing projects shall be Temporary Flexible-reflective Roadway Marker Tabs unless otherwise approved by the Engineer. Tabs are to be installed to provide true alignment for striping crews or as directed by the Engineer. Tabs will be placed at the spacing indicated. Tabs should be applied to the pavement no more than two (2) days before the surfacing is applied. After the surfacing is rolled and swept, the cover over the reflective strip shall be removed.

B. Tabs shall not be used to simulate edge lines.

C. Tab placement for overlay/inlay operations shall be as shown on the WZ(STPM) standard sheet.

COORDINATION OF SIGN LOCATIONS

A. The location of warning signs at the beginning and end of a work area are to be coordinated with other signing typically shown on the Barricade and Construction Standards for project limits to ensure adequate sign spacing.

B. Where possible the ROAD WORK AHEAD (CW20-1D), LOOSE GRAVEL (CW8-7), and NO CENTER LINE (CW8-12) signs should be placed in the sequence shown following the OBEY WARNING SIGNS STATE LAW (R20-3T) and the TRAFFIC FINES DOUBLE (R20-5T) sign, and one "X" sign spacing prior to the CONTRACTOR (G20-6T)sign typically located at or near the limits of surfacing. LOOSE GRAVEL and NO CENTER LINE signs will then be repeated as described above.

Posted Speed *	Minimum Sign Spacing "X" Distance
30	120′
35	160′
40	240′
45	320′
50	400′
55	500′
60	600′
65	700′
70	800′
75	900′

* Conventional Roads Only

TYPICAL USAGE				
MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
			✓	✓

GENERAL NOTES

1. The traffic control devices detailed on this sheet will be furnished and erected as directed by the Engineer on sections of roadway where tabs must be placed prior to the surfacing operation which will cover or obliterate the existing pavement markings.
2. The devices shown on this sheet are to be used to supplement those required by the BC Standards or others required elsewhere in the plans.
3. Signs shall be erected as detailed on the BC Standards or the Compliant Work Zone Traffic Control Devices List (CWZTCD) on supports approved for Long-Term / Intermediate-Term Work Zone Sign Supports.
4. When surfacing operations take place on divided highways, freeways or expressways, the size of diamond shaped construction warning signs shall be 48" x 48".
5. Signs on divided highways, freeways and expressways will be placed on both right and left sides of the roadway based on roadway conditions as directed by the Engineer.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL DETAILS FOR SURFACING OPERATIONS

TCP(7-1)-13

FILE: tcp7-1.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT March 1991	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
4-92 4-98	DIST	COUNTY		SHEET NO.
1-97 7-13	WAC	BELL		55

Alignment Name: 2115HA
Alignment Description:
Alignment Style:
Station Northing Easting

Element: Linear
POB ( ) 9+78.7467 R1 10308851.6801 3170566.9787
PC ( ) 10+65.6631 R1 10308765.3820 3170556.6299
Tangential Direction: S 6.84 W
Tangential Length: 86.9164

Element: Circular
PC ( ) 10+65.6631 R1 10308765.3820 3170556.6299
PI ( ) 12+04.7339 R1 10308627.3005 3170540.0713
CC ( ) 10309027.9857 3168366.7924
PT ( ) 13+43.4370 R1 10308492.3926 3170506.2991
Radius: 2205.5269
Delta: 7.22 Right
Degree of Curvature (Arc): 2.60
Length: 277.7740
Tangent: 139.0709
Chord: 277.5904
Middle Ordinate: 4.3716
External: 4.3802
Tangent Direction: S 6.84 W
Radial Direction: N 83.16 W
Chord Direction: S 10.45 W
Radial Direction: N 75.95 W
Tangent Direction: S 14.05 W

Element: Linear
PT ( ) 13+43.4370 R1 10308492.3926 3170506.2991
PC ( ) 23+70.1990 R1 10307496.3657 3170256.9589
Tangential Direction: S 14.05 W
Tangential Length: 1026.7620

Element: Circular
PC ( ) 23+70.1990 R1 10307496.3657 3170256.9589
PI ( ) 25+27.1998 R1 10307344.0645 3170218.8326
CC ( ) 10307202.4551 3171431.0284
PT ( ) 26+82.4568 R1 10307187.0764 3170220.8275
Radius: 1210.2986
Delta: 14.78 Left
Degree of Curvature (Arc): 4.73
Length: 312.2578
Tangent: 157.0008
Chord: 311.3925
Middle Ordinate: 10.0564
External: 10.1406
Tangent Direction: S 14.05 W
Radial Direction: N 75.95 W
Chord Direction: S 6.66 W
Radial Direction: S 89.27 W
Tangent Direction: S 0.73 E

Element: Linear
PT ( ) 26+82.4568 R1 10307187.0764 3170220.8275
PC ( ) 29+20.2748 R1 10306949.2776 3170223.8494
Tangential Direction: S 0.73 E
Tangential Length: 237.8180

Element: Circular
PC ( ) 29+20.2748 R1 10306949.2776 3170223.8494
PI ( ) 31+03.9847 R1 10306765.5826 3170226.1837
CC ( ) 10306934.9847 3169099.0875
PT ( ) 32+84.4792 R1 10306590.6897 3170169.9538
Radius: 1124.8527
Delta: 18.55 Right
Degree of Curvature (Arc): 5.09
Length: 364.2043
Tangent: 183.7099
Chord: 362.6156
Middle Ordinate: 14.7081
External: 14.9029
Tangent Direction: S 0.73 E
Radial Direction: S 89.27 W
Chord Direction: S 8.55 W
Radial Direction: N 72.18 W
Tangent Direction: S 17.82 W

Element: Linear
PT ( ) 32+84.4792 R1 10306590.6897 3170169.9538
PC ( ) 35+17.5544 R1 10306368.8007 3170098.6141
Tangential Direction: S 17.82 W
Tangential Length: 233.0753

Element: Circular
PC ( ) 35+17.5544 R1 10306368.8007 3170098.6141
PI ( ) 37+15.4236 R1 10306180.4281 3170038.0503
CC ( ) 10306643.5844 3169243.9498
PT ( ) 39+07.0653 R1 10306034.9697 3169903.9083
Radius: 897.7511
Delta: 24.86 Right
Degree of Curvature (Arc): 6.38
Length: 389.5108
Tangent: 197.8692
Chord: 386.4628
Middle Ordinate: 21.0421
External: 21.5471
Tangent Direction: S 17.82 W
Radial Direction: N 72.18 W
Chord Direction: S 30.25 W
Radial Direction: N 47.32 W
Tangent Direction: S 42.68 W

Element: Linear
PT ( ) 39+07.0653 R1 10306034.9697 3169903.9083
PC ( ) 40+64.7761 R1 10305919.0326 3169796.9909
Tangential Direction: S 42.68 W
Tangential Length: 157.7109

Element: Circular
PC ( ) 40+64.7761 R1 10305919.0326 3169796.9909
PI ( ) 46+41.7333 R1 10305494.8975 3169405.8528
CC ( ) 10305263.2352 3170508.1125
PT ( ) 51+05.2399 R1 10304949.1906 3169593.1589
Radius: 967.3490
Delta: 61.63 Left
Degree of Curvature (Arc): 5.92
Length: 1040.4637
Tangent: 576.9572
Chord: 991.0303
Middle Ordinate: 136.5489
External: 158.9918
Tangent Direction: S 42.68 W
Radial Direction: N 47.32 W
Chord Direction: S 11.87 W
Radial Direction: S 71.06 W
Tangent Direction: S 18.94 E

Element: Linear
PT ( ) 51+05.2399 R1 10304949.1906 3169593.1589
PI ( ) 58+97.9847 R1 10304199.3839 3169850.5192
Tangential Direction: S 18.94 E
Tangential Length: 792.7448

Element: Linear
PI ( ) 58+97.9847 R1 10304199.3839 3169850.5192
PC ( ) 74+77.1051 R1 10302707.8221 3170369.0407
Tangential Direction: S 19.17 E
Tangential Length: 1579.1204

Element: Circular
PC ( ) 74+77.1051 R1 10302707.8221 3170369.0407
PI ( ) 76+58.1919 R1 10302536.7762 3170428.5026
CC ( ) 10302122.1109 3168684.2034
PT ( ) 78+38.0420 R1 10302357.2700 3170452.3761
Radius: 1783.7417
Delta: 11.59 Right
Degree of Curvature (Arc): 3.21
Length: 360.9368
Tangent: 181.0867
Chord: 360.3214
Middle Ordinate: 9.1216
External: 9.1685
Tangent Direction: S 19.17 E
Radial Direction: S 70.83 W
Chord Direction: S 13.37 E
Radial Direction: S 82.42 W
Tangent Direction: S 7.58 E

Element: Linear
PT ( ) 78+38.0420 R1 10302357.2700 3170452.3761
PC ( ) 103+53.4636 R1 10299863.8038 3170783.9961
Tangential Direction: S 7.58 E
Tangential Length: 2515.4216

Element: Circular
PC ( ) 103+53.4636 R1 10299863.8038 3170783.9961
PI ( ) 105+67.5238 R1 10299651.6119 3170812.2167
CC ( ) 10299736.3123 3169825.3818
PT ( ) 107+74.7905 R1 10299447.3325 3170748.2502
Radius: 967.0550
Delta: 24.96 Right
Degree of Curvature (Arc): 5.92
Length: 421.3270
Tangent: 214.0603
Chord: 418.0026
Middle Ordinate: 22.8549
External: 23.4081
Tangent Direction: S 7.58 E
Radial Direction: S 82.42 W
Chord Direction: S 4.91 W
Radial Direction: N 72.61 W
Tangent Direction: S 17.39 W

Element: Linear
PT ( ) 107+74.7905 R1 10299447.3325 3170748.2502
PC ( ) 108+24.1259 R1 10299400.2513 3170733.5076
Tangential Direction: S 17.39 W
Tangential Length: 49.3354

Element: Circular
PC ( ) 108+24.1259 R1 10299400.2513 3170733.5076
PI ( ) 113+69.3961 R1 10298879.8955 3170570.5674
CC ( ) 10299737.6890 3169655.8872
PT ( ) 118+40.0907 R1 10298683.9239 3170061.7308
Radius: 1129.2165
Delta: 51.55 Right
Degree of Curvature (Arc): 5.07
Length: 1015.9648
Tangent: 545.2702
Chord: 982.0433
Middle Ordinate: 112.3450
External: 124.7570
Tangent Direction: S 17.39 W
Radial Direction: N 72.61 W
Chord Direction: S 43.16 W
Radial Direction: N 21.06 W
Tangent Direction: S 68.94 W

Element: Linear
PT ( ) 118+40.0907 R1 10298683.9239 3170061.7308
PC ( ) 120+53.8944 R1 10298607.0822 3169862.2128
Tangential Direction: S 68.94 W
Tangential Length: 213.8038

Element: Circular
PC ( ) 120+53.8944 R1 10298607.0822 3169862.2128
PI ( ) 130+07.2693 R1 10298264.4366 3168972.5401
CC ( ) 10297717.2436 3170204.9223
PT ( ) 135+51.5536 R1 10297374.7000 3169315.0198
Radius: 953.5527
Delta: 89.99 Left
Degree of Curvature (Arc): 6.01
Length: 1497.6592

Tangent: 953.3748
Chord: 1348.4013
Middle Ordinate: 279.2262
External: 394.8487
Tangent Direction: S 68.94 W
Radial Direction: N 21.06 W
Chord Direction: S 23.94 W
Radial Direction: S 68.95 W
Tangent Direction: S 21.05 E

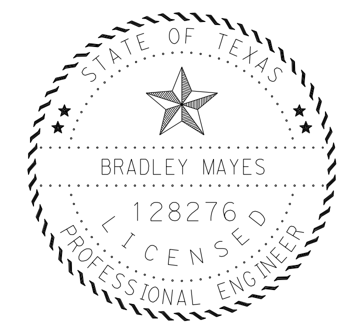
Element: Linear
PT ( ) 135+51.5536 R1 10297374.7000 3169315.0198
PI ( ) 151+68.9297 R1 10295865.2845 3169896.0278
Tangential Direction: S 21.05 E
Tangential Length: 1617.3761

Element: Linear
PI ( ) 151+68.9297 R1 10295865.2845 3169896.0278
PI ( ) 164+97.3492 R1 10294634.2295 3170395.2291
Tangential Direction: S 22.07 E
Tangential Length: 1328.4195

Element: Linear
PI ( ) 164+97.3492 R1 10294634.2295 3170395.2291
PC ( ) 169+24.6235 R1 10294236.0263 3170550.1403
Tangential Direction: S 21.26 E
Tangential Length: 427.2743

Element: Circular
PC ( ) 169+24.6235 R1 10294236.0263 3170550.1403
PI ( ) 178+61.3346 R1 10293363.0474 3170889.7514
CC ( ) 10187241.0432 2895516.8723
PT ( ) 187+98.0395 R1 10292487.9303 3171223.8139
Radius: 295112.2243
Delta: 0.36 Right
Degree of Curvature (Arc): 0.02
Length: 1873.4160
Tangent: 936.7111
Chord: 1873.4128
Middle Ordinate: 1.4866
External: 1.4866
Tangent Direction: S 21.26 E
Radial Direction: S 68.74 W
Chord Direction: S 21.08 E
Radial Direction: S 69.11 W
Tangent Direction: S 20.89 E

Element: Linear
PT ( ) 187+98.0395 R1 10292487.9303 3171223.8139
PC ( ) 207+61.8321 R1 10290653.2681 3171924.1680
Tangential Direction: S 20.89 E
Tangential Length: 1963.7926



Bradley Mayes 8/28/2021
SIGNATURE OF REGISTRANT & DATE

HORIZONTAL ALIGNMENT DATA

SHEET 1 OF 2

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	56

NODE

Element: Circular
PC ( ) 207+61.8321 R1 10290653.2681 3171924.1680
PI ( ) 209+52.2149 R1 10290475.4040 3171992.0649
CC ( ) 10287861.1116 3164609.7767
PT ( ) 211+42.5227 R1 10290294.4499 3172051.2364
Radius: 7829.2054
Delta: 2.79 Right
Degree of Curvature (Arc): 0.73
Length: 380.6907
Tangent: 190.3828
Chord: 380.6532
Middle Ordinate: 2.3137
External: 2.3144
Tangent Direction: S 20.89 E
Radial Direction: S 69.11 W
Chord Direction: S 19.50 E
Radial Direction: S 71.89 W
Tangent Direction: S 18.11 E

Element: Linear
PT ( ) 211+42.5227 R1 10290294.4499 3172051.2364
PC ( ) 215+99.0893 R1 10289860.4951 3172193.1385
Tangential Direction: S 18.11 E
Tangential Length: 456.5665

Element: Circular
PC ( ) 215+99.0893 R1 10289860.4951 3172193.1385
PI ( ) 217+71.4437 R1 10289696.6767 3172246.7068
CC ( ) 10292226.0156 3179427.2025
PT ( ) 219+43.7392 R1 10289535.4510 3172307.6357
Radius: 7611.0031
Delta: 2.59 Left
Degree of Curvature (Arc): 0.75
Length: 344.6499
Tangent: 172.3544
Chord: 344.6205
Middle Ordinate: 1.9508
External: 1.9513
Tangent Direction: S 18.11 E
Radial Direction: S 71.89 W
Chord Direction: S 19.40 E
Radial Direction: S 69.30 W
Tangent Direction: S 20.70 E

Element: Linear
PT ( ) 219+43.7392 R1 10289535.4510 3172307.6357
PC ( ) 220+52.8482 R1 10289433.3871 3172346.2069
Tangential Direction: S 20.70 E
Tangential Length: 109.1091

Element: Circular
PC ( ) 220+52.8482 R1 10289433.3871 3172346.2069
PI ( ) 222+66.4034 R1 10289233.6210 3172421.7007
CC ( ) 10289111.3119 3171493.9560
PT ( ) 224+72.3845 R1 10289021.1150 3172400.5587
Radius: 911.0784
Delta: 26.38 Right
Degree of Curvature (Arc): 6.29
Length: 419.5363
Tangent: 213.5551
Chord: 415.8394
Middle Ordinate: 24.0422
External: 24.6938
Tangent Direction: S 20.70 E
Radial Direction: S 69.30 W
Chord Direction: S 7.51 E
Radial Direction: N 84.32 W
Tangent Direction: S 5.68 W

Element: Linear
PT ( ) 224+72.3845 R1 10289021.1150 3172400.5587
PC ( ) 226+54.0069 R1 10288840.3849 3172382.5781
Tangential Direction: S 5.68 W
Tangential Length: 181.6224

Element: Circular
PC ( ) 226+54.0069 R1 10288840.3849 3172382.5781
PI ( ) 228+77.6370 R1 10288617.8533 3172360.4387
CC ( ) 10288749.0066 3173301.0548
PT ( ) 230+92.8115 R1 10288409.8657 3172442.6069
Radius: 923.0110
Delta: 27.24 Left
Degree of Curvature (Arc): 6.21
Length: 438.8046
Tangent: 223.6302
Chord: 434.6840
Middle Ordinate: 25.9537
External: 26.7046
Tangent Direction: S 5.68 W
Radial Direction: N 84.32 W
Chord Direction: S 7.94 E
Radial Direction: S 68.44 W
Tangent Direction: S 21.56 E

Element: Linear
PT ( ) 230+92.8115 R1 10288409.8657 3172442.6069
PC ( ) 267+02.4753 R1 10285052.6921 3173768.9017
Tangential Direction: S 21.56 E
Tangential Length: 3609.6638

Element: Circular
PC ( ) 267+02.4753 R1 10285052.6921 3173768.9017
PI ( ) 269+26.1751 R1 10284844.6397 3173851.0955
CC ( ) 10285557.8365 3175047.5446
PT ( ) 271+45.9881 R1 10284673.3779 3173995.0088
Radius: 1374.8085
Delta: 18.48 Left
Degree of Curvature (Arc): 4.17
Length: 443.5128
Tangent: 223.6998
Chord: 441.5921
Middle Ordinate: 17.8459
External: 18.0806
Tangent Direction: S 21.56 E
Radial Direction: S 68.44 W
Chord Direction: S 30.80 E
Radial Direction: S 49.96 W
Tangent Direction: S 40.04 E

Element: Linear
PT ( ) 271+45.9881 R1 10284673.3779 3173995.0088
PC ( ) 282+44.2129 R1 10283832.5911 3174701.5321
Tangential Direction: S 40.04 E
Tangential Length: 1098.2248

Element: Circular
PC ( ) 282+44.2129 R1 10283832.5911 3174701.5321
PI ( ) 287+55.5329 R1 10283441.1311 3175030.4807
CC ( ) 10283221.0568 3173973.7855
PT ( ) 291+82.4502 R1 10282950.8966 3174885.1596
Radius: 950.5732
Delta: 56.55 Right
Degree of Curvature (Arc): 6.03
Length: 938.2373
Tangent: 511.3199
Chord: 900.6133
Middle Ordinate: 113.4272
External: 128.7958
Tangent Direction: S 40.04 E
Radial Direction: S 49.96 W
Chord Direction: S 11.76 E
Radial Direction: N 73.49 W
Tangent Direction: S 16.51 W

Element: Linear
PT ( ) 291+82.4502 R1 10282950.8966 3174885.1596
PC ( ) 296+83.7904 R1 10282470.2303 3174742.6749
Tangential Direction: S 16.51 W
Tangential Length: 501.3402

Element: Circular
PC ( ) 296+83.7904 R1 10282470.2303 3174742.6749
PI ( ) 299+80.6175 R1 10282185.6436 3174658.3143
CC ( ) 10282073.5761 3176080.7714
PT ( ) 302+68.7291 R1 10281891.3573 3174697.0687
Radius: 1395.6493
Delta: 24.01 Left
Degree of Curvature (Arc): 4.11
Length: 584.9387
Tangent: 296.8271
Chord: 580.6668
Middle Ordinate: 30.5326
External: 31.2156
Tangent Direction: S 16.51 W
Radial Direction: N 73.49 W
Chord Direction: S 4.50 W
Radial Direction: S 82.50 W
Tangent Direction: S 7.50 E

Element: Linear
PT ( ) 302+68.7291 R1 10281891.3573 3174697.0687
PC ( ) 304+42.6295 R1 10281718.9454 3174719.7735
Tangential Direction: S 7.50 E
Tangential Length: 173.9005

Element: Circular
PC ( ) 304+42.6295 R1 10281718.9454 3174719.7735
PI ( ) 307+61.0041 R1 10281403.2960 3174761.3411
CC ( ) 10281591.4611 3173751.7049
PT ( ) 310+58.1517 R1 10281123.8116 3174608.8589
Radius: 976.4266
Delta: 36.12 Right
Degree of Curvature (Arc): 5.87
Length: 615.5222
Tangent: 318.3746
Chord: 605.3811
Middle Ordinate: 48.1016
External: 50.5940
Tangent Direction: S 7.50 E
Radial Direction: S 82.50 W
Chord Direction: S 10.56 W
Radial Direction: N 61.38 W
Tangent Direction: S 28.62 W

Element: Linear
PT ( ) 310+58.1517 R1 10281123.8116 3174608.8589
POE ( ) 313+02.7705 R1 10280909.0735 3174491.7012
Tangential Direction: S 28.62 W
Tangential Length: 244.6188

8/28/2021
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HORIZONTAL ALIGNMENT DATA

SHEET 2 OF 2

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		57

Horizontal Alignment: 2115HA
Horizontal Description:
Horizontal Style: Geom_Centerline

Vertical Alignment: 2115VA
Vertical Description:
Vertical Style: Geom_Centerline
Station Elevation

Element: Linear
POB 9+78.7467 R1 695.0209
PVC 10+55.9498 R1 694.1153
Tangent Grade: -1.1730%
Tangent Length: 77.2031

Element: Symmetrical Parabola
PVC 10+55.9498 R1 694.1153
PVI 12+93.0155 R1 691.3344
PVT 15+30.0812 R1 696.8182
VLOW 12+15.4836 R1 693.1796
Length: 474.1314
Entrance Grade: -1.1730%
Exit Grade: 2.3132%
r = (g2 - g1) / L: 0.7353
K = l / (g2 - g1): 136.0000
Middle Ordinate: 2.0662

Element: Linear
PVT 15+30.0812 R1 696.8182
PVC 15+30.2772 R1 696.8228
Tangent Grade: 2.3132%
Tangent Length: 0.1960

Element: Symmetrical Parabola
PVC 15+30.2772 R1 696.8228
PVI 16+67.1352 R1 699.9886
PVT 18+03.9932 R1 699.8684
VHIGH 17+93.9841 R1 699.8728
Length: 273.7160
Entrance Grade: 2.3132%
Exit Grade: -0.0878%
r = (g2 - g1) / L: -0.8772
K = l / (g2 - g1): 114.0000
Middle Ordinate: -0.8215

Element: Linear
PVT 18+03.9932 R1 699.8684
PVC 25+22.0265 R1 699.2380
Tangent Grade: -0.0878%
Tangent Length: 718.0333

Element: Symmetrical Parabola
PVC 25+22.0265 R1 699.2380
PVI 25+60.8421 R1 699.2039
PVT 25+99.6577 R1 699.3914
VLOW 25+33.9673 R1 699.2328
Length: 77.6312
Entrance Grade: -0.0878%
Exit Grade: 0.4830%
r = (g2 - g1) / L: 0.7353
K = l / (g2 - g1): 136.0000
Middle Ordinate: 0.0554

Element: Linear
PVT 25+99.6577 R1 699.3914
PVC 26+28.6444 R1 699.5314
Tangent Grade: 0.4830%
Tangent Length: 28.9867

Element: Symmetrical Parabola
PVC 26+28.6444 R1 699.5314
PVI 27+14.8911 R1 699.9480
PVT 28+01.1378 R1 699.0596
VHIGH 26+83.7084 R1 699.6644
Length: 172.4934
Entrance Grade: 0.4830%
Exit Grade: -1.0301%
r = (g2 - g1) / L: -0.8772
K = l / (g2 - g1): 114.0000
Middle Ordinate: -0.3262

Element: Linear
PVT 28+01.1378 R1 699.0596
PVC 28+10.2023 R1 698.9662
Tangent Grade: -1.0301%
Tangent Length: 9.0646

Element: Symmetrical Parabola
PVC 28+10.2023 R1 698.9662
PVI 28+57.9284 R1 698.4746
PVT 29+05.6545 R1 698.5596
VLOW 28+91.5788 R1 698.5471
Length: 95.4522
Entrance Grade: -1.0301%
Exit Grade: 0.1782%
r = (g2 - g1) / L: 1.2658
K = l / (g2 - g1): 79.0000
Middle Ordinate: 0.1442

Element: Linear
PVT 29+05.6545 R1 698.5596
PVC 29+57.8267 R1 698.6526
Tangent Grade: 0.1782%
Tangent Length: 52.1722

Element: Symmetrical Parabola
PVC 29+57.8267 R1 698.6526
PVI 30+34.0653 R1 698.7884
PVT 31+10.3040 R1 699.3939
Length: 152.4773
Entrance Grade: 0.1782%
Exit Grade: 0.7941%
r = (g2 - g1) / L: 0.4040
K = l / (g2 - g1): 247.5379
Middle Ordinate: 0.1174

Element: Linear
PVT 31+10.3040 R1 699.3939
PVC 52+95.9474 R1 716.7511
Tangent Grade: 0.7941%
Tangent Length: 2185.6434

Element: Symmetrical Parabola
PVC 52+95.9474 R1 716.7511
PVI 53+20.6929 R1 716.9477
PVT 53+45.4384 R1 717.2250
Length: 49.4910
Entrance Grade: 0.7941%
Exit Grade: 1.1207%
r = (g2 - g1) / L: 0.6599
K = l / (g2 - g1): 151.5425
Middle Ordinate: 0.0202

Element: Linear
PVT 53+45.4384 R1 717.2250
PVC 68+19.5712 R1 733.7460
Tangent Grade: 1.1207%
Tangent Length: 1474.1328

Element: Symmetrical Parabola
PVC 68+19.5712 R1 733.7460
PVI 71+68.9572 R1 737.6617
PVT 75+18.3433 R1 738.0820
Length: 698.7720
Entrance Grade: 1.1207%
Exit Grade: 0.1203%
r = (g2 - g1) / L: -0.1432
K = l / (g2 - g1): 698.4611
Middle Ordinate: -0.8739

Element: Linear
PVT 75+18.3433 R1 738.0820
PVC 75+84.3731 R1 738.1614
Tangent Grade: 0.1203%
Tangent Length: 66.0299

Element: Symmetrical Parabola
PVC 75+84.3731 R1 738.1614
PVI 80+64.7025 R1 738.7392
PVT 85+45.0319 R1 746.4055
Length: 960.6588
Entrance Grade: 0.1203%
Exit Grade: 1.5960%
r = (g2 - g1) / L: 0.1536
K = l / (g2 - g1): 650.9572
Middle Ordinate: 1.7721

Element: Linear
PVT 85+45.0319 R1 746.4055
PVC 93+70.8861 R1 759.5865
Tangent Grade: 1.5960%
Tangent Length: 825.8542

Element: Symmetrical Parabola
PVC 93+70.8861 R1 759.5865
PVI 96+90.8531 R1 764.6933
PVT 100+10.8201 R1 773.0542
Length: 639.9340
Entrance Grade: 1.5960%
Exit Grade: 2.6130%
r = (g2 - g1) / L: 0.1589
K = l / (g2 - g1): 629.2511
Middle Ordinate: 0.8135

Element: Linear
PVT 100+10.8201 R1 773.0542
PVC 101+01.7943 R1 775.4313
Tangent Grade: 2.6130%
Tangent Length: 90.9741

Element: Symmetrical Parabola
PVC 101+01.7943 R1 775.4313
PVI 102+41.5604 R1 779.0835
PVT 103+81.3265 R1 781.1706
Length: 279.5322
Entrance Grade: 2.6130%
Exit Grade: 1.4933%
r = (g2 - g1) / L: -0.4006
K = l / (g2 - g1): 249.6523
Middle Ordinate: -0.3912

Element: Linear
PVT 103+81.3265 R1 781.1706
PVC 104+19.3601 R1 781.7386
Tangent Grade: 1.4933%
Tangent Length: 38.0337

Element: Symmetrical Parabola
PVC 104+19.3601 R1 781.7386
PVI 105+70.9995 R1 784.0031
PVT 107+22.6388 R1 788.3650
Length: 303.2787
Entrance Grade: 1.4933%
Exit Grade: 2.8765%
r = (g2 - g1) / L: 0.4561
K = l / (g2 - g1): 219.2656
Middle Ordinate: 0.5244

Element: Linear
PVT 107+22.6388 R1 788.3650
PVC 110+43.3408 R1 797.5900
Tangent Grade: 2.8765%
Tangent Length: 320.7020

Element: Symmetrical Parabola
PVC 110+43.3408 R1 797.5900
PVI 111+52.0320 R1 800.7165
PVT 112+60.7233 R1 801.7704
Length: 217.3824
Entrance Grade: 2.8765%
Exit Grade: 0.9696%
r = (g2 - g1) / L: -0.8772
K = l / (g2 - g1): 114.0000
Middle Ordinate: -0.5181

Element: Linear
PVT 112+60.7233 R1 801.7704
PVC 116+62.2572 R1 805.6638
Tangent Grade: 0.9696%
Tangent Length: 401.5340

Element: Symmetrical Parabola
PVC 116+62.2572 R1 805.6638
PVI 120+50.7246 R1 809.4305
PVT 124+39.1920 R1 826.0127
Length: 776.9347
Entrance Grade: 0.9696%
Exit Grade: 4.2686%
r = (g2 - g1) / L: 0.4246
K = l / (g2 - g1): 235.5073
Middle Ordinate: 3.2039

Element: Linear
PVT 124+39.1920 R1 826.0127
PVC 124+47.9104 R1 826.3849
Tangent Grade: 4.2686%
Tangent Length: 8.7185

Element: Symmetrical Parabola
PVC 124+47.9104 R1 826.3849
PVI 128+09.2032 R1 841.8071
PVT 131+70.4959 R1 834.3288
VHIGH 129+34.5328 R1 836.7709
Length: 722.5855
Entrance Grade: 4.2686%
Exit Grade: -2.0699%
r = (g2 - g1) / L: -0.8772
K = l / (g2 - g1): 114.0000
Middle Ordinate: -5.7251

Element: Linear
PVT 131+70.4959 R1 834.3288
PVC 137+36.9603 R1 822.6039
Tangent Grade: -2.0699%
Tangent Length: 566.4644

Element: Symmetrical Parabola
PVC 137+36.9603 R1 822.6039
PVI 139+85.2282 R1 817.4651
PVT 142+33.4961 R1 825.1673
VLOW 139+35.6661 R1 820.5474
Length: 496.5358
Entrance Grade: -2.0699%
Exit Grade: 3.1024%
r = (g2 - g1) / L: 1.0417
K = l / (g2 - g1): 96.0000
Middle Ordinate: 3.2103

Element: Linear
PVT 142+33.4961 R1 825.1673
PVC 142+93.0534 R1 827.0150
Tangent Grade: 3.1024%
Tangent Length: 59.5573

Element: Symmetrical Parabola
PVC 142+93.0534 R1 827.0150
PVI 144+93.0434 R1 833.2195
PVT 146+93.0335 R1 832.4072
VHIGH 146+46.7265 R1 832.5012
Length: 399.9800
Entrance Grade: 3.1024%
Exit Grade: -0.4062%
r = (g2 - g1) / L: -0.8772
K = l / (g2 - g1): 114.0000
Middle Ordinate: -1.7542

Element: Linear
PVT 146+93.0335 R1 832.4072
PVC 157+64.4681 R1 828.0550
Tangent Grade: -0.4062%
Tangent Length: 1071.4346

Element: Symmetrical Parabola
PVC 157+64.4681 R1 828.0550
PVI 163+65.0501 R1 825.6154
PVT 169+65.6322 R1 817.1548

Length: 1201.1641
Entrance Grade: -0.4062%
Exit Grade: -1.4087%
r = (g2 - g1) / L: -0.0835
K = l / (g2 - g1): 1198.1246
Middle Ordinate: -1.5053

Element: Linear
PVT 169+65.6322 R1 817.1548
PVC 174+78.1128 R1 809.9353
Tangent Grade: -1.4087%
Tangent Length: 512.4806

Element: Symmetrical Parabola
PVC 174+78.1128 R1 809.9353
PVI 179+25.5643 R1 803.6318
PVT 183+73.0158 R1 803.1193
Length: 894.9030
Entrance Grade: -1.4087%
Exit Grade: -0.1146%
r = (g2 - g1) / L: 0.1446
K = l / (g2 - g1): 691.4826
Middle Ordinate: 1.4477

Element: Linear
PVT 183+73.0158 R1 803.1193
PVC 184+04.6570 R1 803.0830
Tangent Grade: -0.1146%
Tangent Length: 31.6412

Element: Symmetrical Parabola
PVC 184+04.6570 R1 803.0830
PVI 186+24.0476 R1 802.8317
PVT 188+43.4383 R1 804.7272
VLOW 184+56.0254 R1 803.0536
Length: 438.7813
Entrance Grade: -0.1146%
Exit Grade: 0.8640%
r = (g2 - g1) / L: 0.2230
K = l / (g2 - g1): 448.4054
Middle Ordinate: 0.5367

Element: Linear
PVT 188+43.4383 R1 804.7272
PVC 188+54.5068 R1 804.8228
Tangent Grade: 0.8640%
Tangent Length: 11.0686

Element: Symmetrical Parabola
PVC 188+54.5068 R1 804.8228
PVI 189+54.9165 R1 805.6903
PVT 190+55.3262 R1 804.7890
VHIGH 189+53.0004 R1 805.2483
Length: 200.8194
Entrance Grade: 0.8640%
Exit Grade: -0.8976%
r = (g2 - g1) / L: -0.8772
K = l / (g2 - g1): 114.0000
Middle Ordinate: -0.4422

Element: Linear
PVT 190+55.3262 R1 804.7890
PVC 197+86.0022 R1 798.2305
Tangent Grade: -0.8976%
Tangent Length: 730.6759

Bradley Mayes 8/28/2021
SIGNATURE OF REGISTRANT & DATE

VERTICAL ALIGNMENT DATA

SHEET 1 OF 2

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	58

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NODE

Element: Symmetrical Parabola
PVC 197+86.0022 R1 798.2305
PVI 198+80.3274 R1 797.3839
PVT 199+74.6527 R1 797.7822
VLOW 199+14.2938 R1 797.6548
Length: 188.6505
Entrance Grade: -0.8976%
Exit Grade: 0.4223%
r = (g2 - g1) / L: 0.6997
K = l / (g2 - g1): 142.9283
Middle Ordinate: 0.3112

Element: Linear
PVT 199+74.6527 R1 797.7822
PVC 202+28.4011 R1 798.8538
Tangent Grade: 0.4223%
Tangent Length: 253.7484

Element: Symmetrical Parabola
PVC 202+28.4011 R1 798.8538
PVI 206+52.4746 R1 800.6447
PVT 210+76.5481 R1 819.0947
Length: 848.1470
Entrance Grade: 0.4223%
Exit Grade: 4.3507%
r = (g2 - g1) / L: 0.4632
K = l / (g2 - g1): 215.9029
Middle Ordinate: 4.1648

Element: Linear
PVT 210+76.5481 R1 819.0947
PVC 212+04.2541 R1 824.6508
Tangent Grade: 4.3507%
Tangent Length: 127.7060

Element: Symmetrical Parabola
PVC 212+04.2541 R1 824.6508
PVI 216+27.6019 R1 843.0693
PVT 220+50.9497 R1 841.9178
VHIGH 220+01.1293 R1 841.9855
Length: 846.6956
Entrance Grade: 4.3507%
Exit Grade: -0.2720%
r = (g2 - g1) / L: -0.5460
K = l / (g2 - g1): 183.1613
Middle Ordinate: -4.8925

Element: Linear
PVT 220+50.9497 R1 841.9178
PVC 220+86.6820 R1 841.8206
Tangent Grade: -0.2720%
Tangent Length: 35.7322

Element: Symmetrical Parabola
PVC 220+86.6820 R1 841.8206
PVI 224+31.5282 R1 840.8826
PVT 227+76.3744 R1 834.0106
Length: 689.6925
Entrance Grade: -0.2720%
Exit Grade: -1.9928%
r = (g2 - g1) / L: -0.2495
K = l / (g2 - g1): 400.8086
Middle Ordinate: -1.4835

Element: Linear
PVT 227+76.3744 R1 834.0106
PVC 230+08.5951 R1 829.3830
Tangent Grade: -1.9928%
Tangent Length: 232.2206

Element: Symmetrical Parabola
PVC 230+08.5951 R1 829.3830
PVI 232+04.5044 R1 825.4790
PVT 234+00.4137 R1 826.5795
VLOW 233+14.2533 R1 826.3375
Length: 391.8186
Entrance Grade: -1.9928%
Exit Grade: 0.5617%
r = (g2 - g1) / L: 0.6520
K = l / (g2 - g1): 153.3847
Middle Ordinate: 1.2511

Element: Linear
PVT 234+00.4137 R1 826.5795
PVC 236+23.5395 R1 827.8329
Tangent Grade: 0.5617%
Tangent Length: 223.1259

Element: Symmetrical Parabola
PVC 236+23.5395 R1 827.8329
PVI 237+59.2519 R1 828.5952
PVT 238+94.9644 R1 824.9723
VHIGH 236+70.7246 R1 827.9654
Length: 271.4248
Entrance Grade: 0.5617%
Exit Grade: -2.6695%
r = (g2 - g1) / L: -1.1905
K = l / (g2 - g1): 84.0000
Middle Ordinate: -1.0963

Element: Linear
PVT 238+94.9644 R1 824.9723
PVC 241+46.5570 R1 818.2560
Tangent Grade: -2.6695%
Tangent Length: 251.5926

Element: Symmetrical Parabola
PVC 241+46.5570 R1 818.2560
PVI 243+52.0295 R1 812.7709
PVT 245+57.5020 R1 810.1388
Length: 410.9450
Entrance Grade: -2.6695%
Exit Grade: -1.2810%
r = (g2 - g1) / L: 0.3379
K = l / (g2 - g1): 295.9599
Middle Ordinate: 0.7133

Element: Linear
PVT 245+57.5020 R1 810.1388
PVC 249+26.9246 R1 805.4065
Tangent Grade: -1.2810%
Tangent Length: 369.4226

Element: Symmetrical Parabola
PVC 249+26.9246 R1 805.4065
PVI 249+94.5029 R1 804.5408
PVT 250+62.0811 R1 803.0702
Length: 135.1565
Entrance Grade: -1.2810%
Exit Grade: -2.1761%
r = (g2 - g1) / L: -0.6623
K = l / (g2 - g1): 151.0000
Middle Ordinate: -0.1512

Element: Linear
PVT 250+62.0811 R1 803.0702
PVC 257+78.5517 R1 787.4792
Tangent Grade: -2.1761%
Tangent Length: 716.4705

Element: Symmetrical Parabola
PVC 257+78.5517 R1 787.4792
PVI 259+80.6084 R1 783.0823
PVT 261+82.6651 R1 781.3785
Length: 404.1134
Entrance Grade: -2.1761%
Exit Grade: -0.8432%
r = (g2 - g1) / L: 0.3298
K = l / (g2 - g1): 303.1918
Middle Ordinate: 0.6733

Element: Linear
PVT 261+82.6651 R1 781.3785
PVC 279+27.8978 R1 766.6624
Tangent Grade: -0.8432%
Tangent Length: 1745.2327

Element: Symmetrical Parabola
PVC 279+27.8978 R1 766.6624
PVI 282+18.5083 R1 764.2120
PVT 285+09.1187 R1 776.4492
VLOW 280+24.8678 R1 766.2536
Length: 581.2209
Entrance Grade: -0.8432%
Exit Grade: 4.2109%
r = (g2 - g1) / L: 0.8696
K = l / (g2 - g1): 115.0000
Middle Ordinate: 3.6719

Element: Linear
PVT 285+09.1187 R1 776.4492
PVC 285+75.8248 R1 779.2581
Tangent Grade: 4.2109%
Tangent Length: 66.7061

Element: Symmetrical Parabola
PVC 285+75.8248 R1 779.2581
PVI 290+05.0737 R1 797.3333
PVT 294+34.3225 R1 793.5836
VHIGH 292+86.8251 R1 794.2278
Length: 858.4977
Entrance Grade: 4.2109%
Exit Grade: -0.8735%
r = (g2 - g1) / L: -0.5922
K = l / (g2 - g1): 168.8485
Middle Ordinate: -5.4562

Element: Linear
PVT 294+34.3225 R1 793.5836
PVC 303+08.8623 R1 785.9440
Tangent Grade: -0.8735%
Tangent Length: 874.5398

Element: Symmetrical Parabola
PVC 303+08.8623 R1 785.9440
PVI 305+02.8916 R1 784.2491
PVT 306+96.9210 R1 779.4383
Length: 388.0587
Entrance Grade: -0.8735%
Exit Grade: -2.4794%
r = (g2 - g1) / L: -0.4138
K = l / (g2 - g1): 241.6510
Middle Ordinate: -0.7790

Element: Linear
PVT 306+96.9210 R1 779.4383
PVC 309+16.4860 R1 773.9944
Tangent Grade: -2.4794%
Tangent Length: 219.5651

Element: Symmetrical Parabola
PVC 309+16.4860 R1 773.9944
PVI 310+38.2248 R1 770.9760
PVT 311+59.9635 R1 770.1370
Length: 243.4775
Entrance Grade: -2.4794%
Exit Grade: -0.6891%
r = (g2 - g1) / L: 0.7353
K = l / (g2 - g1): 136.0000
Middle Ordinate: 0.5449

Element: Linear
PVT 311+59.9635 R1 770.1370
PVC 312+02.5531 R1 769.8435
Tangent Grade: -0.6891%
Tangent Length: 42.5896

Element: Symmetrical Parabola
PVC 312+02.5531 R1 769.8435
PVI 312+52.4031 R1 769.5000
PVT 313+02.2530 R1 765.3334
Length: 99.6999
Entrance Grade: -0.6891%
Exit Grade: -8.3584%
r = (g2 - g1) / L: -7.6923
K = l / (g2 - g1): 13.0000
Middle Ordinate: -0.9558

Element: Linear
PVT 313+02.2530 R1 765.3334
POE 313+02.7705 R1 765.2901
Tangent Grade: -8.3584%
Tangent Length: 0.5175

STATE OF TEXAS
BRADLEY MAYES
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Bradley Mayes 8/28/2021
SIGNATURE OF REGISTRANT & DATE

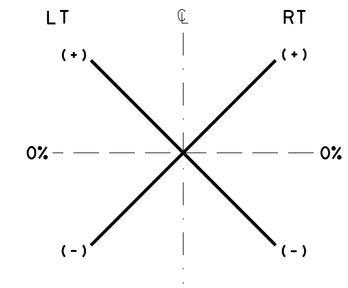
VERTICAL ALIGNMENT DATA

SHEET 2 OF 2

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		59

NODE

SUPERELEVATION TRANSITION SUMMARY				
DESIGN SPEED	STATION	CROSS SLOPE		TRANSITION TYPE
		LT	RT	
50 MPH	9+78.75	-0.38%	-2.00%	BEGIN PROJECT (MATCH EXISTING)
	10+50.00	2.00%	-2.00%	REVERSE CROWN IN (LT)
	11+10.00	4.00%	-4.00%	FULL SUPER IN (LT)
	13+00.00	4.00%	-4.00%	FULL SUPER OUT (LT)
	13+60.00	2.00%	-2.00%	REVERSE CROWN OUT (LT)
	14+80.00	-2.00%	-2.00%	NORMAL CROWN OUT (LT)
	22+10.00	-2.00%	-2.00%	NORMAL CROWN IN (RT)
	23+30.00	-2.00%	2.00%	REVERSE CROWN IN (RT)
	24+35.00	-5.60%	5.60%	FULL SUPER IN (RT)
	26+20.00	-5.60%	5.60%	FULL SUPER OUT (RT)
	29+90.00	5.60%	-5.60%	FULL SUPER IN (LT)
	32+15.00	5.60%	-5.60%	FULL SUPER OUT (LT)
	32+68.34	2.00%	-2.00%	REVERSE CROWN OUT (LT)
	33+26.00	-2.00%	-2.00%	NORMAL CROWN OUT (LT)
	34+73.00	-2.00%	-2.00%	NORMAL CROWN IN (LT)
	35+32.24	2.00%	-2.00%	REVERSE CROWN IN (LT)
	35+90.00	6.00%	-6.00%	FULL SUPER IN (LT)
	38+35.00	6.00%	-6.00%	FULL SUPER OUT (LT)
	41+50.00	-6.00%	6.00%	FULL SUPER IN (RT)
	50+15.00	-6.00%	6.00%	FULL SUPER OUT (RT)
	51+32.00	-2.00%	2.00%	REVERSE CROWN OUT (RT)
	52+52.00	-2.00%	-2.00%	NORMAL CROWN OUT (RT)
	73+37.00	-2.00%	-2.00%	NORMAL CROWN IN (LT)
	74+57.00	2.00%	-2.00%	REVERSE CROWN IN (LT)
	75+35.00	4.60%	-4.60%	FULL SUPER IN (LT)
	77+75.00	4.60%	-4.60%	FULL SUPER OUT (LT)
	78+53.00	2.00%	-2.00%	REVERSE CROWN OUT (LT)
	79+73.00	-2.00%	-2.00%	NORMAL CROWN OUT (LT)
	101+98.00	-2.00%	-2.00%	NORMAL CROWN IN (LT)
	103+18.00	2.00%	-2.00%	REVERSE CROWN IN (LT)
	104+35.00	6.00%	-6.00%	FULL SUPER IN (LT)
	107+00.00	6.00%	-6.00%	FULL SUPER OUT (LT)
	107+09.00	5.60%	-5.60%	FULL SUPER IN (LT)
	117+75.00	5.60%	-5.60%	FULL SUPER OUT (LT)
	121+30.00	-6.00%	6.00%	FULL SUPER IN (RT)
	134+80.00	-6.00%	6.00%	FULL SUPER OUT (RT)
	135+97.00	-2.00%	2.00%	REVERSE CROWN OUT (RT)
	137+17.00	-2.00%	-2.00%	NORMAL CROWN OUT (RT)
	206+80.00	-2.00%	-2.00%	NORMAL CROWN IN (LT)
	208+00.00	2.00%	-2.00%	FULL SUPER IN (LT)
	211+10.00	2.00%	-2.00%	FULL SUPER OUT (LT)
	212+30.00	-2.00%	-2.00%	NORMAL CROWN OUT (LT)
	218+93.00	-2.00%	-2.00%	NORMAL CROWN IN (LT)
	220+13.00	2.00%	-2.00%	REVERSE CROWN IN (LT)
	221+30.00	6.00%	-6.00%	FULL SUPER IN (LT)
	223+95.00	6.00%	-6.00%	FULL SUPER OUT (LT)
	227+30.00	-6.00%	6.00%	FULL SUPER IN (RT)
	230+30.00	-6.00%	6.00%	FULL SUPER OUT (RT)
	231+47.00	-2.00%	2.00%	REVERSE CROWN OUT (RT)
	232+67.00	-2.00%	-2.00%	NORMAL CROWN OUT (RT)
	265+54.00	-2.00%	-2.00%	NORMAL CROWN IN (RT)
	266+74.00	-2.00%	2.00%	REVERSE CROWN IN (RT)
	267+70.00	-5.20%	5.20%	FULL SUPER IN (RT)
	270+85.00	-5.20%	5.20%	FULL SUPER OUT (RT)
	271+81.00	-2.00%	2.00%	REVERSE CROWN OUT (RT)
	273+01.00	-2.00%	-2.00%	NORMAL CROWN OUT (RT)
	281+15.00	-2.00%	-2.00%	NORMAL CROWN IN (LT)
	282+35.00	2.00%	-2.00%	REVERSE CROWN IN (LT)
	283+55.00	6.00%	-6.00%	FULL SUPER IN (LT)
	286+07.49	6.00%	-6.00%	FULL SUPER OUT (LT)
	286+13.49	5.80%	-5.80%	FULL SUPER IN (LT)
	291+25.00	5.80%	-5.80%	FULL SUPER OUT (LT)
	292+39.00	2.00%	-2.00%	REVERSE CROWN OUT (LT)
	293+59.00	-2.00%	-2.00%	NORMAL CROWN OUT (LT)
	295+39.00	-2.00%	-2.00%	NORMAL CROWN IN (RT)
	296+59.00	-2.00%	2.00%	REVERSE CROWN IN (RT)
	297+55.00	-5.20%	5.20%	FULL SUPER IN (RT)
	302+05.00	-5.20%	5.20%	FULL SUPER OUT (RT)
	305+15.00	6.00%	-6.00%	FULL SUPER IN (LT)
	309+90.00	6.00%	-6.00%	FULL SUPER OUT (LT)
	311+07.00	2.00%	-2.00%	REVERSE CROWN OUT (LT)
	312+27.00	-2.00%	-2.00%	NORMAL CROWN OUT (LT)
	313+02.77	-2.00%	-2.00%	END PROJECT (MATCH EXISTING)



CROSS SLOPE SIGN CONVENTION

℄ CONTROL

STATE OF TEXAS
BRADLEY MAYES
128276
LICENSED
PROFESSIONAL ENGINEER

Bradley Mayes 8/28/2021

SIGNATURE OF REGISTRANT & DATE

SUPERELEVATION TABLE

SHEET 1 OF 2

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		60

SUPERELEVATION TABLE

℄ FM 2115

Left Slope	Right Slope	Type	Station
0.38%	2.0%	MATCH EXISTING SLOPE	STA 9+78.75
2.0%	2.0%	REVERSE CROWN	STA 10+50.00
4.0%	4.0%	FULL SUPERELEVATION	STA 11+10.00 TO STA 13+00.00
2.0%	2.0%	REVERSE CROWN	STA 13+60.00
2.0%	2.0%	NORMAL CROWN	STA 14+80.00 TO STA 22+10.00
2.0%	2.0%	REVERSE CROWN	STA 23+30.00
5.5%	5.5%	FULL SUPERELEVATION	STA 24+35.00 TO STA 26+20.00
5.7%	5.7%	FULL SUPERELEVATION	STA 29+90.00 TO STA 32+15.00
2.0%	2.0%	REVERSE CROWN	STA 32+68.34
2.0%	2.0%	NORMAL CROWN	STA 32+68.34 TO STA 34+73.00
2.0%	2.0%	REVERSE CROWN	STA 35+32.24
5.9%	5.9%	FULL SUPERELEVATION	STA 35+90.00 TO STA 38+35.00

℄ FM 2115

Left Slope	Right Slope	Type	Station
5.9%	5.9%	FULL SUPERELEVATION	STA 41+50.00 TO STA 50+15.00
5.9%	5.9%	FULL SUPERELEVATION	STA 41+50.00 TO STA 50+15.00
2.0%	2.0%	REVERSE CROWN	STA 51+32.00
2.0%	2.0%	NORMAL CROWN	STA 52+52.00 TO STA 73+37.00
2.0%	2.0%	REVERSE CROWN	STA 74+57.00
4.6%	4.6%	FULL SUPERELEVATION	STA 75+35.00 TO STA 77+75.00
2.0%	2.0%	REVERSE CROWN	STA 78+53.00
2.0%	2.0%	NORMAL CROWN	STA 79+73.00 TO STA 101+98.00
2.0%	2.0%	REVERSE CROWN	STA 103+18.00
5.9%	5.9%	FULL SUPERELEVATION	STA 104+35.00 TO STA 107+00.00
5.6%	5.6%	FULL SUPERELEVATION	STA 107+09.00 TO STA 117+75.00
5.9%	5.9%	FULL SUPERELEVATION	STA 121+30.00 TO STA 134+80.00

℄ FM 2115

Left Slope	Right Slope	Type	Station
2.0%	2.0%	REVERSE CROWN	STA 135+97.00
2.0%	2.0%	NORMAL CROWN	STA 137+17.00 TO STA 206+80.00
2.0%	2.0%	FULL SUPERELEVATION	STA 208+00.00 TO STA 211+10.00
2.0%	2.0%	NORMAL CROWN	STA 212+30.00 TO STA 218+93.00
2.0%	2.0%	REVERSE CROWN	STA 220+13.00
5.9%	5.9%	FULL SUPERELEVATION	STA 221+30.00 TO STA 223+95.00
5.9%	5.9%	FULL SUPERELEVATION	STA 227+30.00 TO STA 230+30.00
2.0%	2.0%	REVERSE CROWN	STA 231+47.00
2.0%	2.0%	NORMAL CROWN	STA 232+67.00 TO STA 265+67.00
2.0%	2.0%	REVERSE CROWN	STA 266+74.00
5.2%	5.2%	FULL SUPERELEVATION	STA 267+70.00 TO STA 270+85.00
2.0%	2.0%	REVERSE CROWN	STA 271+81.00

℄ FM 2115

Left Slope	Right Slope	Type	Station
2.0%	2.0%	NORMAL CROWN	STA 273+01 TO STA 281+15.00
2.0%	2.0%	REVERSE CROWN	STA 282+35.00
6.0%	6.0%	FULL SUPERELEVATION	STA 283+55.00 TO STA 286+07.49
5.8%	5.8%	FULL SUPERELEVATION	STA 286+13.49 TO STA 291+25.00
2.0%	2.0%	REVERSE CROWN	STA 292+39.00
2.0%	2.0%	NORMAL CROWN	STA 293+59.00 TO STA 295+39.00
2.0%	2.0%	REVERSE CROWN	STA 296+59.00
5.2%	5.2%	FULL SUPERELEVATION	STA 297+55.00 TO STA 302+05.00
5.9%	5.9%	FULL SUPERELEVATION	STA 305+15.00 TO STA 309+90.00
2.0%	2.0%	REVERSE CROWN	STA 311+07.00
2.0%	2.0%	NORMAL CROWN	STA 312+27.00
2.0%	2.0%	MATCH EXISTING SLOPE	STA 313+07.77

STATE OF TEXAS
BRADLEY MAYES
128276
LICENSED
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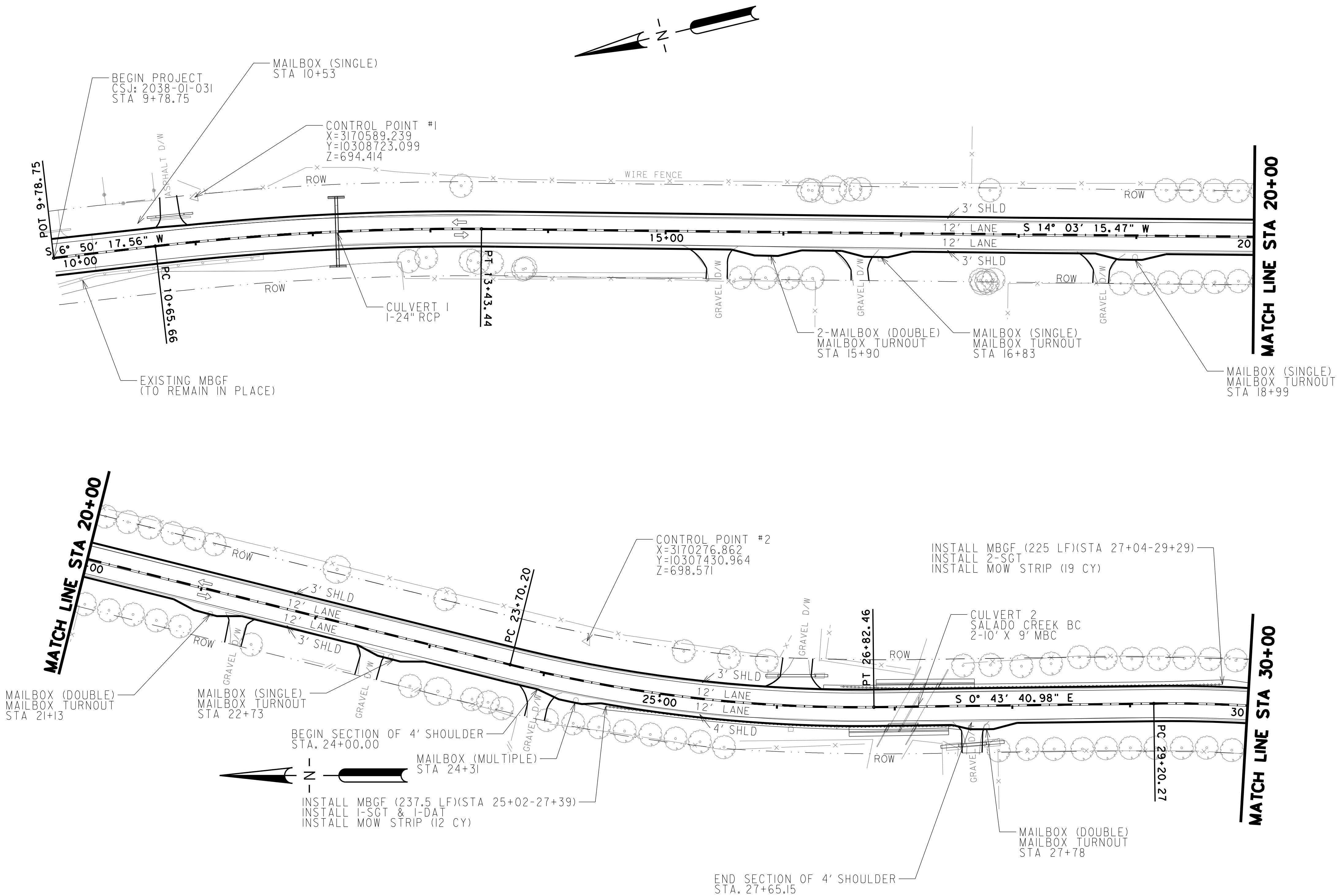
8/28/2021
SIGNATURE OF REGISTRANT & DATE

SUPERELEVATION TABLE

SHEET 2 OF 2

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		61



STATE OF TEXAS
BRADLEY MAYES
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LICENSED
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Bradley Mayes 8/28/2021

SIGNATURE OF REGISTRANT & DATE

PLAN LAYOUTS

SCALE: FEET 1" = 100' HORIZ.

SHEET 1 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	62

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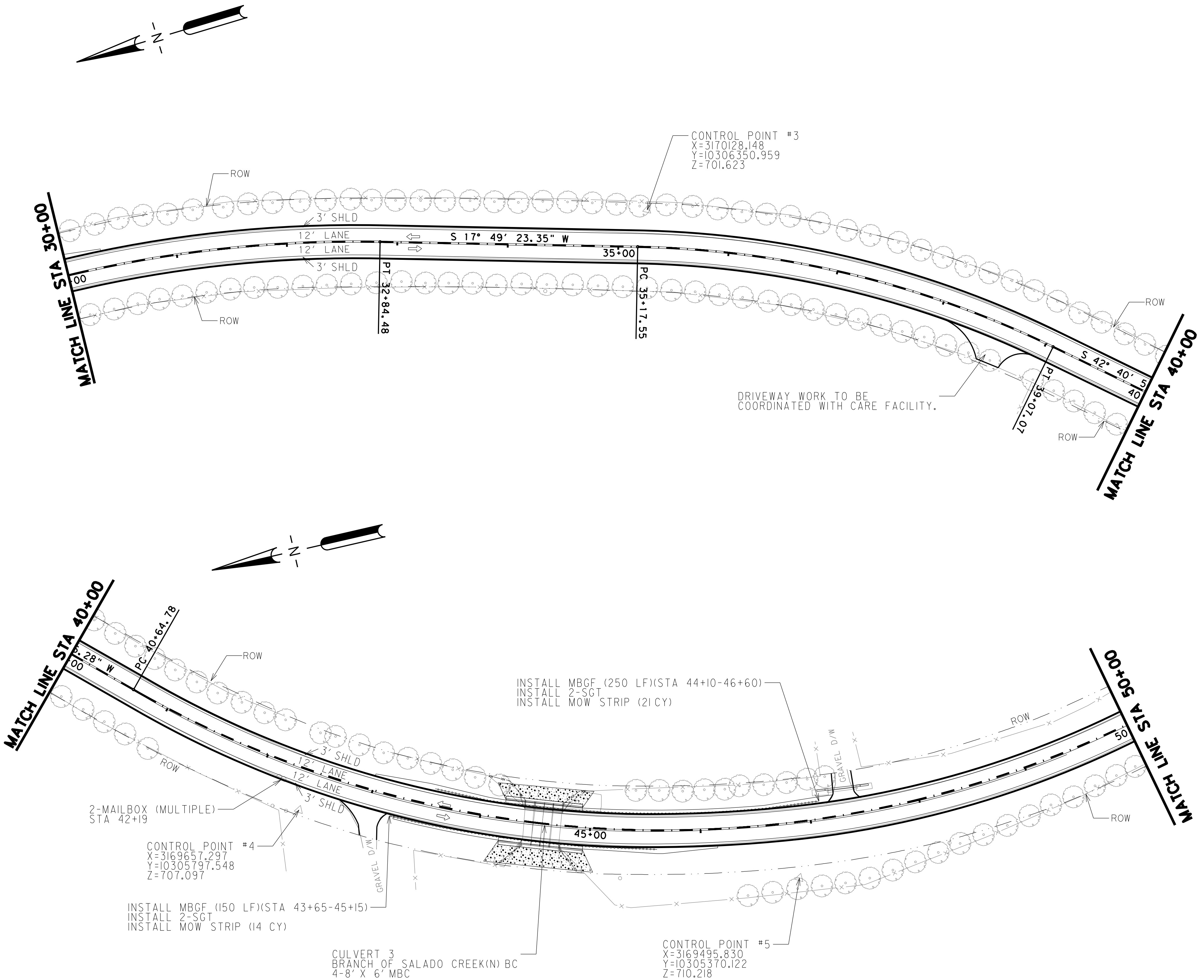
NODE



STATE OF TEXAS
BRADLEY MAYES
128276
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Bradley Mayes 9/20/2021

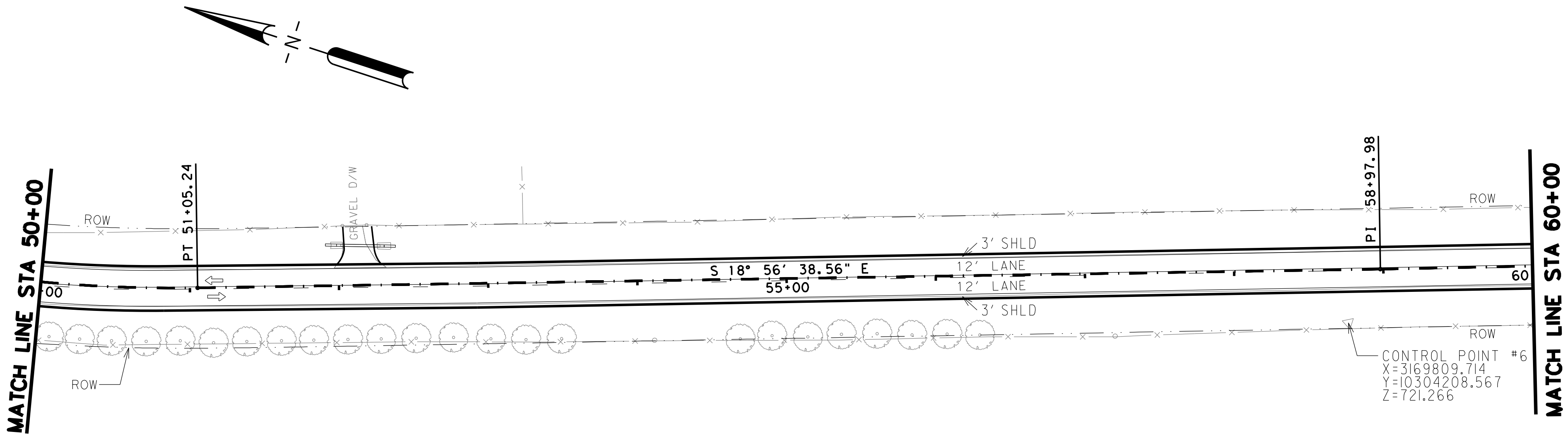
SIGNATURE OF REGISTRANT & DATE

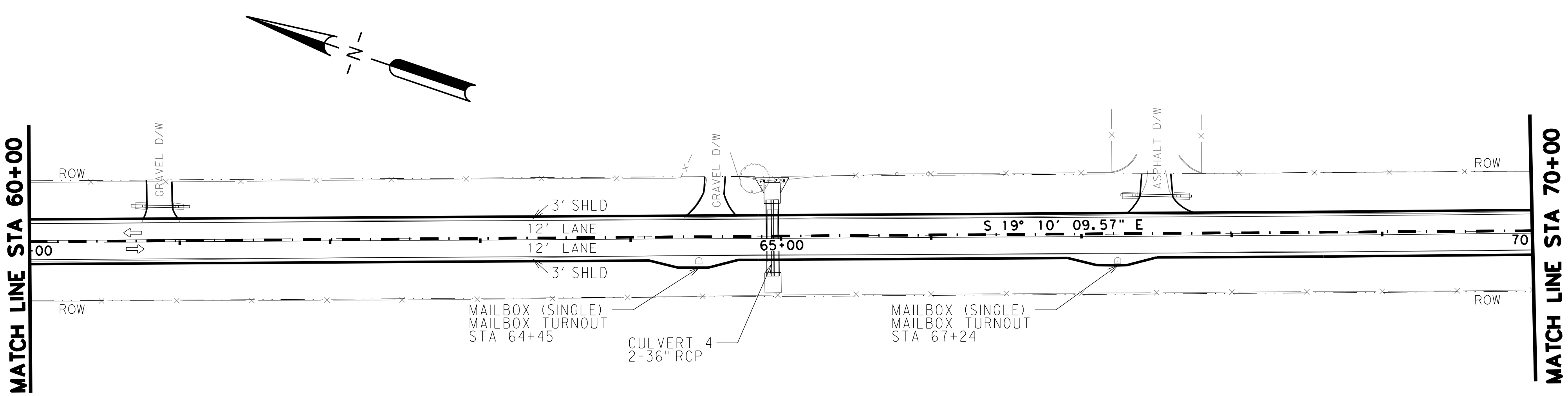
PLAN LAYOUTS

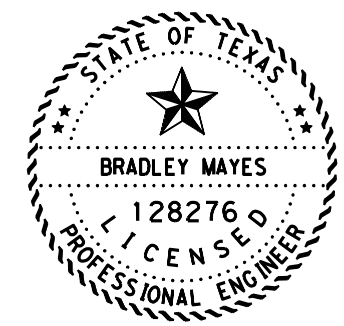
SCALE: FEET
1" = 100' HORIZ.

SHEET 2 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	63







Bradley Mayes 8/28/2021

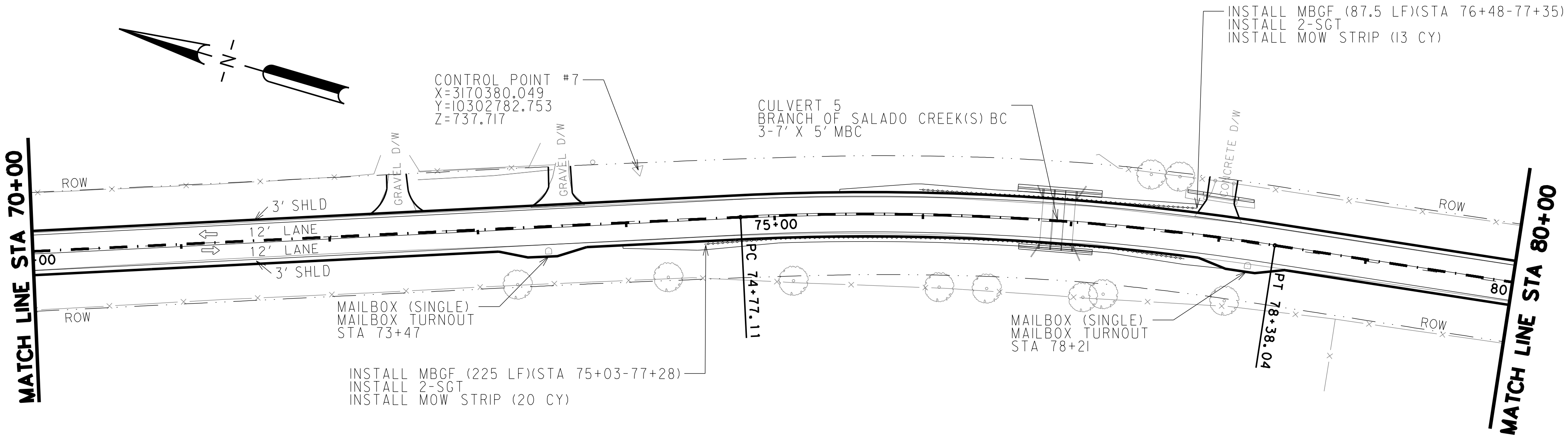
SIGNATURE OF REGISTRANT & DATE

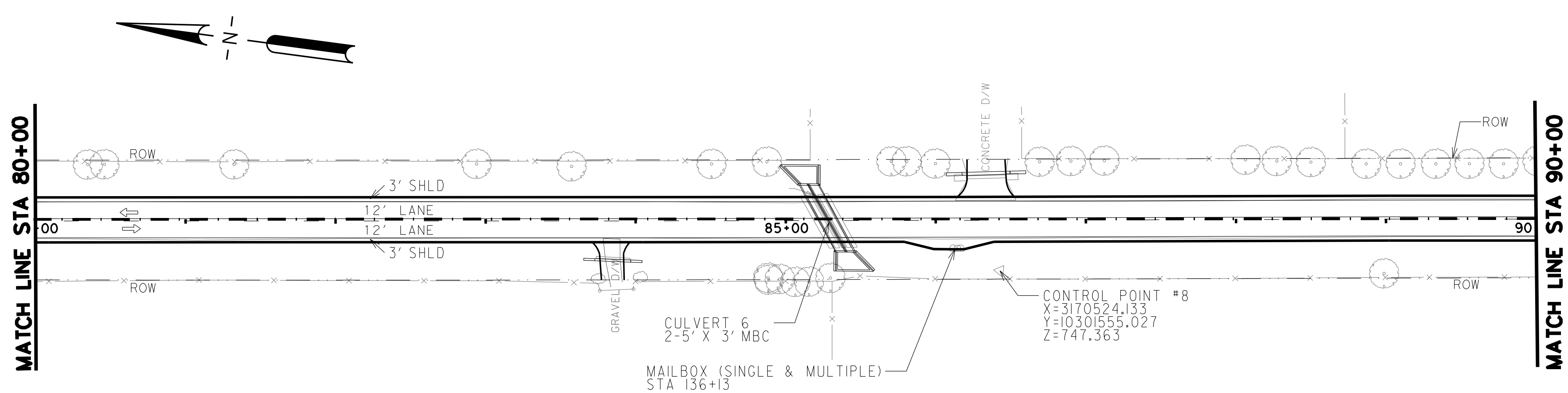
PLAN LAYOUTS

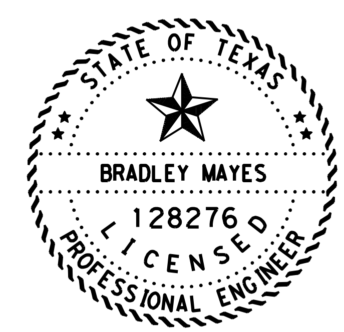
SCALE: FEET
1" = 100' HORIZ.

SHEET 3 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		64







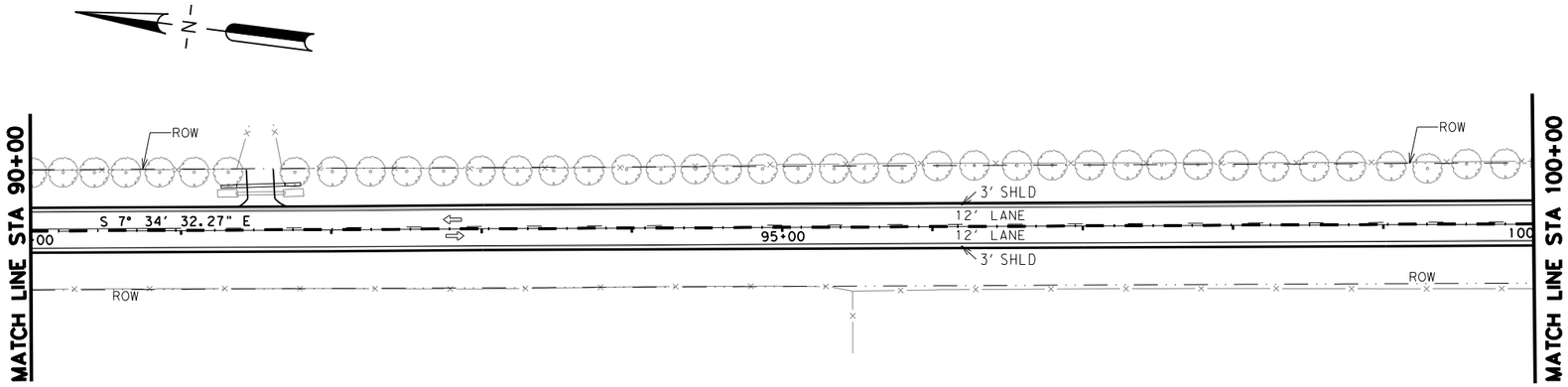
Bradley Mayes 8/28/2021
SIGNATURE OF REGISTRANT & DATE

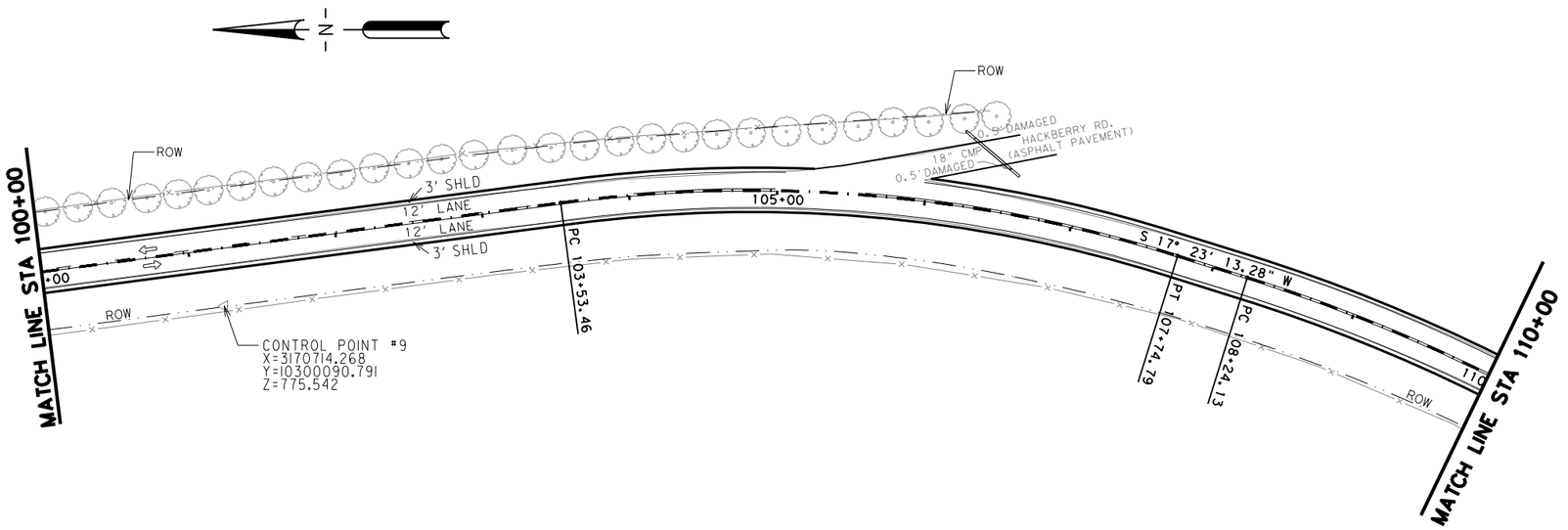
PLAN LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 4 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	65





STATE OF TEXAS
BRADLEY MAYES
128276
LICENSED
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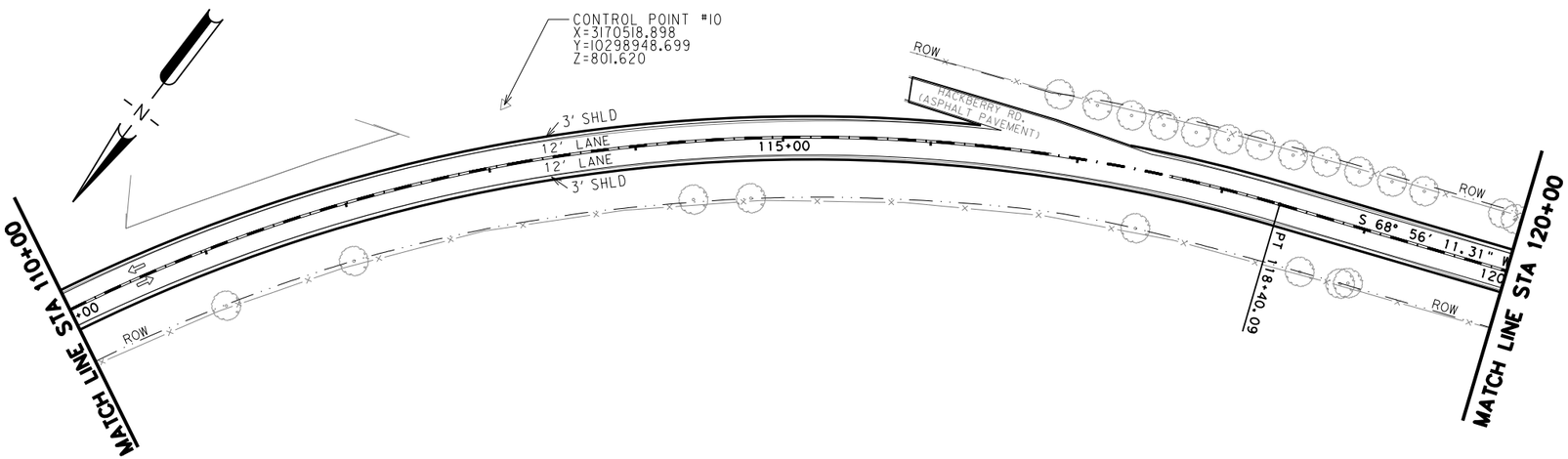
Bradley Mayes 8/28/2021
SIGNATURE OF REGISTRANT & DATE

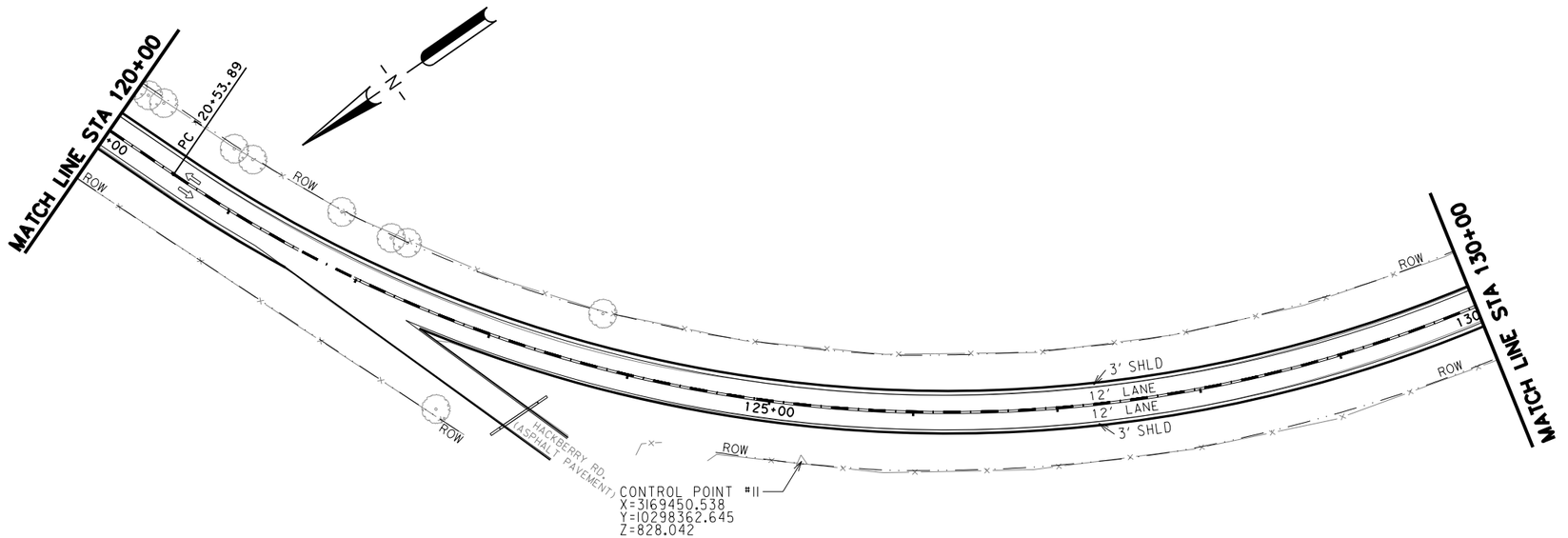
PLAN LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 5 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		66





STATE OF TEXAS
BRADLEY MAYES
128276
LICENSED
PROFESSIONAL ENGINEER

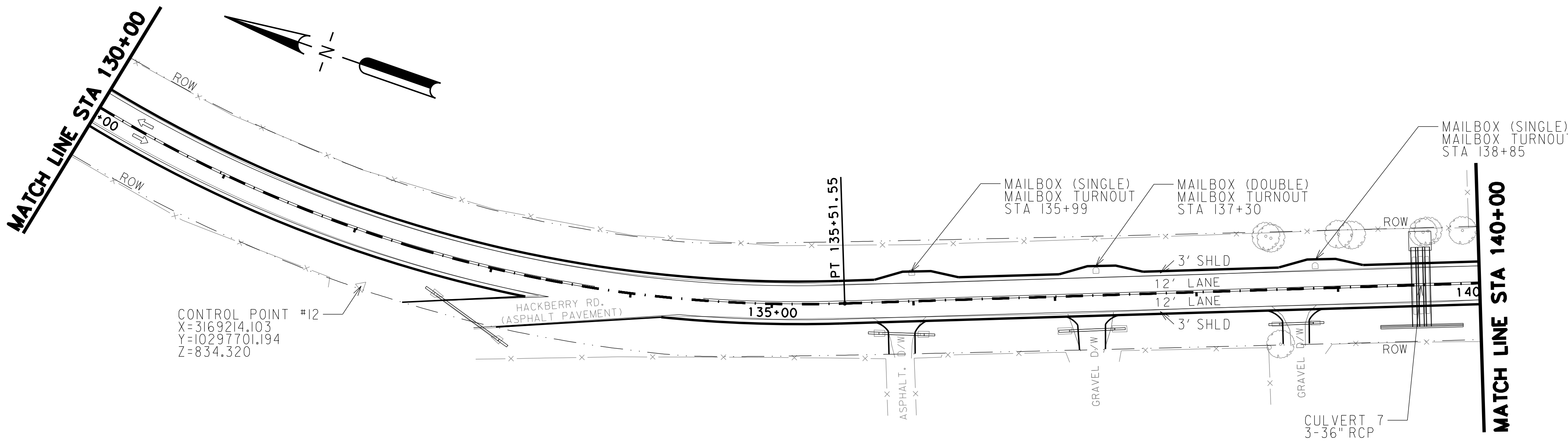
Bradley Mayes 8/28/2021
SIGNATURE OF REGISTRANT & DATE

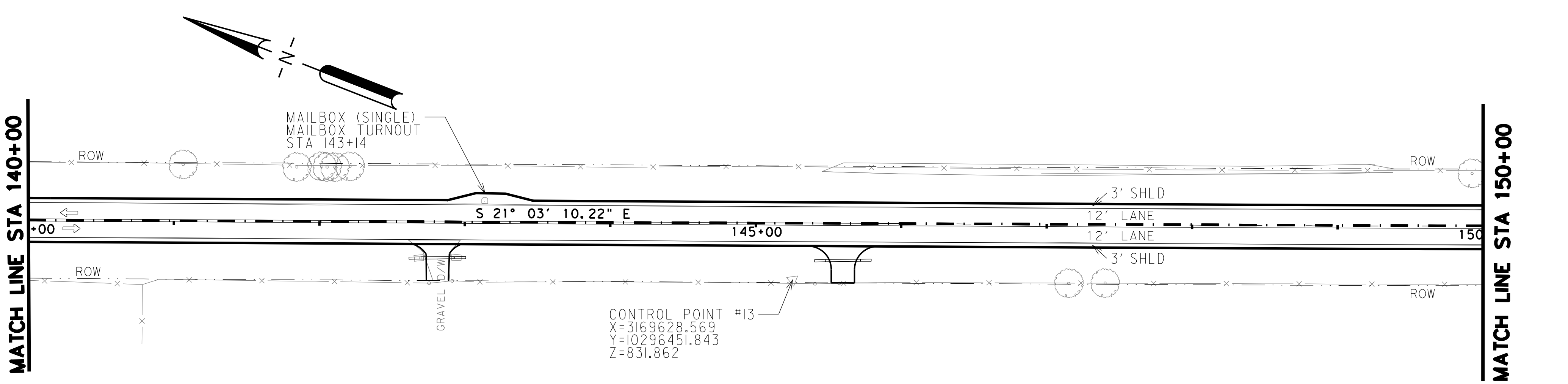
PLAN LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 6 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		67





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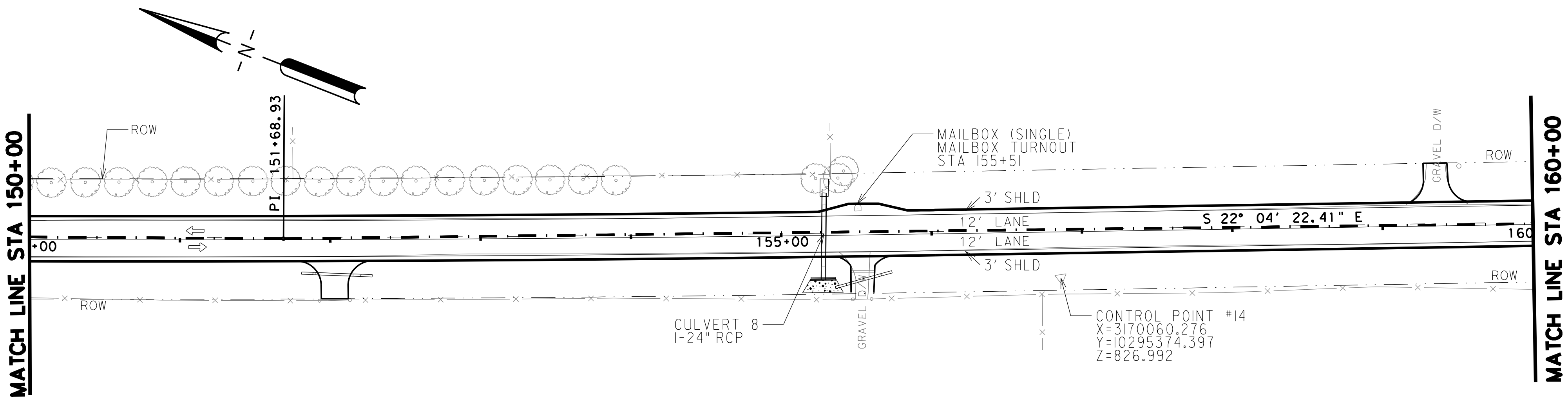
PLAN LAYOUTS

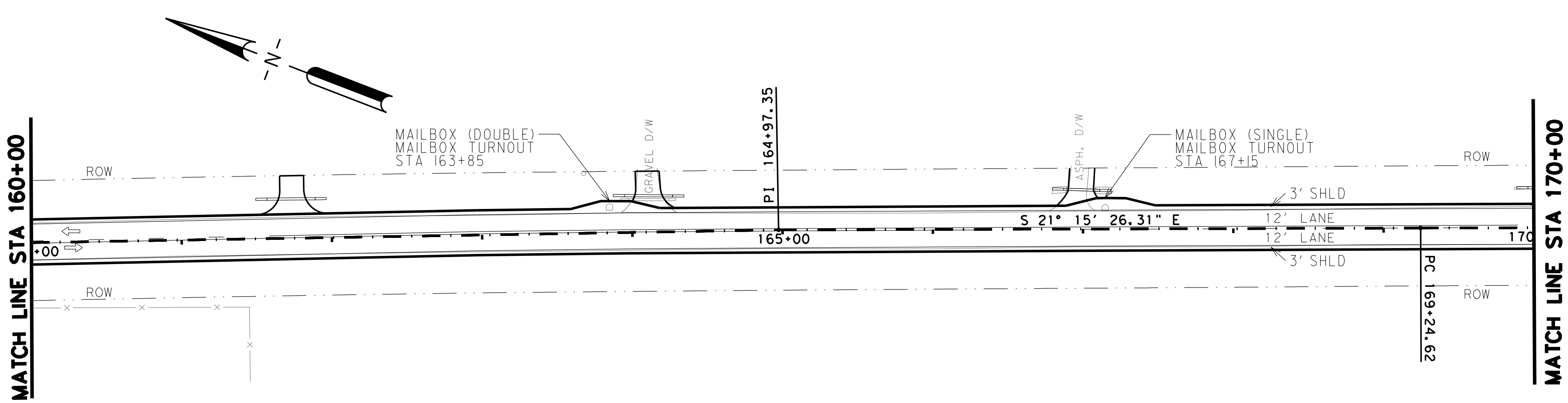
SCALE: FEET
1" = 100' HORIZ.

SHEET 7 OF 15

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		68

NODE





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Bradley Mayes 8/28/2021

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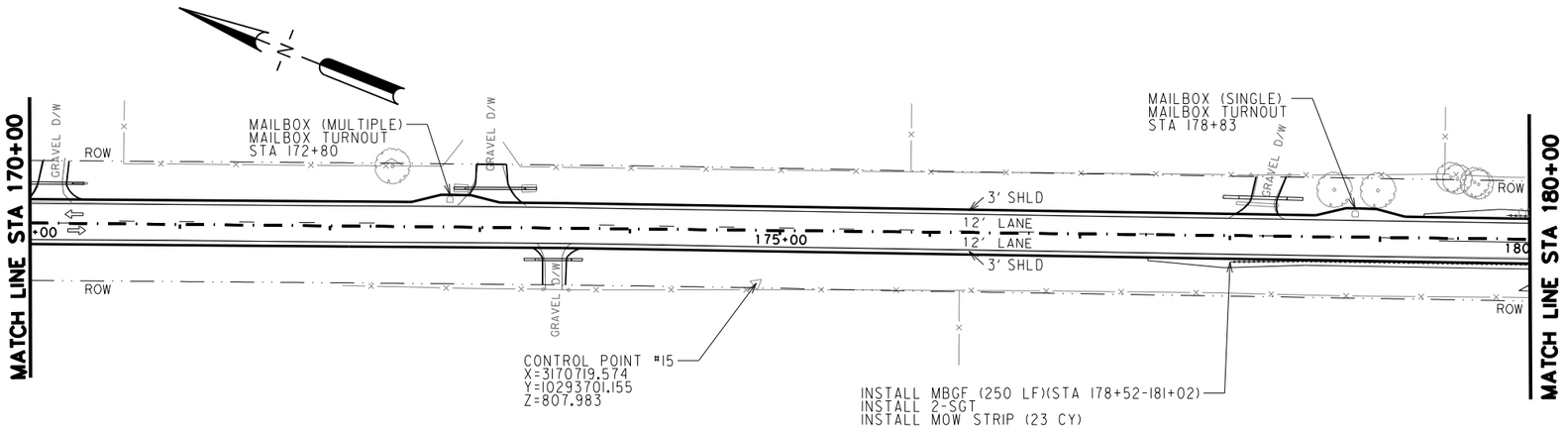
PLAN LAYOUTS

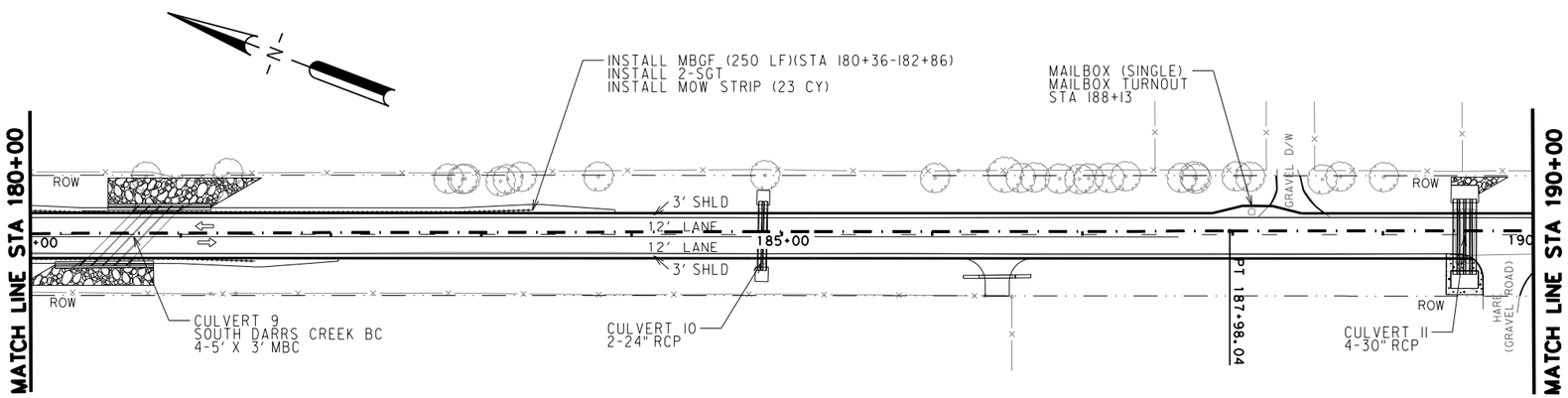
SCALE: FEET
1" = 100' HORIZ.

SHEET 8 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		69

NODE





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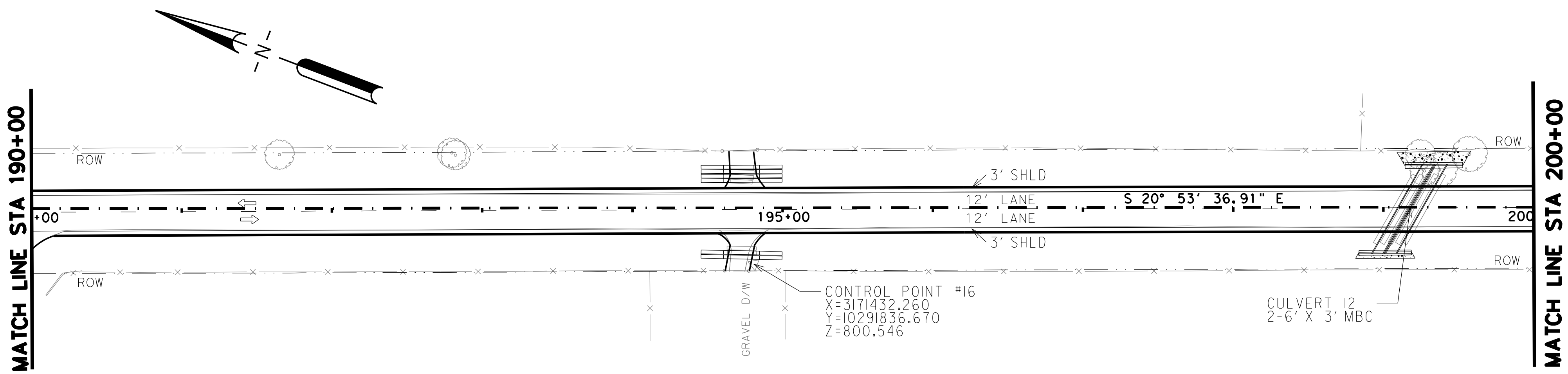
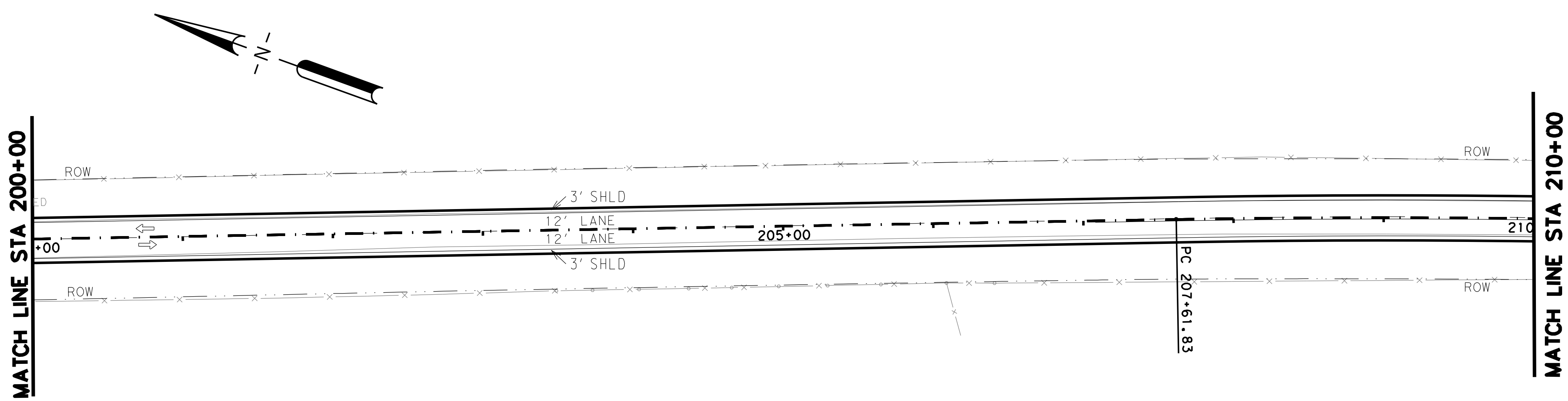
PLAN LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 9 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		70





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Bradley Mayes 8/28/2021
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PLAN LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 10 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		71

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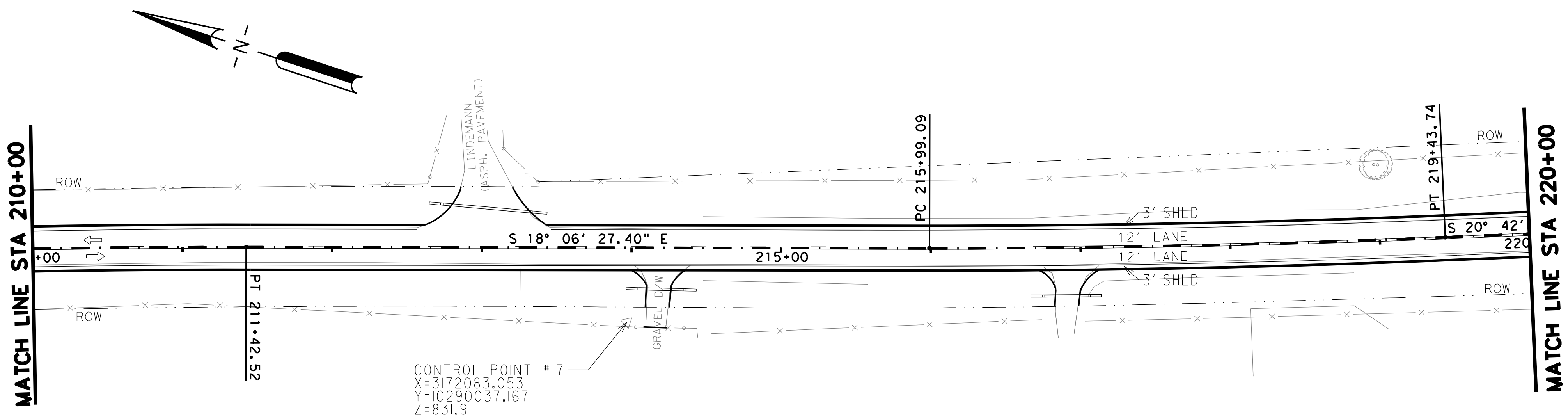
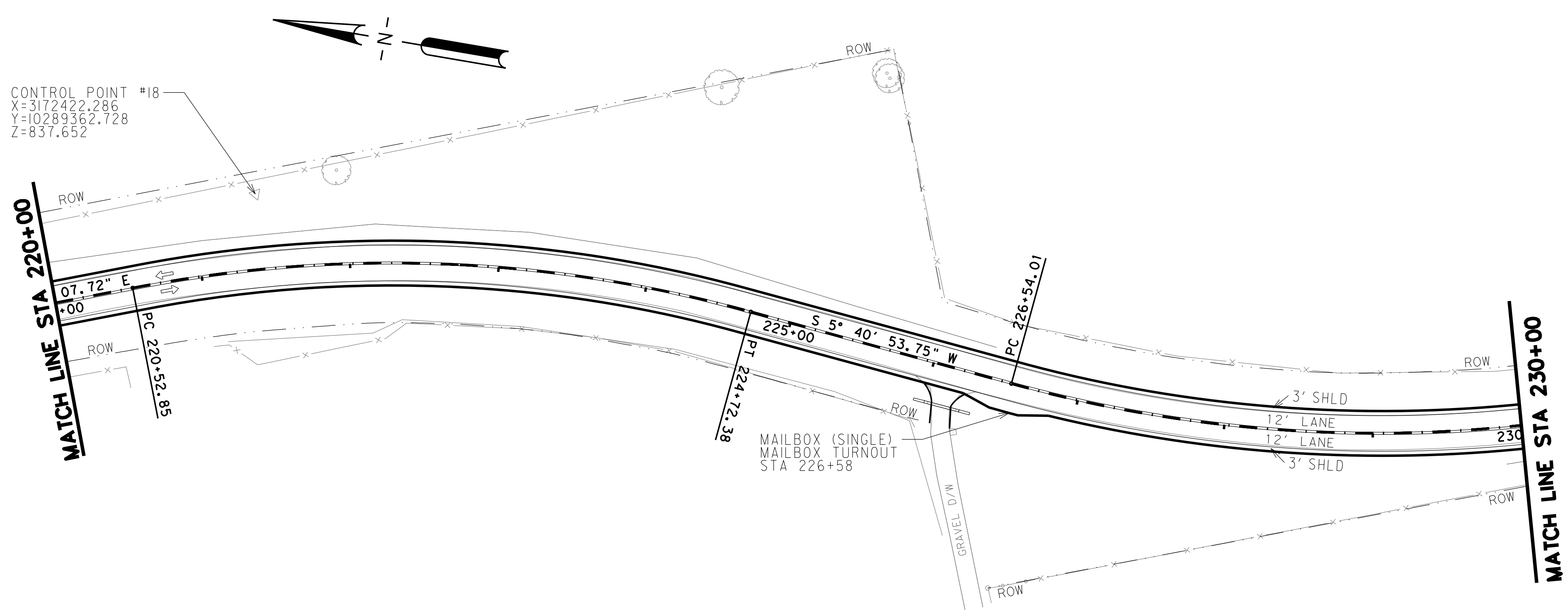
NODE





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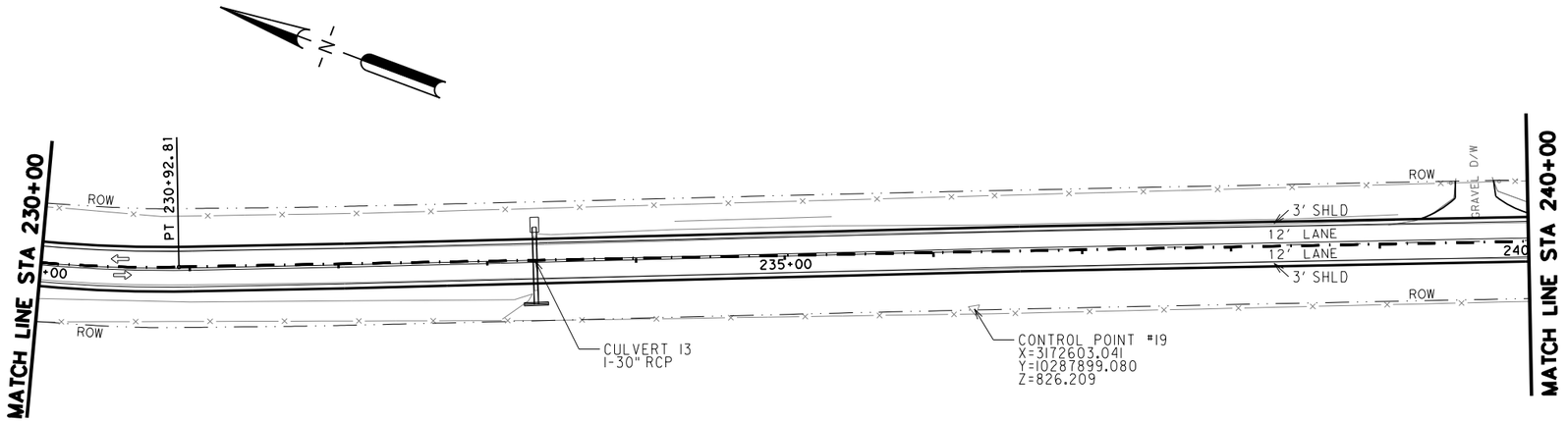
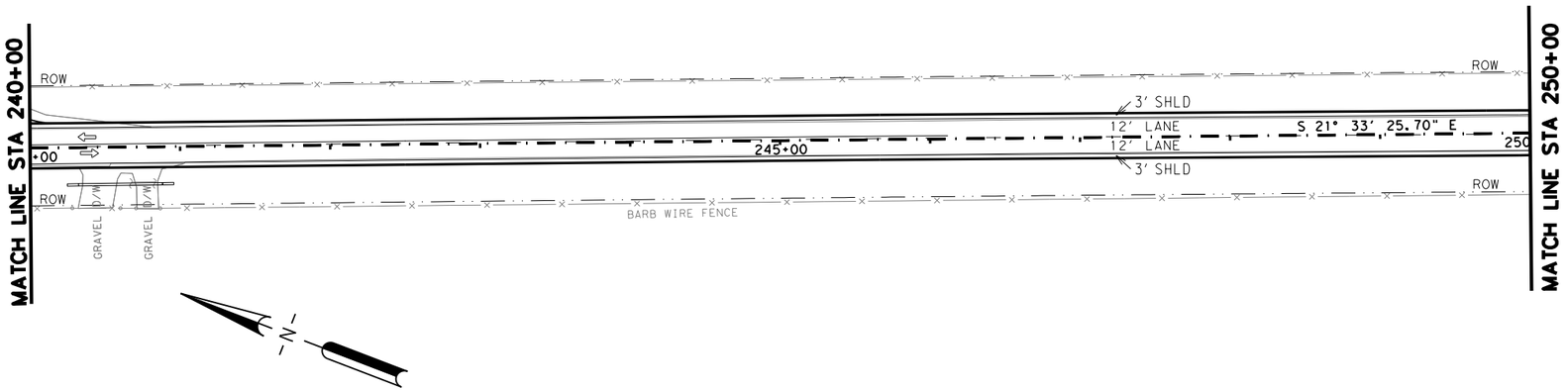
PLAN LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 11 OF 15

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		72





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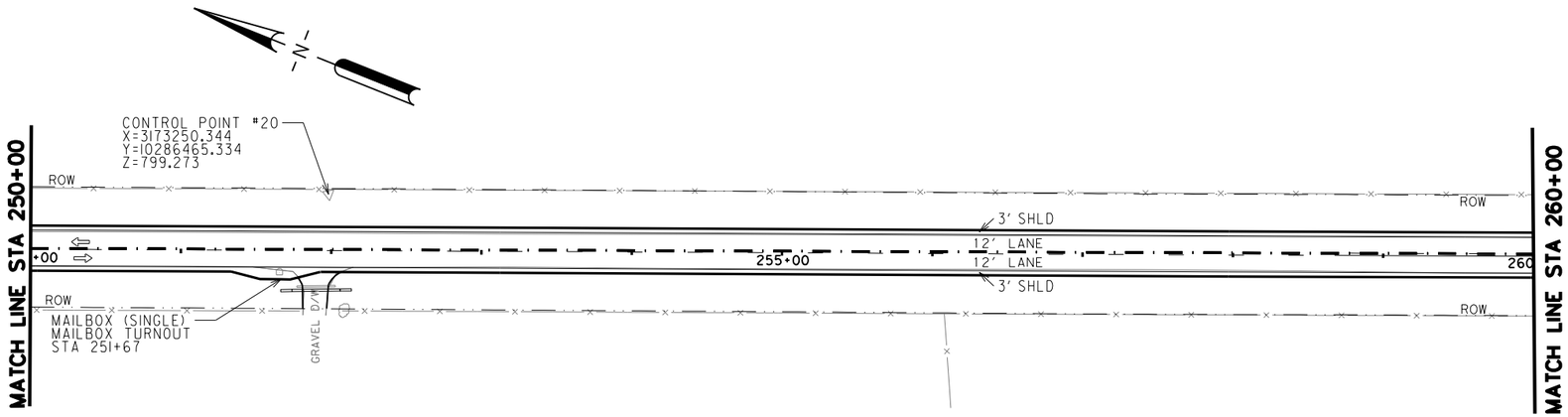
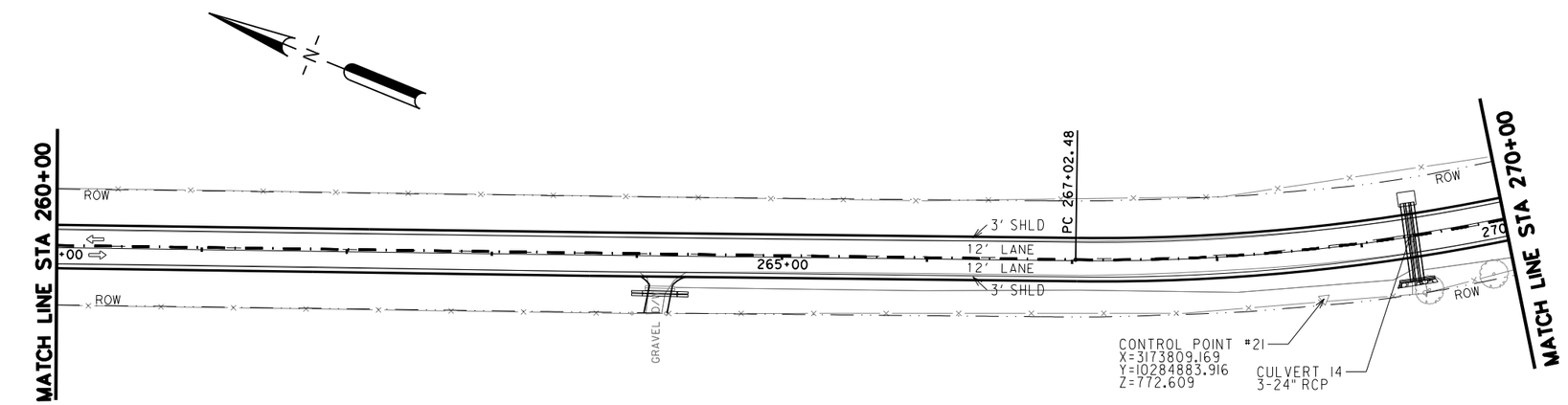
PLAN LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 12 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		73





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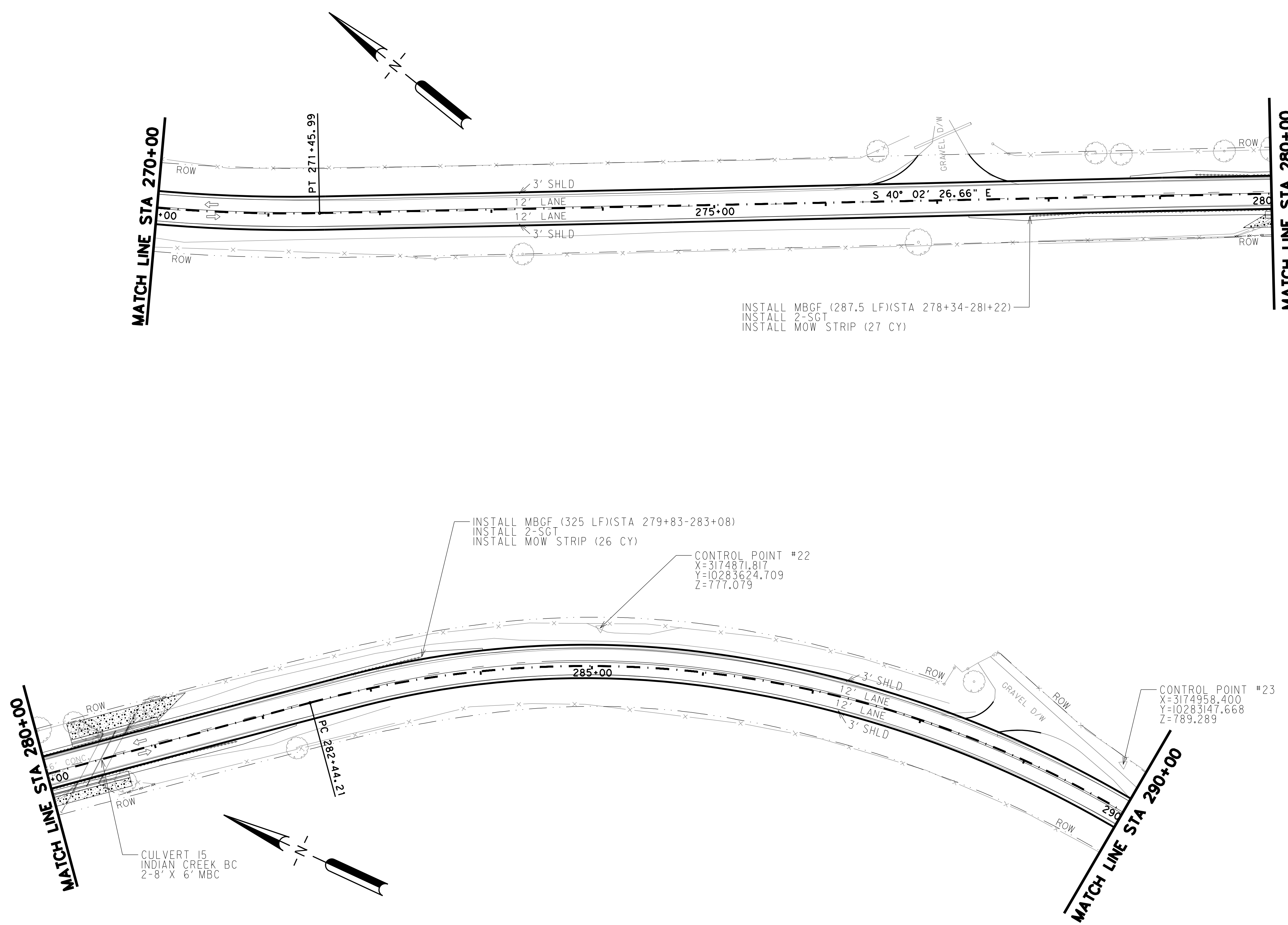
SIGNATURE OF REGISTRANT & DATE

PLAN LAYOUTS

SCALE: 1" = 100' HORIZ. FEET

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		74



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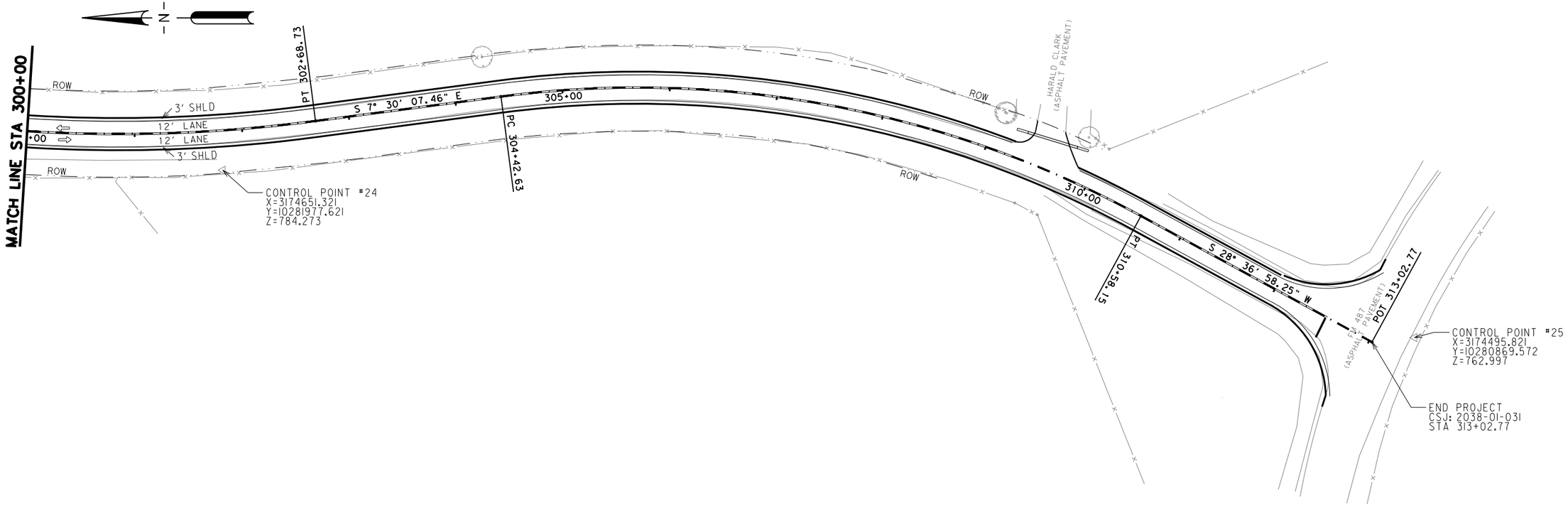
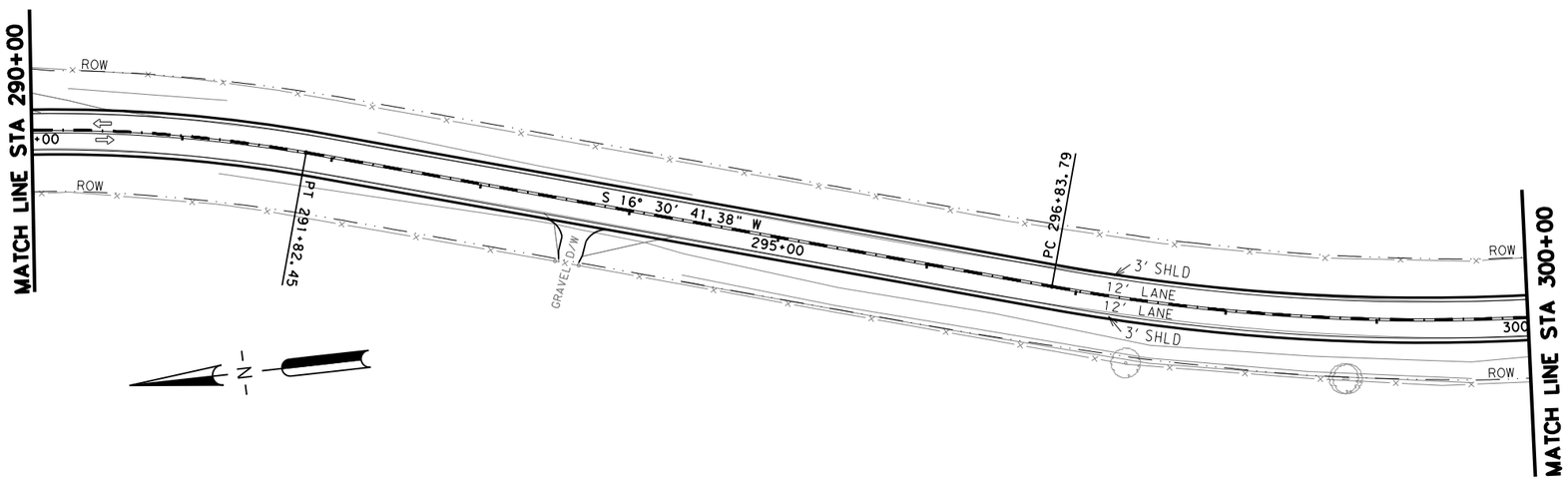
PLAN LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 14 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		75





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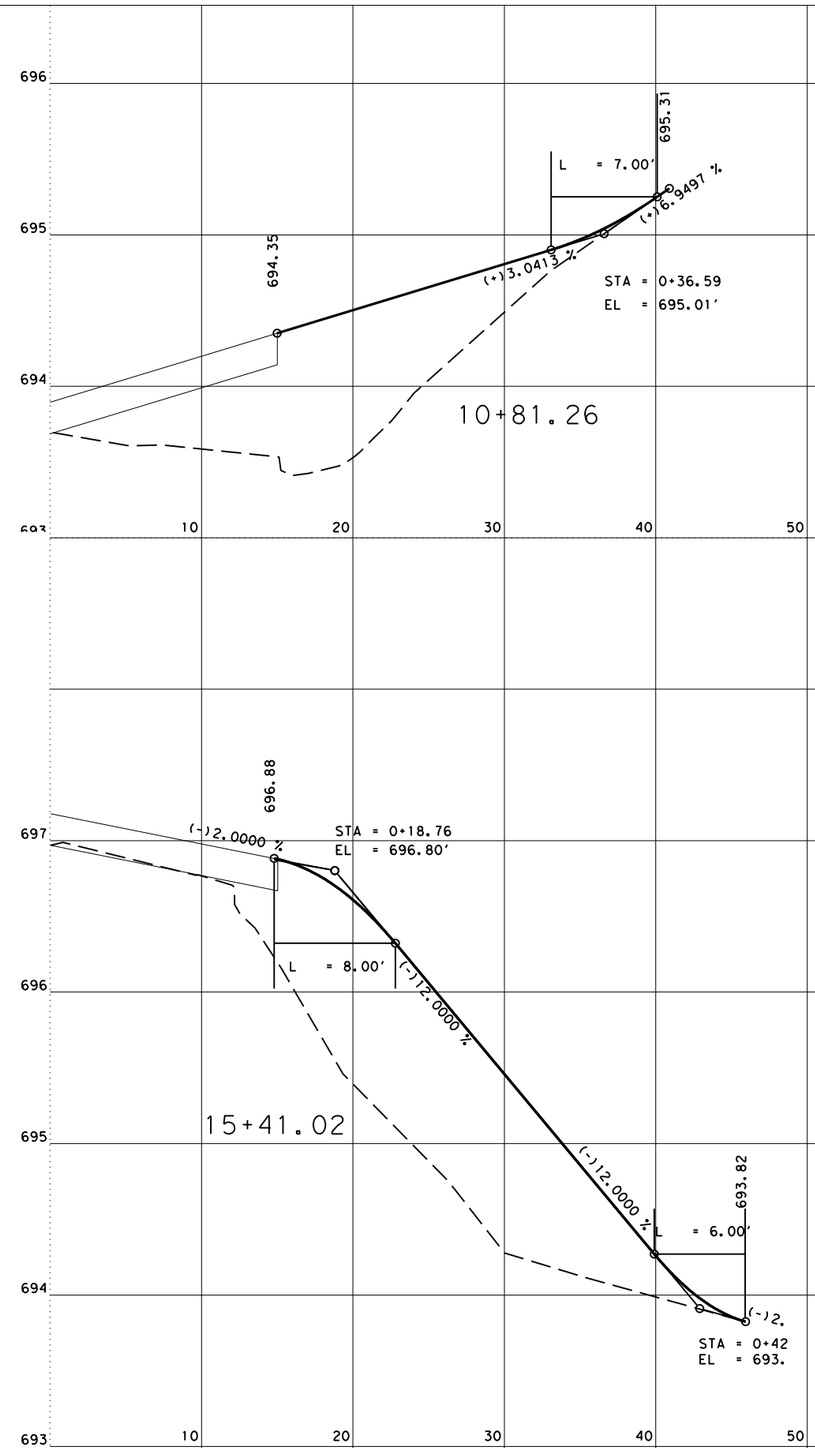
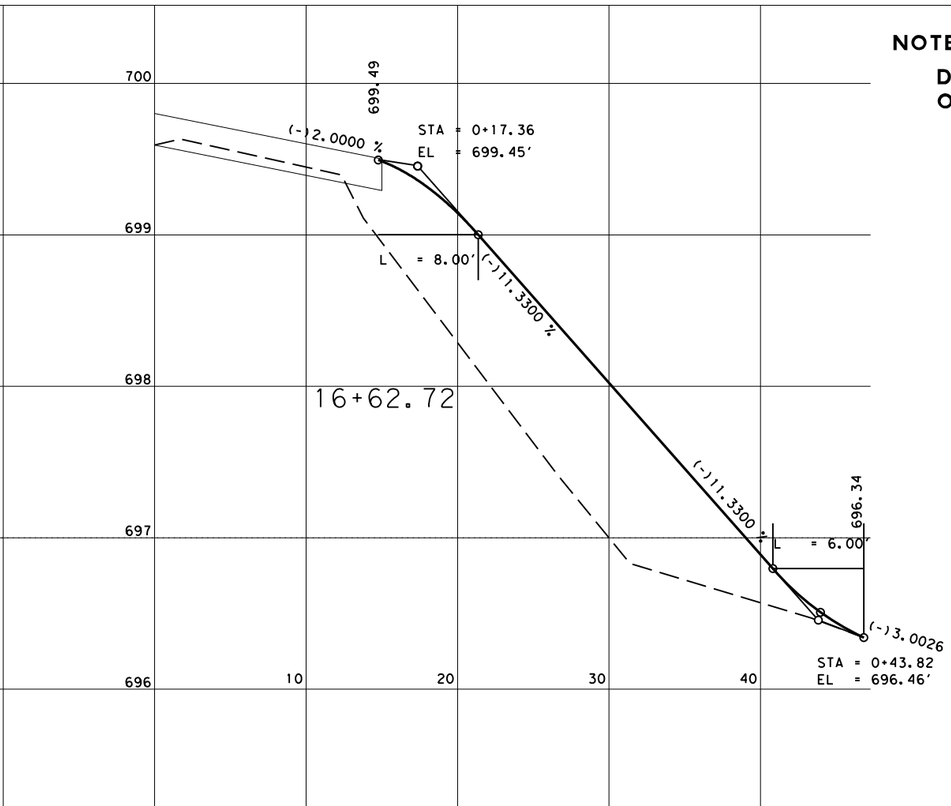
PLAN LAYOUTS

SCALE: 1" = 100' HORIZ. FEET

SHEET 15 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		76





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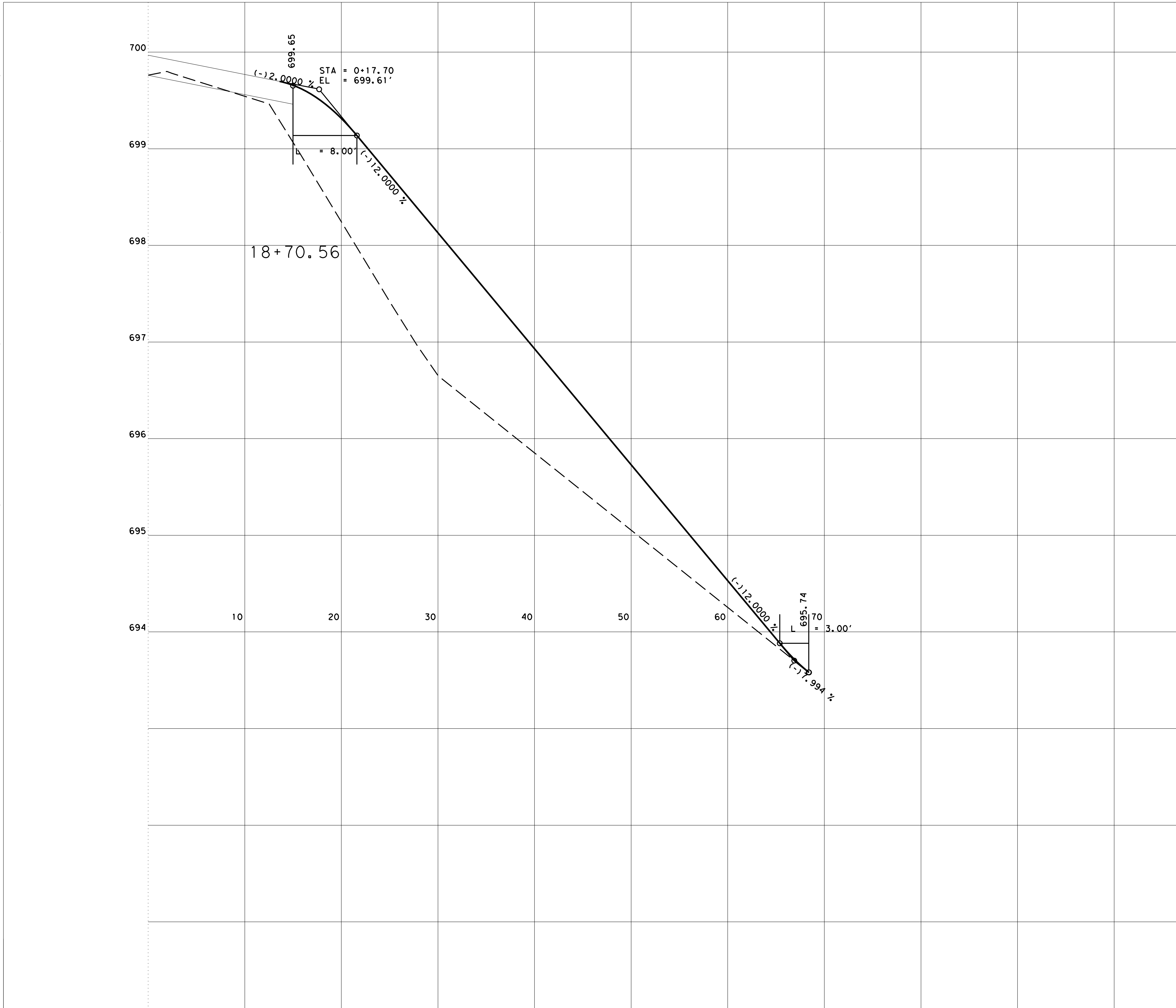
Bradley Mayes 8/28/2021
SIGNATURE OF REGISTRANT & DATE

DRIVEWAY PROFILES

SCALE: FEET
1" = 10' HORIZ.
1" = 1' VERT.

SHEET 1 OF 19

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		77



NOTES:

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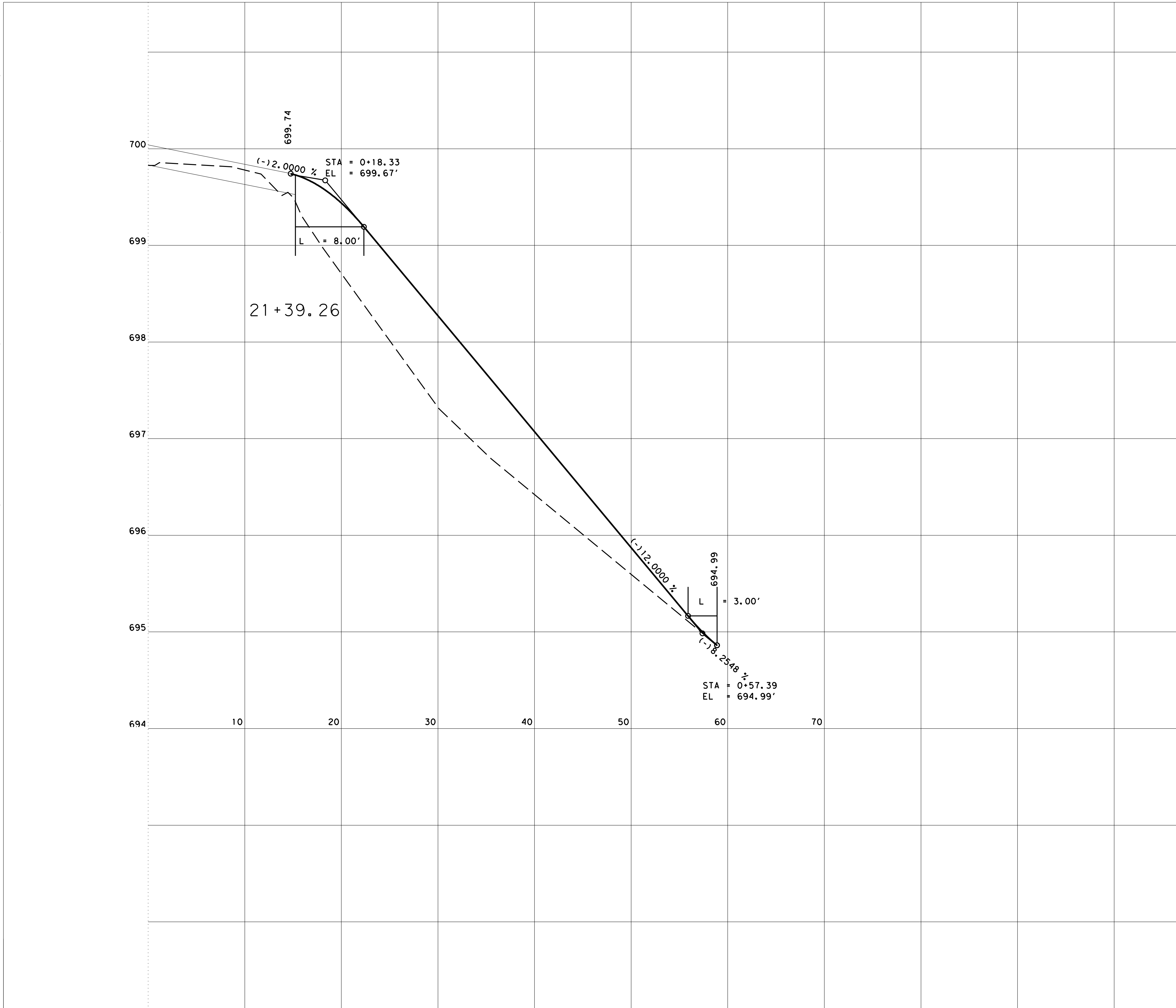
DRIVEWAY PROFILES

SCALE: FEET
1" = 10' HORIZ.
1" = 1' VERT.

SHEET 2 OF 19

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	78



NOTES:

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DRIVEWAY PROFILES

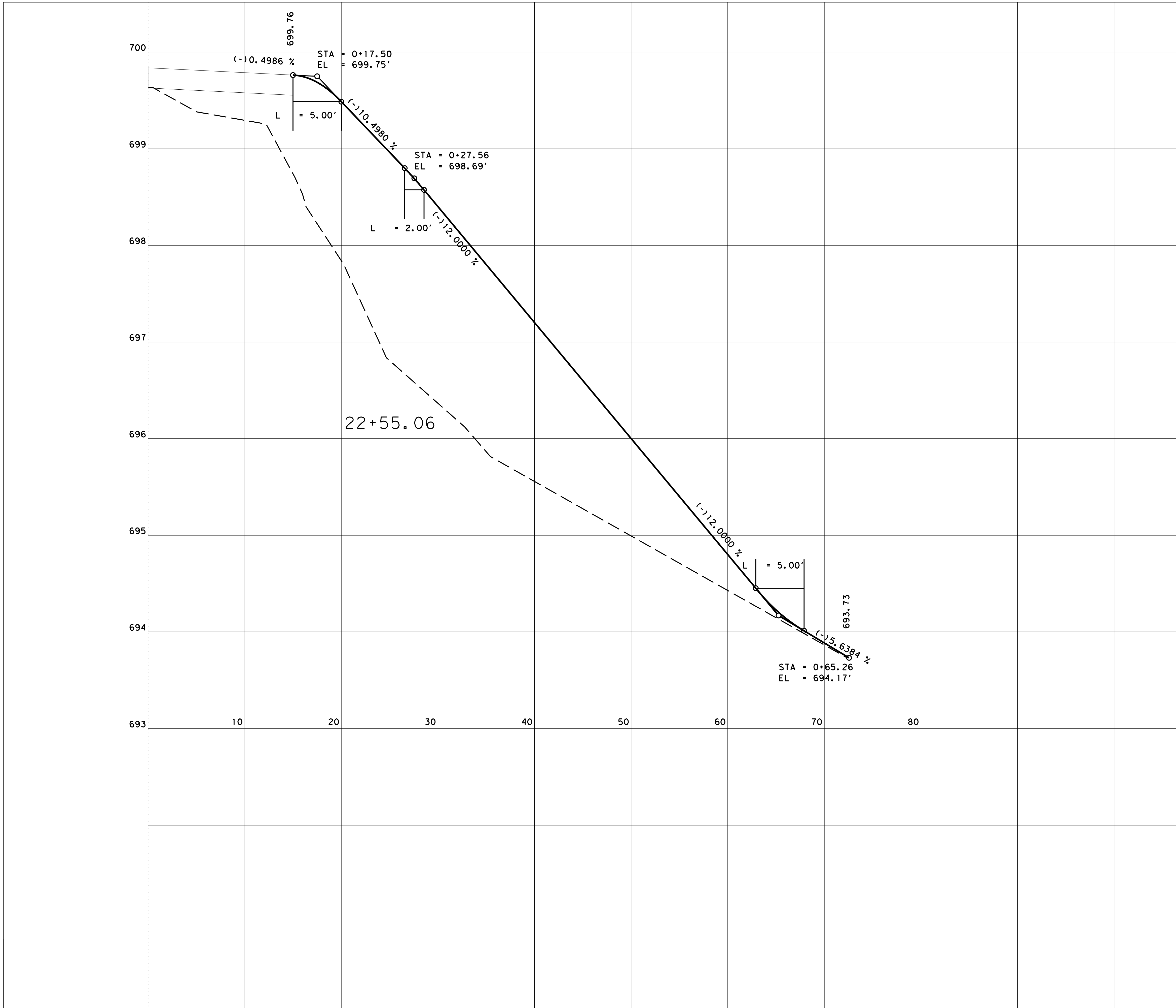
SCALE: FEET
1" = 10' HORIZ.
1" = 1' VERT.

SHEET 3 OF 19

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	79

NOTES:

DRIVEWAY STATIONING IS BASED OFF OF FM 2115 CENTERLINE.



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NODE

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Bradley Mayes 8/28/2021

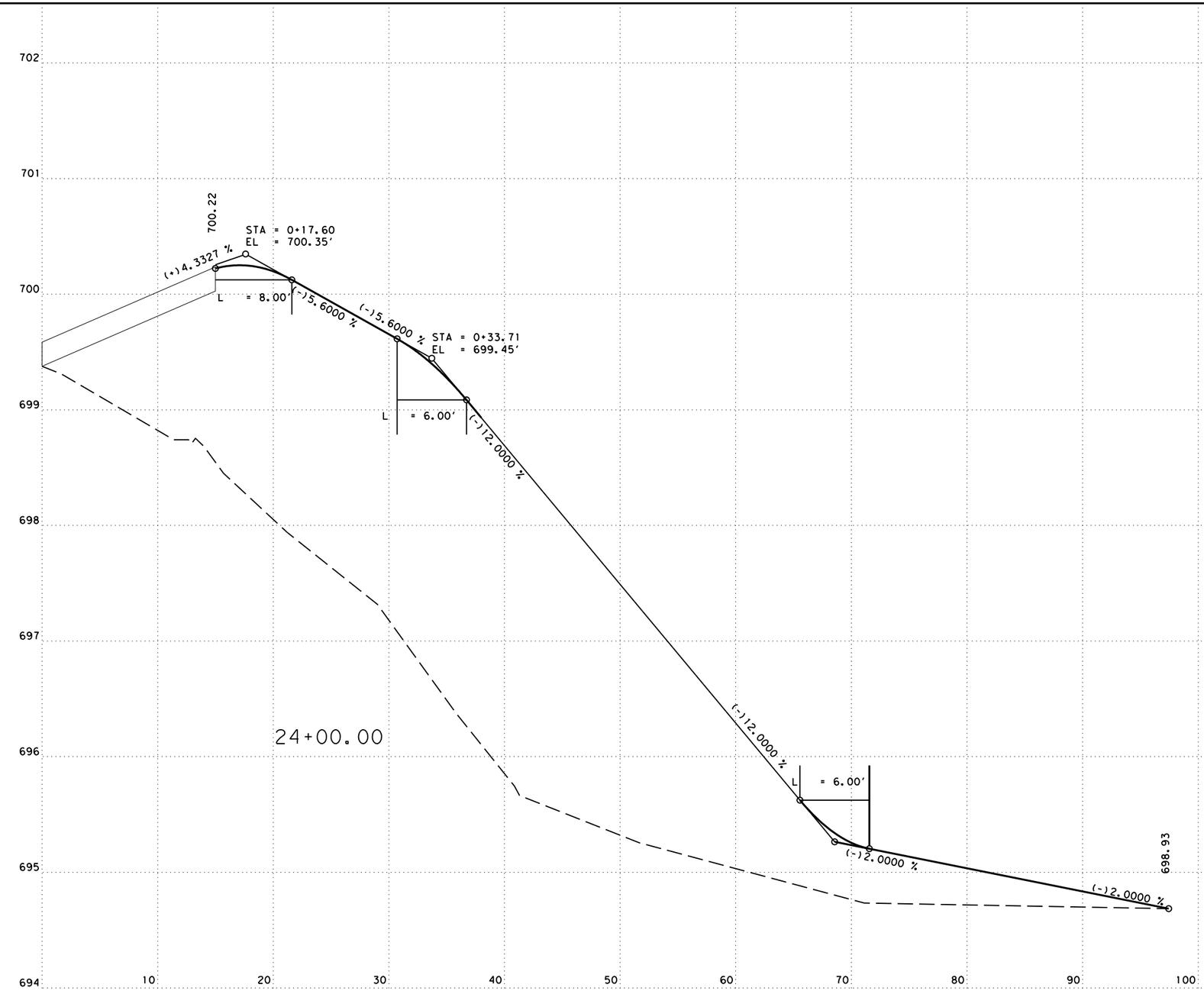
SIGNATURE OF REGISTRANT & DATE

DRIVEWAY PROFILES

SCALE: FEET
1" = 10' HORIZ.
1" = 1' VERT.

SHEET 4 OF 19

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	80



NOTES:

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Bradley Mayes 9/2/2021

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DRIVEWAY PROFILES

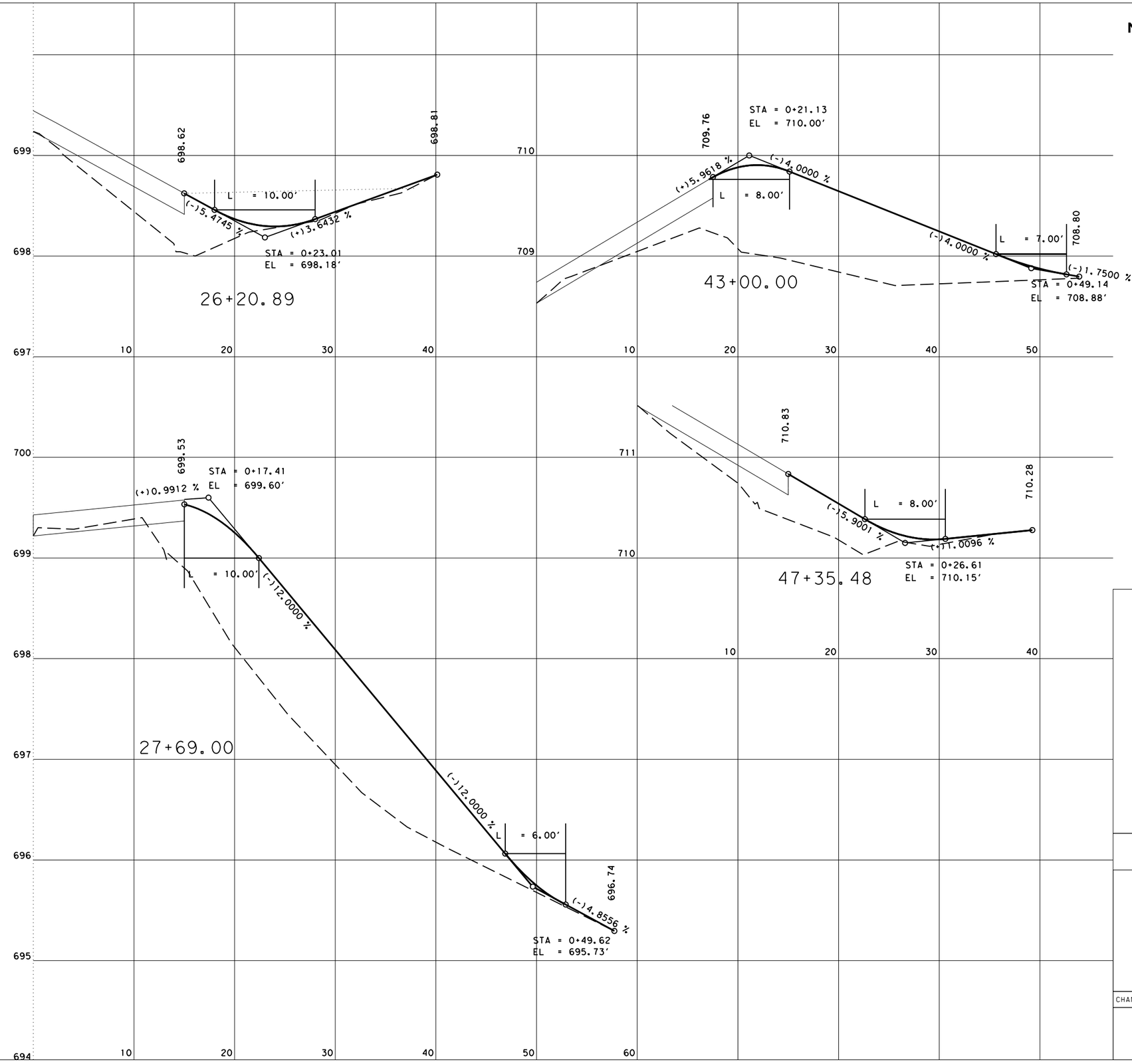
SCALE: FEET
1" = 10' HORIZ.
1" = 1' VERT.

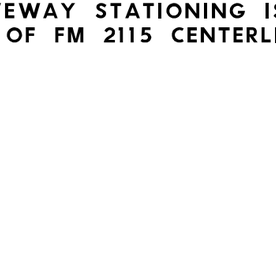
SHEET 5 OF 19

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		81

NOTES:

DRIVEWAY STATIONING IS BASED OFF OF FM 2115 CENTERLINE.





