

FED. RD. DIV. NO.	PROJECT NO.	SHEET NO.
6	STP 2B24(345)HES	1
STATE	STATE DIST.	COUNTY
TEXAS	HOU	HARRIS
CONT.	SECT.	JOB
0502	01	237
		HIGHWAY NO.
		SH 225

INDEX OF SHEETS
SEE SHEET NO. 2

STATE OF TEXAS

DEPARTMENT OF TRANSPORTATION

PLANS OF PROPOSED STATE HIGHWAY IMPROVEMENT

FEDERAL PROJECT NO. STP 2B24(345)HES
CSJ: 0502-01-237

FOR THE CONSTRUCTION/INSTALLATION OF TRAFFIC SIGNAL
IMPROVEMENTS CONSISTING OF: FIBER OPTIC INTERCONNECT
AND VIVDS

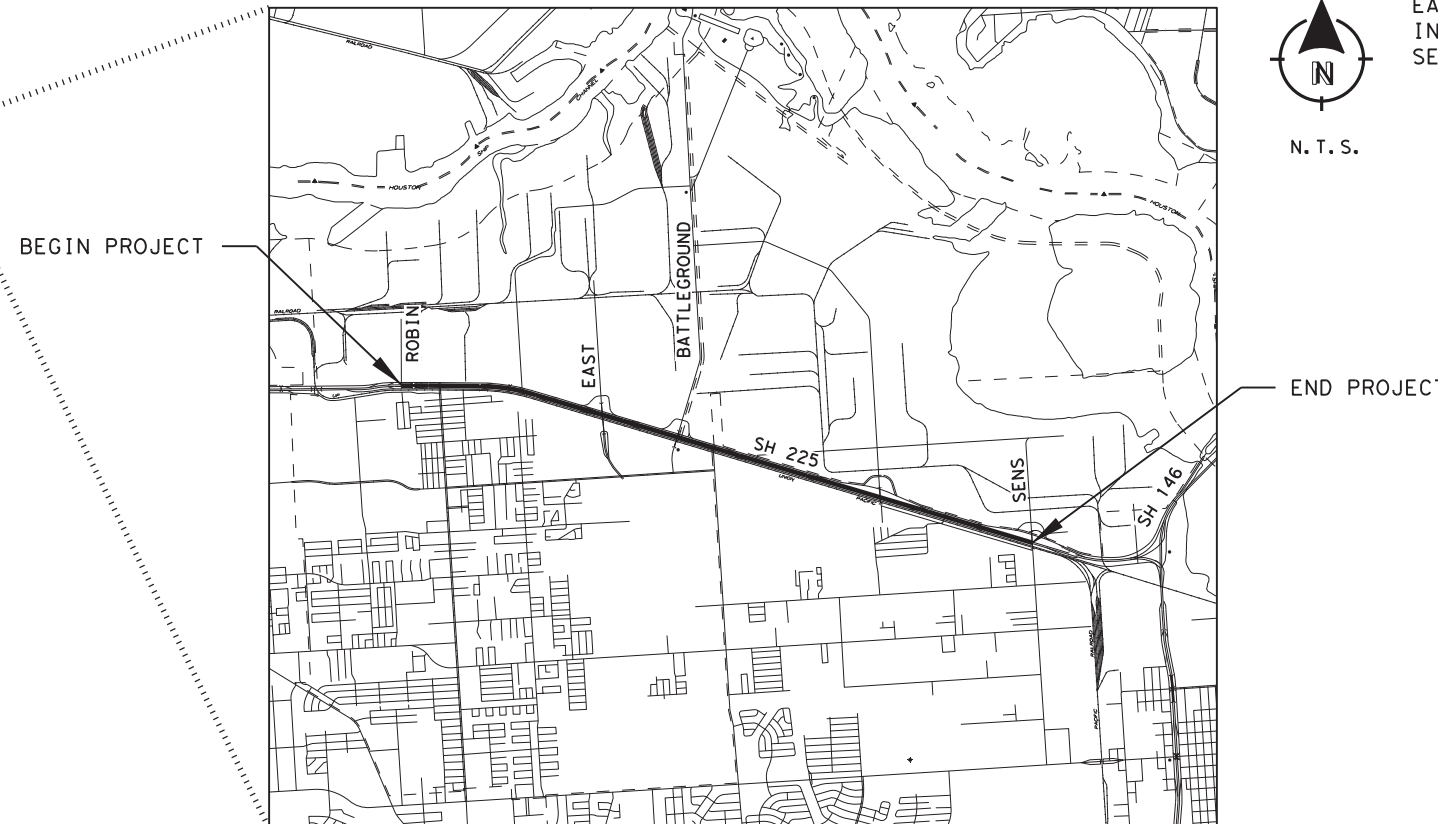
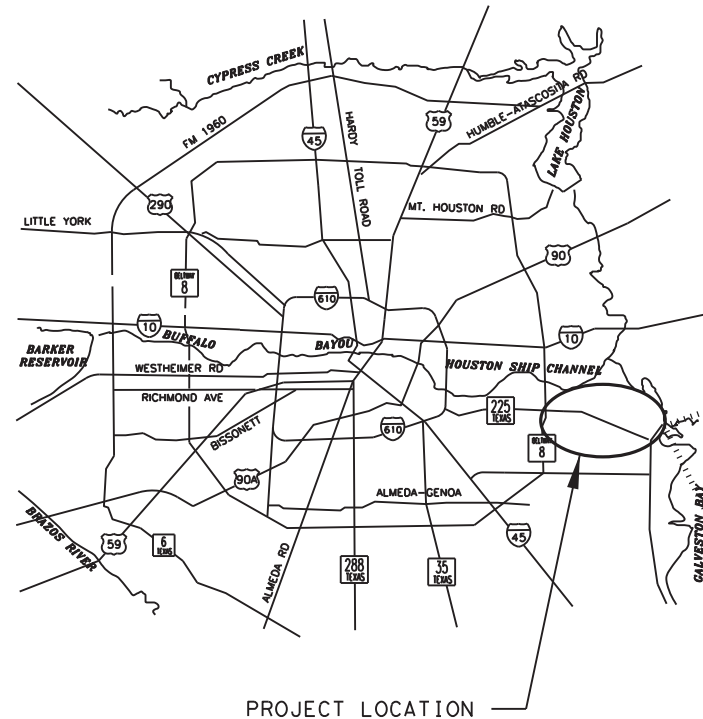
HARRIS COUNTY - SH 225
LIMITS: ROBIN STREET TO SENS ROAD

POSTED SPEED = 50 MPH (SH 225 FRONTAGE ROAD)
POSTED SPEED = 35 MPH (TIDAL RD)
POSTED SPEED = 40 MPH (EAST BLVD)
POSTED SPEED = 50 MPH (BATTLEGROUND RD)
POSTED SPEED = 55 MPH (INDEPENDENCE PKWY)
POSTED SPEED = 40 MPH (SENS RD)
AREA OF DISTURBED SOIL = < 1 ACRE
ACCESSIBILITY STANDARDS = PROWAG

LETTING DATE: 08/01/2024

REGISTERED ACCESSIBILITY SPECIALIST INSPECTION
NOT REQUIRED

AVERAGE DAILY TRAFFIC (ADT)	2024	2044
SH 225 EB FRONTAGE ROAD	1,651	2,311
SH 225 WB FRONTAGE ROAD	4,183	5,856
ROBIN ST	4,488	6,733
TIDAL RD	7,826	10,957
EAST BLVD	10,552	14,773
INDEPENDENCE PKWY	19,323	27,052
SENS RD	7,196	10,075



Kimley»Horn

11700 Katy Freeway, Suite 800, Houston, Texas 77079
TEXAS REGISTRATION NO. F-928
281-597-9300



SUBMITTED FOR LETTING **05/13/2024**

Lauren P. Schindler PE
For DISTRICT TRAFFIC ENGINEER

APPROVED FOR LETTING **5/23/2024**

DocuSigned by:
Brett McLeod, P.E.

For DISTRICT ENGINEER

NOTES:

- SPECIFICATIONS ADOPTED BY THE TEXAS DEPARTMENT OF TRANSPORTATION, NOVEMBER 1, 2014 AND SPECIFICATION ITEMS LISTED AND DATED AS FOLLOWS, SHALL GOVERN ON THIS PROJECT: REQUIRED CONTRACT PROVISIONS FOR ALL FEDERAL-AID CONSTRUCTION CONTRACTS (FORM FHWA 1273, OCTOBER 23, 2023).
- FOR BARRICADES AND SIGNING ALONG THE ROADWAY AND AT INDIVIDUAL INTERSECTIONS UNDER SIGNAL CONSTRUCTION REFER TO STANDARD SHEETS TCP(1-1)-18 THRU TCP(1-4)-18, TCP(2-4)-18 THRU TCP(2-6)-18, WZ(BTS-1)-13 & WZ(BTS-2)-13.

HARRIS COUNTY
EXCEPTIONS: N/A
EQUATIONS: N/A
R. R. CROSSINGS: N/A

FILE LOCATION
http://www.txdot.gov/inside-txdot/district/san-antonio/specinfo.html

FILENAME: K:\HOU_TPTO\068928203 - TxDOT HOU TRF WA 3 Misc Study-Signal-Final-FO\Task 3 - FO Design\CADD\Sheets\002_Index_of_Sheets.dgn
 PLOTTED: 6/17/2024 3:25:09 PM

SHEET NO.	DESCRIPTION
GENERAL	
1	TITLE SHEET
2	INDEX OF SHEETS
3, 3A - 3E	GENERAL NOTES
4	SH 225 TRAFFIC SIGNAL NOTES
5	ESTIMATE AND QUANTITY SHEET
6	SH 225 SUMMARY OF QUANTITIES
TRAFFIC ITEMS	
7 - 11	SH 225 FIBER OPTIC CABLE LAYOUT
12 - 14	SH 225 COMMUNICATIONS SCHEMATIC
SH 225 AT EAST BOULEVARD	
15 - 16	TRAFFIC SIGNAL MODIFICATION LAYOUT
17	TRAFFIC SIGNAL MODIFICATION DETAILS
SH 225 AT BATTLEGROUND ROAD/INDEPENDENCE PARKWAY	
18 - 19	TRAFFIC SIGNAL MODIFICATION LAYOUT
20	TRAFFIC SIGNAL MODIFICATION DETAILS
SH 225 AT SENS ROAD	
21 - 22	TRAFFIC SIGNAL MODIFICATION LAYOUT
23	TRAFFIC SIGNAL MODIFICATION DETAILS
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27 - 30	* ITS(30)-16 THRU ITS(33)-16
31	* ITS(36)-16
32 - 33	* ITS(37)-22 & ITS(38)-17
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40	** VC/MD (HOU DIST)
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68 - 69	** WZ(BTS-1)-13 & WZ(BTS-2)-13
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LANDSCAPE	
71	** FSSSCW-15 (HOU DIST)
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72	** EC(1)-16
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RAILROAD	
76, 76A-76C	** RR SCOPE OF WORK



Mark C. Conway

MARK C. CONWAY, P.E.

6/17/2024

DATE

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



Lauren Schindler

LAUREN P. SCHINDLER, P.E.

6/17/2024

DATE

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

Kimley»Horn F-928



INDEX OF SHEETS

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6	-	SH 225	
STATE	DIST.	COUNTY	SHEET NO.
TEXAS	HOU	HARRIS	002
CONT.	SECT.	JOB	
0502	01	237	

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Control: 0502-01-237

Highway: SH 225

General Notes:

General:

Area Engineer contact information for this project follows:

Dock Gee, P.E., (713) 802-5405, Dock.Gee@txdot.com

Submit any questions about this project via the Letting Pre-Bid Q&A web page, located at:

<https://tableau.txdot.gov/views/ProjectInformationDashboard/NoticetoContractors>

The Letting Pre-Bid Q&A web page for each project can be accessed by scrolling or filtering the dashboard using the controls on the left side to navigate to the project. Hover over the blue hyperlink of the project to view the Q&A and click on the link in the window that pops up.

Large files with relevant project documentation, such as Geotech reports, As-Built plans, and cross-sections will continue to be provided on the following FTP site:

[Index of /pub/txdot-info/Pre-Letting Responses/Houston District \(state.tx.us\)](https://pub.txdot-info/Pre-Letting%20Responses/Houston%20District) or

<https://ftp.dot.state.tx.us/pub/txdot-info/Pre-Letting%20Responses/Houston%20District/>

References to manufacturer's trade name or catalog numbers are for the purpose of identification only. Similar materials from other manufacturers are permitted if they are of equal quality, comply with the specifications for this project, and are approved, except for roadway illumination, electrical, and traffic signal items.

The cost for materials, labor, and incidentals to provide for traffic across the roadway and for ingress and egress to private property in accordance with Section 7.2.4 of the standard specifications is subsidiary to the various bid items. Restore access roadways to their original condition upon completing construction.

Clearly mark or highlight on the shop drawings, the items being furnished for this project. Submit required shop drawings in accordance with the shop drawing distribution list shown in the note for Item 5 for review and distribution.

Make requests for additional soil information for this project at the Area Engineer's office.

Unless otherwise shown on the plans or otherwise directed, commence work after sunrise and ensure construction equipment is off the road by sunset.

Procure permits and licenses, which are to be issued by the City, County, or Municipal Utility District

General: Roadway Illumination and Electrical

For roadway illumination and electrical items, use materials from pre-qualified producers as shown on the Construction Division (CST) of the Department's material producers list. Check the latest link on

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the Department's website for this list. The category/item is "Roadway Illumination and Electrical Supplies." No substitutions will be allowed for materials found on this list.

Perform electrical work in conformance with the National Electrical Code (NEC) and the Department's standard sheets.

General: Traffic Signals

For traffic signal items, use materials from the Pre-Qualified Producers List (located at <http://www.dot.state.tx.us/GSD/purchasing/supps.htm>) and the materials pre-qualified for illumination and electrical items (located at <https://www.txdot.gov/content/dam/docs/mpl/riaes.pdf>) as shown on the Department's Material Producers List and the Roadway Illumination and Electrical Supplies List. Check the latest links on the Department's website for these lists. No substitutions will be allowed for materials found on these lists.

General: Site Management

Mow the grass and weeds within the project limits a maximum of 3 times a year as directed. This work is subsidiary to the various bid items.

Do not mix or store materials, or store or repair equipment, on top of concrete pavement or bridge decks unless authorized by the Engineer. Permission will be granted to store materials on surfaces if no damage or discoloration will result.

Personal vehicles of employees are not permitted to park within the right of way, including sections closed to public traffic. Employees may park on the right of way at the Contractor's office, equipment, and materials storage yard sites.

Assume ownership of debris and dispose of at an approved location. Do not dispose of debris on private property unless approved in writing by the District Engineer.

General: Traffic Control and Construction

When design details are not shown on the plans, provide signs and arrows conforming to the latest "Standard Highway Sign Designs for Texas" manual.

General: Utilities

Consider the locations of underground utilities depicted in the plans as approximate and employ responsible care to avoid damaging utility facilities. Depending upon scope and magnitude of planned construction activities, advanced field confirmation by the utility owner or operator may be prudent. Where possible, protect and preserve permanent signs, markers, and designations of underground facilities

If the Contractor damages or causes damage (breaks, leaks, nicks, dents, gouges, etc.) to the utility, contact the utility facility owner or operator immediately.

Be aware that an operational Computerized Transportation Management System (CTMS) exists within the limits of this project and that the system must remain operational throughout construction. If the

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Contractor damages or causes damage to this system, repair such damage within 8 hours of occurrence at no cost to the Department. In the event of system damage, notify the Director of Traffic Management Systems at 713-881-3283 within one hour of occurrence. Failure of the Contractor to repair damage to the main fiber optic cable and CCTV cable trunk lines, which convey all corridor information to TranStar, will result in the Contractor being billed for the full cost of emergency repairs.

At least 72 hours before starting work, make arrangements for locating existing Department-owned above ground and underground fiber optic, communications, power, illumination, and traffic signal cabling and conduit. Do this by calling the Department’s Houston District Traffic Signal Operations Office at 713-802-5662, or by e-mailing the Department’s Houston District Traffic Signal Operations Office at: HOU-LocateRequest@txdot.gov, to schedule marking of underground lines on the ground. Use caution if working in these areas to avoid damaging or interfering with existing facilities.

If overhead or underground power lines need to be de-energized, contact the electrical service provider to perform this work. Costs associated with de-energizing the power lines or other protective measures required are at no expense to the Department.

If working near power lines, comply with the appropriate sections of Texas State Law and Federal Regulations relating to the type of work involved.

Perform electrical work in conformance with the National Electrical Code (NEC) and Department’s standard sheets.

Before beginning any underground work, notify the City of Houston’s Chief Inspector, Public Works and Engineering, to establish the locations of any existing electrical systems for lighting facilities within the limits of this project.

Item 5: Control of Work

Submit shop drawings electronically for the fabrication of items as documented in Table 2 below. Information and requirements for electronic submittals can be viewed in the “Guide to Electronic Shop Drawing Submittal” which can be accessed through the following web link, https://ftp.txdot.gov/pub/txdot-info/library/pubs/bus/bridge/e_submit_guide.pdf. References to 11 in. x 17 in. sheets in individual specifications for structural items imply electronic CAD sheets.

Table 2

2014 Construction Specification Required Shop/Working Drawing Submittals - Consultant Generated Plans

Spec Item No.'s	Product	Submittal Required	Approval Required (Y/N)	Contractor/Fabricator P.E. Seal Required	Reviewing Party	Shop or Working Drawing (Note 1)
7.16.1&2	Construction Load Analyses	Y	Y	Y	D	WD
680	Installation of Highway Traffic Signals	Y	Y	N	D	SD
684	Traffic Signal Cables	Y	Y	N	D	SD
SS	Fiber Optic/Communication Cable	Y	Y	N	TMS	SD
SS	VIVDS System for Signals	Y	Y	N	D	SD

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Notes:

1. Document flow for Working Drawings differs from Shop Drawings in that Working Drawings must be submitted to the Engineer rather than the Engineer of Record and they are for the information of the Engineer only; an approval stamp and distribution to all project offices is not required.

Key to Reviewing Party

D – Consultant: Submit to Engineer of Record at lauren.schindler@kimley-horn.com	
TMS – Traffic Management System	
Computerized Traffic Management Systems (CTMS)	HOU-CTMSShpDrwgs@txdot.gov

When a precast or cast-in-place concrete element is included in the plans, a precast concrete alternate may be submitted 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 Engineer. Impacts to the project schedule and any additional costs resulting from the use of alternates are the sole responsibility of the Contractor.

Item 6: Control of Materials

To comply with the latest provisions of the Build America, Buy America Act (BABA Act) of the Bipartisan Infrastructure Law, the Contractor must submit an original of the TxDOT Construction Material Buy America Certification Form for items classified as construction materials. This form is not required for materials classified as a manufactured product.

Refer to the Buy America Material Classification Sheet for clarification on material categorization.

The Buy America Material Classification Sheet is located at the below link.

<https://www.txdot.gov/business/resources/materials/buy-america-material-classification-sheet.html> for clarification on material categorization.

Item 7: Legal Relations and Responsibilities

Do not initiate activities in a Project Specific Location (PSL), associated with a U.S. Army Corps of Engineers (USACE) permit area, that have not been previously evaluated by the USACE as part of the permit review of this project. Such activities include those pertaining to, but are not limited to, haul roads, equipment staging areas, borrow and disposal sites. Associated defined here means materials are delivered to or from the PSL. The permit area includes the waters of the U.S. or associated wetlands affected by activities associated with this project. Special restrictions may be required for such work. Assume responsibility for consultations with the USACE regarding activities, including PSLs that have not been previously evaluated by the USACE. Provide the Department with a copy of consultations or approvals from the USACE before initiating activities.

The Contractor may proceed with activities in PSLs that do not affect a USACE permit area if a self-determination has been made that the PSL is non-jurisdictional or if proper USACE clearances have been obtained in jurisdictional areas or have been previously evaluated by the USACE as part of the permit review of this project. The Contractor is solely responsible for documenting any determinations

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that their activities do not affect a USACE permit area. Maintain copies of their determinations for review by the Department or any regulatory agency.

Document and coordinate with the USACE, if required, before hauling any excavation from or hauling any embankment to a USACE permit area by either 1 or 2 below:

1. **Restricted Use of Materials for the Previously Evaluated Permit Areas.** Document both the Project Specific Locations (PSL) and their authorization. Maintain copies for review by the Department or any regulatory agency. When an area within the project limits has been evaluated by the USACE as part of the permit process for this project:
 - a. Suitable excavation of required material in the areas shown on the plans and cross sections as specified in the Item, "Excavation" is used for permanent or temporary fill (under the Item, "Embankment") within a USACE permit area.
 - b. Suitable embankment (under the Item, "Embankment") from within the USACE permit area is used as fill within a USACE evaluated area.
 - c. Unsuitable excavation or excess excavation, "Waste" (under the Item, "Excavation"), that is disposed of at a location approved within a USACE evaluated area.
2. **Contractor Materials from Areas Other than Previously Evaluated Areas.** Provide the Department with a copy of USACE coordination or approvals before initiating any activities for an area within the project limits that has not been evaluated by the USACE or for any off-right-of-way locations used for the following, but not limited to, haul roads, equipment staging areas, borrow and disposal sites:
 - a. The Item, "Embankment" used for temporary or permanent fill within a USACE permit area.
 - b. Unsuitable excavation or excess excavation, "Waste" (under the Item, "Excavation"), that is disposed of outside a USACE evaluated area.

Maintain the roadway slope stability. Maintaining slope stability is subsidiary to the various bid items.

If the work is on or in the vicinity of an at-grade railroad crossing, involves incidental work on railroad right of way, or involves construction of a railroad grade separation structure, notify the railroad company's Division Engineer and the Department's Project Engineer at least 30 days before performing any work on the railroad right of way and make arrangements for railroad flaggers unless otherwise shown in the contract. Obtain the required Railroad Right of Entry Permit from the railroad company. Payment of applicable permit fees is the responsibility of the Contractor. Acquiring the Railroad Right of Entry Permit is a lengthy process, allow sufficient time for this.

This project is on a hurricane evacuation route. Provide at the pre-construction meeting a written plan outlining procedures to suspend work, secure the job site, and safely handle traffic through and across the project in the event of a hurricane evacuation.

During the hurricane season (June 1 through November 30), do not close any travel lanes except when the Contractor can demonstrate that he/she can provide labor, equipment, material, a work plan, and quality of work to satisfactorily return all lanes to an open, all-weather travel surface within 3 days of receiving written or verbal notice but no later than 3 days before the predicted hurricane landfall.

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Construction of temporary lanes to an all-weather surface will be paid for in accordance with Article 9.7, "Payment for Extra Work and Force Account Method."

In addition to lane closures, cease work 3 days before the predicted hurricane landfall on or near the roadway that adversely impacts the flow of traffic and reduces the capacity of the highway during an evacuation. Vehicles of the Contractor, subcontractors, or material suppliers will not be allowed to enter or exit the traffic stream, including those for the purpose of material hauling and delivery, and mobilization or demobilization of equipment. When directed, this prohibition will include a reasonable time period for the evacuees to return to their point of origin.

No significant traffic generator events have been identified.

Item 8: Prosecution and Progress

The Department will supply bidders, upon written request, one electronic copy of the time determination schedule. The time determination schedule provided is for informational use only and is not intended for bidding or construction purposes.

The Department will not adjust the number of days for the project and milestones, if any, due to differences in opinion regarding any assumptions made in the preparation of the schedule or for errors, omissions, or discrepancies found in the time determination schedule.

Working days will be computed and charged based on a standard workweek in accordance with Section 8.3.1.1.

The maximum number of days the time charges on this contract may be suspended due to contractor mobilization, and material fabrication/accumulation or processing delays is 120 days. The Engineer and the Contractor may mutually agree, in writing, to decrease this maximum number of days.

Item 502: Barricades, Signs, and Traffic Handling

Use a traffic control plan for handling traffic through the various phases of construction. Follow the phasing sequence unless otherwise agreed upon by the Area Engineer and the Project Manager. Ensure this plan conforms to the latest "Texas Manual on Uniform Traffic Control Devices" and the latest Barricade and Construction (BC) Standard Sheets. The latest versions of Work Zone Standard Sheets WZ (BTS-1) and WZ (BTS-2) are the traffic control plan for the signal installations. Submit changes to the traffic control plan to the Area Engineer. Provide a layout showing the construction phasing, signs, striping, and signalizations for changes to the original traffic control plan.

Furnish and maintain the barricades and warning signs, including the necessary temporary and portable traffic control devices, during the various phases of construction. Place and construct these barricades and warning signs in accordance with the latest "Texas Manual on Uniform Traffic Control Devices" for typical construction layouts.

Cover work zone signs when work related to the signs is not in progress, or when any hazard related to the signs no longer exists.

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Keep the delineation devices, signs, and pavement markings clean. This work is subsidiary to the Item, "Barricades, Signs, and Traffic Handling."

Cover or remove the permanent signs and construction signs that are incorrect or that do not apply to the current situation for a particular phase.

Replace the overhead signs, informational signs, and exit signs to be removed, with temporary signs providing the correct information to the traveling public. Size the replacement signs and include them in the traffic control plan.

Do not mount signs on drums or barricades, except those listed in the latest Barricades and Construction standard sheets.

Do not reduce the existing number of lanes open to traffic except as shown on the following time schedule:

One Lane Closure

Day	Daytime Closure Hours	Nighttime Closure Hours	Restricted Hours Subject to Lane Assessment Fee
Monday	9:00 AM – 3:00 PM	N/A	N/A
Tuesday	9:00 AM – 3:00 PM	N/A	N/A
Wednesday	9:00 AM – 3:00 PM	N/A	N/A
Thursday	9:00 AM – 3:00 PM	N/A	N/A
Friday	9:00 AM – 3:00 PM	N/A	N/A
Saturday	N/A	N/A	N/A
Sunday	N/A	N/A	N/A

The above times are approved for the traffic control conditions listed. The Area Engineer may approve other closure times if traffic counts warrant. The Area Engineer may reduce the above times for special events.

Law enforcement assistance will be required for this project and is expected to be required for major traffic control changes and lane closures. Coordinate with local law enforcement and arrange for law enforcement as directed or agreed by the Engineer. Before payment will be made, complete the "Daily Report on Law Enforcement Force Account Work" (Form 318), provided by the Department and submit daily invoices that agree with this form for any day during the month in which approved services were provided.

Provide full-time, off-duty, uniformed, certified peace officers, as part of traffic control operations. The peace officers must be able to show proof of certification by the Texas Commission on Law Enforcement Officers Standards. The cost of the officers is paid for on a force account basis.

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.

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Item 506: Temporary Erosion, Sedimentation and Environmental Controls

The use of hay bales is not permitted as Storm Water Pollution Prevention Plan (SWP3) measures.

Due to the nature of the work involved, a Storm Water Pollution Prevention Plan (SWP3) is not required. However, if a SWP3 becomes necessary, it will be paid as extra work.

The Storm Water Pollution Prevention Plan (SWP3) consists of temporary erosion control measures needed and provided for under this Item. The disturbed area is less than one acre and use of erosion control measures is not anticipated. If physical conditions encountered at the job site require necessary controls, BMP installation, maintenance, and removal will be paid as extra work on a force account basis per Articles 4.4 and 9.7. Since the disturbed area is less than 5 acres, a "Notice of Intent" (NOI) is not required.

Use appropriate measures to prevent, minimize, and control the spill of hazardous materials in the construction staging area. Remove and dispose of materials in compliance with State and Federal laws.

Before starting construction, review with the Engineer the SWP3 used for temporary erosion control as outlined on the plans. Before construction, place the temporary erosion and sedimentation control features as shown on the SWP3.

Schedule the seeding or sodding work as soon as possible. The project schedule provides for a vegetation management plan.

After completing earthwork operations, restore and reseed the disturbed areas in accordance with the Department's specifications for permanent or temporary erosion control.

Implement temporary and permanent erosion control measures to comply with the National Pollution Discharge Elimination System (NPDES) general permit under the Clean Water Act.

Before starting grading operations and during the project duration, place the temporary or permanent erosion control measures to prevent sediment from leaving the right of way.

Item 618: Conduit

Item 620: Electrical Conductors

Item 628: Electrical Services

If the specifications for electrical items require UL-listed products, this means UL-listed or CSA-listed

Item 618: Conduit

When backfilling bore pits, ensure that the conduit is not damaged during installation or due to settling backfill material. Compact select backfill in 3 equal lifts to the bottom of the conduit; or if using sand, place it 2 in. above the conduit. Ensure backfill density is equal to that of the existing soil. Prevent material from entering the conduit.

Construct bore pits a minimum of 5 ft. from the edge of the base or pavement. Close the bore pit holes overnight.

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Unless otherwise shown on the plans, install underground conduit a minimum of 24 in. deep. Install the conduit in accordance with the latest National Electrical Code (NEC) and applicable Department standard sheets. Place conduit under driveways or roadways a minimum of 24 in. below the pavement surface.

If using casing to place bored conduit, the casing is subsidiary to the conduit.

If placing the conduit under existing pavement to reach the service poles, bore the conduit in place and extend it a minimum distance of 5 ft. beyond the edge of shoulder or the back of curb.

Provide a single 1/C #14 insulated wire in conduit runs which have been identified in the plans to carry fiber optic cable. Provide UL-listed solid copper wire with orange color low density polyethylene insulation, suitable for conduit installation, rated for a temperature range of -20 C to +60 C and a voltage rating of 600V. This wire will serve as a tracer, or locate, wire for locating underground conduit containing fiber optic cabling and will be paid for under Item 620, "Electrical Conductors."

Item 620: Electrical Conductors

Test each wire of each cable or conductor after installation. Incomplete circuits or damage to the wire or the cable are cause for immediate rejection of the entire cable being tested. Remove and replace the entire cable at no expense to the Department. Also test the replacement cable after installation.

When pulling cables or conductors through the conduit, do not exceed the manufacturer's recommended pulling tensions. Lubricate the cables or conductors with a lubricant recommended by the cable manufacturer.

Ensure that circuits test clear of faults, grounds, and open circuits.

Split bolt connectors are allowed only for splices on the grounding conductors.

For Roadside Flashing Beacon Assemblies (Item 685) and Pedestal Pole Assemblies (Item 687) within the project, provide single-pole breakaway disconnects as shown on the Construction Division (CST) material producers list. Check the latest link on the Department's website for this list. The category is "Roadway Illumination and Electrical Supplies." The fuse holder is shown on the list under Item 685. For underground (hot) conductors, install a breakaway connector with a dummy fuse (slug). Provide dummy fuse (slug). For grounded (neutral) conductors, install a breakaway connector with a white colored marking and a permanently installed dummy fuse (slug). For electrical licensing and electrical certification requirements for this project, see Item 7 of the Standard Specifications and any applicable special provisions to Item 7.

Item 624: Ground Boxes

The ground box locations are approximate. Alternate ground box locations may be used as directed, to avoid placing in sidewalks or driveways.

Ground metal ground box covers. Bond the ground box cover and ground conductors to a ground rod located in the ground box and to the system ground.

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Ground the existing metal ground box covers as shown on the latest standard sheet ED (4)-14.

During construction and until project completion, provide personnel and equipment necessary to remove ground box lids for inspection. Provide this assistance within 24 hours of notification.

Construct concrete aprons in accordance with the latest standard sheet ED (4)-14. Make the depth of the concrete apron the same as the depth of the ground box, except for Type 1 and Type 2 ground boxes. For Type 1 or Type 2 ground boxes, construct the concrete apron in accordance with details shown on the "Ground Box Details Installations" standard.

Item 628: Electrical Services

Verify and coordinate the electrical service location with the engineering section of the appropriate utility district or company.

Identify the electrical service pole with an address number assigned by the Utility Service Provider. Provide 2-in. numerals visible from the highway. Provide numbers cut out aluminum figures nailed to wood poles or painted figures on steel poles or service cabinets.

Item 680: Highway Traffic Signals

Clearly mark or highlight on the shop drawings the items being furnished for this project.

Furnish labor, tools, equipment, and materials as shown on the plans and specifications for a complete and operating signal installation.

Furnish the type of controller cabinet specified on the plans. Refer to the table shown in the Departmental Material Specifications (DMS-11170, Fully Actuated, Solid-State Traffic Signal Controller Assembly), Section 11170.6.A, Type 2 cabinet, page 4 of 39, regarding the size of the cabinet, back panel configuration, and the size of the load bay. Use the following website to view this specification:

<https://www.txdot.gov/business/resources/materials/material-specifications.html>

Complete traffic signal construction work, including correcting discrepancies shown on the Department inspector's "Traffic Signal Installation Inspection Report" before the beginning of the test period. Provide a full-time qualified traffic signal technician responsible for installing, maintaining, or replacing traffic signal devices.

Staking in the field is subject to approval.

Adjust project construction, if needed, due to conflicts with underground utilities.

Provide continuous conductors without splices from signal controller to signal heads. Route the conductors for luminaires to the service enclosure. Splices or attachments to the terminal block in the access compartment of the mast arm pole are not permitted except for the luminaire cable.

County: Harris

Control: 0502-01-237

Highway: SH 225

Abrasions to the conductor insulation caused while pulling cable for the traffic signal system are cause for immediate rejection. Remove and replace the entire damaged cable at no expense to the Department.

When pulling cables or conductors through conduit, do not exceed the manufacturer's recommended pulling tensions. Lubricate the cables or conductors with a lubricant as recommended by the cable manufacturer.

Bond the controller housing, signal poles, conduit, and spans to a minimum No. 6 AWG stranded copper conductor. An equipment grounding conductor is required in every conduit to form a continuous grounding system. Effectively connect the grounding system to ground rods or concrete encased grounding electrodes as indicated in the plans.

The Contractor may use ready mix concrete.

Apply membrane curing on concrete work in accordance with Section 420.4.10.3, "Membrane Curing."

The standard 4.5-in. galvanized pipe type poles, except the breakaway type, are subject only to the Engineer's inspection for their acceptance. Mill test reports or documentation will not be required.

Item 6306: Video Imaging Vehicle Detection System

Furnish the cable to operate the Video Imaging Vehicle Detection System (VIVDS) in accordance with the manufacturer's recommendations or purchase it from the same manufacturer as the VIVDS equipment.

Supply VIVDS equipment that can process up to a maximum of 6 camera inputs per intersection.

Additional equipment to accommodate up to 6 camera inputs is subsidiary to the various bid items.

No extra compensation will be allowed for additional equipment needed to make the VIVDS equipment fully operational under this Item.

Supply a laptop computer and a video monitor as described in this Special Specification Item.

Detector zone videotaping for this project will not be required.

County: Harris

Control: 0502-01-237

Highway: SH 225

Special Specification 6306 Video Imaging Vehicle Detection System Requirements

Specification Items	Description	Not Required	Required	State Supplied
1	Description		X	
	Variable Focal Cameras		X	
	VIVDS Card Rack Processor System		X	
	Field Setup Computer (1 Required) (Laptop)	X		
	Field Setup Video Monitor (1 Ea. Controller)		X	
	Connectors and Camera Mounting Hardware		X	
3	Functional Capabilities			
	System Software		X	
4	Vehicle Detection			
	Detection Zone Video Taping	X		
5	VIVDS Processor Unit			
	Provide both TS1 and TS2 Environmental Requirements		X	
	12 Volt/5 Amp Power Supply		X	
6	Camera Assembly			
	Camera Interface Panel		X	
7	Field Communications Link			
	Lightning and Transient Surge Suppression Devices		X	
9	Temporary Use and Retesting			
			X	
10	Operation from Central Control	X		
	Telephone Interconnect	X		
	ISDN Interconnect	X		
11	Installation and Training			
			X	

Other items not specifically listed in this table are required. When shown in the plans, remove and deliver temporary VIVDS equipment to the Department's Signal Shop, 6810 Old Katy Rd., Houston, Texas, or as directed.

VIVDS devices covered under the Department's Purchasing Special Specification T.O.-6291 (<http://www.dot.state.tx.us/gsd/purchasing/supps.htm#divspecs>) will also be allowed for use.

NOTES FOR PERMANENT TRAFFIC SIGNAL:

1. USE TYPE B (HIGH INTENSITY PRISMATIC) OR TYPE D (DIAMOND GRADE) RETROREFLECTIVE SHEETING FOR SIGNS MOUNTED UNDER OR ADJACENT TO THE SIGNAL HEADS AS SHOWN ON PLANS.
2. ROUTE CABLE FOR LUMINAIRES (#12/4C TRAY CABLE) TO THE SERVICE ENCLOSURE. SEE ELECTRICAL DETAIL SHEETS. DO NOT PASS LUMINAIRE CONDUCTORS THROUGH THE SIGNAL CONTROLLER CABINET.
3. FURNISH AND INSTALL FULL-ACTUATED CONTROLLER WITH INTERNAL TIME BASE COORDINATION UNIT IN A CABINET, MOUNTED ON AN 18-INCH BASE EXTENSION.
4. FURNISH ALL MATERIALS. SUPPLY THE CONTROLLER WITH DETECTION PHASE SEQUENCE, DETECTOR UNITS, DETECTOR CARDS, DETECTOR CARD RACK, AND POWER SUPPLY, TO THE DEPARTMENT'S SIGNAL SHOP, 6810 KATY ROAD, HOUSTON, TEXAS FORTY FIVE (45) DAYS IN ADVANCE FOR INSPECTION, SET UP, AND TESTING. CONTACT MR. MICHAEL AWA, P. E., IN WRITING, AT LEAST FIFTEEN (15) WORKING DAYS PRIOR TO PICKING UP THE MATERIALS.

ADDRESS: TEXAS DEPARTMENT OF TRANSPORTATION
P. O. BOX 1386
HOUSTON, TEXAS 77251-1386
TEL. NO. (713) 802-5661
5. THE DEPARTMENT'S TRAFFIC SIGNAL MAINTENANCE OFFICE WILL PROVIDE PHASING FOR TEMPORARY AND PERMANENT TRAFFIC SIGNALS. THE CONTRACTOR WILL PROVIDE TIMING.
6. LOCATE CABINET(S), STEEL SIGNAL POLES, SIGNAL DETECTORS, ETC., AS APPROVED.
7. REPAIR OR REPLACE PAVEMENT AND SIDEWALKS DAMAGED BY THE CONTRACTOR'S FORCES DURING CONSTRUCTION AT NO COST TO THE DEPARTMENT.
8. ASSUME OWNERSHIP OF THE REMOVED EXISTING SIGNS.
9. SEAL ENDS OF ALL CONDUITS WITH DUCT SEAL, EXPANDABLE FOAM, OR BY OTHER METHODS APPROVED BY THE ENGINEER. SEAL CONDUIT IMMEDIATELY AFTER COMPLETION OF CONDUCTOR INSTALLATION AND PULL TESTS. DO NOT USE DUCT TAPE AS PERMANENT CONDUIT SEALANT. DO NOT USE SILICON CAULK AS A CONDUIT SEALANT.
10. CAP SPARE CONDUITS INSTALLED IN POLE FOUNDATIONS AND GROUND BOXES USING APPROVED CAPPING DEVICES.
11. DO NOT PLACE SIGNAL HEADS OVER THE ROADWAY UNTIL ALL NECESSARY MATERIALS ARE ON HAND AS APPROVED.
12. INSTALL TWO SET SCREWS ON ALL VEHICLE SIGNAL HEAD MOUNTING HARDWARE FITTINGS.
13. PROVIDE CONTINUED OPERATION OF THE EXISTING SIGNAL(S) DURING CONSTRUCTION AND UNTIL THE PROPOSED OPERATION IS COMPLETED.
14. INSTALL A 5/8-IN. (MINIMUM) EYE BOLT FOR THE POINT OF ATTACHMENT BELOW THE SERVICE ENTRANCE WEATHERHEAD FOR THE SERVICE DROP TO STEEL OR WOOD POLE.
15. AIM LUMINAIRE ARMS MOUNTED ON TRAFFIC SIGNAL POLES PERPENDICULAR TO THE CENTERLINE OF THE ROADWAY IT IS INTENDED TO COVER, TO DEVELOP THE PROPER ILLUMINATION PATTERN FOR THE INTERSECTION.
16. GROUND STEEL MAST ARM POLE ASSEMBLIES IN ACCORDANCE WITH REQUIREMENTS SHOWN ON THE LATEST TRAFFIC SIGNAL POLE FOUNDATION STANDARD. USE THE GROUNDING LUG ON THE POLE TO GROUND THE POLE TO THE GROUND CONDUCTORS FROM THE CONDUITS.
17. VERIFY THE CORRECT MAST ARM POLE LENGTHS FOR EACH SIGNALIZED INTERSECTION PRIOR TO ORDERING THE EQUIPMENT.
18. INSTALL A CLOSE NIPPLE WITH LOCK NUT AND BUSHING (SIZE AS REQUIRED) WHERE THE CABLE ENTERS THE UPPER PORTION OF THE SIGNAL POLE.
19. REFER TO TXDOT'S WEBSITE FOR PREQUALIFIED PRODUCTS LIST REGARDING RADAR DETECTORS, VIVDS CAMERAS, WIRELESS MAGNETOMETERS, VEHICLE LED TRAFFIC SIGNAL LAMP UNIT, SYMBOLIC PEDESTRIAN SIGNAL HEAD, SYMBOLIC PEDESTRIAN SIGNAL LAMP, ACCESSIBLE PEDESTRIAN SIGNALS, SIGNAL CONTROLLERS, SIGNAL CABINETS, BUS INTERFACE UNITS, BATTERY BACKUP UNITS. CHECK WEBSITE PERIODICALLY FOR CURRENT UPDATES.
20. THE CONTRACTOR IS RESPONSIBLE FOR THE SIGNAL CARRYING CAPABILITY AND PERFORMANCE OF THE CABLE. INSTALL EACH WIRE WITH A LIGHTNING PROTECTION DEVICE UNLESS OTHERWISE NOTED.
21. CONTRACTOR TO ADJUST SIGNAL HEAD ALIGNMENT, AS NEEDED, USING ARTICULATING SIGNAL BRACKET ASSEMBLIES WITH A MINIMUM OF THREE ADJUSTABLE AXES.
22. SEAL WITH WATERPROOF SEALANT EACH END OF THE COMMUNICATIONS CABLE THAT IS EXPOSED TO THE ELEMENTS DURING STORAGE OR AFTER INSTALLATION.
23. THE CONTRACTOR TO FURNISH AND INSTALL ALL EQUIPMENT CALLED FOR AND REQUIRED AS NEEDED FOR A FULLY OPERATIONAL TRAFFIC SIGNAL.
24. REMOVE THE EXISTING PAVEMENT MARKING AS DIRECTED. REMOVE THE PAVEMENT MARKING TO THE EXTENT THAT THEY ARE EITHER COMPLETELY REMOVED OR OBLITERATED TO THE SATISFACTION OF THE ENGINEER.
25. PLACE PAVEMENT MARKINGS AS SHOWN ON THE PLANS OR AS DIRECTED.
26. ALL TRAFFIC SIGNAL DETECTION DEVICES AND RELATED COMPONENTS SHALL BE SALVAGED AND RETURNED TO THE DEPARTMENT'S SIGNAL SHOP AT 6810 OLD KATY ROAD, HOUSTON, TEXAS, BETWEEN 9:00 AM AND 3:00 PM, MONDAY THROUGH FRIDAY. CAREFULLY REMOVE THE MATERIALS SO THAT THEY WILL NOT BE MARRED OR DAMAGED. REPLACE MATERIALS THAT ARE SCARRED, BATTERED OR BROKEN BY THE CONTRACTOR AT NO EXPENSE TO THE DEPARTMENT
27. ONCE THE INTEGRITY AND/OR FUNCTION OF THE EXISTING TRAFFIC SIGNAL(S) IS ALTERED BY THE CONTRACTOR, MAINTAIN AND OPERATE THE EXISTING TRAFFIC SIGNAL(S) UNTIL THE TRAFFIC SIGNAL WORK IS ACCEPTED BY THE DEPARTMENT. DURING THE CONSTRUCTION OF THE PROPOSED TRAFFIC SIGNAL WORK, MAINTAIN THE EXISTING TRAFFIC SIGNAL(S) AND/OR TEMPORARY CONSTRUCTION TRAFFIC SIGNAL(S) IN CONFORMANCE WITH THE LATEST TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

NOTES FOR PERMANENT TRAFFIC SIGNAL (CONTINUED):

28. DURING CONSTRUCTION OF THE PROPOSED SIGNAL WORK, IF THE EXISTING TRAFFIC SIGNAL EQUIPMENT REQUIRES REPLACEMENT DUE TO WEAR, DETERIORATION, OR ANY CIRCUMSTANCE OVER WHICH THE CONTRACTOR HAS NO CONTROL, THE EQUIPMENT WILL BE FURNISHED BY THE DEPARTMENT AT NO COST TO THE CONTRACTOR. INSTALL THIS EQUIPMENT AT NO COST TO THE DEPARTMENT. SUCH MATERIALS WILL BE PROVIDED AT THE DEPARTMENT'S SIGNAL SHOP LOCATED AT 6810 KATY ROAD, HOUSTON, TEXAS. CONTACT MR. MICHAEL AWA, P.E., AT TELEPHONE NUMBER (713) 802-5661.
29. MAINTAIN THE INTEGRITY AND FUNCTION OF EACH EXISTING SIGNALIZED INTERSECTION. ONCE THE INTEGRITY OR FUNCTION OF THE SIGNAL HAS BEEN ALTERED, PURSUE THE WORK AT THAT LOCATION WITHOUT DELAY OR INTERRUPTION TO RESTORE OPERATION TO ITS ORIGINAL OR FINAL OPERATIONAL FORM.
30. FURNISH VIDEO IMAGING VEHICLE DETECTION SYSTEM (VIVDS) CABLE RECOMMENDED BY MANUFACTURER OR PURCHASE CABLE FROM THE SAME MANUFACTURER THAT SUPPLIED/PROVIDED THE VIVDS EQUIPMENT.
31. FOR VIVDS CAMERA(S) MOUNTED TO LUMINAIRE ARMS, STRAP THE VIVDS CABLE TO THE LUMINAIRE ARMS WITH A METAL CABLE STRAP (ALUMINUM OR STAINLESS STEEL), 3/4-IN MINIMUM WIDTH AND TWO WRAPS AT 8-IN MAXIMUM SPACING.
32. THE LOCATION OF THE VIVDS DETECTION ZONE IS APPROXIMATE. THE EXACT LOCATION WILL BE DETERMINED BY THE ENGINEER AND/OR DEPARTMENT'S TRAFFIC OPERATIONS SECTION.

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SH 225

TRAFFIC SIGNAL NOTES

FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.	
6	-	SH 225	
STATE	DIST.	COUNTY	SHEET NO.
TEXAS	HOU	HARRIS	004
CONT.	SECT.	JOB	
0502	01	237	



Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0502-01-237

DISTRICT Houston
HIGHWAY SH 225


COUNTY Harris


CONTROL SECTION JOB				0502-01-237		TOTAL EST.	TOTAL FINAL
PROJECT ID				A00186876			
COUNTY				Harris			
HIGHWAY				SH 225			
ALT	BID CODE	DESCRIPTION	UNIT	EST.	FINAL		
	500-6001	MOBILIZATION	LS	1.000		1.000	
	502-6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	10.000		10.000	
	618-6046	CONDT (PVC) (SCH 80) (2")	LF	1,870.000		1,870.000	
	618-6047	CONDT (PVC) (SCH 80) (2") (BORE)	LF	935.000		935.000	
	618-6053	CONDT (PVC) (SCH 80) (3")	LF	1,930.000		1,930.000	
	618-6054	CONDT (PVC) (SCH 80) (3") (BORE)	LF	1,725.000		1,725.000	
	618-6058	CONDT (PVC) (SCH 80) (4")	LF	55.000		55.000	
	618-6074	CONDT (RM) (3")	LF	165.000		165.000	
	620-6002	ELEC CONDR (NO.14) INSULATED	LF	1,855.000		1,855.000	
	620-6007	ELEC CONDR (NO.8) BARE	LF	5,235.000		5,235.000	
	620-6012	ELEC CONDR (NO.4) INSULATED	LF	2,630.000		2,630.000	
	621-6005	TRAY CABLE (4 CONDR) (12 AWG)	LF	6,725.000		6,725.000	
	624-6010	GROUND BOX TY D (162922)W/APRON	EA	18.000		18.000	
	628-6189	ELC SRV TY D 120/240 070(NS)SS(E)SP(U)	EA	3.000		3.000	
	628-6309	ELC SRV TY T 120/240 000(NS)GS(N)TP(O)	EA	3.000		3.000	
	680-6004	REMOVING TRAFFIC SIGNALS	EA	3.000		3.000	
	680-6011	INSTALL HWY TRF SIG (UPGRADE)	EA	3.000		3.000	
	684-6012	TRF SIG CBL (TY A)(12 AWG)(7 CONDR)	LF	17,065.000		17,065.000	
	6007-6011	FIBER OPTIC CBL (SNGLE-MODE)(12 FIBER)	LF	1,855.000		1,855.000	
	6007-6096	FIBER OPTIC PATCH PANEL (12 POSITION)	EA	3.000		3.000	
	6027-6003	CONDUIT (PREPARE)	LF	225.000		225.000	
	6027-6008	GROUND BOX (PREPARE)	EA	11.000		11.000	
	6058-6001	BBU SYSTEM (EXTERNAL BATT CABINET)	EA	3.000		3.000	
	6186-6002	ITS GND BOX(PCAST) TY 1 (243636)W/APRN	EA	3.000		3.000	
	6186-6008	ITS GND BOX(PCAST) TY 2 (366036)W/APRN	EA	9.000		9.000	
	6306-6001	VIVDS PROSR SYS	EA	3.000		3.000	
	6306-6002	VIVDS CAM ASSY FXD LNS	EA	15.000		15.000	
	6306-6005	VIVDS CNTRL SOFTWARE	EA	3.000		3.000	
	6306-6007	VIVDS CABLING	LF	12,520.000		12,520.000	
	08	CONTRACTOR FORCE ACCOUNT SAFETY CONTINGENCY (NON-PARTICIPATING)	LS	1.000		1.000	
		CONTRACTOR FORCE ACCOUNT WORK (NON-PARTICIPATING)	LS	1.000		1.000	
		CONTRACTOR FORCE ACCOUNT LAW ENFORCEMENT (NON-PARTICIPATING)	LS	1.000		1.000	
		CONTRACTOR FORCE ACCOUNT EROSION CONTROL MAINTENANCE (NON-PARTICIPATING)	LS	1.000		1.000	

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COMPUTERIZED TRANSPORTATION MANAGEMENT SYSTEM AND TRAFFIC SIGNAL MODIFICATION QUANTITIES									
SH 225									
TXDOT SPEC NO.	TXDOT DESC CODE	DESCRIPTION	UNIT	ESTIMATED QUANTITY					
				ROBIN ST	TIDAL RD	EAST BLVD	BATTLEGROUND RD / INDEPENDENCE PKWY	SENS RD	PROJECT TOTAL
500	6001	MOBILIZATION	LS						1
502	6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO						10
618	6046	CONDT (PVC) (SCH 80) (2")	LF			800	465	605	1870
618	6047	CONDT (PVC) (SCH 80) (2") (BORE)	LF			280	305	350	935
618	6053	CONDT (PVC) (SCH 80) (3")	LF			650	660	620	1930
618	6054	CONDT (PVC) (SCH 80) (3") (BORE)	LF			595	605	525	1725
618	6058	CONDT (PVC) (SCH 80) (4")	LF			20	20	15	55
618	6074	CONDT (RM) (3")	LF			55	55	55	165
620	6002	ELEC CONDR (NO. 14) INSULATED	LF	35	40	645	595	540	1855
620	6007	ELEC CONDR (NO. 8) BARE	LF			1795	1750	1690	5235
620	6012	ELEC CONDR (NO. 4) INSULATED	LF			925	800	905	2630
621	6005	TRAY CABLE (4 CONDR) (12 AWG)	LF			2335	2265	2125	6725
624	6010	GROUND BOX TY D (162922)W/APRON	EA			6	5	7	18
628	6189	ELC SRV TY D 120/240 070(NS)SS(E)SP(U)	EA			1	1	1	3
628	6309	ELC SRV TY T 120/240 000(NS)GS(N)TP(O)	EA			1	1	1	3
680	6004	REMOVING TRAFFIC SIGNALS	EA			1	1	1	3
680	6011	INSTALL HWY TRF SIG (UPGRADE)	EA			1	1	1	3
	**	CONTROLLER, FULL ACTUATED W/CABINET TS2-TYPE 1	EA			1	1	1	
	**	TRAFFIC SIGNAL CONTROLLER CONCRETE BASEPAD FOUNDATION	EA			1	1	1	
	**	ROD, 5/8" X 10' COPPER - CLAD GROUND (CONTROLLER ONLY)	EA			1	1	1	
	**	DETECTOR UNIT (DUAL CHANNEL)	EA			1	1	1	
	**	DETECTOR CARD RACK (8 SLOTS) AND (4 SLOTS)	EA			1	1	1	
	**	DMS SIGN - INSTALLED 2 WEEKS BEFORE SIGNAL TURN ON	EA			1	1	1	
	**	18" CABINET BASE EXTENSION	EA			1	1	1	
684	6012	TRF SIG CBL (TY A) (12 AWG) (7 CONDR)	LF			5710	5685	5670	17065
6007	6011	FIBER OPTIC CBL (SNGLE-MODE) (12 FIBER)	LF	35	40	645	595	540	1855
6007	6096	FIBER OPTIC PATCH PANEL (12 POSITION)	EA			1	1	1	3
	**	FIBER OPTIC PATCH PANEL CABLE	EA			1	1	1	
6027	6003	CONDUIT (PREPARE)	LF	35	40	50	25	75	225
6027	6008	GROUND BOX (PREPARE)	EA	1	1	3	3	3	11
6058	6001	BBU SYSTEM (EXTERNAL BATT CABINET)	EA			1	1	1	3
6186	6002	ITS GND BOX (PCAST) TY 1 (243636)W/APRN	EA			1	1	1	3
6186	6008	ITS GND BOX (PCAST) TY 2 (366036)W/APRN	EA			3	3	3	9
6306	6001	VIVDS PROSR SYS	EA			1	1	1	3
6306	6002	VIVDS CAM ASSY FXD LNS	EA			6	3	6	15
6306	6005	VIVDS CNTRL SOFTWARE	EA			1	1	1	3
6306	6007	VIVDS CABLING	LF			4270	4240	4010	12520
TXDOT	0001	ETHERNET SWITCH *	EA			1	1	1	3

* MATERIAL FURNISHED BY TXDOT
 ** ITEM WILL NOT BE PAID FOR DIRECTLY, BUT SHALL BE CONSIDERED SUBSIDIARY TO ITEM ABOVE
 TEMPORARY OR PERMANENT SEEDING TO BE PAID FROM FORCE ACCOUNT





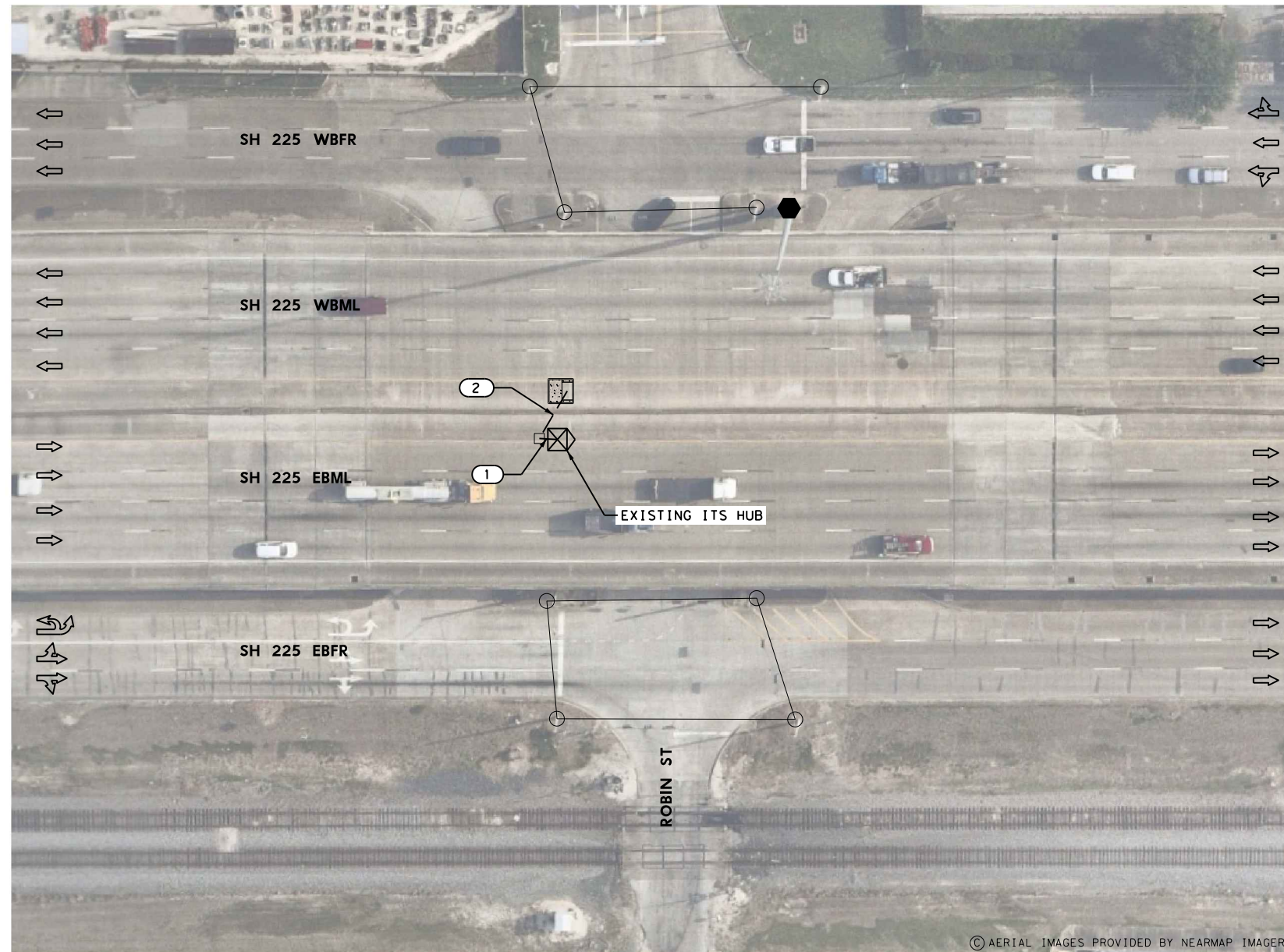
SH 225

SUMMARY OF QUANTITIES

FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
6	-	SH 225
STATE	DIST.	COUNTY
TEXAS	HOU	HARRIS
CONT.	SECT.	JOB
0502	01	237

SHEET NO. 006

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- LEGEND**
- EXISTING SIGNAL POLE W/ MAST ARM
 - EXISTING SIGNAL POLE W/ SPAN WIRE
 - EXISTING ITS POLE
 - EXISTING CCTV FIELD EQUIPMENT
 - EXISTING HIGH MAST ASSEMBLY
 - EXISTING GROUND BOX
 - PROPOSED TYPE D GROUND BOX W/ APRON
 - PROPOSED TYPE 1 ITS GROUND BOX W/ APRON
 - PROPOSED TYPE 2 ITS GROUND BOX W/ APRON
 - EXISTING GROUND MOUNTED CONTROLLER CABINET
 - EXISTING POLE MOUNTED CONTROLLER CABINET
 - PROPOSED GROUND MOUNTED CONTROLLER CABINET
 - EXISTING ITS HUB
 - EXISTING CONDUIT (TRENCH)
 - EXISTING CONDUIT (BORE)
 - PROPOSED CONDUIT (TRENCH)
 - PROPOSED CONDUIT (BORE)
 - DIRECTION OF TRAFFIC



NOTES

1. LOCATIONS OF UNDERGROUND INSTALLATIONS AND RIGHT OF WAY ARE APPROXIMATE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY ALL UNDERGROUND INSTALLATIONS AND RIGHT OF WAY LOCATIONS PRIOR TO ANY CONSTRUCTION.
2. THE CONTRACTOR SHALL CONTACT PUBLIC AND PRIVATE UTILITIES FOR LOCATION OF UNDERGROUND FACILITIES AT LEAST 48 HOURS PRIOR TO ANY DRILLING, BORING, TRENCHING, OR EXCAVATING.
3. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE THESE UTILITIES, WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD.
4. ALL WORK MUST BE PERFORMED WITHIN TxDOT RIGHT OF WAY.
5. CONTRACTOR SHALL INSTALL AND TEST 12-PAIR SMFO FROM PROPOSED TRAFFIC SIGNAL CONTROLLER PATCH PANEL TO EXISTING HUB PATCH PANEL.
6. CONTRACTOR SHALL INSTALL AND TEST NEW FIBER PATCH PANEL TO PROPOSED ETHERNET SWITCH.
7. CONTRACTOR SHALL NOT TERMINATE FIBER OPTIC CABLE. FIBER OPTIC CABLE TERMINATION TO BE DONE BY OTHERS.