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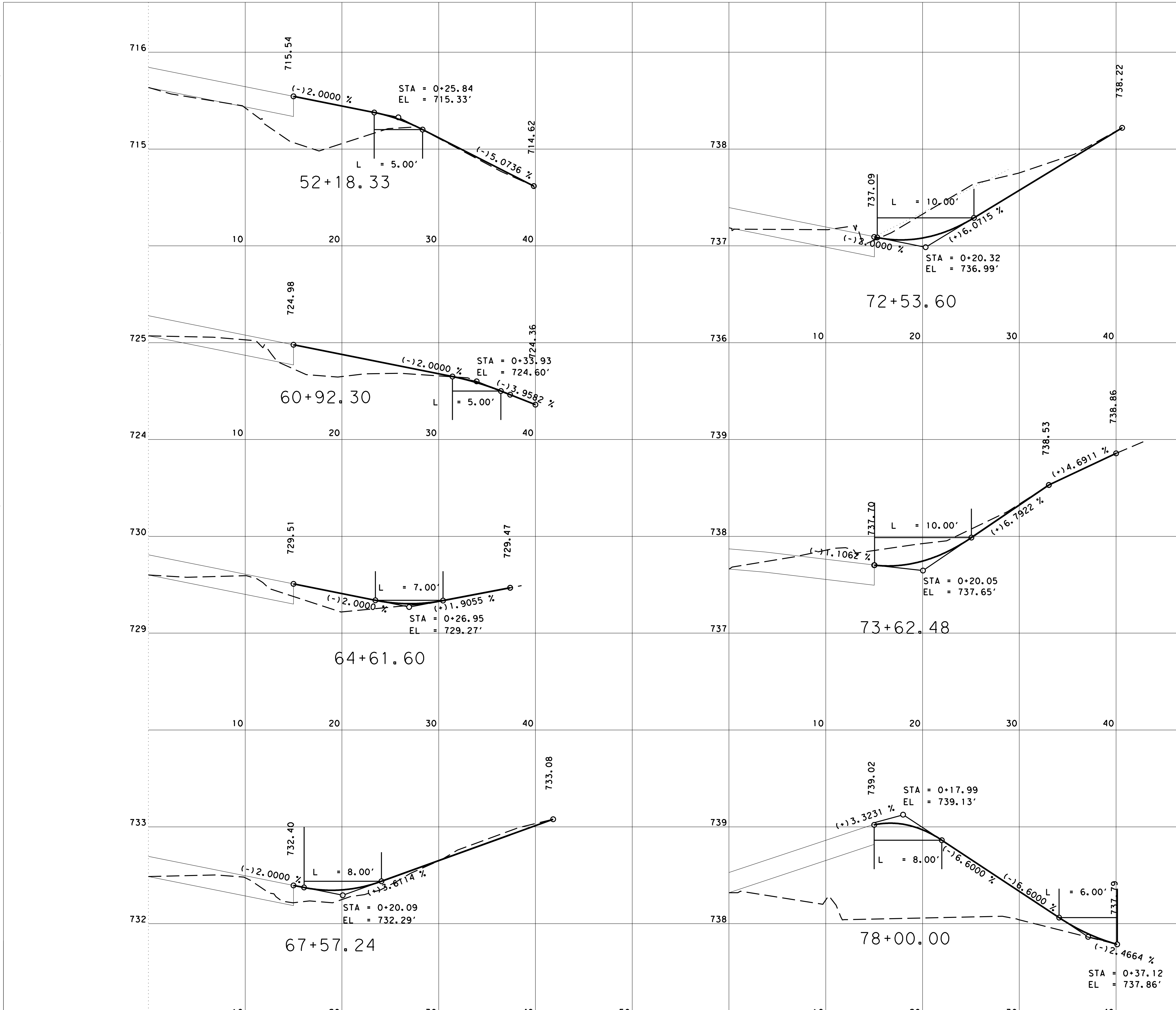
DRIVEWAY PROFILES

SCALE: FEET
1" = 10' HORIZ.
1" = 1' VERT.

SHEET 6 OF 19

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		82



NOTES:

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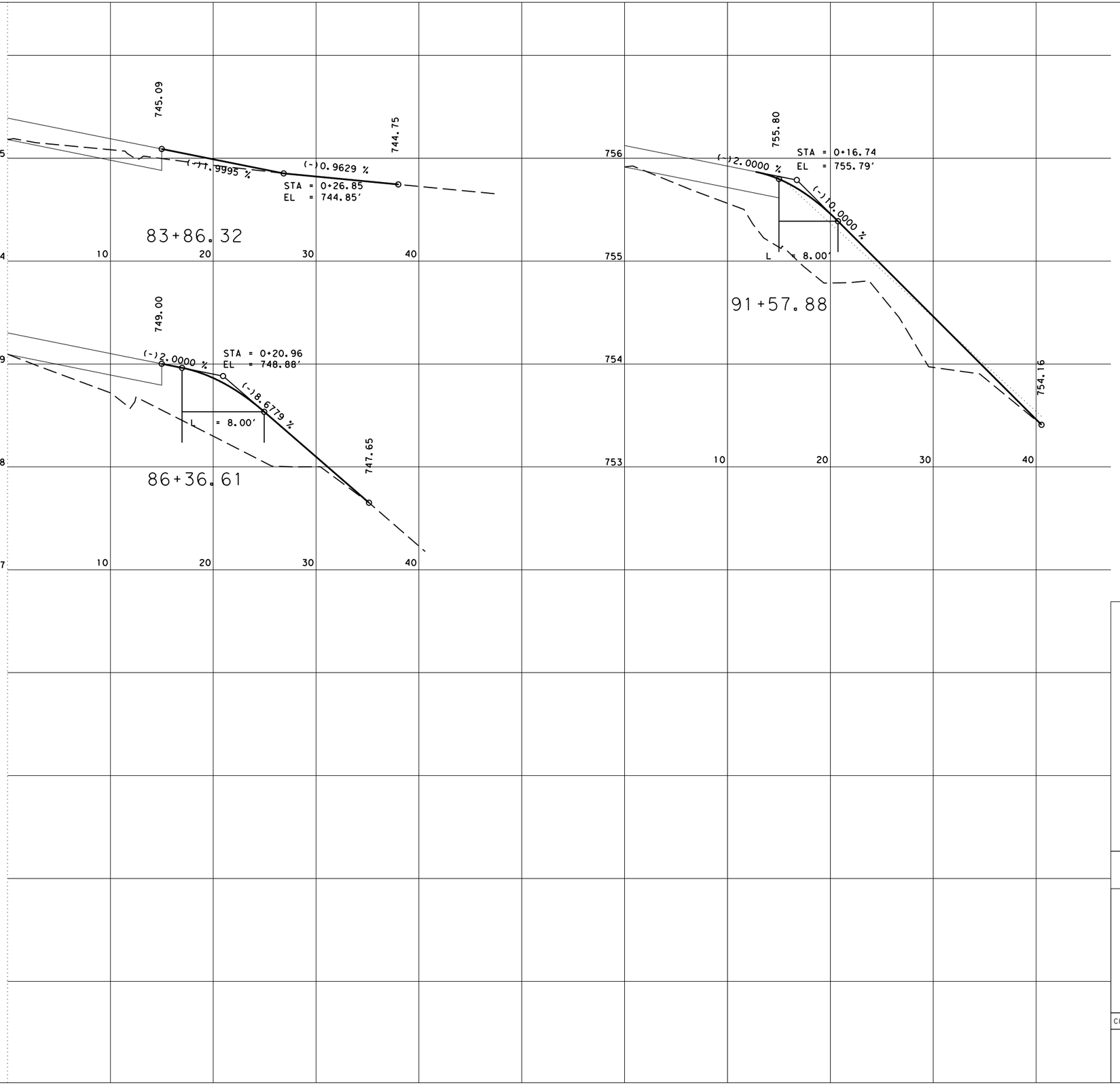
DRIVEWAY PROFILES

SCALE: FEET
1" = 10' HORIZ.
1" = 1' VERT.

SHEET 7 OF 19

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	83



NOTES:

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Bradley Mayes 8/28/2021

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DRIVEWAY PROFILES

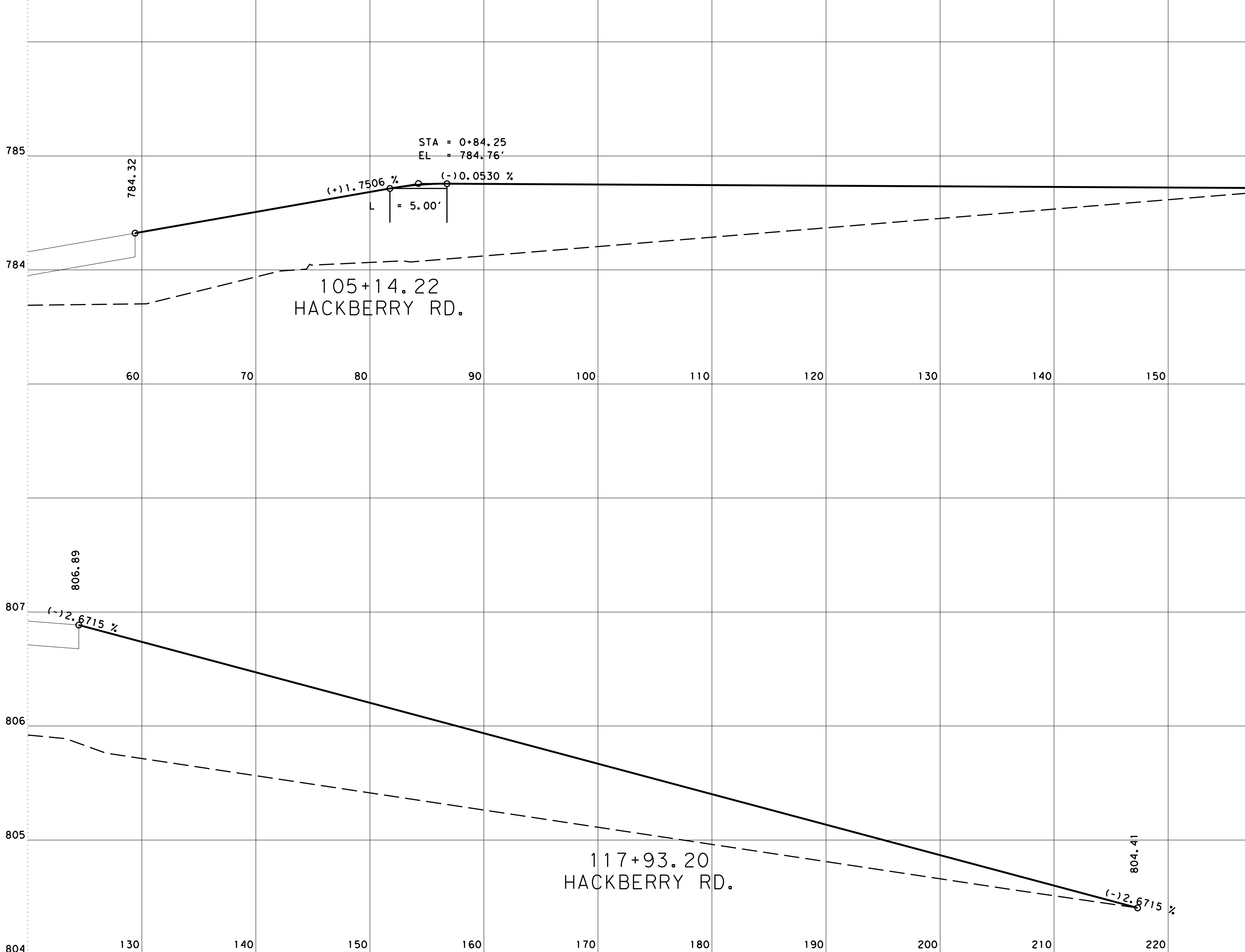
SCALE: FEET
1" = 10' HORIZ.
1" = 1' VERT.

SHEET 8 OF 19

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		84

NOTES:

DRIVEWAY STATIONING IS BASED OFF OF FM 2115 CENTERLINE.



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DRIVEWAY PROFILES

SCALE: FEET
1" = 10' HORIZ.
1" = 1' VERT.

SHEET 9 OF 19

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	85

NODE

NOTES:

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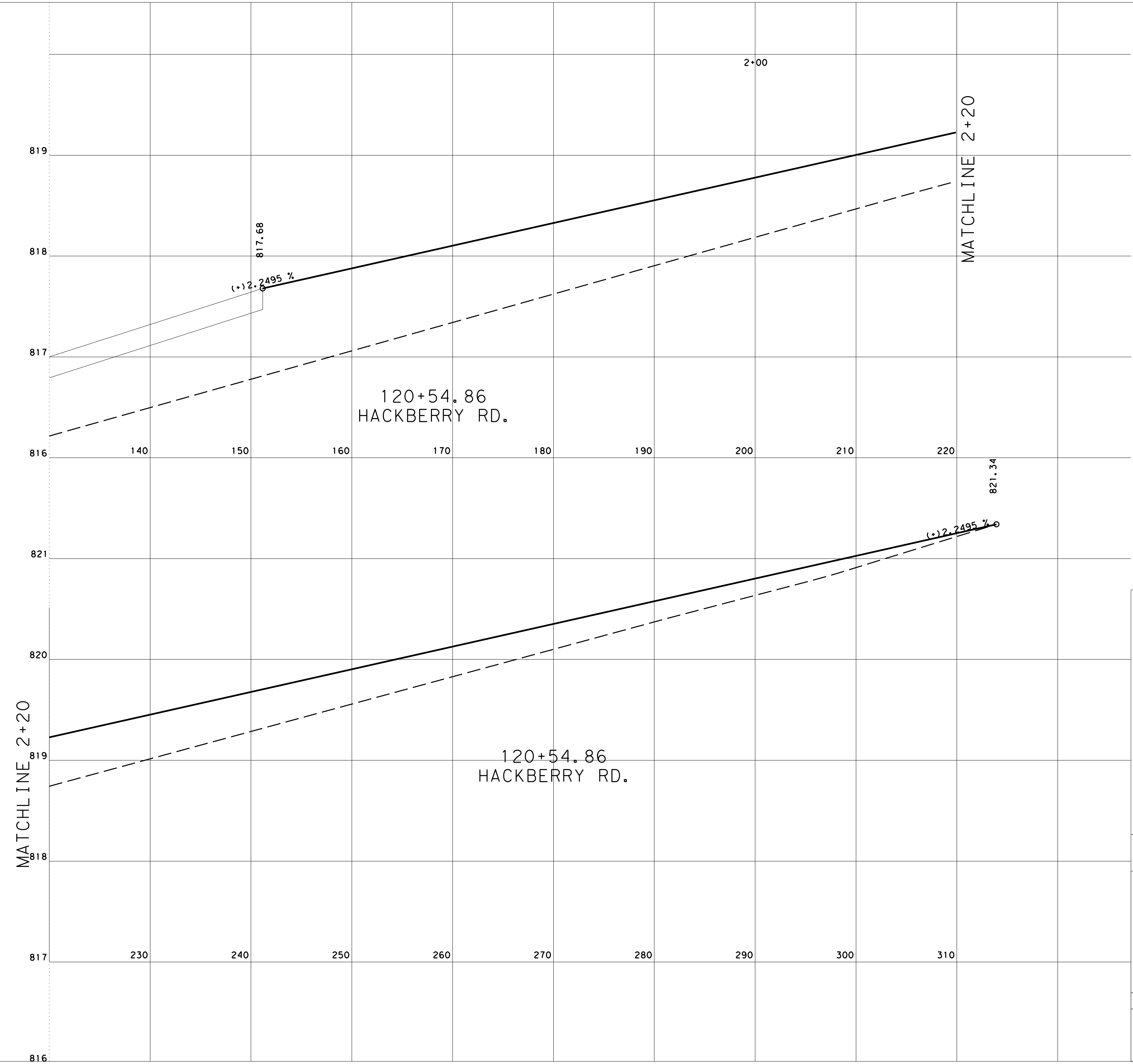

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DRIVEWAY PROFILES

SCALE: FEET
1" = 10' HORIZ.
1" = 1' VERT.

SHEET 10 OF 19

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	86

NODE

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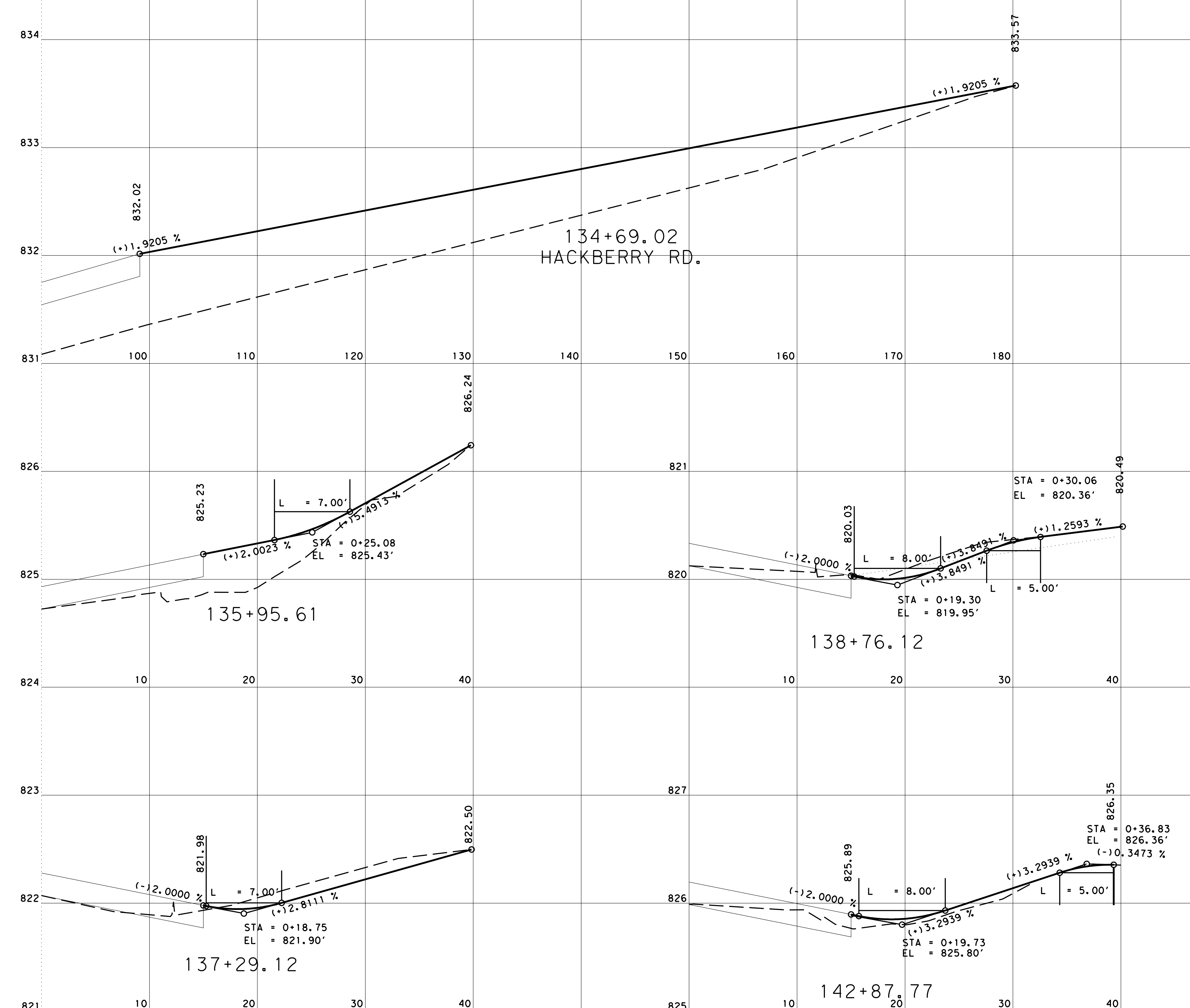

NOTES:

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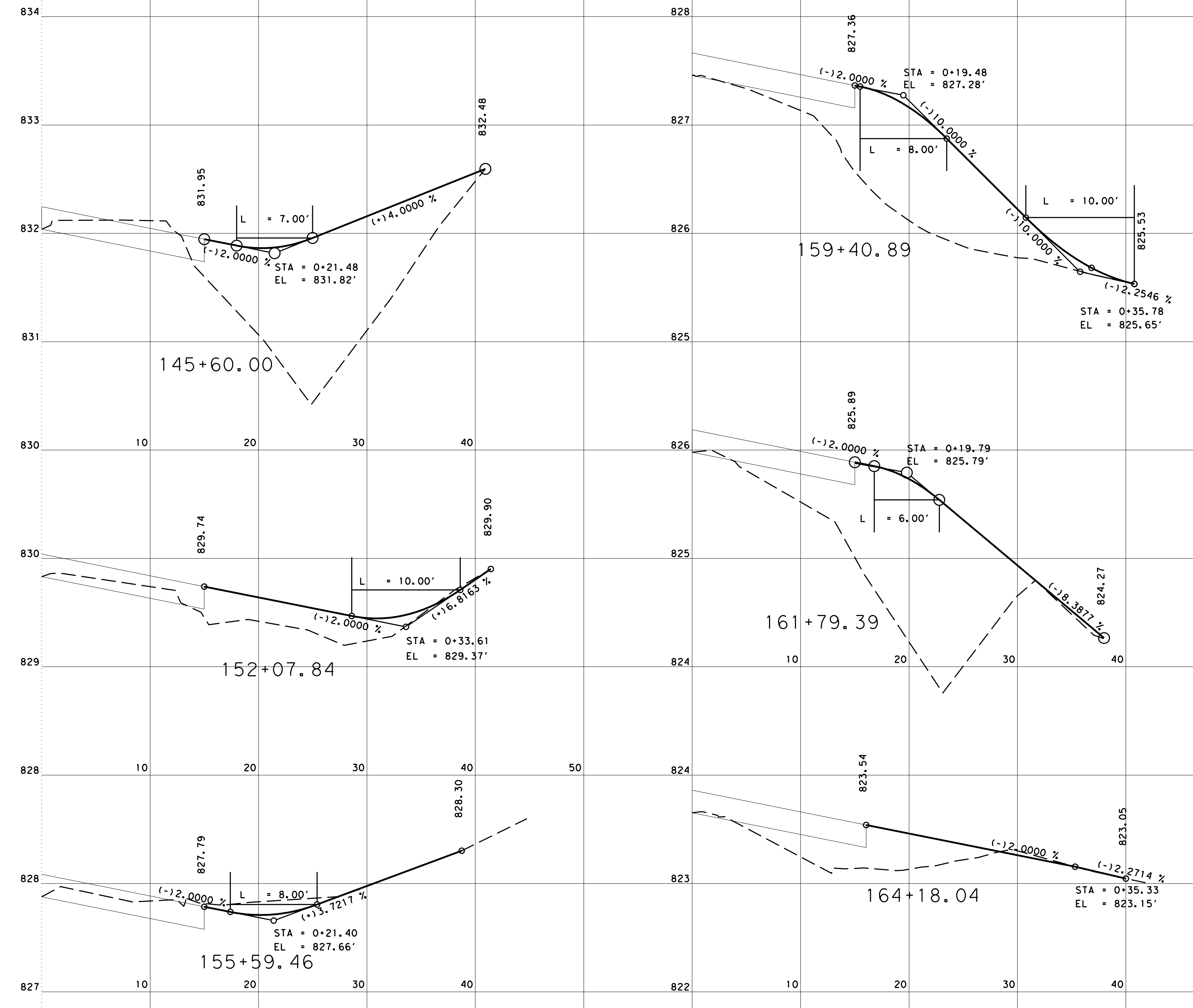
SCALE: FEET
1" = 10' HORIZ.
1" = 1' VERT.

SHEET 11 OF 19

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		87

NODE



NOTES:

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DRIVEWAY PROFILES

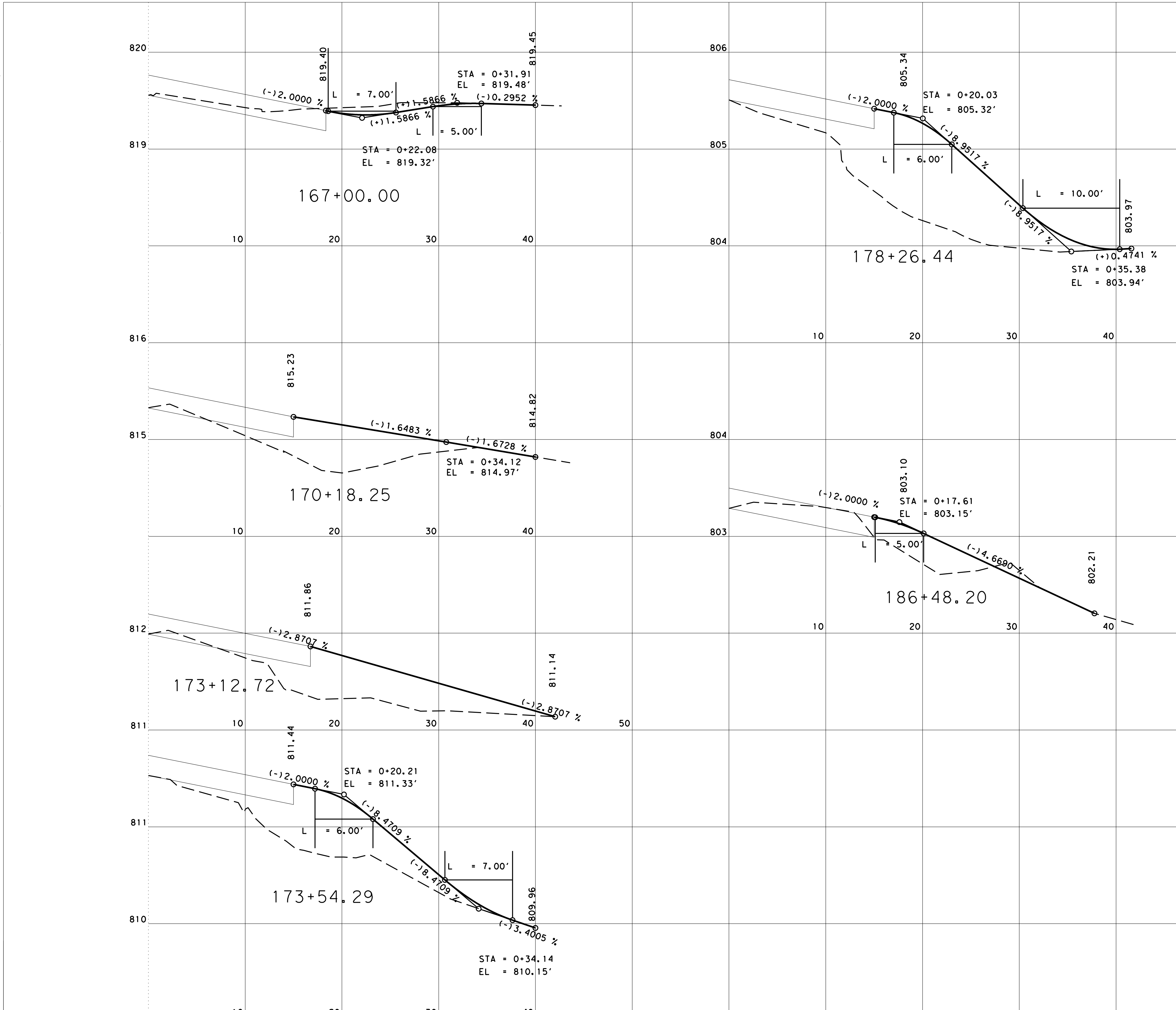
SCALE: FEET
1" = 10' HORIZ.
1" = 1' VERT.

SHEET 12 OF 19

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	88

NOTES:

DRIVEWAY STATIONING IS BASED OFF OF FM 2115 CENTERLINE.



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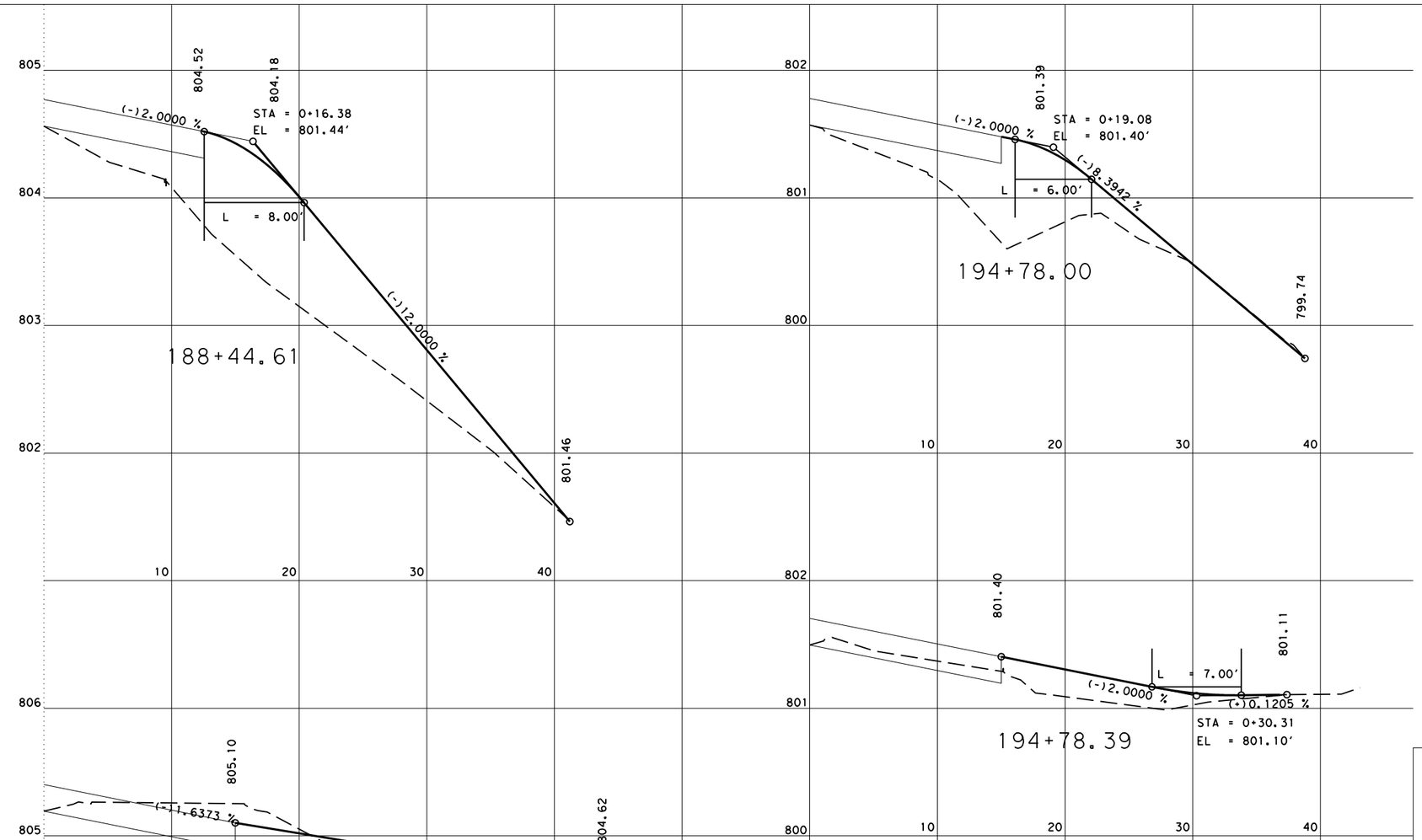
DRIVEWAY PROFILES

SCALE: FEET
1" = 10' HORIZ.
1" = 1' VERT.

SHEET 13 OF 19

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	89

NODE



NOTES:

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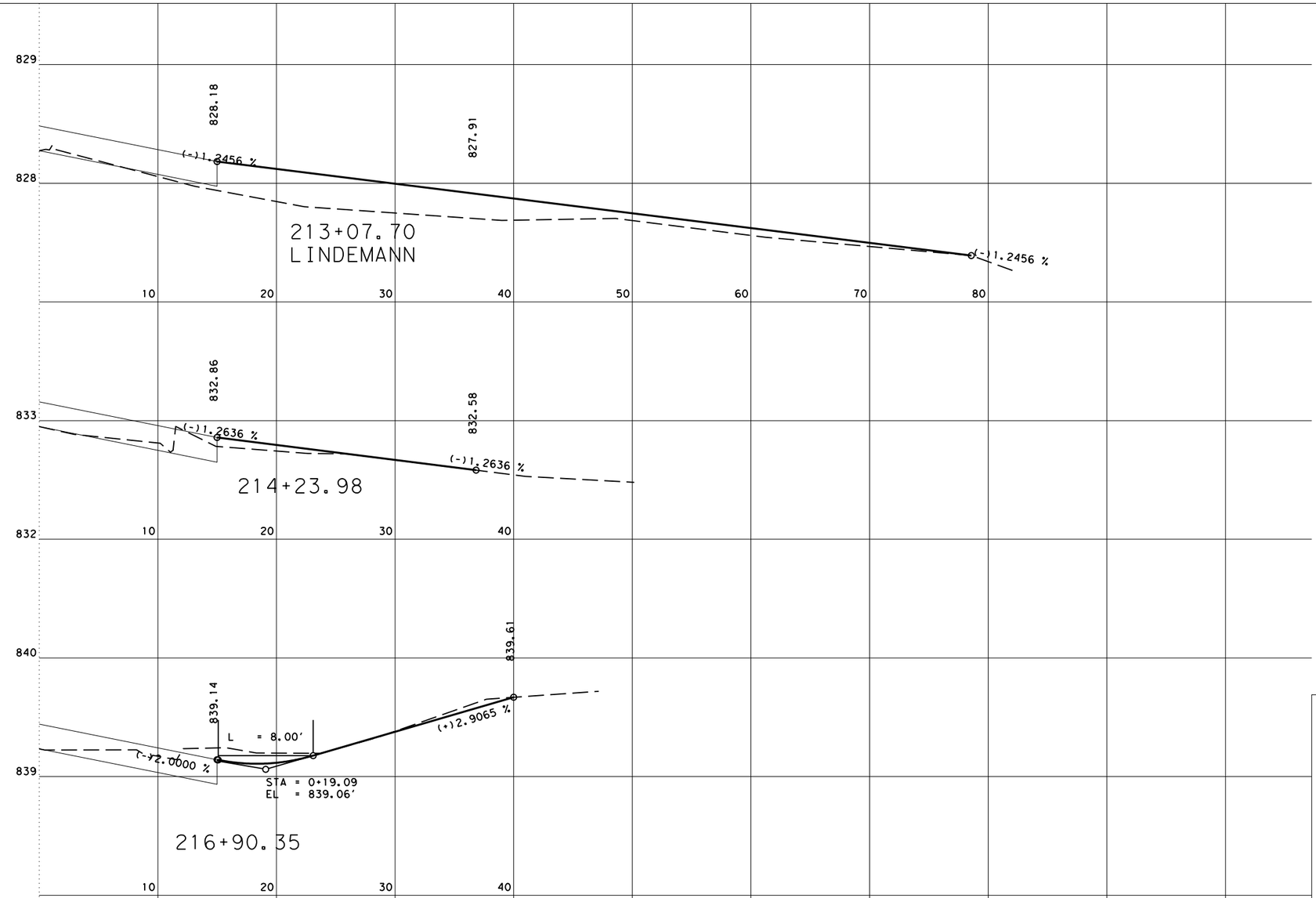
DRIVEWAY PROFILES

SCALE: FEET
1" = 10' HORIZ.
1" = 1' VERT.

SHEET 14 OF 19

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		90



NOTES:

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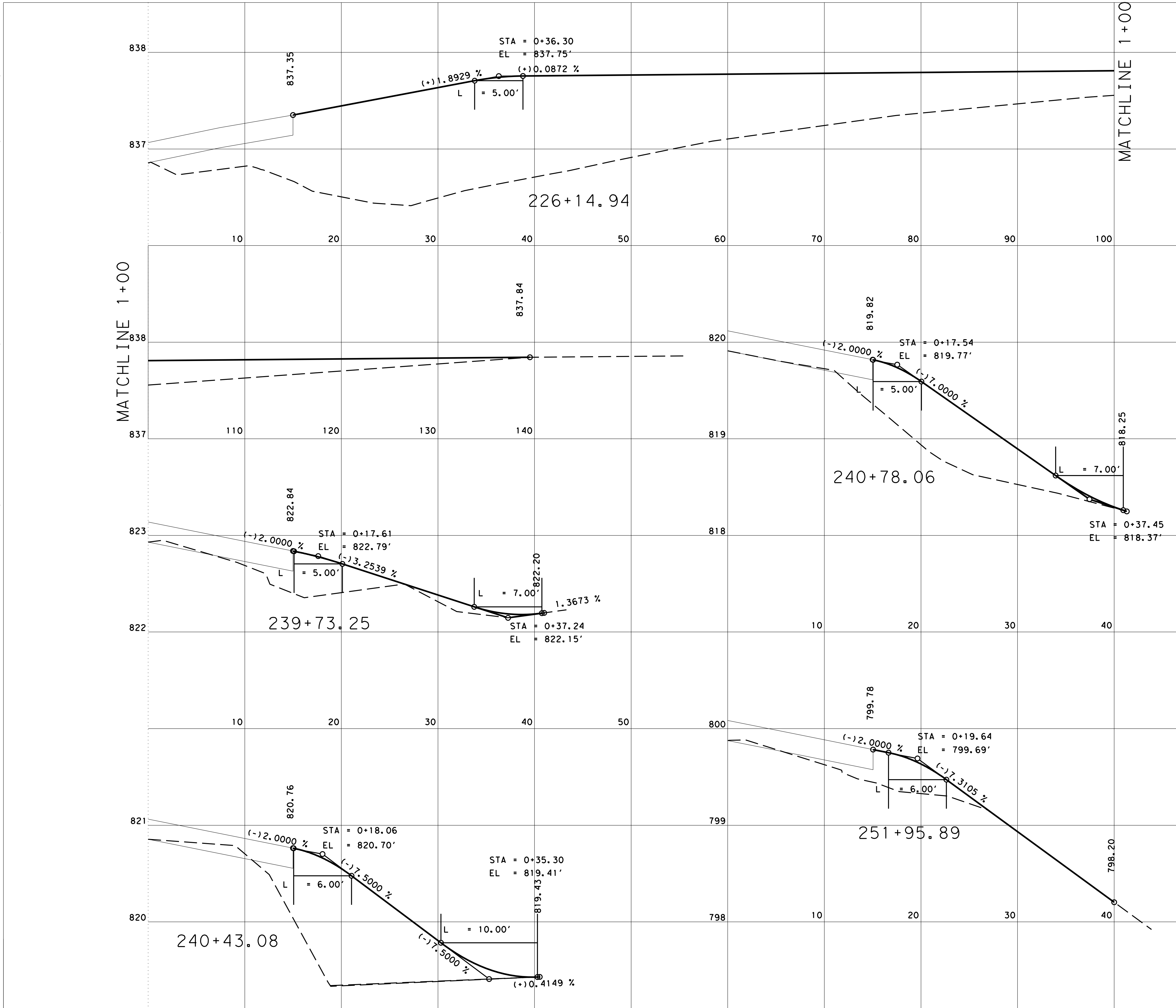
DRIVEWAY PROFILES

SCALE: FEET
1" = 10' HORIZ.
1" = 1' VERT.

SHEET 15 OF 19

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		91



NOTES:

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PROFESSIONAL ENGINEER

Bradley Mayes 8/28/2021
SIGNATURE OF REGISTRANT & DATE

DRIVEWAY PROFILES

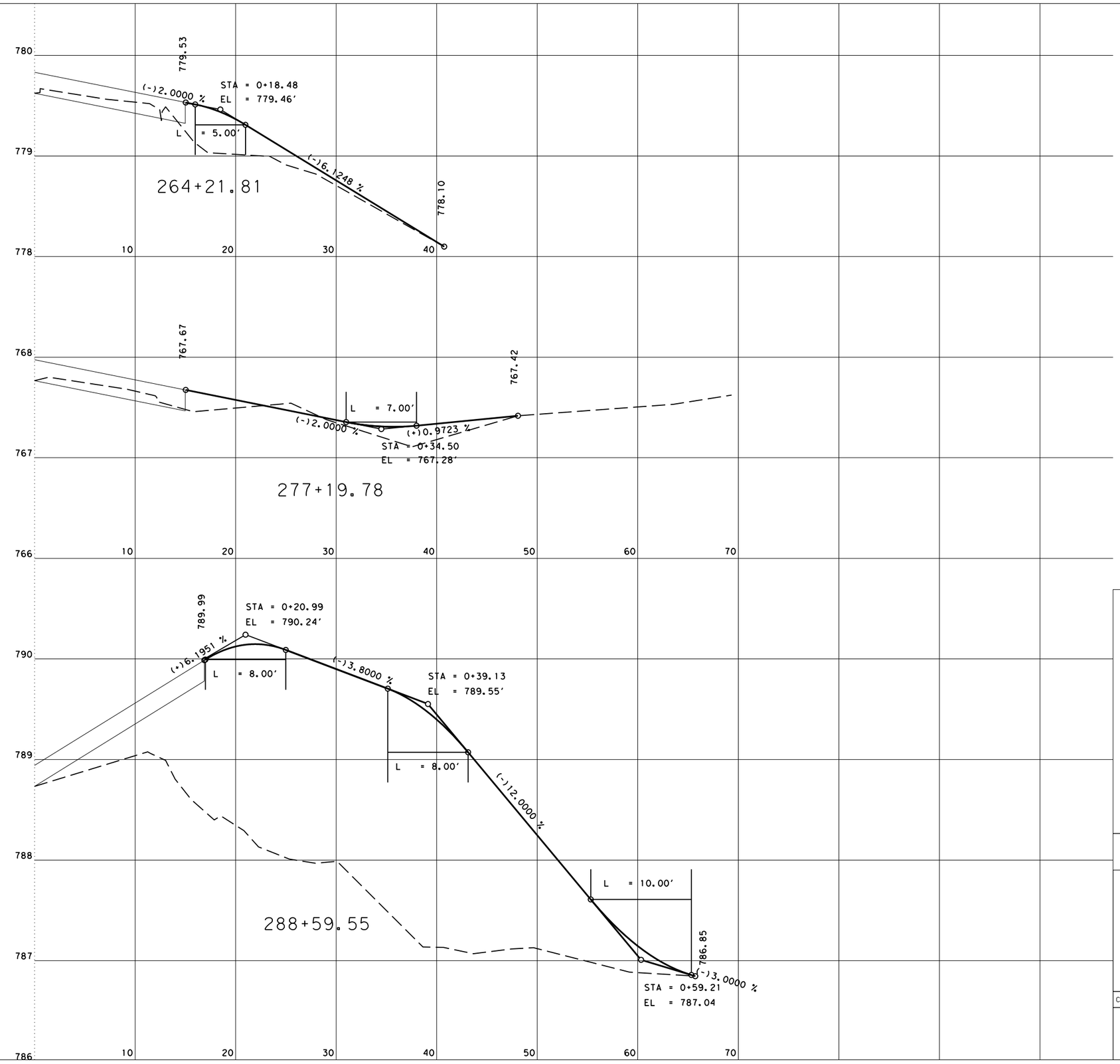
SCALE: FEET
1" = 10' HORIZ.
1" = 1' VERT.

SHEET 16 OF 19

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	92

pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\203801031\4 - Design\Plan Sets\02 Roadway\FM 2115 Driveway Profiles.dgn

NODE



NOTES:

DRIVEWAY STATIONING IS BASED OFF OF FM 2115 CENTERLINE.

STATE OF TEXAS
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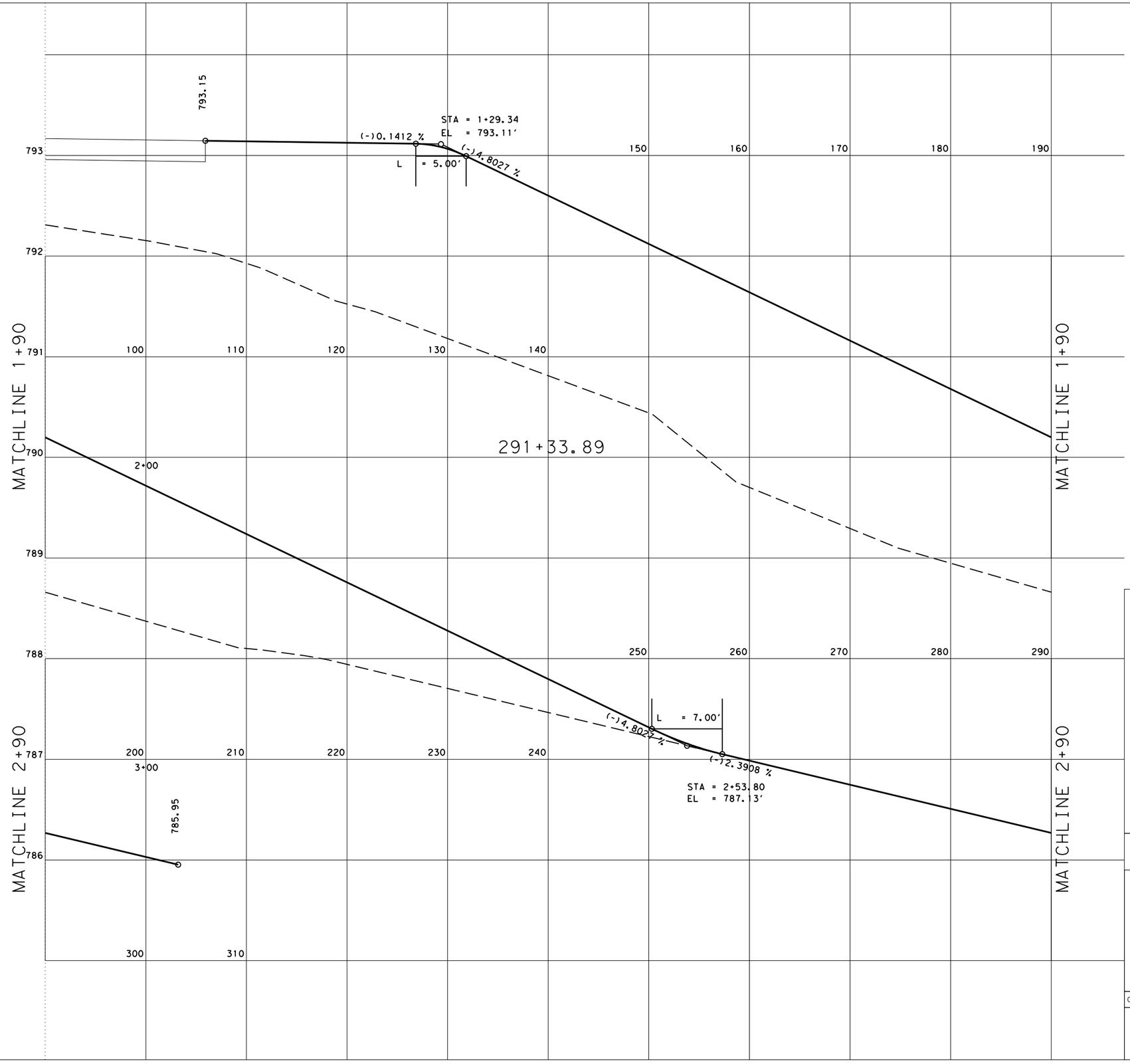
SHEET 17 OF 19

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		93



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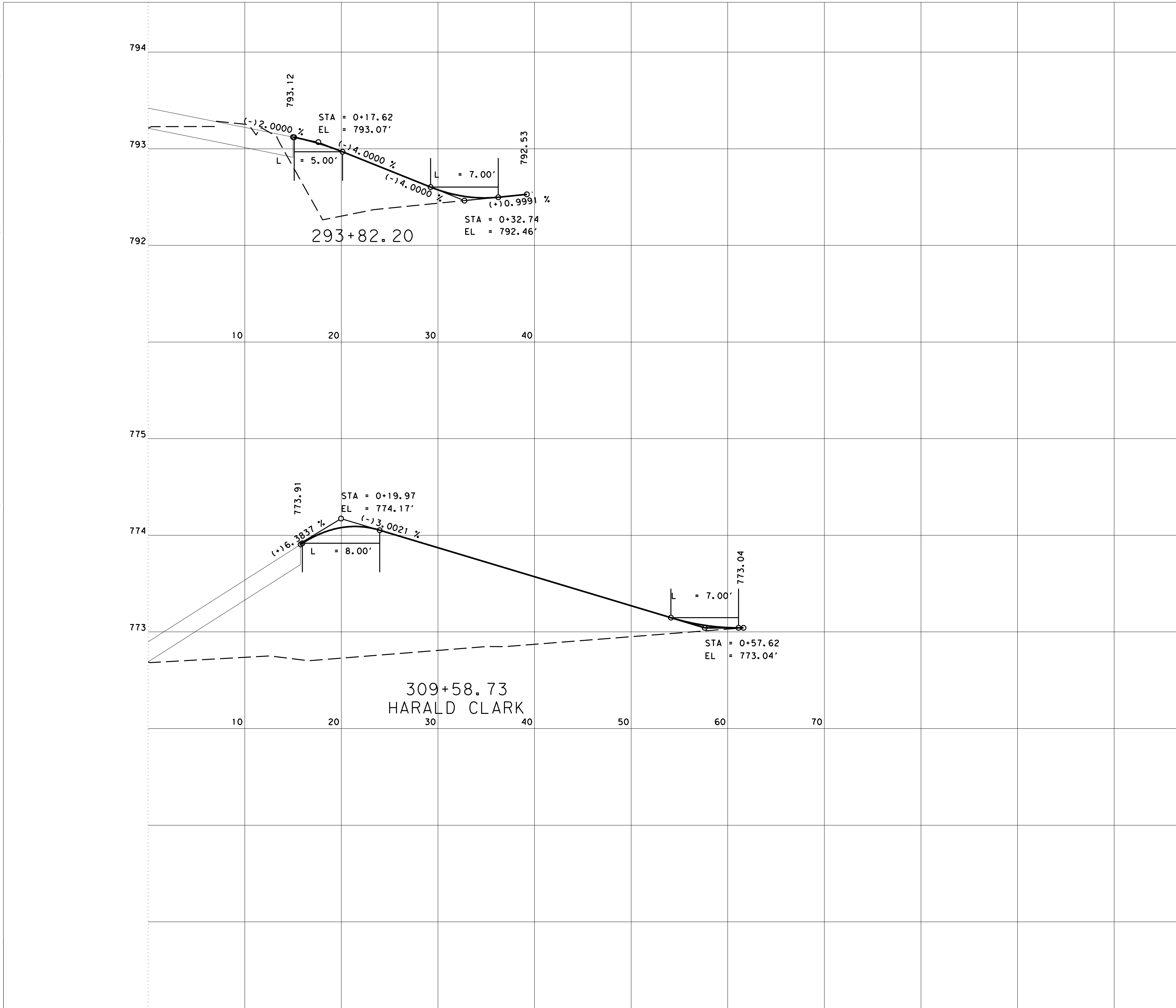
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		94



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SHEET 19 OF 19

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	95

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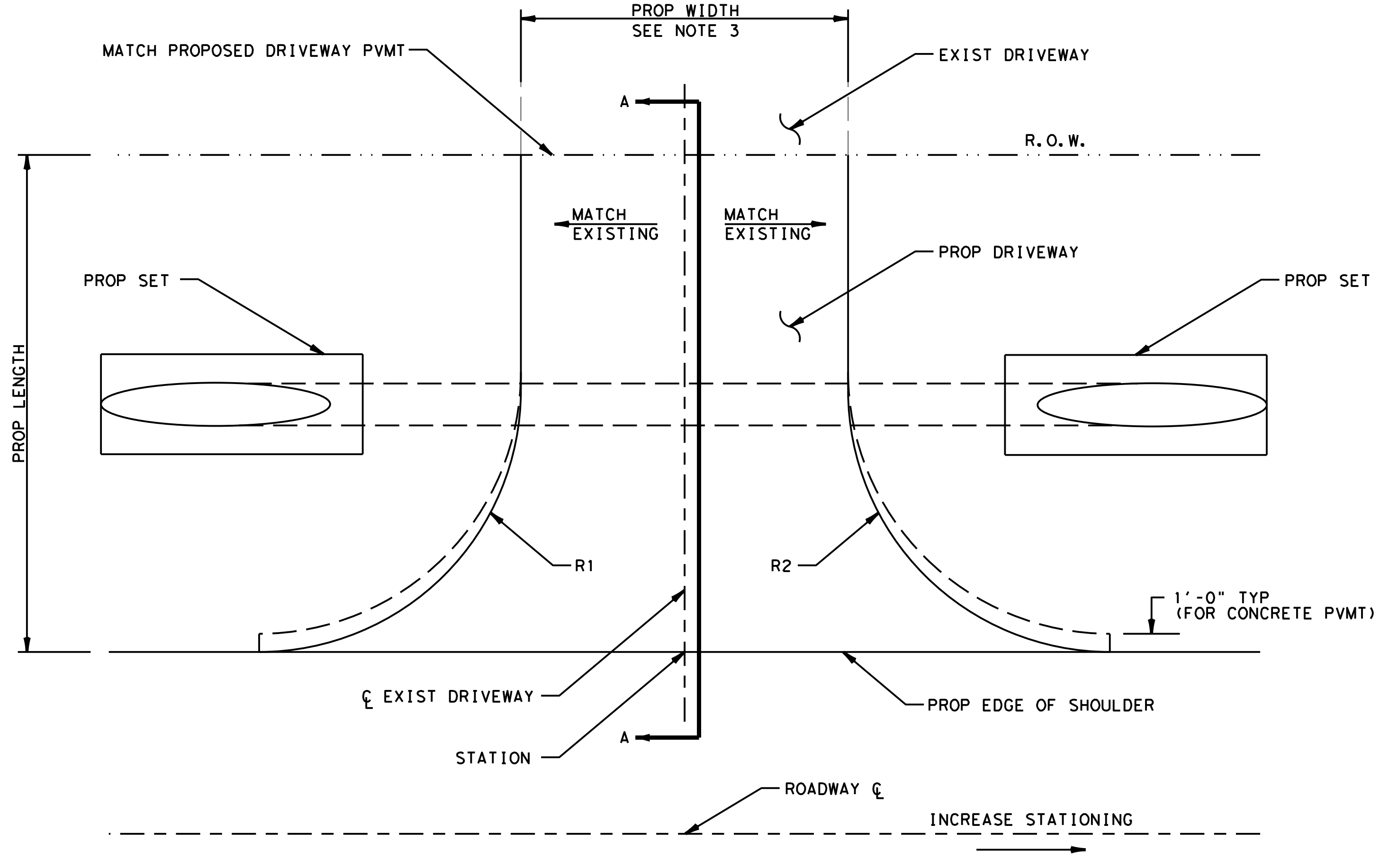
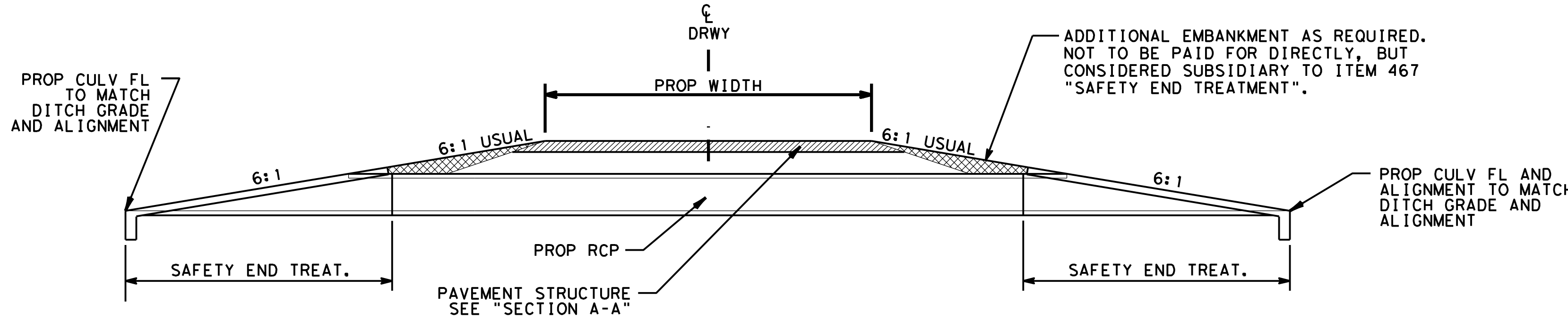


DRIVEWAYS

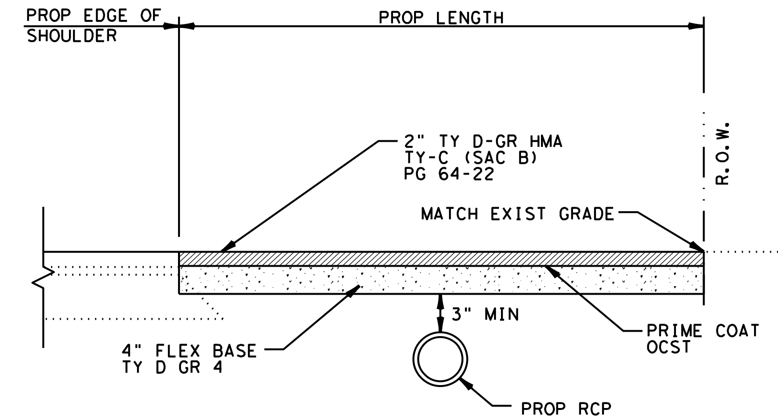
(NOT TO SCALE)

DRIVEWAYS WILL CONSIST OF: BLADING AND RESHAPING THE SUBGRADE, WORKING DITCH SLOPES UPSTREAM AND DOWNSTREAM TO ALLOW POSITIVE DRAINAGE OF ADJACENT DITCHES, PROVIDING ADDITIONAL EMBANKMENT NECESSARY TO ACHIEVE PROPER SUBGRADE WIDTH, PLACEMENT OF 4" FLEX BASE, PRIME, OCST AND 2" TY C ACP OR EMBANKMENT (TY B) AND 6" CL "A" CONCRETE. SEE SECTION A-A FOR DETAILS. ALL WORK IS CONSIDERED SUBSIDIARY TO ITEM 530.



DRIVEWAY TYPICAL SECTION

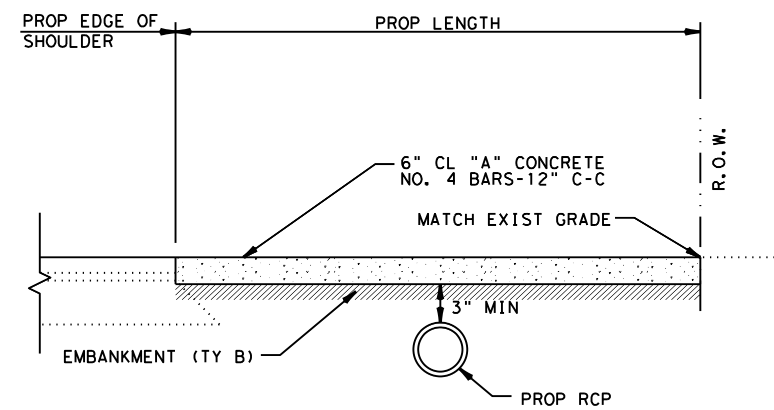
(NOT TO SCALE)



SECTION A-A

(ASPHALT)

(NOT TO SCALE)



SECTION A-A

(CONCRETE)

(NOT TO SCALE)

NOTES:

1. SAW CUT JOINT AT LIMIT OF ROW LINE ON DRIVEWAYS WITH AN EXISTING CONCRETE OR ASPHALT SURFACE
2. SEE PLAN LAYOUTS AND DRIVEWAY QUANTITIES FOR ADDITIONAL DETAILS & DIMENSIONS.
3. MINIMUM DRIVEWAY WIDTH IS 16' FOR DRIVEWAY RECONSTRUCTION. IF EXISTING DRIVEWAY WIDTH AT ROW LINE IS LESS THAN 16', THEN TAPER THE PROPOSED DRIVEWAY WIDTH 5' FROM ROW TO EXISTING DRIVEWAY WIDTH AT ROW.
4. FINAL PAVEMENT SURFACE FOR DRIVEWAY WILL BE CONSTRUCTED WITH FINAL ROADWAY SURFACE. ALL WORK WILL BE PAID UNDER ITEM 530.
5. ADDITIONAL GRADING OF DITCHES ADJACENT TO DRIVEWAY PIPE MAY BE REQUIRED TO PLACE PIPE AT PROPER DEPTH BELOW PROPOSED DRIVEWAY AND MAINTAIN POSITIVE DRAINAGE.
6. REMOVAL OF EXISTING CONCRETE, ASPHALT AND GRAVEL DRIVEWAY IS SUBSIDIARY TO ITEM 530.

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DRIVEWAY DETAILS

(NOT TO SCALE)

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	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	96

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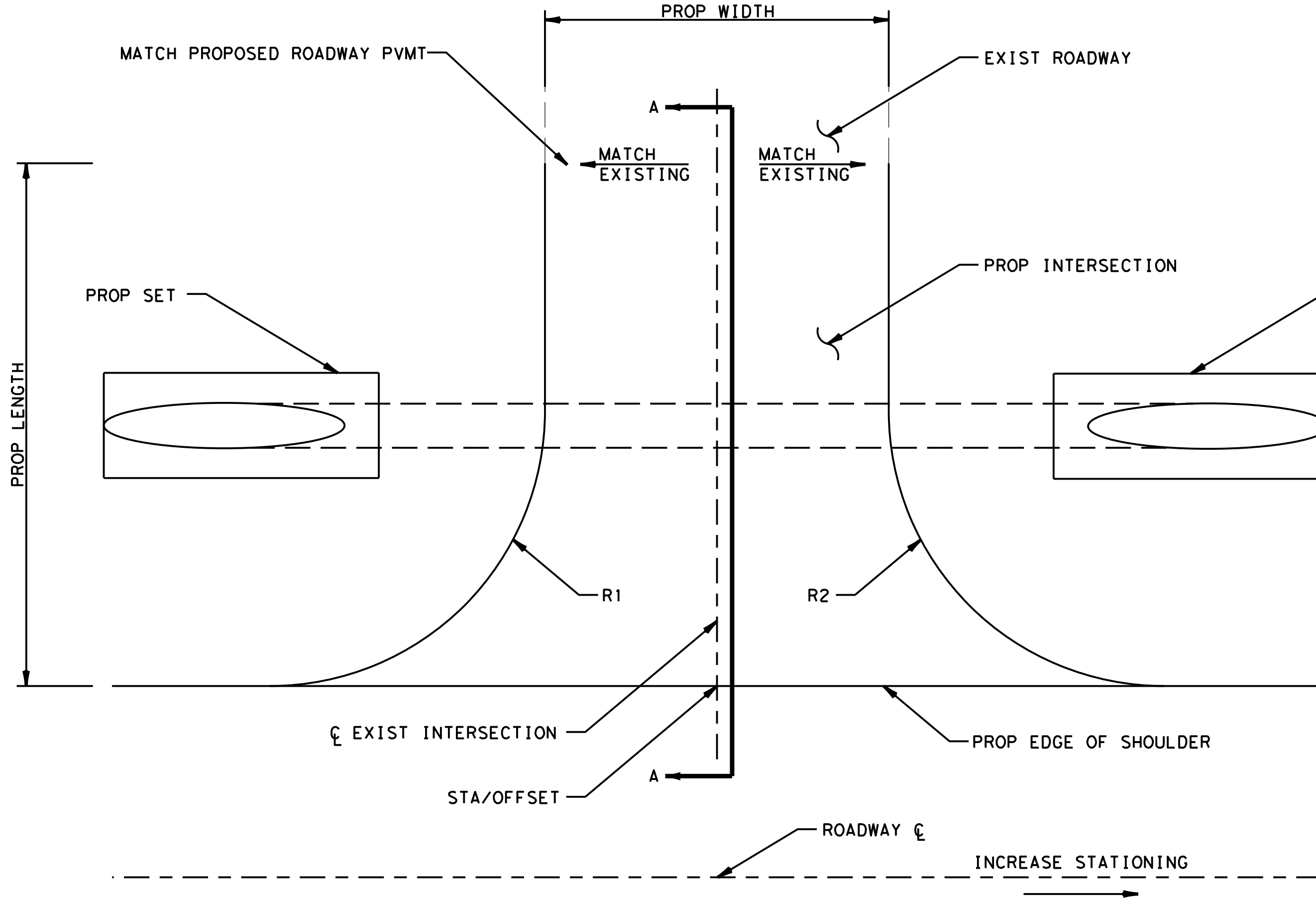
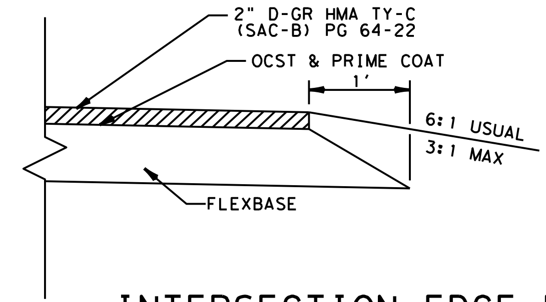
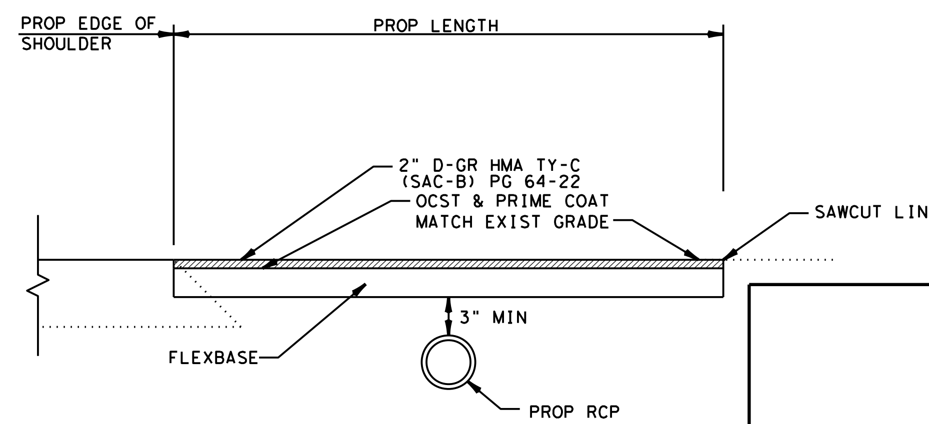


INTERSECTION
(NOT TO SCALE)

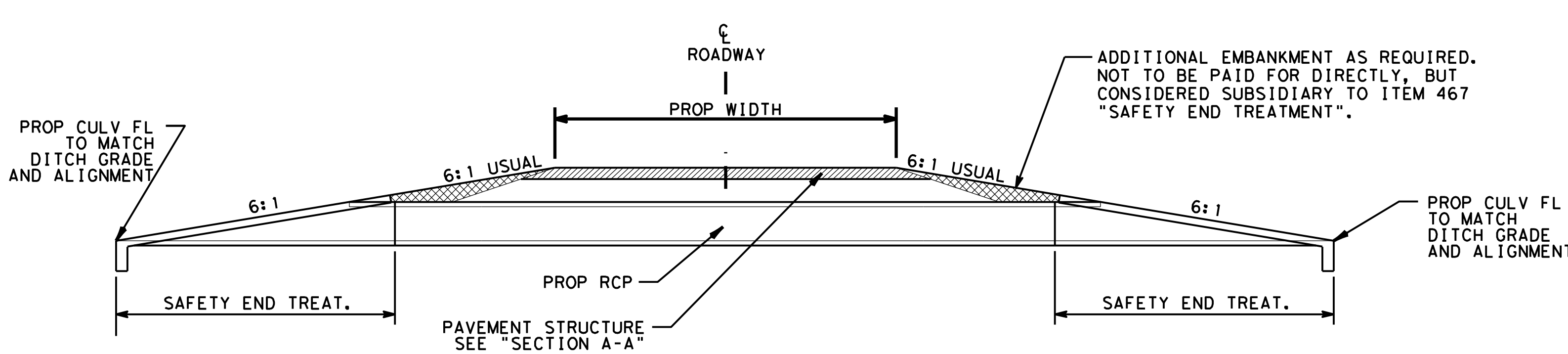
INTERSECTIONS WILL CONSIST OF: BLADING AND RESHAPING THE SUBGRADE, WORKING DITCH SLOPES UPSTREAM AND DOWNSTREAM TO ALLOW POSITIVE DRAINAGE OF ADJACENT DITCHES, PROVIDING ADDITIONAL EMBANKMENT NECESSARY TO ACHIEVE PROPER SUBGRADE WIDTH, PLACEMENT OF 6" TY D GR1-2 FLEXBASE, AND 2" TY C ACP. SEE SECTION A-A FOR DETAILS. ALL WORK IS CONSIDERED SUBSIDIARY TO ITEM 530.



INTERSECTION EDGE DETAILS
(NOT TO SCALE)



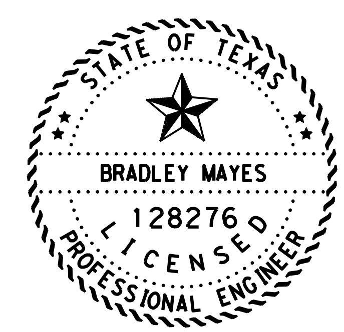
SECTION A-A
(NOT TO SCALE)



INTERSECTION TYPICAL SECTION
(NOT TO SCALE)

NOTES:

1. SAW CUT JOINT AT LIMIT OF PAY LINE ON INTERSECTION WITH AN EXISTING CONCRETE OR ASPHALT SURFACE.
2. SEE PLAN LAYOUTS AND INTERSECTION QUANTITIES FOR ADDITIONAL DETAILS & DIMENSIONS.
3. MINIMUM INTERSECTION WIDTH IS 24' FOR INTERSECTION RECONSTRUCTION. MATCH EXISTING WIDTH FOR INTERSECTION THAT IS TO BE RESURFACED.
4. FINAL PAVEMENT COURSE FOR INTERSECTIONS WILL BE CONSTRUCTED WITH FINAL ROADWAY SURFACE. ALL WORK WILL BE PAID UNDER ITEM 530.
5. ADDITIONAL GRADING OF DITCHES ADJACENT TO INTERSECTION PIPE MAY BE REQUIRED TO PLACE PIPE AT PROPER DEPTH BELOW PROPOSED DRIVEWAY AND MAINTAIN POSITIVE DRAINAGE.
6. REMOVAL OF EXISTING ASPHALT INTERSECTION PAVEMENT IS SUBSIDIARY TO ITEM 530.



Bradley Mayes 8/28/2021

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INTERSECTION DETAILS

(NOT TO SCALE)

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
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	TEXAS	WAC		BELL	97

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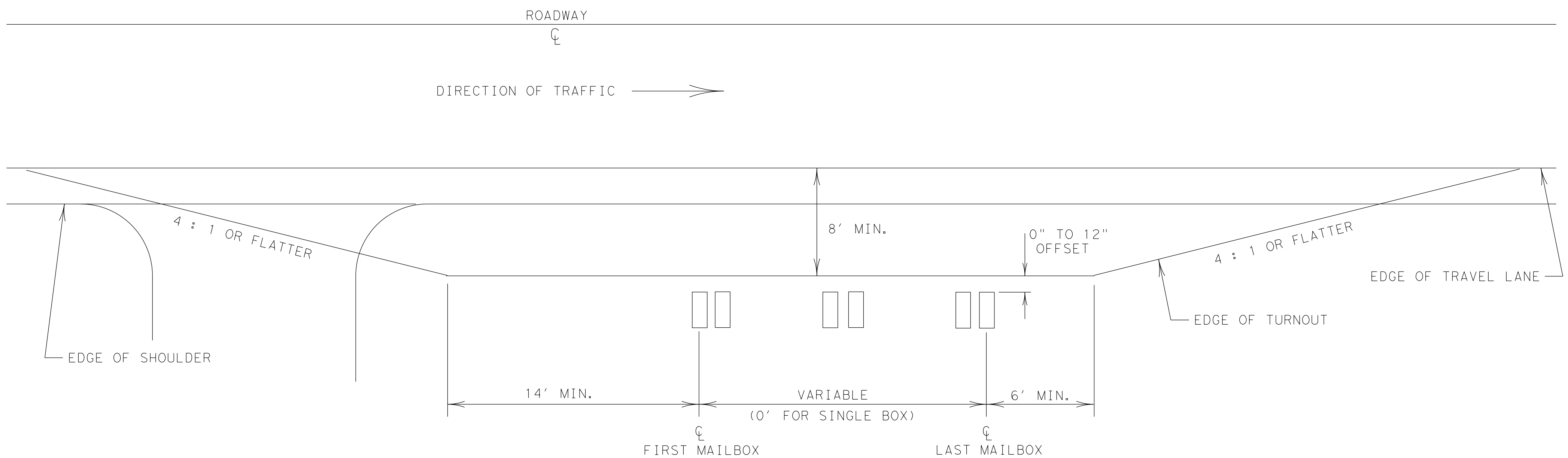
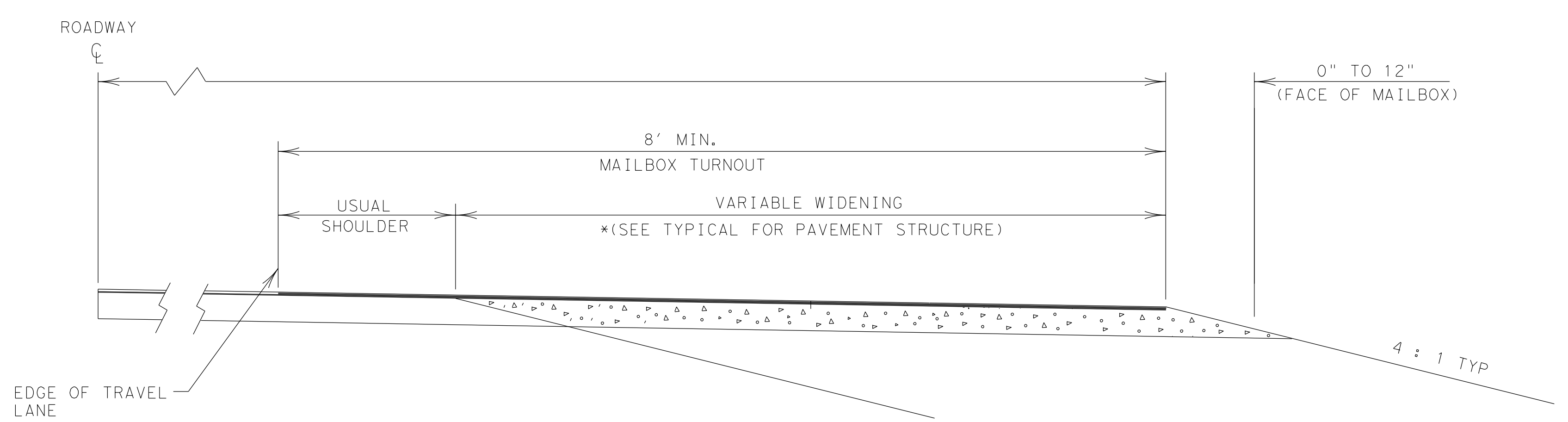
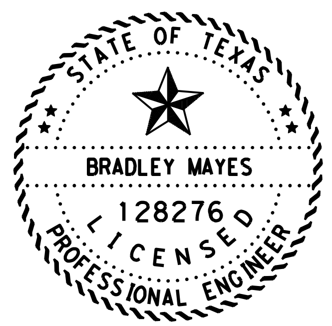


PLAN



TYPICAL SECTION

* MAILBOX TURNOUTS TO BE PAID FOR UNDER REGULAR ROADWAY ITEMS.



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MAILBOX TURNOUT

(NOT TO SCALE)

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
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	TEXAS	WAC	BELL		98

DATE: 8/28/2021
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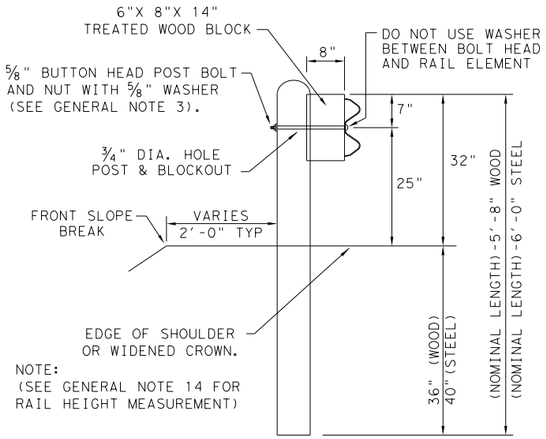
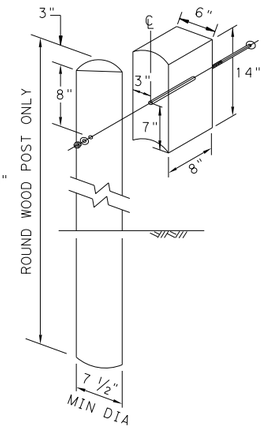
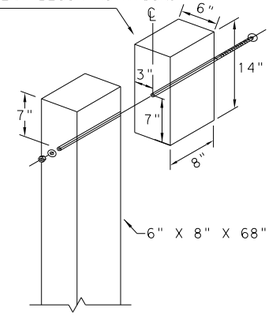


TYPICAL POST PLACEMENT

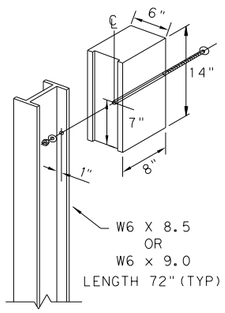


WOOD BLOCK TO
ROUND WOOD POST

NOTE: TOENAIL WITH ONE 16D GALV. NAIL TO PREVENT BLOCK ROTATION.

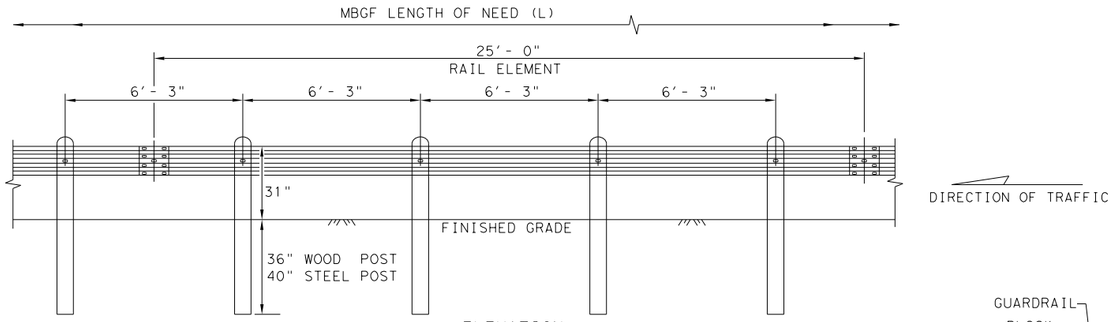


WOOD BLOCK TO
RECTANGULAR WOOD POST



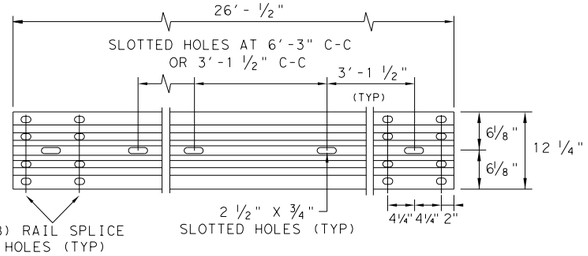
ROUTED WOOD BLOCK
TO I-BEAM STEEL POST

NOTE: ✳✳ "WOOD" INDICATES DIMENSIONS FOR BOTH ROUND AND RECTANGULAR WOOD POST SYSTEMS.



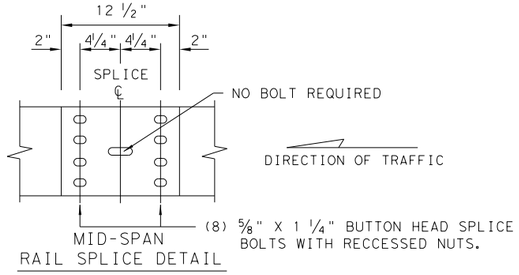
ELEVATION
MID-SPAN RAIL SPLICE

SHOWING A 25'- 0" SECTION OF W-BEAM RAIL. (SEE GENERAL NOTE 2)



ELEVATION 25'- 0"(NOM.) W-BEAM SECTION

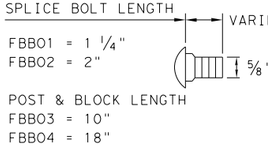
NOTES: SEE GENERAL NOTE 2 FOR ALLOWABLE RAIL TYPES.
SEE RAIL SPLICE DETAIL FOR REQUIRED HARDWARE.



MID-SPAN
RAIL SPLICE DETAIL

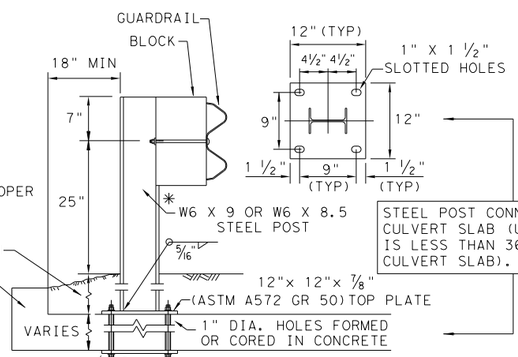
NOTE: GF(31), MID-SPAN RAIL SPLICES ARE REQUIRED WITH 6'-3" POST SPACINGS.

NOTE:
FOUR TYPES OF BUTTON-HEAD GUARD RAIL BOLTS COME WITH A RECCESSED NUT.



BUTTON HEAD BOLT

NOTE: SEE GENERAL NOTE 3 FOR SPLICE & POST BOLT DETAILS.



STEEL POST CONNECTION TO CULVERT SLAB (USE WHEN THERE IS LESS THAN 36" COVER OVER CULVERT SLAB).

LOW FILL CULVERT POST

NOTE: TWO INSTALLATION OPTIONS.

1. BOLT-THROUGH OPTION: REQUIRES A 6" MIN. SLAB THICKNESS. ⅞" DIA (ASTM A449) HEAVY HEX BOLTS WITH TWO HARDENED WASHER EACH AND HEAVY HEX NUTS.
   NOTE: BOLT LENGTH = SLAB PLUS 2 ¼" MIN.

2. EPOXY ANCHOR OPTION: THIS OPTION MAY ONLY BE USED IF THE CULVERT SLAB IS 9" MIN. THICK. THREADED ANCHOR RODS MUST BE ⅞" DIA. ASTM A449 OR A193 GRADE B7 WITH HEAVY HEX NUT, AND ONE HARDENED WASHER EACH. EMBED ANCHOR RODS 6" WITH HILTI HIT RE 500 EPOXY ADHESIVE. OTHER TYPE III CLASS C EPOXY ADHESIVES MEETING THE REQUIREMENTS OF DMS-6100, "EPOXIES AND ADHESIVES", MAY BE USED IF IT CAN BE DEMONSTRATED THAT THEY MEET OR EXCEED THE STRENGTH OF HILTI HIT RE 500 WITH THE SAME EMBEDMENT DEPTH AND THREADED ROD DIA. FOLLOW THE MANUFACTURER'S REQUIREMENTS FOR INSTALLING EPOXIED THREADED RODS. EXTEND RODS ¼" MIN. BEYOND NUT.

NOTE: CULVERTS OF 25 FT. OR LESS, SEE GF(31)LS STANDARD FOR "LONG SPAN" OPTION.

NOTE: TRANSISTIONS TO BRIDGE RAILS OR TRAFFIC BARRIERS.
SEE GF(31)TL3 TR STANDARD FOR HIGH-SPEED TL-3 TRANSITIONS.
SEE GF(31)TL2 TR STANDARD FOR LOW-SPEED TL-2 TRANSITIONS.

GENERAL NOTES

1. THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST, OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. THE EXACT POSITION OF MBGF SHALL BE SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. STEEL POSTS TO BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING."
2. RAIL ELEMENTS SHALL MEET THE REQUIREMENTS OF ITEM 540,"METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED IN THE PLANS. THE CONTRACTOR MAY FURNISH RAIL ELEMENTS OF 25'- 0", OR 12'- 6" (NOM.) LENGTHS. RAIL ELEMENTS MAY HAVE SLOTTED HOLES AT 3'-1 ½" C-C OR 6'-3" C-C. A SPECIAL LENGTH OF RAIL MAY BE MANUFACTURED TO ACCOMMODATE THE DOWNSTREAM ANCHOR TERMINAL (DAT) AND THE TRANSITION SECTIONS OF GUARDRAIL.
3. BUTTON HEAD "POST BOLTS & NUTS" SHALL MEET THE REQUIREMENTS OF (ASTM A307), AND SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT AND ⅝" WASHER (FWC16a) AND NOT MORE THAN 1" BEYOND IT. TRIM REMAINING BOLT LENGTH TO MEET REQUIRED LENGTH.
4. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445,"GALVANIZING." FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
5. CROWN SHALL BE WIDENED TO ACCOMMODATE THE METAL BEAM GUARD FENCE.
6. THE LATERAL APPROACH TO THE GUARD FENCE, SHALL HAVE A MAXIMUM SLOPE OF 1V:10H.
7. IF SHOWN ELSEWHERE IN THE PLANS OR AS DIRECTED BY THE ENGINEER, THE GUARD FENCE MAY BE FLARED AT A RATE OF 25:1 OR FLATTER.
8. UNLESS OTHERWISE SHOWN IN THE PLANS, GUARD FENCE PLACED IN THE VICINITY OF CURBS SHALL BE POSITIONED SO THAT THE FACE OF CURB IS LOCATED DIRECTLY BELOW OR BEHIND THE FACE OF THE RAIL. RAIL PLACED OVER CURBS SHALL BE INSTALLED SO THAT THE POST BOLT IS LOCATED APPROXIMATELY 25 INCHES ABOVE THE GUTTER PAN OR EDGE OF SHOULDER.
9. APPLICATIONS IN SOLID ROCK ARE ONLY ALLOWED WITH STEEL POSTS. IF SOLID ROCK IS ENCOUNTERED WITHIN 0 TO 18" OF THE FINISHED GRADE, DRILL A 24" DIA. HOLE, 24" INTO THE ROCK. IF SOLID ROCK IS ENCOUNTERED BELOW 18", DRILL A 12" DIA. HOLE, 12" INTO THE ROCK OR TO THE STANDARD EMBEDMENT DEPTH, WHICHEVER MAYBE LESS. ANY EXCESS POST LENGTH, AFTER MEETING THESE DEPTHS, MAY BE FIELD CUT TO ENSURE PROPER GUARDRAIL MOUNTING HEIGHT. BACKFILL WITH COARSE AGGREGATE MATERIAL.
10. POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
11. SPECIAL FABRICATION WILL BE REQUIRED AT INSTALLATION LOCATIONS HAVING A CURVATURE OF LESS THAN 150 FT. RADIUS.
12. UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210,"COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. THE CONSTRUCTION DIVISION, TXDOT MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210 ONLY PRODUCERS ON THE MPL MAY FURNISH COMPOSITE MATERIAL BLOCKS.
13. FOR THE LOW FILL CULVERT OPTION, POSTS LOCATED PARTIALLY OR WHOLLY BETWEEN PRECAST BOX CULVERT UNITS, THE USE OF A CAST-IN-PLACE CONCRETE CLOSURE BETWEEN BOXES IS REQUIRED. THE LENGTH OF THE CAST-IN-PLACE CONCRETE CLOSURE SHALL ACCOMMODATE THE PLACEMENT OF THE LOW FILL CULVERT OPTION. SEE CONCRETE CLOSURE DETAILS ON BRIDGE STANDARD SCP-MD.
14. GUARDRAIL HEIGHT MEASUREMENT: WHEN THE GUARDRAIL IS LOCATED ABOVE PAVEMENT, MEASURE THE HEIGHT FROM THE PAVEMENT TO THE TOP OF THE W-BEAM RAIL. WHEN THE GUARDRAIL IS LOCATED UP TO 2 FT. OFF OF THE EDGE OF PAVEMENT OR FOR A PAVEMENT OVERLAY, USE A 10-FOOT STRAIGHTEDGE TO EXTEND THE PAVEMENT/SHOULDER SLOPE TO THE BACK OF RAIL, MEASURE FROM THE BOTTOM OF STRAIGHTEDGE TO THE TOP OF RAIL. FOR GUARDRAIL LOCATED DOWN A 10:1 SLOPE, MEASURE FROM THE NOMINAL TERRAIN.

Texas Department of Transportation

Design Division Standard

METAL BEAM GUARD FENCE
TL-3 MASH COMPLIANT
GF(31)-19

FILE: gf3119.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG
©TxDOT: NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		99

DATE: 8/28/2021
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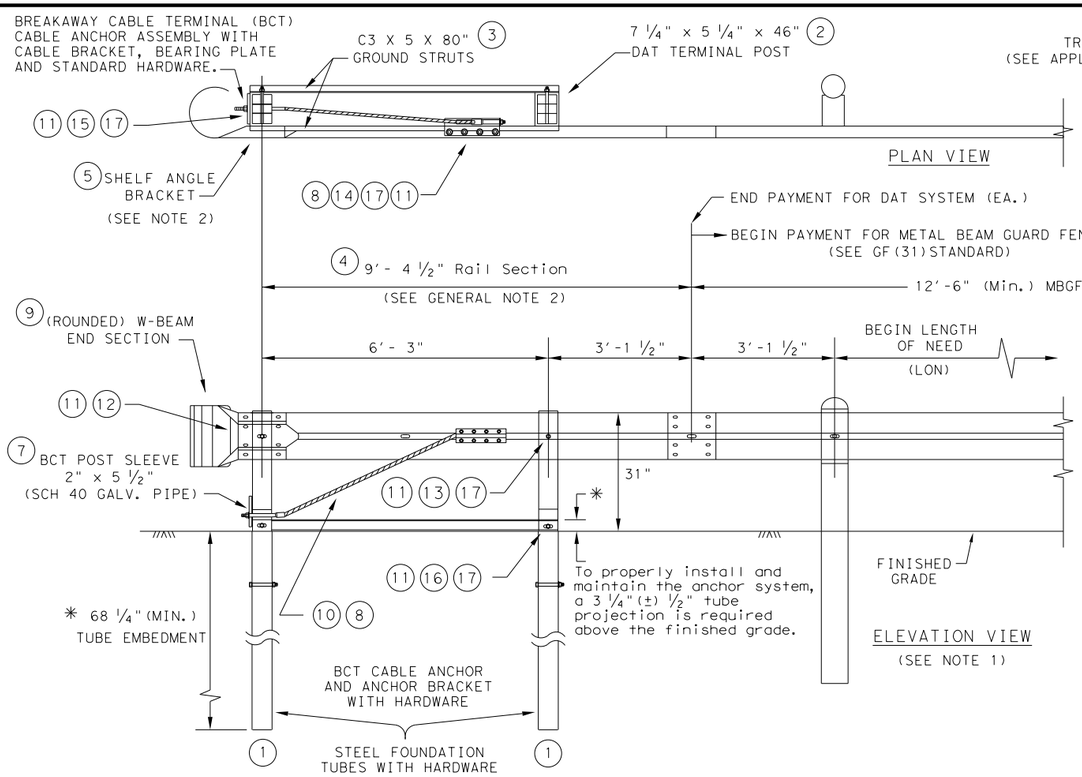


DOWNSTREAM ANCHOR TERMINAL (DAT)

NOTE: ONLY FOR DOWNSTREAM USE, WHEN LOCATED OUTSIDE THE HORIZONTAL CLEARANCE AREA OF OPPOSING TRAFFIC.

GENERAL NOTES

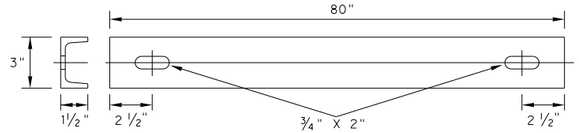
1. THE DETAIL SHOWN IS THE MINIMUM LENGTH OF NEED (LON) FOR A DOWNSTREAM ANCHOR TERMINAL (DAT) CONNECTED TO A CONCRETE RAIL.
2. THE RAIL SECTION AT THE END POST IS SUPPORTED BY THE SHELF ANGLE BRACKET. THE RAIL ELEMENT IS NOT ATTACHED TO THE END POST.
3. THE FOUNDATION TUBES SHALL NOT PROJECT MORE THAN 3 3/4" ABOVE THE FINISHED GRADE.
4. ALL HARDWARE FOR DAT SHALL BE ASTM A307 UNLESS OTHERWISE SHOWN.
5. REFER TO GF(31) SHEET FOR TERMINAL CONNECTION DETAILS.

MOW STRIP INSTALLATION

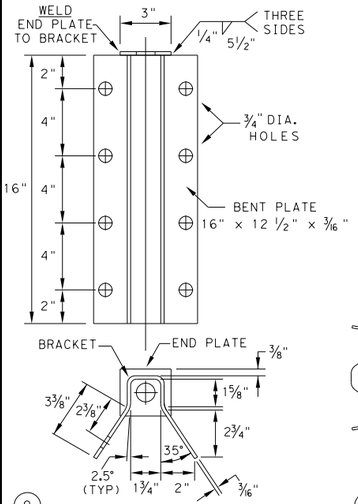
IF A MOW STRIP IS REQUIRED WITH THE DAT INSTALLATION THE LEAVE-OUT AREA AROUND THE STEEL FOUNDATION TUBES AND THE TWO CHANNEL STRUTS MAY BE OMITTED. THIS WILL REQUIRE A FULL POUR AT THE FOUNDATION TUBES.

#	(DAT) PARTS LIST	QTY
(1)	STEEL FOUNDATION TUBE	2
(2)	DAT TERMINAL POST	2
(3)	CHANNEL STRUT	2
(4)	TERMINAL RAIL ELEMENT	1
(5)	SHELF ANGLE BRACKET	1
(6)	BCT BEARING PLATE	1
(7)	BCT POST SLEEVE	1
(8)	GUARDRAIL ANCHOR BRACKET	1
(9)	(ROUNDED)W-BEAM END SECTION	1
(10)	BCT CABLE ANCHOR	1
(11)	RECESSED NUT, GUARDRAIL	20
(12)	1 1/4" BUTTON HEAD BOLT	4
(13)	10" BUTTON HEAD BOLT	2
(14)	5/8" X 2" HEX HEAD BOLT	8
(15)	5/8" X 8" HEX HEAD BOLT	4
(16)	5/8" X 10" HEX HEAD BOLT	2
(17)	5/8" FLAT WASHER	18

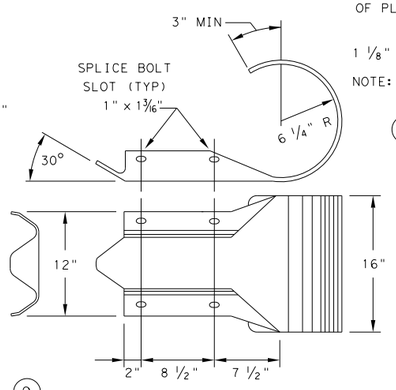
(4) TERMINAL RAIL ELEMENT FOR DAT



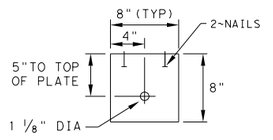
(3) CHANNEL STRUT
C3 X 5 X 80", GRADE A36



(8) GUARDRAIL ANCHOR BRACKET

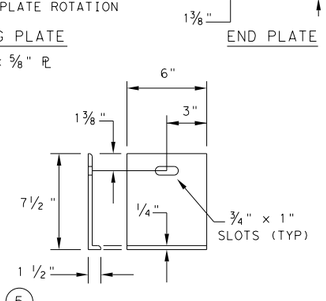


(9) W-BEAM END SECTION (ROUNDED) (12 GA.)

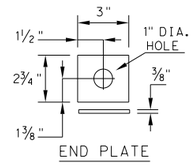


NOTE: DRIVE NAILS AND BEND OVER TO PREVENT PLATE ROTATION

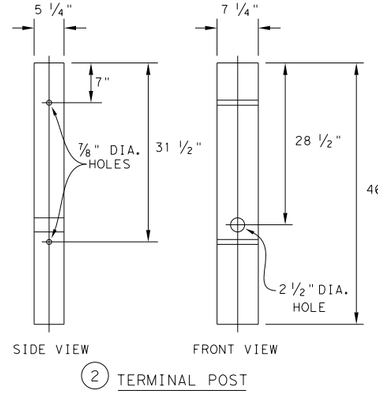
(6) BEARING PLATE
8"x 8"x 5/8" PL



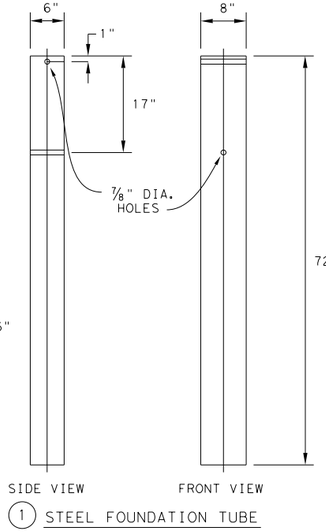
(5) SHELF ANGLE BRACKET



END PLATE



(2) TERMINAL POST
7 1/4"x 5 1/4"x 46" WOOD POST



(1) STEEL FOUNDATION TUBE
6"x 8"x 1/8" x 72" STEEL TUBE

Texas Department of Transportation

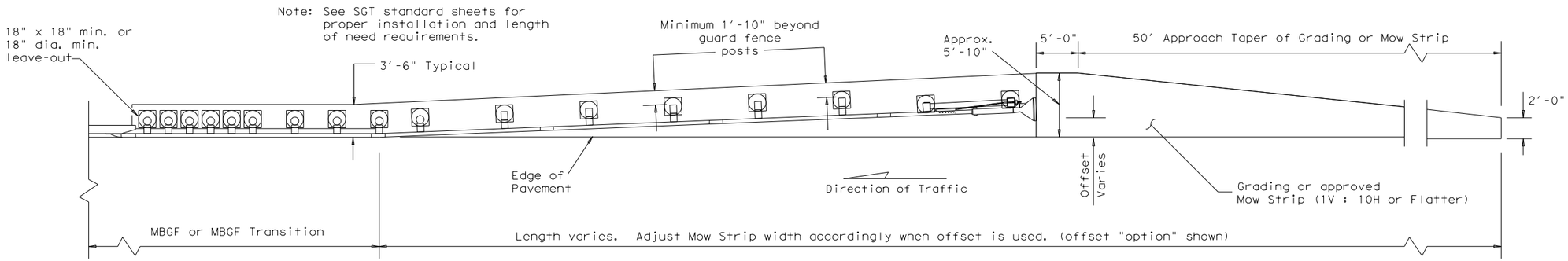
Design Division Standard

METAL BEAM GUARD FENCE
(DOWNSTREAM ANCHOR TERMINAL)
TL-3 MASH COMPLIANT

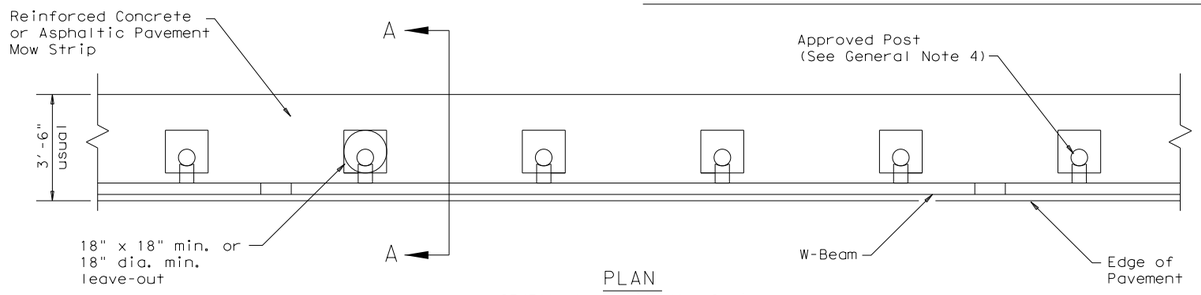
GF(31)DAT-19

FILE: gf31dat19.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG
©TxDOT: NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		100

DATE: 8/28/2021
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\2038010314 - Design\Plan Set\3. Roadway\Standards\gf31ms19.dgn

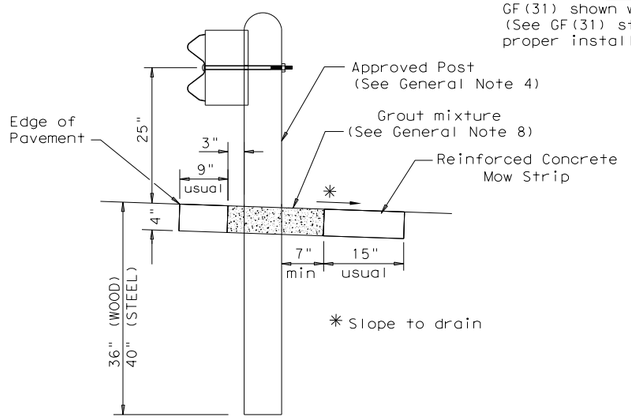


GRADING AND MOW STRIP AT GUARDRAIL END TREATMENTS



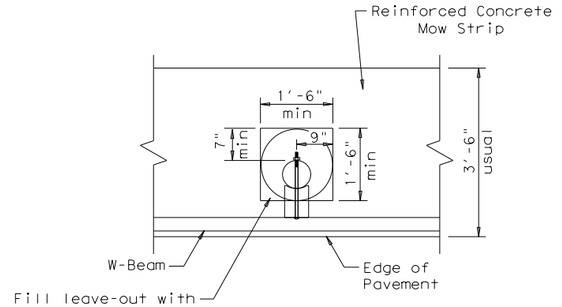
PLAN

GF(31) shown with Mow Strip
(See GF(31) standard sheet for proper installation)



SECTION A-A

Typical



MOW STRIP DETAIL

Reinforced Concrete Mow Strip with 18" x 18" Square or 18" Dia. minimum leave-out.

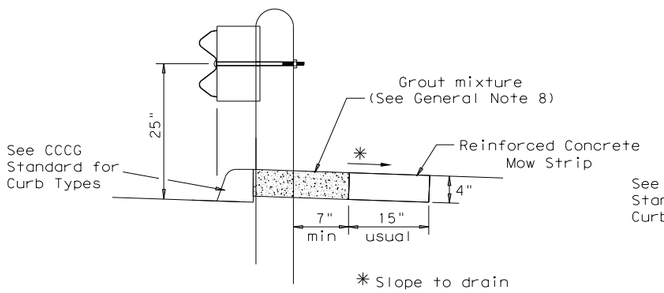
Note: Site Condition(s)

Site conditions may exist where grading is required for the proper installation of metal guard fence and end treatments.

Approach grading or mow strip may be decreased or eliminated, as directed by the Engineer.

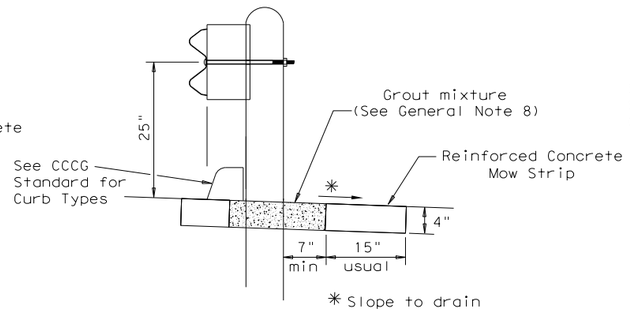
GENERAL NOTES

1. This mow strip design is for use with metal beam guard fence, guard fence transitions, and guard fence end treatments. See applicable GF(31) MBGF or GF(31) Transition Standard sheet for additional information.
2. Mow strips shall be reinforced concrete with (wire mesh or synthetic fiber), as shown on the plans and will be paid for under the pertinent bid item. Reinforced concrete shall be placed in accordance with Item 432, "Riprap." The use of the synthetic fiber in lieu of steel reinforcing is acceptable, provided the fiber producer is on the Department Material Producer List (MPL), maintained by TxDOT, Construction Division.
3. The leave-out behind the post shall be a minimum of 7".
4. Only steel (W6 x 8.5 or W6 x 9.0), or 7 ½" Dia. round wood posts are acceptable for use in the mow strip. See GF(31) Standard for additional details.
5. Other curb placement options may be used. Curbs are not considered part of the mow strip and will be paid for under other pertinent bid item.
6. Thickness of the mow strip will be 4".
7. The limits of payment for reinforced concrete will include leave-outs for the posts.
8. The leave-outs shall be filled with a Grout mixture consisting of: 2719 pounds sand, 188 pounds Type 1 or II cement, and 550 pounds of water per cubic yard, with a 28-day compressive strength of approximately 230 psi or less. Provide grout with a consistency that will flow into and completely fill all voids. Due to auger size, larger leave-out dimensions are acceptable from both an impact performance and maintenance repair standpoint (Suggested Maximum leave-out of 20"). Payment for furnishing and placing the grout mixture will be subsidiary to the pay item of riprap mow strip.



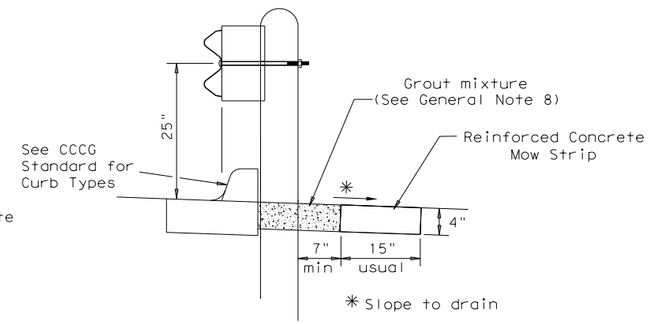
CURB OPTION (1)

This option will increase the post embedment throughout the system.



CURB OPTION (2)

Curb shown on top of mow strip



CURB OPTION (3)

Texas Department of Transportation

Design Division Standard

METAL BEAM GUARD FENCE (MOW STRIP) TL-3 MASH COMPLIANT

GF(31)MS-19

FILE: gf31ms19.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG
©TxDOT: NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		101

DATE: 8/28/2021 5:40:07 PM
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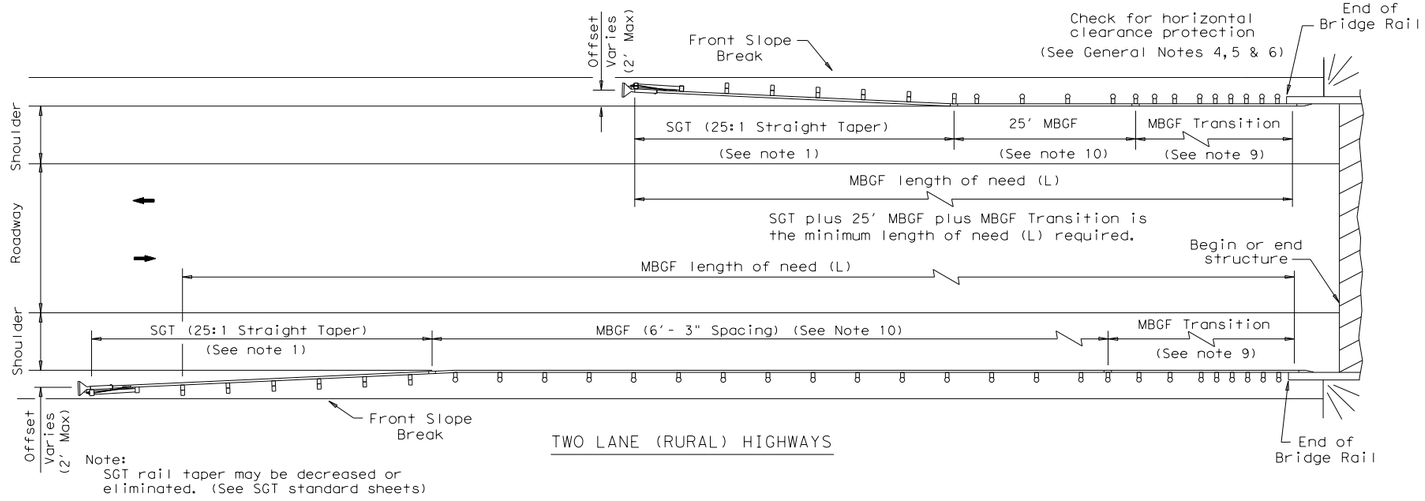
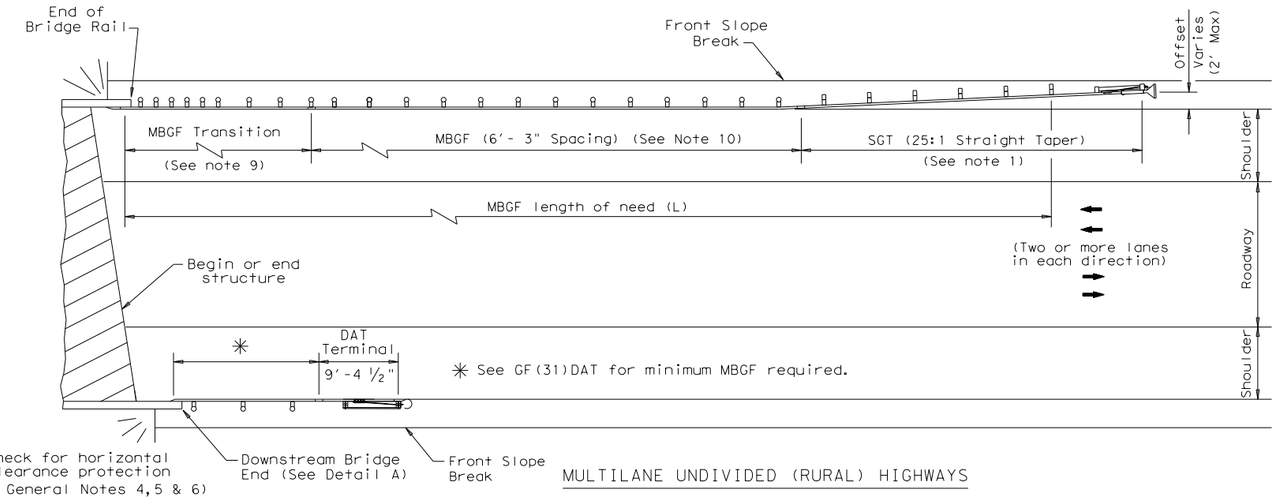
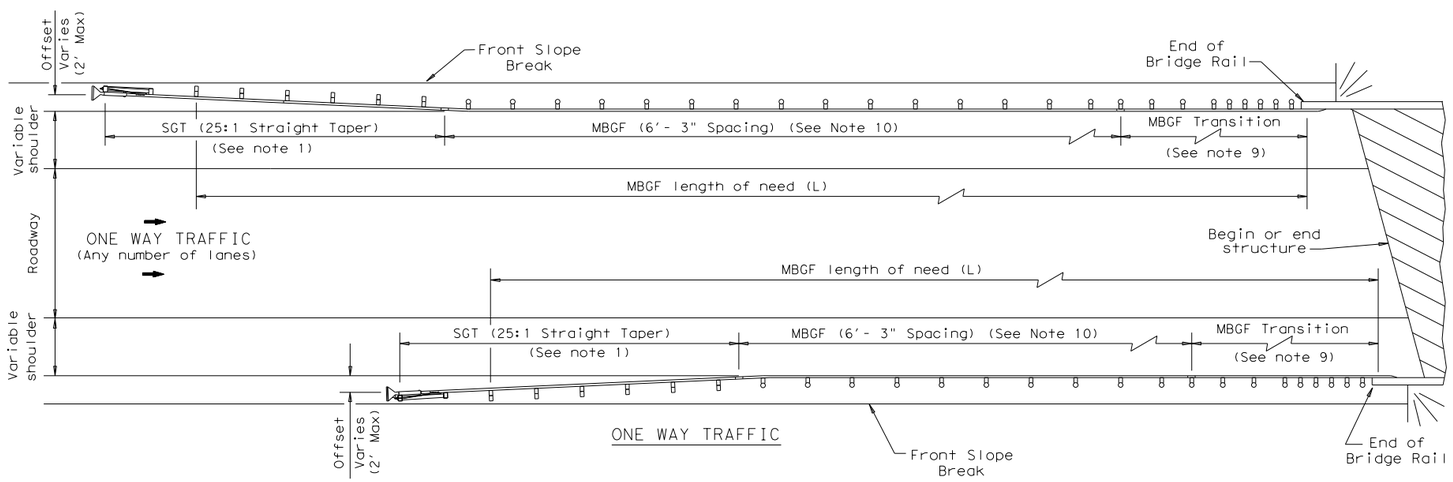


TWO LANE (RURAL) HIGHWAYS

Note:
SGT rail taper may be decreased or eliminated. (See SGT standard sheets)



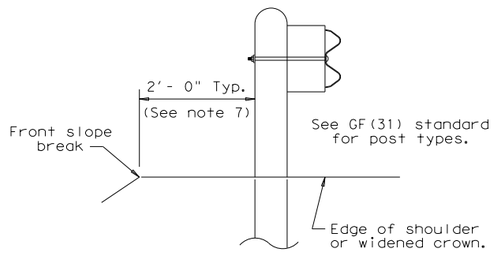
MULTILANE UNDIVIDED (RURAL) HIGHWAYS



ONE WAY TRAFFIC

GENERAL NOTES

1. For more detail: See GF(31), SGT( )31, GF(31)TR, and GF(31)TL2 standard sheets.
2. Quantities of metal beam guard fence (MBGF) at individual bridge ends are as shown in the plans.
3. Use average daily traffic (ADT) for the current year to determine MBGF length of need in accordance with the Roadway Design Manual unless otherwise specified. Where significant traffic volume growth is anticipated on low volume (0-750 ADT) highways, use length determinations for the higher volume category.
4. MBGF may not be required to shield departure end of bridge unless other obstacles within the horizontal clearance limits or opposing traffic indicate a MBGF consideration.
5. Downstream anchor terminals (DAT) are only for downstream end anchorage use, outside the horizontal clearance area of opposing traffic.
6. Direct connection of MBGF to concrete rails are only for downstream rail connections outside the horizontal clearance area of opposing traffic. (This requires a minimum of three standard line posts plus the DAT terminal, See Detail A)
7. The crown shall be widened to accommodate MBGF. Typically the "front slope" break should be 2'- 0" from the back of the MBGF post. This applies to new construction on new alignment or where existing roadway cross section is to be widened to increase roadway width. This does not apply to rehabilitation work where existing roadway crown width is to be retained (See Typical Cross Section at MBGF).
8. For restrictive bridge widths: The MBGF should be properly transitioned from the existing bridge rail to the adjoining MBGF (See MBGF Transition Standards). Metal beam guard fence at these bridge location(s) shall be flared at the rate of 25:1 or flatter, and be of the length necessary to locate the terminal end at the 2 ft. "maximum" offset from the shoulder edge in the approach direction.
9. Transition length and post spacing will vary depending on the transition type. Transition type will be shown elsewhere in the plans.
10. A minimum 25' length of MBGF will be required.



TYPICAL CROSS SECTION AT MBGF

Note:
All rail elements shall be lapped in the direction of adjacent traffic.

DETAIL A
Showing Downstream Rail Attachment

Texas Department of Transportation

Design Division Standard

BRIDGE END DETAILS

(METAL BEAM GUARD FENCE APPLICATIONS TO RIGID RAILS)

BED-14

FILE: bed14.dgn	DN: TxDOT	CK: AM	DW: BD/VP	CK: CGL
©TxDOT: December 2011	CONT	SECT	JOB	HIGHWAY
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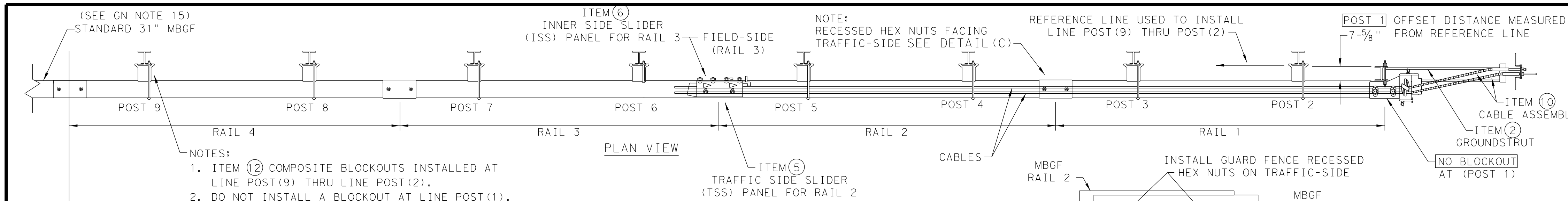
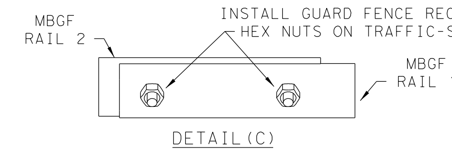
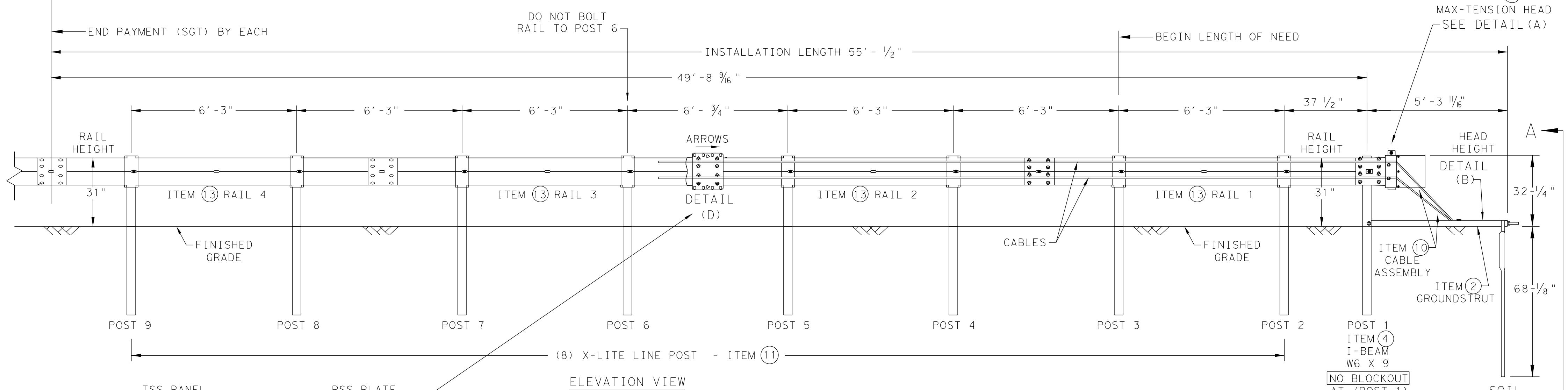
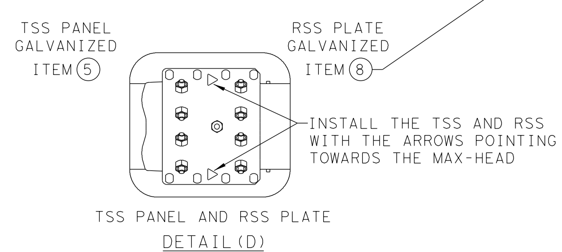
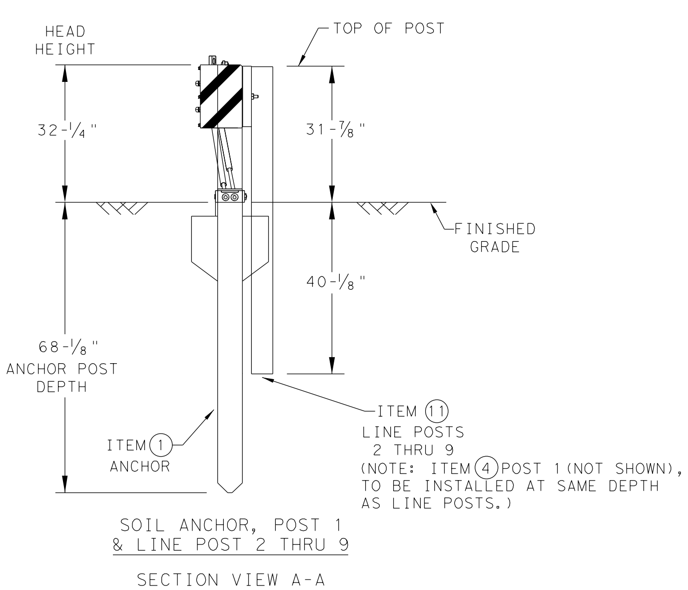
REVISED APRIL 2014 SEE (MEMO 0414)	DIST	COUNTY		SHEET NO.
	WAC	BELL		102

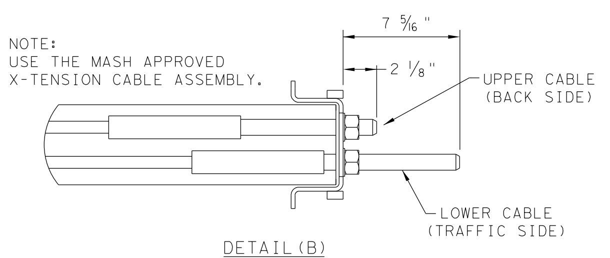


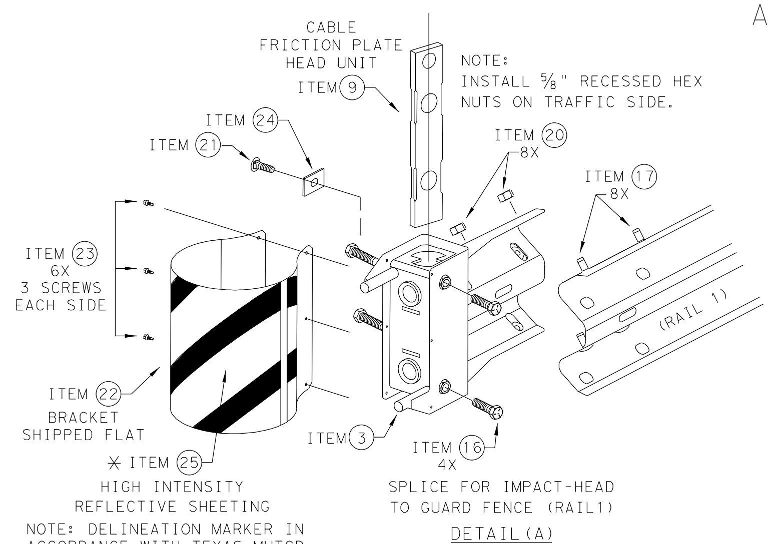


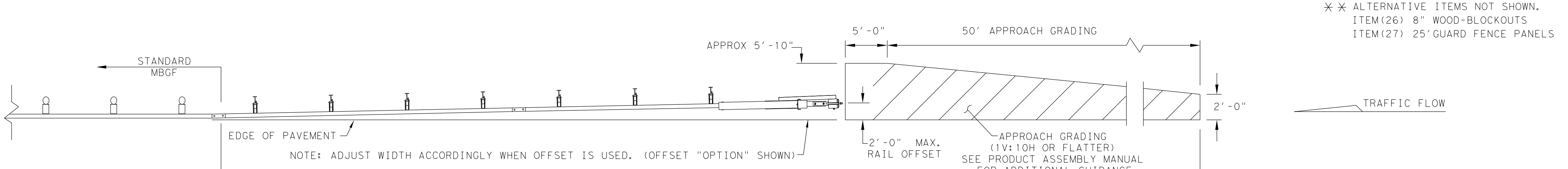












NOTE: TXDOT GENERIC APPROACH GRADING LAYOUT USED FOR ALL TANGENT TYPE END TREATMENTS.

APPROACH GRADING AT GUARDRAIL END TREATMENTS

GENERAL NOTES

1. FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: LINDSAY TRANSPORTATION SOLUTIONS (LTS) - BARRIER SYSTEMS, INC. AT (707) 374-6800
2. FOR INSTALLATION, REPAIR, & MAINTENANCE REFER TO THE; MAX-TENSION INSTALLATION INSTRUCTION MANUAL. P/N MANMAX REV D (ECN 3516).
3. APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" ON THE FRONT FACE OF THE DEVICE PER MANUFACTURE'S RECOMMENDATIONS. OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
4. FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TXDOT'S LATEST ROADWAY MOW STRIP STANDARD.
5. ALL STEEL COMPONENTS ARE GALVANIZED PER ASTM A123 OR EQUIVALENT UNLESS OTHERWISE STATED.
6. SYSTEM SHOWN USING STEEL WIDE FLANGE POST WITH COMPOSITE BLOCKOUTS.
7. COMPOSITE MATERIAL BLOCKOUT THAT MEETS THE REQUIREMENTS OF DMS-7210, MAY BE SUBSTITUTED FOR BLOCKOUTS SIMILAR DIMENSIONS. SEE CONSTRUCTION DIVISION MATERIAL PRODUCER LIST(MPL)FOR CERTIFIED PRODUCERS.
8. REFER TO INSTALLATION MANUAL FOR SPECIFIC PANEL LAPPING GUIDANCE.
9. IF SOLID ROCK IS ENCOUNTERED SEE THE MANUFACTURER'S INSTALLATION MANUAL FOR INSTALLATION GUIDANCE.
10. POSTS SHALL NOT BE SET IN CONCRETE.
11. A DRIVING CAP WITH A TIMBER OR PLASTIC INSERT SHALL BE USED WHEN DRIVING POST TO PREVENT DAMAGE TO THE GALVANIZING ON TOP OF THE POST.
12. MAX-TENSION SYSTEM SHALL NEVER BE INSTALLED WITHIN A CURVED SECTION OF GUARDRAIL.
13. IF A DELINEATION MARKER IS REQUIRED, MARKER SHALL BE IN ACCORDANCE WITH TEXAS MUTCD.
14. THE SYSTEM IS SHOWN WITH 12'-6" MBGF PANELS, 25'-0" MBGF PANELS ARE ALSO ALLOWED.
15. A MINIMUM OF 12'-6" OF 12GA. MBGF IS REQUIRED IMMEDIATELY DOWNSTREAM OF THE MAX-TENSION SYSTEM.

	ITEM#	PART NUMBER	DESCRIPTION	QTY
	1	BSI-1610060-00	SOIL ANCHOR - GALVANIZED	1
	2	BSI-1610061-00	GROUND STRUT - GALVANIZED	1
	3	BSI-1610062-00	MAX-TENSION IMPACT HEAD	1
	4	BSI-1610063-00	W6x9 I-BEAM POST 6FT.-GALVANIZED	1
	5	BSI-1610064-00	TSS PANEL - TRAFFIC SIDE SLIDER	1
	6	BSI-1610065-00	ISS PANEL - INNER SIDE SLIDER	1
	7	BSI-1610066-00	TOOTH - GEOMET	1
	8	BSI-1610067-00	RSS PLATE - REAR SIDE SLIDER	1
	9	B061058	CABLE FRICTION PLATE - HEAD UNIT	1
	10	BSI-1610069-00	CABLE ASSEMBLY - MASH X-TENSION	2
	11	BSI-1012078-00	X-LITE LINE POST-GALVANIZED	8
	12	B090534	8" W-BEAM COMPOSITE-BLOCKOUT XT110	8
	13	BSI-4004386	12'-6" W-BEAM GUARD FENCE PANELS 12GA.	4
	14	BSI-1102027-00	X-LITE SQUARE WASHER	1
	15	BSI-2001886	5/8" X 7" THREAD BOLT HH (GR.5)GEOMET	1
	16	BSI-2001885	3/4" X 3" ALL-THREAD BOLT HH (GR.5)GEOMET	4
	17	4001115	5/8" X 1 1/4" GUARD FENCE BOLTS (GR.2)MGAL	48
	18	2001840	5/8" X 10" GUARD FENCE BOLTS MGAL	8
	19	2001636	5/8" WASHER F436 STRUCTURAL MGAL	2
	20	4001116	5/8" RECESSED GUARD FENCE NUT (GR.2)MGAL	59
	21	BSI-2001888	5/8" X 2" ALL THREAD BOLT (GR.5)GEOMET	1
	22	BSI-1701063-00	DELINEATION MOUNTING (BRACKET)	1
	23	BSI-2001887	1/4" X 3/4" SCREW SD HH 410SS	7
	24	4002051	GUARDRAIL WASHER RECT AASHTO FWR03	1
⁎	25	SEE NOTE BELOW	HIGH INTENSITY REFLECTIVE SHEETING	1
⁎⁎	26	4002337	8" W-BEAM TIMBER-BLOCKOUT, PDB01B	8
⁎⁎	27	BSI-4004431	25' W-BEAM GUARDRAIL PANEL,8-SPACE,12GA.	2
	28	MANMAX Rev-(D)	MAX-TENSION INSTALLATION INSTRUCTIONS	1

⁎ TO BE PROVIDED BY DISTRIBUTOR OR CONTRACTOR.

⁎⁎ ALTERNATIVE ITEMS NOT SHOWN.
ITEM(26) 8" WOOD-BLOCKOUTS
ITEM(27) 25' GUARD FENCE PANELS

NOTE:
THIS STANDARD IS A BASIC REPRESENTATION OF THE MAX-TENSION END TERMINAL, IT IS NOT INTENDED TO REPLACE THE PRODUCT DESCRIPTION ASSEMBLY MANUAL.

Texas Department of Transportation — Design Division Standard

MAX-TENSION END TERMINAL MASH - TL-3

SGT(11S)31-18

FILE: sgt11s3118.dgn	DN: TxDOT	CK: KM	DW: TxDOT	CK: CL
© TxDOT: FEBRUARY 2018	CONT 2038	SECT 01	JOB 031	HIGHWAY FM 2115
REVISIONS	DIST WAC	COUNTY BELL		SHEET NO. 103

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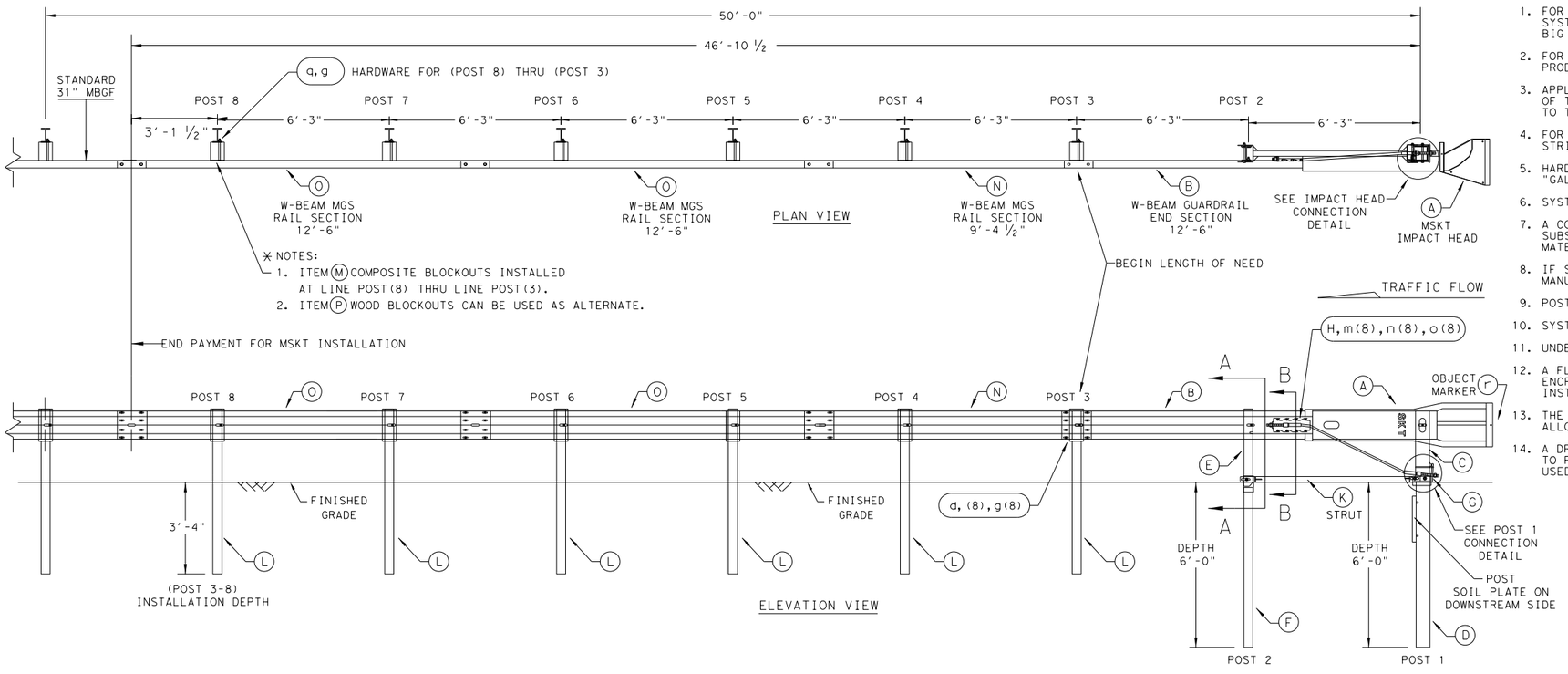


NOTE: SEE (GENERAL NOTE 14) FOR DRIVING CAP INFORMATION.

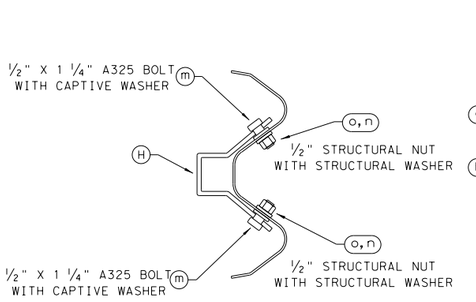
GENERAL NOTES

1. FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: ROAD SYSTEMS, INC. (432)263-2435. 3616 OLD HOWARD COUNTY AIRPORT, BIG SPRING, TX 79720
2. FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO THE; MSKT END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY MANUAL (PUBLICATION~062717).
3. APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" ON THE FRONT FACE OF THE DEVICE PER MANUFACTURER'S RECOMMENDATIONS. OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
4. FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TXDOT'S LATEST ROADWAY MOW STRIP STANDARD.
5. HARDWARE (BOLTS, NUTS, & WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
6. SYSTEM SHOWN USING STEEL WIDE FLANGE POSTS WITH COMPOSITE BLOCKOUTS.
7. A COMPOSITE MATERIAL BLOCKOUTS THAT MEETS THE REQUIREMENTS OF DMS-7210, MAY BE SUBSTITUTED FOR BLOCKOUTS OF SIMILAR DIMENSIONS. SEE CONSTRUCTION DIVISION MATERIAL PRODUCER LIST (MPL) FOR CERTIFIED PRODUCERS.
8. IF SOLID ROCK IS ENCOUNTERED IN THE AREA OF (POST 1) AND / OR (POST 2) CONTACT THE MANUFACTURER, & REFER TO THE LATEST ROADWAY MBGF STANDARD FOR INSTALLATION GUIDANCE.
9. POSTS SHALL NOT BE SET IN CONCRETE.
10. SYSTEM MUST BE ATTACHED TO STANDARD 31" MBGF.
11. UNDER NO CIRCUMSTANCES SHALL THE GUARDRAIL WITHIN THE MSKT SYSTEM BE CURVED.
12. A FLARE RATE OF UP TO 25:1 MAY BE USED TO PREVENT THE TERMINAL HEAD FROM ENCROACHING ON THE SHOULDER. THE FLARE MAY BE DECREASED OR ELIMINATED FOR SPECIFIC INSTALLATIONS, IF DIRECTED BY THE ENGINEER.
13. THE SYSTEM IS SHOWN WITH TWO 12'-6" MBGF PANELS, ONE 25'-0" MBGF PANEL IS ALSO ALLOWED IN THEIR PLACE.
14. A DRIVING CAP WITH A TIMBER OR PLASTIC INSERT SHALL BE USED WHEN DRIVING POSTS 3-8 TO PREVENT DAMAGE TO THE GALVANIZING ON TOP OF THE POST. SPECIAL DRIVING CAP TO BE USED ON LOWER POSTS 1 & 2 TO PREVENT DAMAGE TO THE WELDED PLATES.

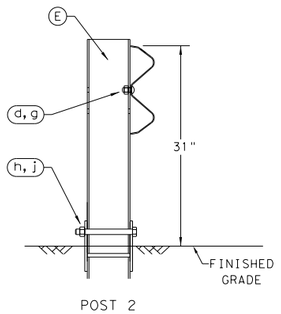
SEE NOTES: ✳

ALTERNATIVE ITEMS NOT SHOWN. ✳✳
✳ ITEM(P) 8" WOOD-BLOCKOUT
✳✳ ITEM(Q) 25'GUARD FENCE PANEL

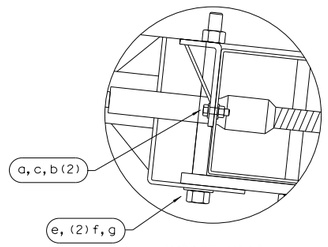
ITEM	QTY	MAIN SYSTEM COMPONENTS	ITEM NUMBERS
A	1	MSKT IMPACT HEAD	MS3000
B	1	W-BEAM GUARDRAIL END SECTION, 12 Ga.	SF1303
C	1	POST 1 - TOP (6" X 6" X 1/8" TUBE)	MTPHP1A
D	1	POST 1 - BOTTOM (6' W6X15)	MTPHP1B
E	1	POST 2 - ASSEMBLY TOP	UHP2A
F	1	POST 2 - ASSEMBLY BOTTOM (6' W6X9)	HP2B
G	1	BEARING PLATE	E750
H	1	CABLE ANCHOR BOX	S760
J	1	BCT CABLE ANCHOR ASSEMBLY	E770
K	1	GROUND STRUT	MS785
L	6	W6x9 OR W6x8.5 STEEL POST	P621
M	6	COMPOSITE BLOCKOUTS	CBSP-14
N	1	W-BEAM MGS RAIL SECTION (9'-4 1/2")	G12025
O	2	W-BEAM MGS RAIL SECTION (12'-6")	G1203A
P	6	WOOD BLOCKOUT 6" X 8" X 14"	P675
Q	1	W-BEAM MGS RAIL SECTION (25'-0")	G1209
		SMALL HARDWARE	
a	2	5/16" x 1" HEX BOLT (GRD 5)	B5160104A
b	4	5/16" WASHER	W0516
c	2	5/16" HEX NUT	N0516
d	25	5/8" Dia. x 1 1/4" SPLICE BOLT (POST 2)	B580122
e	2	5/8" Dia. x 9" HEX BOLT (GRD A449)	B580904A
f	3	5/8" WASHER	W050
g	33	5/8" Dia. H.G.R NUT	N050
h	1	3/4" Dia. x 8 1/2" HEX BOLT (GRD A449)	B340854A
j	1	3/4" Dia. HEX NUT	N030
k	2	1 ANCHOR CABLE HEX NUT	N100
l	2	1 ANCHOR CABLE WASHER	W100
m	8	1/2" x 1 1/4" A325 BOLT WITH CAPTIVE WASHER	SB12A
n	8	1/2" STRUCTURAL NUTS	N012A
o	8	1 1/16" O.D. x 5/16" I.D. STRUCTURAL WASHERS	W012A
p	1	BEARING PLATE RETAINER TIE	CT-100ST
q	6	5/8" x 10" H.G.R. BOLT	B581002
r	1	OBJECT MARKER 18" X 18"	E3151



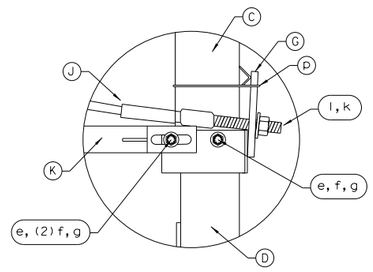
SECTION B-B
ANCHOR BRACKET



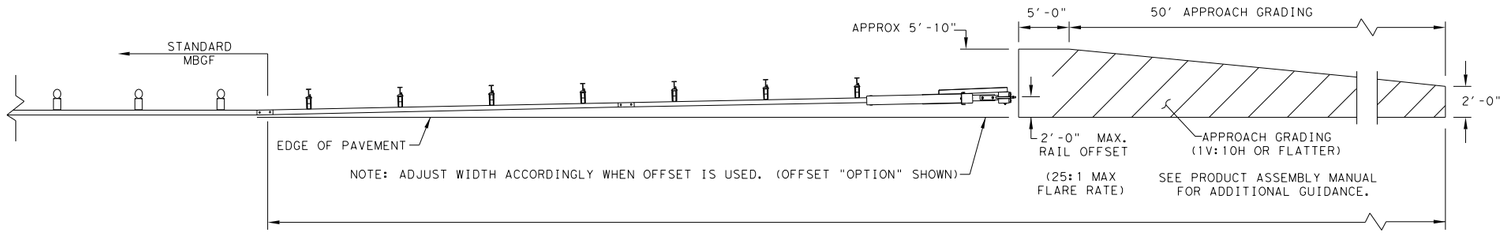
POST 2
SECTION A-A



IMPACT HEAD
CONNECTION DETAIL



POST 1
CONNECTION DETAIL



APPROACH GRADING AT GUARDRAIL END TREATMENTS

NOTE: TXDOT GENERIC APPROACH GRADING LAYOUT USED FOR ALL TANGENT TYPE END TREATMENTS.

NOTE: THIS STANDARD IS A BASIC REPRESENTATION OF THE MSKT END TERMINAL, IT IS NOT INTENDED TO REPLACE THE PRODUCT DESCRIPTION ASSEMBLY MANUAL.

Texas Department of Transportation

Design Division Standard

SINGLE GUARDRAIL TERMINAL

MSKT-MASH-TL-3

SGT(12S)31-18

FILE: sgt12s3118.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CL	
© TxDOT: APRIL 2018	CONT	SECT	JOB	HIGHWAY	
REVISIONS	2038	01	031	FM 2115	
	DIST	COUNTY		SHEET NO.	
	WAC	BELL		104	

DATE: 8/28/2021
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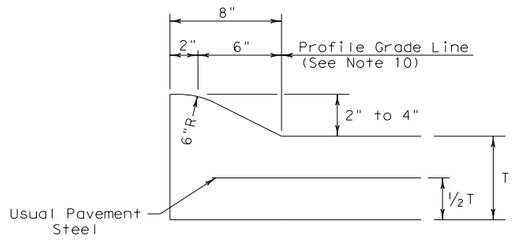
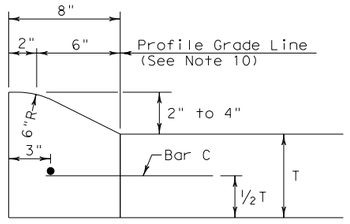


TYPE I CURB (MONOLITHIC)
2" - 4" HEIGHT



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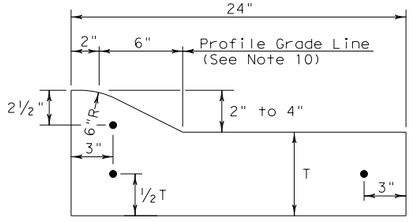
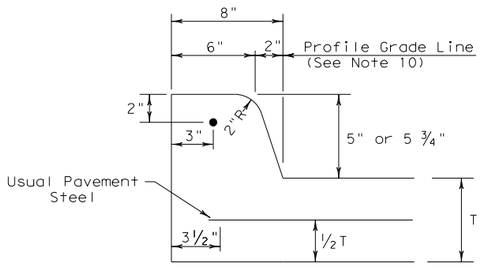
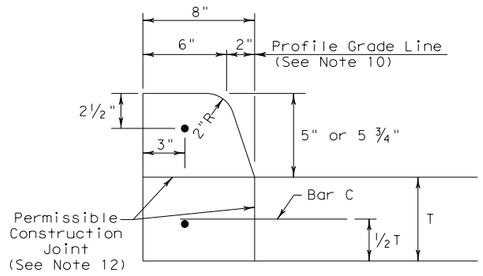


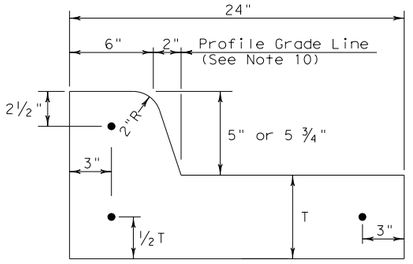
TYPE I CURB AND GUTTER
2" - 4" HEIGHT



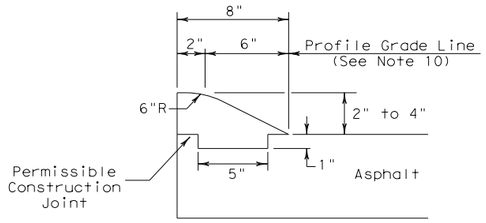
TYPE II CURB (MONOLITHIC)
5" - 5 ¾" HEIGHT



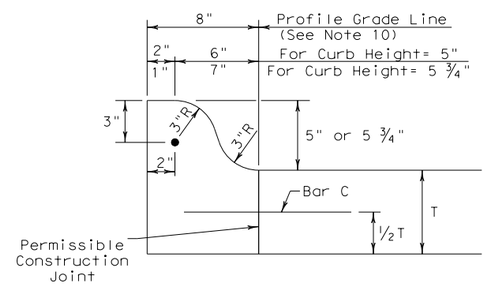
TYPE II CURB
5" - 5 ¾" HEIGHT



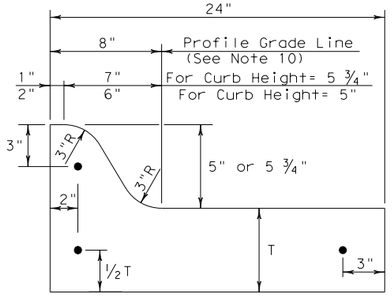
TYPE II CURB AND GUTTER
5" - 5 ¾" HEIGHT



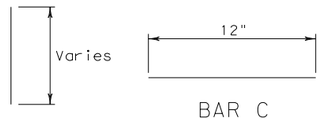
TYPE III CURB (KEYED)
2" - 4" HEIGHT



TYPE IIa CURB
5" - 5 ¾" HEIGHT

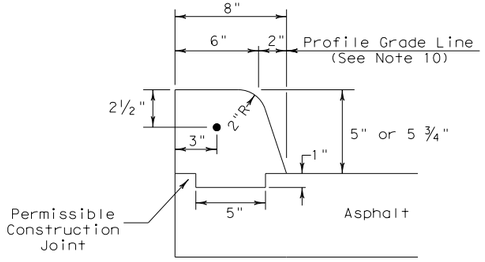


TYPE IIa CURB AND GUTTER
5" - 5 ¾" HEIGHT

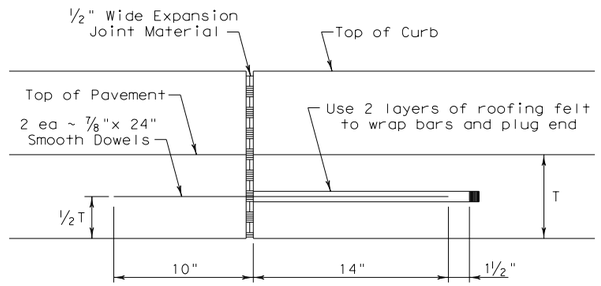


BAR B

BAR C

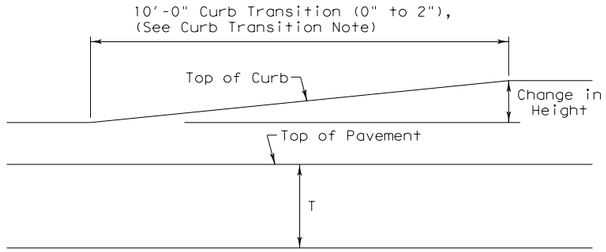


TYPE IV CURB (KEYED)
5" - 5 ¾" HEIGHT



EXPANSION JOINT DETAIL

CURB TRANSITION NOTE:
Field conditions may require a longer or shorter transition, and shall be shown elsewhere in the plans, or as directed by the Engineer.



CURB TRANSITION
Note: To be paid for as Highest Curb

GENERAL NOTES

1. All materials and construction shall be in accordance with Item 529, "Concrete Curb, Gutter, and Combined Curb and Gutter."
2. Concrete shall be Class A.
3. When reinforcing bars are used, they shall be No.4 unless otherwise shown. The use of fiber reinforced concrete in lieu of reinforcing steel is acceptable. Use fibers meeting the requirements of DMS 4550, "Fibers for Concrete," and dose fibers in accordance with Material Producers List (MPL) "Fibers for Class A and B Concrete Applications."
4. Round exposed sharp edges with a rounding tool, to a minimum radius of ¼ inch.
5. All existing curbs and driveways to be removed shall be sawed or removed at existing joints.
6. Where concrete curb is to be placed on existing concrete pavement, Bar B may be drilled and the grouted in place, or may be inserted into fresh concrete.
7. Expansion and contraction joints shall be constructed to match pavement joints in all curbs and curb and gutter adjacent to jointed concrete pavement. Where placement of curb or curb and gutter is not adjacent to concrete pavement, expansion joints shall be provided at structures, curb returns at streets, and at locations directed by The Engineer.
8. Vertical and horizontal dowel bars and transverse reinforcing bars shall be placed at four feet C~C.
9. Dimension 'T' shown is the thickness of concrete pavement. When curb is installed adjacent to flexible pavement dimension 'T' is 8" maximum.
10. Usual profile grade line. Refer to typical sections and plan-profile sheets for exact locations.
11. One-half inch expansion joint material shall be provided where curb or curb and gutter is adjacent to sidewalk or riprap.
12. When horizontal permissible construction joints are used, the longitudinal pavement steel shall be placed in accordance with pavement details shown elsewhere in the plans. Reinforcing steel for curb section shall then conform to that required for concrete curb.
13. Bar B used as needed to support curb reinforcing steel during concrete placement.

Texas Department of Transportation

Design Division Standard

CONCRETE CURB AND CURB AND GUTTER

CCCG-21

FILE: cccg21.dgn	DN: TXDOT	CK: AN	DW: SS	CK: KM
©TxDOT: FEBRUARY 2021	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		105

DATE: 8/28/2021
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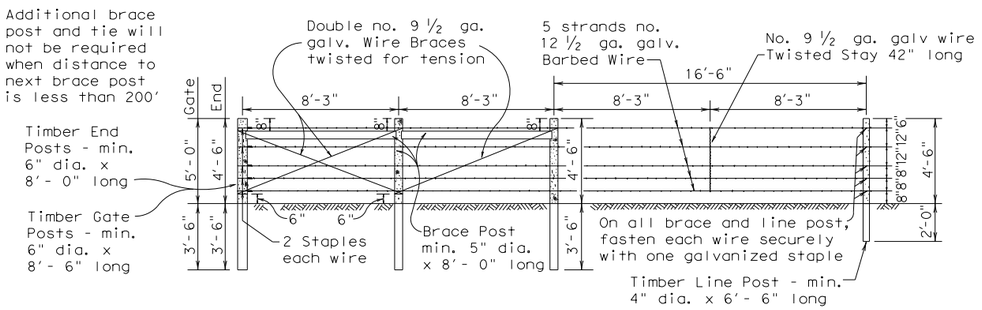
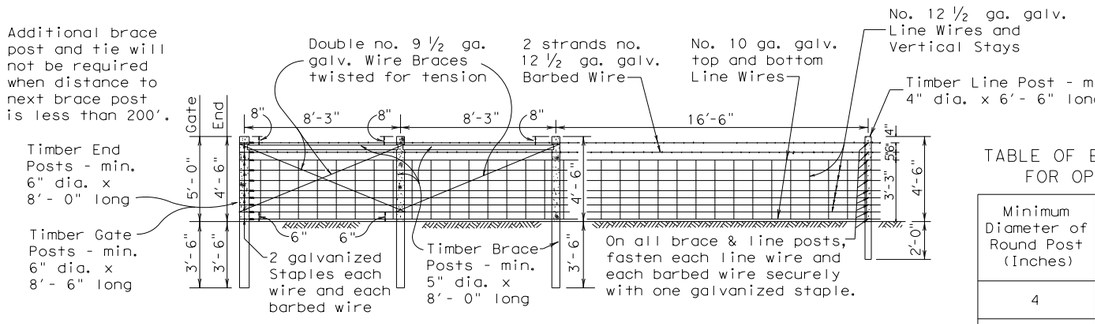


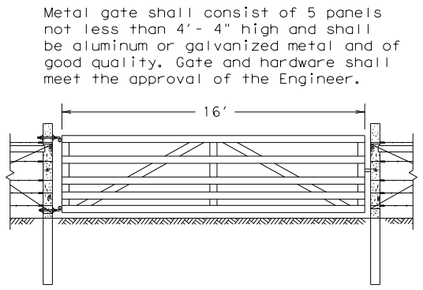
SECTION GALVANIZED BARBED WIRE FENCE WITH WOOD POSTS
Bracing Detail Used at Ends and Gates
TYPE "A" FENCE
(See General Note 6)



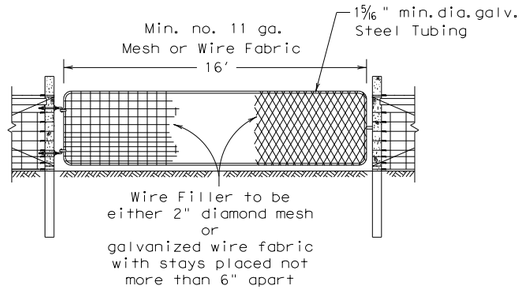
SECTION GALVANIZED WOVEN WIRE FENCE WITH WOOD POSTS
Bracing Detail Used at Ends and Gates
TYPE "B" FENCE
(See General Note 6)

TABLE OF EQUIVALENT SIZES FOR OPTIONAL SHAPE

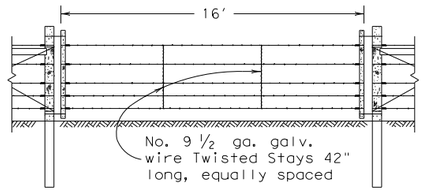
Minimum Diameter of Round Post (Inches)	Minimum Equivalent Dimension for Each Side of Square Post (Inches)
4	3 ½
5	4 ½
6	5 ¼



DETAIL TYPE 1 GATE



DETAIL TYPE 2 GATE

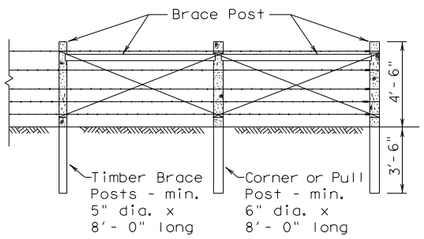


DETAIL TYPE 3 GATE

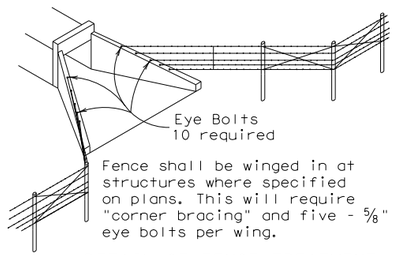
GENERAL NOTES

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.

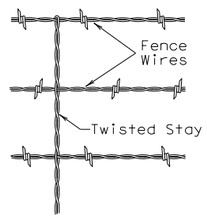
   Woven Wire Fence (Type B) shall be in accordance with ASTM A 116 (Class 1) No. 12-1/2 Grade 60 (See Table 1 ASTM A 116) to the height and design shown on the plans, or as approved by the Engineer.
7. The location of gates and corner posts will be as indicated elsewhere on these plans.
8. Square wood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



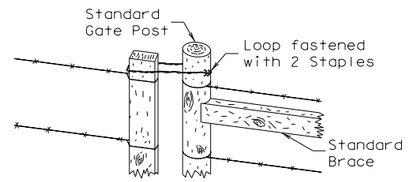
CORNER OR PULL POST ASSEMBLY



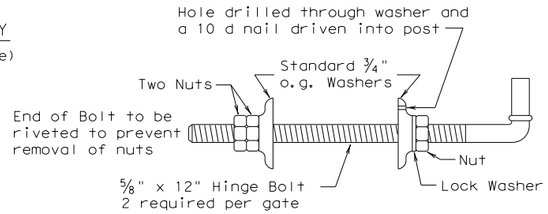
DETAIL OF FENCE TREATMENT AT STRUCTURES



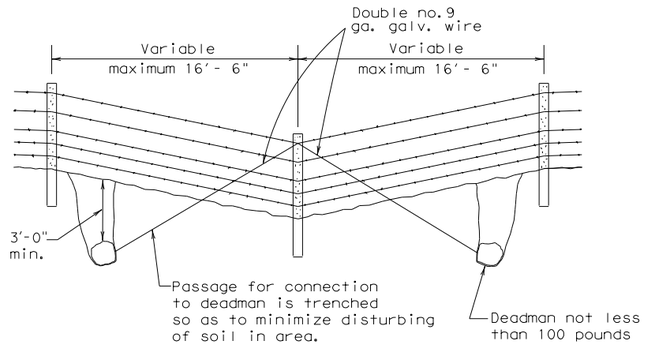
DETAIL OF STAY
(Barbed wire fence)



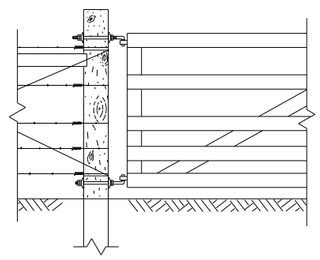
DETAIL FASTENER TYPE 3 GATE



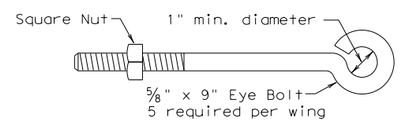
DETAIL OF GATE HINGE BOLT ASSEMBLY



DETAIL OF FENCE SAG
(Single Line Connection)



DETAIL SHOWING INSTALLATION OF HINGES OF TYPE 1 & 2 GATE



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
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	DIST	COUNTY		SHEET NO.
	WAC	BELL		106

DATE: 8/28/2021
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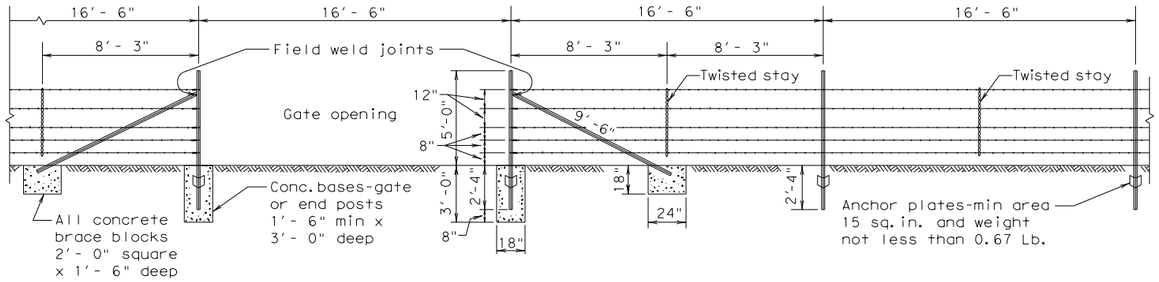
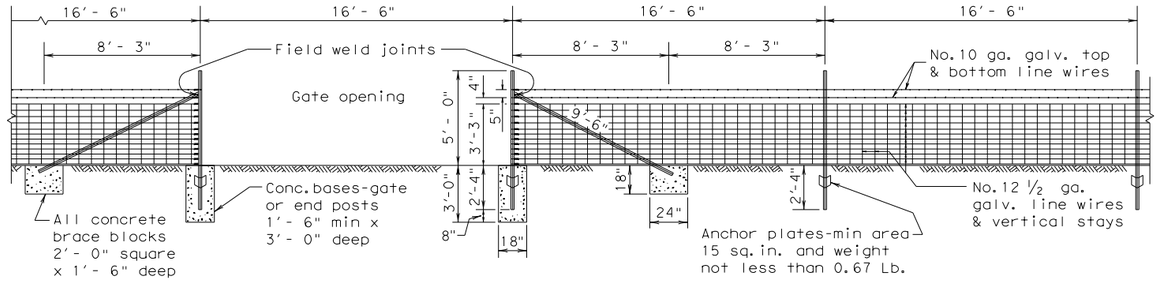
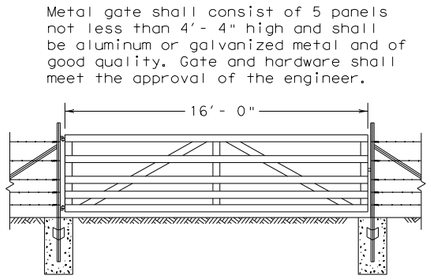


SECTION GALVANIZED BARBED WIRE FENCE WITH METAL POSTS
BRACING DETAIL USED AT ENDS AND GATES
TYPE "C" FENCE
(See General Note 8)

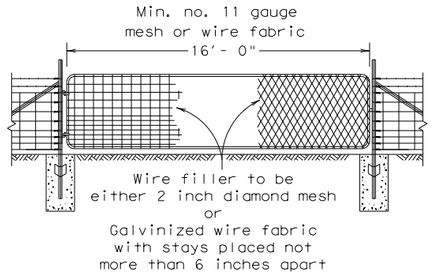
Note:
For Steel pipe and T-Post requirements. (See General Notes 6 & 7)



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



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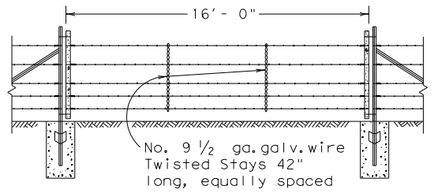
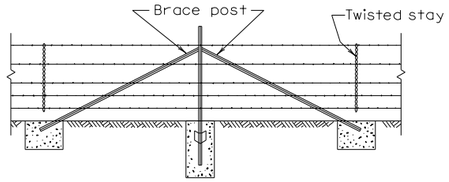
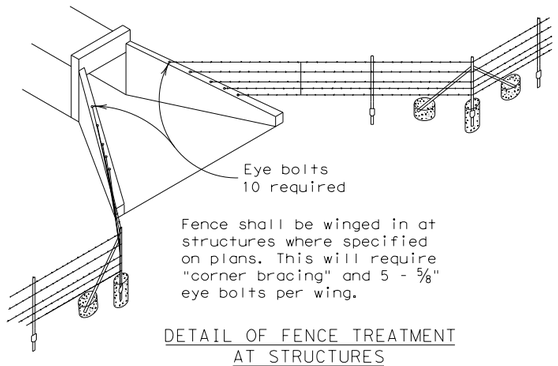


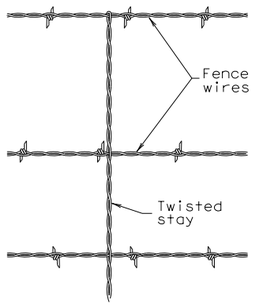
DETAIL TYPE 3 GATE



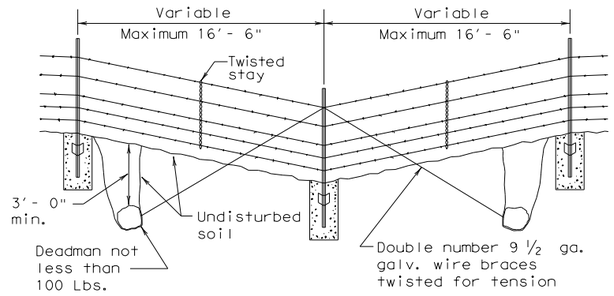
CORNER OR PULL POST ASSEMBLY



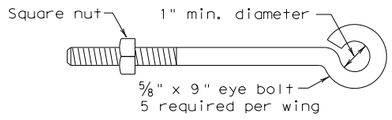
DETAIL OF FENCE TREATMENT AT STRUCTURES



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

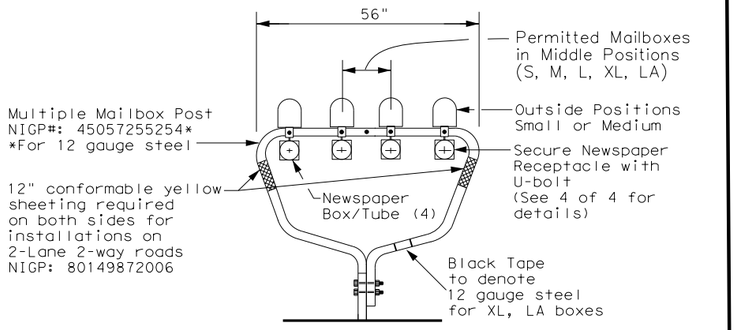
Design Division Standard

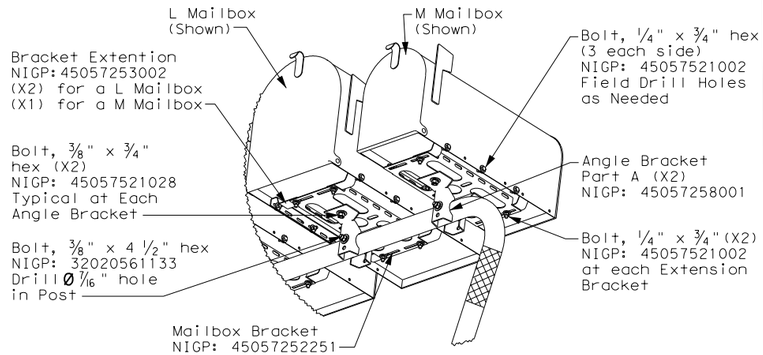
BARBED WIRE AND WOVEN WIRE FENCE (STEEL POSTS)

WF(2)-10

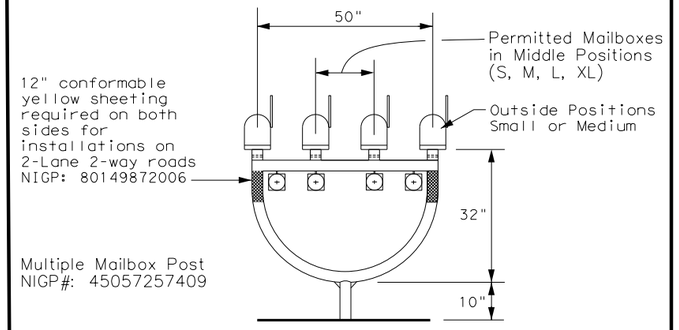
FILE: wf210.dgn	DN: TxDOT	CK: AM	DW: VP	CK:
© TxDOT 1996	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		107

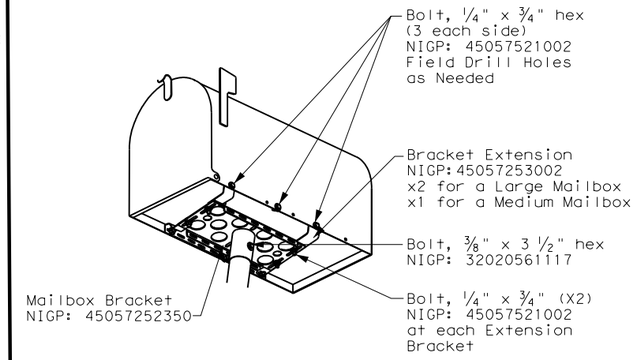
TYPE 1 - MULTIPLE





TYPE 4 - MULTIPLE





MAILBOX SIZES

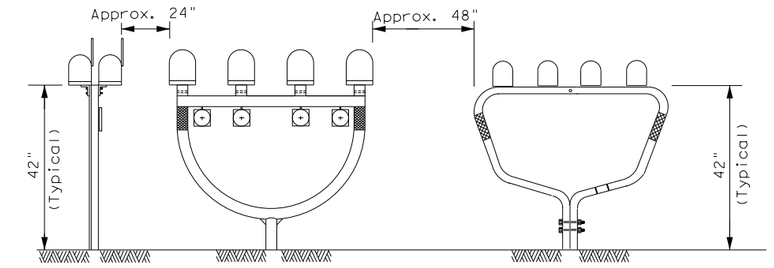
MAILBOX SIZE	TYPICAL DIMENSIONS			MAX **
	LENGTH	WIDTH	HEIGHT	WEIGHT
SMALL	19 1/2"	6"	7"	6 LBS
MEDIUM	22 1/2" *	8" *	11 1/2" *	8 LBS
LARGE	23 1/2"	11 1/2"	13 1/2"	11 LBS
EXTRA LARGE	18"	14"	12"	13 LBS
LOCKABLE	18"	11 1/2"	15"	23 LBS

* See Note 1.
** Excluding Molded Plastic on 4 X 4 Post

GENERAL NOTES:

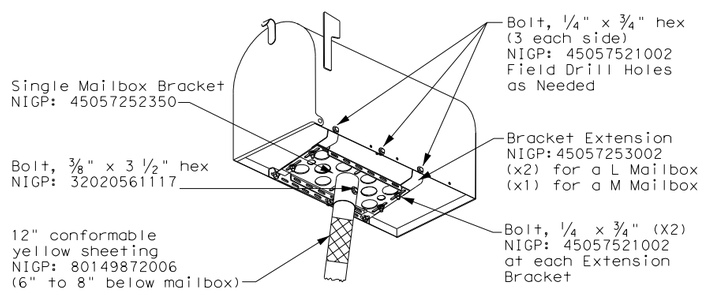
1. Dimensions shown (length, width, and height) are typical, not maximums. However, anytime a medium size mailbox is mounted on a single/double mount or on the outside position on a multi mount, the dimensions shown are maximums.
2. Mailboxes shall be made of light weight sheet metal or light weight plastic. Heavy steel, cast iron or decorative mailboxes shall not be used on the state highway system.

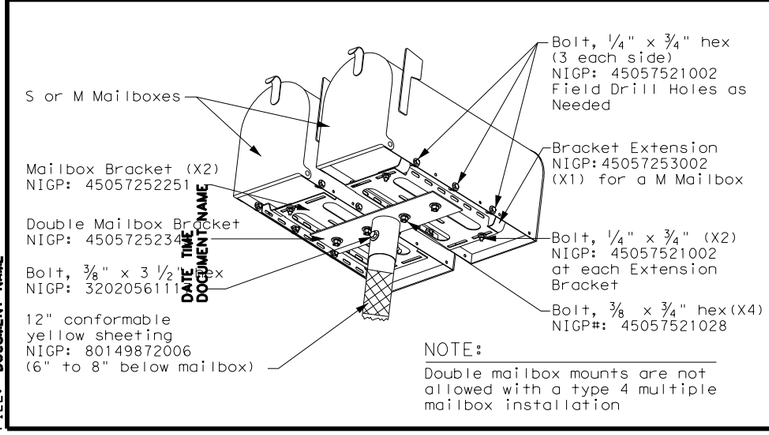
TYPICAL INSTALLATION MEASUREMENTS



NOTE:
Mailbox installations in sidewalk areas shall be in accordance with the latest TxDOT Design Standard sheets PED-Pedestrian Facilities Curb Ramps.

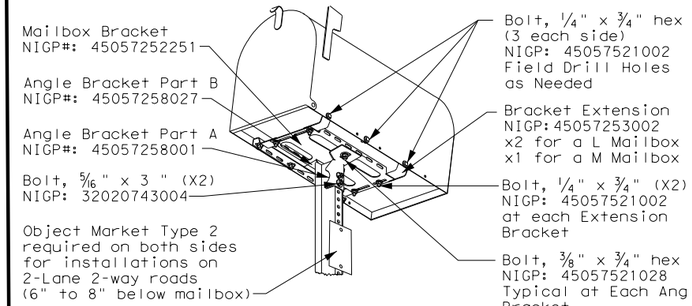
TYPE 2 and 4 - SINGLE/DOUBLE

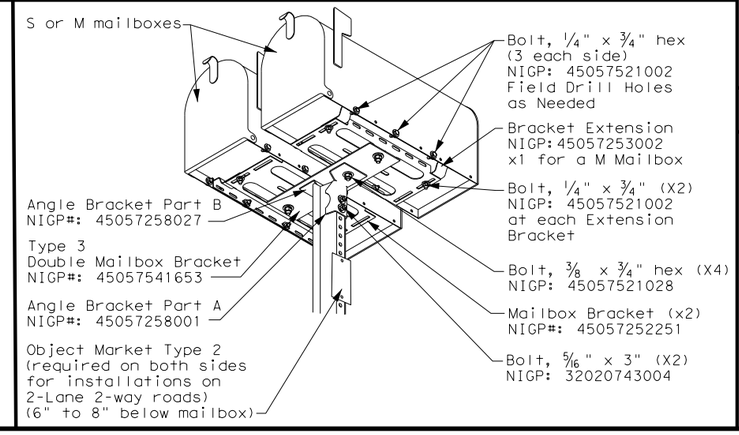




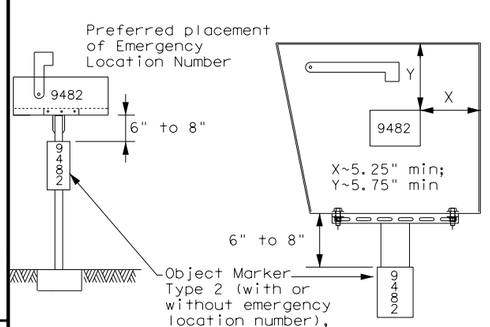
NOTE:
Double mailbox mounts are not allowed with a type 4 multiple mailbox installation

TYPE 3 - SINGLE/DOUBLE





PLACEMENT OF EMERGENCY LOCATION NUMBER

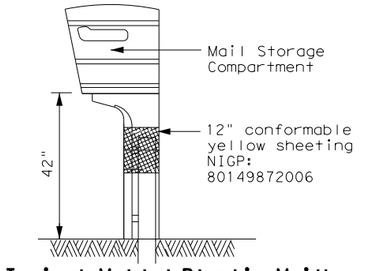


NOTES:

1. Location numbers are provided by homeowner. Minimum size 1" height.
2. Location number is typically placed on the mailbox in a contrasting color.
3. Black numbers may be placed on the Type 2 object marker if the numbers cannot be placed on the mailbox.
4. Alternatively, a green or blue plate with white numbers attached may be mounted below the object marker. Other contrasting color configuration, as approved, may be used.
5. See 3 of 4 for Foundation details.
6. See 4 of 4 for Hardware details.

SHEET 1 OF 4

TYPE 5



Typical Molded Plastic Mailbox

Texas Department of Transportation — *Maintenance Division Standard*

MAILBOX MOUNTING AND ASSEMBLY

MB(1)-21

FILE: MB-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT March 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS 2/2005 11/2009 4/2015 6/2005 1/2011 11/2006 7/2014	2031	01	031	FM 2115
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	WAC	BELL		108

DATE: 08/16/2021 04:35 PM
FILE: DOCUMENT NAME
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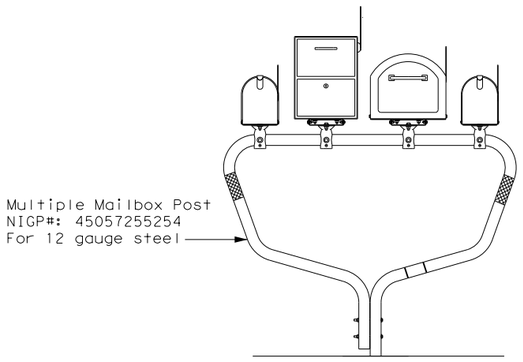
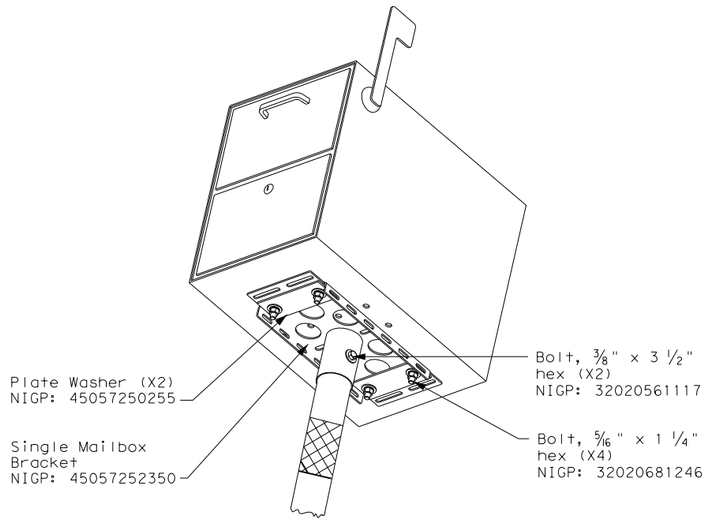
DATE: 08/16/2021 04:35 PM
FILE: DOCUMENT NAME

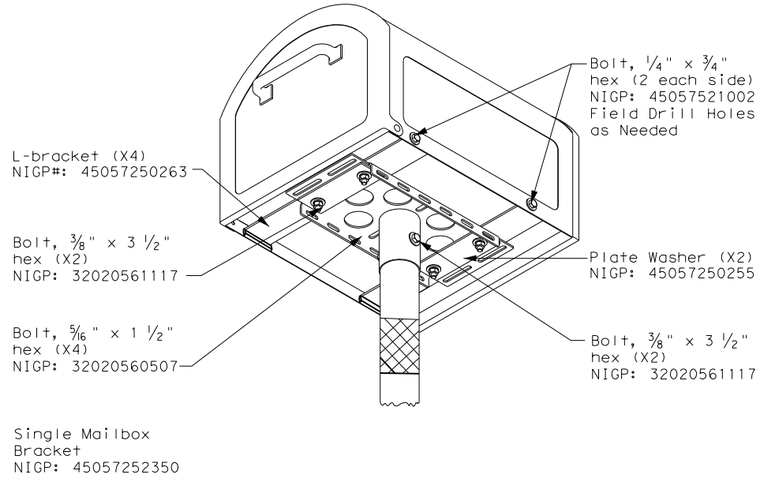
TYPE 1- MULTI LOCKABLE AND XL MAILBOX



TYPE 2/4 - SINGLE LOCKABLE MAILBOX

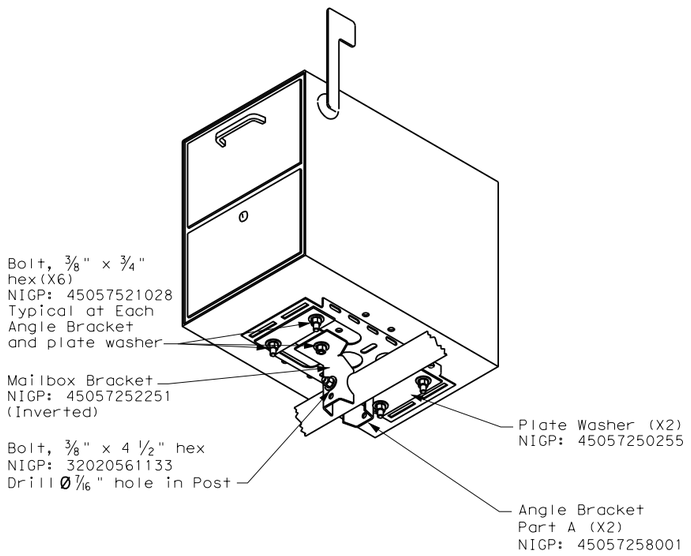


TYPE 2/4 - SINGLE XL MAILBOX

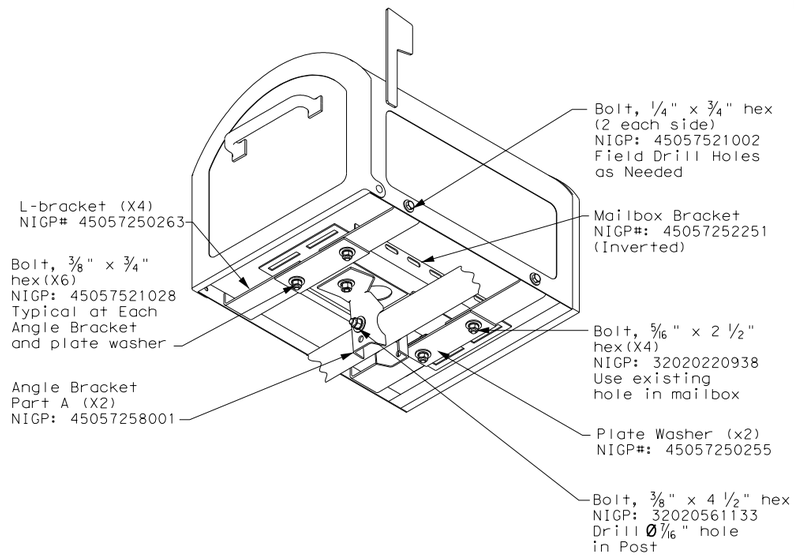


NOTE:
Follow same configuration when mounting an XL mailbox on a Type 4 multi post.

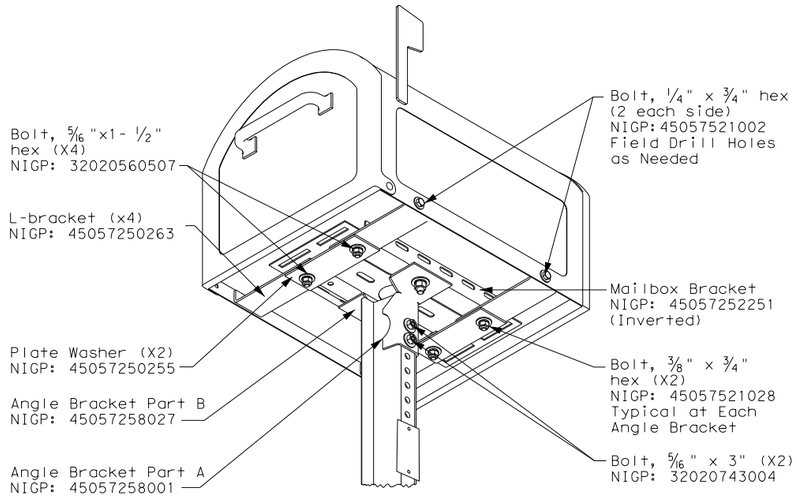
TYPE 1 MULTI – LOCKABLE ARCHITECTURAL (LA)



TYPE 1 MULTI – XL MAILBOX



TYPE 3 - XL MAILBOX MOUNTING



Texas Department of Transportation

Maintenance Division Standard

XL AND LOCKABLE ARCHITECTURAL MAILBOX ASSEMBLY

MB(2)-21

FILE: MB-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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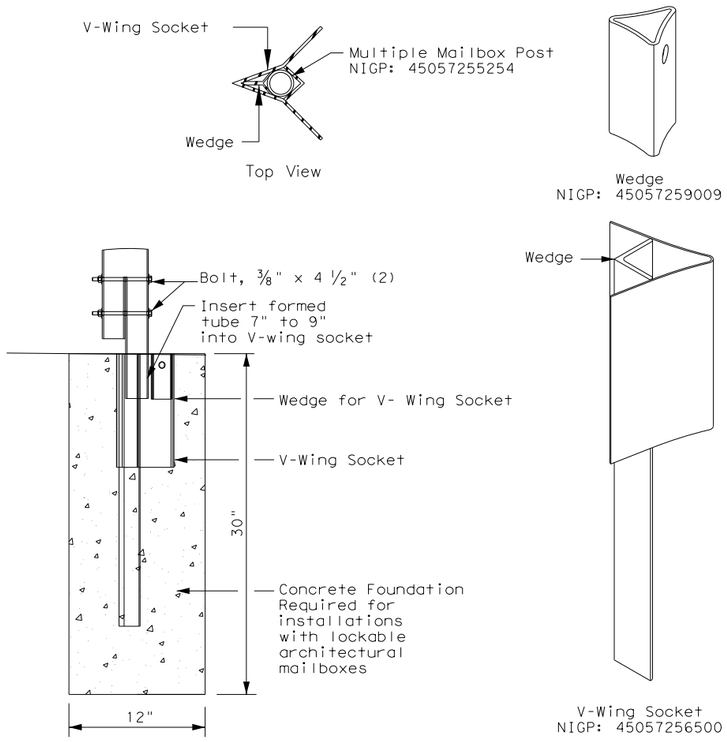
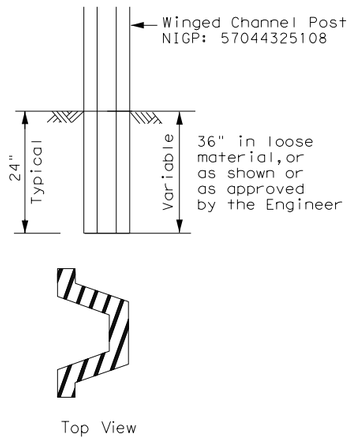
REVISIONS 2/2005 11/2009 4/2015 6/2005 1/2011 11/2006 7/2014	2031	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		109

TYPE 1 - SUPPORT/FOUNDATION
Thin Wall Tube w/ V-LOC Anchorage

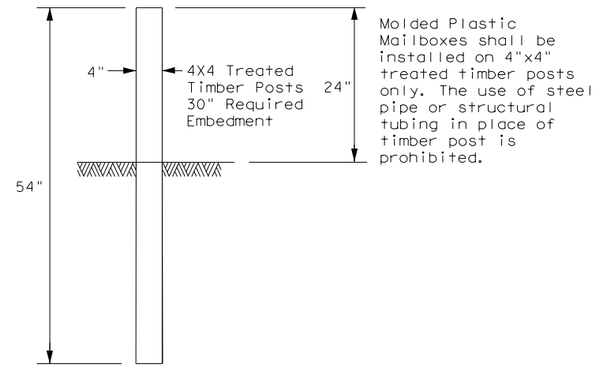


TYPE 3 - SUPPORT/FOUNDATION

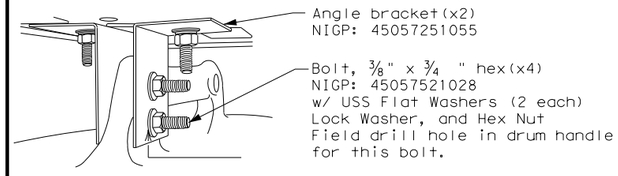


NOTES:
1. Attach Object Marker(OM) facing direction of traffic.
2. OM will also be required on opposite side if installed on a 2-Lane, 2-Way roadway.

TYPE 5 - SUPPORT/FOUNDATION



TYPE 6 - TEMPORARY MAILBOX SUPPORT

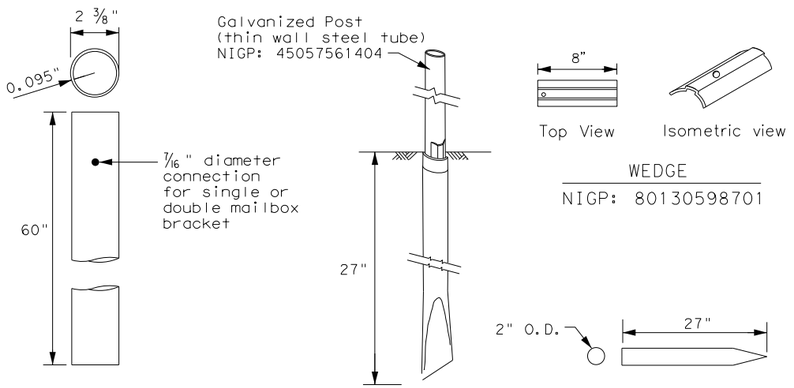


Plastic Drum NIGP: 55093383655
Rubber Collar NIGP: 55093387102

NOTES:
1. Place on approved plastic drum as shown in the Compliant Work Zone Traffic Control Devices (CWZTCD).
2. Existing attachment hardware shall be used unless damaged. Damaged hardware shall be replaced.

GENERAL NOTES:
1. Erect post plumb or vertical.
2. When galvanized part is required galvanize in accordance with Item 445.
3. Use a concrete footing as shown or when directed. Concrete footing will be required when soils do not hold the support/foundations in a stable condition, only on Type 1, Type 2, and Type 4

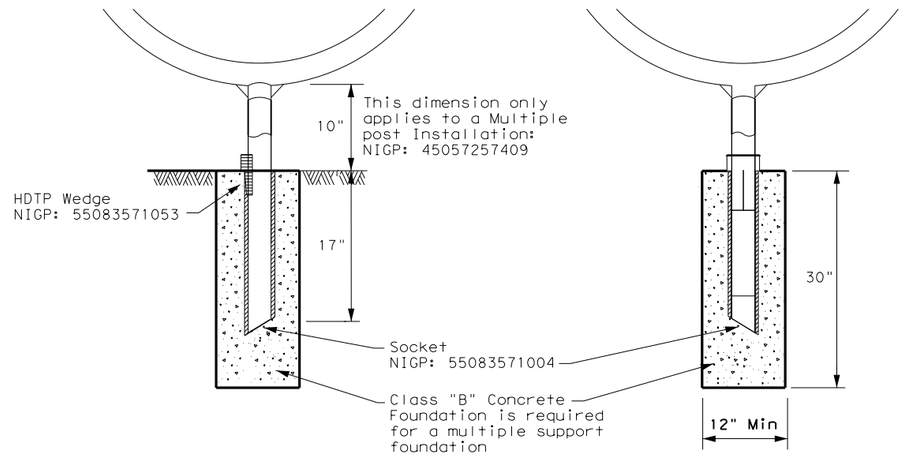
TYPE 2 - SUPPORT/FOUNDATION
Thin Wall Steel Tube w/Wedge Anchor System



MAILBOX POST

WEDGE ANCHOR
NIGP: 80130238407

TYPE 4 - SUPPORT/FOUNDATION
Whitecoated steel post NIGP: 45057561107
Multiple post NIGP: 45057257409
Recycled Rubber post (RR) NIGP: 45057561057



SHEET 3 OF 4

Texas Department of Transportation | Maintenance Division Standard

MAILBOX SUPPORT AND FOUNDATION

MB(3)-21

FILE: MB-21.dgn	DN:	CK:	DW:	CK:
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	DIST	COUNTY		SHEET NO.
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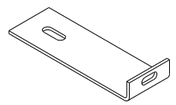
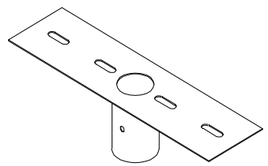
DATE:
FILE:

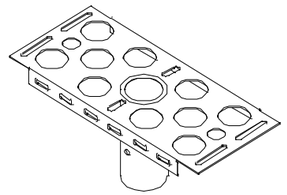
TYPE	TYPE 1	TYPE 2	TYPE 3	TYPE 4			TYPE 5	TYPE 6
Configuration	Multiple	Single or Double	Single or Double	Single	Double	Multiple	Single	Single
Mailbox Size NIGP #	Outside Position: S or M Inside Position: S, M, L, XL, or LA	Single: S, M, L, XL, or LA Double: SS, SM, MM	Single: S, M, L, or XL Double: SS, SM, MM	S, M, L, XL, or LA	SS, SM, or MM	Outside Position: S or M Inside Position: S, M, L, or XL	Molded Plastic	S, or M
Mailbox Post NIGP #	45057255254 (Galvanized Multiple)	45057561404 (Thin Walled Gavanize)	57044325108 (Wing Channel Post)	45057561107 (Thin walled white powder coated) 45057561057 (Recycled Rubber Post: S or M only)	45057561107 (Thin Walled White Powder Coated)	45057257409 (White Powder Coated Multiple)	4x4 Timber	Construction Barrel
Post and Mailbox Hardware NIGP #	45057259009 (Wedge) 45057256500 (V-Wing Socket) 45057253002 (Bracket Extension) 45057252251 (Mailbox Bracket) 45057258001 (Part A Angle Bracket x2) 45057250255 (Plate Washer for XL/LA x2) 45057250263 (L-Bracket for XL x4)	80130598701 (Wedge) 80130238407 (Wedge Anchor) 45057253002 (Bracket Extension) 45057252343 (Double MB Bracket) 45057252350 (S. Mailbox Bracket) 45057252251 (Mailbox Bracket) 45057250255 (Plate Washer for XL/LA x2) 45057250263 (L-Bracket forXL x4)	45057541653 (Type 3 Double Mailbox Bracket) 45057252251 (Mailbox Bracket) 45057253002 (Bracket Extension) 45057258001 (Part A Angle Bracket) 45057258027 (Part B Angle Bracket) 45057250255 (Plate Washer for XL x2) 45057250263 (L-Bracket for XL x4)	55083571053 (Wedge) 55083571004 (Socket) 45057252350 (Single Mailbox Bracket) 45057253002 (Bracket Extension) 45057250255 (Plate Washer for XL/LA x2) 45057250263 (L-Bracket for XL x4)	55083571053 (Wedge) 55083571004 (Socket) 45057253002 (Bracket Extension) 45057252343 (Double Mount Bracket) 45057252251 (Mailbox Bracket x2)	55083571053 (Wedge) 55083571004 (Socket) 45057253002 (Bracket Extension) 45057252350 (Single Mount Bracket) 45057250255 (Plate Washer for XL x2) 45057250263 (L-Bracket for XL x4)	None	45057251055 Angle Bracket (x2)
Foundation Used	Class B Concrete (Required for LA Mailboxes)	Class B Concrete (Required for LA Mailboxes)	None	Class B Concrete (not used with recycled rubber post, required for LA Mailboxes)	Class B Concrete (not required)	Class B Concrete	None	None



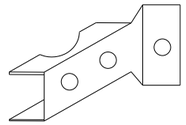
NIGP: 45057250263
L-Bracket x4 for
XL sized mailboxes



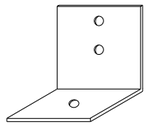
NIGP: 45057252343
Double Mailbox Bracket
For Type 2 and Type 4
double mount



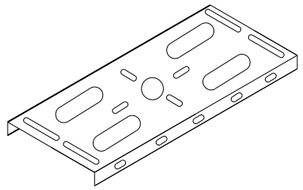
NIGP: 45057252350
Single Mailbox Bracket
For Type 2 single and for
Type 4 single and multi mount



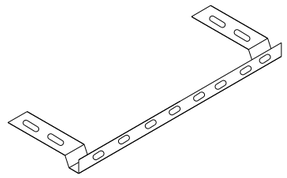
NIGP: 45057258001
Part "A" Angle Bracket
For Type 1 multi (2 per mailbox)
and Type 3 single and double



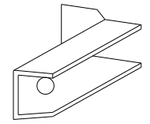
NIGP: 45057251055
Type 6 Angle Bracket
(2 per mailbox)



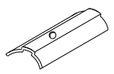
NIGP: 45057252251
Mailbox Bracket
For Type 1 multi and
any double mount (use 2)



NIGP: 45057253002
Bracket Extension
Use 1 for a medium Mailbox
Use 2 for a Large Mailbox



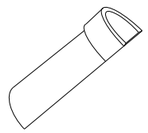
NIGP: 45057258027
Part "B" Angle Bracket
For Type 3 single
and double



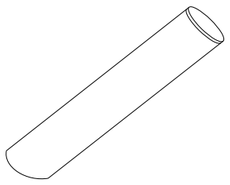
NIGP: 80130598701
Wedge for Type 2

NIGP: 45057250255
Plate Washer for Architecural
and XL Mailboxes

NIGP: 45057541653
Type 3 double mailbox bracket

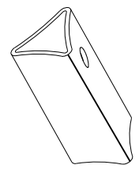


NIGP: 55083571053
Type 4 Mailbox Wedge

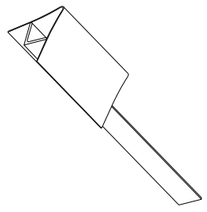


NIGP: 55083571004
Type 4 Mailbox Socket

NIGP: 80130238407
Type 2 Wedge Anchor



NIGP: 45057259009
Wedge for Type 1 V-wing Socket



NIGP: 45057256500
V-wing Socket for
Type 1 Foundation

NIGP #	OBJECT MARKERS AND CONFORMABLE SHEETING
55008311759	Type 2 OM 4"x4" (3 Needed) for Type 3 Wing Channel Post
55008312906	Type 2 OM 6"x12" (1 needed) for Type 3 Wing Channel Post
80149872006	12" Conformable Reflective Yellow Sheeting for Flexible Posts

NOTES:

1. Type 2 object marker in accordance with Traffic Engineering Standard Delineators & Object Markers.
2. A light weight receptacle for newspaper delivery can be attached to mailbox posts if the receptacle does not touch the mailbox, present a hazard to traffic or delivery of the mail, extend beyond the front of the mailbox, or display advertising, except the publication title.

BID CODES FOR CONTRACTS

MB-(X) ASSM TY (XXX) (X)

Type of Mailbox
- S = Single
- D = Double
- M = Multiple
- MP = Molded Plastic

Type of Post
- WC = Winged Channel Post
- RR = Recycled Rubber
- TWW = Thin Walled White Tubing
- TWG = Thin Walled Galvanized Tubing
- TIM = Timber

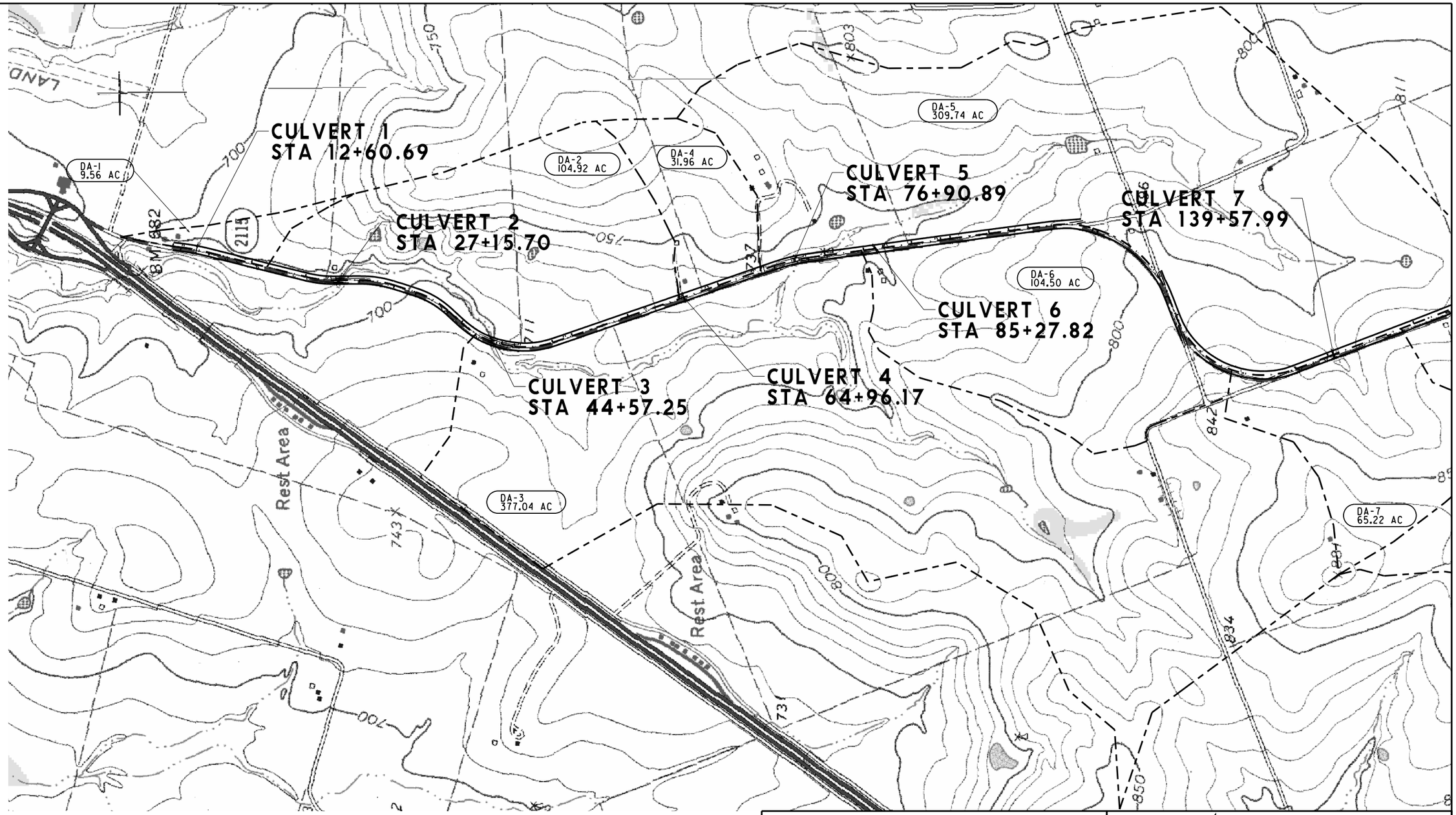
Type of Foundation
- Ty 1 = V-Loc
- Ty 2 = Wedge Anchor Steel System
- Ty 3 = Winged Channel post
- Ty 4 = Wedge Anchor Plastic System
- Ty 5 = 4 X 4 Post

Texas Department of Transportation — Maintenance Division Standard

NIGP PARTS LIST AND COMPATIBILITY

MB(4)-21

FILE: MB-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT March 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	2031	01	031	FM 2115
2/2005 11/2009 4/2015 6/2005 1/2011 11/2006 7/2014	DIST	COUNTY		SHEET NO.
	WAC	BELL		111



STATE OF TEXAS
BRADLEY MAYES
128276
LICENSED
PROFESSIONAL ENGINEER

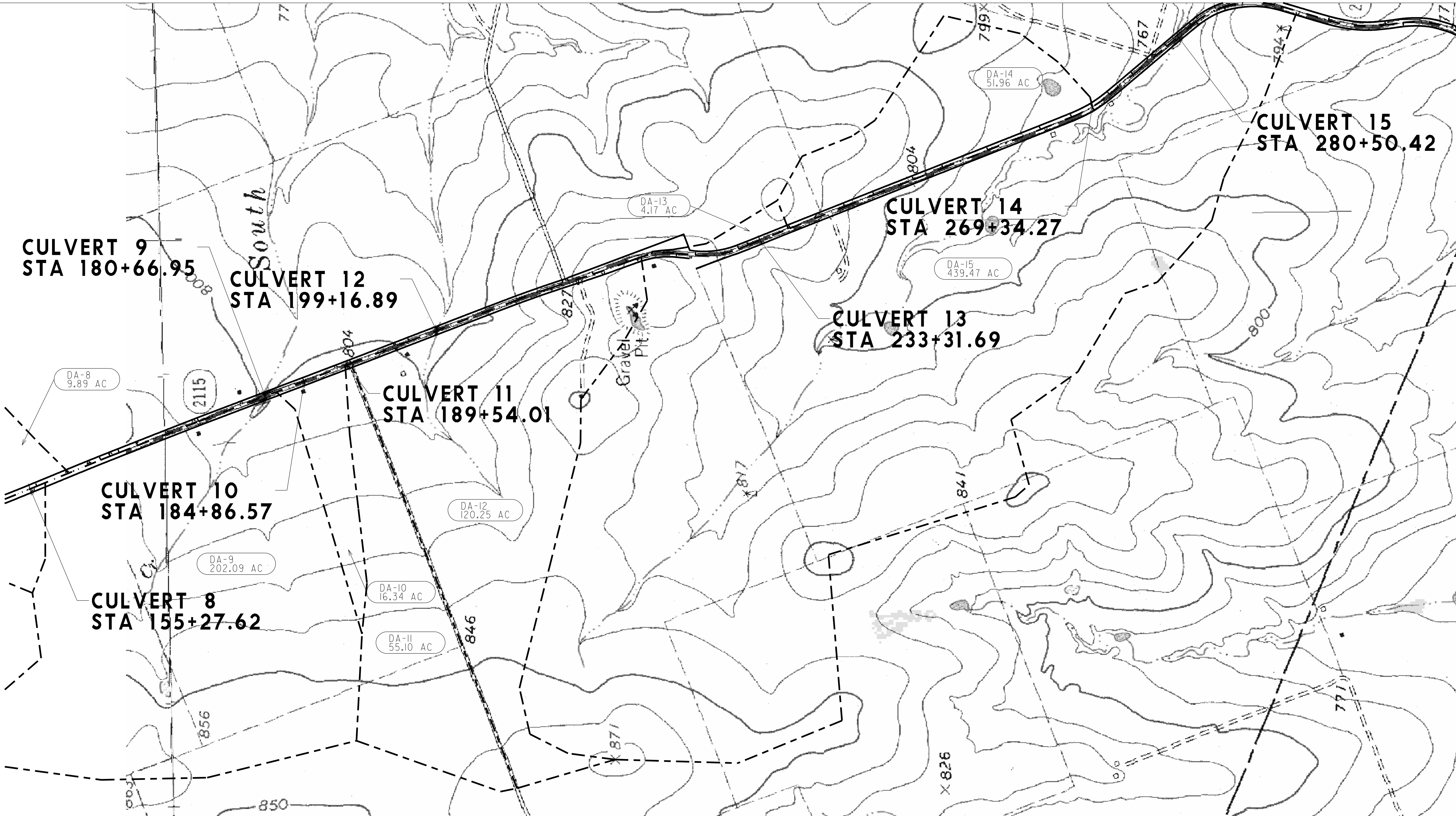
Bradley Mayes 9/2/2021
SIGNATURE OF REGISTRANT & DATE

DRAINAGE AREA LAYOUTS

SCALE: 1" = 500' HORIZ. FEET

SHEET 1 OF 2

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		112



DRAINAGE AREA LAYOUTS

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SCALE: FEET
1" = 500' HORIZ.

SHEET 2 OF 2

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	113

STATE OF TEXAS
BRADLEY MAYES
128276
LICENSED
PROFESSIONAL ENGINEER

Bradley Mayes 8/28/2021
SIGNATURE OF REGISTRANT & DATE

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NODE

						Rational Method					SCS Method					
							Intensity (in/hr)		Runoff (cfs)						Runoff (cfs)	
Drainage Area	Drainage Structure	Proposed Structure	Station	Drainage Area (ac)	Time of Concentration (hours)	Runoff Coefficient (C)	10-Yr	100-Yr	10-Yr	100-Yr	CN	Rainfall Distribution Type	Rainfall Depth (10-Yr) (in)	Rainfall Depth	10-Yr	100-Yr
DA 1	CULVERT 1	1-24"x60' RCP	12+20.685	10	0.66	0.41	3.6	5.7	14	22						
DA 2	CULVERT 2	2-10'x9'x47.7' BOX	27+15.7009	1003	3.06						69	III	6.21	10.90	678	1655
DA 3	CULVERT 3	4-8'x6'x38.7' BOX	44+57.2509	898	2.76						69	III	6.21	10.90	609	1490
DA 4	CULVERT 4	2-36"x48' RCP	64+96.1697	32	0.77	0.40	3.3	5.2	42	66						
DA 5	CULVERT 5	3-7'x5'x39.8' BOX	76+90.8864	489	2.24						69	III	6.21	10.90	383	930
DA 6	CULVERT 6	2-5'x3'x52' BOX	85+27.8222	104	0.80	0.41	3.2	5.1	137	217						
DA 7	CULVERT 7	3-36"x55' RCP	139+57.9932	65	1.04	0.40	2.7	4.3	70	112						
DA 8	CULVERT 8	1-30"x60' RCP	155+27.6182	10	0.74	0.41	3.4	5.4	14	22						
DA 9	CULVERT 9	4-5'x3'x55' BOX	180+66.9487	202	1.24						69	III	6.21	10.90	219	537
DA 10	CULVERT 10	2-24"x44' RCP	184+86.5737	16	0.90	0.40	3.0	4.7	19	31						
DA 11	CULVERT 11	4-30"x48' RCP	189+54.0064	55	1.01	0.40	2.8	4.4	61	97						
DA 12	CULVERT 12	2-6'x3'x68' BOX	199+16.8914	120	1.29	0.40	2.3	3.7	112	180						
DA 13	CULVERT 13	1-30"x50' RCP	233+31.6859	4	0.64	0.44	3.7	5.8	7	11						
DA 14	CULVERT 14	2-24"x54' RCP	269+34.2712	52	0.89	0.44	3.0	4.8	69	109						
DA 15	CULVERT 15	2-8'x6'x46.3' BOX	280+50.4210	496	1.68						69	III	6.21	10.90	459	1110

SCS Method output was calculated using HEC-HMS Version 4.2.
CULVERT 2 DRAINAGE AREA INCLUDES AREAS DA 2, DA 3, DA 4, DA 5, DA 6, DA 7, & DA 8.
CULVERT 3 DRAINAGE AREA INCLUDES AREAS DA 3, DA 4, DA 5, DA 6, DA 7, & DA 8.
CULVERT 5 DRAINAGE AREA INCLUDES AREAS DA 5, DA 6, DA 7, DA 8.
CULVERT 15 DRAINAGE AREA INCLUDES AREAS DA 13, DA 14, AND DA 15.

CURVE NUMBERS ARE ADJUSTED BY -15 PER HYDRAULIC DESIGN MANUAL FIGURE 4-20.

(HY 8 V7.50 USED FOR CULVERT STRUCTURES)					OUTLET CHANNEL					CULVERT ANALYSIS		
LOCATION/STATION	FREQ. (YR)	Q (CFS)	EXIST HW (ELEV)	ALLOW HW (ELEV)	W (FT)	SS	MANNINGS "n"	TW (ELEV)	STRUCTURE DATA	AVG. SLOPE (FT/FT)	HW (ELEV)	VEL. OUT (FPS)
CULVERT 1 - 12+20.685	10	14	689.06	690.06	0	2:1	0.040	688.82	1-24"x60' RCP	0.071	689.58	4.49
	100	22	690.60	691.60				689.27			690.67	7.10
CULVERT 4 - 64+96.1697	10	42	728.59	729.59	0	2:1	0.040	728.21	2-36"x48' RCP	0.010	728.48	2.96
	100	66	729.83	730.83				728.89			729.57	4.70
CULVERT 6 - 85+27.8222	10	137	746.92	747.92	0	2:1	0.040	745.40	2-5'x3'x52' BOX	0.014	746.24	4.69
	100	217	748.24	749.24				745.98			747.62	7.24
CULVERT 7 - 139+57.9932	10	70	819.26	820.26	0	2:1	0.040	818.77	3-36"x55' RCP	0.011	819.09	3.32
	100	112	819.78	820.78				819.61			819.96	4.61
CULVERT 8 - 155+27.6182	10	14	826.05	827.05	0	2:1	0.040	825.63	1-30"x60' RCP	0.012	825.90	2.82
	100	22	827.03	828.03				826.07			826.66	4.42
CULVERT 10 - 184+86.5737	10	19	802.61	803.61	0	2:1	0.040	802.10	2-24"x44' RCP	0.002	802.42	3.09
	100	31	803.16	804.16				802.62			803.35	4.79
CULVERT 11 - 189+54.0064	10	61	805.36	806.36	0	2:1	0.040	805.04	4-30"x48' RCP	-0.006	805.35	3.09
	100	97	805.84	806.84				805.84			805.84	3.80
CULVERT 12 - 199+16.8914	10	112	797.13	798.13	0	2:1	0.040	796.64	2-6'x3'x68' BOX	0.014	796.90	3.11
	100	180	797.80	798.80				797.65			797.94	4.46
CULVERT 13 - 233+31.6859	10	7	824.24	825.24	0	2:1	0.040	824.13	1-30"x50' RCP	0.024	824.53	1.39
	100	11	824.56	825.56				824.47			824.90	2.18
CULVERT 14 - 269+34.2712	10	69	775.21	776.21	0	10:1	0.040	771.97	2-24"x54' RCP	0.019	774.16	7.96
	100	109	775.36	776.36				772.25			775.41	9.51

STATE OF TEXAS
BRADLEY MAYES
128276
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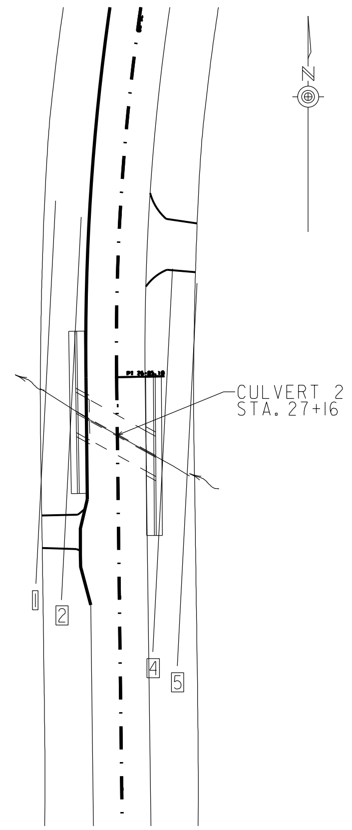
PROFESSIONAL ENGINEER

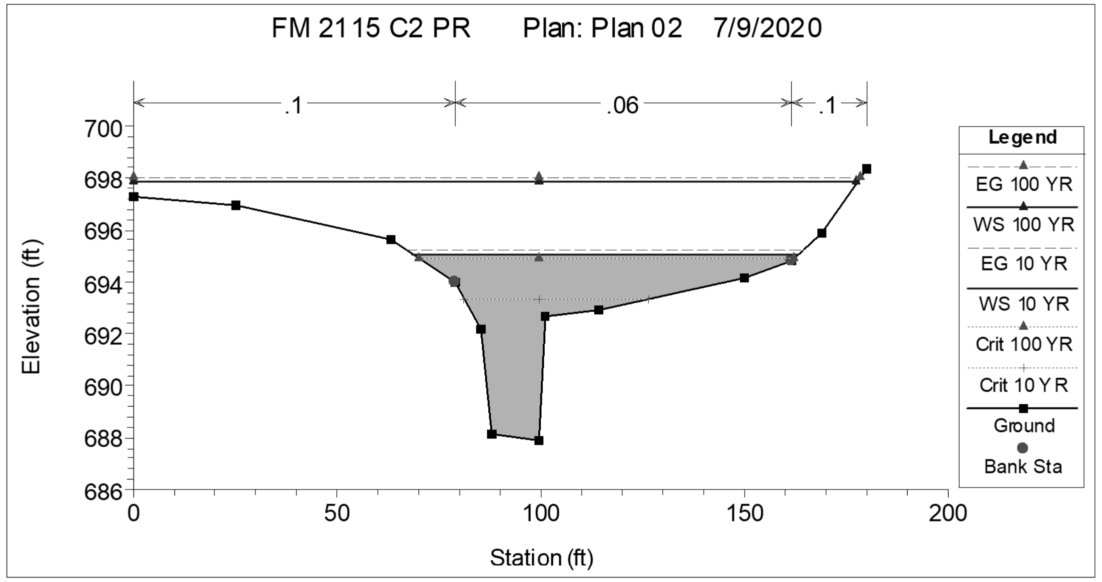
Bradley Mayes 8/28/2021
SIGNATURE OF REGISTRANT & DATE

DRAINAGE CALCULATIONS

SHEET 1 OF 6

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	114





Existing

Reach	River Sta	Profile	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
C2	5	10 YR	677.7	688.76	695.19		695.26	0.001285	2.37	370.84	120.86	0.19
C2	5	100 YR	1655.3	688.76	697.92		698.04	0.001284	3.13	700.62	120.86	0.2
C2	4	10 YR	677.7	687.92	695.05	693.34	695.22	0.005785	3.29	210.55	94.66	0.37
C2	4	100 YR	1655.3	687.92	697.83	694.91	698.01	0.002358	3.47	585.51	177.66	0.27
C2	3		Culvert									
C2	2	10 YR	677.7	687.82	694.14	694.14	695.05	0.053727	7.64	88.68	49.6	1.01
C2	2	100 YR	1655.3	687.82	695.63	695.63	696.99	0.042628	9.39	179.25	68.92	0.99
C2	1	10 YR	677.7	686.49	690.24	690.24	691.1	0.044837	7.42	91.38	54.29	1
C2	1	100 YR	1655.3	686.49	691.69	691.69	692.93	0.038791	8.95	189.73	81.19	1

Proposed

Reach	River Sta	Profile	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
C2	5	10 YR	677.7	688.76	695.19		695.27	0.001283	2.37	371.04	120.86	0.19
C2	5	100 YR	1655.3	688.76	697.91		698.03	0.00129	3.14	699.61	120.86	0.2
C2	4	10 YR	677.7	687.92	695.05	693.34	695.22	0.005769	3.29	210.73	94.7	0.37
C2	4	100 YR	1655.3	687.92	697.83	694.91	698	0.002375	3.48	583.9	177.62	0.27
C2	3		Culvert									
C2	2	10 YR	677.7	687.82	694.14	694.14	695.05	0.053727	7.64	88.68	49.6	1.01
C2	2	100 YR	1655.3	687.82	695.63	695.63	696.99	0.042628	9.39	179.25	68.92	0.99
C2	1	10 YR	677.7	686.49	690.24	690.24	691.1	0.044837	7.42	91.38	54.29	1
C2	1	100 YR	1655.3	686.49	691.69	691.69	692.93	0.038791	8.95	189.73	81.19	1

NORMAL DEPTH COMPUTATIONS WERE USED FOR THE UPSTREAM AND DOWNSTREAM BOUNDARY CONDITIONS. A SLOPE OF 0.1401 WAS USED FOR EXISTING AND PROPOSED DOWNSTREAM CONDITIONS. A SLOPE OF 0.1667 WAS USED FOR THE EXISTING PROPOSED UPSTREAM CONDITION.

STATE OF TEXAS
BRADLEY MAYES
128276
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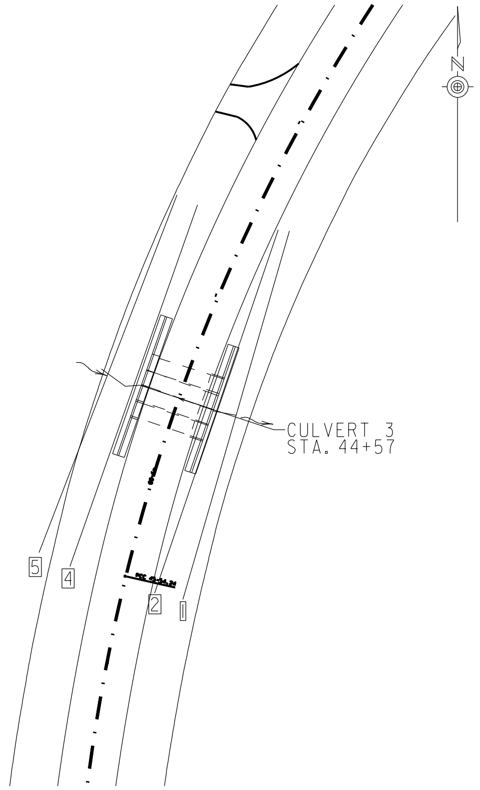
PROFESSIONAL ENGINEER

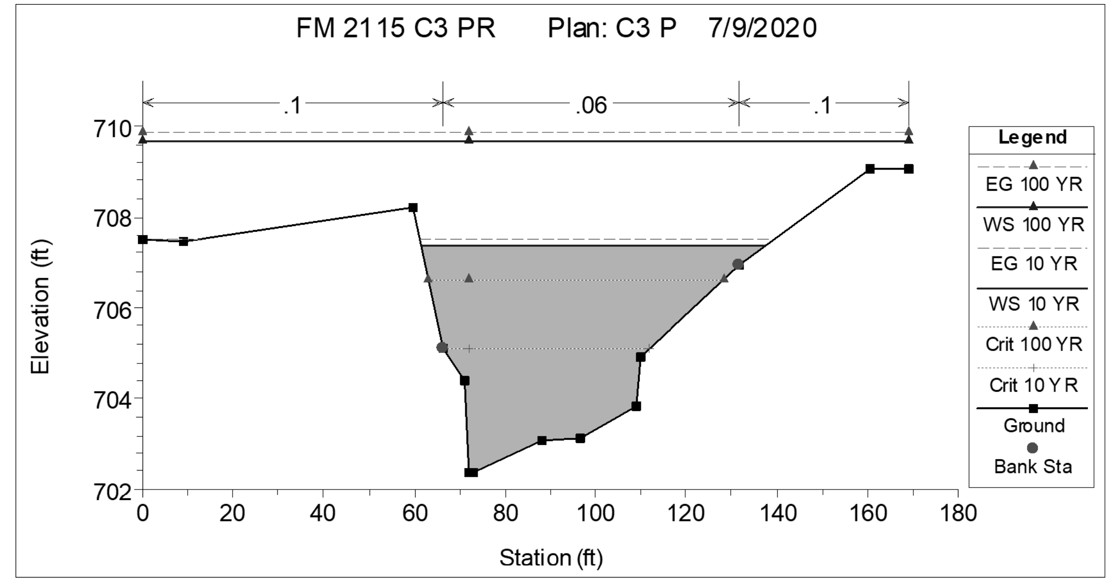
Bradley Mayes 8/28/2021
SIGNATURE OF REGISTRANT & DATE

DRAINAGE CALCULATIONS

SHEET 2 OF 6

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		115





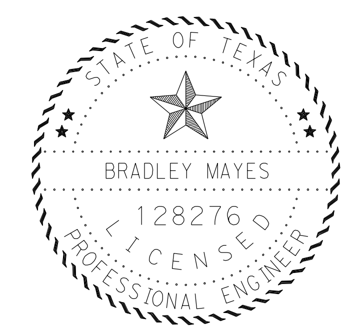
Existing

Reach	River Sta	Profile	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
C3	5	10 YR	609.1	704.06	707.28		707.66	0.020908	4.98	122.36	79.24	0.68
C3	5	100 YR	1490.2	704.06	709.69		709.89	0.004126	3.95	496.07	193.63	0.35
C3	4	10 YR	609.1	702.36	707.36	705.11	707.49	0.002986	2.88	216.44	75.89	0.28
C3	4	100 YR	1490.2	702.36	709.66	706.62	709.84	0.002264	3.6	546.72	168.9	0.27
C3	3		Culvert									
C3	2	10 YR	609.1	702.84	707.2		707.25	0.001209	1.7	381.28	170.76	0.18
C3	2	100 YR	1490.2	702.84	708.39		708.5	0.002075	2.81	594.84	188.93	0.25
C3	1	10 YR	609.1	704.44	707.08	706.36	707.21	0.007323	3.23	243.91	160.62	0.42
C3	1	100 YR	1490.2	704.44	708.22	707.06	708.46	0.00733	4.44	462.72	199.11	0.45

Proposed

Reach	River Sta	Profile	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
C3	5	10 YR	609.1	704.06	707.28		707.67	0.02078	4.97	122.66	79.72	0.68
C3	5	100 YR	1490.2	704.06	709.71		709.92	0.004022	3.91	500.95	193.63	0.35
C3	4	10 YR	609.1	702.36	707.36	705.11	707.49	0.002976	2.87	216.68	75.94	0.28
C3	4	100 YR	1490.2	702.36	709.69	706.62	709.86	0.002221	3.57	551.01	168.9	0.27
C3	3		Culvert									
C3	2	10 YR	609.1	702.84	707.2		707.25	0.001209	1.7	381.28	170.76	0.18
C3	2	100 YR	1490.2	702.84	708.39		708.5	0.002075	2.81	594.84	188.93	0.25
C3	1	10 YR	609.1	704.44	707.08	706.36	707.21	0.007323	3.23	243.91	160.62	0.42
C3	1	100 YR	1490.2	704.44	708.22	707.06	708.46	0.00733	4.44	462.72	199.11	0.45

NORMAL DEPTH COMPUTATIONS WERE USED FOR THE UPSTREAM AND DOWNSTREAM BOUNDARY CONDITIONS. A SLOPE OF 0.0073 WAS USED FOR EXISTING AND PROPOSED DOWNSTREAM CONDITIONS. A SLOPE OF 0.1667 WAS USED FOR THE EXISTING PROPOSED UPSTREAM CONDITION.



Bradley Mayes 8/28/2021

SIGNATURE OF REGISTRANT & DATE

DRAINAGE CALCULATIONS

SHEET 3 OF 6

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		116

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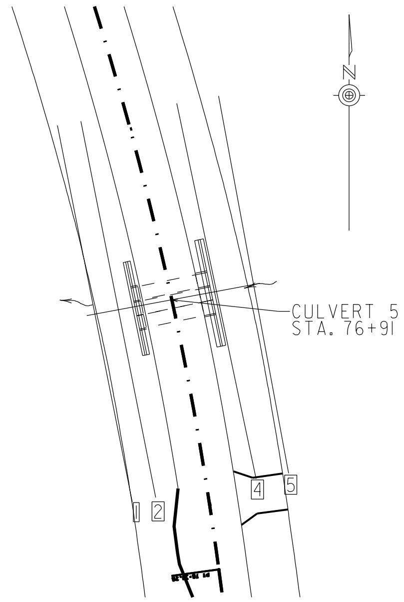
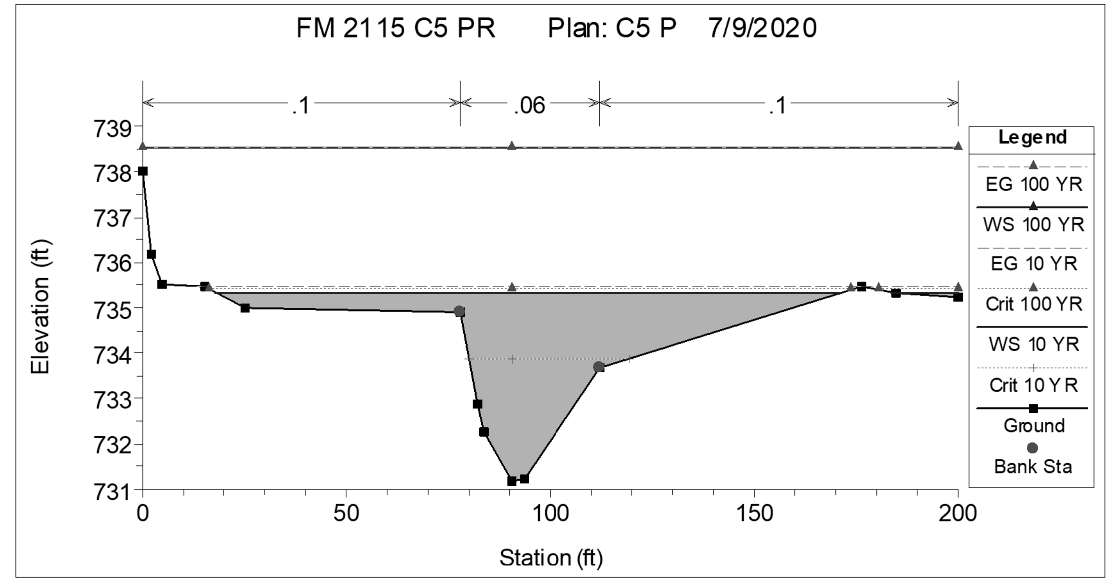
NODE





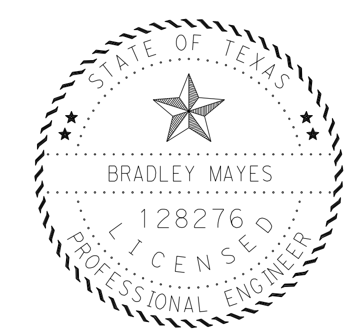
Existing

Reach	River Sta	Profile	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
C5	5	10 YR	382.7	731.8	735.19		735.67	0.016518	5.88	84.39	52.75	0.65
C5	5	100 YR	930.1	731.8	738.33		738.5	0.002902	4.2	373.25	101.31	0.31
C5	4	10 YR	382.7	731.19	735.26	733.89	735.41	0.004726	3.39	160.45	152.77	0.35
C5	4	100 YR	930.1	731.19	738.4	735.4	738.43	0.000676	2.1	777.74	199.94	0.15
C5	3		Culvert									
C5	2	10 YR	382.7	729.08	732.86		733.01	0.0068	3.11	123.03	64.88	0.4
C5	2	100 YR	930.1	729.08	734.01		734.31	0.009457	4.36	228.35	130.44	0.49
C5	1	10 YR	382.7	729.33	732.01	732.01	732.62	0.051747	6.28	60.97	51.33	1.02
C5	1	100 YR	930.1	729.33	733.07	733.07	733.85	0.041562	7.1	134.59	107.11	0.97

Proposed

Reach	River Sta	Profile	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
C5	5	10 YR	382.7	731.8	735.27		735.71	0.014745	5.66	88.45	53.96	0.61
C5	5	100 YR	930.1	731.8	738.45		738.61	0.002639	4.06	385.75	101.31	0.3
C5	4	10 YR	382.7	731.19	735.34	733.89	735.48	0.00417	3.24	173.27	169.61	0.33
C5	4	100 YR	930.1	731.19	738.51	735.4	738.55	0.000618	2.03	801.47	199.94	0.14
C5	3		Culvert									
C5	2	10 YR	382.7	729.08	732.86		733.01	0.0068	3.11	123.03	64.88	0.4
C5	2	100 YR	930.1	729.08	734.01		734.31	0.009457	4.36	228.35	130.44	0.49
C5	1	10 YR	382.7	729.33	732.01	732.01	732.62	0.051747	6.28	60.97	51.33	1.02
C5	1	100 YR	930.1	729.33	733.07	733.07	733.85	0.041562	7.1	134.59	107.11	0.97

NORMAL DEPTH COMPUTATIONS WERE USED FOR THE UPSTREAM AND DOWNSTREAM BOUNDARY CONDITIONS. A SLOPE OF 0.1443 WAS USED FOR EXISTING AND PROPOSED DOWNSTREAM CONDITIONS. A SLOPE OF 0.1667 WAS USED FOR THE EXISTING PROPOSED UPSTREAM CONDITION.



Bradley Mayes 8/28/2021

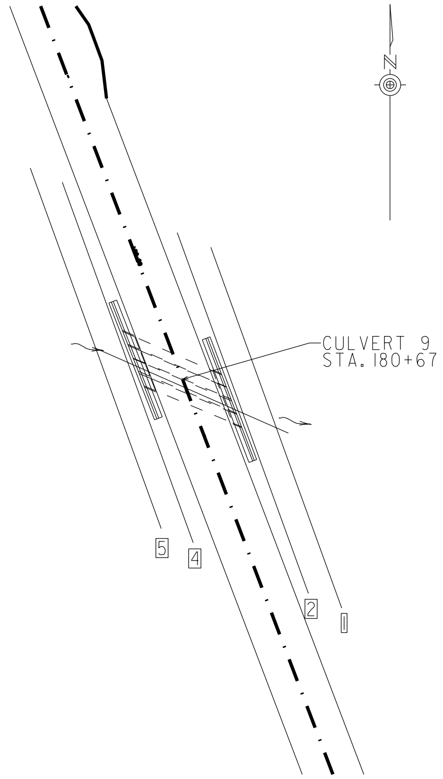
SIGNATURE OF REGISTRANT & DATE

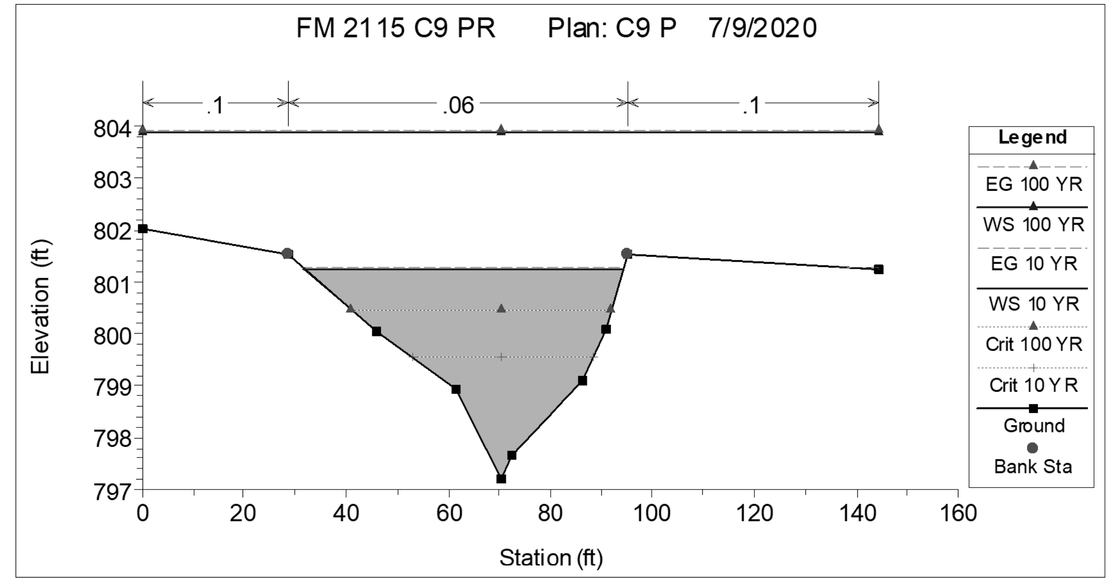
DRAINAGE CALCULATIONS

SHEET 4 OF 6

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	117

NODE





Existing

Reach	River Sta	Profile	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
C9	5	10 YR	219	797.19	801.28		801.32	0.001898	1.66	131.76	68.42	0.21
C9	5	100 YR	537.4	797.19	803.88		803.91	0.000481	1.48	464.88	144.59	0.12
C9	4	10 YR	219	797.19	801.23	799.55	801.28	0.002279	1.82	120.38	62.69	0.23
C9	4	100 YR	537.4	797.19	803.87	800.45	803.9	0.000489	1.47	479.23	144.59	0.12
C9	3		Culvert									
C9	2	10 YR	219	796.52	799.33		799.64	0.017325	4.49	48.86	30.62	0.62
C9	2	100 YR	537.4	796.52	800.8		801.18	0.010026	5.17	139.92	97.92	0.52
C9	1	10 YR	219	795.17	798.28	798.28	799.08	0.049869	7.17	30.56	19.67	1.01
C9	1	100 YR	537.4	795.17	799.64	799.64	800.76	0.043076	8.49	63.3	28.3	1

Proposed

Reach	River Sta	Profile	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
C9	5	10 YR	219	797.19	801.28		801.32	0.001898	1.66	131.76	68.42	0.21
C9	5	100 YR	537.4	797.19	803.88		803.91	0.000481	1.48	464.88	144.59	0.12
C9	4	10 YR	219	797.19	801.23	799.55	801.28	0.002279	1.82	120.38	62.69	0.23
C9	4	100 YR	537.4	797.19	803.87	800.45	803.9	0.000489	1.47	479.23	144.59	0.12
C9	3		Culvert									
C9	2	10 YR	219	796.52	799.33		799.64	0.017325	4.49	48.86	30.62	0.62
C9	2	100 YR	537.4	796.52	800.8		801.18	0.010026	5.17	139.92	97.92	0.52
C9	1	10 YR	219	795.17	798.28	798.28	799.08	0.049869	7.17	30.56	19.67	1.01
C9	1	100 YR	537.4	795.17	799.64	799.64	800.76	0.043076	8.49	63.3	28.3	1

NORMAL DEPTH COMPUTATIONS WERE USED FOR THE UPSTREAM AND DOWNSTREAM BOUNDARY CONDITIONS. A SLOPE OF 0.1667 WAS USED FOR EXISTING AND PROPOSED DOWNSTREAM CONDITIONS. A SLOPE OF 0.1667 WAS USED FOR THE EXISTING PROPOSED UPSTREAM CONDITION.

STATE OF TEXAS
BRADLEY MAYES
128276
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Bradley Mayes 8/28/2021

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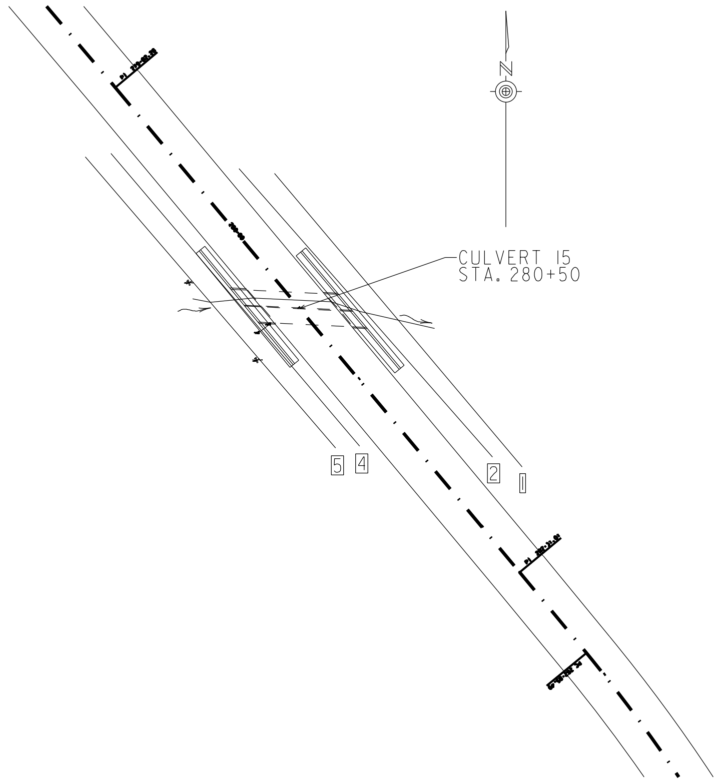
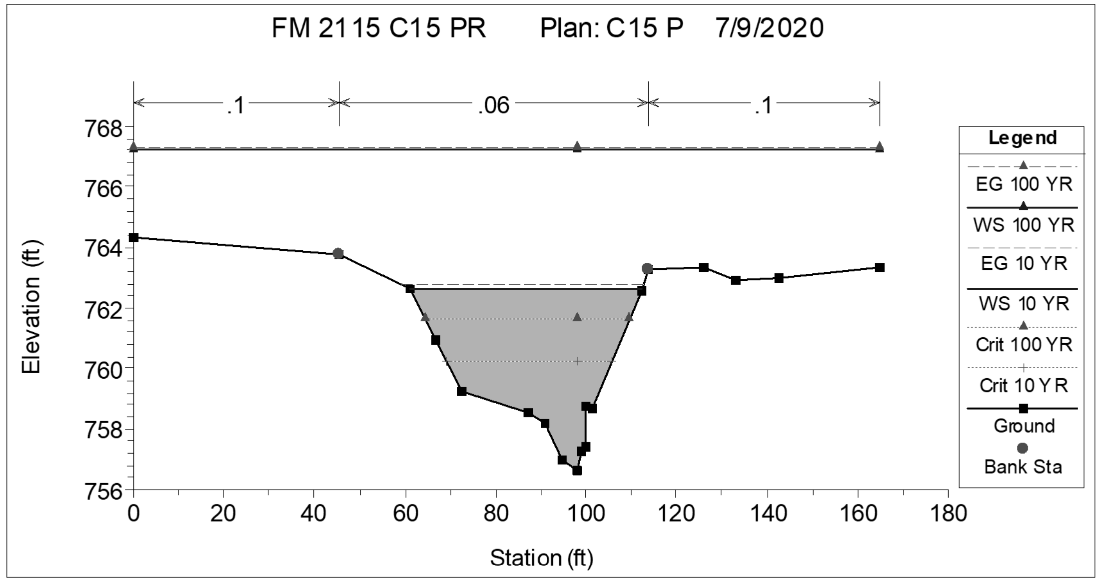
DRAINAGE CALCULATIONS

SHEET 5 OF 6

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		118

pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\203801031\4 - Design\Plan Sheets\Drainage\FM 2115 Drainage Plan Sheets.dgn
8/28/2021
NODE





Existing

Reach	River Sta	Profile	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
C15	5	10 YR	459	756.39	762.75		762.79	0.000614	1.51	376.64	164.83	0.13
C15	5	100 YR	1110.2	756.39	767.26		767.29	0.000176	1.35	1119.84	164.83	0.08
C15	4	10 YR	459	756.63	762.65	760.26	762.76	0.002717	2.74	167.35	51.3	0.27
C15	4	100 YR	1110.2	756.63	767.24	761.65	767.28	0.000434	1.82	826.65	164.83	0.12
C15	3		Culvert									
C15	2	10 YR	459	755.29	759.93	759.21	760.64	0.022609	6.75	67.96	24.61	0.72
C15	2	100 YR	1110.2	755.29	761.5	761.5	762.85	0.033127	9.36	126.3	67.04	0.91
C15	1	10 YR	459	756.01	759.01	759.01	760.07	0.044057	8.24	55.72	26.64	1
C15	1	100 YR	1110.2	756.01	760.95	760.95	761.92	0.031483	8.06	157.24	93.56	0.89

Proposed

Reach	River Sta	Profile	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
C15	5	10 YR	459	756.39	762.75		762.79	0.000614	1.51	376.64	164.83	0.13
C15	5	100 YR	1110.2	756.39	767.26		767.29	0.000176	1.35	1119.84	164.83	0.08
C15	4	10 YR	459	756.63	762.65	760.26	762.76	0.002717	2.74	167.35	51.3	0.27
C15	4	100 YR	1110.2	756.63	767.24	761.65	767.28	0.000434	1.82	826.65	164.83	0.12
C15	3		Culvert									
C15	2	10 YR	459	755.29	759.93	759.21	760.64	0.022609	6.75	67.96	24.61	0.72
C15	2	100 YR	1110.2	755.29	761.5	761.5	762.85	0.033127	9.36	126.3	67.04	0.91
C15	1	10 YR	459	756.01	759.01	759.01	760.07	0.044057	8.24	55.72	26.64	1
C15	1	100 YR	1110.2	756.01	760.95	760.95	761.92	0.031483	8.06	157.24	93.56	0.89

NORMAL DEPTH COMPUTATIONS WERE USED FOR THE UPSTREAM AND DOWNSTREAM BOUNDARY CONDITIONS. A SLOPE OF 0.1667 WAS USED FOR EXISTING AND PROPOSED DOWNSTREAM CONDITIONS. A SLOPE OF 0.1667 WAS USED FOR THE EXISTING PROPOSED UPSTREAM CONDITION.

Bradley Mayes 8/28/2021

SIGNATURE OF REGISTRANT & DATE

DRAINAGE CALCULATIONS

SHEET 6 OF 6

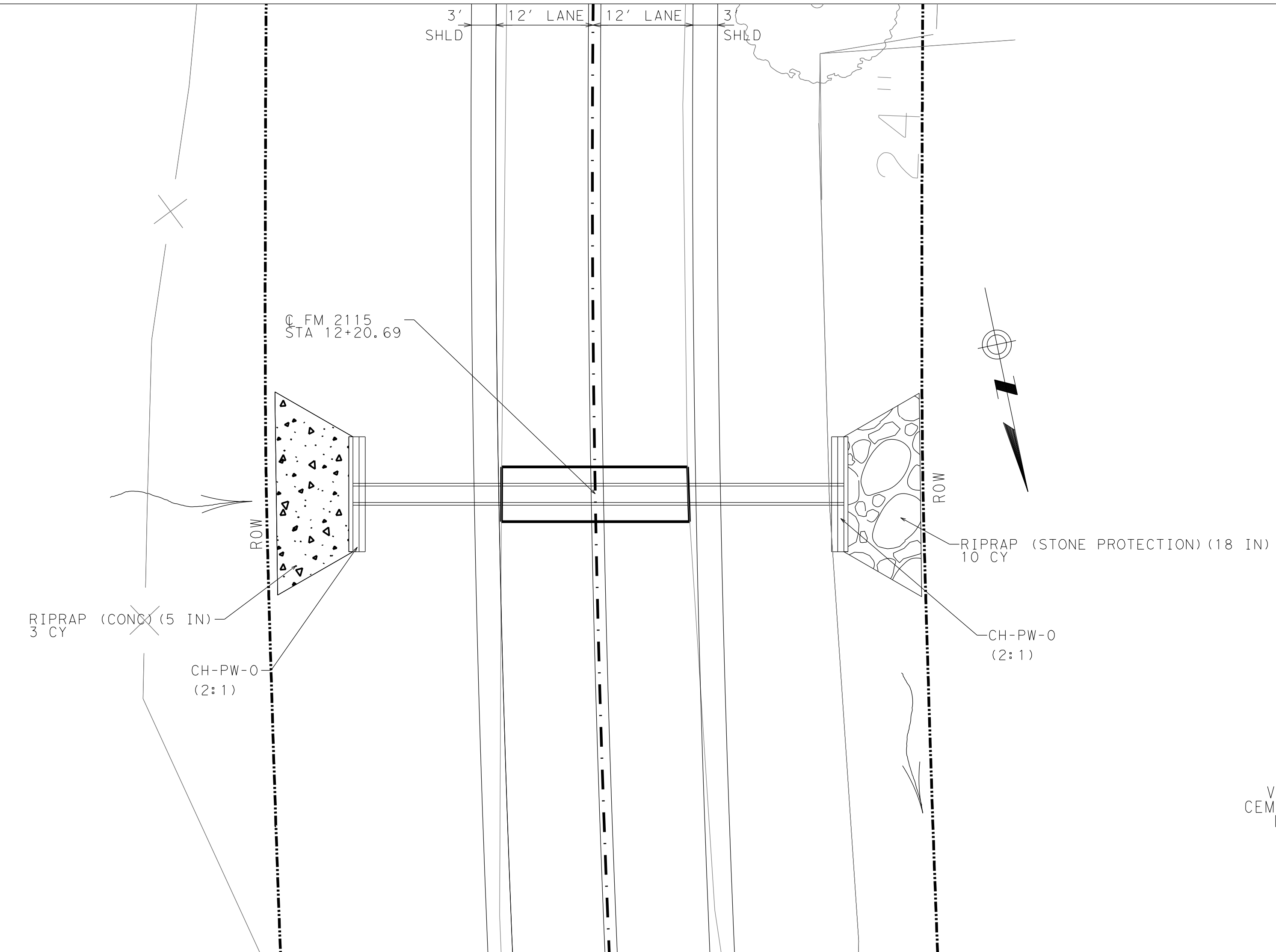
CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		119

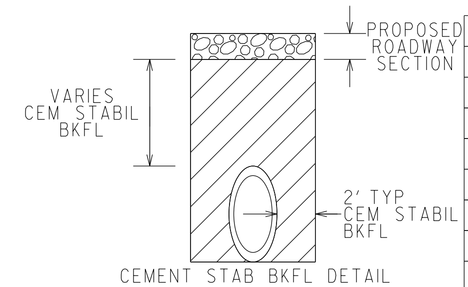
NODE

NOTES:

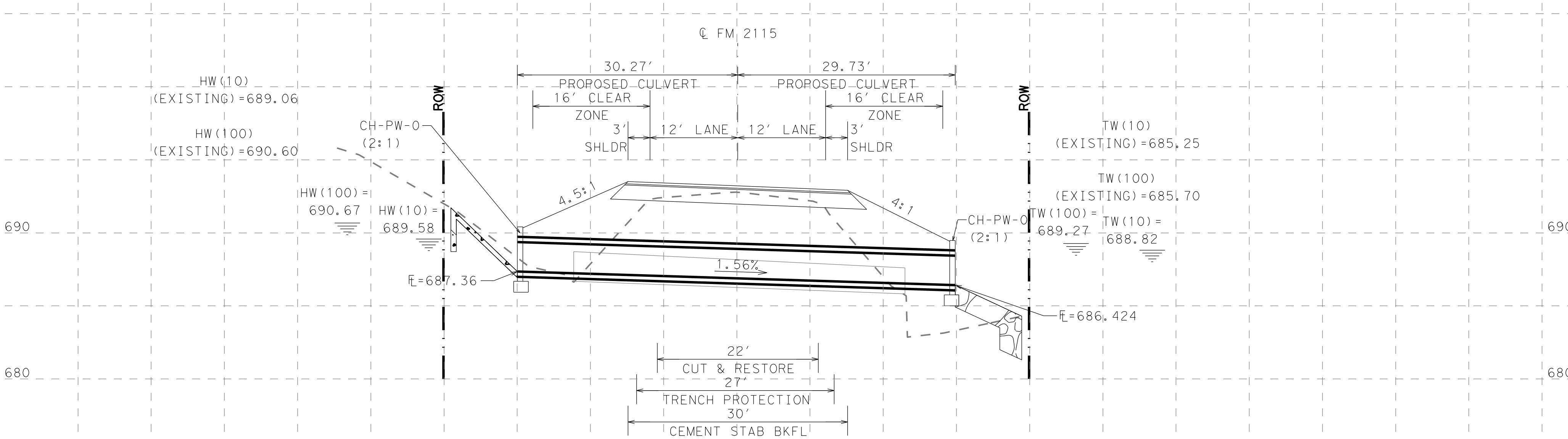
SLOPES ARE APPROXIMATE. MATCH EXISTING GROUND AT 1' FROM ROW.

CONTRACTOR TO ENSURE POSITIVE DRAINAGE.





ITEM	DESCRIPTION	QTY	UNIT
400 6005	CEM STABIL BKFL	59	CY
400 6006	CUT & RESTORING PAV	17	SY
402 6001	TRENCH EXCAVATION PROTECTION	27	LF
432 6002	RIPRAP (CONC)(5 IN)	3	CY
432 6033	RIPRAP (STONE PROTECTION)(18 IN)	10	CY
464 6005	RC PIPE (CL III)(24 IN)	60	LF
466 6097	HEADWALL (CH-PW-0)(DIA=24 IN)	2	EA
496 6007	REMOV STR (PIPE)	45	LF



STATION 12+20.69 (CULVERT 1)
EXISTING 1-24"X45.43' CMP
REMOVE & REPLACE WITH 1-24"X60' RCP
CH-PW-O LT & RT

STATE OF TEXAS
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128276
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Bradley Mayes 8/28/2021

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CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERTICAL

SHEET 1 OF 15

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	120

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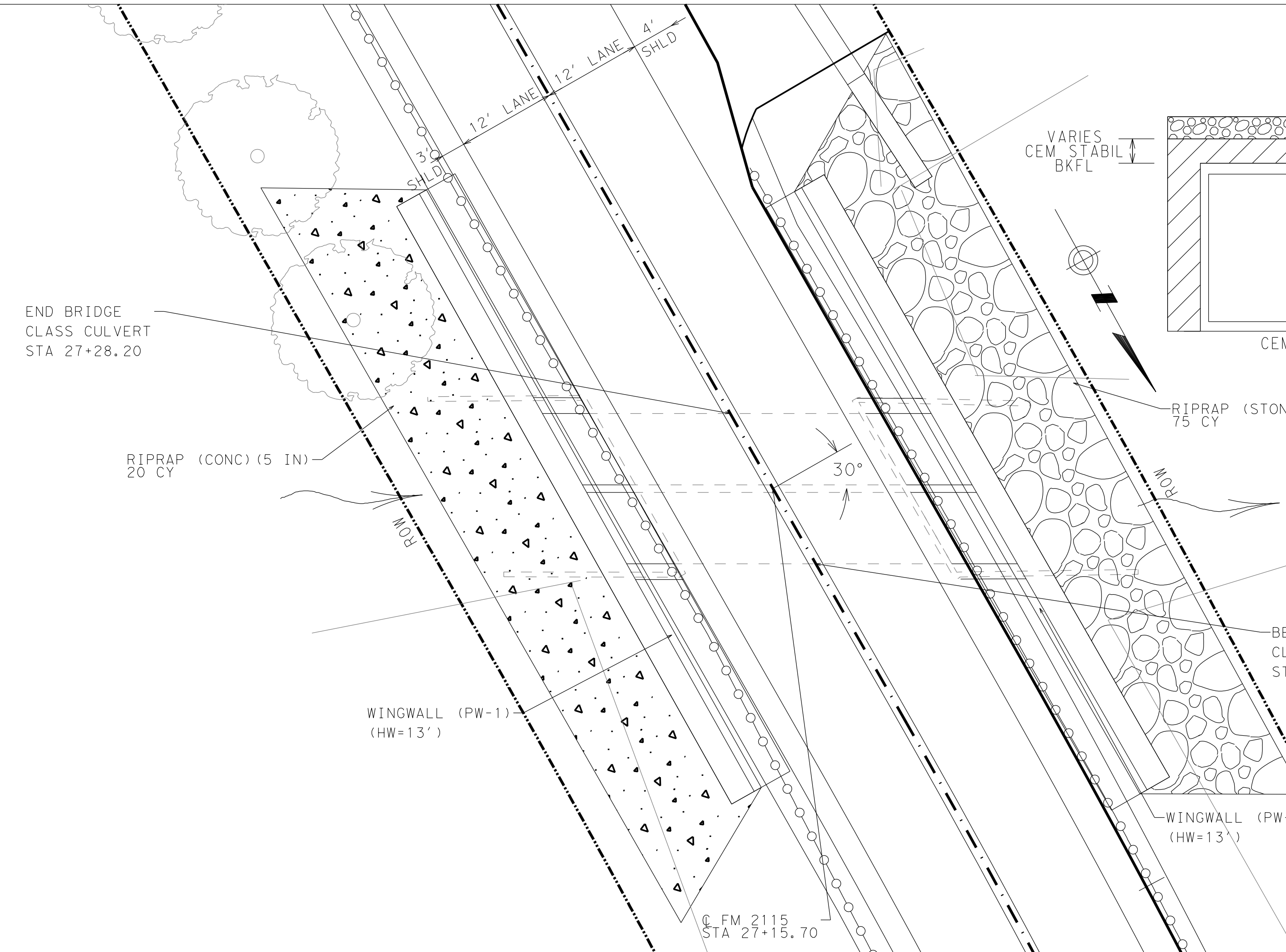
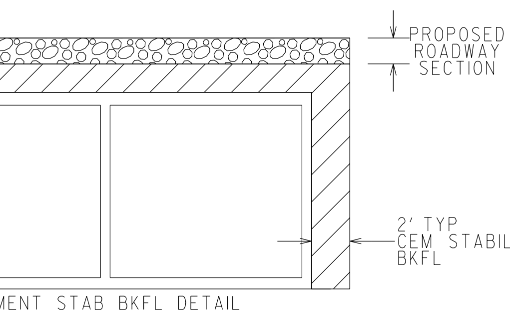
NODE

NOTES:

SLOPES ARE APPROXIMATE. MATCH EXISTING GROUND AT 1' FROM ROW.

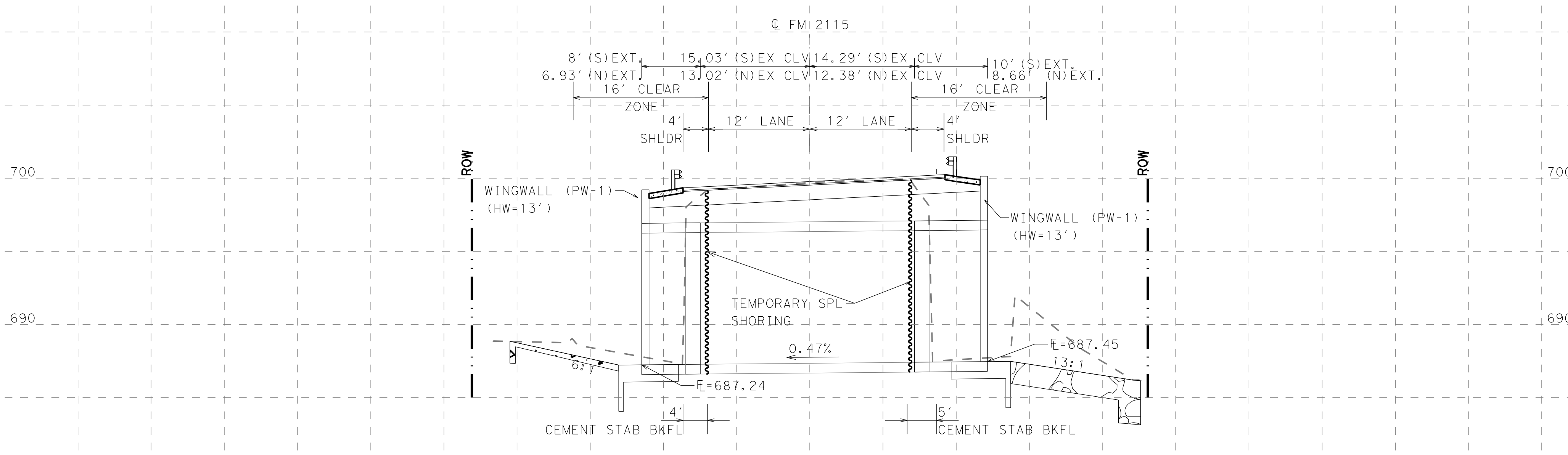
CONTRACTOR TO ENSURE POSITIVE DRAINAGE.





ITEM	DESCRIPTION	QTY	UNIT
400 6005	CEM STABIL BKFL	7	CY
403 6001	TEMPORARY SPL SHORING	1955	SF
432 6002	RIPRAP (CONC)(5 IN)	20	CY
432 6033	RIPRAP (STONE PROTECTION)(18 IN)	75	CY
462 6077	CONC BOX CULV (10 FT X 9 FT)(EXTEND)	28	LF
466 6174	WINGWALL (PW-1)(HW=13 FT)	2	EA

NBI: 09-014-0-2038-01-001



STATION 27+15.70 (CULVERT 2)
EXISTING 2-10'X9'X33.74' MBC (SKEW 30°)
EXTEND 6' LT & 8' RT
PW-1 LT & RT, MC-10-13, MC-MD, & ECD

STATE OF TEXAS
BRADLEY MAYES
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Bradley Mayes 9/7/2021
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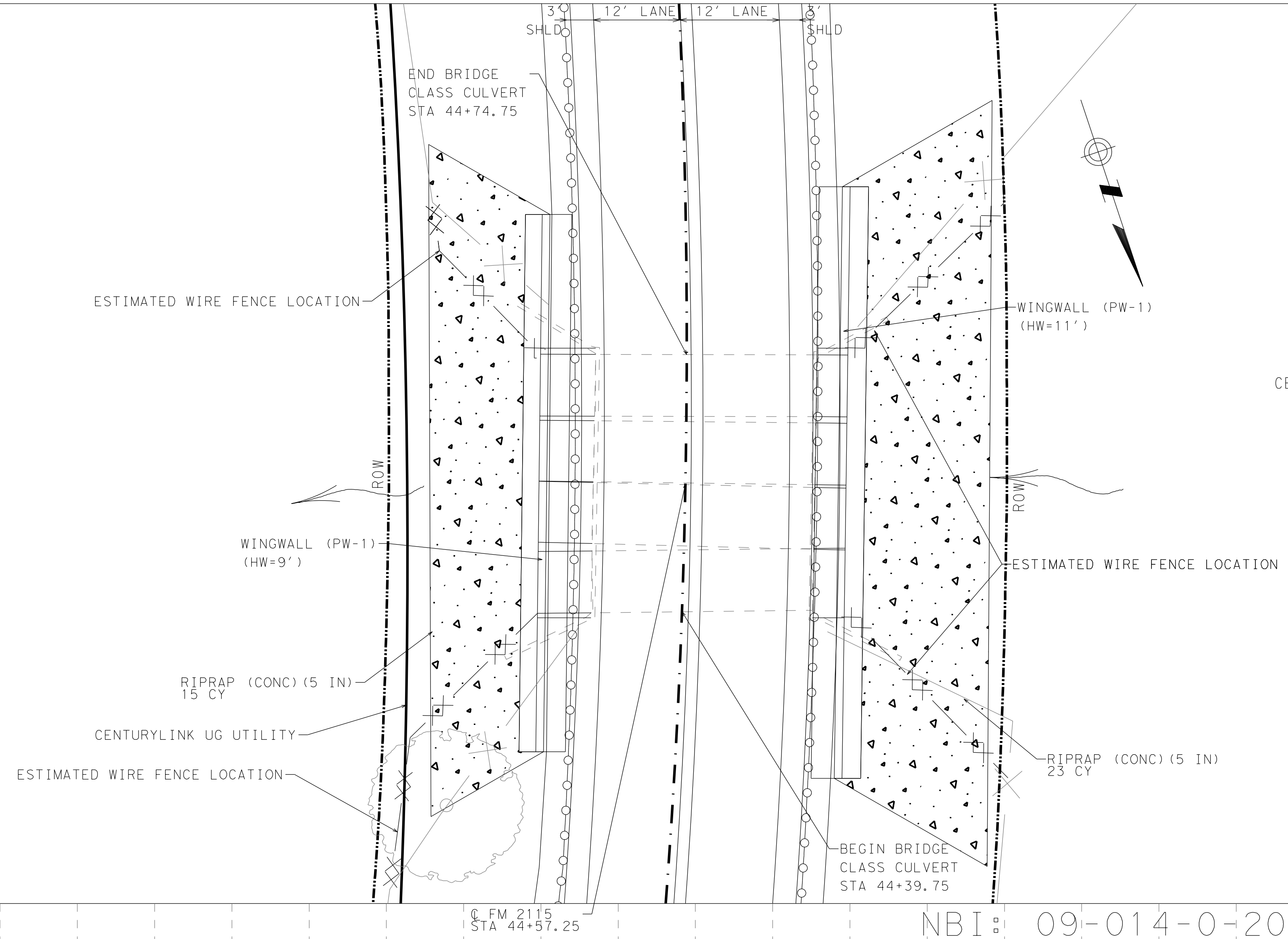
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERTICAL

SHEET 2 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	121



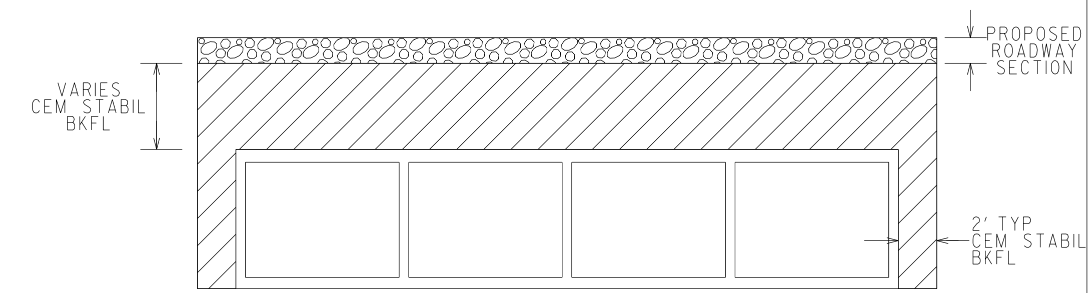
NOTES:

SLOPES ARE APPROXIMATE. MATCH EXISTING GROUND AT 1' FROM ROW.

CONTRACTOR TO ENSURE POSITIVE DRAINAGE.

CONCRETE RIPRAP TO INCLUDE LEAVE-OUTS FORMED IN THE METHOD USED IN GF(31)MS-19 AT SPACING IN ACCORDANCE WITH THE WF(2)-10 STANDARD.

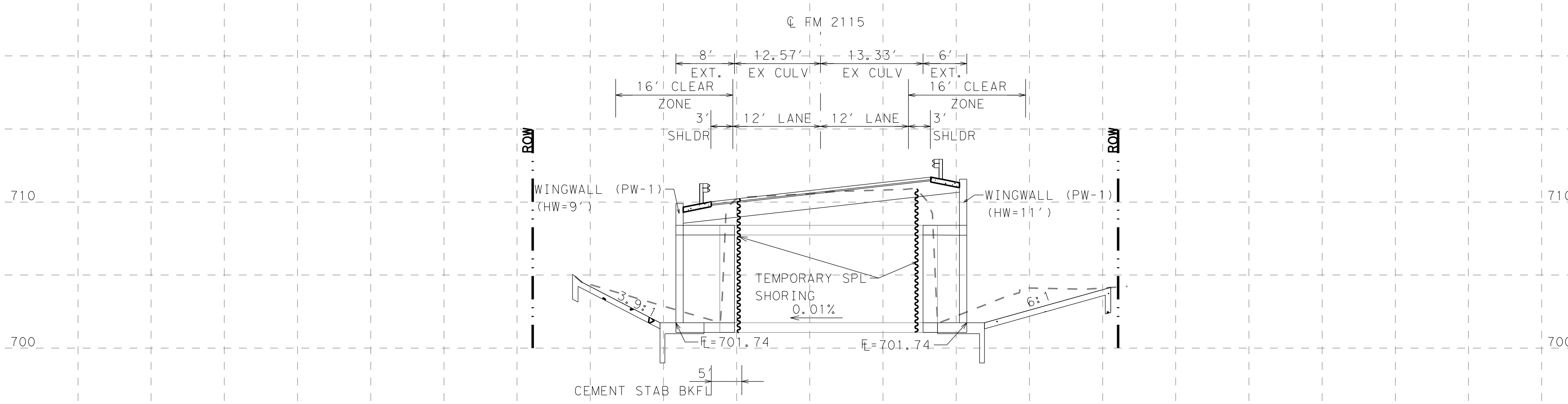
UTILITY LOCATION APPROXIMATE. CONTRACTOR TO VERIFY.



CEMENT STAB BKFL DETAIL

ITEM	DESCRIPTION	QTY	UNIT
400 6005	CEM STABIL BKFL	3	CY
403 6001	TEMPORARY SPL SHORING	1119	SF
432 6002	RIPRAP (CONC)(5 IN)	38	CY
462 6065	CONC BOX CULV (8 FT X 6 FT)(EXTEND)	56	LF
466 6172	WINGWALL (PW-1)(HW=11 FT)	1	EA
466 6184	WINGWALL (PW-1)(HW=9 FT)	1	EA
552 6003	WIRE FENCE (TY C)	133	EA

NBI: 09-014-0-2038-01-002



STATION 44+57.25 (CULVERT 3)(LIVESTOCK PASS)
EXISTING 4-8'X6'X28.70' MBC
EXTEND 6' LT & 4' RT
PW-1 LT & RT; MC-8-13, MC-MD, SP, & ECD

9/7/2021
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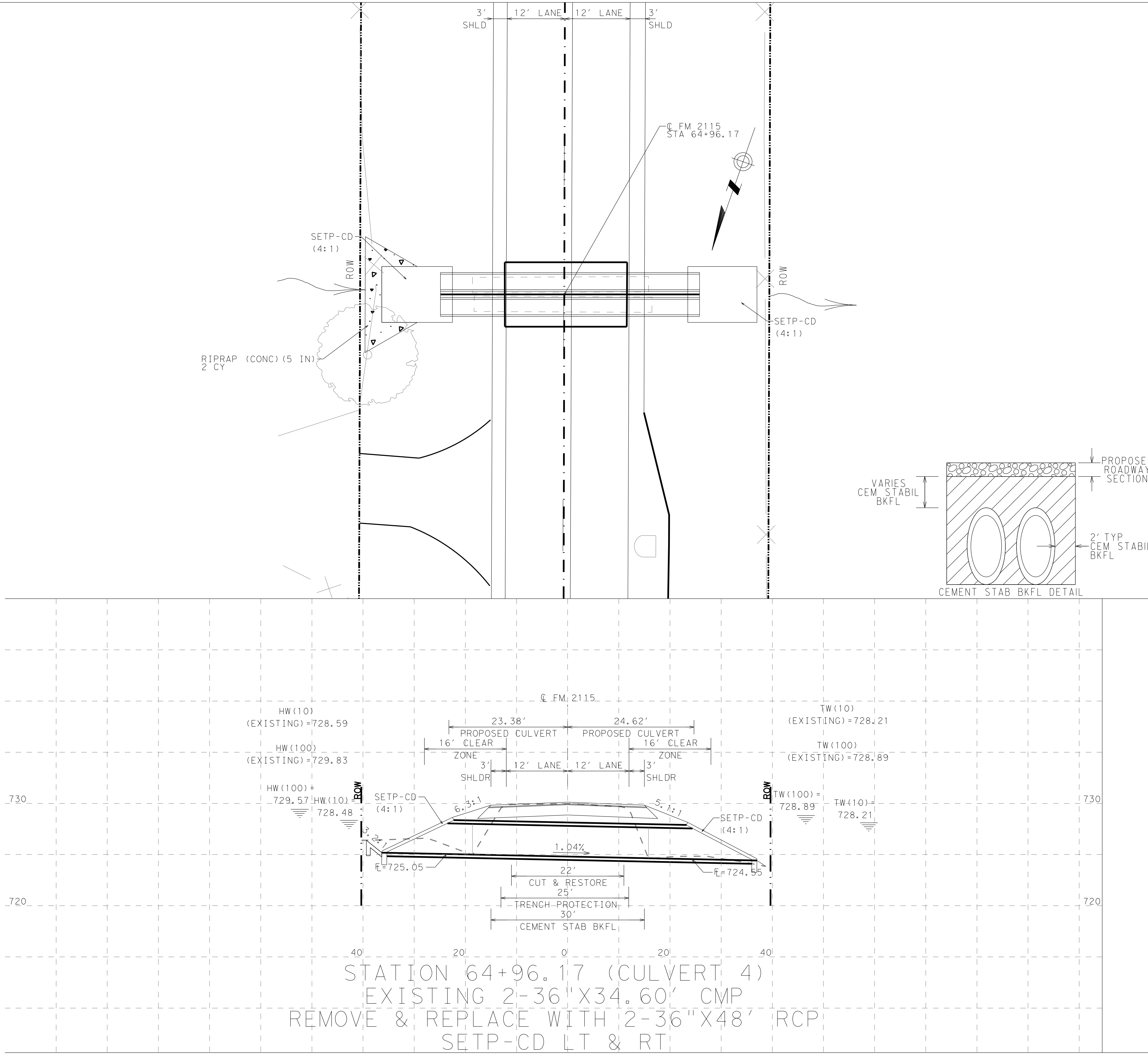
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERTICAL

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	122

NOTES:
SLOPES ARE APPROXIMATE. MATCH EXISTING GROUND AT 1' FROM ROW.

CONTRACTOR TO ENSURE POSITIVE DRAINAGE.



STATION 64+96.17 (CULVERT 4)
EXISTING 2-36"X34.60' CMP
REMOVE & REPLACE WITH 2-36"X48' RCP
SETP-CD LT & RT

ITEM	DESCRIPTION	QTY	UNIT
400 6005	CEM STABIL BKFL	42	CY
400 6006	CUT & RESTORING PAV	31	SY
402 6001	TRENCH EXCAVATION PROTECTION	25	LF
432 6002	RIPRAP (CONC)(5 IN)	2	CY
464 6008	RC PIPE (CL III)(36 IN)	96	LF
467 6450	SET (TY II)(36 IN)(RCP)(4:1)(C)	4	EA
496 6007	REMOV STR (PIPE)	70	LF

STATE OF TEXAS
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Bradley Mayes 8/28/2021
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CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERTICAL

SHEET 4 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		123

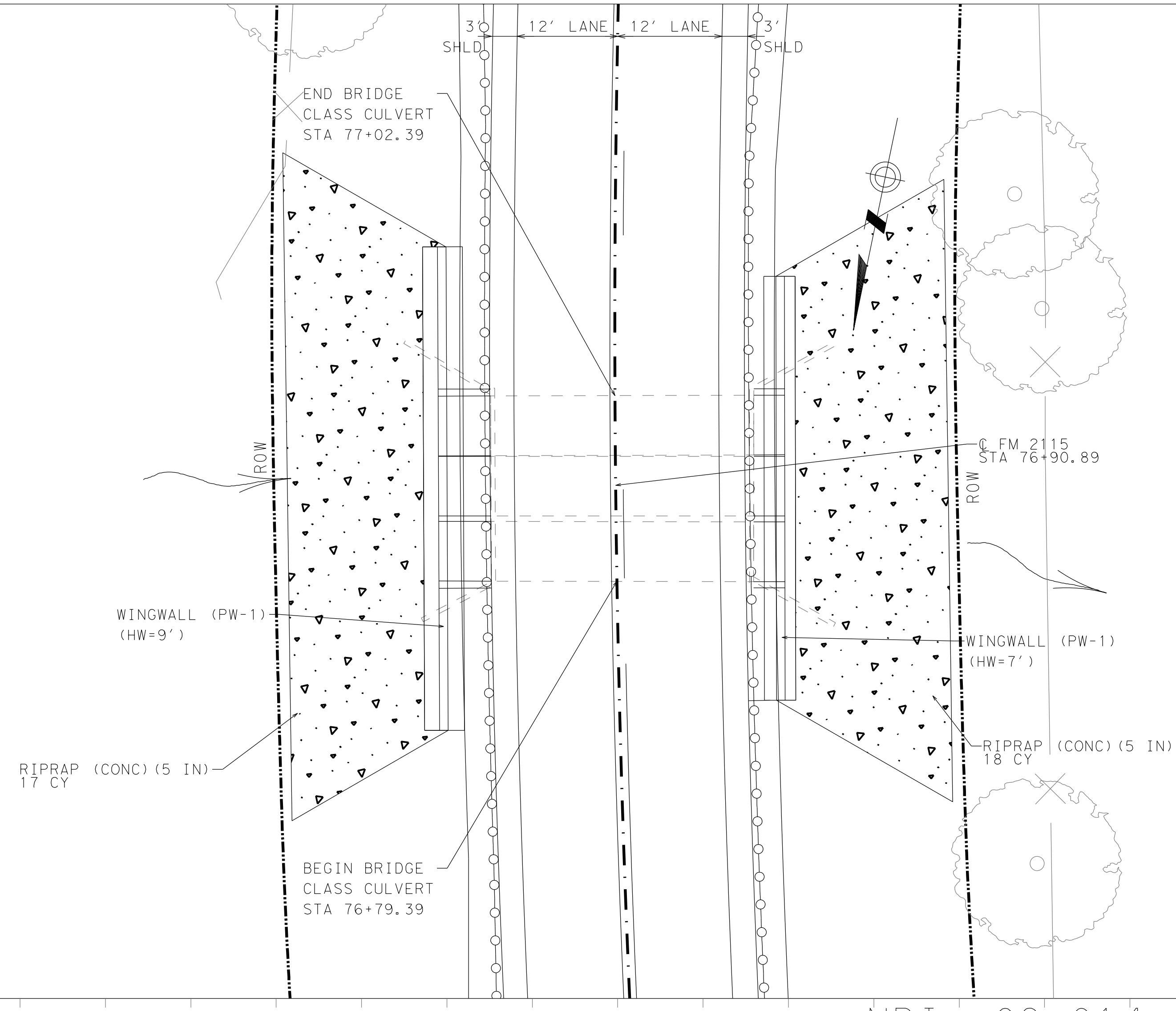
pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\203801031\4 - Design\Plan Sets\Drainage\FM 2115 Drainage Plan Sheets.dgn 8/28/2021

NODE

NOTES:

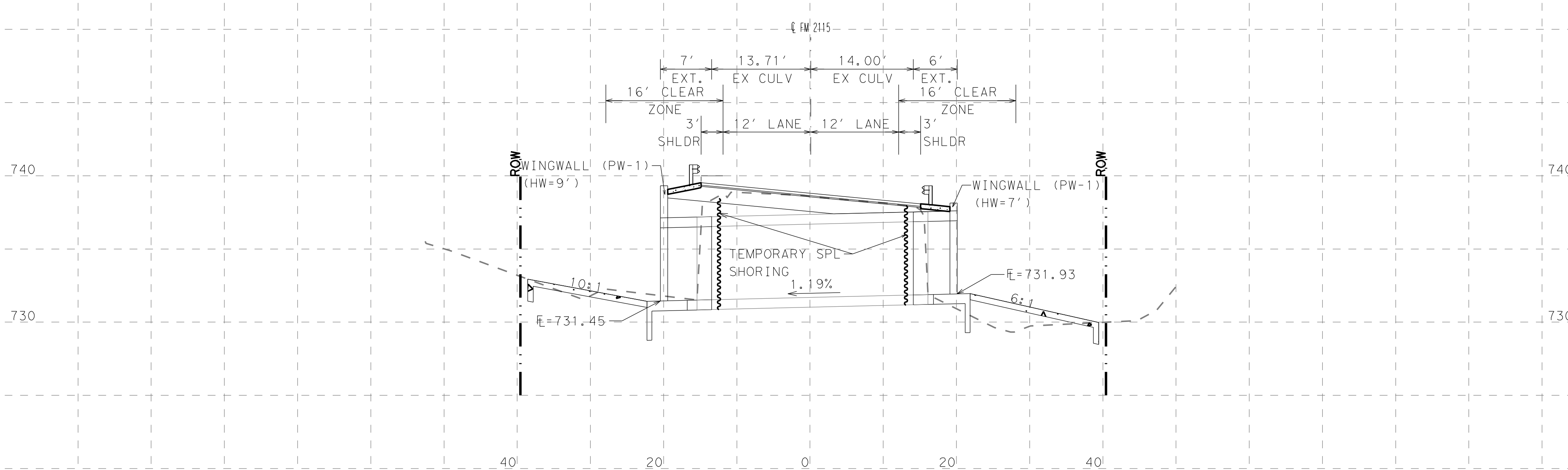
SLOPES ARE APPROXIMATE. MATCH EXISTING GROUND AT 1' FROM ROW.

CONTRACTOR TO ENSURE POSITIVE DRAINAGE.



ITEM	DESCRIPTION	QTY	UNIT
403 6001	TEMPORARY SPL SHORING	658	SF
432 6002	RIPRAP (CONC)(5 IN)	35	CY
462 6060	CONC BOX CULV (7 FT X 5 FT)(EXTEND)	39	LF
466 6182	WINGWALL (PW-1)(HW=7 FT)	1	EA
466 6184	WINGWALL (PW-1)(HW=9 FT)	1	EA

NBI: 09-014-0-2038-01-003



STATION 76+90.89 (CULVERT 5)
EXISTING 3-7'X5'X30.77' MBC
EXTEND 5' LT & 4' RT
PW-1 LT & RT; MC-7-10, MC-MD, & ECD

STATE OF TEXAS
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Bradley Mayes 8/28/2021

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CULVERT LAYOUTS

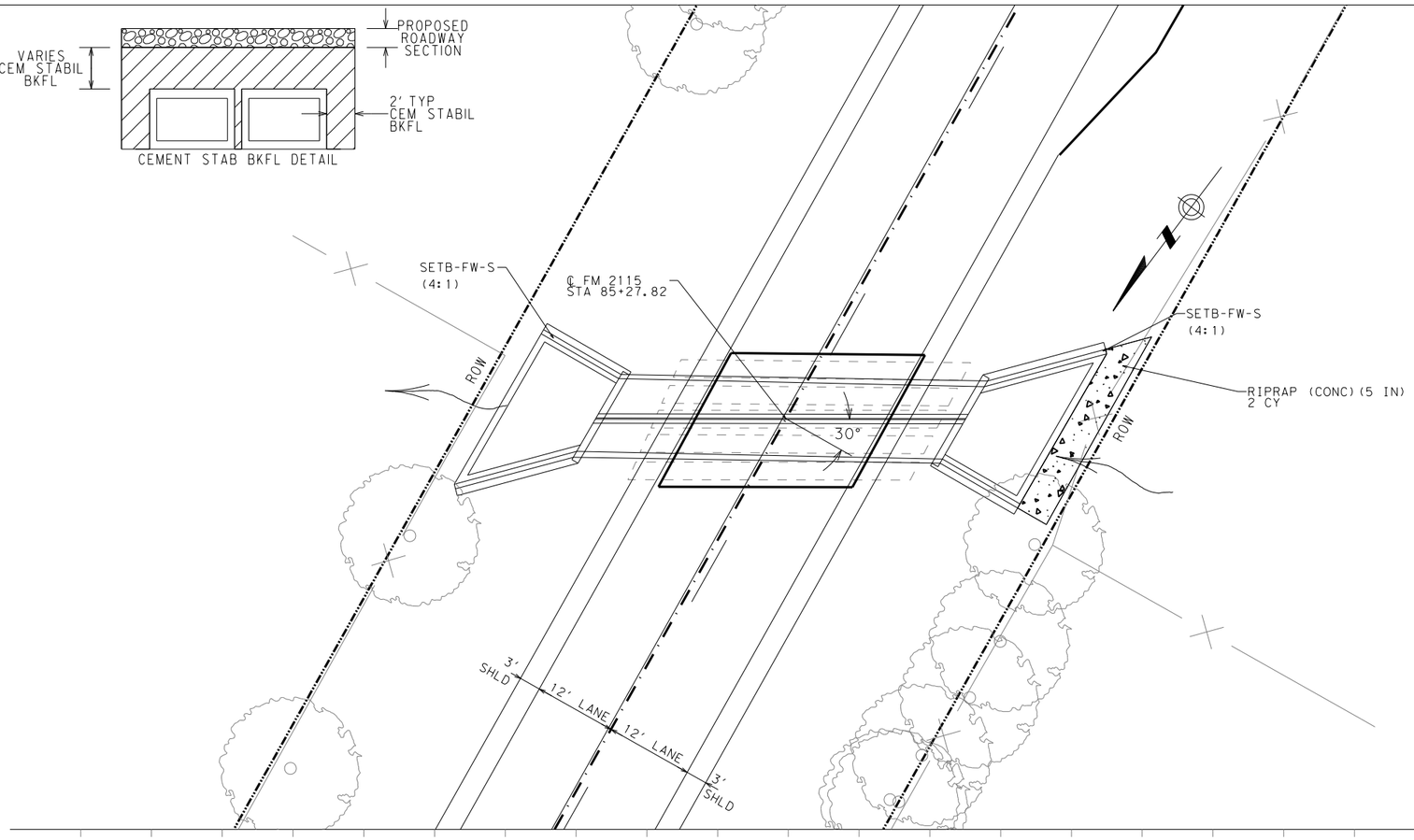
SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERTICAL

SHEET 5 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	124

NODE

CEMENT STAB BKFL DETAIL

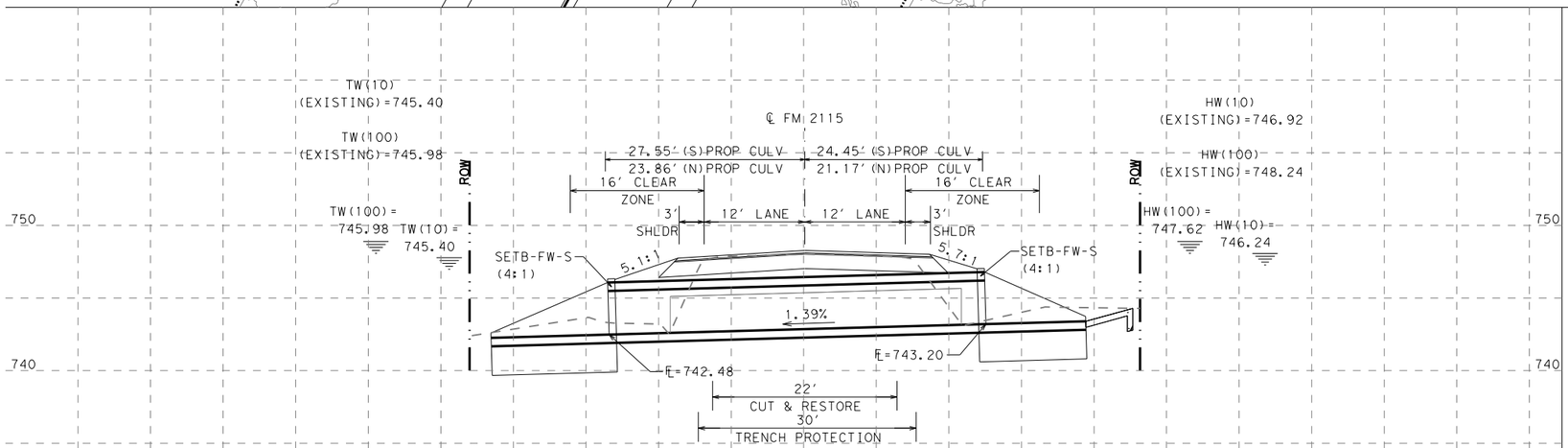


NOTES:

SLOPES ARE APPROXIMATE. MATCH EXISTING GROUND AT 1' FROM ROW.

CONTRACTOR TO ENSURE POSITIVE DRAINAGE.

ITEM	DESCRIPTION	QTY	UNIT
400 6005	CEM STABIL BKFL	42	CY
400 6006	CUT & RESTORING PAV	51	SY
402 6001	TRENCH EXCAVATION PROTECTION	30	LF
432 6002	RIPRAP (CONC)(5 IN)	2	CY
462 6007	CONC BOX (5 FT X 3 FT)	104	LF
467 6177	SET (TY I)(S=5 FT)(HW=4 FT)(4:1)(C)	4	EA
496 6007	REMOV STR (PIPE)	205	LF



STATION 85+27.82 (CULVERT 6)
EXISTING 5-30"X40.11' CMP (SKEW 30°)
REMOVE & REPLACE WITH 2-5'X3'X52' MBC
SETB-FW-S LT & RT; SCP-5 & SCP-MD

STATE OF TEXAS
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Bradley Mayes 8/28/2021

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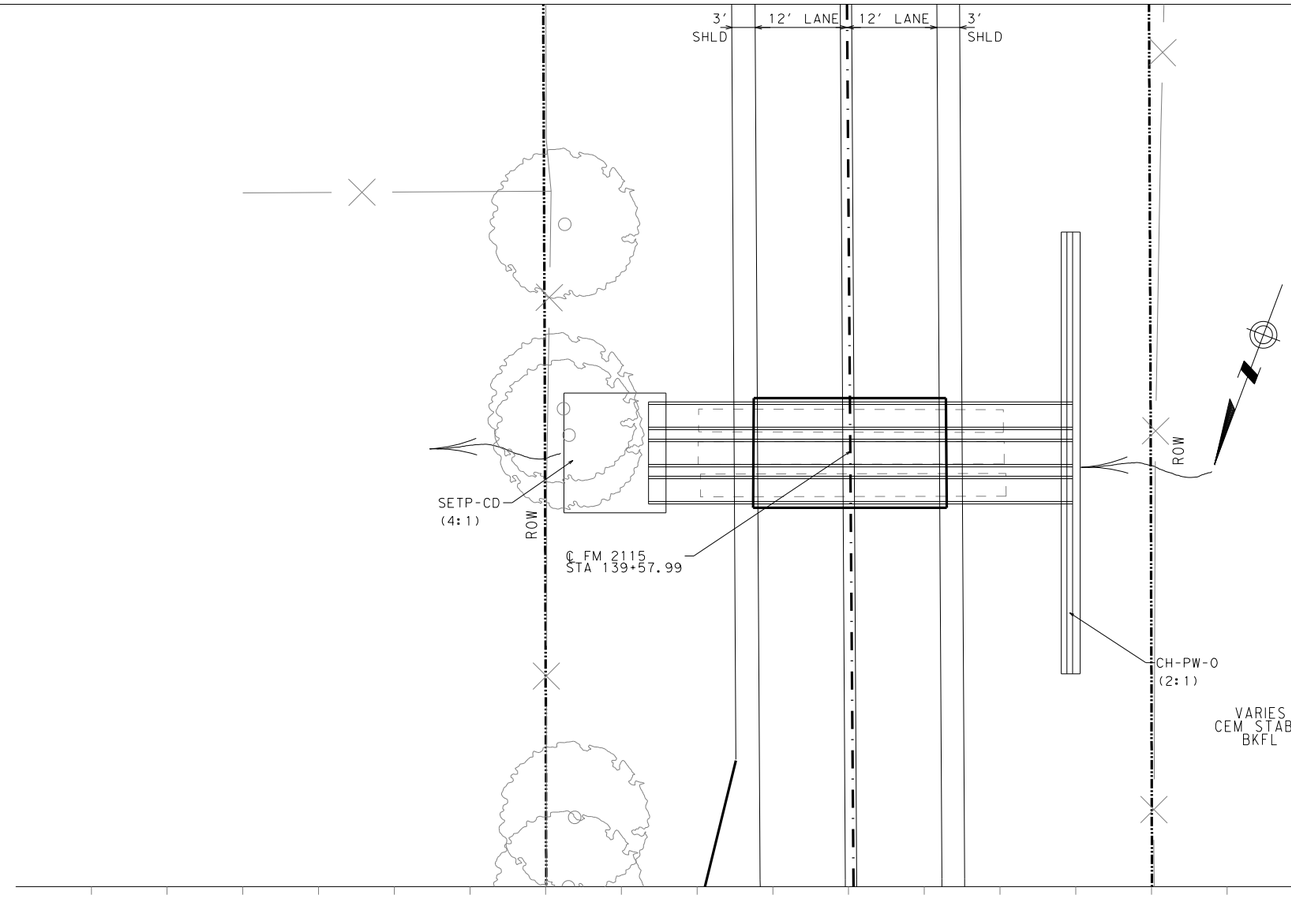
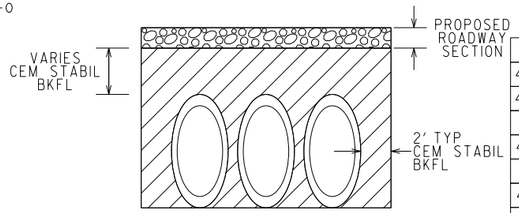
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERTICAL

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		125



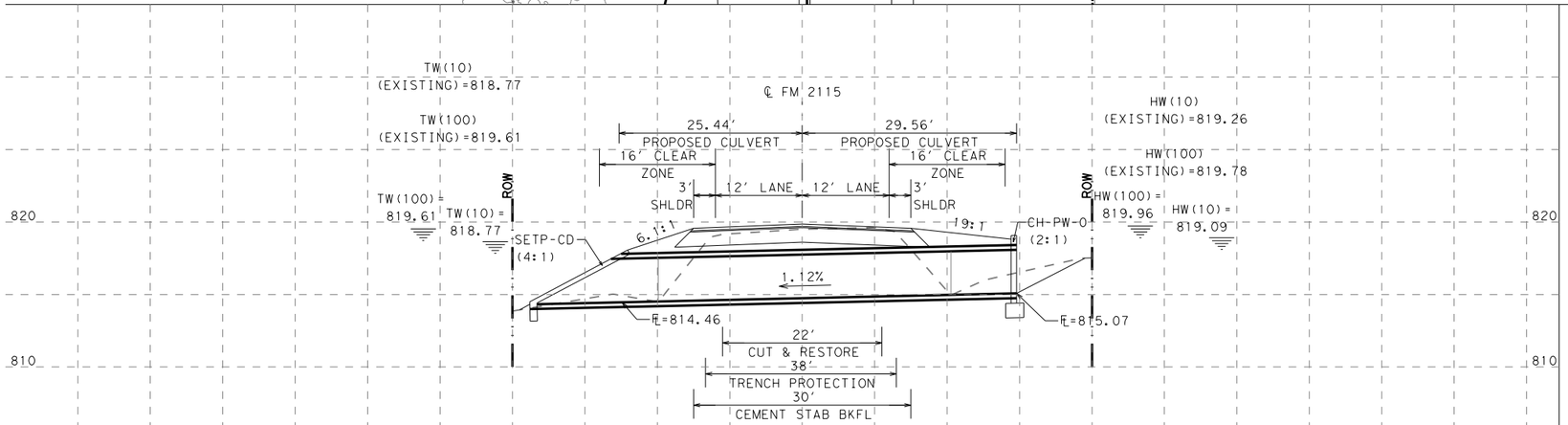


NOTES:

SLOPES ARE APPROXIMATE. MATCH EXISTING GROUND AT 1' FROM ROW.

CONTRACTOR TO ENSURE POSITIVE DRAINAGE.

ITEM	DESCRIPTION	QTY	UNIT
400 6005	CEM STABIL BKFL	47	CY
400 6006	CUT & RESTORING PAV	41	SY
402 6001	TRENCH EXCAVATION PROTECTION	38	LF
464 6008	RC PIPE (CL III)(36 IN)	165	LF
466 6101	HEADWALL (CH-PW-0)(DIA=36 IN)	1	EA
467 6450	SET (TY II)(36 IN)(RCP)(4:1)(C)	3	EA
496 6007	REMOV STR (PIPE)	123	LF



STATION 139+57.99 (CULVERT 7)
EXISTING 3-36"X40.31' CMP
REMOVE & REPLACE WITH 3-36"X55' RCP
SETP-CD LT & CH-PW-0 RT

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Bradley Mayes 8/28/2021

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CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERTICAL

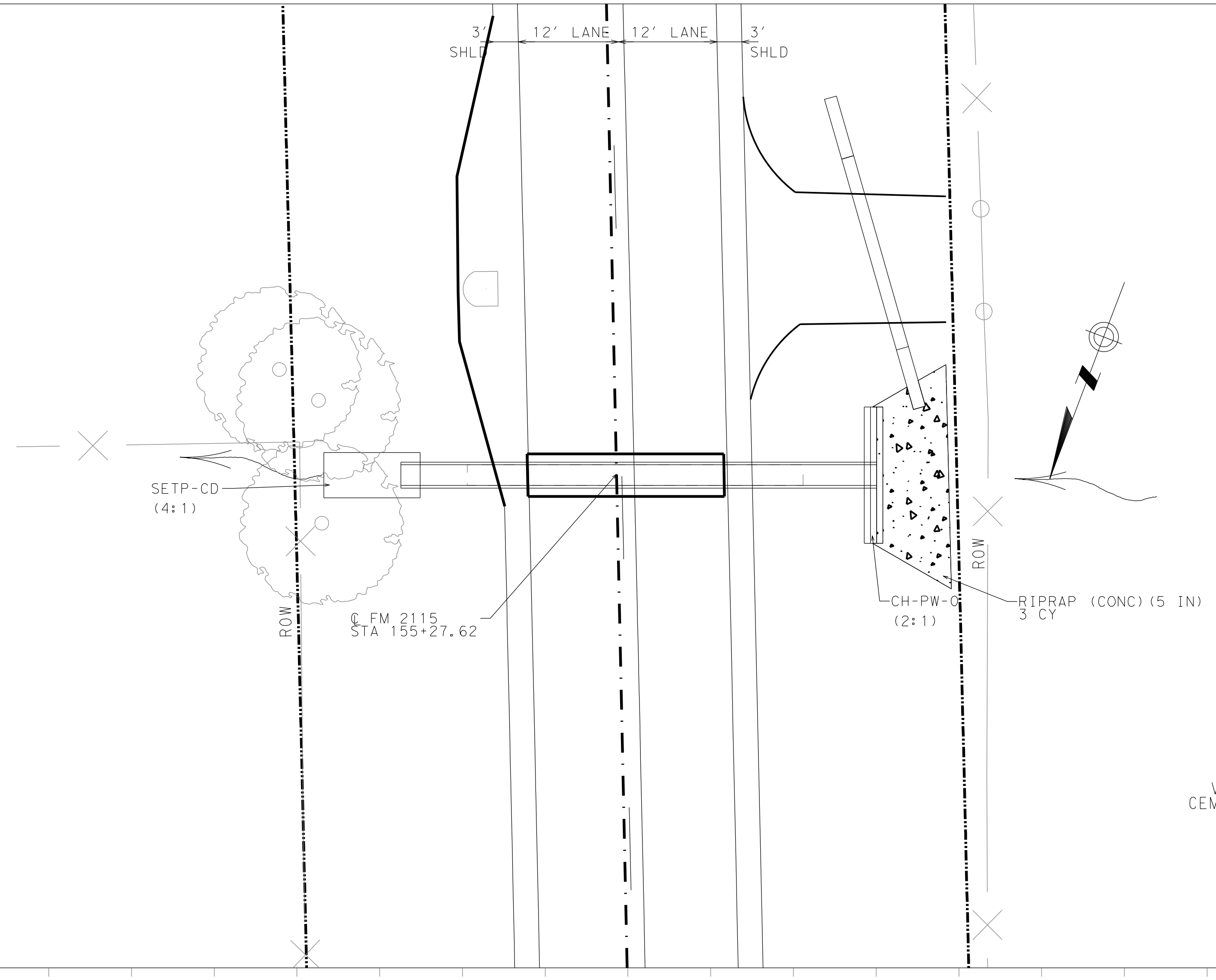
SHEET 7 OF 15

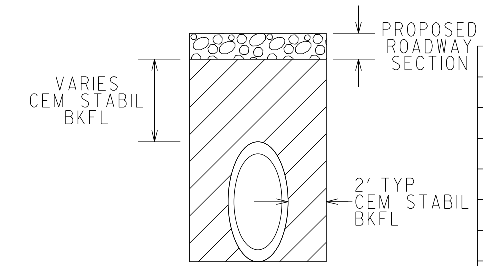
CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		126

NOTES:

SLOPES ARE APPROXIMATE. MATCH EXISTING GROUND AT 1' FROM ROW.