CONDUIT AND CONDUCTOR SUMMARY							
RUN NO	CONDUIT STATUS	CABLE STATUS	CONDUCTORS				RUN LENGTH (FEET)
			06206002		60076011		
			ELEC CONDR (NO. 14) INSULATED	FIBER OPTIC CBL (SNGLE-MODE) (12 FIBER)	FIBER OPTIC CBL (SNGLE-MODE) (12 FIBER)		
			QTY	LF	QTY	LF	
1	E	I	1	10	1	10	10
2	E	I	1	25	1	25	25
TOTALS			-	35	35		

E = EXISTING CONDUIT/CONDUCTOR
 I = PROPOSED CONDUIT/CONDUCTOR

Kimley»Horn F-928



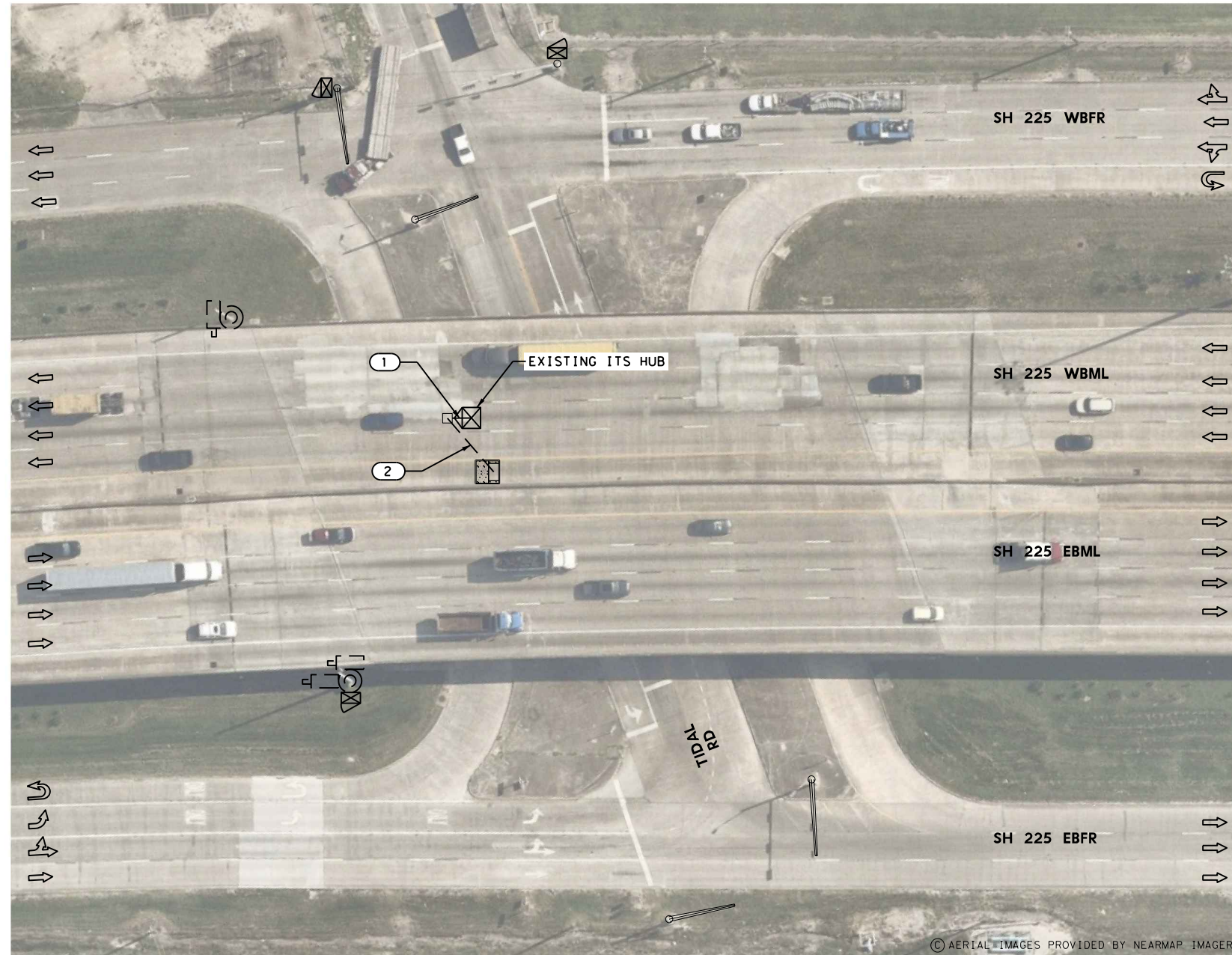
SH 225
FIBER OPTIC CABLE
LAYOUT

SH 225 AT ROBIN ST

SHEET 1 OF 5

FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.	
6	-	SH 225	
STATE	DIST.	COUNTY	SHEET NO.
TEXAS	HOU	HARRIS	007
CONT.	SECT.	JOB	
0502	01	237	

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- LEGEND**
- EXISTING SIGNAL POLE W/ MAST ARM
 - EXISTING SIGNAL POLE W/ SPAN WIRE
 - EXISTING ITS POLE
 - EXISTING CCTV FIELD EQUIPMENT
 - EXISTING HIGH MAST ASSEMBLY
 - EXISTING GROUND BOX
 - PROPOSED TYPE D GROUND BOX W/ APRON
 - PROPOSED TYPE 1 ITS GROUND BOX W/ APRON
 - PROPOSED TYPE 2 ITS GROUND BOX W/ APRON
 - EXISTING GROUND MOUNTED CONTROLLER CABINET
 - EXISTING POLE MOUNTED CONTROLLER CABINET
 - PROPOSED GROUND MOUNTED CONTROLLER CABINET
 - EXISTING ITS HUB
 - EXISTING CONDUIT (TRENCH)
 - EXISTING CONDUIT (BORE)
 - PROPOSED CONDUIT (TRENCH)
 - PROPOSED CONDUIT (BORE)
 - DIRECTION OF TRAFFIC



NOTES

1. LOCATIONS OF UNDERGROUND INSTALLATIONS AND RIGHT OF WAY ARE APPROXIMATE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY ALL UNDERGROUND INSTALLATIONS AND RIGHT OF WAY LOCATIONS PRIOR TO ANY CONSTRUCTION.
2. THE CONTRACTOR SHALL CONTACT PUBLIC AND PRIVATE UTILITIES FOR LOCATION OF UNDERGROUND FACILITIES AT LEAST 48 HOURS PRIOR TO ANY DRILLING, BORING, TRENCHING, OR EXCAVATING.
3. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE THESE UTILITIES, WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD.
4. ALL WORK MUST BE PERFORMED WITHIN TxDOT RIGHT OF WAY.
5. CONTRACTOR SHALL INSTALL AND TEST 12-PAIR SMFO FROM PROPOSED TRAFFIC SIGNAL CONTROLLER PATCH PANEL TO EXISTING HUB PATCH PANEL.
6. CONTRACTOR SHALL INSTALL AND TEST NEW FIBER PATCH PANEL TO PROPOSED ETHERNET SWITCH.
7. CONTRACTOR SHALL NOT TERMINATE FIBER OPTIC CABLE. FIBER OPTIC CABLE TERMINATION TO BE DONE BY OTHERS.

CONDUIT AND CONDUCTOR SUMMARY							
RUN NO	CONDUIT STATUS	CABLE STATUS	CONDUCTORS				RUN LENGTH (FEET)
			06206002		60076011		
			ELEC CONDR (NO. 14) INSULATED	FIBER OPTIC CBL (SNGLE-MODE) (12 FIBER)	FIBER OPTIC CBL (SNGLE-MODE) (12 FIBER)	FIBER OPTIC CBL (SNGLE-MODE) (12 FIBER)	
			QTY	LF	QTY	LF	
1	E	I	1	10	1	10	10
2	E	I	1	30	1	30	30
TOTALS				40		40	

E = EXISTING CONDUIT/CONDUCTOR
 I = PROPOSED CONDUIT/CONDUCTOR

Kimley»Horn F-928



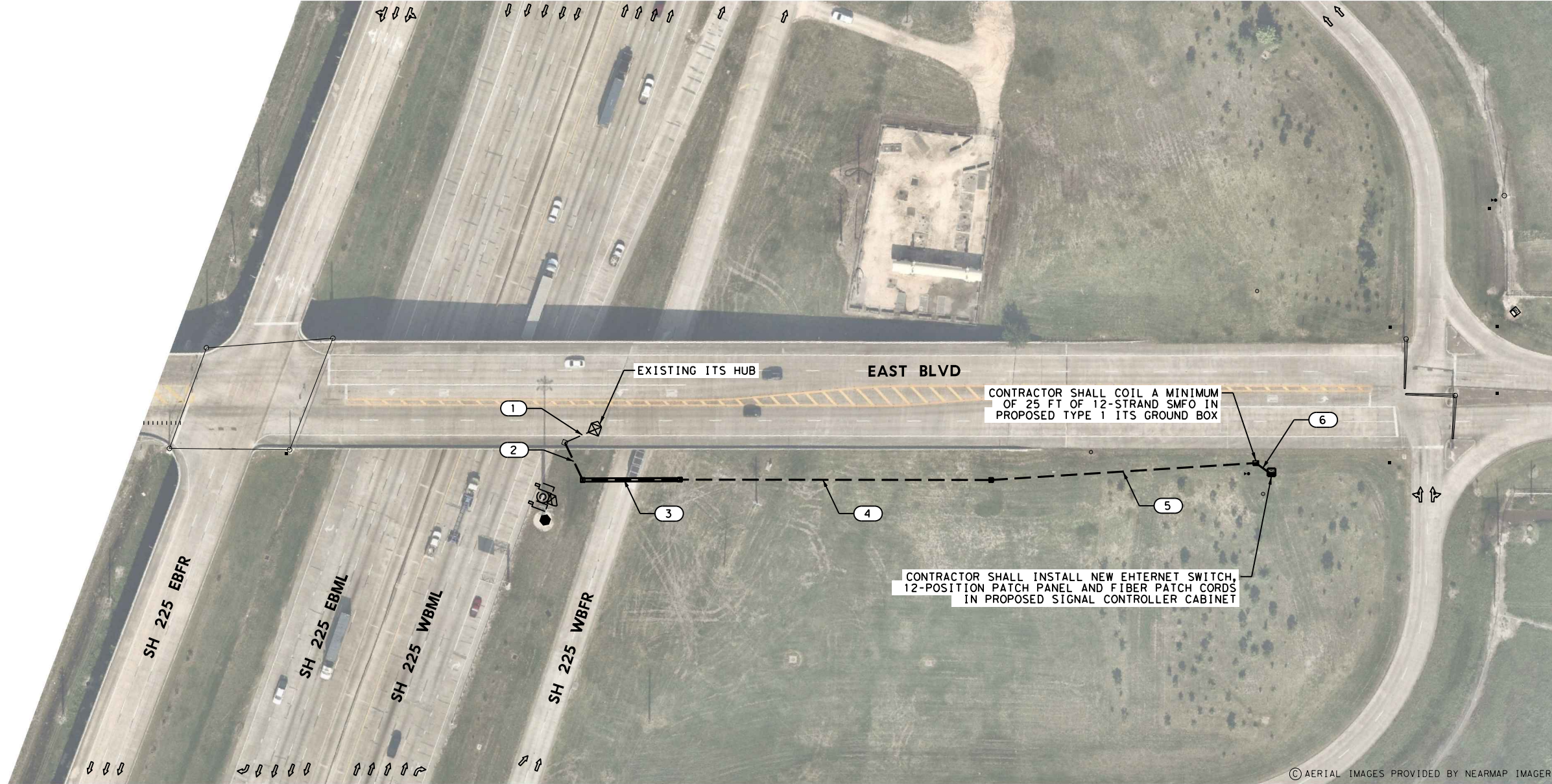
SH 225
FIBER OPTIC CABLE
LAYOUT

SH 225 AT TIDAL RD

SHEET 2 OF 5

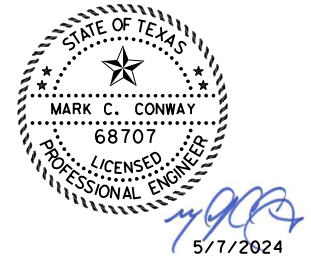
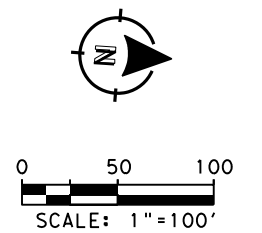
FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.	
6	-	SH 225	
STATE	DIST.	COUNTY	SHEET NO.
TEXAS	HOU	HARRIS	008
CONT.	SECT.	JOB	
0502	01	237	

FILENAME: K:\HOU\TPT\068928203 - TXDOT HOU TRF WA 3 Misc Study-Signal-FOV\Task 3 - FO Design\CADD\Sheets\104_FOC Layout 04.dgn
 PLOTTED: 5/7/2024 6:03:27 PM



LEGEND

- EXISTING SIGNAL POLE W/ MAST ARM
- EXISTING SIGNAL POLE W/ SPAN WIRE
- EXISTING ITS POLE
- EXISTING CCTV FIELD EQUIPMENT
- EXISTING HIGH MAST ASSEMBLY
- EXISTING GROUND BOX
- PROPOSED TYPE D GROUND BOX W/ APRON
- PROPOSED TYPE 1 ITS GROUND BOX W/ APRON
- PROPOSED TYPE 2 ITS GROUND BOX W/ APRON
- EXISTING GROUND MOUNTED CONTROLLER CABINET
- EXISTING POLE MOUNTED CONTROLLER CABINET
- PROPOSED GROUND MOUNTED CONTROLLER CABINET
- EXISTING ITS HUB
- EXISTING CONDUIT (TRENCH)
- EXISTING CONDUIT (BORE)
- PROPOSED CONDUIT (TRENCH)
- PROPOSED CONDUIT (BORE)
- DIRECTION OF TRAFFIC



SH 225
FIBER OPTIC CABLE
LAYOUT
 SH 225 AT EAST BLVD

SHEET 3 OF 5

FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
6	-	SH 225
STATE	DIST.	COUNTY
TEXAS	HOU	HARRIS
CONT.	SECT.	JOB
0502	01	237
		SHEET NO.
		009

NOTES

1. LOCATIONS OF UNDERGROUND INSTALLATIONS AND RIGHT OF WAY ARE APPROXIMATE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY ALL UNDERGROUND INSTALLATIONS AND RIGHT OF WAY LOCATIONS PRIOR TO ANY CONSTRUCTION.
2. THE CONTRACTOR SHALL CONTACT PUBLIC AND PRIVATE UTILITIES FOR LOCATION OF UNDERGROUND FACILITIES AT LEAST 48 HOURS PRIOR TO ANY DRILLING, BORING, TRENCHING, OR EXCAVATING.
3. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE THESE UTILITIES, WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD.
4. ALL WORK MUST BE PERFORMED WITHIN TXDOT RIGHT OF WAY.
5. CONTRACTOR SHALL INSTALL AND TEST 12-PAIR SMFO FROM PROPOSED TRAFFIC SIGNAL CONTROLLER PATCH PANEL TO EXISTING HUB PATCH PANEL.
6. CONTRACTOR SHALL INSTALL AND TEST NEW FIBER PATCH PANEL TO PROPOSED ETHERNET SWITCH.
7. CONTRACTOR SHALL NOT TERMINATE FIBER OPTIC CABLE. FIBER OPTIC CABLE TERMINATION TO BE DONE BY OTHERS.
8. REFER TO TRAFFIC SIGNAL MODIFICATION LAYOUT SHEETS FOR INFORMATION AND DETAILS REGARDING TRAFFIC SIGNAL CONDUCTORS AND TRAFFIC SIGNAL MODIFICATION.

CONTRACTOR SHALL COIL A MINIMUM OF 25 FT OF 12-STRAND SMFO IN PROPOSED TYPE 1 ITS GROUND BOX

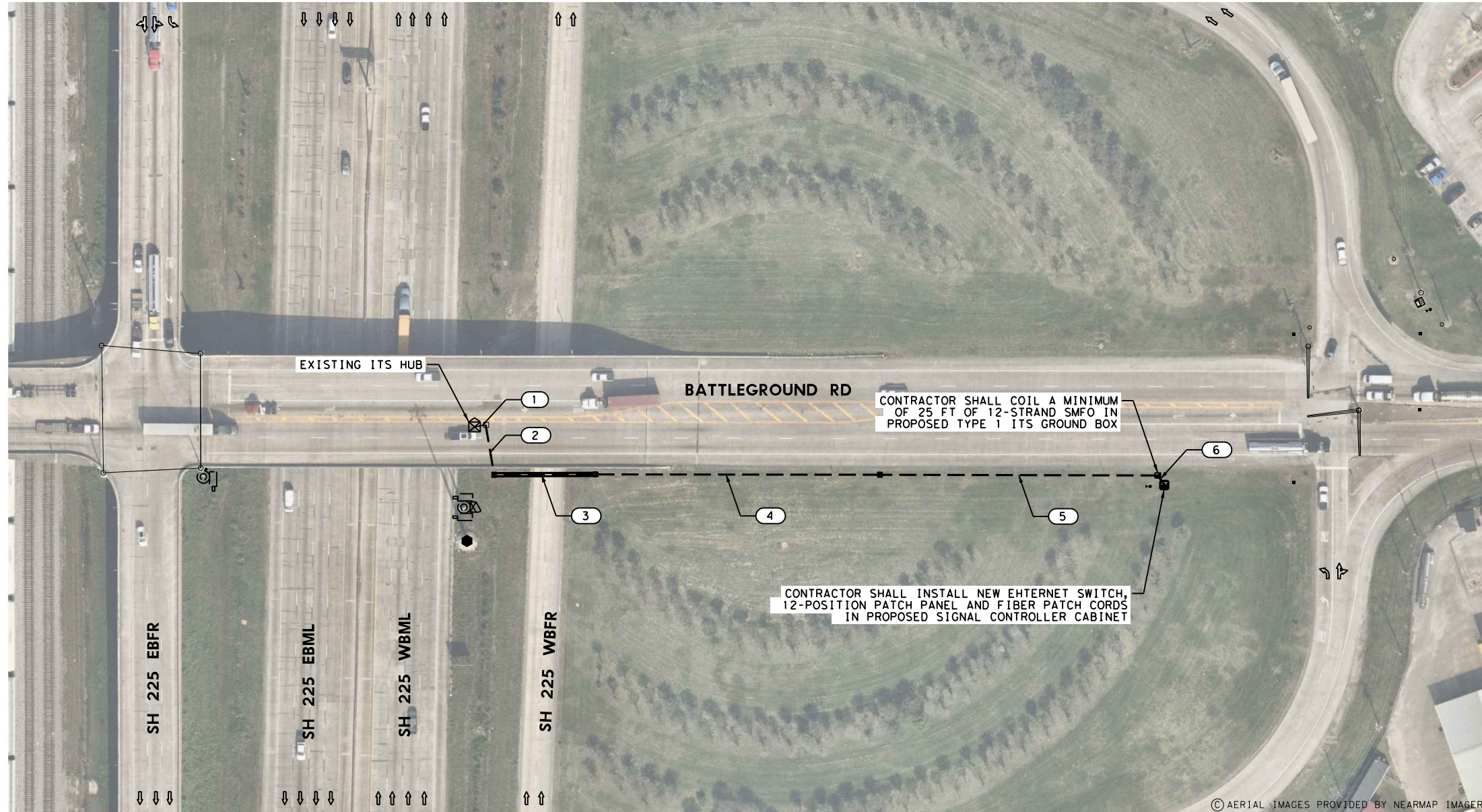
CONTRACTOR SHALL INSTALL NEW ETHERNET SWITCH, 12-POSITION PATCH PANEL AND FIBER PATCH CORDS IN PROPOSED SIGNAL CONTROLLER CABINET

CONDUIT AND CONDUCTOR SUMMARY

RUN NO	CONDUIT STATUS	CONDUCTORS				CABLE STATUS	CONDUCTORS				RUN LENGTH (FEET)
		06186046		06186047			06206002		60076011		
		COND (PVC) (SCH 80) (2")	COND (PVC) (SCH 80) (2") (BORE)	ELEC CONDR (NO. 14) INSULATED	FIBER OPTIC CBL (SNGLE-MODE) (12 FIBER)		QTY	LF	QTY	LF	
1	E					I	1	30	1	30	30
2	I	1	35			I	1	35	1	35	35
3	I			1	75	I	1	75	1	75	75
4	I	1	250			I	1	250	1	250	250
5	I	1	215			I	1	215	1	215	215
6	I	1	40			I	1	40	1	40	40
TOTALS		540	75			-	645	645	645	645	

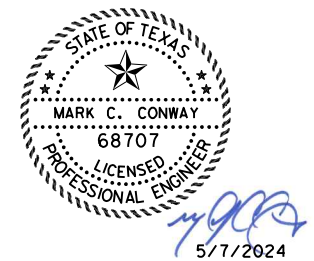
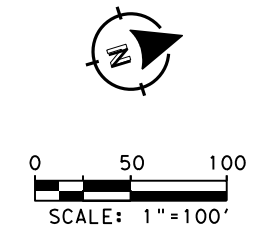
E = EXISTING CONDUIT/CONDUCTOR
 I = PROPOSED CONDUIT/CONDUCTOR

FILENAME: K:\HOU\TPT\068928203 - TxDOT HOU TRF WA 3 Misc Study-Signal-FOVTask 3 - FO Design\CADD\Sheets\105_FOC Layout 05.dgn
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LEGEND

- EXISTING SIGNAL POLE W/ MAST ARM
- EXISTING SIGNAL POLE W/ SPAN WIRE
- EXISTING ITS POLE
- EXISTING CCTV FIELD EQUIPMENT
- EXISTING HIGH MAST ASSEMBLY
- EXISTING GROUND BOX
- PROPOSED TYPE D GROUND BOX W/ APRON
- PROPOSED TYPE 1 ITS GROUND BOX W/ APRON
- PROPOSED TYPE 2 ITS GROUND BOX W/ APRON
- EXISTING GROUND MOUNTED CONTROLLER CABINET
- EXISTING POLE MOUNTED CONTROLLER CABINET
- PROPOSED GROUND MOUNTED CONTROLLER CABINET
- EXISTING ITS HUB
- EXISTING CONDUIT (TRENCH)
- EXISTING CONDUIT (BORE)
- PROPOSED CONDUIT (TRENCH)
- PROPOSED CONDUIT (BORE)
- DIRECTION OF TRAFFIC



NOTES

1. LOCATIONS OF UNDERGROUND INSTALLATIONS AND RIGHT OF WAY ARE APPROXIMATE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY ALL UNDERGROUND INSTALLATIONS AND RIGHT OF WAY LOCATIONS PRIOR TO ANY CONSTRUCTION.
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7. CONTRACTOR SHALL NOT TERMINATE FIBER OPTIC CABLE. FIBER OPTIC CABLE TERMINATION TO BE DONE BY OTHERS.
8. REFER TO TRAFFIC SIGNAL MODIFICATION LAYOUT SHEETS FOR INFORMATION AND DETAILS REGARDING TRAFFIC SIGNAL CONDUCTORS AND TRAFFIC SIGNAL MODIFICATION.

CONDUIT AND CONDUCTOR SUMMARY											
RUN NO	CONDUIT STATUS	CONDUCTORS				CABLE STATUS	CONDUCTORS				RUN LENGTH (FEET)
		06186046		06186047			06206002		60076011		
		COND (PVC) (SCH 80) (2")	COND (PVC) (SCH 80) (2") (BORE)	ELEC CONDR (NO. 14) INSULATED	FIBER OPTIC CBL (SNGLE-MODE) (12 FIBER)						
QTY	LF	QTY	LF	QTY	LF	QTY	LF				
1	E					I	1	10	1	10	10
2	I	1	40			I	1	40	1	40	40
3	I			1	75	I	1	75	1	75	75
4	I	1				I	1	220	1	220	220
5	I	1	215			I	1	215	1	215	215
6	I	1	35			I	1	35	1	35	35
TOTALS			290		75	-		595		595	

E = EXISTING CONDUIT/CONDUCTOR
 I = PROPOSED CONDUIT/CONDUCTOR

Kimley»Horn F-928



SH 225

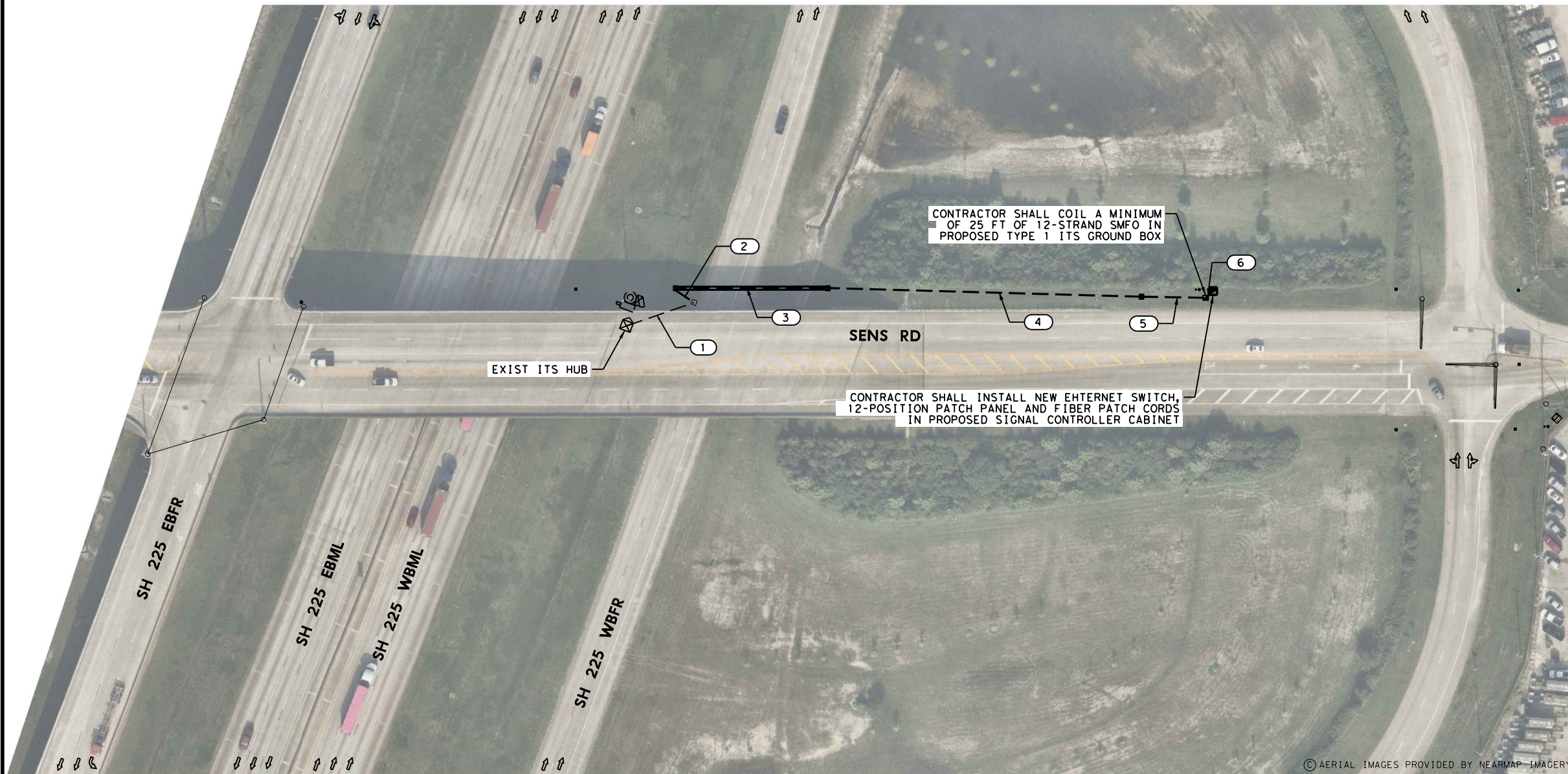
FIBER OPTIC CABLE LAYOUT

SH 225 AT BATTLEGROUND RD/
 INDEPENDENCE PKWY

SHEET 4 OF 5

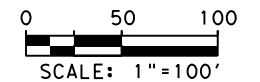
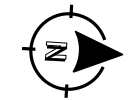
FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
6	-	SH 225
STATE	DIST.	COUNTY
TEXAS	HOU	HARRIS
CONT.	SECT.	JOB
0502	01	237
SHEET NO.		010

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LEGEND

- EXISTING SIGNAL POLE W/ MAST ARM
- EXISTING SIGNAL POLE W/ SPAN WIRE
- EXISTING ITS POLE
- EXISTING CCTV FIELD EQUIPMENT
- EXISTING HIGH MAST ASSEMBLY
- EXISTING GROUND BOX
- PROPOSED TYPE D GROUND BOX W/ APRON
- PROPOSED TYPE 1 ITS GROUND BOX W/ APRON
- PROPOSED TYPE 2 ITS GROUND BOX W/ APRON
- EXISTING GROUND MOUNTED CONTROLLER CABINET
- EXISTING POLE MOUNTED CONTROLLER CABINET
- PROPOSED GROUND MOUNTED CONTROLLER CABINET
- EXISTING ITS HUB
- EXISTING CONDUIT (TRENCH)
- EXISTING CONDUIT (BORE)
- PROPOSED CONDUIT (TRENCH)
- PROPOSED CONDUIT (BORE)
- DIRECTION OF TRAFFIC



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NOTES

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4. ALL WORK MUST BE PERFORMED WITHIN TXDOT RIGHT OF WAY.
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6. CONTRACTOR SHALL INSTALL AND TEST NEW FIBER PATCH PANEL TO PROPOSED ETHERNET SWITCH.
7. CONTRACTOR SHALL NOT TERMINATE FIBER OPTIC CABLE. FIBER OPTIC CABLE TERMINATION TO BE DONE BY OTHERS.
8. REFER TO TRAFFIC SIGNAL MODIFICATION LAYOUT SHEETS FOR INFORMATION AND DETAILS REGARDING TRAFFIC SIGNAL CONDUCTORS AND TRAFFIC SIGNAL MODIFICATION.

CONDUIT AND CONDUCTOR SUMMARY

RUN NO	CONDUIT STATUS	06186046		06186047		CABLE STATUS	CONDUCTORS				RUN LENGTH (FEET)
		CONDT (PVC) (SCH 80) (2")		CONDT (PVC) (SCH 80) (2") (BORE)			06206002		60076011		
		QTY	LF	QTY	LF		ELEC CONDR (NO. 14) INSULATED		FIBER OPTIC CBL (SNGLE-MODE) (12 FIBER)		
1	E					I	1	60	1	60	60
2	I	1	20			I	1	20	1	20	20
3	I			1	120	I	1	120	1	120	120
4	I	1	250			I	1	250	1	250	250
5	I	1	55			I	1	55	1	55	55
6	I	1	35			I	1	35	1	35	35
TOTALS			360		120	-		540		540	

E = EXISTING CONDUIT/CONDUCTOR
 I = PROPOSED CONDUIT/CONDUCTOR

Kimley»Horn F-928



SH 225

FIBER OPTIC CABLE LAYOUT

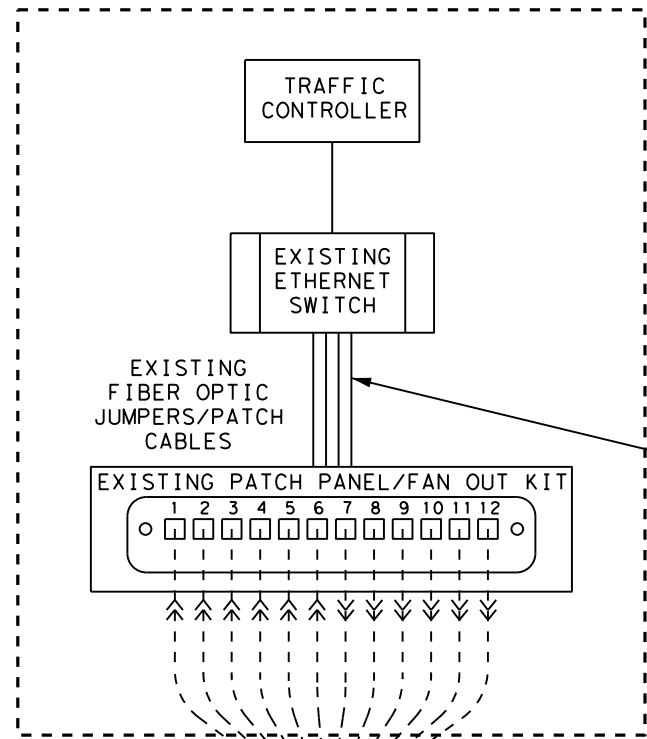
SH 225 AT SENS RD

SHEET 5 OF 5

FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.	
6	-	SH 225	
STATE	DIST.	COUNTY	SHEET NO.
TEXAS	HOU	HARRIS	011
CONT.	SECT.	JOB	
0502	01	237	

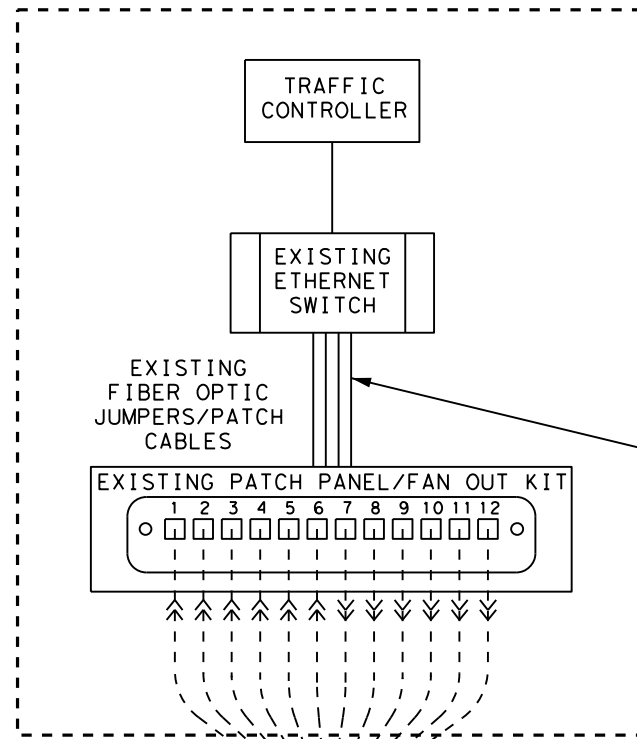
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TYPICAL TRAFFIC SIGNAL CABINET
SH 225 AT ROBIN ST



PATCH PANEL TO SWITCH TERMINATIONS TO BE DONE BY OTHERS

TYPICAL TRAFFIC SIGNAL CABINET
SH 225 AT TIDAL RD



PATCH PANEL TO SWITCH TERMINATIONS TO BE DONE BY OTHERS

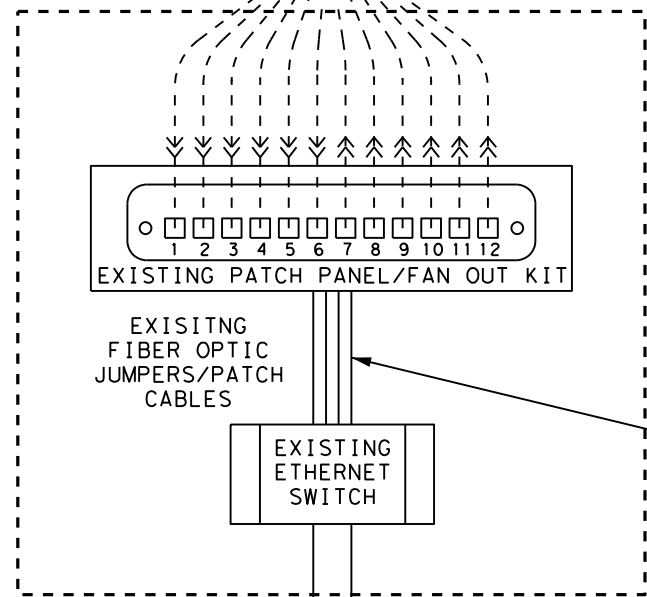
LEGEND

- EXISTING CABLE
- - - PROPOSED CABLE

NOTES

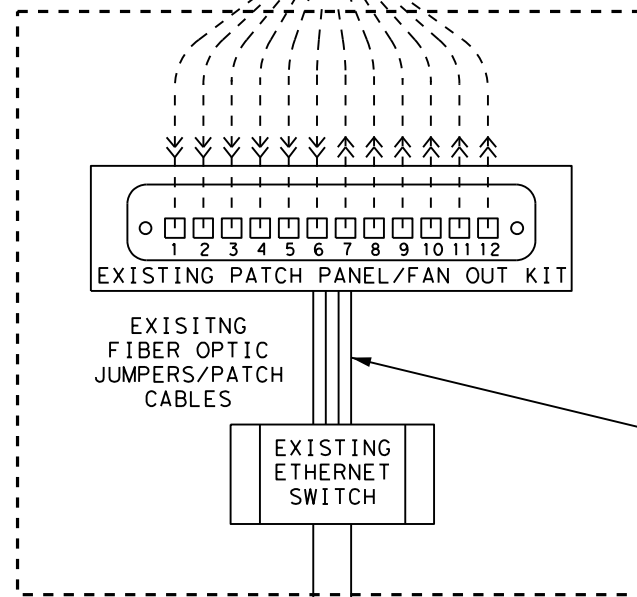
1. CONTRACTOR SHALL INSTALL AND TEST 12-PAIR SMFO FROM EXISTING TRAFFIC SIGNAL CONTROLLER PATCH PANEL TO EXISTING HUB PATCH PANEL.
2. CONTRACTOR SHALL NOT TERMINATE FIBER OPTIC CABLE. FIBER OPTIC CABLE TERMINATION TO BE DONE BY OTHERS.

ITS HUB CABINET
SH 225 AT ROBIN ST



PATCH PANEL TO SWITCH TERMINATIONS TO BE DONE BY OTHERS

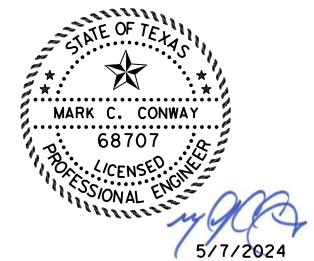
ITS HUB CABINET
SH 225 AT TIDAL RD



PATCH PANEL TO SWITCH TERMINATIONS TO BE DONE BY OTHERS

EXISTING 144 STRAND SMFO CABLE (WB) EXISTING 144 STRAND SMFO CABLE (EB)

EXISTING 144 STRAND SMFO CABLE (WB) EXISTING 144 STRAND SMFO CABLE (EB)



Kimley»Horn F-928



SH 225

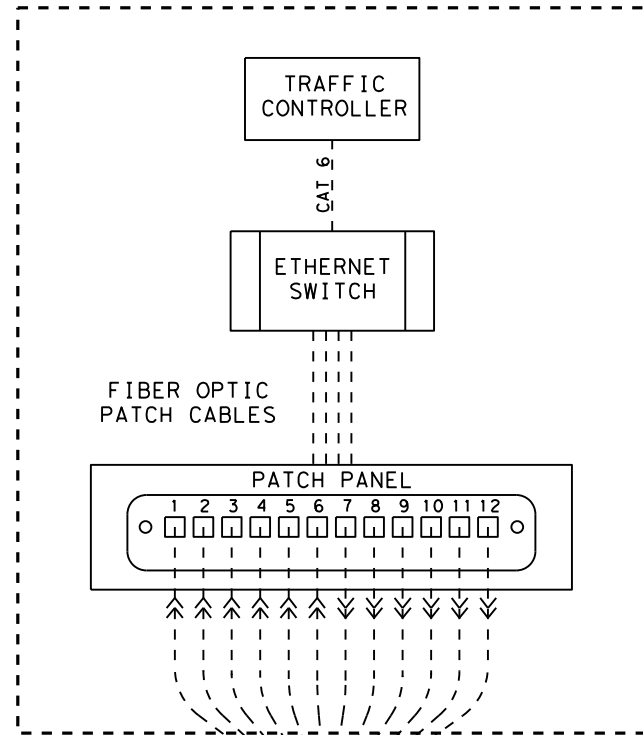
COMMUNICATIONS SCHEMATIC

SHEET 1 OF 3

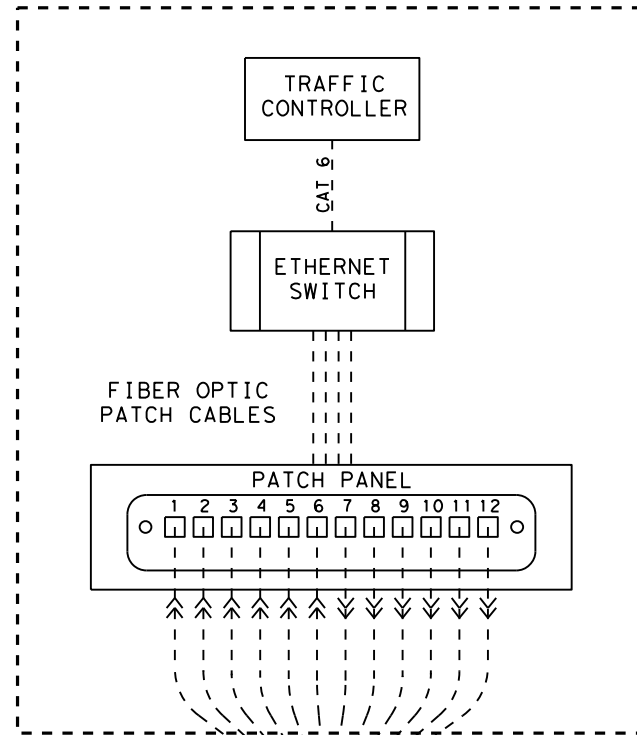
FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
6	-	SH 225
STATE	DIST.	COUNTY
TEXAS	HOU	HARRIS
CONT.	SECT.	JOB
0502	01	237
		SHEET NO.
		012

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TYPICAL TRAFFIC SIGNAL CABINET
 SH 225 AT EAST BLVD



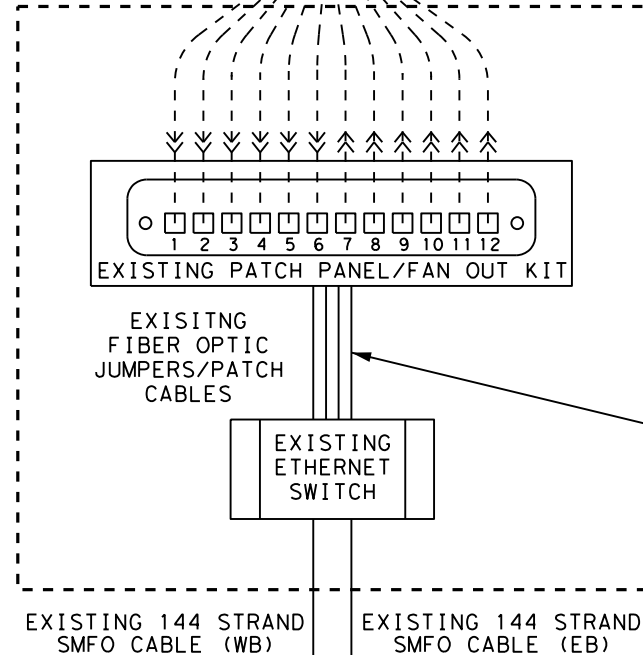
TYPICAL TRAFFIC SIGNAL CABINET
 SH 225 AT BATTLEGROUND RD



LEGEND
 ——— EXISTING CABLE
 - - - - PROPOSED CABLE

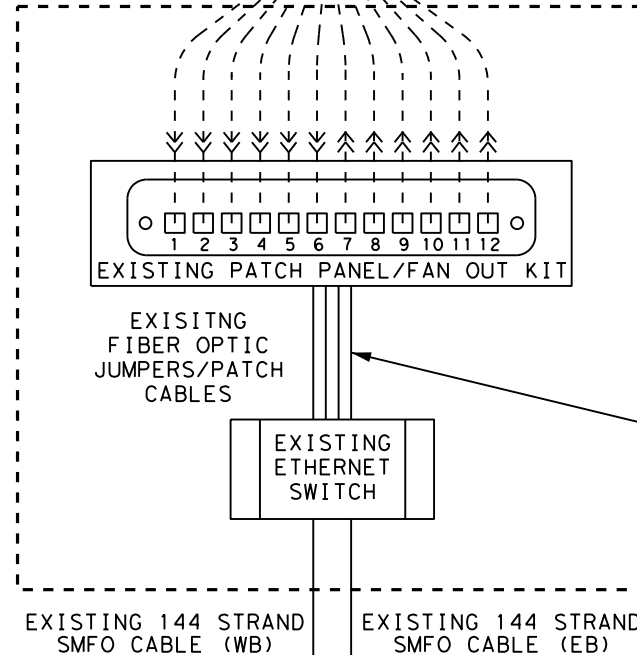
- NOTES**
1. CONTRACTOR SHALL INSTALL AND TEST 12-PAIR SMFO FROM PROPOSED TRAFFIC SIGNAL CONTROLLER PATCH PANEL TO EXISTING HUB PATCH PANEL.
 2. CONTRACTOR SHALL NOT TERMINATE FIBER OPTIC CABLE. FIBER OPTIC CABLE TERMINATION TO BE DONE BY OTHERS.
 3. CONTRACTOR SHALL INSTALL AND TEST NEW FIBER PATCH CORDS FROM PROPOSED PATCH PANEL TO PROPOSED ETHERNET SWITCH.
 4. FURNISH AND INSTALL OF PROPOSED CAT 6 CABLE WILL NOT BE PAID FOR DIRECTLY BUT SHALL BE CONSIDERED INCIDENTAL TO THE VARIOUS BID ITEMS.
 5. CONTRACTOR SHALL INSTALL ETHERNET SWITCH, PATCH PANEL AND FIBER OPTIC PATCH CABLES IN PROPOSED TRAFFIC SIGNAL CABINET.
 6. ETHERNET SWITCHES TO BE PROVIDED BY TxDOT.

ITS HUB CABINET
 SH 225 AT EAST BLVD



PATCH PANEL TO SWITCH TERMINATIONS TO BE DONE BY OTHERS

ITS HUB CABINET
 SH 225 AT BATTLEGROUND RD



PATCH PANEL TO SWITCH TERMINATIONS TO BE DONE BY OTHERS



Kimley»Horn F-928

Texas Department of Transportation © 2024

SH 225

COMMUNICATIONS SCHEMATIC

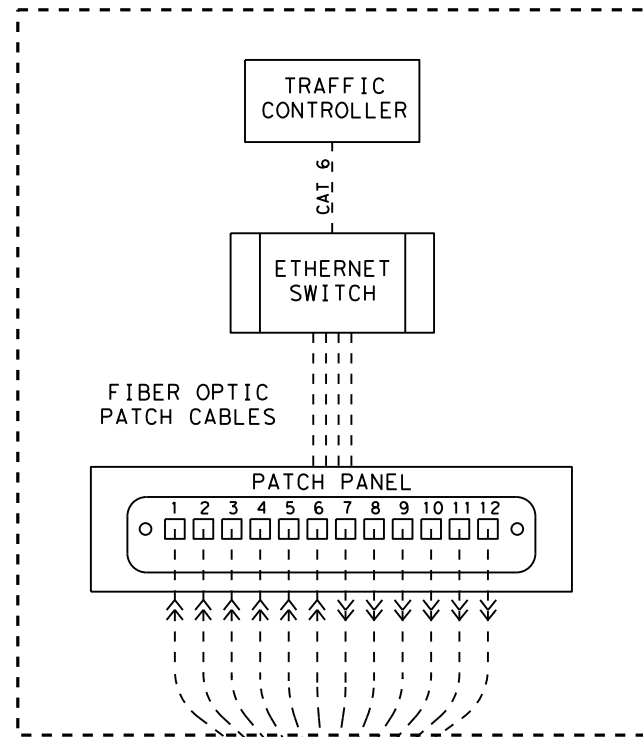
SHEET 2 OF 3

FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
6	-	SH 225
STATE	DIST.	COUNTY
TEXAS	HOU	HARRIS
CONT.	SECT.	JOB
0502	01	237

SHEET NO. 013

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TYPICAL TRAFFIC SIGNAL CABINET
 SH 225 AT SENS RD



TRAFFIC
 CONTROLLER

CAT 6

ETHERNET
 SWITCH

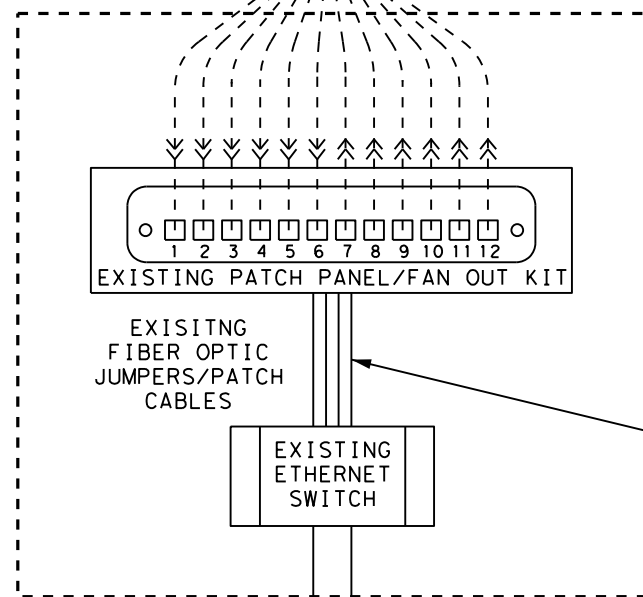
FIBER OPTIC
 PATCH CABLES

PATCH PANEL

1 2 3 4 5 6 7 8 9 10 11 12

12 STRAND
 SMFO CABLE

ITS HUB CABINET
 SH 225 AT SENS RD



EXISTING PATCH PANEL/FAN OUT KIT

EXISTING
 FIBER OPTIC
 JUMPERS/PATCH
 CABLES

EXISTING
 ETHERNET
 SWITCH

EXISTING 144 STRAND
 SMFO CABLE (WB)

EXISTING 144 STRAND
 SMFO CABLE (EB)

PATCH PANEL TO
 SWITCH TERMINATIONS
 TO BE DONE BY OTHERS

LEGEND

- EXISTING CABLE
- - - - PROPOSED CABLE

NOTES

1. CONTRACTOR SHALL INSTALL AND TEST 12-PAIR SMFO FROM PROPOSED TRAFFIC SIGNAL CONTROLLER PATCH PANEL TO EXISTING HUB PATCH PANEL.
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5. CONTRACTOR SHALL INSTALL ETHERNET SWITCH, PATCH PANEL AND FIBER OPTIC PATCH PANEL CABLES IN PROPOSED TRAFFIC SIGNAL CABINET.
6. ETHERNET SWITCHES TO BE PROVIDED BY TxDOT.