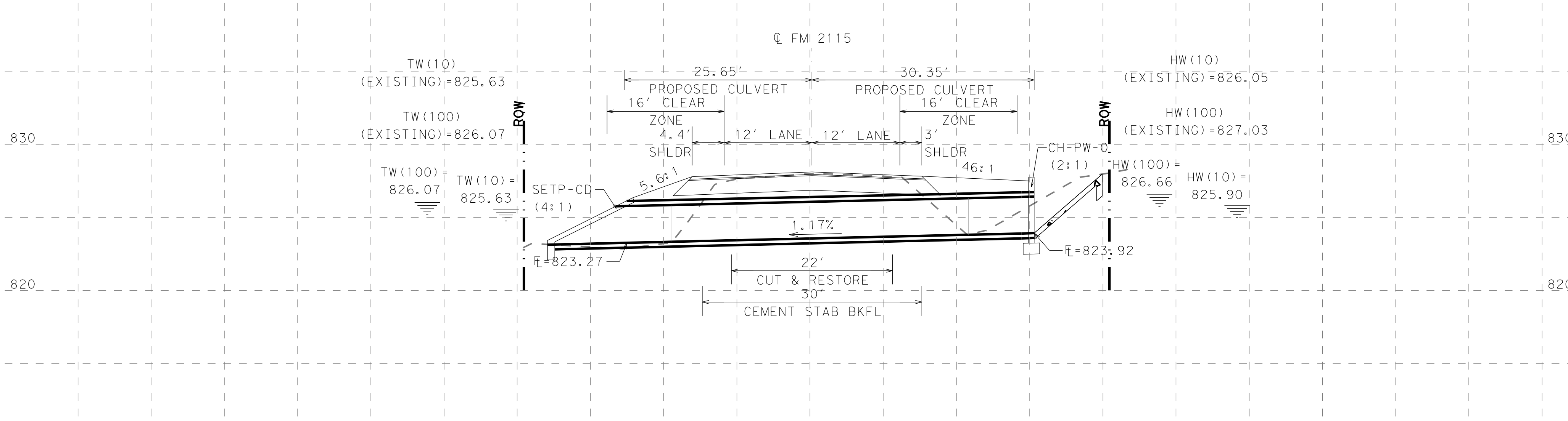
CONTRACTOR TO ENSURE POSITIVE DRAINAGE.





CEMENT STAB BKFL DETAIL

ITEM	DESCRIPTION	QTY	UNIT
400 6005	CEM STABIL BKFL	23	CY
400 6006	CUT & RESTORING PAV	18	SY
432 6002	RIPRAP (CONC)(5 IN)	3	CY
464 6007	RC PIPE (CL III)(30 IN)	56	LF
466 6099	HEADWALL (CH-PW-0)(DIA=30 IN)	1	EA
467 6419	SET(TY II)(30 IN)(RCP)(4:1)(C)	1	EA
496 6007	REMOV STR (PIPE)	41	LF



STATION 155+27.62 (CULVERT 8)
EXISTING 1-30"X40.57' CMP
REMOVE & REPLACE WITH 1-24"X56' RCP
SETP-CD LT & CH-PW-0 RT

STATE OF TEXAS
BRADLEY MAYES
128276
LICENSED
PROFESSIONAL ENGINEER

Bradley Mayes 8/28/2021

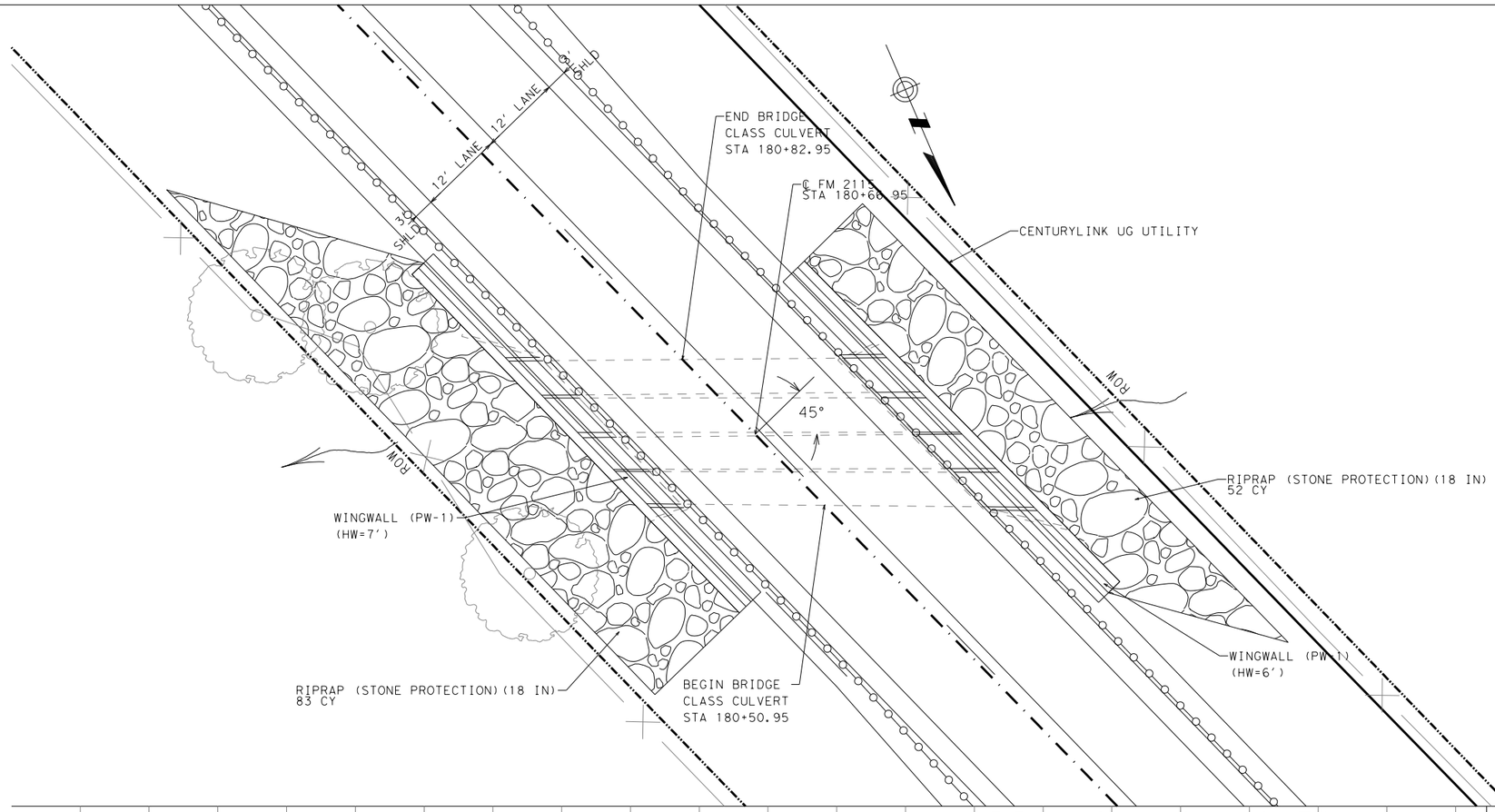
SIGNATURE OF REGISTRANT & DATE

CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERTICAL

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	127

NODE



NOTES:

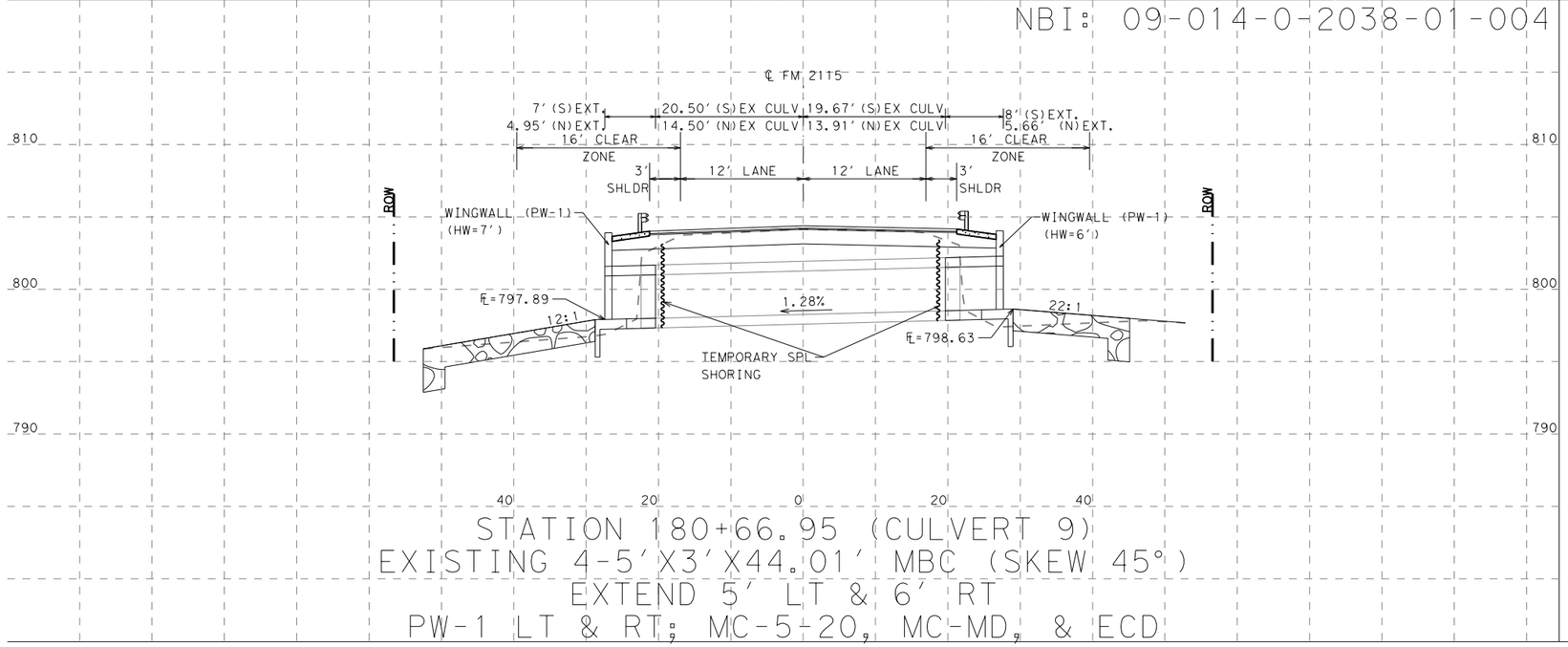
SLOPES ARE APPROXIMATE. MATCH EXISTING GROUND AT 1' FROM ROW.

CONTRACTOR TO ENSURE POSITIVE DRAINAGE.

UTILITY LOCATION APPROXIMATE. CONTRACTOR TO VERIFY.

ITEM	DESCRIPTION	QTY	UNIT
403 6001	TEMPORARY SPL SHORING	726	SF
432 6033	RIPRAP (STONE PROTECTION)(18 IN)	135	CY
462 6051	CONC BOX CULV (5 FT X 3 FT)(EXTEND)	60	LF
466 6181	WINGWALL (PW-1)(HW=6 FT)	1	EA
466 6182	WINGWALL (PW-1)(HW=7 FT)	1	EA

NBI: 09-014-0-2038-01-004



STATION 180+66.95 (CULVERT 9)
EXISTING 4-5'X3'X44.01' MBC (SKEW 45°)
EXTEND 5' LT & 6' RT
PW-1 LT & RT: MC-5-20, MC-MD, & ECD

STATE OF TEXAS
BRADLEY MAYES
128276
LICENSED
PROFESSIONAL ENGINEER

Bradley Mayes 9/7/2021
SIGNATURE OF REGISTRANT & DATE

CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERTICAL

SHEET 9 OF 15

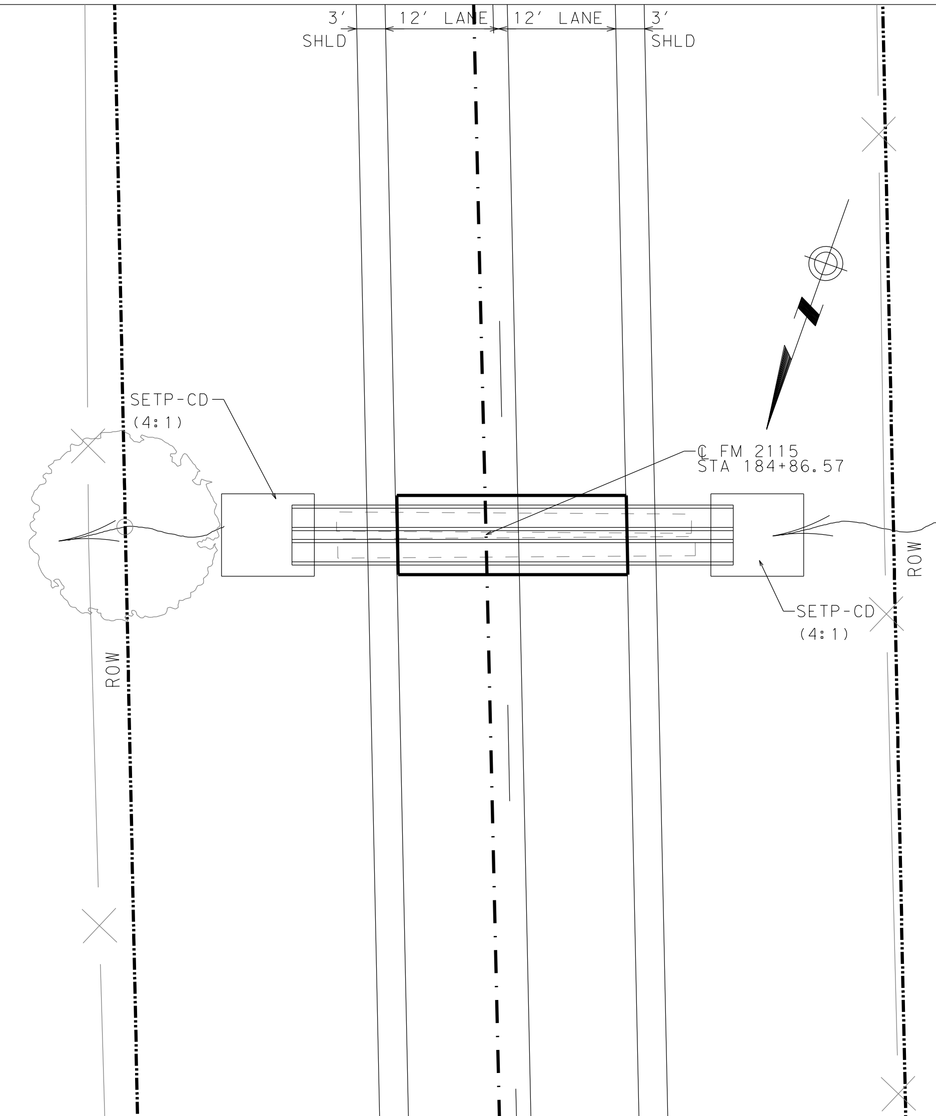
CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		128

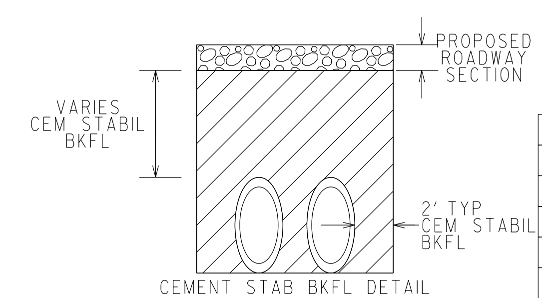
pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\2038010031\4 - Design\Plans\Drainage\FM 2115 Drainage Plan Sheets.dgn

NOTES:

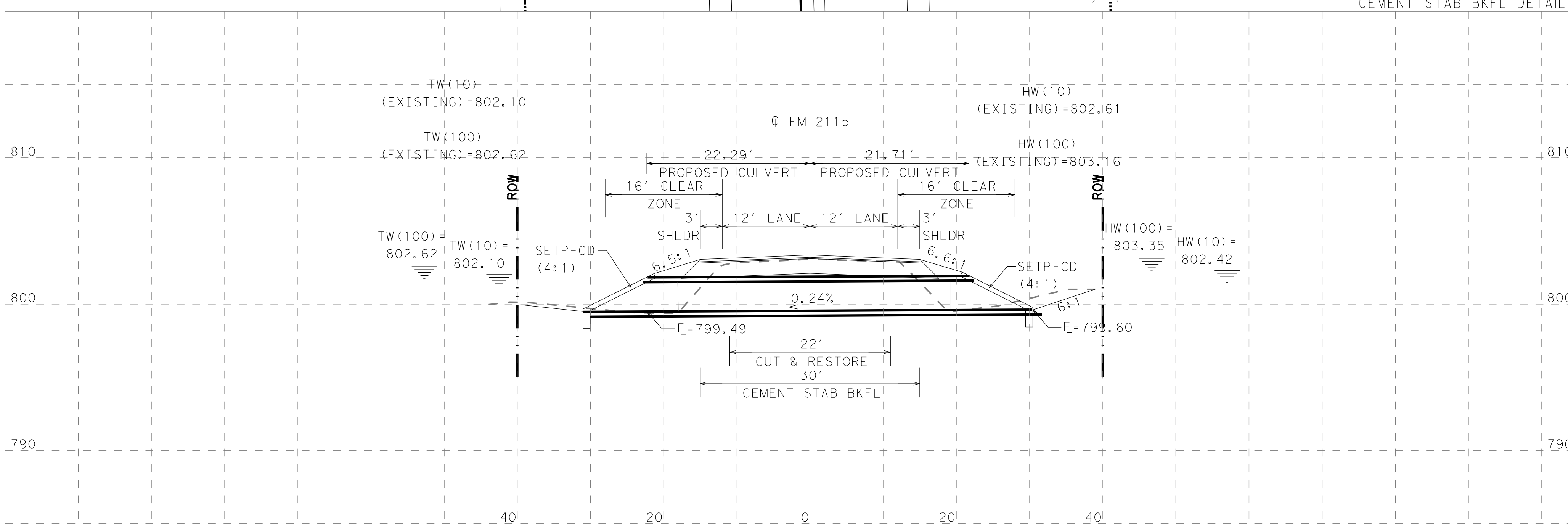
SLOPES ARE APPROXIMATE. MATCH EXISTING GROUND AT 1' FROM ROW.

CONTRACTOR TO ENSURE POSITIVE DRAINAGE.





	DESCRIPTION	QTY	UNIT
400 6005	CEM STABIL BKFL	30	CY
400 6006	CUT & RESTORING PAV	26	SY
464 6005	RC PIPE (CL III)(24 IN)	88	LF
467 6390	SET (TY II)(24 IN)(RCP)(4:1)(C)	4	EA
496 6007	REMOV STR (PIPE)	76	LF



STATION 184+86.57 (CULVERT 10)
EXISTING 2-24"X37.11' CMP
REMOVE & REPLACE WITH 2-24"X44' RCP
SETP-CD LT & RT

STATE OF TEXAS
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Bradley Mayes 8/28/2021

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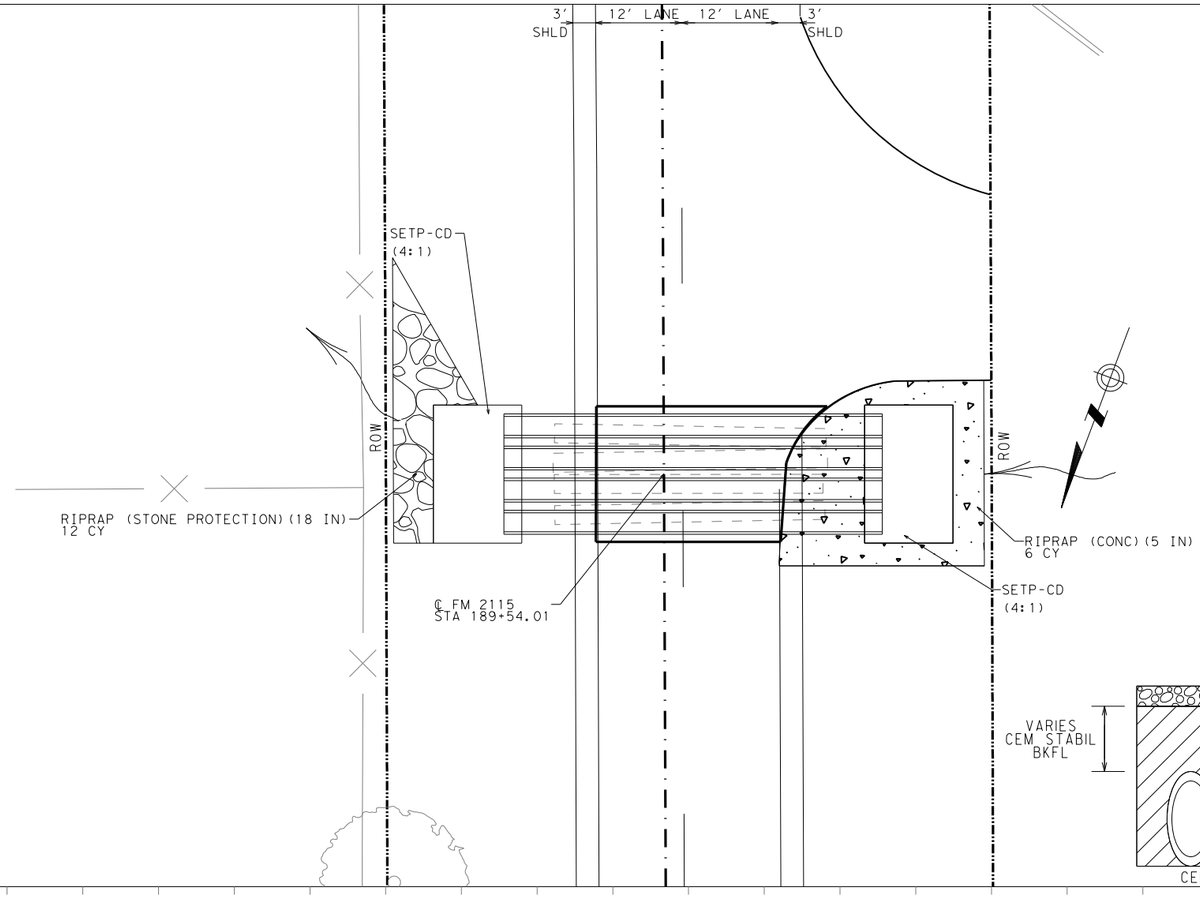
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERTICAL

SHEET 10 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	129

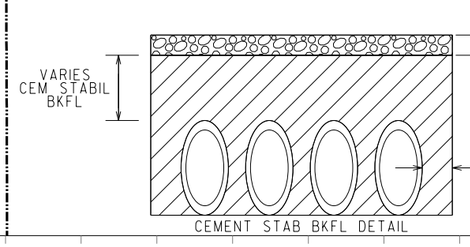
NODE



NOTES:

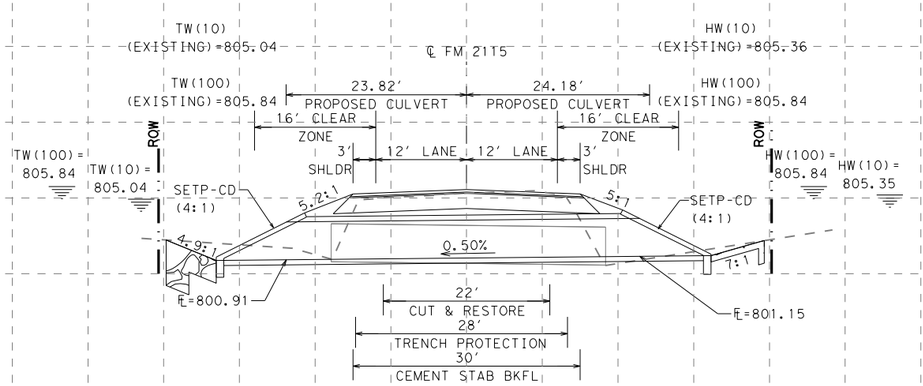
SLOPES ARE APPROXIMATE. MATCH EXISTING GROUND AT 1' FROM ROW.

CONTRACTOR TO ENSURE POSITIVE DRAINAGE.



CEMENT STAB BKFL DETAIL

ITEM	DESCRIPTION	QTY	UNIT
400 6005	CEM STABIL BKFL	59	CY
400 6006	CUT & RESTORING PAV	49	SY
402 6001	TRENCH EXCAVATION PROTECTION	28	LF
432 6002	RIPRAP (CONC)(5 IN)	6	CY
432 6033	RIPRAP (STONE PROTECTION)(18 IN)	12	CY
464 6007	RC PIPE (CL III)(30 IN)	192	LF
467 6419	SET (TY II)(30 IN)(RCP)(4:1)(C)	8	EA
496 6007	REMOV STR (PIPE)	144	LF



STATION 189+54.01 (CULVERT 11)
EXISTING 4-30"X35.48' CMP
REMOVE & REPLACE WITH 4-30"X48' RCP
SETP-CD LT & RT

STATE OF TEXAS
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128276
LICENSED
PROFESSIONAL ENGINEER

Bradley Mayes 8/28/2021
SIGNATURE OF REGISTRANT & DATE

CULVERT LAYOUTS

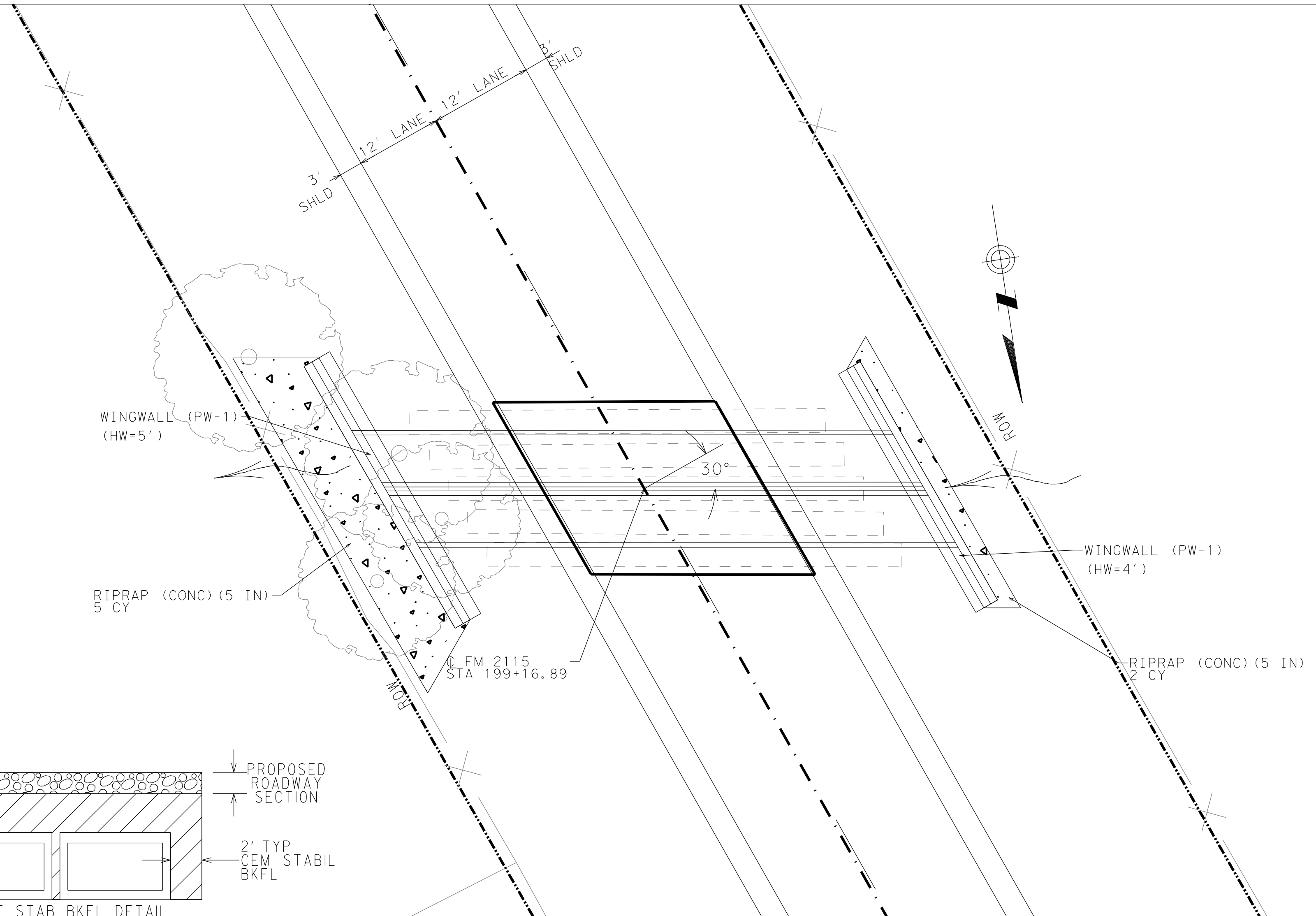
SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERTICAL

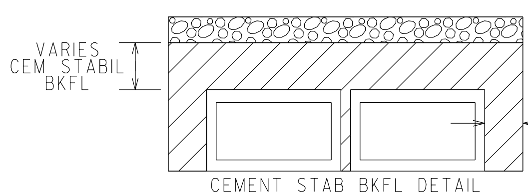
SHEET 11 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		130

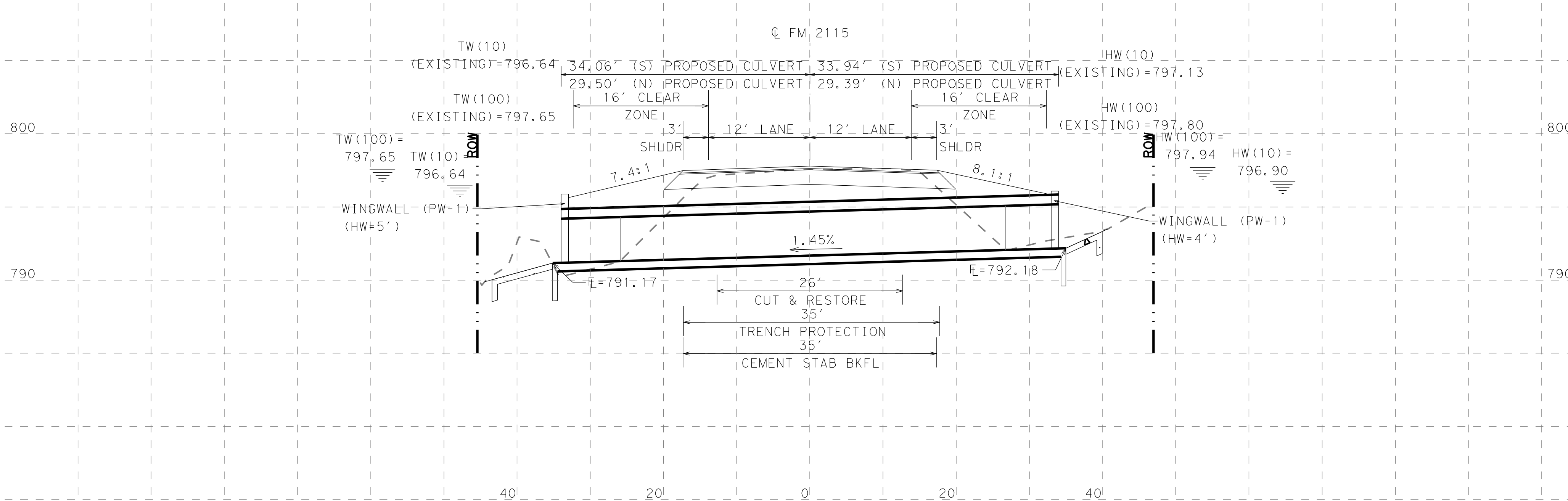
NOTES:
SLOPES ARE APPROXIMATE. MATCH EXISTING GROUND AT 1' FROM ROW.

CONTRACTOR TO ENSURE POSITIVE DRAINAGE.





ITEM	DESCRIPTION	QTY	UNIT
400 6005	CEM STABIL BKFL	60	CY
400 6006	CUT & RESTORING PAV	59	SY
402 6001	TRENCH EXCAVATION PROTECTION	35	LF
432 6002	RIPRAP (CONC)(5 IN)	7	CY
462 6010	CONC BOX CULV (6 FT X 3 FT)	136	LF
466 6179	WINGWALL (PW-1)(HW=4 FT)	1	EA
466 6180	WINGWALL (PW-1)(HW=5 FT)	1	EA
496 6007	REMOV STR (PIPE)	265	LF



STATION 199+16.89 (CULVERT 12)
EXISTING 5-36"X52.64' CMP (SKEW 30°)
REMOVE & REPLACE WITH 2-6'X3'X68' MBC
PW-1 LT & RT; SCP-6, SCP-MD, & ECD

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Bradley Mayes 8/28/2021
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CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERTICAL

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	131

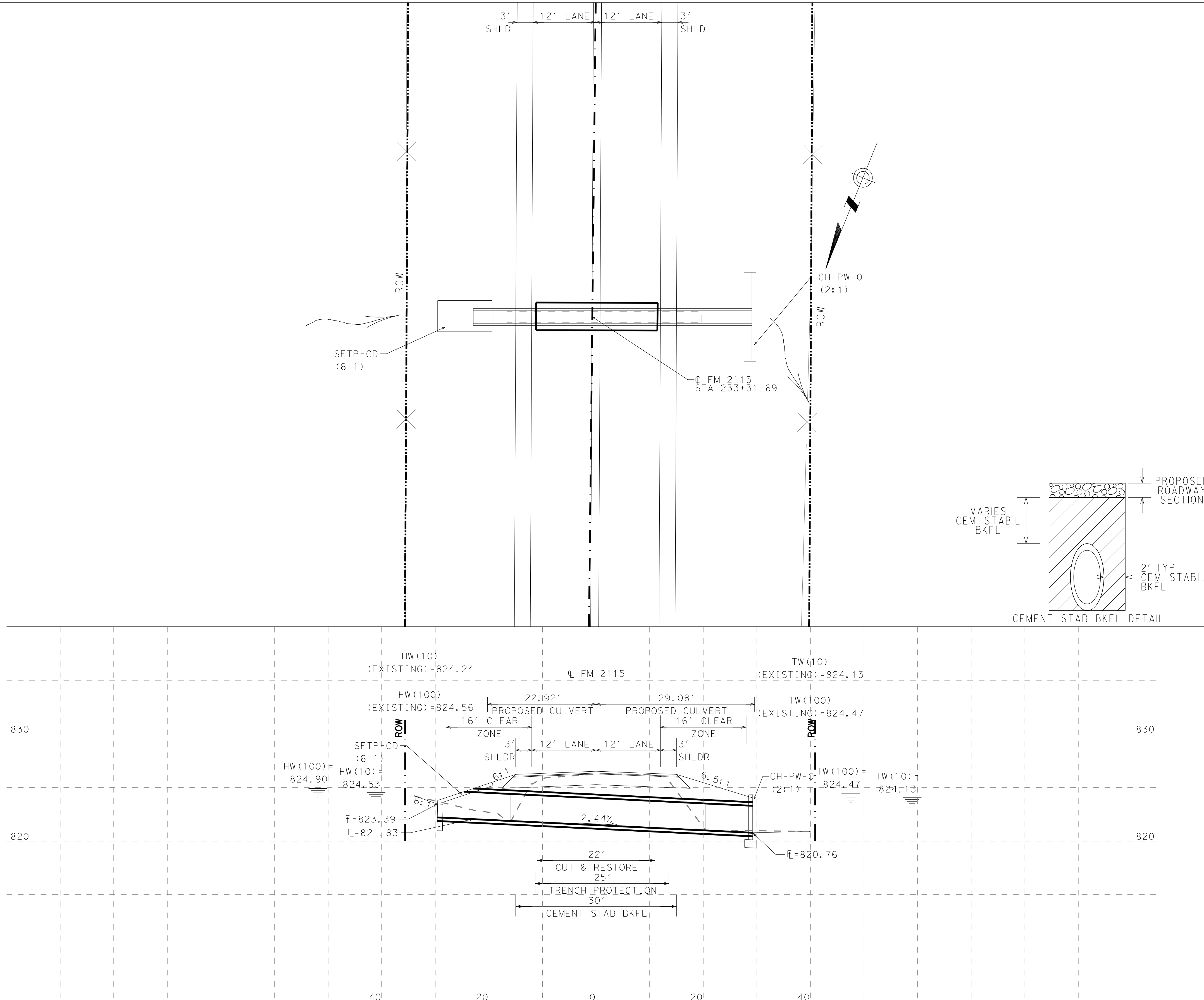
NODE

NOTES:

SLOPES ARE APPROXIMATE. MATCH EXISTING GROUND AT 1' FROM ROW.

CONTRACTOR TO ENSURE POSITIVE DRAINAGE.

SETP-CD (6:1) IS TO BE CAST IN PLACE, AS SHOWN ON SETP-CD(MOD).



ITEM	DESCRIPTION	QTY	UNIT
400 6005	CEM STABIL BKFL	26	CY
400 6006	CUT & RESTORING PAV	18	SY
402 6001	TRENCH EXCAVATION PROTECTION	25	LF
464 6007	RC PIPE (CL III)(30 IN)	52	LF
466 6099	HEADWALL (CH-PW-0)(DIA=30 IN)	1	EA
467 6422	SET (TY II)(30 IN)(RCP)(6:1)(C)	1	EA
496 6007	REMOV STR (PIPE)	37	LF

STATION 233+31.69 (CULVERT 13)
EXISTING 1-30"X36.38' CMP
REMOVE & REPLACE WITH 1-30"X50' RCP
SETP-CD(MOD) LT & CH-PW-0 RT

STATE OF TEXAS
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Bradley Mayes 8/28/2021

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CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERTICAL

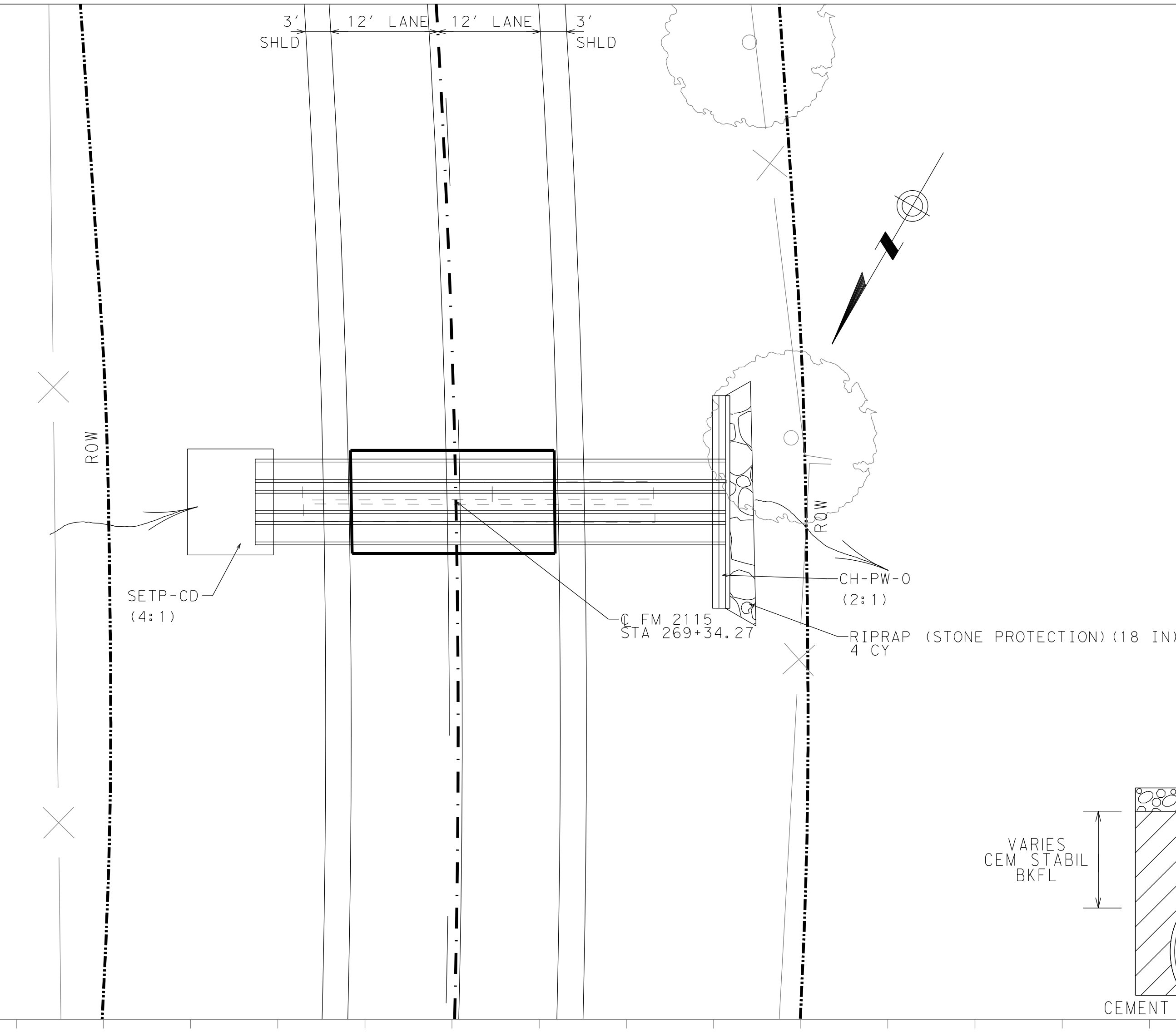
CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	132

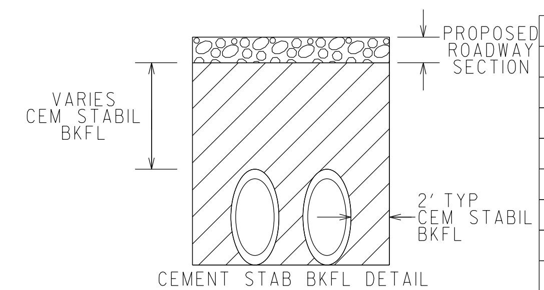
NODE

NOTES:

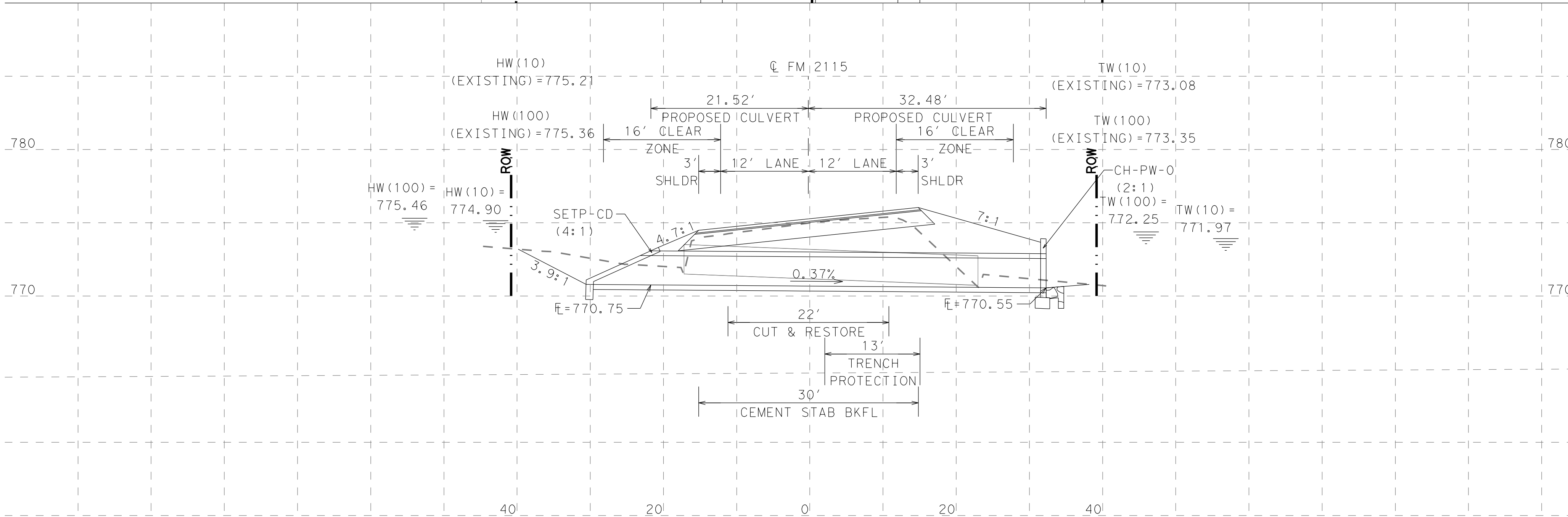
SLOPES ARE APPROXIMATE. MATCH EXISTING GROUND AT 1' FROM ROW.

CONTRACTOR TO ENSURE POSITIVE DRAINAGE.





ITEM	DESCRIPTION	QTY	UNIT
400 6005	CEM STABIL BKFL	35	CY
400 6006	CUT & RESTORING PAV	26	SY
402 6001	TRENCH EXCAVATION PROTECTION	13	LF
432 6033	RIPRAP (STONE PROTECTION)(18 IN)	4	CY
464 6005	RC PIPE (CL III)(24 IN)	162	LF
466 6097	HEADWALL (CH-PW-0)(DIA=24 IN)	1	EA
467 6390	SET (TY II)(24 IN)(RCP)(4:1)(C)	2	EA
496 6007	REMOV STR (PIPE)	82	LF



STATION 269+34.27 (CULVERT 14)
EXISTING 2-24"X40.27' CMP
REMOVE & REPLACE WITH 3-24"X54' RCP
SETP-CD LT & CH-PW-O RT

STATE OF TEXAS
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Bradley Mayes 8/28/2021
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CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERTICAL

SHEET 14 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	133

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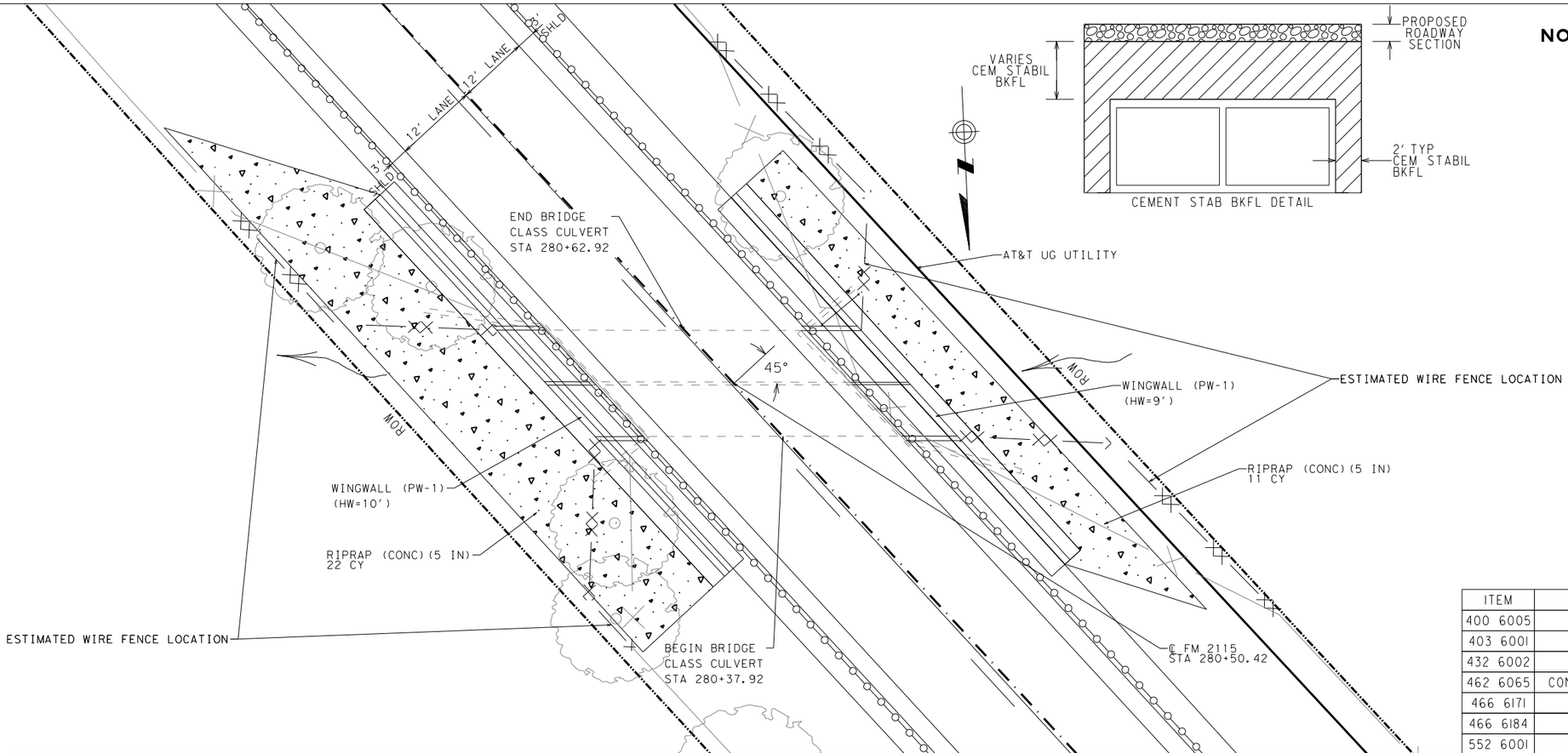
NODE



NOTES:

SLOPES ARE APPROXIMATE. MATCH EXISTING GROUND AT 1' FROM ROW.

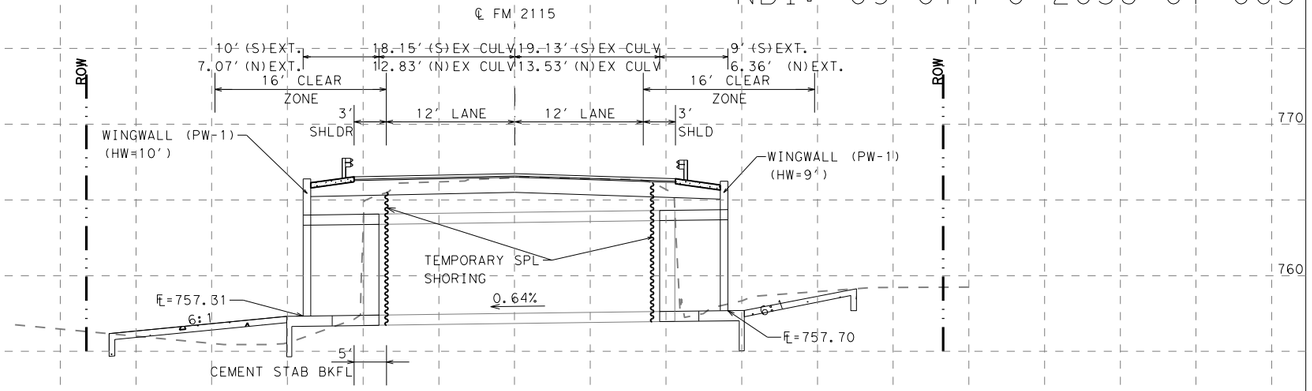
CONTRACTOR TO ENSURE POSITIVE DRAINAGE.

CONCRETE RIPRAP TO INCLUDE LEAVE-OUTS FORMED IN THE METHOD USED IN GF(3I)MS-19 AT SPACING IN ACCORDANCE WITH THE WF(I)-10 STANDARD.

UTILITY LOCATION APPROXIMATE. CONTRACTOR TO VERIFY.

ITEM	DESCRIPTION	QTY	UNIT
400 6005	CEM STABIL BKFL	4	CY
403 6001	TEMPORARY SPL SHORING	1324	SF
432 6002	RIPRAP (CONC)(5 IN)	33	CY
462 6065	CONC BOX CULV (8 FTX 6 FT)(EXTEND)	38	LF
466 6171	WINGWALL (PW-1)(HW=10 FT)	1	EA
466 6184	WINGWALL (PW-1)(HW=9 FT)	1	EA
552 6001	WIRE FENCE (TY A)	201	LF

NBI: 09-014-0-2038-01-005



STATION 280+50.42 (CULVERT 15)(LIVESTOCK PASS)
EXISTING 2-8'X6'X31.32' MBC (SKEW 45°)
EXTEND 8' LT & 7' RT
PW-1 LT & RT; MC-8-13, MC-MD, SP, & ECD

STATE OF TEXAS
BRADLEY MAYES
128276
LICENSED
PROFESSIONAL ENGINEER

Bradley Mayes 9/7/2021
SIGNATURE OF REGISTRANT & DATE

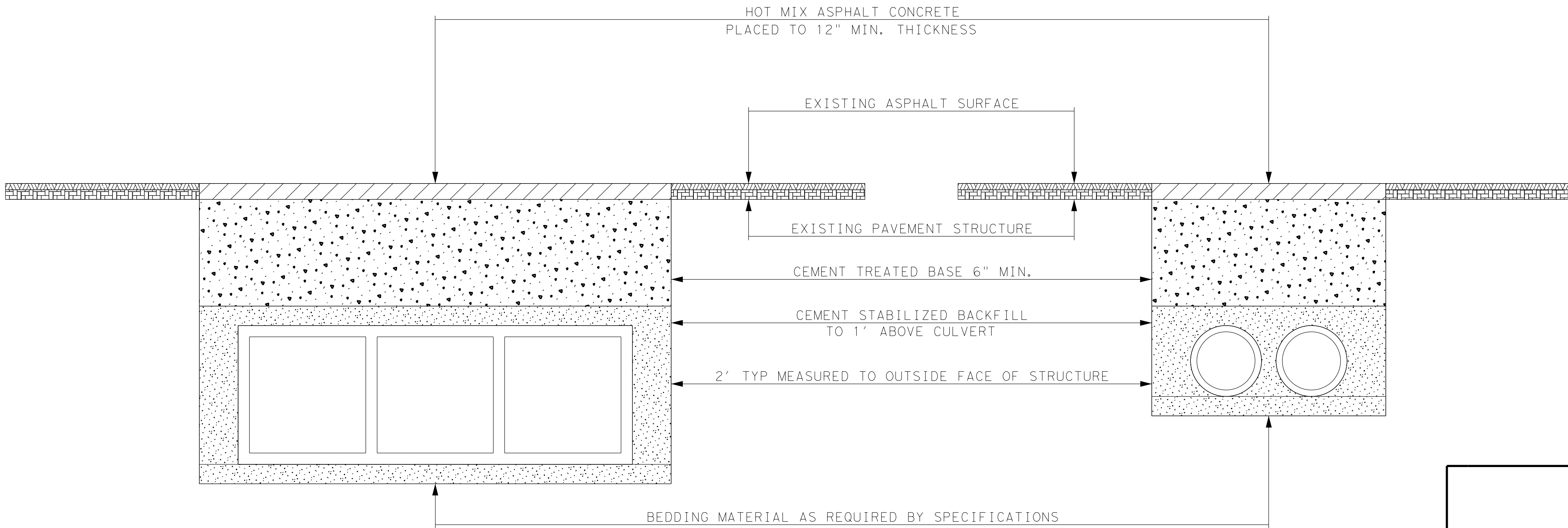
CULVERT LAYOUTS

SCALE: FEET
1" = 20' HORIZ.
1" = 10' VERTICAL

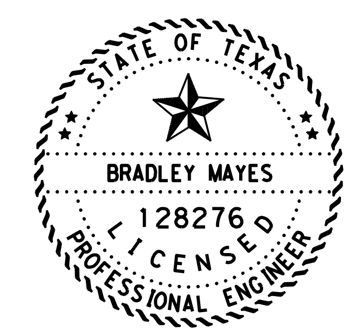
SHEET 15 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		134

NOTE:
SAW CUT EXISTING PAVEMENT ON BOTH SIDES OF CULVERT TO PROVIDE A SMOOTH, EVEN EDGE FOR PAVEMENT REPAIR. SAW CUTTING WILL BE SUBSIDIARY TO CULVERT ITEMS.



CULVERT PLACEMENT UNDER TRAFFIC DETAIL



Bradley Mayes 9/2/2021
SIGNATURE OF REGISTRANT & DATE

CULVERT BACKFILL DETAIL

SCALE: N.T.S.

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		135

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 "C" Conc (Curb) (2) (CY)	Class "C" Conc (Wingwall) (3) (CY)	Total Wingwall Area (SF)
CULVERT 2 (STA 27+15.70) (Lt)	2 ~ 10' X 9'	12'	MC-10-13	PW-1	30	2:1	10"	8"	2.750	12.583	N/A	N/A	29.060	25.403	N/A	0.0	2.6	57.1	731
CULVERT 2 (STA 27+15.70) (Rt)	2 ~ 10' X 9'	13'	MC-10-13	PW-1	30	2:1	10"	8"	3.000	12.833	N/A	N/A	29.637	25.403	N/A	0.0	2.8	58.2	761
CULVERT 3 (STA 44+57.25) (Lt)	4 ~ 8' X 6'	9'	MC-8-13	PW-1	0	2:1	8"	7"	2.000	8.667	N/A	N/A	17.333	34.917	N/A	0.0	2.6	23.5	300
CULVERT 3 (STA 44+57.25) (Rt)	4 ~ 8' X 6'	10'	MC-8-13	PW-1	0	2:1	8"	7"	3.750	10.417	N/A	N/A	20.833	34.917	N/A	0.0	4.8	29.8	434
CULVERT 5 (STA 76+90.89) (Lt)	3 ~ 7' X 5'	8'	MC-7-10	PW-1	0	2:1	8"	7"	2.750	8.417	N/A	N/A	16.833	23.333	N/A	0.0	2.4	19.1	283
CULVERT 5 (STA 76+90.89) (Rt)	3 ~ 7' X 5'	7'	MC-7-10	PW-1	0	2:1	8"	7"	1.000	6.667	N/A	N/A	13.333	23.333	N/A	0.0	0.9	13.7	178
CULVERT 6 (STA 85+27.82) (Both)	2 ~ 5' X 3'	4'	SCP-5	SETB-FW-S	30	4:1	6"	6"	0.250	3.500	12.667	12.667	17.913	N/A	25.946	6.2	0.2	12.0	N/A
CULVERT 9 (STA 180+66.95) (Lt)	4 ~ 5' X 3'	7'	MC-5-20	PW-1	45	2:1	8"	7"	2.792	6.458	N/A	N/A	18.267	32.409	N/A	0.0	3.4	16.6	236
CULVERT 9 (STA 180+66.95) (Rt)	4 ~ 5' X 3'	6'	MC-5-20	PW-1	45	2:1	8"	7"	2.250	5.917	N/A	N/A	16.735	32.409	N/A	0.0	2.7	14.7	198
CULVERT 12 (STA 199+16.89) (Lt)	2 ~ 6' X 3'	5'	SCP-6	PW-1	30	2:1	7"	7"	1.000	4.583	N/A	N/A	10.585	17.128	N/A	0.0	0.6	8.0	97
CULVERT 12 (STA 199+16.89) (Rt)	2 ~ 6' X 3'	4'	SCP-6	PW-1	30	2:1	7"	7"	0.250	3.833	N/A	N/A	8.853	17.128	N/A	0.0	0.2	5.9	68
CULVERT 15 (STA 280+50.42) (Lt)	2 ~ 8' X 6'	10'	MC-8-13	PW-1	45	2:1	8"	7"	3.000	9.667	N/A	N/A	27.341	25.102	N/A	0.0	2.8	36.7	529
CULVERT 15 (STA 280+50.42) (Rt)	2 ~ 8' X 6'	9'	MC-8-13	PW-1	45	2:1	8"	7"	2.500	9.167	N/A	N/A	25.927	25.102	N/A	0.0	2.3	32.2	475

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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.

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BRADLEY MAYES
128276
LICENSED
PROFESSIONAL ENGINEER

Bradley Mayes 8/28/2021
SIGNATURE OF REGISTRANT & DATE

(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.

SPECIAL NOTE:

This sheet is a supplement to the box culvert standards. It is to be filled out by the culvert specifier and provides dimensions for the construction of the box culvert wingwalls and safety end treatments.

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.

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	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		136

DATE: 8/28/2021 5:41:40 PM
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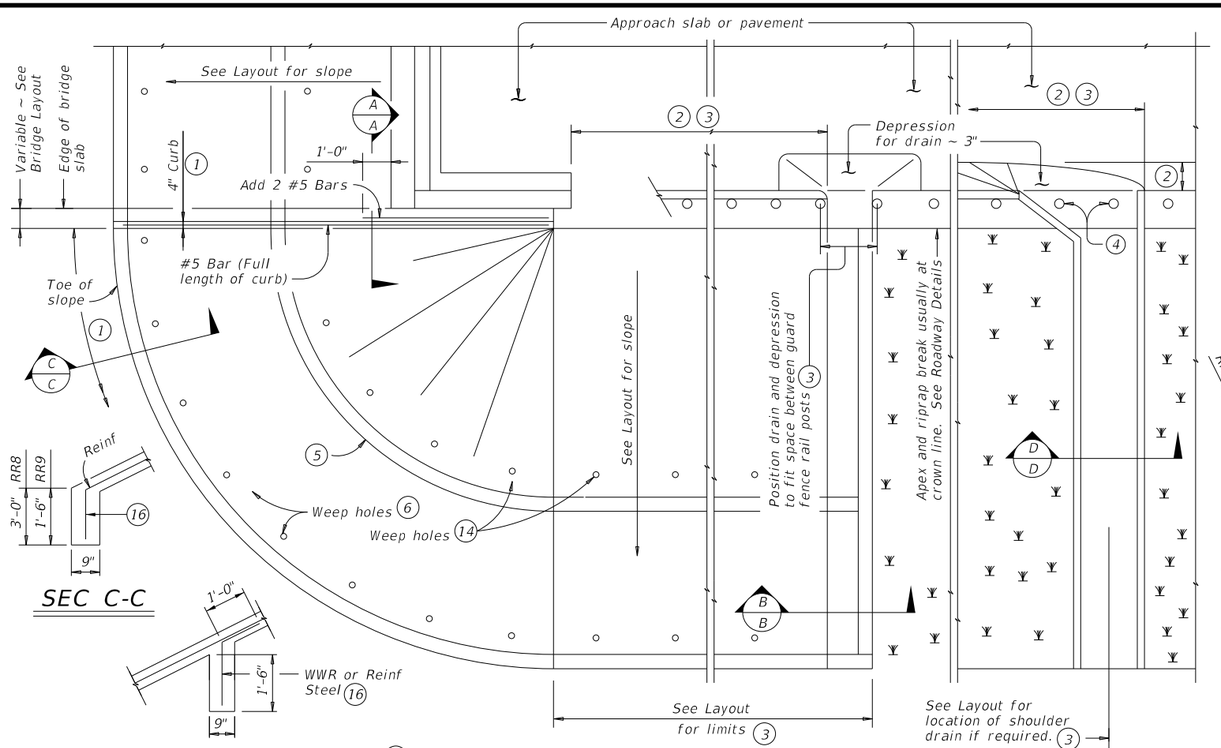
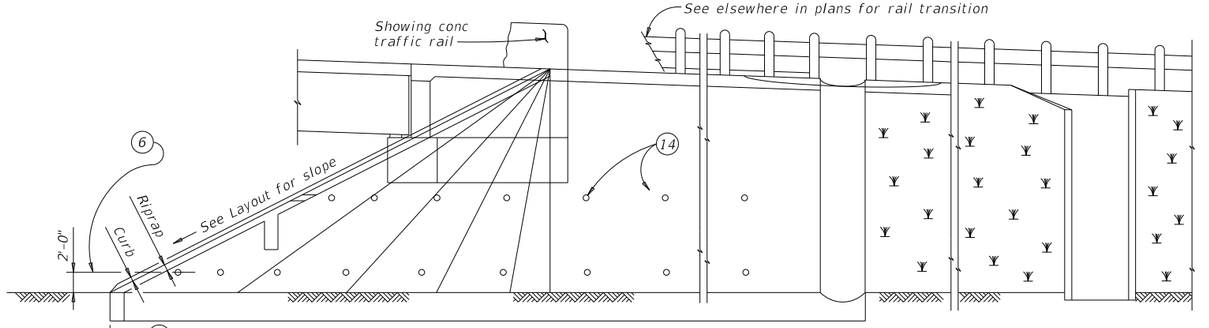


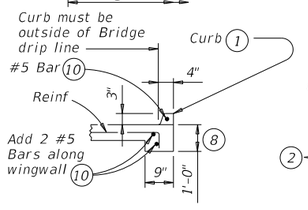
PLAN

SEC C-C

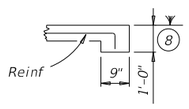
INTERMEDIATE TOEWALL



ELEVATION

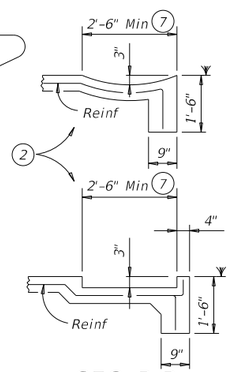


SEC A-A



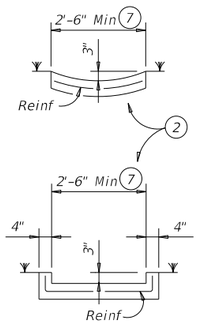
SEC B-B

(No drain)



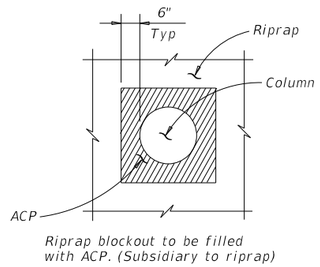
SEC B-B

(Shoulder drain integral with riprap)



SEC D-D

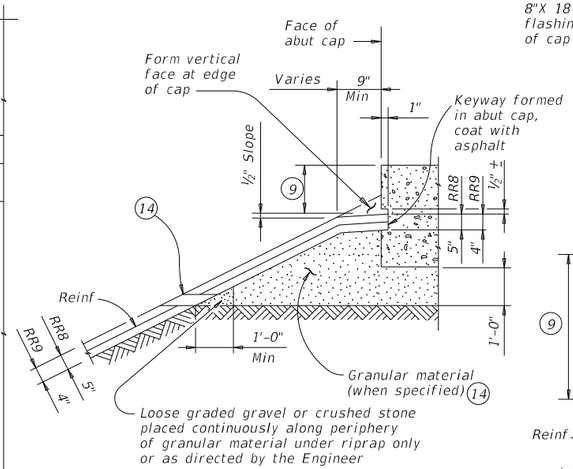
(Shoulder drain)



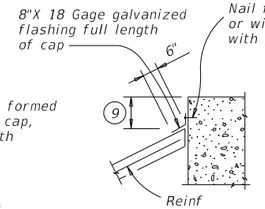
Riprap blockout to be filled with ACP. (Subsidiary to riprap)

RIPRAP DETAIL AT COLUMNS

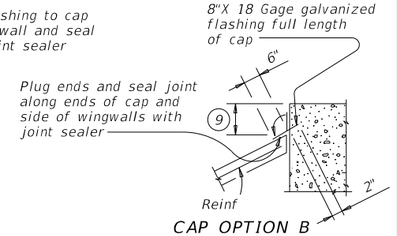
(As directed by the Engineer)



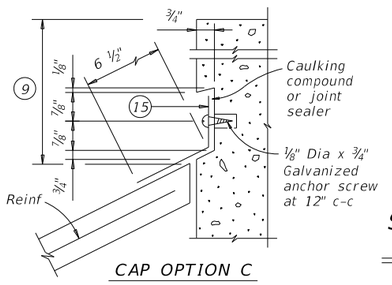
SHOWING KEYWAY OPTION



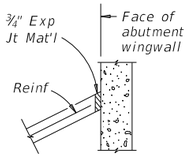
CAP OPTION A



CAP OPTION B

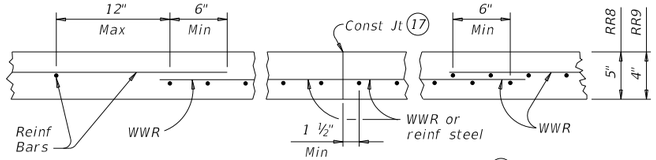


CAP OPTION C



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 REVISIONS	CONT	SECT	JOB	HIGHWAY
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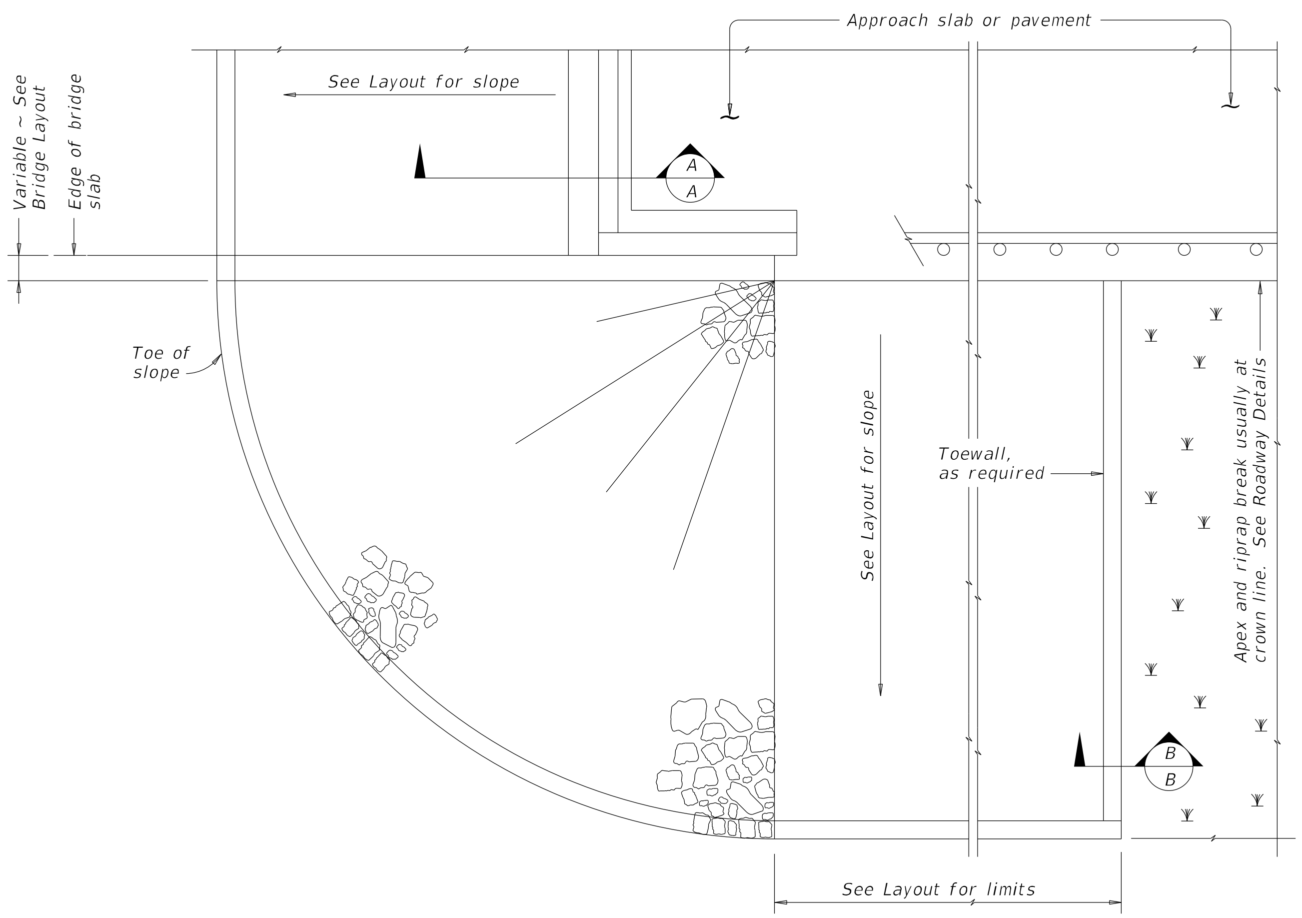
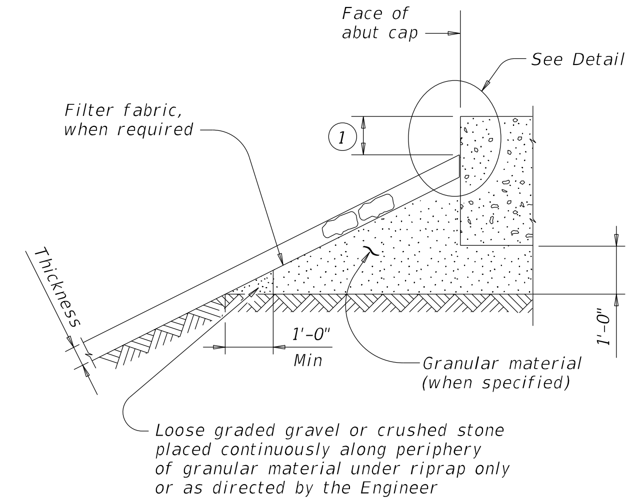
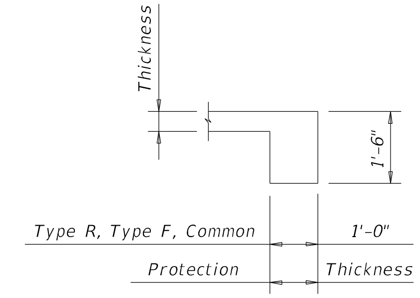
	WAC	BELL		137



PLAN

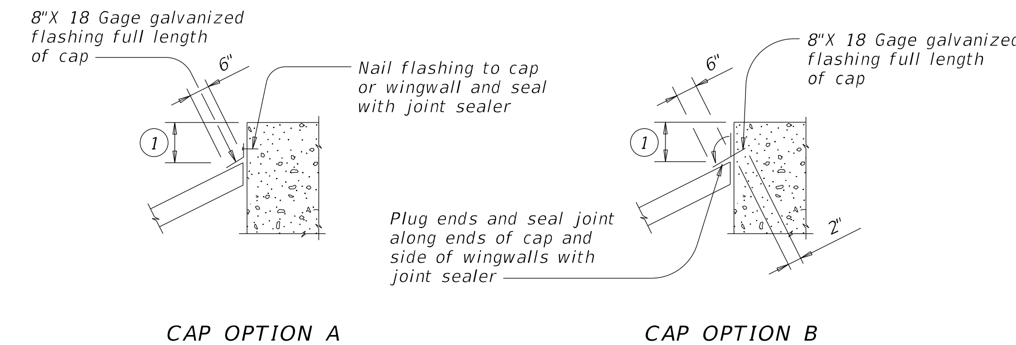


SECTION A-A AT CAP

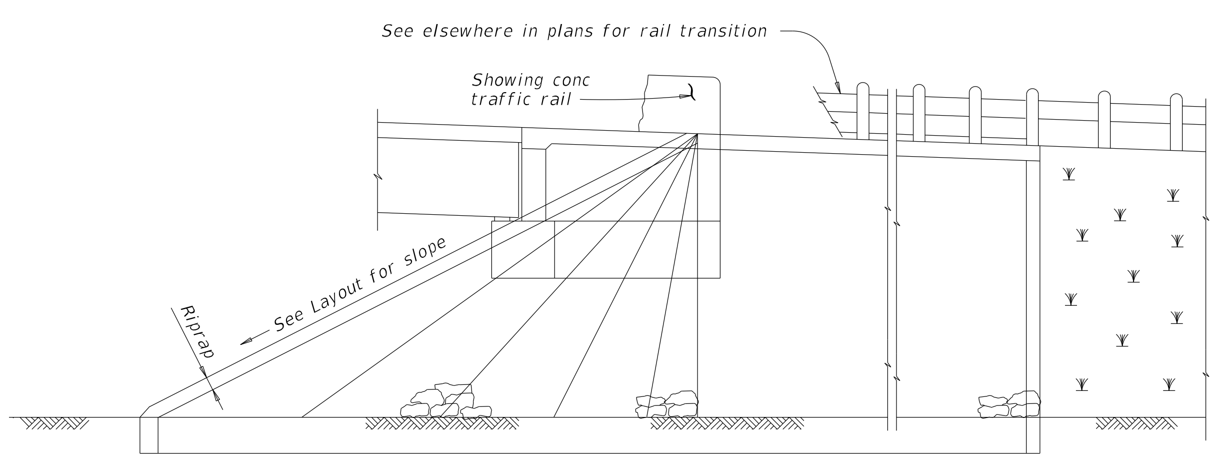


SECTION B-B

Provide toewall when shoulder drain is located adjacent to limits of stone riprap. Omit toewall when thickness of protection riprap is greater than 18".



DETAIL C



ELEVATION

GENERAL NOTES:

Refer to Item 432, "Riprap" for stone size and gradation, and construction details. See Layout for limits and thickness of riprap specified.

See elsewhere in plans for locations and details of shoulder drains.

(1) Top of cap to top of riprap dimension varies as directed by the Engineer. Provide 9" Min for beam/slab type bridges and 1'-6" for slab span, box beam, or slab beam bridges.

Texas Department of Transportation | Bridge Division Standard

STONE RIPRAP

SRR

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©TxDOT April 2019	CONT 2038	SECT 01	JOB 031	HIGHWAY FM 2115
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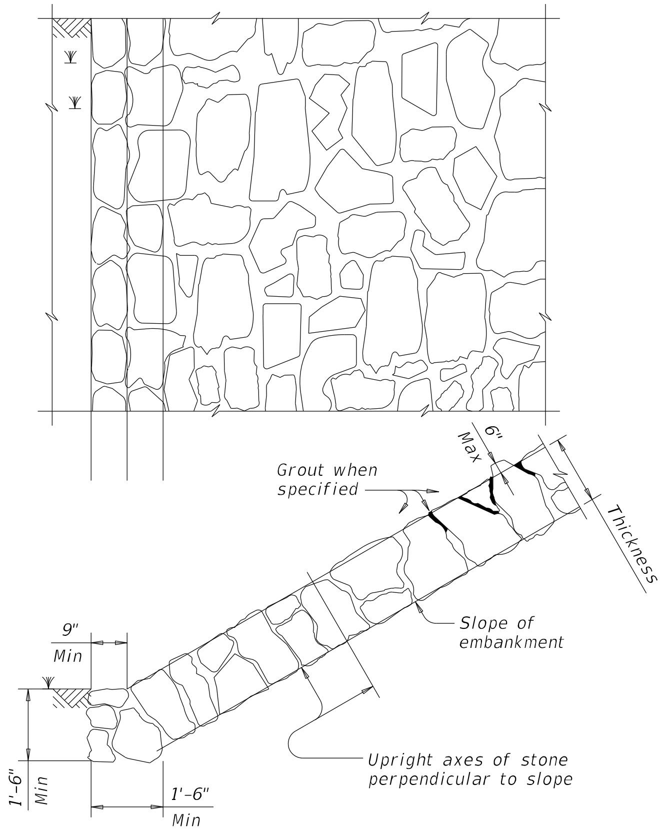


FIGURE 1 ~ TYPE R STONE RIPRAP

dry or grouted

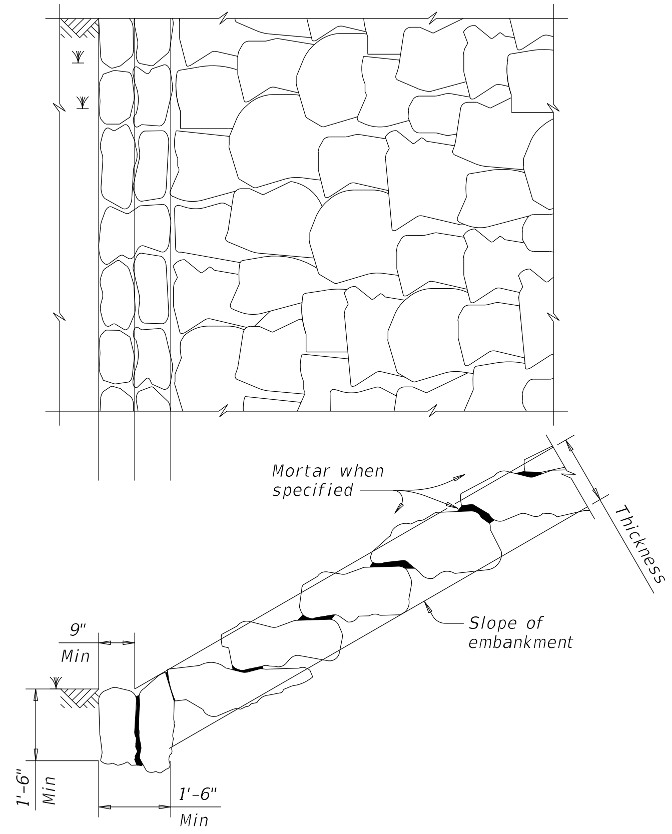


FIGURE 2 ~ TYPE F STONE RIPRAP

dry or mortared

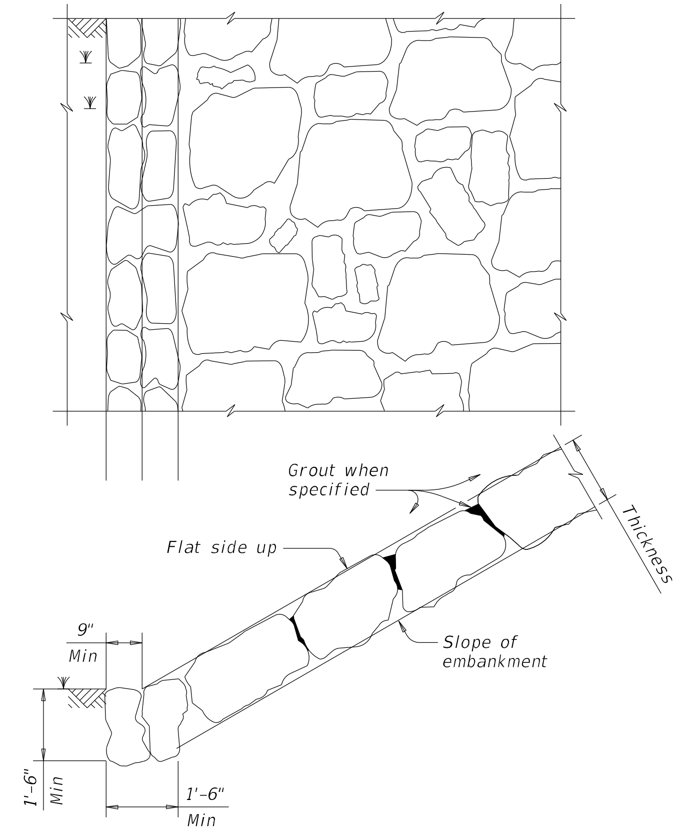


FIGURE 3 ~ TYPE F STONE RIPRAP

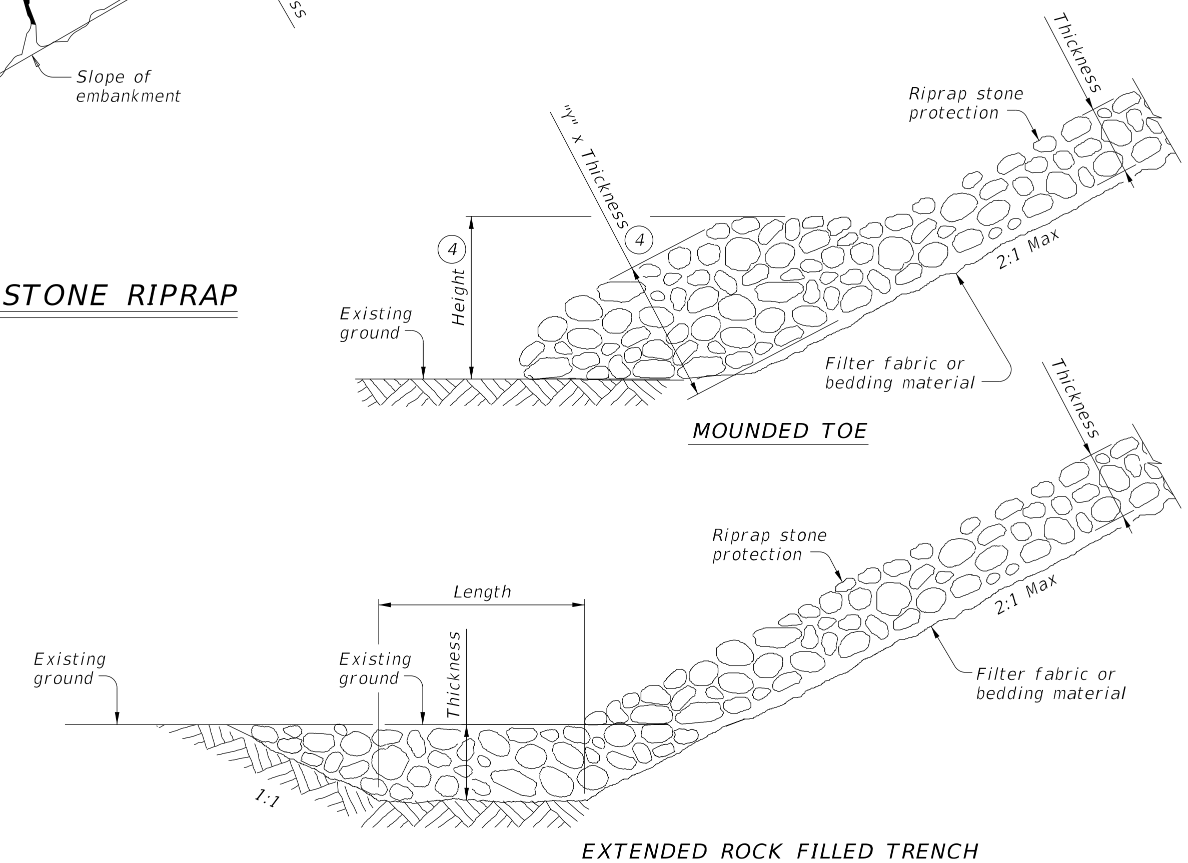
grouted

(2) Provide bedding material instead of filter fabric if shown elsewhere in plans. See Layout for thickness of bedding material.

(3) Minimum toe depth is the larger of the maximum scour depth or 2 times the riprap thickness.

(4) "Y" and Height need to be defined. See layout or detail sheet for values if this option is used.

(5) List Stone Protection as size (XX inch) and thickness (YY inch) on the layout.
Example: Riprap (Stone Protection) XX inch, Thickness = YY inch.



PROTECTION STONE RIPRAP TOE OPTIONS (5)

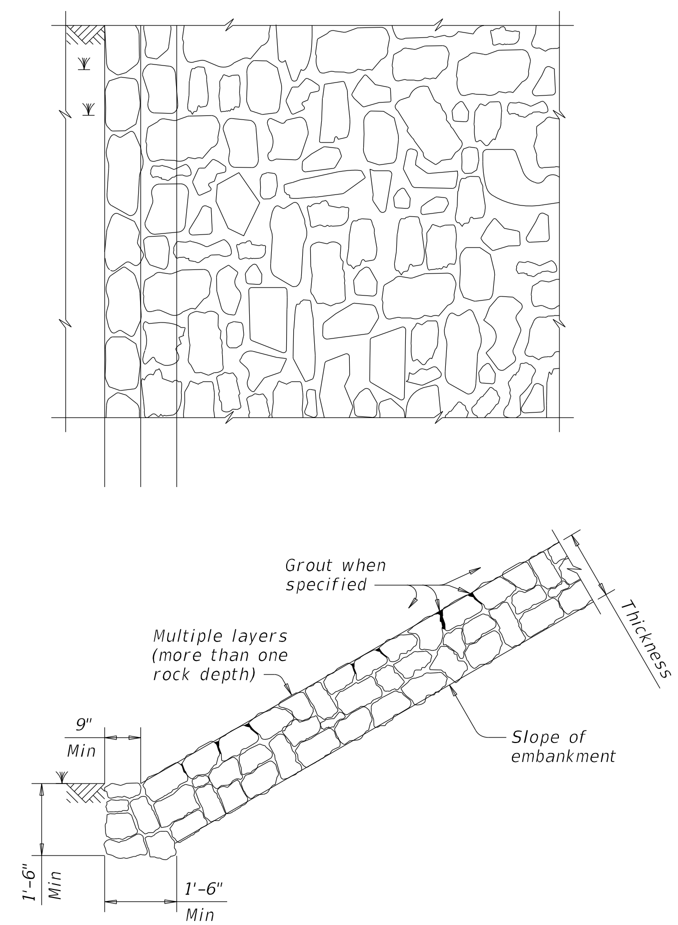


FIGURE 4 ~ COMMON STONE RIPRAP

dry or grouted

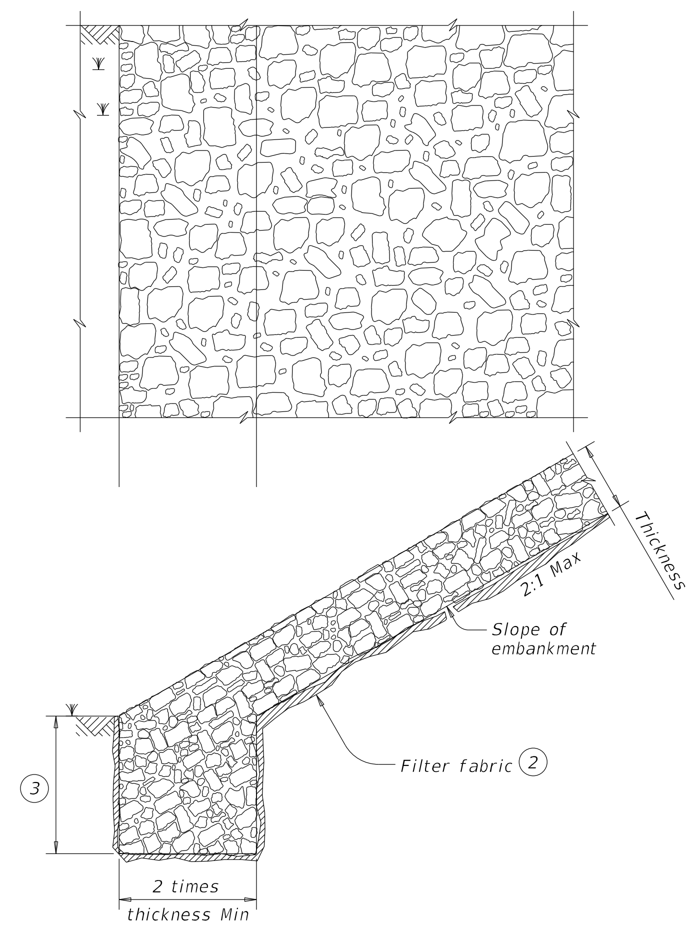


FIGURE 5 ~ PROTECTION STONE RIPRAP (5)

SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

STONE RIPRAP

SRR

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©TxDOT April 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
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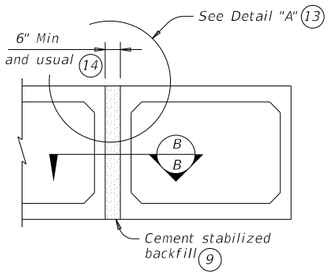
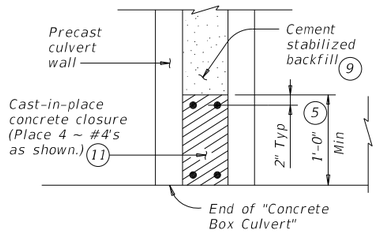
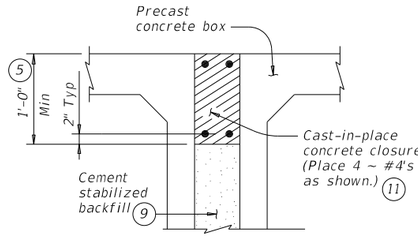


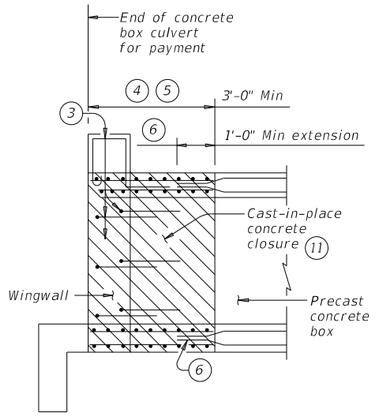
MULTIPLE UNIT PLACEMENT



SECTION B-B

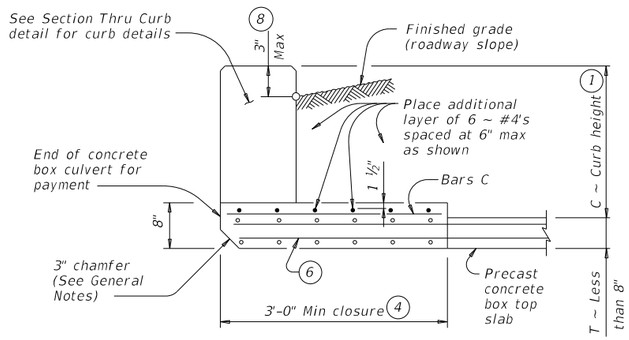


DETAIL "A" (13)

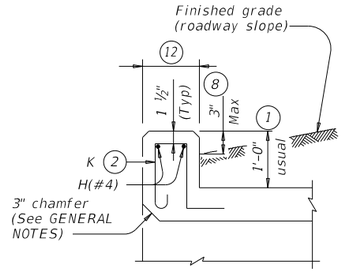


WINGWALL CONNECTION

(Also applies to safety end treatment.)

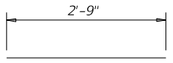


SECTION THRU TOP SLABS LESS THAN 8"

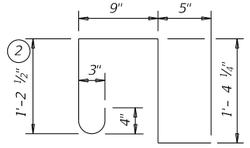


SECTION THRU CURB

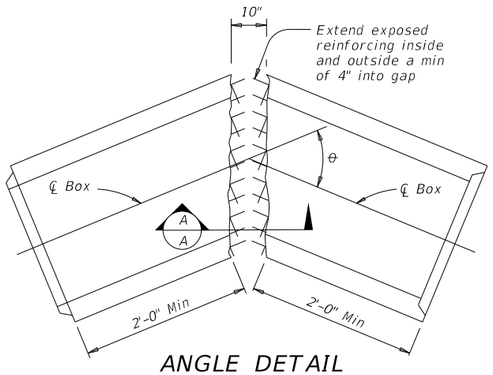
QUANTITIES PER FOOT OF CURB (10)	
Reinforcing Steel	4.12 Lb
Concrete	0.037 CY



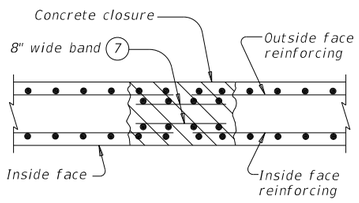
BARS C (#4)
(Spa = 1'–0" Max)



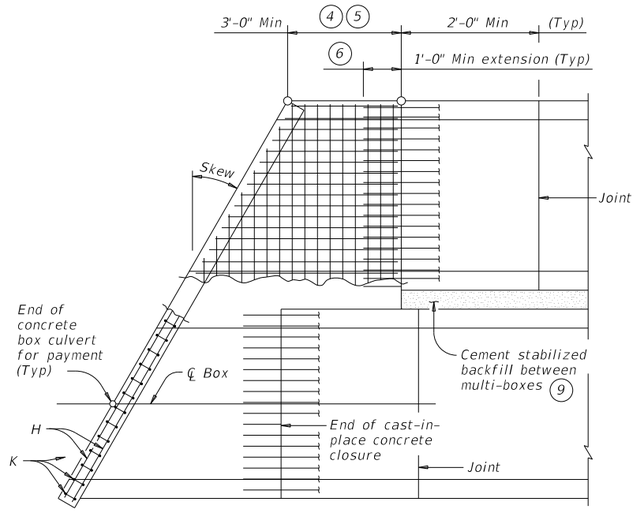
BARS K (#4)
(Spa = 1'–0" Max)
(Length = 4'–2")



ANGLE DETAIL



SECTION A-A



PLAN OF SKEWED ENDS

(Showing multi-box placement.)

1. 0" Min to 5'–0" Max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail, bicycle rail, or curbs taller than 1'–0, refer to 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 Box Culvert Rail Mounting Details (RAC) standard sheet for structures with bridge rail other than T631 or T631LS.
2. 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.
3. Extend curb, wingwall, or safety end treatment reinforcing into concrete closure. Bend or trim, as necessary, any reinforcing that does not fit into closure area.
4. Provide a 3'–0" Min cast–in–place concrete closure. Break back boxes in the field or cast boxes short. Provide bands of reinforcing in the closure that are the same size and spacing as in the precast box section. Provide #4 longitudinal reinforcement spaced at 12 inches Max within the closure. Except where shown otherwise, construct the cast–in–place closure flush with the inside and outside faces of the precast box section.
5. For multiple unit placements, adjust the length of the closure for the interior walls as necessary. Provide a 3'–0" Min cast–in–place closure in the top slab, bottom slab, and exterior wall. See Section B–B detail when interior walls are cast full length.
6. Extend precast box reinforcing a minimum of 1'–0" into concrete closure (Typ).
7. Place bands of reinforcing matching the inside and outside face reinforcing in the gaps of the top and bottom slabs. Place a band matching the outside face reinforcing of the wall in the gaps of the walls (placed in the outside face only). Tack weld the bands to the exposed reinforcing at each point of contact.
8. 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.
9. Cement stabilized backfill between boxes is considered part of the box culvert for payment.
10. All curb concrete and reinforcing is considered part of the box culvert for payment.
11. Any additional concrete and reinforcing required for the closures will be considered subsidiary to the box culvert for payment.
12. 1'–0" typical. 2'–3" when the Box Culvert Rail Mounting Details (RAC) standard sheet is referred to elsewhere in the plans.
13. For multiple unit placement with overlay, with 1 to 2 course surface treatment, or with the top slab as the final riding surface, provide wall closure as shown in Detail "A".
14. This dimension may be increased with approval of the Engineer to allow the precast boxes to be tunneled or jacked in accordance with Item 476, "Jacking, Boring, or Tunneling Pipe or Box". No payment will be made for any additional material in the gap between adjacent boxes.

MATERIAL NOTES:

Provide Grade 60 reinforcing steel.
Provide ASTM A1064 welded wire reinforcement.
Provide Class C concrete (f'c = 3,600 psi) for the closures.
Provide cement stabilized backfill meeting the requirements of Item 400, "Excavation and Backfill for Structures."
Any additional concrete required for the closures will be considered subsidiary to the box culvert.

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.
Refer to the Single Box Culverts Precast (SCP) standard sheets for details and notes not shown.
Chamfer the bottom edge of the top slab closure 3 inches at culvert closure ends.

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

HL93 LOADING

Texas Department of Transportation

Bridge Division Standard

BOX CULVERTS PRECAST MISCELLANEOUS DETAILS

SCP-MD

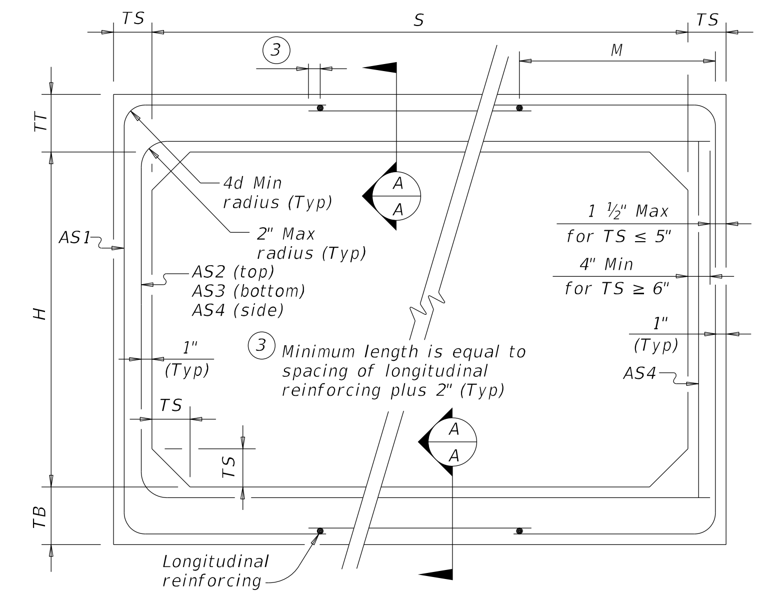
FILE: scpmdsts-20.dgn	DN: GAF	CK: LMW	DW: BWH/TxDOT	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		140

BOX DATA

SECTION DIMENSIONS					Fill Height	M (Min)	REINFORCING (sq. in. / ft.) (2)							(1) Lift Weight
S (ft.)	H (ft.)	TT (in.)	TB (in.)	TS (in.)	(ft.)	(in.)	AS1	AS2	AS3	AS4	AS5	AS7	AS8	(tons)
5	2	8	7	6	< 2	-	0.19	0.27	0.18	0.14	0.19	0.19	0.17	6.0
5	2	6	6	6	2 < 3	44	0.22	0.20	0.16	0.14	-	-	-	5.1
5	2	6	6	6	3 - 5	44	0.16	0.14	0.14	0.14	-	-	-	5.1
5	2	6	6	6	10	36	0.15	0.14	0.14	0.14	-	-	-	5.1
5	2	6	6	6	15	36	0.20	0.18	0.18	0.14	-	-	-	5.1
5	2	6	6	6	20	36	0.26	0.23	0.24	0.14	-	-	-	5.1
5	2	6	6	6	25	36	0.33	0.29	0.29	0.14	-	-	-	5.1
5	2	6	6	6	30	36	0.39	0.34	0.35	0.14	-	-	-	5.1
5	3	8	7	6	< 2	-	0.19	0.31	0.21	0.14	0.19	0.19	0.17	6.6
5	3	6	6	6	2 < 3	45	0.18	0.24	0.19	0.14	-	-	-	5.7
5	3	6	6	6	3 - 5	36	0.14	0.17	0.16	0.14	-	-	-	5.7
5	3	6	6	6	10	36	0.14	0.16	0.17	0.14	-	-	-	5.7
5	3	6	6	6	15	35	0.16	0.21	0.22	0.14	-	-	-	5.7
5	3	6	6	6	20	35	0.21	0.27	0.28	0.14	-	-	-	5.7
5	3	6	6	6	25	35	0.26	0.34	0.34	0.14	-	-	-	5.7
5	3	6	6	6	30	35	0.31	0.41	0.41	0.14	-	-	-	5.7
5	4	8	7	6	< 2	-	0.19	0.33	0.24	0.14	0.19	0.19	0.17	7.2
5	4	6	6	6	2 < 3	45	0.16	0.27	0.22	0.14	-	-	-	6.3
5	4	6	6	6	3 - 5	45	0.14	0.19	0.18	0.14	-	-	-	6.3
5	4	6	6	6	10	36	0.14	0.18	0.18	0.14	-	-	-	6.3
5	4	6	6	6	15	35	0.14	0.23	0.24	0.14	-	-	-	6.3
5	4	6	6	6	20	35	0.17	0.30	0.31	0.14	-	-	-	6.3
5	4	6	6	6	25	35	0.21	0.37	0.38	0.14	-	-	-	6.3
5	4	6	6	6	30	35	0.25	0.44	0.45	0.14	-	-	-	6.3
5	5	8	7	6	< 2	-	0.19	0.35	0.26	0.14	0.19	0.19	0.17	7.8
5	5	6	6	6	2 < 3	45	0.14	0.29	0.24	0.14	-	-	-	6.9
5	5	6	6	6	3 - 5	45	0.14	0.21	0.20	0.14	-	-	-	6.9
5	5	6	6	6	10	45	0.14	0.19	0.20	0.14	-	-	-	6.9
5	5	6	6	6	15	36	0.14	0.24	0.25	0.14	-	-	-	6.9
5	5	6	6	6	20	35	0.15	0.31	0.32	0.14	-	-	-	6.9
5	5	6	6	6	25	35	0.18	0.38	0.39	0.14	-	-	-	6.9
5	5	6	6	6	30	35	0.21	0.46	0.47	0.14	-	-	-	6.9

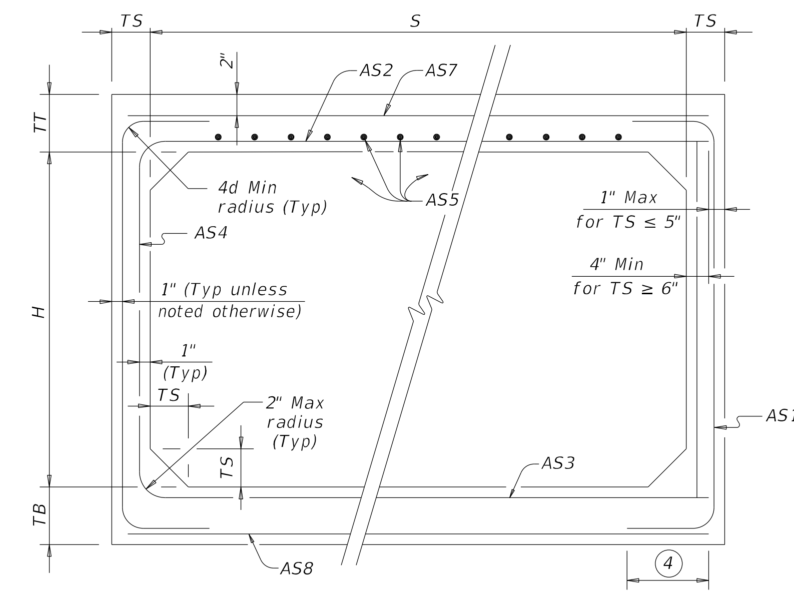
(1) For box length = 8'-0"

(2) AS1 thru AS4, AS7 and AS8 are minimum required areas of reinforcement per linear foot of box length. AS5 is minimum required area of reinforcement per linear foot of box width.



CORNER OPTION "A" CORNER OPTION "B"

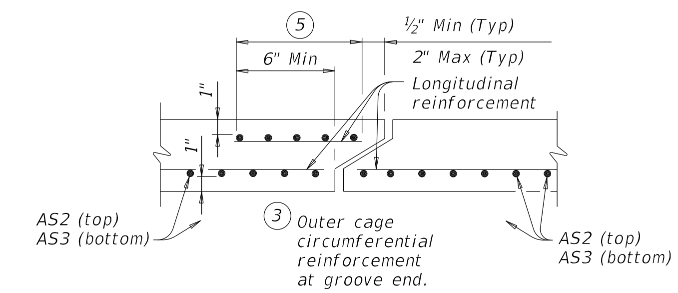
FILL HEIGHT 2 FT AND GREATER



CORNER OPTION "A" CORNER OPTION "B"

FILL HEIGHT LESS THAN 2 FT

(4) Length is equal to spacing of longitudinal reinforcing plus 2". (10" Min) (Typ)



SECTION A-A

(Showing top and bottom slab joint reinforcement.)

MATERIAL NOTES:

Provide 0.03 sq. in./ft. minimum longitudinal reinforcement at each face in slabs and walls. This minimum requirement may be met by the transverse wires when wire mesh reinforcement is used.

Provide Class H concrete (f'c = 5,000 psi).

GENERAL NOTES:

Designs shown conform to ASTM C1577. Refer to ASTM C1577 for information or details not shown.

See Box Culverts Precast Miscellaneous Details (SCP-MD) standard sheet for details and notes not shown.

In lieu of furnishing the designs shown on this sheet, the contractor may furnish an alternate design that is equal to or exceeds the box design for the design fill height in the table. Submit shop plans for alternate designs in accordance with Item "Precast Concrete Structural Members (Fabrication)".

HL93 LOADING

Texas Department of Transportation | Bridge Division Standard

SINGLE BOX CULVERTS PRECAST

5'-0" SPAN

SCP-5

FILE: scp05sts-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST		COUNTY	SHEET NO.
	WAC		BELL	141

DATE: 8/28/2021 5:41:57 PM
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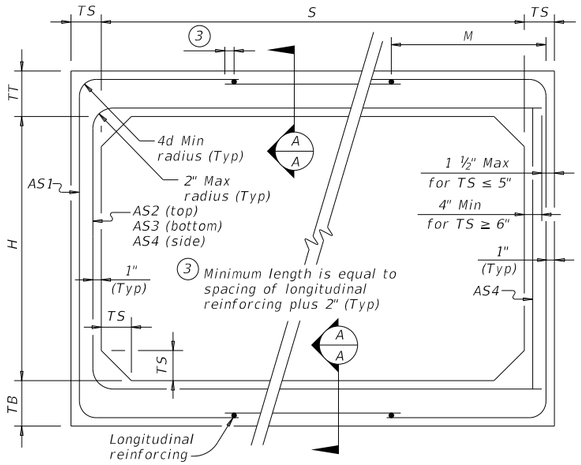
BOX DATA

SECTION DIMENSIONS					Fill Height	M (Min)	REINFORCING (sq. in. / ft.) (2)							(1) Lift Weight
S (ft.)	H (ft.)	TT (in.)	TB (in.)	TS (in.)	(ft.)	(in.)	AS1	AS2	AS3	AS4	AS5	AS7	AS8	(tons)
6	2	8	7	7	< 2	–	0.23	0.27	0.19	0.17	0.19	0.19	0.17	7.2
6	2	7	7	7	2 < 3	43	0.25	0.21	0.17	0.17	–	–	–	6.8
6	2	7	7	7	3 – 5	43	0.20	0.17	0.17	0.17	–	–	–	6.8
6	2	7	7	7	10	39	0.20	0.17	0.17	0.17	–	–	–	6.8
6	2	7	7	7	15	39	0.26	0.20	0.20	0.17	–	–	–	6.8
6	2	7	7	7	20	39	0.34	0.26	0.26	0.17	–	–	–	6.8
6	2	7	7	7	25	39	0.43	0.32	0.32	0.17	–	–	–	6.8
6	2	7	7	7	30	39	0.52	0.38	0.39	0.17	–	–	–	6.8
6	3	8	7	7	< 2	–	0.20	0.31	0.22	0.17	0.19	0.19	0.17	7.9
6	3	7	7	7	2 < 3	43	0.21	0.24	0.19	0.17	–	–	–	7.5
6	3	7	7	7	3 – 5	39	0.17	0.18	0.17	0.17	–	–	–	7.5
6	3	7	7	7	10	39	0.17	0.18	0.19	0.17	–	–	–	7.5
6	3	7	7	7	15	38	0.22	0.24	0.24	0.17	–	–	–	7.5
6	3	7	7	7	20	38	0.28	0.31	0.31	0.17	–	–	–	7.5
6	3	7	7	7	25	38	0.35	0.38	0.39	0.17	–	–	–	7.5
6	3	7	7	7	30	38	0.42	0.46	0.46	0.17	–	–	–	7.5
6	4	8	7	7	< 2	–	0.19	0.34	0.25	0.17	0.19	0.19	0.17	8.6
6	4	7	7	7	2 < 3	43	0.19	0.27	0.21	0.17	–	–	–	8.2
6	4	7	7	7	3 – 5	39	0.17	0.21	0.19	0.17	–	–	–	8.2
6	4	7	7	7	10	39	0.17	0.20	0.21	0.17	–	–	–	8.2
6	4	7	7	7	15	38	0.18	0.27	0.27	0.17	–	–	–	8.2
6	4	7	7	7	20	38	0.24	0.34	0.35	0.17	–	–	–	8.2
6	4	7	7	7	25	38	0.29	0.43	0.42	0.17	–	–	–	8.2
6	4	7	7	7	30	38	0.35	0.51	0.52	0.17	–	–	–	8.2
6	5	8	7	7	< 2	–	0.19	0.37	0.28	0.17	0.19	0.19	0.17	9.3
6	5	7	7	7	2 < 3	43	0.17	0.30	0.24	0.17	–	–	–	8.9
6	5	7	7	7	3 – 5	43	0.17	0.23	0.21	0.17	–	–	–	8.9
6	5	7	7	7	10	39	0.17	0.22	0.23	0.17	–	–	–	8.9
6	5	7	7	7	15	38	0.17	0.28	0.29	0.17	–	–	–	8.9
6	5	7	7	7	20	38	0.20	0.37	0.38	0.17	–	–	–	8.9
6	5	7	7	7	25	38	0.25	0.45	0.46	0.17	–	–	–	8.9
6	5	7	7	7	30	38	0.30	0.54	0.55	0.17	–	–	–	8.9
6	6	8	7	7	< 2	–	0.19	0.38	0.30	0.17	0.19	0.19	0.17	10
6	6	7	7	7	2 < 3	52	0.17	0.32	0.26	0.17	–	–	–	9.6
6	6	7	7	7	3 – 5	52	0.17	0.24	0.22	0.17	–	–	–	9.6
6	6	7	7	7	10	43	0.17	0.23	0.24	0.17	–	–	–	9.6
6	6	7	7	7	15	39	0.17	0.29	0.31	0.17	–	–	–	9.6
6	6	7	7	7	20	39	0.18	0.38	0.39	0.17	–	–	–	9.6
6	6	7	7	7	25	38	0.23	0.46	0.48	0.17	–	–	–	9.6
6	6	7	7	7	30	38	0.27	0.55	0.57	0.17	–	–	–	9.6

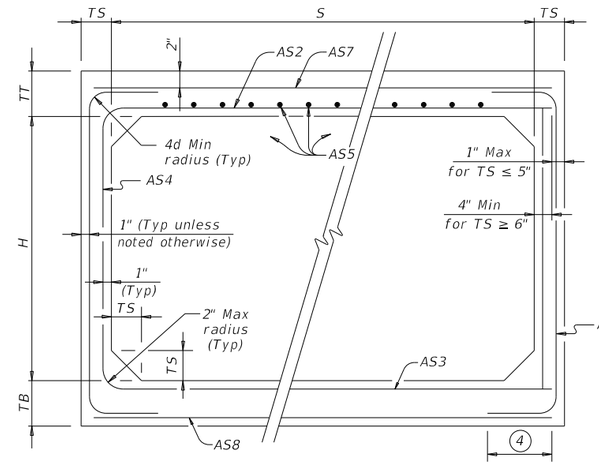
(1) For box length = 8'-0"

(2) AS1 thru AS4, AS7 and AS8 are minimum required areas of reinforcement per linear foot of box length. AS5 is minimum required area of reinforcement per linear foot of box width.



CORNER OPTION "A" CORNER OPTION "B"

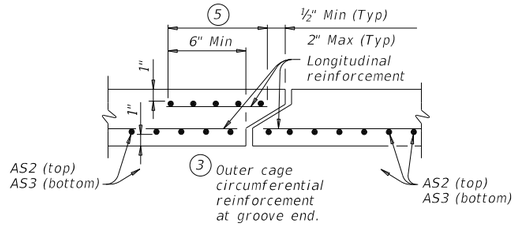
FILL HEIGHT 2 FT AND GREATER



CORNER OPTION "A" CORNER OPTION "B"

FILL HEIGHT LESS THAN 2 FT

(4) Length is equal to spacing of longitudinal reinforcing plus 2". (10" Min) (Typ)



SECTION A-A

(Showing top and bottom slab joint reinforcement.)

MATERIAL NOTES:

Provide 0.03 sq. in./ft. minimum longitudinal reinforcement at each face in slabs and walls. This minimum requirement may be met by the transverse wires when wire mesh reinforcement is used.

Provide Class H concrete (f`c = 5,000 psi).

GENERAL NOTES:

Designs shown conform to ASTM C1577. Refer to ASTM C1577 for information or details not shown.

See Box Culverts Precast Miscellaneous Details (SCP-MD) standard sheet for details and notes not shown.

In lieu of furnishing the designs shown on this sheet, the contractor may furnish an alternate design that is equal to or exceeds the box design for the design fill height in the table. Submit shop plans for alternate designs in accordance with Item "Precast Concrete Structural Members (Fabrication)".

HL93 LOADING

Texas Department of Transportation

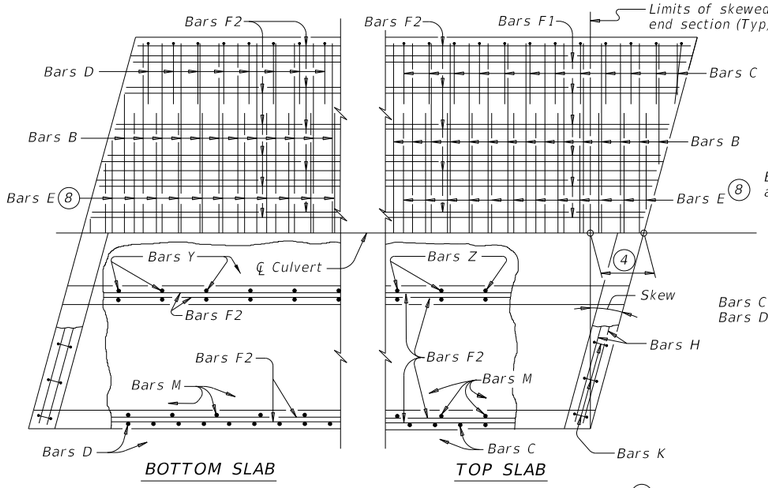
Bridge Division Standard

SINGLE BOX CULVERTS PRECAST

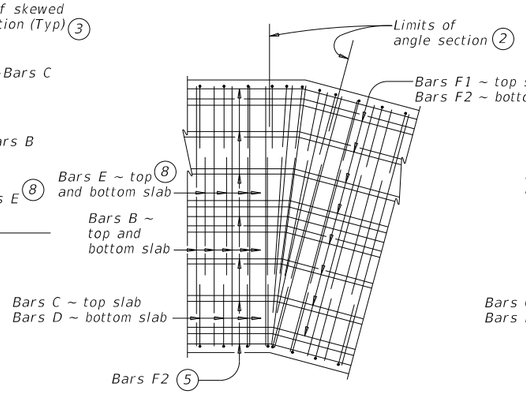
6'-0" SPAN

SCP-6

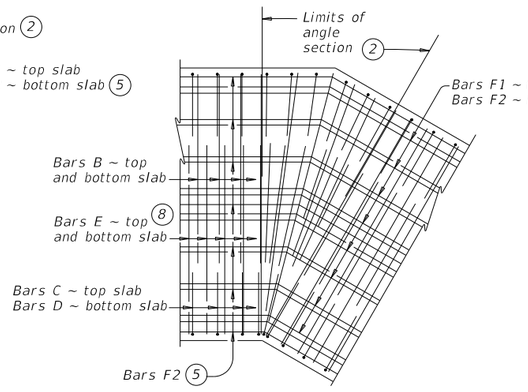
FILE: scp06sts-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		142



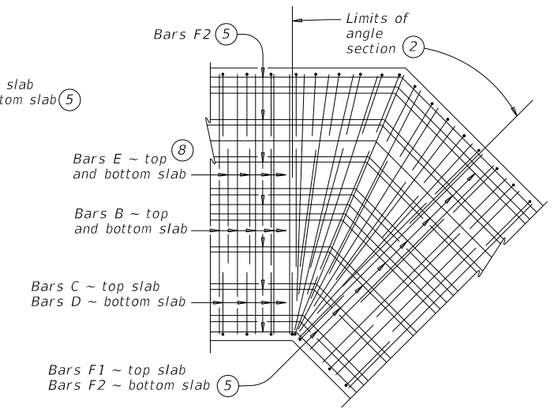
PLAN OF SKEWED ENDS ~ FROM 0° TO 15° 7



PLAN OF ANGLE SECTION ~ FROM 0° TO 15°

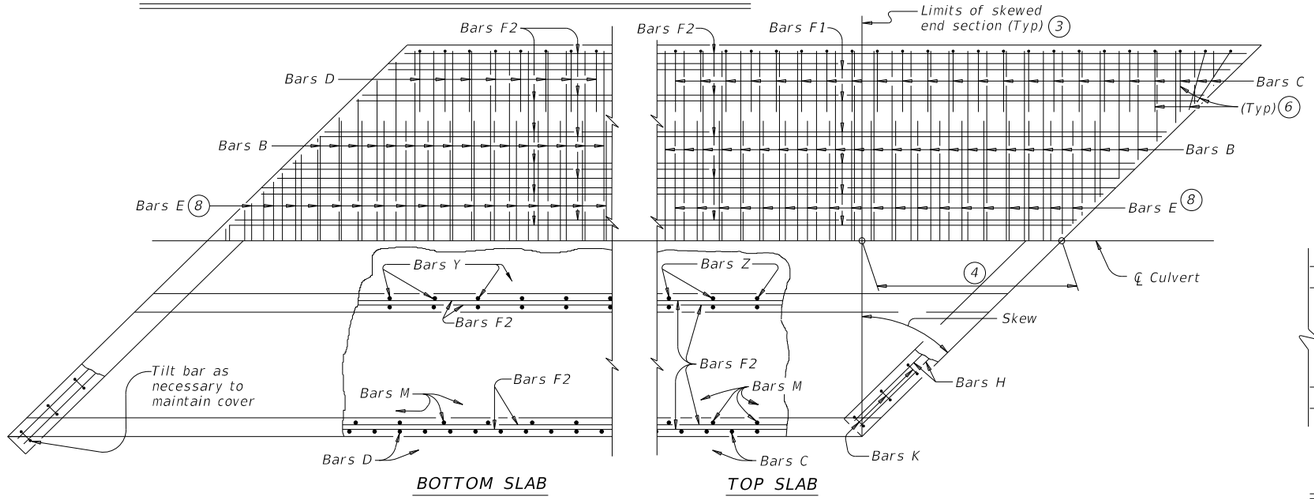


PLAN OF ANGLE SECTION ~ OVER 15° TO 30°



PLAN OF ANGLE SECTION ~ OVER 30° TO 45°

PLAN OF SKEWED ENDS ~ OVER 15° TO 30°



PLAN OF SKEWED ENDS ~ OVER 30° TO 45°

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.

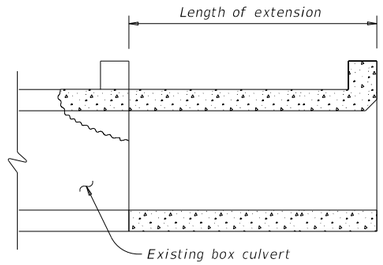
4 [One half of overall width] x [tangent of the skew angle]

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.



LENGTHENING DETAIL 1

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: mc-mdste-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		143

DATE: 8/28/2021 5:42:02 PM
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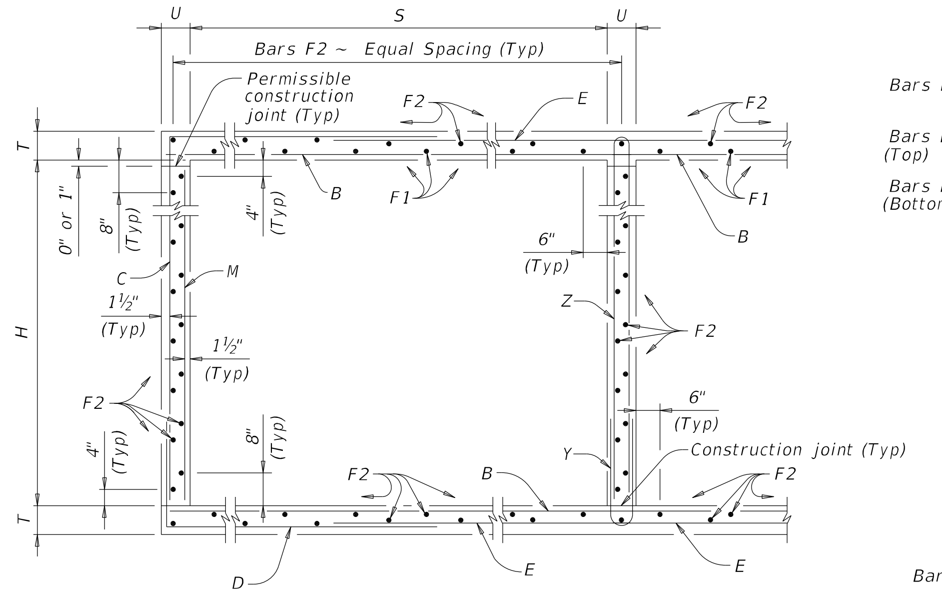
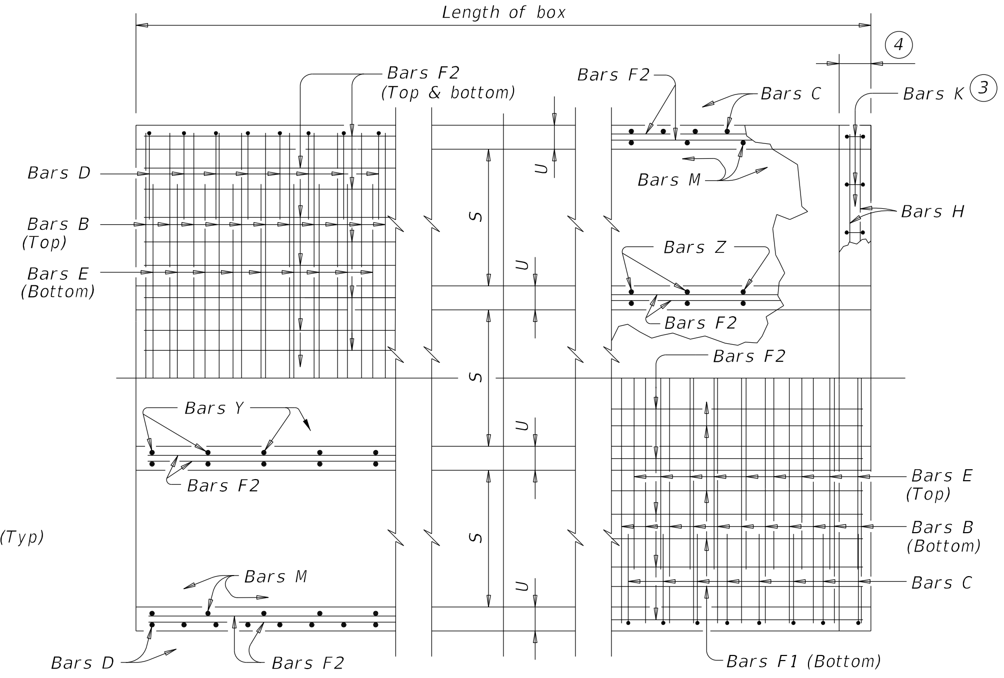


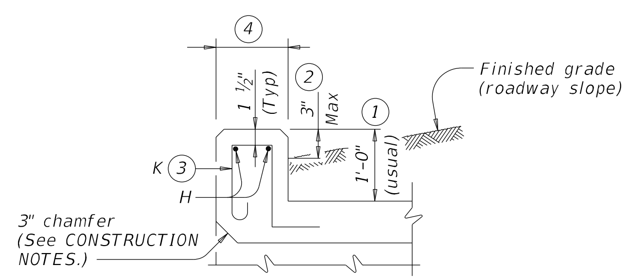
TYPICAL SECTION



BOTTOM SLAB

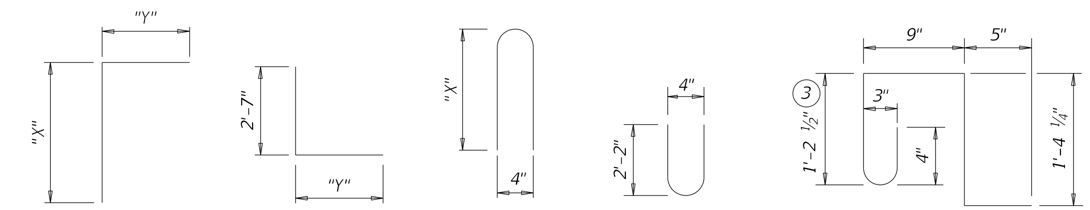
TOP SLAB

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"



BARS C BARS D BARS Z BARS Y BARS K (#4)
(Spa = 1'-0" Max)
(Length = 4'-2")

(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

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	2038	01	031	FM 2115
	DIST		COUNTY	SHEET NO.
	WAC		BELL	144

DATE: 8/28/2021 5:42:06 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\2038010031\4 Design\Plan Set\5_Bridge\Standards\mc520ste-20.dgn

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	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		145

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DATE: 8/28/2021 5:42:10 PM
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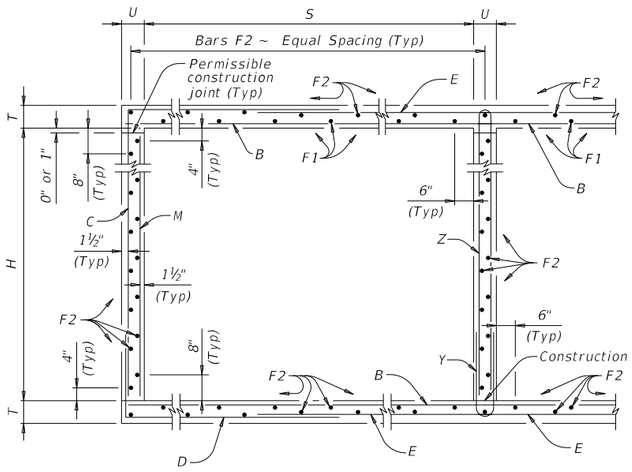
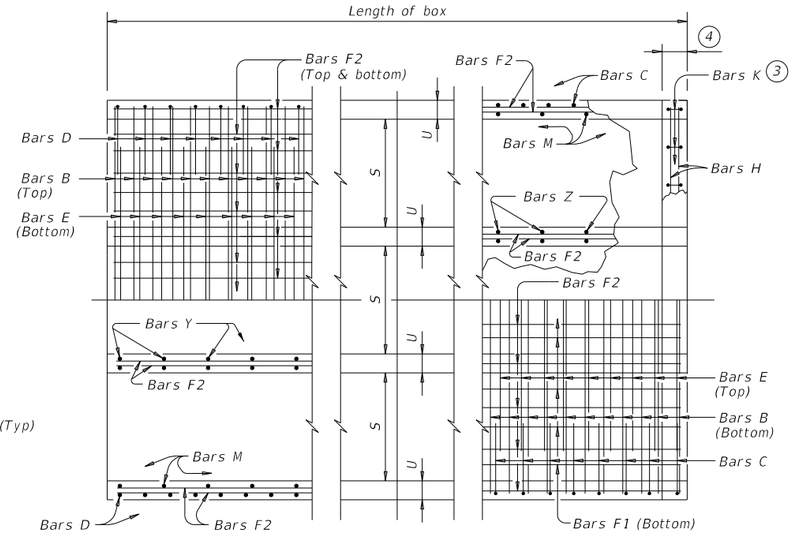
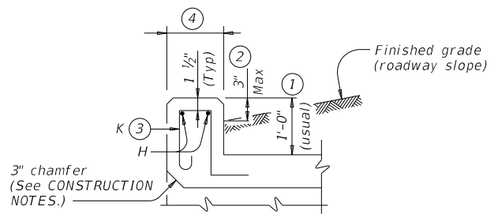


TYPICAL SECTION



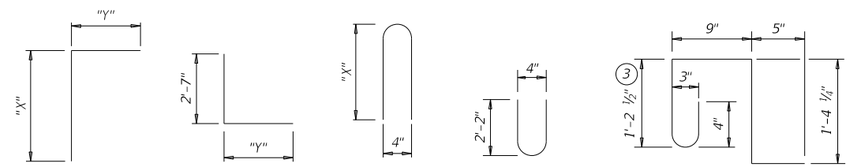
BOTTOM SLAB TOP SLAB

PART PLANS



SECTION THRU CURB

TABLE OF BAR DIMENSIONS		
H	"X"	"Y"
3'-0"	3'-6 ½"	4'-5"
4'-0"	4'-6 ½"	4'-5"
5'-0"	5'-6 ½"	4'-5"
6'-0"	6'-6 ½"	4'-5"
7'-0"	7'-6 ½"	4'-5"



BARS C BARS D BARS Z BARS Y BARS K (#4)
(Spa = 1'-0" Max)
(Length = 4'-2")

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
7'-0" SPAN
0' TO 10' FILL

MC-7-10

FILE: mc710ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		146

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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	7' – 0"	3' – 0"	8"	7"	108	#6	9"	15' – 6"	2,514	162	#5	6"	7' – 11"	1,338	7' – 0"	1,183	108	#6	9"	11' – 5"	1,852	10	18"	39' – 9"	266	54	18"	39' – 9"	1,434	108	9"	3' – 0"	216	54	9"	4' – 7"	165	7' – 3"	262	15' – 6"	41	34	95	0.972	230.8	1.2	136	40.0	9,366
3	7' – 0"	3' – 0"	8"	7"	108	#6	9"	23' – 1"	3,744	162	#5	6"	7' – 11"	1,338	7' – 0"	1,183	108	#6	9"	19' – 0"	3,082	15	18"	39' – 9"	398	77	18"	39' – 9"	2,045	108	9"	3' – 0"	216	108	9"	4' – 7"	331	7' – 3"	523	23' – 1"	62	50	139	1.412	321.5	1.7	201	58.2	13,061
4	7' – 0"	3' – 0"	8"	7"	108	#6	9"	30' – 8"	4,975	162	#5	6"	7' – 11"	1,338	7' – 0"	1,183	108	#6	9"	26' – 7"	4,312	20	18"	39' – 9"	531	100	18"	39' – 9"	2,655	108	9"	3' – 0"	216	162	9"	4' – 7"	496	7' – 3"	785	30' – 8"	82	64	178	1.851	412.3	2.3	260	76.3	16,751
5	7' – 0"	3' – 0"	8"	7"	108	#6	9"	38' – 3"	6,205	162	#5	6"	7' – 11"	1,338	7' – 0"	1,183	108	#6	9"	34' – 2"	5,542	25	18"	39' – 9"	664	123	18"	39' – 9"	3,266	108	9"	3' – 0"	216	216	9"	4' – 7"	661	7' – 3"	1,046	38' – 3"	102	80	223	2.290	503.0	2.8	325	94.4	20,446
6	7' – 0"	3' – 0"	8"	7"	108	#6	9"	45' – 10"	7,435	162	#5	6"	7' – 11"	1,338	7' – 0"	1,183	108	#6	9"	41' – 9"	6,773	30	18"	39' – 9"	797	146	18"	39' – 9"	3,877	108	9"	3' – 0"	216	270	9"	4' – 7"	827	7' – 3"	1,308	45' – 10"	122	94	262	2.729	593.9	3.4	384	112.6	24,138
2	7' – 0"	4' – 0"	8"	7"	108	#6	9"	15' – 6"	2,514	162	#5	6"	8' – 11"	1,507	7' – 0"	1,183	108	#6	9"	11' – 5"	1,852	10	18"	39' – 9"	266	54	18"	39' – 9"	1,434	108	9"	4' – 0"	289	54	9"	4' – 7"	165	9' – 3"	334	15' – 6"	41	34	95	1.037	238.6	1.2	136	42.6	9,680
3	7' – 0"	4' – 0"	8"	7"	108	#6	9"	23' – 1"	3,744	162	#5	6"	8' – 11"	1,507	7' – 0"	1,183	108	#6	9"	19' – 0"	3,082	15	18"	39' – 9"	398	77	18"	39' – 9"	2,045	108	9"	4' – 0"	289	108	9"	4' – 7"	331	9' – 3"	667	23' – 1"	62	50	139	1.498	331.2	1.7	201	61.6	13,447
4	7' – 0"	4' – 0"	8"	7"	108	#6	9"	30' – 8"	4,975	162	#5	6"	8' – 11"	1,507	7' – 0"	1,183	108	#6	9"	26' – 7"	4,312	20	18"	39' – 9"	531	100	18"	39' – 9"	2,655	108	9"	4' – 0"	289	162	9"	4' – 7"	496	9' – 3"	1,001	30' – 8"	82	64	178	1.959	423.7	2.3	260	80.6	17,209
5	7' – 0"	4' – 0"	8"	7"	108	#6	9"	38' – 3"	6,205	162	#5	6"	8' – 11"	1,507	7' – 0"	1,183	108	#6	9"	34' – 2"	5,542	25	18"	39' – 9"	664	123	18"	39' – 9"	3,266	108	9"	4' – 0"	289	216	9"	4' – 7"	661	9' – 3"	1,335	38' – 3"	102	80	223	2.420	516.3	2.8	325	99.6	20,977
6	7' – 0"	4' – 0"	8"	7"	108	#6	9"	45' – 10"	7,435	162	#5	6"	8' – 11"	1,507	7' – 0"	1,183	108	#6	9"	41' – 9"	6,773	30	18"	39' – 9"	797	146	18"	39' – 9"	3,877	108	9"	4' – 0"	289	270	9"	4' – 7"	827	9' – 3"	1,668	45' – 10"	122	94	262	2.881	608.9	3.4	384	118.6	24,740
2	7' – 0"	5' – 0"	8"	7"	108	#6	9"	15' – 6"	2,514	162	#5	6"	9' – 11"	1,676	7' – 0"	1,183	108	#6	9"	11' – 5"	1,852	10	18"	39' – 9"	266	60	18"	39' – 9"	1,593	108	9"	5' – 0"	361	54	9"	4' – 7"	165	11' – 3"	406	15' – 6"	41	34	95	1.102	250.4	1.2	136	45.2	10,152
3	7' – 0"	5' – 0"	8"	7"	108	#6	9"	23' – 1"	3,744	162	#5	6"	9' – 11"	1,676	7' – 0"	1,183	108	#6	9"	19' – 0"	3,082	15	18"	39' – 9"	398	85	18"	39' – 9"	2,257	108	9"	5' – 0"	361	108	9"	4' – 7"	331	11' – 3"	812	23' – 1"	62	50	139	1.584	346.1	1.7	201	65.1	14,045
4	7' – 0"	5' – 0"	8"	7"	108	#6	9"	30' – 8"	4,975	162	#5	6"	9' – 11"	1,676	7' – 0"	1,183	108	#6	9"	26' – 7"	4,312	20	18"	39' – 9"	531	110	18"	39' – 9"	2,921	108	9"	5' – 0"	361	162	9"	4' – 7"	496	11' – 3"	1,217	30' – 8"	82	64	178	2.067	441.8	2.3	260	85.0	17,932
5	7' – 0"	5' – 0"	8"	7"	108	#6	9"	38' – 3"	6,205	162	#5	6"	9' – 11"	1,676	7' – 0"	1,183	108	#6	9"	34' – 2"	5,542	25	18"	39' – 9"	664	135	18"	39' – 9"	3,585	108	9"	5' – 0"	361	216	9"	4' – 7"	661	11' – 3"	1,623	38' – 3"	102	80	223	2.549	537.5	2.8	325	104.8	21,825
6	7' – 0"	5' – 0"	8"	7"	108	#6	9"	45' – 10"	7,435	162	#5	6"	9' – 11"	1,676	7' – 0"	1,183	108	#6	9"	41' – 9"	6,773	30	18"	39' – 9"	797	160	18"	39' – 9"	4,248	108	9"	5' – 0"	361	270	9"	4' – 7"	827	11' – 3"	2,029	45' – 10"	122	94	262	3.032	633.2	3.4	384	124.7	25,713
2	7' – 0"	6' – 0"	8"	7"	108	#6	9"	15' – 6"	2,514	162	#5	6"	10' – 11"	1,845	7' – 0"	1,183	108	#6	9"	11' – 5"	1,852	10	18"	39' – 9"	266	66	18"	39' – 9"	1,752	108	9"	6' – 0"	433	54	9"	4' – 7"	165	13' – 3"	478	15' – 6"	41	34	95	1.167	262.2	1.2	136	47.8	10,624
3	7' – 0"	6' – 0"	8"	7"	108	#6	9"	23' – 1"	3,744	162	#5	6"	10' – 11"	1,845	7' – 0"	1,183	108	#6	9"	19' – 0"	3,082	15	18"	39' – 9"	398	93	18"	39' – 9"	2,469	108	9"	6' – 0"	433	108	9"	4' – 7"	331	13' – 3"	956	23' – 1"	62	50	139	1.671	361.0	1.7	201	68.6	14,642
4	7' – 0"	6' – 0"	8"	7"	108	#6	9"	30' – 8"	4,975	162	#5	6"	10' – 11"	1,845	7' – 0"	1,183	108	#6	9"	26' – 7"	4,312	20	18"	39' – 9"	531	120	18"	39' – 9"	3,186	108	9"	6' – 0"	433	162	9"	4' – 7"	496	13' – 3"	1,434	30' – 8"	82	64	178	2.175	459.9	2.3	260	89.3	18,655
5	7' – 0"	6' – 0"	8"	7"	108	#6	9"	38' – 3"	6,205	162	#5	6"	10' – 11"	1,845	7' – 0"	1,183	108	#6	9"	34' – 2"	5,542	25	18"	39' – 9"	664	147	18"	39' – 9"	3,903	108	9"	6' – 0"	433	216	9"	4' – 7"	661	13' – 3"	1,912	38' – 3"	102	80	223	2.679	558.7	2.8	325	110.0	22,673
6	7' – 0"	6' – 0"	8"	7"	108	#6	9"	45' – 10"	7,435	162	#5	6"	10' – 11"	1,845	7' – 0"	1,183	108	#6	9"	41' – 9"	6,773	30	18"	39' – 9"	797	174	18"	39' – 9"	4,620	108	9"	6' – 0"	433	270	9"	4' – 7"	827	13' – 3"	2,390	45' – 10"	122	94	262	3.183	657.6	3.4	384	130.7	26,687
2	7' – 0"	7' – 0"	8"	7"	108	#6	9"	15' – 6"	2,514	162	#5	6"	11' – 11"	2,014	7' – 0"	1,183	108	#6	9"	11' – 5"	1,852	10	18"	39' – 9"	266	66	18"	39' – 9"	1,752	108	9"	7' – 0"	505	54	9"	4' – 7"	165	15' – 3"	550	15' – 6"	41	34	95	1.231	270.0	1.2	136	50.4	10,937
3	7' – 0"	7' – 0"	8"	7"	108	#6	9"	23' – 1"	3,744	162	#5	6"	11' – 11"	2,014	7' – 0"	1,183	108	#6	9"	19' – 0"	3,082	15	18"	39' – 9"	398	93	18"	39' – 9"	2,469	108	9"	7' – 0"	505	108	9"	4' – 7"	331	15' – 3"	1,100	23' – 1"	62	50	139	1.757	370.7	1.7	201	72.0	15,027
4	7' – 0"	7' – 0"	8"	7"	108	#6	9"	30' – 8"	4,975	162	#5	6"	11' – 11"	2,014	7' – 0"	1,183	108	#6	9"	26' – 7"	4,312	20	18"	39' – 9"	531	120	18"	39' – 9"	3,186	108	9"	7' – 0"	505	162	9"	4' – 7"	496	15' – 3"	1,650	30' – 8"	82	64	178	2.283	471.3	2.3	260	93.6	19,112
5	7' – 0"	7' – 0"	8"	7"	108	#6	9"	38' – 3"	6,205	162	#5	6"	11' – 11"	2,014	7' – 0"	1,183	108	#6	9"	34' – 2"	5,542	25	18"	39' – 9"	664	147	18"	39' – 9"	3,903	108	9"	7' – 0"	505	216	9"	4' – 7"	661	15' – 3"	2,200	38' – 3"	102	80	223	2.809	571.9	2.8	325	115.2	23,202
6	7' – 0"	7' – 0"	8"	7"	108	#6	9"	45' – 10"	7,435	162	#5	6"	11' – 11"	2,014	7' – 0"	1,183	108	#6	9"	41' – 9"	6,773	30	18"	39' – 9"	797	174	18"	39' – 9"	4,620	108	9"	7' – 0"	505	270	9"	4' – 7"	827	15' – 3"	2,750	45' – 10"	122	94	262	3.334	672.6	3.4	384	136.8	27,288

HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS
CAST-IN-PLACE
7'-0" SPAN
0' TO 10' FILL

MC-7-10

FILE: mc710ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		147

DATE: 8/28/2021 5:42:15 PM
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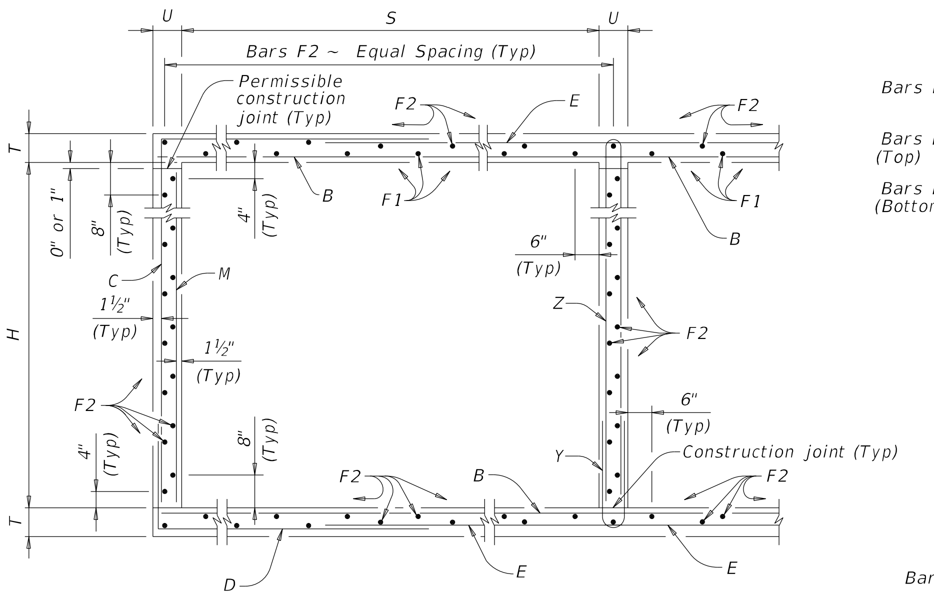
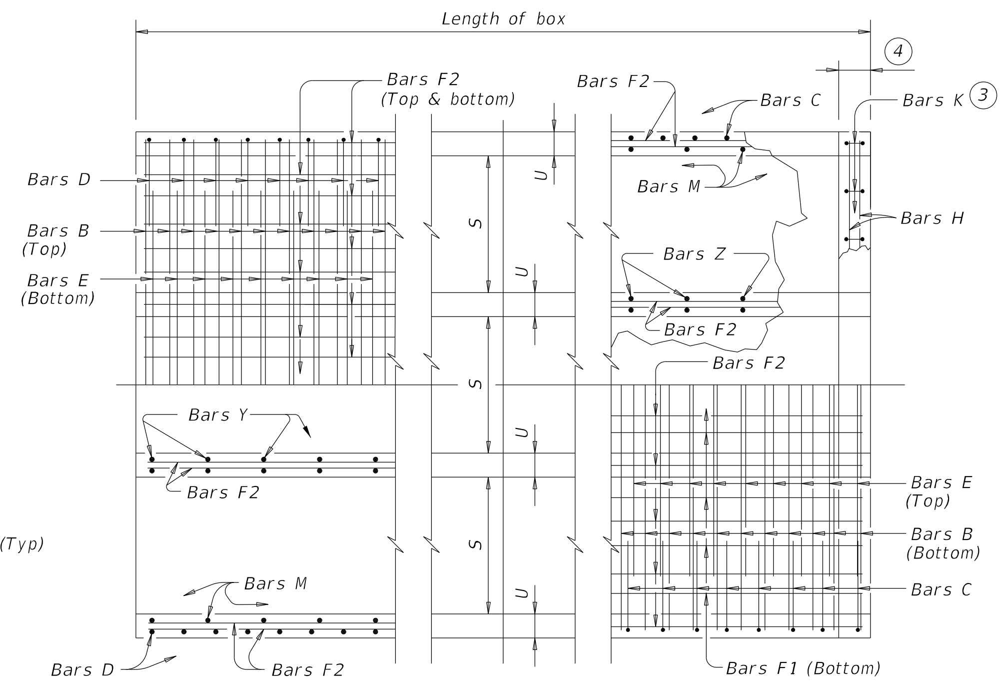