5/7/2024

Kimley»Horn F-928



SH 225

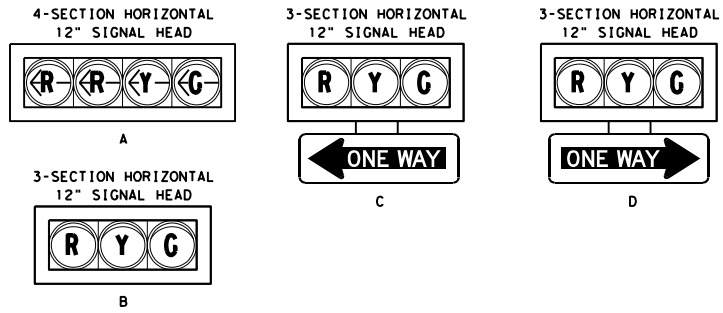
COMMUNICATIONS
 SCHEMATIC

SHEET 3 OF 3

FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
6	-	SH 225
STATE	DIST.	COUNTY
TEXAS	HOU	HARRIS
CONT.	SECT.	JOB
0502	01	237
SHEET NO.		014

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EXISTING TRAFFIC SIGNAL HEADS

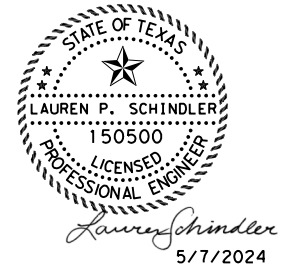
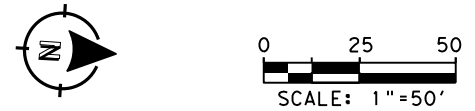
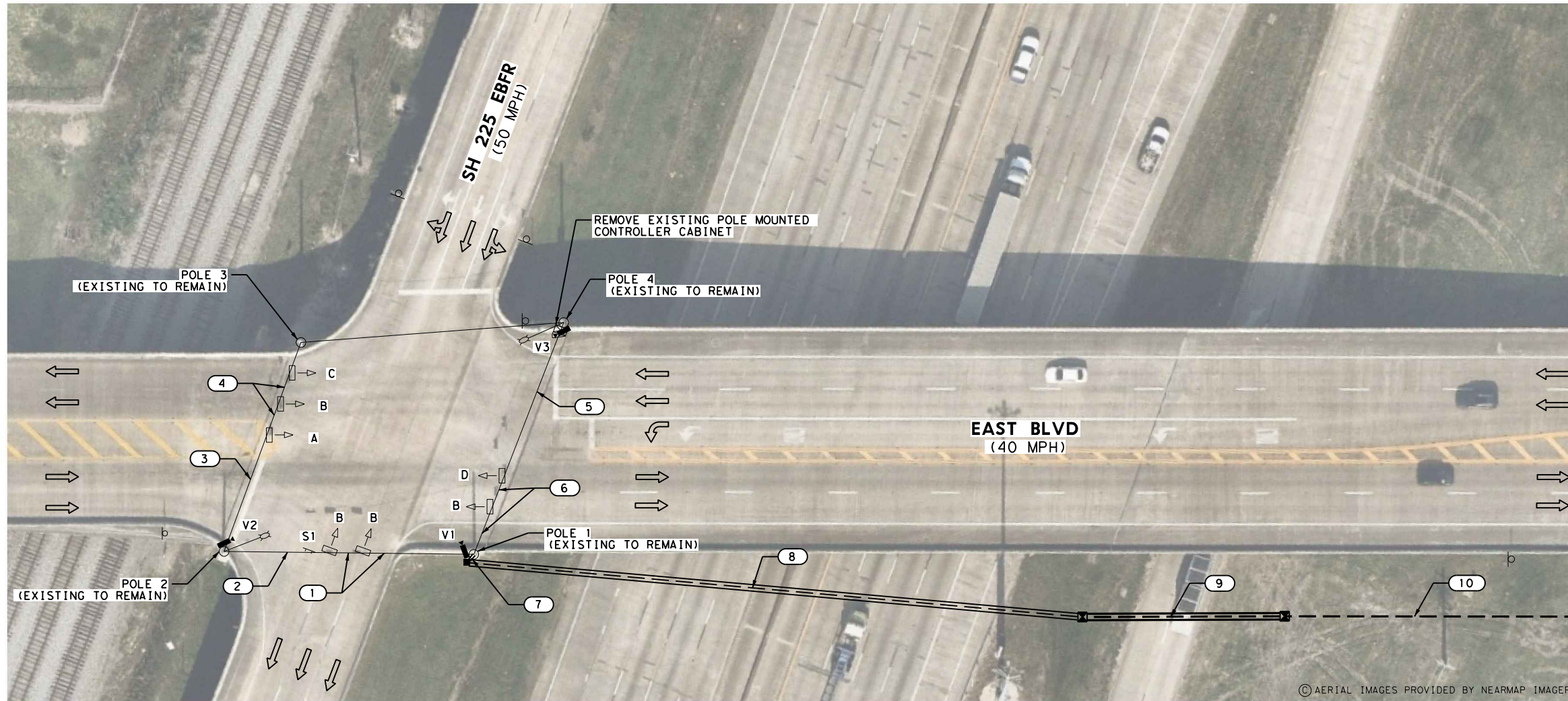


EXISTING SIGNS



LEGEND

- EXISTING SIGNAL POLE WITH SPAN WIRE
- ⊖ EXISTING SIGNAL POLE W/ MAST ARM
- ⊗ EXISTING LUMINAIRE
- ⊔ EXISTING HORIZONTAL SIGNAL HEAD
- ⊕ EXISTING VERTICAL SIGNAL HEAD
- ⊥ EXISTING OVERHEAD SIGN
- ⊞ EXISTING VIVDS DETECTION DEVICE
- ⊟ PROPOSED VIVDS DETECTION DEVICE
- ⊠ EXISTING ANTENNA
- ⊡ EXISTING WIRELESS RADIO
- EXISTING GROUND BOX
- PROPOSED TYPE D GROUND BOX W/ APRON
- ▣ PROPOSED TYPE 1 ITS GROUND BOX W/ APRON
- ▤ PROPOSED TYPE 2 ITS GROUND BOX W/ APRON
- ⊘ EXISTING SERVICE METER AND DISCONNECT
- ⊙ PROPOSED SERVICE METER AND DISCONNECT
- ⊞ EXISTING GROUND MOUNTED CONTROLLER CABINET
- ⊟ EXISTING POLE MOUNTED CONTROLLER CABINET
- ⊠ PROPOSED GROUND MOUNTED CONTROLLER CABINET
- ⊡ EXISTING SIGN ON POST
- PROPOSED LOOP DETECTION
- - - EXISTING CONDUIT (TRENCH)
- - - PROPOSED CONDUIT (TRENCH)
- ▬▬▬ PROPOSED CONDUIT (BORE)
- ▬▬▬ PROPOSED CONDUIT (RIGID METAL)
- ➔ DIRECTION OF TRAFFIC



SH 225
TRAFFIC SIGNAL
MODIFICATION LAYOUT

SH 225 AT EAST BLVD

SHEET 1 OF 3

FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
6	-	SH 225
STATE	DIST.	COUNTY
TEXAS	HOU	HARRIS
CONT.	SECT.	JOB
0502	01	237
		SHEET NO.
		015

NOTES

1. LOCATIONS OF UNDERGROUND INSTALLATIONS AND RIGHT OF WAY ARE APPROXIMATE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY ALL UNDERGROUND INSTALLATIONS AND RIGHT OF WAY LOCATIONS PRIOR TO ANY CONSTRUCTION.
2. THE CONTRACTOR SHALL CONTACT PUBLIC AND PRIVATE UTILITIES FOR LOCATION OF UNDERGROUND FACILITIES AT LEAST 48 HOURS PRIOR TO ANY DRILLING, BORING, TRENCHING, OR EXCAVATING.
3. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE THESE UTILITIES, WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD.
4. ALL WORK MUST BE PERFORMED WITHIN TxDOT RIGHT OF WAY.
5. SIGN MAINTENANCE NEEDS TO BE PERFORMED TO REPLACE DAMAGED SIGNS. THIS WORK SHALL BE SUBSIDIARY TO ITEM 680.
6. EXISTING WIRELESS RADIO EQUIPMENT FOR SIGNAL COMMUNICATION TO BE REMOVED BY CONTRACTOR.
7. REFER TO COMPUTERIZED TRANSPORTATION MANAGEMENT SYSTEM LAYOUT SHEETS FOR INFORMATION AND DETAILS REGARDING FIBER CONNECTIVITY.

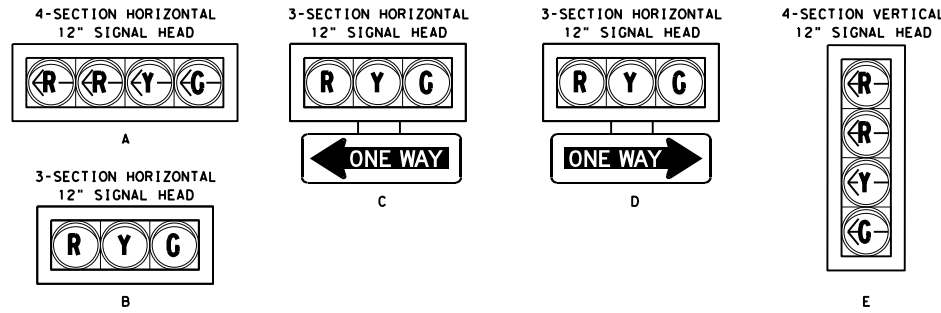
SEQUENCE OF CONSTRUCTION

1. CONTRACTOR SHALL ENSURE EXISTING TRAFFIC SIGNALS REMAIN OPERATIONAL DURING INSTALLATION OF NEW EQUIPMENT.
2. INSTALL NEW SIGNAL EQUIPMENT AS SHOWN IN THE PLANS.
3. INSTALL NEW WIRING TO EXISTING SIGNAL DISPLAYS ON SPAN WIRE WHILE KEEPING EXISTING SIGNAL OPERATIONAL.
4. DISCONNECT EXISTING WIRING AND CONNECT NEW WIRING TO SIGNAL DISPLAYS AT BOTH SH 225 EBFR AND SH 225 WBFR AT THE SAME TIME.
5. ACTIVATE SIGNAL OPERATIONS USING NEW SIGNAL CABINET.
6. REMOVE OLD EQUIPMENT.

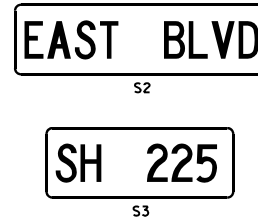
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FILENAME: K:\HOU\TPT\068928203 - TxDOT HOU TRF WA 3 Misc Study-Signal-FOVTask 3 - FO Design\CADD\Sheets\107b_TRF_East (Sheet 2 of 2).dgn
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EXISTING TRAFFIC SIGNAL HEADS

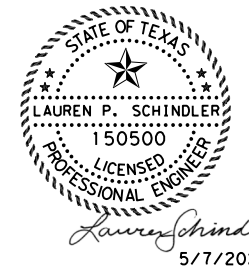
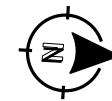


EXISTING SIGNS

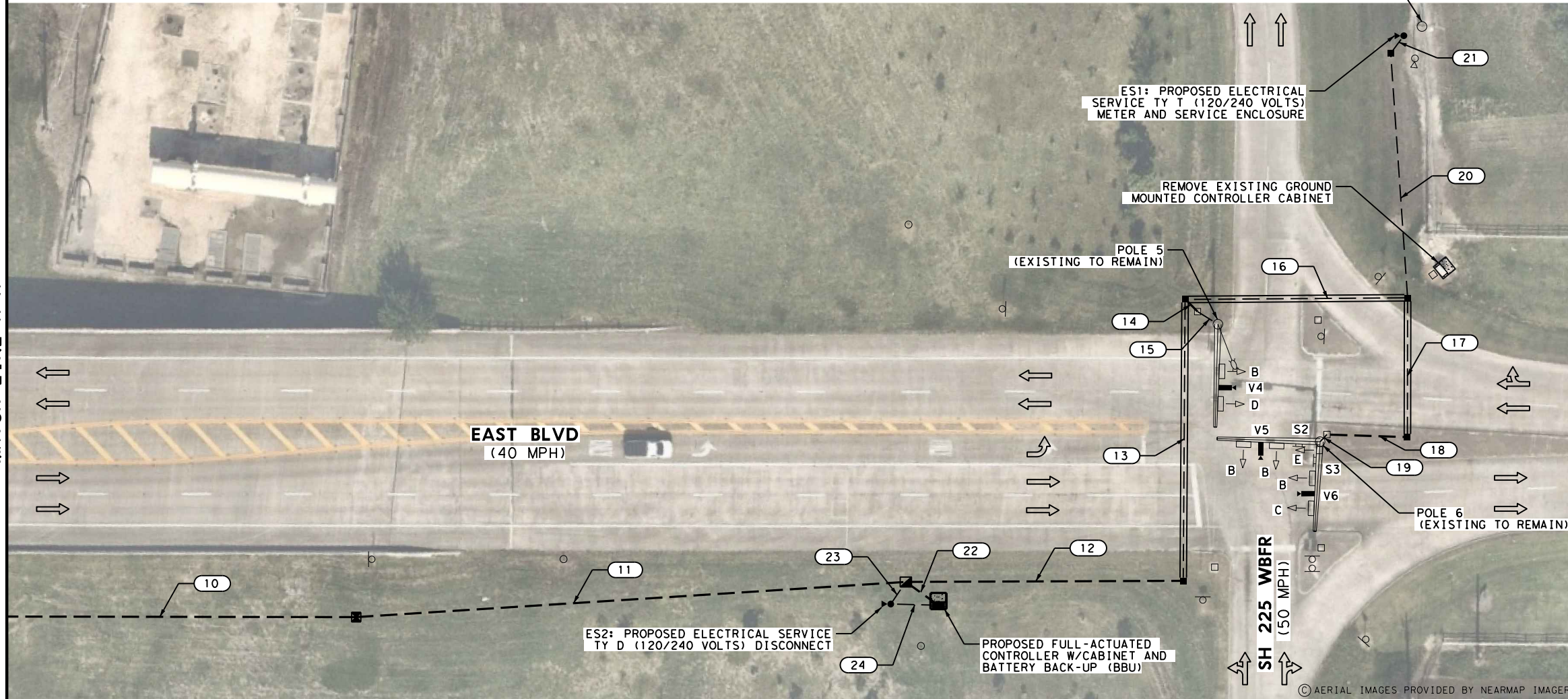


LEGEND

- EXISTING SIGNAL POLE WITH SPAN WIRE
- ⊖ EXISTING SIGNAL POLE W/ MAST ARM
- ⊗ EXISTING LUMINAIRE
- ⊔ EXISTING HORIZONTAL SIGNAL HEAD
- ⊕ EXISTING VERTICAL SIGNAL HEAD
- ⊥ EXISTING OVERHEAD SIGN
- ⊞ EXISTING VIVDS DETECTION DEVICE
- ⊟ PROPOSED VIVDS DETECTION DEVICE
- ⊠ EXISTING ANTENNA
- ⊡ EXISTING WIRELESS RADIO
- EXISTING GROUND BOX
- PROPOSED TYPE D GROUND BOX W/ APRON
- ▣ PROPOSED TYPE 1 ITS GROUND BOX W/ APRON
- ▤ PROPOSED TYPE 2 ITS GROUND BOX W/ APRON
- ⊘ EXISTING SERVICE METER AND DISCONNECT
- ⊙ PROPOSED SERVICE METER AND DISCONNECT
- ⊞ EXISTING GROUND MOUNTED CONTROLLER CABINET
- ⊟ EXISTING POLE MOUNTED CONTROLLER CABINET
- ⊠ PROPOSED GROUND MOUNTED CONTROLLER CABINET
- ⊡ EXISTING SIGN ON POST
- PROPOSED LOOP DETECTION
- - - EXISTING CONDUIT (TRENCH)
- - - PROPOSED CONDUIT (TRENCH)
- ▬ PROPOSED CONDUIT (BORE)
- ▬ PROPOSED CONDUIT (RIGID METAL)
- ➔ DIRECTION OF TRAFFIC



MATCH LINE A-A



NOTES

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3. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE THESE UTILITIES, WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD.
4. ALL WORK MUST BE PERFORMED WITHIN TxDOT RIGHT OF WAY.
5. SIGN MAINTENANCE NEEDS TO BE PERFORMED TO REPLACE DAMAGED SIGNS. THIS WORK SHALL BE SUBSIDIARY TO ITEM 680.
6. EXISTING WIRELESS RADIO EQUIPMENT FOR SIGNAL COMMUNICATION TO BE REMOVED BY CONTRACTOR.
7. REFER TO COMPUTERIZED TRANSPORTATION MANAGEMENT SYSTEM LAYOUT SHEETS FOR INFORMATION AND DETAILS REGARDING FIBER CONNECTIVITY.

SEQUENCE OF CONSTRUCTION

1. CONTRACTOR SHALL ENSURE EXISTING TRAFFIC SIGNALS REMAIN OPERATIONAL DURING INSTALLATION OF NEW EQUIPMENT.
2. INSTALL NEW SIGNAL EQUIPMENT AS SHOWN IN THE PLANS.
3. INSTALL NEW WIRING TO EXISTING SIGNAL DISPLAYS ON MAST ARM WHILE KEEPING EXISTING SIGNAL OPERATIONAL.
4. CONTRACTOR TO CONNECT PROPOSED SIGNAL CABLES TO TERMINAL BLOCK. EXISTING SIGNAL CABLES FROM TERMINAL BLOCK TO SIGNAL HEADS TO BE REUSED.
5. DISCONNECT EXISTING WIRING AND CONNECT NEW WIRING TO SIGNAL DISPLAYS AT BOTH SH 225 EBFR AND SH 225 WBFR AT THE SAME TIME.
6. ACTIVATE SIGNAL OPERATIONS USING NEW SIGNAL CABINET.
7. REMOVE OLD EQUIPMENT.

Kimley»Horn F-928



SH 225

**TRAFFIC SIGNAL
MODIFICATION LAYOUT**

SH 225 AT EAST BLVD

SHEET 2 OF 3

FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
6	-	SH 225
STATE	DIST.	COUNTY
TEXAS	HOU	HARRIS
CONT.	SECT.	JOB
0502	01	237
		SHEET NO.
		016

FILENAME: K:\HOU\TPT\068928203 - TxDOT HOU TRF WA 3 Misc Study-Signal-FOVTask 3 - FO Design\CADD\Sheets\107c_TRF_East_Traffic_Details.dgn
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CONDUIT AND CONDUCTOR RUNS																							
RUN NO.	CONDUIT (618)												CONDUCTORS (620)				TRAY CABLE (621)	CABLES (684)	VIVDS (6306)				
	PVC												RMC		POWER	GROUND	LUMINAIRE	SIGNAL	VIVDS				
	2" (SCHD 80)				3" (SCHD 80)				4" (SCHD 80)		3"	#4 INSULATED	#8 BARE	#12/4C Tray Cable	#12/7C	#12/3C							
	(6046)		(6047)		(6053)		(6054)		(6058)		(6074)		(6012)		(6005)		(6012)		(6007)				
	NO.	TRENCH	NO.	BORE	NO.	TRENCH	NO.	BORE	NO.	TRENCH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH			
EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF				
1																1	60	3	60	1	60		
2																1	40	2	40	1	40		
3																		2	50				
4																		1	40				
5																1	65			1	65		
6																1	35	1	35	1	35		
7										1	50			1	50	2	50	4	50	3	50		
8								1	240					1	240	2	240	4	240	3	240		
9								1	75					1	75	2	75	4	75	3	75		
10								1	250					1	250	2	250	4	250	3	250		
11								1	215					1	215	2	215	4	215	3	215		
12	1	110						1	110					2	110	2	110	1	110	4	110	3	110
13				1	110			1	110					2	110	2	110	1	110	4	110	3	110
14								1	10					1	10	1	10	1	10	1	10	1	10
15								EXISTING						1	10	1	10	1	10	1	10	1	10
16				1	85			1	85					2	85	2	85			3	85	2	85
17								1	55					1	55					3	55	2	55
18								1	30					1	30					3	30	2	30
19								EXISTING						1	10					3	10	2	10
20	1	95												2	95	1	95						
21	1	10												2	10	1	10						
22										1	15			1	15					8	15	6	15
23	1	10												2	10	1	10	3	10				
24	1	20												2	20	1	20						
POLE 1																2	30	4	30	3	30		
POLE 5																1	30				1	20	
MA 5																					1	32	
POLE 6																					2	20	
MA 6a																					1	32	
MA 6b																					1	28	
TOTAL (LF)		245						615		565		15	50	880		1705		2220		5435		4062	
EST. TOTAL		260						650		595		20	55	925		1795		2335		5710		4270	

VEHICLE DETECTOR CHART			
CAMERA	APPROACH	TYPE	MOUNTING LOCATION
V1	EASTBOUND	PRESENCE	POLE 1
V2	SOUTHBOUND	PRESENCE	POLE 2
V3	NORTHBOUND	PRESENCE	POLE 4
V4	SOUTHBOUND	PRESENCE	POLE 5
V5	WESTBOUND	PRESENCE	POLE 6
V6	NORTHBOUND	PRESENCE	POLE 6


POLE SCHEDULE	
POLE ID	DESCRIPTION
POLE 1	EXISTING STEEL POLE (TO REMAIN) AND PROPOSED VIVDS (1 EA)
POLE 2	EXISTING STEEL POLE W/ LUMINAIRE (TO REMAIN) AND PROPOSED VIVDS (1 EA)
POLE 3	EXISTING STEEL POLE (TO REMAIN)
POLE 4	EXISTING STEEL POLE W/ LUMINAIRE (TO REMAIN), POLE MOUNTED CONTROLLER CABINET (TO BE REMOVED), AND PROPOSED VIVDS (1 EA)
POLE 5	EXISTING MAST ARM POLE W/ LUMINAIRE (TO REMAIN) AND PROPOSED VIVDS (1 EA)
POLE 6	EXISTING DUAL MAST ARM POLE (TO REMAIN) AND PROPOSED VIVDS (2 EA)



ELECTRICAL SERVICE DATA											
ELEC. SERVICE ID	ELECTRICAL SERVICE DESCRIPTION (SEE ED (5, 6, 7) -14)	SERVICE CONDUIT SIZE (RMC)	SERVICE CONDUCTORS NO./SIZE	SAFETY SWITCH AMPS	MAIN DISCONNECT CKT. BRK. POLE/AMP	TWO-POLE CONTACTOR AMPS	PANELBD./LOADC ENTER AMP RATING (MIN)	CIRCUIT NO.	BRANCH CKT. BRK. POLE/AMPS	BRANCH CIRCUIT AMPS	KVA LOAD
ES1	TY T (120/240) 000 (NS) GS (N) TP (O)	1 1/4	3/ #6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ES2	TY D (120/240) 070 (NS) SS (E) SP (U)	1 1/4	3/ #6	N/A	2P/70	30	100	T. S.	1P/50	30	5
								LIGHTING	2P/20	8	



F-928



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SH 225

TRAFFIC SIGNAL MODIFICATION DETAILS

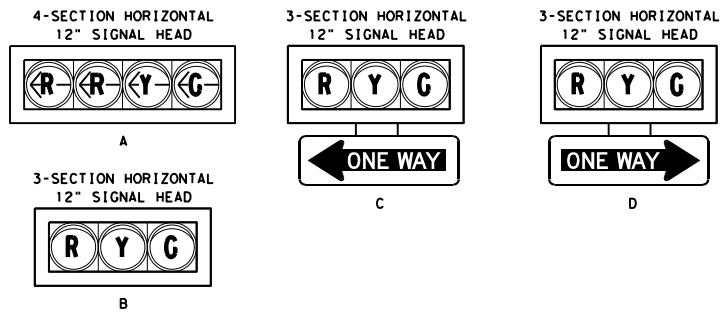
SH 225 AT EAST BLVD

SHEET 3 OF 3

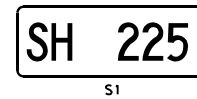
FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
6	-	SH 225
STATE	DIST.	COUNTY
TEXAS	HOU	HARRIS
CONT.	SECT.	JOB
0502	01	237

SHEET NO. 017

EXISTING TRAFFIC SIGNAL HEADS



EXISTING SIGNS



LEGEND

- EXISTING SIGNAL POLE WITH SPAN WIRE
- ⊖ EXISTING SIGNAL POLE W/ MAST ARM
- ⊗ EXISTING LUMINAIRE
- ⊔ EXISTING HORIZONTAL SIGNAL HEAD
- ⊕ EXISTING VERTICAL SIGNAL HEAD
- ⊥ EXISTING OVERHEAD SIGN
- ⊞ EXISTING VIVDS DETECTION DEVICE
- ⊟ PROPOSED VIVDS DETECTION DEVICE
- ⊠ EXISTING ANTENNA
- ⊡ EXISTING WIRELESS RADIO
- EXISTING GROUND BOX
- PROPOSED TYPE D GROUND BOX W/ APRON
- ▣ PROPOSED TYPE 1 ITS GROUND BOX W/ APRON
- ▤ PROPOSED TYPE 2 ITS GROUND BOX W/ APRON
- ⊘ EXISTING SERVICE METER AND DISCONNECT
- ⊙ PROPOSED SERVICE METER AND DISCONNECT
- ⊞ EXISTING GROUND MOUNTED CONTROLLER CABINET
- ⊟ EXISTING POLE MOUNTED CONTROLLER CABINET
- ⊠ PROPOSED GROUND MOUNTED CONTROLLER CABINET
- ⊡ EXISTING SIGN ON POST
- PROPOSED LOOP DETECTION
- - - EXISTING CONDUIT (TRENCH)
- · - · - PROPOSED CONDUIT (TRENCH)
- ▬▬▬ PROPOSED CONDUIT (BORE)
- ▬▬▬ PROPOSED CONDUIT (RIGID METAL)
- ➔ DIRECTION OF TRAFFIC



Kimley»Horn F-928



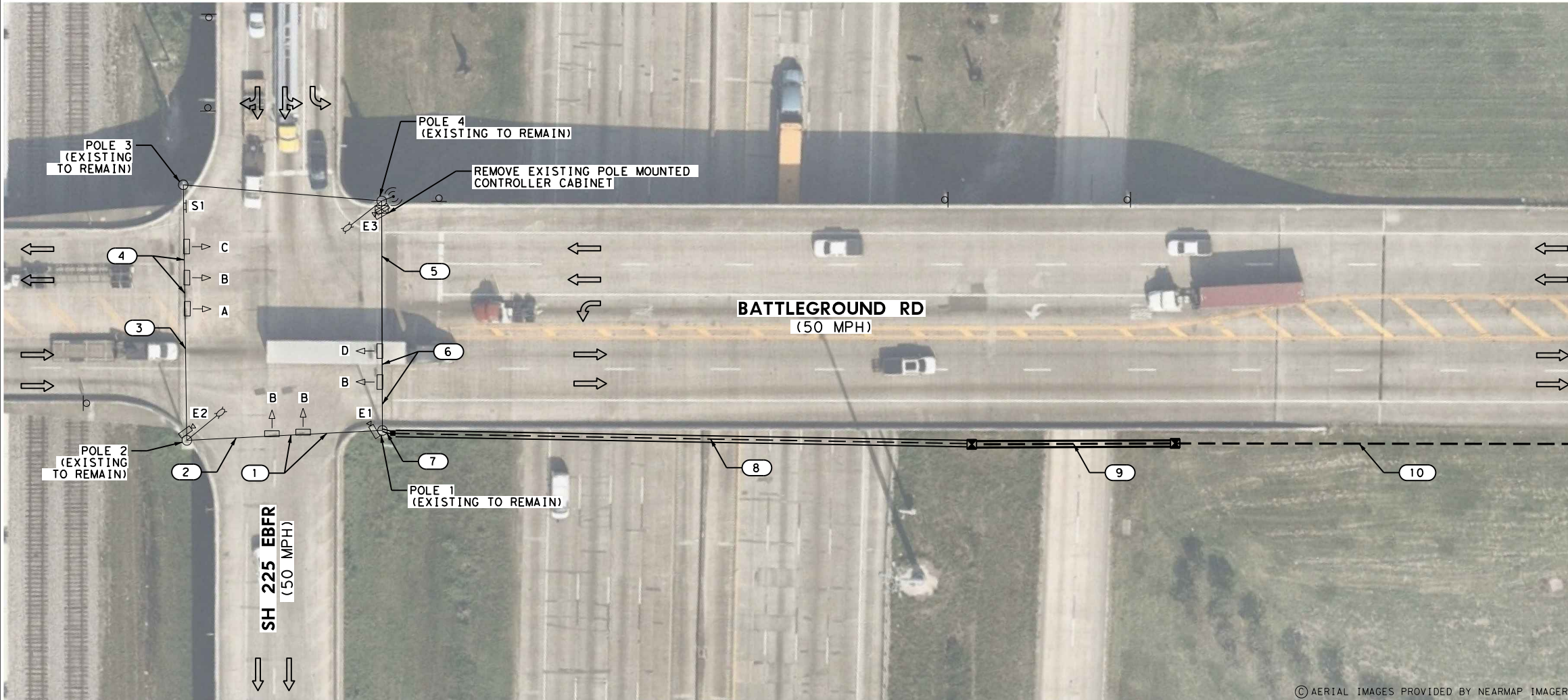
SH 225

TRAFFIC SIGNAL MODIFICATION LAYOUT

SH 225 AT BATTLEGROUND RD/
INDEPENDENCE PKWY

SHEET 1 OF 3

FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.	
6	-	SH 225	
STATE	DIST.	COUNTY	SHEET NO.
TEXAS	HOU	HARRIS	018
CONT.	SECT.	JOB	
0502	01	237	



MATCH LINE B-B

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NOTES

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4. ALL WORK MUST BE PERFORMED WITHIN TXDOT RIGHT OF WAY.
5. SIGN MAINTENANCE NEEDS TO BE PERFORMED TO REPLACE DAMAGED SIGNS. THIS WORK SHALL BE SUBSIDIARY TO ITEM 680.
6. EXISTING WIRELESS RADIO EQUIPMENT FOR SIGNAL COMMUNICATION TO BE REMOVED BY CONTRACTOR.
7. REFER TO COMPUTERIZED TRANSPORTATION MANAGEMENT SYSTEM LAYOUT SHEETS FOR INFORMATION AND DETAILS REGARDING FIBER CONNECTIVITY.

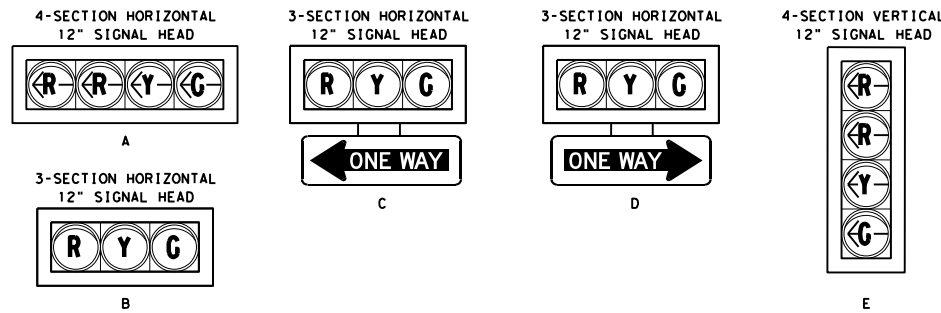
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4. DISCONNECT EXISTING WIRING AND CONNECT NEW WIRING TO SIGNAL DISPLAYS AT BOTH SH 225 EBFR AND SH 225 WBFR AT THE SAME TIME.
5. ACTIVATE SIGNAL OPERATIONS USING NEW SIGNAL CABINET.
6. REMOVE OLD EQUIPMENT.

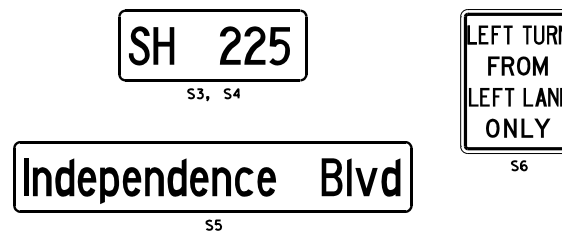
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 PLOTTED: 5/7/2024 3:04:08 PM

EXISTING TRAFFIC SIGNAL HEADS



EXISTING SIGNS



LEGEND

- EXISTING SIGNAL POLE WITH SPAN WIRE
- ⊖ EXISTING SIGNAL POLE W/ MAST ARM
- ⊗ EXISTING LUMINAIRE
- ⊔ EXISTING HORIZONTAL SIGNAL HEAD
- ⊕ EXISTING VERTICAL SIGNAL HEAD
- ⊥ EXISTING OVERHEAD SIGN
- ⊞ EXISTING VIVDS DETECTION DEVICE
- ⊟ PROPOSED VIVDS DETECTION DEVICE
- ⊠ EXISTING ANTENNA
- ⊡ EXISTING WIRELESS RADIO
- EXISTING GROUND BOX
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- ▣ PROPOSED TYPE 1 ITS GROUND BOX W/ APRON
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- ▣ EXISTING POLE MOUNTED CONTROLLER CABINET
- ▤ PROPOSED GROUND MOUNTED CONTROLLER CABINET
- ⊔ EXISTING SIGN ON POST
- PROPOSED LOOP DETECTION
- - - EXISTING CONDUIT (TRENCH)
- - - PROPOSED CONDUIT (TRENCH)
- ▬ PROPOSED CONDUIT (BORE)
- ▭ PROPOSED CONDUIT (RIGID METAL)
- ↔ DIRECTION OF TRAFFIC

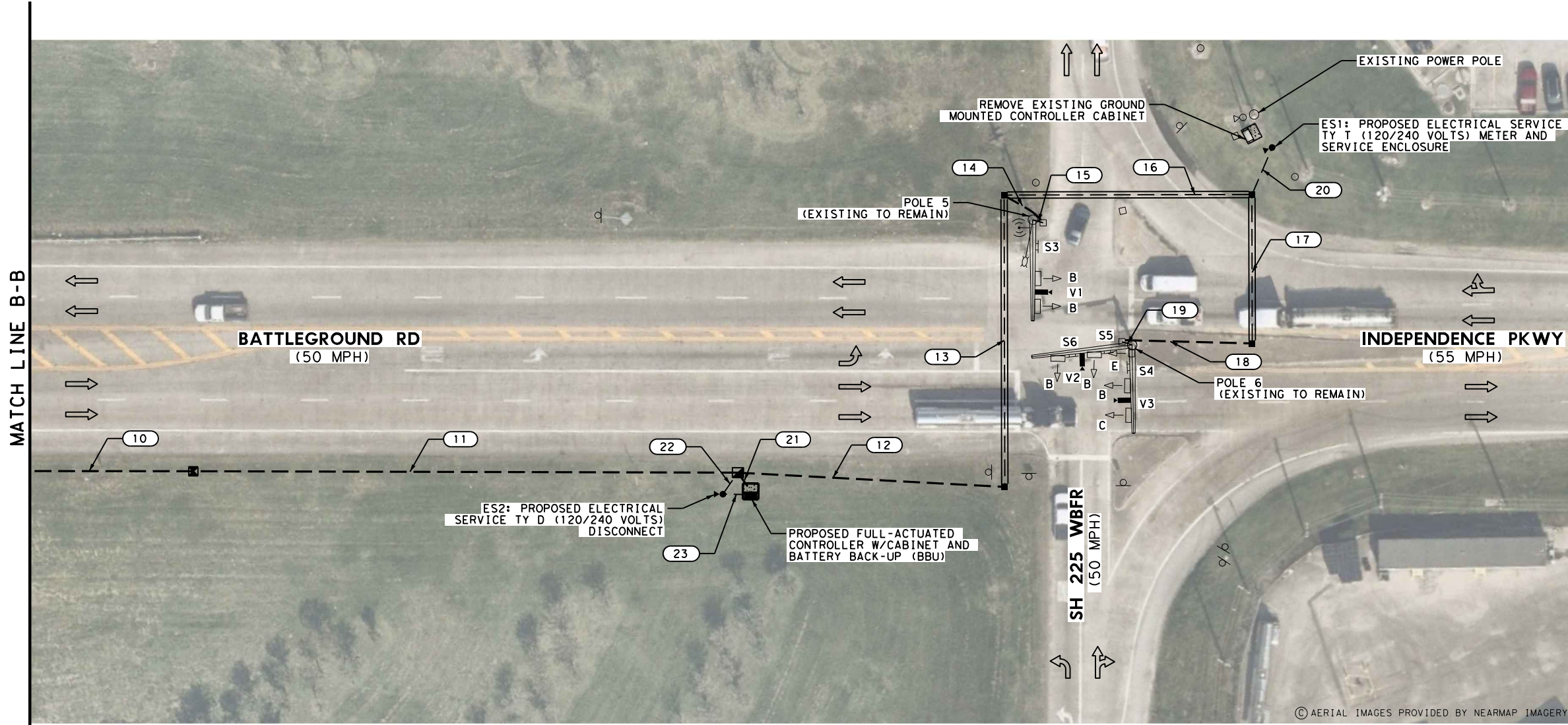


SH 225
TRAFFIC SIGNAL
MODIFICATION LAYOUT

SH 225 AT BATTLEGROUND RD/
 INDEPENDENCE PKWY

SHEET 2 OF 3

FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
6	-	SH 225
STATE	DIST.	COUNTY
TEXAS	HOU	HARRIS
CONT.	SECT.	JOB
0502	01	237
		SHEET NO.
		019



MATCH LINE B-B

NOTES

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4. ALL WORK MUST BE PERFORMED WITHIN TxDOT RIGHT OF WAY.
5. SIGN MAINTENANCE NEEDS TO BE PERFORMED TO REPLACE DAMAGED SIGNS. THIS WORK SHALL BE SUBSIDIARY TO ITEM 680.
6. EXISTING WIRELESS RADIO EQUIPMENT FOR SIGNAL COMMUNICATION TO BE REMOVED BY CONTRACTOR.
7. REFER TO COMPUTERIZED TRANSPORTATION MANAGEMENT SYSTEM LAYOUT SHEETS FOR INFORMATION AND DETAILS REGARDING FIBER CONNECTIVITY.

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2. INSTALL NEW SIGNAL EQUIPMENT AS SHOWN IN THE PLANS.
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4. CONTRACTOR TO CONNECT PROPOSED SIGNAL CABLES TO TERMINAL BLOCK. EXISTING SIGNAL CABLES FROM TERMINAL BLOCK TO SIGNAL HEADS TO BE REUSED.
5. DISCONNECT EXISTING WIRING AND CONNECT NEW WIRING TO SIGNAL DISPLAYS AT BOTH SH 225 EBFR AND SH 225 WBFR AT THE SAME TIME.
6. ACTIVATE SIGNAL OPERATIONS USING NEW SIGNAL CABINET.
7. REMOVE OLD EQUIPMENT.

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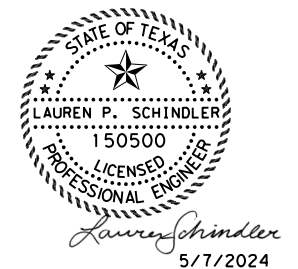
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CONDUIT AND CONDUCTOR RUNS																							
RUN NO.	CONDUIT (618)											CONDUCTORS (620)				TRAY CABLE (621)		CABLES (684)		VIVDS (6306)			
	PVC											RMC		POWER	GROUND	LUMINAIRE	SIGNAL	VIVDS					
	2" (SCHD 80)				3" (SCHD 80)				4" (SCHD 80)			3"	#4 INSULATED	#8 BARE	#12/4C Tray Cable	#12/7C	#12/3C						
	(6046)		(6047)		(6053)		(6054)		(6058)			(6074)		(6012)		(6005)		(6012)		(6007)			
	NO.	TRENCH	NO.	BORE	NO.	TRENCH	NO.	BORE	NO.	TRENCH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	
EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF		
1																		1	45	3	45	1	45
2																		1	35	2	35	1	35
3																				2	65		
4																				1	30		
5																		1	60			1	60
6																		1	35	1	35	1	35
7										1	50			1	50	2	50	4	50	3	50		
8							1	225						1	225	2	225	4	225	3	225		
9							1	75						1	75	2	75	4	75	3	75		
10							1	225						1	225	2	225	4	225	3	225		
11							1	220						1	220	2	220	4	220	3	220		
12	1	110					1	110						2	110	2	110	1	110	4	110	3	110
13				1	115			1	115					2	115	2	115	1	115	4	115	3	115
14							1	20						1	20	1	20	1	20	1	20	1	20
15																		1	10	1	10	1	10
16				1	100			1	100					2	100	2	100			3	100	2	100
17								1	60					1	60					3	60	2	60
18							1	50						1	50					3	50	2	50
19																		1	10			3	10
20	1	25												2	25	1	25						
21										1	15									8	15	6	15
22	1	15												2	15	1	15	3	15				
23	1	15												2	15	1	15						
POLE 1																		2	30	4	30	3	30
POLE 5																		1	30			1	20
MA 5																						1	32
POLE 6																						2	20
MA 6a																						1	32
MA 6b																						1	28
TOTAL (LF)		165		215		625		575		15	50		760		1665		2155		5410				4037
EST. TOTAL		175		230		660		605		20	55		800		1750		2265		5685				4240

VEHICLE DETECTOR CHART			
CAMERA	APPROACH	TYPE	MOUNTING LOCATION
V1	SOUTHBOUND	PRESENCE	POLE 5
V2	WESTBOUND	PRESENCE	POLE 6
V3	NORTHBOUND	PRESENCE	POLE 6
* E1	EASTBOUND	PRESENCE	POLE 1
* E2	SOUTHBOUND	PRESENCE	POLE 2
* E3	NORTHBOUND	PRESENCE	POLE 4

* EXISTING VIVDS INFORMATION PROVIDED FOR CONTRACTOR REFERENCE ONLY

POLE SCHEDULE	
POLE ID	DESCRIPTION
POLE 1	EXISTING STEEL POLE (TO REMAIN) AND VIVDS (TO REMAIN)
POLE 2	EXISTING STEEL POLE W/ LUMINARE (TO REMAIN) AND VIVDS (TO REMAIN)
POLE 3	EXISTING STEEL POLE (TO REMAIN) AND POLE MOUNTED CABINET (TO BE REMOVED)
POLE 4	EXISTING STEEL POLE W/ LUMINARE (TO REMAIN), POLE MOUNTED CONTROLLER CABINET (TO BE REMOVED), WIRELESS RADIO (TO BE REMOVED), AND VIVDS (TO REMAIN)
POLE 5	EXISTING MAST ARM POLE W/ LUMINARE (TO REMAIN), EXISTING WIRELESS RADIO (TO BE REMOVED), AND PROPOSED VIVDS (1 EA)
POLE 6	EXISTING DUAL MAST ARM POLE (TO REMAIN) AND PROPOSED VIVDS (2 EA)

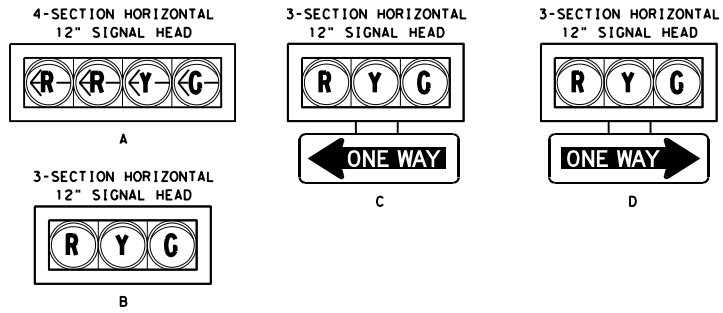


ELECTRICAL SERVICE DATA											
ELEC. SERVICE ID	ELECTRICAL SERVICE DESCRIPTION (SEE ED (5, 6, 7) -14)	SERVICE CONDUIT SIZE (RMC)	SERVICE CONDUCTORS NO./SIZE	SAFETY SWITCH AMPS	MAIN DISCONNECT CKT. BRK. POLE/AMP	TWO-POLE CONTACTOR AMPS	PANELBD./LOADC ENTER AMP RATING (MIN)	CIRCUIT NO.	BRANCH CKT. BRK. POLE/AMPS	BRANCH CIRCUIT AMPS	KVA LOAD
ES1	TY T (120/240) 000 (NS) GS (N) TP (O)	1 1/4	3/ #6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ES2	TY D (120/240) 070 (NS) SS (E) SP (U)	1 1/4	3/ #6	N/A	2P/70	30	100	T. S.	1P/50	30	5
								LIGHTING	2P/20	8	

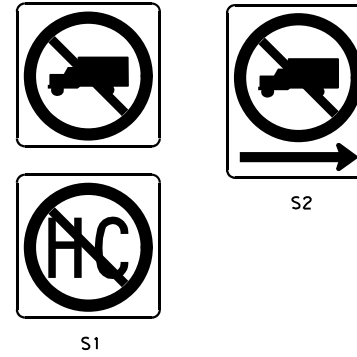
Kimley Horn F-928
 Texas Department of Transportation © 2024
SH 225
TRAFFIC SIGNAL MODIFICATION DETAILS
 SH 225 AT BATTLEGROUND RD/ INDEPENDENCE PKWY
 SHEET 3 OF 3
 FEDERAL AID PROJECT NO. - HIGHWAY NO. SH 225
 STATE TEXAS DIST. HOU COUNTY HARRIS SHEET NO. 020
 CONT. 0502 SECT. 01 JOB 237

FILENAME: K:\HOU\TPT\068928203 - TxDOT HOU TRF WA 3 Misc Study-Signal-FOVTask 3 - FO Design\CADD\Sheets\109a_TRF_Sens (Sheet 1 of 2).dgn
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EXISTING TRAFFIC SIGNAL HEADS

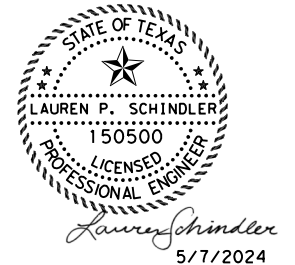
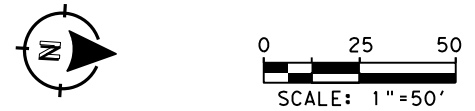


EXISTING SIGNS



LEGEND

- EXISTING SIGNAL POLE WITH SPAN WIRE
- EXISTING SIGNAL POLE W/ MAST ARM
- ⊗ EXISTING LUMINAIRE
- ⊔ EXISTING HORIZONTAL SIGNAL HEAD
- ⊔ EXISTING VERTICAL SIGNAL HEAD
- ⊔ EXISTING OVERHEAD SIGN
- ⊔ EXISTING VIVDS DETECTION DEVICE
- ⊔ PROPOSED VIVDS DETECTION DEVICE
- ⊔ EXISTING ANTENNA
- ⊔ EXISTING WIRELESS RADIO
- EXISTING GROUND BOX
- PROPOSED TYPE D GROUND BOX W/ APRON
- PROPOSED TYPE 1 ITS GROUND BOX W/ APRON
- PROPOSED TYPE 2 ITS GROUND BOX W/ APRON
- ⊗ EXISTING SERVICE METER AND DISCONNECT
- ⊗ PROPOSED SERVICE METER AND DISCONNECT
- ⊔ EXISTING GROUND MOUNTED CONTROLLER CABINET
- ⊔ EXISTING POLE MOUNTED CONTROLLER CABINET
- ⊔ PROPOSED GROUND MOUNTED CONTROLLER CABINET
- ⊔ EXISTING SIGN ON POST
- PROPOSED LOOP DETECTION
- - - EXISTING CONDUIT (TRENCH)
- - - PROPOSED CONDUIT (TRENCH)
- ▬ PROPOSED CONDUIT (BORE)
- ▬ PROPOSED CONDUIT (RIGID METAL)
- ➔ DIRECTION OF TRAFFIC

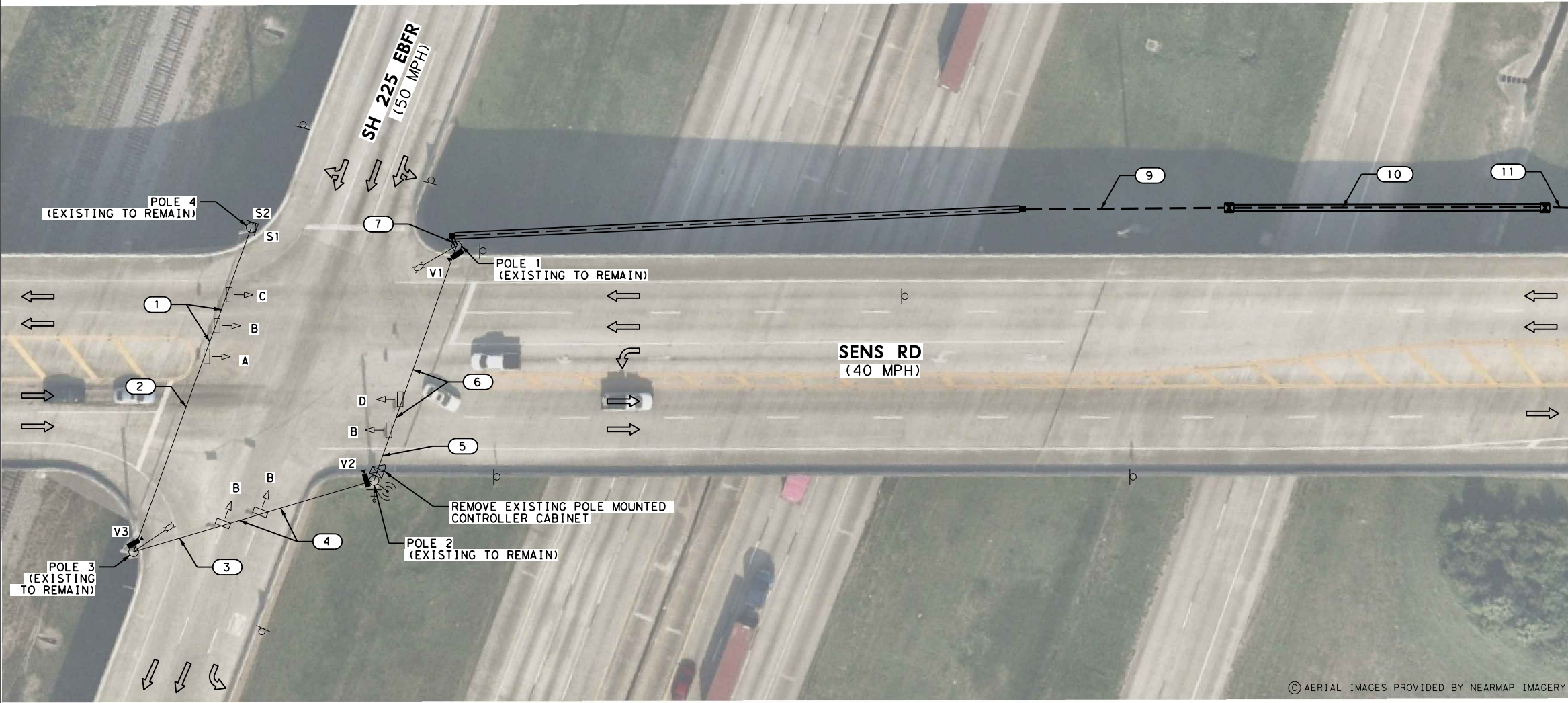


SH 225
TRAFFIC SIGNAL
MODIFICATION LAYOUT

SH 225 AT SENS RD

SHEET 1 OF 3

FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.	
6	-	SH 225	
STATE	DIST.	COUNTY	
TEXAS	HOU	HARRIS	
CONT.	SECT.	JOB	
0502	01	237	
			SHEET NO.
			021



MATCH LINE C-C

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NOTES

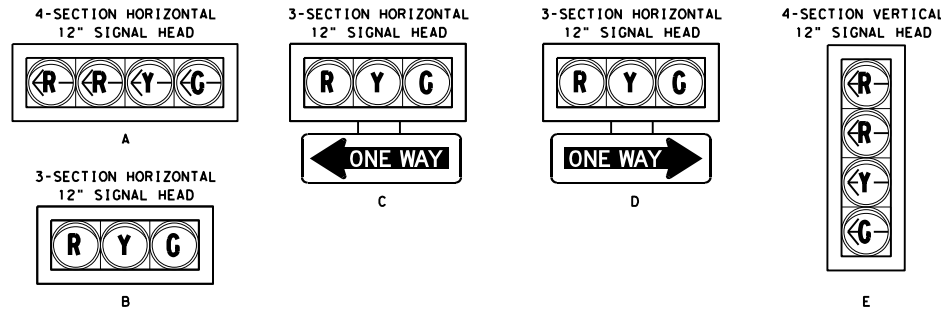
1. LOCATIONS OF UNDERGROUND INSTALLATIONS AND RIGHT OF WAY ARE APPROXIMATE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY ALL UNDERGROUND INSTALLATIONS AND RIGHT OF WAY LOCATIONS PRIOR TO ANY CONSTRUCTION.
2. THE CONTRACTOR SHALL CONTACT PUBLIC AND PRIVATE UTILITIES FOR LOCATION OF UNDERGROUND FACILITIES AT LEAST 48 HOURS PRIOR TO ANY DRILLING, BORING, TRENCHING, OR EXCAVATING.
3. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE THESE UTILITIES, WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD.
4. ALL WORK MUST BE PERFORMED WITHIN TxDOT RIGHT OF WAY.
5. SIGN MAINTENANCE NEEDS TO BE PERFORMED TO REPLACE DAMAGED SIGNS. THIS WORK SHALL BE SUBSIDIARY TO ITEM 680.
6. EXISTING WIRELESS RADIO EQUIPMENT FOR SIGNAL COMMUNICATION TO BE REMOVED BY CONTRACTOR.
7. REFER TO COMPUTERIZED TRANSPORTATION MANAGEMENT SYSTEM LAYOUT SHEETS FOR INFORMATION AND DETAILS REGARDING FIBER CONNECTIVITY.

SEQUENCE OF CONSTRUCTION

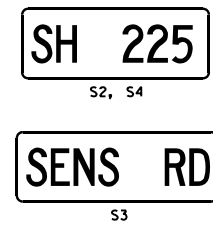
1. CONTRACTOR SHALL ENSURE EXISTING TRAFFIC SIGNALS REMAIN OPERATIONAL DURING INSTALLATION OF NEW EQUIPMENT.
2. INSTALL NEW SIGNAL EQUIPMENT AS SHOWN IN THE PLANS.
3. INSTALL NEW WIRING TO EXISTING SIGNAL DISPLAYS ON SPAN WIRE WHILE KEEPING EXISTING SIGNAL OPERATIONAL.
4. DISCONNECT EXISTING WIRING AND CONNECT NEW WIRING TO SIGNAL DISPLAYS AT BOTH SH 225 EBFR AND SH 225 WBFR AT THE SAME TIME.
5. ACTIVATE SIGNAL OPERATIONS USING NEW SIGNAL CABINET.
6. REMOVE OLD EQUIPMENT.

FILENAME: K:\HOU\TPT\068928203 - TxDOT HOU TRF WA 3 Misc Study-Signal-FOV\Task 3 - FO Design\CADD\Sheets\109b_TRF_Sens (Sheet 2 of 2).dgn
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EXISTING TRAFFIC SIGNAL HEADS

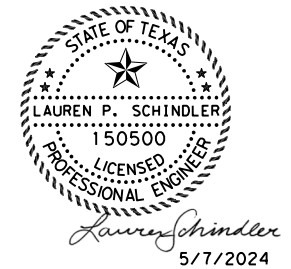
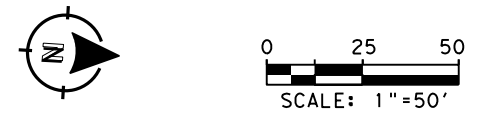


EXISTING SIGNS



LEGEND

- EXISTING SIGNAL POLE WITH SPAN WIRE
- EXISTING SIGNAL POLE W/ MAST ARM
- EXISTING LUMINAIRE
- EXISTING HORIZONTAL SIGNAL HEAD
- EXISTING VERTICAL SIGNAL HEAD
- EXISTING OVERHEAD SIGN
- EXISTING VIVDS DETECTION DEVICE
- PROPOSED VIVDS DETECTION DEVICE
- EXISTING ANTENNA
- EXISTING WIRELESS RADIO
- EXISTING GROUND BOX
- PROPOSED TYPE D GROUND BOX W/ APRON
- PROPOSED TYPE 1 ITS GROUND BOX W/ APRON
- PROPOSED TYPE 2 ITS GROUND BOX W/ APRON
- EXISTING SERVICE METER AND DISCONNECT
- PROPOSED SERVICE METER AND DISCONNECT
- EXISTING GROUND MOUNTED CONTROLLER CABINET
- EXISTING POLE MOUNTED CONTROLLER CABINET
- PROPOSED GROUND MOUNTED CONTROLLER CABINET
- EXISTING SIGN ON POST
- PROPOSED LOOP DETECTION
- EXISTING CONDUIT (TRENCH)
- PROPOSED CONDUIT (TRENCH)
- PROPOSED CONDUIT (BORE)
- PROPOSED CONDUIT (RIGID METAL)
- DIRECTION OF TRAFFIC



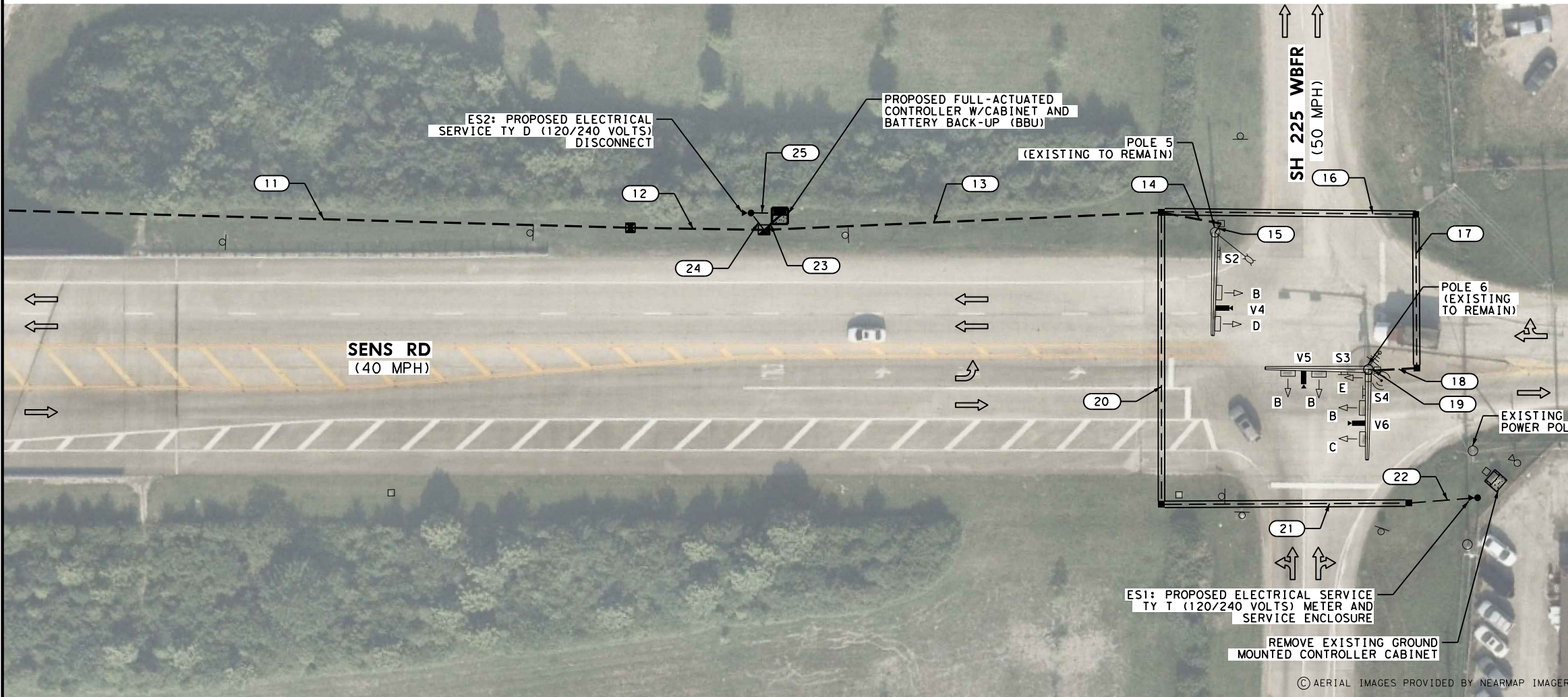
SH 225
TRAFFIC SIGNAL
MODIFICATION LAYOUT

SH 225 AT SENS RD

SHEET 2 OF 3

FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
6	-	SH 225
STATE	DIST.	COUNTY
TEXAS	HOU	HARRIS
CONT.	SECT.	JOB
0502	01	237
		SHEET NO.
		022

MATCH LINE C-C



NOTES

1. LOCATIONS OF UNDERGROUND INSTALLATIONS AND RIGHT OF WAY ARE APPROXIMATE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY ALL UNDERGROUND INSTALLATIONS AND RIGHT OF WAY LOCATIONS PRIOR TO ANY CONSTRUCTION.
2. THE CONTRACTOR SHALL CONTACT PUBLIC AND PRIVATE UTILITIES FOR LOCATION OF UNDERGROUND FACILITIES AT LEAST 48 HOURS PRIOR TO ANY DRILLING, BORING, TRENCHING, OR EXCAVATING.
3. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE THESE UTILITIES, WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD.
4. ALL WORK MUST BE PERFORMED WITHIN TxDOT RIGHT OF WAY.
5. SIGN MAINTENANCE NEEDS TO BE PERFORMED TO REPLACE DAMAGED SIGNS. THIS WORK SHALL BE SUBSIDIARY TO ITEM 680.
6. EXISTING WIRELESS RADIO EQUIPMENT FOR SIGNAL COMMUNICATION TO BE REMOVED BY CONTRACTOR.
7. REFER TO COMPUTERIZED TRANSPORTATION MANAGEMENT SYSTEM LAYOUT SHEETS FOR INFORMATION AND DETAILS REGARDING FIBER CONNECTIVITY.

SEQUENCE OF CONSTRUCTION

1. CONTRACTOR SHALL ENSURE EXISTING TRAFFIC SIGNALS REMAIN OPERATIONAL DURING INSTALLATION OF NEW EQUIPMENT.
2. INSTALL NEW SIGNAL EQUIPMENT AS SHOWN IN THE PLANS.
3. INSTALL NEW WIRING TO EXISTING SIGNAL DISPLAYS ON MAST ARM WHILE KEEPING EXISTING SIGNAL OPERATIONAL.
4. CONTRACTOR TO CONNECT PROPOSED SIGNAL CABLES TO TERMINAL BLOCK. EXISTING SIGNAL CABLES FROM TERMINAL BLOCK TO SIGNAL HEADS TO BE REUSED.
5. DISCONNECT EXISTING WIRING AND CONNECT NEW WIRING TO SIGNAL DISPLAYS AT BOTH SH 225 EBFR AND SH 225 WBFR AT THE SAME TIME.
6. ACTIVATE SIGNAL OPERATIONS USING NEW SIGNAL CABINET.
7. REMOVE OLD EQUIPMENT.

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FILENAME: K:\HOU\TPT\068928203 - TxDOT HOU TRF WA 3 Misc Study-Signal-FOVTask 3 - FO Design\CADD\Sheets\109c_TRF_Sens Traffic Details.dgn
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CONDUIT AND CONDUCTOR RUNS																				
RUN NO.	CONDUIT (618)												CONDUCTORS (620)				TRAY CABLE (621)	CABLES (684)	VIVDS (6306)	
	PVC												RMC	POWER	GROUND	LUMINAIRE	SIGNAL	VIVDS		
	2" (SCHD 80)				3" (SCHD 80)				4" (SCHD 80)		3"	#4 INSULATED	#8 BARE	#12/4C Tray Cable	#12/7C	#12/3C				
	(6046)		(6047)		(6053)		(6054)		(6058)		(6074)		(6012)		(6005)		(6012)		(6007)	
	NO.	TRENCH	NO.	BORE	NO.	TRENCH	NO.	BORE	NO.	TRENCH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH
EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	EA	LF	
1																		1	30	
2																		2	80	
3														1	35	2	35	1	35	
4														1	65	3	65	1	65	
5														1	25	3	25	2	25	
6														1	75	4	75	2	75	
7									1	50				1	50	2	50	4	50	
8							1	220						1	220	2	220	4	220	
9					1	80								1	80	2	80	4	80	
10							1	120						1	120	2	120	4	120	
11					1	255								1	255	2	225	4	255	
12					1	55								1	55	2	55	4	55	
13	1	170			1	170						2	170	2	170	1	170	4	170	
14					1	10								1	10	1	10	1	10	
15					EXISTING										1	5	1	5	1	5
16							1	100						1	100			3	100	
17							1	60						1	60			3	60	
18					1	20								1	20			3	20	
19					EXISTING										1	5			3	5
20			1	115								2	115	1	115					
21			1	100								2	100	1	100					
22	1	30										2	30	1	30					
23									1	10				1	10			8	10	
24	1	15												1	15	3	15			
25	1	15										2	15	1	15					
POLE 1														2	30	4	30	3	30	
POLE 5														1	30			1	20	
MA 5																		1	30	
POLE 6																		2	20	
MA 6A																		1	20	
MA 6B																		1	20	
TOTAL (LF)		230		215		590		500		10	50		860		1605		2020		5400	
EST. TOTAL		245		230		620		525		15	55		905		1690		2125		5670	

VEHICLE DETECTOR CHART			
CAMERA	APPROACH	TYPE	MOUNTING LOCATION
V1	NORTHBOUND	PRESENCE	POLE 1
V2	EASTBOUND	PRESENCE	POLE 2
V3	SOUTHBOUND	PRESENCE	POLE 3
V4	SOUTHBOUND	PRESENCE	POLE 5
V5	WESTBOUND	PRESENCE	POLE 6
V6	NORTHBOUND	PRESENCE	POLE 6

POLE SCHEDULE	
POLE ID	DESCRIPTION
POLE 1	EXISTING STEEL POLE W/ LUMINAIRE (TO REMAIN) AND PROPOSED VIVDS (1 EA)
POLE 2	EXISTING STEEL POLE (TO REMAIN), POLE MOUNTED CONTROLLER CABINET (TO BE REMOVED), WIRELESS RADIO AND ANTENNA (TO BE REMOVED), AND PROPOSED VIVDS (1 EA)
POLE 3	EXISTING STEEL POLE W/ LUMINAIRE (TO REMAIN) AND PROPOSED VIVDS (1 EA)
POLE 4	EXISTING STEEL POLE (TO REMAIN)
POLE 5	EXISTING MAST ARM POLE W/ LUMINAIRE (TO REMAIN) AND PROPOSED VIVDS (1 EA)
POLE 6	EXISTING DUAL MAST ARM POLE (TO REMAIN), WIRELESS RADIO AND ANTENNA (TO BE REMOVED), AND PROPOSED VIVDS (2 EA)



ELECTRICAL SERVICE DATA											
ELEC. SERVICE ID	ELECTRICAL SERVICE DESCRIPTION (SEE ED (5, 6, 7) -14)	SERVICE CONDUIT SIZE (RMC)	SERVICE CONDUCTORS NO./SIZE	SAFETY SWITCH AMPS	MAIN DISCONNECT CKT. BRK. POLE/AMP	TWO-POLE CONTACTOR AMPS	PANELBD./LOADC ENTER AMP RATING (MIN)	CIRCUIT NO.	BRANCH CKT. BRK. POLE/AMPS	BRANCH CIRCUIT AMPS	KVA LOAD
ES1	TY T (120/240) 000 (NS) GS (N) TP (O)	1 1/4	3/ #6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ES2	TY D (120/240) 070 (NS) SS (E) SP (U)	1 1/4	3/ #6	N/A	2P/70	30	100	T. S.	1P/50	30	5
								LIGHTING	2P/20	8	



Kimley-Horn F-928

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SH 225

TRAFFIC SIGNAL MODIFICATION DETAILS

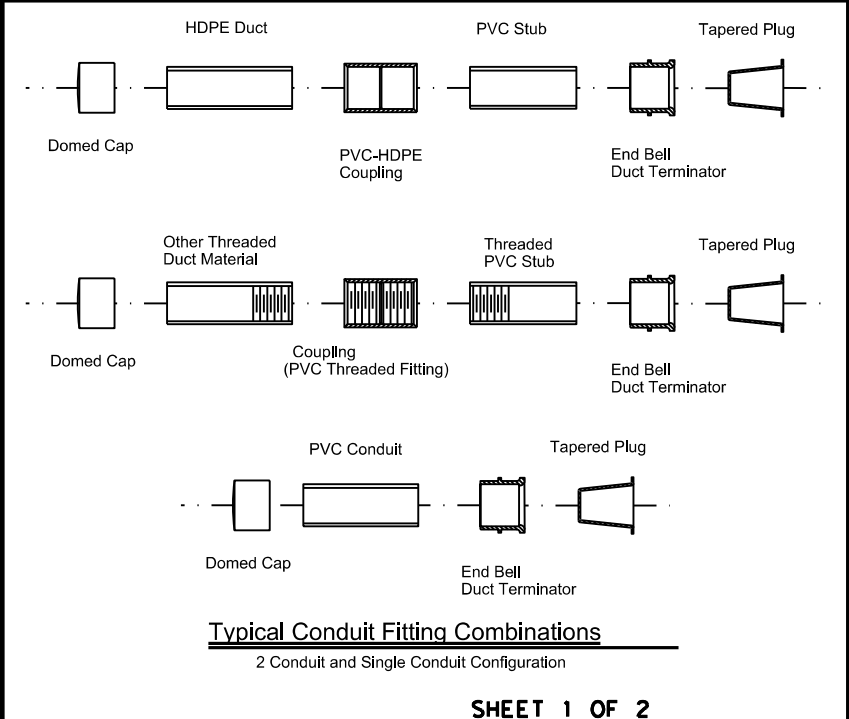
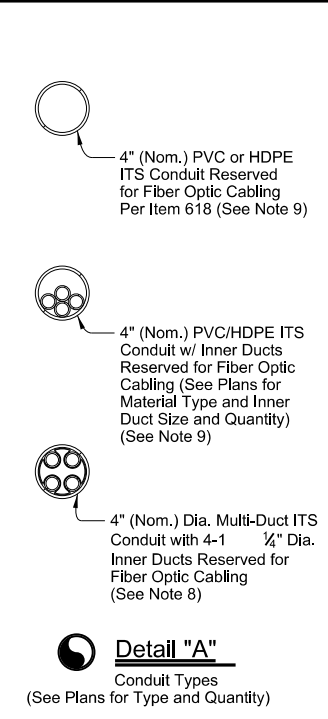
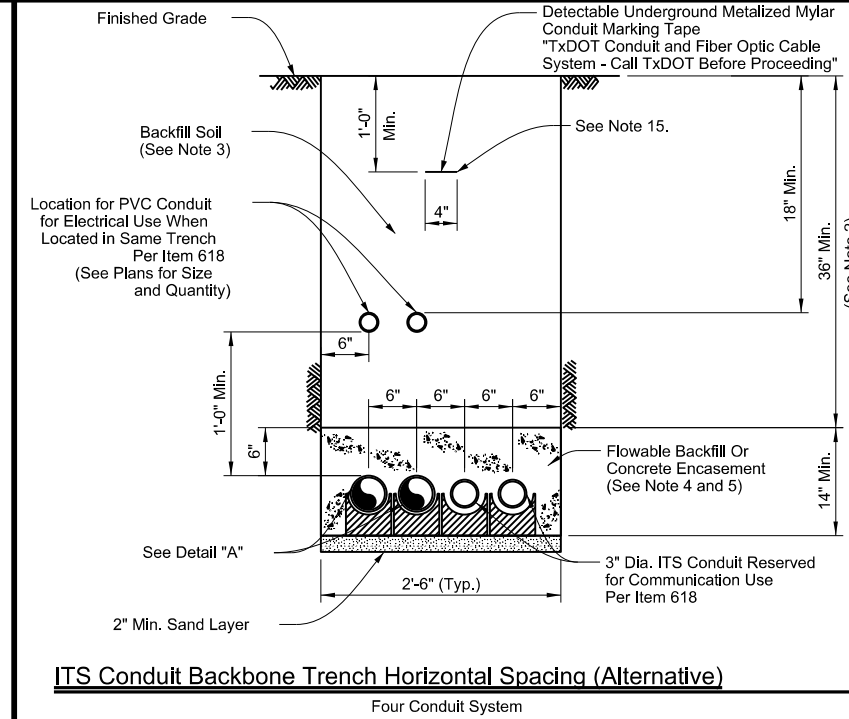
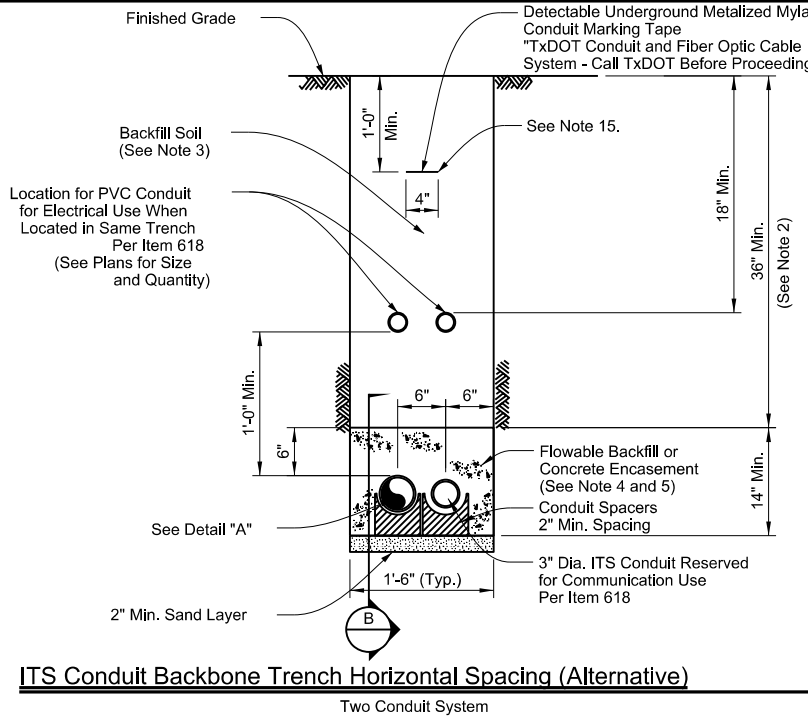
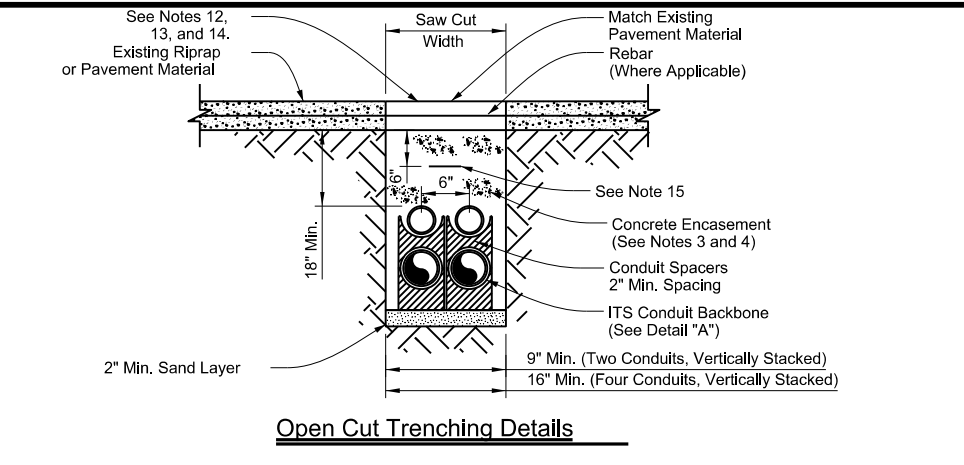
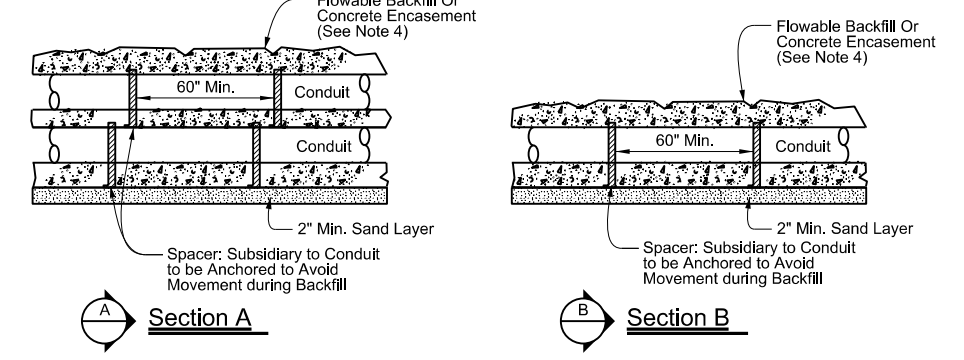
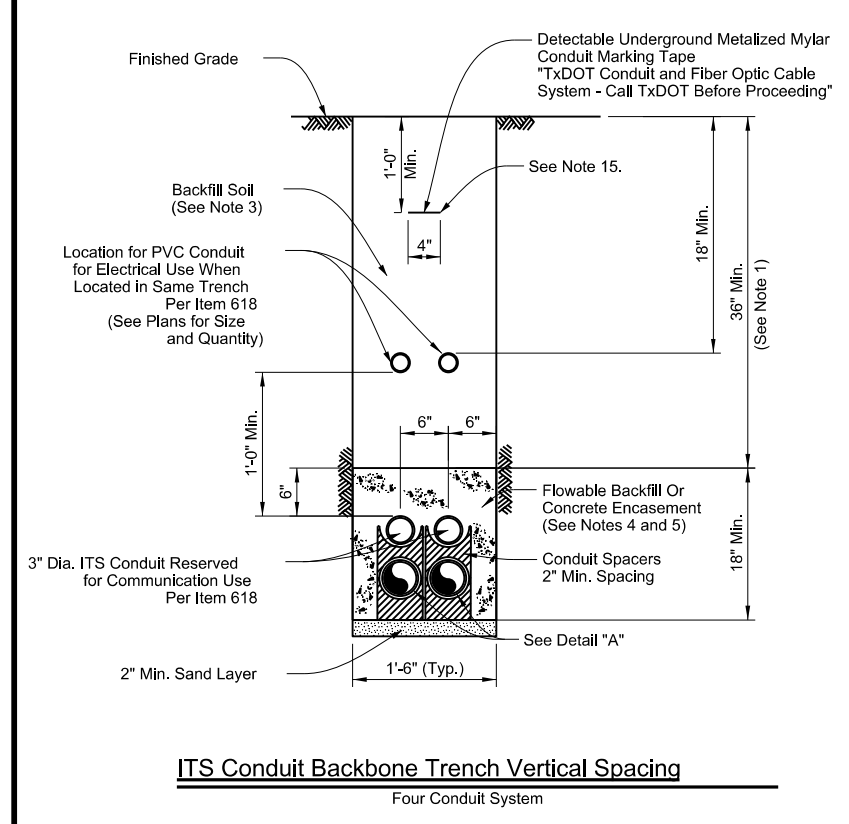
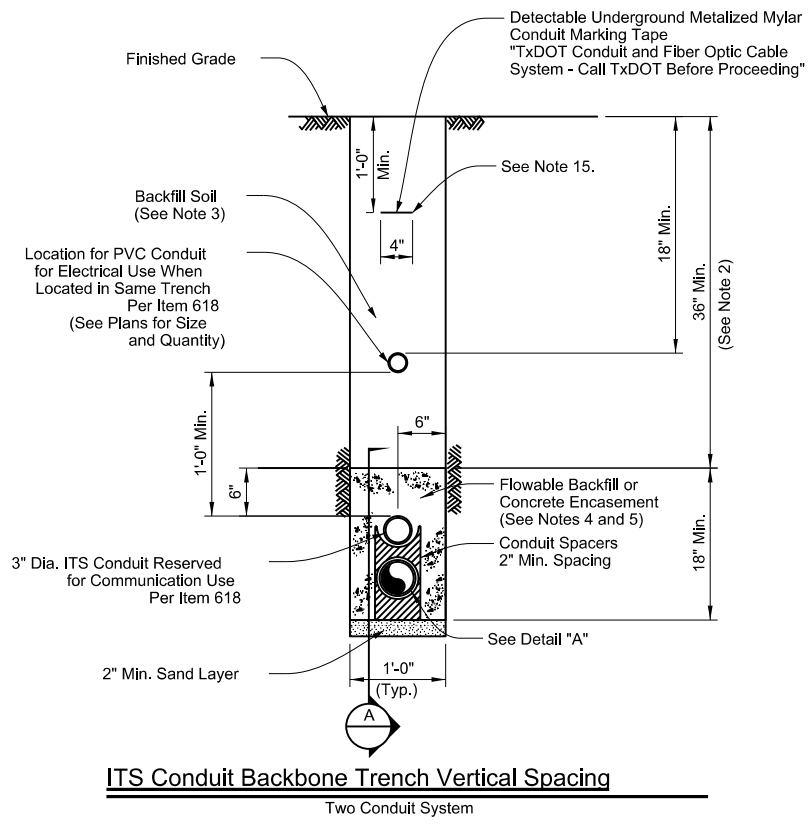
SH 225 AT SENS RD

SHEET 3 OF 3

FED. RD. DIV. NO.	FEDERAL AID PROJECT NO.	HIGHWAY NO.
6	-	SH 225
STATE	DIST.	COUNTY
TEXAS	HOU	HARRIS
CONT.	SECT.	JOB
0502	01	237

SHEET NO. 023

DATE: 5/7/2024 3:04:18 PM
 FILE: K:\HOU_TPT\068928203 - TxDOT_HOU TRF WA 3 Mi.sc Study-Signal-FON\Task of the 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 into a standard for use in any other project or for any damages resulting from its use.



- General Notes:**
- Construct the ITS conduit backbone system by vertically spacing conduit, unless field constraints, obstructions, or utility conflicts require horizontal spacing of conduits. Both vertical and horizontal spacing configurations have been detailed for contractor information for construction.
 - Install ITS conduit backbone system a minimum of 42 inches from finished grade to the top of the conduit unless otherwise directed or to avoid conflicts or field conditions such as utilities or obstructions. Vary depth of the trench in order to pass over/under any existing utilities. Refer to ITS Conduit Obstruction Crossing Standard ITS(35) for further detail.
 - Perform trench excavation and backfilling in accordance with Item 400, "Excavation and Backfill for Structures."
 - When a trench depth greater than 24 inches can be achieved from the finished grade to the top of ITS conduit, encase the conduits with flowable backfill in accordance with Item 401, "Flowable Backfill." Use Class B concrete as a substitute in accordance with Item 421, "Hydraulic Cement Concrete" at the discretion of the Engineer.
 - When a trench depth of less than 24 inches is required due to field conditions, encase the conduits in Class B concrete in accordance with Item 421, "Hydraulic Cement Concrete."
 - Concrete encasement will be paid for under Special Specification "ITS Multi-Duct Conduit" or as shown on the plans.
 - Provide ITS PVC conduit identified for electrical and communication use in accordance with Item 618, "Conduit."
 - Provide ITS multi-duct conduit identified for fiber optic communication use in accordance with Special Specification "ITS Multi-Duct Conduit."

- Conduit per Item 618, "Conduit" (See Plans for Material Type and Quantity).
- Provide a single 1/C #14 insulated wire in conduit runs which have been identified in the plans to carry fiber optic cable. Provide UL listed solid copper wire with orange color low density polyethylene insulation suitable for conduit installation rated for temperature range -20 C to 60 C and a voltage rating of 600V. This wire will serve as a tracer, or locate, wire for locating underground conduit containing fiber optic cabling and will be paid for under Item 620, "Electrical Conductors."
- Provide a flat pull cord in all empty conduits and innerducts. Provide a pull cord with a tensile strength of 1,250 Lbs. minimum and have foot markings to determine length installed. Pull cord and installation to be subsidiary to various bid items.
- Remove saw cut width to accommodate conduit installation.
- Replace rebar as necessary, lapped and tied a minimum of 3 inches to existing rebar.
- Replace broken pavement materials with similar materials to exact shape, and thickness of existing.
- Place marking tape a minimum of 1 foot - 0 inches below grade when no other electrical marking tape required, or 8 inches below electrical marking tape when provisioned under Item 618.
- Provide a 1/C #8 insulated grounding conductor within one inner duct of a pre-assembled multi-duct when no other grounding conductor is provisioned for in the plans.

SHEET 1 OF 2

Texas Department of Transportation
 Traffic Operations Division Standard

ITS CONDUIT TRENCH DETAILS

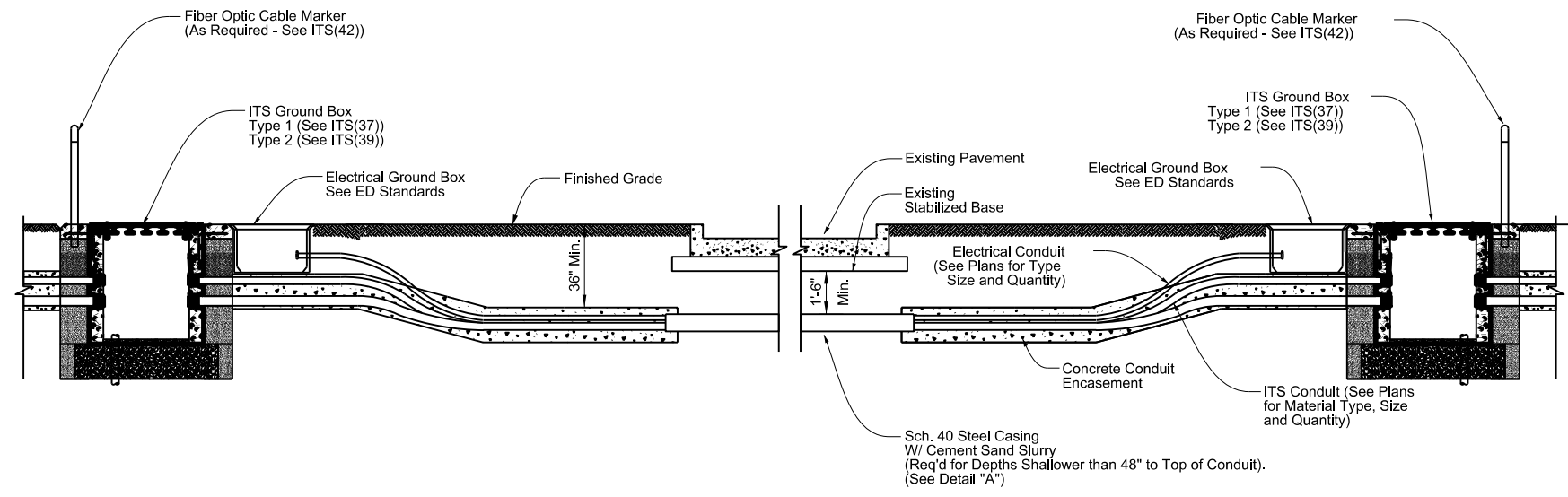
ITS(27)-16

FILE: its(27)-16.dgn	DW: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT FEBRUARY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	0502	01	237	SH 225
DIST	COUNTY		SHEET NO.	
HOU	HARRIS		024	

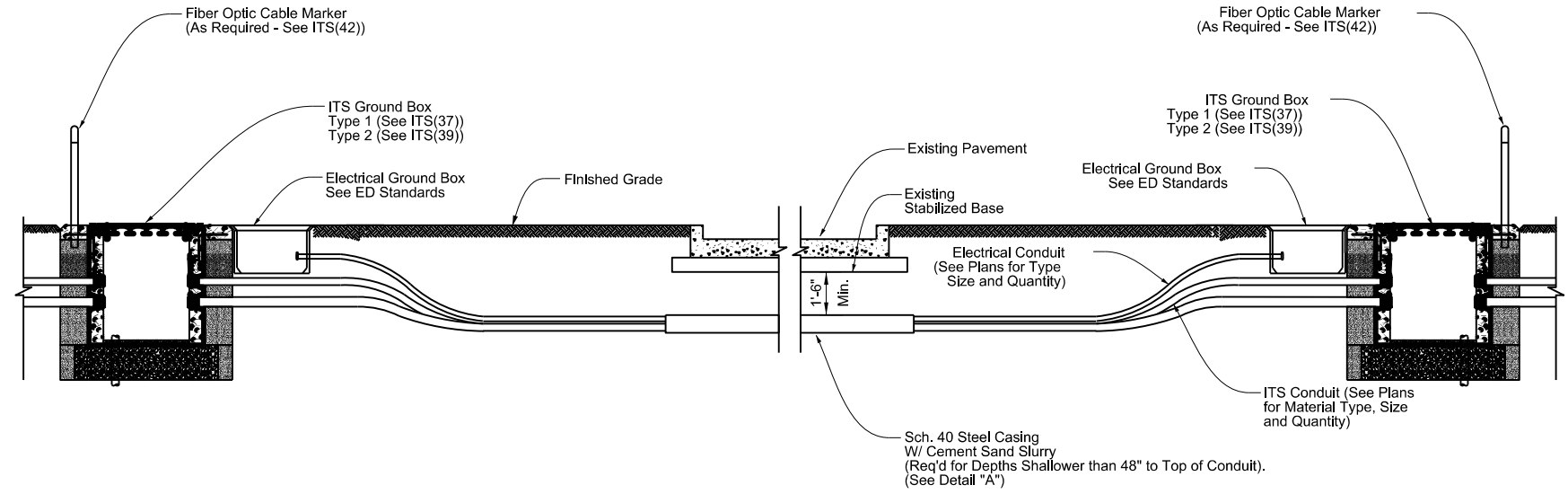
Sheet Details
 Not to Scale

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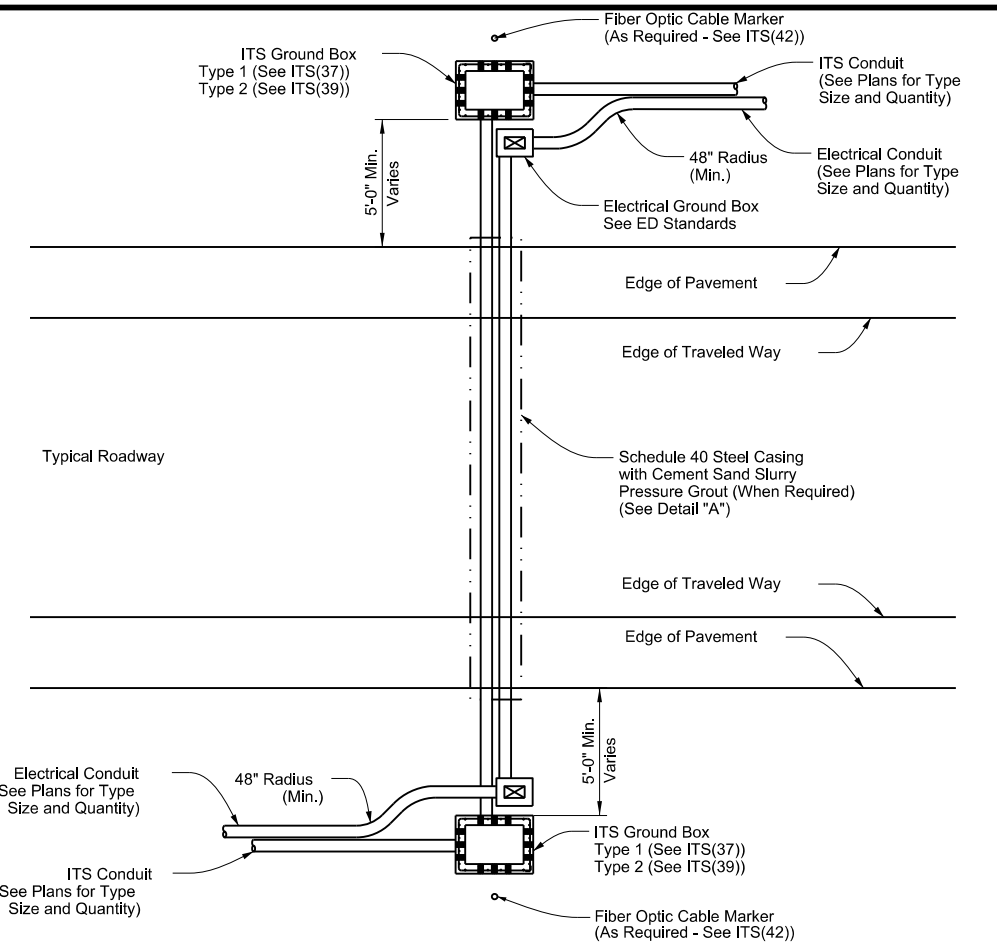
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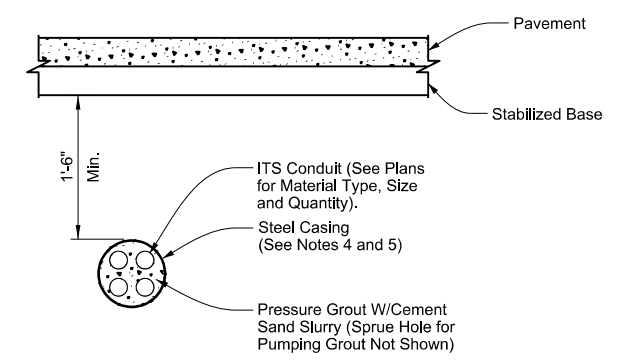
Typical Conduit Installation Jacking or Boring Beneath Existing Roadway



Typical Conduit Installation Jacking or Boring Beneath Existing Roadway (Where Concrete Encasement Not Required)



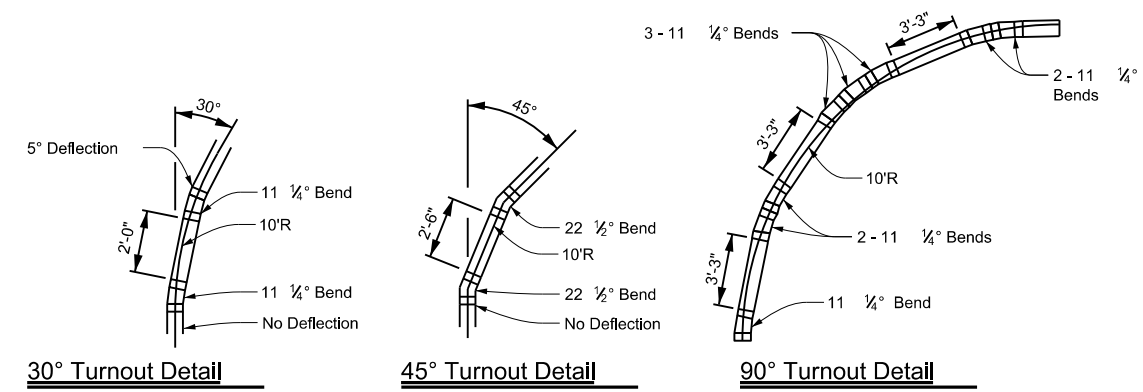
Bore Under Pavement



Steel Casing Detail "A"

General Notes:

1. Typical conduit installation details for jacking or boring beneath existing roadway is diagrammatic in nature. Roadway cross-slopes may vary for each crossing.
2. Jack or bore in accordance with Item 476, "Jacking, Boring, or Tunneling Pipe or Box" except for measurement and payment.
3. Furnishing and installation of pressure grouting will not be paid for directly but considered incidental to Special Specification "ITS Multi-Duct Conduit" or Item 618, "Conduit."
4. When boring under pavement shallower than 48 inches from finished grade to top of conduit, provide Schedule 40 steel casing under pavement to encase the conduit system. Provide steel casing of a size to accommodate ITS conduit and electrical conduit as shown in the plans. Provide a minimum 20 percent void space around all conduits. Steel casing will not be paid for directly but considered incidental to Special Specification, "ITS Multi-Duct Conduit" or Item 618, "Conduit."
5. When a depth greater than 48 inches can be achieved from finished grade to top of conduit, provide Schedule 80 PVC. No steel casing required unless otherwise directed.
6. Ensure all conduit bends are in conformance with the latest edition of the National Electrical Code.
7. Provide GPS coordinate points to the District for all ground boxes installed, and shifts or deviations of the conduit alignment from the plans required to avoid obstructions or utilities. Take GPS coordinate points at the start of the transition, at the point of curvature, and at the end of the transition at the point of tangency. Document the turnout radius and installed depth. Provide GPS coordinate points in NAD83 coordinate system and be accurate to 5 feet.



30° Turnout Detail

45° Turnout Detail

90° Turnout Detail

Provide this arrangement of conduit and fittings or approved equal at all 30°, 45°, and 90° bends, horizontal and vertical, to achieve a nominal 10' conduit radius for pre-assembled multi-duct conduit. See Note 7.

Sheet Details
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SHEET 2 OF 2



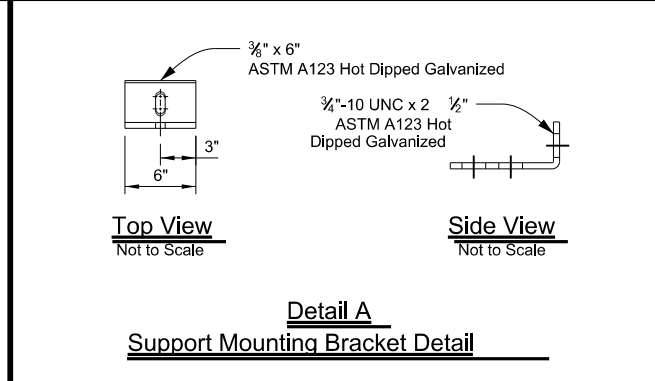
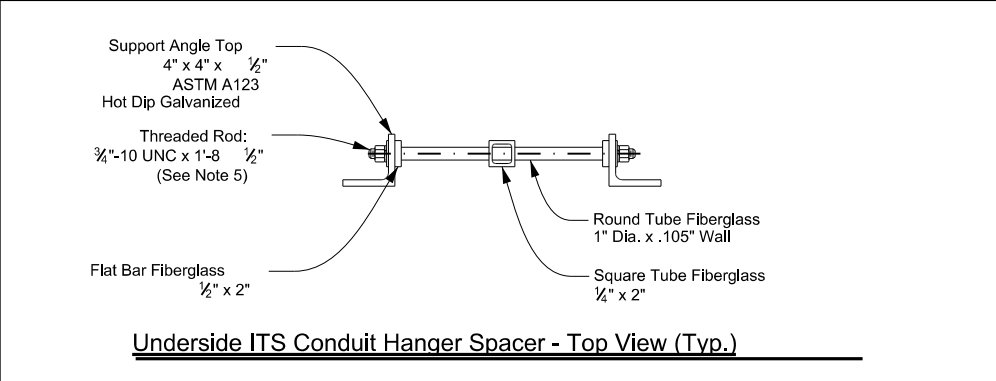
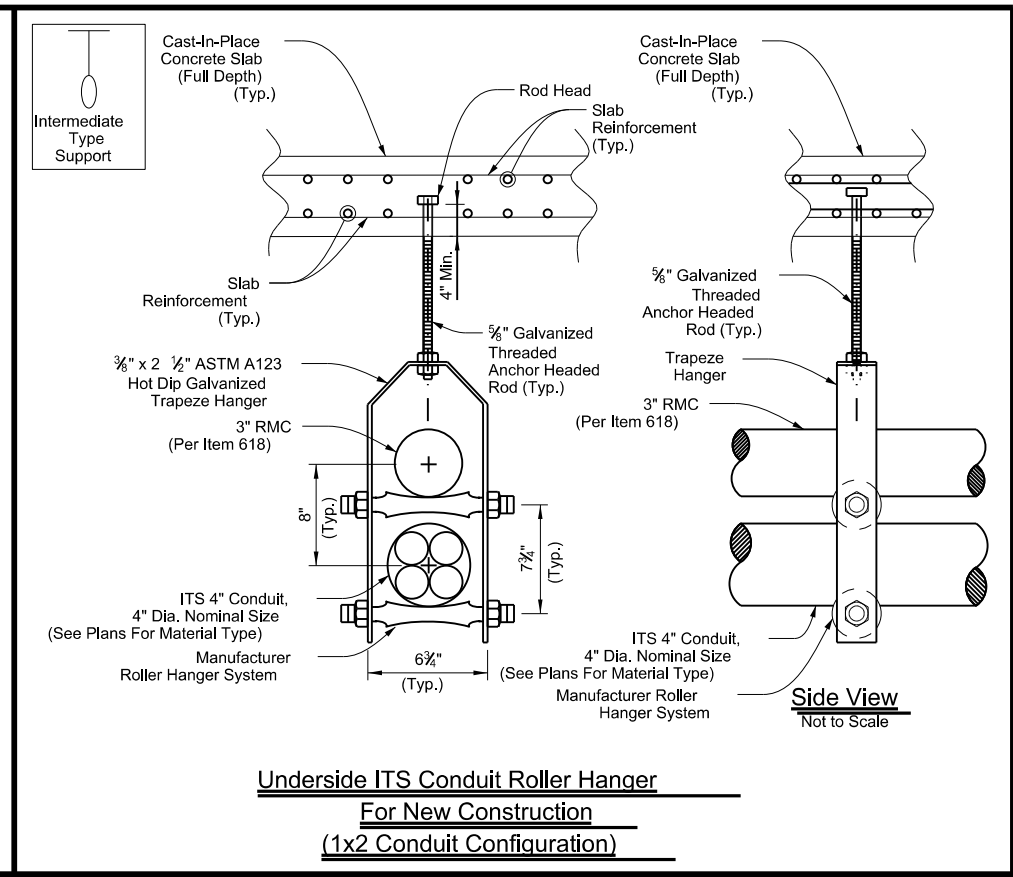
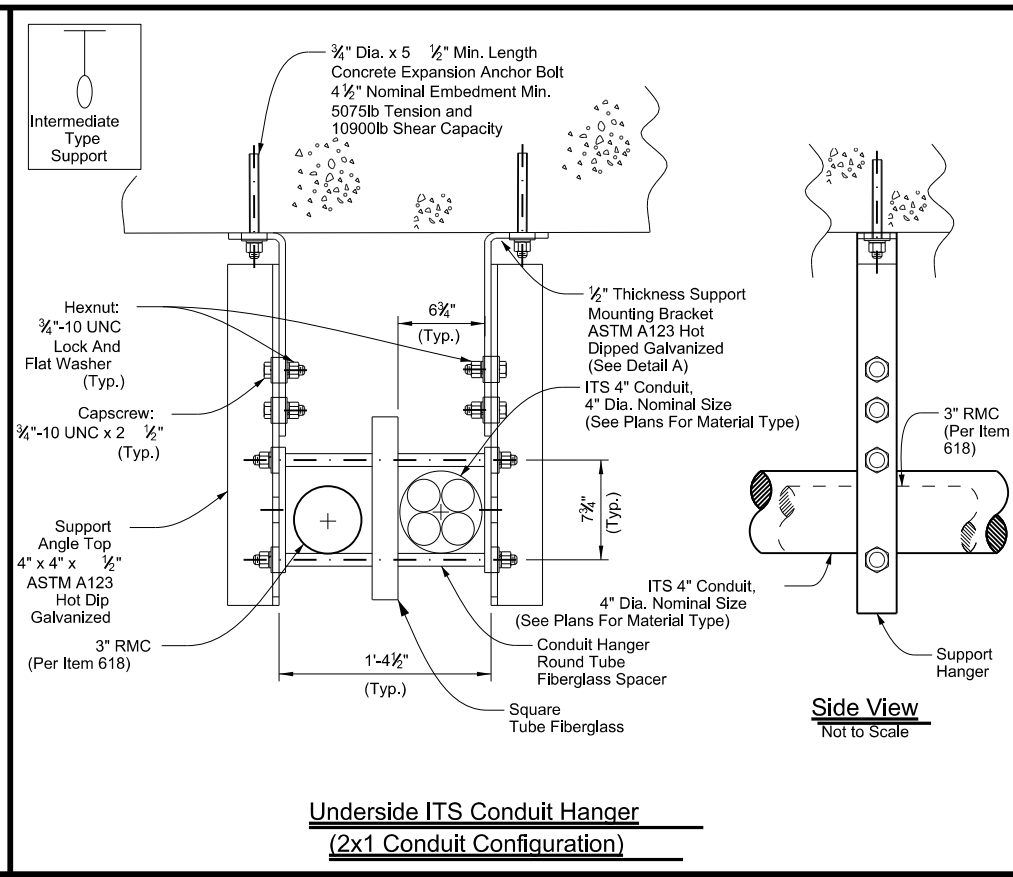
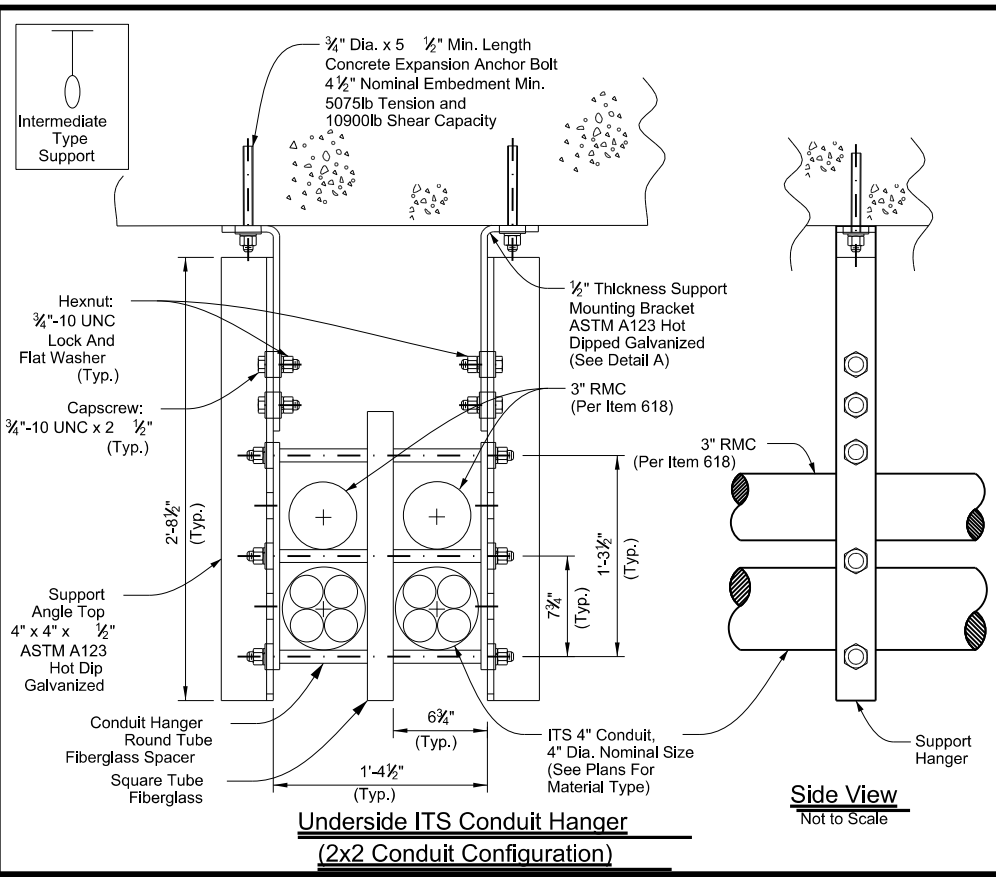
ITS CONDUIT BORE AND STEEL CASING DETAILS

ITS (28) - 16

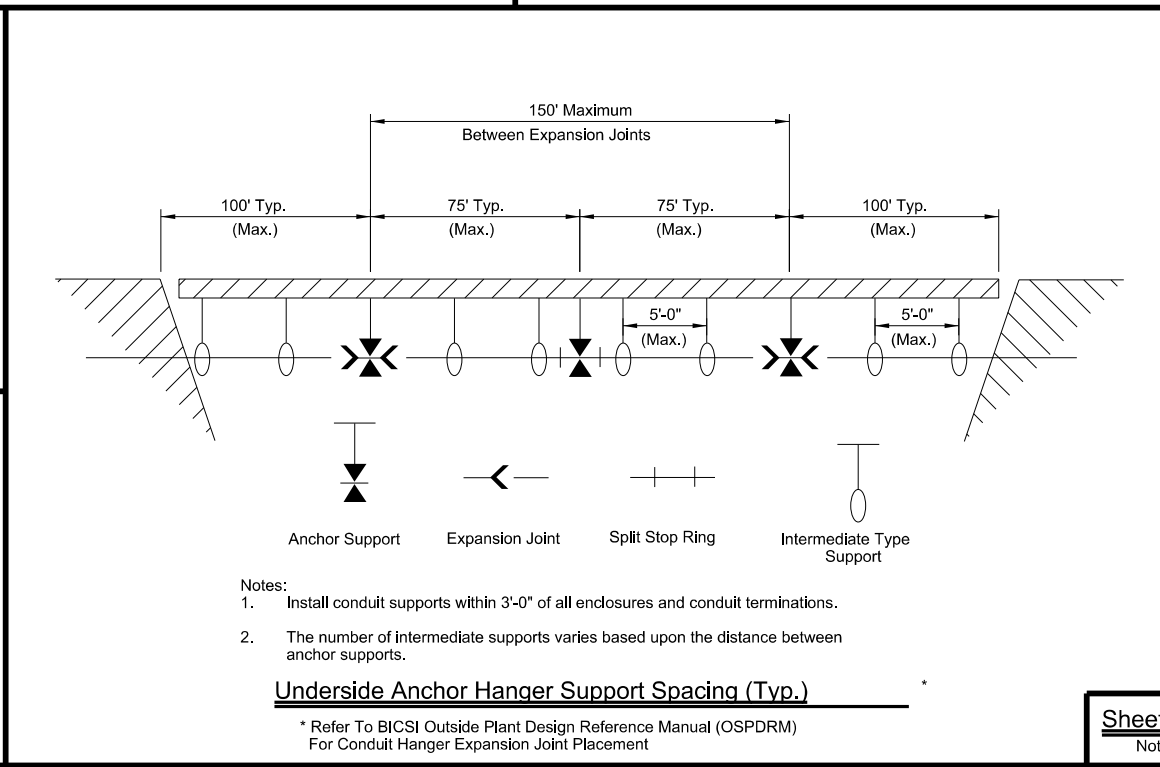
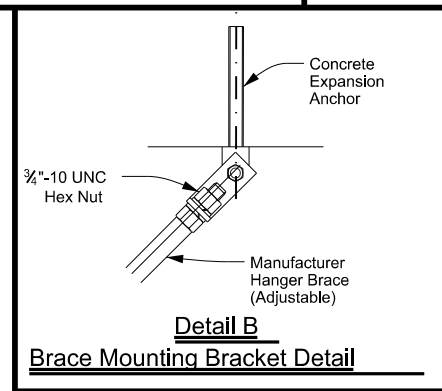
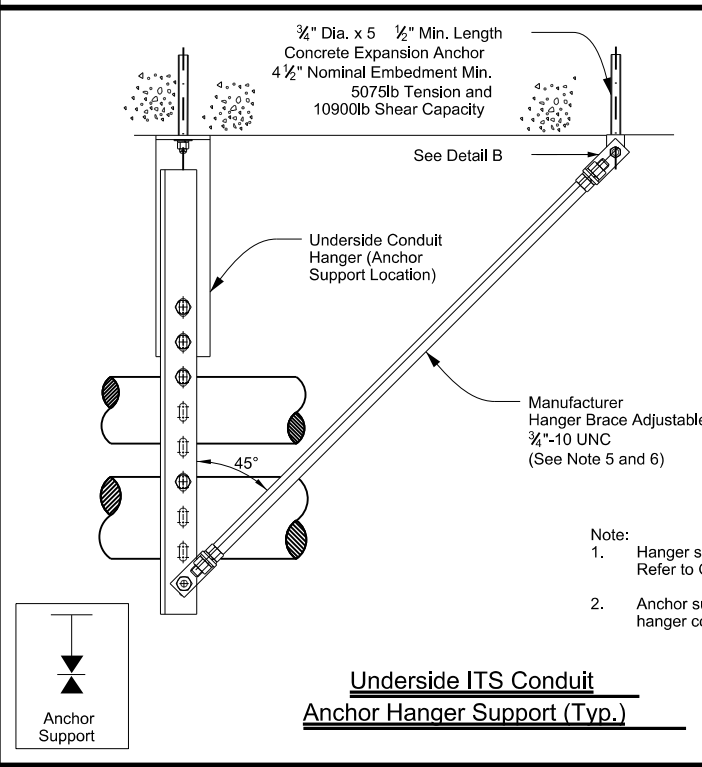
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© TxDOT FEBRUARY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	0502	01	237	SH 225
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- General Notes:**
- Use commercially designed multiple conduit support hangers as an alternative to the hanger details on this sheet, or standard sheet ED(2)-14 may be used. Verify sufficient tension and shear capacity before proposed substitution. Submit hanger details and specifications to the Engineer for approval prior to using on project.
 - Refer to the contract plans for conduit design and hanger configuration requirements. For two (2) conduit configurations, use the typical underside hanger or roller hanger system.
 - Maximum spacing of intermediate conduit hangers is 5'-0" C-C.
 - Hangers vary in length, but do not allow conduit to hang below bridge beams. Refer to ITS(30) for minimum clearance requirement below bridge deck.
 - Ensure all conduit hanger steel shapes conform to ASTM A36 and expansion anchors conform to ASTM A307 and are supplied with minimum of one nut and washer per bolt. Galvanize all steel plate, shapes, and hardware per Item 445, "Galvanizing".
 - Use angle bracing on both sides of conduit support for conduit anchor point hangers.
 - Refer to ITS(32) for expansion-deflection joint details.
 - Provide a minimum of two (2) expansion joints at all bridges. Ensure expansion joint spacing does not exceed manufacturer recommendations.
 - Select conduit lengths so that couplings do not coincide with conduit hanger locations.
 - Allowable types of outer duct material for above ground ITS conduit include rigid metallic conduit (RMC) and fiberglass.
 - Refer to ITS(30) for anchor details through pre-stressed concrete panels.
 - Bond all external structure conduit throughout entire length of run and ground at ground box locations according to ITS(38).