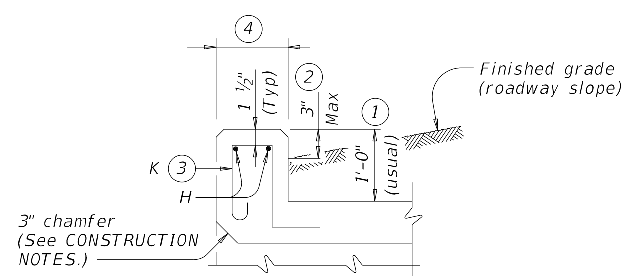
TYPICAL SECTION



BOTTOM SLAB

TOP SLAB

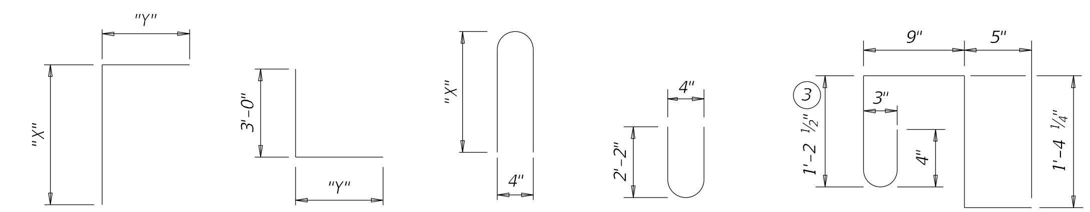
PART PLANS



SECTION THRU CURB

TABLE OF BAR DIMENSIONS

H	"X"	"Y"
3'-0"	3'-6 ½"	5'-1"
4'-0"	4'-6 ½"	5'-1"
5'-0"	5'-6 ½"	5'-1"
6'-0"	6'-6 ½"	5'-1"
7'-0"	7'-6 ½"	5'-1"
8'-0"	8'-6 ½"	5'-1"



BARS C　BARS D　BARS Z　BARS Y　BARS K (#4)
(Spa = 1'-0" Max)
(Length = 4'-2")

(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
8'-0" SPAN
0' TO 13' FILL

MC-8-13

FILE: mc813ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST		COUNTY	SHEET NO.
	WAC		BELL	148

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	8' - 0"	3' - 0"	8"	7"	162	#6	6"	17' - 6"	4,258	108	#6	9"	8' - 8"	1,406	8' - 2"	1,325	162	#6	6"	12' - 9"	3,102	12	18"	39' - 9"	319	56	18"	39' - 9"	1,487	108	9"	3' - 0"	216	54	9"	4' - 7"	165	7' - 3"	262	17' - 6"	47	38	106	1.071	313.5	1.3	153	44.2	12,693
3	8' - 0"	3' - 0"	8"	7"	162	#6	6"	26' - 1"	6,347	108	#6	9"	8' - 8"	1,406	8' - 2"	1,325	162	#6	6"	21' - 4"	5,191	18	18"	39' - 9"	478	80	18"	39' - 9"	2,124	108	9"	3' - 0"	216	108	9"	4' - 7"	331	7' - 3"	523	26' - 1"	70	56	156	1.560	448.5	1.9	226	64.3	18,167
4	8' - 0"	3' - 0"	8"	7"	162	#6	6"	34' - 8"	8,435	108	#6	9"	8' - 8"	1,406	8' - 2"	1,325	162	#6	6"	29' - 11"	7,279	24	18"	39' - 9"	637	104	18"	39' - 9"	2,762	108	9"	3' - 0"	216	162	9"	4' - 7"	496	7' - 3"	785	34' - 8"	93	72	200	2.048	583.5	2.6	293	84.5	23,634
5	8' - 0"	3' - 0"	8"	7"	162	#6	6"	43' - 3"	10,524	108	#6	9"	8' - 8"	1,406	8' - 2"	1,325	162	#6	6"	38' - 6"	9,368	30	18"	39' - 9"	797	128	18"	39' - 9"	3,399	108	9"	3' - 0"	216	216	9"	4' - 7"	661	7' - 3"	1,046	43' - 3"	116	90	251	2.537	718.6	3.2	367	104.7	29,109
6	8' - 0"	3' - 0"	8"	7"	162	#6	6"	51' - 10"	12,612	108	#6	9"	8' - 8"	1,406	8' - 2"	1,325	162	#6	6"	47' - 1"	11,457	36	18"	39' - 9"	956	152	18"	39' - 9"	4,036	108	9"	3' - 0"	216	270	9"	4' - 7"	827	7' - 3"	1,308	51' - 10"	138	106	295	3.026	853.6	3.8	433	124.9	34,576
2	8' - 0"	4' - 0"	8"	7"	162	#6	6"	17' - 6"	4,258	108	#6	9"	9' - 8"	1,568	8' - 2"	1,325	162	#6	6"	12' - 9"	3,102	12	18"	39' - 9"	319	56	18"	39' - 9"	1,487	108	9"	4' - 0"	289	54	9"	4' - 7"	165	9' - 3"	334	17' - 6"	47	38	106	1.136	321.2	1.3	153	46.8	13,000
3	8' - 0"	4' - 0"	8"	7"	162	#6	6"	26' - 1"	6,347	108	#6	9"	9' - 8"	1,568	8' - 2"	1,325	162	#6	6"	21' - 4"	5,191	18	18"	39' - 9"	478	80	18"	39' - 9"	2,124	108	9"	4' - 0"	289	108	9"	4' - 7"	331	9' - 3"	667	26' - 1"	70	56	156	1.646	458.0	1.9	226	67.8	18,546
4	8' - 0"	4' - 0"	8"	7"	162	#6	6"	34' - 8"	8,435	108	#6	9"	9' - 8"	1,568	8' - 2"	1,325	162	#6	6"	29' - 11"	7,279	24	18"	39' - 9"	637	104	18"	39' - 9"	2,762	108	9"	4' - 0"	289	162	9"	4' - 7"	496	9' - 3"	1,001	34' - 8"	93	72	200	2.156	594.8	2.6	293	88.8	24,085
5	8' - 0"	4' - 0"	8"	7"	162	#6	6"	43' - 3"	10,524	108	#6	9"	9' - 8"	1,568	8' - 2"	1,325	162	#6	6"	38' - 6"	9,368	30	18"	39' - 9"	797	128	18"	39' - 9"	3,399	108	9"	4' - 0"	289	216	9"	4' - 7"	661	9' - 3"	1,335	43' - 3"	116	90	251	2.667	731.7	3.2	367	109.9	29,633
6	8' - 0"	4' - 0"	8"	7"	162	#6	6"	51' - 10"	12,612	108	#6	9"	9' - 8"	1,568	8' - 2"	1,325	162	#6	6"	47' - 1"	11,457	36	18"	39' - 9"	956	152	18"	39' - 9"	4,036	108	9"	4' - 0"	289	270	9"	4' - 7"	827	9' - 3"	1,668	51' - 10"	138	106	295	3.177	868.5	3.8	433	130.9	35,171
2	8' - 0"	5' - 0"	8"	7"	162	#6	6"	17' - 6"	4,258	108	#6	9"	10' - 8"	1,730	8' - 2"	1,325	162	#6	6"	12' - 9"	3,102	12	18"	39' - 9"	319	62	18"	39' - 9"	1,646	108	9"	5' - 0"	361	54	9"	4' - 7"	165	11' - 3"	406	17' - 6"	47	38	106	1.201	332.8	1.3	153	49.4	13,465
3	8' - 0"	5' - 0"	8"	7"	162	#6	6"	26' - 1"	6,347	108	#6	9"	10' - 8"	1,730	8' - 2"	1,325	162	#6	6"	21' - 4"	5,191	18	18"	39' - 9"	478	88	18"	39' - 9"	2,337	108	9"	5' - 0"	361	108	9"	4' - 7"	331	11' - 3"	812	26' - 1"	70	56	156	1.733	472.8	1.9	226	71.3	19,138
4	8' - 0"	5' - 0"	8"	7"	162	#6	6"	34' - 8"	8,435	108	#6	9"	10' - 8"	1,730	8' - 2"	1,325	162	#6	6"	29' - 11"	7,279	24	18"	39' - 9"	637	114	18"	39' - 9"	3,027	108	9"	5' - 0"	361	162	9"	4' - 7"	496	11' - 3"	1,217	34' - 8"	93	72	200	2.264	612.7	2.6	293	93.1	24,800
5	8' - 0"	5' - 0"	8"	7"	162	#6	6"	43' - 3"	10,524	108	#6	9"	10' - 8"	1,730	8' - 2"	1,325	162	#6	6"	38' - 6"	9,368	30	18"	39' - 9"	797	140	18"	39' - 9"	3,717	108	9"	5' - 0"	361	216	9"	4' - 7"	661	11' - 3"	1,623	43' - 3"	116	90	251	2.796	752.7	3.2	367	115.1	30,473
6	8' - 0"	5' - 0"	8"	7"	162	#6	6"	51' - 10"	12,612	108	#6	9"	10' - 8"	1,730	8' - 2"	1,325	162	#6	6"	47' - 1"	11,457	36	18"	39' - 9"	956	166	18"	39' - 9"	4,408	108	9"	5' - 0"	361	270	9"	4' - 7"	827	11' - 3"	2,029	51' - 10"	138	106	295	3.328	892.6	3.8	433	137.0	36,138
2	8' - 0"	6' - 0"	8"	7"	162	#6	6"	17' - 6"	4,258	108	#6	9"	11' - 8"	1,893	8' - 2"	1,325	162	#6	6"	12' - 9"	3,102	12	18"	39' - 9"	319	68	18"	39' - 9"	1,806	108	9"	6' - 0"	433	54	9"	4' - 7"	165	13' - 3"	478	17' - 6"	47	38	106	1.265	344.5	1.3	153	51.9	13,932
3	8' - 0"	6' - 0"	8"	7"	162	#6	6"	26' - 1"	6,347	108	#6	9"	11' - 8"	1,893	8' - 2"	1,325	162	#6	6"	21' - 4"	5,191	18	18"	39' - 9"	478	96	18"	39' - 9"	2,549	108	9"	6' - 0"	433	108	9"	4' - 7"	331	13' - 3"	956	26' - 1"	70	56	156	1.819	487.6	1.9	226	74.7	19,729
4	8' - 0"	6' - 0"	8"	7"	162	#6	6"	34' - 8"	8,435	108	#6	9"	11' - 8"	1,893	8' - 2"	1,325	162	#6	6"	29' - 11"	7,279	24	18"	39' - 9"	637	124	18"	39' - 9"	3,293	108	9"	6' - 0"	433	162	9"	4' - 7"	496	13' - 3"	1,434	34' - 8"	93	72	200	2.372	630.6	2.6	293	97.5	25,518
5	8' - 0"	6' - 0"	8"	7"	162	#6	6"	43' - 3"	10,524	108	#6	9"	11' - 8"	1,893	8' - 2"	1,325	162	#6	6"	38' - 6"	9,368	30	18"	39' - 9"	797	152	18"	39' - 9"	4,036	108	9"	6' - 0"	433	216	9"	4' - 7"	661	13' - 3"	1,912	43' - 3"	116	90	251	2.926	773.7	3.2	367	120.3	31,316
6	8' - 0"	6' - 0"	8"	7"	162	#6	6"	51' - 10"	12,612	108	#6	9"	11' - 8"	1,893	8' - 2"	1,325	162	#6	6"	47' - 1"	11,457	36	18"	39' - 9"	956	180	18"	39' - 9"	4,780	108	9"	6' - 0"	433	270	9"	4' - 7"	827	13' - 3"	2,390	51' - 10"	138	106	295	3.479	916.8	3.8	433	143.0	37,106
2	8' - 0"	7' - 0"	8"	7"	162	#6	6"	17' - 6"	4,258	108	#6	9"	12' - 8"	2,055	8' - 2"	1,325	162	#6	6"	12' - 9"	3,102	12	18"	39' - 9"	319	68	18"	39' - 9"	1,806	108	9"	7' - 0"	505	54	9"	4' - 7"	165	15' - 3"	550	17' - 6"	47	38	106	1.330	352.1	1.3	153	54.5	14,238
3	8' - 0"	7' - 0"	8"	7"	162	#6	6"	26' - 1"	6,347	108	#6	9"	12' - 8"	2,055	8' - 2"	1,325	162	#6	6"	21' - 4"	5,191	18	18"	39' - 9"	478	96	18"	39' - 9"	2,549	108	9"	7' - 0"	505	108	9"	4' - 7"	331	15' - 3"	1,100	26' - 1"	70	56	156	1.905	497.0	1.9	226	78.1	20,107
4	8' - 0"	7' - 0"	8"	7"	162	#6	6"	34' - 8"	8,435	108	#6	9"	12' - 8"	2,055	8' - 2"	1,325	162	#6	6"	29' - 11"	7,279	24	18"	39' - 9"	637	124	18"	39' - 9"	3,293	108	9"	7' - 0"	505	162	9"	4' - 7"	496	15' - 3"	1,650	34' - 8"	93	72	200	2.480	641.9	2.6	293	101.8	25,968
5	8' - 0"	7' - 0"	8"	7"	162	#6	6"	43' - 3"	10,524	108	#6	9"	12' - 8"	2,055	8' - 2"	1,325	162	#6	6"	38' - 6"	9,368	30	18"	39' - 9"	797	152	18"	39' - 9"	4,036	108	9"	7' - 0"	505	216	9"	4' - 7"	661	15' - 3"	2,200	43' - 3"	116	90	251	3.056	786.8	3.2	367	125.5	31,838
6	8' - 0"	7' - 0"	8"	7"	162	#6	6"	51' - 10"	12,612	108	#6	9"	12' - 8"	2,055	8' - 2"	1,325	162	#6	6"	47' - 1"	11,457	36	18"	39' - 9"	956	180	18"	39' - 9"	4,780	108	9"	7' - 0"	505	270	9"	4' - 7"	827	15' - 3"	2,750	51' - 10"	138	106	295	3.631	931.7	3.8	433	149.1	37,700
2	8' - 0"	8' - 0"	8"	7"	162	#6	6"	17' - 6"	4,258	108	#6	9"	13' - 8"	2,217	8' - 2"	1,325	162	#6	6"	12' - 9"	3,102	12	18"	39' - 9"	319	74	18"	39' - 9"	1,965	108	9"	8' - 0"	577	54	9"	4' - 7"	165	17' - 3"	622	17' - 6"	47	38	106	1.395	363.8	1.3	153	57.1	14,703
3	8' - 0"	8' - 0"	8"	7"	162	#6	6"	26' - 1"	6,347	108	#6	9"	13' - 8"	2,217	8' - 2"	1,325	162	#6	6"	21' - 4"	5,191	18	18"	39' - 9"	478	104	18"	39' - 9"	2,762	108	9"	8' - 0"	577	108	9"	4' - 7"	331	17' - 3"	1,244	26' - 1"	70	56	156	1.992	511.8	1.9	226	81.6	20,698
4	8' - 0"	8' - 0"	8"	7"	162	#6	6"	34' - 8"	8,435	108	#6	9"	13' - 8"	2,217	8' - 2"	1,325	162	#6	6"	29' - 11"	7,279	24	18"	39' - 9"	637	134	18"	39' - 9"	3,558	108	9"	8' - 0"	577	162	9"	4' - 7"	496	17' - 3"	1,867	34' - 8"	93	72	200	2.588	659.8	2.6	293	106.1	26,684
5	8' - 0"	8' - 0"	8"	7"	162	#6	6"	43' - 3"	10,524	108	#6	9"	13' - 8"	2,217	8' - 2"	1,325	162	#6	6"	38' - 6"	9,368	30	18"	39' - 9"	797	164	18"	39' - 9"	4,355	108	9"	8' - 0"	577	216	9"	4' - 7"	661	17' - 3"	2,489	43' - 3"	116	90	251	3.185	807.8	3.2	367	130.6	32,680
6	8' - 0"	8' - 0"	8"	7"	162	#6	6"	51' - 10"	12,612	108	#6	9"	13' - 8"	2,217	8' - 2"	1,325	162	#6	6"	47' - 1"	11,457	36	18"	39' - 9"	956	194	18"	39' - 9"	5,151	108	9"	8' - 0"	577	270	9"	4' - 7"	827	17' - 3"	3,111	51' - 10"	138	106	295	3.782	955.8	3.8	433	155.1	38,666

HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE

8'-0" SPAN

0' TO 13' FILL

MC-8-13

FILE: mc813ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		149

DATE: 8/28/2021 5:42:15 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\203801053\mc813ste-20.dgn

DATE: 8/28/2021 5:42:19 PM
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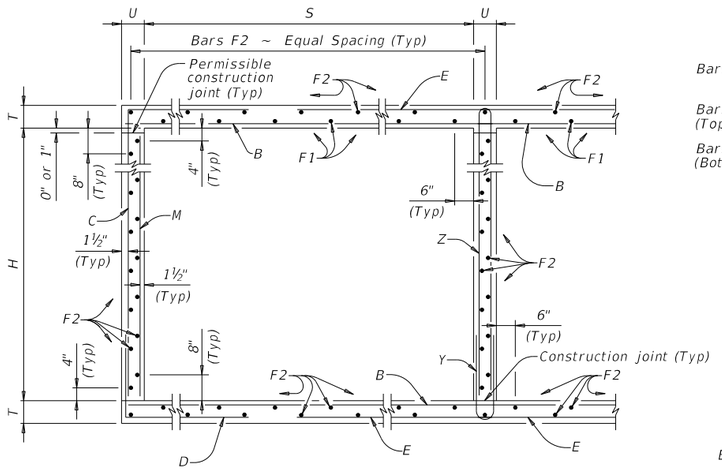
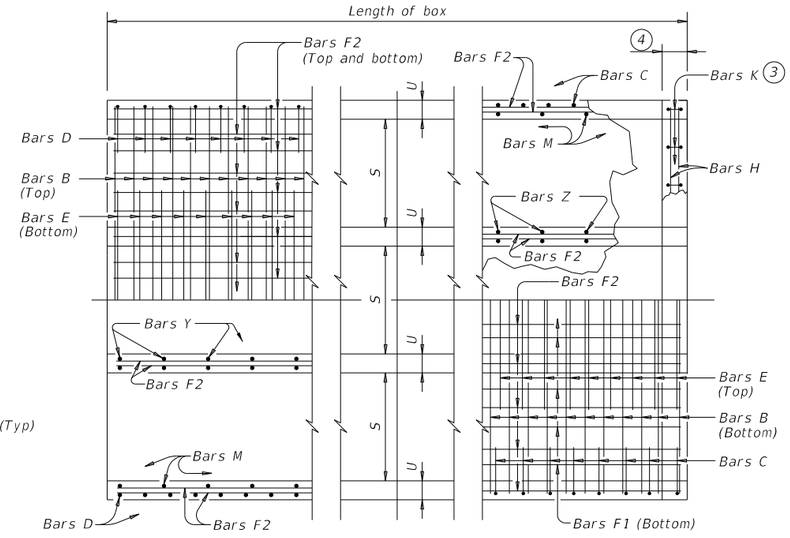
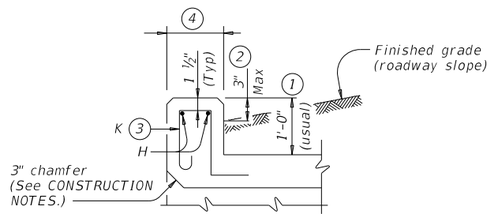


TYPICAL SECTION

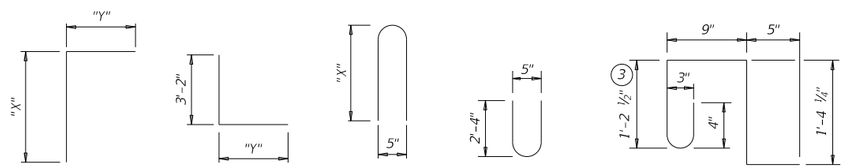


PART PLANS



SECTION THRU CURB

TABLE OF BAR DIMENSIONS		
H	"X"	"Y"
4'-0"	4'-8 ½"	5'-10"
5'-0"	5'-8 ½"	5'-10"
6'-0"	6'-8 ½"	5'-10"
7'-0"	7'-8 ½"	5'-10"
8'-0"	8'-8 ½"	5'-10"
9'-0"	9'-8 ½"	5'-10"
10'-0"	10'-8 ½"	5'-10"



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.
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
10'-0" SPAN
2' TO 13' FILL

MC-10-13

FILE: mc113ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		150

NUMBER OF SPANS	SECTION DIMENSIONS				BILLS OF REINFORCING STEEL (For Box Length = 40 feet)																																QUANTITIES					
					Bars B (5)					Bars C & D							Bars E					Bars F1 ~ #4				Bars F2 ~ #4				Bars M ~ #4				Bars Y & Z ~ #4						Bars H 4 ~ #4 (5)		Bars K		Per Foot of Barrel		Curb		Total	
												Bars C		Bars D																		Bars Y		Bars Z											
	S	H	T	U	No.	Size	Spa	Length	Wt	No.	Size	Spa	Length	Wt	Length	Wt	No.	Size	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	No.	Spa	Length	Wt	Length	Wt	No.	Wt	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)	Conc (CY)	Renf (Lb)
2	10' – 0"	4' – 0"	10"	8"	162	#6	6"	21' – 9"	5,292	108	#6	9"	10' – 7"	1,717	9' – 1"	1,473	162	#6	6"	9' – 7"	2,332	14	18"	39' – 9"	372	66	18"	39' – 9"	1,752	82	12"	4' – 0"	219	41	12"	5' – 0"	137	9' – 8"	265	21' – 9"	58	46	128	1.654	339.0	1.6	186	67.8	13,745
3	10' – 0"	4' – 0"	10"	8"	162	#6	6"	32' – 5"	7,888	108	#6	9"	10' – 7"	1,717	9' – 1"	1,473	162	#6	6"	19' – 7"	4,765	21	18"	39' – 9"	558	95	18"	39' – 9"	2,523	82	12"	4' – 0"	219	82	12"	5' – 0"	274	9' – 8"	530	32' – 5"	87	68	189	2.412	498.7	2.4	276	98.9	20,223
4	10' – 0"	4' – 0"	10"	8"	162	#6	6"	43' – 1"	10,483	108	#6	9"	10' – 7"	1,717	9' – 1"	1,473	162	#6	6"	29' – 7"	7,198	28	18"	39' – 9"	743	124	18"	39' – 9"	3,293	82	12"	4' – 0"	219	123	12"	5' – 0"	411	9' – 8"	794	43' – 1"	115	90	251	3.169	658.3	3.2	366	130.0	26,697
5	10' – 0"	4' – 0"	10"	8"	162	#6	6"	53' – 9"	13,079	108	#6	9"	10' – 7"	1,717	9' – 1"	1,473	162	#6	6"	39' – 7"	9,632	35	18"	39' – 9"	929	153	18"	39' – 9"	4,063	82	12"	4' – 0"	219	164	12"	5' – 0"	548	9' – 8"	1,059	53' – 9"	144	110	306	3.926	818.0	4.0	450	161.0	33,169
6	10' – 0"	4' – 0"	10"	8"	162	#6	6"	66' – 11"	16,282	108	#6	9"	10' – 7"	1,717	9' – 1"	1,473	162	#6	6"	49' – 7"	12,065	42	18"	39' – 9"	1,115	182	18"	39' – 9"	4,833	82	12"	4' – 0"	219	205	12"	5' – 0"	685	9' – 8"	1,324	66' – 1"	177	132	367	4.683	992.8	4.8	544	192.1	40,257
2	10' – 0"	5' – 0"	10"	8"	162	#6	6"	21' – 9"	5,292	108	#6	9"	11' – 7"	1,879	9' – 1"	1,473	162	#6	6"	9' – 7"	2,332	14	18"	39' – 9"	372	72	18"	39' – 9"	1,912	82	12"	5' – 0"	274	41	12"	5' – 0"	137	11' – 8"	320	21' – 9"	58	46	128	1.728	349.8	1.6	186	70.7	14,177
3	10' – 0"	5' – 0"	10"	8"	162	#6	6"	32' – 5"	7,888	108	#6	9"	11' – 7"	1,879	9' – 1"	1,473	162	#6	6"	19' – 7"	4,765	21	18"	39' – 9"	558	103	18"	39' – 9"	2,735	82	12"	5' – 0"	274	82	12"	5' – 0"	274	11' – 8"	639	32' – 5"	87	68	189	2.510	512.1	2.4	276	102.8	20,761
4	10' – 0"	5' – 0"	10"	8"	162	#6	6"	43' – 1"	10,483	108	#6	9"	11' – 7"	1,879	9' – 1"	1,473	162	#6	6"	29' – 7"	7,198	28	18"	39' – 9"	743	134	18"	39' – 9"	3,558	82	12"	5' – 0"	274	123	12"	5' – 0"	411	11' – 8"	959	43' – 1"	115	90	251	3.292	674.5	3.2	366	134.9	27,344
5	10' – 0"	5' – 0"	10"	8"	162	#6	6"	53' – 9"	13,079	108	#6	9"	11' – 7"	1,879	9' – 1"	1,473	162	#6	6"	39' – 7"	9,632	35	18"	39' – 9"	929	165	18"	39' – 9"	4,381	82	12"	5' – 0"	274	164	12"	5' – 0"	548	11' – 8"	1,278	53' – 9"	144	110	306	4.074	836.8	4.0	450	166.9	33,923
6	10' – 0"	5' – 0"	10"	8"	162	#6	6"	66' – 11"	16,282	108	#6	9"	11' – 7"	1,879	9' – 1"	1,473	162	#6	6"	49' – 7"	12,065	42	18"	39' – 9"	1,115	196	18"	39' – 9"	5,204	82	12"	5' – 0"	274	205	12"	5' – 0"	685	11' – 8"	1,598	66' – 1"	177	132	367	4.856	1,014.4	4.8	544	199.0	41,119
2	10' – 0"	6' – 0"	10"	8"	162	#6	6"	21' – 9"	5,292	108	#6	9"	12' – 7"	2,041	9' – 1"	1,473	162	#6	6"	9' – 7"	2,332	14	18"	39' – 9"	372	78	18"	39' – 9"	2,071	82	12"	6' – 0"	329	41	12"	5' – 0"	137	13' – 8"	374	21' – 9"	58	46	128	1.802	360.5	1.6	186	73.7	14,607
3	10' – 0"	6' – 0"	10"	8"	162	#6	6"	32' – 5"	7,888	108	#6	9"	12' – 7"	2,041	9' – 1"	1,473	162	#6	6"	19' – 7"	4,765	21	18"	39' – 9"	558	111	18"	39' – 9"	2,947	82	12"	6' – 0"	329	82	12"	5' – 0"	274	13' – 8"	749	32' – 5"	87	68	189	2.609	525.6	2.4	276	106.8	21,300
4	10' – 0"	6' – 0"	10"	8"	162	#6	6"	43' – 1"	10,483	108	#6	9"	12' – 7"	2,041	9' – 1"	1,473	162	#6	6"	29' – 7"	7,198	28	18"	39' – 9"	743	144	18"	39' – 9"	3,824	82	12"	6' – 0"	329	123	12"	5' – 0"	411	13' – 8"	1,123	43' – 1"	115	90	251	3.416	690.6	3.2	366	139.8	27,991
5	10' – 0"	6' – 0"	10"	8"	162	#6	6"	53' – 9"	13,079	108	#6	9"	12' – 7"	2,041	9' – 1"	1,473	162	#6	6"	39' – 7"	9,632	35	18"	39' – 9"	929	177	18"	39' – 9"	4,700	82	12"	6' – 0"	329	164	12"	5' – 0"	548	13' – 8"	1,497	53' – 9"	144	110	306	4.222	855.7	4.0	450	172.9	34,678
6	10' – 0"	6' – 0"	10"	8"	162	#6	6"	66' – 11"	16,282	108	#6	9"	12' – 7"	2,041	9' – 1"	1,473	162	#6	6"	49' – 7"	12,065	42	18"	39' – 9"	1,115	210	18"	39' – 9"	5,576	82	12"	6' – 0"	329	205	12"	5' – 0"	685	13' – 8"	1,872	66' – 1"	177	132	367	5.029	1,036.0	4.8	544	205.9	41,982
2	10' – 0"	7' – 0"	10"	8"	162	#6	6"	21' – 9"	5,292	108	#6	9"	13' – 7"	2,203	9' – 1"	1,473	162	#6	6"	9' – 7"	2,332	14	18"	39' – 9"	372	78	18"	39' – 9"	2,071	82	12"	7' – 0"	383	41	12"	5' – 0"	137	15' – 8"	429	21' – 9"	58	46	128	1.877	367.3	1.6	186	76.7	14,878
3	10' – 0"	7' – 0"	10"	8"	162	#6	6"	32' – 5"	7,888	108	#6	9"	13' – 7"	2,203	9' – 1"	1,473	162	#6	6"	19' – 7"	4,765	21	18"	39' – 9"	558	111	18"	39' – 9"	2,947	82	12"	7' – 0"	383	82	12"	5' – 0"	274	15' – 8"	858	32' – 5"	87	68	189	2.708	533.7	2.4	276	110.7	21,625
4	10' – 0"	7' – 0"	10"	8"	162	#6	6"	43' – 1"	10,483	108	#6	9"	13' – 7"	2,203	9' – 1"	1,473	162	#6	6"	29' – 7"	7,198	28	18"	39' – 9"	743	144	18"	39' – 9"	3,824	82	12"	7' – 0"	383	123	12"	5' – 0"	411	15' – 8"	1,287	43' – 1"	115	90	251	3.539	700.1	3.2	366	144.8	28,371
5	10' – 0"	7' – 0"	10"	8"	162	#6	6"	53' – 9"	13,079	108	#6	9"	13' – 7"	2,203	9' – 1"	1,473	162	#6	6"	39' – 7"	9,632	35	18"	39' – 9"	929	177	18"	39' – 9"	4,700	82	12"	7' – 0"	383	164	12"	5' – 0"	548	15' – 8"	1,716	53' – 9"	144	110	306	4.370	866.6	4.0	450	178.8	35,113
6	10' – 0"	7' – 0"	10"	8"	162	#6	6"	66' – 11"	16,282	108	#6	9"	13' – 7"	2,203	9' – 1"	1,473	162	#6	6"	49' – 7"	12,065	42	18"	39' – 9"	1,115	210	18"	39' – 9"	5,576	82	12"	7' – 0"	383	205	12"	5' – 0"	685	15' – 8"	2,145	66' – 1"	177	132	367	5.202	1,048.2	4.8	544	212.9	42,471
2	10' – 0"	8' – 0"	10"	8"	162	#6	6"	21' – 9"	5,292	108	#6	9"	14' – 7"	2,366	9' – 1"	1,473	162	#6	6"	9' – 7"	2,332	14	18"	39' – 9"	372	84	18"	39' – 9"	2,230	82	12"	8' – 0"	438	41	12"	5' – 0"	137	17' – 8"	484	21' – 9"	58	46	128	1.951	378.1	1.6	186	79.7	15,310
3	10' – 0"	8' – 0"	10"	8"	162	#6	6"	32' – 5"	7,888	108	#6	9"	14' – 7"	2,366	9' – 1"	1,473	162	#6	6"	19' – 7"	4,765	21	18"	39' – 9"	558	119	18"	39' – 9"	3,160	82	12"	8' – 0"	438	82	12"	5' – 0"	274	17' – 8"	968	32' – 5"	87	68	189	2.807	547.3	2.4	276	114.7	22,166
4	10' – 0"	8' – 0"	10"	8"	162	#6	6"	43' – 1"	10,483	108	#6	9"	14' – 7"	2,366	9' – 1"	1,473	162	#6	6"	29' – 7"	7,198	28	18"	39' – 9"	743	154	18"	39' – 9"	4,089	82	12"	8' – 0"	438	123	12"	5' – 0"	411	17' – 8"	1,452	43' – 1"	115	90	251	3.663	716.3	3.2	366	149.7	29,019
5	10' – 0"	8' – 0"	10"	8"	162	#6	6"	53' – 9"	13,079	108	#6	9"	14' – 7"	2,366	9' – 1"	1,473	162	#6	6"	39' – 7"	9,632	35	18"	39' – 9"	929	189	18"	39' – 9"	5,019	82	12"	8' – 0"	438	164	12"	5' – 0"	548	17' – 8"	1,935	53' – 9"	144	110	306	4.519	885.5	4.0	450	184.7	35,869
6	10' – 0"	8' – 0"	10"	8"	162	#6	6"	66' – 11"	16,282	108	#6	9"	14' – 7"	2,366	9' – 1"	1,473	162	#6	6"	49' – 7"	12,065	42	18"	39' – 9"	1,115	224	18"	39' – 9"	5,948	82	12"	8' – 0"	438	205	12"	5' – 0"	685	17' – 8"	2,419	66' – 1"	177	132	367	5.374	1,069.8	4.8	544	219.7	43,335
2	10' – 0"	9' – 0"	10"	8"	162	#6	6"	21' – 9"	5,292	162	#6	6"	15' – 7"	3,792	9' – 1"	2,210	162	#6	6"	9' – 7"	2,332	14	18"	39' – 9"	372	90	18"	39' – 9"	2,390	108	9"	9' – 0"	649	41	12"	5' – 0"	137	19' – 8"	539	21' – 9"	58	46	128	2.025	442.8	1.6	186	82.6	17,899
3	10' – 0"	9' – 0"	10"	8"	162	#6	6"	32' – 5"	7,888	162	#6	6"	15' – 7"	3,792	9' – 1"	2,210	162	#6	6"	19' – 7"	4,765	21	18"	39' – 9"	558	127	18"	39' – 9"	3,372	108	9"	9' – 0"	649	82	12"	5' – 0"	274	19' – 8"	1,077	32' – 5"	87	68	189	2.905	614.6	2.4	276	118.6	24,861
4	10' – 0"	9' – 0"	10"	8"	162	#6	6"	43' – 1"	10,483	162	#6	6"	15' – 7"	3,792	9' – 1"	2,210	162	#6	6"	29' – 7"	7,198	28	18"	39' – 9"	743	164	18"	39' – 9"	4,355	108	9"	9' – 0"	649	123	12"	5' – 0"	411	19' – 8"	1,616	43' – 1"	115	90	251	3.786	786.4	3.2	366	154.6	31,823
5	10' – 0"	9' – 0"	10"	8"	162	#6	6"	53' – 9"	13,079	162	#6	6"	15' – 7"	3,792	9' – 1"	2,210	162	#6	6"	39' – 7"	9,632	35	18"	39' – 9"	929	201	18"	39' – 9"	5,337	108	9"	9' – 0"	649	164	12"	5' – 0"	548	19' – 8"	2,155	53' – 9"	144	110	306	4.667	958.3	4.0	450	190.7	38,781
6	10' – 0"	9' – 0"	10"	8"	162	#6	6"	66' – 11"	16,282	162	#6	6"	15' – 7"	3,792	9' – 1"	2,210	162	#6	6"	49' – 7"	12,065	42	18"	39' – 9"	1,115	238	18"	39' – 9"	6,320	108	9"	9' – 0"	649	205	12"	5' – 0"	685	19' – 8"	2,693	66' – 1"	177	132	367	5.547	1,145.3	4.8	544	226.7	46,355
2	10' – 0"	10' – 0"	10"	8"	162	#6	6"	21' – 9"	5,292	162	#6	6"	16' – 7"	4,035	9' – 1"	2,210	162	#6	6"	9' – 7"	2,332	14	18"	39' – 9"	372	90	18"	39' – 9"	2,390	162	6"	10' – 0"	1,082	41	12"	5' – 0"	137	21' – 8"	593	21' – 9"	58	46	128	2.099	461.1	1.6	186	85.6	18,629
3	10' – 0"	10' – 0"	10"	8"	162	#6	6"	32' – 5"	7,888	162	#6	6"	16' – 7"	4,035	9' – 1"	2,210	162	#6	6"	19' – 7"	4,765	21	18"	39' – 9"	558	127	18"	39' – 9"	3,372	162	6"	10' – 0"	1,082	82	12"	5' – 0"	274	21' – 8"	1,187	32' – 5"	87	68	189	3.004	634.3	2.4	276	122.6	25,647
4	10' – 0"	10' – 0"	10"	8"	162	#6	6"	43' – 1"	10,483	162	#6	6"	16' – 7"	4,035	9' – 1"	2,210	162	#6	6"	29' – 7"	7,198	28	18"	39' – 9"	743	164	18"	39' – 9"	4,355	162	6"	10' – 0"	1,082	123	12"	5' – 0"	411	21' – 8"	1,780	43' – 1"	115	90	251	3.909	807.4	3.2	366	159.6	32,663
5	10' – 0"	10' – 0"	10"	8"	162	#6	6"	53' – 9"	13,079	162	#6	6"	16' – 7"	4,035	9' – 1"	2,210	162	#6	6"	39' – 7"	9,632	35	18"	39' – 9"	929	201	18"	39' – 9"	5,337	162	6"	10' – 0"	1,082	164	12"	5' – 0"	548	21' – 8"	2,374	53' – 9"	144	110	306	4.815	980.7	4.0	450	196.6	39,676
6	10' – 0"	10' – 0"	10"	8"	162	#6	6"	66' – 11"	16,282	162	#6	6"	16' – 7"	4,035	9' – 1"	2,210	162	#6	6"	49' – 7"	12,065	42	18"	39' – 9"	1,115	238	18"	39' – 9"	6,320	162	6"	10' – 0"	1,082	205	12"	5' – 0"	685	21' – 8"	2,967	66' – 1"	177	132	367	5.720	1,169.0	4.8	544	233.6	47,305

(5) Bar lengths over 60' include one bar lap; refer to MATERIAL NOTES for minimum lap lengths.

HL93 LOADING SHEET 2 OF 2

Texas Department of Transportation

Bridge Division Standard

MULTIPLE BOX CULVERTS CAST-IN-PLACE

10'-0" SPAN

2' TO 13' FILL

MC-10-13

FILE: mc113ste-20.dgn	DN: TBE	CK: BMP	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		151

DATE: 8/28/2021 5:42:20 PM
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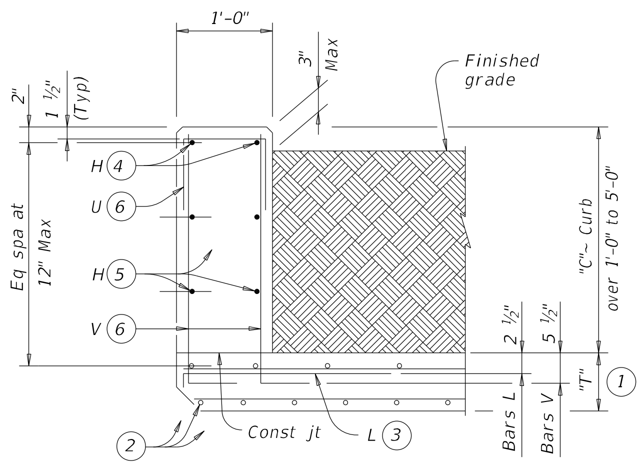
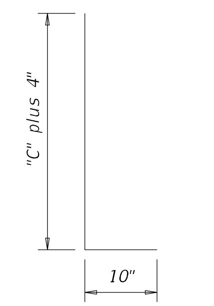
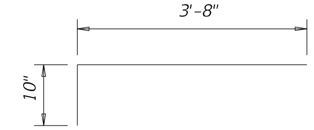


TYPICAL SECTION

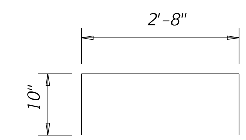
Used for curbs over 1'-0" to 5'-0"



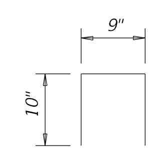
BARS V (#5) (6)
Spaced at 12" Max



BARS L (#5) (3)
Spaced at 12" Max



OPTIONAL BARS L (#5) (3)(7)
Spaced at 12" Max



BARS U (#4) (6)
Spaced at 12" Max

(1) "T" is equal to the culvert top slab thickness. For precast boxes with slabs less than 8" thick, see SCP-MD standard for additional details.

(2) Adjust normal culvert slab bars as necessary to clear obstructions.

(3) Place bars L as shown. Tilt hook as necessary to maintain cover.

(4) Place normal culvert curb bars H(#4) as shown. Adjust as necessary to clear obstructions.

(5) Additional bars H(#4) as required to maintain 12" Max spacing.

(6) Replace normal culvert curb bars K with one bar U and two bars V as shown spaced at 12" Max. Adjust length of bars V as necessary to maintain clear cover.

(7) Optional bars L are to be used only for precast box culverts with 3'-0" closure pour.

(8) Quantities shown are for Contractor's information only. Quantities are per linear foot of curb length. The value in table can be interpolated for intermediate values of curb height, "C". Quantity includes bars K (when applicable).

TABLE OF ESTIMATED CURB QUANTITIES (8)

Curb Height "C"	Conc (CY/LF)	Reinf Steel (Lb/LF)
1'-0"	0.037	10.4
1'-6"	0.056	14.5
2'-0"	0.074	15.6
2'-6"	0.093	18.0
3'-0"	0.111	19.0
3'-6"	0.130	21.3
4'-0"	0.148	22.4
4'-6"	0.167	24.8
5'-0"	0.185	25.9

CONSTRUCTION NOTES:

Adjust reinforcing steel as necessary to provide 1 ¼" cover.
For vehicle safety, top of the curb must not project more than 3" above the finished grade.

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) minimum for curbs.
Provide bar laps, where required, as follows:

- Uncoated or galvanized ~ #4 = 1'-8" Min

GENERAL NOTES:

Designed according to AASHTO LRFD Bridge Design Specifications.
These extended curb details have sufficient strength to allow for future retrofit of Type T631 or T631LS railing. These details are suitable for use with PR11, PR22 and PR3 type rails. These details are not suitable for the mounting of other rail types. For new construction using T631 or T631LS railing, use the T631-CM standard.
This Curb is considered as part of the Box Culvert for payment.

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

Texas Department of Transportation | Bridge Division Standard

EXTENDED CURB DETAILS

FOR BOX CULVERTS WITH CURBS OVER 1'-0" TO 5'-0" TALL

ECD

FILE: ecdstde1-20.dgn	DN: GAF	CK: TxDOT	DW: TxDOT	CK: GAF
©TxDOT February 2020	CONT 2038	SECT 01	JOB 031	HIGHWAY FM 2115
REVISIONS	DIST WAC		COUNTY BELL	SHEET NO. 152

DATE: 8/28/2021 5:42:24 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\20380103114 Design\Plan Set\5. Drainage\Standards\ecdstde1-20.dgn

TABLE OF DIMENSIONS AND REINFORCING STEEL
(Wings for one structure end)

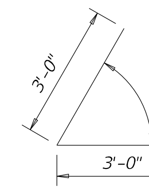
Dimensions					Variable Reinforcing				Estimated Quantities per ft of wing (2~wings) (4)		Estimated Quantities per ft of Toewall (1~toewall)	
Maximum Wingwall Height Hw	W	X	Y	Z	Bars J1		Bars J2					
					Size	Spa	Size	Spa	Reinf (Lb/Ft)	Conc (CY/Ft)	Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	48.64	0.406	6.85	0.071
2'-9"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	49.31	0.424	6.85	0.071
3'-0"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	49.98	0.444	6.85	0.071
3'-3"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	53.32	0.462	6.85	0.071
3'-6"	2'-10"	10"	1'-0"	7"	#4	1'-0"	#4	1'-0"	53.98	0.480	6.85	0.071
4'-0"	3'-2"	1'-2"	1'-0"	7"	#4	1'-0"	#4	1'-0"	55.77	0.532	6.85	0.071
4'-6"	3'-2"	1'-2"	1'-0"	7"	#4	1'-0"	#4	1'-0"	59.77	0.568	6.85	0.071
5'-0"	3'-9"	1'-7"	1'-2"	7"	#4	1'-0"	#4	1'-0"	63.45	0.632	6.96	0.075
5'-6"	3'-9"	1'-7"	1'-2"	7"	#4	1'-0"	#4	1'-0"	67.46	0.668	6.96	0.075
6'-0"	4'-4"	2'-0"	1'-4"	7"	#5	1'-0"	#5	1'-0"	80.67	0.730	7.07	0.078
6'-6"	4'-4"	2'-0"	1'-4"	7"	#5	1'-0"	#5	1'-0"	85.05	0.768	7.07	0.078
7'-0"	5'-0"	2'-3"	1'-9"	8"	#5	1'-0"	#5	1'-0"	92.15	0.864	8.07	0.093
7'-6"	5'-0"	2'-3"	1'-9"	8"	#5	1'-0"	#5	1'-0"	96.54	0.902	8.07	0.093
8'-0"	5'-6"	2'-8"	1'-10"	8"	#5	6"	#5	6"	139.04	0.962	8.13	0.095
8'-6"	5'-6"	2'-8"	1'-10"	8"	#5	6"	#5	6"	144.47	1.000	8.13	0.095
9'-6"	6'-0"	2'-10"	2'-2"	9"	#5	6"	#5	6"	156.93	1.136	8.41	0.110
10'-6"	6'-5"	3'-0"	2'-5"	9"	#6	6"	#5	6"	196.27	1.234	8.57	0.117
11'-6"	7'-2"	3'-6"	2'-8"	11"	#6	6"	#6	6"	230.13	1.438	9.52	0.140
12'-6"	7'-8"	3'-9"	2'-11"	1'-0"	#7	6"	#6	6"	283.41	1.592	9.74	0.157
13'-6"	8'-2"	4'-0"	3'-2"	1'-2"	#8	6"	#6	6"	348.72	1.804	10.02	0.186
14'-6"	8'-10"	4'-5"	3'-5"	1'-4"	#9	6"	#6	6"	432.94	2.046	10.30	0.218
15'-6"	9'-6"	4'-10"	3'-8"	1'-6"	#9	6"	#7	6"	489.52	2.302	11.24	0.253
16'-0"	9'-11"	5'-0"	3'-11"	1'-7"	#9	6"	#7	6"	505.72	2.448	11.47	0.279

TABLE OF WINGWALL REINFORCING
(2~wings)

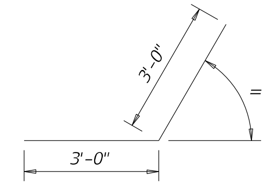
Bar	Size	No.	Spa
D1	#6	~	1'-0"
D2	#6	~	1'-0"
E1	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	~	8"
M1	#4	4	~
P	#4	~	1'-0"
V	#4	~	1'-0"

TABLE OF TOEWALL REINFORCING

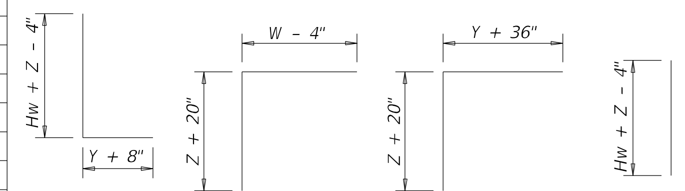
Bar	Size	No.	Spa
J3	#4	~	1'-0"
M2	#4	2	~
E2	#4	~	1'-0"



BARS D1



BARS D2



BARS J1 BARS J2 BARS J3 BARS V

WING DIMENSION FORMULAS:

(All values are in feet.)

Hw = H + T + C
Lw = (Hw) (SL) ÷ cosine (θ) for Type PW-1
= (Hw - 1') (SL) ÷ cosine (θ) for Type PW-2 and Hw ≥ 4'
= (Hw - 0.5') (SL) ÷ cosine (θ) for Type PW-2 and Hw < 4'

For cast-in-place culverts:
Ltw = [(N) (S) + (N + 1) (U)] ÷ cosine (θ)

For precast culverts:
Ltw = [(N) (2 U + S) + (N - 1) (0.5')] ÷ cosine (θ)
Total Wingwall Area (two wings ~ SF)
= (2)(Hw)(Lw) for Type PW-1
= (2)(Hw)(Lw) - 6 SF for Type PW-2 and Hw ≥ 4'
= (2)(Hw)(Lw) - 1.5 SF for Type PW-2 and Hw < 4'

Hw = Height of wingwall
Lw = Length of wingwall
Ltw = Culvert toewall length
N = Number of culvert spans
SL:1 = Channel slope ratio. (horizontal: 1 vertical, usual value is 2:1)
θ = Culvert skew

See applicable box culvert standard sheet for S, H, T, and U values.

(1) Skew = 0°

(2) At discharge end, chamfer may be ¾" minimum.

(3) For 15° skew ~ 1"
For 30° skew ~ 2"
For 45° skew ~ 3"

(4) Quantities shown are for two Type PW-1 wings. Adjust concrete volume for Type PW-2 wings. To determine estimated quantities for two wings, multiply the tabulated values by Lw. Quantities shown do not include weight of Bars D.

(5) Provide weepholes for Hw = 5'-0" and greater. Fill around weepholes with coarse gravel.

(6) Extend Bars E2 1'-6" minimum into the wingwall footing.

(7) Lap Bars M1 1'-6" minimum with Bars M2.

(8) Place Bars G as shown, equally spaced at 8" maximum. Provide at least two pairs of Bars G per wing.

(9) 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 Box Culvert Rail Mounting Details (RAC) standard sheet for structures with bridge rail other than T631 or T631LS.

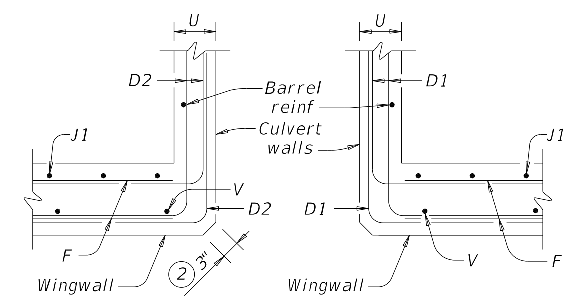
(10) For vehicle safety, the following requirements must be met:
- For structures without bridge rail, construct curbs no more than 3" above finished grade.
- For structures with bridge rail, construct curbs flush with finished grade.

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.

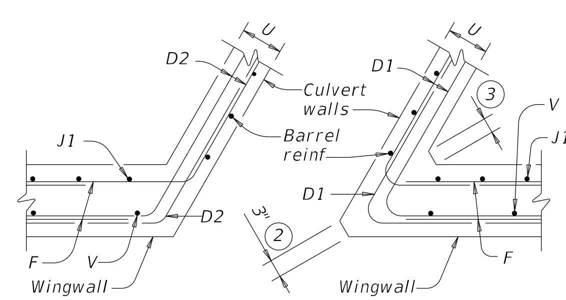
(11) 1'-0" typical. 2'-3" when the Box Culvert Rail Mounting Details (RAC) standard sheet is referred to elswhere in the plans.

(12) 3'-0" for Hw < 4'.

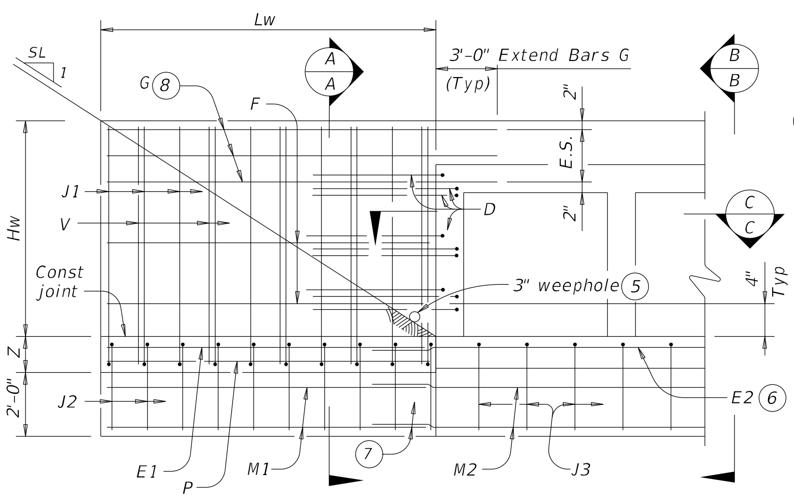
(13) 6" for Hw < 4'.



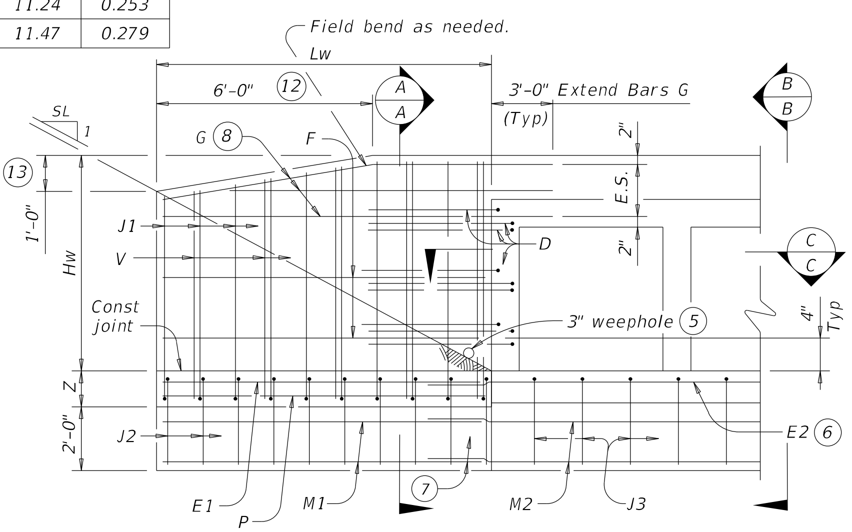
SECTION C-C - PW-1



SECTION C-C - PW-2



PARTIAL ELEVATION - PW-1



PARTIAL ELEVATION - PW-2

DESIGNER NOTES:

Type PW-1 can be used for all applications and must be used if railing is to be mounted to the wingwall.
Type PW-2 can only be used for applications without a railing mounted to the wingwall.

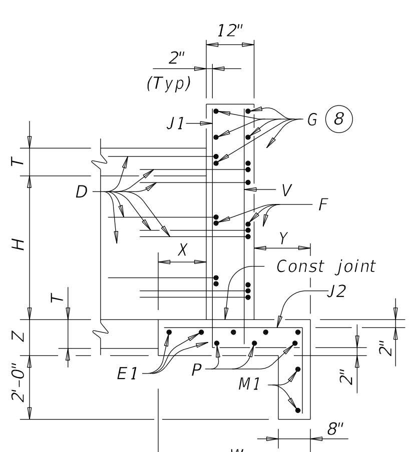
MATERIAL NOTES:

Provide Class C concrete (f'c=3,600 psi).
Provide Grade 60 reinforcing steel.
Provide galvanized reinforing steel if required elsewhere in the plans.

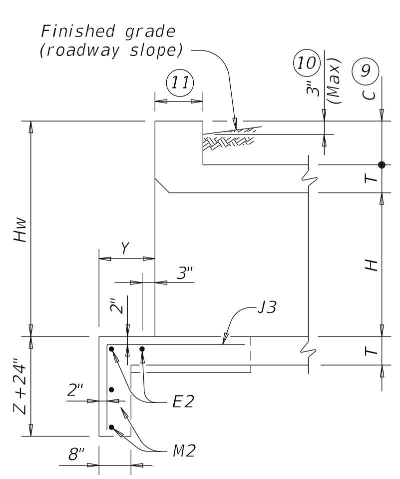
GENERAL NOTES:

Designed in accordance with AASHTO LRFD Bridge Design Specifications.
Depth of toewalls for wingwalls and culverts may be reduced or eliminated when founded on solid rock, when directed by the Engineer.
See Box Culvert Supplement (BCS) standard sheet for wingwall type and additional dimensions and information.
Quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for the Contractor's information only.

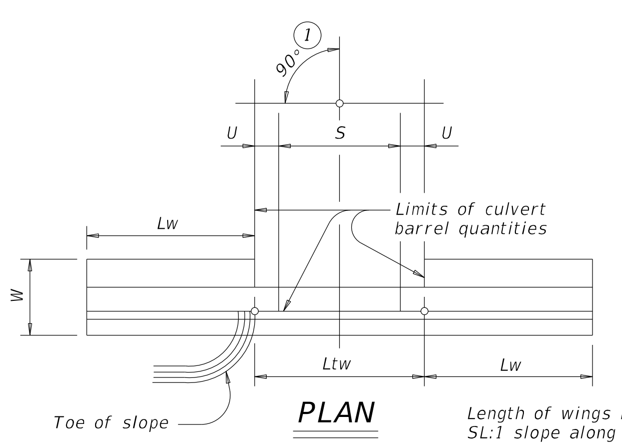
Cover dimensions are clear dimensions, unless noted otherwise.
Reinforcing dimensions are out-to-out of bars.



SECTION A-A
(Showing wing reinforcement.)

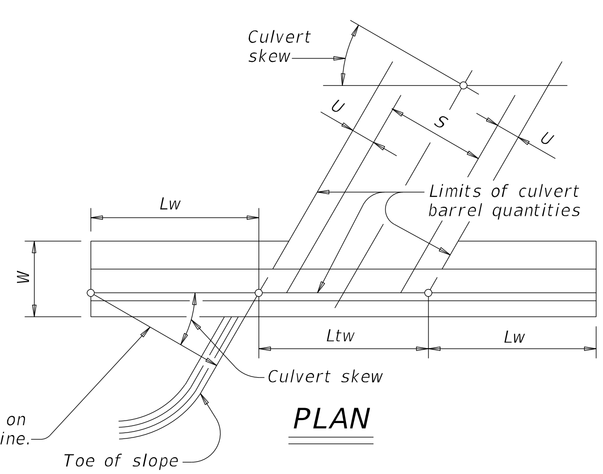


SECTION B-B
(Showing wing reinforcement.)



PLAN

DETAILS FOR
NON-SKEWED BOX CULVERTS



PLAN

DETAILS FOR
SKEWED BOX CULVERTS
(Showing 30° skew.)

Texas Department of Transportation | Bridge Division Standard

CONCRETE WINGWALLS WITH PARALLEL WINGS FOR BOX CULVERTS TYPES PW-1 AND PW-2

PW

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©TxDOT February 2020	CONT 2038	SECT 01	JOB 031	HIGHWAY FM 2115
REVISIONS	DIST WAC	COUNTY BELL		SHEET NO. 153

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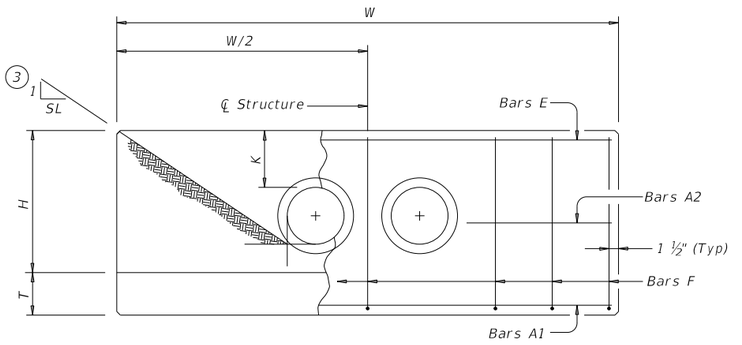
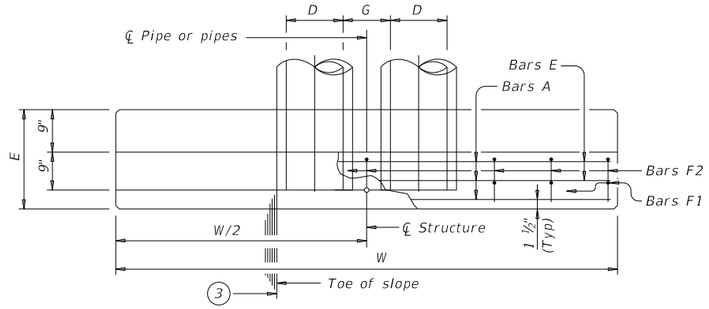
TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL (5)

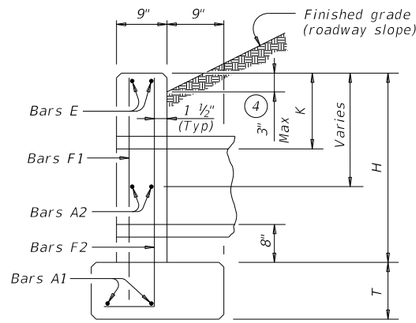
Slope	Dia of Pipe (D)	Values for One Pipe			Values To Be Added for Each Addt'l Pipe		
		W	Reinf (Lbs) (1)	Conc (CY) (2)	W	Reinf (Lbs) (1)	Conc (CY) (2)
2:1	12"	9' – 0"	122	1.1	1' – 9"	15	0.2
	15"	10' – 3"	136	1.3	2' – 2"	16	0.2
	18"	11' – 6"	163	1.5	2' – 8"	19	0.3
	21"	12' – 9"	200	1.8	3' – 1"	31	0.4
	24"	14' – 0"	217	2.1	3' – 7"	34	0.4
	27"	15' – 3"	254	2.4	3' – 11"	37	0.5
	30"	16' – 6"	272	2.7	4' – 4"	40	0.6
	33"	17' – 9"	314	3.1	4' – 8"	43	0.6
	36"	19' – 0"	371	3.9	5' – 1"	46	0.8
	42"	21' – 6"	442	4.9	5' – 10"	52	1.0
	48"	25' – 0"	569	6.4	6' – 7"	59	1.3
	54"	27' – 6"	701	7.5	7' – 6"	82	1.6
	60"	30' – 0"	794	8.8	8' – 3"	90	1.8
	66"	32' – 6"	894	10.2	8' – 9"	96	2.0
	72"	35' – 0"	1,055	11.7	9' – 4"	103	2.3
3:1	12"	13' – 0"	175	1.6	1' – 9"	14	0.2
	15"	14' – 9"	193	1.9	2' – 2"	17	0.2
	18"	16' – 6"	228	2.2	2' – 8"	19	0.3
	21"	18' – 3"	299	2.6	3' – 1"	31	0.4
	24"	20' – 0"	323	3.0	3' – 7"	33	0.4
	27"	21' – 9"	371	3.5	3' – 11"	37	0.5
	30"	23' – 6"	415	4.0	4' – 4"	40	0.5
	33"	25' – 3"	469	4.6	4' – 8"	43	0.6
	36"	27' – 0"	556	5.7	5' – 1"	46	0.8
	42"	30' – 6"	675	7.1	5' – 10"	52	1.0
	48"	35' – 6"	837	9.2	6' – 7"	59	1.3
	54"	39' – 0"	1,015	11.0	7' – 6"	84	1.6
	60"	42' – 6"	1,171	12.9	8' – 3"	91	1.8
	66"	46' – 0"	1,298	14.9	8' – 9"	98	2.0
	72"	49' – 6"	1,561	17.1	9' – 4"	103	2.3
4:1	12"	17' – 0"	229	2.0	1' – 9"	15	0.2
	15"	19' – 3"	266	2.4	2' – 2"	17	0.2
	18"	21' – 6"	308	2.9	2' – 8"	19	0.3
	21"	23' – 9"	382	3.5	3' – 1"	31	0.3
	24"	26' – 0"	430	3.9	3' – 7"	34	0.4
	27"	28' – 3"	486	4.7	3' – 11"	37	0.5
	30"	30' – 6"	539	5.2	4' – 4"	40	0.6
	33"	32' – 9"	603	6.0	4' – 8"	42	0.6
	36"	35' – 0"	738	7.5	5' – 1"	47	0.8
	42"	39' – 6"	881	9.3	5' – 10"	52	1.0
	48"	46' – 0"	1,102	12.1	6' – 7"	61	1.3
	54"	50' – 6"	1,364	14.4	7' – 6"	84	1.6
	60"	55' – 0"	1,547	16.9	8' – 3"	91	1.8
	66"	59' – 6"	1,741	19.5	8' – 9"	98	2.0
	72"	64' – 0"	2,077	22.4	9' – 4"	102	2.3
6:1	12"	25' – 0"	336	3.0	1' – 9"	14	0.2
	15"	28' – 3"	384	3.6	2' – 2"	17	0.2
	18"	31' – 6"	452	4.2	2' – 8"	19	0.3
	21"	34' – 9"	581	5.1	3' – 1"	31	0.4
	24"	38' – 0"	644	5.8	3' – 7"	34	0.4
	27"	41' – 3"	737	6.9	3' – 11"	37	0.5
	30"	44' – 6"	807	7.7	4' – 4"	39	0.6
	33"	47' – 9"	912	8.9	4' – 8"	44	0.6
	36"	51' – 0"	1,108	11.0	5' – 1"	48	0.8
	42"	57' – 6"	1,318	13.7	5' – 10"	54	1.0
	48"	67' – 0"	1,682	17.9	6' – 7"	59	1.3
	54"	73' – 6"	2,072	21.3	7' – 6"	83	1.6
	60"	80' – 0"	2,351	24.9	8' – 3"	89	1.8
	66"	86' – 6"	2,643	28.9	8' – 9"	96	2.0
	72"	93' – 0"	3,121	33.1	9' – 4"	101	2.3



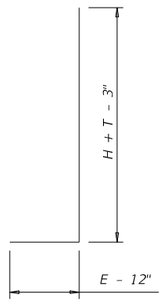
ELEVATION



PLAN OF NON-SKEWED PIPES



SECTION AT CENTER OF PIPE



BARS F2

(1) Total quantities include one 3'-1" lap for bars over 60' in length.

(2) Quantities shown are for concrete pipe and will increase slightly for metal pipe installations.

(3) Indicated slope is perpendicular to centerline pipe or pipes.

(4) For vehicle safety, construct curbs no more than 3" above finished grade. Reduce curb heights, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

(5) Dimensions shown are usual and maximum.

(6) Quantities shown are for one structure end only (one headwall).

TABLE OF CONSTANT DIMENSIONS

Dia of Pipe (D)	G	K (5)	H	T	E
12"	0' – 9"	1' – 0"	2' – 8"	0' – 9"	1' – 9"
15"	0' – 11"	1' – 0"	2' – 11"	0' – 9"	1' – 9"
18"	1' – 2"	1' – 0"	3' – 2"	0' – 9"	1' – 9"
21"	1' – 4"	1' – 0"	3' – 5"	0' – 9"	2' – 0"
24"	1' – 7"	1' – 0"	3' – 8"	0' – 9"	2' – 0"
27"	1' – 8"	1' – 0"	3' – 11"	0' – 9"	2' – 3"
30"	1' – 10"	1' – 0"	4' – 2"	0' – 9"	2' – 3"
33"	1' – 11"	1' – 0"	4' – 5"	0' – 9"	2' – 6"
36"	2' – 1"	1' – 0"	4' – 8"	1' – 0"	2' – 6"
42"	2' – 4"	1' – 0"	5' – 2"	1' – 0"	2' – 9"
48"	2' – 7"	1' – 3"	5' – 11"	1' – 0"	3' – 0"
54"	3' – 0"	1' – 3"	6' – 5"	1' – 0"	3' – 3"
60"	3' – 3"	1' – 3"	6' – 11"	1' – 0"	3' – 6"
66"	3' – 3"	1' – 3"	7' – 5"	1' – 0"	3' – 9"
72"	3' – 4"	1' – 3"	7' – 11"	1' – 0"	4' – 0"

TABLE OF REINFORCING STEEL (6)

Bar	Size	Spa	No.
A1	#5	~	2
A2	#5	1' – 6"	~
E	#5	~	2
F	#5	1' – 0"	~

MATERIAL NOTES:
Provide Grade 60 reinforcing steel.
Provide Class C concrete (f'c = 3,600 psi).

GENERAL NOTES:
Designed according to AASHTO LRFD Bridge Design Specifications.
Do not mount bridge rails of any type directly to these culvert headwalls.
This standard may not be used for wall heights, H, exceeding the values shown.

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

Texas Department of Transportation

Bridge Division Standard

CONCRETE HEADWALLS WITH PARALLEL WINGS FOR NON-SKEWED PIPE CULVERTS

CH-PW-0

FILE: chpw0ste-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
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TABLE OF DIMENSIONS AND REINFORCING STEEL
(Wings for One Structure End)

Maximum Wingwall Height (10) Hw	Dimensions W	X	Y	Z	Variable Reinforcing: Bars J1 Size	Bars J1 Spa	Bars J2 Size	Bars J2 Spa	Estimated Quantities per ft of wing length (Two~Wings) (3): 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 WINGWALL REINFORCING (Two~Wings)

Bar	Size	No.	Spa
DL & DS	#5	~	1'-0"
E	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	4	~
M	#4	4	~
P	#4	~	1'-0"
RL	#5	3	~
RS	#5	3	~
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	3	~
OS	#4	3	~
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 11#2" clearcover 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 0.5 (A+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 Extended 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) Culvert skew (limit to 15° or 30°)

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

(11) Typical wingwall angle for all skews.

TABLE OF MAXIMUM WING HEIGHTS (10)

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

WING DIMENSION CALCULATIONS:

Formulas:

Hw = H + T + C - 0.250' (10)
A = (Hw - 0.333') (SL)
B = (A) [tan (θ + 15°)]
Lw = (A) ÷ [cos (θ + 15°)]

For cast-in-place culverts:
Ltw = [(N) (S) + (N + 1) (U)] ÷ (cos θ)

For precast culverts:
Ltw = [(N) (2U + S) + (N - 1) (0.500')] ÷ (cos θ)

Lc = (Ltw) - (2U) ÷ (cos θ)
Atw = (Lc) + (B)
Total Wingwall Area (two wings ~ S.F.) = (0.5) (Hw + 0.333') (Lw + A)

Hw = Height of wingwall (feet)
SL:1 = Side slope ratio (horizontal : 1 vertical)
Lw = Length of wingwall (feet)
Ltw = Culvert toewall length (feet)
Lc = Culvert curb between wings (feet)
Atw = Anchor toewall length (feet)
N = Number of culvert spans
θ = Culvert skew
See applicable box culvert standard for H, S, T, and U values.
See Table of Maximum Wall Heights for limits on Hw.

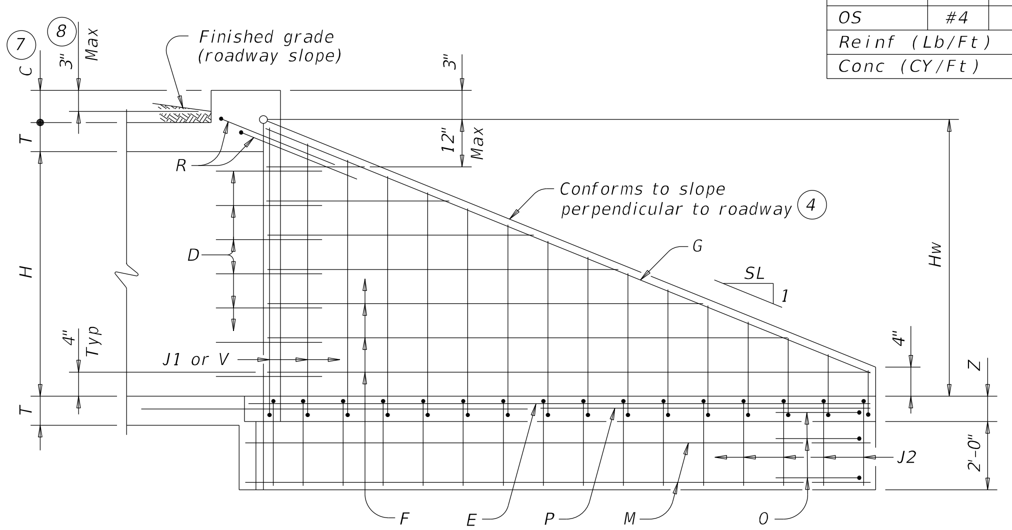
MATERIAL NOTES:

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 elsewherein 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.

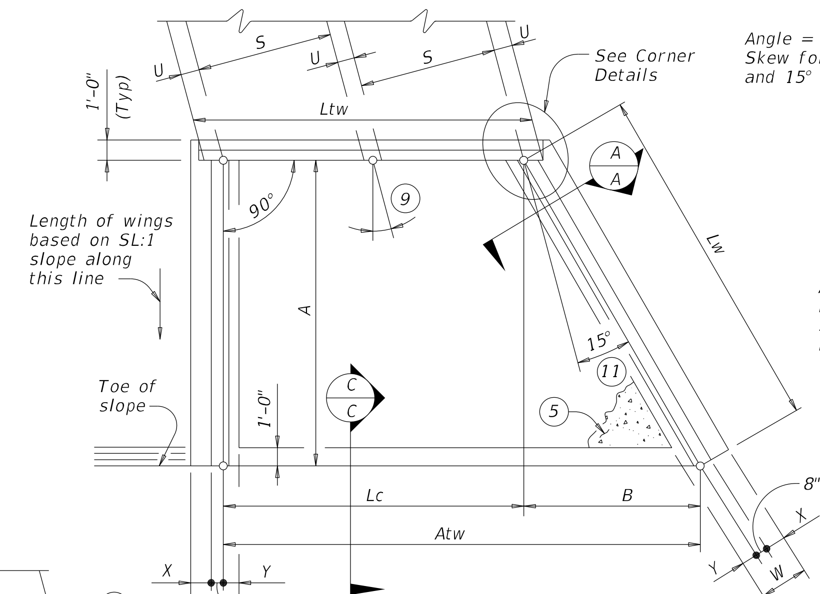
GENERAL NOTES:

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 Box Culvert Supplement (BCS) standard sheet for additional dimensions and information.

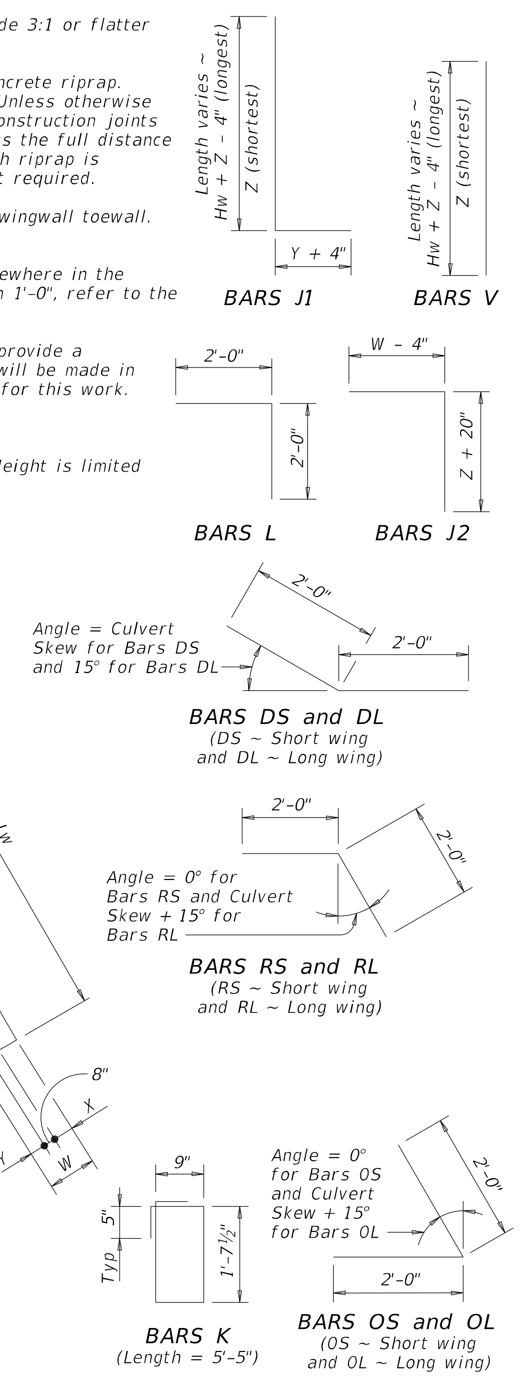
Cover dimensions are clear dimensions, unless noted otherwise.
Reinforcing dimensions are out-to-out of bars.

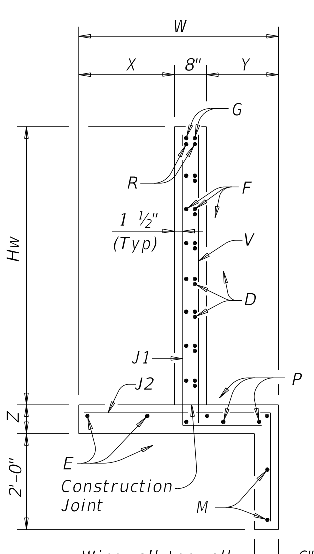


INSIDE ELEVATION OF WINGWALL
(Showing reinforcing. Culvert and culvert toewall reinforcing not shown for clarity.)

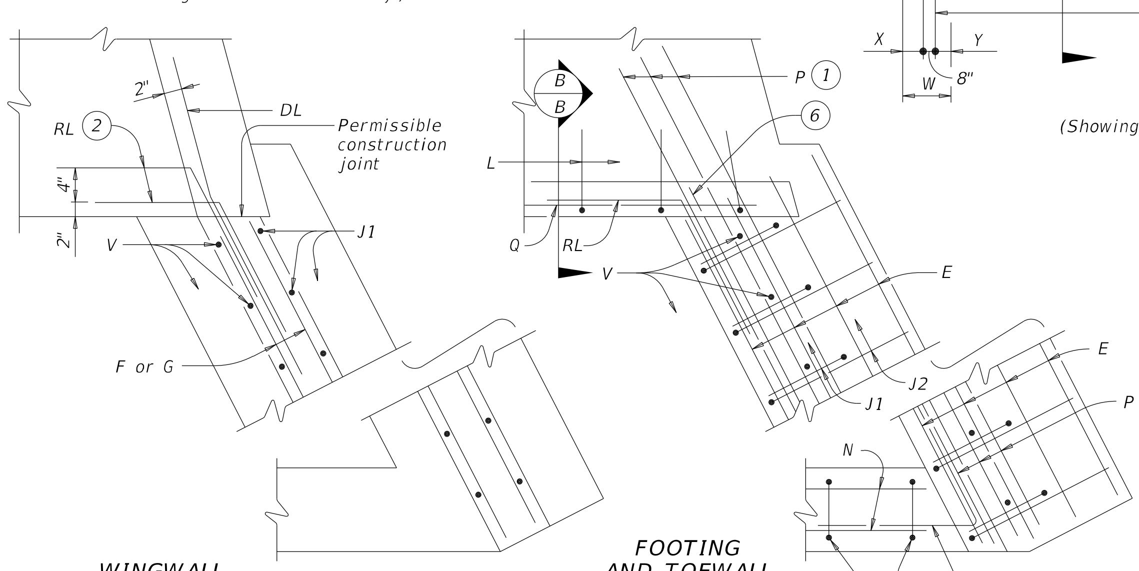


PLAN
(Showing dimensions and 15° skew.)

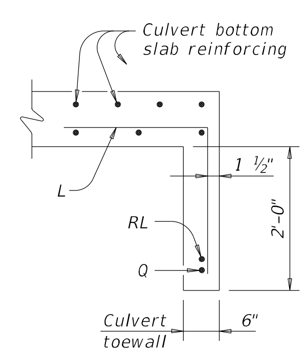




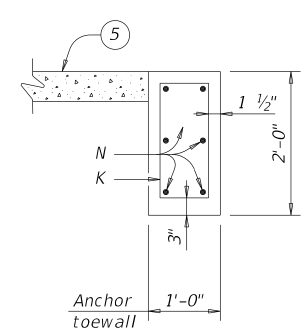
SECTION A-A



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 15° AND 30° SKEW BOX CULVERTS
TYPE I ~ CROSS DRAINAGE

SETB-FW-S

FILE: setbfsse-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT 2038	SECT 01	JOB 031	HIGHWAY FM 2115
REVISIONS	DIST WAC		COUNTY BELL	SHEET NO. 155

DATE: 8/28/2021 5:42:45 PM
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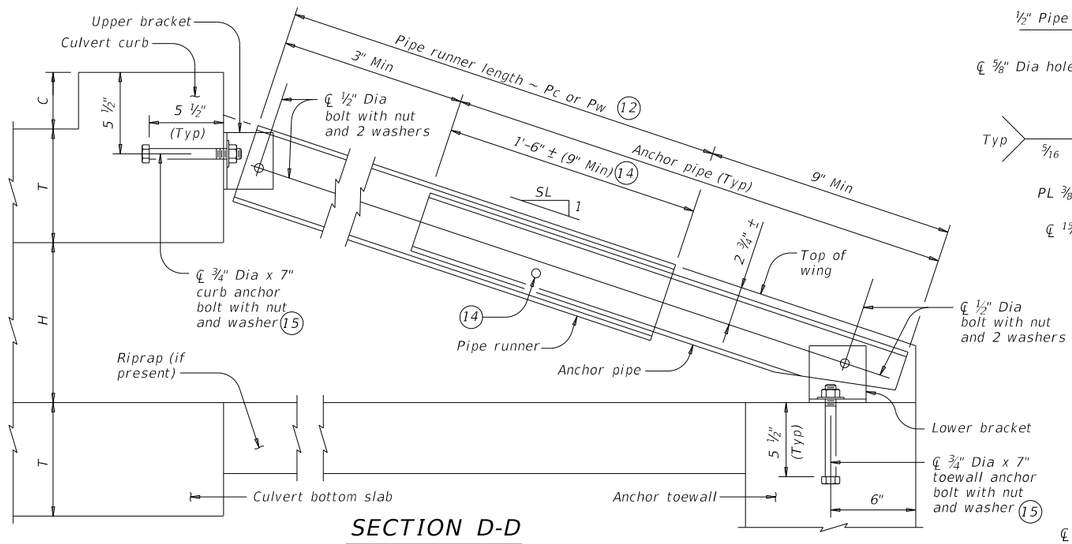
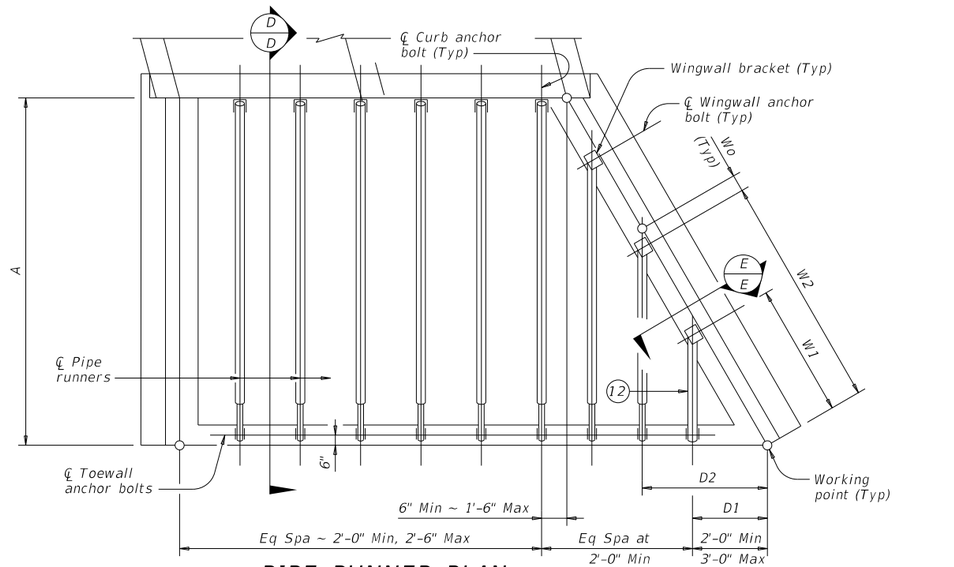
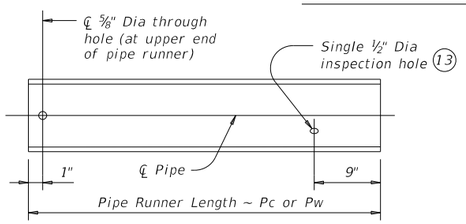


SECTION D-D

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

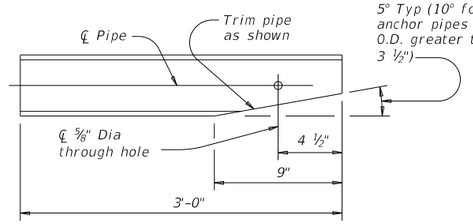


PIPE RUNNER PLAN

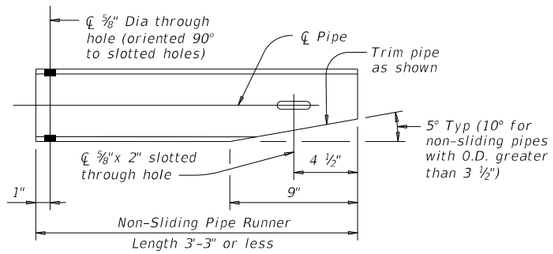


Note: Use pipe diameter required for curb pipe runner for wingwall pipe runner.

PIPE RUNNER DETAILS

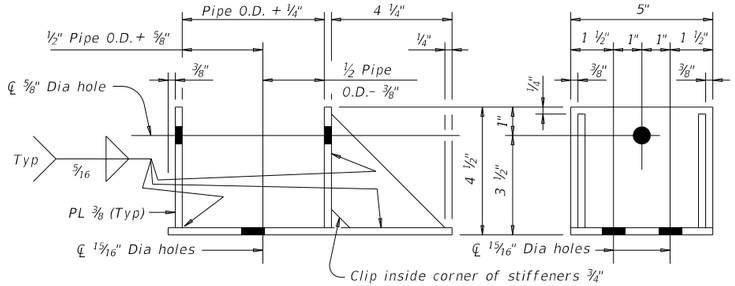


ANCHOR PIPE DETAILS



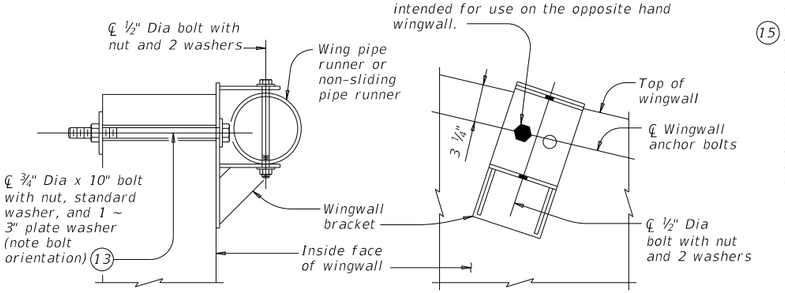
Note: Pipe size is the same as required for curb pipe runner. Adjust the corresponding lower bracket accordingly.

NON-SLIDING PIPE RUNNER DETAILS



ELEVATION

SIDE VIEW



SECTION E-E

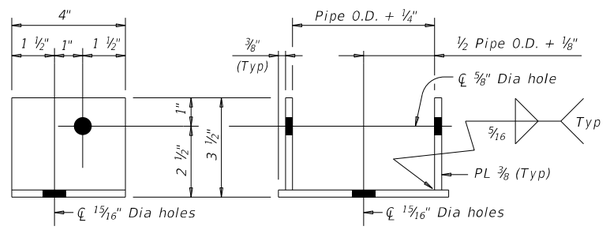
(Showing installed bracket.)

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 AND ANCHOR PIPE 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"

(12) 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.

(13) 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.

(14) 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.

(15) 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 = (K3) (Dn) – (Wo)
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	K2~15° Skew	K2~30° Skew
3:1	~ 1.054	~ 1.826	~ 1.054
4:1	~ 1.031	~ 1.785	~ 1.031
6:1	~ 1.014	~ 1.756	~ 1.014

K3 = 15° Skew ~ 2.000
30° Skew ~ 1.414
n = Wing pipe runner number
Wo = 15° Skew ~ 5"
30° Skew ~ 2 ½"

Texas Department of Transportation

Bridge Division Standard

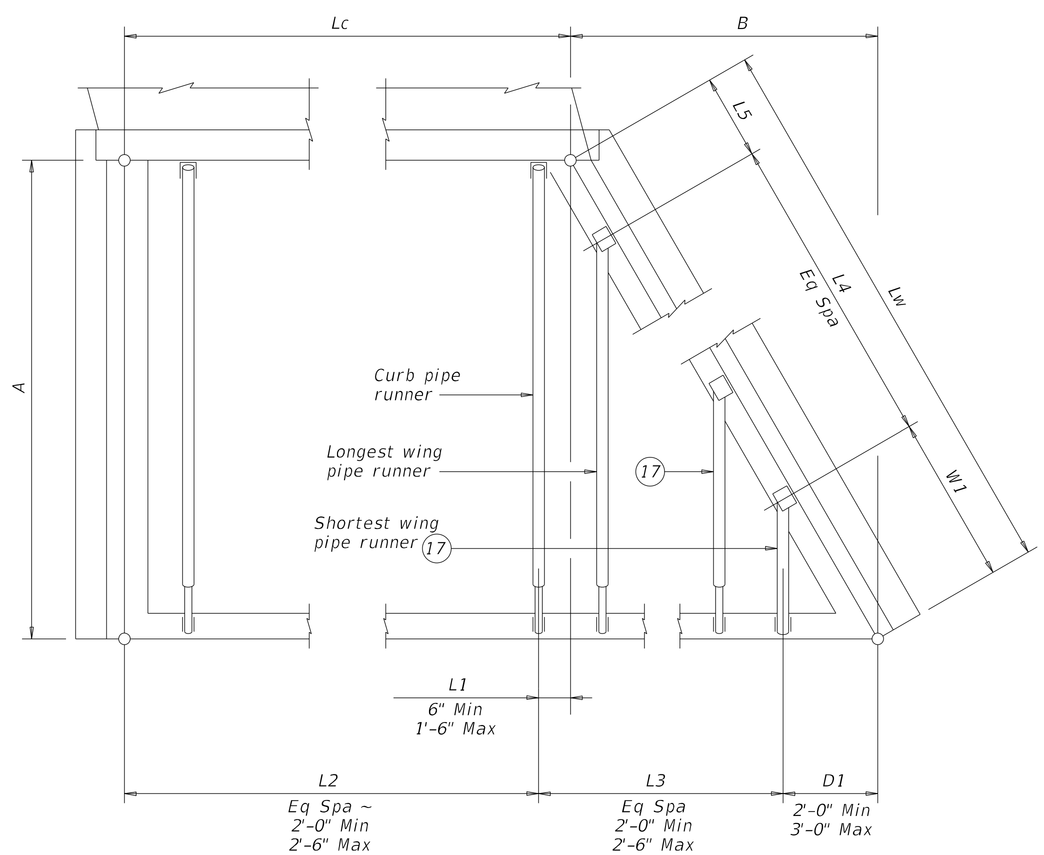
SAFETY END TREATMENT WITH FLARED WINGS

FOR 15° AND 30° SKEW BOX CULVERTS
TYPE I ~ CROSS DRAINAGE

SETB-FW-S

FILE: setbfsse-20.dgn	DN: GAF	CK: CAT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		156

Culvert Station and/or Creek name followed by applicable end (Lt, Rt or Both) (16)	Lc (Ft)	L1 (Ft)	L2 No. Spa	L2 Spa at (Ft)	L2 Overall Length (Ft)	D1 (Ft)	L3 No. Spa	L3 Spa at (Ft)	L3 Overall Length (Ft)	W1 (Ft)	L4 No. Spa	L4 Spa at (Ft)	L4 Overall Length (Ft)	L5 (Ft)	Curb Pipe Runner (Pc) No.	Curb Pipe Runner (Pc) Length (Ft)	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 Size (3",4" or 5")	Curb, Wing, and/or Non-Sliding Pipe Runners Total Length (Ft) (16)	3'-0" Anchor Pipe Size (2",3" or 4")	3'-0" Anchor Pipe Total Length (Ft) (16)
CULVERT 6 (STA 85+27.82) (Both)	13.279 '	0.500 '	6	2.130 '	12.779 '	3.000 '	5	2.033 '	10.167 '	4.034 '	4	2.875 '	11.501 '	2.379 '	6	11.375 '	9.417 '	3.125 '	2.521 '	4"	191.708 '	3"	60.000 '



PIPE RUNNER LAYOUT

Note: Right forward culvert skew shown, actual culvert skew may be opposite hand.

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

(17) 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.

STATE OF TEXAS
BRADLEY MAYES
128276
LICENSED
PROFESSIONAL ENGINEER

Bradley Mayes 8/28/2021
SIGNATURE OF REGISTRANT & DATE

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT WITH FLARED WINGS

FOR 15° AND 30° SKEW BOX CULVERTS
TYPE I ~ CROSS DRAINAGE

SETB-FW-S

FILE: setbfsse-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2020	CONT 2038	SECT 01	JOB 031	HIGHWAY FM 2115
REVISIONS	DIST WAC	COUNTY BELL		SHEET NO. 157

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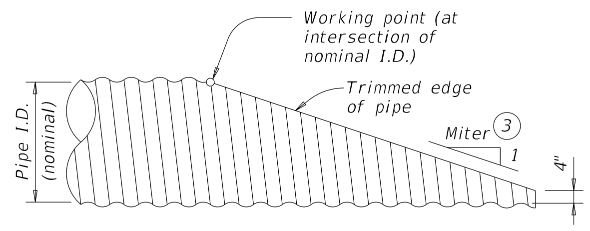
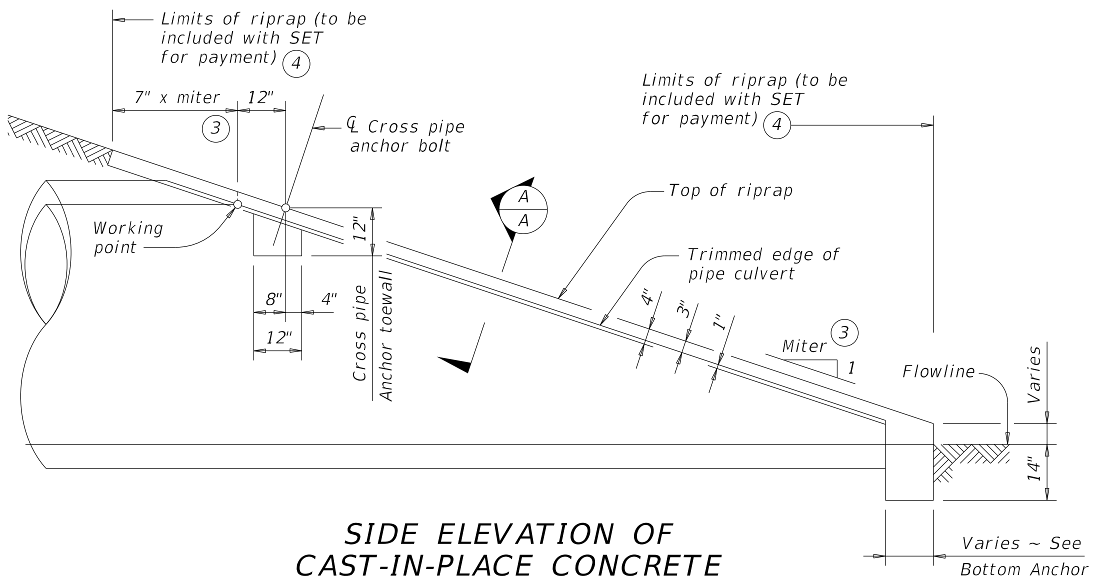


NOTE: All pipe runners, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

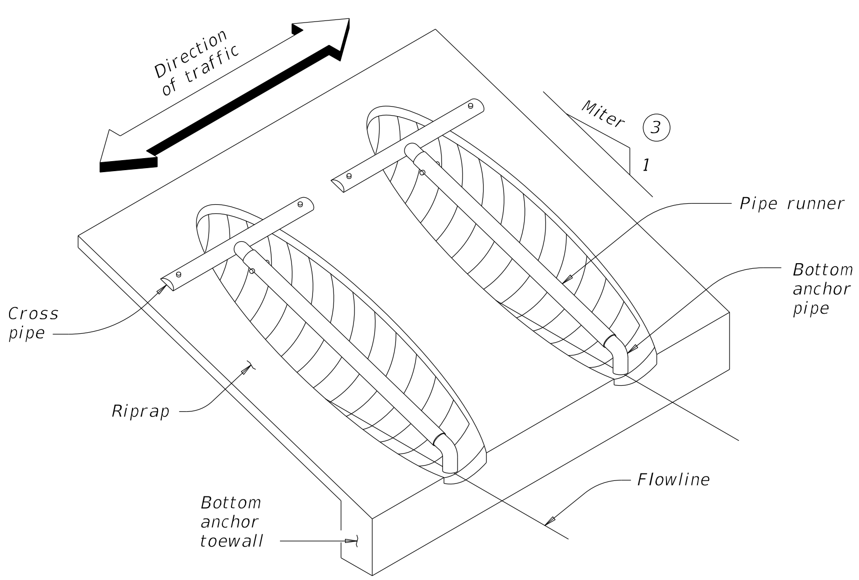
(Showing corrugated metal pipe (CMP) culvert. Details of reinforced concrete pipe (RCP) culvert are similar.)



SIDE ELEVATION OF CAST-IN-PLACE CONCRETE

Varies ~ See Bottom Anchor Toewall Details

(Showing reinforced concrete pipe (RCP) culvert. Details of corrugated metal pipe (CMP) culvert are similar. Pipe runners not shown for clarity)



ISOMETRIC VIEW OF TYPICAL INSTALLATION

(Showing installation with no skew.)

CROSS PIPE LENGTHS AND PIPE RUNNER LENGTHS ① ②

Nominal Culvert I.D.	Pipe Culvert Spa ~ G	Cross Pipe Length	Pipe Runner Length											
			3:1 Side Slope				4:1 Side Slope				6:1 Side Slope			
			0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew
24"	1' - 7"	3' - 5"	N/A	N/A	N/A	5' - 10"	N/A	N/A	N/A	8' - 1"	N/A	N/A	N/A	12' - 9"
27"	1' - 8"	3' - 8"	N/A	N/A	5' - 5"	6' - 11"	N/A	N/A	7' - 7"	9' - 7"	N/A	N/A	11' - 11"	14' - 11"
30"	1' - 10"	3' - 11"	N/A	N/A	6' - 4"	8' - 0"	N/A	N/A	8' - 9"	11' - 0"	N/A	N/A	13' - 8"	17' - 0"
33"	1' - 11"	4' - 2"	6' - 2"	6' - 5"	7' - 3"	9' - 1"	8' - 6"	8' - 10"	10' - 0"	12' - 5"	13' - 3"	13' - 9"	15' - 5"	19' - 2"
36"	2' - 1"	4' - 5"	6' - 11"	7' - 3"	8' - 2"	10' - 2"	9' - 6"	9' - 11"	11' - 2"	13' - 10"	14' - 9"	15' - 3"	17' - 2"	21' - 3"
42"	2' - 4"	4' - 11"	8' - 6"	8' - 10"	9' - 11"	12' - 4"	11' - 7"	12' - 0"	13' - 6"	16' - 8"	17' - 9"	18' - 5"	20' - 8"	25' - 7"
48"	2' - 7"	5' - 5"	10' - 1"	10' - 5"	11' - 9"	N/A	13' - 7"	14' - 2"	15' - 10"	N/A	20' - 9"	21' - 6"	24' - 2"	N/A
54"	3' - 0"	5' - 11"	11' - 8"	12' - 1"	N/A	N/A	15' - 8"	16' - 3"	N/A	N/A	23' - 10"	24' - 8"	N/A	N/A
60"	3' - 3"	6' - 5"	13' - 3"	N/A	N/A	N/A	17' - 9"	N/A	N/A	N/A	26' - 10"	N/A	N/A	N/A

TYPICAL PIPE CULVERT MITERS ③

Side Slope	0° Skew	15° Skew	30° Skew	45° Skew
3:1	3:1	3.106:1	3.464:1	4.243:1
4:1	4:1	4.141:1	4.619:1	5.657:1
6:1	6:1	6.212:1	6.928:1	8.485:1

CONDITIONS WHERE PIPE RUNNERS ARE NOT REQUIRED ②

Nominal Culvert I.D.	Single Pipe Culvert	Multiple Pipe Culverts
12" thru 21"	Skews thru 45°	Skews thru 45°
24"	Skews thru 45°	Skews thru 30°
27"	Skews thru 30°	Skews thru 15°
30"	Skews thru 15°	Skews thru 15°
33"	Skews thru 15°	Always required
36"	Normal (no skew)	Always required
42" thru 60"	Always required	Always required

STANDARD PIPE SIZES AND MAX PIPE RUNNER LENGTHS ①

Pipe Size	Pipe O.D.	Pipe I.D.	Max Pipe Runner Length
2" STD	2.375"	2.067"	N/A
3" STD	3.500"	3.068"	10' - 0"
4" STD	4.500"	4.026"	19' - 8"
5" STD	5.563"	5.047"	34' - 2"

ESTIMATED CONCRETE RIPRAP QUANTITIES (CY) ⑤

Nominal Culvert I.D.	3:1 Side Slope				4:1 Side Slope				6:1 Side Slope			
	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew	0° Skew	15° Skew	30° Skew	45° Skew
12"	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.7	0.7	0.7	0.8
15"	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.9
18"	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.8	0.9	1.0
21"	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.9	0.9	0.9	1.0	1.2
24"	0.6	0.7	0.7	0.8	0.8	0.8	0.8	1.0	1.0	1.0	1.1	1.3
27"	0.7	0.7	0.8	0.9	0.8	0.9	0.9	1.1	1.1	1.1	1.2	1.4
30"	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.2	1.2	1.2	1.3	1.6
33"	0.8	0.8	0.9	1.0	1.0	1.0	1.1	1.3	1.3	1.4	1.5	1.7
36"	0.9	0.9	0.9	1.1	1.1	1.1	1.2	1.4	1.4	1.5	1.6	1.8
42"	1.0	1.0	1.1	1.3	1.2	1.3	1.3	1.6	1.6	1.7	1.8	2.1
48"	1.1	1.1	1.2	N/A	1.4	1.4	1.5	N/A	1.9	1.9	2.1	N/A
54"	1.3	1.3	N/A	N/A	1.6	1.6	N/A	N/A	2.1	2.1	N/A	N/A
60"	1.4	N/A	N/A	N/A	1.7	N/A	N/A	N/A	2.3	N/A	N/A	N/A

① Provide pipe runner of the size shown in the tables. Provide cross pipe of the same size as the pipe runner. Provide cross pipe stub out and bottom anchor pipe of the next smaller size pipe as shown in the Standard Pipe Sizes and Max Pipe Runner Lengths table.

② This standard allows for the placement of only one pipe runner across each culvert pipe opening. In order to limit the clear opening to be traversed by an errant vehicle, the following conditions must be met:

For 60" culvert pipes, the skew must not exceed 0°.
For 54" culvert pipes, the skew must not exceed 15°.
For 48" culvert pipes, the skew must not exceed 30°.
For all culvert pipe sizes 42" and less, the skew must not exceed 45°.

If the above conditions cannot be met, the designer should consider using a safety end treatment with flared wings. For further information, refer to the TxDOT Roadway Design Manual.

③ Miter = slope of mitered end of pipe culvert.

④ Riprap placed beyond the limits shown will be paid for as concrete riprap in accordance with Item 432, "Riprap".

⑤ Quantities shown are for one end of one reinforced concrete pipe (RCP) culvert. For multiple pipe culverts or for corrugated metal pipe (CMP) culverts, quantities will need to be adjusted. Riprap quantities are for Contractor's information only.

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT

FOR 12" DIA TO 60" DIA PIPE CULVERTS
TYPE II ~ CROSS DRAINAGE

SETP-CD

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©TxDOT February 2020	CONT 2038	SECT 01	JOB 031	HIGHWAY FM 2115
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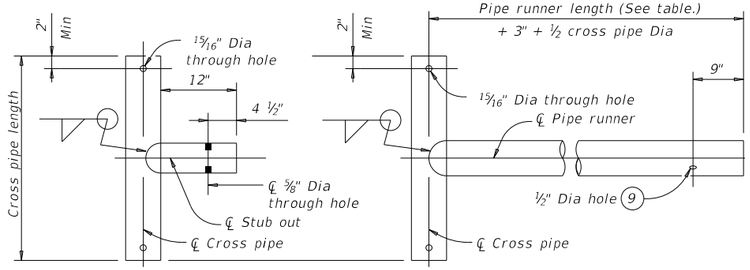
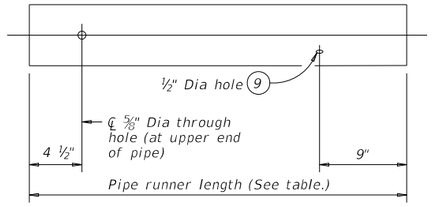


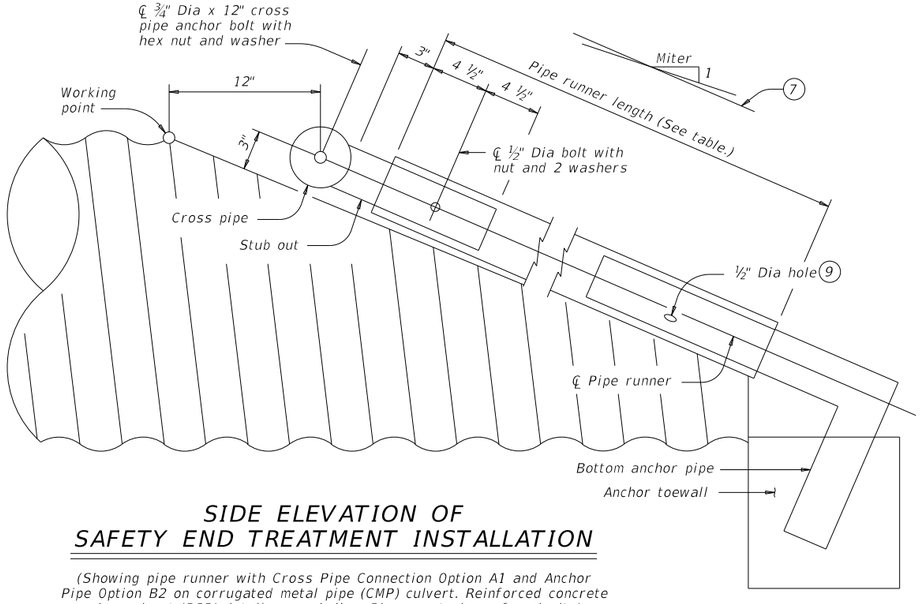
OPTION A1 OPTION A2

CROSS PIPE AND CONNECTIONS DETAILS



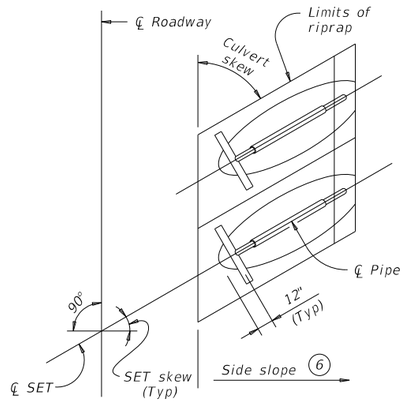
NOTE: The separate pipe runner shown is required when Cross Pipe Connection Option A1 is used.

PIPE RUNNER DETAILS

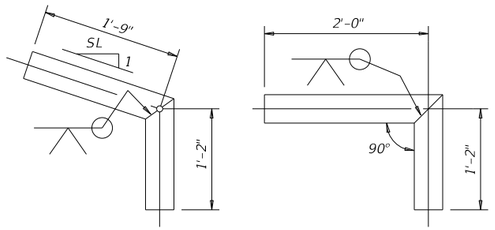


SIDE ELEVATION OF SAFETY END TREATMENT INSTALLATION

(Showing pipe runner with Cross Pipe Connection Option A1 and Anchor Pipe Option B2 on corrugated metal pipe (CMP) culvert. Reinforced concrete pipe culvert (RCP) details are similar. Riprap not shown for clarity)

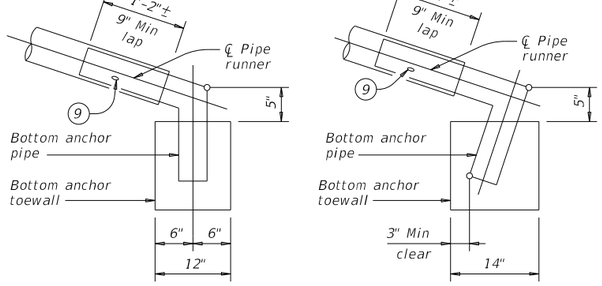


PLAN OF SKEWED INSTALLATION



OPTION B1 OPTION B2

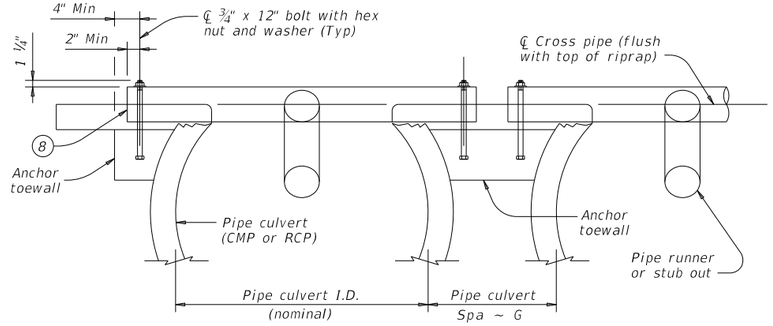
BOTTOM ANCHOR PIPE DETAILS (10)



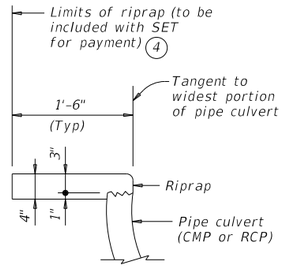
OPTION B1 OPTION B2

BOTTOM ANCHOR TOEWALL DETAILS

(Culvert and riprap not shown for clarity.)



SHOWING CROSS PIPE AND ANCHOR TOEWALL



SHOWING TYPICAL PIPE CULVERT AND RIPRAP

SECTION A-A

(4) Riprap placed beyond the limits shown will be paid for as concrete riprap in accordance with Item 432, "Riprap".

(6) Recommended values of side slope are 3:1, 4:1, and 6:1. All quantities, calculations, and dimensions shown herein are based on these recommended values. Slope of 3:1 or flatter is required for vehicle safety.

(7) Note that actual slope of pipe runner may vary slightly from side slope of riprap and trimmed culvert pipe edge.

(8) Ensure that riprap concrete does not flow into the cross pipe so as to permit disassembly of the bolted connection to allow cleanout access.

(9) After installation, inspect the 1/2" hole to ensure that the lap of the pipe runner with the bottom anchor pipe is adequate.

(10) At fabricator's option, a heat bend to a smooth 5" radius or a manufactured elbow (of the same material as the runner) may be substituted for the mitered and welded joint in the bottom anchor pipe.

MATERIAL NOTES:

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 pipe runners, cross pipes, and anchor pipes conforming to the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 Gr B, or API 5LX52.

Provide ASTM A307 bolts and nuts.

Galvanize all steel components, except concrete reinforcing, after fabrication.

Repair galvanizing damaged during transport or construction in accordance with the specifications.

GENERAL NOTES:

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.

Safety end treatments (SET) 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.

Payment for riprap and toewall is included in the price bid for each safety end treatment.

Construct concrete riprap and all necessary inverts in accordance with the requirements of Item 432, "Riprap".

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT

FOR 12" DIA TO 60" DIA
PIPE CULVERTS
TYPE II ~ CROSS DRAINAGE

SETP-CD

FILE: setpcdse-20.dgn	DN: GAF	CK: CAT	DW: JRP	CK: GAF
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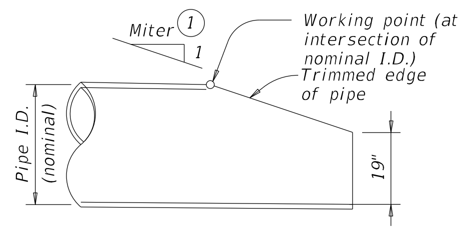
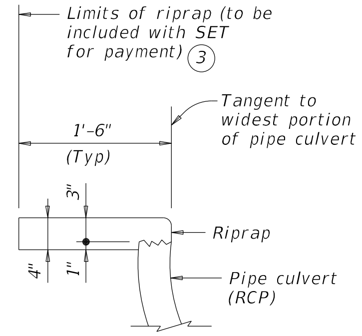


NOTE: All pipe runners, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

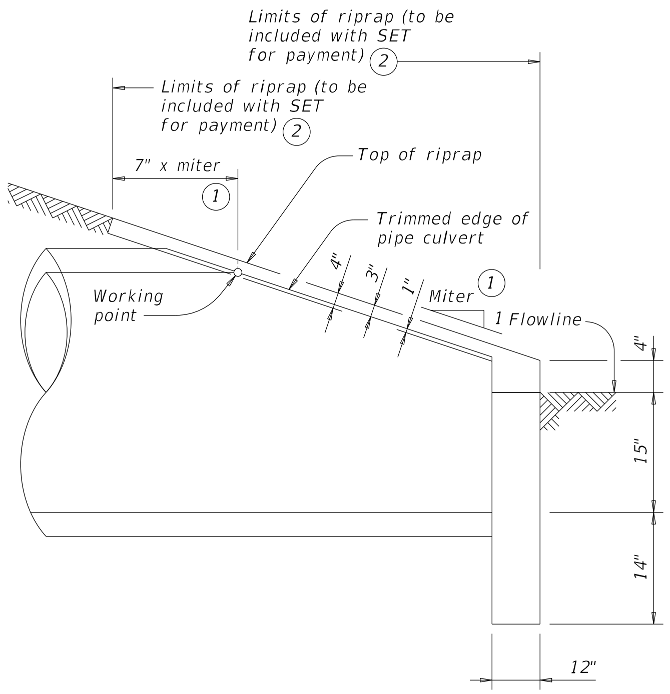
(Showing reinforced concrete pipe (RCP) culvert.)



SHOWING TYPICAL PIPE CULVERT AND RIPRAP

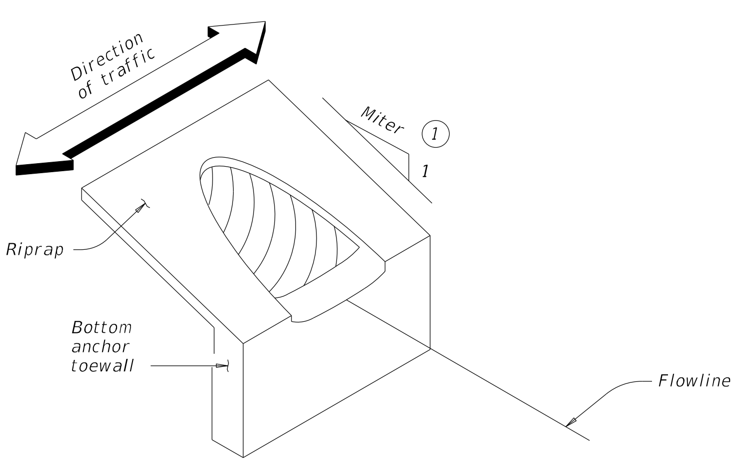
ESTIMATED CONCRETE RIPRAP QUANTITIES (CY) (3)	
Nominal Culvert I.D.	6:1 Side Slope / 0° Skew
30"	1.0

TYPICAL PIPE CULVERT MITERS (1)	
Side Slope	0° Skew
6:1	6:1



SIDE ELEVATION OF CAST-IN-PLACE CONCRETE

(Showing reinforced concrete pipe (RCP) culvert.)



ISOMETRIC VIEW OF TYPICAL INSTALLATION

(Showing installation with no skew.)

(1) Miter = slope of mitered end of pipe culvert.

(2) Riprap placed beyond the limits shown will be paid for as concrete riprap in accordance with Item 432, "Riprap".

(3) Quantities shown are for one end of one reinforced concrete pipe (RCP) culvert. Riprap quantities are for Contractor's information only.

MATERIAL NOTES:

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.

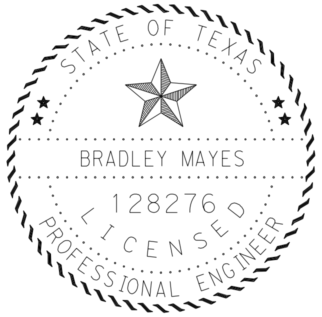
Galvanize all steel components, except concrete reinforcing, after fabrication.

GENERAL NOTES:

Safety end treatments (SET) shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the culvert flowline.

Payment for riprap and toewall is included in the price bid for each safety end treatment.

Construct concrete riprap and all necessary inverts in accordance with the requirements of Item 432, "Riprap".



8/28/2021
SIGNATURE OF REGISTRANT & DATE

SHEET 1 OF 1

Texas Department of Transportation — Bridge Division Standard

SAFETY END TREATMENT

FOR 12" DIA TO 60" DIA PIPE CULVERTS TYPE II ~ CROSS DRAINAGE

SETP-CD (MOD)

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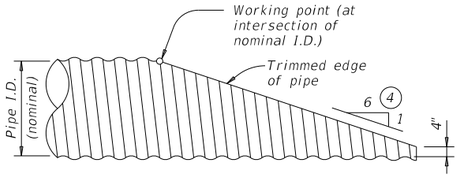
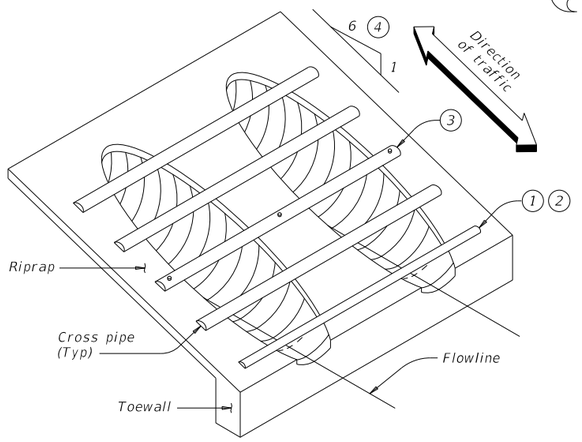


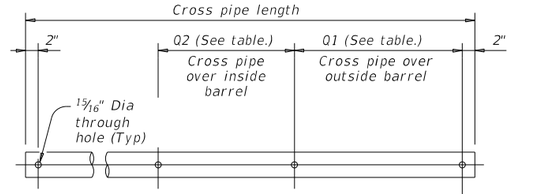
NOTE: All cross pipes, calculations, and dimensions are based on the pipe culverts mitered as shown in this detail. Alternate styles of mitered ends will require that appropriate adjustments be made to the values presented on this standard.

SIDE ELEVATION OF TYPICAL PIPE CULVERT MITER

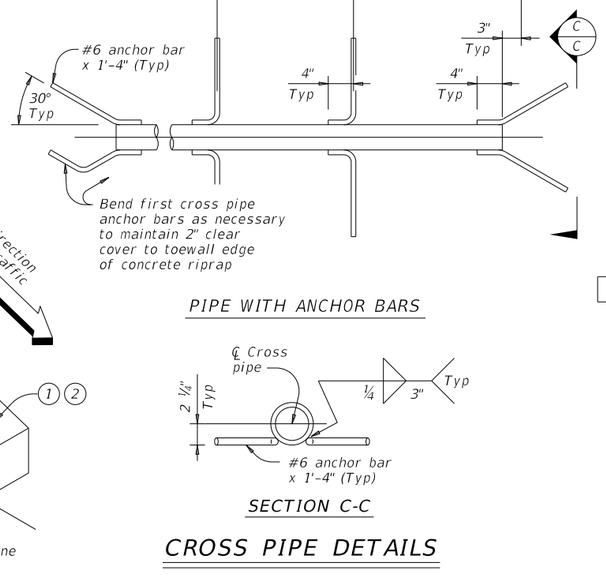
(Showing corrugated metal pipe (CMP) culvert Details at reinforced concrete pipe (RCP) culvert are similar.)



ISOMETRIC VIEW OF TYPICAL INSTALLATION



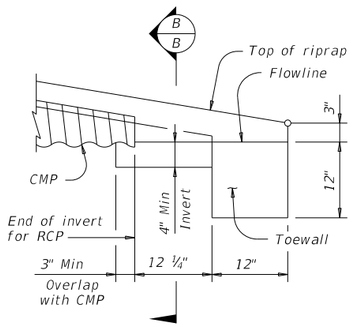
PIPE WITH BOLTED ANCHOR



PIPE WITH ANCHOR BARS

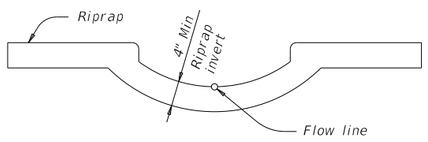
SECTION C-C

CROSS PIPE DETAILS



DETAIL "A"

(Showing invert with corrugated metal pipe (CMP) culvert. Reinforced concrete pipe (RCP) culvert details are similar. Cross pipes not shown for clarity.)



SECTION B-B

(Cross pipes not shown for clarity.)

CROSS PIPE LENGTHS, REQUIRED PIPE SIZES, AND RIPRAP QUANTITIES (2)

Nominal Culvert I.D.	Conc Riprap (CY) (6)	Pipe Culvert Spa ~ G	Single Barrel ~ Q1	Multi-Barrel ~ Q1	Q2	Conditions for Use of Cross Pipes	Cross Pipe Sizes
12"	0.6	0' – 9"	N/A	2' – 1"	1' – 9"	3 or more pipe culverts	3" Std (3.500" O.D.)
15"	0.7	0' – 11"	N/A	2' – 5"	2' – 2"		
18"	0.8	1' – 2"	N/A	2' – 10"	2' – 8"		
21"	0.9	1' – 4"	N/A	3' – 2"	3' – 1"		
24"	0.9	1' – 7"	N/A	3' – 6"	3' – 7"		
27"	1.0	1' – 8"	N/A	3' – 10"	3' – 11"	3 or more pipe culverts	3 ½" Std (4.000" O.D.)
30"	1.1	1' – 10"	N/A	4' – 2"	4' – 4"	2 or more pipe culverts	
33"	1.2	1' – 11"	4' – 2"	4' – 5"	4' – 8"	All pipe culverts	
36"	1.3	2' – 1"	4' – 5"	4' – 9"	5' – 1"	All pipe culverts	4" Std (4.500" O.D.)
42"	1.5	2' – 4"	4' – 11"	5' – 5"	5' – 10"		
48"	1.7	2' – 7"	5' – 5"	6' – 0"	6' – 7"	All pipe culverts	5" Std (5.563" O.D.)
54"	2.0	3' – 0"	5' – 11"	6' – 9"	7' – 6"		
60"	2.2	3' – 3"	6' – 5"	7' – 4"	8' – 3"		
66"	2.4	3' – 3"	6' – 11"	7' – 10"	8' – 9"		
72"	2.7	3' – 4"	7' – 5"	8' – 5"	9' – 4"		

(1) The proper installation of the first cross pipe is critical for vehicle safety. Place the top of the first cross pipe no more than 6" above the flow line.

(2) Provide cross pipes, except the first bottom pipe, of the size shown in the table. Provide a 3 1#2" standard pipe (4" O.D.) for the first bottom pipe.

(3) Install the third cross pipe from the bottom of the culvert using a bolted connection. Ensure that riprap concrete does not flow into the cross pipe so as to permit disassembly of the bolted connection to allow cleanout access. At the Contractor's option, install all other cross pipes using the bolted connection details.

(4) Match cross slope as shown elsewhere in the plans. Cross slope of 6:1 or flatter is required for vehicle safety.

(5) Riprap placed beyond the limits shown will be paid for as concrete riprap in accordance with Item 432, "Riprap".

(6) Quantities shown are for one end of one reinforced concrete pipe (RCP) culvert. For multiple pipe culverts or for corrugated metal pipe (CMP) culverts, quantities will need to be adjusted. Riprap quantities are for contractor's information only.

MATERIAL NOTES:

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 cross pipes that meet the requirements of ASTM A53 (Type E or S, Gr B), ASTM A500 (Gr B), or API 5LX52.

Provide ASTM A307 bolts and nuts.

Galvanize all steel components, except concrete reinforcing, after fabrication. Repair galvanizing damaged during transport or construction in accordance with the specifications.

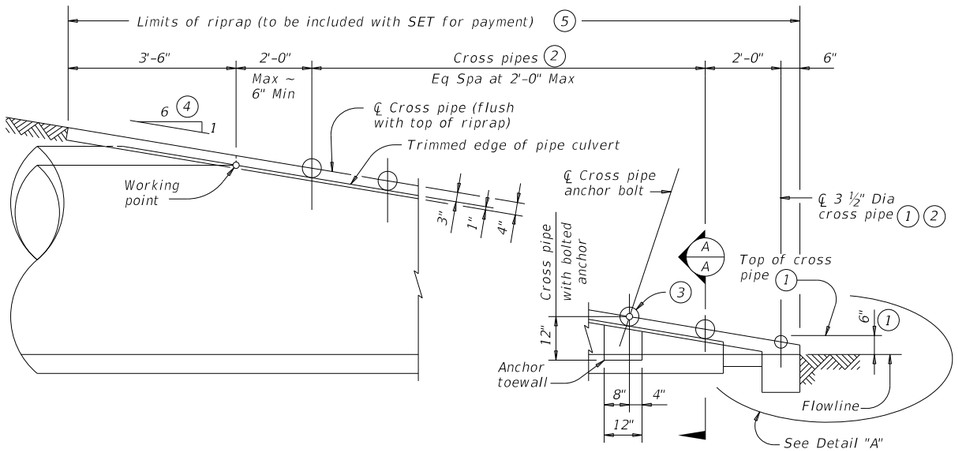
GENERAL NOTES:

Cross pipes are designed for a traversing load of 10,000 pounds at yield as recommended by Research Report 280-2F, "Safety Treatment of Roadside Parallel-Drainage Structures", Texas Transportation Institute, March 1981.

Safety end treatments (SET) shown herein are intended for use in those installations where out of control vehicles are likely to traverse the openings approximately perpendicular to the cross pipes.

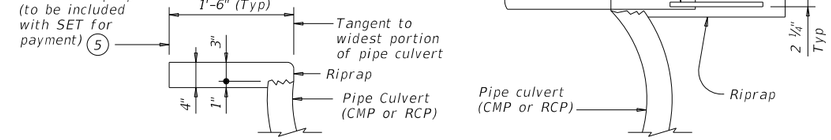
Construct concrete riprap and all necessary inverts in accordance with the requirements of Item 432, "Riprap".

Payment for riprap and toewall is included in the Price Bid for each Safety End Treatment.



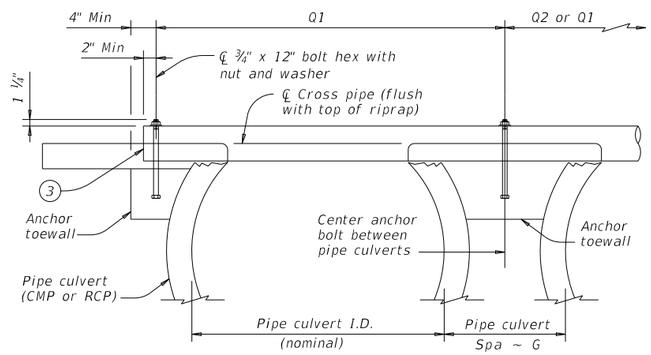
SIDE ELEVATION OF CAST-IN-PLACE CONCRETE

(Showing reinforced concrete pipe (RCP) culvert. Details at corrugated metal pipe (CMP) culvert are similar.)



SHOWING CROSS PIPE WITH ANCHOR BAR

SHOWING TYPICAL PIPE CULVERT AND RIPRAP



SHOWING CROSS PIPE WITH BOLTED ANCHOR

SECTION A-A

Texas Department of Transportation

Bridge Division Standard

SAFETY END TREATMENT

FOR 12" DIA TO 72" DIA PIPE CULVERTS TYPE II ~ PARALLEL DRAINAGE

SETP-PD

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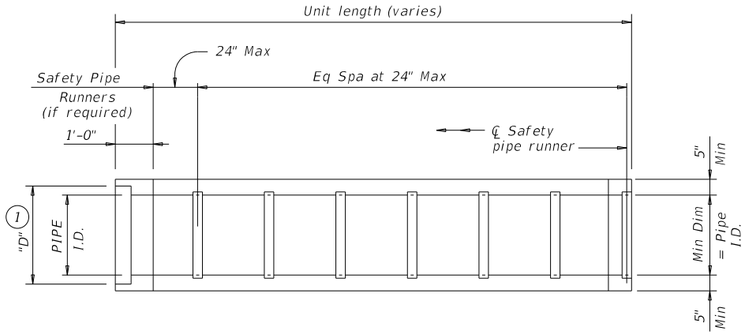
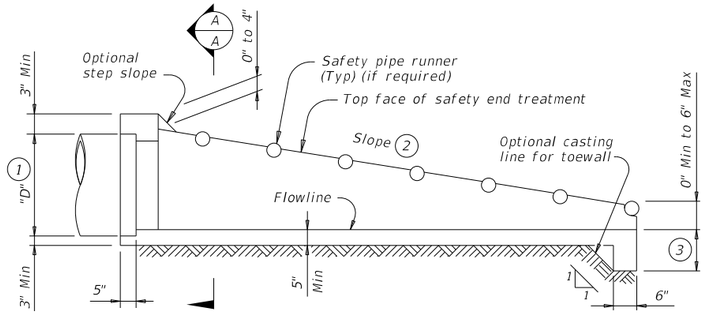


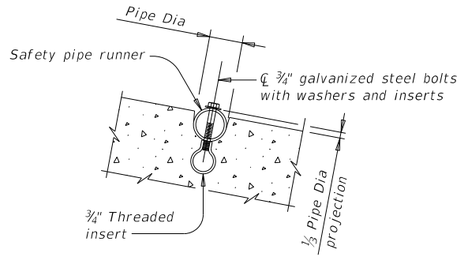
PLAN

(Showing bell end connection.)



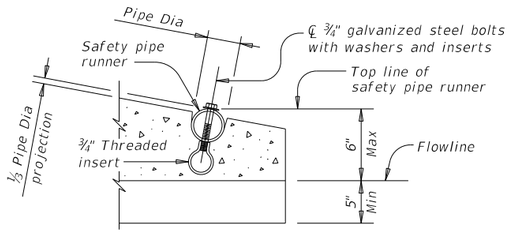
LONGITUDINAL ELEVATION

(Showing bell end connection.)

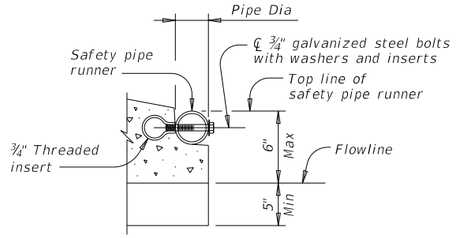


INSTALLATION DETAIL FOR SAFETY PIPE RUNNERS

(If required)



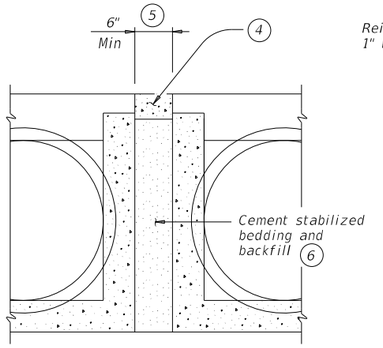
OPTION A



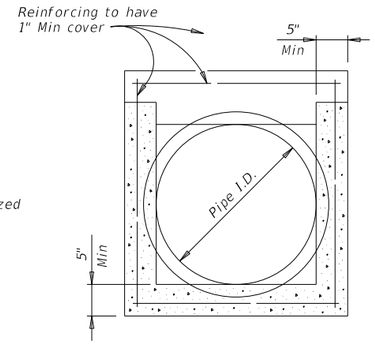
OPTION B

END DETAILS FOR INSTALLATION OF SAFETY PIPE RUNNERS

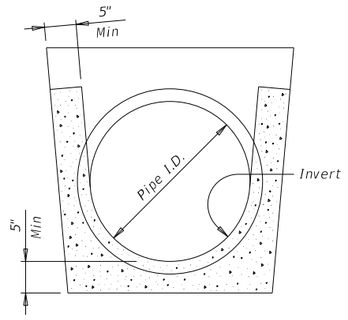
(If required)



MULTIPLE PIPE INSTALLATION

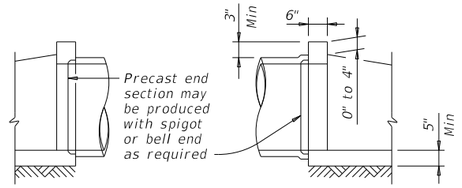


OPTION WITH SQUARE BOTTOM



OPTION WITH INVERT BOTTOM

SECTION A-A



OPTIONAL JOINT FOR RCP

(Showing joint between RCP and precast safety end treatment.)

REQUIREMENTS FOR CULVERT PIPES AND SAFETY PIPE RUNNERS

Pipe I.D.	RCP Wall "B" Thickness	TP Wall Thickness (7)	"D" (1)	Slope	Min Length	Pipe Runners Required		Required Pipe Runner Size		
						Single Pipe	Multiple Pipe	Nominal Dia.	O.D.	I.D.
12"	2"	1.15"	17.00"	6:1	4' – 9"	No	Yes, for > 2 pipes	3" STD	3.500"	3.068"
15"	2 ¼"	1.30"	20.50"	6:1	6' – 5"	No	Yes, for > 2 pipes	3" STD	3.500"	3.068"
18"	2 ½"	1.60"	24.00"	6:1	8' – 0"	No	Yes, for > 2 pipes	3" STD	3.500"	3.068"
24"	3"	1.95"	31.00"	6:1	11' – 3"	No	Yes, for > 2 pipes	3" STD	3.500"	3.068"
30"	3 ½"	2.65"	38.50"	6:1	14' – 8"	No	Yes	4" STD	4.500"	4.026"
36"	4"	2.75"	45.50"	6:1	17' – 11"	Yes	Yes	4" STD	4.500"	4.026"
42"	4 ½"	N/A	52.50"	6:1	21' – 2"	Yes	Yes	4" STD	4.500"	4.026"

(1) Dimension "D" is based on reinforced concrete pipe (RCP) meeting the requirements of ASTM C-76, Class III, (RCP Wall "B" thickness). Adjust "D" for any other wall thickness used. For thermoplastic pipe (TP) take into account the annular space requirements for grouted connections.

(2) Slope as shown elsewhere in the plans. Slope of 6:1 or flatter is required for vehicle safety.

(3) Toewall to be used only when dimension is shown elsewhere in the plans.

(4) Fill the top 4" of void between precast end treatments with concrete riprap. Concrete riprap is considered subsidiary to the Item 467, "Safety End Treatment".

(5) Adjust clear distance between pipes to provide for the minimum distance between safety end treatments.

(6) Provide cement stabilized bedding and backfill in accordance with the Item 400, "Excavation and Backfill for Structures". Bedding and backfill is considered subsidiary to the Item 467, "Safety End Treatment". When concrete riprap is specified around the safety end treatment, backfill as directed by Engineer.

(7) Thermoplastic pipe wall thickness may vary. Adjust accordingly. Thermoplastic pipe requires the safety end treatments to have a bell end for grouted connections.

GENERAL NOTES:

Precast safety end treatment for reinforced concrete pipe (RCP), and thermoplastic pipe (TP) may be used for TYPE II end treatment as specified in Item "Safety End Treatment".

When precast safety end treatment is used as a Contractor's alternate to mitered RCP, riprap will not be required unless noted otherwise on 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.

Manufacture this product in accordance with Item 467, "Safety End Treatment" except as noted below :

A. Provide minimum reinforcing of #4 at 6" (Grade 40) or #4 at 9" (Grade 60) each way or 6"x6" – D12 x D12 or 5"x5" – D10 x D10 welded wire reinforcement (WWR).

B. For precast (steel formed) sections, provide Class "C" concrete (f'c = 3,600 psi).

At the option and expense of the Contractor the next larger size of safety end treatment may be furnished; as long as the "D" dimension cast is that of the required size of pipe.

Pipe runners are designed for a traversing load of 10,000 Lbs at yield as recommended by Research Report 280-2F, "Safety Treatment of Roadside Parallel-Drainage Structures", Texas Transportation Institute, March 1981.

Provide pipe runners meeting the requirements of ASTM A53 (Type E or S, Grade B), ASTM A500 (Grade B), or API 5LX52.

Galvanize all steel components except reinforcing steel after fabrication. Repair galvanizing damaged during transport or construction in accordance with the specifications.

Connect RCP using the Optional Joint for RCP detail shown or in accordance with Item 464, "Reinforced Concrete Pipe". Connect TP by grouting. See PBGC standard for grouted connections with TP and precast safety end treatment.

Texas Department of Transportation

Bridge Division Standard

PRECAST SAFETY END TREATMENT

TYPE II ~ PARALLEL DRAINAGE

PSET-SP

FILE: psetspss-20.dgn	DN: RLW	CK: KLR	DW: JTR	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		162

DATE: 8/28/2021 5:43:26 PM
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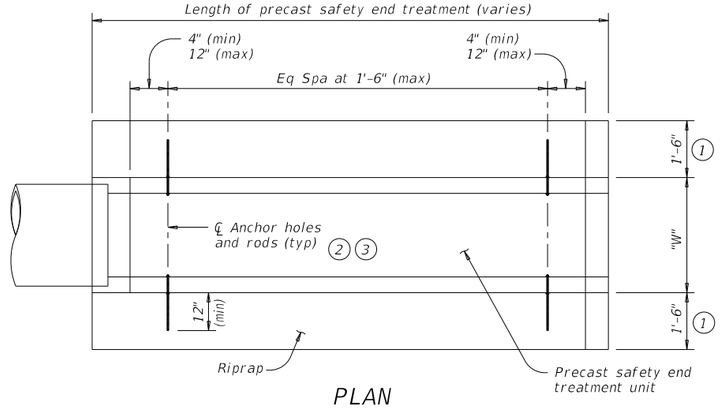
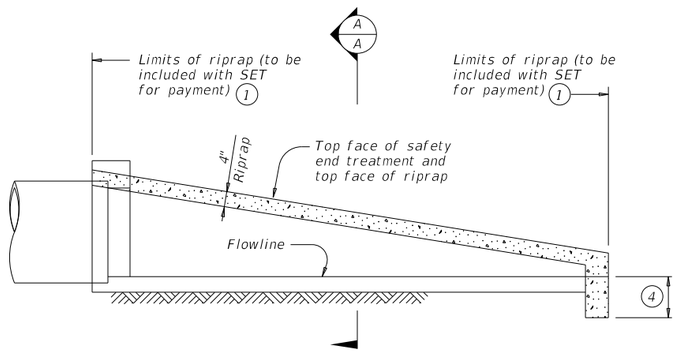


PLAN



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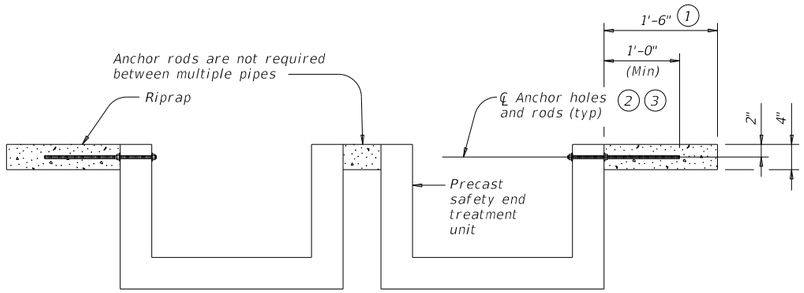
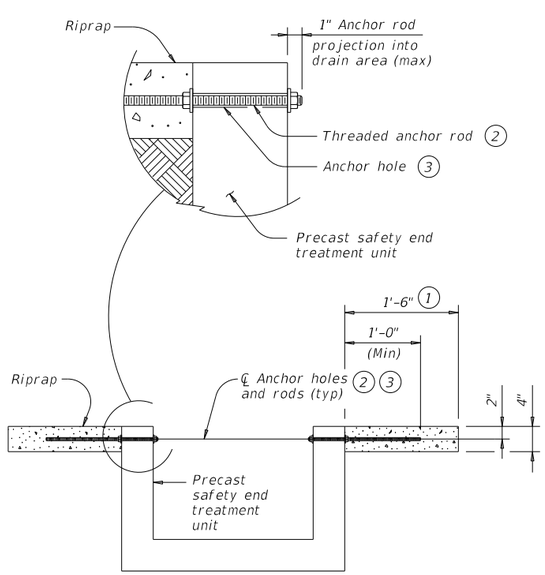


MULTIPLE PIPE INSTALLATION



SINGLE PIPE INSTALLATION

SECTION A-A

ESTIMATED CONCRETE RIPRAP QUANTITIES (CY) 5

Nominal Culvert (Pipe) I.D.	PSET-SC and PSET-SP Standards				PSET-RC and PSET-RP Standards			
	Unit Width "W"	Side Slope			Unit Width "W"	Side Slope		
		3:1	4:1	6:1		3:1	4:1	6:1
12"	23.0"	0.1	0.2	0.2	16.0"	0.1	0.1	0.2
15"	26.5"	0.2	0.2	0.3	19.5"	0.1	0.2	0.2
18"	30.0"	0.2	0.2	0.3	23.0"	0.2	0.2	0.3
24"	37.0"	0.3	0.3	0.5	30.0"	0.2	0.3	0.4
30"	44.5"	0.3	0.4	0.6	37.0"	0.3	0.3	0.5
36"	51.5"	0.4	0.5	0.7	44.0"	0.3	0.4	0.6
42"	58.5"	0.5	0.6	0.8	51.0"	0.4	0.5	0.7

(1) Riprap placed beyond the limits shown will be paid as concrete riprap in accordance with Item 432, "Riprap". When riprap is cast integrally with the precast safety end treatment, this dimension is 1'-0" minimum.

(2) 1#2" Dia ASTM A307 Gr A threaded anchor rod with 2 nuts and 2 washers. Galvanize all components in accordance with Item 445, "Galvanizing". Repair galvanizing that is damaged during transport or construction in accordance with the specifications.

(3) 3#4" through holes in walls of safety end treatment for riprap anchor rods may be drilled with rotary (coring or masonry) type drilling equipment or may be formed. Do not use percussive (star) type drilling equipment. If holes are drilled, patch spalls in the inside face of the wall exceeding 1#2" from the holes.

(4) Provide riprap toe wall when dimension is shown elsewhere in the plans or when field conditions require a toe wall.

(5) Quantities shown are for one end of one reinforced concrete pipe culvert. For multiple pipe culverts, quantities will need to be adjusted. Riprap quantities are for Contractor's information only. Quantities are based on the minimum unit lengths shown on the Precast Saftey End Treatment (SET) standard sheets.

MATERIAL NOTES:

Provide Class "B" riprap in accordance with Item 432, "Riprap".

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. The anchor rods shown are always required.

GENERAL NOTES:

Precast safety end treatment for reinforced concrete pipe may be used for TYPE II end treatment as specified in Item 467, "Safety End Treatment".

Refer to PSET-SC or PSET-SP standard sheets for details of square safety end treatments not shown. Refer to PSET-RC or PSET-RP standard sheets for details of round safety end treatments not shown.

For precast units with integrally cast riprap, substitute reinforcing steel in the amount on 0.26 in./ft. minimum for the threaded anchor rods shown. When requested, submit sealed engineering drawings for approval prior to construction. Shop drawings will not be required. Note that a proprietary precast unit with integral riprap is available from L&R Precast Concrete Works, Inc. (956) 583-6293 or www.lrprecast.com.

Payment for riprap and toewalls is included in the price bid for each safety end treatment.

These riprap details are only applicable when notes that require placement of riprap with precast safety end treatments are shown elsewhere in the plans.

Precast units with integrally cast riprap are permitted unless noted otherwise on the plans.

Texas Department of Transportation

Bridge Division Standard

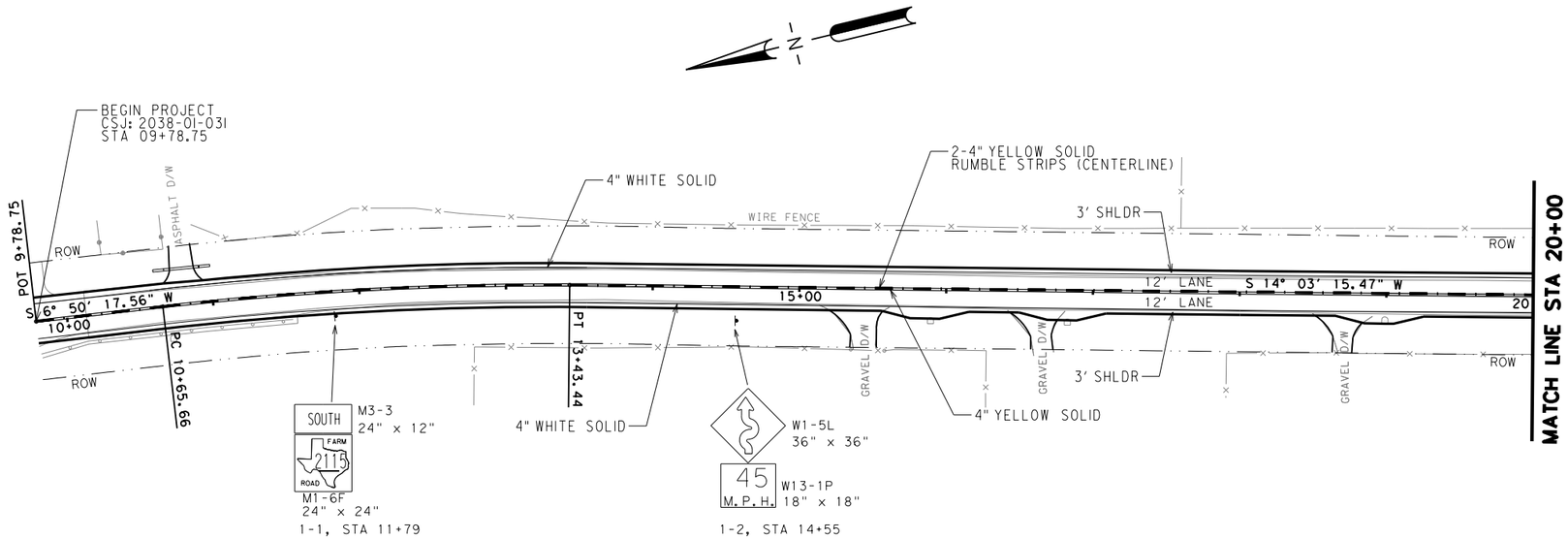
PRECAST SAFETY END TREATMENT
TYPE II
RIPRAP DETAILS

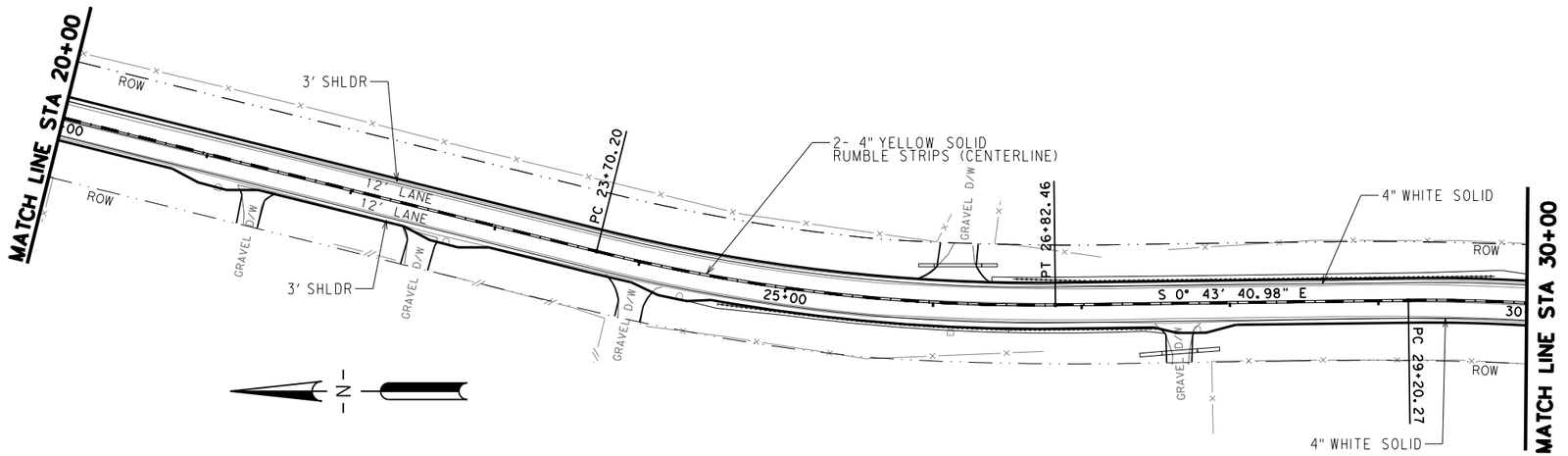
PSET-RR

FILE: psetrrse-20.dgn	DN: GAF	CK: TxDOT	DW: JRP	CK: GAF
©TxDOT February 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		163

NOTES:

SEE EXISTING PROJECT LAYOUTS FOR TREATMENT OF EXISTING SIGNS DURING CONSTRUCTION.