Texas Department of Transportation
 Traffic Safety Division Standard

ITS CONDUIT HANGER DETAILS

ITS (29) - 22

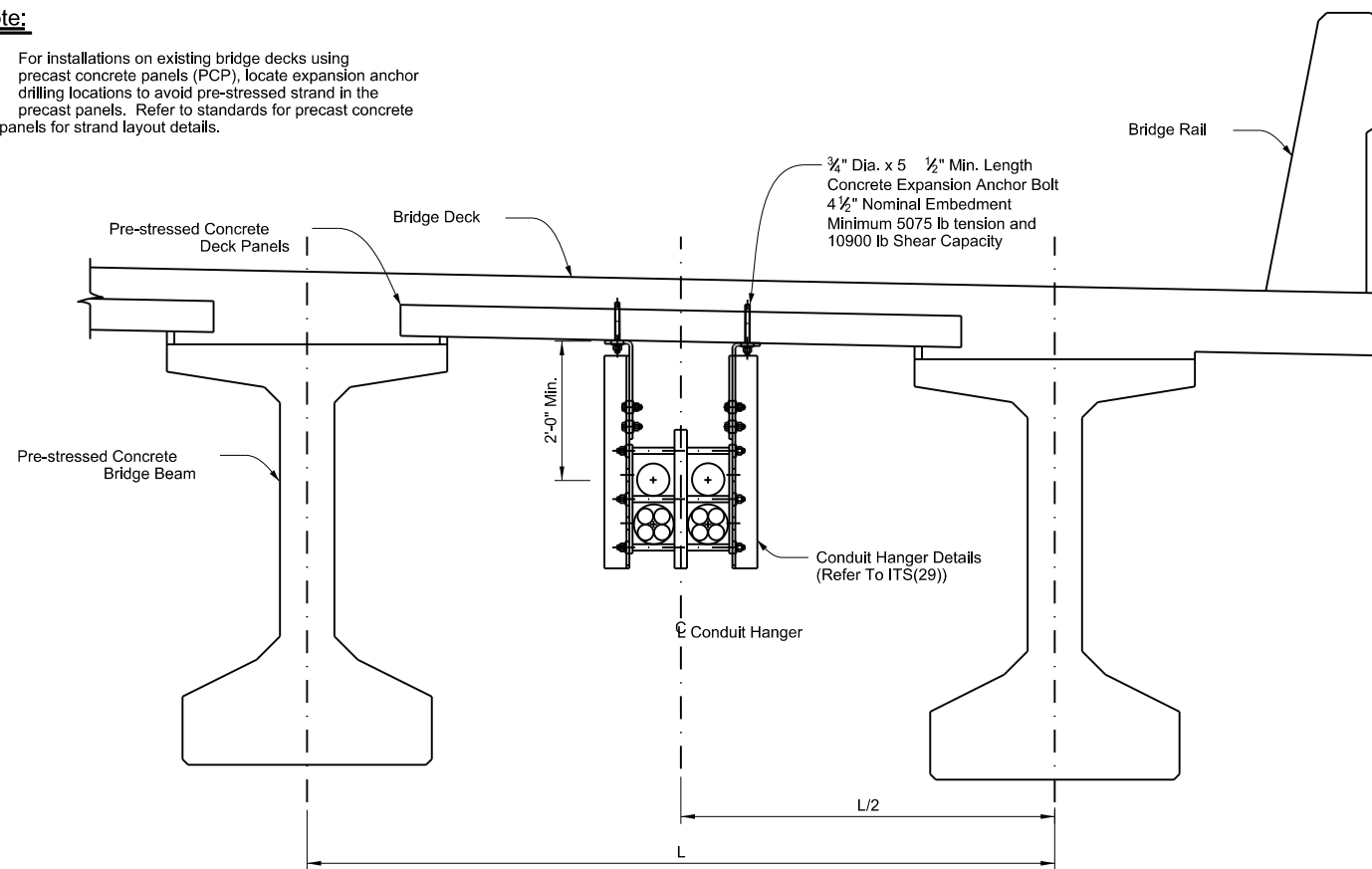
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Note:

- For installations on existing bridge decks using precast concrete panels (PCP), locate expansion anchor drilling locations to avoid pre-stressed strand in the precast panels. Refer to standards for precast concrete panels for strand layout details.

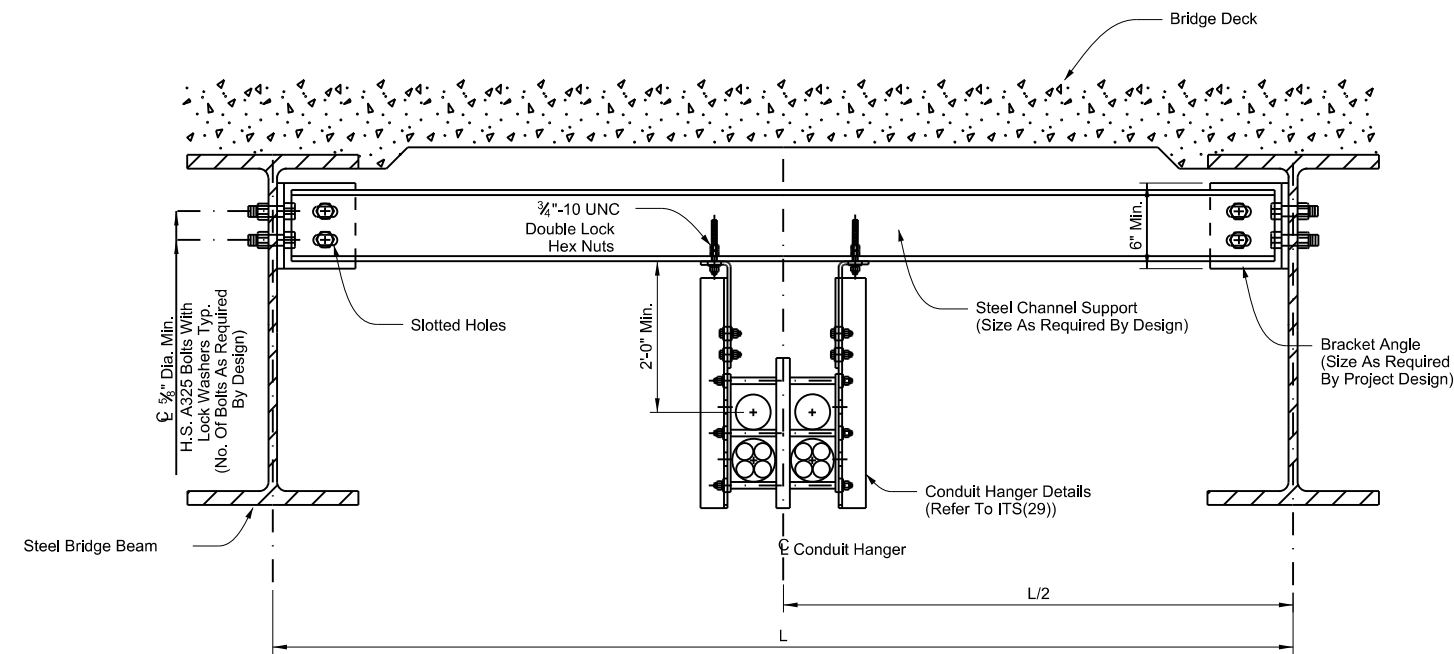


Structure Mounted ITS Conduit - Concrete Bridge Deck With Precast Panels

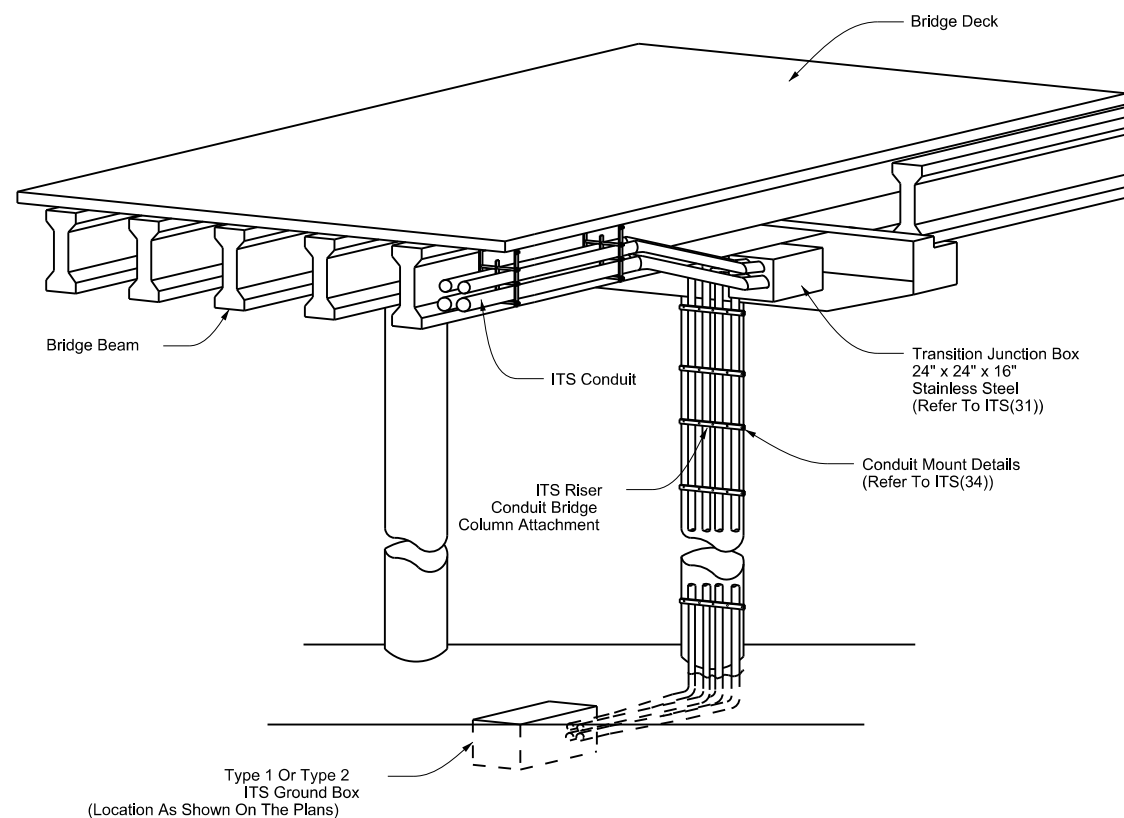
Refer To ITS(29) For General Notes

Note:

- Position conduit hanger height to avoid conflicts with diaphragms in the conduit runs.



Typical Alternate Conduit Hanger Support (Steel I-Beam Mount)



Underside Conduit Hanger Transition Detail

Type 1 Or Type 2
ITS Ground Box
(Location As Shown On The Plans)

General Notes:

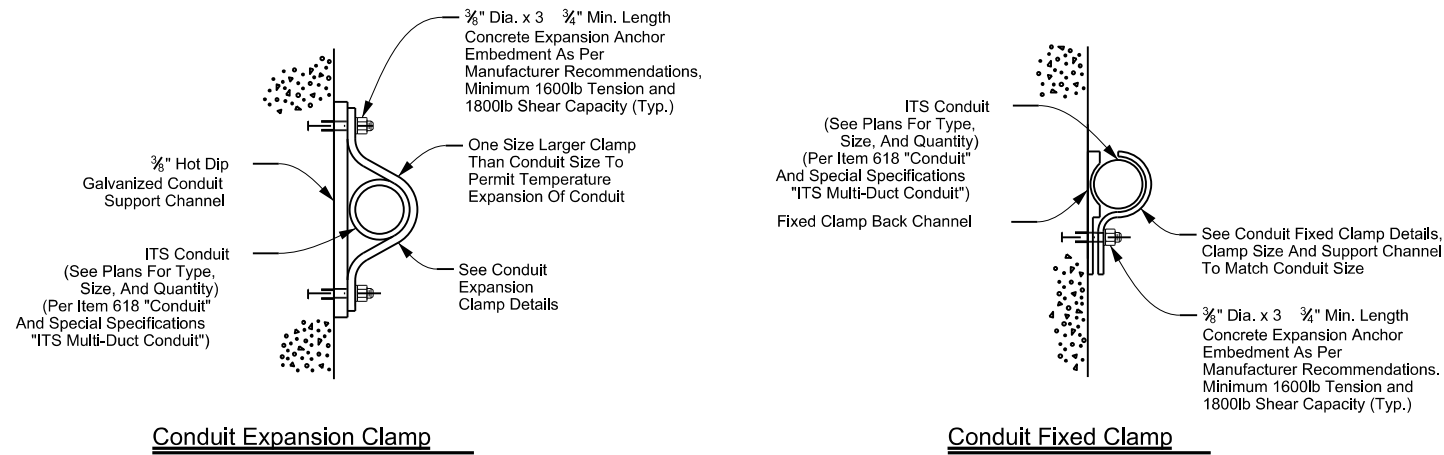
- The alternative mounting conduit hanger support mounting detail for steel I-Beam structures as shown is a suggested detail for steel structures. Submit details for the configuration shown on this sheet via shop drawings and include structural load analysis, support member and connection design. Seal all calculations and shop drawings by a Texas P.E.
- Conduit hanger support mounting details for concrete bridge deck with precast panels as shown are a suggested method for pre-stressed concrete beam structures. Submit any deviation from these details via shop drawing and include structural load analysis, support member, and connection design. Seal all calculations and shop drawings by a Texas P.E.
- Locate auxiliary conduit hanger supports for steel structures at a maximum 5'-0" spacing.
- For conduit loads located between beams exceeding 5 lbs per ft, furnish structural load analysis calculations for adjacent beams in the shop drawing submission.
- Submit design details for structure with cathodic protection in the shop drawing submission.
- Do not extend conduit hangers below the bottom of the bridge beams (any exceptions at end spans are subject to approval).
- Drilling in pre-stressed beams or field welding of steel beams is not permitted. Submit any exceptions on a case by case basis for evaluation and approval by the Engineer.
- Ensure all conduit hanger assemblies are furnished and supplied by the conduit hanger manufacturer.
- Galvanize all hardware and structural steel that is not stainless steel. Ensure all bolt hardware used to secure hangers to steel structures conforms to A325 for high strength. Ensure all expansion anchors conform to ASTM A307. Separate dissimilar materials for use of galvanized hardware with weathering steel girders.
- Select conduit lengths so that couplings do not coincide with conduit hanger locations.
- Refer to Special Specification, "ITS Multi-Duct Conduit" or Item 618 "Conduit", for details on conduit mandreling and other testing required upon conduit installation.
- Provide a flat pull cord in each conduit and inner duct to allow for installation of future cables to match 1250 lbs-ft tension. Refer to ITS(27) for additional conduit details.
- Provide a transition junction box for conduit access located outside the abutments for bridge spans < 800 ft. For bridge spans > 800 ft., locate an additional junction box for conduit access near the mid-span/pier.
- Provide ITS conduit of the type and configuration shown on the plans in accordance with Special Specification, "ITS Multi-Duct Conduit" or Item 618 "Conduit". Ensure all other conduit is in accordance with Item 618 "Conduit" and as shown on the plans.
- Bond all external structure mounted conduit throughout entire length of run and ground the run at ground box locations according to ITS(37) and ITS(39).

		Traffic Operations Division Standard	
<h2>STRUCTURE MOUNTED ITS CONDUIT</h2>			
<h3>ITS (30) - 16</h3>			
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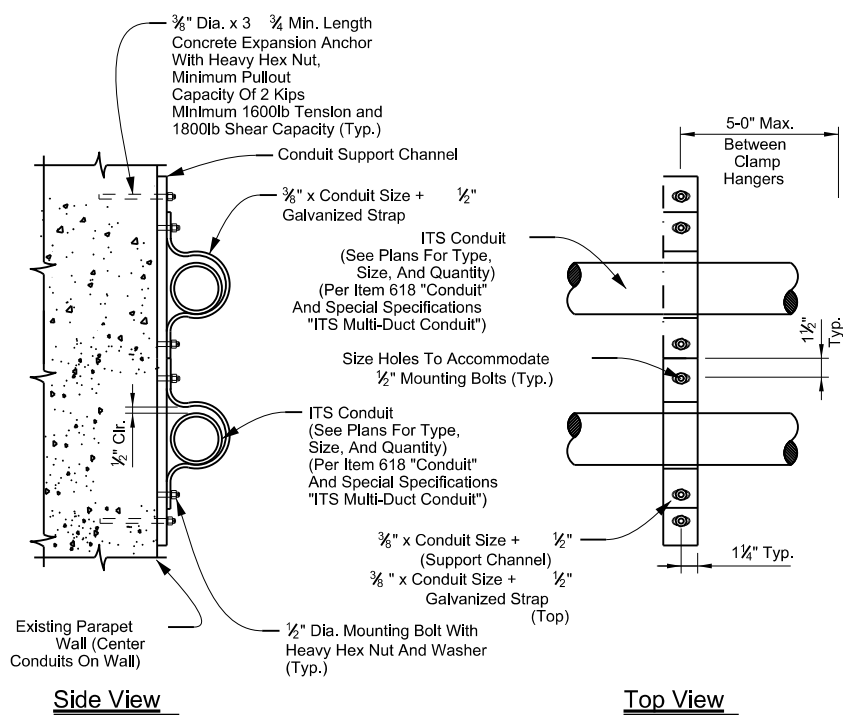
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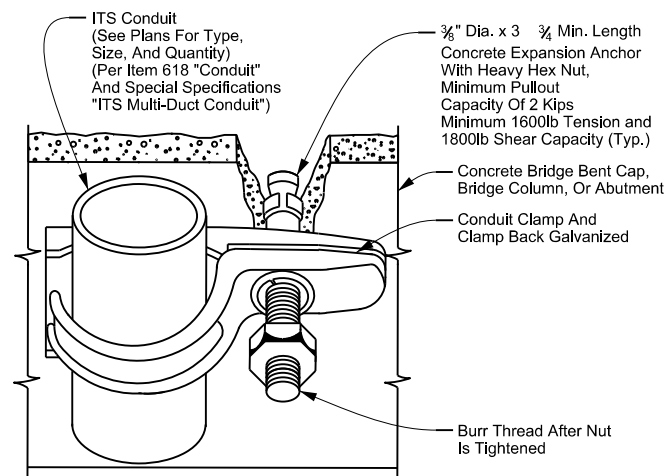


Conduit Clamp Details (Typ.)

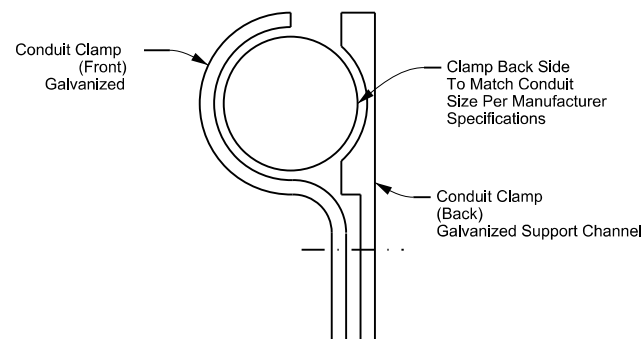


Elevation View

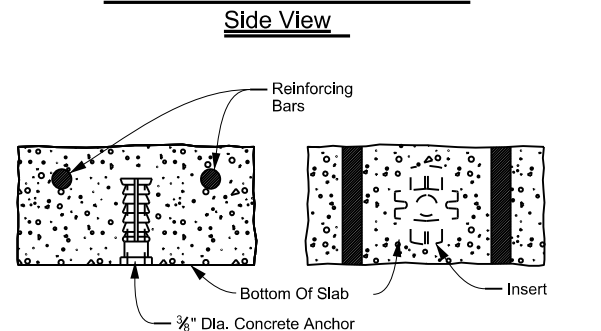
Conduit Expansion Clamp Details



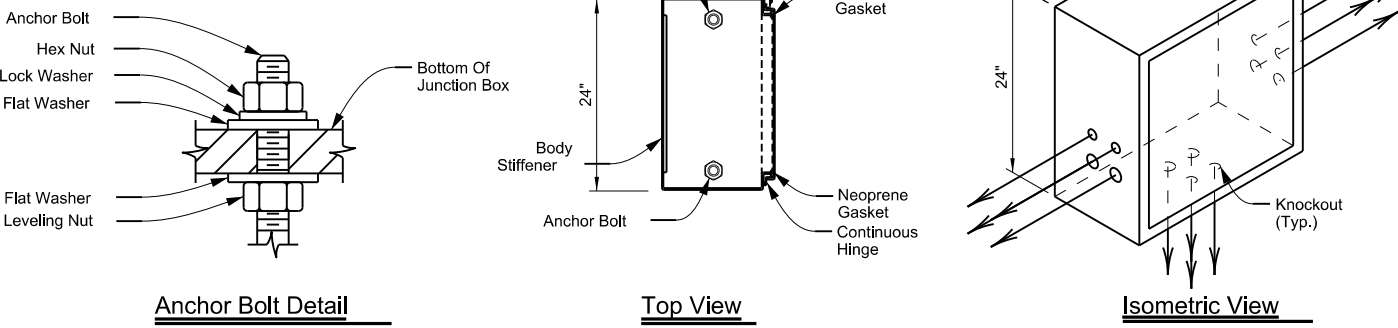
Conduit Fixed Clamp Back Channel



Conduit Fixed Clamp Details



Conduit Fixed Clamp Concrete Insert Detail



Front View

Side View

Anchor Bolt Detail

(May Vary On Mounting Scenario)

Top View

Isometric View

24" X 24" X 16" Stainless Steel Transition Junction Box Detail

- Notes:
- Transition box as depicted is top mount. Actual anchor fasteners and knockout location will vary based upon mount location and manufacturer recommendations.
 - Secure the transition box cover using self tapping screws with industry safety/security mechanism.
 - Typical knockout locations shown are for diagrammatic purposes only. The number of transition boxes required at a given location will vary depending on the number of conduits and cable storage requirements for cabling run(s).

General Notes:

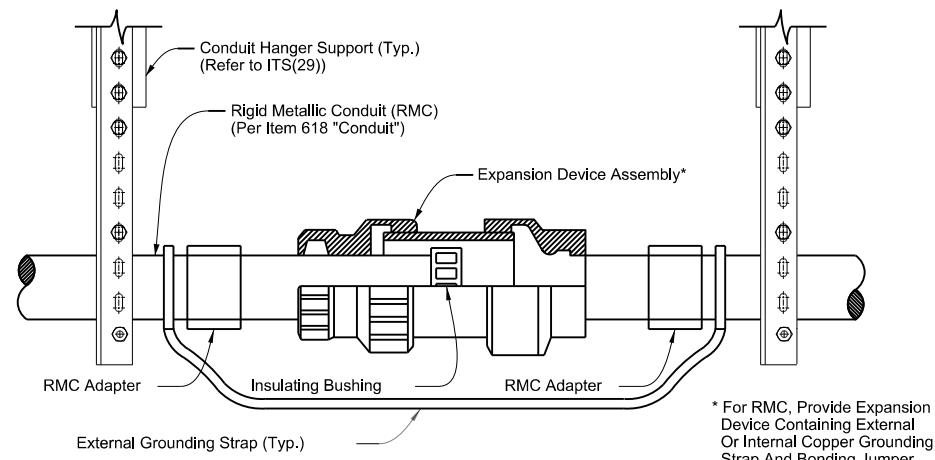
- Ensure all duct/conduit bends are in accordance with the latest version of the NFPA 70, National Electrical Code and as recommended by the manufacturer.
- Utilize separate transition junction boxes for communications and electrical conduit runs.
- Maintain constant slope in all duct/conduit runs.
- Ensure maximum spacing of conduit clamps is 5'-0" C-C.
- Galvanize all hardware, including anchor bolts, nuts, and washers per TxDOT Item 445, "Galvanizing". Ensure all expansion anchors conform to ASTM A307.
- Provide a minimum NEMA 3R junction boxes. Construct all junction boxes in accordance with manufacturer specifications. Install junction boxes in accordance with the latest edition of NFPA 70, National Electrical Code.
- Junction boxes and associated appurtenances are incidental to ITS conduit.
- Install all conduit sweeps into junction boxes in accordance with allowable bend radius of the installed cable.
- Install conduit support within 3'-0" of all enclosures and conduit terminations.
- Refer to ED standard sheets for additional details on parapet mounted conduit.

Sheet Details
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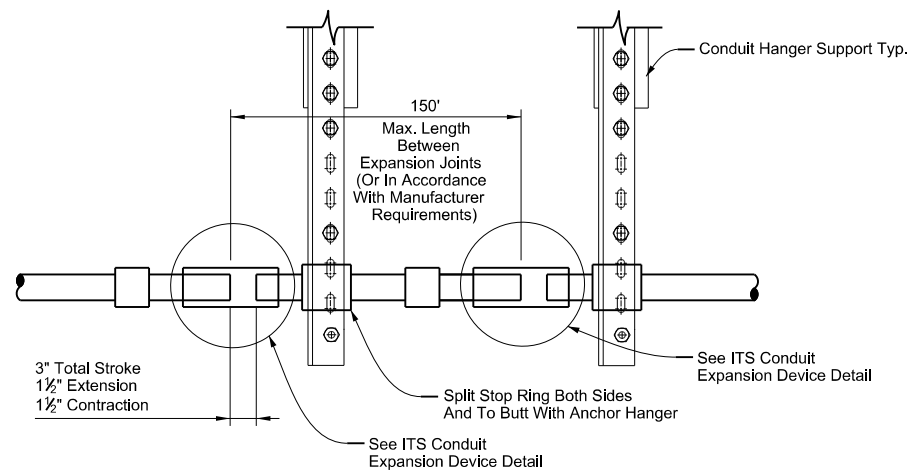
		Traffic Operations Division Standard	
<h2>PARAPET MOUNTED ITS CONDUIT AND TRANSITION BOX DETAIL</h2>			
<h3>ITS(31)-16</h3>			
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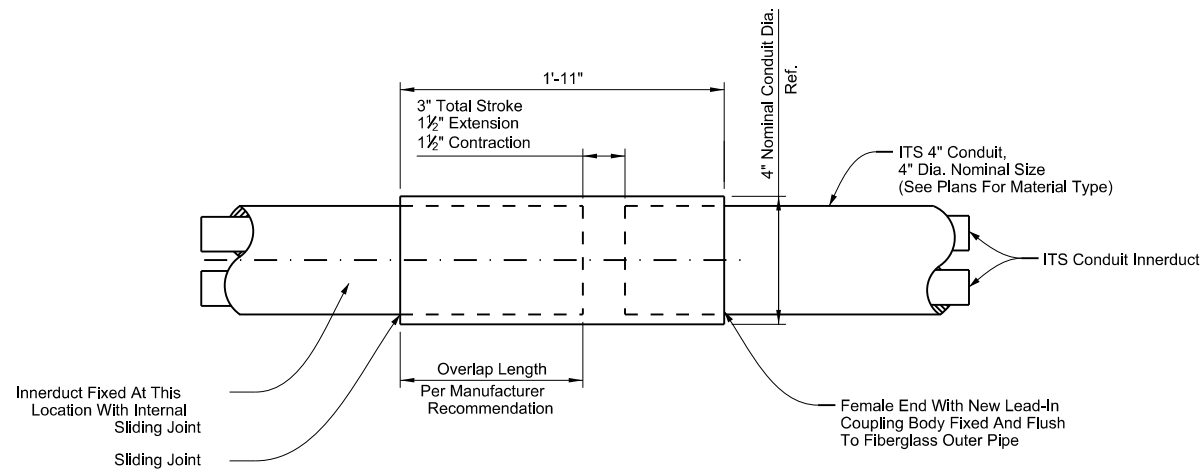
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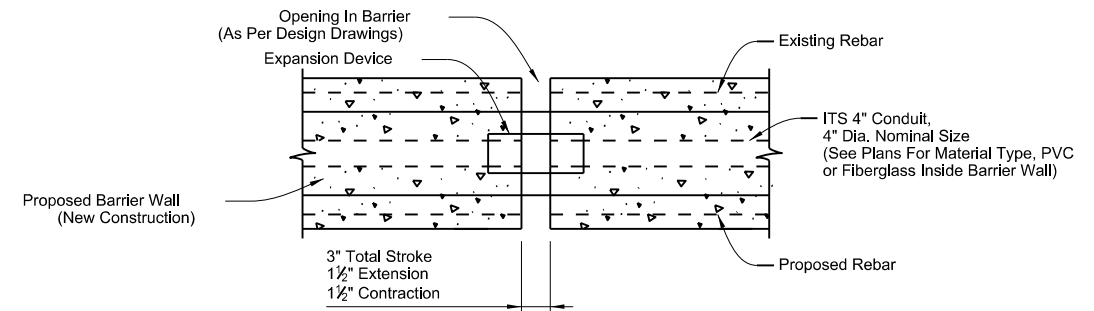
RMC Conduit Expansion Device Detail (Typ.)



ITS Conduit Expansion Device Placement (Typ.)



ITS Conduit Expansion Device Detail



ITS Conduit In New Construction Barrier Wall Expansion And Deflection Joint Fitting (Typ.)

General Notes:

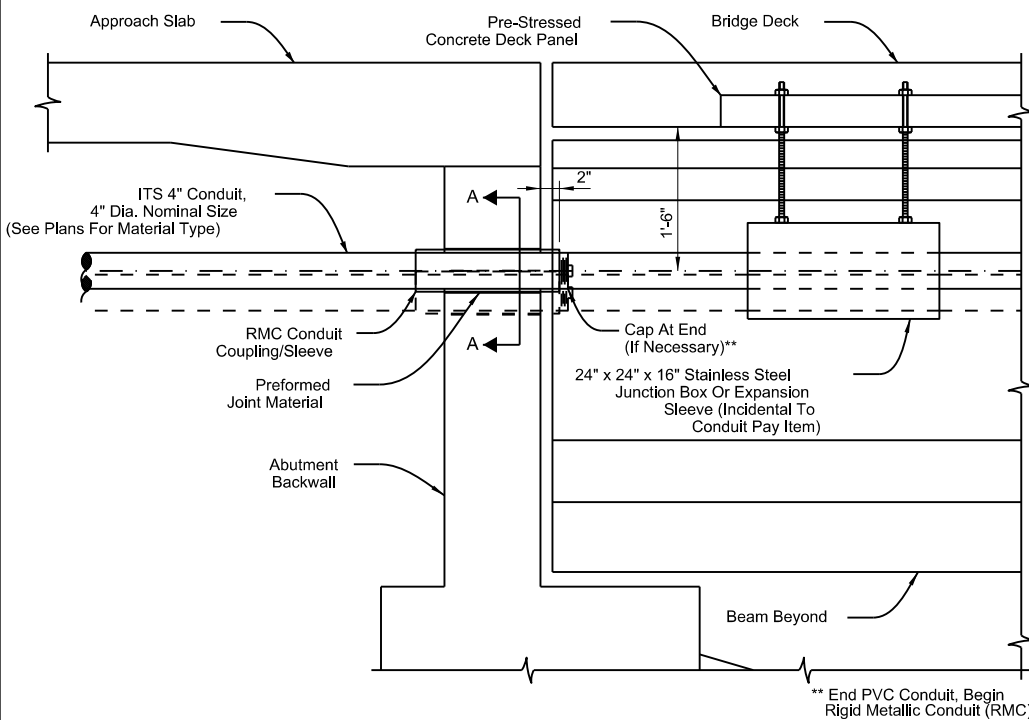
1. Install expansion device at all open joints, at each end of bridge abutments and between bridge bents, allowing for 3" movement.
2. Provide a minimum of two (2) expansion joints at all bridges. Ensure expansion joint spacing does not exceed manufacturer recommendations.
3. Ensure conduit lengths are selected so that couplings do not coincide with hanger locations.
4. Ensure all rigid metallic conduit (RMC) expansion devices are constructed per manufacturer specifications.
5. Bond all external structure mounted conduit throughout entire length of run and ground the run at ground box locations according to ITS(37) and ITS(39).

Sheet Details
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		Traffic Operations Division Standard	
<h2>EXPANSION / DEFLECTION JOINT</h2> <h3>ITS(32)-16</h3>			
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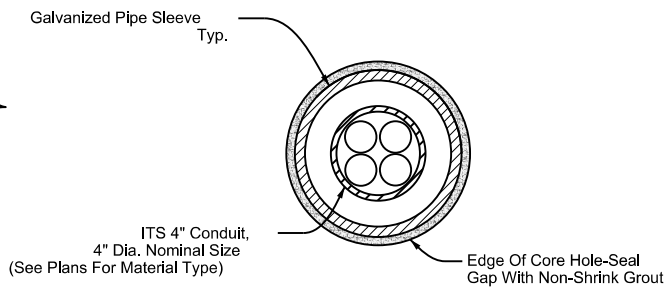
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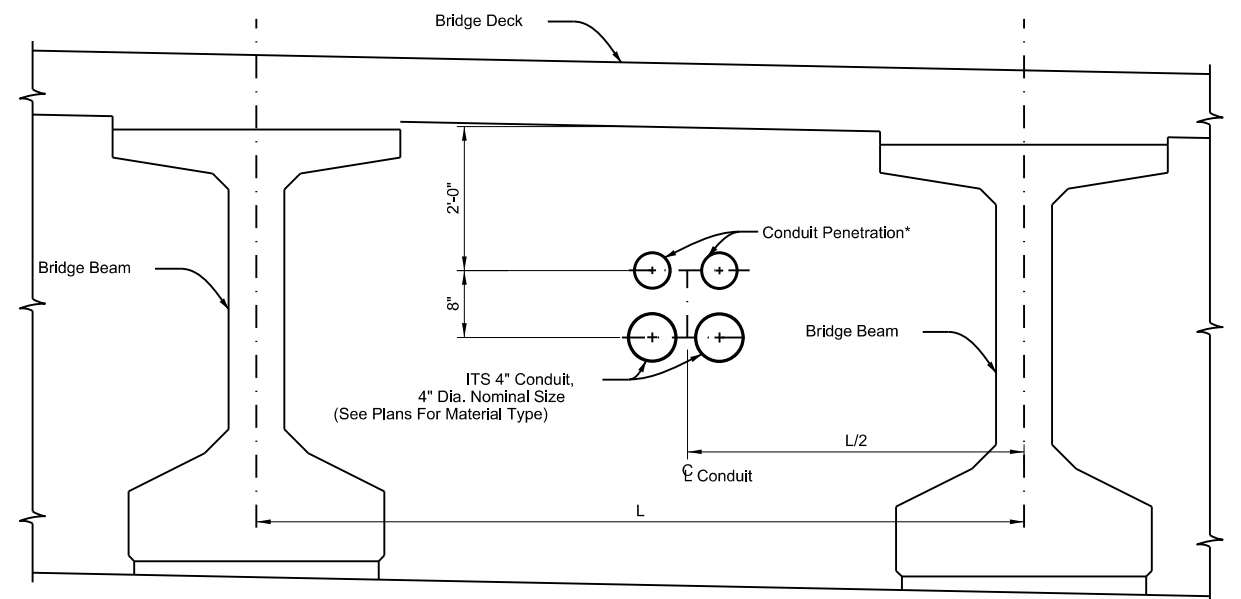
Section Through New Construction Abutment Backwall

Standard Notes:

1. If constant conduit elevation is maintained from the abutment backwall to the underside conduit hangers, provide an expansion joint sleeve (same size as conduit) with one travel overlap. If conduit elevation varies from the abutment backwall to the underside conduit hangers, provide an abutment wall mounted transition junction box (NEMA 3R rated).
2. Provide separate pipe sleeve for each conduit through abutment backwall. Size sleeve per manufacturer recommendations.



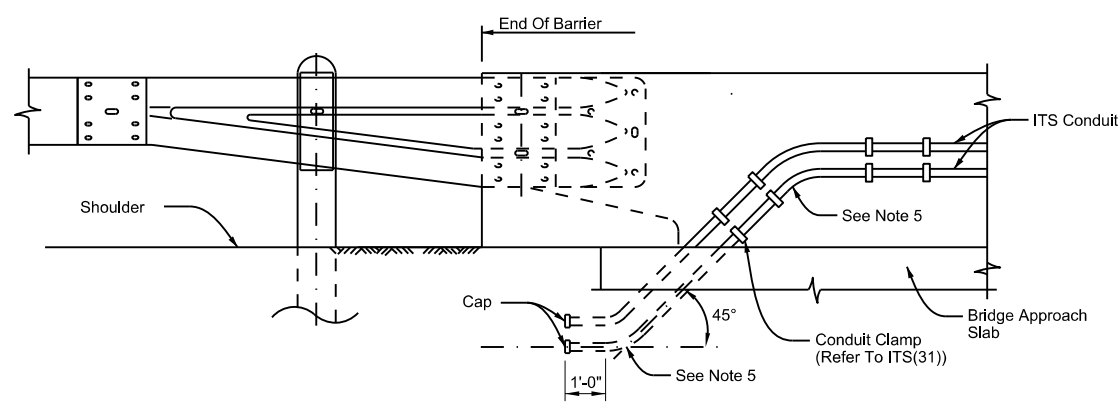
Section A-A (Typical Pipe Sleeve)



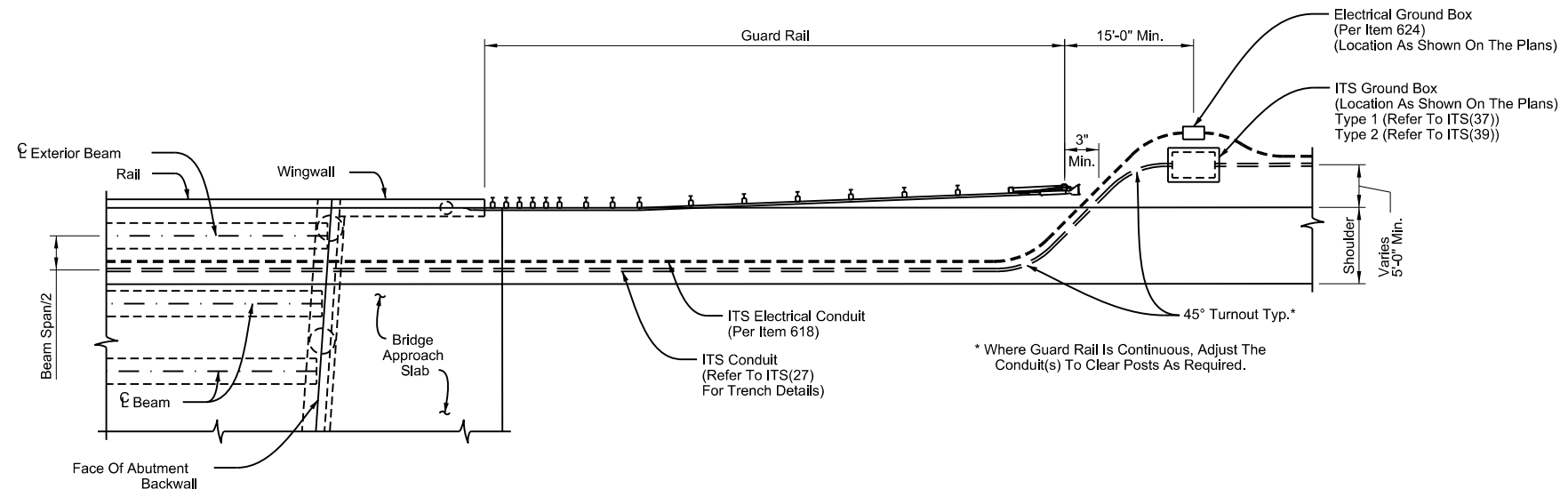
Abutment Elevation

* Showing Control Dimensions For Conduits Thru Abutment Backwall. 2 x 2 Conduit Configuration Shown.

ITS Conduit Transition At Bridge Abutment Detail



Parapet Mounted Conduit Transition To Ground Detail



Conduit Through Abutment Backwall Transition To Ground Box Detail

General Notes:

1. An alternative option to conduit mountings shown is conduit encased within parapet or bridge structure at crossings. Submit shop drawings and specifications to the engineer for approval.
2. Install expansion sleeves at bridge expansion joints and per manufacturer recommendations.
3. For conduit crossings over bridges, provide ITS communications junction boxes at 1000' maximum spacing and electrical junction boxes at 450' maximum spacing.
4. Keep all junction boxes sufficiently clear of guard rail or other obstructions to maintain clear access.
5. Install conduit sweep at an angle that accommodates cable bend radius. Do not exceed 45 degrees to the shoulder line. Refer to ITS(28) for conduit turn-out details.
6. Do not install junction boxes within paved shoulder area.
7. Ensure all work is in compliance with the latest edition of NFPA 70, National Electrical Code.
8. Junction boxes and associated appurtenances are incidental to ITS conduit.
9. For installation requiring ITS conduit transition within mechanically stabilized earth (MSE) walls with select fill, locate conduit to avoid reinforced straps. Refer to retaining wall standards for further details.
10. Bond all external structure mounted conduit throughout entire length of run and ground the run at ground box locations according to ITS(37) and ITS(39).



ITS CONDUIT TRANSITION AT ABUTMENT

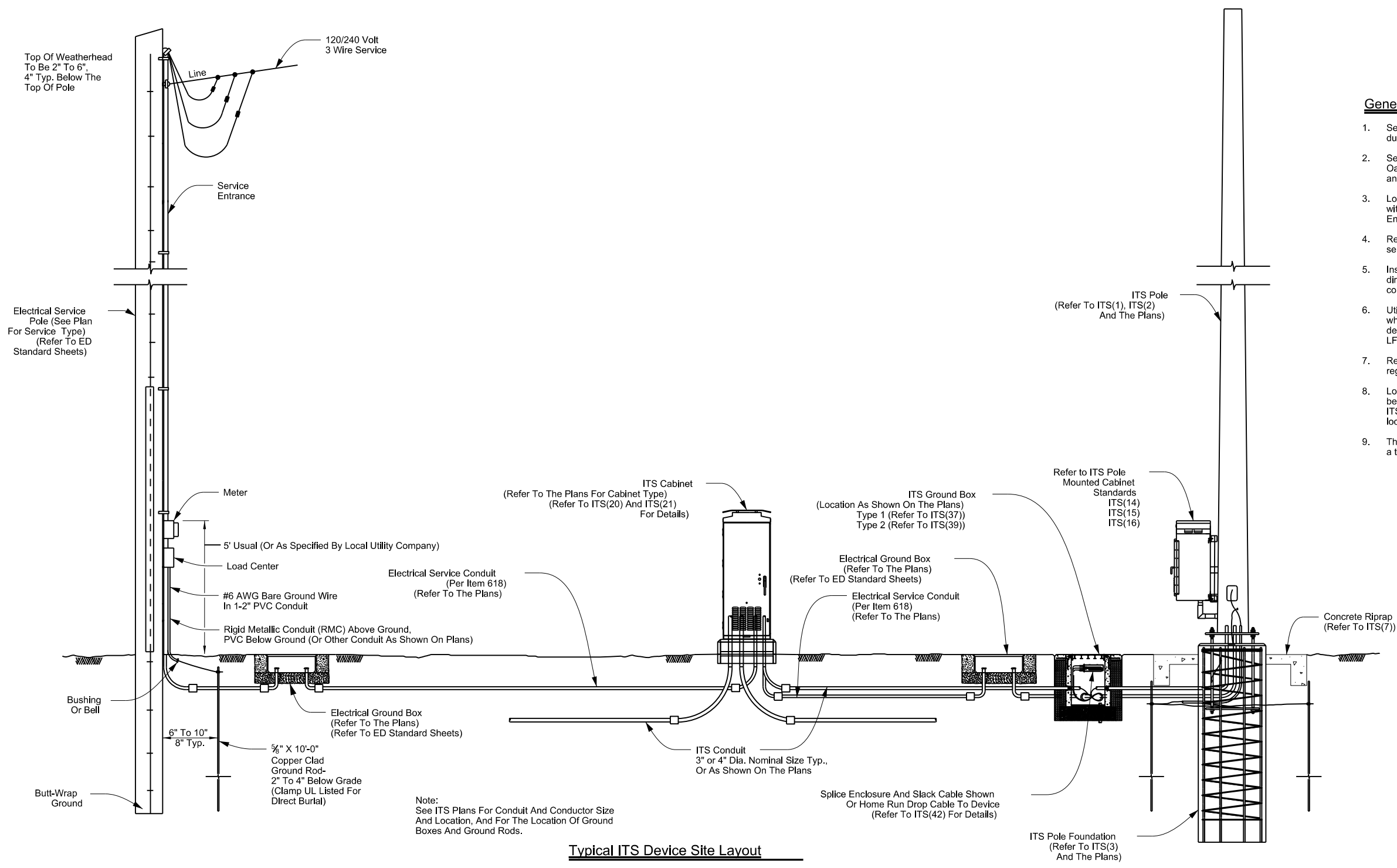
ITS(33)-16

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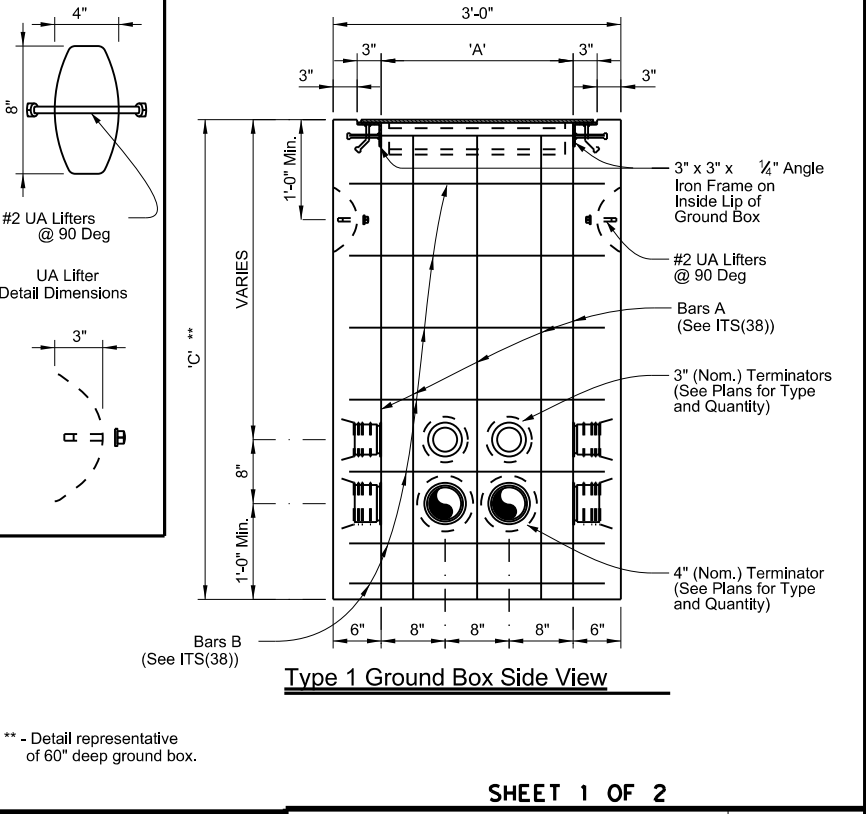
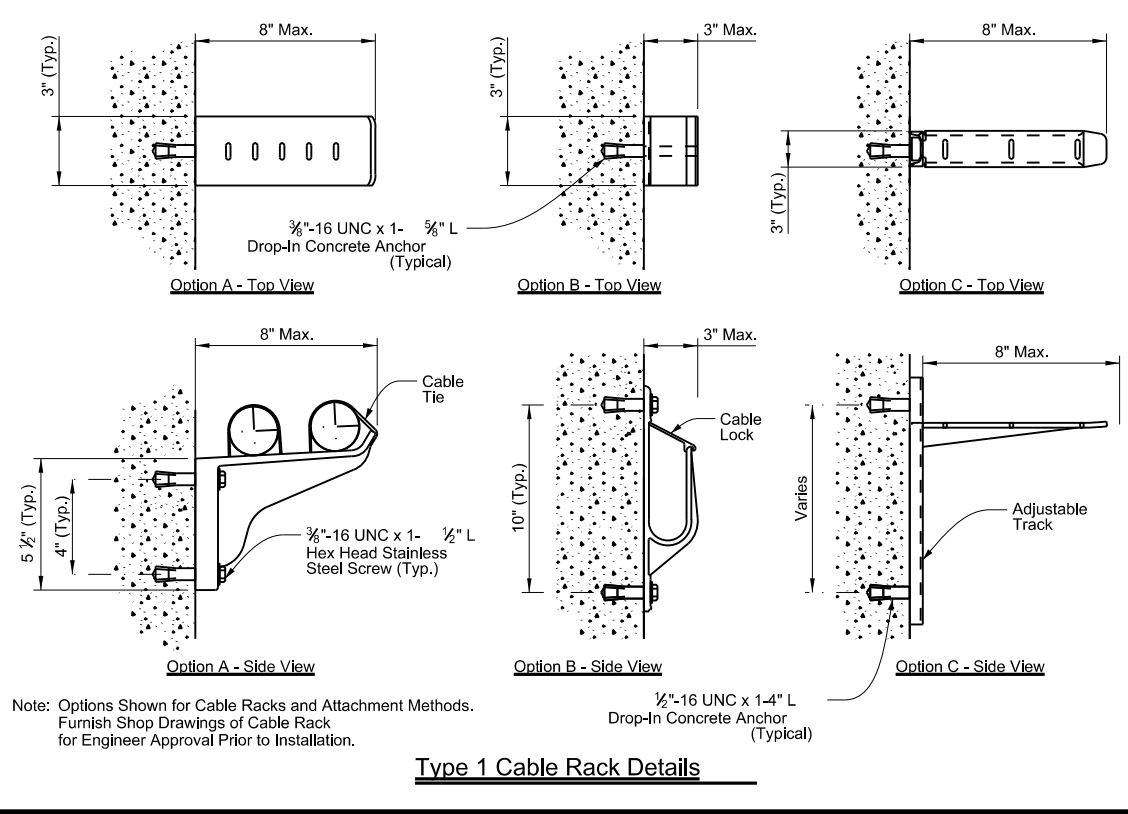
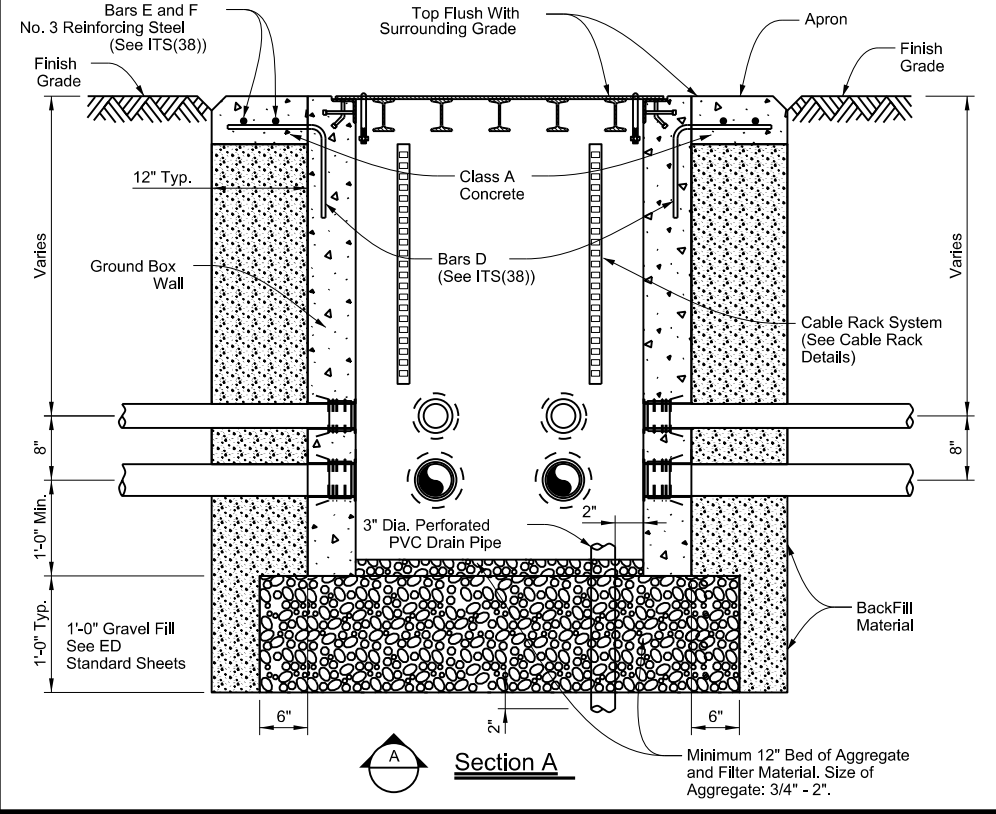
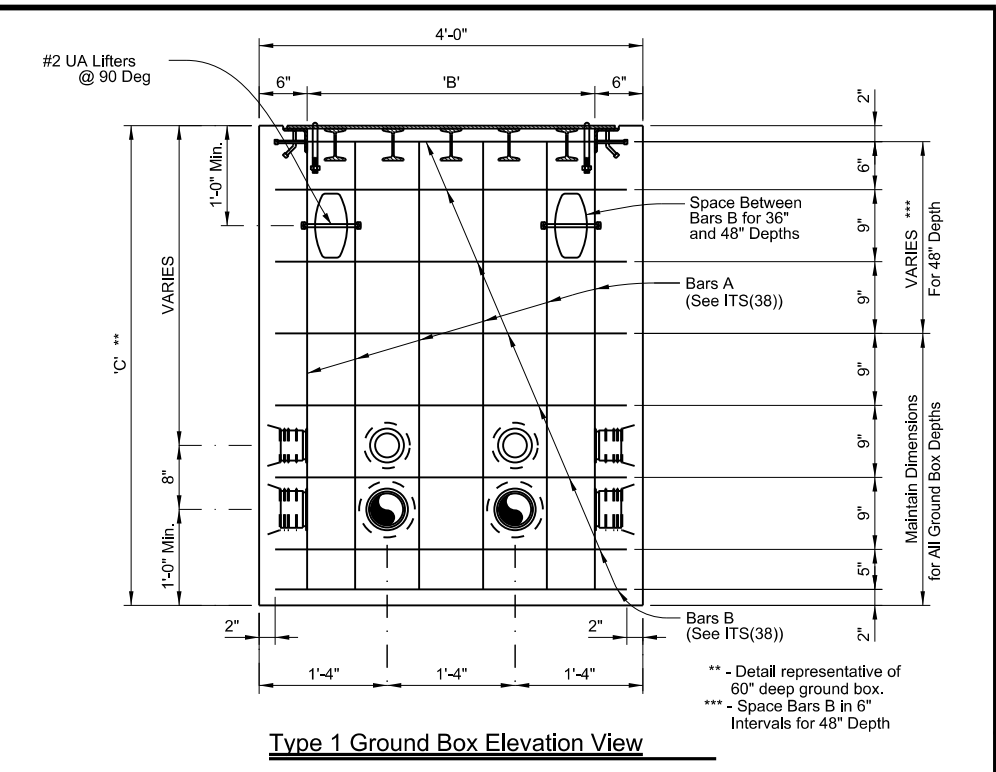
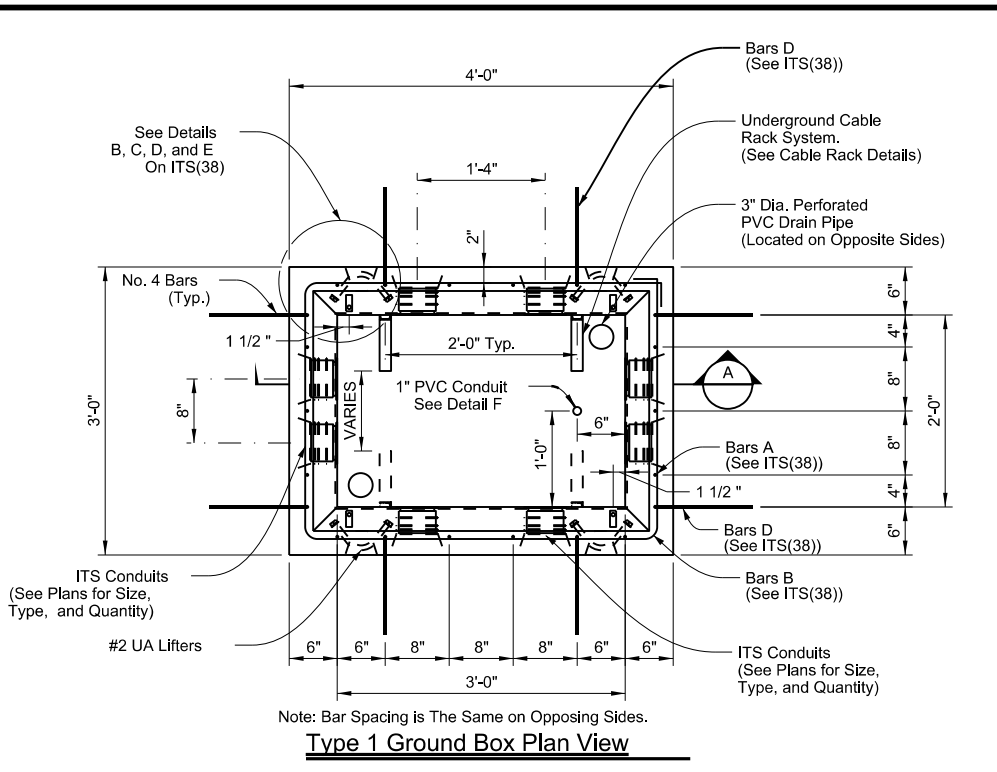
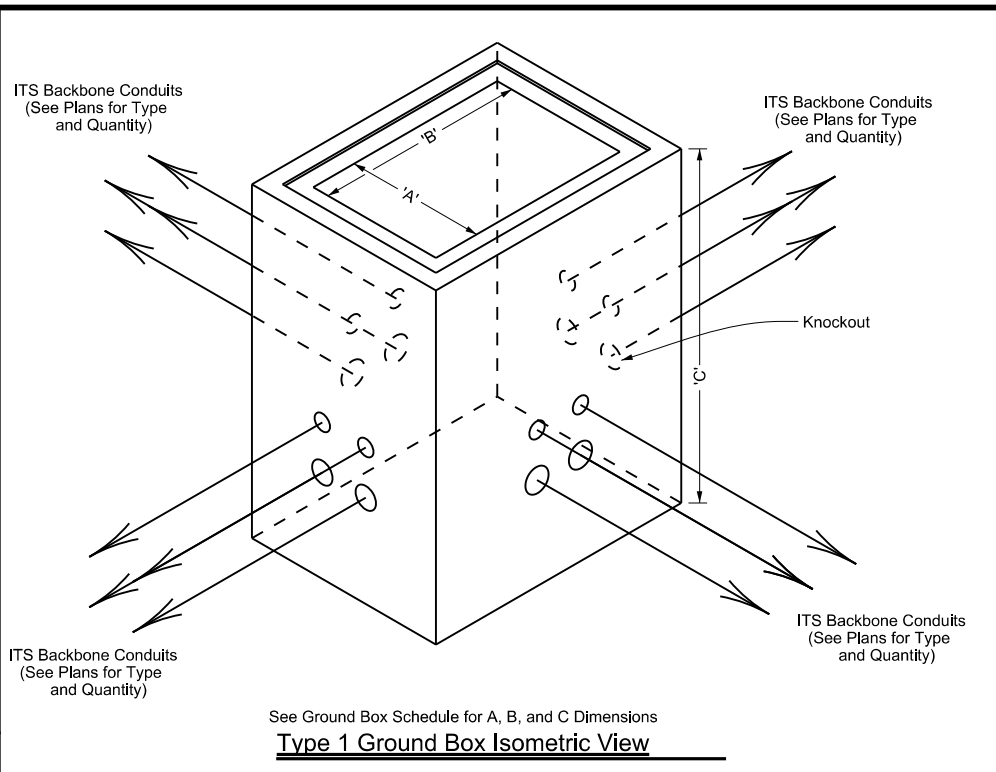
1. Seal all ITS communications conduits with waterproof duct plugs and seals.
2. Seal ends of all conduit entries into ITS cabinets with Oakum or other as approved by the District representative and pack with duct sealant.
3. Locate ground boxes for electrical and ITS communications within 5'-0" of cabinet enclosure, or as directed by the Engineer.
4. Refer to ED standard sheets for additional notes regarding electrical service.
5. Install service pole ground rod at alternate location when directed by the engineer. Maintain a minimum of 8'-0" in contact with the earth.
6. Utilize liquidtight flexible metal conduit (LFMC), as required when meter and service enclosure are mounted 90 to 180 degrees to each other. Refer to ED standard sheets for details on LFMC use.
7. Refer to ITS(21), ITS(37) and ITS(39) for details regarding conduit depth and entry into ITS ground boxes.
8. Lock all enclosures and bolt all ground box covers before power is applied to the circuit. Refer to the ITS cabinet references indicated on this sheet for cabinet lock requirements.
9. The detail shown is diagrammatic and is intended to represent a typical layout from electrical service to ITS devices.

Typical ITS Device Site Layout

		Traffic Operations Division Standard	
<h2>TYPICAL ITS DEVICE SITE LAYOUT</h2>			
<h3>ITS(36) - 16</h3>			
FILE: its(36)-16.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
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- General Notes:**
- Conduit entry points shown represent the standard configuration for backbone conduit as detailed on ITS(27). Additional conduits may be required as shown on the plans.
 - Provide Class A concrete for Type "1" ground boxes.
 - Provide terminators for the PVC conduit cast in the walls and placed symmetrically about the centerline of the box at the depths shown, unless otherwise noted, for the number of conduits identified on the plans to enter the box.
 - Provide terminators appropriately sized for the conduits indicated on the plans. Provide terminators with an air tight and water tight connection.
 - Closed bottom Type "1" ground boxes are acceptable in lieu of open bottom boxes. Provide two 3" Dia. perforated PVC drain pipes on opposite corners to optimize water drainage. Provide 12-inch bed of aggregate that extends 6 inches in all directions from the perimeter of the box for closed bottom boxes. Aggregate bed will be subsidiary to Special Specification, "ITS Ground Box."
 - Install all open bottom Type "1" ground boxes on a 12-inch bed of aggregate that extends 6 inches in all directions from the perimeter of the box. Aggregate bed will be subsidiary to Special Specification, "ITS Ground Box."

- Cap and seal terminators that do not have conduits attached.
- When additional conduit entry points are needed to accommodate existing conduit, core drill conduit knockouts in the field of the appropriate number and size of conduit at each location, as directed by the Engineer.
- Provide a bell fitting on the end of each conduit to ensure a flush fit inside the ground box.
- Concrete grout around the knockout (inside and out) and around the conduit and bell fitting to ensure a neat watertight fit after the conduit and bell fitting have been placed in a knockout. Ensure all openings in the ground box are sealed prior to grouting operations.
- Install a nylon string and plug all unused conduits with tug-plugs sized for the particular conduits. Provide split innerduct plugs in conduits or innerducts with cables to seal the innerduct around the cables to prevent water and dirt from entering.
- Provide steel (ASTM A-153), glass reinforced nylon, or equivalent cable rack assemblies designed to support the amount of cable storage slack identified in the plans. Locate cable rack system on one side only (longer length side) to allow access to the inside of the ground box. Cable racks may be installed at the factory or in the field. When mounting cable racks in the field, seal all penetrations to the concrete side wall to prevent moisture penetration. Ground metallic cable rack systems to grounding system inside ground box in accordance with the National Electrical Code.

Ground Box Schedule			
Ground Box Type	'A' Width Inside (Inches)	'B' Length Inside (Inches)	'C' Depth Inside (Inches)
Type 1	24	36	36, 48, 60

SHEET 1 OF 2

**ITS GROUND BOX DETAILS
TYPE "1" WITH STEEL COVER**

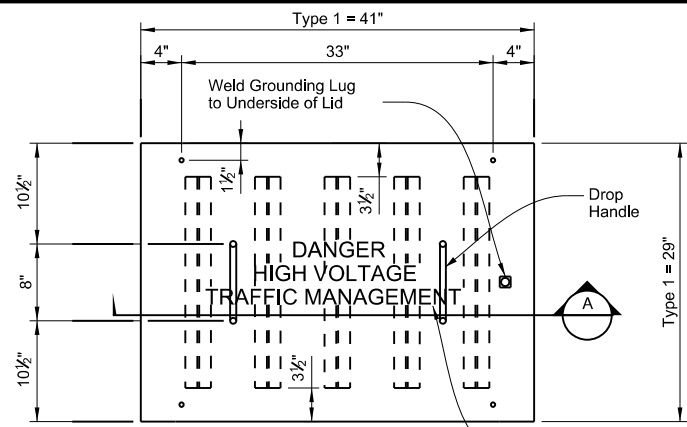
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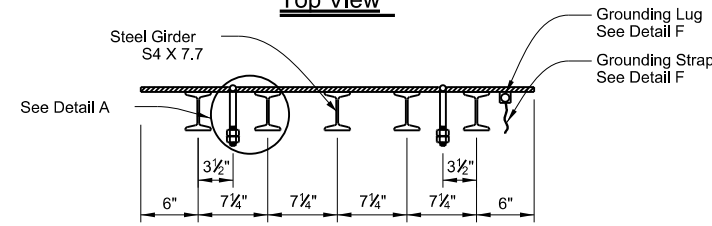
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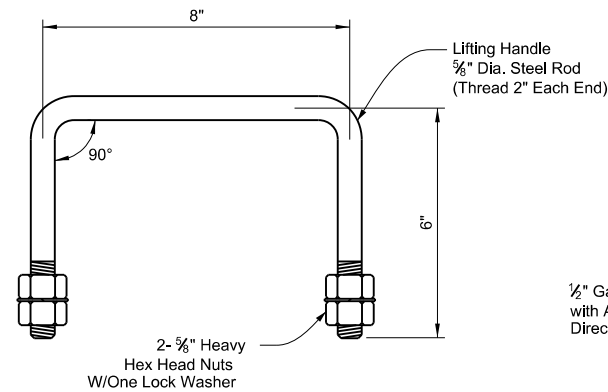
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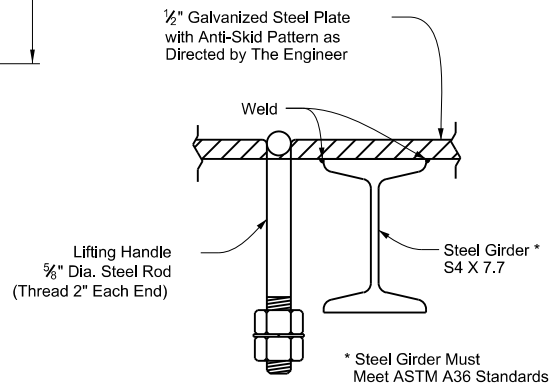
Type 1 Steel Cover Details
Top View



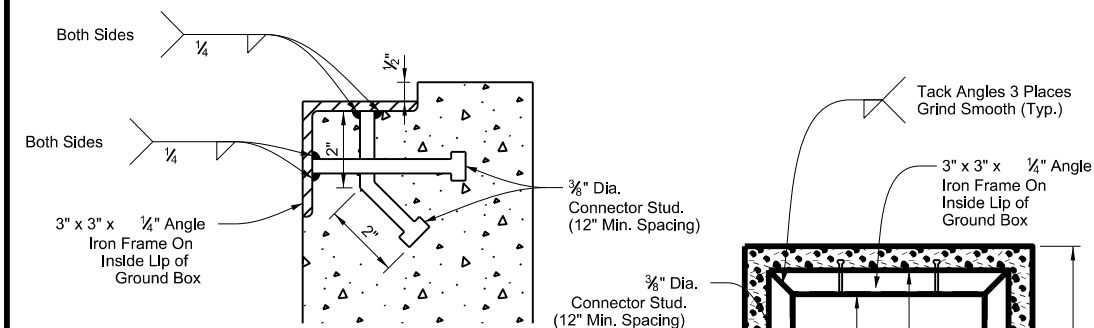
Section A



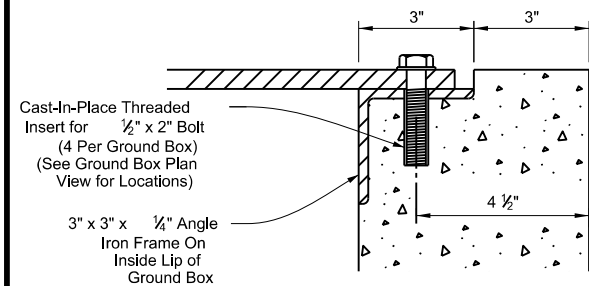
Drop Handle Detail



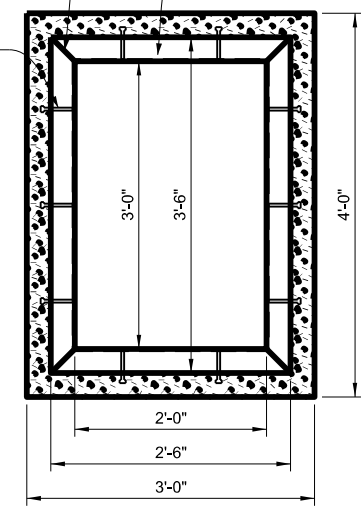
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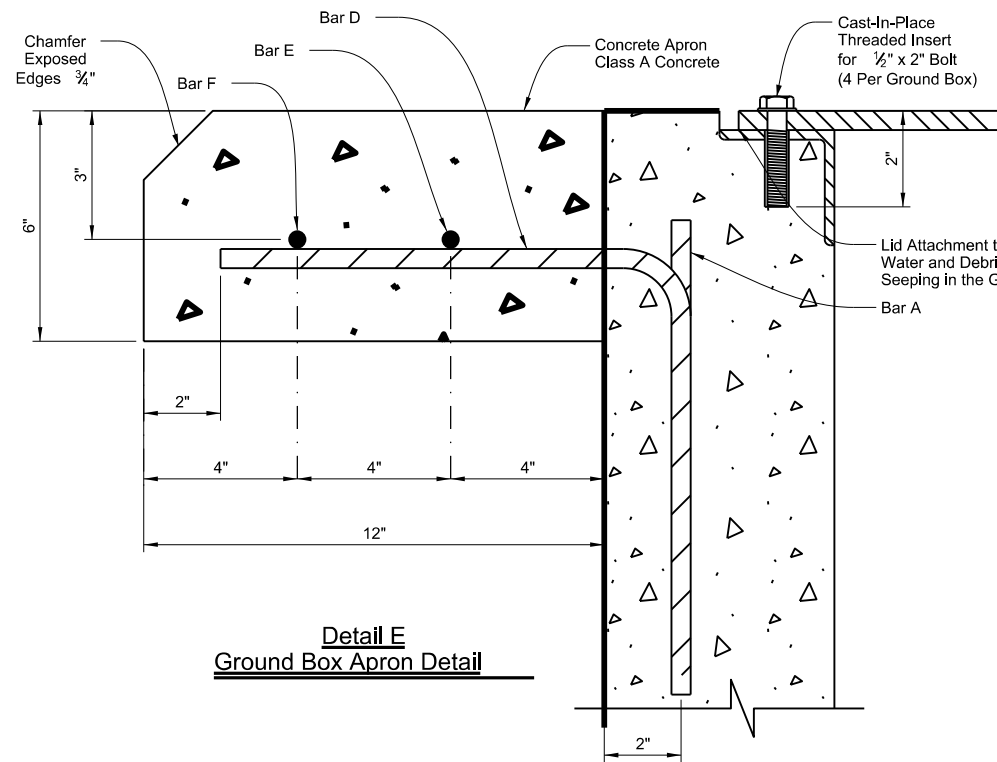
Detail B



Detail C
Lid Attachment Detail



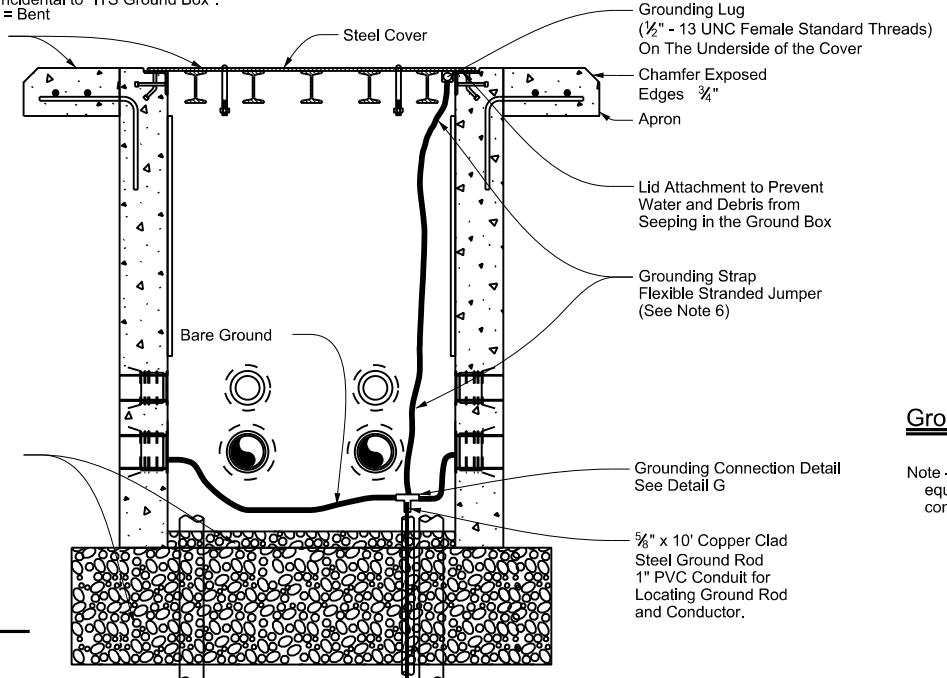
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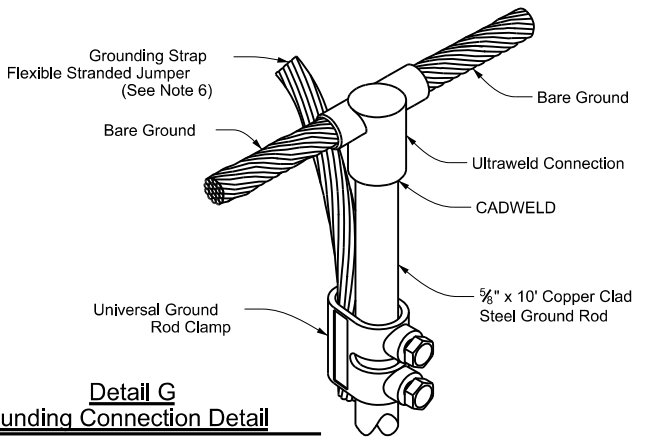
Detail E
Ground Box Apron Detail

Ground Box Type 1	BAR A					BAR B					BAR D					BAR E					BAR F					TOTALS						
	No.	Size	Ty.	Length	Weight	No.	Size	Ty.	Length	Weight	No.	Size	Ty.	Length	Weight	No.	Size	Ty.	Length	Weight	No.	Size	Ty.	Length	Weight	No.	Size	Ty.	Length	Weight	Steel * LBS.	Conc. * CY
36" Depth	22	#4	St.	2'-8"	39.3	5	#4	Bt.	13'-2"	44.1	8	#4	Bt.	2'-0"	10.7	1	#3	Bt.	17'-2"	6.5	1	#3	Bt.	19'-10"	7.5	1	#3	Bt.	19'-10"	7.5	108.1	.67
48" Depth	22	#4	St.	3'-8"	54.0	7	#4	Bt.	13'-2"	61.8	8	#4	Bt.	2'-0"	10.7	1	#3	Bt.	17'-2"	6.5	1	#3	Bt.	19'-10"	7.5	1	#3	Bt.	19'-10"	7.5	140.5	.89
60" Depth	22	#4	St.	4'-8"	68.8	8	#4	Bt.	13'-2"	70.6	8	#4	Bt.	2'-0"	10.7	1	#3	Bt.	17'-2"	6.5	1	#3	Bt.	19'-10"	7.5	1	#3	Bt.	19'-10"	7.5	164.1	1.11

* - For Contractors Information Only. Incidental to "ITS Ground Box".
 Legend: Ty. = Type, St. = Straight, Bt. = Bent



Detail F
Grounding Detail



Detail G
Grounding Connection Detail

Note - All grounding connections to be CADWELD or approved equal. This work will not be paid for directly, but is considered incidental to ITS ground box.

General Notes:

- See ITS(37) for additional Type "1" ground box details.
- Hot-dip galvanized steel covers after all welds are made.
- Label top of cover with the words "DANGER HIGH VOLTAGE TRAFFIC MANAGEMENT" using template-guided, hand-welded lettering at a height of 2 inches to ensure neatness.
- Provide all Type "1" ground boxes with a securable, tamper-proof cover equipped with a bolting system that positively secures the cover in place.
- Ground steel covers in accordance with the National Electrical Code.
- Ground covers to the grounding cable using a split-bolt kearney clamp, and a minimum 8-foot long flexible stranded jumper the same size as the grounding conductor. Terminate to metal ground box cover with a tank ground type lug as approved and directed by the Engineer.
- Provide Type "1" ground box and cover designed for heavy duty loading in accordance with AASHTO H20 loading when located where the box may experience deliberate, continuous vehicular traffic, such as near the shoulder or an auxiliary lane, or immediately adjacent to the unprotected edge of pavement.
- Provide a Type "1" ground box and cover tested by a laboratory independent of the manufacturer certifying loading requirements are met. Provide certification of such tests to the Engineer for approval.
- Provide a steel or cast iron cover in accordance with Item 471, Article 471.2, "Frames, Grates, Rings, and Covers." Provide covers with the number of drop handles shown. Provide Class "A" concrete for ground box construction and aprons.
- Fabricate cover so to fits properly on the ground box, and no undue noise results when traffic contacts the cover.

SHEET 2 OF 2



**ITS GROUND BOX DETAILS
TYPE "1" WITH STEEL COVER**

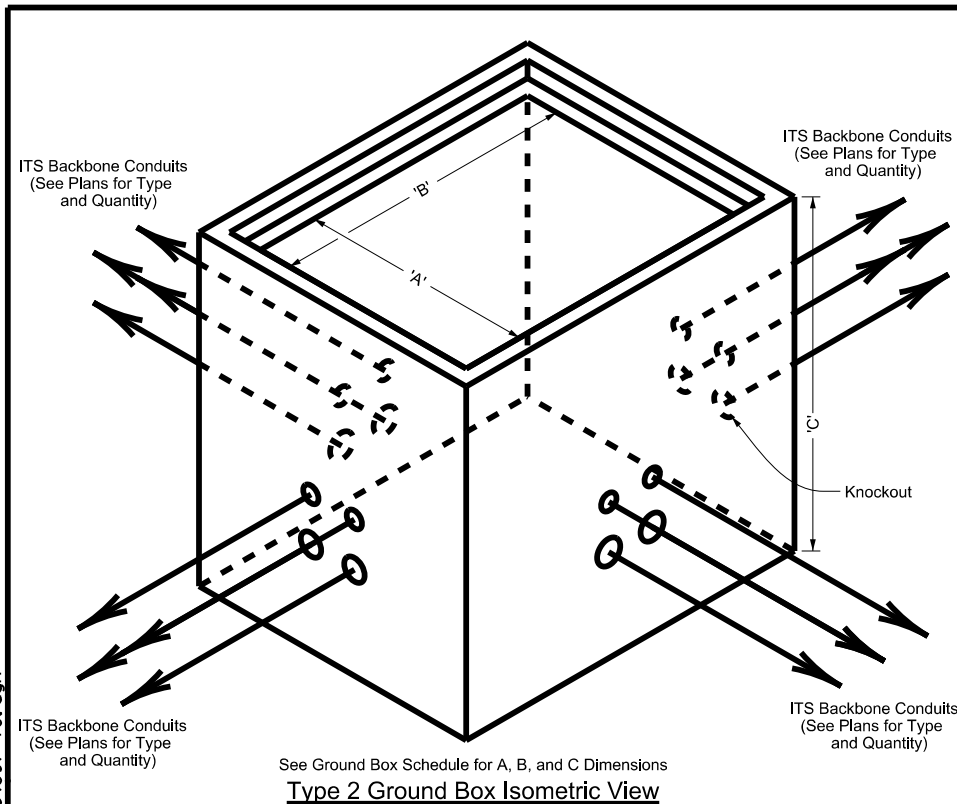
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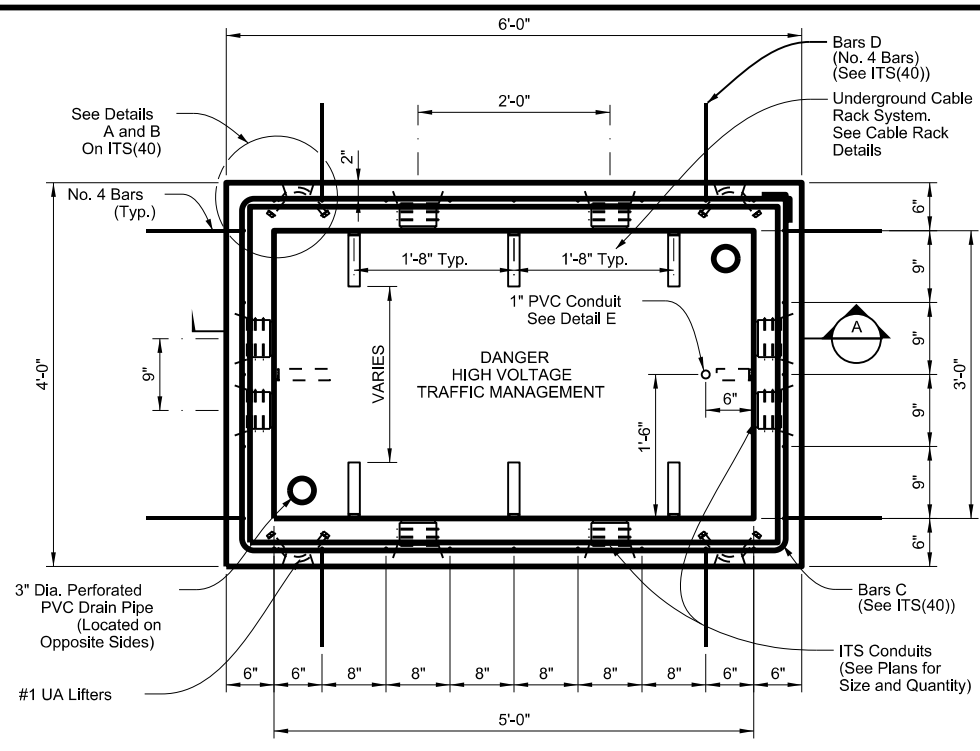
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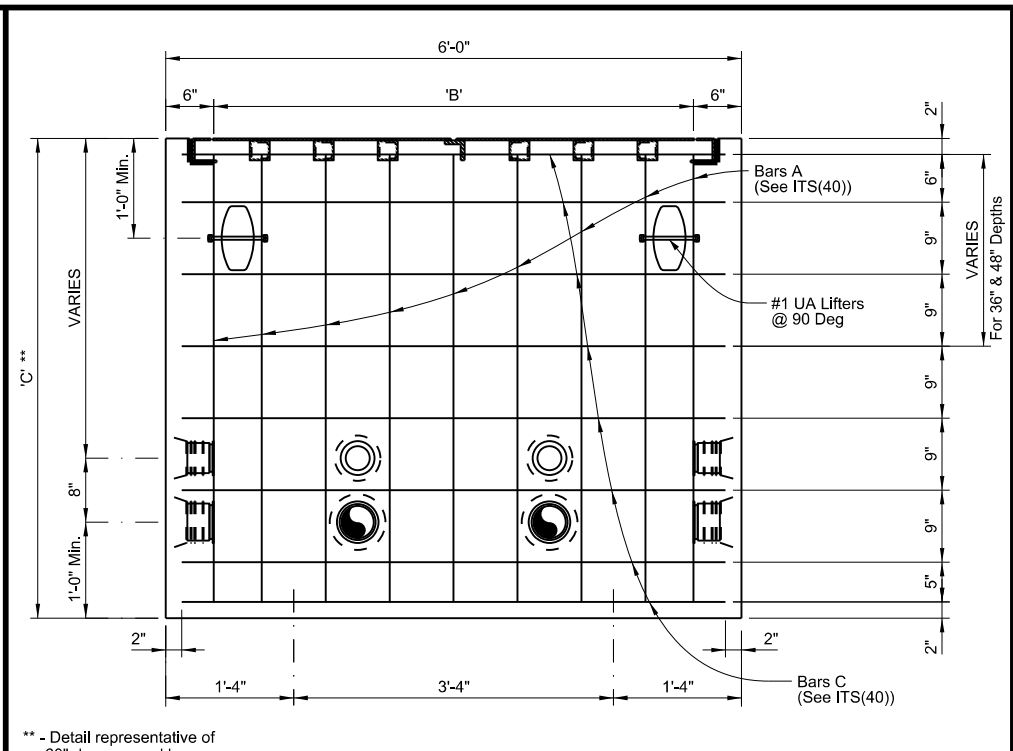
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See Ground Box Schedule for A, B, and C Dimensions
Type 2 Ground Box Isometric View

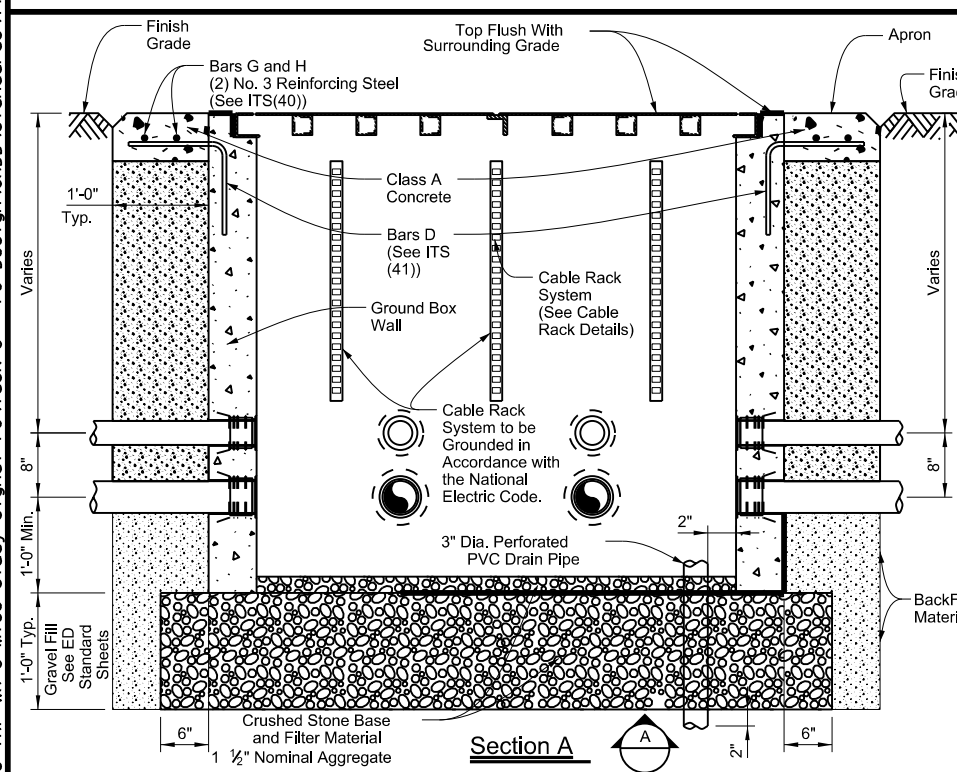


Note: Bar Spacing is The Same on Opposing Sides.
Type 2 Ground Box Plan View

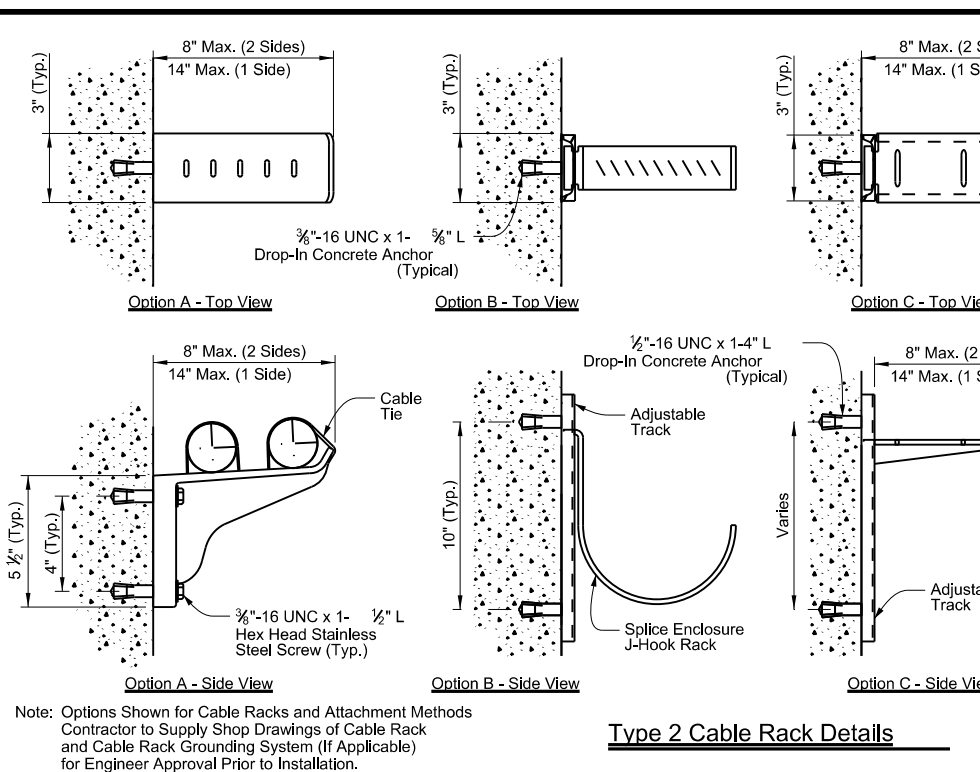


** - Detail representative of 60" deep ground box.

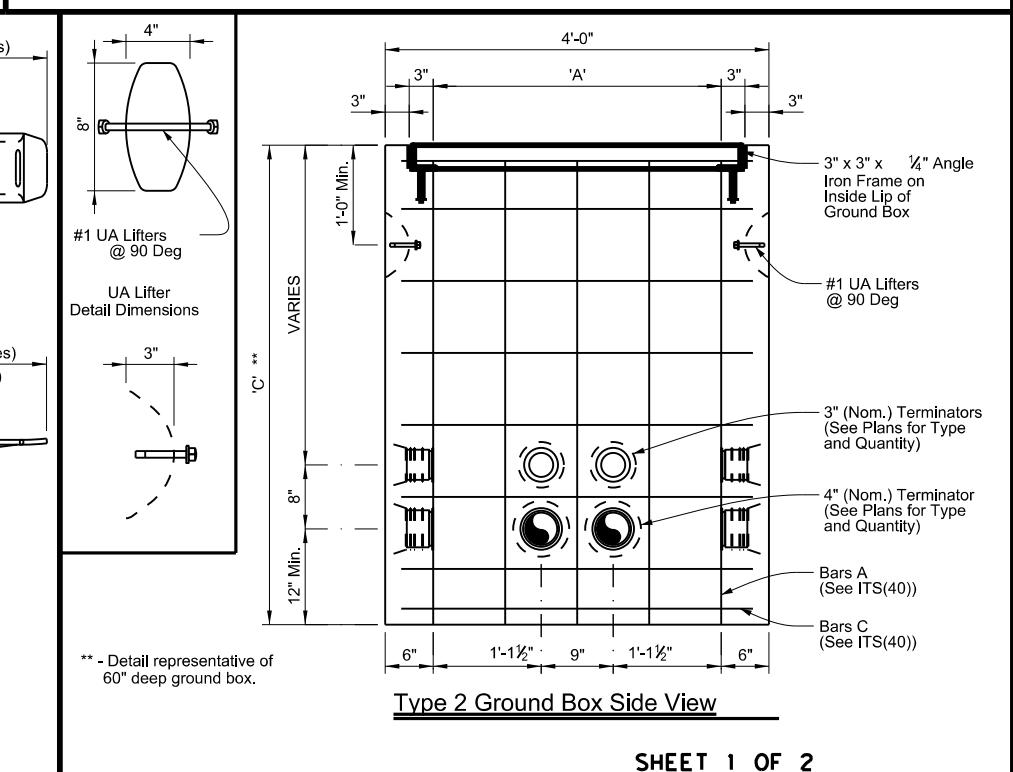
Type 2 Ground Box Elevation View



Section A



Type 2 Cable Rack Details



Type 2 Ground Box Side View

** - Detail representative of 60" deep ground box.

General Notes:

- Conduit entry points shown represent the standard configuration for backbone conduit as detailed on ITS(27). Additional conduits may be required as shown on the plans.
- Provide Class "A" concrete for Type "2" ground boxes.
- Provide terminators for the PVC conduit cast in the walls and placed symmetrically about the centerline of the box at the depths shown, unless otherwise noted, for the number of conduits identified on the plans to enter the box.
- Provide terminators appropriately sized for the conduits indicated on the plans. Provide terminators with an air tight and water tight connection.
- Closed bottom Type "2" ground boxes are acceptable in lieu of open bottom boxes. Provide two 3" Dia. perforated PVC drain pipes on opposite corners to optimize water drainage. Provide closed bottom boxes with a 12-inch base of crushed stone which extends 6 inches in all directions from the perimeter of the box. Crushed stone will be subsidiary to Special Specification, "ITS Ground Box."
- When additional conduit entry points are needed to accommodate existing conduit, core drill conduit knockouts in the field of the appropriate number and size of conduit at each location, as directed by the Engineer.
- Provide a bell fitting on the end of each conduit to ensure a flush fit inside the ground box.

- Concrete grout around the knockout (inside and out) and around the conduit and bell fitting to ensure a neat watertight fit after the conduit and bell fitting have been placed in a knockout. Ensure all openings in the ground box are sealed prior to grouting operations.
- Install a nylon string and plug all unused conduits with tug-plugs sized for the particular conduits. Provide split innerduct plugs in conduits or innerducts with cables to seal the innerduct around the cables to prevent water and dirt from entering.
- Install all open bottom Type "2" ground boxes on a 12-inch base of crushed stone which extends 6 inches in all directions from the perimeter of the box. Crushed stone will be subsidiary to special specification, "ITS Ground Box."
- Cap and seal terminators that do not have conduits attached.
- Backfill in accordance with Item 400, "Excavation and Backfill for Structures."
- Provide steel (ASTM A-153), glass reinforced nylon, or equivalent cable rack assemblies designed to support the amount of cable storage slack and splice enclosures identified in the plans. Locate cable rack system on any side but allow for sufficient access to the inside of the ground box. Cable racks may be installed at the factory or in the field. When mounting cable racks in the field, seal all penetrations to the concrete side wall to prevent moisture penetration. Ground metallic cable rack systems to grounding system inside ground box in accordance with the National Electrical Code.

Ground Box Schedule			
Ground Box Type	'A' Width Inside (Inches)	'B' Length Inside (Inches)	'C' Depth Inside (Inches)
Type 2	36	60	36, 48, 60

Sheet Details
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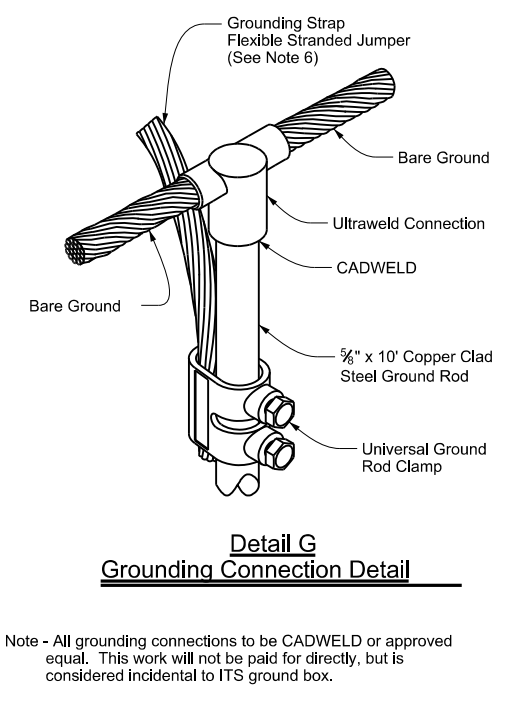
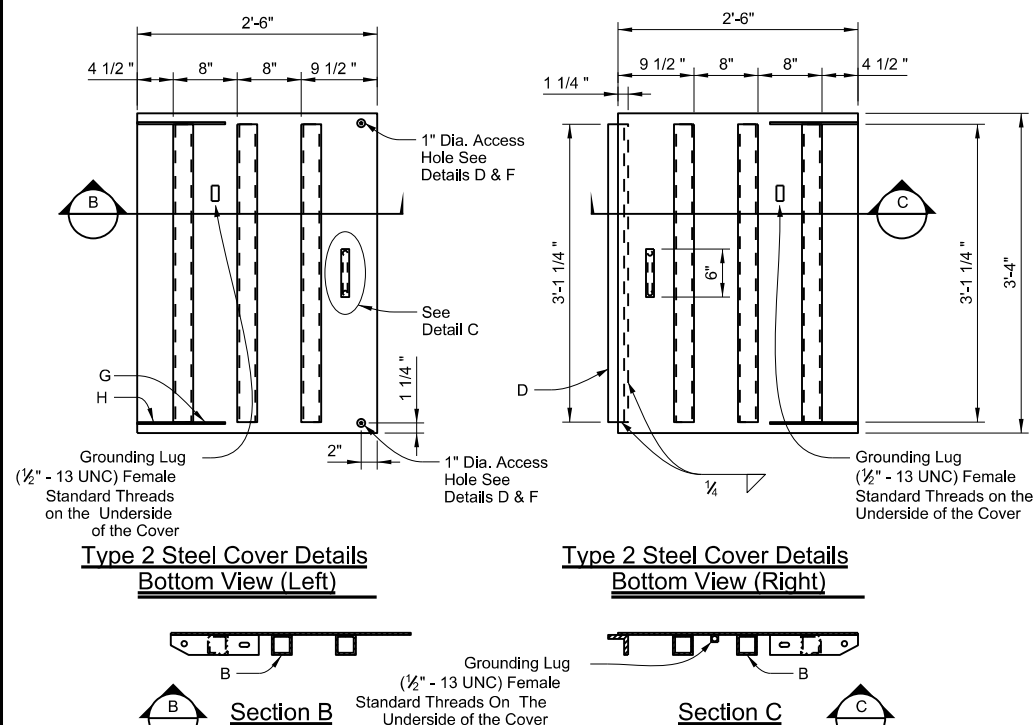
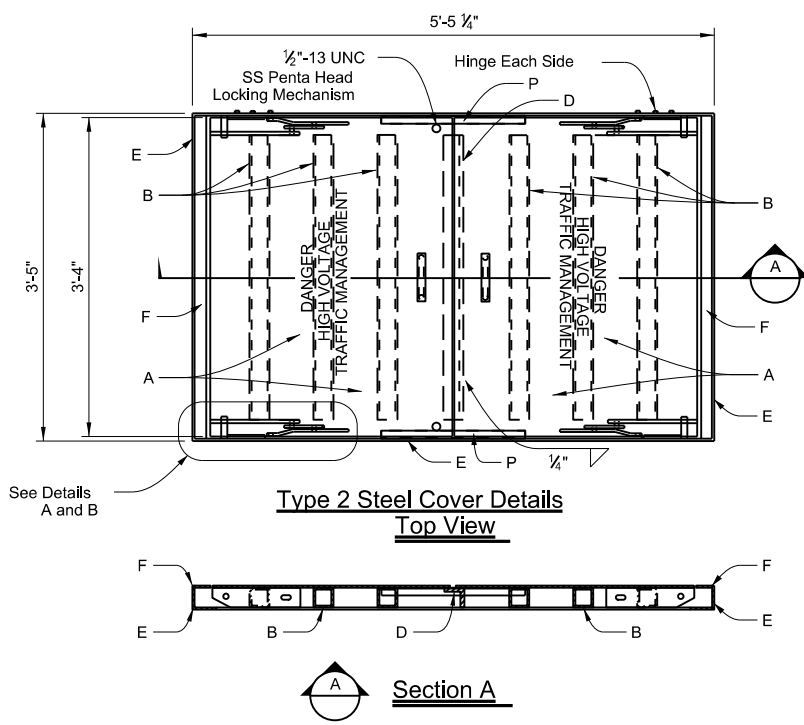
SHEET 1 OF 2

ITS GROUND BOX DETAILS TYPE "2" WITH STEEL COVER

ITS(39) - 16

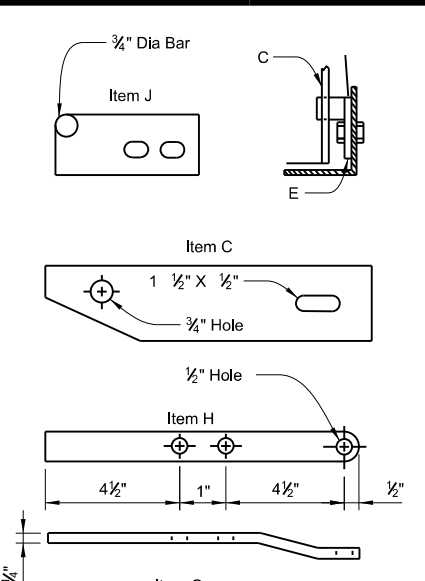
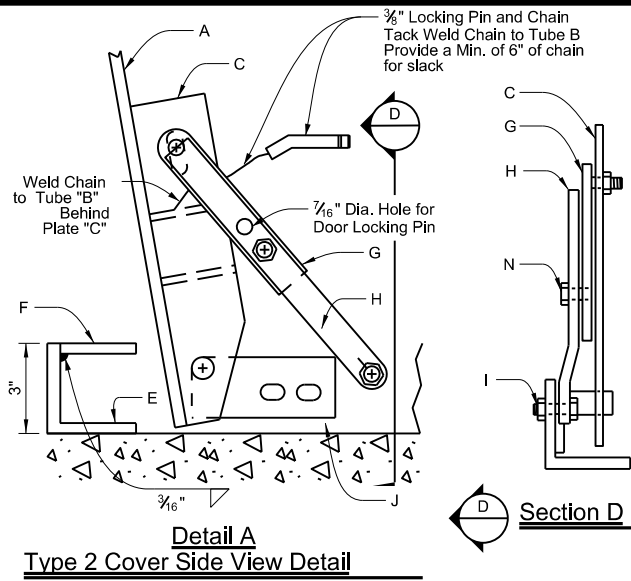
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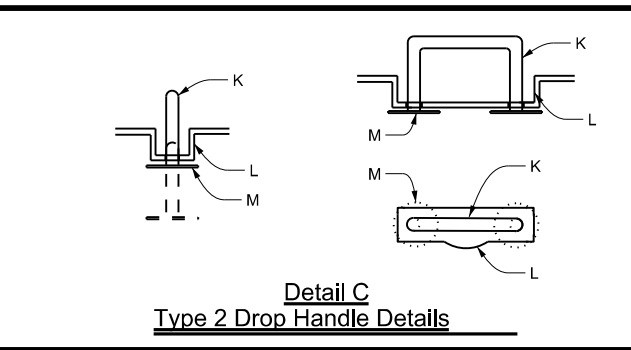
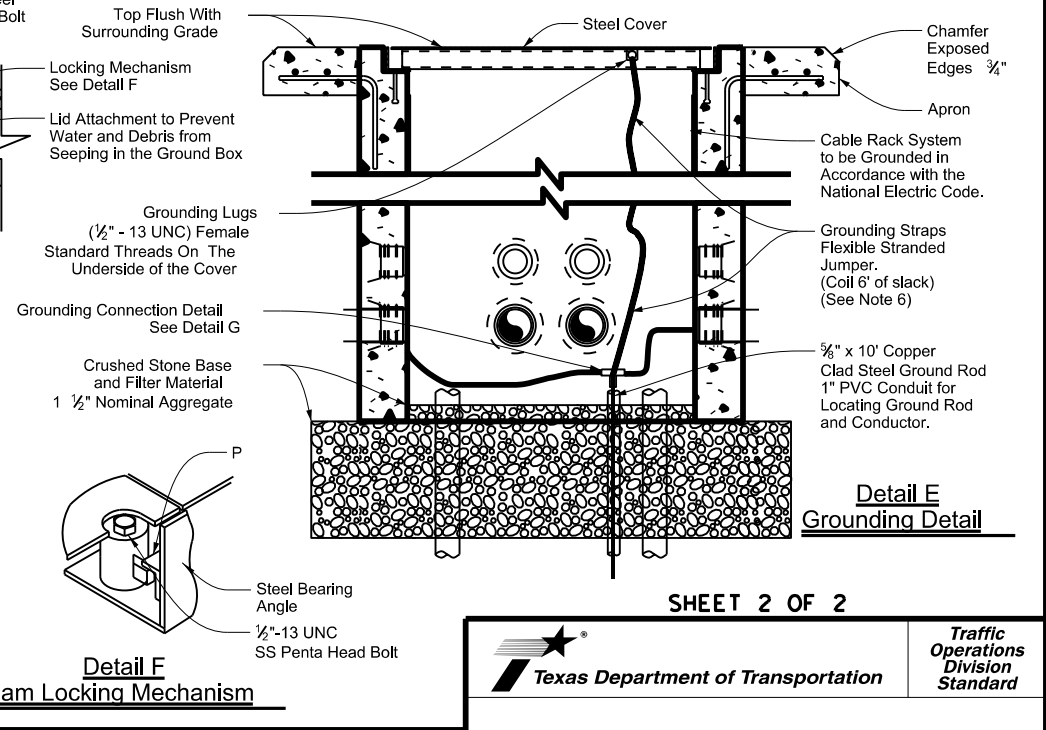
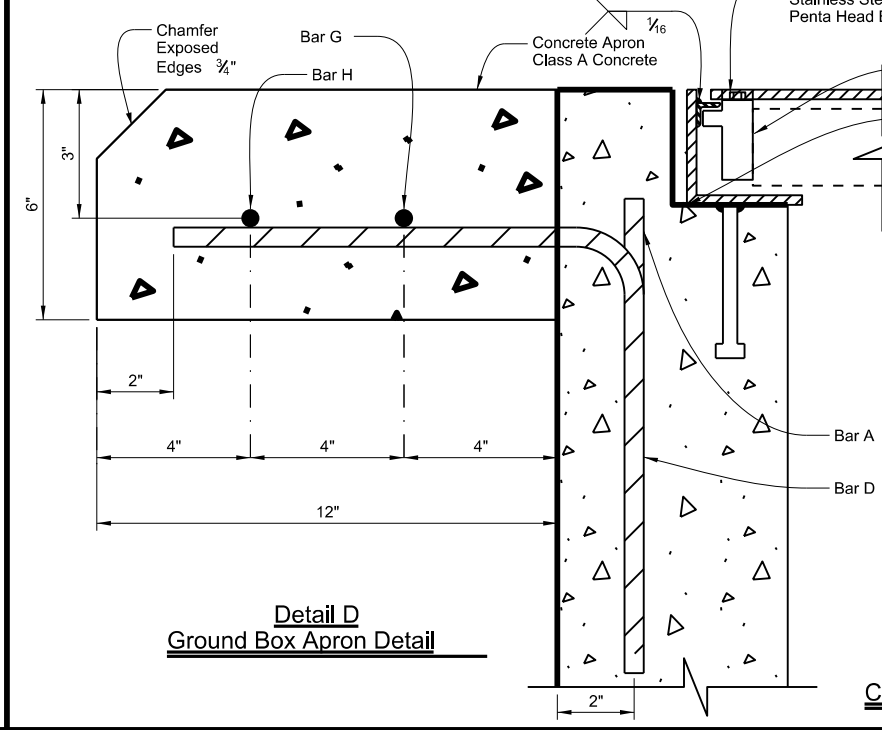
Item	Qty	Incidental "ITS Ground Box" Material
A	2	1/4" Floor Plate 40" x 30"
B	6	2 1/2" x 2 1/2" x 37 1/4" Tube
C	4	11" x 2 1/2" x 1/4" Plate
D	1	2 1/2" x 2 1/2" x 1/2" x 37" 1/4" Angle
E	4	3" x 3" x 1/4" Angle
F	2	40 1/2" x 2" x 1/4" Plate
G	4	6 1/2" x 1 1/4" x 1/4" Plate
H	4	10 1/2" x 1 1/4" x 1/4" Plate
I	12	1/2" Bolt/Nut
J	4	4 3/4" x 2" x 3/4" Plate
K	2	5/8" Drop Handle
L	2	1 1/2" x 5/8" x 3/16" Channel x 7"
M	4	1 1/2" x 1/8" P Disk
N	8	1/2" x 5/8" Bolt
P	2	1" x 1" x 1/8" Angle x 18"

Note - All grounding connections to be CADWELD or approved equal. This work will not be paid for directly, but is considered incidental to ITS ground box.