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Bradley Mayes 8/28/2021

SIGNATURE OF REGISTRANT & DATE

SIGNING & PAVEMENT MARKING LAYOUTS

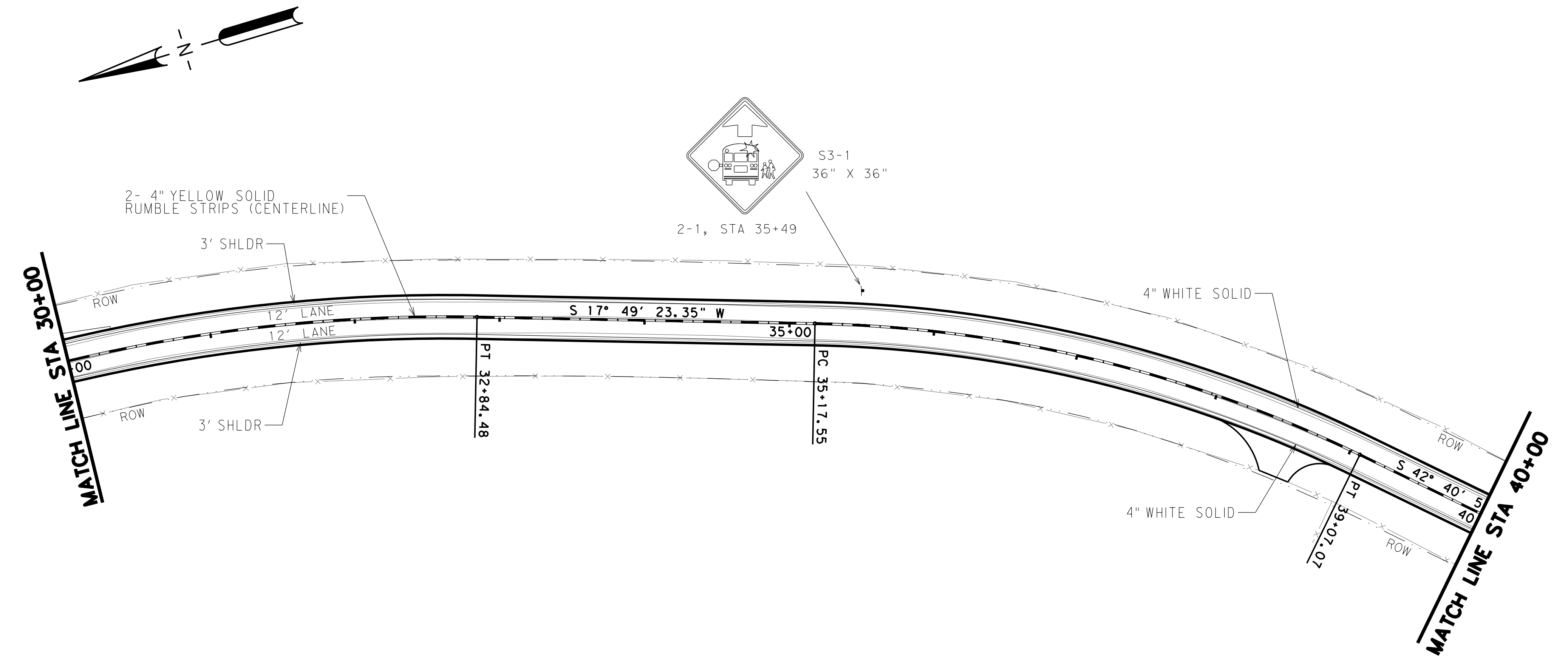
SCALE: 1" = 100' HORIZ. FEET

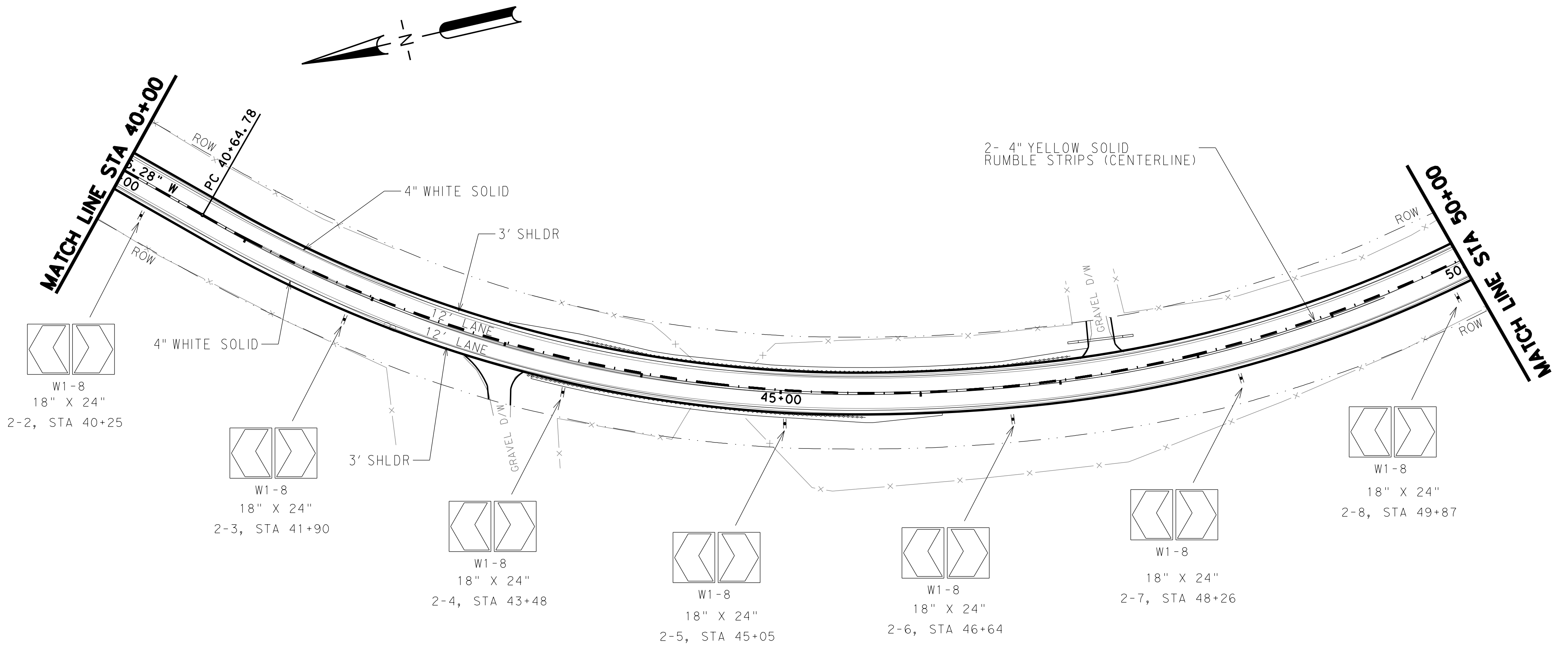
SHEET 10F 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		164

NOTES:

SEE EXISTING PROJECT LAYOUTS FOR TREATMENT OF EXISTING SIGNS DURING CONSTRUCTION.





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SIGNING & PAVEMENT MARKING LAYOUTS

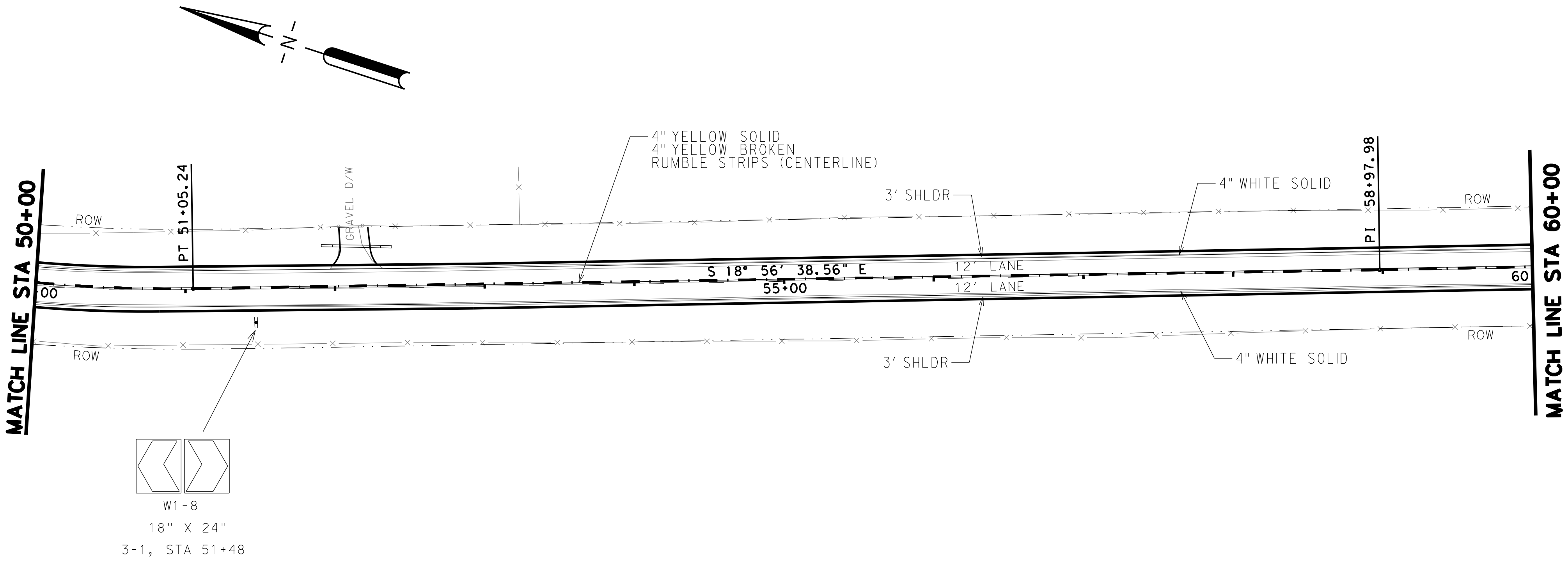
SCALE: FEET
1" = 100' HORIZ.

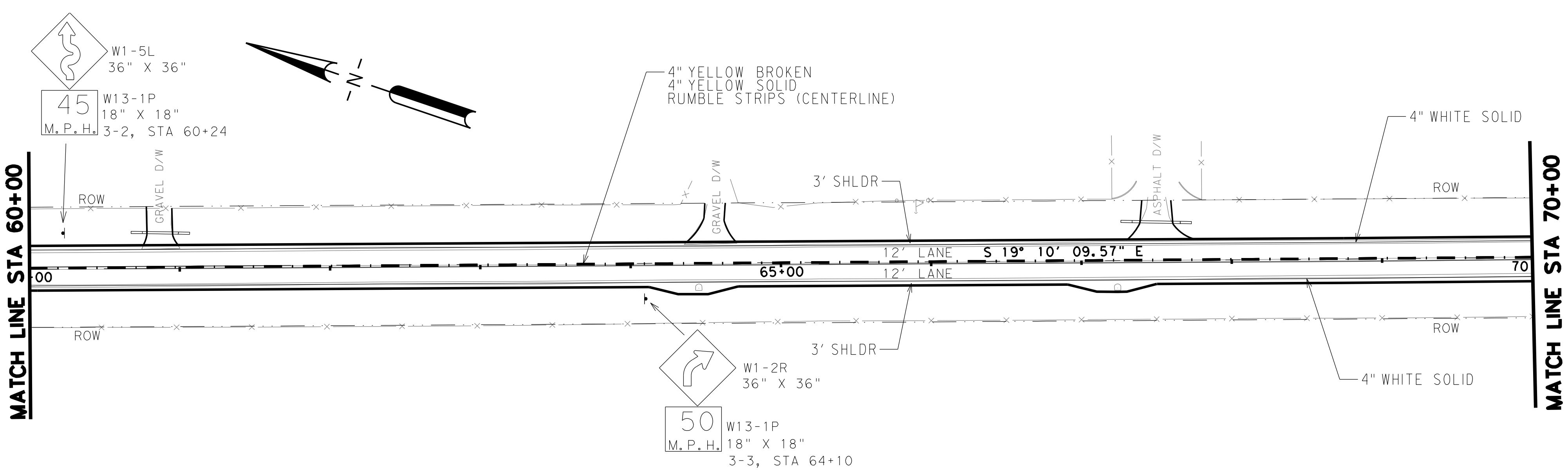
SHEET 2 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		165

NOTES:

SEE EXISTING PROJECT LAYOUTS FOR TREATMENT OF EXISTING SIGNS DURING CONSTRUCTION.





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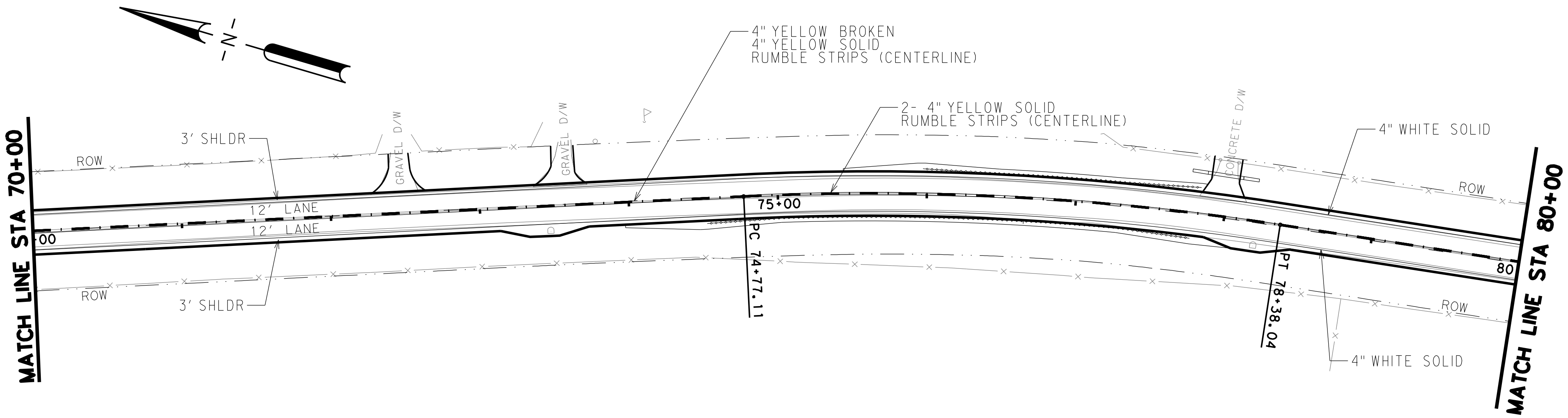
SCALE: FEET 1" = 100' HORIZ.

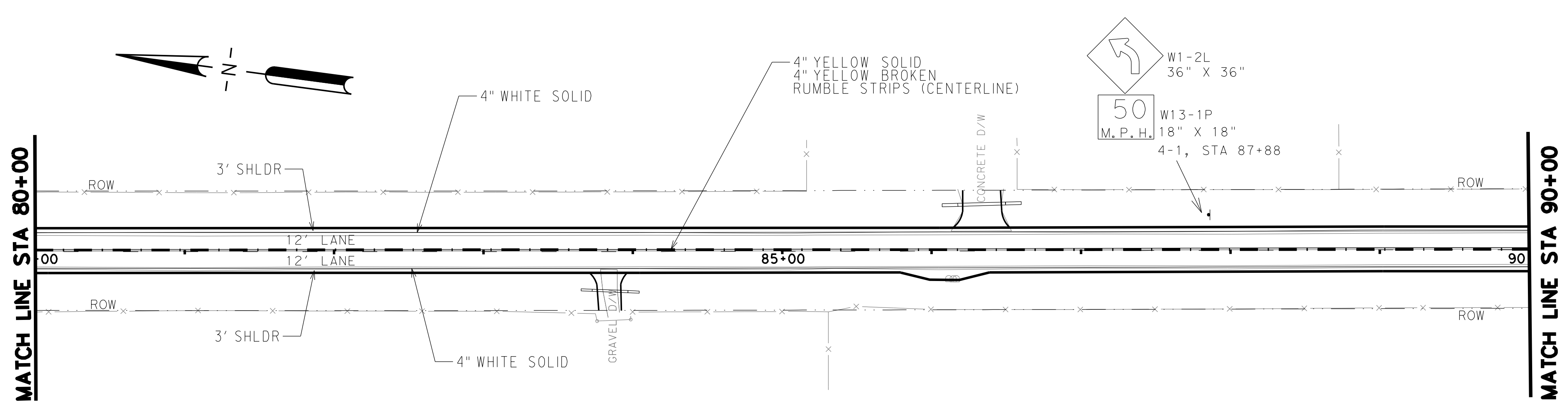
SHEET 3 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		166

NOTES:

SEE EXISTING PROJECT LAYOUTS FOR TREATMENT OF EXISTING SIGNS DURING CONSTRUCTION.





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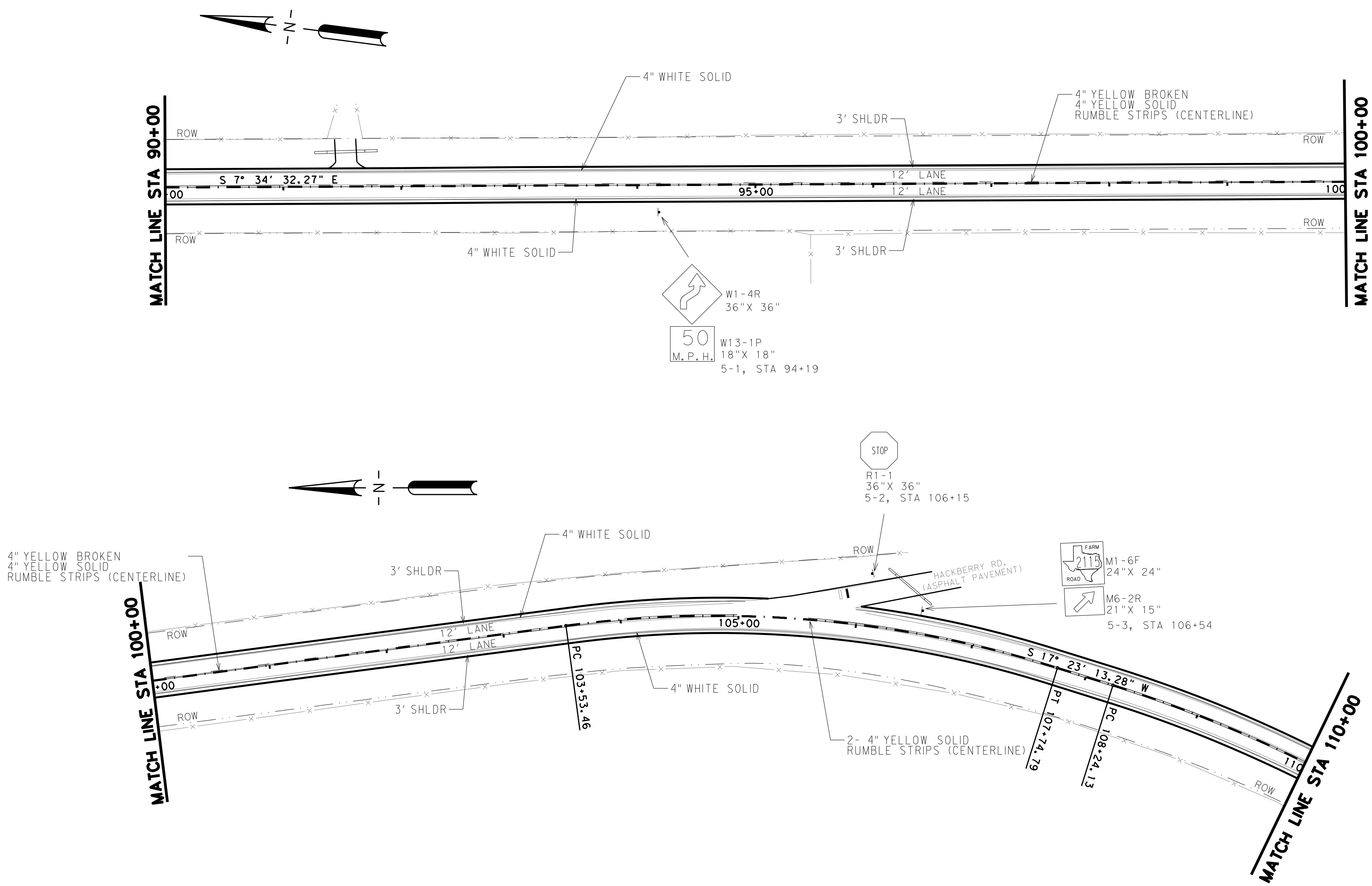
SCALE: FEET 1" = 100' HORIZ.

SHEET 4 OF 15

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		167

NOTES:

SEE EXISTING PROJECT LAYOUTS FOR TREATMENT OF EXISTING SIGNS DURING CONSTRUCTION.



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CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	168

NOTES:

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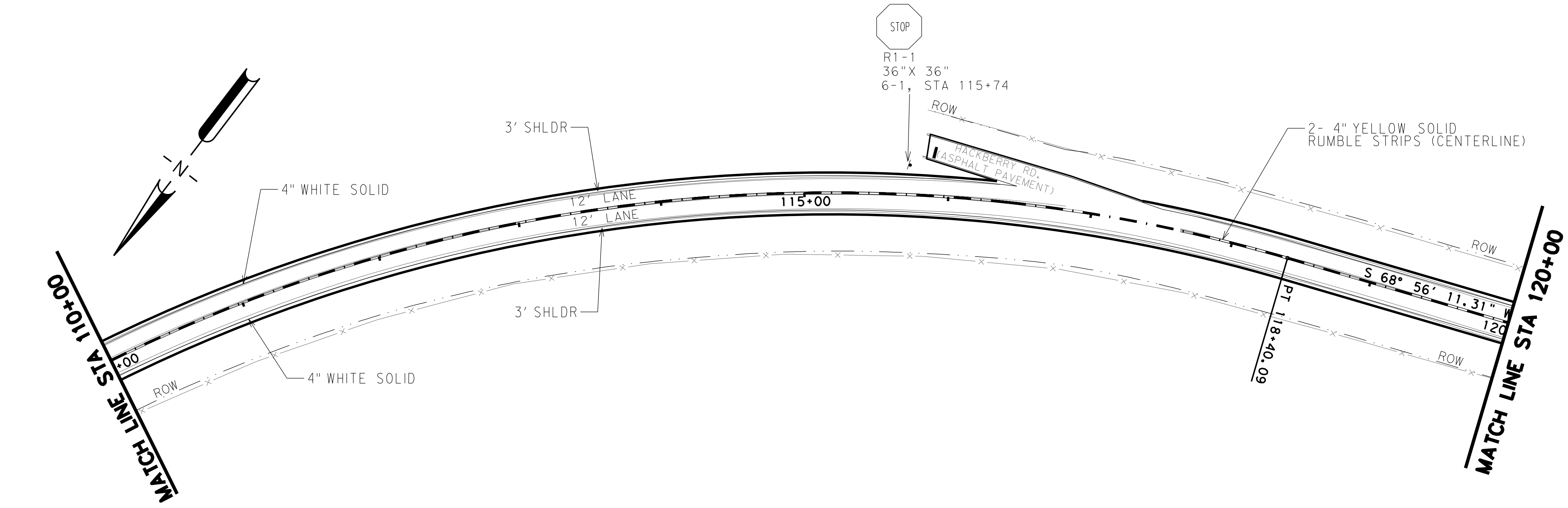

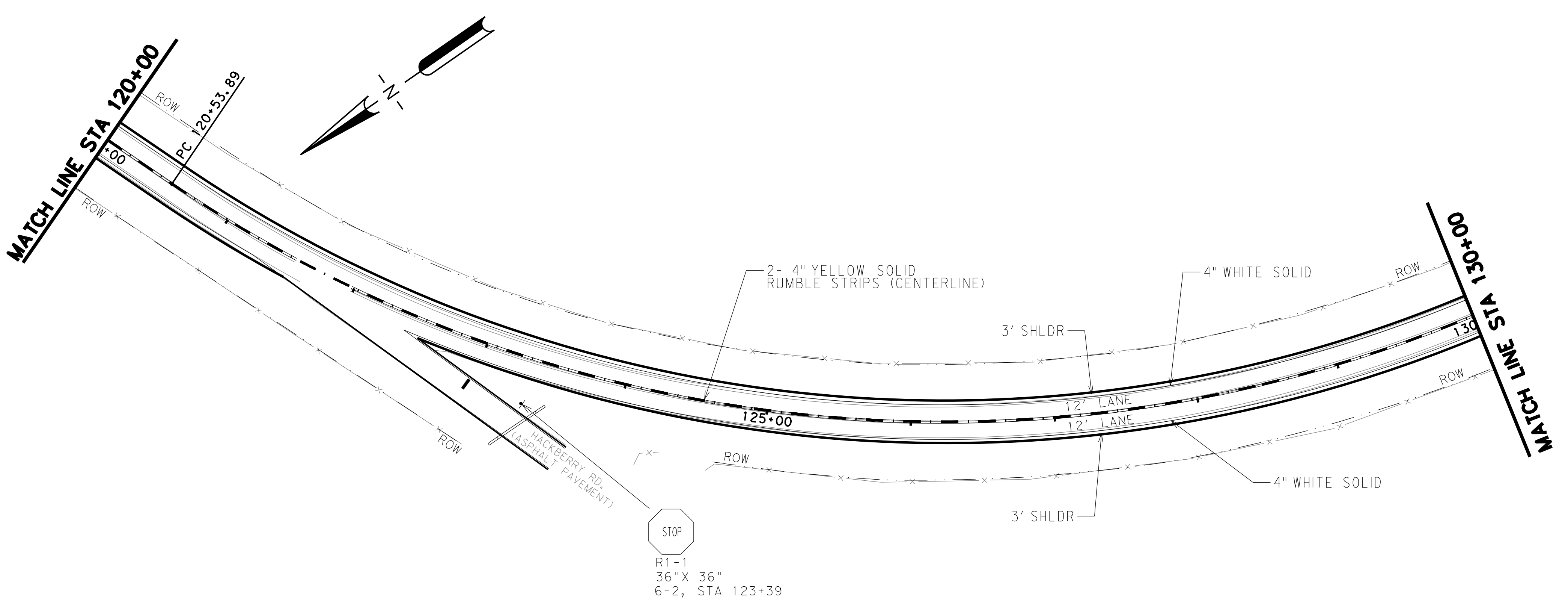

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SHEET 6 OF 15

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	169

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NODE

NOTES:

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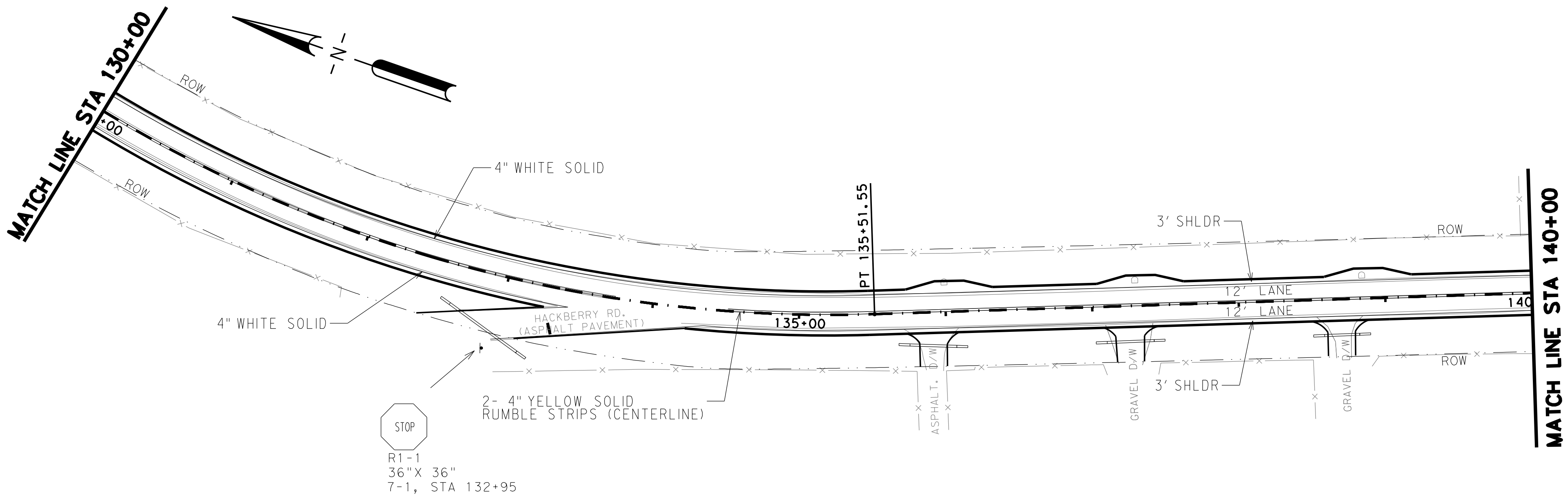

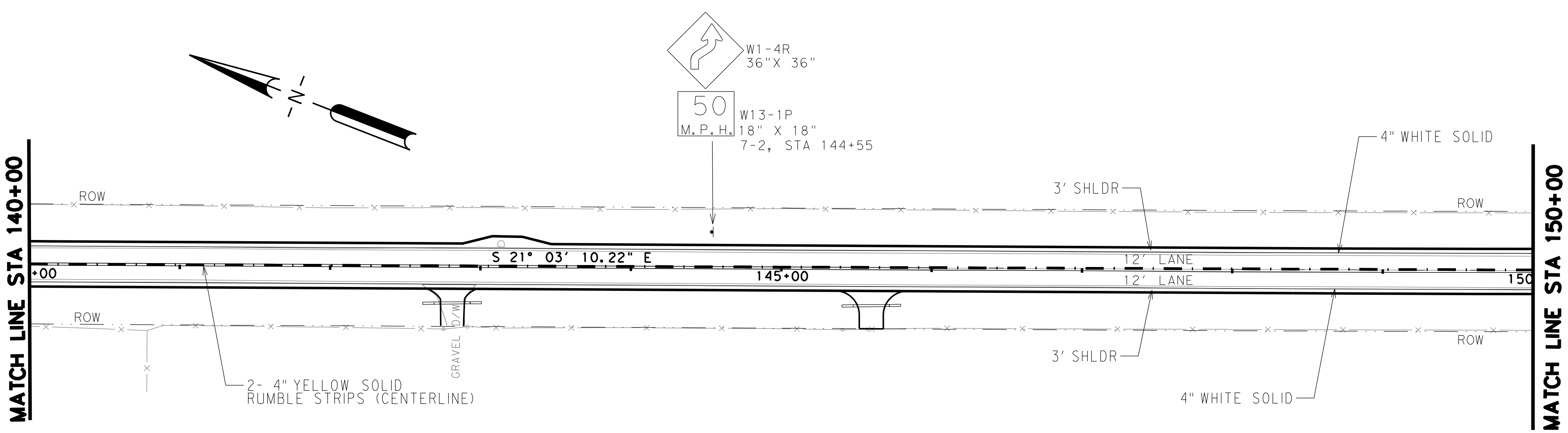

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SHEET 7 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
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	STATE	DIST	COUNTY		SHEET NO.
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NODE

NOTES:

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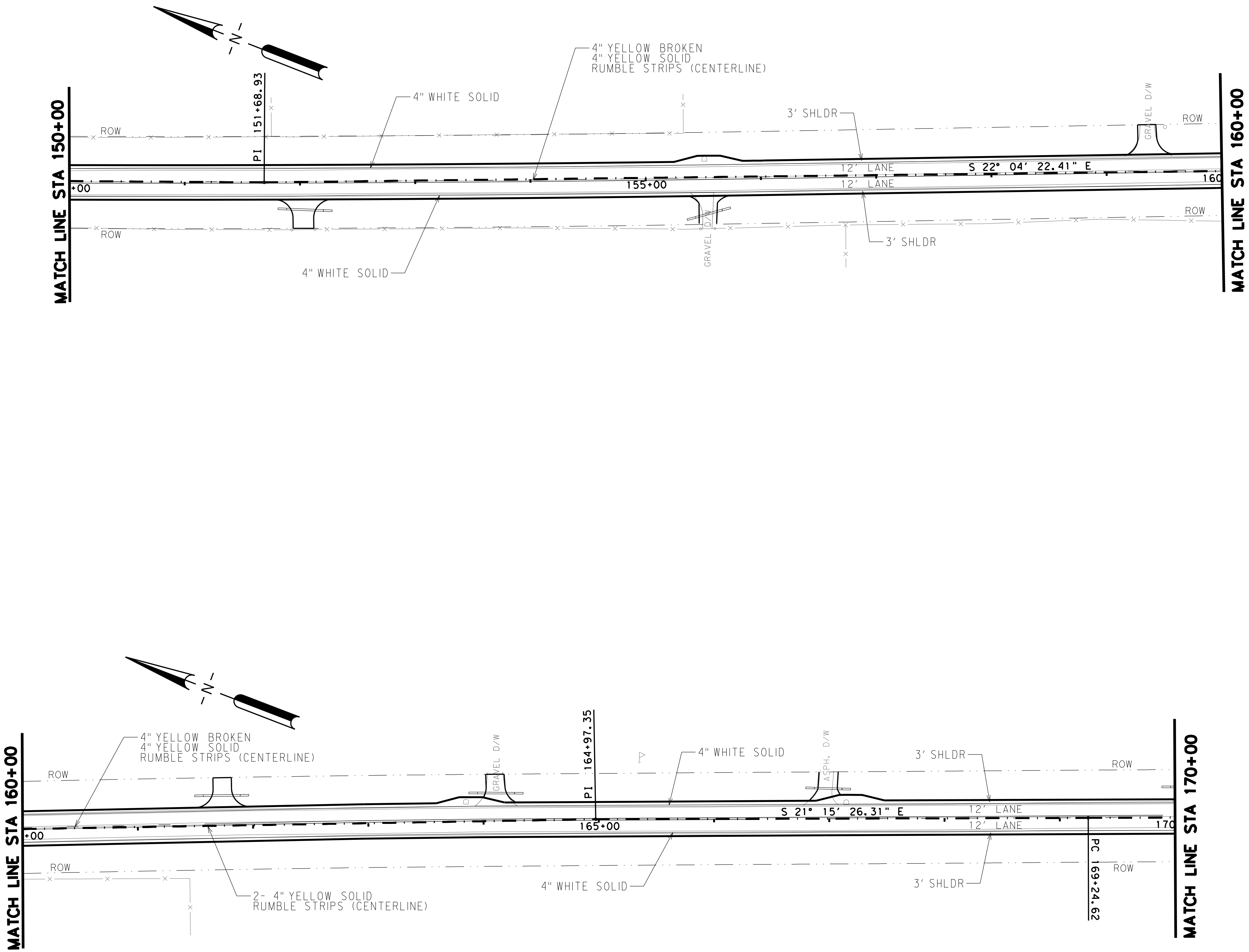

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SHEET 8 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
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	TEXAS	WAC	BELL		171

NOTES:

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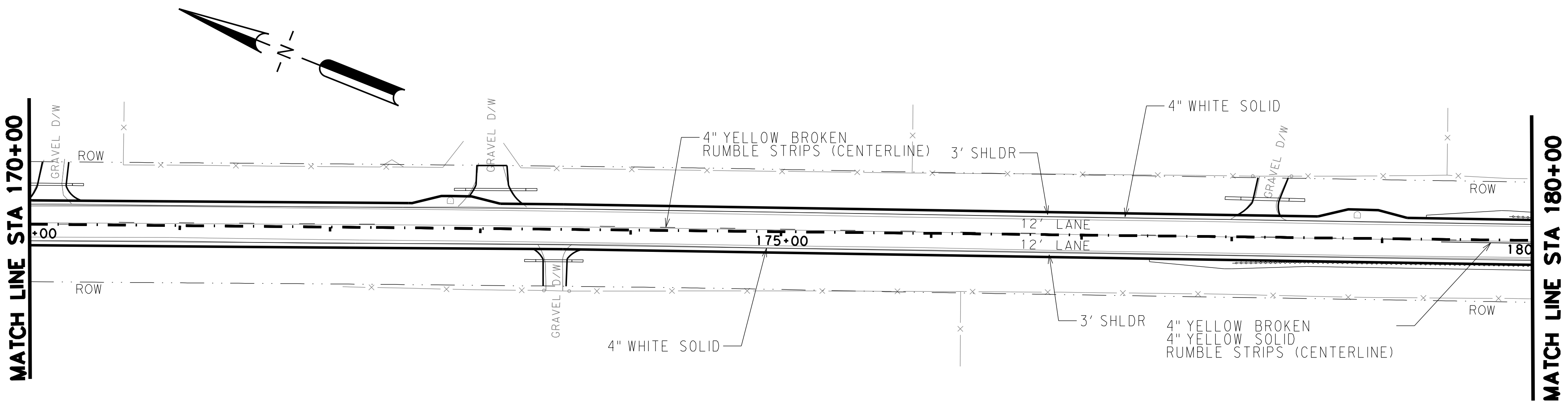

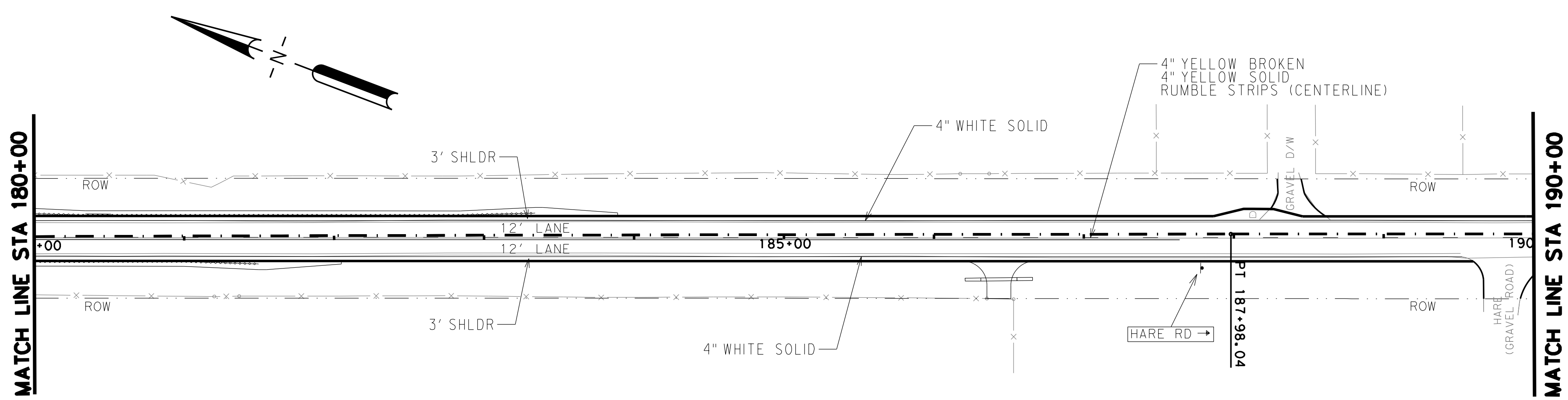

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SHEET 9 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		172

NOTES:

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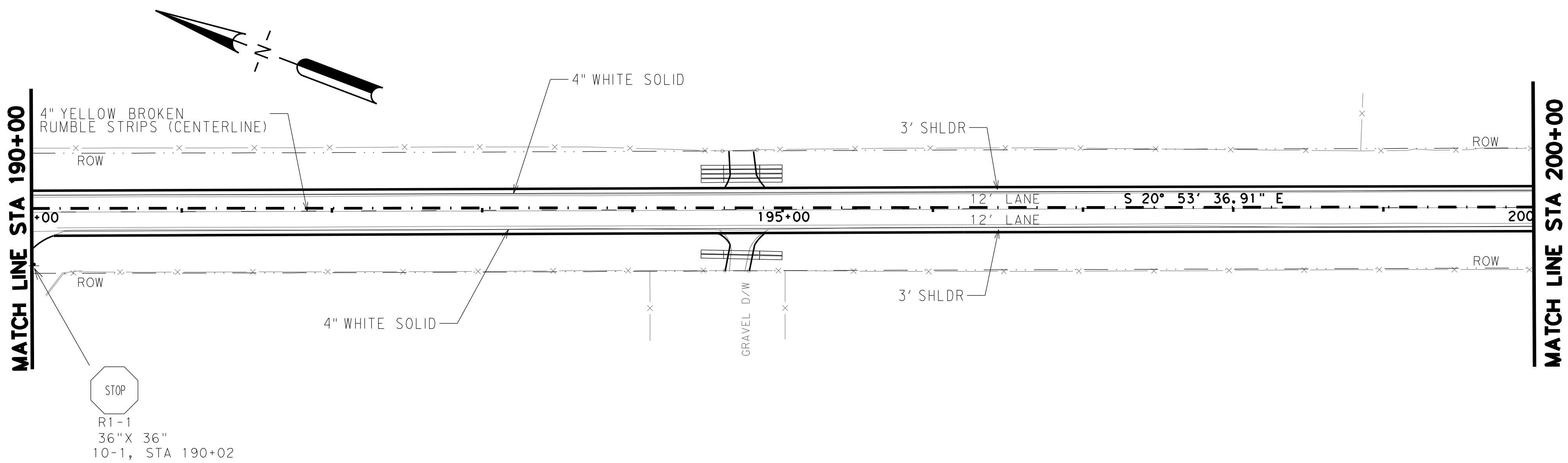

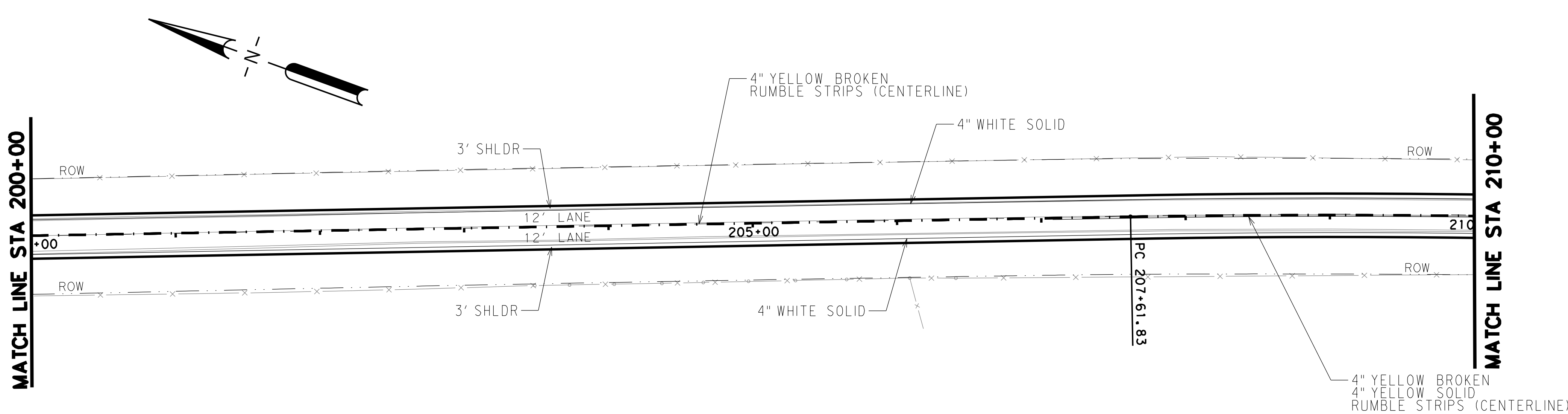

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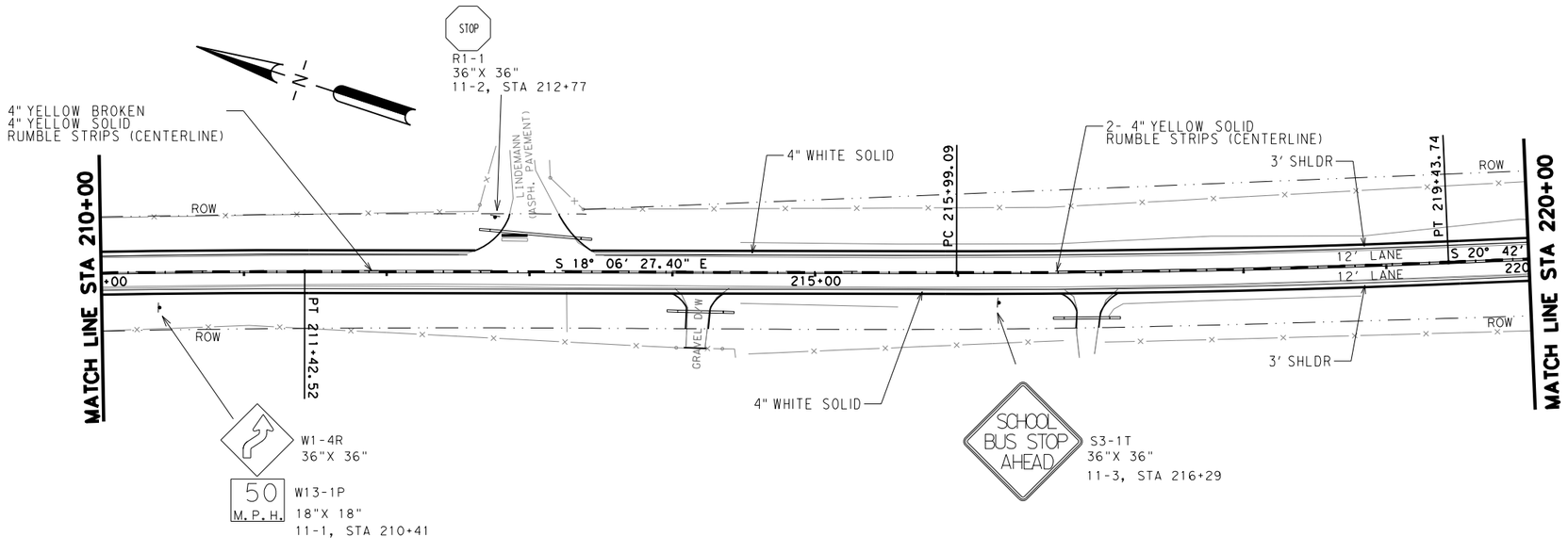
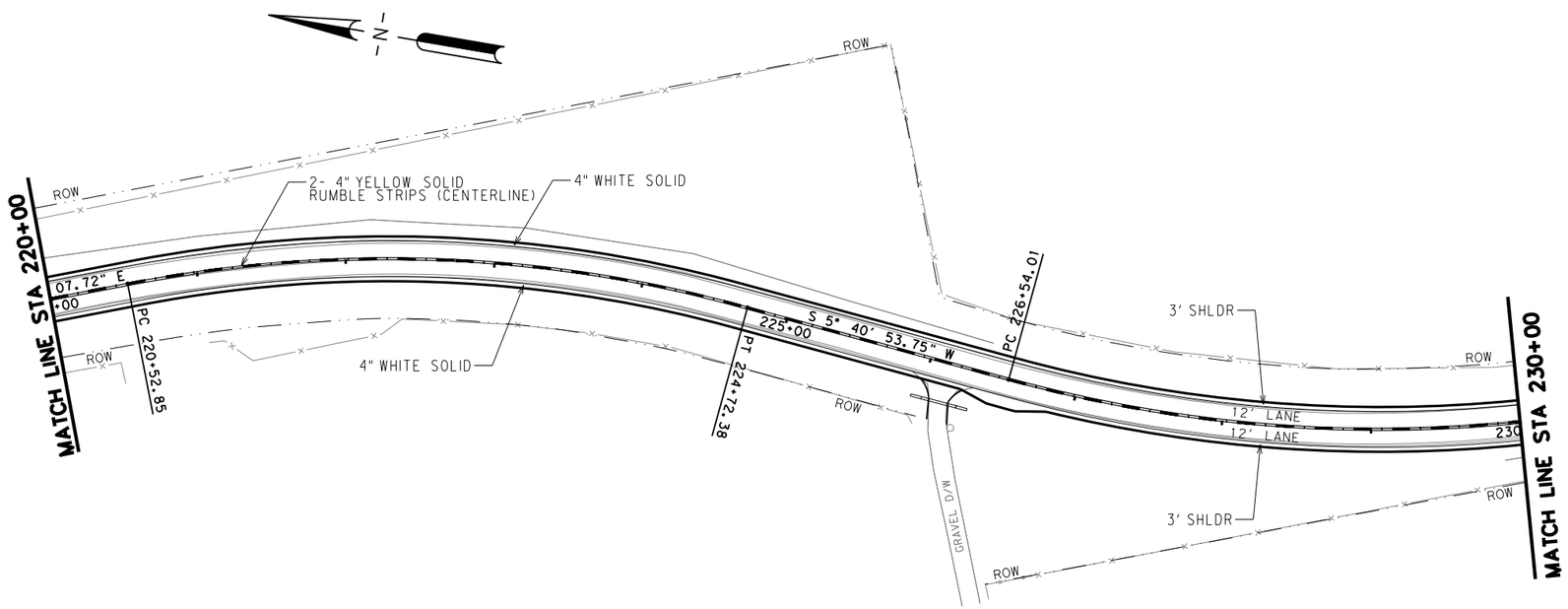
SHEET 10 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		173

NOTES:

SEE EXISTING PROJECT LAYOUTS FOR TREATMENT OF EXISTING SIGNS DURING CONSTRUCTION.





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SIGNING & PAVEMENT MARKING LAYOUTS

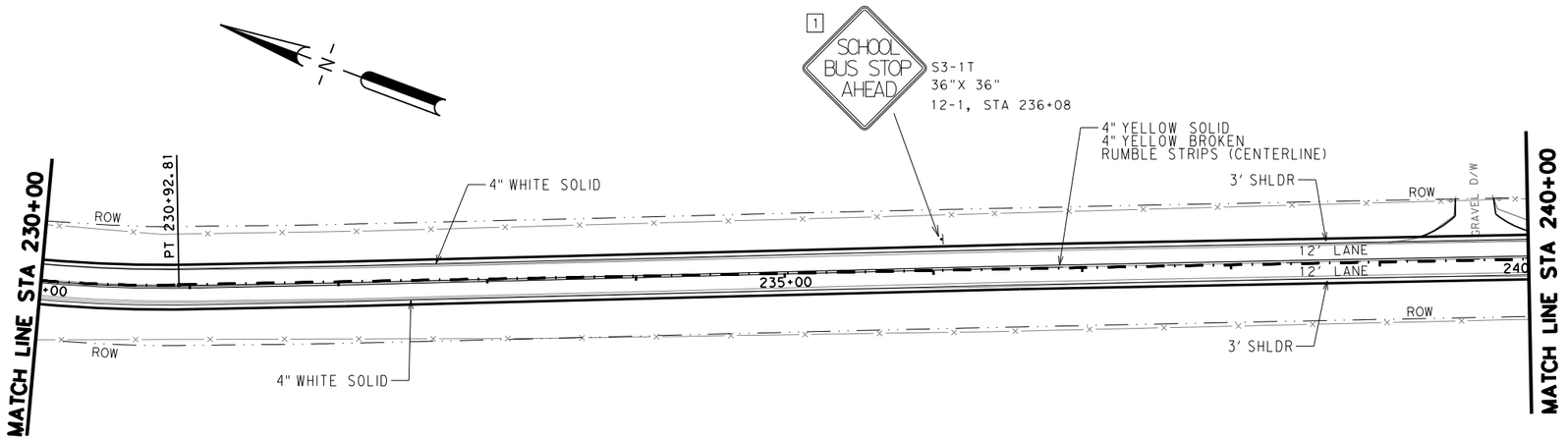
SCALE: 1" = 100' HORIZ. FEET

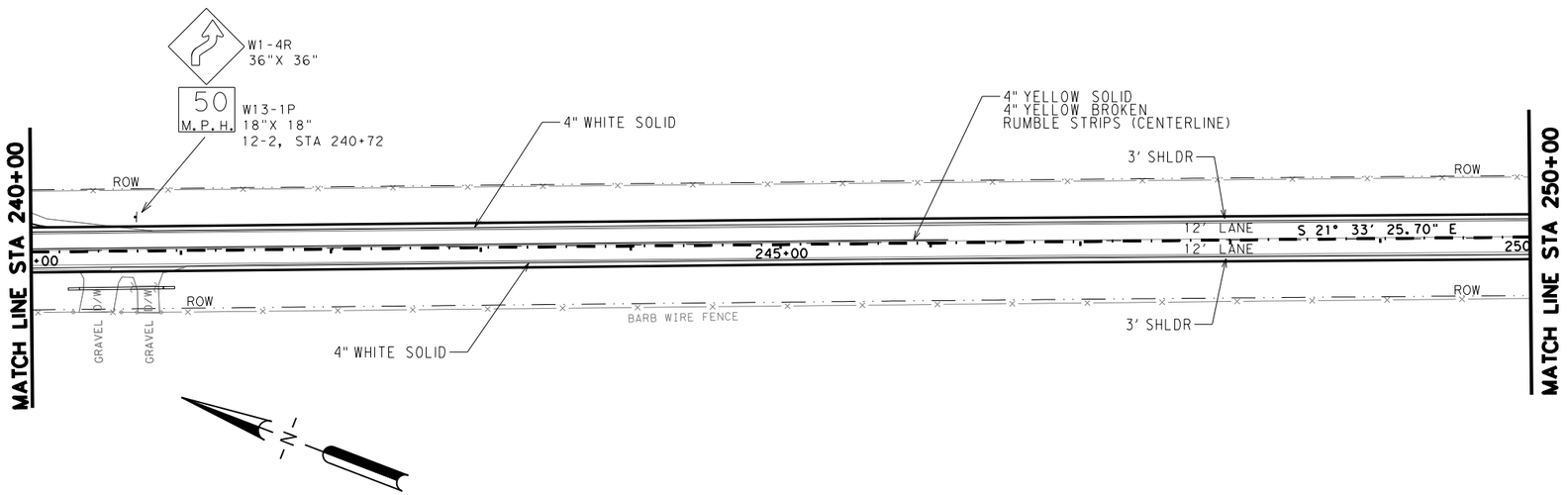
SHEET 11 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		174

NOTES:

SEE EXISTING PROJECT LAYOUTS FOR TREATMENT OF EXISTING SIGNS DURING CONSTRUCTION.





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SIGNING & PAVEMENT MARKING LAYOUTS

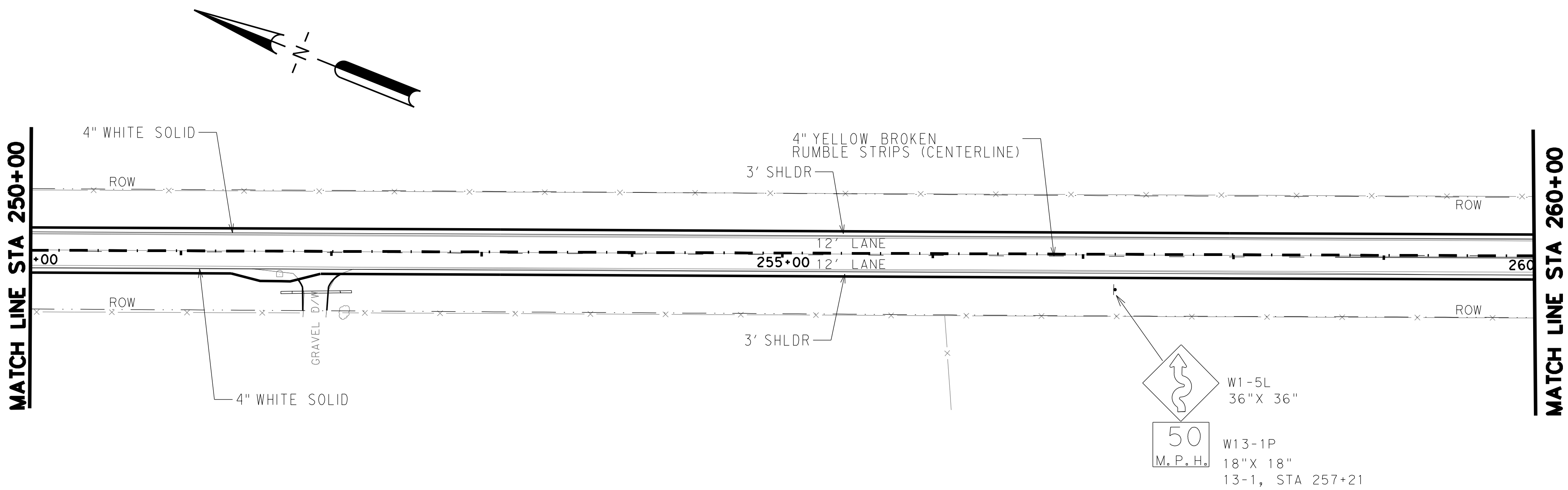
SCALE: 1" = 100' HORIZ. FEET

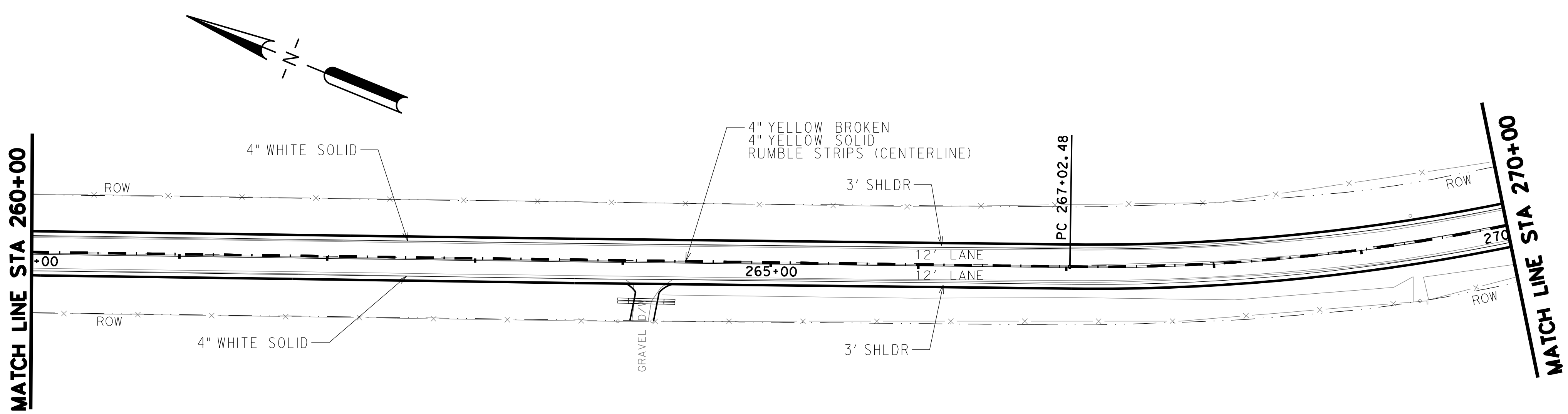
SHEET 12 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		175

NOTES:

SEE EXISTING PROJECT LAYOUTS FOR TREATMENT OF EXISTING SIGNS DURING CONSTRUCTION.





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SIGNING & PAVEMENT MARKING LAYOUTS

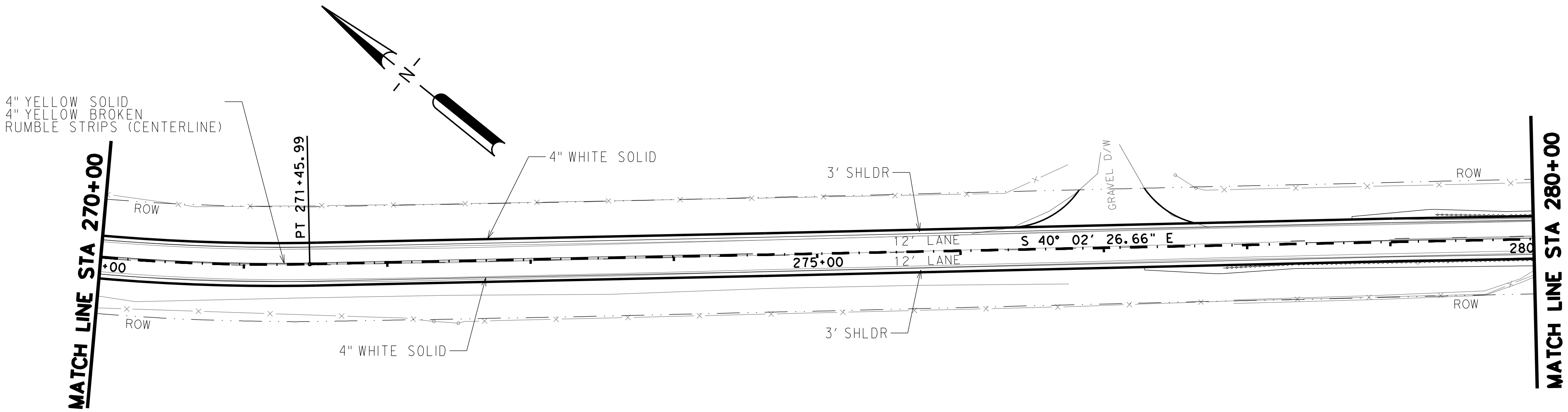
SCALE: FEET
1" = 100' HORIZ.

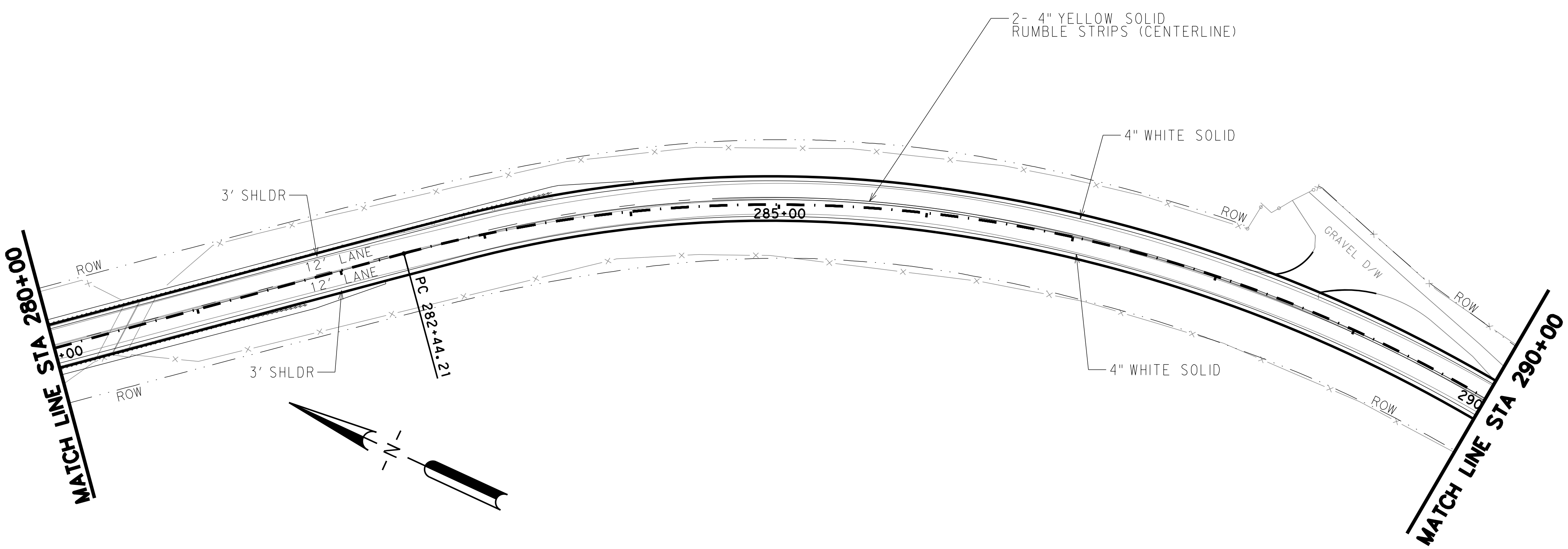
SHEET 13 OF 15

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	176

NOTES:

SEE EXISTING PROJECT LAYOUTS FOR TREATMENT OF EXISTING SIGNS DURING CONSTRUCTION.





STATE OF TEXAS
BRADLEY MAYES
128276
LICENSED
PROFESSIONAL ENGINEER

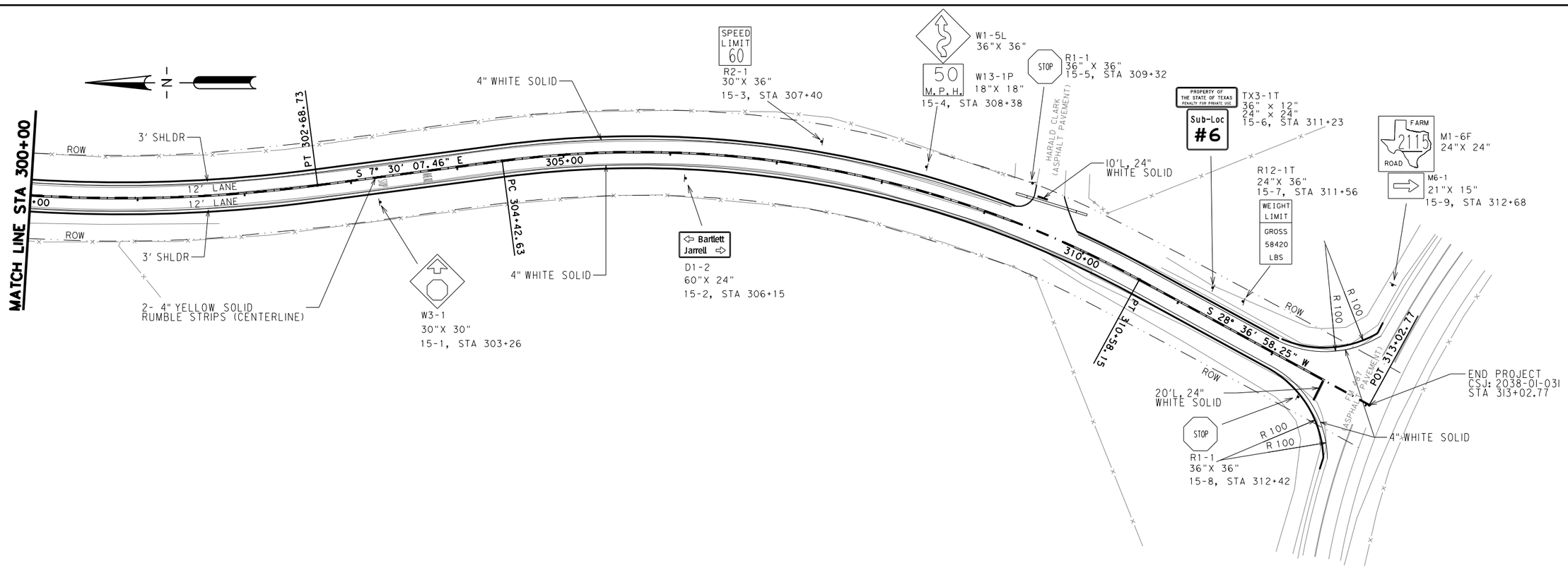
8/28/2021
SIGNATURE OF REGISTRANT & DATE

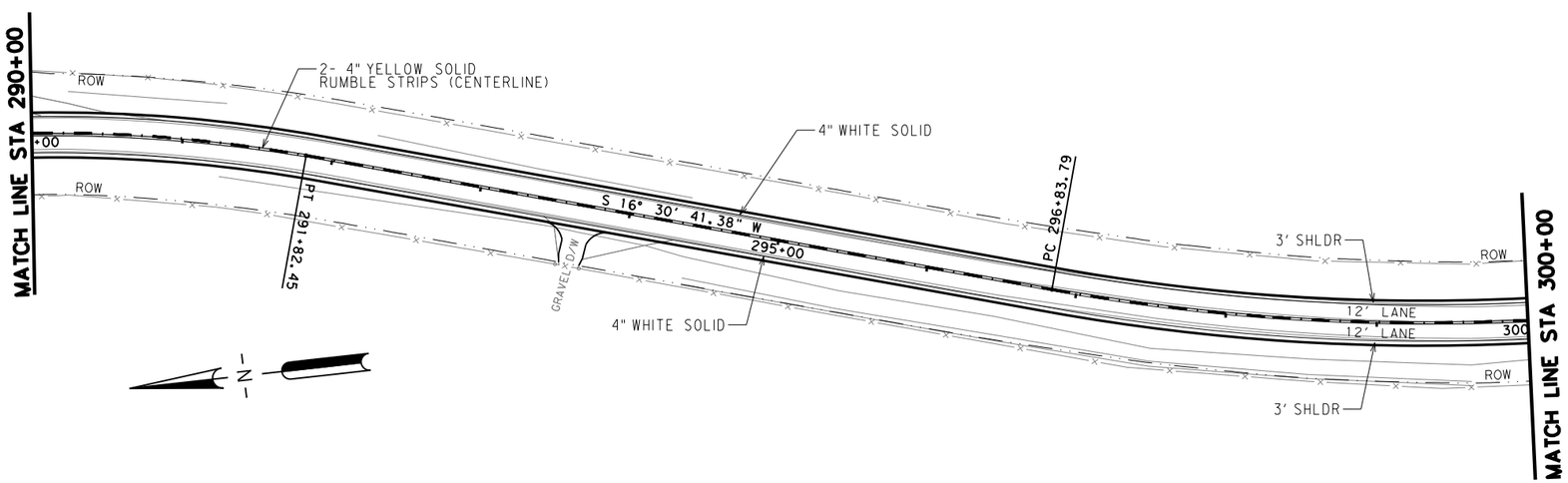
SIGNING & PAVEMENT MARKING LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 14 OF 15

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	177





NOTES:

SEE EXISTING PROJECT LAYOUTS FOR TREATMENT OF EXISTING SIGNS DURING CONSTRUCTION.

STATE OF TEXAS
BRADLEY MAYES
128276
LICENSED
PROFESSIONAL ENGINEER

Bradley Mayes 8/28/2021

SIGNATURE OF REGISTRANT & DATE

SIGNING & PAVEMENT MARKING LAYOUTS

SCALE: 1" = 100' HORIZ. FEET

SHEET 15 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		178

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DATE:
FILE:

SUMMARY OF SMALL SIGNS

SMA RD SGN ASSM TY XXXXX (X) XX (X-XXXX)

PLAN SHEET NO.	SIGN NO.	SIGN DESIGNATION	SIGN CONTENT	SIGN DIMENSIONS (See above Note)	ALUMINUM TYPE A	ALUMINUM TYPE G	Post Type: FRP = Fiberglass TWT = Thin-wall 10BWG = 10 BWG S80 = Sched 80	Posts (1 or 2)	Anchor Type: UA = Univer-Conc UB = Univer-Bolt SA = Slip-Conc SB = Slip-Bolt WS = Wedge Steel WP = Wedge	Mounting Designation: P = Prefb. "Plain" T = Prefab. "T" U = Prefab. "U"	1EXT or 2EXT = # of Ext. BM = Extruded Beam WC = 1.12 #/ft Wing Chan. EXAL = Extruded Alum. Signs	BRIDGE MOUNT CLEARANCE SIGNS: TY N = Type N TY S = Type S
1 OF 15												
	1	M3-3	SOUTH FARM 2115 ROAD	24 x 12			TWT	1	WS	P		
		M1-6F		24 x 24								
	2	W1-5L	45 M.P.H.	36 x 36								
		W13-1P		18 x 18			TWT	1	WS	P		
2 OF 15												
	1	S3-1		36 X 36			TWT	1	WS	P		
	2	W1-8R		18 x 24			TWT	1	WS	P		
		W1-8L		18 x 24								
	3	W1-8R		18 x 24			TWT	1	WS	P		
		W1-8L		18 x 24								
	4	W1-8R		18 x 24			TWT	1	WS	P		
		W1-8L		18 x 24								
	5	W1-8R		18 x 24			TWT	1	WS	P		
		W1-8L		18 x 24								
	6	W1-8R		18 x 24			TWT	1	WS	P		
		W1-8L		18 x 24								
	7	W1-8R		18 x 24			TWT	1	WS	P		
		W1-8L		18 x 24								
	8	W1-8R		18 x 24			TWT	1	WS	P		
		W1-8L		18 x 24								
3 OF 15												
	1	W1-8R		18 x 24			TWT	1	WS	P		
		W1-8L		18 x 24								
	2	W1-5L	45 M.P.H.	36 x 36			TWT	1	WS	P		
		W13-1P		18 x 18								

ALUMINUM SIGN BLANKS THICKNESS	
Square Feet	Minimum Thickness
Less than 7.5	0.080"
7.5 to 15	0.100"
Greater than 15	0.125"

The Standard Highway Sign Designs for Texas (SHSD) can be found at the following website.

http://www.txdot.gov/

NOTE:

1. Sign supports shall be located as shown on the plans, except that the Engineer may shift the sign supports, within design guidelines, where necessary to secure a more desirable location or to avoid conflict with utilities. Unless otherwise shown on the plans, the Contractor shall stake and the Engineer will verify all sign support locations.
2. For installation of bridge mount clearance signs, see Bridge Mounted Clearance Sign Assembly (BMCS)Standard Sheet.
3. For Sign Support Descriptive Codes, see Sign Mounting Details Small Roadside Signs General Notes & Details SMD(GEN).

Texas Department of Transportation

Traffic Operations Division Standard

SUMMARY OF SMALL SIGNS

SOSS

FILE: sums16.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT May 1987	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
4-16	DIST	COUNTY		SHEET NO.
8-16	WAC	BELL		179

TB

SUMMARY OF SMALL SIGNS

PLAN SHEET NO.	SIGN NO.	SIGN DESIGNATION	SIGN CONTENT	SIGN DIMENSIONS (See above Note)	ALUMINUM TYPE A	ALUMINUM TYPE G	SMA RD SGN ASSM TY XXXXX (X) XX (X-XXXX) Post Type: FRP = Fiberglass, TWT = Thin-wall, 10BWG = 10 BWG, S80 = Sched 80	Posts (1 or 2)	Anchor Type: UA = Univer-Conc, UB = Univer-Bolt, SA = Slip-Conc, SB = Slip-Bolt, WS = Wedge Steel, WP = Wedge	Mounting Designation: P = Prefb. "Plain" T = Prefab. "T" U = Prefab. "U"	1EXT or 2EXT = # of Ext., BM = Extruded Beam, WC = 1.12 #/ft Wing Chan., EXAL = Extruded Alum. Signs	BRIDGE MOUNT CLEARANCE SIGNS: TY N = Type N, TY S = Type S
3 OF 15												
	3	W1-2R		36 x 36								
		W13-1P		18 x 18			TWT	1	WS	P		
4 OF 15												
	1	W1-2L		36 x 36								
		W13-1P		18 x 18			TWT	1	WS	P		
5 OF 15												
	1	W1-4R		36 x 36								
		W13-1P		18 x 18			TWT	1	WS	P		
	2	R1-1		36 x 36			TWT	1	WS	P		
	3	M1-6F		24 x 24			TWT	1	WS	P		
		M6-2R		21 x 15								
6 of 15												
	1	R1-1		36 x 36			TWT	1	WS	P		
	2	R1-1		36 x 36			TWT	1	WS	P		
7 of 15												
	1	R1-1		36 x 36			TWT	1	WS	P		
	2	W1-4R		36 x 36								
		W13-1P		18 x 18			TWT	1	WS	P		
10 OF 15												
	1	R1-1		36 x 36			TWT	1	WS	P		
11 OF 15												
	1	W1-4R		36 x 36								
		W13-1P		18 x 18			TWT	1	WS	P		
	2	R1-1		36 x 36			TWT	1	WS	P		

ALUMINUM SIGN BLANKS THICKNESS	
Square Feet	Minimum Thickness
Less than 7.5	0.080"
7.5 to 15	0.100"
Greater than 15	0.125"

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NOTE:

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2. For installation of bridge mount clearance signs, see Bridge Mounted Clearance Sign Assembly (BMCS)Standard Sheet.
3. For Sign Support Descriptive Codes, see Sign Mounting Details Small Roadside Signs General Notes & Details SMD(GEN).

DATE:
FILE:

Texas Department of Transportation

Traffic Operations Division Standard

SUMMARY OF SMALL SIGNS

SOSS

FILE: sums16.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT May 1987	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
4-16	DIST	COUNTY		SHEET NO.
8-16	WAC	BELL		180

DATE:
FILE:

SUMMARY OF SMALL SIGNS

SMA RD SGN ASSM TY XXXXX (X) XX (X-XXXX)
Post Type — Anchor Type — Mounting Designation

PLAN SHEET NO.	SIGN NO.	SIGN DESIGNATION	SIGN CONTENT	SIGN DIMENSIONS (See above Note)	ALUMINUM TYPE A	ALUMINUM TYPE G	FRP = Fiberglass TWT = Thin-wall 10BWG = 10 BWG S80 = Sched 80	Posts (1 or 2)	UA = Univer-Conc UB = Univer-Bolt SA = Slip-Conc SB = Slip-Bolt WS = Wedge Steel WP = Wedge	P = Prefb. "Plain" T = Prefab. "T" U = Prefab. "U"	1EXT or 2EXT = # of Ext. BM = Extruded Beam WC = 1.12 #/ft Wing Chan. EXAL = Extruded Alum. Signs	BRIDGE MOUNT CLEARANCE SIGNS TY N = Type N TY S = Type S
11 OF 15												
	3	S3-1T	SCHOOL BUS STOP AHEAD	36 x 36			TWT	1	WS	P		
12 OF 15												
	1	S3-1T	SCHOOL BUS STOP AHEAD	36 x 36			TWT	1	WS	P		
	2	W1-4R		36 x 36								
		W13-1P	50 M.P.H.	18 x 18			TWT	1	WS	P		
13 OF 15												
	1	W1-5L		36 x 36								
		W13-1P	50 M.P.H.	18 x 18			TWT	1	WS	P		
15 OF 15												
	1	W3-1		30 x 30			TWT	1	WS	P		
	2	D1-2	Bartlett Jarrell	60 x 24			TWT	1	WS	P		
	3	R2-1	SPEED LIMIT 60	30 x 36			TWT	1	WS	P		
	4	W1-5L		36 x 36								
		W13-1P	50 M.P.H.	18 x 18			TWT	1	WS	P		
	5	R1-1	STOP	36 x 36			TWT	1	WS	P		
	6	TX3-1T	PROPERTY OF THE STATE OF TEXAS FINALTY FOR PRIVATE USE Sub-Loc #6	36" X 12" 24" X 24"			TWT	1	WS	P		
	7	R12-1T	WEIGHT LIMIT GROSS 58420 LBS	24 x 36			TWT	1	WS	P		
	8	R1-1	STOP	36 x 36			TWT	1	WS	P		
	9	M1-6F	FARM 2115 ROAD	24 x 24								
		M6-1		21 x 15			TWT	1	WS	P		

ALUMINUM SIGN BLANKS THICKNESS	
Square Feet	Minimum Thickness
Less than 7.5	0.080"
7.5 to 15	0.100"
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3. For Sign Support Descriptive Codes, see Sign Mounting Details Small Roadside Signs General Notes & Details SMD(GEN).

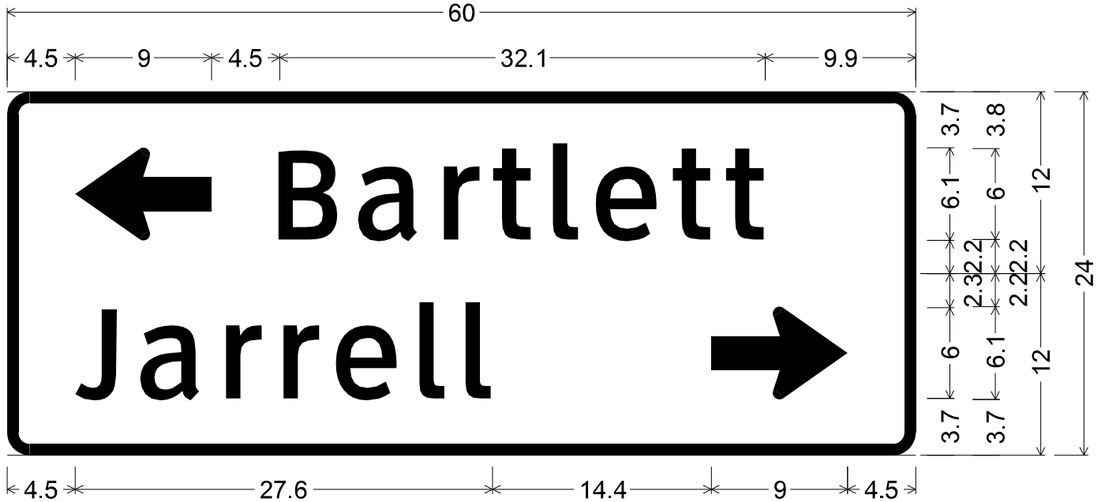
Texas Department of Transportation

Traffic Operations Division Standard

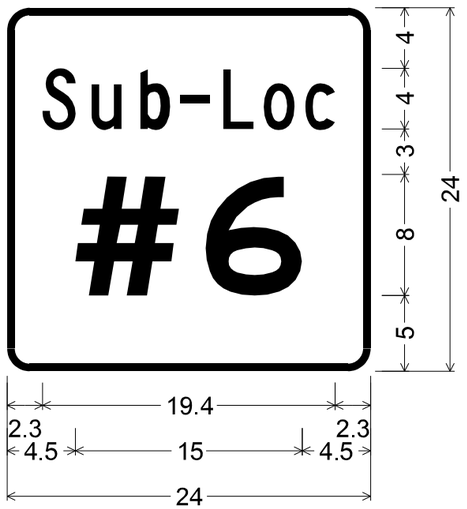
SUMMARY OF SMALL SIGNS

SOSS

FILE: sums16.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT May 1987	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-16 8-16	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		18



Identifier : D1-2 6in LT-RT;
1.5" Radius, 0.8" Border, White on Green;
Standard Arrow Custom 9.0" X 6.1" 180°; [Bartlett] ClearviewHwy-3-W;
1.5" Radius, 0.8" Border, White on Green;
[Jarrell] ClearviewHwy-3-W; Standard Arrow Custom 9.0" X 6.1" 0°;



Identifier : M5-5G_24x18;
1.5" Radius, 0.5" Border, White on Green;
[Sub-Loc] C; [#6] E;

STATE OF TEXAS
BRADLEY MAYES
128276
LICENSED
PROFESSIONAL ENGINEER

Bradley Mayes 8/28/2021
SIGNATURE OF REGISTRANT & DATE

SMALL SIGN DETAILS

SCALE: FEET
1" = 100' HORIZ.

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		182

DATE: 8/28/2021 5:44:00 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\203801031\4 - Design\Plan Set\8. Traffic\Standards\smdgen.dgn

SIGN SUPPORT DESCRIPTIVE CODES

(Descriptive Codes correspond to project estimate and quantities sheets)

SM RD SGN ASSM TY XXXXX(X)XX(X-XXXX)

Post Type
- FRP = Fiberglass Reinforced Plastic Pipe (see SMD(FRP))
- TWT = Thin-Walled Tubing (see SMD(TWT))
- 10BWG = 10 BWG Tubing (see SMD(SLIP-1) to (SLIP-3))
- S80 = Schedule 80 Pipe (see SMD(SLIP-1) to (SLIP-3))

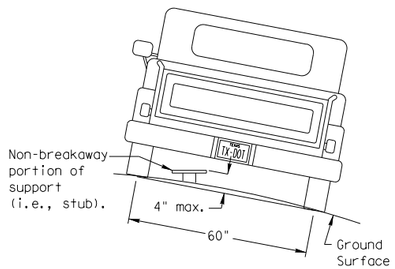
Number of Posts (1 or 2)

Anchor Type
- UA = Universal Anchor - Concreted (see SMD(FRP) and (TWT))
- UB = Universal Anchor - Bolted down (see SMD(FRP) and (TWT))
- WS = Wedge Anchor Steel - (see SMD(TWT))
- WP = Wedge Anchor Plastic (see SMD(TWT))
- SA = Slipbase - Concreted (see SMD(SLIP-1) to (SLIP-3))
- SB = Slipbase - Bolted Down (see SMD(SLIP-1) to (SLIP-3))

Sign Mounting Designation
- P = Prefab. "Plain" (see SMD(SLIP-1) to (SLIP-3), (TWT), (FRP))
- T = Prefab. "T" (see SMD(SLIP-1) to (SLIP-3), (TWT))
- U = Prefab. "U" (see SMD(SLIP-1) to (SLIP-3))

IF REQUIRED
- 1EXT or 2EXT = Number of Extensions (see SMD(SLIP-1) to (SLIP-3), (TWT))
- BM = Extruded Wind Beam (see SMD(SLIP-1) to (SLIP-3))
- WC = 1.12 #/ft Wing Channel (see SMD(SLIP-1) to (SLIP-3))
- EXAL = Extruded Aluminum Sign Panels (see SMD(SLIP-3))

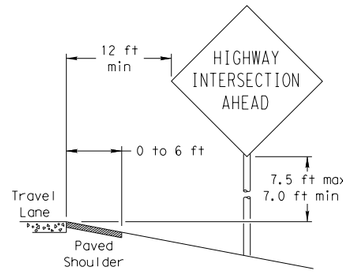
REQUIRED CLEARANCE FOR BREAKAWAY SUPPORT



To avoid vehicle undercarriage snagging, any substantial remains of a breakaway support, when it is broken away, should not project more than 4 inches above a 60-inch chord (i.e., typical space between wheel paths).

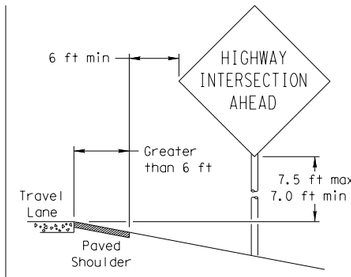
SIGN LOCATION

PAVED SHOULDERS



LESS THAN 6 FT. WIDE

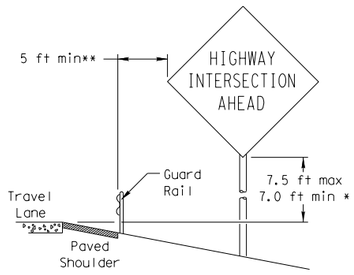
When the shoulder is 6 ft. or less in width, the sign must be placed at least 12 ft. from the edge of the travel lane.



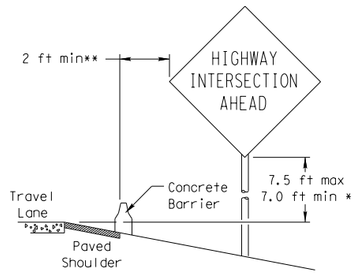
GREATER THAN 6 FT. WIDE

When the shoulder is greater than 6 ft in width, the sign must be placed at least 6 ft. from the edge of the shoulder.

BEHIND BARRIER



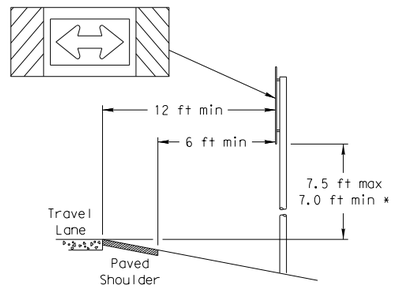
BEHIND GUARDRAIL



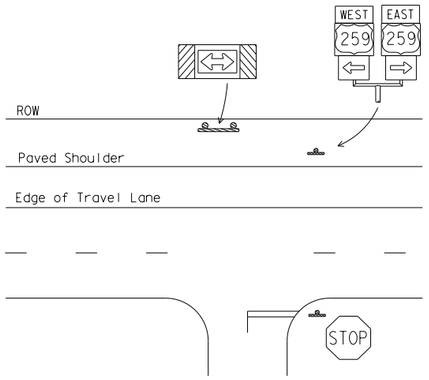
BEHIND CONCRETE BARRIER

**Sign clearance based on distance required for proper guard rail or concrete barrier performance.

T-INTERSECTION



When this sign is needed at the end of a two-lane, two way roadway, the right edge of the sign should be in line with the centerline of the roadway. Place as close to ROW as practical.



* Signs shall be mounted using the following condition that results in the greatest sign elevation:

(1) a minimum of 7 to a maximum of 7.5 feet above the edge of the travel lane or

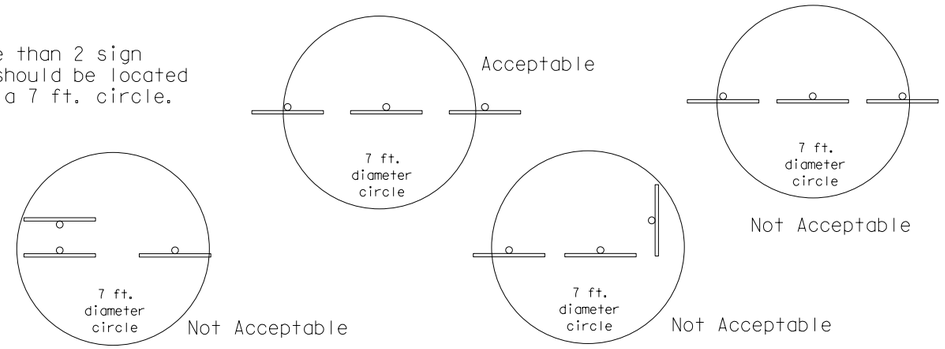
(2) a minimum of 7 to a maximum of 7.5 feet above the grade at the base of the support when sign is installed on the backslope.

The maximum values may be increased when directed by the Engineer.

See the Traffic Operations Division website for detailed drawings of sign clamps, Triangular Slipbase System components and Wedge Anchor System components.

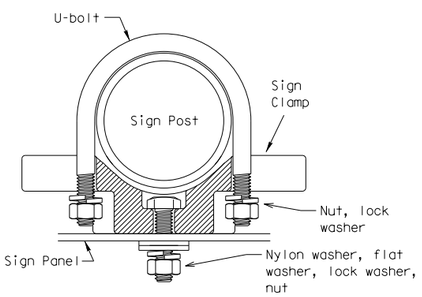
The website address is:
http://www.txdot.gov/publications/traffic.htm

No more than 2 sign posts should be located within a 7 ft. circle.



TYPICAL SIGN ATTACHMENT DETAIL

Single Signs

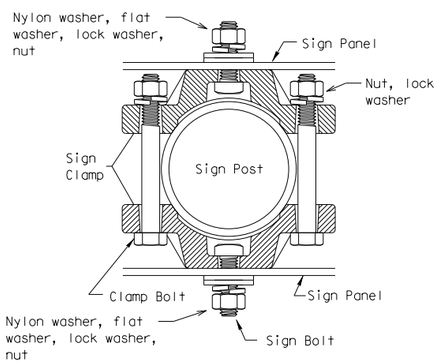


Bolts used to mount sign panels to the clamp are 5/16-18 UNC galvanized square head with nut, nylon washer, flat washer and lock washer. The bolt length is 1 inch for aluminum.

When two sign clamps are used to mount signs back-to-back, use a 5/16-18 UNC galvanized hex head per ASTM A307 with nut and helical-spring lock washer. The approximate bolt lengths for various post sizes and sign clamp types are given in the table at right. The bolt length may need to be adjusted depending upon field conditions.

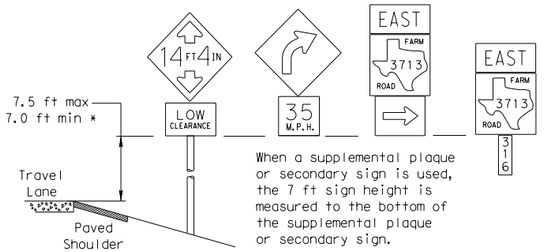
Sign clamps may be either the specific size clamp or the universal clamp.

Back-to-Back Signs



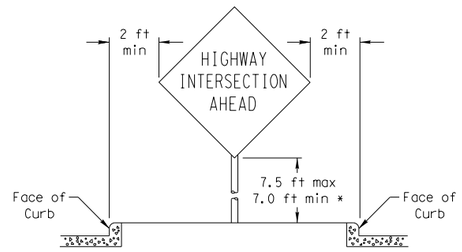
Pipe Diameter	Approximate Bolt Length	
	Specific Clamp	Universal Clamp
2" nominal	3"	3 or 3 1/2"
2 1/2" nominal	3 or 3 1/2"	3 1/2 or 4"
3" nominal	3 1/2 or 4"	4 1/2"

SIGNS WITH PLAQUES



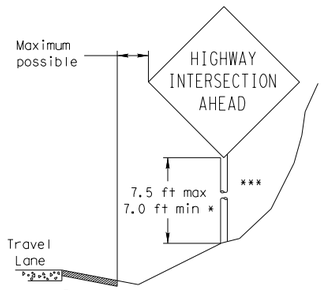
When a supplemental plaque or secondary sign is used, the 7 ft sign height is measured to the bottom of the supplemental plaque or secondary sign.

CURB & GUTTER OR RAISED ISLAND



RESTRICTED RIGHT-OF-WAY

(When 6 ft min. is not possible.)



Right-of-way restrictions may be created by rocks, water, vegetation, forest, buildings, a narrow island, or other factors.

In situations where a lateral restriction prevents the minimum horizontal clearance from the edge of the travel lane, signs should be placed as far from the travel lane as practical.

*** Post may be shorter if protected by guardrail or if Engineer determines the post could not be hit due to extreme slope.

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS GENERAL NOTES & DETAILS

SMD(GEN)-08

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

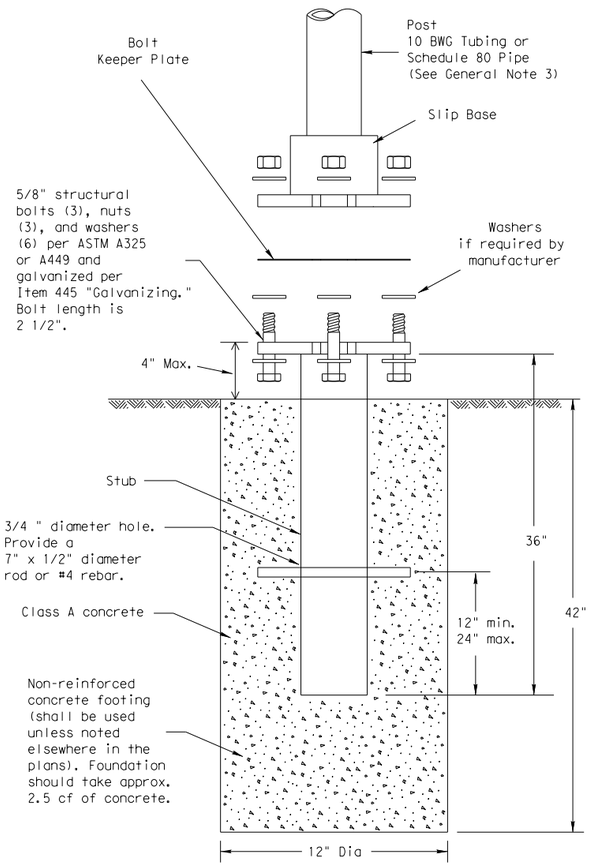
REVISIONS
9-08

CONT	SECT	JOB	HIGHWAY
2038	01	031	FM 2115
DIST	COUNTY		SHEET NO.
WAC	BELL		183

26A

DATE: 8/28/2021 5:44:04 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\203801031\4 - Design\Plan Set\8. Traffic\Standards\smdsl.dgn

TRIANGULAR SLIPBASE INSTALLATION GENERAL REQUIREMENTS



SM RD SGN ASSM TY XXXXX(X)SA(X-XXXX)

NOTE

There are various devices approved for the Triangular Slipbase System. Please reference the Material Producer List for approved slip base systems. http://www.txdot.gov/business/producer_list.htm The devices shall be installed per manufacturers' recommendations. Installation procedures shall be provided to the Engineer by Contractor.

GENERAL NOTES:

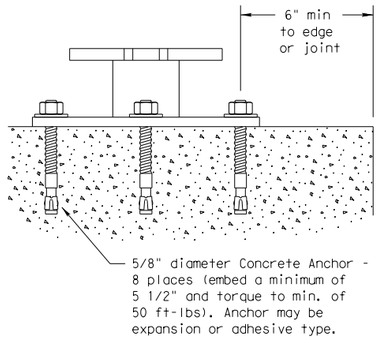
1. Slip base shall be permanently marked to indicate manufacturer. Method, design, and location of marking are subject to approval of the TxDOT Traffic Standards Engineer.
2. Material used as post with this system shall conform to the following specifications:
   10 BWG Tubing (2.875" outside diameter)
   0.134" nominal wall thickness
   Seamless or electric-resistance welded steel tubing or pipe
   Steel shall be HSLAS Gr 55 per ASTM A1011 or ASTM A1008
   Other steels may be used if they meet the following:
   55,000 PSI minimum yield strength
   70,000 PSI minimum tensile strength
   20% minimum elongation in 2"
   Wall thickness (uncoated) shall be within the range of 0.122" to 0.138"
   Outside diameter (uncoated) shall be within the range of 2.867" to 2.883"
   Galvanization per ASTM A123 or ASTM A653 G210. For precoated steel tubing (ASTM A653), recoat tube outside diameter weld seam by metallizing with zinc wire per ASTM B833.
   Schedule 80 Pipe (2.875" outside diameter)
   0.276" nominal wall thickness
   Steel tubing per ASTM A500 Gr C
   Other seamless or electric-resistance welded steel tubing or pipe with equivalent outside diameter and wall thickness may be used if they meet the following:
   46,000 PSI minimum yield strength
   62,000 PSI minimum tensile strength
   21% minimum elongation in 2"
   Wall thickness (uncoated) shall be within the range of 0.248" to 0.304"
   Outside diameter (uncoated) shall be within the range of 2.855" to 2.895"
   Galvanization per ASTM A123
3. See the Traffic Operations Division website for detailed drawings of sign clamps and Texas Universal Triangular Slipbase System components. The website address is: http://www.txdot.gov/publications/traffic.htm
4. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.

ASSEMBLY PROCEDURE

Foundation
1. Prepare 12-inch diameter by 42-inch deep hole. If solid rock is encountered, the depth of the foundation may be reduced such that it is embedded a minimum of 18 inches into the solid rock.
2. The Engineer may permit batches of concrete less than 2 cubic yards to be mixed with a portable, motor-driven concrete mixer. For small placements less than 0.5 cubic yards, hand mixing in a suitable container may be allowed by Engineer. Concrete shall be Class A.
3. Push the pipe end of the slip base stub into the center of the concrete. Rotate the stub back and forth while pushing it down into the concrete to assure good contact between the concrete and stub. Continue to work the stub into the concrete until it is between 2 to 4 inches above the ground.
4. Plumb the stub. Allow a minimum of 4 days to set, unless otherwise directed by the Engineer.
5. The triangular slipbase system is multidirectional and is designed to release when struck from any direction.

Support
1. Cut support so that the bottom of the sign will be 7 to 7.5 feet above the edge of the travelway (i.e., edge of the closest lane) when slip plate is below the edge of pavement or 7 to 7.5 feet above slip plate when the slip plate is above the edge of the travelway. The cut shall be plumb and straight.
2. Attach sign to support using connections shown. When multiple signs are installed on the same support, ensure the minimum clearance between each sign is maintained. See SMD(SLIP-2) for clearances based on sign types.

CONCRETE ANCHOR



SM RD SGN ASSM TY XXXXX(X)SB(X-XXXX)

Concrete anchor consists of 5/8" diameter stud bolt with UNC series bolt threads on the upper end. Heavy hex nut per ASTM A563, and hardened washer per ASTM F436. The stud bolt shall have a minimum yield and ultimate tensile strength of 50 and 75 KSI, respectively. Nuts, bolts and washers shall be galvanized per Item 445, "Galvanizing." Adhesive type anchors shall have stud bolts installed with Type III epoxy per DMS-6100, "Epoxies and Adhesives." Adhesive anchors may be loaded after adequate epoxy cure time per the manufacturer's recommendations. Top of bolt shall extend at least flush with top of the nut when installed. The anchor, when installed in 4000 psi normal-weight concrete with a 5 1/2" minimum embedment, shall have a minimum allowable tension and shear of 3900 and 3100 psi, respectively.

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-1)-08

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

REVISIONS
9-08

CONT	SECT	JOB	HIGHWAY
2038	01	031	FM 2115

DIST	COUNTY	SHEET NO.
WAC	BELL	184

26B

DATE: 8/28/2021 5:44:08 PM
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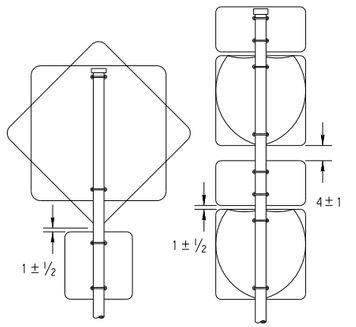
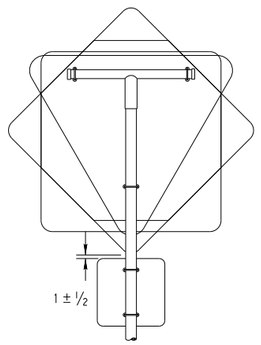


SM RD SGN ASSM TY XXXXX(1)XX(P)



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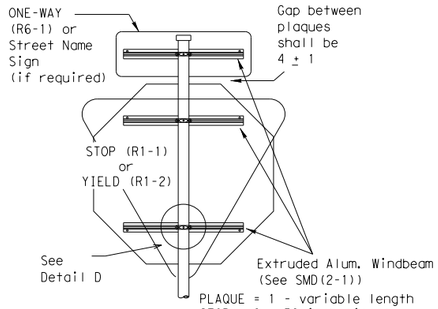

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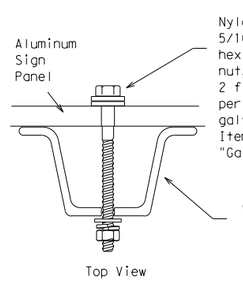
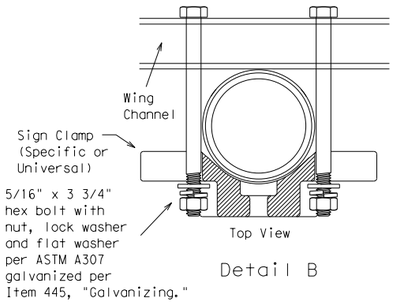


Detail A



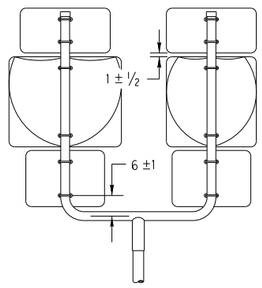
Detail B

GENERAL NOTES:

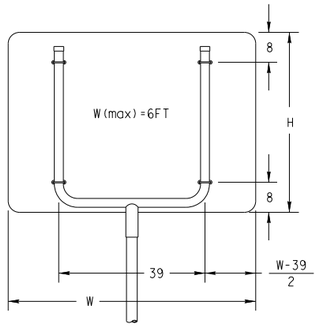
1.

SIGN SUPPORT	# OF POSTS	MAX. SIGN AREA
10 BWG	1	16 SF
10 BWG	2	32 SF
Sch 80	1	32 SF
Sch 80	2	64 SF

2. The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
3. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
4. Aluminum sign blanks shall conform to Departmental Material Specifications DMS-7110 and shall have the following minimum thicknesses: 0.080 for signs less than 7.5 sq. ft., 0.100 for signs 7.5 to 15 sq. ft., and 0.125 for signs greater than 15 sq. ft.
5. Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
6. For horizontal rectangular signs fabricated from flat aluminum, T-brackets are used for signs 24 inches or less in height. U-brackets are used for signs of greater height.
7. When two triangular slipbase supports are used to support a single sign, they shall not be "rigidly" connected to each other except through the sign panel. This will allow each support to act independently when impacted by an errant vehicle.
8. Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
9. Excess pipe, wing channel, or windbeam shall be cut off so that it does not extend beyond the sign panel (i.e., excess support shall not be visible when the sign is viewed from the front.) Repair galvanized coating at cut support ends per Item 445, "Galvanizing."
10. Additional route markers may be added vertically, provided the total sign area does not exceed the maximum allowable amount per Note 1.
11. Additional sign clamp required on the "T-bracket" post for 24 inch height signs. Place the clamp 3 inches above bottom of sign when possible.
12. Post open ends shall be fitted with Friction Caps.
13. Sign blanks shall be the sizes and shapes shown on the plans.



SM RD SGN ASSM TY XXXXX(1)XX(U)



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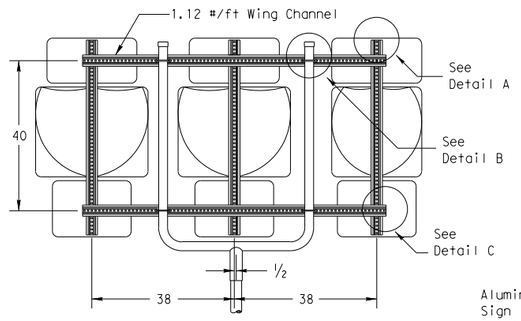
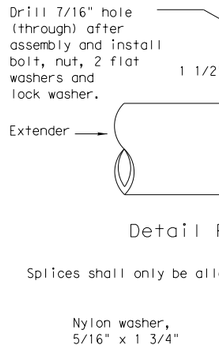
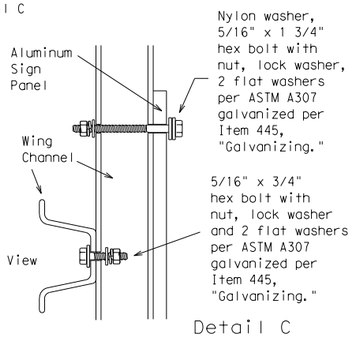


SM RD SGN ASSM TY XXXXX(1)XX(U-WC)
(See Note 11)



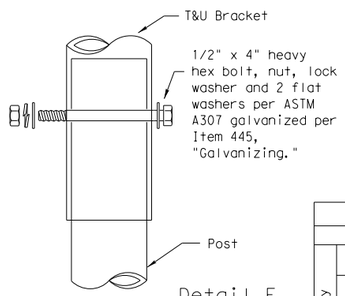
Detail F

Splices shall only be allowed behind the sign substrate.

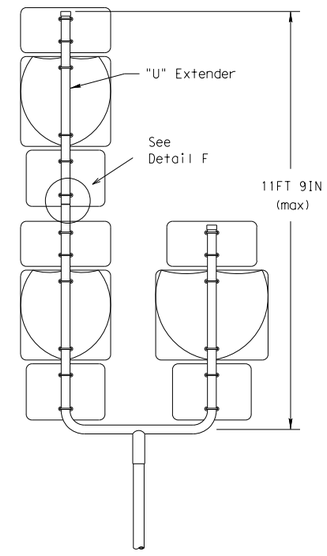


SIDE VIEW

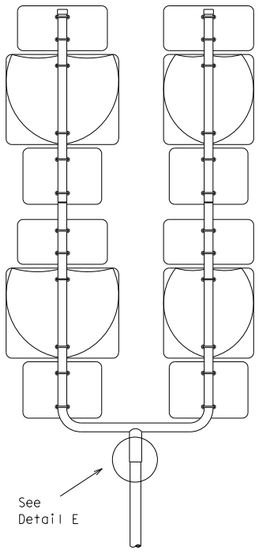
Detail C



Detail E



SM RD SGN ASSM TY S80(1)XX(U-1EXT)



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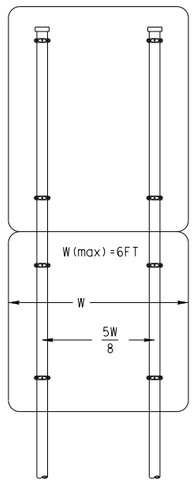
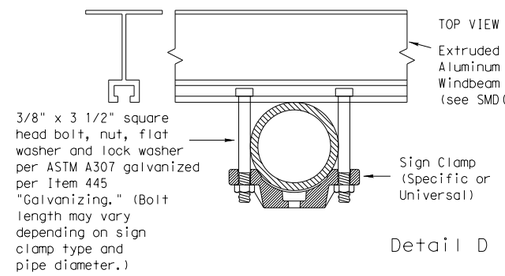
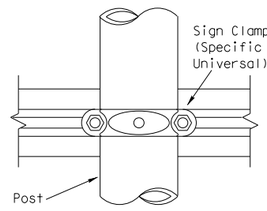


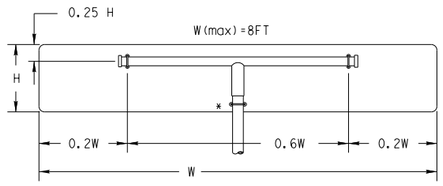
SM RD SGN ASSYM TY XXXXX(2)XX(P)



Detail D



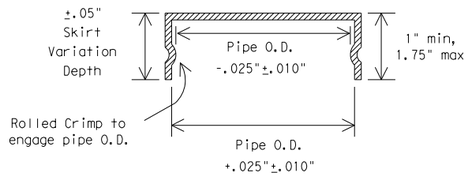
REQUIRED SUPPORT		
	SIGN DESCRIPTION	SUPPORT
Regulatory	48-inch STOP sign (R1-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	60-inch YIELD sign (R1-2)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	48x16-inch ONE-WAY sign (R6-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	36x48, 48x36, and 48x48-inch signs	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
Warning	48x48-inch signs (diamond or square)	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
	48-inch Advance School X-ing sign (S1-1)	TY 10BWG(1)XX(T)
	48-inch School X-ing sign (S2-1)	TY 10BWG(1)XX(T)
	Large Arrow sign (W1-6 & W1-7)	TY 10BWG(1)XX(T)



SM RD SGN ASSM TY XXXXX(1)XX(T)
(* - See Note 12)

All dimensions are in english unless detailed otherwise.

FRICTION CAP DETAIL



Friction caps may be manufactured from hot rolled or cold rolled steel sheets. The minimum sheet metal thickness shall be 24 gauge for all cap sizes.

The rim edges shall be reasonably straight and smooth. Caps shall be sized and formed in such a manner as to produce a drive-on friction fit and have no tendency to rock when seated on the pipe. The depth shall be sufficient to give positive protection against entrance of rainwater. They shall be free of sharp creases or indentations and show no evidence of metal fracture.

Caps shall have an electrodeposited coating of zinc in accordance with the requirements of ASTM B633 Class FE/ZN 8.

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS
SMALL ROADSIDE SIGNS
TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-2)-08

REVISIONS	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
9-08	CONT	SECT	JOB	HIGHWAY
	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		185

26C

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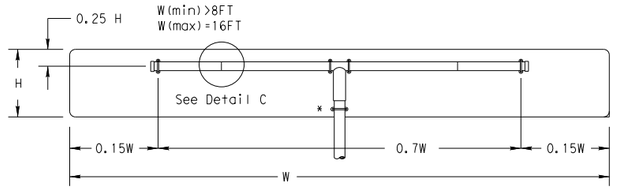
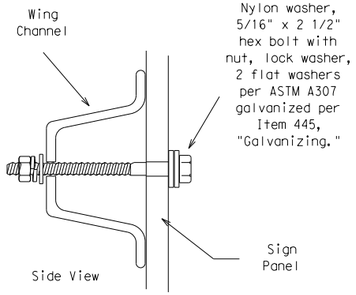
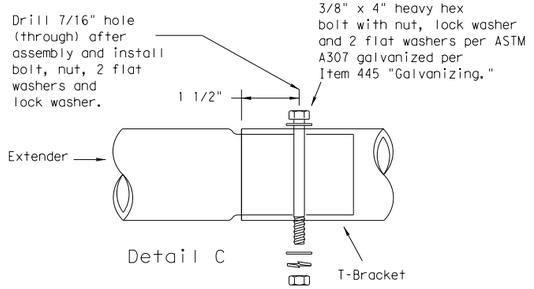


SM RD SGN ASSM TY XXXXX(1)XX(T-2EXT)
(* - See Note 12)



Detail B



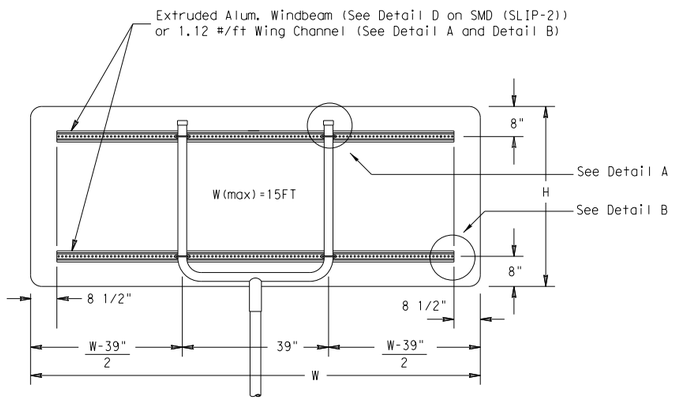
Detail C

Splices shall only be allowed behind the sign substrate.

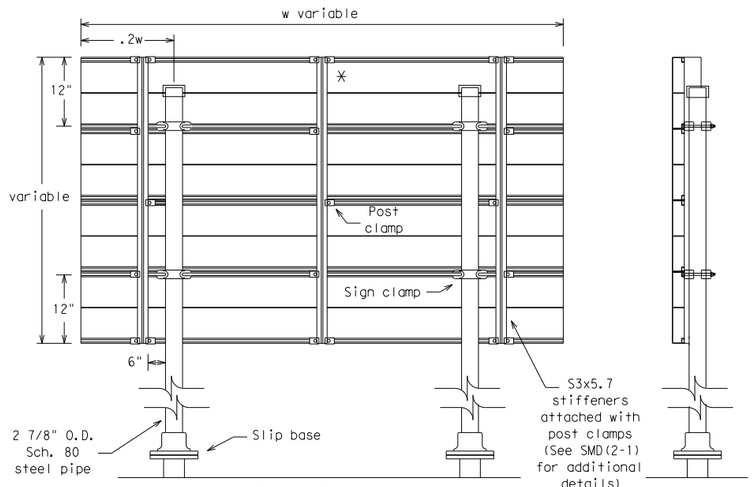
GENERAL NOTES:

SIGN SUPPORT	# OF POSTS	MAX. SIGN AREA
10 BWG	1	16 SF
10 BWG	2	32 SF
Sch 80	1	32 SF
Sch 80	2	64 SF

1. See table above.
2. The Engineer may require that a Schedule 80 post be used in place of a 10 BWG where a sign height is abnormally high due to a fill slope.
3. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
4. Aluminum sign blanks shall conform to Departmental Material Specifications DMS-7110 and shall have the following minimum thicknesses: 0.080 for signs less than 7.5 sq. ft., 0.100 for signs 7.5 to 15 sq. ft., and 0.125 for signs greater than 15 sq. ft.
5. Signs that require specific supports due to reasons in addition to windloading are indicated on the "REQUIRED SUPPORT" table on this sheet.
6. For horizontal rectangular signs fabricated from flat aluminum, T-brackets are used for signs 24 inches or less in height. U-brackets are used for signs of greater height.
7. When two triangular slipbase supports are used to support a single sign, they shall not be "rigidly" connected to each other except through the sign panel. This will allow each support to act independently when impacted by an errant vehicle.
8. Wing channel shall meet ASTM A 1011 SS Gr 50 and be galvanized per ASTM A 123.
9. Excess pipe, wing channel, or windbeam shall be cut off so that it does not extend beyond the sign panel (i.e., excess support shall not be visible when the sign is viewed from the front.) Repair galvanized coating at cut support ends per Item 445, "Galvanizing."
10. Sign blanks shall be the sizes and shapes shown on the plans.
11. Additional sign clamp required on the "T-bracket" post for 24 inch high signs. Place the clamp 3 inches above bottom of sign when possible.
12. Post open ends shall be fitted with Friction Caps.



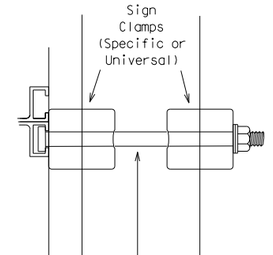
SM RD SGN ASSM TY XXXXX(1)XX(U-XX)



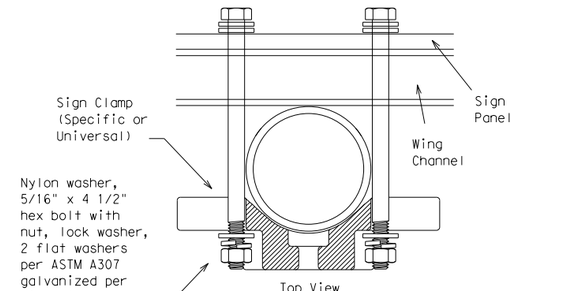
Typical Sign Mount

SM RD SGN ASSM TY S80(2)XX(P-EXAL)

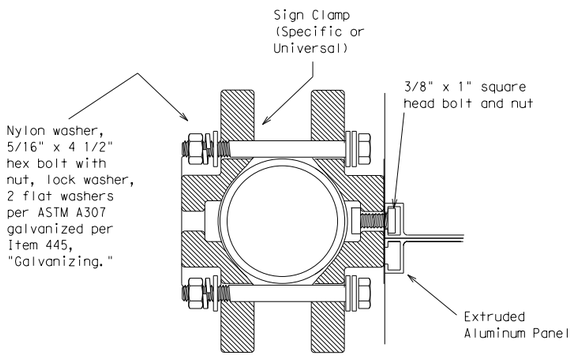
* Additional stiffener placed at approximate center of signs when sign width is greater than 10'.



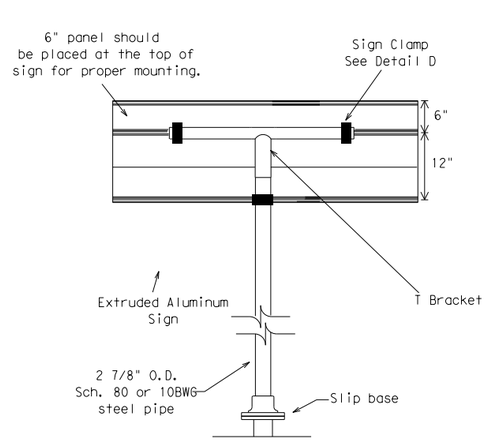
Detail E



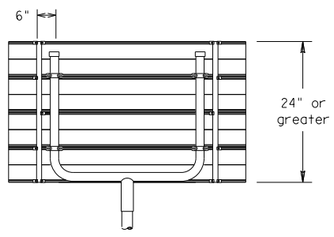
Detail A



Detail D
EXTRUDED ALUMINUM SIGN WITH T BRACKET



Extruded Aluminum Sign
With T Bracket



Use Extruded Alum. Windbeam as stiffeners
See SMD (2-1) for additional details

See Detail E
for clamp installation

REQUIRED SUPPORT		
	SIGN DESCRIPTION	SUPPORT
Regulatory	48-inch STOP sign (R1-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	60-inch YIELD sign (R1-2)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	48x16-inch ONE-WAY sign (R6-1)	TY 10BWG(1)XX(T) TY 10BWG(1)XX(P-BM)
	36x48, 48x36, and 48x48-inch signs	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
Warning	48x48-inch signs (diamond or square)	TY 10BWG(1)XX(T)
	48x60-inch signs	TY S80(1)XX(T)
	48-inch Advance School X-ing sign (S1-1)	TY 10BWG(1)XX(T)
	48-inch School X-ing sign (S2-1)	TY 10BWG(1)XX(T)
	Large Arrow sign (W1-6 & W1-7)	TY 10BWG(1)XX(T)

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS TRIANGULAR SLIPBASE SYSTEM

SMD(SLIP-3)-08

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

REVISIONS
9-08

CONT	SECT	JOB	HIGHWAY
2038	01	031	FM 2115

DIST	COUNTY	SHEET NO.
WAC	BELL	186

26D

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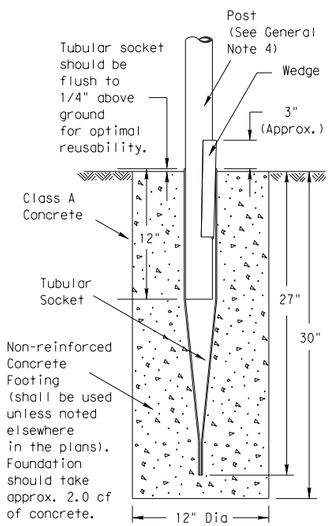
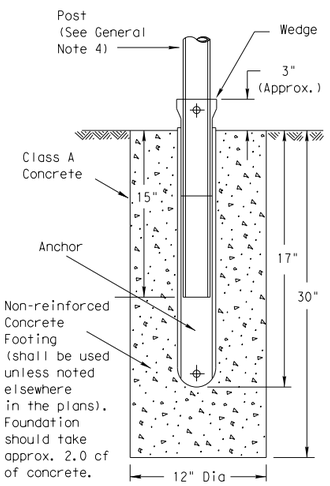
Wedge Anchor Steel System



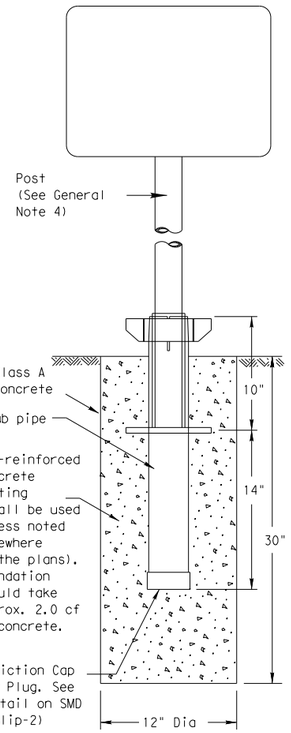
SM RD SGN ASSM TY TWT(X)WS(X)

Wedge Anchor High Density Polyethylene (HDPE) System

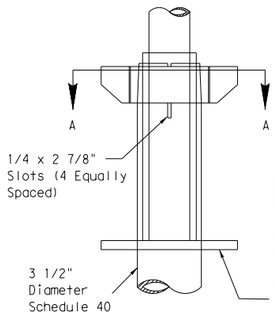


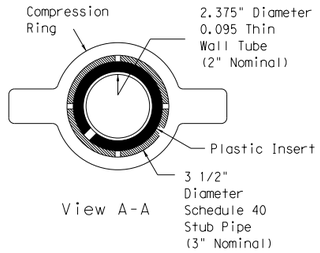
SMD RD SGN ASSM TY TWT(X)WP(X)

Universal Anchor System with Thin-Walled Tubing Post



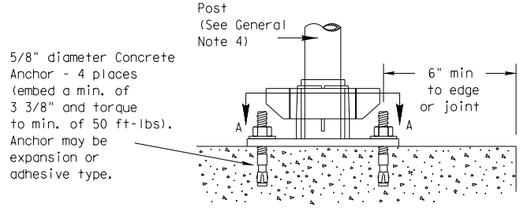
SM RD SGN ASSM TY TWT(X)UA(P)



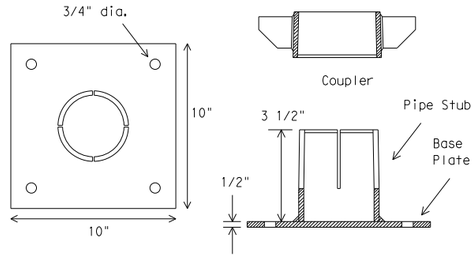


View A-A

Plastic insert must be used when using the TWT with either the Universal Anchor System or the Bolt Down Universal Anchor System. The insert should be approx. 10" long and cover the tubing from just above the top of the stub pipe to the bottom of the sign post when using the Universal Anchor System. The insert should be cut to approx. 4 1/2" when used with the Bolt Down Universal Anchor System.

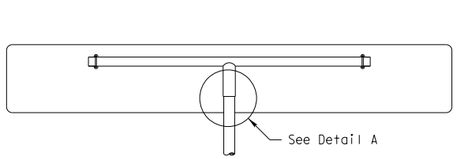


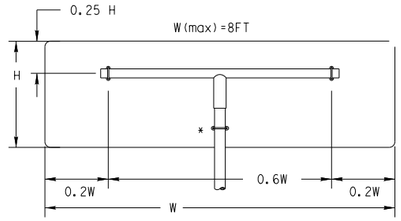
Concrete anchor consists of 5/8" diameter stud bolt with UNC series bolt threads on the upper end. A heavy hex nut per ASTM A563 and hardened washer per ASTM F436. The stud bolt shall have minimum yield and ultimate tensile strengths of 50 and 75 ksi, respectively. Nuts, bolts and washers shall be galvanized per Item 445, "Galvanizing." Top of bolt shall extend at least flush with top of nut when installed. The anchor, when installed in 4000 psi normal-weight concrete with a 3 3/8" minimum embedment, shall have a minimum allowable tension and shear of 2450 and 1525 psi, respectively. Adhesive type anchors shall have stud bolts installed with Type III epoxy per DMS-6100, "Epoxies and Adhesives." Adhesive anchors may be loaded after adequate epoxy cure time per the manufacturer's recommendations.



SM RD SGN ASSM TY TWT(X)UB(P)

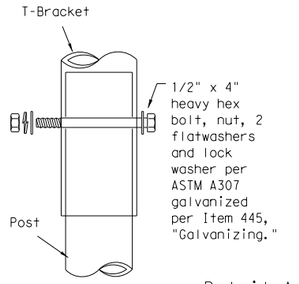
Sign Installation Using a Prefabricated T-Bracket for Thin-Wall Tubing Post





SM RD SGN ASSM TY TWT(X)XX(T)

(* - See General Note 6)



Detail A

9/16" hole may need to be drilled through post to accommodate bolt.

NOTE

The devices shall be installed per manufacturer's recommendations.
Installation procedures shall be provided to the Engineer by Contractor.

GENERAL NOTES:

1. The Wedge Anchor System and the Universal Anchor System with thin wall tubing post may be used to support up to 10 square feet of sign area.
2. The tubular socket, wedge and prefabricated T-bracket shall be permanently marked to indicate manufacturer. Method, design, and location of marking are subject to the approval of the TxDOT Traffic Standards Engineer.
3. Except for posts (13 BWG Tubing), clamps, nuts and bolts, all components shall be prequalified. A list of prequalified vendors may be obtained from the Material Producer List web page. The website address is: http://www.txdot.gov/business/producer list.htm
4. Material used as post with this system shall conform to the following specifications:
   13 BWG Tubing (2.375" outside diameter) (TWT)
   0.095" nominal wall thickness
   Seamless or electric-resistance welded steel tubing
   Steel shall be HSLAS Gr 55 per ASTM A1011 or ASTM A1008
   Other steels may be used if they meet the following:
   55,000 PSI minimum yield strength
   70,000 PSI minimum tensile strength
   18% minimum elongation in 2"
   Wall thickness (uncoated) shall be within the range of .083" to .099"
   Outside diameter (uncoated) shall be within the range of 2.369" to 2.381"
   Galvanization per ASTM 123 or ASTM A653 G210. For precoated steel tubing (ASTM A653), recoat tube outside diameter weld seam by metallizing with zinc wire per ASTM B833.
5. Sign blanks shall be the sizes and shapes shown on the plans.
6. Additional sign clamp required on the "T-bracket" post for 24" high signs. Place clamp at least 3" above bottom of sign when possible.
7. Sign supports shall not be spliced except where shown. Sign support posts shall not be spliced.
8. See the Traffic Operations Division website for detailed drawings of sign clamps and Wedge Anchor System components. The website address is: http://www.txdot.gov/publications/traffic.htm

WEDGE ANCHOR SYSTEM INSTALLATION PROCEDURE

1. Dig foundation hole. Where solid rock is encountered at ground level, the foundation shall be a minimum depth of 18". When solid rock is encountered below ground level, the foundation shall extend in the solid rock a minimum depth of 18" or provide a minimum foundation depth of 30". If solid rock is encountered, the socket/stub may be reduced in length as required to a minimum length of 18". Any material removed from the socket/stub shall be from the bottom and the clearance requirements given on SMD(GEN) must be followed. The inner surfaces of the socket/stub must remain free of concrete or other debris.
2. The Engineer may permit batches of concrete less than 2 cubic yards to be mixed with a portable, motor driven concrete mixer. For small placements less than 0.5 cubic yards, hand mixing in a suitable container may be allowed by Engineer. Place concrete into hole until it is approximately flush with the ground. Concrete shall be Class A.
3. Insert tubular socket into concrete until top of socket is approximaely 1/4 " above the concrete footing.
4. Plumb the socket. Allow a minimum 4 days for concrete to set, unless otherwise directed by Engineer..
5. Attach the sign to the sign post.
6. Insert the sign post into socket and align sign face with roadway.
7. Drive the wedge into the socket to secure post. This will leave approximately 3 inches of the wedge exposed.

UNIVERSAL ANCHOR SYSTEM INSTALLATION PROCEDURE

1. Dig foundation hole. Where solid rock is encountered at ground level, the foundation shall be a minimum depth of 18". When solid rock is encountered below ground level, the foundation shall extend in the solid rock a minimum depth of 18" or provide a minimum foundation depth of 30". If solid rock is encountered, the socket/stub may be reduced in length as required to a minimum length of 18". Any material removed from the socket/stub shall be from the bottom and the clearance requirements given on SMD(GEN) must be followed. The inner surfaces of the socket/stub must remain free of concrete or other debris.
2. Insert base post in hole to depths shown and backfill hole with concrete.
3. Level and plumb the base post using a torpedo level and allow concrete adequate time to set. The bottom of the slots provided in the stub pipe shall remain above the top of the concrete foundation.
4. Attach the sign to the sign post.
5. Install plastic insert around bottom of post.
6. Insert sign post into base post. Lower until the post comes to rest on steel rod.
7. Seat compression ring using a hammer. Typically, the top of compression ring will be approximately level with top of stub post when optimally installed.
8. Check sign post by hand to ensure it is unable to turn. If loose, increase the tightening of the compression ring.

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS SMALL ROADSIDE SIGNS WEDGE & UNIVERSAL ANCHOR WITH THIN WALL TUBING POST

SMD(TWT)-08

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

9-08 REVISIONS

CONT	SECT	JOB	HIGHWAY
2038	01	031	FM 2115
DIST	COUNTY		SHEET NO.
WAC	BELL		187

26E

DATE: 8/28/2021 5:44:20 PM
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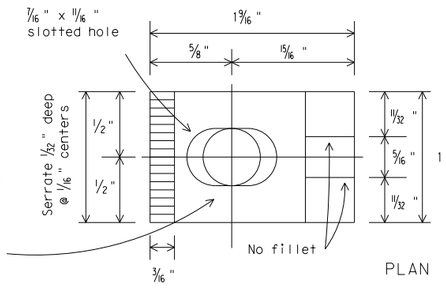
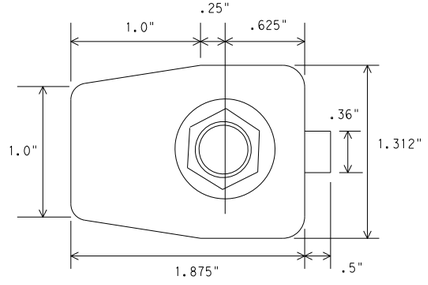
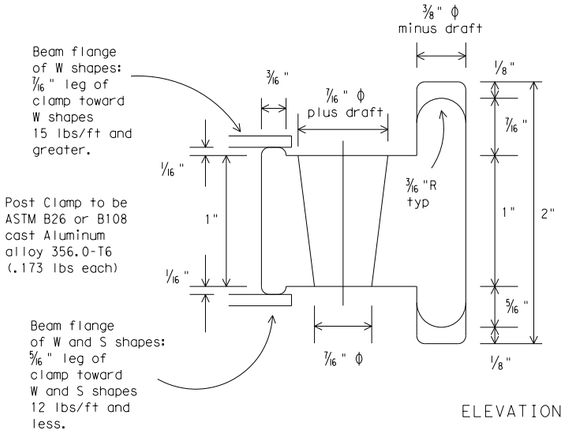
NOTE: centerline of hole for 3/8" diameter squarehead bolt x 2 1/4" long with a flat washer and self-locking nut, or lock washer and hex. nut. Bolt head dimensions shall be in accordance with ANSI B 18.2.1 as referred to in the AISC Manual of steel construction. Bolt assembly shall be galvanized.



PLAN

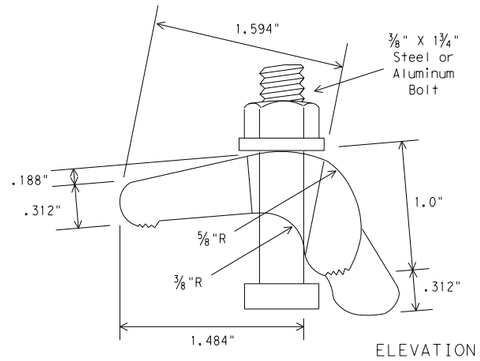


PLAN



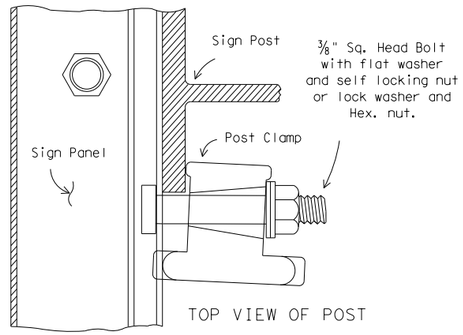
ELEVATION

POST CLAMP DETAIL

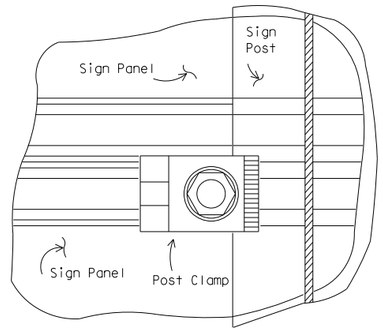


ELEVATION

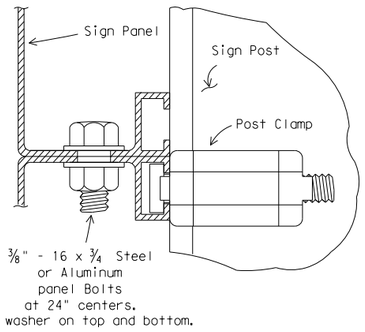
ALTERNATE POST CLAMP DETAIL



TOP VIEW OF POST



TOP VIEW OF CLAMP



SIDE VIEW OF PANELS

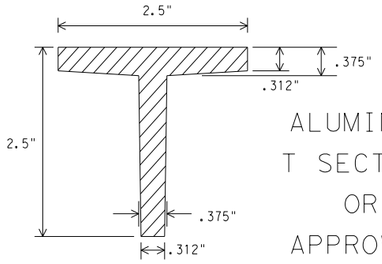
CONNECTION DETAILS

DEPARTMENTAL MATERIAL SPECIFICATIONS

SIGN HARDWARE DMS-7120

GENERAL NOTES:

1. Design conforms with AASHTO Specifications for the design and construction of structural supports for highway signs.
2. Materials and fabrication shall conform to the requirements of the Department material specifications.
3. Structural steel shall be "low-alloy steel" for non-bridge structures per Item 442, "Metal For Structures."
4. For fiberglass substrate connection details, see manufacturer's recommendations.

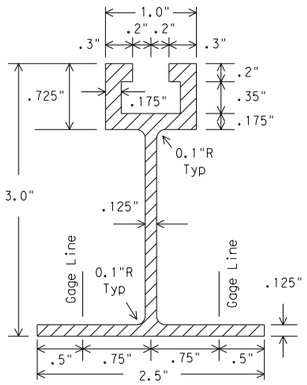


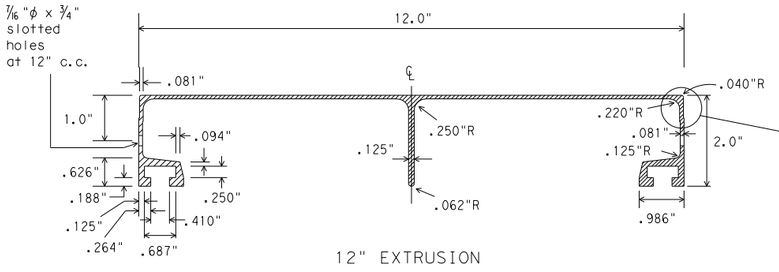
1.912 lbs/ft

ALUMINUM T SECTION OR APPROVED ALTERNATIVE

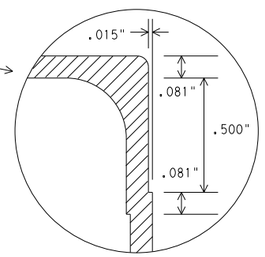
WINDBEAM CROSS SECTION

Windbeam to be extruded aluminum (1.175 lbs/ft) or approved alternative

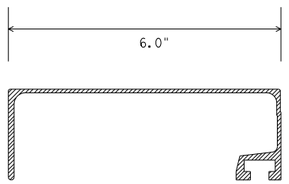




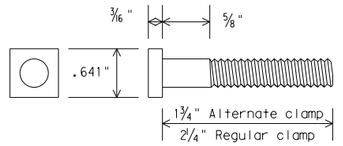
12" EXTRUSION



ALUMINUM SIGN PANEL EXTRUSION DETAILS



6" EXTRUSION



POST CLAMP BOLT DETAIL

Texas Department of Transportation
Traffic Operations Division

SIGN MOUNTING DETAILS- EXTRUDED ALUMINUM SIGN PANELS & HARDWARE

SMD(2-1)-08

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

REVISIONS	CONT	SECT	JOB	HIGHWAY
9-08	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		188

27A

DATE: 8/28/2021 5:44:25 PM
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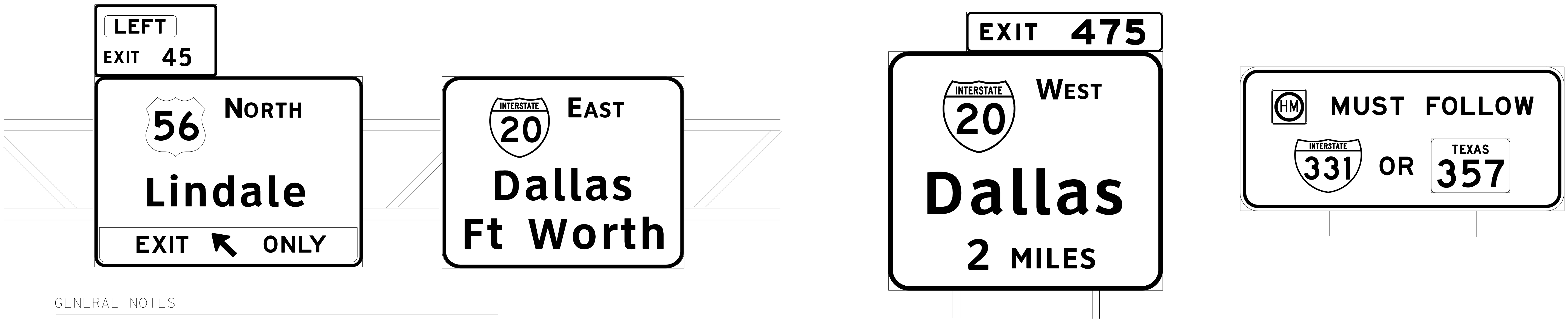
REQUIREMENTS FOR OVERHEAD AND LARGE GROUND-MOUNTED SIGNS

TYPICAL EXAMPLES



GENERAL NOTES

1. Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign summary sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD).
2. Black legend shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets (B, C, D, E, Emod, or F). White legend shall use the Clearview Alphabet. The following Clearview fonts shall be used to replace the existing white FHWA lettering, when not specified in the SHSD or in the plans.

B	CV-1W
C	CV-2W
D	CV-3W
E	CV-4W
Emod	CV-5WR
F	CV-6W

3. Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.
4. Black legend shall be applied by screening process or cut-out acrylic non-reflective black film to background sheeting, or combination thereof.
5. White legend and borders shall be cut-out white sheeting applied to colored background sheeting.
6. Information regarding borders and radii for signs is found in the "Standard Highway Sign Designs for Texas". Dimensions shown and described for borders and corner radii on parent sign are nominal. Borders may vary in width as much as 1/2 inch. Corner radii above 3 inches may vary in width as much as 1 inch. Borders and corner radii within a parent sign must be of matching widths. The sign area outside the corner radius need not be trimmed or rounded if fabricated from an extruded material.
7. Sign substrate for ground-mounted signs shall be any material that meets the Departmental Material Specification requirements of DMS-7110 or approved alternative. Sign substrate for overhead signs shall be any material that meets DMS-7110. Exit Number Panels attached above the parent sign shall be made with the same substrate and sheeting as the parent sign.
8. Mounting details of attachments to parent sign face are shown on Standard Plan Sheet TSR(5). Mounting details of exit number panels above parent sign are shown in the "SMD series" Standard Plan Sheets.
9. Background sheeting shall be applied to the substrate per sheeting manufacturer's recommendations. Sheeting will not be allowed to bridge the horizontal gap between panels.
10. Cut all legend, symbols, borders, and direct applied sign attachments at panel joints.

DEPARTMENTAL MATERIAL SPECIFICATIONS	
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

The Standard Highway Sign Designs for Texas (SHSD) can be found at the following website.
http://www.txdot.gov/

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE B OR C SHEETING
BACKGROUND	ALL OTHERS	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE D SHEETING
LEGEND & BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM

Texas Department of Transportation
Traffic Operations Division Standard

TYPICAL SIGN REQUIREMENTS

TSR(1)-13

FILE: tsr1-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT	
©TxDOT October 2003	CONT	SECT	JOB	HIGHWAY	
REVISIONS 12-03 7-13 9-08	2038	01	031	FM 2115	
	DIST	COUNTY		SHEET NO.	
	WAC	BELL		189	

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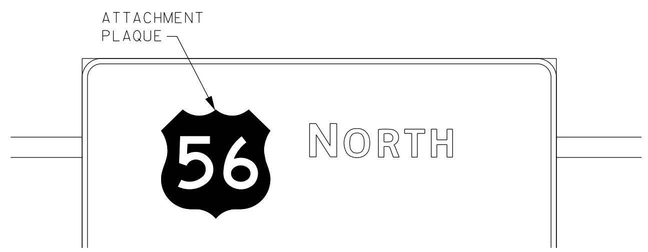
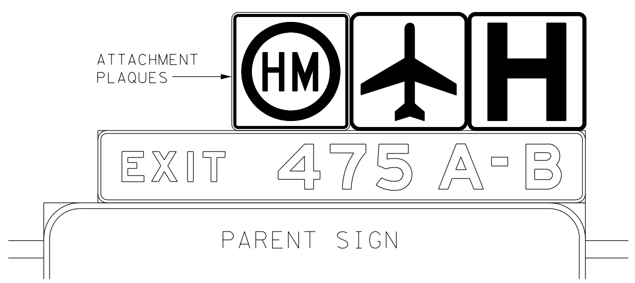
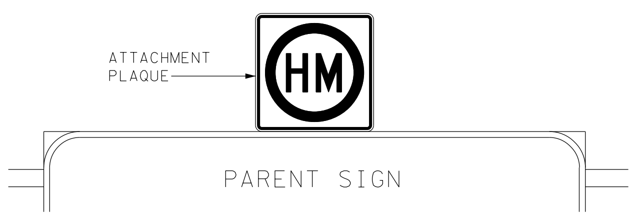
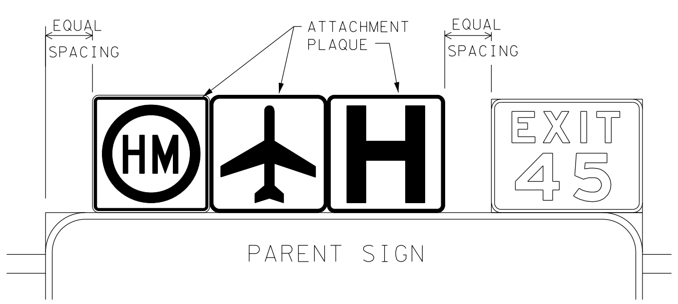
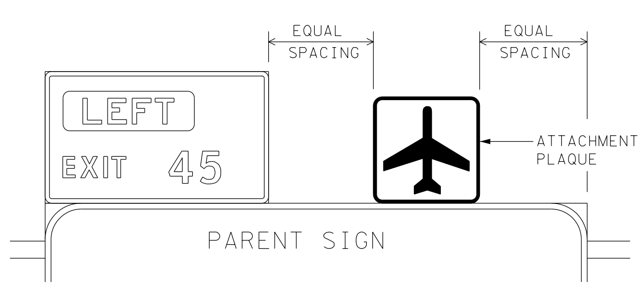
REQUIREMENTS FOR ATTACHMENTS TO OVERHEAD AND LARGE GROUND MOUNTED SIGNS









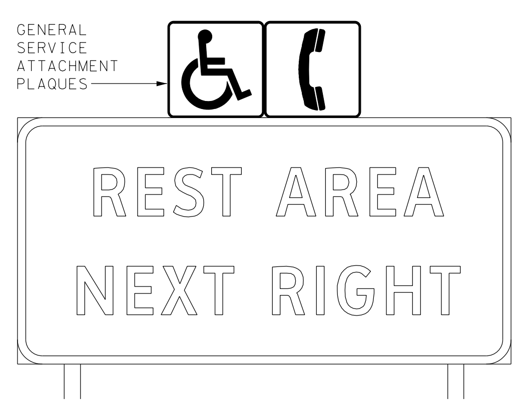


DEPARTMENTAL MATERIAL SPECIFICATIONS	
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	ALL	TYPE B OR C SHEETING
LEGEND & BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND & BORDERS	ALL OTHERS	TYPE B OR C SHEETING

GENERAL NOTES

1. Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign tabulation sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD).
2. Route Marker legends (ie. IH, US, SH and FM shields) shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets (B, C, D, E, Emod, or F).
3. Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.
4. Black legend and borders shall be applied by screening process or cut-out acrylic non-reflective black film to background sheeting, or combination thereof.
5. White legend and borders shall be applied by screening process with transparent colored ink, transparent colored overlay film to white background sheeting or cut-out white sheeting to colored background sheeting, or combination thereof.
6. Colored legend and borders shall be applied by screening process with transparent colored ink, transparent colored overlay film or colored sheeting to white background sheeting, or combination thereof.
7. Route markers and other attachments within the parent sign face shall be direct applied unless otherwise specified in the plans. Attachments not direct applied shall use 0.063 inch thick one piece sheet aluminum signs (Type A).
8. General Service Plaques shall be 0.080 inch thick and Routing Plaques shall be 0.100 inch thick.
9. The priority for Routing Plaques shall be (left to right) Hazardous Material, Airport then Hospital. See examples for mounting location.
10. Mounting details of attachments to parent signs face are shown on Standard Plan Sheet TSR(5). Mounting details of sign plaque attachments above and below parent sign are shown in the "SMD series" Standard Plan Sheets.
11. Plaques shall be horizontally centered at the top of the parent sign. If an exit number panel exists, the plaque shall be centered between the edge of the parent sign and the edge of the exit number panel. The plaque may be placed above the exit number panel when there is insufficient space.