Ground Box Type 2	BAR A					BAR C					BAR D					BAR G					BAR H					TOTALS	
	No.	Size	Ty.	Length	Weight	No.	Size	Ty.	Length	Weight	No.	Size	Ty.	Length	Weight	No.	Size	Ty.	Length	Weight	No.	Size	Ty.	Length	Weight	Steel * LBS.	Conc. * CY
36" Depth	28	#4	St.	2'-8"	50.0	5	#4	Bt.	19'-1"	63.9	8	#4	Bt.	2'-0"	10.7	1	#3	Bt.	23'-3"	8.8	1	#3	Bt.	25'-11"	9.8	143.2	1.00
48" Depth	28	#4	St.	3'-8"	68.8	7	#4	Bt.	19'-1"	89.5	8	#4	Bt.	2'-0"	10.7	1	#3	Bt.	23'-3"	8.8	1	#3	Bt.	25'-11"	9.8	187.6	1.33
60" Depth	28	#4	St.	4'-8"	87.5	8	#4	Bt.	19'-1"	102.3	8	#4	Bt.	2'-0"	10.7	1	#3	Bt.	23'-3"	8.8	1	#3	Bt.	25'-11"	9.8	219.1	1.67

* - For Contractors Information Only. Incidental to "ITS Ground Box".
 Legend: Ty. = Type, St. = Straight, Bt. = Bent



General Notes:

- See ITS(39) for additional Type "2" ground box details.
- Hot-dip galvanized steel covers after all welds are made.
- Label top of cover with the words "DANGER HIGH VOLTAGE TRAFFIC MANAGEMENT" using template-guided, hand-welded lettering at a height of 2 inches to ensure neatness.
- Provide all Type "2" ground boxes with a securable, tamper-proof cover equipped with a bolting system that positively secures the cover in place.
- Ground steel covers in accordance with the National Electrical Code.
- Ground covers to the grounding cable using a split-bolt kearney clamp, and a minimum 8-foot long flexible stranded jumper the same size as the grounding conductor. Terminate to metal ground box cover with a tank ground type lug as approved and directed by the Engineer.

- Provide Type "2" ground box and cover designed for heavy duty loading in accordance with AASHTO H20 loading when located where the box may experience deliberate, continuous vehicular traffic, such as near the shoulder or an auxiliary lane, or immediately adjacent to the unprotected edge of pavement.
- Provide a Type "2" ground box and cover tested by a laboratory independent of the manufacturer certifying loading requirements are met. Provide certification of such tests to the Engineer for approval.
- Provide a steel or cast iron cover in accordance with Item 471, Article 471.2, "Frames, Grates, Rings, and Covers." Provide covers with the number of drop handles shown. Provide Class "A" concrete for ground box construction and aprons.
- Fabricate cover so to fits properly on the ground box, and no undue noise results when traffic contacts the cover.

SHEET 2 OF 2

Texas Department of Transportation
 Traffic Operations Division Standard

ITS GROUND BOX DETAILS TYPE "2" WITH STEEL COVER

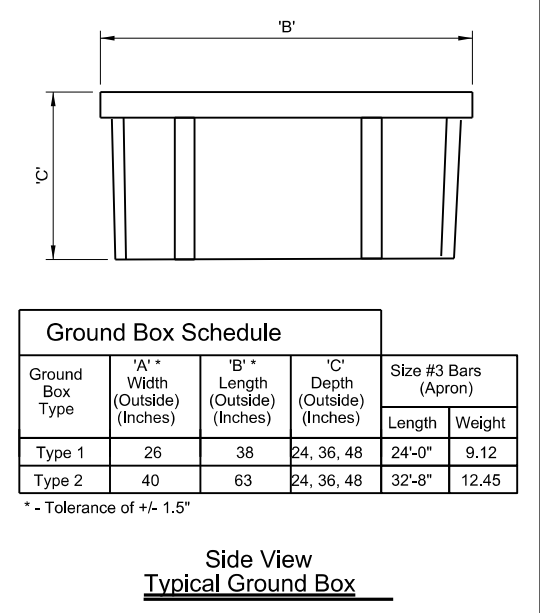
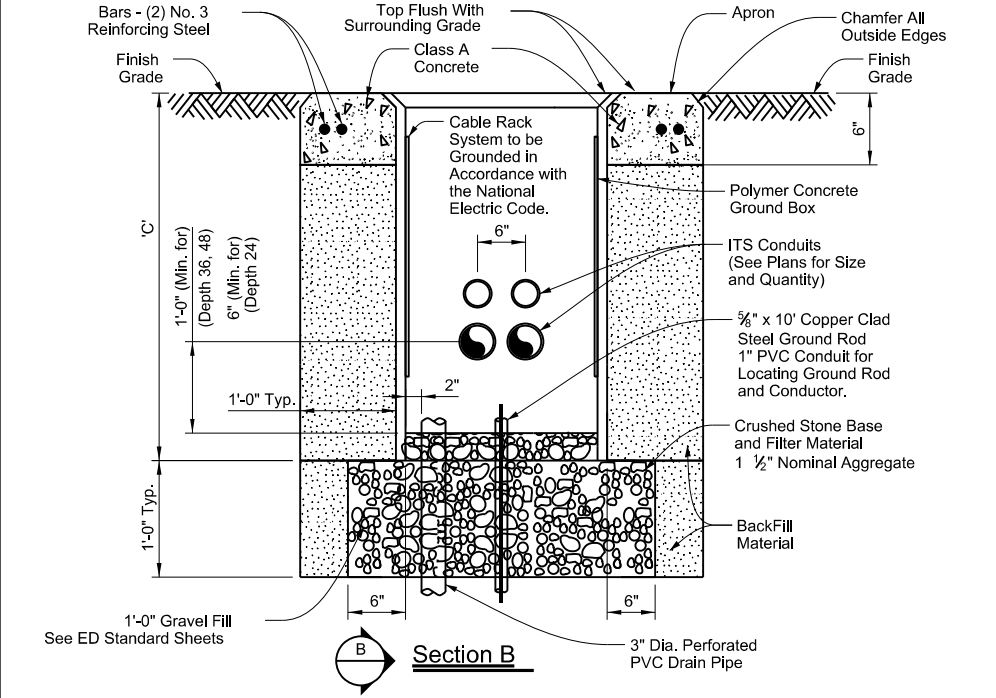
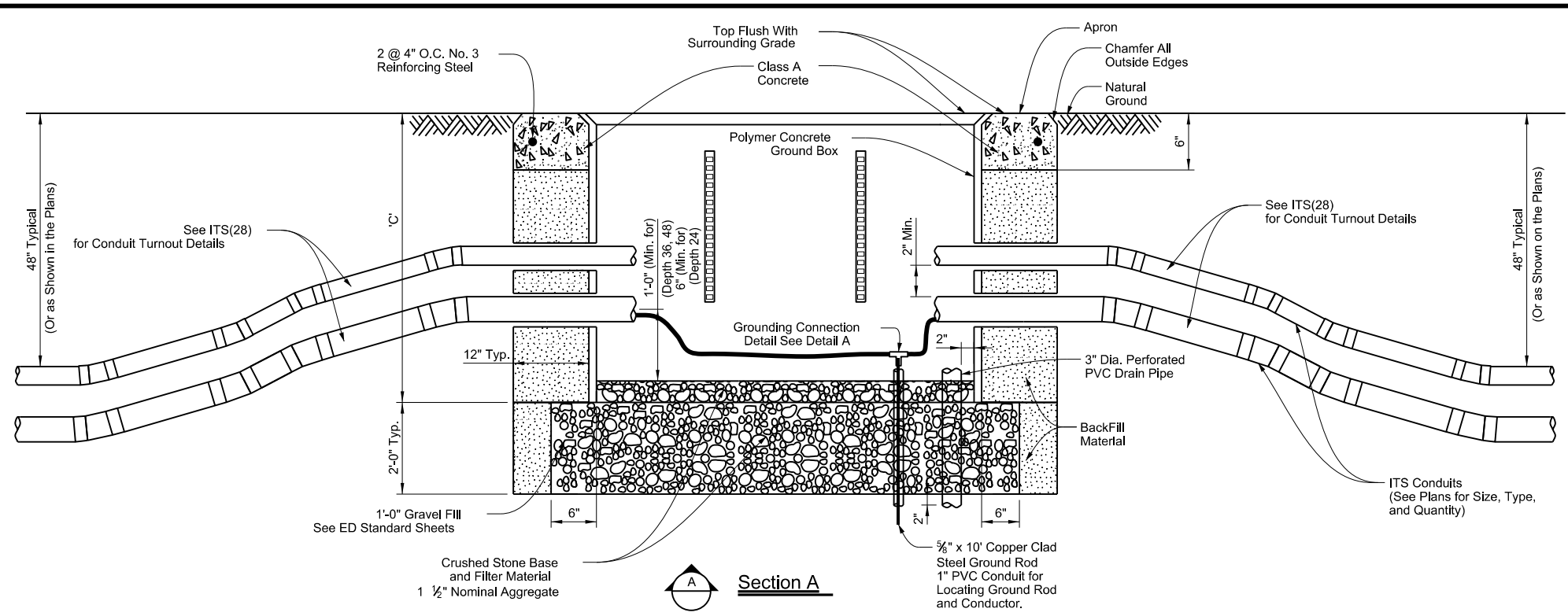
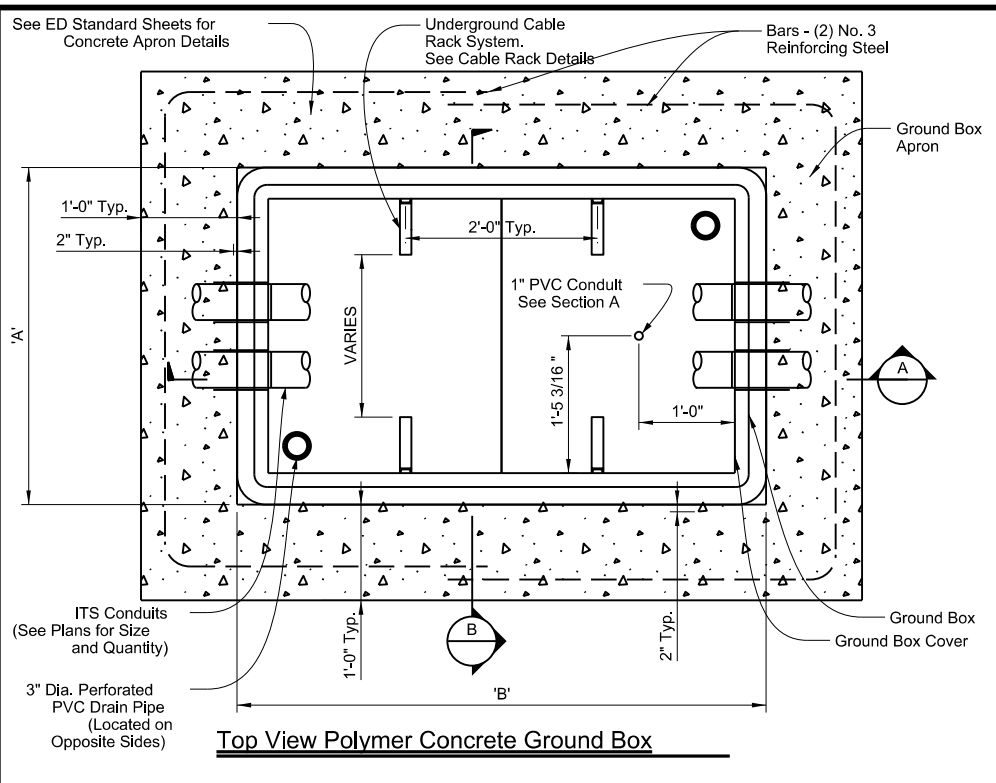
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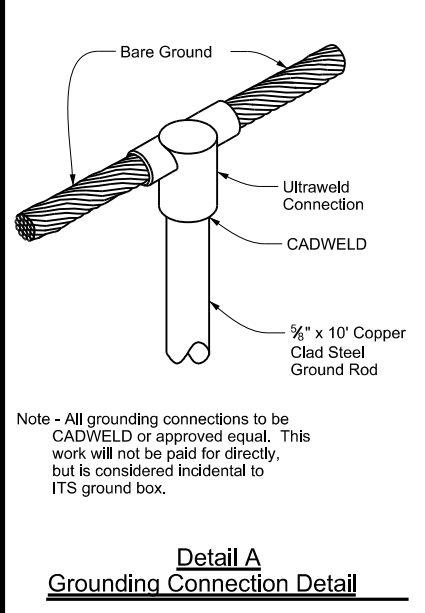
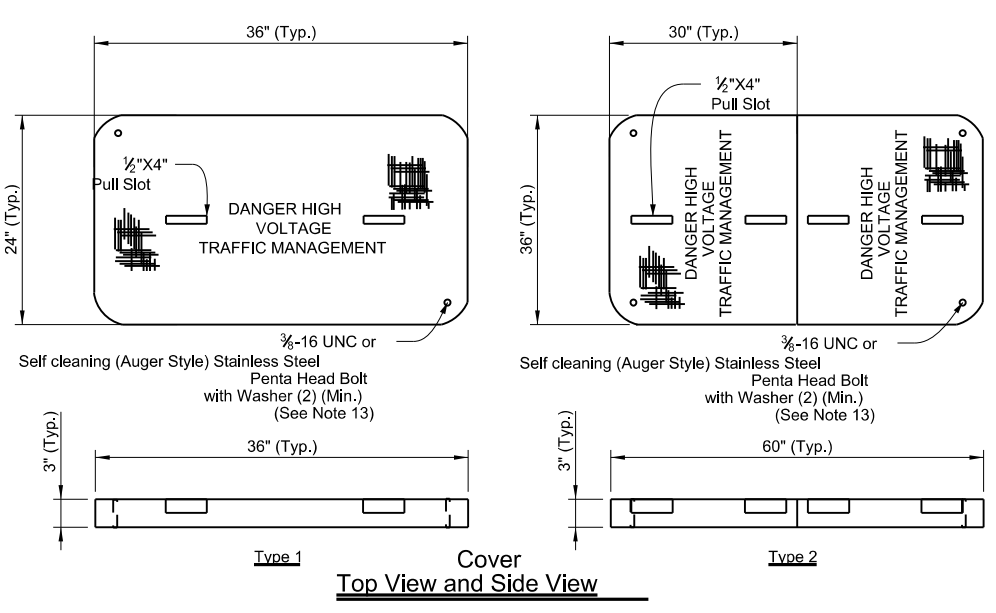
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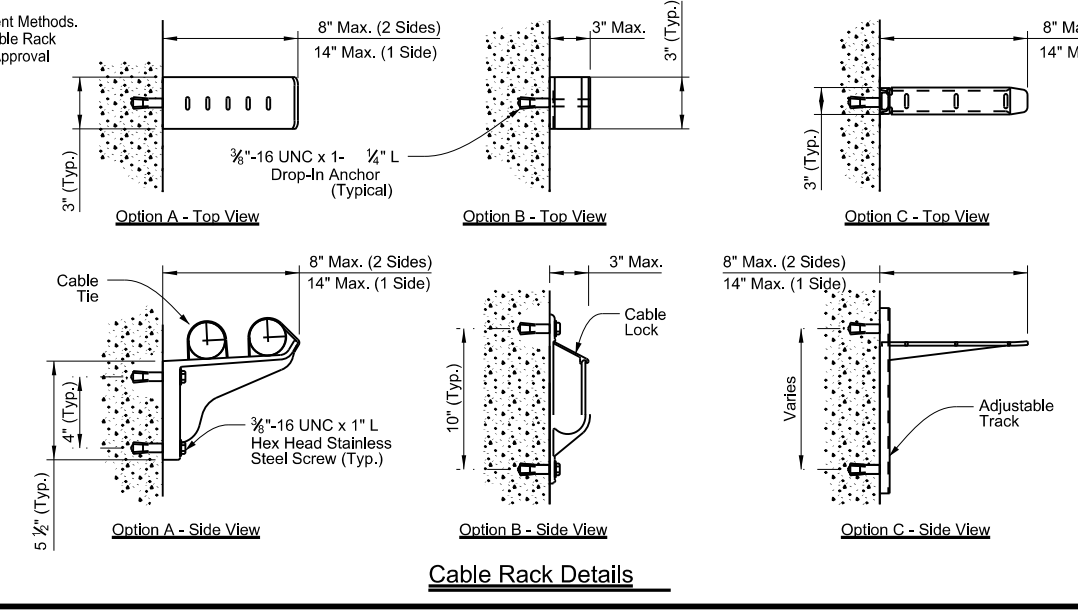
Ground Box Schedule

Ground Box Type	'A' * Width (Outside) (Inches)	'B' * Length (Outside) (Inches)	'C' Depth (Outside) (Inches)	Size #3 Bars (Apron)	
				Length	Weight
Type 1	26	38	24, 36, 48	24'-0"	9.12
Type 2	40	63	24, 36, 48	32'-8"	12.45

* - Tolerance of +/- 1.5"



- General Notes:**
- Conduit shown is for example only. Additional conduits may be required as shown on the plans.
 - Provide polymer concrete ground box and cover.
 - Provide Type "2" ground boxes when splice enclosure is required, as shown on the plans.
 - Terminate conduits through the side of the ground box.
 - Provide terminators for conduits cast in the walls and placed symmetrically about the centerline of the box at the depths shown, unless otherwise noted, for the number of conduits identified on the plans to enter the box.
 - Provide terminators appropriately sized for the conduits indicated on the plans. Provide terminators with an air tight and water tight connection.
 - Provide ground box with open bottom. Provide two 3" Dia. perforated PVC drain pipes on opposite corners and extend 2" below bottom of gravel bed to optimize water drainage.
 - Install ground box on a 12-inch base of crushed stone which extends 6 inches in all directions from the perimeter of the box. Crushed stone will be subsidiary to special specification, "ITS Ground Box."
 - When additional conduit entry points are needed to accommodate existing conduit, core drill conduit knockouts in the field of the appropriate number and size of conduit at each location, as directed by the Engineer.
 - Provide a bell fitting on the end of each conduit to ensure a flush fit inside the ground box.
 - Concrete grout around the knockout (inside and out) and around the conduit and bell fitting to ensure a neat watertight fit after the conduit and bell fitting have been placed in a knockout. Ensure all openings in the ground box are sealed prior to grouting operations.
 - Label top of cover with the words "DANGER HIGH VOLTAGE TRAFFIC MANAGEMENT."
 - Equip all covers with a bolting system that will positively secure the cover in place.
 - Backfill in accordance with Item 400, "Excavation and Backfill for Structures."
 - Provide p
 - Provide steel (ASTM A-153), glass reinforced nylon, or equivalent cable rack assemblies designed to support the amount of cable storage slack and splice enclosures identified in the plans. Locate cable rack system on any side but allow for sufficient access to the inside of the ground box. Cable racks may be installed at the factory or in the field. When mounting cable racks in the field, seal all penetrations to the side wall to prevent moisture penetration. Ground metallic cable rack systems to grounding system inside ground box in accordance with the National Electrical Code.



Sheet Details
Not to Scale

Texas Department of Transportation

Traffic Operations Division Standard

ITS GROUND BOX POLYMER CONCRETE

ITS(41)-16

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© TxDOT FEBRUARY 2016 CONT SECT JOB HIGHWAY

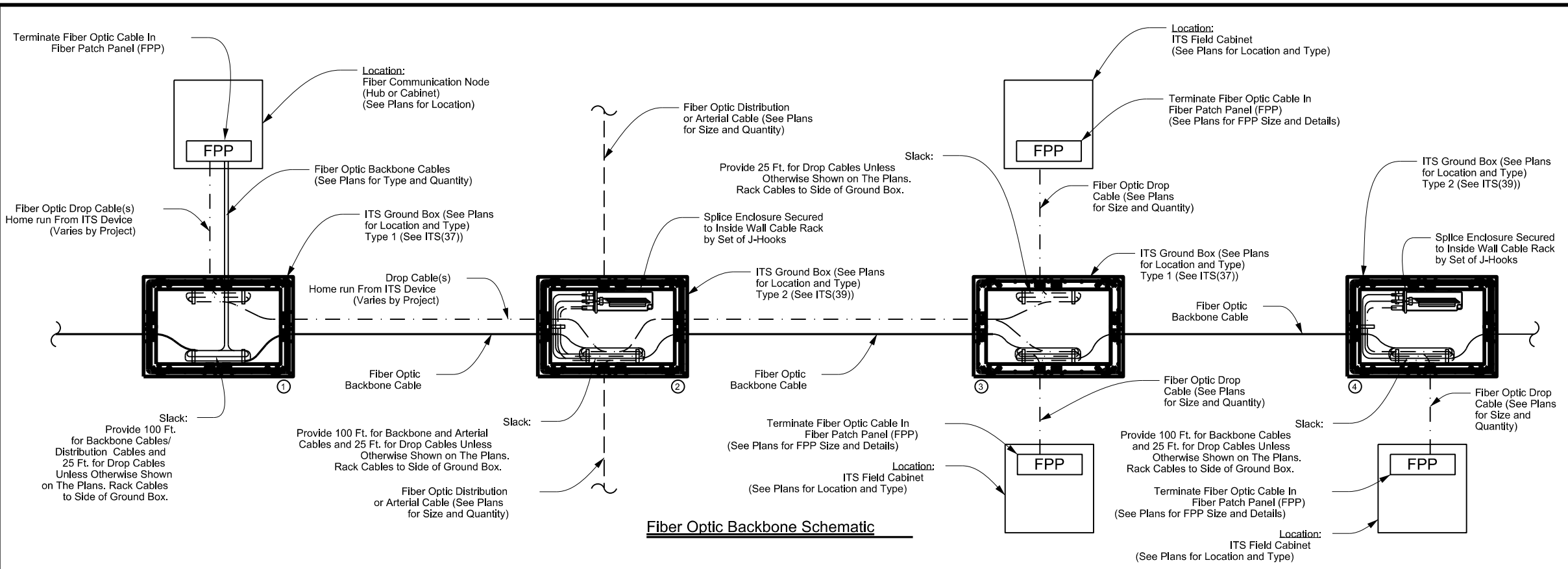
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DIST COUNTY SHEET NO.

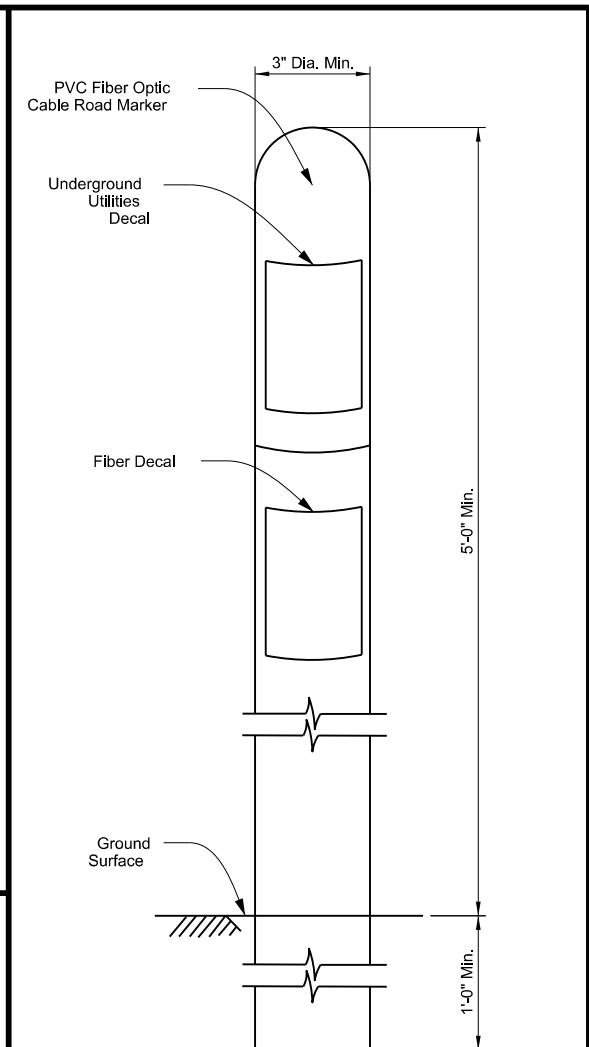
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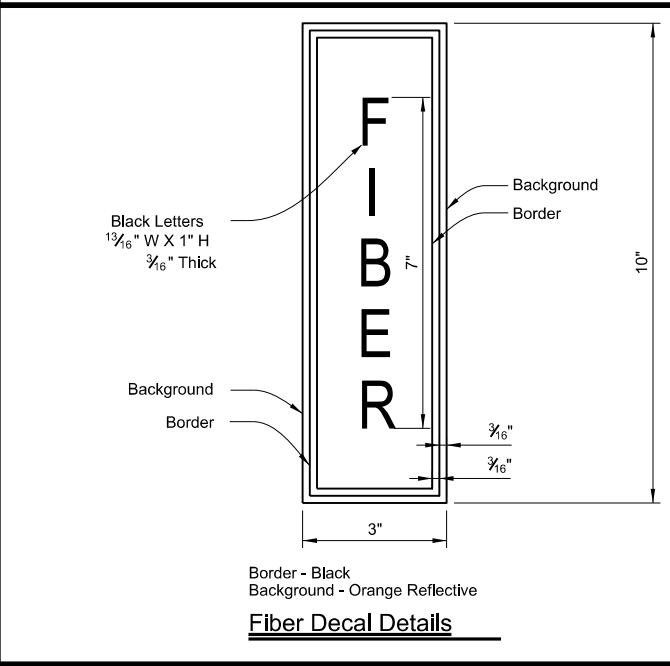


Fiber Optic Backbone Schematic

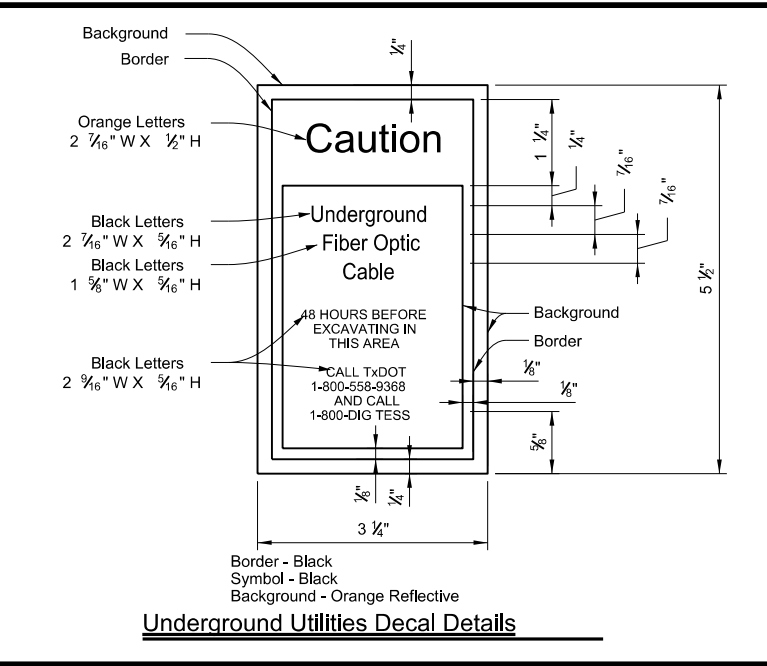


- Notes:
1. Space fiber optic cable road markers at maximum 1000' intervals or at significant changes in direction such as a 90 degree turn.
 2. Provide all orange fiber optic cable road markers for non-splice locations.
 3. Provide orange fiber optic cable road markers with white dome for splice locations.
 4. Locate marker within concrete apron of fiber ground box.

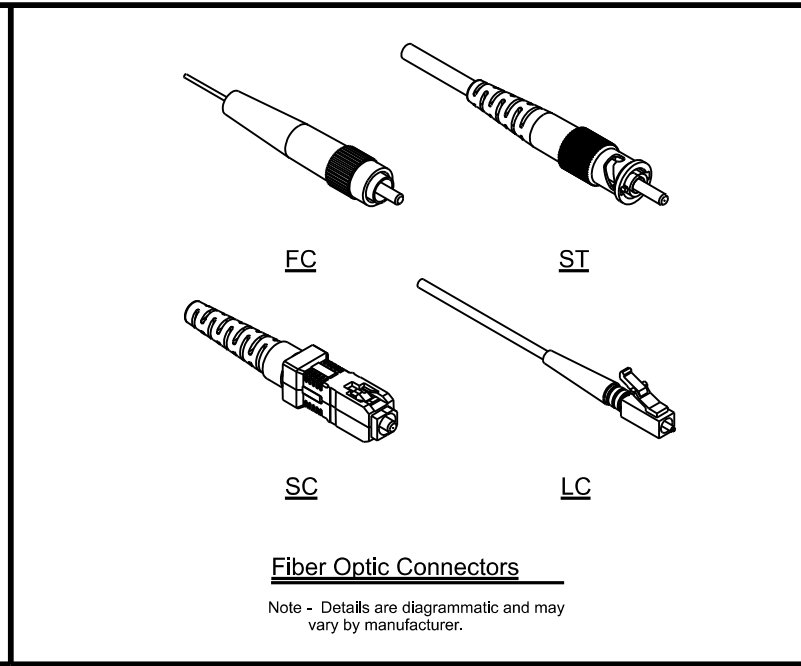
Fiber Optic Cable Road Markers



Fiber Decal Details



Underground Utilities Decal Details



Fiber Optic Connectors

Note - Details are diagrammatic and may vary by manufacturer.

General Notes:

1. The fiber optic backbone schematic shown is diagrammatic only and intended to represent the various fiber optic communication architectures seen across the state and may not show all configurations seen. Connection of ITS field equipment to ITS communication nodes or hubs is achieved through home run drop cables or spliced to the backbone in a splice enclosure. Refer to fiber communication schematic details and fiber termination information shown on the plans for further information.
2. Install a flat pull cord in all empty conduits and inner-ducts identified for communication use. The pull cord must have a tensile strength of 1,250 lbs minimum and have foot markings to determine length installed. Furnish and installation of pull cord will be subsidiary to special specification "ITS Fiber Optic Cable".
3. Color code each type of fiber optic cable to identify the cable as a "backbone" (green or blue), "distribution" (red), or "drop" (orange or yellow).
4. Terminate fibers at fiber patch panel (FPP), also referred to as patch panel, with SC connectors for new installations. When connecting to existing FPP, terminate with FC or ST connectors as shown on the plans. Provide connector adaptors as required to accommodate existing equipment if information is not provided in the plans.
5. Provide a list showing cable number assignments and highway or facility that the cable services.
6. Provide a single 1/8" #14 insulated wire in conduit runs which have been identified in the plans to carry fiber optic cable. Provide UL listed solid copper wire with orange color low density polyethylene insulation suitable for conduit installation rated for temperature range -20 C to 60 C and a voltage rating of 600V. This wire will serve as a tracer, or locate, wire for locating underground conduit containing fiber optic cabling and will be paid for under Item 620, "Electrical Conductors."
7. Ensure each cable is marked on the outer jacket with a label detailing the manufacturer's name, the date of manufacturer (month/year), the fiber count (Example: 48F SM or 48 SMF), and sequential length markings at maximum 3 FT increments.

Reference Notes:

- ① Fiber architecture at communication node.
- ② Fiber architecture for splicing arterial distribution cables.
- ③ Fiber architecture for home run of drop cables from ITS field equipment cabinets to communication node.
- ④ Fiber architecture for splicing drop cable from ITS field equipment cabinet.

SHEET 1 OF 2



ITS FIBER OPTIC CABLE MISCELLANEOUS DETAILS

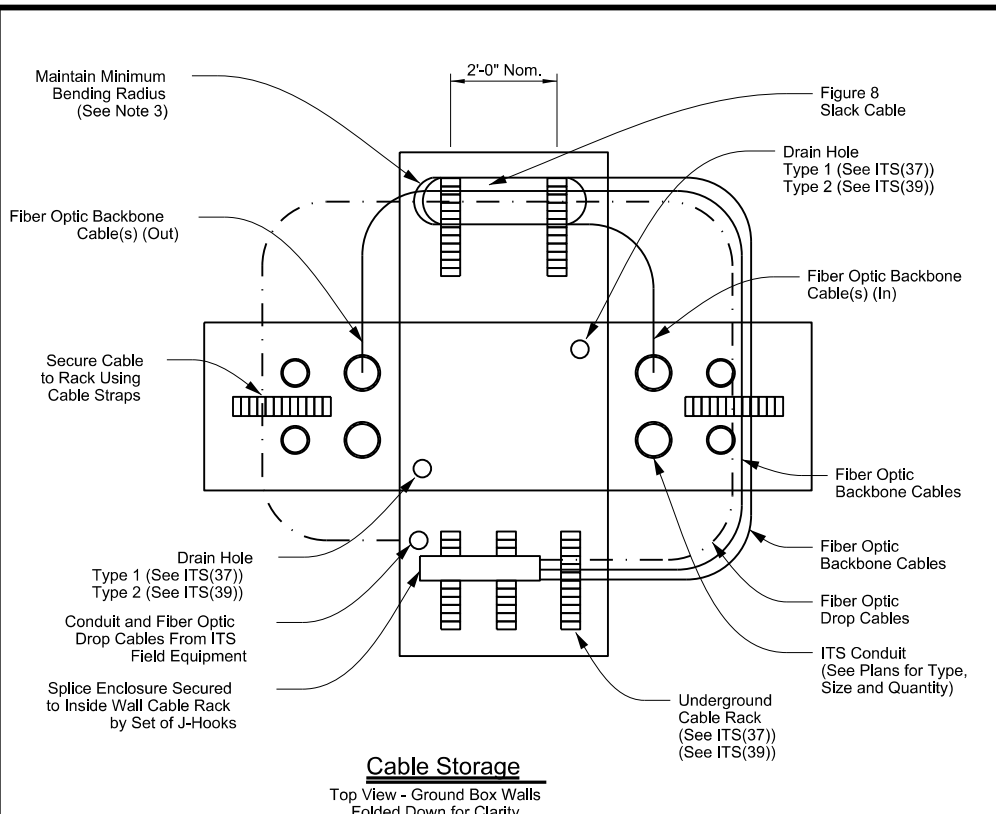
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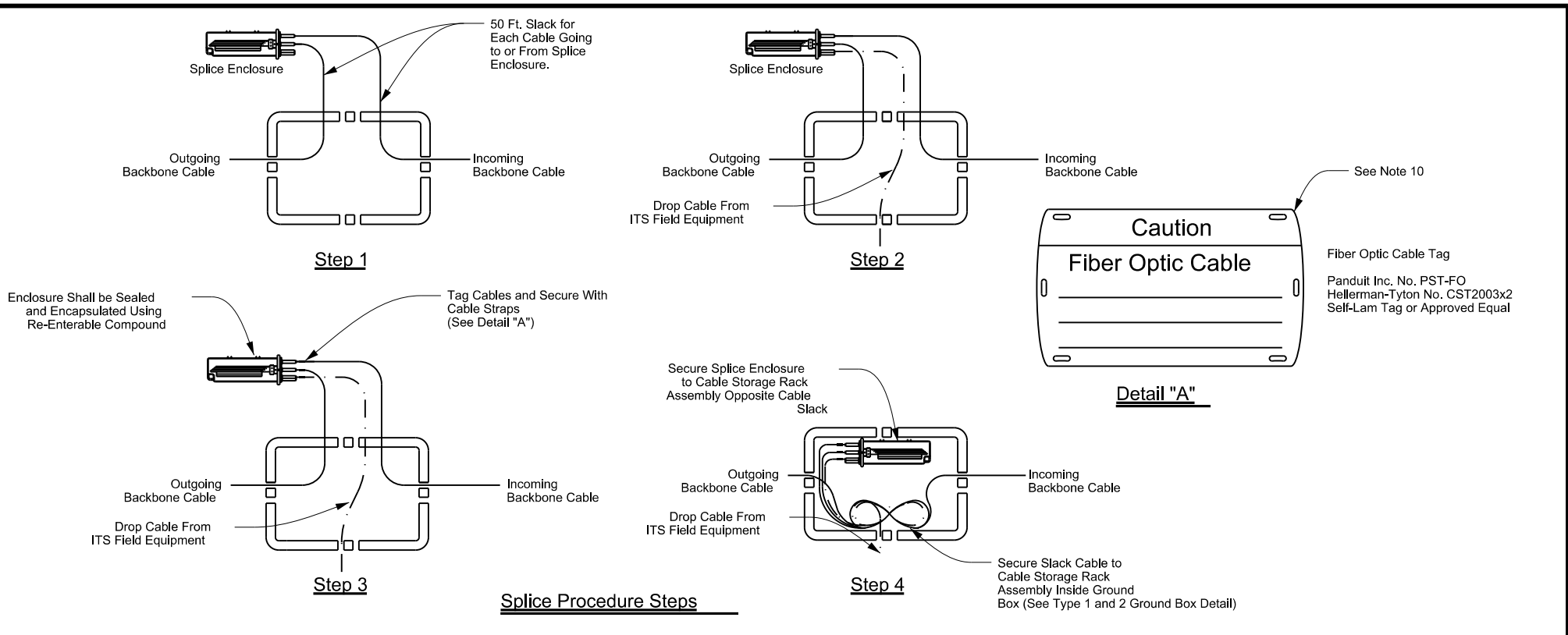
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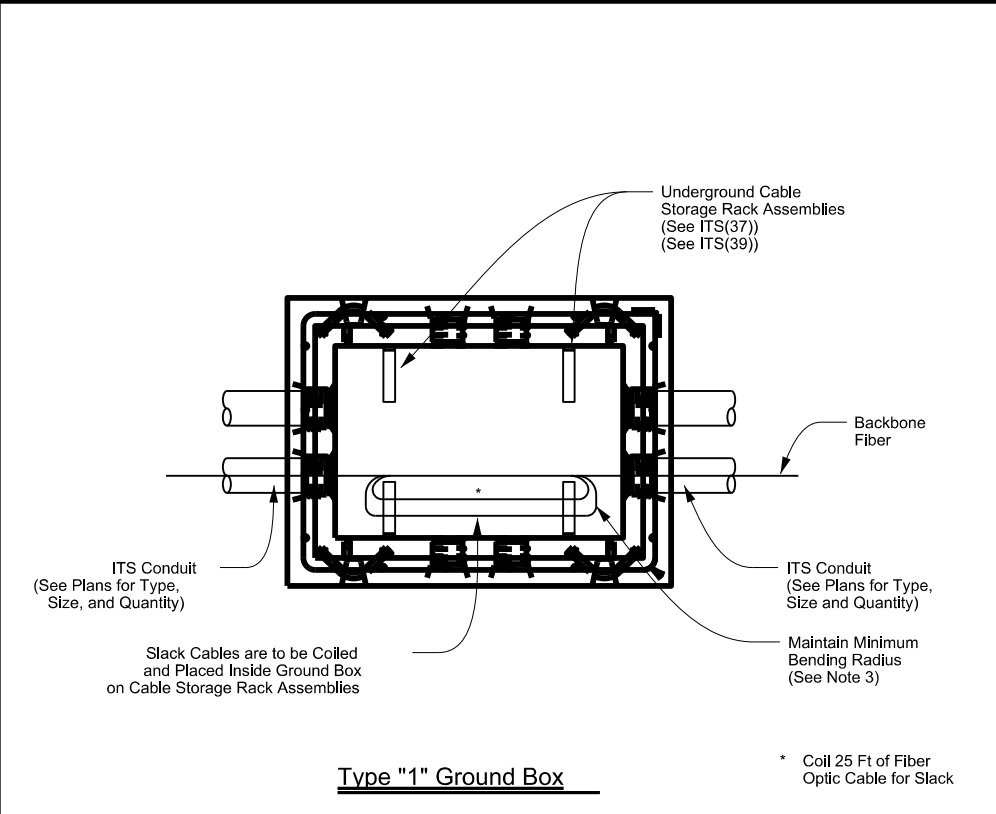
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Cable Storage
 Top View - Ground Box Walls Folded Down for Clarity

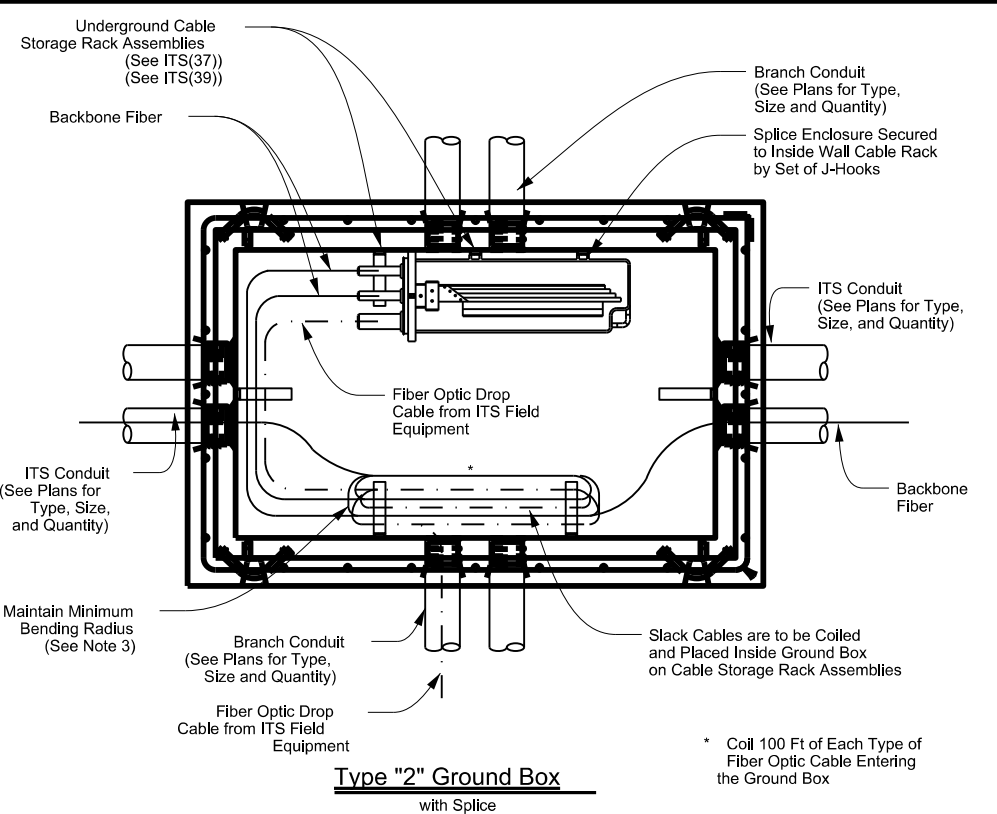


Splice Procedure Steps



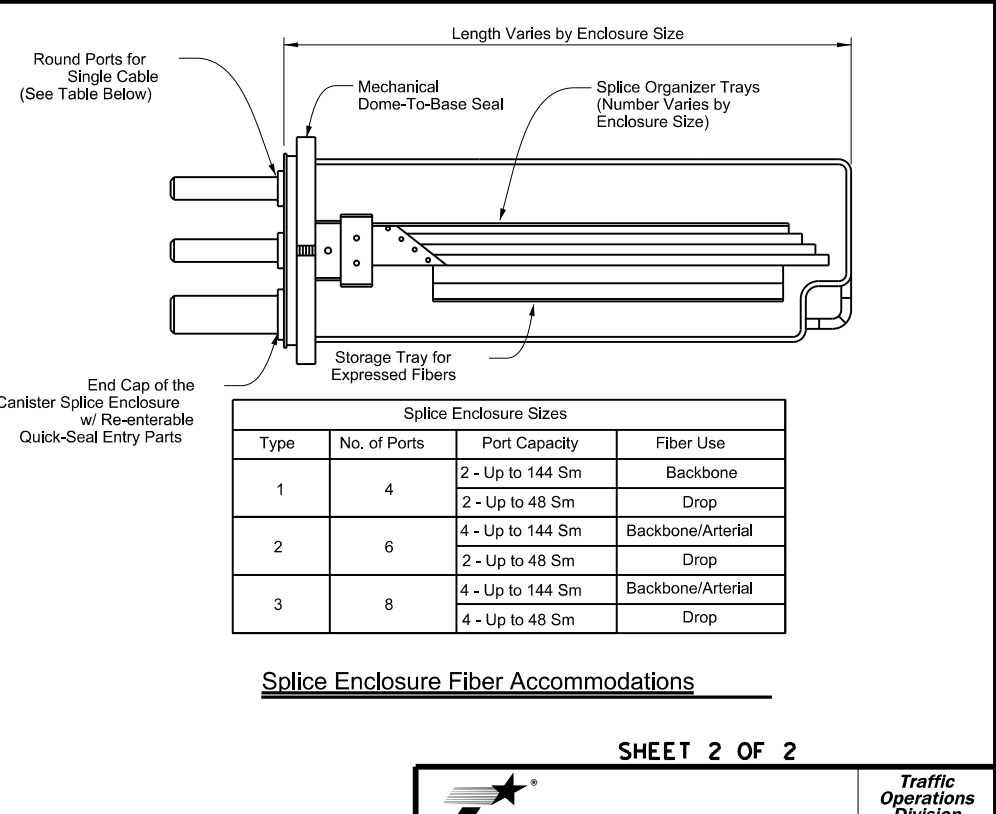
Type "1" Ground Box

* Coil 25 Ft of Fiber Optic Cable for Slack



Type "2" Ground Box with Splice

* Coil 100 Ft of Each Type of Fiber Optic Cable Entering the Ground Box



Splice Enclosure Fiber Accommodations

General Notes:

1. Conduit entry points to the Type 1 and Type 2 ground boxes are diagrammatic. Refer to ITS ground box standards, ITS(37) and ITS(39), for more information. Additional conduits may be required as shown on the plans.
2. Type 2 ground boxes are to be used, as shown on the plans, when splice enclosures are required.
3. Maintain a minimum bend radius of 20 times the fiber optic cable diameter during installation, relocation, and removal and a minimum of 10 times the fiber optic cable diameter when in operation.
4. Caulk all conduit around the top of the cable ducts with an engineer approved caulking compound to seal clearance between the cables and ducts. Place conduit plugs in all vacant conduits or inner-ducts.
5. Provide cable straps that will withstand ultra-violet exposure and do not damage cables when tightening.
6. All incidental equipment necessary for the cable installation and mounting of splice enclosure within the ground box will be incidental to Special Specification, "ITS Fiber Optic Cable."
7. Submit all splice locations to the field engineer for approval before beginning work.

8. Provide splice enclosures designed to seal, bond, anchor, and protect fiber optic cable splices. Provide splice enclosures designed to handle mechanical and fusion type splices. Provide splice enclosures with port configurations for the sizes detailed above.
9. Provide splice enclosures designed for underground placement with a sealing system preventing water penetration when submerged under 10 ft. of water.
10. Furnish, install, and secure fiber optic cable tags for each fiber optic cable entering a ground box, ITS field equipment cabinet (ground and pole), and hub building or communication node as detailed above. Provide information including fiber optic type, count, origin, and destination on the cable tag. Use UV resistant tie-wraps for securing the tag to the cable. Provide tie-wraps that do not damage fiber when securing to cable.