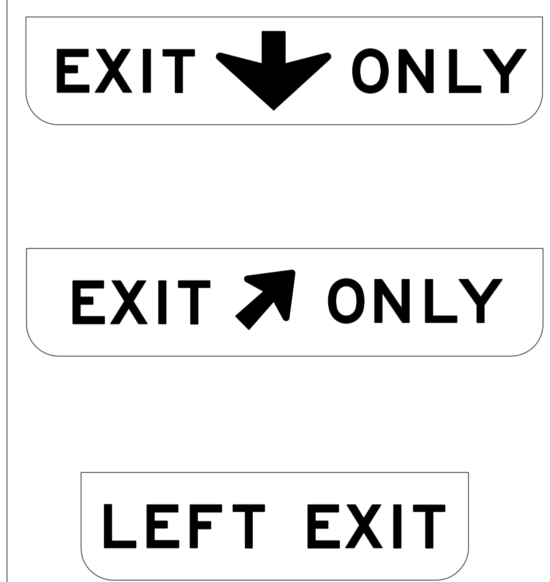


TYPICAL EXAMPLES

REQUIREMENTS FOR EXIT ONLY AND LEFT EXIT PANELS

DEPARTMENTAL MATERIAL SPECIFICATIONS	
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

SHEETING REQUIREMENTS FOR OVERHEAD EXIT PANELS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	FLUORESCENT YELLOW	TYPE B_{FL} OR C_{FL} SHEETING
LEGEND	BLACK	ACRYLIC NON-REFLECTIVE FILM



TYPICAL EXAMPLES

GENERAL NOTES

1. Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign tabulation sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD). Individual panel sizes shown in the plans may be adjusted to fit actual parent sign sizes if necessary.
2. Exit Panel legend shall use the Federal Highway Administration (FHWA)Standard Highway Alphabets E Series.
3. Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.
4. Black legend shall be applied by screening process or cut-out acrylic non-reflective black film to yellow background sheeting, or combination thereof.
5. Exit Only and Left Exit panels within the parent sign face shall be direct applied unless otherwise specified in the plans. Panels not direct applied shall use 0.063 inch thick one piece sheet aluminum signs (Type A).
6. Mounting details of Exit Only and Left Exit panel attachments to parent signs face are shown on Standard Plan Sheet TSR(5).

The Standard Highway Sign Designs for Texas (SHSD) can be found at the following website.
http://www.txdot.gov/

Texas Department of Transportation — Traffic Operations Division Standard

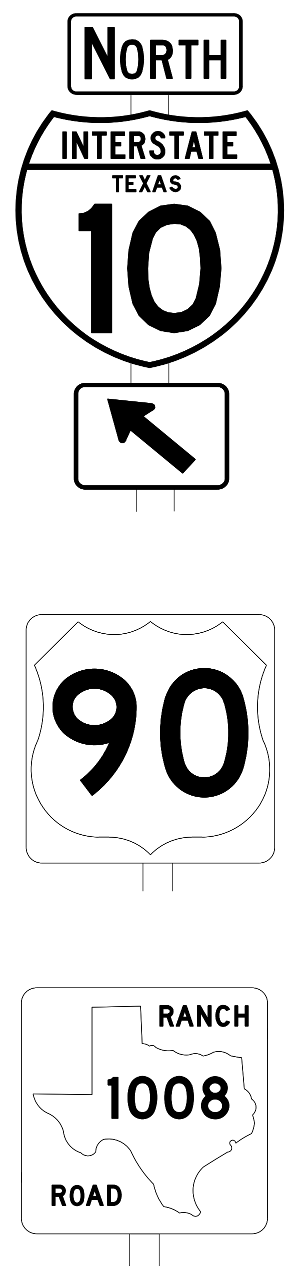
TYPICAL SIGN REQUIREMENTS

TSR(2)-13

FILE: tsr2-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT October 2003	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
12-03 7-13	DIST		COUNTY	SHEET NO.
9-08	WAC		BELL	190

REQUIREMENTS FOR INDEPENDENT MOUNTED ROUTE SIGNS

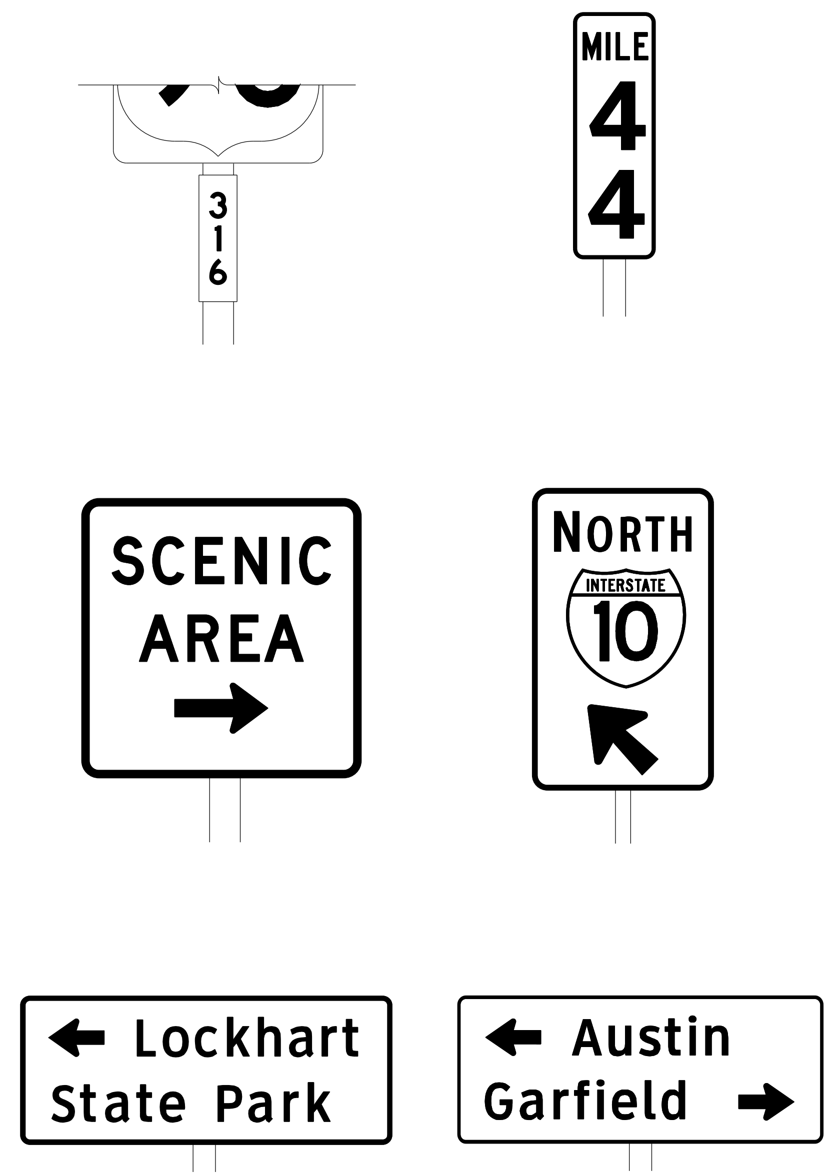
SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	ALL OTHERS	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE A SHEETING
LEGEND & BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND & BORDERS	ALL OTHERS	TYPE B or C SHEETING



TYPICAL EXAMPLES

REQUIREMENTS FOR BLUE, BROWN & GREEN D AND I SERIES GUIDE SIGNS

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	ALL	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE D SHEETING
LEGEND, SYMBOLS & BORDERS	ALL OTHERS	TYPE B OR C SHEETING



TYPICAL EXAMPLES

GENERAL NOTES

1. Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign tabulation sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD).

2. White legend shall use the Clearview Alphabet. The following Clearview fonts shall be used to replace the existing white Federal Highway Administration (FHWA) Standard Highway Alphabets, when not specified in the SHSD, or in the plans.

B	CV-1W
C	CV-2W
D	CV-3W
E	CV-4W
Emod	CV-5WR
F	CV-6W

3. Route sign legend (ie. IH, US, SH and FM shields) shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets B, C, D, E, Emod or F).

4. Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.

5. Independent mounted route sign with white or colored legend and borders shall be applied by screening process with transparent color ink, transparent colored overlay film to white background sheeting or cut-out white sheeting to colored background sheeting, or combination thereof. White legend, symbols and borders on all other signs shall be cut-out white sheeting applied to colored background sheeting.

6. Information regarding borders and radii for signs is found in the "Standard Highway Sign Designs for Texas". Dimensions shown and described for borders and corner radii on parent sign are nominal. Borders may vary in width as much as 1/2 inch. Corner radii above 3 inches may vary in width as much as 1 inch. Borders and corner radii within a parent sign must be of matching widths. The sign area outside the corner radius should be trimmed or rounded.

7. Sign substrate shall be any material that meets the Departmental Material Specification requirements of DMS-7110 or approved alternative.

8. Mounting details of roadside signs are shown in the "SMD series" Standard Plan Sheets.

DEPARTMENTAL MATERIAL SPECIFICATIONS	
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

ALUMINUM SIGN BLANKS THICKNESS	
Square Feet	Minimum Thickness
Less than 7.5	0.080
7.5 to 15	0.100
Greater than 15	0.125

The Standard Highway Sign Designs for Texas (SHSD) can be found at the following website.

http://www.txdot.gov/

Texas Department of Transportation

Traffic Operations Division Standard

TYPICAL SIGN REQUIREMENTS

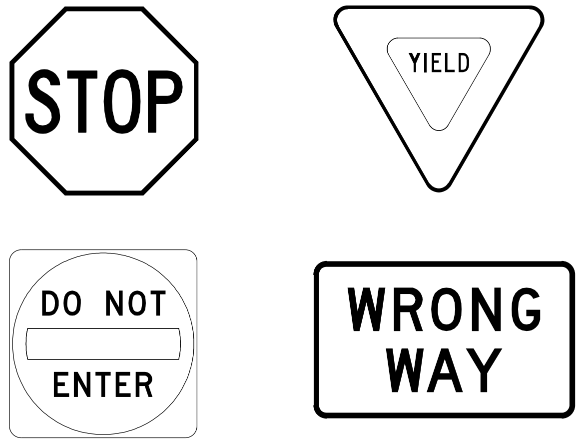
TSR(3)-13

FILE: tsr3-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT October 2003	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
12-03 7-13 9-08	DIST	COUNTY		SHEET NO.
	WAC	BELL		191

3

REQUIREMENTS FOR RED BACKGROUND REGULATORY SIGNS

(STOP, YIELD, DO NOT ENTER AND WRONG WAY SIGNS)



REQUIREMENTS FOR FOUR SPECIFIC SIGNS ONLY

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	RED	TYPE B OR C SHEETING
BACKGROUND	WHITE	TYPE B OR C SHEETING
LEGEND & BORDERS	WHITE	TYPE B OR C SHEETING
LEGEND	RED	TYPE B OR C SHEETING

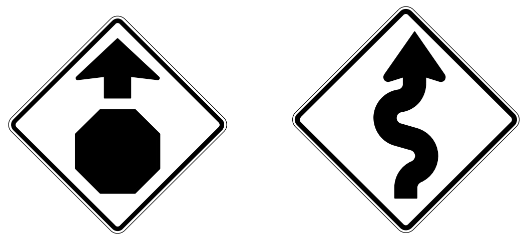
REQUIREMENTS FOR WHITE BACKGROUND REGULATORY SIGNS

(EXCLUDING STOP, YIELD, DO NOT ENTER AND WRONG WAY SIGNS)

TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	ALL OTHERS	TYPE B OR C SHEETING
LEGEND, BORDERS AND SYMBOLS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND, BORDERS AND SYMBOLS	ALL OTHER	TYPE B OR C SHEETING

REQUIREMENTS FOR WARNING SIGNS



TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	FLOURESCENT YELLOW	TYPE B_{FL} OR C_{FL} SHEETING
LEGEND & BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM
LEGEND & SYMBOLS	ALL OTHER	TYPE B OR C SHEETING

REQUIREMENTS FOR SCHOOL SIGNS

TYPICAL EXAMPLES

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	WHITE	TYPE A SHEETING
BACKGROUND	FLOURESCENT YELLOW GREEN	TYPE B_{FL} OR C_{FL} SHEETING
LEGEND, BORDERS AND SYMBOLS	BLACK	ACRYLIC NON-REFLECTIVE FILM
SYMBOLS	RED	TYPE B OR C SHEETING

GENERAL NOTES

1. Signs to be furnished shall be as detailed elsewhere in the plans and/or as shown on sign tabulation sheet. Standard sign designs and arrow dimensions can be found in the "Standard Highway Sign Designs for Texas" (SHSD).
2. Sign legend shall use the Federal Highway Administration (FHWA) Standard Highway Alphabets (B, C, D, E, Emod or F).
3. Lateral spacing between letters and numerals shall conform with the SHSD, and any approved changes thereto. Lateral spacing of legend shall provide a balanced appearance when spacing is not shown.
4. Black legend and borders shall be applied by screening process or cut-out acrylic non-reflective black film to background sheeting, or combination thereof.
5. White legend and borders shall be applied by screening process with transparent colored ink, transparent colored overlay film to white background sheeting or cut-out white sheeting to colored background sheeting, or combination thereof.
6. Colored legend shall be applied by screening process with transparent colored ink, transparent colored overlay film or colored sheeting to background sheeting, or combination thereof.
7. Sign substrate shall be any material that meets the Departmental Material Specification requirements of DMS-7110 or approved alternative.
8. Mounting details for roadside mounted signs are shown in the "SMD series" Standard Plan Sheets.

ALUMINUM SIGN BLANKS THICKNESS	
Square Feet	Minimum Thickness
Less than 7.5	0.080
7.5 to 15	0.100
Greater than 15	0.125

DEPARTMENTAL MATERIAL SPECIFICATIONS	
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

The Standard Highway Sign Designs for Texas (SHSD) can be found at the following website.

http://www.txdot.gov/

Texas Department of Transportation

Traffic Operations Division Standard

TYPICAL SIGN REQUIREMENTS

TSR(4)-13

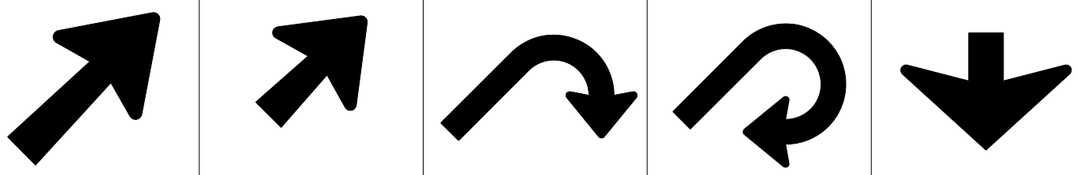
FILE: tsr4-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT October 2003	CONT	SECT	JOB	HIGHWAY
REVISIONS 12-03 7-13 9-08	2038	01	031	FM 2115
	DIST		COUNTY	SHEET NO.
	WAC		BELL	192

4

DATE: 8/28/2021 5:44:41 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects\2038-01-031 TSR

ARROW DETAILS

for Large Ground-Mounted and Overhead Guide Signs



TYPE	LETTER SIZE	USE
A-1	10.67" U/L and 10" Caps	Single Lane Exits
A-2	13.33" U/L and 12" Caps	
A-3	16" & 20" U/L	
B-1	10.67" U/L and 10" Caps	Multiple Lane Exits
B-2	13.33" U/L and 12" Caps	
B-3	16" & 20" U/L	

CODE	USED ON SIGN NO.
E-3	E5-1aT
E-4	E5-1bT

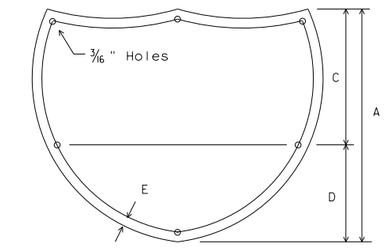
NOTE

Arrow dimensions are shown in the "Standard Highway Sign Designs for Texas" manual.

The Standard Highway Sign Designs for Texas (SHSD) can be found at the following website.

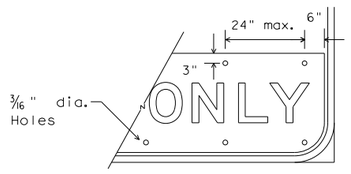
http://www.txdot.gov/

SIGN BLANK PUNCHING DETAILS FOR ATTACHMENTS WHEN SPECIFIED TO BE TYPE A ALUMINUM SIGNS (FOR MOUNTING TO GUIDE SIGN FACE)

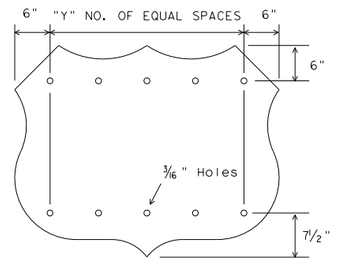


INTERSTATE ROUTE MARKERS

A	C	D	E
36	21	15	1 1/2
48	28	20	1 3/4

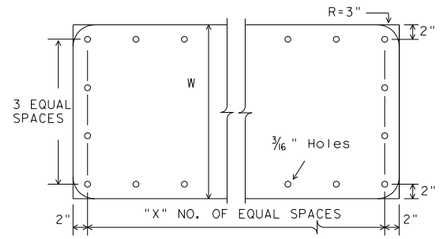


EXIT ONLY PANEL



U.S. ROUTE MARKERS

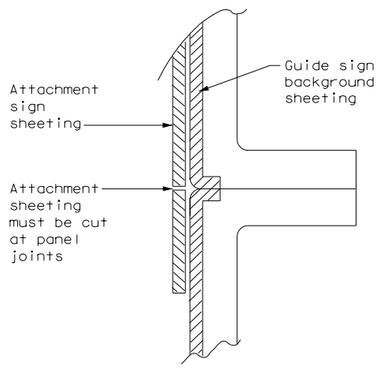
Sign Size	"Y"
24x24	2
30x24	3
36x36	3
45x36	4
48x48	4
60x48	5



STATE ROUTE MARKERS

No. of Digits	W	X
4	24	4
4	36	5
4	48	6
3	24	3
3	36	4
3	48	5

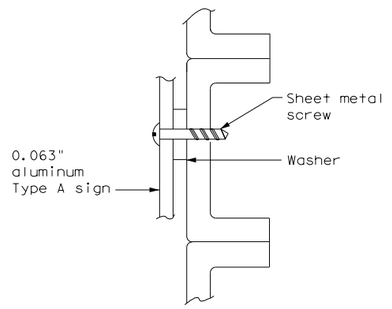
MOUNTING DETAILS OF ATTACHMENTS TO GUIDE SIGN FACE ("EXIT ONLY" AND "LEFT EXIT" PANELS, ROUTE MARKERS AND OTHER ATTACHMENTS)



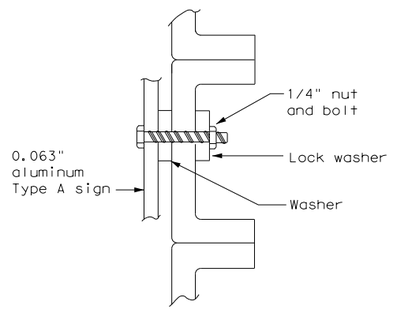
DIRECT APPLIED ATTACHMENT

NOTE:

1. Sheeting for legend, symbols, and borders must be cut at panel joints.
2. Direct applied attachment signs will be subsidiary to "Aluminum Signs" or "Fiberglass Signs".



SCREW ATTACHMENT



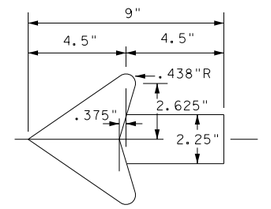
NUT/BOLT ATTACHMENT

NOTE:

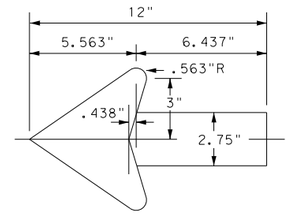
Furnish Type A aluminum sign attachments only when specified in the plans. These signs will be paid for under "Aluminum Signs".

ARROW DETAILS

for Destination Signs (Type D)



Standard arrow to be used with 6 inch letters.



Standard arrow to be used with 8 inch letters.

Texas Department of Transportation

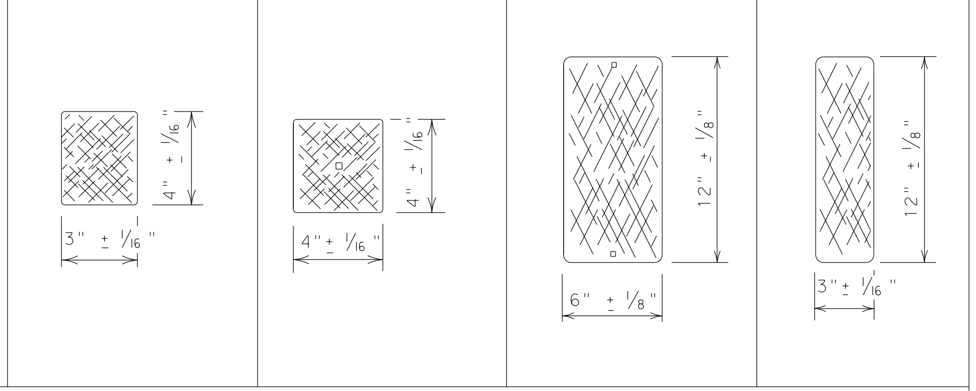
Traffic Operations Division Standard

TYPICAL SIGN REQUIREMENTS

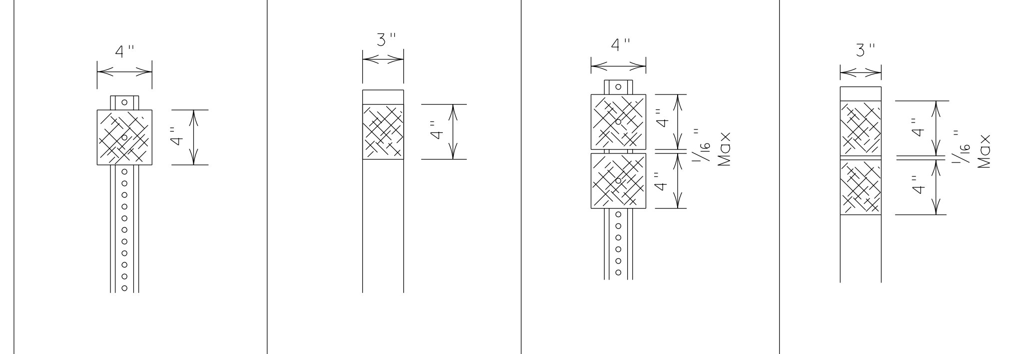
TSR(5)-13

FILE: tsr5-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT October 2003	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
12-03 7-13	DIST	COUNTY		SHEET NO.
9-08	WAC	BELL		193

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)

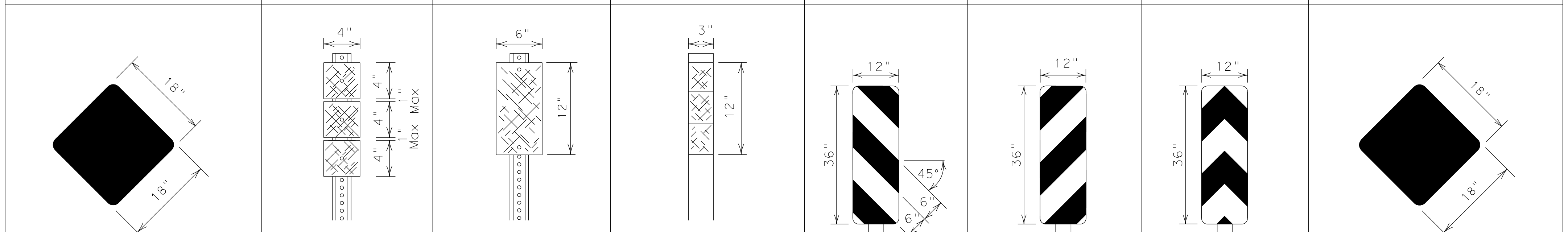
TYPE OF POST
- WC = Wing Channel Post
- WFLX = White Flexible Post
- TWT = Thin Walled Tubing

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

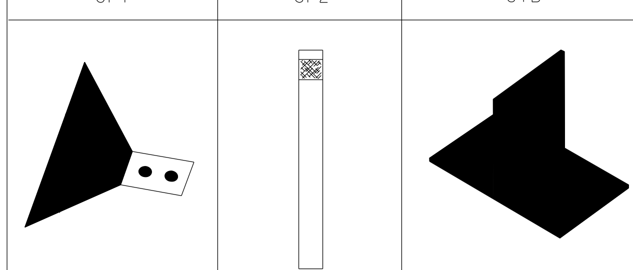
DIRECTION
- If Required
- BI = Bi-Directional

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

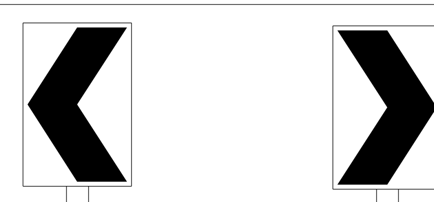
OBJECT MARKERS

	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

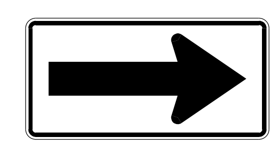
BARRIER REFLECTORS (BRF)

	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: doml-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
© TxDOT August 2004	CONT 2038	SECT 01	JOB 031	HIGHWAY FM 2115
REVISIONS 10-09 3-15, 4-10 7-20	DIST WAC		COUNTY BELL	SHEET NO. 194

20A

DATE: 8/28/2021 5:44:45 PM
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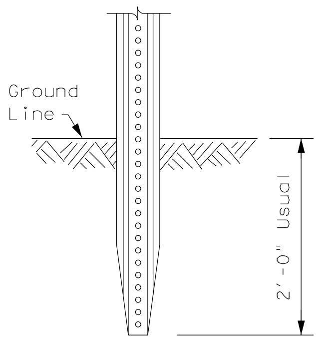
POST TYPE AND SUPPORT FOUNDATION DETAILS

WING CHANNEL (WC)

GND

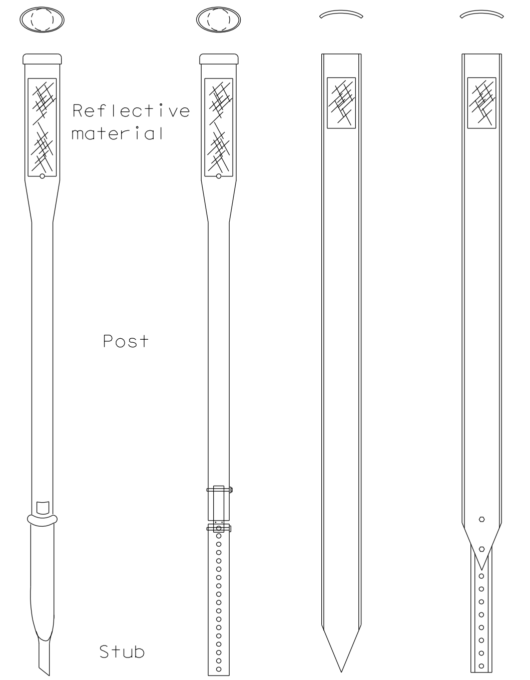


NOTES

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.

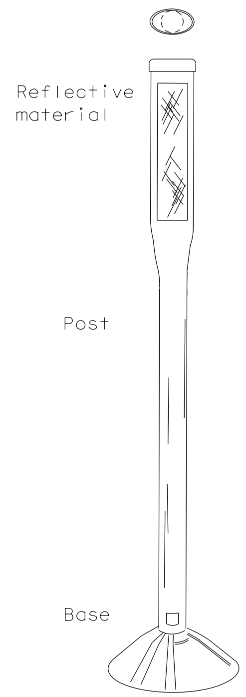
FLEXIBLE POSTS (YFLX, WFLX)

GND



EMBEDDED

SRF



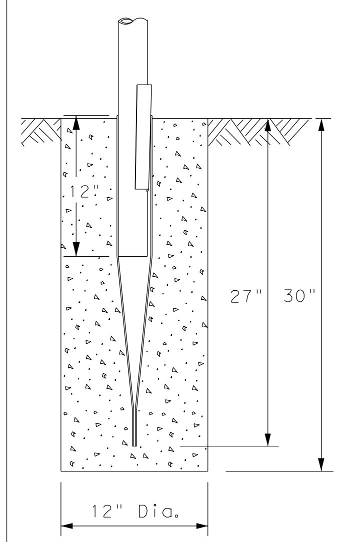
SURFACE MOUNT

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.

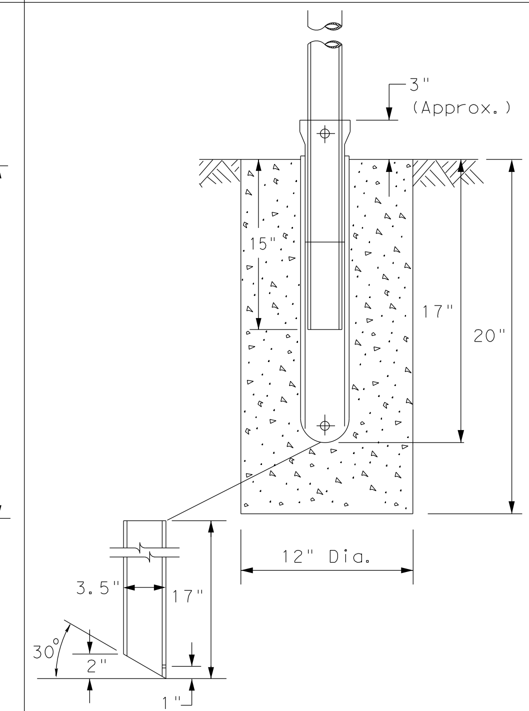
WEDGE ANCHOR SYSTEMS

WAS



STEEL

WAP



PLASTIC

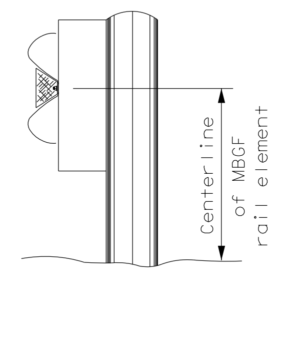
NOTE

1. Install per manufacturer's recommendations.

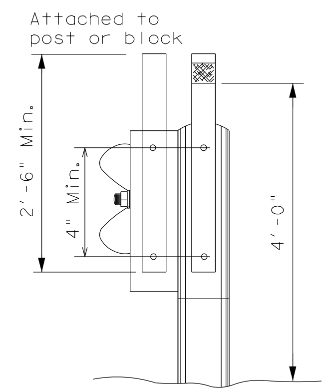
TYPE OF BARRIER MOUNTS

GUARD FENCE ATTACHMENT

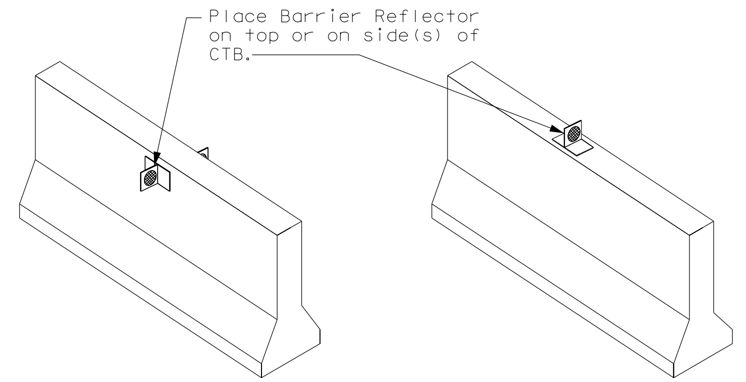
GF1



GF2



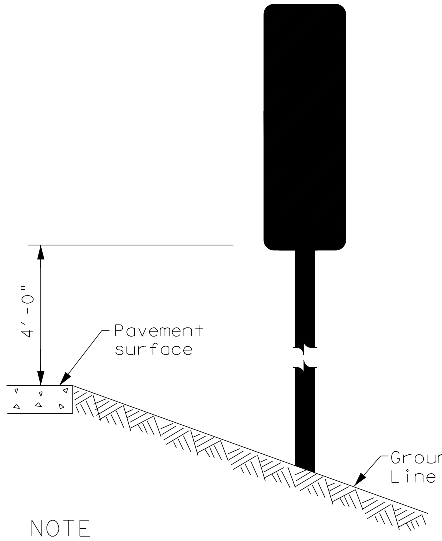
CONCRETE TRAFFIC BARRIER (CTB)



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.

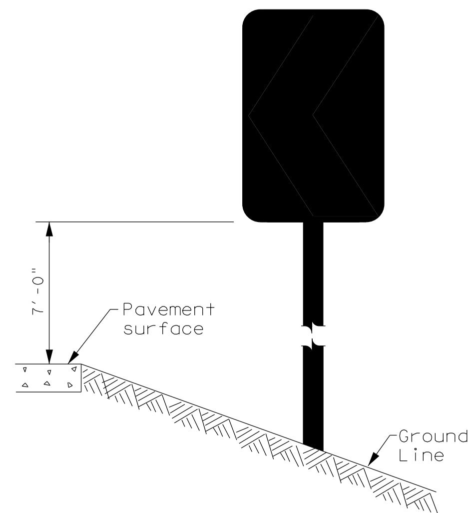
TYPES 1, 3, AND 4 OBJECT MARKERS AND CHEVRONS



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)

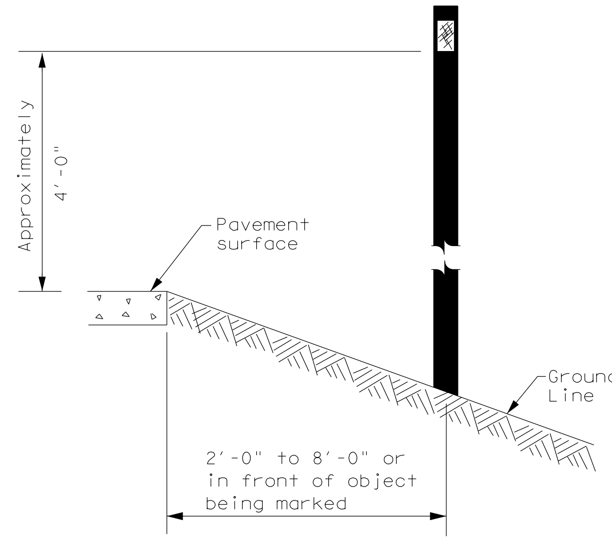
CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN



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.

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Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER INSTALLATION

D & OM(2)-20

FILE: dom2-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
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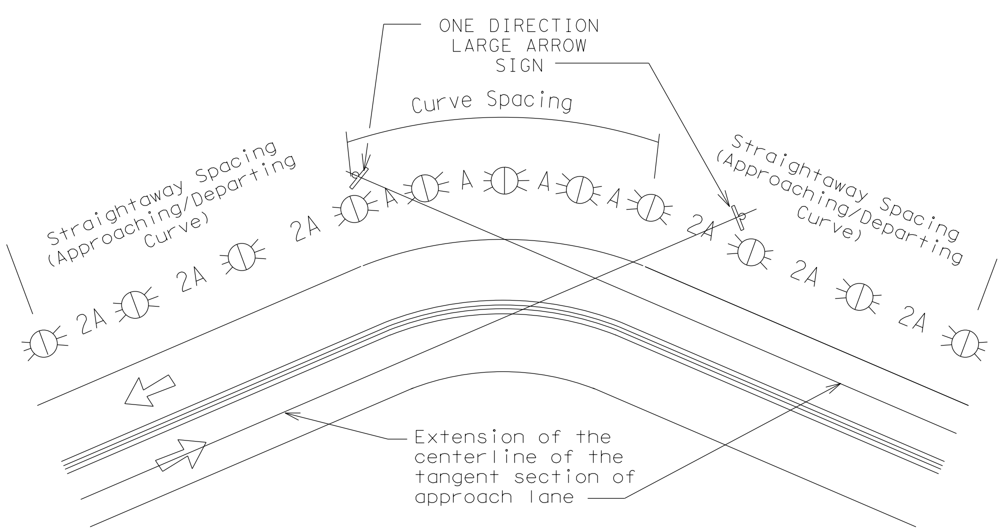
REVISIONS	2038	01	031	FM 2115
10-09 3-15	DIST		COUNTY	SHEET NO.
4-10 7-20	WAC		BELL	195

20B

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 (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

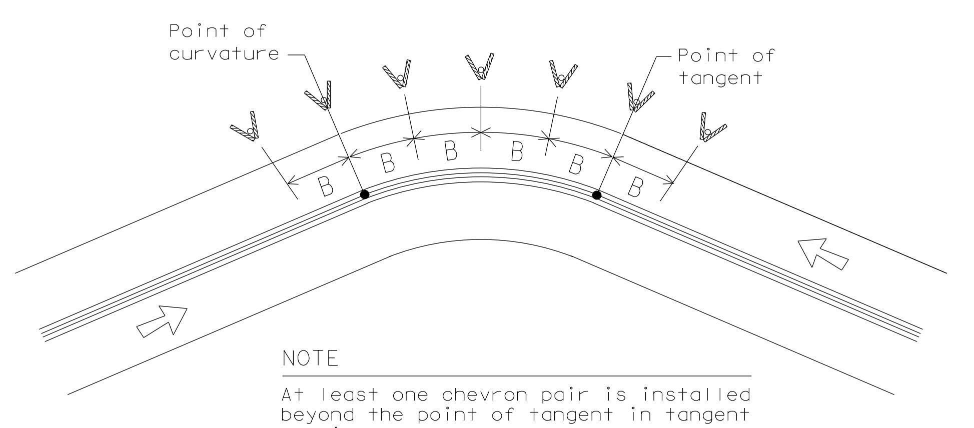
SUGGESTED SPACING FOR DELINEATORS ON HORIZONTAL CURVES



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	Radius of Curve (FEET)	Spacing in Curve (FEET)	Spacing in Straightaway (FEET)	Chevron Spacing in Curve (FEET)
		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	Meaning
	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
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REVISIONS 3-15 8-15 8-15 7-20	DIST WAC		COUNTY BELL	SHEET NO. 196

20C

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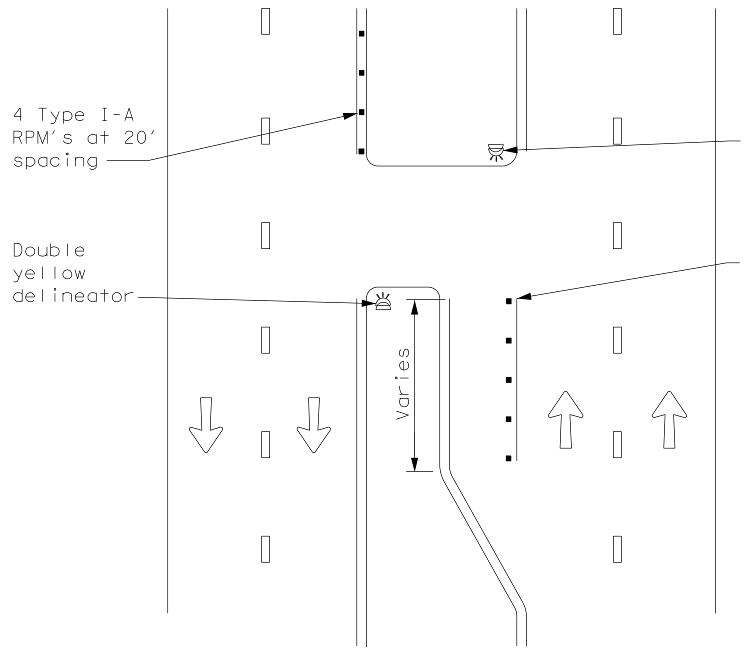
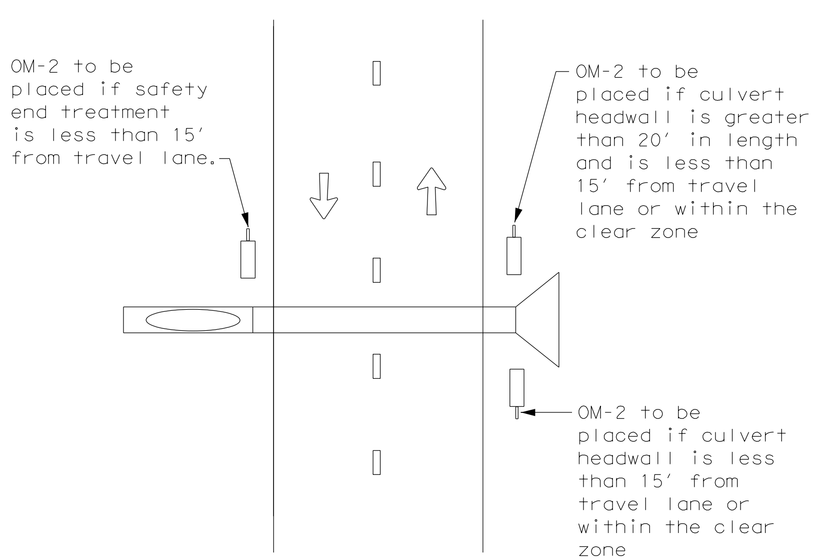
CROSSOVERS



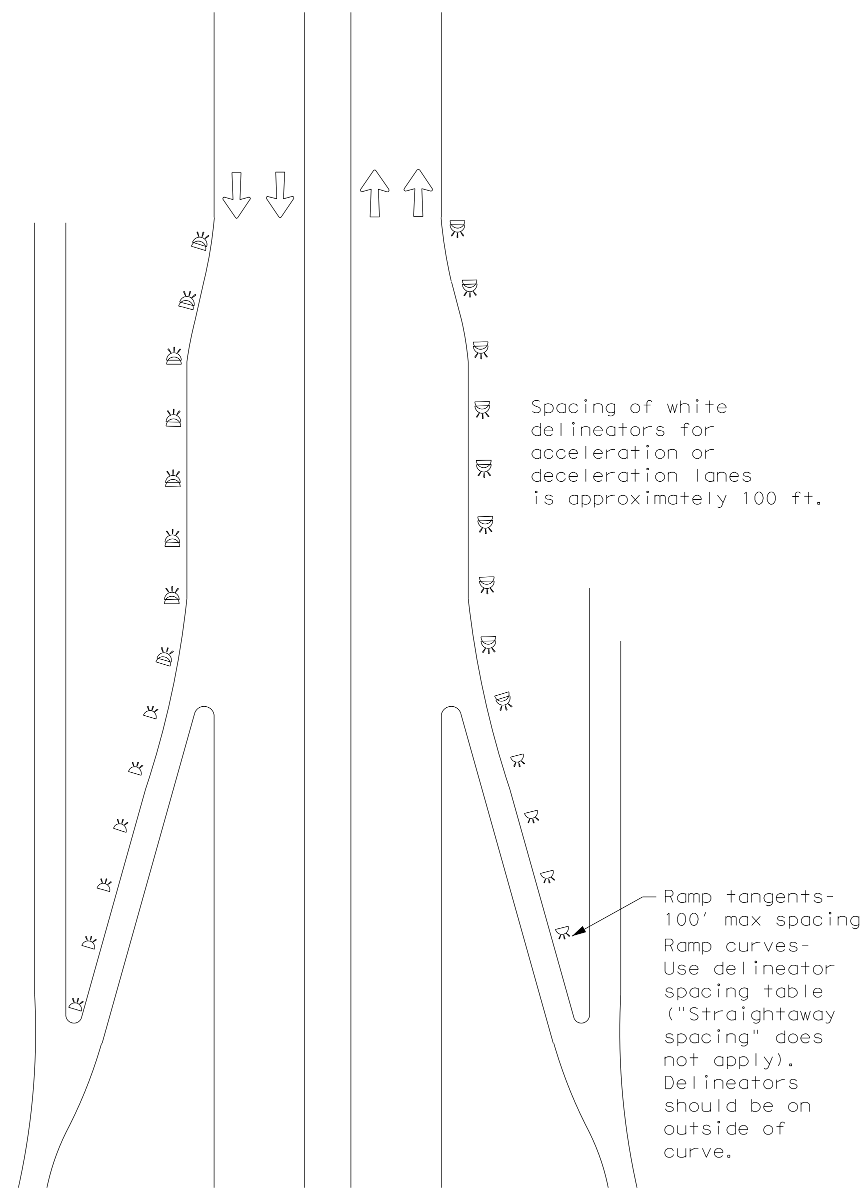
DETAIL 1

FOR CULVERTS WITHOUT MBGF



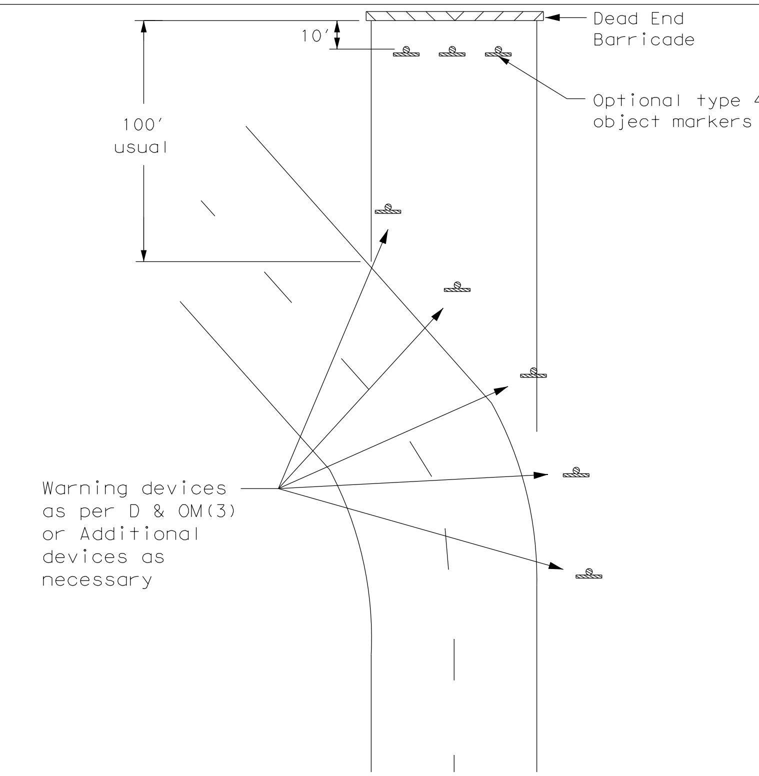
DETAIL 2

FREEWAY DELINEATION FOR RAMPS AND ACCELERATION/DECELERATION LANES



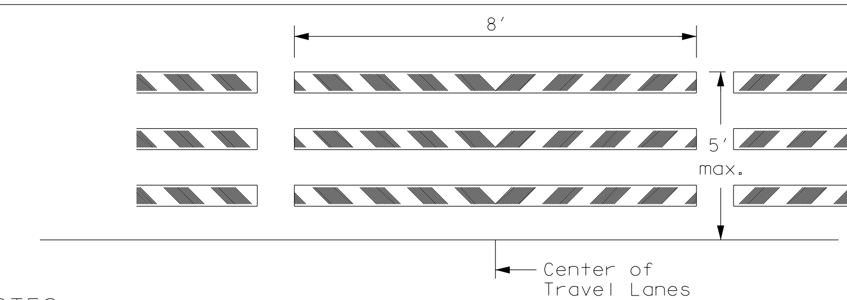
DETAIL 3

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
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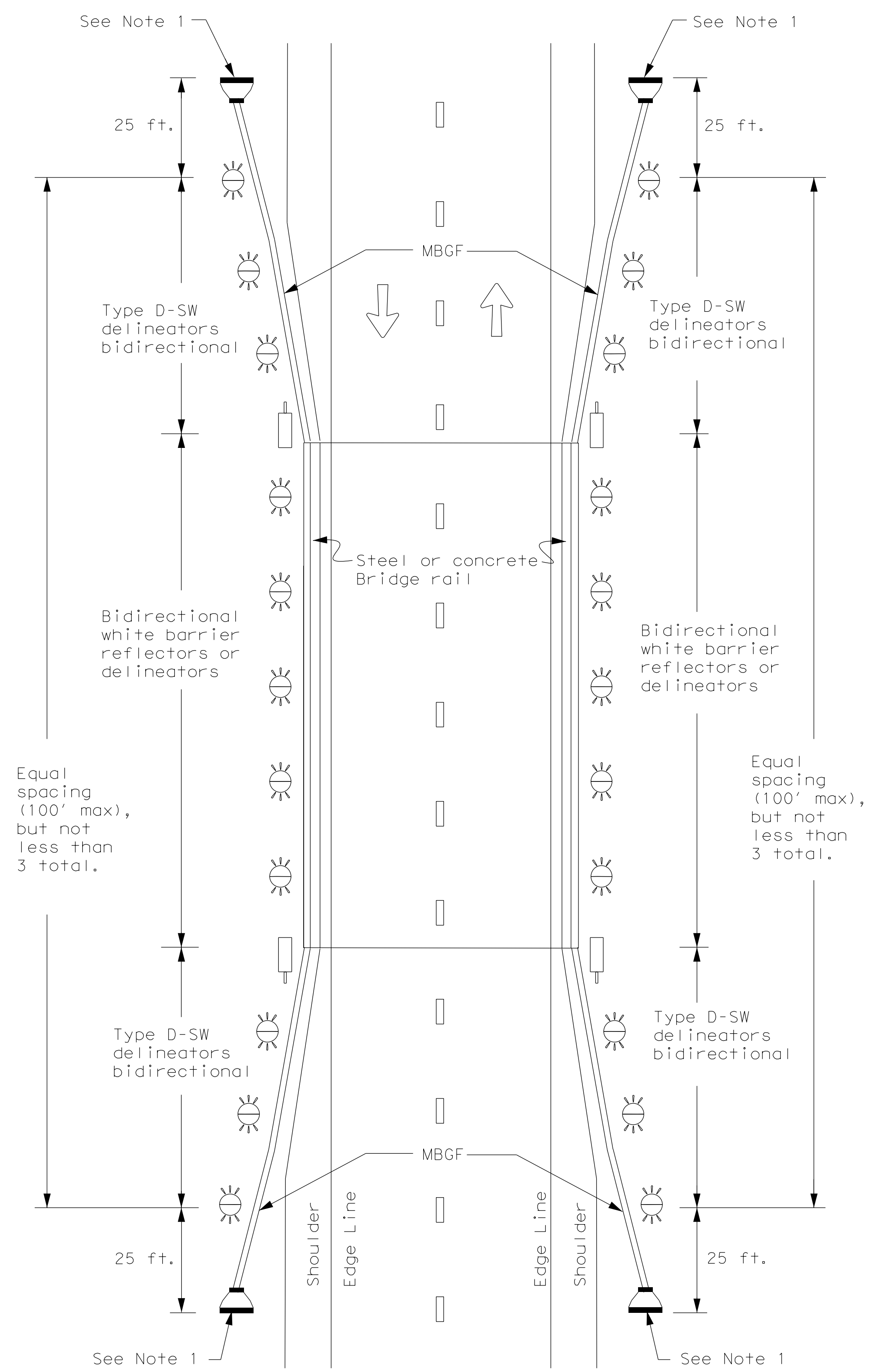
REVISIONS 3-15 7-20	2038	01	031	FM 2115
	DIST		COUNTY	SHEET NO.
	WAC		BELL	197

20D

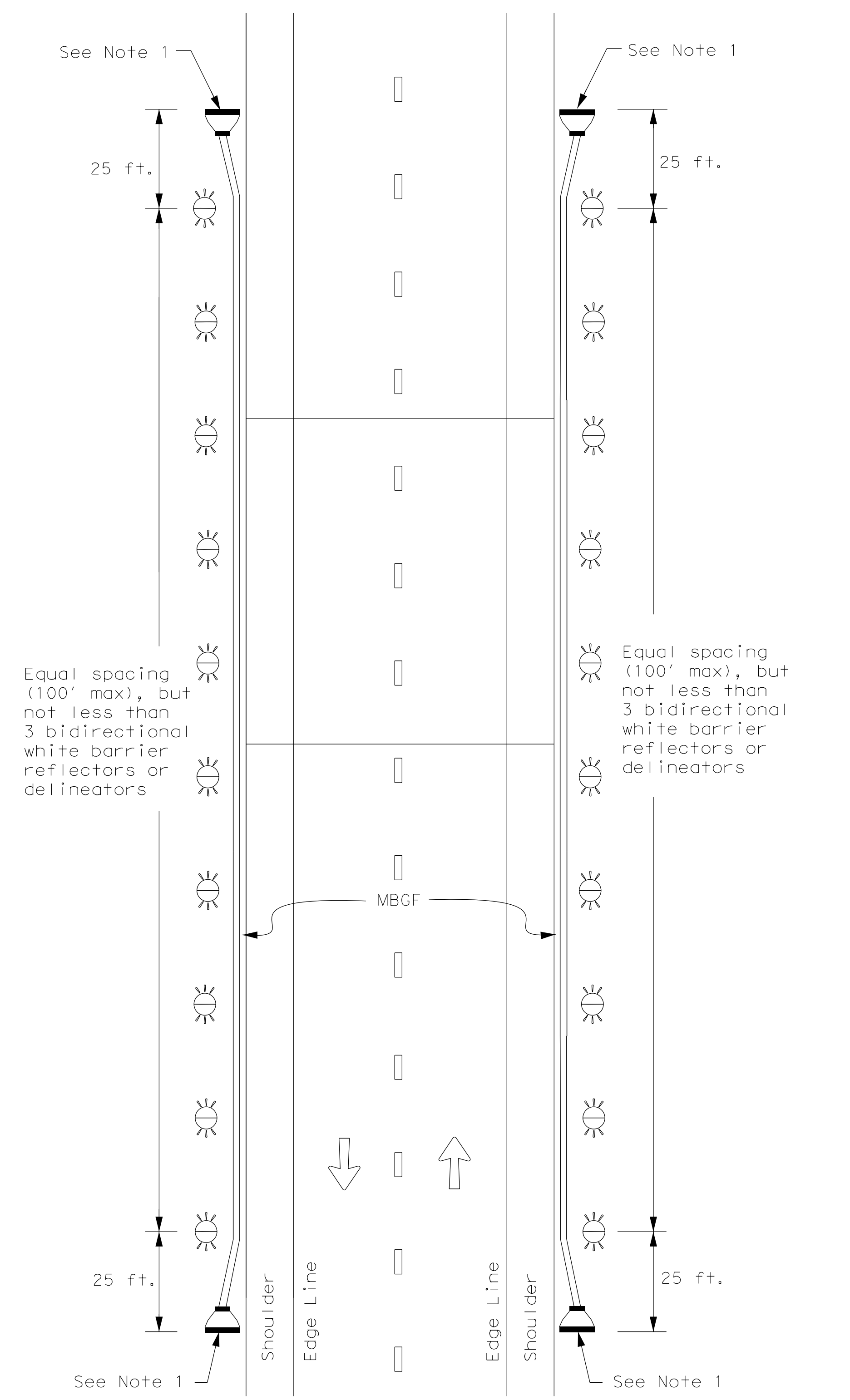
TWO-WAY, TWO LANE ROADWAY WITH REDUCED WIDTH APPROACH RAIL



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.

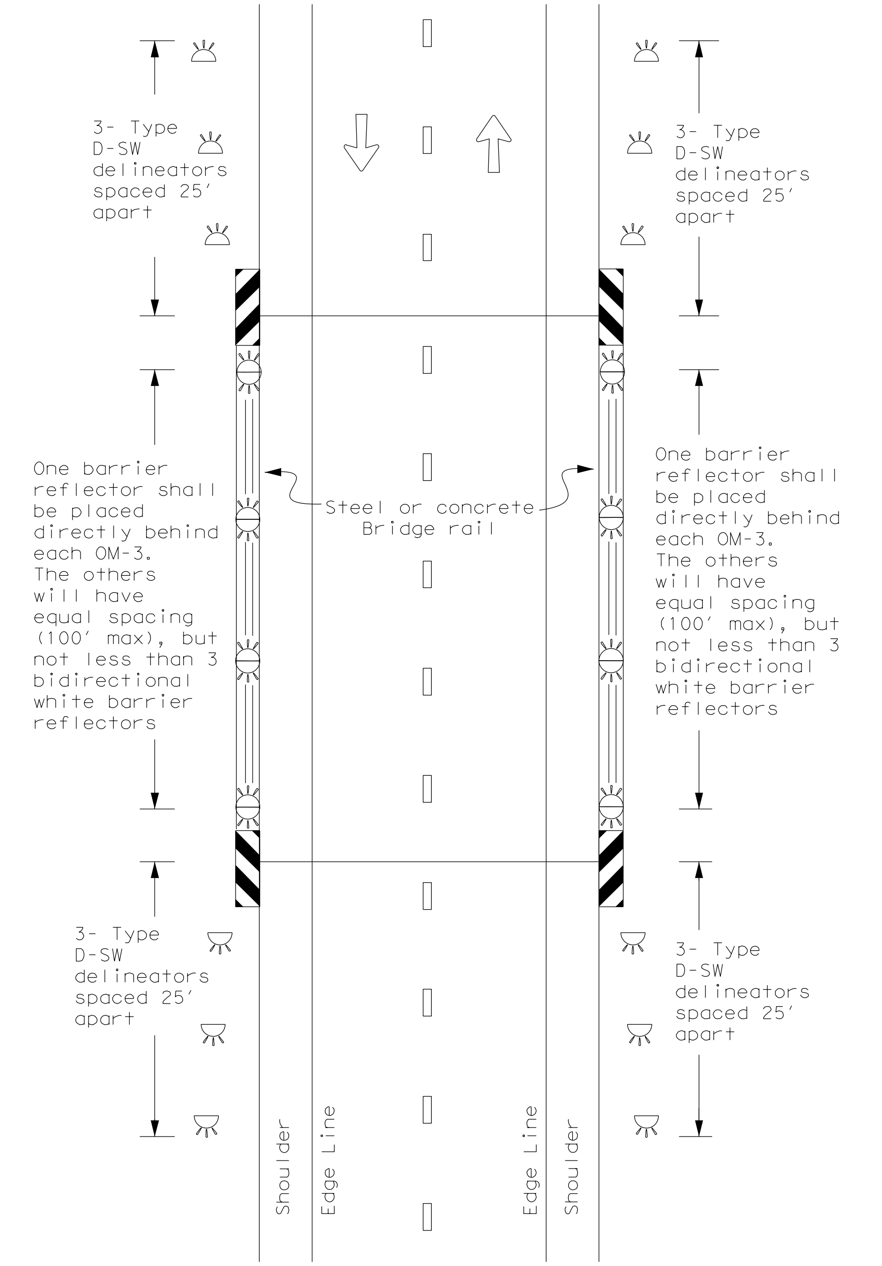
TWO-WAY, TWO LANE ROADWAY WITH METAL BEAM GUARD FENCE (MBGF)



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

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DELINEATOR & OBJECT MARKER PLACEMENT DETAILS

D & OM(5)-20

FILE:	dom5-20.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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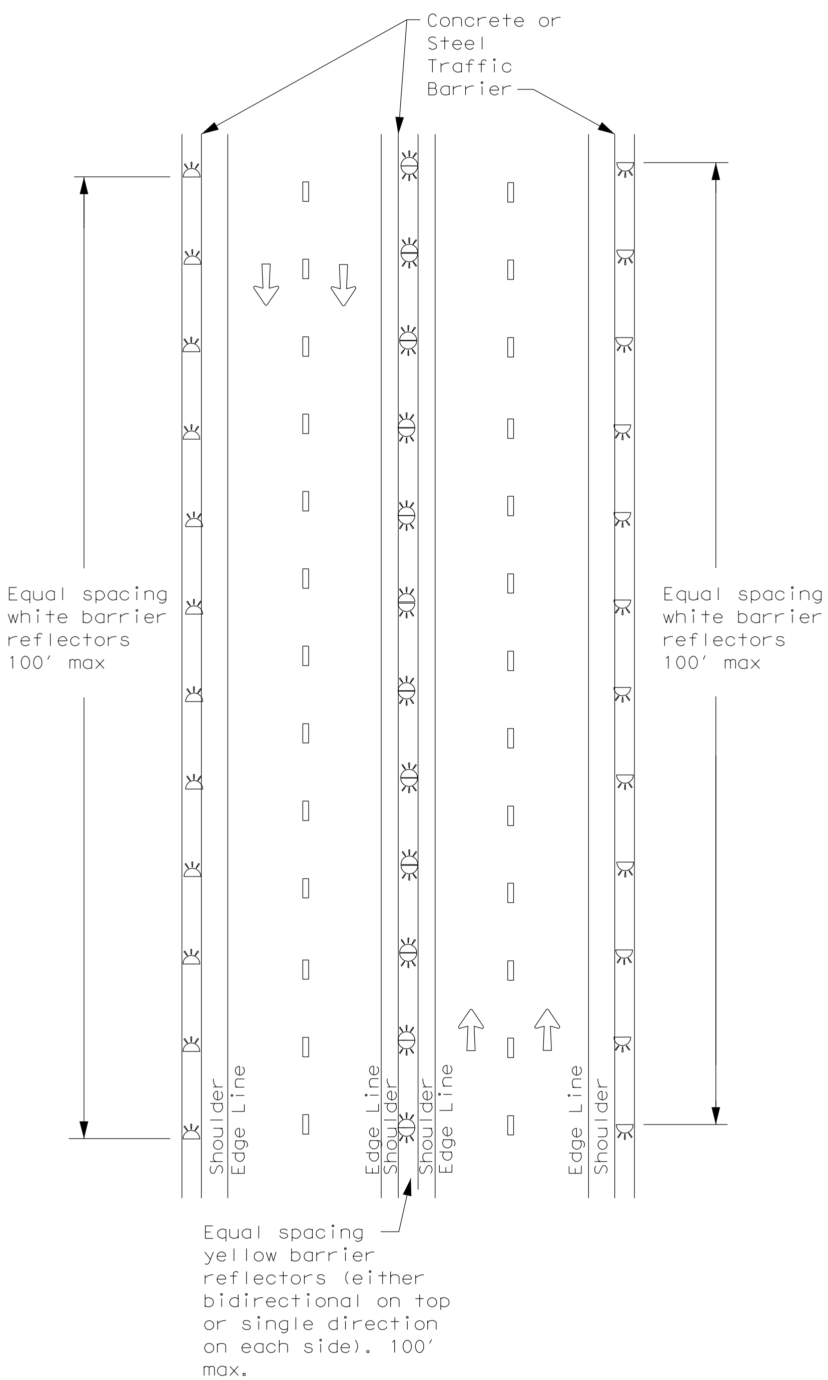
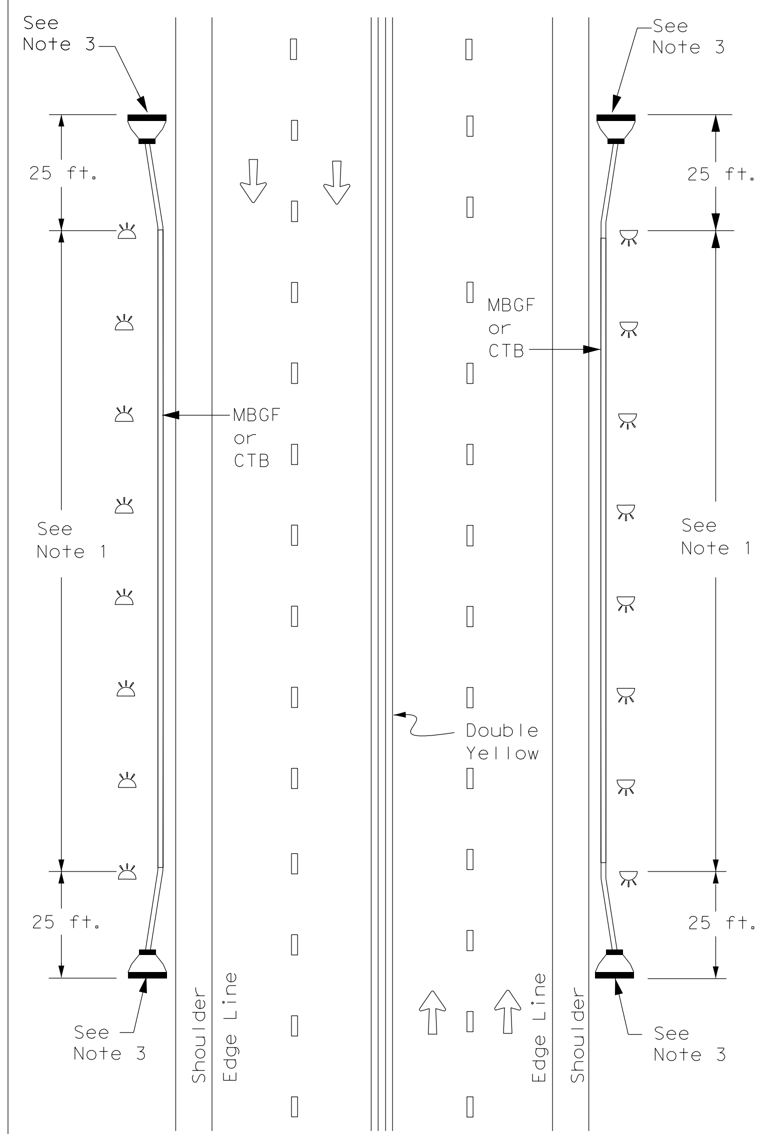
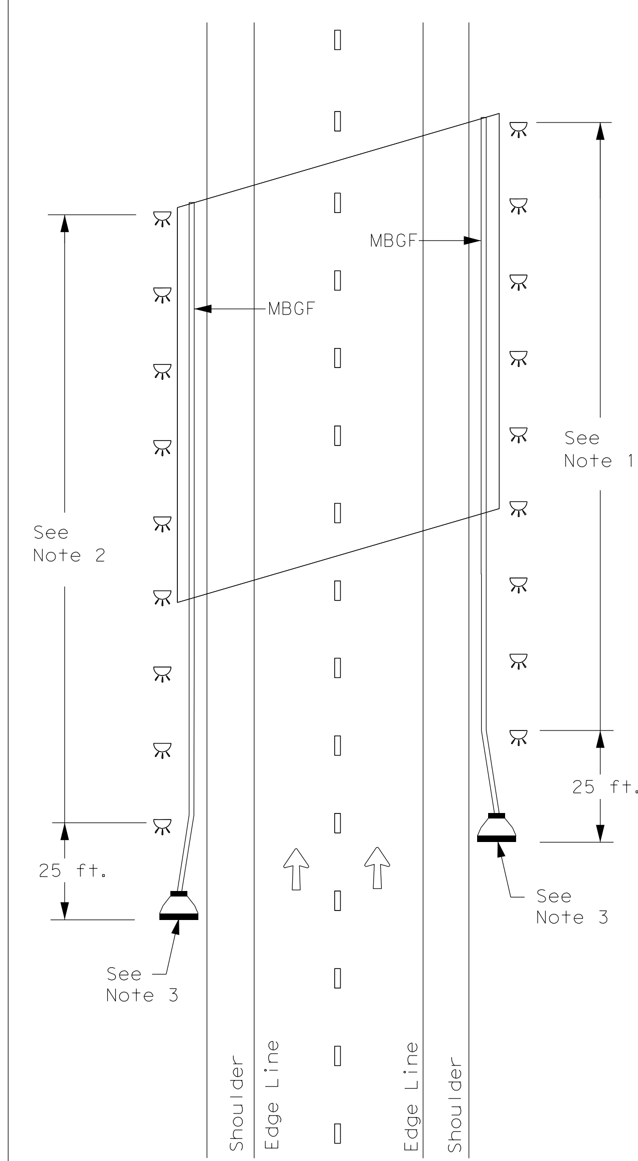
REVISIONS		2038	01	031	FM 2115
7-20		DIST		COUNTY	SHEET NO.
		WAC		BELL	198

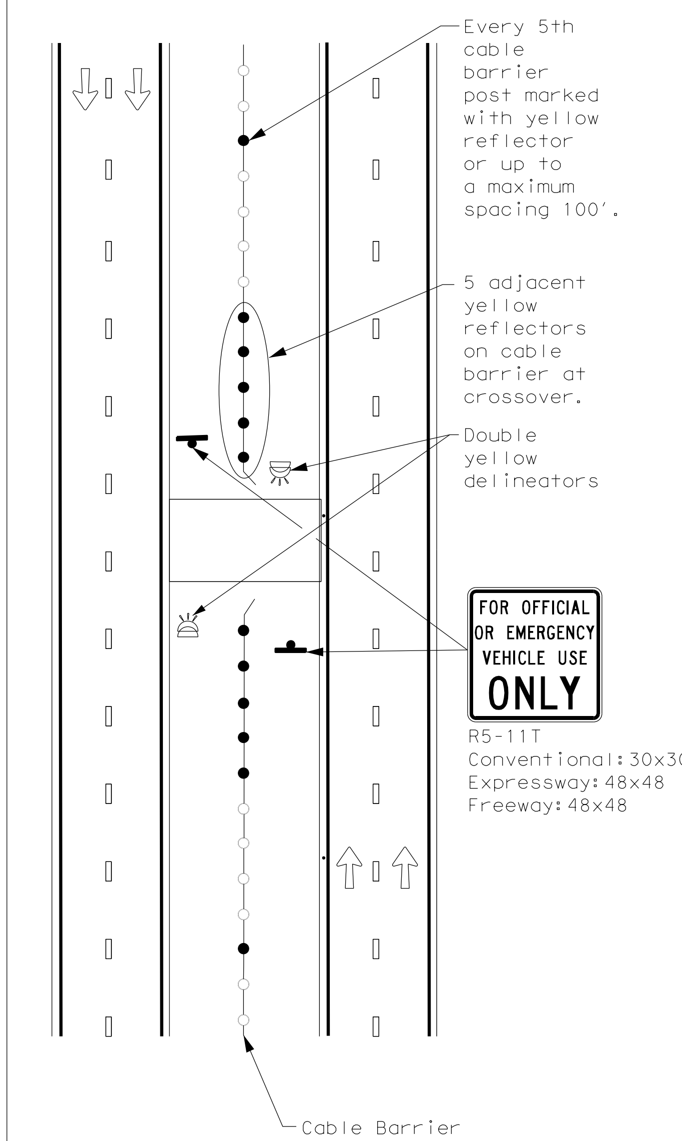
20E

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

Symbol	Description
	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
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7-20	DIST		COUNTY	SHEET NO.
	WAC		BELL	199

20F

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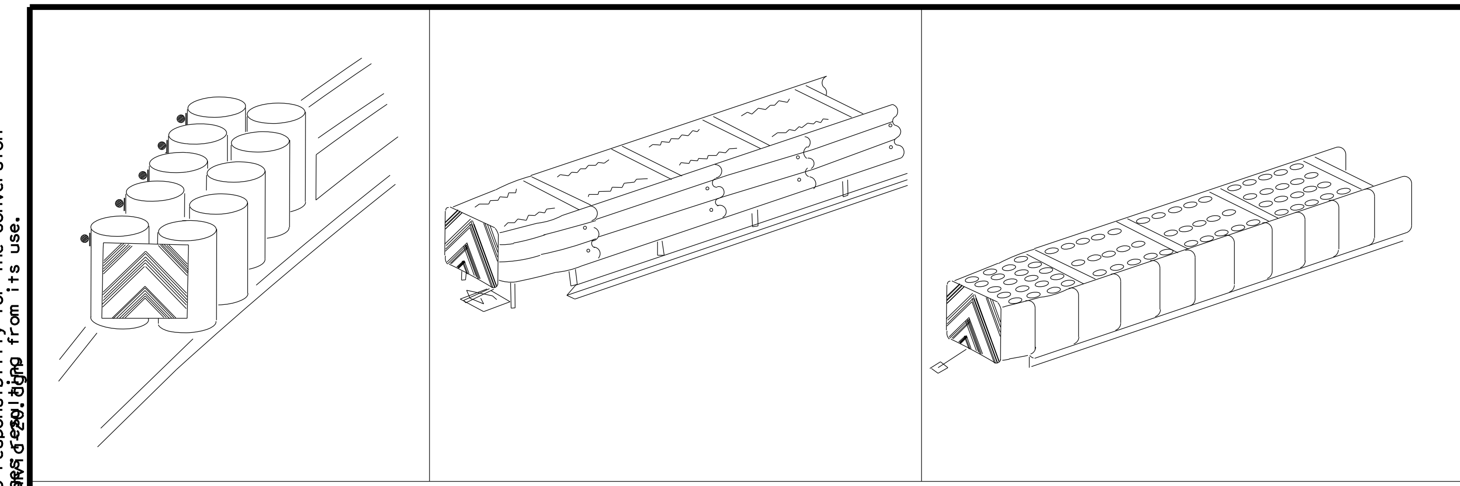
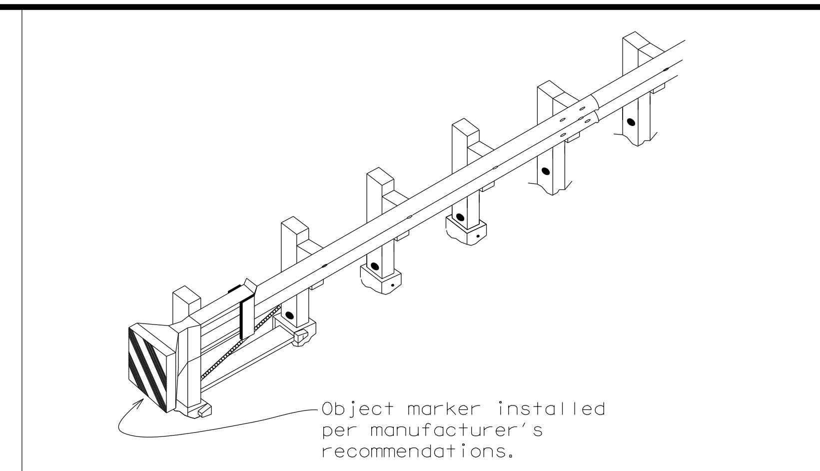
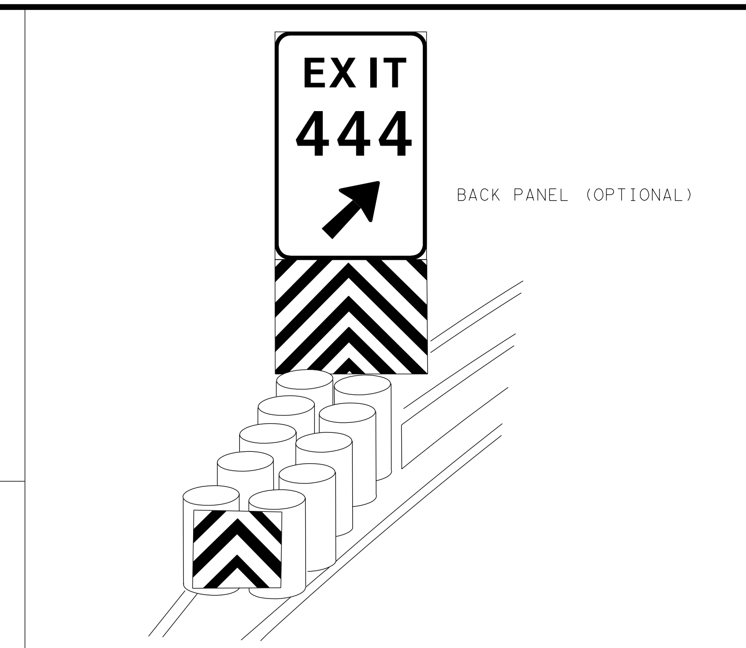
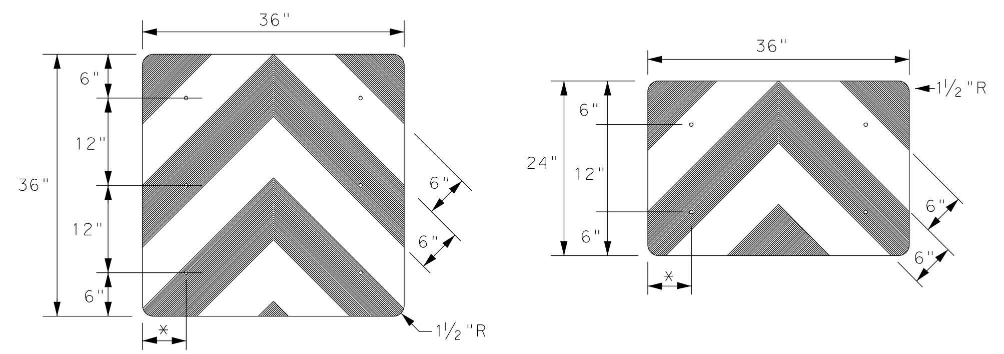
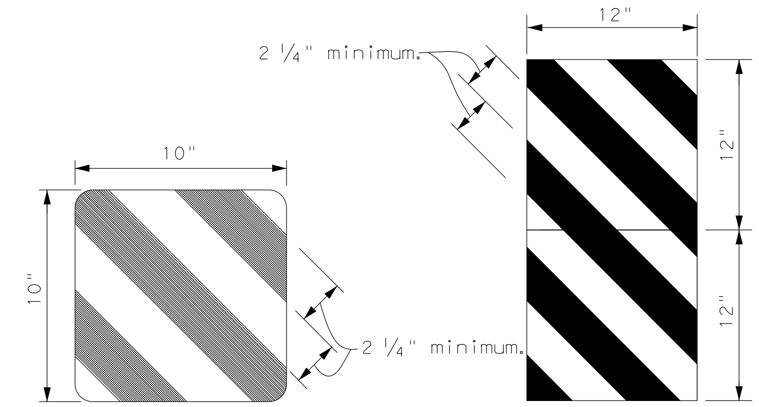




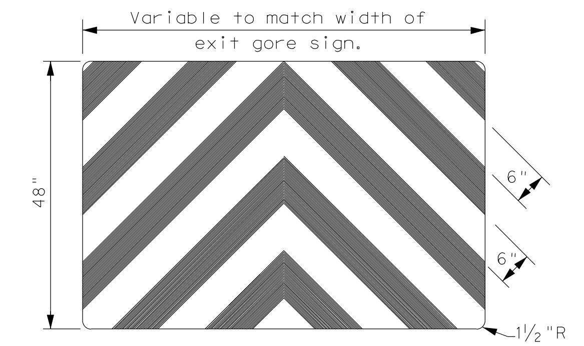


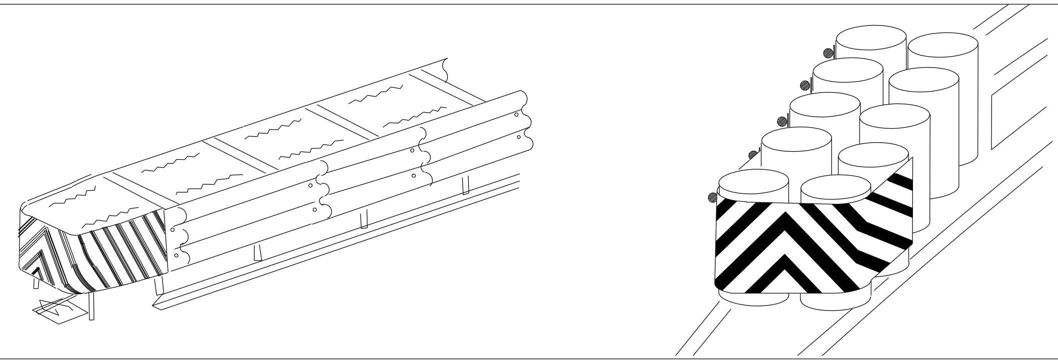


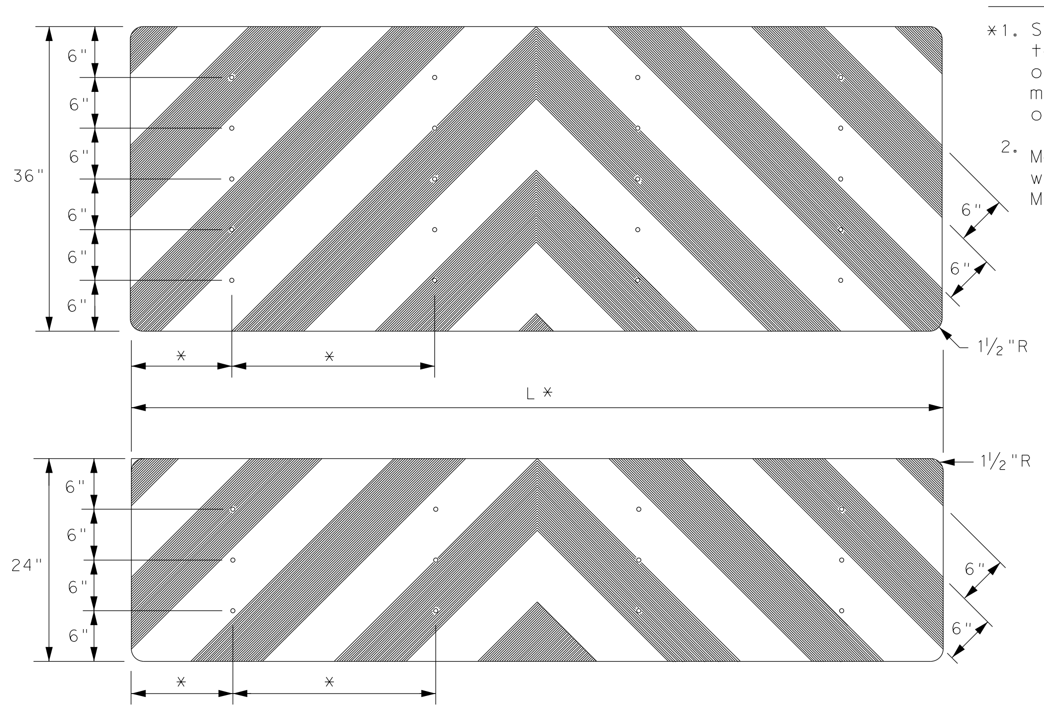
* Adjust to fit attenuator per manufacturer's recommendation, or as directed by the Engineer



OBJECT MARKERS SMALLER THAN 3 FT^2







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".

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 ¼".

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.

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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	2038	01	031	FM 2115	
4-92 8-04	DIST		COUNTY	SHEET NO.	
8-95 3-15 4-98 7-20	WAC		BELL	200	

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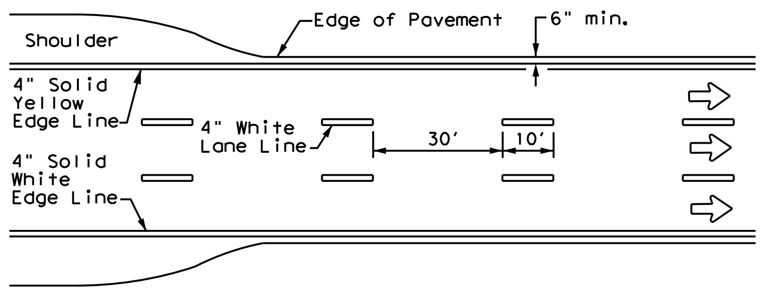
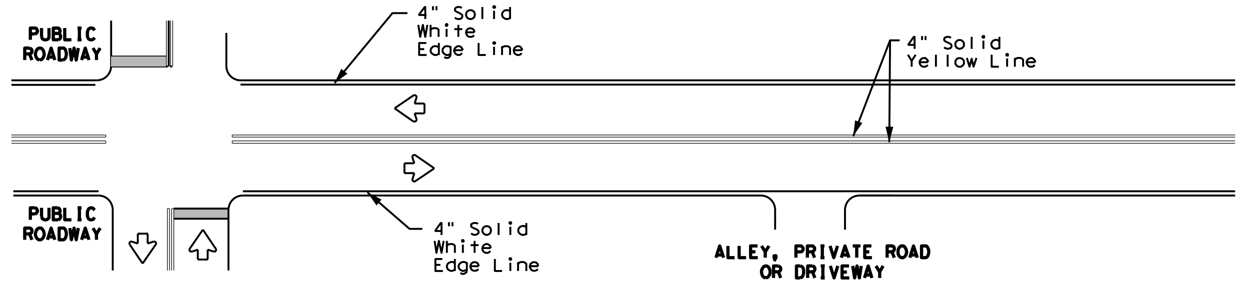


EDGE LINE AND LANE LINES
ONE-WAY ROADWAY
WITH OR WITHOUT SHOULDERS



TYPICAL TWO-LANE, TWO-WAY PAVEMENT
MARKINGS THROUGH INTERSECTIONS

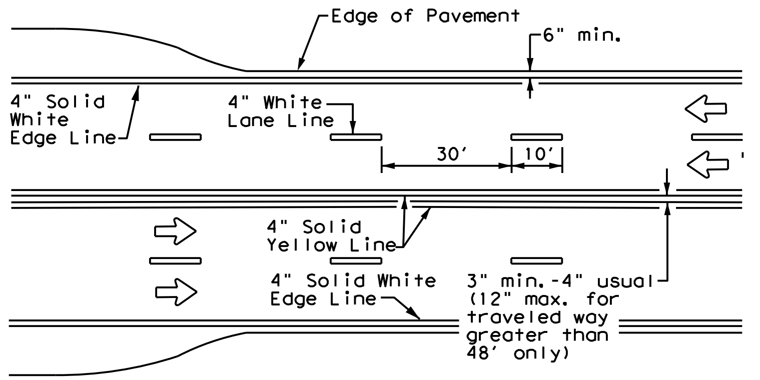
GENERAL NOTES

1. Edgeline striping shall be as shown in the plans or as directed by the Engineer. The edgeline should not be placed less less than 6 inches from the edge of pavement. This distance may vary due to pavement raveling or other conditions. Edgelines are not required in curb and gutter sections of roadways.

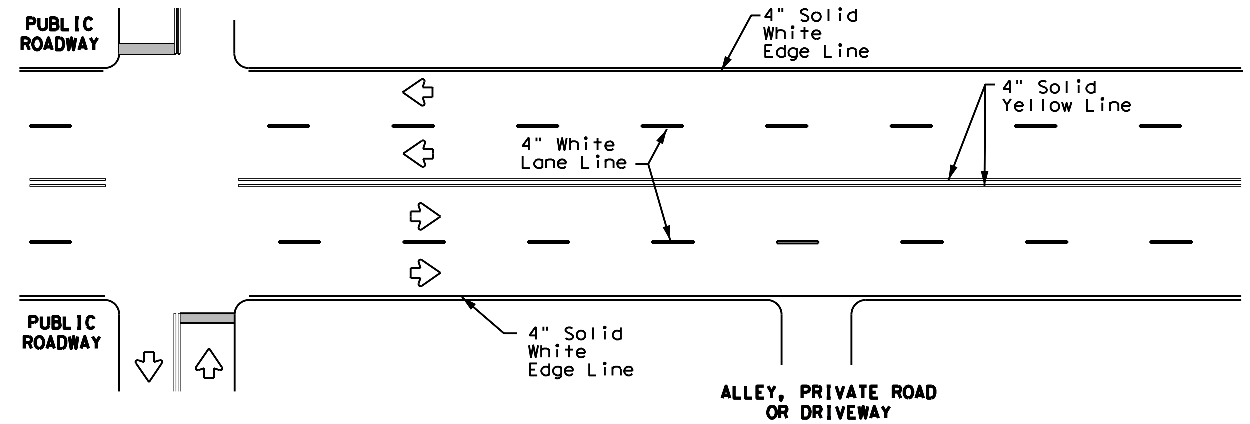
2. The traveled way includes only that portion of the roadway used for vehicular travel. It does not include the parking lanes, sidewalks, berms and shoulders. The traveled ways shall be measured from the inside of edgeline to the inside of edgeline of a two lane roadway.

MATERIAL SPECIFICATIONS	
PAVEMENT MARKERS (REFLECTORIZED)	DMS-4200
EPOXY AND ADHESIVES	DMS-6100
BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS	DMS-6130
TRAFFIC PAINT	DMS-8200
HOT APPLIED THERMOPLASTIC	DMS-8220
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240

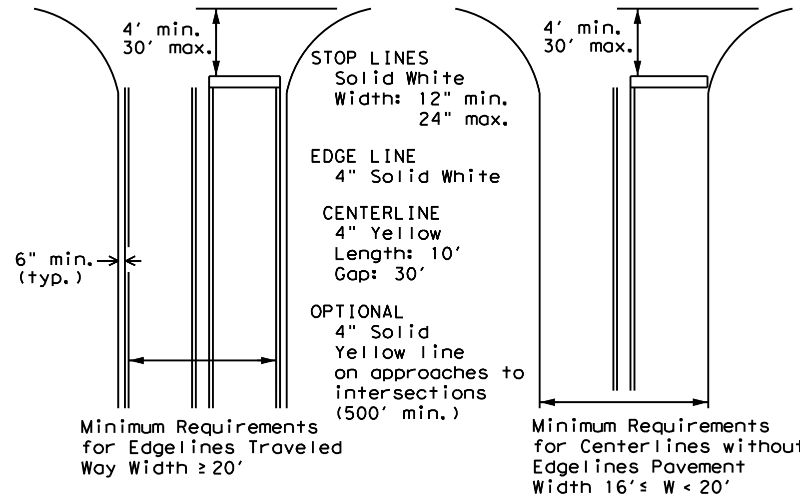
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



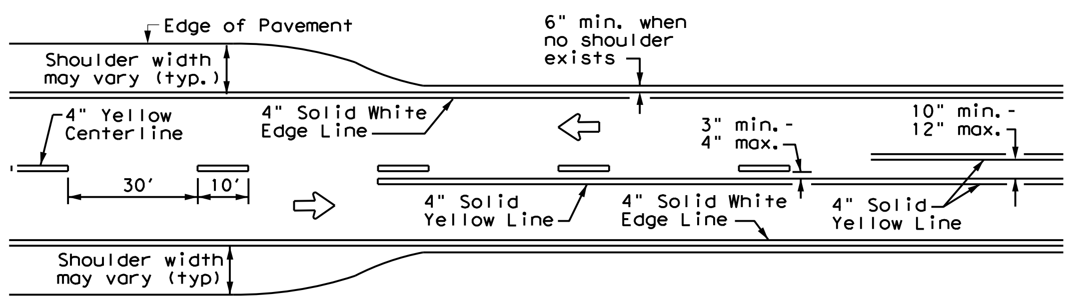
CENTERLINE AND LANE LINES
FOUR LANE TWO-WAY ROADWAY
WITH OR WITHOUT SHOULDERS



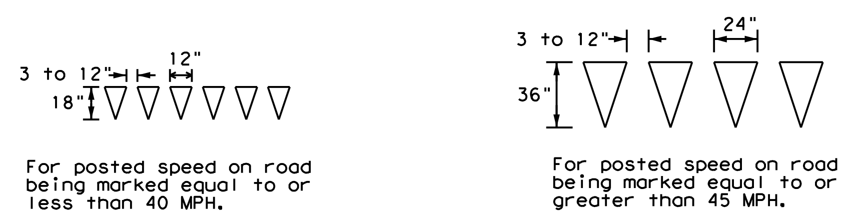
TYPICAL MULTI-LANE, TWO-WAY PAVEMENT
MARKINGS THROUGH INTERSECTIONS



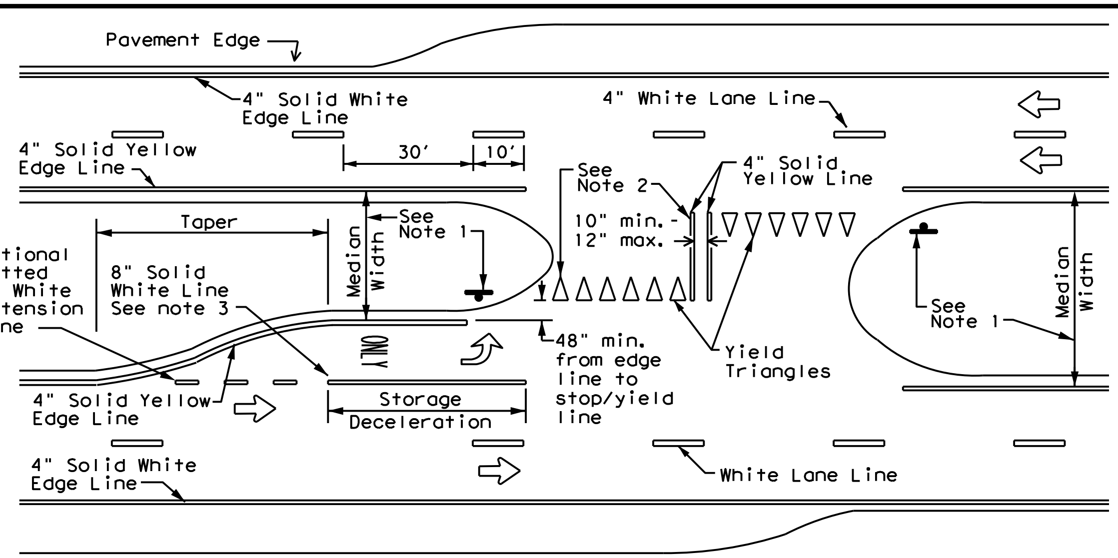
GUIDE FOR PLACEMENT OF STOP LINES,
EDGE LINE & CENTERLINE
Based on Traveled Way and Pavement Widths for Undivided Highways



TWO LANE TWO-WAY ROADWAY
WITH OR WITHOUT SHOULDERS



YIELD LINES



FOUR LANE DIVIDED ROADWAY CROSSOVERS

NOTES

1. Where divided highways are separated by median widths at the median opening itself of 30 feet or more, median openings shall be signed as two separate intersections. Each median opening has two width measurements, with one measurement for each approach. The narrow median width will be the controlling width to determine if signs are required. Yield signs are the typical intersection control. Stop signs are optional as determined by the Engineer.

2. Install median striping (double yellow centerlines and stop bars/yield triangles) when a 50' or greater median centerline can be placed. Stop bars shall only be used with stop signs. Yield troingles shall only be used with yield signs.

3. Length of turn bays, including taper, deceleration, and storage lengths shall be as shown on the plans or as directed by the Engineer.

Texas Department of Transportation
Traffic Safety Division Standard

TYPICAL STANDARD PAVEMENT MARKINGS

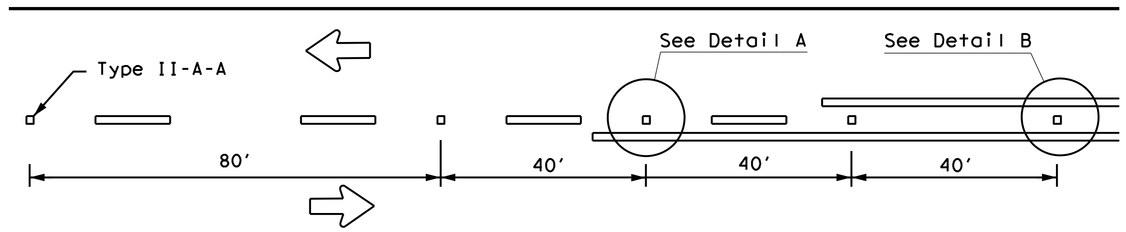
PM(1)-20

FILE: pm1-20.dgn	DN:	CK:	DW:	CK:
© TxDOT November 1978	CONT	SECT	JOB	HIGHWAY
REVISIONS 8-95 3-03 / 5-00 2-12 / 8-00 6-20	2038	01	031	FM 2115
	DIST		COUNTY	SHEET NO.
	WAC		BELL	201

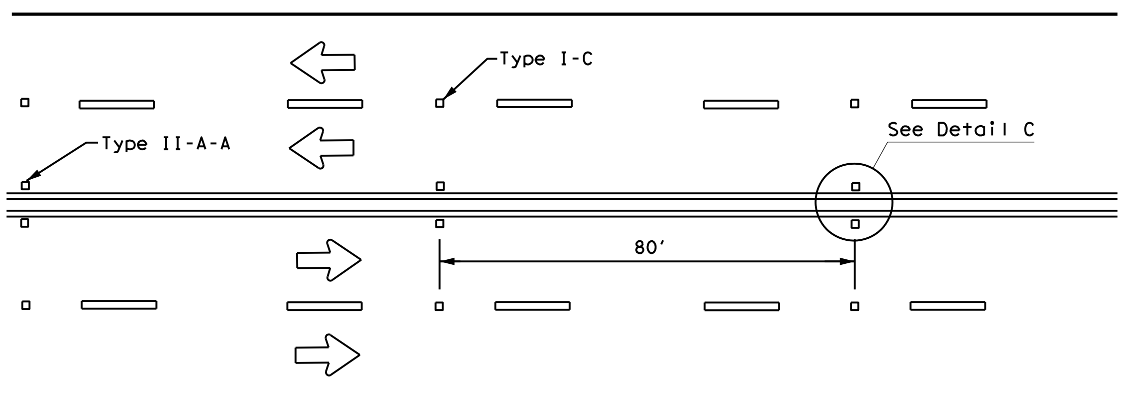
22A

DATE: 8/28/2021 5:45:16 PM
FILE: pw:\\txdot.projectwiseonline.com:TXDOT3\Documents\09 - WAC\Design Projects

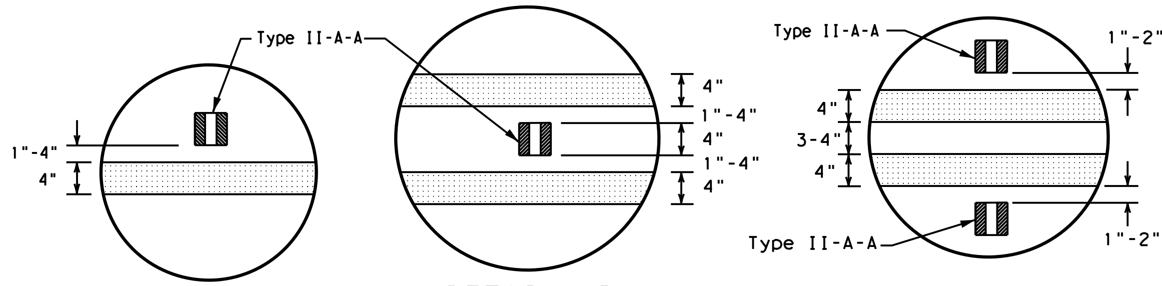
REFLECTIVE RAISED PAVEMENT MARKERS FOR VEHICLE POSITIONING GUIDANCE



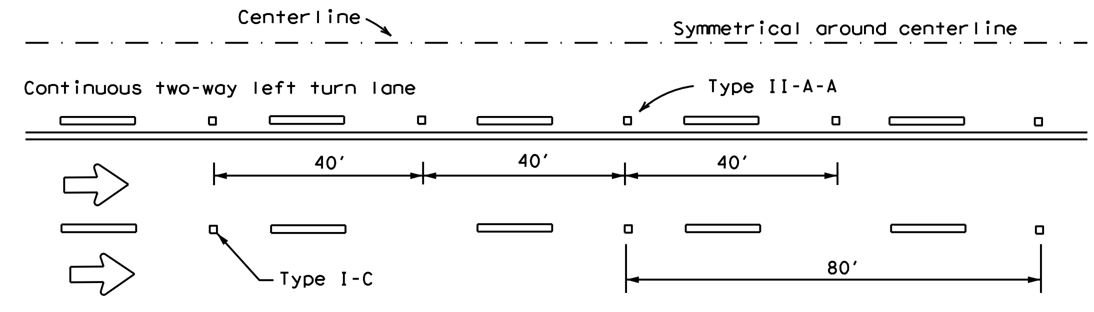
CENTERLINE FOR ALL TWO LANE ROADWAYS



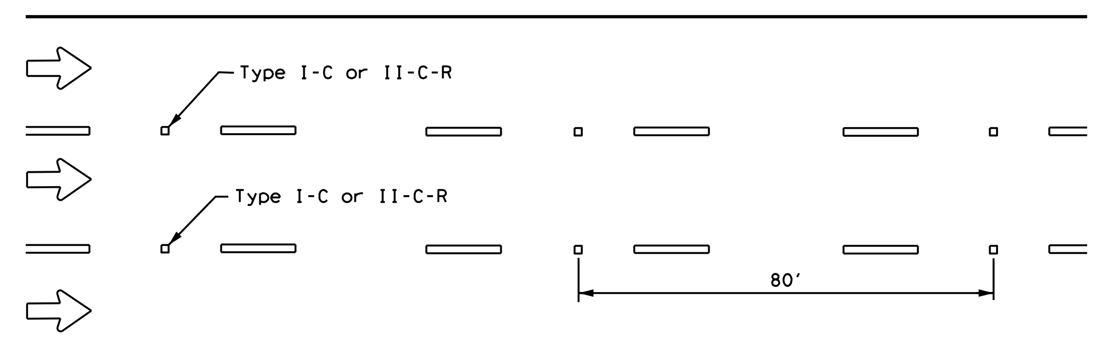
CENTERLINE & LANE LINES FOR FOUR LANE TWO-WAY HIGHWAYS



DETAIL "A" DETAIL "B" DETAIL "C"



CENTERLINE AND LANE LINES FOR TWO-WAY LEFT TURN LANE

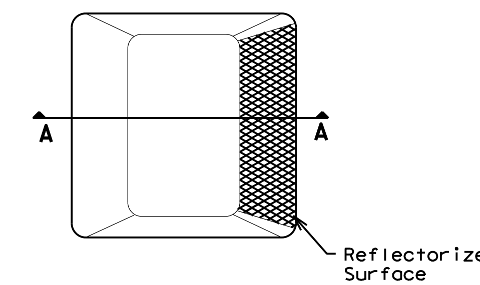


LANE LINES FOR ONE-WAY ROADWAY (NON-FREEWAY FACILITIES)

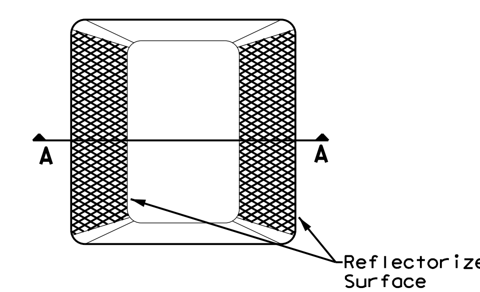
Raised pavement markers Type II-C-R shall have clear face toward normal traffic and red face toward wrong-way traffic.

MATERIAL SPECIFICATIONS	
PAVEMENT MARKERS (REFLECTORIZED)	DMS-4200
EPOXY AND ADHESIVES	DMS-6100
BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS	DMS-6130
TRAFFIC PAINT	DMS-8200
HOT APPLIED THERMOPLASTIC	DMS-8220
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240

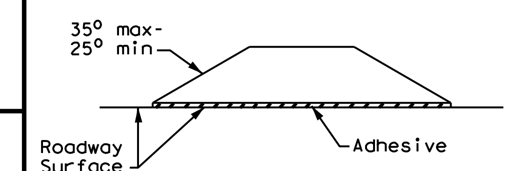
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



Type I (Top View)

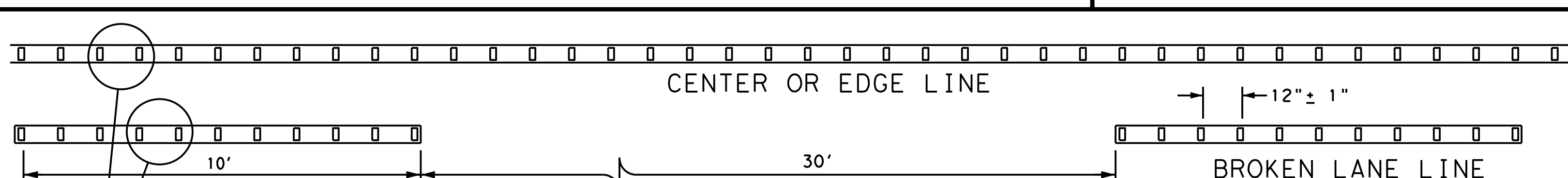


Type II (Top View)



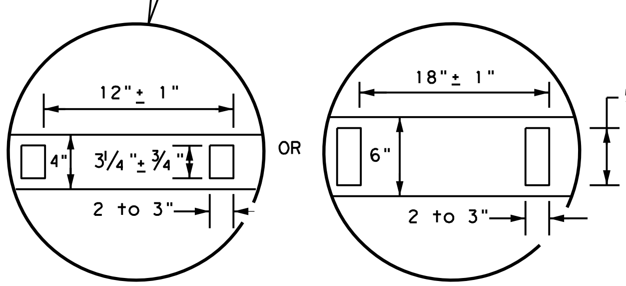
SECTION A

RAISED PAVEMENT MARKERS



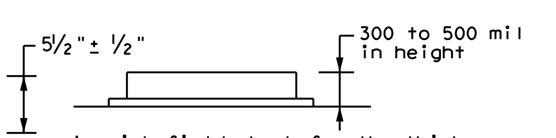
REFLECTORIZED PROFILE PATTERN DETAIL

USING REFLECTIVE PROFILE PAVEMENT MARKINGS



4" EDGE LINE, CENTER LINE OR LANE LINE

OPTIONAL 6" EDGE LINE, CENTER LINE OR LANE LINE



A quick field check for the thickness of base line and profile marking is approximately equal to a stack of 5 quarters to a maximum height of 7 quarters.

NOTE

Profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.

GENERAL NOTES

1. All raised pavement markers placed in broken lines shall be placed in line with and midway between the stripes.
2. On concrete pavements the raised pavement markers should be placed to one side of the longitudinal joints.

Texas Department of Transportation — Traffic Safety Division Standard

POSITION GUIDANCE USING RAISED MARKERS RELECTORIZED PROFILE MARKINGS PM(2)-20

FILE: pm2-20.dgn	DN:	CK:	DW:	CK:
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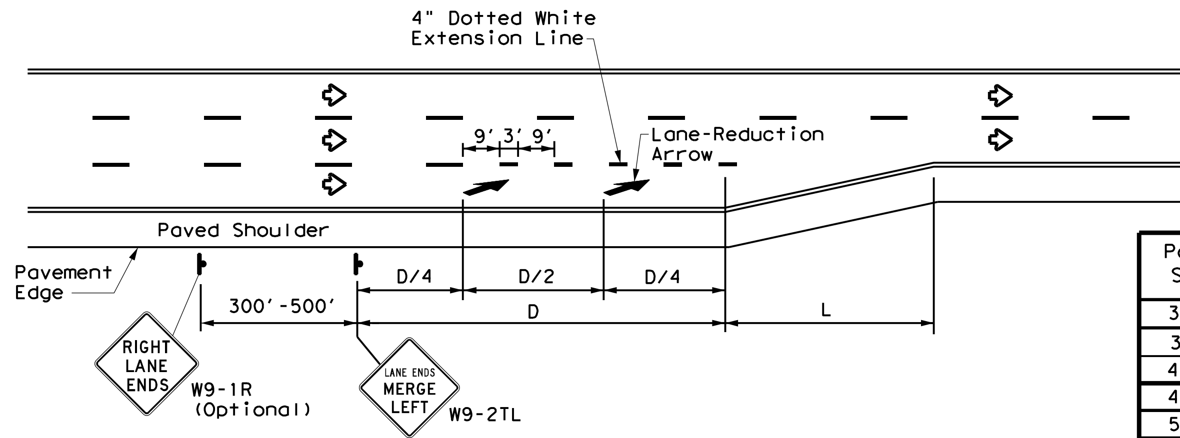
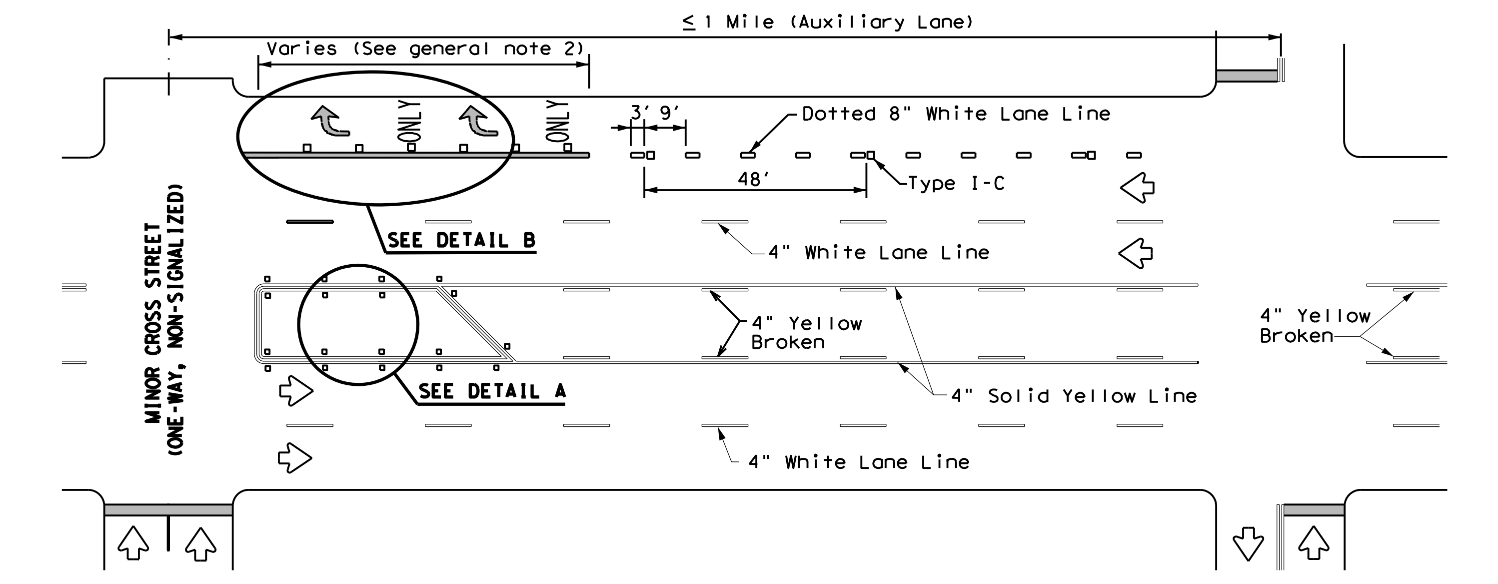
REVISIONS 4-92 2-10, 5-00 2-12, 8-00 6-20	2038	01	031	FM 2115
	DIST		COUNTY	SHEET NO.
	WAC		BELL	202

22B

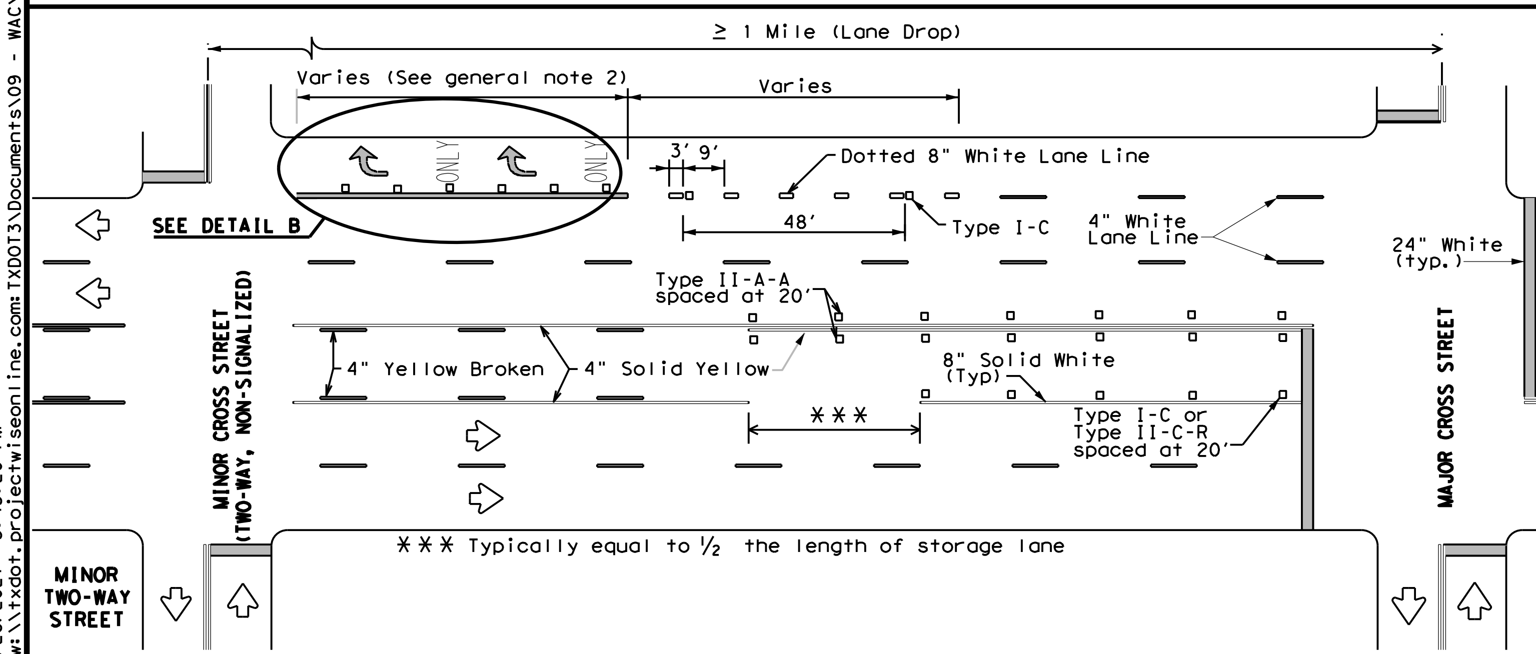


LANE REDUCTION

Posted Speed	D (ft)	L (ft)
30 MPH	460	$L = \frac{WS^2}{60}$
35 MPH	565	
40 MPH	670	
45 MPH	775	L=WS
50 MPH	885	
55 MPH	990	
60 MPH	1,100	
65 MPH	1,200	
70 MPH	1,250	
75 MPH	1,350	



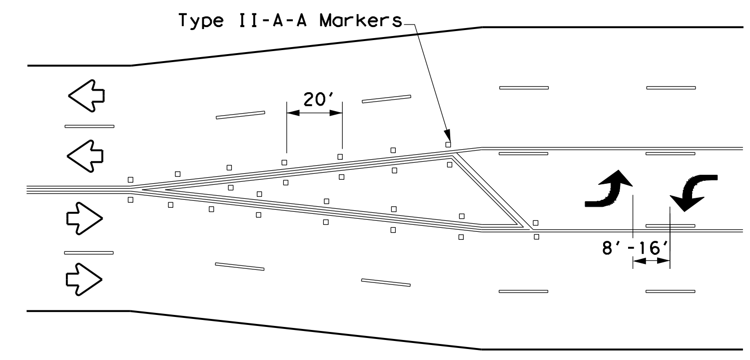
TYPICAL TWLTL AT ONE-WAY STREET AND RIGHT TURN AUXILIARY LANE



TYPICAL TWLTL AT TWO-WAY CROSS STREET AND RIGHT TURN LANE DROP

NOTES

1. Lane reduction pavement markings are used where the number of through lanes is reduced because of narrowing of the roadway or because of a section of on-street parking in what would otherwise be a through lane. For Texas Super 2 Passing Lanes, see TS2(PL) standard sheets.
2. On divided highways, an additional W9-1R "RIGHT LANE ENDS" sign may be installed in the median aligned with the W9-1R sign on the right side of the highway.
3. Lane reduction arrows are required for speeds of 45 mph or greater. An optional third lane reduction arrow may be added based on engineering judgement. If used, the optional third lane reduction arrow should be centered between the first and last lane reduction arrows.
4. For lane reductions on Freeways and Expressways, signing shall conform to the TxDOT Freeway Signing Handbook.



A two-way left-turn (TWLT) lane-use arrow pavement marking should be used at or just downstream from the beginning of a two-way left-turn lane within a corridor. Repeating the marking after each intersection or dedicated turn bay is not required unless stated elsewhere in the plans.

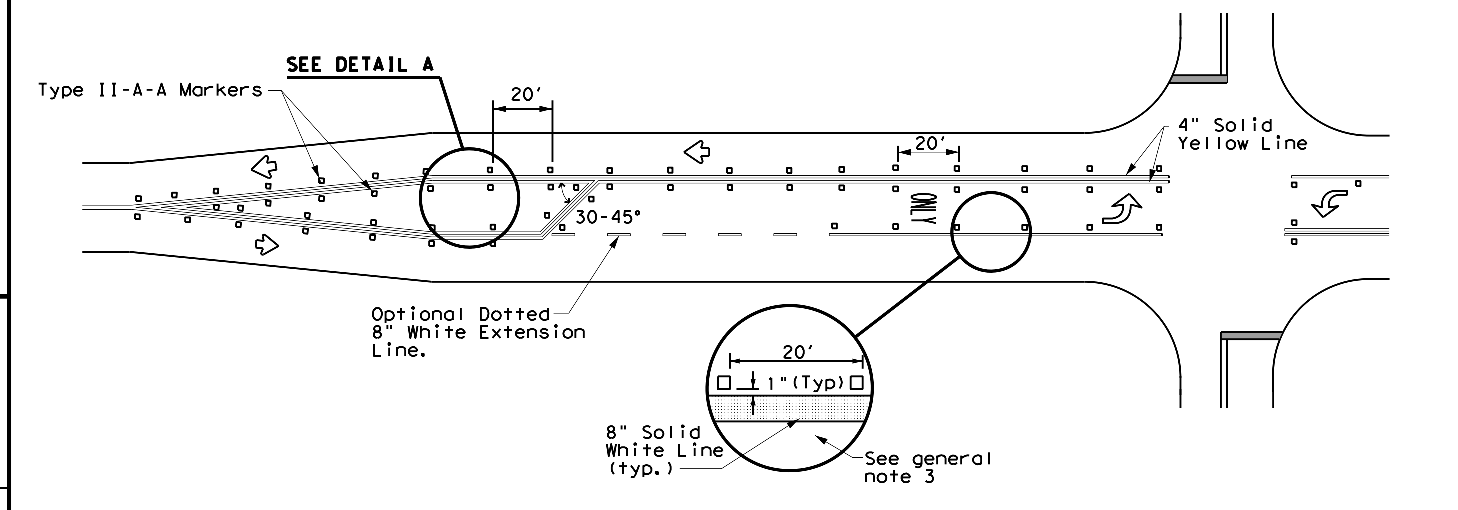
TYPICAL TRANSITION FOR TWLTL AND DIVIDED HIGHWAY

GENERAL NOTES

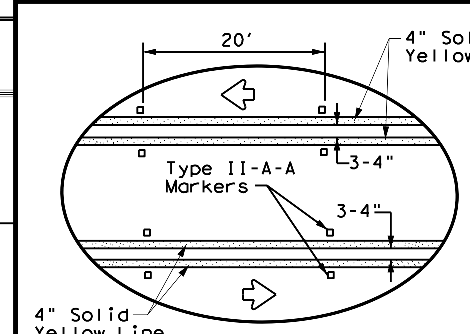
1. Lane use word and arrow markings shall be used where through lanes approaching an intersection become mandatory turn lanes. Lane use word and arrow markings should be used in auxiliary lanes of substantial length. Lane use arrow markings or word and arrow markings may be used in other lanes and turn bays for emphasis. Details for words and arrows are as shown in the Standard Highway Sign Designs for Texas.
2. When lane-use words and arrow markings are used, two sets of arrows should be used if the length of the bay is greater than 180 feet. When a single lane use arrow or word and arrow marking is used for a short turn lane, it should be located at or near the upstream end of the full-width turn lane.
3. Use raised pavement marker Type I-C with undivided highways, flush medians and two way left turn lanes. Use raised pavement marker Type II-C-R with divided highways and raised medians.
4. Length of turn bays, including taper, deceleration, and storage lengths shall be as shown on the plans or as directed by the Engineer.

MATERIAL SPECIFICATIONS	
PAVEMENT MARKERS (REFLECTORIZED)	DMS-4200
EPOXY AND ADHESIVES	DMS-6100
BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS	DMS-6130
TRAFFIC PAINT	DMS-8200
HOT APPLIED THERMOPLASTIC	DMS-8220
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240

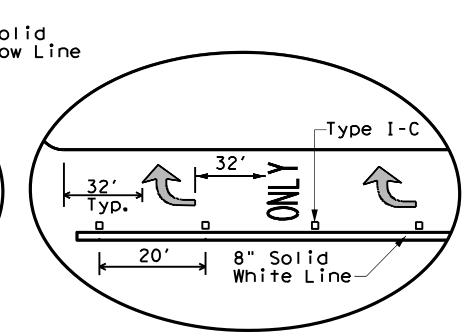
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



TYPICAL TWO-LANE HIGHWAY INTERSECTION WITH LEFT TURN BAYS



DETAIL A



DETAIL B

Texas Department of Transportation

Traffic Safety Division Standard

TWO-WAY LEFT TURN LANES, RURAL LEFT TURN BAYS, AND LANE REDUCTION PAVEMENT MARKINGS

PM(3)-20

FILE: pm3-20.dgn	DN:	CK:	DW:	CK:
© TxDOT April 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS 5-00 2-10 8-00 2-12 3-03 6-20	2038	01	031	FM 2115
	DIST		COUNTY	SHEET NO.
	WAC		BELL	203

22C

DATE: 8/28/2021 5:45:20 PM
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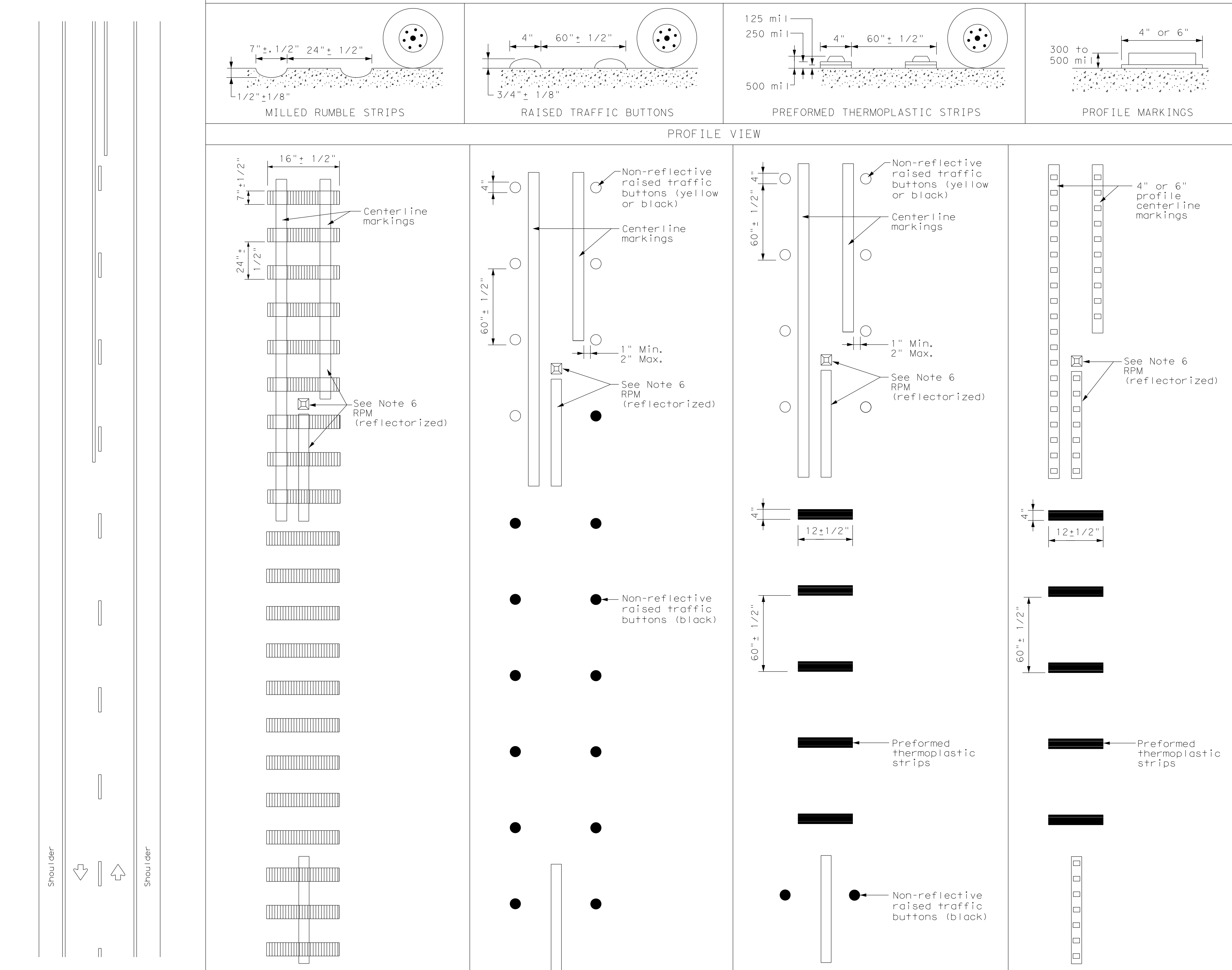
CENTERLINE RUMBLE STRIPS



TWO LANE TWO-WAY ROADWAYS

PLAN VIEW
OPTION 1
MILLED CENTERLINE RUMBLE STRIPS

PLAN VIEW
OPTION 2
RAISED CENTERLINE RUMBLE STRIPS

PLAN VIEW
OPTION 3
RAISED CENTERLINE RUMBLE STRIPS AND PREFORMED THERMOPLASTIC STRIPS

PLAN VIEW
OPTION 4
PROFILE CENTERLINE MARKINGS AND PREFORMED THERMOPLASTIC STRIPS

GENERAL NOTES

1. This standard sheet provides guidelines for installing centerline rumble strips on two-lane highways with or without shoulders.
2. Centerline and edgeline rumble strips or profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.
3. Milled rumble strips are preferred when adequate pavement depth is available. If pavement thickness is less than 2 inches, milled rumble strips shall not be used. Rumble strips shall not be milled or depressed into bridge decks.
4. See dimensions for milled rumble strips. Other shapes and dimensions may be used if approved by the Traffic Operations Division.
5. Breaks in milled centerline rumble strips shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossings, intersections and driveways with high usage of large trucks.
6. Use Standard Sheet PM(2) for positioning, dimensioning, and spacing of all reflective raised pavement markers, and dimensions pavement markings and profile markings.
7. Consideration should be given to noise levels when centerline rumble strips are installed near residential areas, schools, churches, etc. A minimum of 3/8 inch depth of milled rumble strip may be considered in these areas.
8. Pavement markings must be applied over milled centerline rumble strips.

WHEN INSTALLING CENTERLINE RUMBLE STRIPS:

9. Raised rumble strips consisting of non-reflective raised traffic buttons may be used. Non-reflective raised traffic buttons can be affixed to asphalt or concrete with bitumen or adhesives, as per manufacturer's recommendations.
10. When using non-reflective raised traffic buttons as a centerline rumble strip, the button shall be placed adjacent to the pavement marking delineating the centerline. The buttons will be paid for under Item 672, "Raised Pavement Markers." Non-reflective traffic buttons must meet the requirements of DMS-4300.
11. The color of the button should be yellow for a continuous no passing roadway. Black buttons should be used in areas where passing is allowed.

WHEN INSTALLING EDGELINE RUMBLE STRIPS WITH OR WITHOUT CENTERLINE RUMBLE STRIPS ON UNDIVIDED HIGHWAYS:

12. See standard sheet RS(4).

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Texas Department of Transportation®
Traffic Operations Division Standard

CENTERLINE RUMBLE STRIPS ON TWO LANE TWO-WAY HIGHWAYS

RS(3)-13

FILE:	rs(3)-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT October 2013	CONT	SECT	JOB	HIGHWAY	
REVISIONS	2038	01	031	FM 2115	
	DIST		COUNTY	SHEET NO.	
	WAC		BELL	204	

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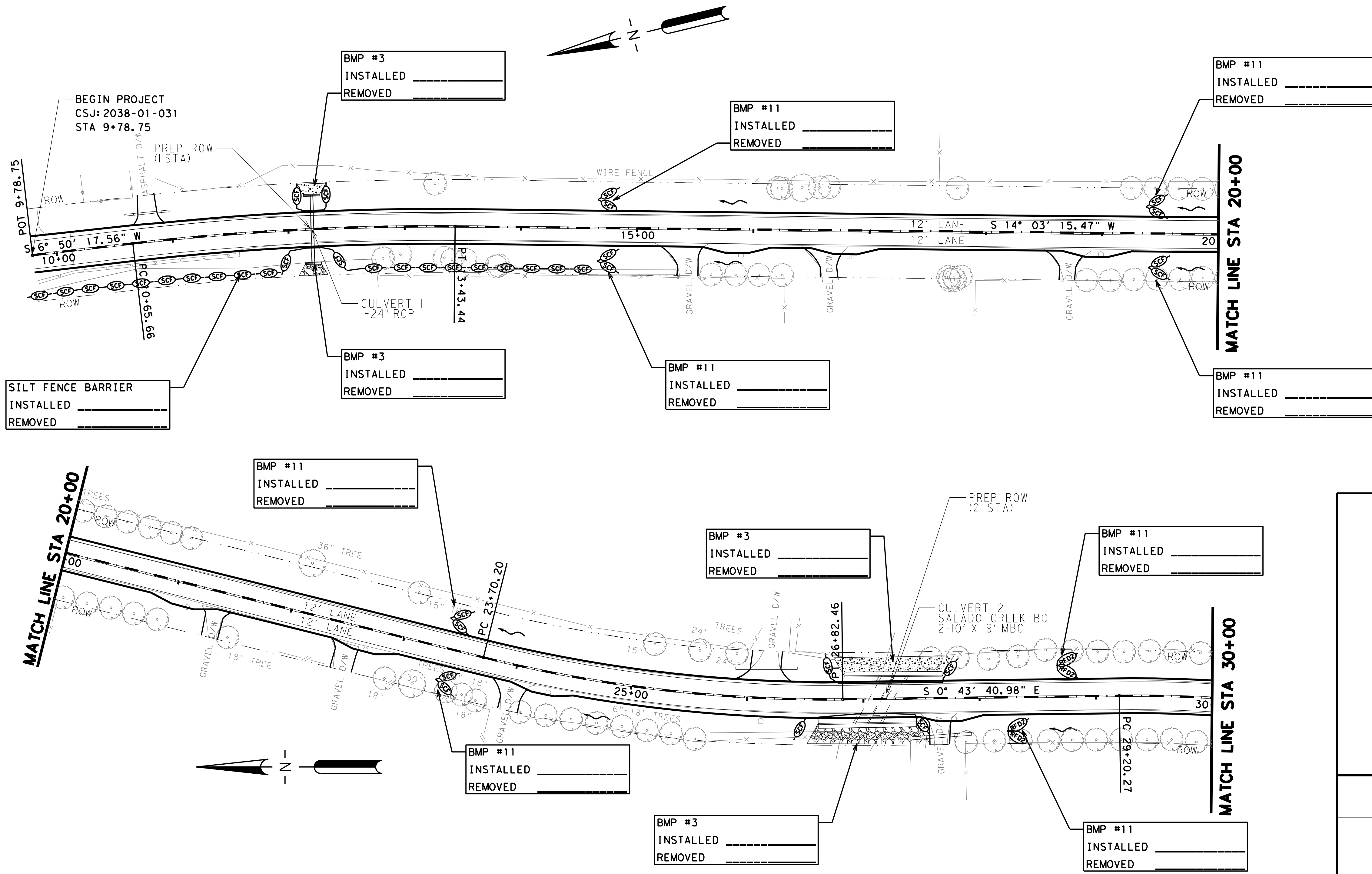
LEGEND

SYMBOL	DESCRIPTION
SCF SCF SCF	SEDIMENT FENCE
RFD2 RFD2 RFD2	ROCK FILTER DAM TYPE 2
~	DRAINAGE FLOW ARROWS



STATE OF TEXAS
BRADLEY MAYES
128276
LICENSED
PROFESSIONAL ENGINEER

Bradley Mayes 8/28/2021

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SW3P LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 1 OF 15

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	205

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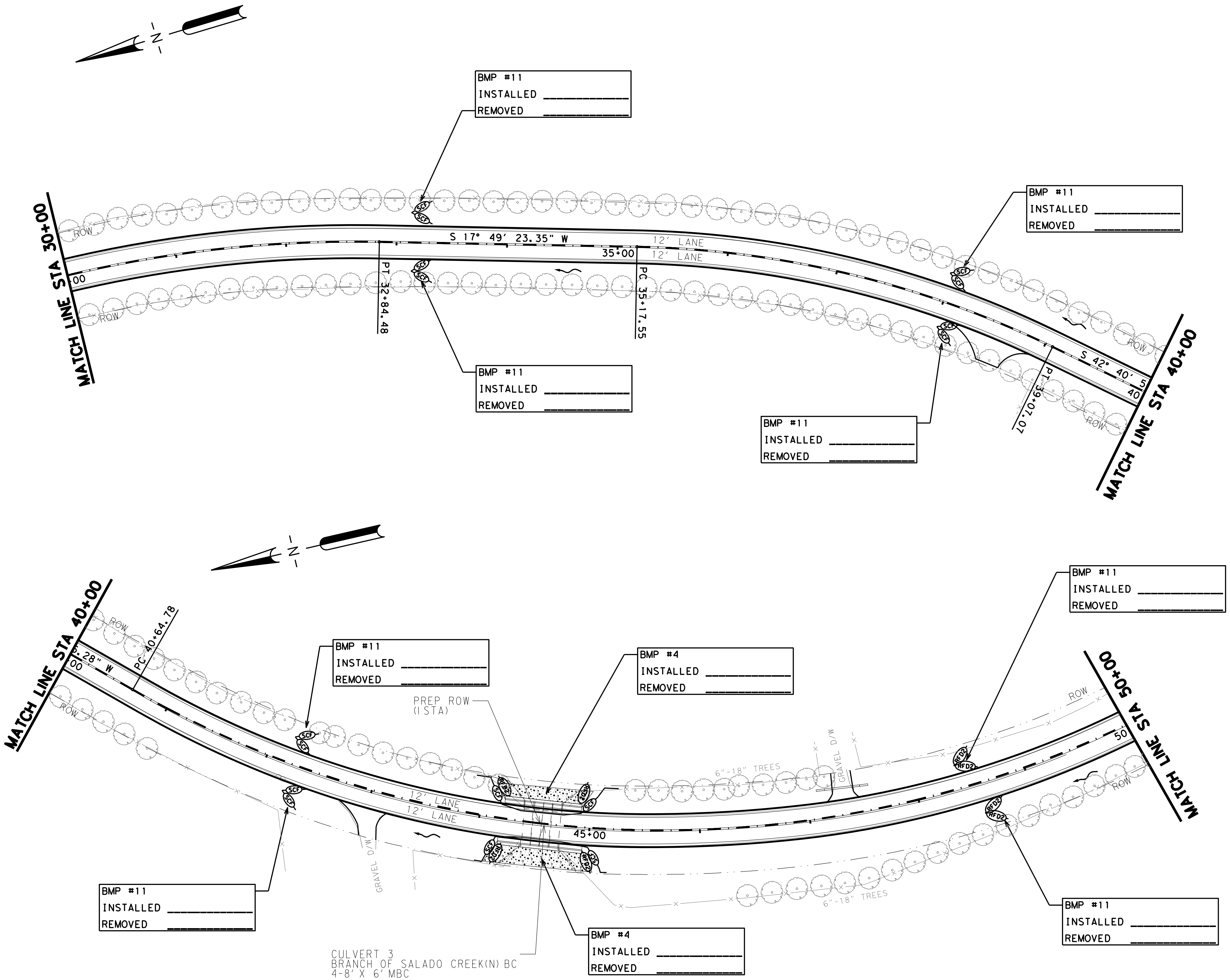

LEGEND

SYMBOL	DESCRIPTION
SCF	SEDIMENT FENCE
RFD2	ROCK FILTER DAM TYPE 2
	DRAINAGE FLOW ARROWS

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SW3P LAYOUTS

SCALE: FEET
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SHEET 2 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
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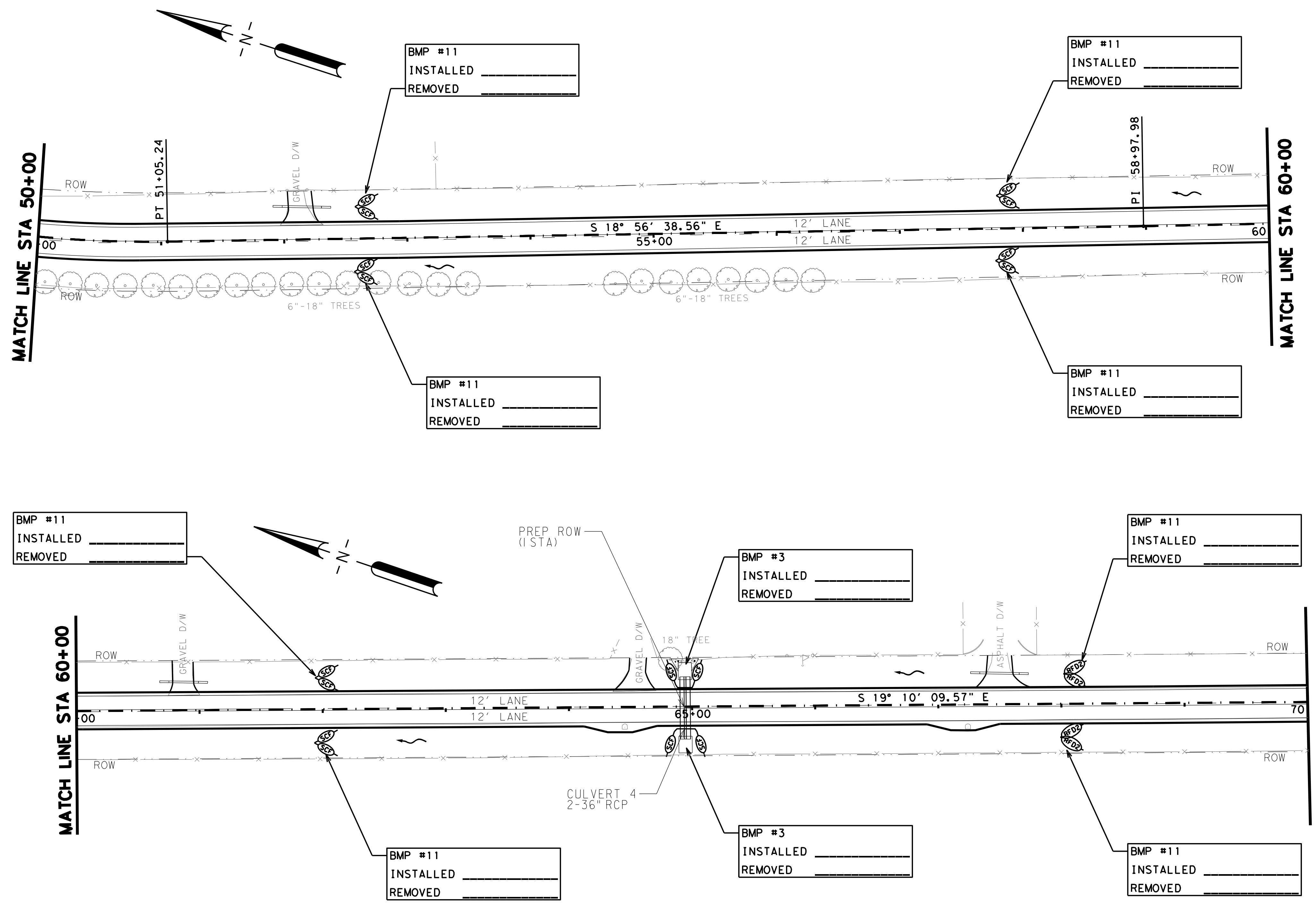
	TEXAS	WAC	BELL		206

NODE



LEGEND

SYMBOL	DESCRIPTION
SCF SCF SCF	SEDIMENT FENCE
RFD2 RFD2 RFD2	ROCK FILTER DAM TYPE 2
~	DRAINAGE FLOW ARROWS

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SW3P LAYOUTS

SCALE: FEET
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SHEET 3 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		207

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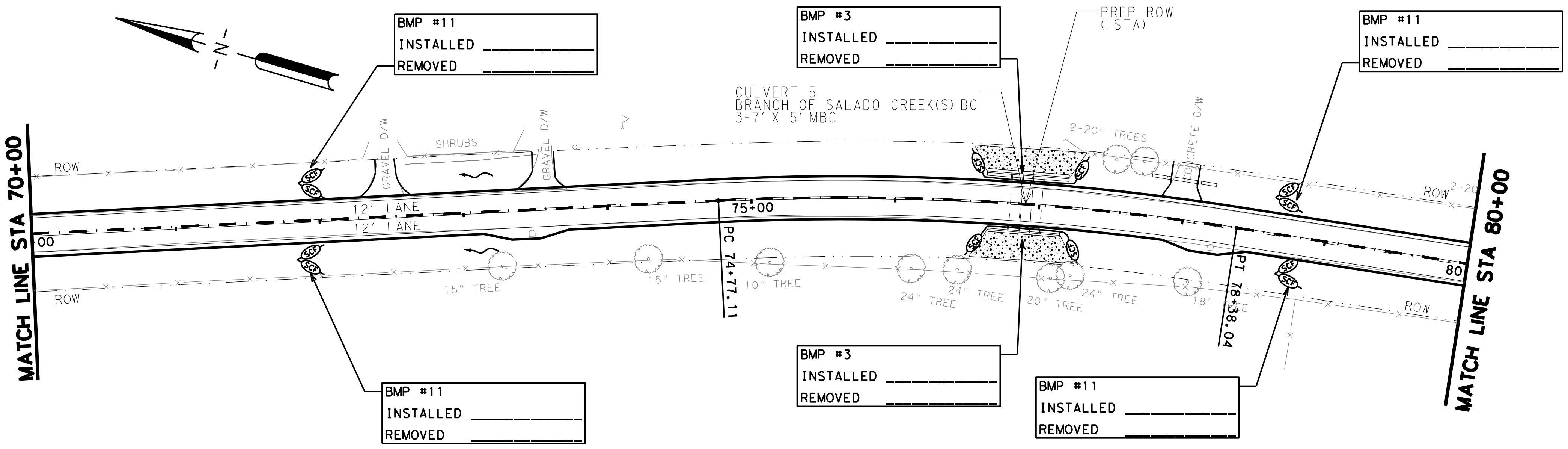

LEGEND

SYMBOL	DESCRIPTION
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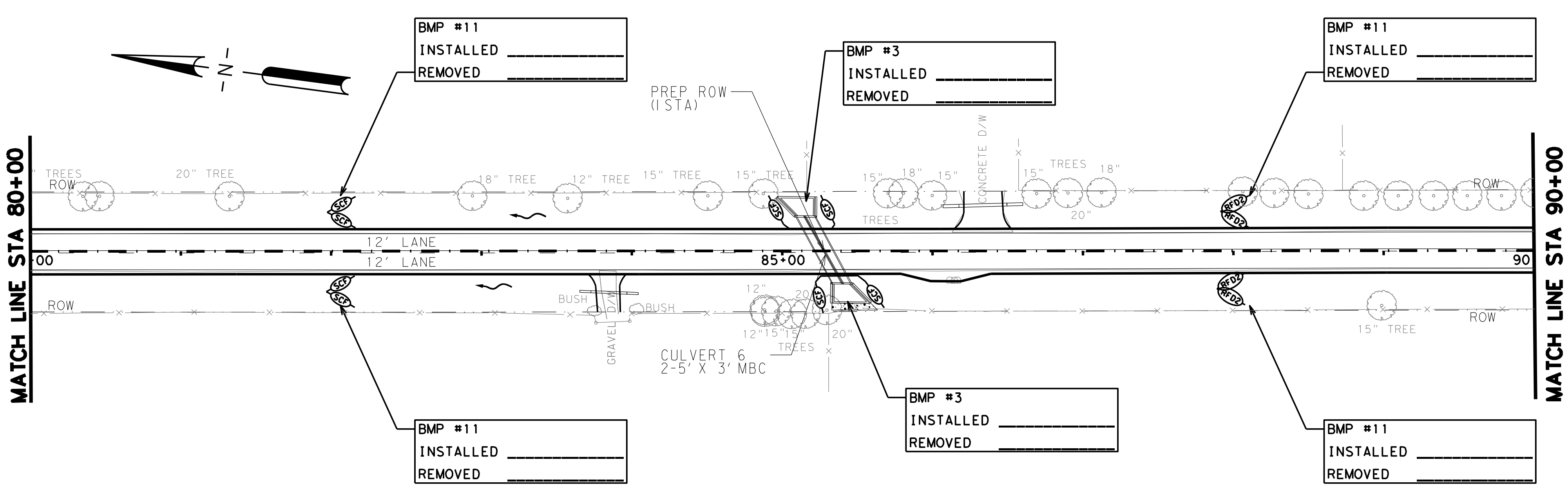
RFD2 RFD2 RFD2	ROCK FILTER DAM TYPE 2
~	DRAINAGE FLOW ARROWS



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SW3P LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 4 OF 15

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		208

NODE

LEGEND

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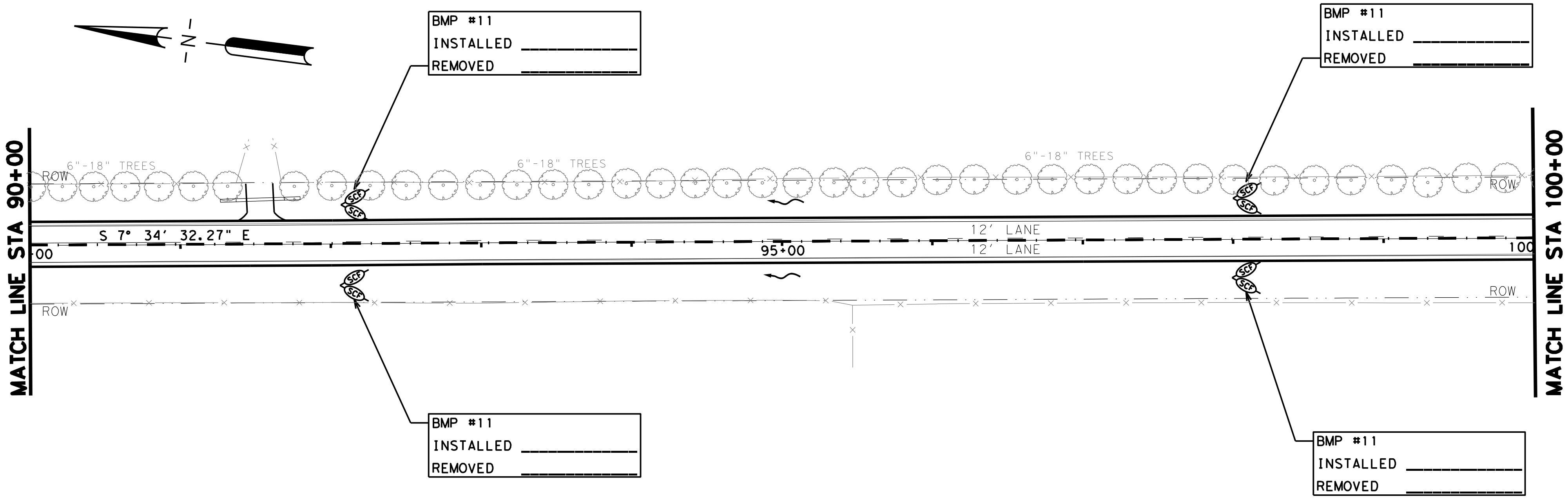
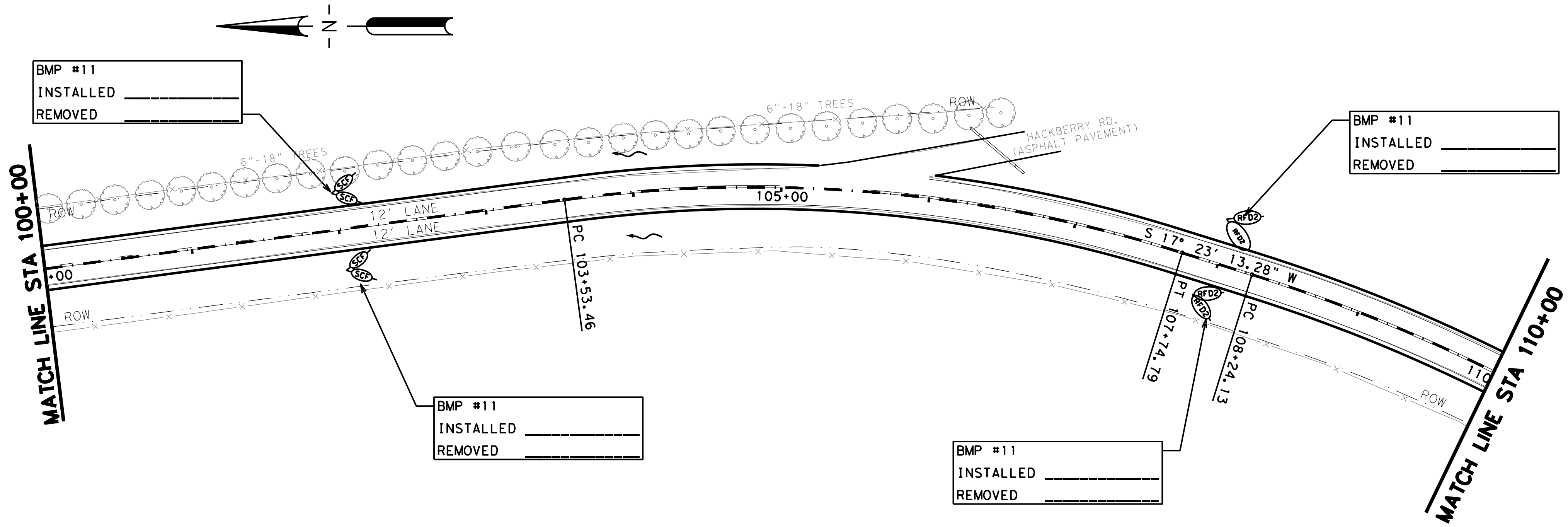
(arrow)	DRAINAGE FLOW ARROWS





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SW3P LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 5 OF 15

CHANGE ORDER	FED.RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		209

NODE

LEGEND

SYMBOL	DESCRIPTION
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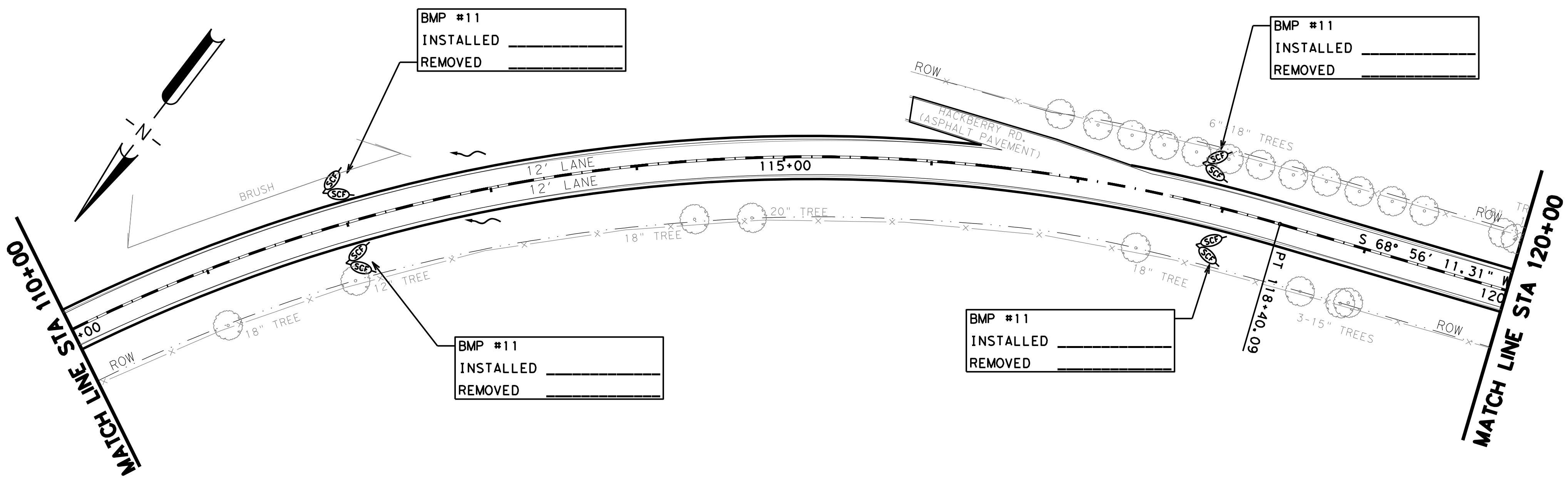
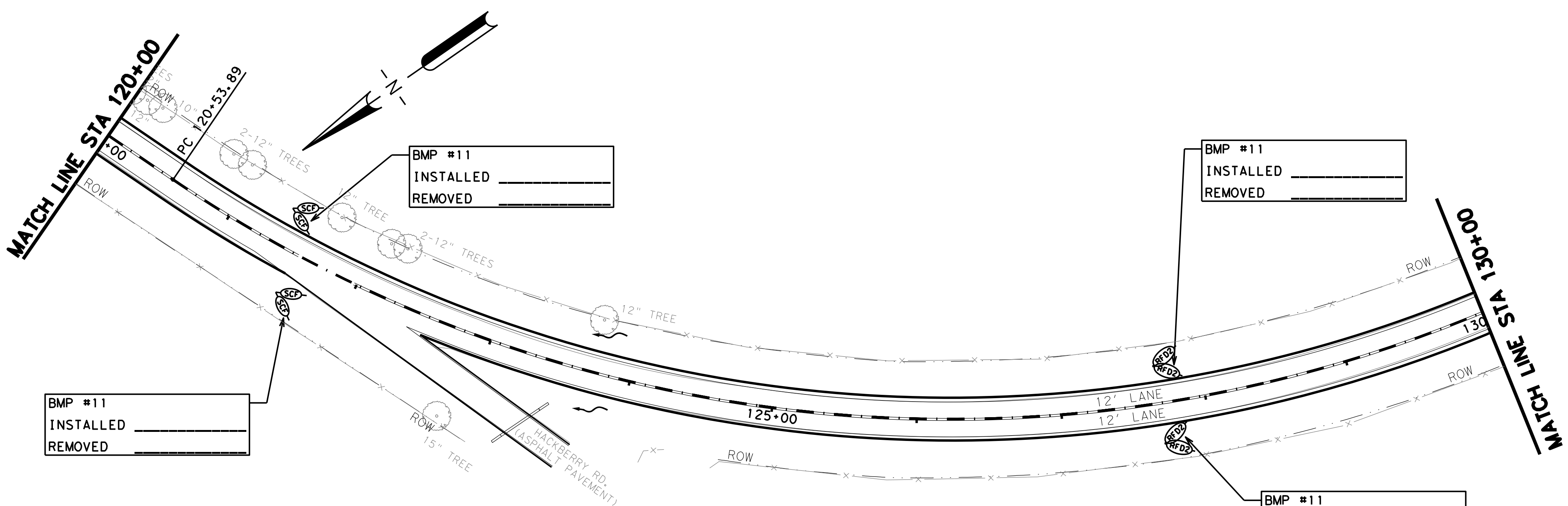
~	DRAINAGE FLOW ARROWS





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SW3P LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 6 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		210

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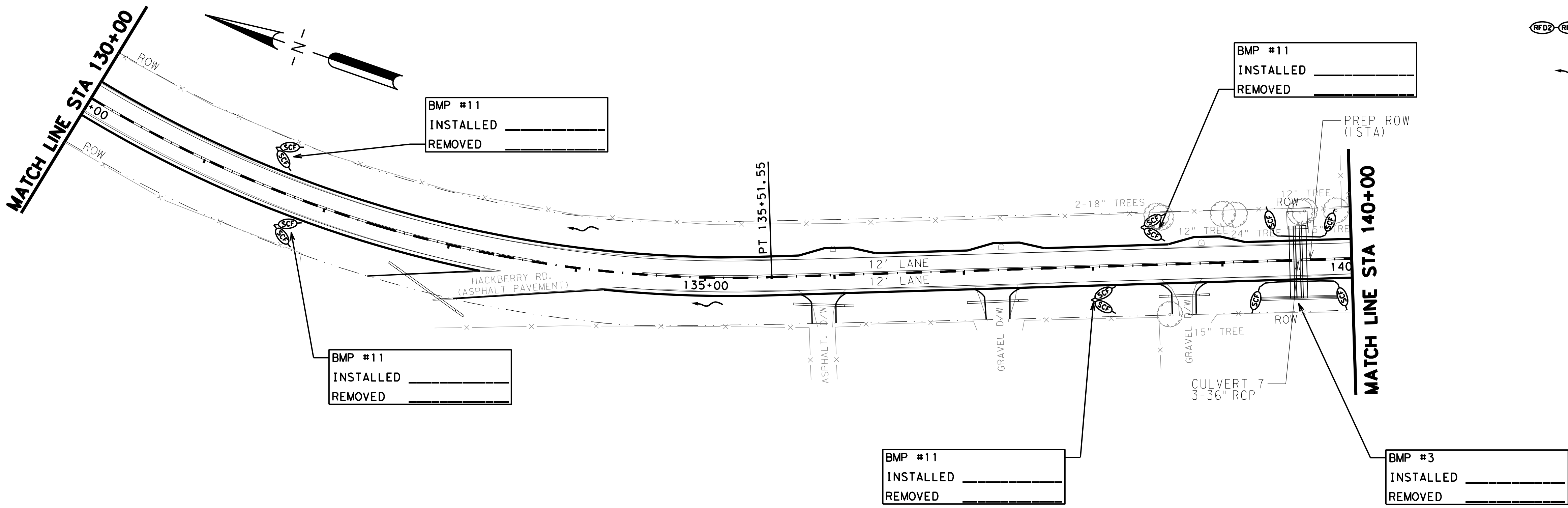

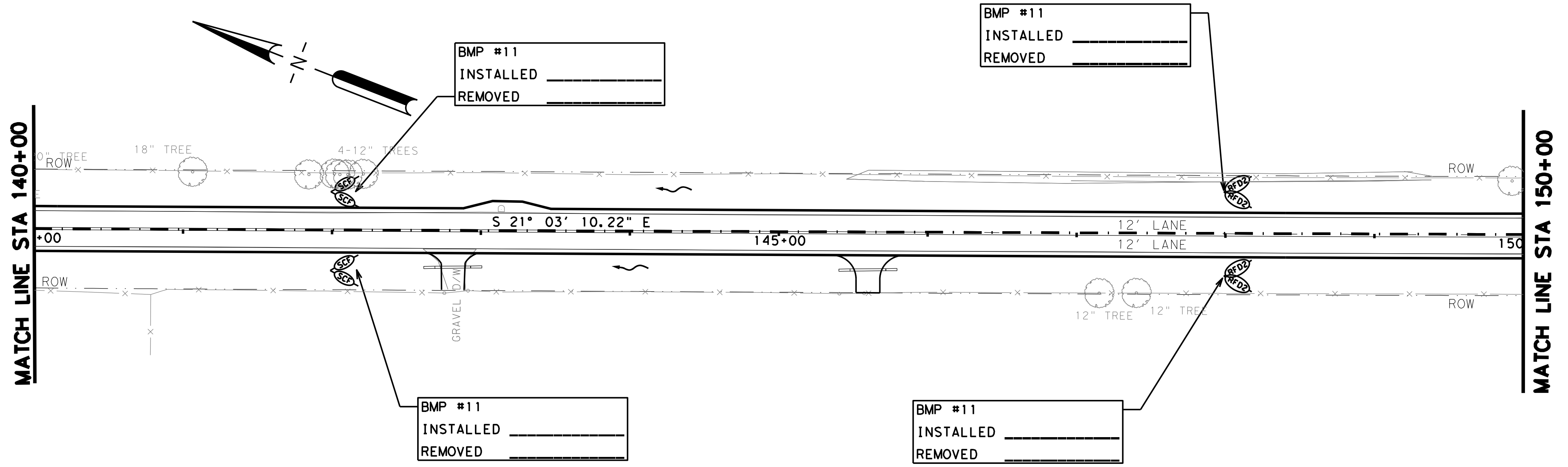

LEGEND

SYMBOL	DESCRIPTION
SCF	SEDIMENT FENCE
RFD2	ROCK FILTER DAM TYPE 2
~	DRAINAGE FLOW ARROWS

STATE OF TEXAS
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SW3P LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 7 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
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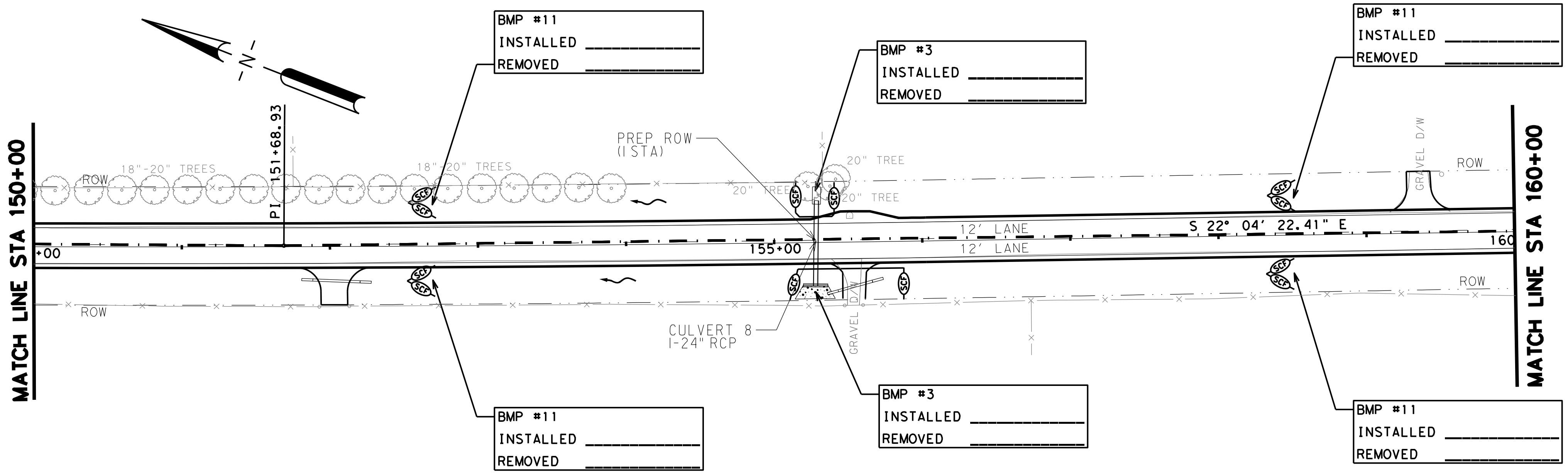
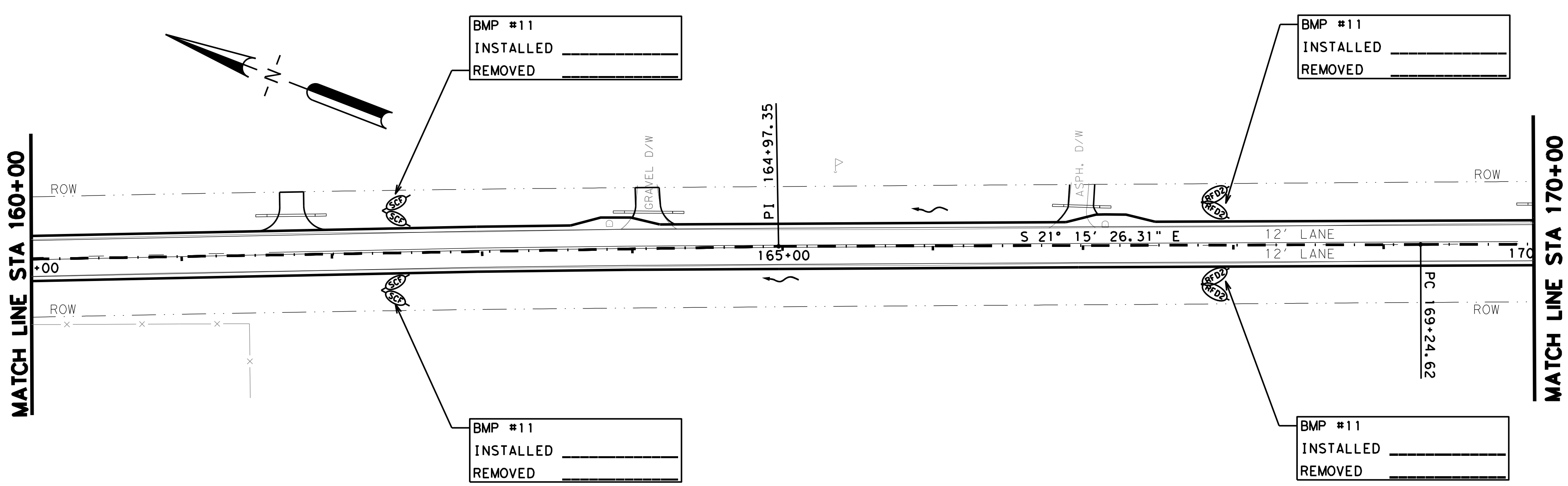
	TEXAS	WAC	BELL		211

NODE





LEGEND

SYMBOL	DESCRIPTION
SCF	SEDIMENT FENCE
RFD2	ROCK FILTER DAM TYPE 2
~	DRAINAGE FLOW ARROWS

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SW3P LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 8 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST		COUNTY	SHEET NO.
	TEXAS	WAC		BELL	212

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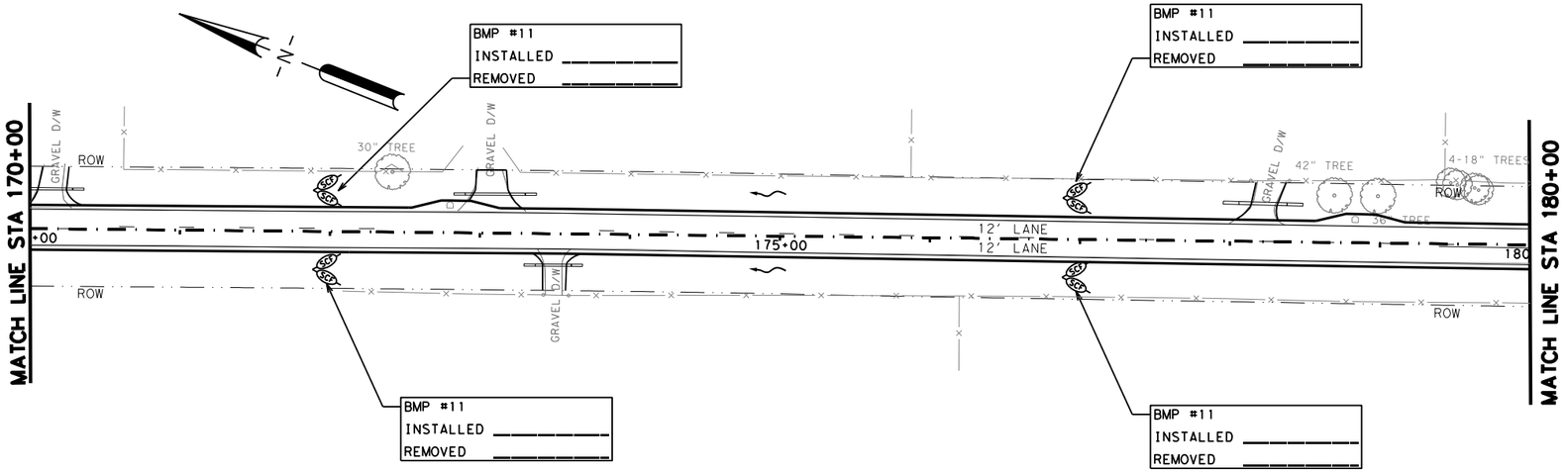
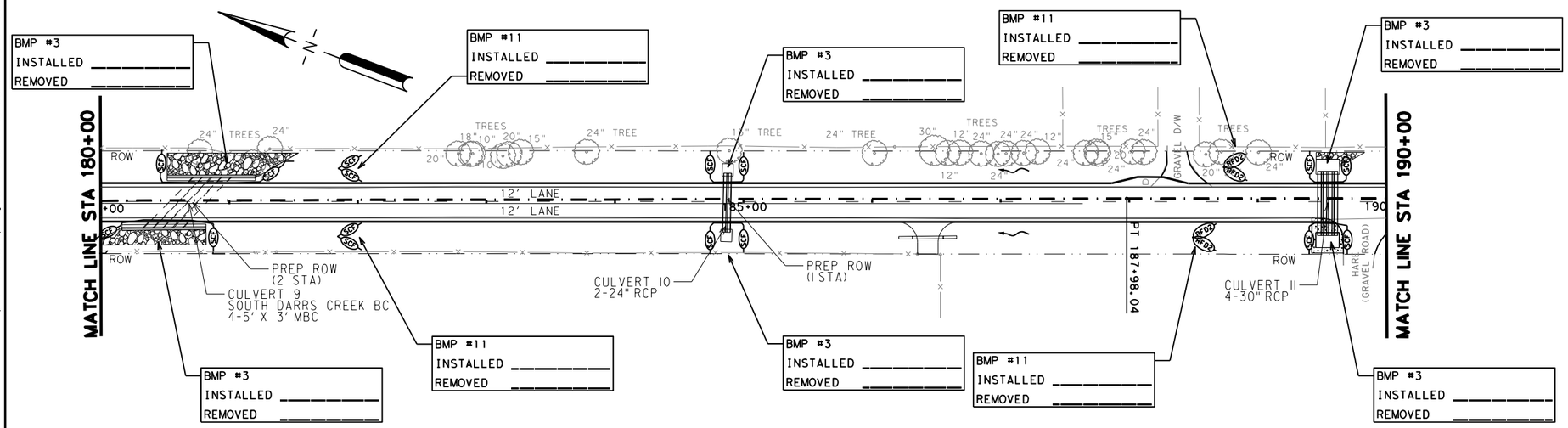
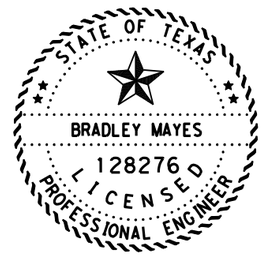
NODE

LEGEND

SYMBOL	DESCRIPTION
SCF SCF SCF	SEDIMENT FENCE
RFD2 RFD2 RFD2	ROCK FILTER DAM TYPE 2
~	DRAINAGE FLOW ARROWS







Bradley Mayes 8/28/2021

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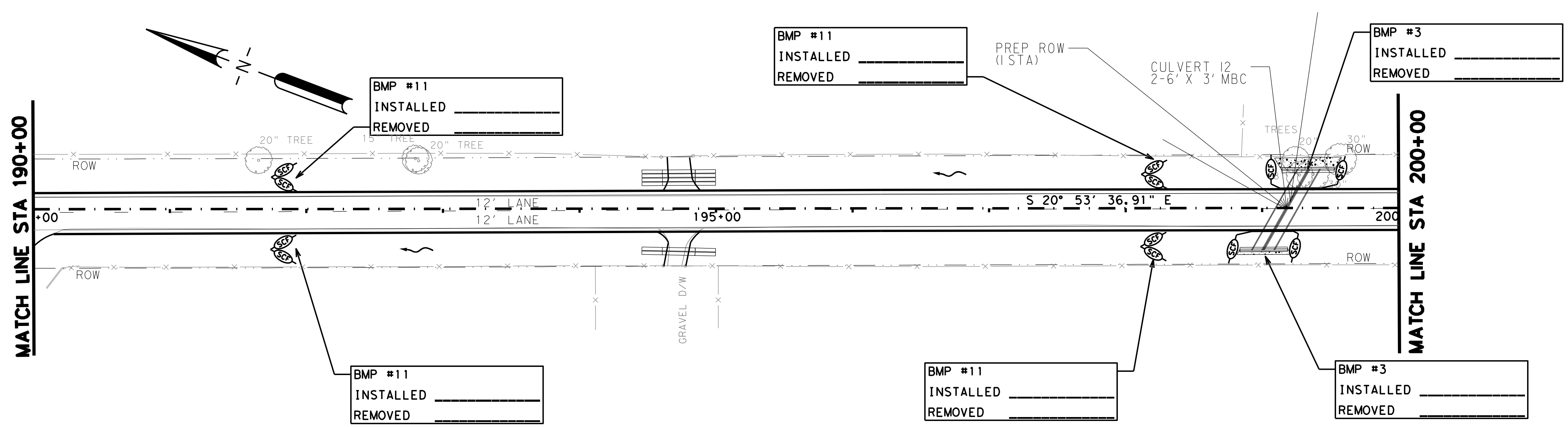
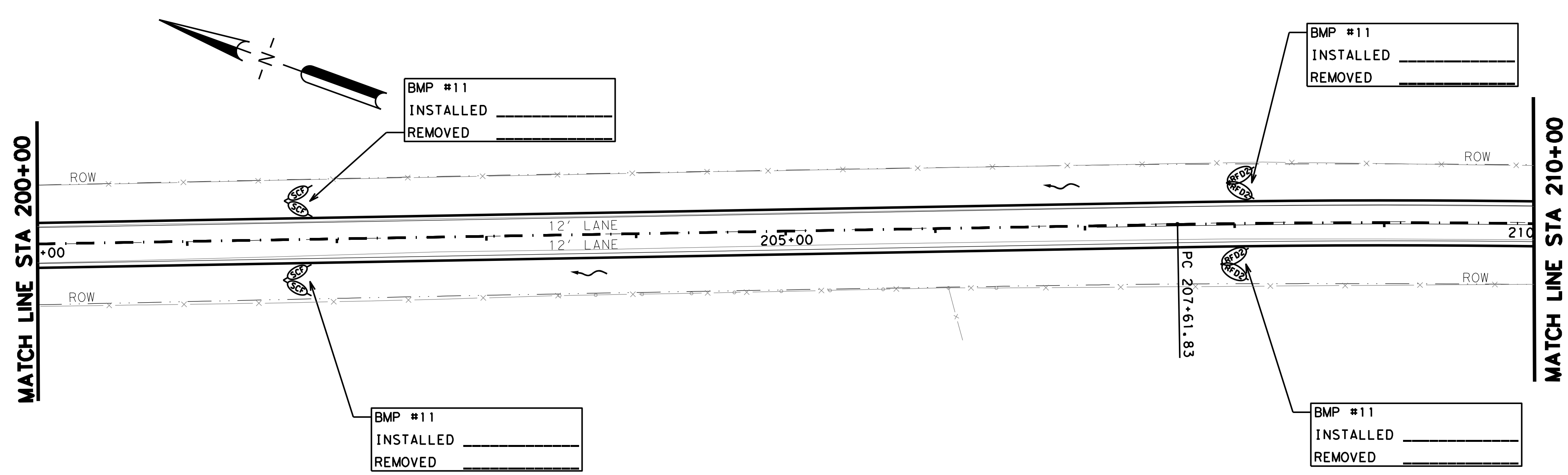
SW3P LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		213





LEGEND

SYMBOL	DESCRIPTION
SCF-SCF-SCF	SEDIMENT FENCE
RFD2-RFD2-RFD2	ROCK FILTER DAM TYPE 2
~	DRAINAGE FLOW ARROWS

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8/28/2021

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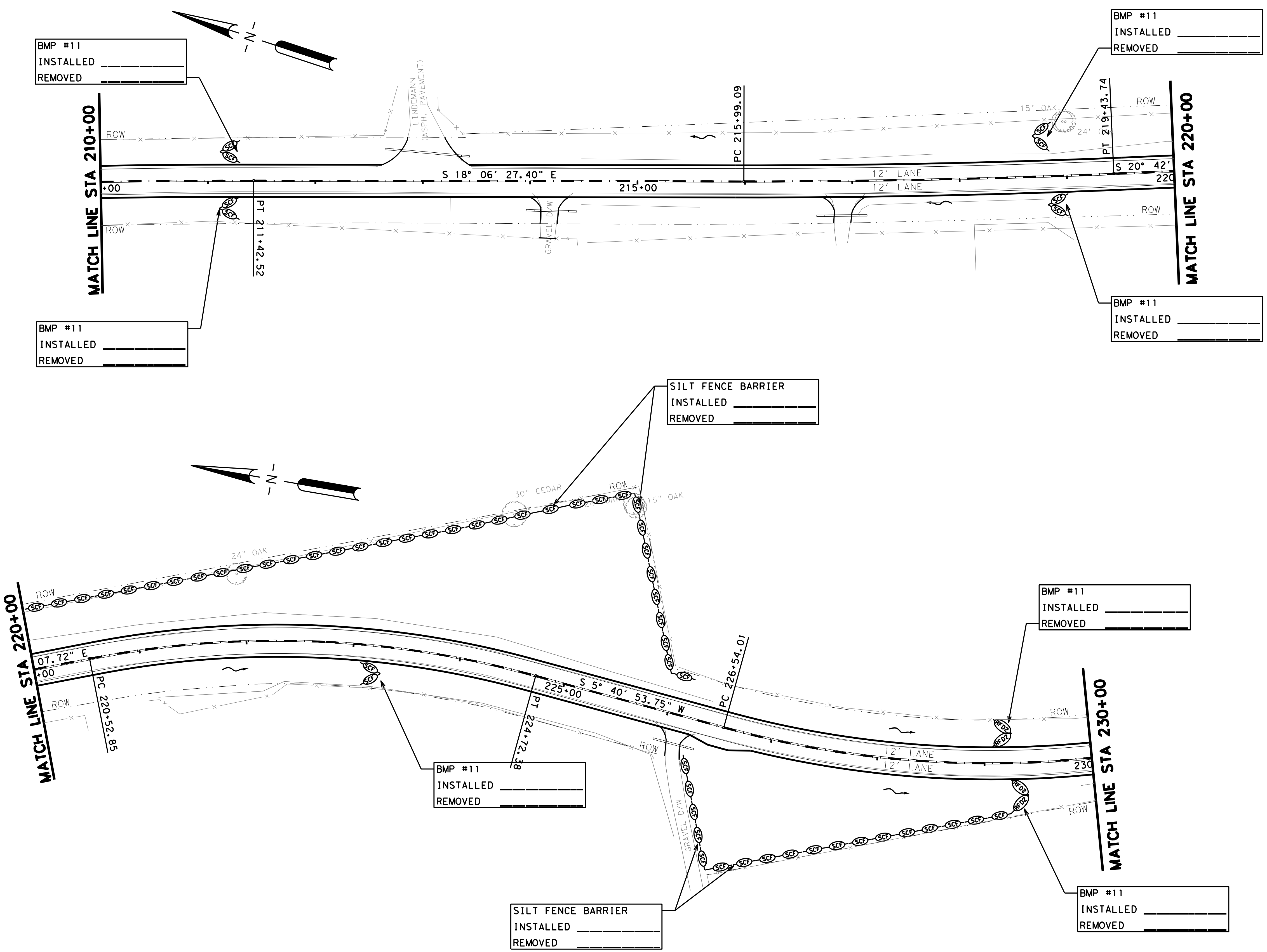
SW3P LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 10 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		214



LEGEND

SYMBOL	DESCRIPTION
SCF SCF SCF	SEDIMENT FENCE
RFD2 RFD2 RFD2	ROCK FILTER DAM TYPE 2
~	DRAINAGE FLOW ARROWS

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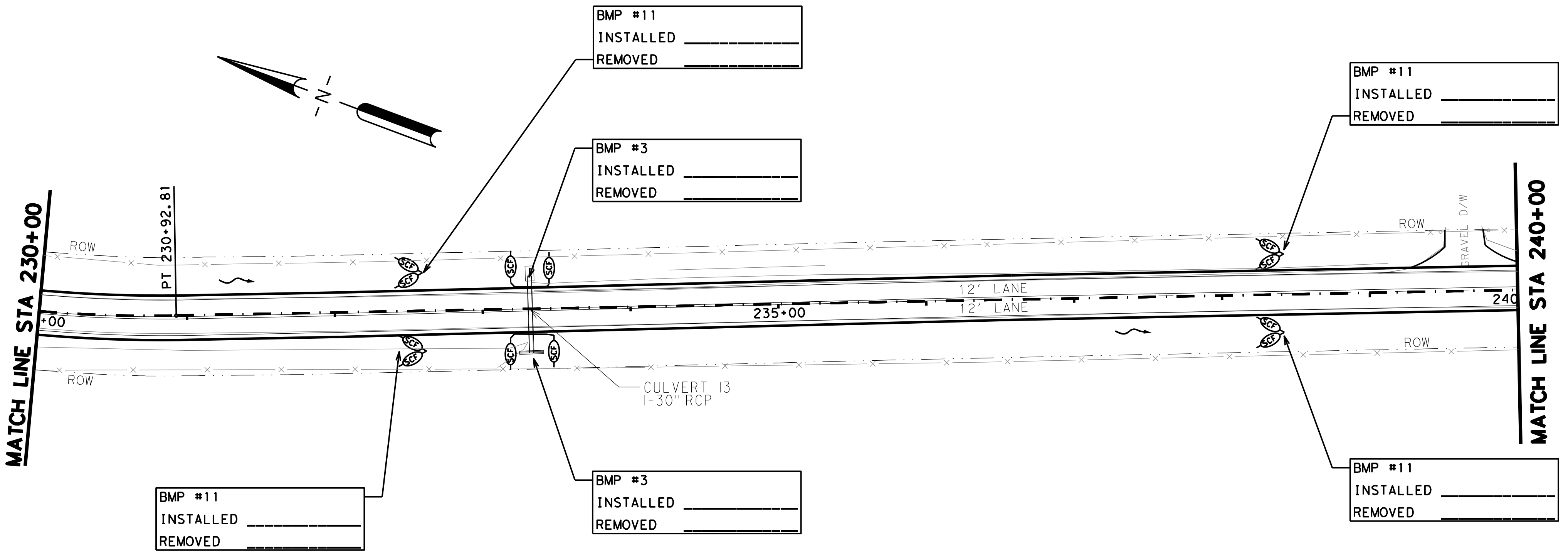
SW3P LAYOUTS

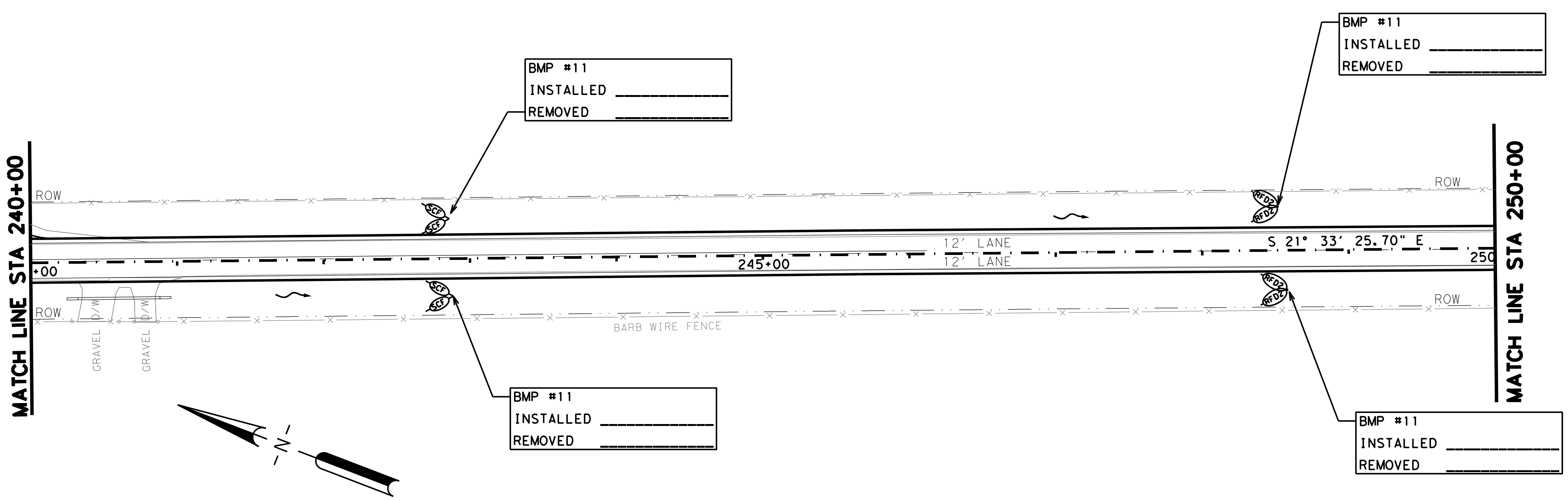
SCALE: FEET
1" = 100' HORIZ.

SHEET 11 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		215

NODE





LEGEND

SYMBOL	DESCRIPTION
SCF-SCF-SCF	SEDIMENT FENCE
RFD2-RFD2-RFD2	ROCK FILTER DAM TYPE 2
~	DRAINAGE FLOW ARROWS

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SW3P LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 12 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		216

LEGEND

SYMBOL	DESCRIPTION
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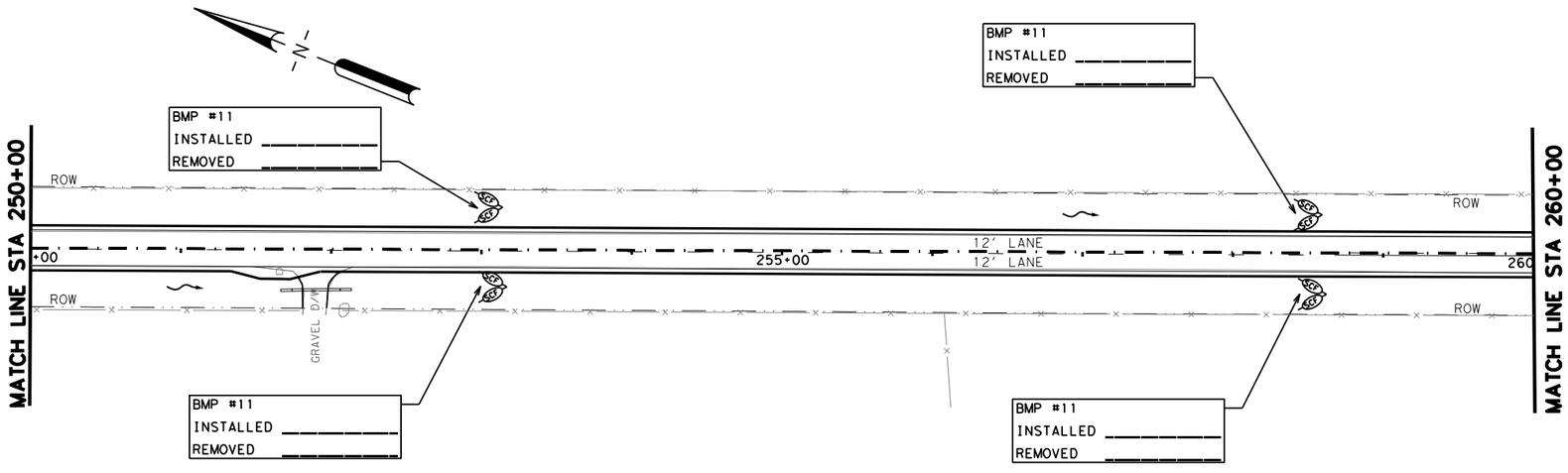
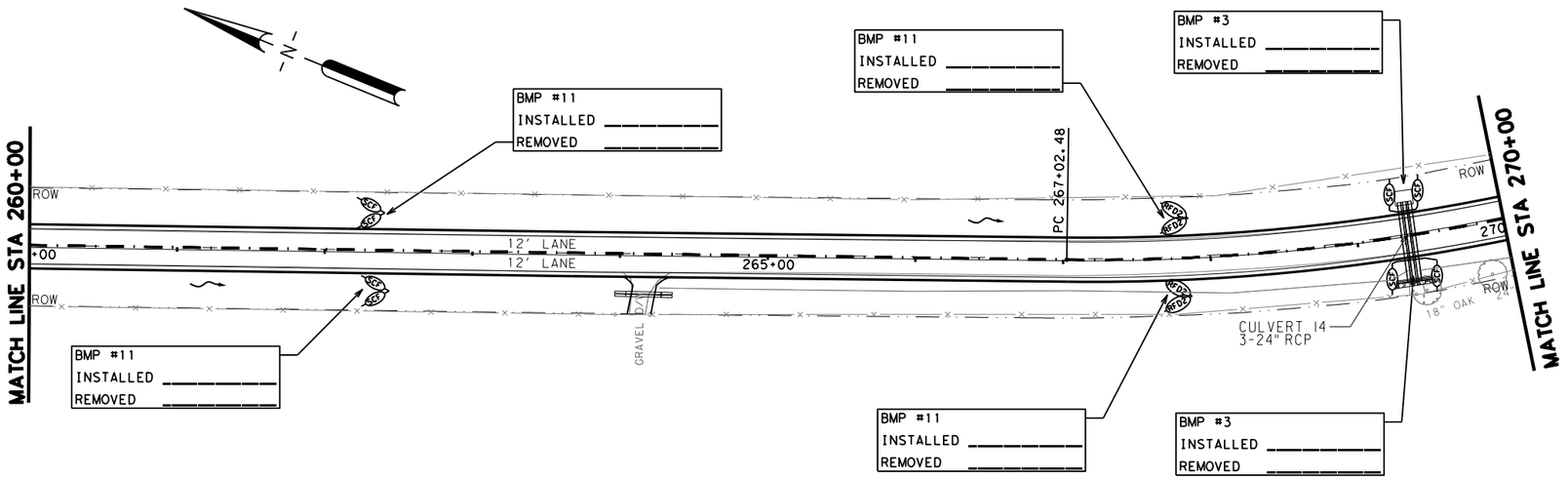
~	DRAINAGE FLOW ARROWS





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SW3P LAYOUTS

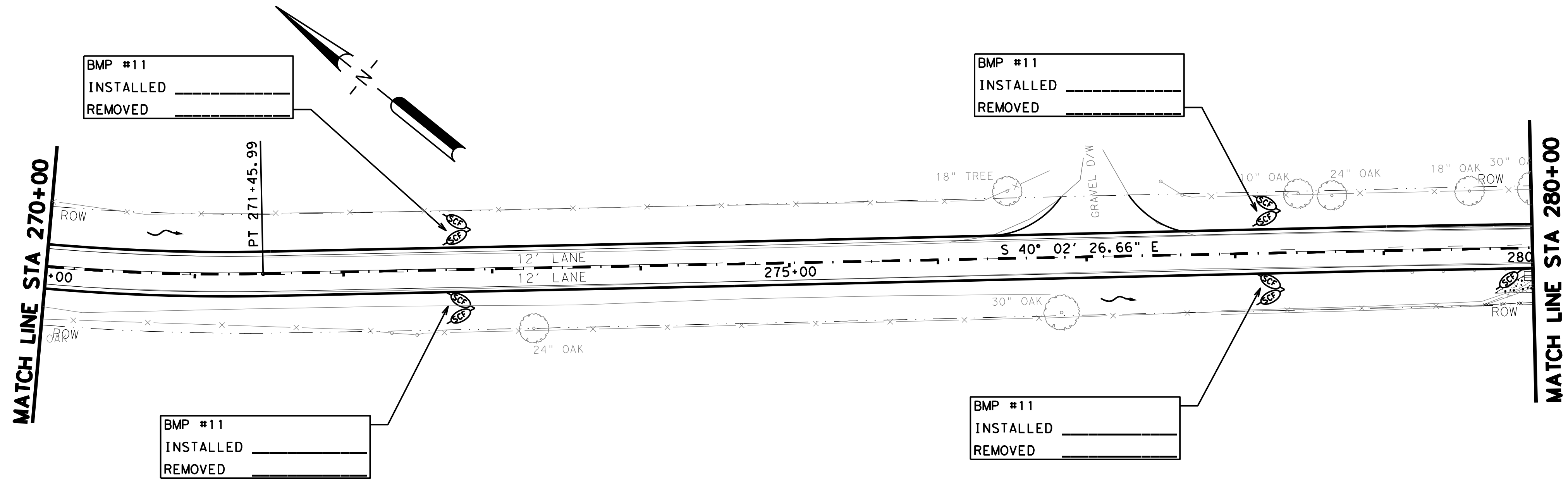
SCALE: 1" = 100' HORIZ. FEET

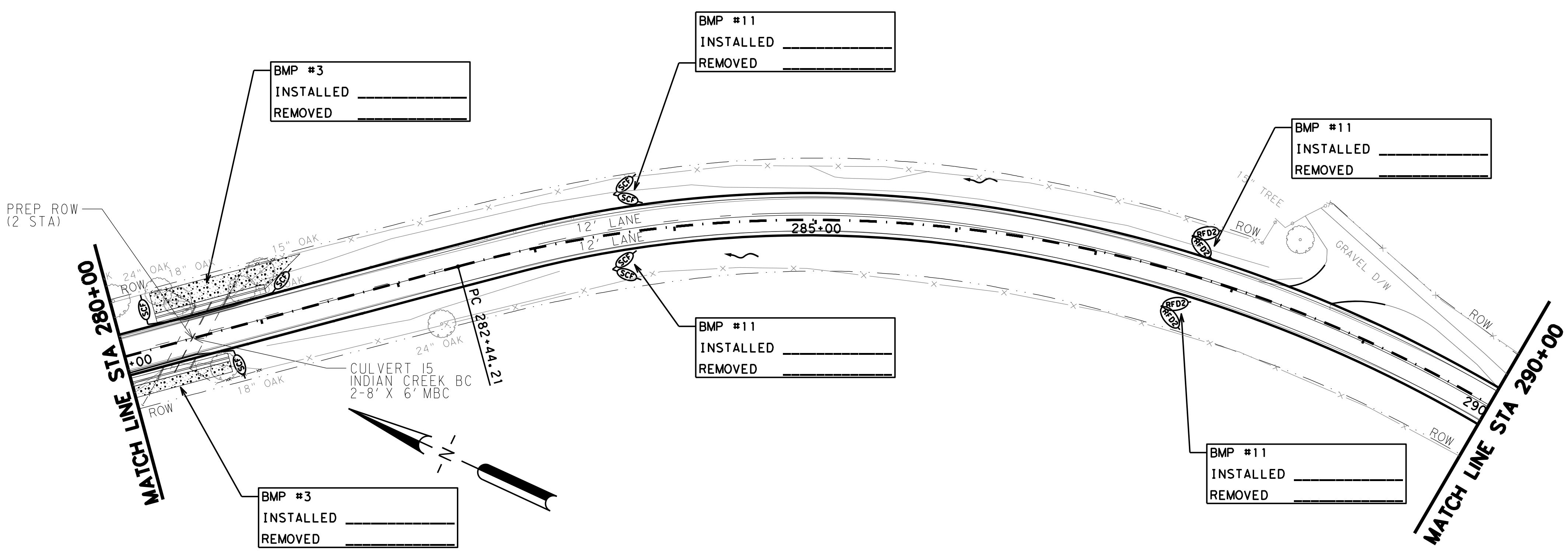
SHEET 13 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		217

LEGEND

SYMBOL	DESCRIPTION
SCF	SEDIMENT FENCE
RFD2	ROCK FILTER DAM TYPE 2
~	DRAINAGE FLOW ARROWS





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SW3P LAYOUTS

SCALE: FEET
1" = 100' HORIZ.

SHEET 14 OF 15

CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		218

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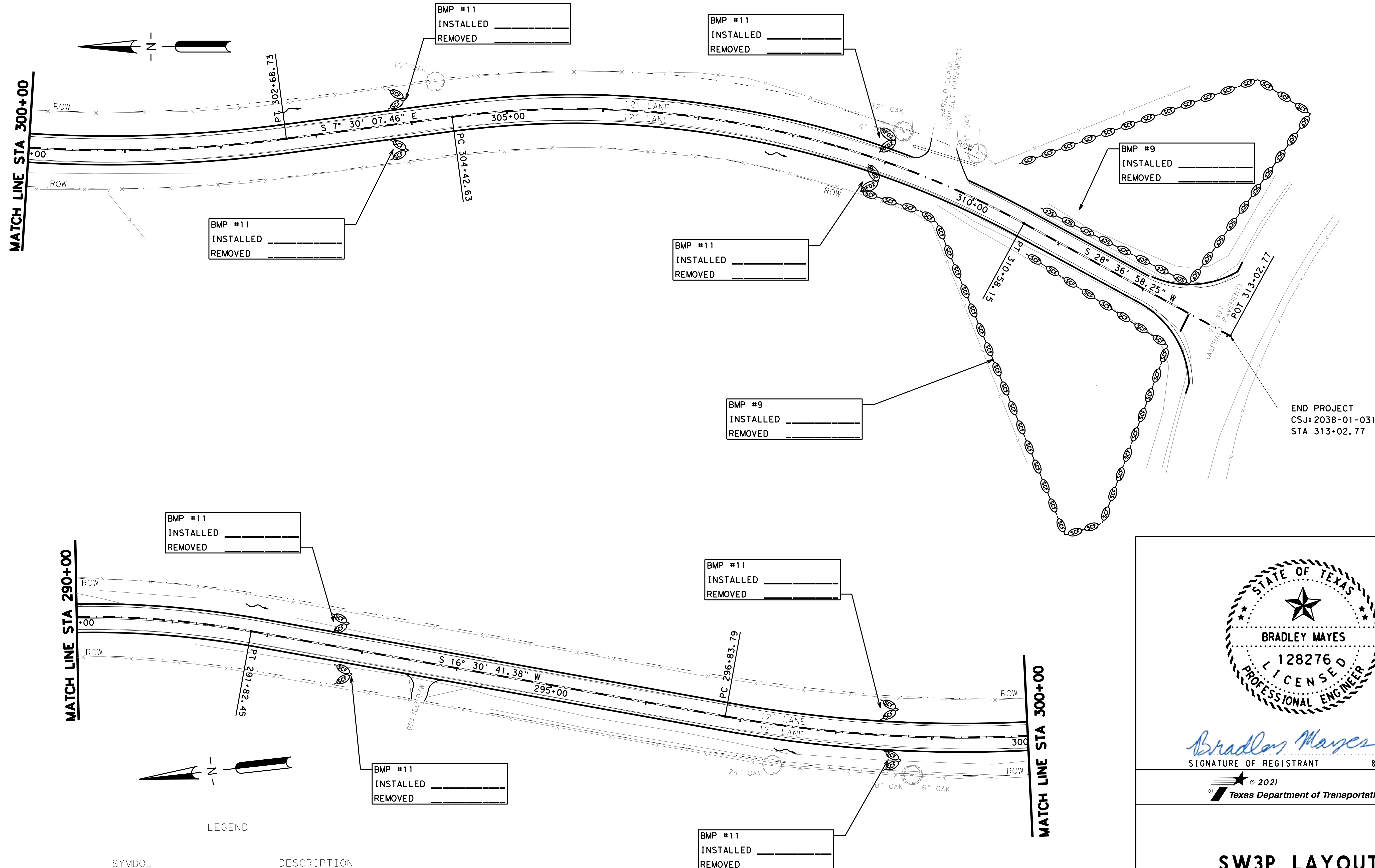
NODE



LEGEND

SYMBOL	DESCRIPTION
SCF SCF SCF	SEDIMENT FENCE
RFD2 RFD2 RFD2	ROCK FILTER DAM TYPE 2
~	DRAINAGE FLOW ARROWS

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SW3P LAYOUTS

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CHANGE ORDER	FED. RD. DIV. NO.	CONT	SECT	JOB	HIGHWAY
	6	2038	01	031	FM 2115
	STATE	DIST	COUNTY		SHEET NO.
	TEXAS	WAC	BELL		219

NODE

SITE DESCRIPTION

PROJECT LIMITS:

From IH 35 To FM 487

LOCATION MAPS:

Refer to the Title Sheet for project location map

PROJECT DESCRIPTION:

CSJ 2038-01-031:

For the construction of rehab of existing road consisting of widen shoulders.

MAJOR SOIL DISTURBING ACTIVITIES:

The major soil disturbing activities for this project Will consist of install drainage structures and construct proposed pavement up through the OCST on flex base.

TOTAL PROJECT AREA:	59.0 AC
TOTAL AREA TO BE DISTURBED:	37.3 AC

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

CSJ 2038-01-031:

Predominate soil type is Houston Black Clay. Vegetative cover is in average condition with 80% coverage.

NAME OF RECEIVING WATERS:

CSJ 2038-01-031:

Varous creeks recieve all of the drainage from this project, which drain into Little River segment 1213, which drains into the Brazos River segment 1242, which ultimately drains into the Gulf of Mexico.

EROSION AND SEDIMENT CONTROLS

SOIL STABILIZATION PRACTICES:

- [X] TEMPORARY SEEDING
- [X] PERMANENT PLANTING, SODDING, OR SEEDING
- [ ] MULCHING
- [X] SOIL RETENTION BLANKET
- [X] NATURAL BARRIERS OR BUFFER ZONES
- [ ] PRESERVATION OF NATURAL RESOURCES

OTHER: TXR 150000, Part III, Section G, 2 Stabilization of disturbed areas must, at a minimum, be initiated immediately whenever any clearing, grading, excavating, or other earth disturbing activities have permanently ceased on any portion of the site, or temporarily ceased on any portion of the site and Will not resume for a period exceeding 14 calendar days. Temporary stabilization must be completed no more than 14 calendar days after initiation of soil stabilization measures, and final stabilization must be achieved prior to termination of permit coverage.

STRUCTURAL PRACTICES: (Select T = Temporary or P = Permanent, As Applicable)

- [T] SILT FENCES
- [ ] HAY BALES
- [T] SANDBAG OR ROCK BERMS
- [ ] DIVERSION, INTERCEPTOR, OR PERIMETER DIKES
- [ ] DIVERSION, INTERCEPTOR, OR PERIMETER SWALES
- [ ] DIVERSION DIKE AND SWALE COMBINATIONS
- [ ] PIPE SLOPE DRAINS
- [ ] PAVED FLUMES
- [ ] ROCK BEDDING AT CONSTRUCTION EXIT
- [ ] TIMBER MATTING AT CONSTRUCTION EXIT
- [ ] CHANNEL LINERS
- [ ] SEDIMENT TRAPS
- [ ] SEDIMENT BASINS
- [ ] STORM INLET SEDIMENT TRAP
- [ ] STONE OUTLET STRUCTURES
- [ ] CURBS AND GUTTERS
- [ ] STORM SEWERS
- [ ] VELOCITY CONTROL DEVICES

OTHER:

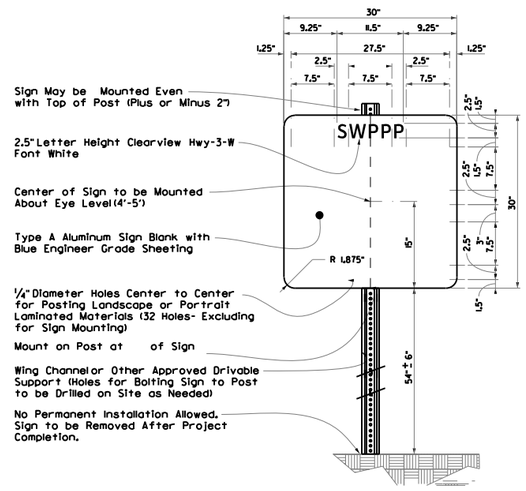
NARRATIVE-SEQUENCE OF CONSTRUCTION (STORM WATER MANAGEMENT) ACTIVITIES:

The order of activities Will be as follows:
1. Preserve existing vegetative cover as much as possible.
2. Install temporary sediment control fencing, rock berms and other items as shown on plans prior to any soil disturbing activities.
3. Construct proposed culvert and roadway and perform any necessary excavation, embankment and grading.
4. Place soil retention blankets and temporary/permanent seeding as shown in the plans and as directed by the engineer.

STORM WATER MANAGEMENT:

An integral part of the SWPPP for this project includes the EPIC Sheet, Item 506, Waco District Waters of the US Notes, Waco District Typical Applications for Best Management Practices, Form 2118 TxDOT inspection forms, Contractor daily inspection forms, miscellaneous general notes on environmental requirements, TxDOT EC Standards, 2014 Standard Specifications, TxDOT roadway design drawings, SWPPP design and working BMP drawings, Site Manager Data Base, EMS Stage Gate Inspections and the Waco District environmental folders. The requirements of the TxDOT EMS Will be fully implemented including training requirements for Contractors and TxDOT staff.

STORM WATER POLLUTION PREVENTION PLAN PERMIT POSTING



OTHER EROSION AND SEDIMENT CONTROLS:

MAINTENANCE:

All erosion and sediment best management practices (BMPs) Will be maintained in good working order per the environmental notes, details and standards included as part of the project plans and contract documents. BMP repairs Will be made at the earliest possible date, but no later than seven calendar days after the inspection report has been completed and immediately after the ground has dried sufficiently to allow equipment access. BMPs damaged by the Contractor Will be repaired or replaced immediately. The installation and repair of BMPs at creeks and outfalls Will be given priority.

INSPECTION:

TxDOT Form 2118 inspections to support TXR150000 and 404 permits Will be conducted on a seven day interval on the same day of the week, until permits are terminated. The Contractor Will provide daily BMP inspection reports on work days. Stage Gate Inspections and other BMP inspections Will be conducted by the District and Area Office Staff based on requirements of the TxDOT Environmental Management System (EMS).

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. The Contractor Will maintain a list of all chemicals and wastes required for the project; including chemicals used by sub-contractors, and Will implement written spill prevention and clean-up plans.

SANITARY WASTE:

Sanitary waste from portable units Will be collected by a licensed sanitary waste management contractor.

OFF SITE VEHICLE TRACKING:

- [ ] HAUL ROADS DAMPENED FOR DUST CONTROL
- [X] LOADED HAUL TRUCKS TO BE COVERED WITH TARPAULIN
- [X] EXCESS DIRT ON ROAD REMOVED DAILY
- [ ] STABILIZED CONSTRUCTION ENTRANCE

REMARKS:

Disposal areas, stockpiles,and haul roads Will be constructed in a manner that Will minimize and control the amount of sediment that may enter receiving waters. Disposal areas Will not be located in any wetland, waterbody or streambed. Construction staging area and vehicle maintenance area Will be constructed by the contractor in a manner to minimize the runoff pollutants.

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 Will be subsidiary to Item 506.

SEDIMENTATION BASINS:

Since the area disturbed is less than 10 acres, per outfall location, a sedimentation basin is not required.

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Bradley Mayes 9/8/2021
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WACO DISTRICT STORM WATER POLLUTION PREVENTION PLAN (SW3P)

SHEET 1 OF 1

FED. RD. DIV. NO.	STATE	CONT	SECT	JOB	HIGHWAY
6	TEXAS	2038	01	031	FM 2115
		DIST	COUNTY		SHEET NO.
		WAC	BELL		220

DISCLAIMER:
The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

DATE:
FILE:

I. STORMWATER POLLUTION PREVENTION-CLEAN WATER ACT SECTION 402

TPDES TXR 150000: Stormwater Discharge Permit or Construction General Permit required for projects with 1 or more acres disturbed soil. Projects with any disturbed soil must protect for erosion and sedimentation in accordance with Item 506.

List MS4 Operator(s) that may receive discharges from this project. They may need to be notified prior to construction activities.

1.

2.

☐ No Action Required ☒ Required Action

Action No.

1. Prevent stormwater pollution by controlling erosion and sedimentation in accordance with TPDES Permit TXR 150000
2. Comply with the SW3P and revise when necessary to control pollution or required by the Engineer.
3. Post Construction Site Notice (CSN) with SW3P information on or near the site, accessible to the public and TCEQ, EPA or other inspectors.
4. Project will disturb more than 5 acres, submit NOI to TCEQ and the Engineer.

II. WORK IN OR NEAR STREAMS, WATERBODIES AND WETLANDS CLEAN WATER ACT SECTIONS 401 AND 404

USACE Permit required for filling, dredging, excavating or other work in any water bodies, rivers, creeks, streams, wetlands or wet areas.

The Contractor must adhere to all of the terms and conditions associated with the following permit(s):

☐ No Permit Required

☒ Nationwide Permit 14 - PCN not Required (less than 1/10th acre waters or wetlands affected)

☐ Nationwide Permit 14 - PCN Required (1/10 to <1/2 acre, 1/3 in tidal waters)

☐ Individual 404 Permit Required

☐ Other Nationwide Permit Required: NWP# _____

Required Actions: List waters of the US permit applies to, location in project and check Best Management Practices planned to control erosion, sedimentation and post-project TSS.

1. Station 27+10
2. Station 44+75
3. Station 76+90
4. Station 180+50
5. Station 280+50
6.
7.
8.

The elevation of the ordinary high water marks of any areas requiring work to be performed in the waters of the US requiring the use of a nationwide permit can be found on the Bridge Layouts.

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	☐ Grassy Swales

III. CULTURAL RESOURCES

Refer to TxDOT Standard Specifications in the event historical issues or archeological artifacts are found during construction. 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.

1. SEE STATEMENT ABOVE

IV. VEGETATION RESOURCES

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.

☐ No Action Required ☒ Required Action

Action No.

1. SEE STATEMENT ABOVE

2.

V. WILDLIFE RESOURCES

☐ No Action Required ☒ Required Action

Action No.

1. Comply with Migratory Bird Treaty Act (MBTA)
2. Plains Spotted Skunk: Contractors will be advised of potential occurence in the project area, and to avoid harming the species if encountered, and to avoed unnecessary impacts to dens
3.
4.
5. SEE STATEMENT BELOW

If any of the listed species are observed, cease work in the immediate area, do not disturb species or habitat and contact the Engineer immediately. The work may not remove active nests from bridges and other structures during nesting season of the birds associated with the nests. If caves or sinkholes are discovered, cease work in the immediate area, and contact the Engineer immediately.

LIST OF ABBREVIATIONS

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

VI. HAZARDOUS MATERIALS OR CONTAMINATION ISSUES

General (applies to all projects):

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.

Contact the Engineer if any of the following are detected:

* Dead or distressed vegetation (not identified as normal)
* Trash piles, drums, canister, barrels, etc.
* Undesirable smells or odors
* Evidence of leaching or seepage of substances

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

☒ Yes ☐ No

If "No", then no further action is required.
If "Yes", then TxDOT is responsible for completing asbestos assessment/inspection.

Are the results of the asbestos inspection positive (is asbestos present)?

☐ Yes ☒ No

If "Yes", then TxDOT must retain a 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 15 working days prior to scheduled demolition.

If "No", then TxDOT is still required to notify DSHS 15 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.

Any other evidence indicating possible hazardous materials or contamination discovered on site. Hazardous Materials or Contamination Issues Specific to this Project:

☒ No Action Required ☐ Required Action

Action No.

1.

VII. OTHER ENVIRONMENTAL ISSUES

(includes regional issues such as Edwards Aquifer District, etc.)

☒ No Action Required ☐ Required Action

Action No.

1.

2.

3.

Texas Department of Transportation

Design Division Standard

ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS

EPIC

FILE: epic.dgn	DN: TxDOT	CK: RG	DW: VP	CK: AR	
©TxDOT: February 2015	CONT	SECT	JOB	HIGHWAY	
REVISIONS	2038	01	031	FM 2115	
12-12-2011 (DS) 05-07-14 ADDED NOTE SECTION IV. 01-23-2015 SECTION I (CHANGED ITEM 1122 TO ITEM 506, ADDED GRASSY SWALES.	DIST	COUNTY		SHEET NO.	
	09	Bell		221	

BEST MANAGEMENT PRACTICE (BMP) GENERAL NOTES

1. Prior to TxDOT allowing the Contractor to start construction, the Contractor will provide the required storm water and 404 permit documentation and support activities, including but not limited to the following:

   - Provide a list of all chemicals, construction and waste products that will be generated, stored or brought upon TxDOT ROW. The list includes expected construction debris, sanitary wastes, construction chemicals and petroleum products used or generated by the Contractor and sub-contractors. Along with the list, the Contractor will supply a spill prevention plan and clean up procedures that will include each of these chemical products or generated waste.

   - Provide in the construction schedule the necessary line items that will comply with the schedule and planning requirements of the storm water permit.

   - Post the TxDOT storm water permit and any Contractor permits, per permit requirements.

   - Provide copies of storm water permits for Contractor PSL(s). As new PSL(s) may be obtained for the project, provide copies of new or amended permits to TxDOT. The Contractor will not disturb soil without the proper permits.

   - Provide scale drawings of off ROW PSL's within one mile of the project, for field offices, borrow sources, plant sites or other uses.

   - Provide permit information on any Contractor batch plants or concrete crushing plants to be located at a Contractor PSL(s) within one mile of the project limits or boundaries. Copies of the air and water permits are to be provided to TxDOT before materials will be used on the project. No asphalt or concrete batch plants or concrete crushing plants will be located on TxDOT ROW.

   - Provide a letter indicating a Contractor Responsible Person for environmental compliance (CRP) for the project, and maintain a CRP throughout the project duration.

   - Provide all environmental documentation including certification of compliance and EMS training documents/certificates prior to starting work. The Contractor is to provide daily BMP inspection reports that document all field BMPs needing repair or replacement. The Contractor is to clearly document specific BMPs needing repair and location each work day. The Contractor is encouraged to be proactive in fixing BMPs without TxDOT direction.

   - Provide documentation required for Waters of the US, Note #3 and submittals for Item 496 bridge removal. Bridge removal methods submitted will follow all Waters of the US note requirements. The Contractor is not to start construction within the Ordinary High Water Marks of any stream until receiving approval for stream channel construction methods from TxDOT.

   - Provide a written procedure for managing all chemicals and construction items placed in vertical containment structures. Also, provide methods to be used for the treatment, disposal, collection or release of storm water.

   - Provide an estimated date by letter, for the submittal of marked up bridge drawings, indicating cut locations for any structural steel requiring cutting or torching of steel, coated with lead containing paints.

2. Place and maintain trash cans and portable sanitary facilities at locations where there is active construction. Worker generated trash and construction debris will be kept from being transported by storm water and will be collected daily from the ground and routinely hauled from the work area.

3. Contractor will provide TxDOT copies of all correspondence with MS4s, TCEQ, EPA, DSHS and Corps of Engineers regarding activities on this project.

4. Contractor to conduct storm water inspections and develop SWPPP documents to support Contractor permits obtained for the project including PSL(s).

5. Contractor will maintain written documentation of locations of all portable sanitary facilities. The Contractor is required to document the location and disposition of all spills and cleanups from portable sanitary facilities.

6. Contractor will not store chemicals on TxDOT ROW, unless chemicals are stored following all environmental and safety regulations. Fuels for construction equipment will not be stored on TxDOT ROW.

7. The Contractor will store fuels and bulk chemicals on Contractor PSL(s) using a secondary containment method, such as double lined tanks and/or free standing containment reservoirs made of plastic or steel designed to hold bulk chemicals or drums.

8. The Contractor will not remove sediment controls without the prior approval of TxDOT, except for a sediment control that may back up water and cause safety or traffic problems.

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TYPICAL APPLICATIONS FOR BEST MANAGEMENT PRACTICES

TA-BMP

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	CONT	SECT	JOB		HIGHWAY	
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BEST MANAGEMENT PRACTICE (BMP) GENERAL NOTES

9. Any sediment controls removed by the Contractor must be re-installed before the next rainfall event or by the end of day, as approved in advance.

10. Vegetative buffer strips may be used in place of temporary sediment controls such as silt fences and rock filter dams. The amount of disturbed soil area will be limited to 1/3 of an acre or less for a minimum of 50 feet of grassed ditch and 2/3 of an acre of disturbed soil for a minimum of 100 feet of grassed ditch.

11. Construction equipment found to be leaking oil, fuel or coolant will be immediately stopped, the leaking fluid collected and the equipment fixed. Equipment continuing to leak will be removed from the project at no cost to TxDOT. Leaking fluids from equipment will be collected and removed from the project or PSL.

12. Earth berms or mounds typically used to stockpile topsoil and used in place of boundary silt fence will be seeded upon being constructed. Long term use of earth berms or mounds will not be continued without establishing grass on the control.

13. The Contractor will inform TxDOT of new areas where soil will be disturbed to facilitate planning for new sediment controls. Areas of vegetated soil will not be disturbed by the Contractor, unless adequate sediment controls can be installed before the next rainfall event. The Contractor will assist TxDOT in keeping an accurate set of working SWPPP drawings that show the locations of all temporary sediment and erosion controls.

14. The Contractor will maintain an adequate amount of temporary sediment controls on hand at the field office or project staging area for critical SWPPP maintenance, including silt fence (minimum of 200 feet) and rock / fabric for rock filter dams (minimum for 100 feet of Type III dams).

    The requirement for BMP rock quantities on hand is waived for small projects for on and off system bridge installations. The Contractor having a BMP Subcontractor does not eliminate the requirement for the Contractor to have the required silt fence and rock on hand, typically stored at the Contractor PSL.

15. Failure of a sub-contractor to complete storm water work on time will require the Contractor to start storm water sediment control work immediately and complete the work with high priority, or be subject to stop work on the entire project.

16. Earth materials on roads as a result of soil tracking will not be allowed to be transported off ROW in storm water. Soil or rock material found on roadways deposited from Contractor equipment will be removed daily.

17. Unless approved, completed concrete curb inlets will not be blocked by sediment controls. The contractor will frequently sweep the completed or partially completed roadway to keep sediment out of drainage pipes.

18. The Contractor will be responsible for proper dust control and will route construction traffic in a manner that minimizes dust generation.

19. Water for dust control will contain no pollutants, but may be non-potable from upland stock ponds. No quantity of water to be used for construction purposes may be taken from a 404 stream, prior to the proper authorizations or permits being obtained by the Contractor.

20. Contractor is to direct workers and sub-contractors to use portable sanitary facilities provided by the Contractor and not to trespass off ROW.

21. Contractor will provide written verification to TxDOT that earth borrow pits and disposal sources meet environmental and regulatory requirements, prior to use. Excavations will meet all OSHA requirements and the current safety guidelines established for TxDOT Quarries and Pits.

22. Boundary silt fences that are terminated down slope, with one end being at the lowest elevation, will be installed with an L - hook to contain sediment. Boundary silt fences that are installed on flat ground will have L-hooks on both ends.

23. Rock filter dams across ditches will be constructed where the rock filter dam ends are embedded within the ditch side slopes and ditch bottom. The top center elevation of the rock filter dam will be at least 6 inches lower than the elevations on the rock filter dam ends.

24. Silt fence will be constructed in a U or V pattern across ditch lines and up the ditch side slope to keep storm water from flowing around the ends of the silt fence. Small silt fences that do not adequately span the ditch and allows storm water around the end(s) will not be used. Where there is adequate space, large U pattern silt fences are preferred to facilitate sediment collection and sediment removal with equipment.

25. Sediment controls (RFDs or silt fences) will be located along road ditches as marked on the SWPPP drawings. Modifications to the sediment control spacing will be adjusted during the project based on sediment control effectiveness. The installation and maintenance of sediment controls at or near outfalls, where storm water leaves TxDOT ROW, takes persistent over ditch line sediment controls.

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TYPICAL APPLICATIONS FOR BEST MANAGEMENT PRACTICES

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BEST MANAGEMENT PRACTICE (BMP) GENERAL NOTES

26. Storm water draining sheet flow over disturbed soil sloped towards the ROW property line, will be intercepted by a boundary silt fence typically installed with L-shaped ends.

27. For ditch grading and shoulder up work, the Contractor is limited during good weather to remove up to one mile (limited to five acres of disturbed soil) of ditch line sediment controls; on one side of the roadway. Outfall controls cannot be removed during this activity. Ditch line controls must be replaced upon completion of work and before the next rain event.

28. Sediment controls damaged by the Contractor, as defined by permit, must be fixed or replaced immediately upon discovery.

29. Notches in silt fences are not typically allowed. Specific silt fences that back up water onto lanes of traffic may be notched if approved.

30. For silt fence maintenance, the Contractor will leave approximately 4 inches of deposited sediment up stream of silt fences and not over excavate around silt fences or rock filter dams.

31. The Contractor will inform TxDOT of new construction areas and where soil is planned to be disturbed. Sediment controls will be installed at outfalls prior to the Contractor beginning soil disturbing activities up slope from the outfall.

32. Water from concrete saw cutting, concrete grinding and concrete coring activities; or fine materials from concrete chipping and salvage will not be allowed to enter storm drains or enter streams.

33. Storm water containing suspended sediment and turbidity needing to be removed from excavations or low areas will be pumped or gravity drained through vegetated buffer strips (50 foot minimum) or placed in ditches with temporary sediment controls, prior to the water being discharged into a stream.

34. Uncontaminated water from natural groundwater seepage, springs, foundations and drains that does not contain suspended sediment or any pollutants may be discharged without storm water controls.

35. Lime or cement if spilled in ditches or outside the defined limits of application is considered a pollutant and will be excavated and removed the same day, to avoid contaminating streams.

36. If located along the project ROW, RAP stockpiles will be located where there is a minimum 100 feet of vegetative buffer strip before storm water will reach a stream. RAP will not be used as a construction material within the Ordinary High Water Marks of a stream channel of a 404 designated stream.

37. If allowed on the project, concrete truck wash out areas will have adequate volume to allow 12 inch freeboard for rain and will be lined with 6 mils of plastic. No concrete will be stored higher than the 12 inch freeboard. Cleaning of truck chutes and equipment does not constitute concrete truck wash out and this activity may be completed at the concrete placement location. Wash out areas will not be located closer than 50 ft from down slope inlets or stream channels.

38. For outfalls near stock ponds closer than 50 foot from disturbed soil at the ROW line, redundant sediment controls will be provided, typically a combination of rock filter dam and a silt fence constructed in line of the flow.

39. Earth stockpiles will utilize silt fence sediment controls, positioned on the low end of the stockpile drainage area with L-hooks or silt fence installed around the entire stockpile.

40. Sediment controls including rock filter dams and silt fences will not be installed across any 404 streams. Sediment controls at 404 streams will be positioned to limit sediment entering the stream from the banks and around structures/culverts, and will allow free flow of storm water to pass through the ROW without being dammed by any sediment controls. Remove loose materials from stream channels prior to each rain event.

41. Sediment controls for non-404 streams may be constructed across the drainage channel in unlimited locations. It is appropriate to use sediment control details typically used for 404 streams for non-404 streams when flow velocities are high. Remove loose material from stream channels prior to each rain event.

42. Incomplete drainage pipe installation across the roadway does not remove the requirement for having sediment controls around the ends of the pipe. To stay within permit requirements, sediment controls should be installed over and around the terminated end and along each side of the banks as soon as construction on the pipe has been completed. Remove loose material from stream channels prior to each rain event.

43. Safety end / headwall construction temporarily will require the removal of part of the sediment control placed over and around the pipe end. Retain in place as much functioning sediment control as possible. Replace the silt fence over and around the top of the pipe, immediately upon concrete placement and form removal. Do not remove culvert sediment controls that cannot be replaced before the next rain event. Sediment control at the ends of culverts must be in place and available for any rain event until the disturbed soil areas are re-vegetated.

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TYPICAL APPLICATIONS FOR BEST MANAGEMENT PRACTICES

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BEST MANAGEMENT PRACTICE (BMP) GENERAL NOTES

44. Between the Ordinary High Water Marks of a 404 stream channel, the Contractor will disturb only the minimum amount of stream channel that is necessary to complete the work.

45. Rock riprap for erosion control does not replace the requirements to maintain sediment control until vegetation is re-established. Replace sediment controls immediately after installing erosion rock.

46. At the direction of TxDOT, sediment deposited into existing and new culverts will be removed subsidiary to Item 506. Sediment to be removed is either pre-existing material before construction starts or sediment generated as a part of this project.

47. Provide treated 2X4 cross bracing for rectangular inlet silt fence, subsidiary to Item 506.

48. Loose or granular earth materials will not be used to repair silt fence undercuts. Silt fence undercut repairs will be conducted with well compacted soils or the silt fence will be reset in a nearby location.

49. Silt fence steel T posts of approximately 1.25 pounds per foot are allowed at a spacing of 8 feet or less. Silt fence steel T posts between approximately 1.25 pounds per foot and 0.85 pounds per foot are allowed for T post spacing of 5 feet or less.

50. Silt fence to be used to slow the flow of storm water down slopes will be positioned approximately horizontal (on the contour) with L hooks on the ends and limited to approximately 200 feet in length. Multiple sections and levels of silt fence may be required in addition to temporary / permanent erosion control flumes.

51. Soil retention blankets will be installed rolled down the slope with the small dimension side embedded at the top of slope, unless recommended otherwise by the manufacturer. Excess grass, rocks, trash, debris or clods will be removed before seeding and installing soil retention blankets. All installations will be by the manufacturer recommendations. Contractor equipment, including tractor mowers will be kept off areas with soil retention blankets until the grass is established.

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TYPICAL APPLICATIONS FOR BEST MANAGEMENT PRACTICES

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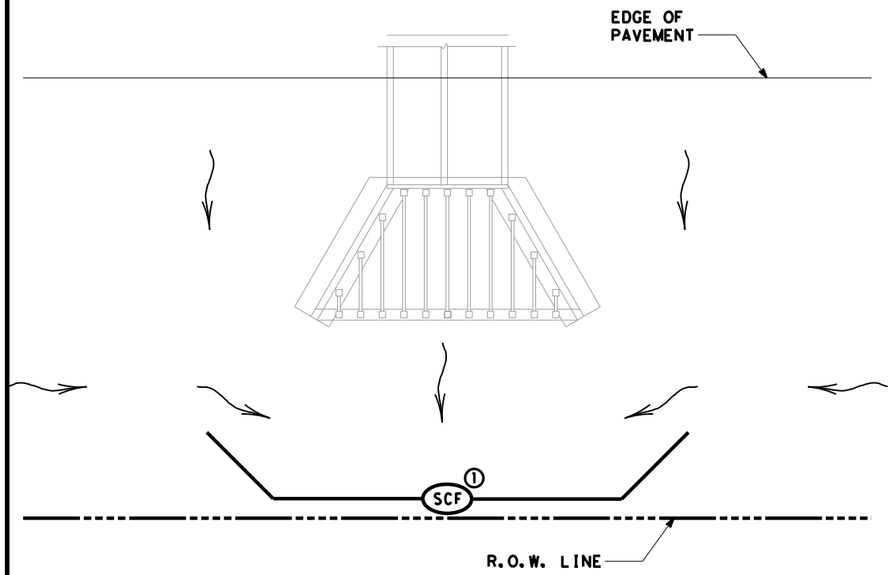
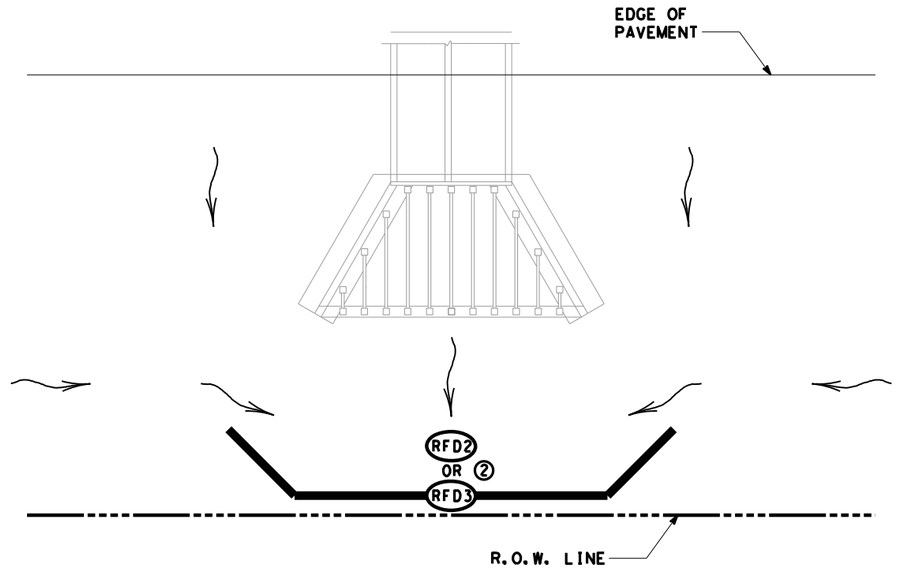


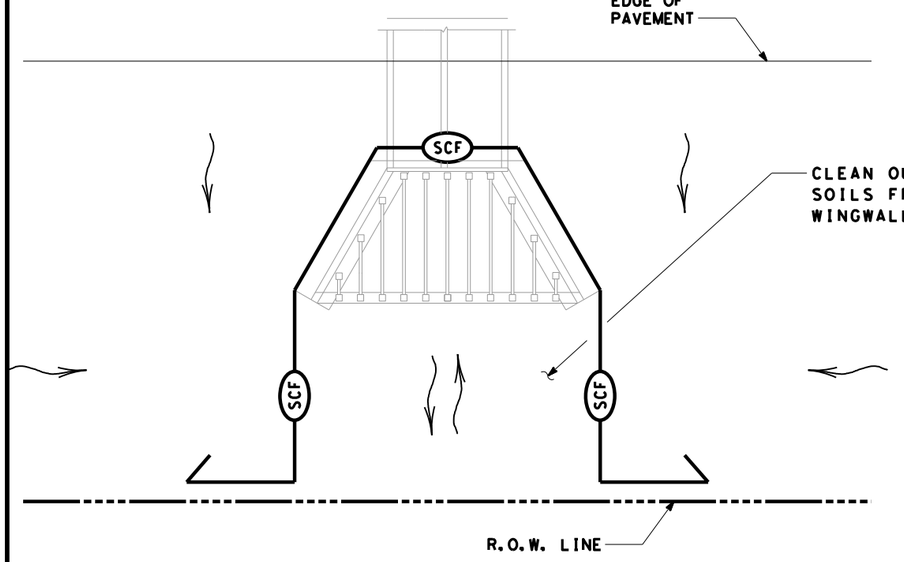
BEST MANAGEMENT PRACTICE (BMP) #1

FOR NON-404 STREAMS ONLY ~ SEDIMENT CONTROL AT EXIT OF CULVERT



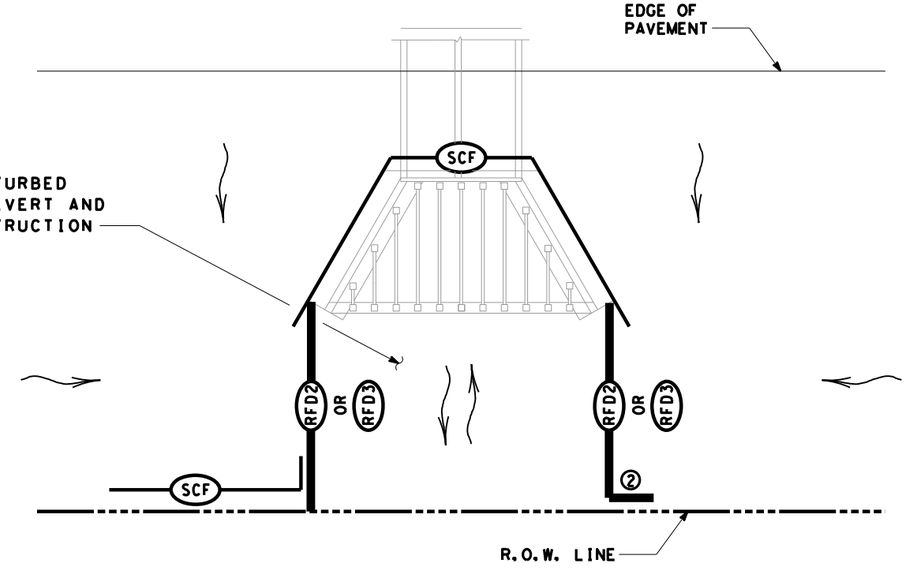
BEST MANAGEMENT PRACTICE (BMP) #2

FOR NON-404 STREAMS ONLY ~ SEDIMENT CONTROL AT EXIT OF CULVERT



BEST MANAGEMENT PRACTICE (BMP) #3

FOR 404 OR NON-404 STREAMS ~ SEDIMENT CONTROL AT EXIT OR ENTRANCE OF CULVERT



BEST MANAGEMENT PRACTICE (BMP) #4

FOR 404 OR NON-404 STREAMS ~ SEDIMENT CONTROL AT EXIT OR ENTRANCE OF CULVERT

SCF	SEDIMENT CONTROL FENCE
RFD2	ROCK FILTER DAM (TY 2)
RFD3	ROCK FILTER DAM (TY 3)
	DIRECTION OF FLOW

NOTES:

1. EXTEND SILT FENCE SO STORM WATER DOES NOT GO AROUND THE ENDS. USE L-HOOKS ON ENDS AS REQUIRED.
2. EXTEND ROCK FILTER DAM SO STORM WATER DOES NOT GO AROUND THE ENDS.

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TYPICAL APPLICATIONS FOR BEST MANAGEMENT PRACTICES

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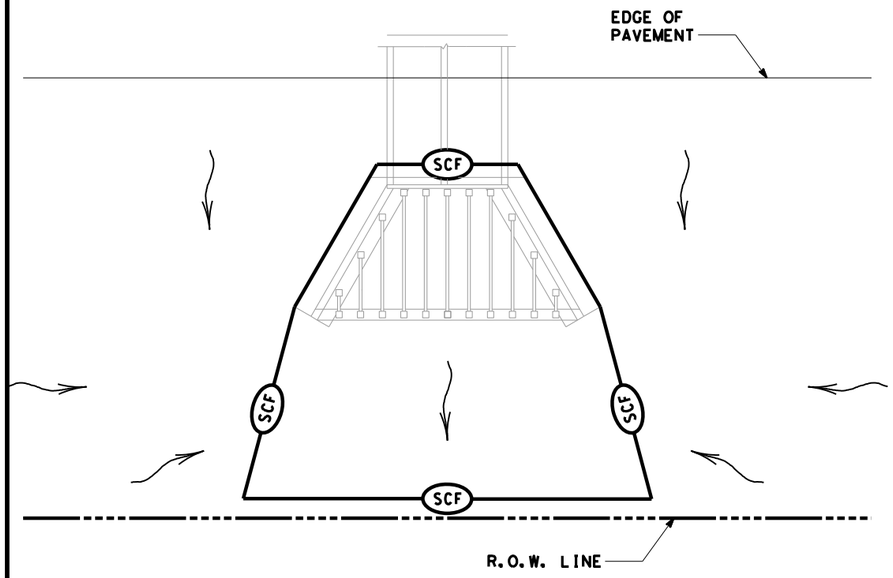
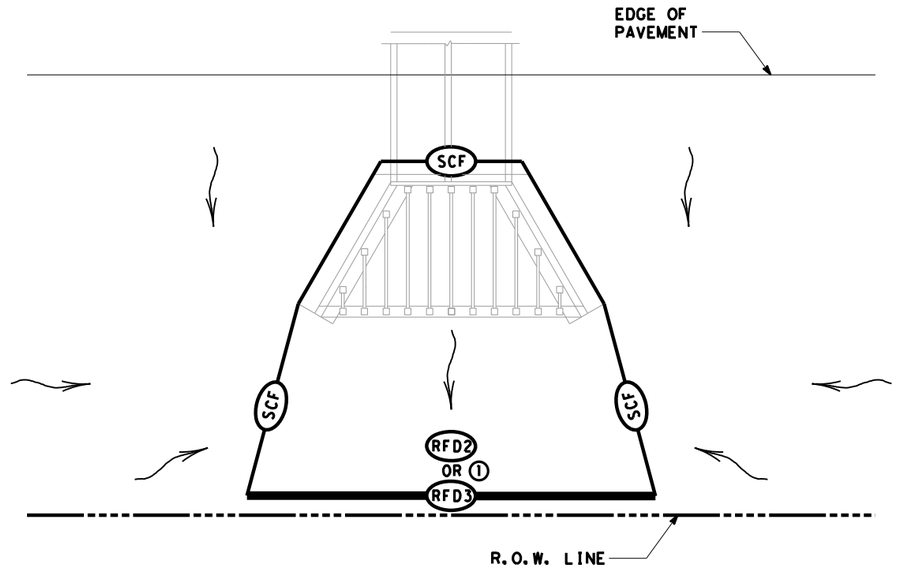


BEST MANAGEMENT PRACTICE (BMP) #5

FOR NON-404 STREAMS ONLY ~ SEDIMENT CONTROL AT EXIT OF CULVERT



BEST MANAGEMENT PRACTICE (BMP) #6

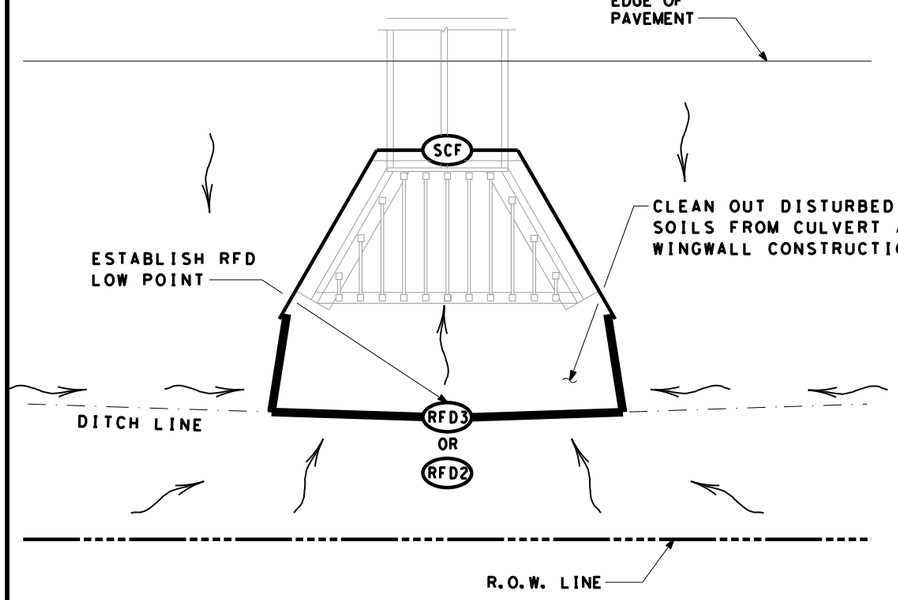
FOR NON-404 STREAMS ONLY ~ SEDIMENT CONTROL AT EXIT OF CULVERT

SCF	SEDIMENT CONTROL FENCE
RFD2	ROCK FILTER DAM (TY 2)
RFD3	ROCK FILTER DAM (TY 3)
	DIRECTION OF FLOW

NOTES:

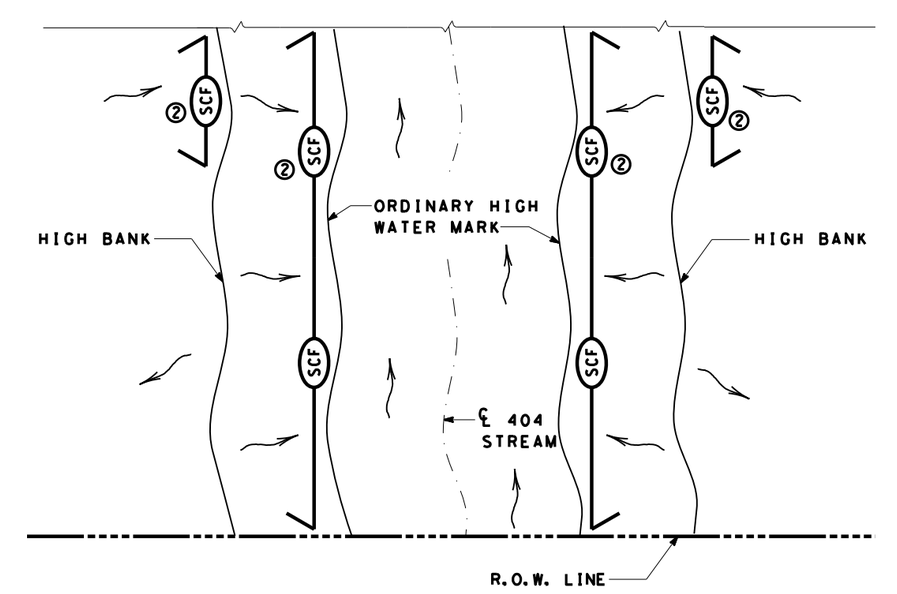
① PROVIDE OVERLAP OF SILT FENCE WITH ROCK FILTER DAM.

② USE SILT FENCE L-HOOKS ON ENDS TO BLOCK STORM WATER SEDIMENT



BEST MANAGEMENT PRACTICE (BMP) #7

FOR NON-404 STREAMS ONLY ~ SEDIMENT CONTROL AT ENTRANCE OF CULVERT



BEST MANAGEMENT PRACTICE (BMP) #8

FOR 404 STREAMS ~ SEDIMENT CONTROL DURING PROJECT CLEARING AND GRUBBING

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TYPICAL APPLICATIONS FOR BEST MANAGEMENT PRACTICES

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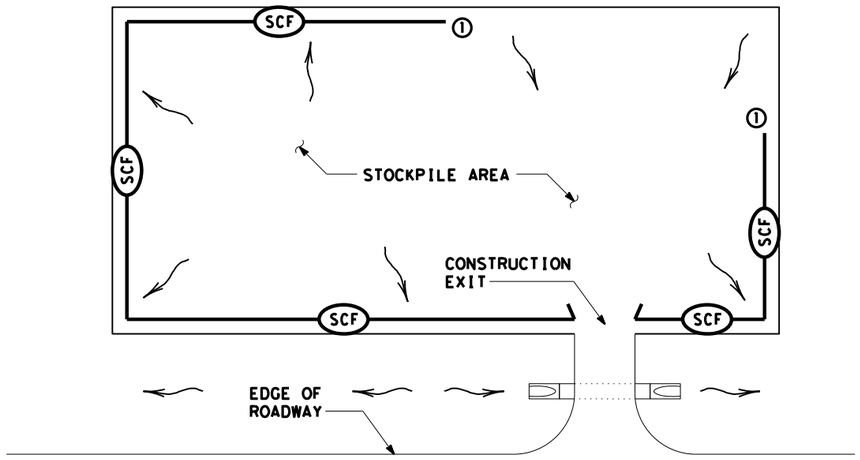
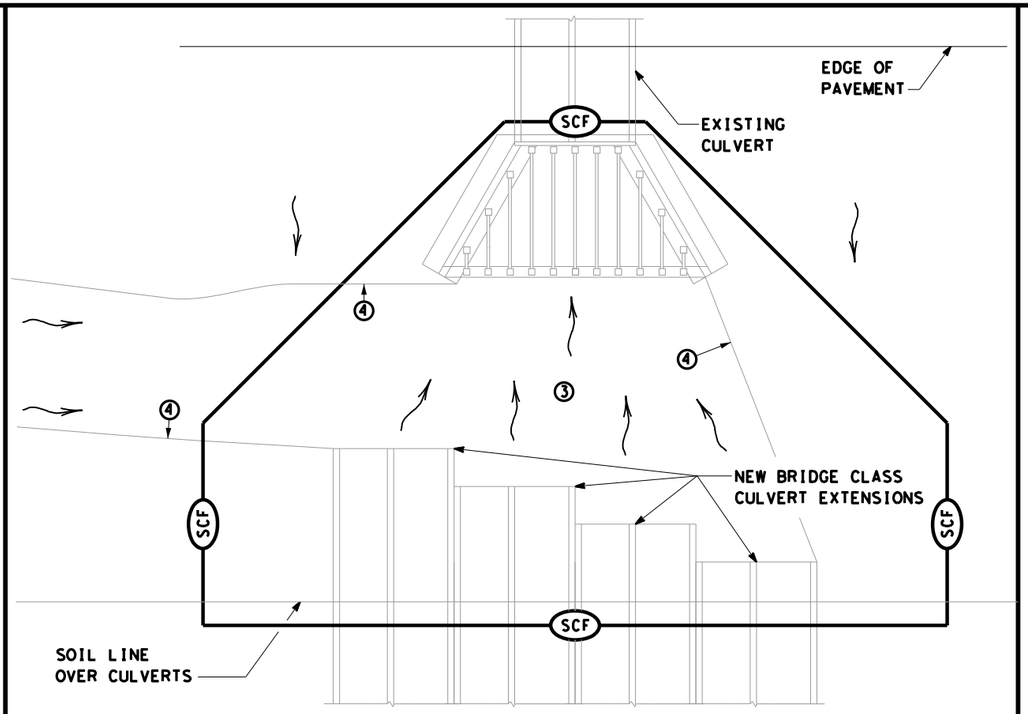


BEST MANAGEMENT PRACTICE (BMP) #9

STOCKPILE SEDIMENT CONTROL



BEST MANAGEMENT PRACTICE (BMP) #10

FOR 404 OR NON-404 STREAMS ONLY ~
SEDIMENT CONTROL AT PHASED CONSTRUCTION OF BRIDGE CLASS CULVERTS

SCF	SEDIMENT CONTROL FENCE
RFD2	ROCK FILTER DAM (TY 2)
RFD3	ROCK FILTER DAM (TY 3)
	DIRECTION OF FLOW

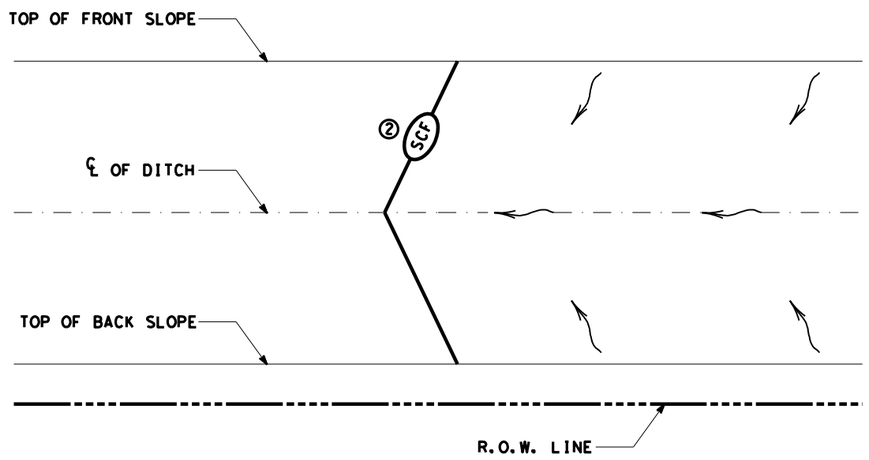
NOTES:

① START SEDIMENT CONTROL AT LOCATION SO ALL STORM WATER WITH SEDIMENT IS COLLECTED

② ROCK FILTER DAMS OR EARTH/GRASSED EMBANKMENTS CAN BE SUBSTITUTED AS DIRECTED.

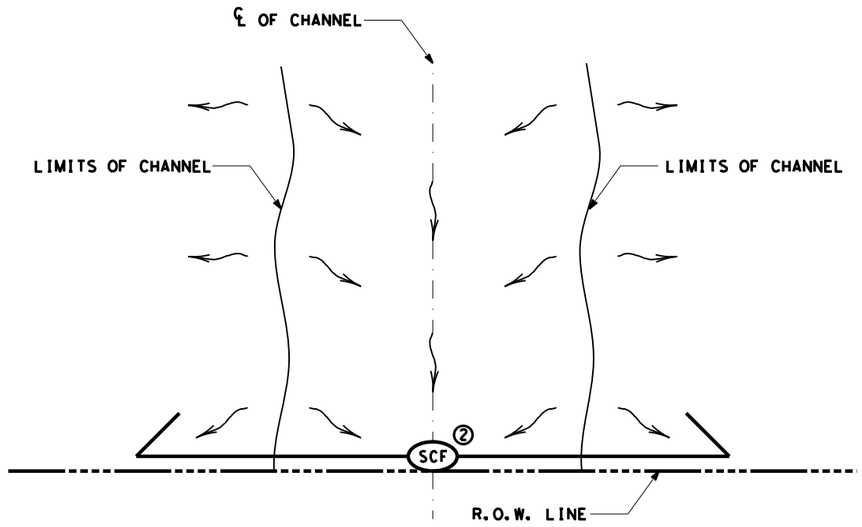
③ PROVIDE A SMOOTH TRANSITION FROM THE INVERT ELEVATIONS BETWEEN CULVERTS. REMOVE LOOSE SOIL FROM EXCAVATED AREA BETWEEN CULVERTS.

④ PROVIDE AND INSTALL PNEUMATICALLY PLACED CONCRETE ON THE DITCH BOTTOM AND SIDE SLOPES BETWEEN TEMPORARY TERMINATIONS BETWEEN OLD AND NEW CULVERTS. PNEUMATICALLY PLACED CONCRETE WILL BE PLACED TO THE HEIGHT OF THE LARGEST CULVERT ON THE DITCH SIDE SLOPES; AND TO A LIMIT 10 FEET OUTSIDE THE LOCATION OF BMPS ALONG THE DITCH BOTTOM. CEMENT STABILIZED SAND MAY BE SUBSTITUTED FOR PNEUMATICALLY PLACED CONCRETE, IN AREAS WHERE INSTALLATION WORKS AND AT THE OPTION OF TXDOT.



BEST MANAGEMENT PRACTICE (BMP) #11

BOUNDRY SEDIMENT CONTROL ~ BOTH ENDS OF CONTROL TERMINATED UP SLOPE



BEST MANAGEMENT PRACTICE (BMP) #12

BOUNDRY SEDIMENT CONTROL ~ BOTH ENDS OF CONTROL TERMINATED DOWN SLOPE

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TYPICAL APPLICATIONS FOR BEST MANAGEMENT PRACTICES

TA-BMP

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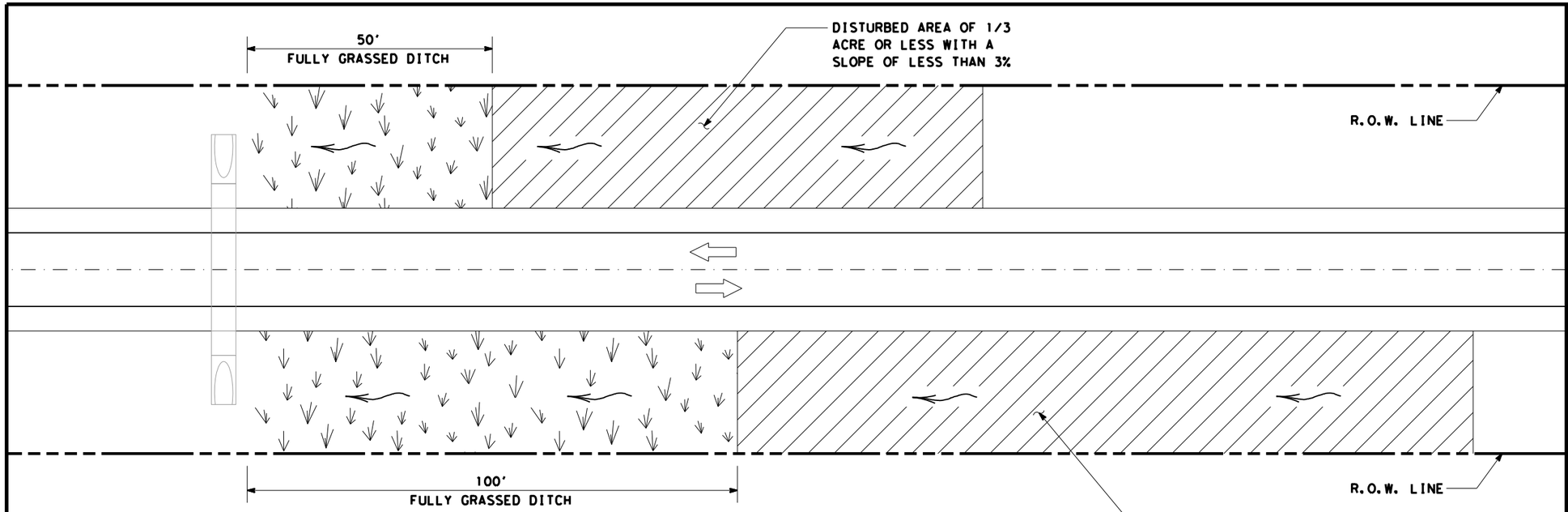
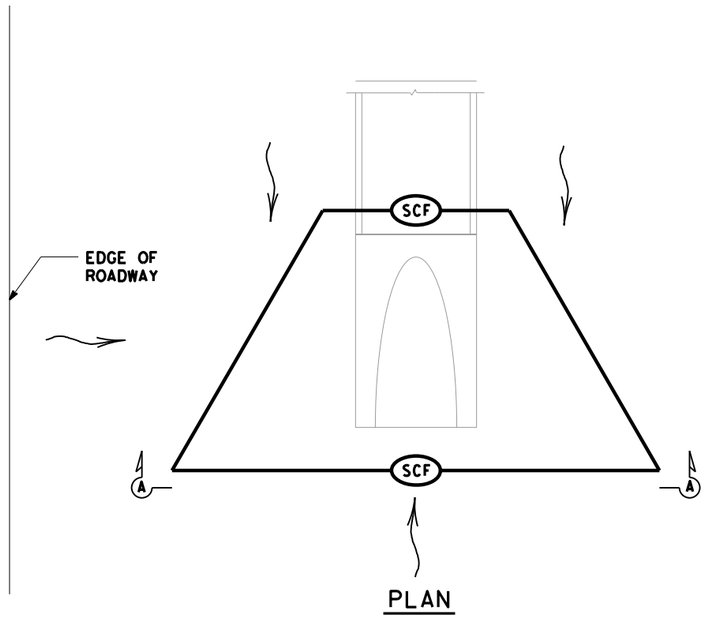
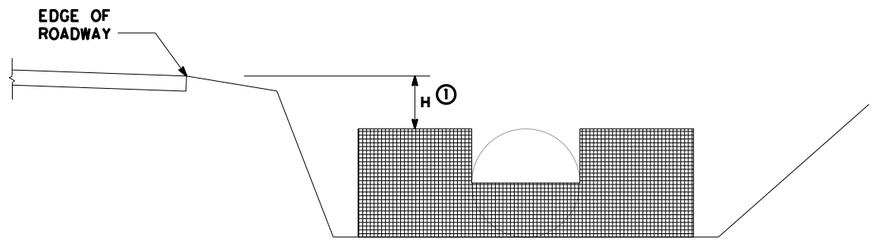


BEST MANAGEMENT PRACTICE (BMP) #13

USE OF VEGETATIVE BUFFERS IN PLACE OF TEMPORARY SEDIMENT CONTROLS SUCH AS SILT FENCE AND ROCK FILTER DAMS



PLAN



VIEW A-A

BEST MANAGEMENT PRACTICE (BMP) #14

NON-404 STREAMS AND DITCHES ONLY - SEDIMENT CONTROL AT PARALLEL DRAINAGE STRUCTURE ENTRANCE ②

	FULLY GRASSED DITCH
	DISTURBED AREA
	DIRECTION OF FLOW
SCF	SEDIMENT CONTROL FENCE

① FOR H DIMENSIONS LESS THAN 1.5' SILT FENCE MAY NEED TO BE NOTCHED AS SHOWN IN VIEW A-A. ADD EXTRA POSTS AT NOTCH.

② BMP #14 MAY BE USED AT CROSS DRAINAGE STRUCTURES AS DIRECTED.

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TYPICAL APPLICATIONS FOR BEST MANAGEMENT PRACTICES

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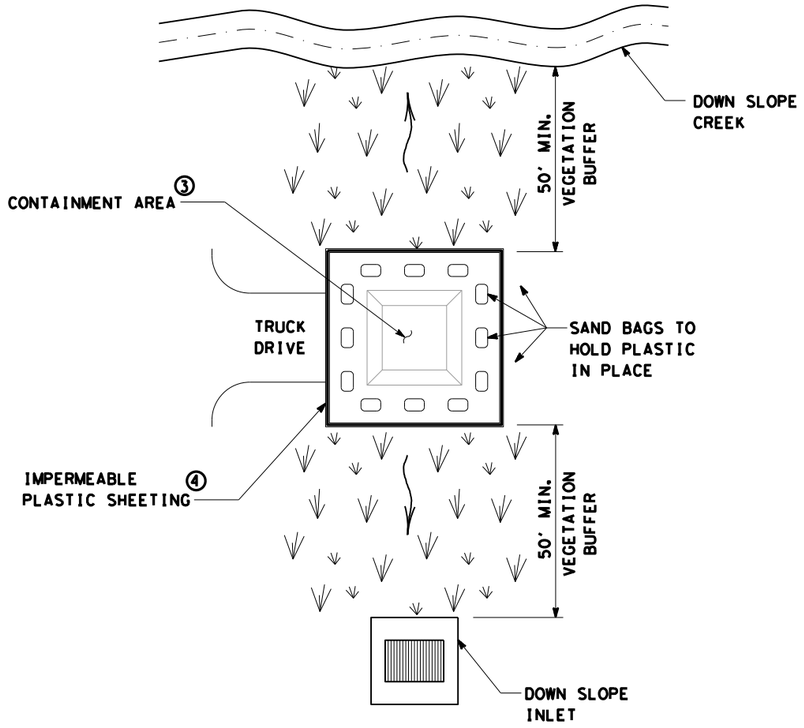
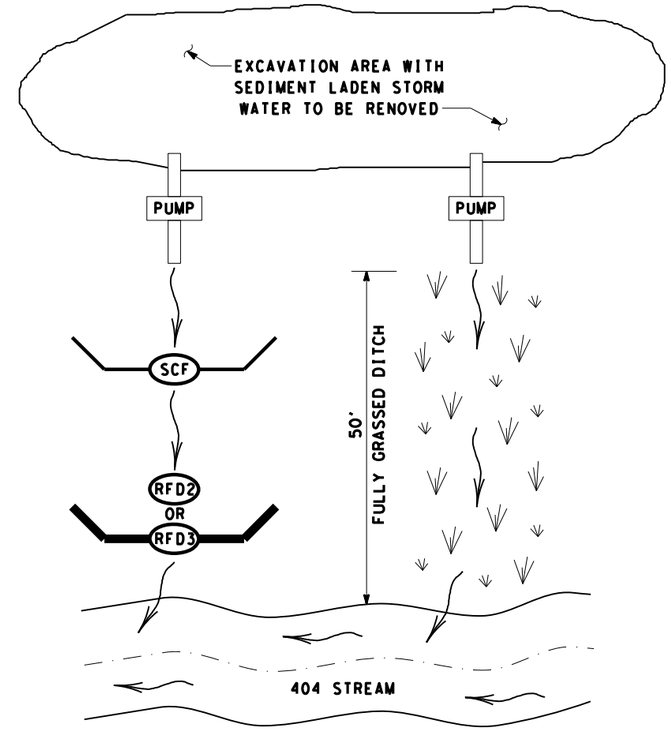


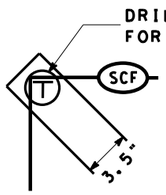
BEST MANAGEMENT PRACTICE (BMP) #15

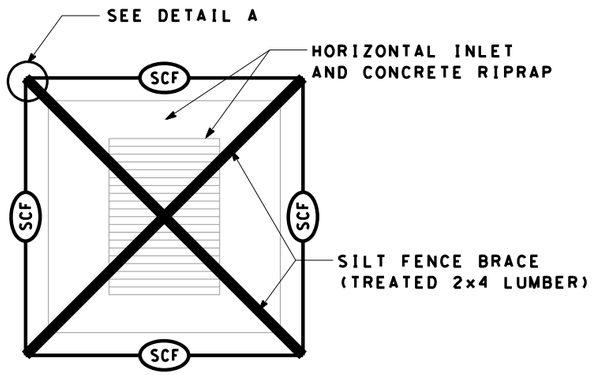
CONCRETE TRUCK WASHOUT AREA



BEST MANAGEMENT PRACTICE (BMP) #16

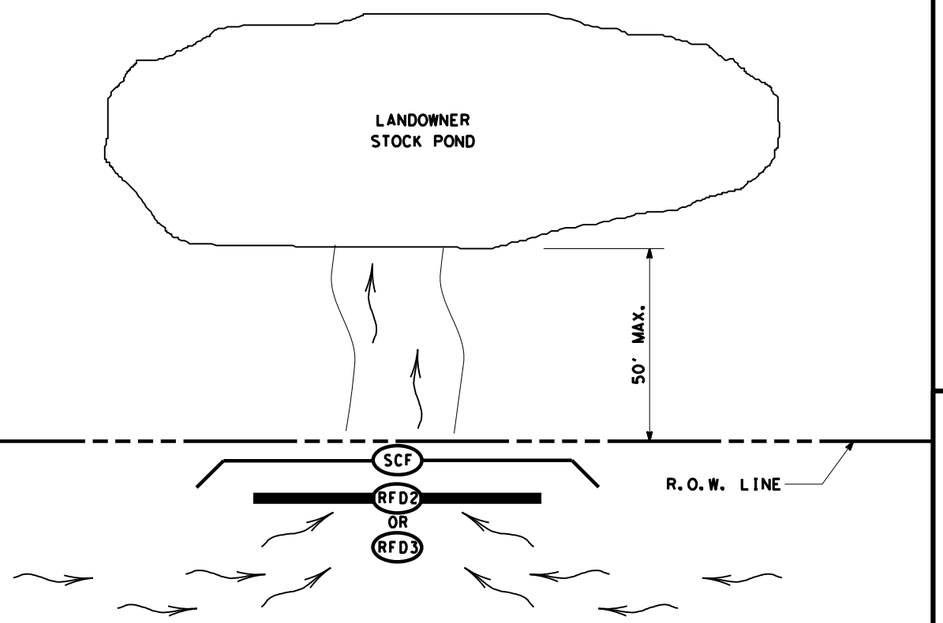
PUMPED STORM WATER SEDIMENT CONTROLS ①





BEST MANAGEMENT PRACTICE (BMP) #17

HORIZONTAL INLET SEDIMENT CONTROL



BEST MANAGEMENT PRACTICE (BMP) #18

LANDOWNER STOCKPOND SEDIMENT CONTROL ②

	FULLY GRASSED DITCH
	DIRECTION OF FLOW
SCF	SEDIMENT CONTROL FENCE
RFD2	ROCK FILTER DAM (TY 2)
RFD3	ROCK FILTER DAM (TY 3)

① PUMPED STROM WATER FROM AN EXCAVATION AREA SHOULD BE DISCHARGED IN A 50' VEGETATIVE BARRIER OR THROUGH TWO TEMPORARY SEDIMENT CONTROLS BEFORE ENTERING A 404 STREAM.

② FOR LANDOWNER STOCKPONDS WITHIN 50' OF THE RIGHT OF WAY LINE, PROVIDE REDUNDANT SEDIMENT CONTROLS AT THE CONVEYANCE OF THE POND. MINIMUM OF TWO SEDIMENT CONTROLS.

③ WHEN CONTAINMENT AREA REACHES 1' FREEBOARD, DISCONTINUE WASHOUT PLACEMENT AND REMOVE MATERIAL UPON SOLIDIFICATION.

④ EACH TIME SOLIDIFIED MATERIAL IS REMOVED REPLACE PLASTIC SHEETING.

SCALE = NTS SHEET 9 OF 10

Texas Department of Transportation
Waco District Standard

TYPICAL APPLICATIONS FOR BEST MANAGEMENT PRACTICES

TA-BMP

FILE: BMPLAYOUTS.dgn		DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT		
©TxDOT 2009		CONT	SECT	JOB		HIGHWAY	
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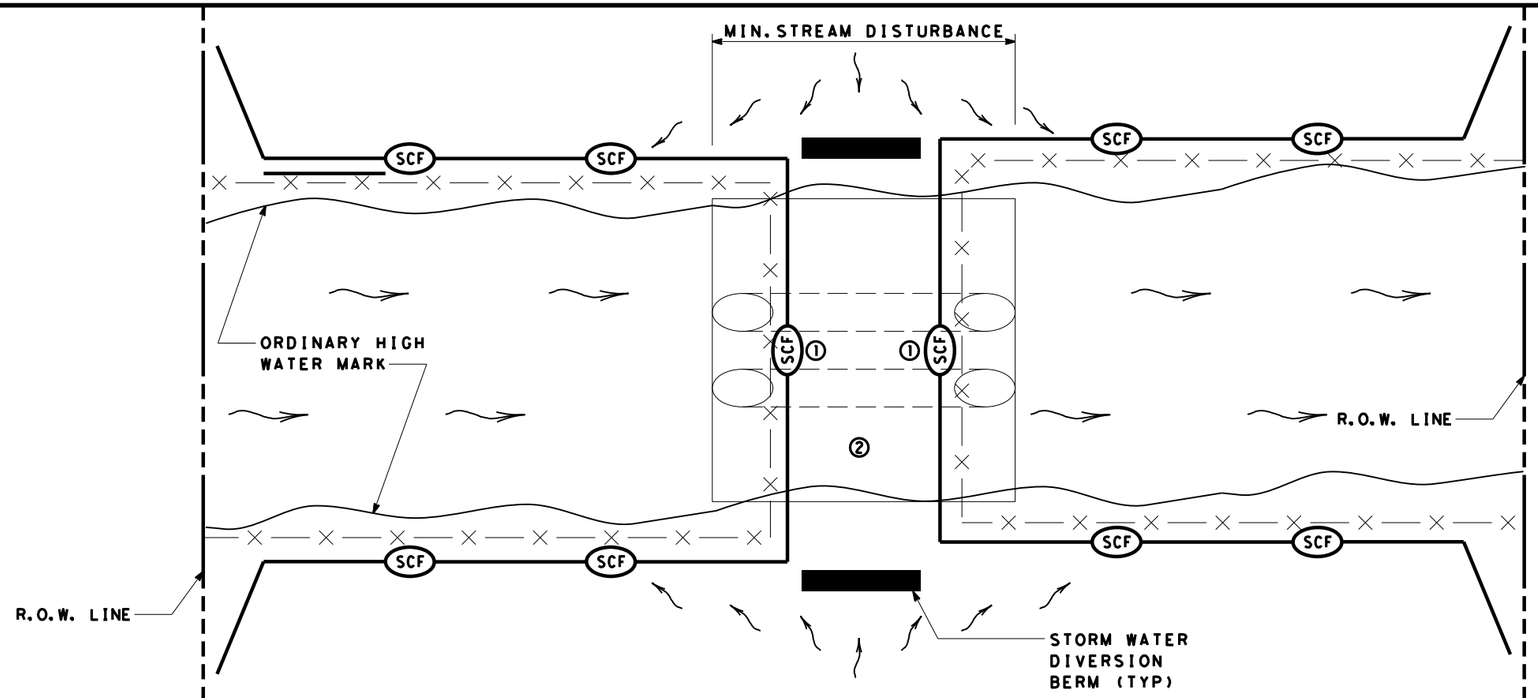
FEB 2015		WAC	BELL			230	



BEST MANAGEMENT PRACTICE (BMP) #19

TYPICAL 404 STREAM CROSSING (SEDIMENT CONTROL AT CROSSING)

	DIRECTION OF FLOW
SCF	SEDIMENT CONTROL FENCE
RFD	ROCK FILTER DAM
	SECURITY FENCING

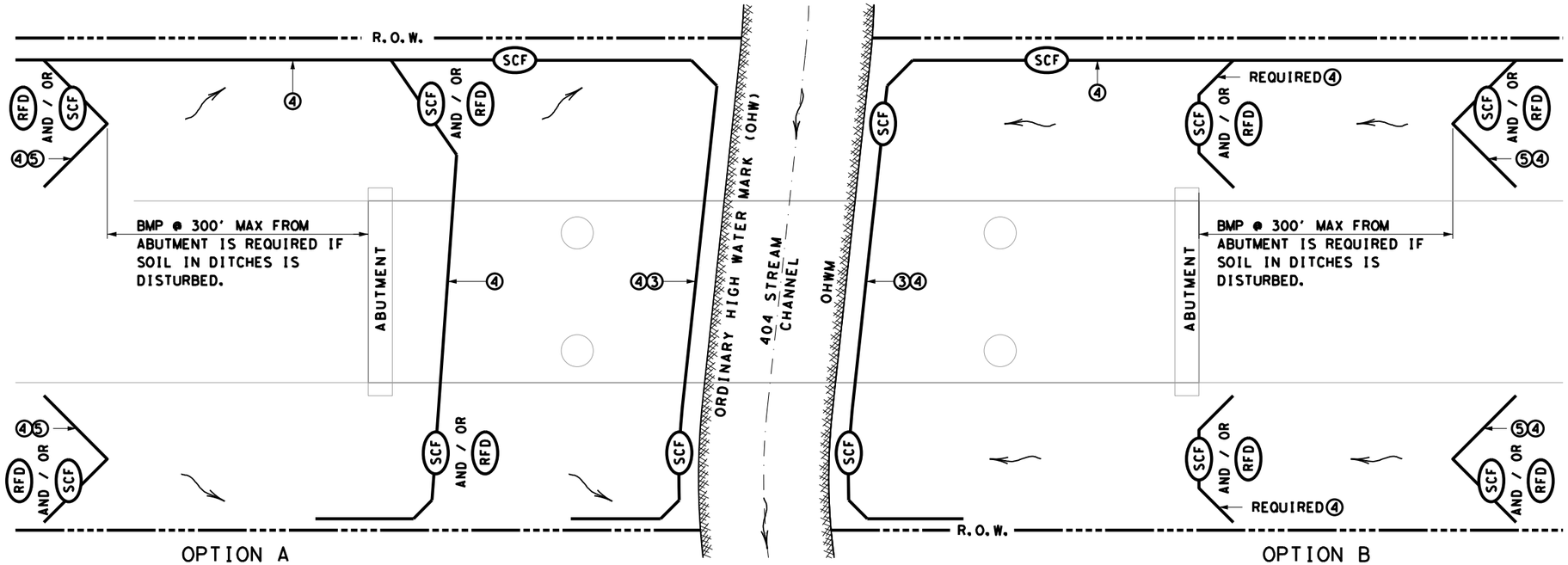
① HAY BALES MAY BE SUBSTITUTED FOR SILT FENCE OVER THE STREAM CROSSING.

② CROSSING WILL BE AS PER REQUIREMENTS OF THE WATERS OF THE US GENERAL NOTES.

③ INSTALL SILT FENCE SLIGHTLY UP FROM OHW MARK FROM R.O.W. TO R.O.W.

④ USE SILT FENCE L-HOOKS ON LEVEL OR DOWN SLOPING ENDS TO BLOCK STORM WATER SEDIMENT

⑤ INSTALL LARGE V OR U SHAPED BMP'S FROM ABUTMENT AS SHOWN. IF THERE IS STEEP DITCH CONDITIONS DECREASE SPACING AND CONSIDER RFD'S. ADD ADDITIONAL BMP'S IF GRADE IS STEEP OR IF FLOW IS HIGH.



OPTION A

OPTION B

BEST MANAGEMENT PRACTICE (BMP) #20

FOR 404 STREAMS ~ BMP'S AT BRIDGES

SCALE = NTS SHEET 10 OF 10

Texas Department of Transportation
Waco District Standard

TYPICAL APPLICATIONS FOR BEST MANAGEMENT PRACTICES

TA-BMP

FILE: BMPLAYOUTS.dgn	DN: TXDOT		CK: TXDOT	DW: TXDOT	CK: TXDOT
© TxDOT 2009	CONT	SECT	JOB	HIGHWAY	
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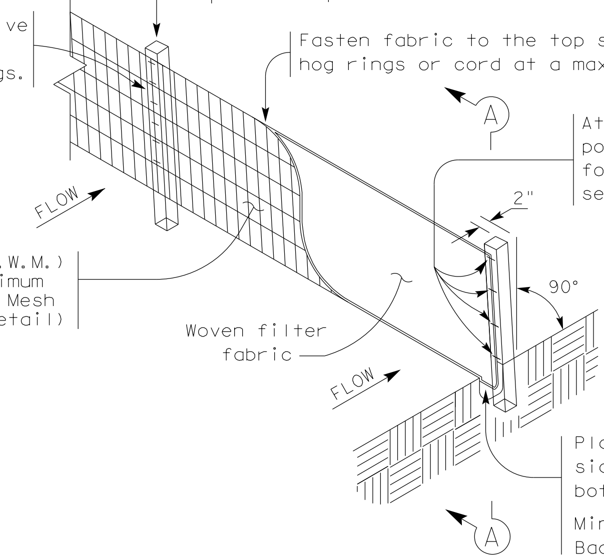
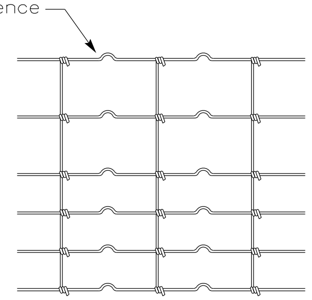
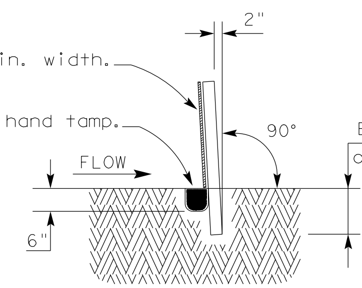


TEMPORARY SEDIMENT CONTROL FENCE

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.

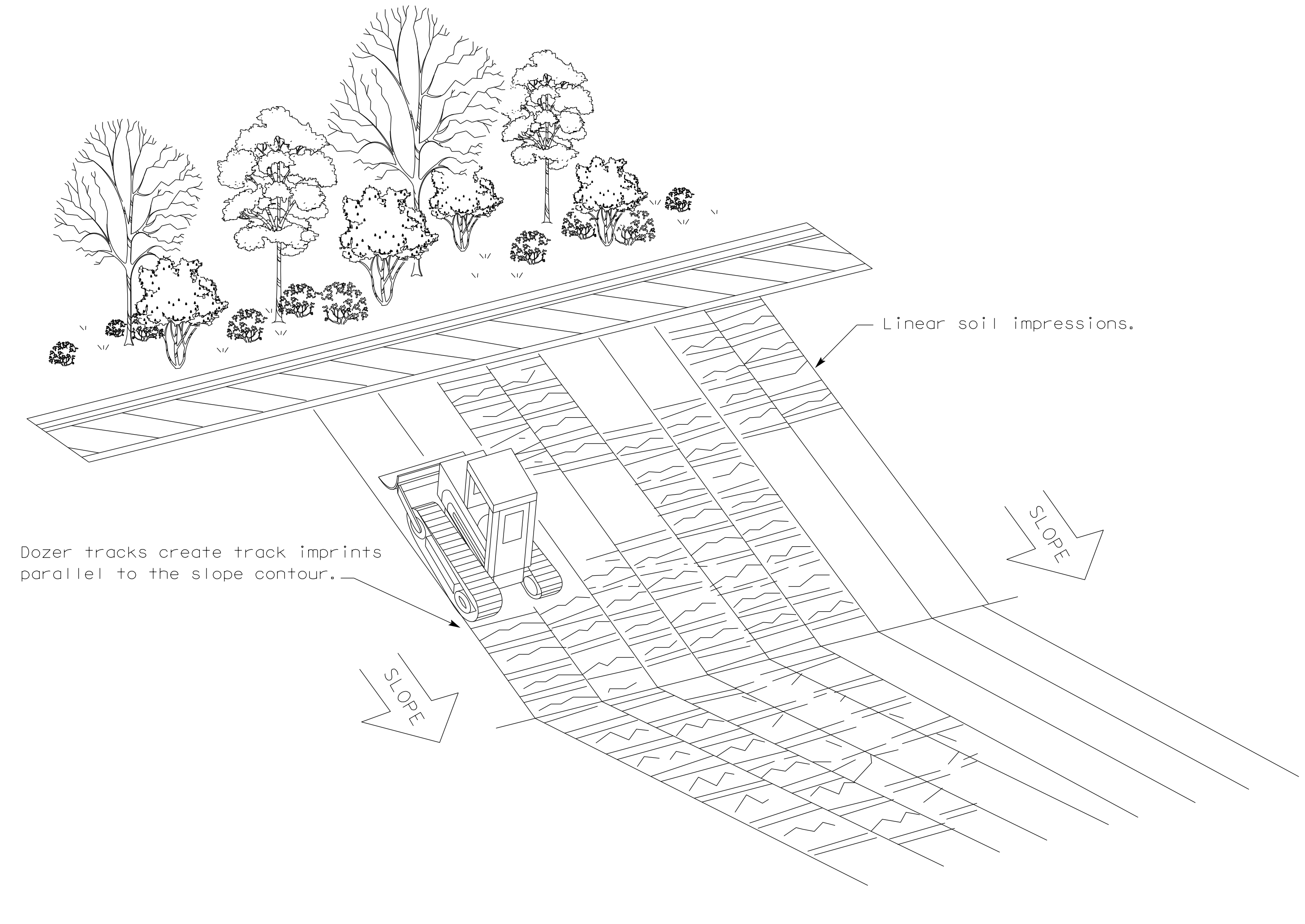
LEGEND

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
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	DIST		COUNTY	SHEET NO.
	WAC		BELL	232

DATE: 8/28/2021
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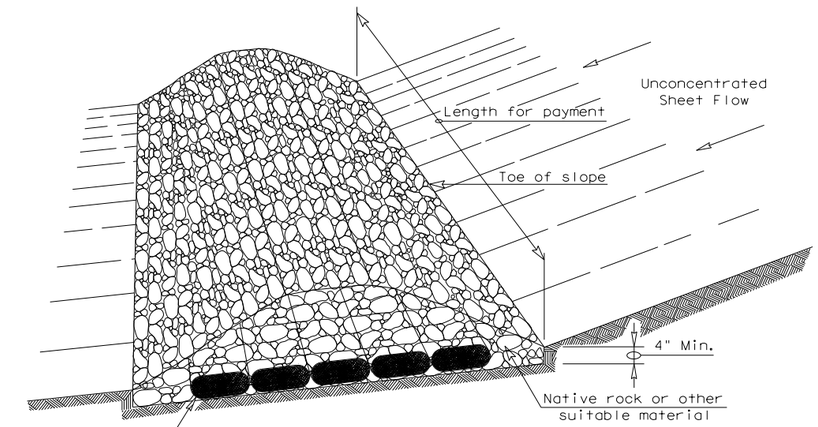
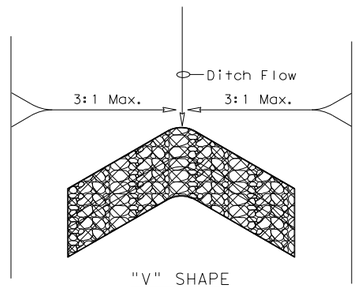
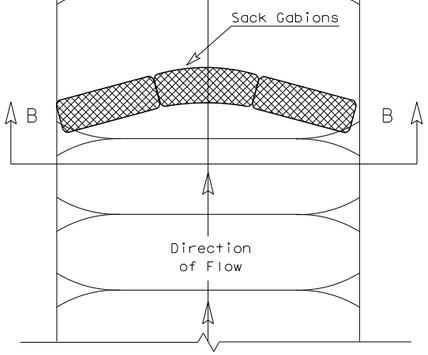


FILTER DAM AT TOE OF SLOPE

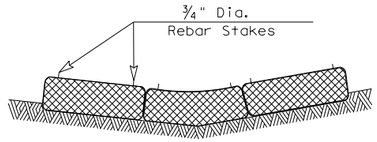
RFD1



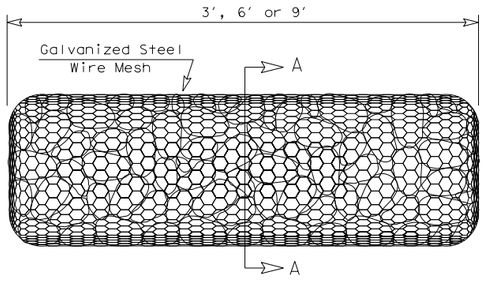
"V" SHAPE
PLAN VIEW



PLAN VIEW

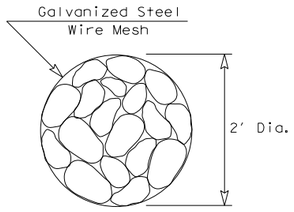


SECTION B-B

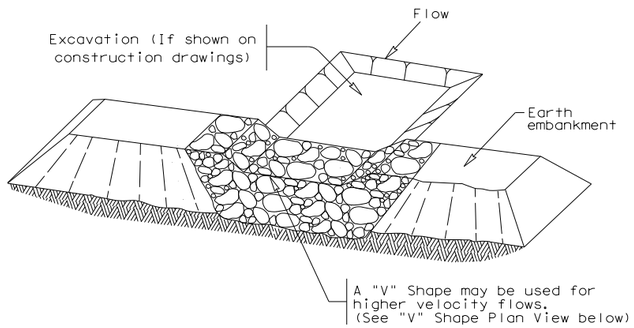


TYPE 4 (SACK GABIONS)

RFD4

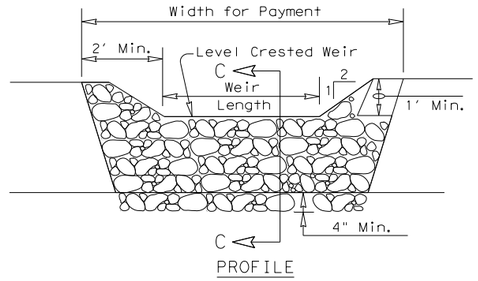


SECTION A-A

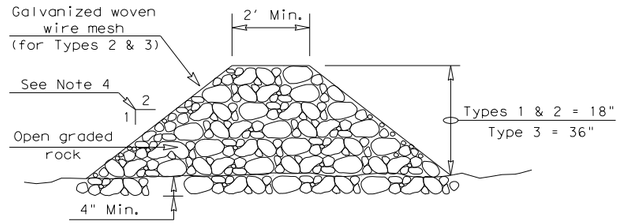


FILTER DAM AT SEDIMENT TRAP

RFD1 OR RFD2



PROFILE



SECTION C-C

ROCK FILTER DAM USAGE GUIDELINES

Rock Filter Dams should be constructed downstream from disturbed areas to intercept sediment from overland runoff and/or concentrated flow. The dams should be sized to filter a maximum flow through rate of 60 GPM/FT^2 of cross sectional area. A 2 year storm frequency may be used to calculate the flow rate.

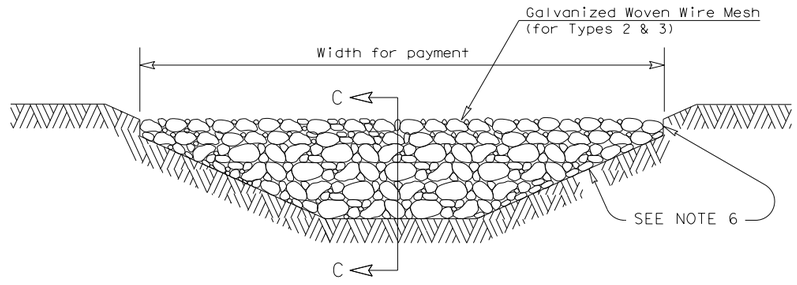
Type 1 (18" high with no wire mesh) (3" to 6" aggregate): Type 1 may be used at the toe of slopes, around inlets, in small ditches, and at dike or swale outlets. This type of dam is recommended to control erosion from a drainage area of 5 acres or less. Type 1 may not be used in concentrated high velocity flows (approximently 8 Ft/Sec or more) in which aggregate wash out may occur. Sandbags may be used at the embedded foundation (4" deep min.) for better filtering efficiency of low flows if called for on the plans or directed by the Engineer.

Type 2 (18" high with wire mesh) (3" to 6" aggregate): Type 2 may be used in ditches and at dike or swale outlets.

Type 3 (36" high with wire mesh) (4" to 8" aggregate): Type 3 may be used in stream flow and should be secured to the stream bed.

Type 4 (Sack gabions) (3" to 6" aggregate): Type 4 May be used in ditches and smaller channels to form an erosion control dam.

Type 5: Provide rock filter dams as shown on plans.



FILTER DAM AT CHANNEL SECTIONS

RFD1 OR RFD2 OR RFD3

GENERAL NOTES

1. If shown on the plans or directed by the Engineer, filter dams should be placed near the toe of slopes where erosion is anticipated, upstream and/or downstream at drainage structures, and in roadway ditches and channels to collect sediment.
2. Materials (aggregate, wire mesh, sandbags, etc.) shall be as indicated by the specification for "Rock Filter Dams for Erosion and Sedimentation Control".
3. The rock filter dam dimensions shall be as indicated on the SW3P plans.
4. Side slopes should be 2:1 or flatter. Dams within the safety zone shall have sideslopes of 6:1 or flatter.
5. Maintain a minimum of 1' between top of rock filter dam weir and top of embankment for filter dams at sediment traps.
6. Filter dams should be embedded a minimum of 4" into existing ground.
7. The sediment trap for ponding of sediment laden runoff shall be of the dimensions shown on the plans.
8. Rock filter dam types 2 & 3 shall be secured with 20 gauge galvanized woven wire mesh with 1" diameter hexagonal openings. The aggregate shall be placed on the mesh to the height & slopes specified. The mesh shall be folded at the upstream side over the aggregate and tightly secured to itself on the downstream side using wire ties or hog rings. For in stream use, the mesh should be secured or staked to the stream bed prior to aggregate placement.
9. Sack Gabions should be staked down with ¾" dia. rebar stakes, and have a double-twisted hexagonal weave with a nominal mesh opening of 2 ½" x 3 ¼"
10. Flow outlet should be onto a stabilized area (vegetation, rock, etc.).
11. The guidelines shown hereon are suggestions only and may be modified by the Engineer.

PLAN SHEET LEGEND

Type 1 Rock Filter Dam — RFD1
Type 2 Rock Filter Dam — RFD2
Type 3 Rock Filter Dam — RFD3
Type 4 Rock Filter Dam — RFD4

Texas Department of Transportation

Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

ROCK FILTER DAMS

EC(2)-16

FILE: ec216	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	2038	01	031	FM 2115
	DIST	COUNTY		SHEET NO.
	WAC	BELL		233

DATE: 8/28/2021
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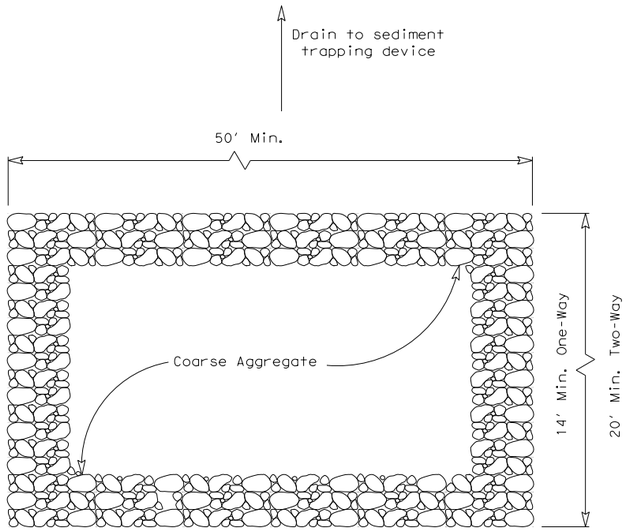
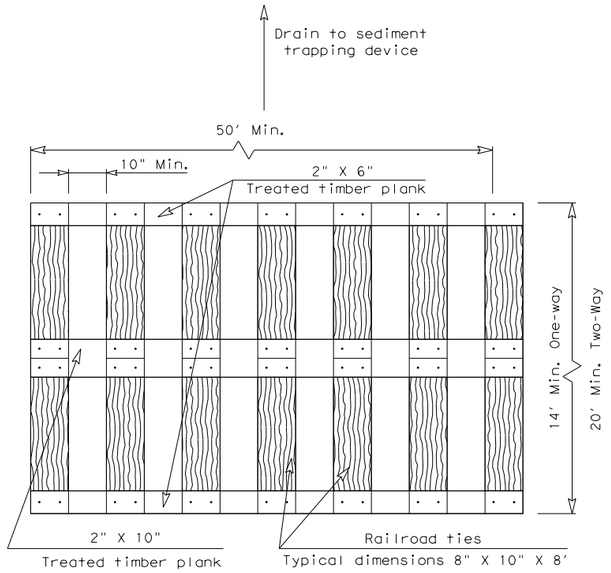


PLAN VIEW



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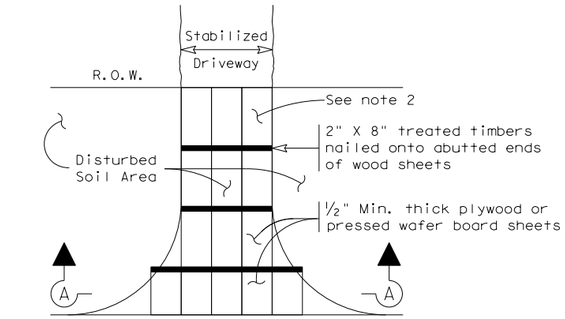

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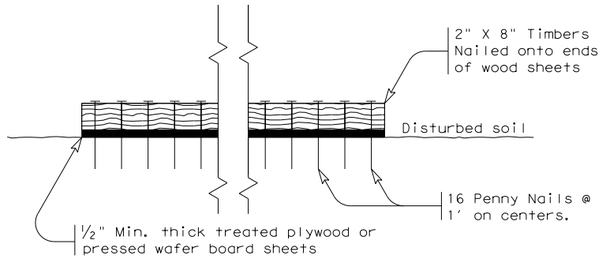
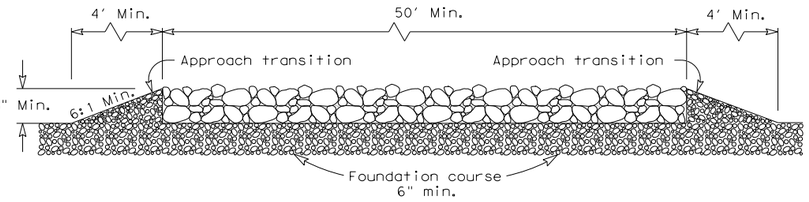


SECTION A-A

CONSTRUCTION EXIT (TYPE 3)

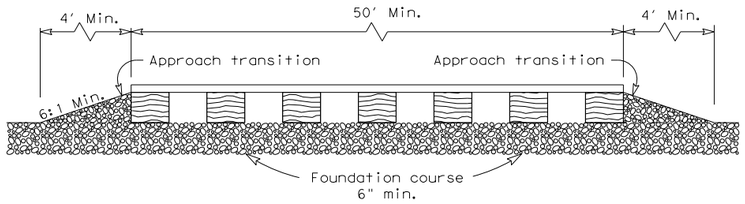
SHORT TERM



ELEVATION VIEW

CONSTRUCTION EXIT (TYPE 1)

ROCK CONSTRUCTION (LONG TERM)



ELEVATION VIEW

CONSTRUCTION EXIT (TYPE 2)

TIMBER CONSTRUCTION (LONG TERM)

GENERAL NOTES (TYPE 1)

1. The length of the type 1 construction exit shall be as indicated on the plans, but not less than 50′.
2. The coarse aggregate should be open graded with a size of 4" to 8".
3. The approach transitions should be no steeper than 6:1 and constructed as directed by the Engineer.
4. The construction exit foundation course shall be flexible base, bituminous concrete, portland cement concrete or other materialas approved by the Engineer.
5. The construction exit shall be graded to allow drainage to a sediment trapping device.
6. The guidelines shown hereon are suggestions only and may be modified by the Engineer.
7. Construct exits with a width of at least 14 ft. for one-way and 20 ft. for two-way traffic for the full width of the exit, or as directed by the engineer.

GENERAL NOTES (TYPE 2)

1. The length of the type 2 construction exit shall be as indicated on the plans, but not less than 50′.
2. The treated timber planks shall be attached to the railroad ties with ½"x 6" min. lag bolts. Other fasteners may be used as approved by the Engineer.
3. The treated timber planks shall be #2 grade min., and should be free from large and loose knots.
4. The approach transitions shall be no steeper than 6:1 and constructed as directed by the Engineer.
5. The construction exit foundation course shall be flexible base, bituminous concrete, portland cement concrete or other material as approved by the Engineer.
6. The construction exit should be graded to allow drainage to a sediment trapping device.
7. The guidelines shown hereon are suggestions only and may be modified by the Engineer.
8. Construct exits with a width of at least 14 ft. for one-way and 20 ft. for two-way traffic for the full width of the exit, or as directed by the engineer.

GENERAL NOTES (TYPE 3)

1. The length of the type 3 construction exit shall be as shown on the plans, or as directed by the Engineer.
2. The type 3 construction exit may be constructed from open graded crushed stone with a size of two to four inches spread a min. of 4" thick to the limits shown on the plans.
3. The treated timber planks shall be #2 grade min., and should be free from large and loose knots.
4. The guidelines shown hereon are suggestions only and may be modified by the Engineer.

Texas Department of Transportation

Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

CONSTRUCTION EXITS

EC(3)-16

FILE: ec316	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
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REVISIONS	2038	01	031	FM 2115
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