SHEET 2 OF 2



ITS FIBER OPTIC CABLE MISCELLANEOUS DETAILS

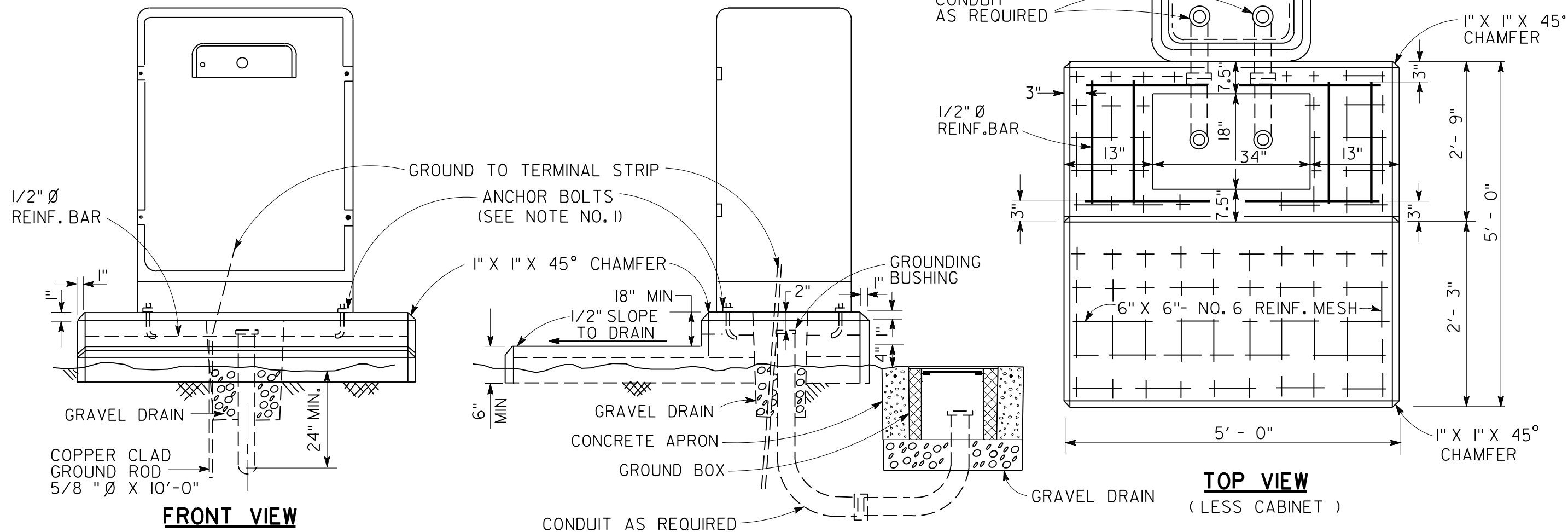
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CABINET AS PER CONTROLLER MANUFACTURER

NOTE: SEE PLAN LAYOUT FOR CONDUIT ENTRANCES AND SIZES



FRONT VIEW

SIDE VIEW

TOP VIEW
(LESS CABINET)

NOTES:

1. CABINET MANUFACTURER TO PROVIDE DETAILS OF ANCHOR BOLT LOCATION.
2. MODIFY DIMENSIONS FOR CONCRETE BASE TO FIT EQUIPMENT FURNISHED, IF NECESSARY.
3. PROVIDE GRAVEL DRAIN FOR CONTROLLER AND ALL GROUND BOXES.
4. FURNISH CLASS "B" OR CLASS "C" CONCRETE.
5. SET CONTROLLER FOUNDATION LEVEL WITH THE PAVEMENT SURFACE OR AS APPROVED BY THE ENGINEER.
6. FURNISH AT NO COST TO THE DEPARTMENT ANY ADDITIONAL CONCRETE WHICH MAY BE NECESSARY TO STABILIZE THE FOUNDATION AT UNUSUAL LOCATIONS.
7. PLACE REINFORCING BARS AS DIRECTED.
8. UPON INSTALLING THE CONTROLLER CABINET, APPLY A SILICON-BASED CAULKING COMPOUND AROUND THE BASE OF THE CONTROLLER CABINET.

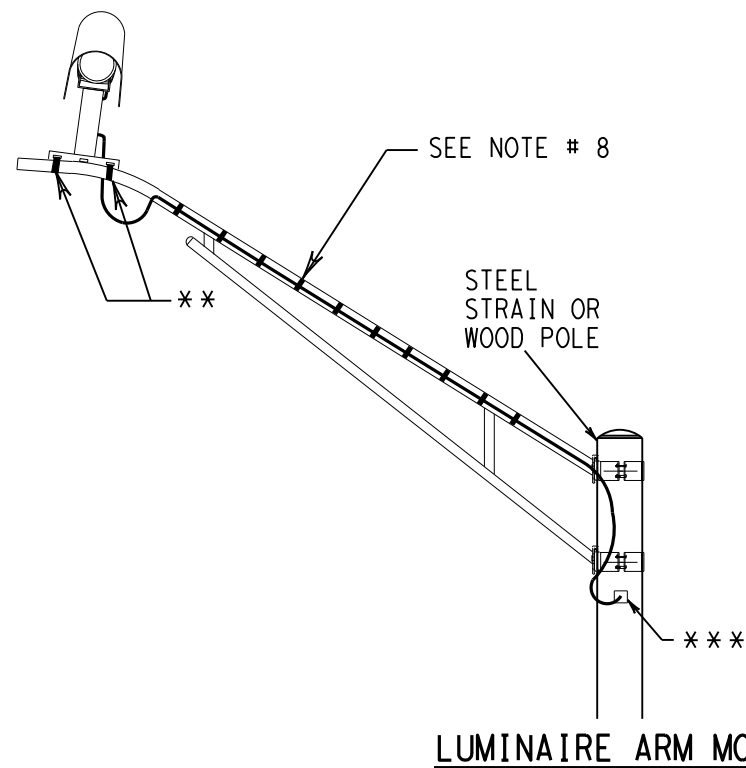
Texas Department of Transportation
Houston District

**SIGNAL DETAILS/STANDARDS
CONTROLLER FOUNDATION
DETAIL
SD/SCFD**

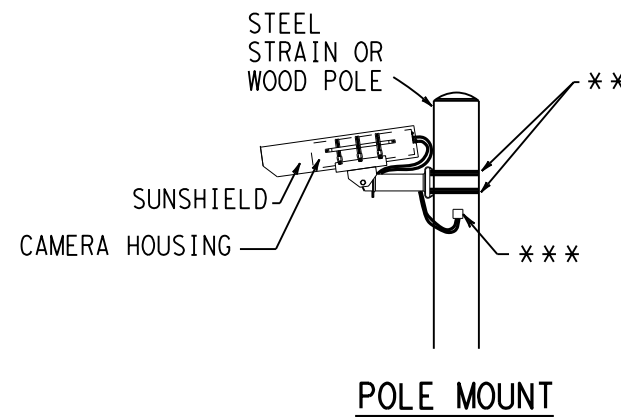
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NOTES FOR VIDEO DETECTION:

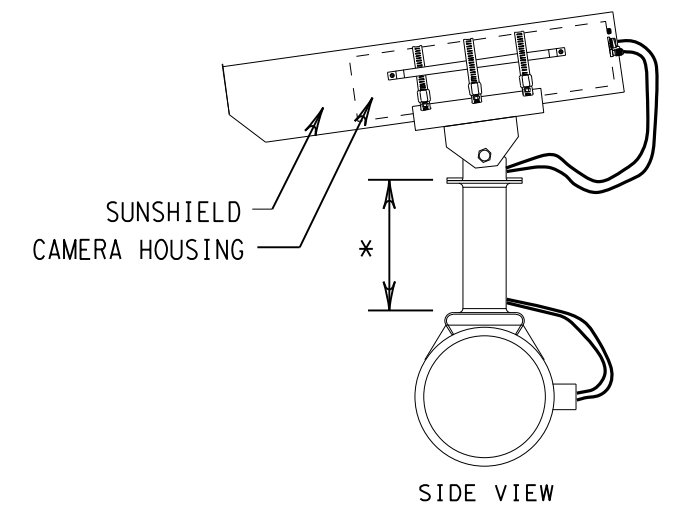
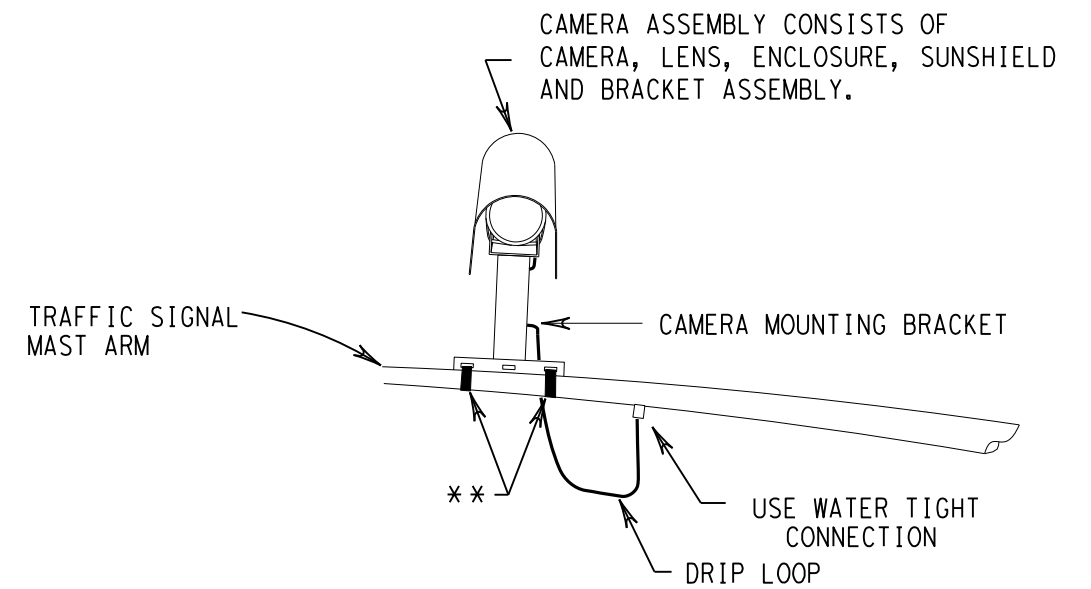
1. INSTALL VIDEO DETECTION PROCESSOR UNIT INSIDE CONTROLLER CABINET.
2. INSTALL VIDEO DETECTION CAMERA & BRACKET AS DETAILED OR AS DIRECTED BY THE VIDEO DETECTION SUPPLIER.
3. MOUNT CAMERAS AS FAR OVER THE ROADWAY AS POSSIBLE.
4. USE 3/4 IN. STAINLESS STEEL BANDING MATERIAL TO INSTALL CAMERA MOUNTS.
5. AIM CAMERA SO THAT HORIZON IS NOT VISIBLE IN THE FIELD OF VIEW.
6. INSTALL CAMERA ENCLOSURE ASSEMBLY SO THAT IT CAN ROTATE AFTER INSTALLATION TO PROVIDE PROPER ALIGNMENT.
7. PROVIDE WATER TIGHT CABLE ENTRY AND EXIT POINTS IN THE MAST ARM AND/OR POLES.
8. FOR VIVDS COAX AND POWER CABLES ATTACHED TO LUMINAIRE ARM, PROVIDE A METAL CABLE STRAP (ALUMINUM OR STAINLESS STEEL), 3/4-IN MINIMUM WIDTH AND TWO WRAPS AT 8 IN. MAXIMUM SPACING.



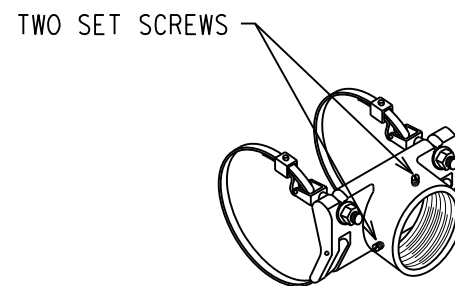
LUMINAIRE ARM MOUNT



POLE MOUNT



SIDE VIEW



BAND MOUNT BRACKET DETAIL

- * 4 FT. PIPE EXTENSION WHEN MOUNTED ON TRAFFIC SIGNAL MAST ARM.
- ** 3/4 IN. (MIN) STAINLESS STEEL BANDING 2 PLACES MIN.
- *** ENTRY INTO STEEL POLE OR CONDUIT WEATHERHEAD ON WOOD POLE

Texas Department of Transportation
Houston District

SIGNAL DETAILS/STANDARDS
VIVDS CAMERA
MOUNTING DETAILS
VC/MD

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GENERAL NOTES FOR ALL ELECTRICAL WORK

1. The location of all conduits, junction boxes, ground boxes, and electrical services is diagrammatic and may be shifted to accommodate field conditions.
2. Provide new and unused materials. Ensure that all materials and installations comply with the applicable articles of the National Electrical Code (NEC), TxDOT standards and specifications, National Electrical Manufacturers Association (NEMA), and are listed by Underwriters Laboratories (UL) or a Nationally Recognized Testing Lab (NRTL). NRTLs such as Canadian Standard Association (CSA), Intertek Testing Services NA Inc., or FM Approvals LLC can be considered equivalent to UL. Where reference is made to NEMA listed devices, International Electrotechnical Commission (IEC) listed devices will not be considered an acceptable equal to a NEMA listed device. Acceptable devices may have both a NEMA and IEC listing. Faulty fabrication or poor workmanship in any material, equipment, or installation is justification for rejection. Replace or reinstall rejected material or equipment at no additional cost to the Department.
3. Miscellaneous nuts, bolts and hardware, except for high strength bolts, may be stainless steel when plans specify galvanized, provided the bolt size is 1/2 in. or less in diameter.
4. Provide the following test equipment as required by the Engineer to confirm compliance with the contract and the NEC: voltmeter, ammeter, megohm meter (1000 volt DC), ground resistance tester, torque wrenches, and torque screwdrivers. Ensure all equipment has been properly calibrated within the last year. Provide calibration certification to the Engineer upon request. Operate test equipment during inspection as requested by the Engineer.
5. Install grounding as shown on the plans and in accordance with the NEC. Ensure all metallic conduits; metal poles; luminaires; and metal enclosures are bonded to the equipment grounding conductor. Provide stranded bare copper or green insulated grounding conductors. Ground rods, connectors, and bonding jumpers are subsidiary to the various bid items.
6. When required by the Engineer, notify the Department in writing of materials from the Material Producers List (MPL) intended for use on each project. Prequalified materials are listed on the MPL on TxDOT's website under "Roadway Illumination and Electrical Supplies." No substitutions will be allowed for materials on this list.

CONDUIT

A. MATERIALS

1. Provide conduit, junction boxes, fittings, and hardware as per TxDOT Departmental Material Specification (DMS) 11030 "Conduit" and Item 618 "Conduit" of TxDOT's "Standard Specifications For Construction And Maintenance Of Highways, Streets, And Bridges," latest edition. Provide conduits listed under Item 618 on the MPL under "Roadway Illumination and Electrical Supplies." Provide conduit types according to the descriptive code or as shown on the plans. Do not substitute other types of conduits for those shown. Provide liquidtight flexible metal conduit (LFMC) when flexible conduit is called for on galvanized steel rigid metallic conduit (RMC) systems. Provide liquidtight flexible nonmetallic conduit (LFNC) when flexible conduit is called for on polyvinyl chloride (PVC) systems.
2. Provide galvanized steel RMC for all exposed conduits, unless otherwise shown on the plans. Properly bond all metal conduits.
3. Unless otherwise shown on the plans, provide junction boxes with a minimum size as shown in the following table, which applies to the greatest number of conductors entering the box through one conduit with no more than four conduits per box. When a mixture of conductor sizes is present, count the conductors as if all are of the larger size. For situations not applicable to the table, size junction boxes in accordance with NEC.


AWG	3 CONDUCTORS	5 CONDUCTORS	7 CONDUCTORS
#1	10" x 10" x 4"	12" x 12" x 4"	16" x 16" x 4"
#2	8" x 8" x 4"	10" x 10" x 4"	12" x 12" x 4"
#4	8" x 8" x 4"	10" x 10" x 4"	10" x 10" x 4"
#6	8" x 8" x 4"	8" x 8" x 4"	10" x 10" x 4"
#8	8" x 8" x 4"	8" x 8" x 4"	8" x 8" x 4"

4. Junction boxes with an internal volume of less than 100 cu. in. and supported by entering raceways must have threaded entries or hubs identified for the intended purpose and supported by connection of two or more rigid metal conduits. Secure conduit within 3 ft. of the enclosure or within 18 in. of the enclosure if all conduit entries are on the same side. Mechanically secure all junction boxes with an internal volume greater than 100 cu. inches.
5. Provide hot dipped galvanized cast iron or sand cast aluminum outlet boxes for junction boxes containing only 10 AWG or 12 AWG conductors. Do not use die cast aluminum boxes. Size outlet boxes according to the NEC.
6. Do not use intermediate metal conduit (IMC) or electrical metallic tubing (EMT) unless specifically required by the plan sheets. When EMT is called for, provide junction boxes made from galvanized steel sheeting, listed and approved for outdoor use, unless otherwise noted on the plans. Size all galvanized steel junction boxes in accordance with the NEC. Provide junction boxes for IMC conduit systems that meet the same requirements for junction boxes used with RMC systems.
7. Provide PVC junction boxes intended for outdoor use on PVC conduit systems, unless otherwise noted on the plans.

8. Provide PVC elbows in PVC conduit systems, unless otherwise shown on the plans. Use only a flat, high tensile strength polyester fiber pull tape for pulling conductors through the PVC conduit system. When galvanized steel RMC elbows are specifically called for in the plans and any portion of the RMC elbow is buried less than 18 in., ground the RMC elbow by means of a grounding bushing on a rigid metal extension. Grounding of the rigid metal elbow is not required if the entire RMC elbow is encased in a minimum of 2 in. of concrete. PVC extensions are allowed on these concrete encased rigid metal elbows. RMC or PVC elbows are subsidiary to various bid items.
9. When required, provide High-Density Polyethylene (HDPE) conduit with factory installed internal conductors according to Item 622 "Duct Cable." At the Contractor's request and with approval by the Engineer, substitute HDPE conduit with no conductors for bored schedule 40 or schedule 80 PVC conduit bid under Item 618. Ensure bored HDPE substituted for PVC is schedule 40 and of the same size PVC called for in the plans. Ensure the substituted HDPE meets the requirements of Item 622, except that the conduit is supplied without factory-installed conductors. Make the transition of the HDPE conduit to PVC (or RMC elbow when required) at the bore pit. Provide conduit of the size and schedule as shown on the plans. Do not extend substituted conduit into ground boxes or foundations. Provide PVC or galvanized steel RMC elbows as called for at all ground boxes and foundations.
10. Use two-hole straps when supporting 2 in. and larger conduits. On electrical service poles, properly sized stainless steel or hot dipped galvanized one-hole standoff straps are allowed on the service riser conduit.

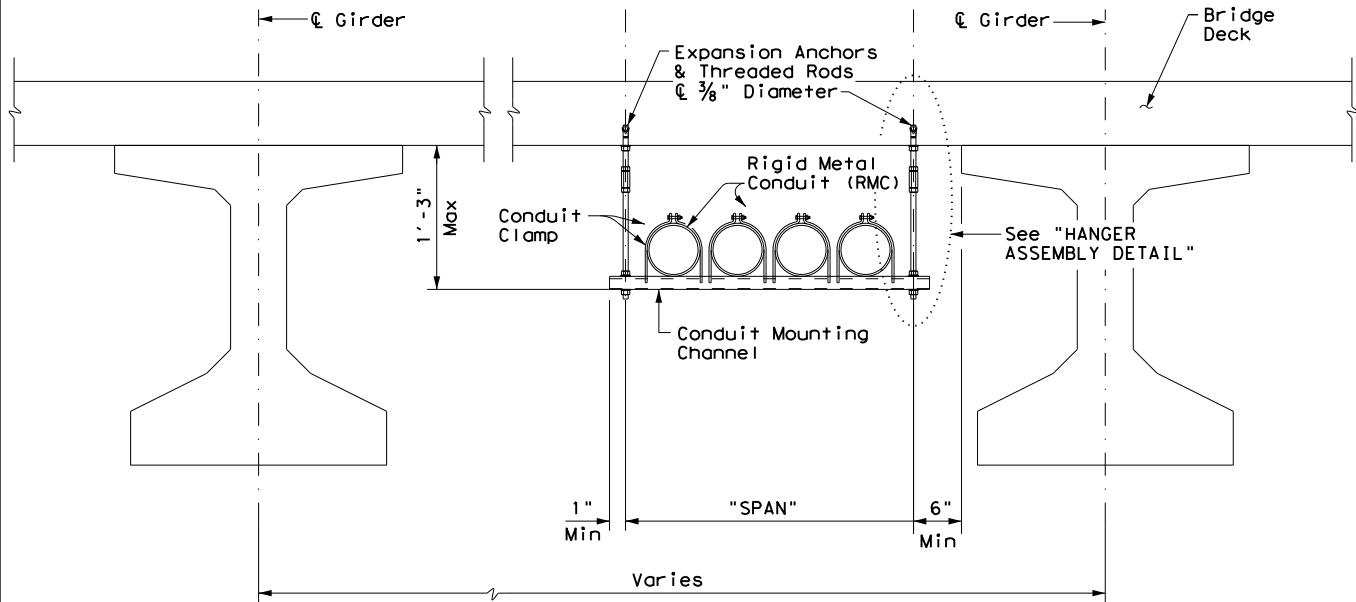
B. CONSTRUCTION METHODS

1. Provide and install expansion joint conduit fittings on all structure-mounted conduits at the structure's expansion joints to allow for movement of the conduit. In addition, provide and install expansion joint fittings on all continuous runs of galvanized steel RMC conduit externally exposed on structures such as bridges at maximum intervals of 150 ft. When requested by the project Engineer, supply manufacturer's specification sheet for expansion joint conduit fittings. Repair or replace expansion joint fittings that do not allow for movement at no additional cost to the Department. Provide the method of determining the amount of expansion to the Engineer upon request. Do not use LFMC or LFNC as a substitute for the required expansion conduit fittings.
2. Space all conduit supports at maximum intervals of 5 ft. Install conduit spacers when attaching metal conduit to surface of concrete structures. See "Conduit Mounting Options" on ED(2). Install conduit support within 3 ft. of all enclosures and conduit terminations.
3. Do not attach conduit supports directly to pre-stressed concrete beams except as shown specifically in the plans or as approved by the Engineer.
4. Unless otherwise shown on the plans, jack or bore conduit placed beneath existing roadways, driveways, sidewalks, or after the base or surfacing operation has begun. Backfill and compact the bore pits below the conduit per Item 476 "Jacking, Boring, or Tunneling Pipe or Box" prior to installing conduit or duct cable to prevent bending of the connections.
5. When placing conduit in the sub-grade of new roadways, backfill all trenches with excavated material unless otherwise noted on the plans. When placing conduit in the sub-base of new roadways, backfill all trenches with cement-stabilized base as per requirements of Items 110 "Excavation", 400 "Excavation and Backfill for Structures", 401 "Flowable Backfill", 402 "Trench Excavation Protection", and 403 "Temporary Special Shoring."
6. Provide and place warning tape approximately 10 in. above all trenched conduit as per Item 618.
7. During construction, temporarily cap or plug open ends of all conduit and raceways immediately after installation to prevent entry of dirt, debris and animals. Temporary caps constructed of durable duct tape are allowed. Tightly fix the tape to the conduit opening. Clean out the conduit and prove it clear in accordance with Item 618 prior to installing any conductors.
8. Ensure conduit entry into the top of any enclosure is waterproof by installing conduit sealing hubs or using boxes with threaded bosses. This includes surface mounted safety switches, meter cans, service enclosures, auxiliary enclosures and junction boxes. Grounding bushings on water tight sealing hubs are not required.
9. Fit the ends of all PVC conduit terminations with bushings or bell end fittings. Provide and install a grounding type bushing on all metal conduit terminations.
10. Install a bonding jumper from each grounding bushing to the nearest ground rod, grounding lug, or equipment grounding conductor. Ensure all bonding jumpers are the same size as the equipment grounding conductor. Bonding of conduit used as a casing under roadways for duct cable is not required, if the duct extends the full length through the casing.
11. At all electrical services, install a 6 AWG solid copper grounding electrode conductor.
12. Place conduits entering ground boxes so that the conduit openings are between 3 in. and 6 in. from the bottom of the box. See the ground box detail on sheet ED(4).
13. Seal ends of all conduits with duct seal, expandable foam, or by other methods approved by the Engineer. Seal conduit immediately after completion of conductor installation and pull tests. Do not use duct tape as a permanent conduit sealant. Do not use silicone caulk as a conduit sealant.
14. File smooth the cut ends of all mounting strut and conduit. Before installing, paint the field cut ends of all mounting strut and RMC (threaded or non-threaded) with zinc rich paint (94% or more zinc content) to alleviate overspray. Use zinc rich paint to touch up galvanized material as allowed under Item 445 "Galvanizing." Do not paint non-galvanized material with a zinc rich paint as an alternative for materials required to be galvanized.

				Traffic Operations Division	
<h1>ELECTRICAL DETAILS CONDUITS & NOTES</h1>					
<h2>ED(1) - 14</h2>					
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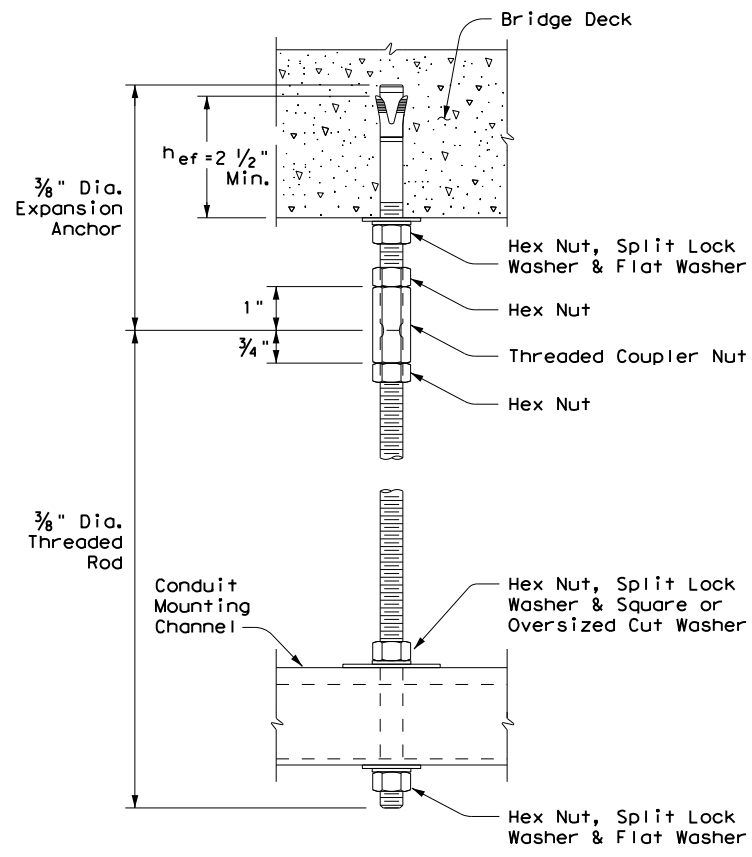
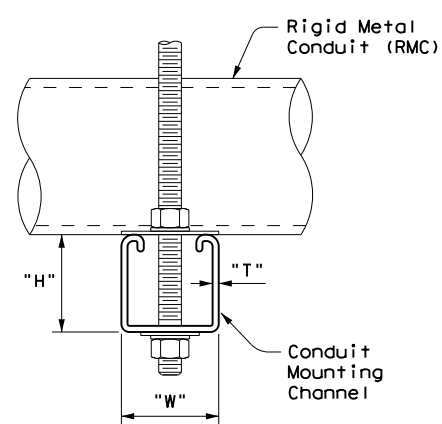
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CONDUIT HANGING DETAIL

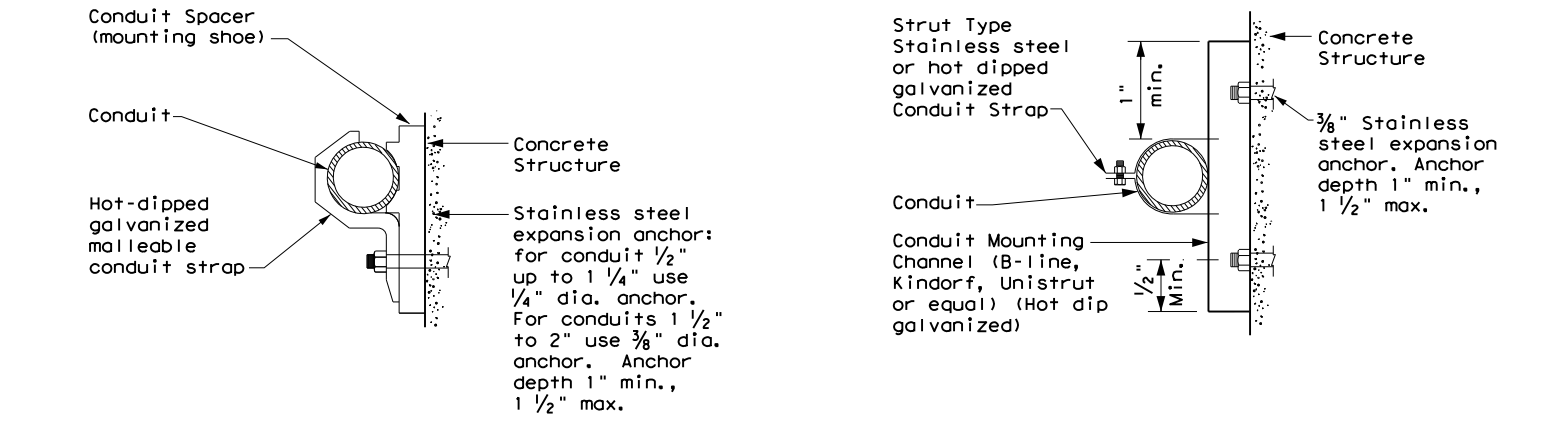
CONDUIT MOUNTING CHANNEL		
"SPAN"	"W" x "H"	"T"
less than 2'	1 5/8" x 1 3/8"	12 Ga.
2'-0" to 2'-6"	1 5/8" x 1 5/8"	12 Ga.
>2'-6" to 3'-0"	1 5/8" x 2 1/16"	12 Ga.

Channels with round or short slotted hole patterns are allowed, if the load carrying capacity is not reduced by more than 15%.



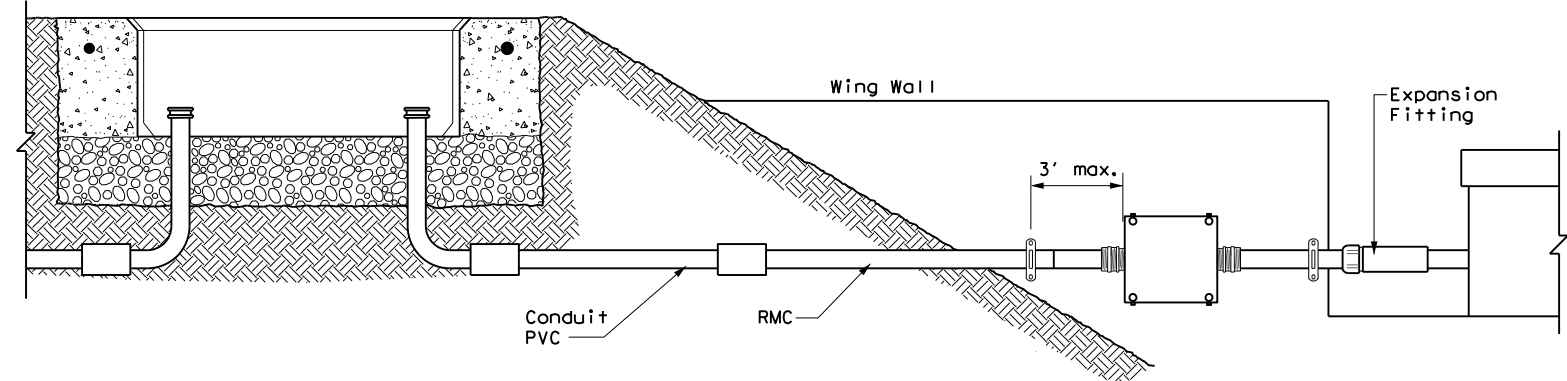
HANGER ASSEMBLY DETAIL

ELECTRIC CONDUIT TO BRIDGE DECK ATTACHMENT



CONDUIT MOUNTING OPTIONS

Attachment to concrete surfaces
 See ED(1)B.2



TYPICAL CONDUIT ENTRY TO BRIDGE STRUCTURE DETAIL

EXPANSION ANCHOR NOTES FOR BRIDGE DECK ATTACHMENT

1. Use torque controlled mechanical expansion anchors that are approved for use in cracked concrete by the International Code Council, Evaluation Service (ICC-ES). The chosen anchor product shall have a designated ICC-ES Evaluation Report number, and its approval status shall be maintained on the ICC-ES website under Division 031600 for Concrete Anchors.
2. Unless otherwise approved by the Engineer: do not use adhesive anchors; do not use expansion anchors that are not included in the ICC-ES approval list; and do not use expansion anchors that are only approved for use in uncracked concrete.
3. Use anchors manufactured with stainless steel expansion wedges. Anchors manufactured with carbon steel expansion wedges are not allowed. Anchor bodies can be either zinc-plated carbon steel or stainless steel. For application in marine environment, both the anchor body and expansion wedge shall be stainless steel.
4. Install anchors as shown on the plans and in accordance with the anchor manufacturer's published installation instructions. Arrange a field demonstration test to evaluate the procedures and tools. The test shall be witnessed and approved by the Engineer prior to furnishing anchors on the structure.
5. Prior to hole drilling, use rebar locator to ensure clearing of existing deck strands or reinforcement. Install anchors to ensure a minimum effective embedment depth, (h_{ef}), as shown. Increase (h_{ef}) as needed to ensure sufficient thread length for proper torquing and tightening of anchors.
6. Use anchors of minimum 1600 Lbs tensile capacity (minimum of steel, concrete breakout, and concrete pullout strengths as determined by ACI 318 Appendix D) at the required minimum embedment depth (h_{ef}). No lateral loads shall be introduced after conduit installation.

		Traffic Operations Division Standard	
<h2>ELECTRICAL DETAILS CONDUIT SUPPORTS</h2>			
<h3>ED(2) - 14</h3>			
FILE: ed2-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
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REVISIONS	0502	01	237
	DIST	COUNTY	SHEET NO.
	HOU	HARRIS	042

ELECTRICAL CONDUCTORS

A. MATERIAL INFORMATION

1. Provide Type XHHW insulated conductors in accordance with Departmental Material Specification (DMS) 11040 "Conductors" and Item 620 "Electrical Conductors." Provide conductors as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies" Item 620. Color code insulated conductors in conformance with the NEC. Identify grounded (neutral) conductors with white insulation. Identify grounding conductors (ground wires) with green insulation or bare conductors. Identify ungrounded (hot) conductors with any color insulation except green, white, or gray. Keep color scheme consistent throughout the wiring system. Identify conductors 6 American Wire Gauge (AWG) and smaller by continuous color jacket. Identify electrical conductors 4 AWG and larger by continuous color jacket or by colored tape. When identifying conductors with colored tape, mark at least 6 in. of the conductor's insulation with half laps of tape.
2. Provide a solid copper 6 AWG grounding electrode conductor to bond the electrical service equipment to the concrete encased grounding electrode or the ground rod at the service location. Connect the grounding electrode conductor to the ground rod with a UL listed connector in accordance with DMS 11040. Connect the grounding electrode conductor to the concrete encased grounding electrode as shown in the plans.
3. Where two or more circuits are present in one conduit or enclosure, permanently identify the conductors of each branch circuit by attaching a non-metallic tag around both circuit conductors at each accessible location. Provide tags with two straps, large enough to indicate circuit number, letter, or other identification as shown in the plans. Print circuit identification on the tag with a permanent marker.
4. Use listed compression or screw type pressure connectors, terminal blocks, or split bolt connectors for splicing as specified in DMS 11040. Use hot melt adhesive tape to fill the gap and seal the ends of heat shrink tubing. Provide UL listed gel-filled insulating splice covers. Splicing materials, insulating materials, breakaway disconnects, splice covers, and fuse holders are subsidiary to various bid items.

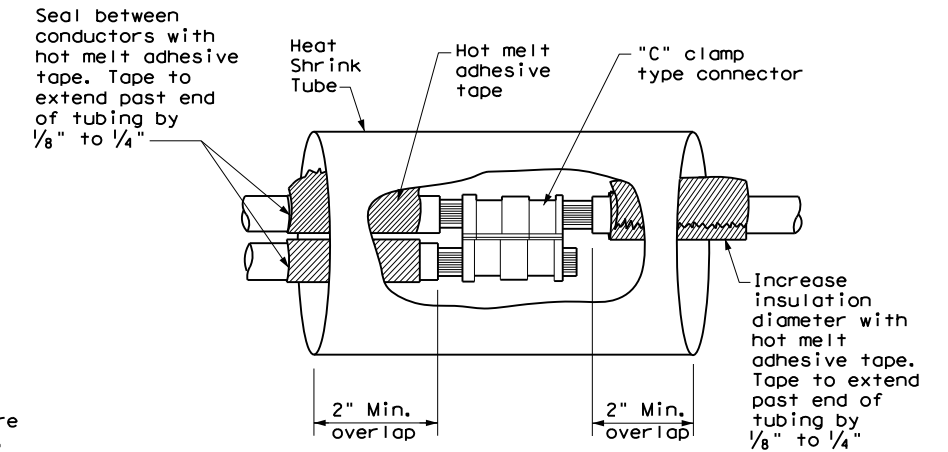
B. CONSTRUCTION METHODS

1. Use only a flat, high tensile strength polyester fiber pull tape for pulling conductors through the conduit system. After installing conductors in conduit, perform conductor pull test. If a conductor cannot be freely pulled, make any needed alterations or repairs at no additional cost to the department. Perform insulation resistance tests in accordance with Item 620. Coordinate with the Engineer to witness the tests.
2. Leave 2 ft. minimum, 3 ft. maximum length for each conductor up to the splice in ground boxes. Leave 3 ft. minimum, 4 ft. maximum length of conductor in ground boxes when pulled through with no splice. Leave 1 ft. minimum, 1.5 ft. maximum length of conductor at enclosures, weatherheads and pole bases.
3. Make splices only in junction boxes, ground boxes, pole bases, or electrical enclosures and use only listed compression or screw type pressure connectors, terminal blocks, or split bolt connectors. Insulate splices with heavy wall heat shrink tubing or gel-filled insulating splice covers to provide a watertight seal. Overlap conductor insulation with heat shrink tubing a minimum of 2 in. past both sides of the splice. Where heat shrink tubing may not shrink sufficiently to provide a watertight seal around the individual conductors, prior to heating the tubing, increase the diameter of the conductor insulation using hot melt adhesive tape to provide a watertight seal between the individual conductors and the heat shrink tubing. Ensure the tape extends past the heat shrink tubing. Use hot melt adhesive tape to fill the gap and seal the ends of heat shrink tubing. Heat shrink tubing that appears to have been burned, or overheated, is considered defective and must be replaced.
4. Size and install gel-filled insulating splice covers according to manufacturer's specifications when used in place of heat shrink tubing.
5. Wire nuts with factory applied waterproof sealant may be used for 8 AWG or smaller conductors in above ground junction boxes, but not in pole bases or ground boxes. Install wire nuts in an upright position to prevent the accumulation of water.
6. Support conductors in illumination poles with a J-hook at the top of the pole.
7. When terminating conductors, remove the insulation and jacketing material without nicking the individual strands of the conductor. Conductors with nicked individual conductor strands or removed strands will be considered damaged.
8. Replace conductors and cables that are damaged beyond repair or that fail an insulation resistance test at no additional cost to the department.
9. Do not repair damaged conductors with duct tape, electrical tape, or wire nuts. Use only approved splicing methods.
10. Do not terminate more than one conductor under a single connector, unless the connector is rated for multiple conductors. Do not exceed the pressure connector's listing for maximum number and size of conductors allowed.
11. Install breakaway connectors on conductors bid under Item 620 whenever those conductors pass through a breakaway support device. Follow manufacturer's instructions when terminating conductors to breakaway connectors. Properly torque threaded connections. Proper terminations are critical to the safe operation of breakaway devices. Trim waterproofing boots on breakaway connectors to fit snugly around the conductor to ensure waterproof connection. Only one conductor may enter a single opening in a boot. Provide waterproof boots with the correct number of openings. Leave unused openings factory sealed. Use prequalified breakaway connectors as shown on the MPL.

12. Provide and install a separate stranded equipment grounding conductor (EGC) in all conduits that contain circuit wiring of 50 volts or more. Unless shown elsewhere, size the EGC to be the same size as the largest current carrying conductor contained in the conduit. Ensure all EGCs are bonded together at every accessible location. For traffic signal installations, provide a minimum size 8 AWG EGC. The EGC is paid for under Item 620.

C. TEMPORARY WIRING

1. Install temporary conductors and electrical equipment in accordance with the NEC article "Temporary Installations" and Department standard sheets.
2. Provide a ground fault circuit interrupter (GFCI) for power outlets for portable electrical equipment, power tools, ice machines, ice storage bins and refrigerators located outdoors at grade. GFCI may be any one of the following: molded cord and plug set, receptacle, or circuit breaker type.
3. Use listed wire nuts with factory applied sealant for temporary wiring where approved.
4. Enclose conductor splices within a listed enclosure or ground box, or ensure the splices are more than 10 ft. above grade vertically and more than 5 ft. horizontally from any metal structure. Where installing temporary conductors in areas subject to vehicle traffic or mobile construction equipment, ensure the vertical clearance to ground is at least 18 ft. when measured at the lowest point. Ground messenger wires that support power conductors in conformance with the NEC.
5. Protect and when necessary repair any existing electrical conduits uncovered during the construction process in a timely manner and in conformance with the NEC.



**SPLICE OPTION 1
Compression Type**

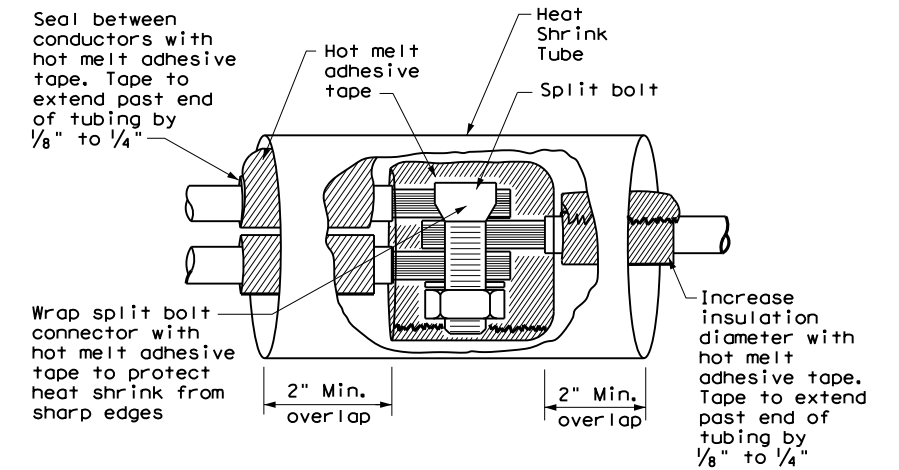
GROUND RODS & GROUNDING ELECTRODES

A. MATERIAL INFORMATION

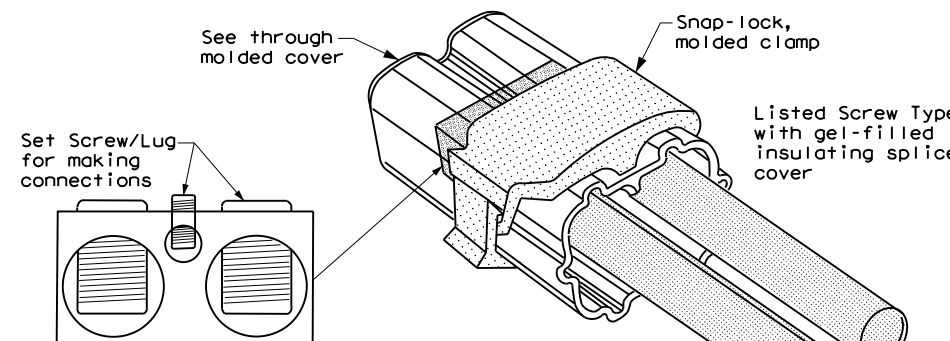
1. Provide and install a grounding electrode at electrical services. Provide ground rods according to DMS 11040 and the plans. Larger diameter or longer length rods may be called for in some specific locations, see the individual plans sheets. Concrete encased grounding electrodes may be called for in specific locations including electrical service, see individual plan sheets.

B. CONSTRUCTION METHODS

1. Furnish auxiliary ground rods for lightning protection and install in soil, concrete, or both, as called for in the plans. For ground rods installed in concrete, ensure the connection of the conductor to the ground rod is readily accessible for inspection or repairs. For ground rods installed in soil, ensure that the upper end is between 2 to 4 in. below finished grade.
2. Do not place ground rods in the same drilled hole as a timber pole.
3. Install ground rods so the imprinted part number is at the upper end of the rod.
4. Remove all non-conductive coatings such as concrete splatter from the rod at the clamp location.
5. Route all conductors as short and straight as possible for connection to lightning protection ground rods. When a bend is required, ensure a minimum radius bend of four inches for these conductors.
6. Unless otherwise called for in the plans, protect grounding electrode conductors with non-metallic conduit. When protecting grounding electrode conductors with metal conduit, provide and install a grounding type bushing and properly sized bonding jumper on each end of the metal conduit.
7. Written authorization is required before installing a ground rod in a horizontal trench for rocky soil or a solid rock bottom.



**SPLICE OPTION 2
Split Bolt Type**



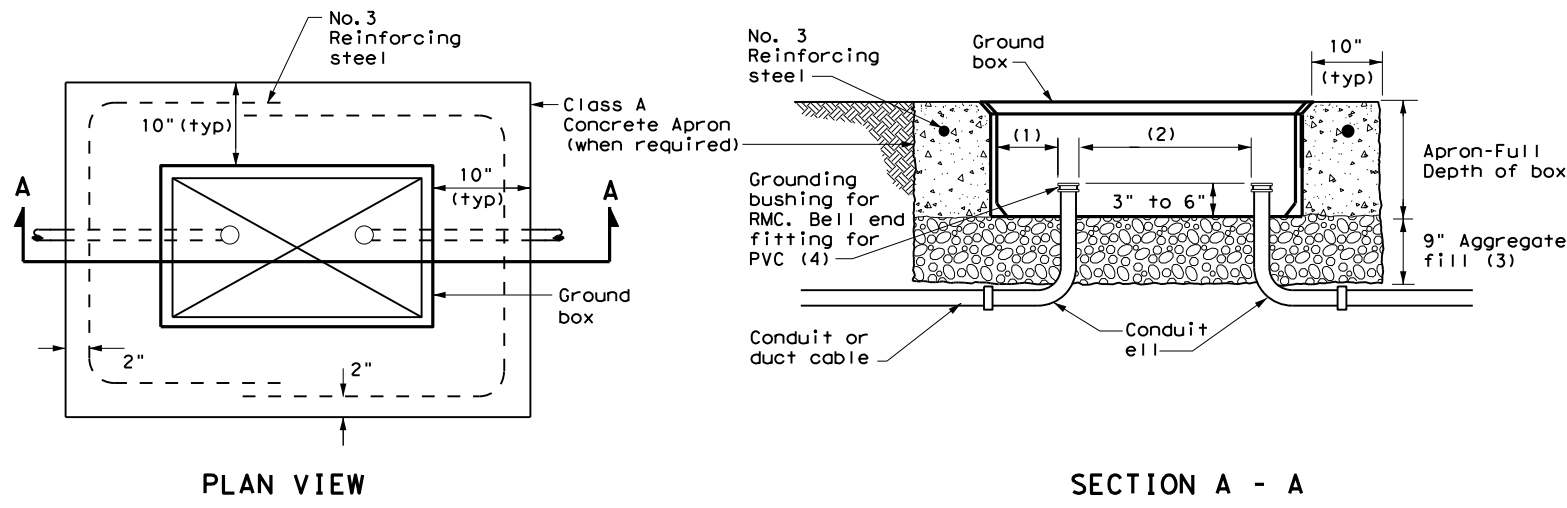
**SPLICE OPTION 3
Listed Screw Type**

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		Traffic Operations Division Standard	
<h1>ELECTRICAL DETAILS CONDUCTORS</h1>			
<h2>ED(3) - 14</h2>			
FILE: ed3-14.dgn	DW: TxDOT	CK: TxDOT	CR: TxDOT
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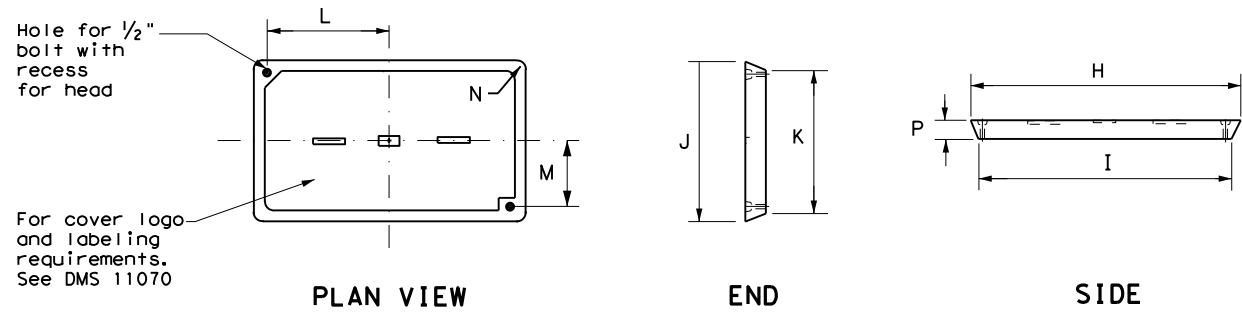


APRON FOR GROUND BOX

- (1) Uniformly space ends of conduits within the ground box. Position ends of conduits so that ground box walls do not interfere with the installation of grounding bushings or bell end fittings.
- (2) Maintain sufficient space between conduits to allow for proper installation of bushing.
- (3) Place aggregate under the box, not in the box. Aggregate should not encroach on the interior volume of the box.
- (4) Install a grounding bushing on the upper end of all RMC terminating in a ground box. Ground RMC elbows when any part of the elbow is less than 18 in. below the bottom of the ground box. Install a PVC bushing or bell end fitting on the upper end of all PVC conduits terminating in a ground box.

GROUND BOX DIMENSIONS	
TYPE	OUTSIDE DIMENSIONS (INCHES) (Width x Length X Depth)
A	12 X 23 X 11
B	12 X 23 X 22
C	16 X 29 X 11
D	16 X 29 X 22
E	12 X 23 X 17

GROUND BOX COVER DIMENSIONS								
TYPE	DIMENSIONS (INCHES)							
	H	I	J	K	L	M	N	P
A, B & E	23 1/4	23	13 3/4	13 1/2	9 7/8	5 1/8	1 3/8	2
C & D	30 1/2	30 1/4	17 1/2	17 1/4	13 1/4	6 3/4	1 3/8	2



GROUND BOX COVER

GROUND BOXES

A. MATERIALS

1. Provide polymer concrete ground boxes measuring 16x30x24 in. (WxLxD) or smaller in accordance with Departmental Material Specification (DMS) 11070 "Ground Boxes" and Item 624 "Ground Boxes."
2. Provide Type A, B, C, D, and E ground boxes as shown in the plans, and as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies," Item 624.
3. Ensure ground box cover is correctly labeled in accordance with DMS 11070.
4. Provide larger ground boxes in accordance with Item 624 and as shown in the plans.

B. CONSTRUCTION METHODS

1. Remove all gravel and dirt from conduit. Cap all conduits prior to placing aggregate and setting ground box. Provide Grade 3 or 4 coarse aggregate as shown on Table 2 of Item 302 "Aggregates for Surface Treatments." Ensure aggregate bed is in place and at least 9 inches deep, prior to setting the ground box. Install ground box on top of aggregate.
2. Cast ground box aprons in place. Reinforcing steel may be field bent. Ensure the depth of concrete for the apron extends from finished grade to the top of the aggregate bed under the box. Ground box aprons, including concrete and reinforcing steel, are subsidiary to ground boxes when called for by descriptive code.
3. Keep bolt holes in the box clear of dirt. Bolt covers down when not working in ground boxes.
4. Install all conduits and ells in a neat and workmanlike manner. Uniformly space conduits so grounding bushings and bell end fittings can easily be installed.
5. Temporarily seal all conduits in the ground box until conductors are installed.
6. Permanently seal conduits immediately after the completion of conductor installation and pull tests. Permanently seal the ends of all conduits with duct seal, expandable foam, or other method as approved. Do not use duct tape as a permanent conduit sealant. Do not use silicone caulk as a sealant.
7. When a ground rod is present in a ground box, bond all equipment grounding conductors together and to the ground rod with listed connectors.
8. When a type B or D ground box is stacked to meet volume requirements, it is allowable to cut an appropriately sized hole for conduit entry in the side wall at least 18 inches below grade.
9. If an existing ground box in the contract has a metal cover, bond the cover to the equipment grounding conductor with a 3 ft. long stranded bonding jumper the same size as the grounding conductor. The bonding jumper is subsidiary to various bid items. Verify existing ground boxes with metal covers are shown on the plans, with notes fully describing the work required.
10. If other ground boxes with metal covers are within the project limits but are not part of the contract, the Engineer may direct the Contractor to bond the metal covers, identifying the specific boxes in writing. This work will be paid for separately.
11. Bond metal ground box covers to the grounding conductor with a tank ground type lug.

				Traffic Operations Division Standard	
<h2>ELECTRICAL DETAILS</h2> <h3>GROUND BOXES</h3> <h4>ED(4) - 14</h4>					
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DIST	COUNTY		SHEET NO.		
HOU	HARRIS		044		

ELECTRICAL SERVICES NOTES

- Provide new materials. Ensure installation and materials comply with the applicable provisions of the National Electrical Code (NEC) and National Electrical Manufacturers Association (NEMA) standards. Ensure material is Underwriters Laboratories (UL) listed. Provide and install electrical service conduits, conductors, disconnects, contactors, circuit breaker panels, and branch circuit breakers as shown on the Electrical Service Data chart in the plans. Faulty fabrication or poor workmanship in material, equipment, or installation is justification for rejection. Where manufacturers provide warranties and guarantees as a customary trade practice, furnish these to the State.
- Provide electrical services in accordance with Electrical Details standard sheets, Departmental Material Specification (DMS) 11080 "Electrical Services," DMS 11081 "Electrical Services-Type A," DMS 11082 "Electrical Services-Type C," DMS 11083 "Electrical Services-Type D," DMS 11084 "Electrical Services-Type T," DMS 11085 "Electrical Services-Pedestal (PS)", and Item 628 "Electrical Services" of the Standard Specifications. Provide electrical service types A, C, and D, as listed on the Material Producers List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies," Item 628. Provide other service types as detailed on the plans.
- Provide all work, materials, services, and any incidentals needed to install a complete electrical service as specified in the plans.
- Coordinate with the Engineer and the utility provider for metering and compliance with utility requirements. Primary line extensions, connection charges, meter charges, and other charges by the utility company to provide power to the location are paid for in accordance with Item 628. Get approval for the costs associated with these charges prior to engaging the utility company to do the work. Consult with the utility provider to determine costs and requirements, and coordinate the work as approved.
- The enclosure manufacturer will provide Master Lock Type 2 with brass tumblers keyed #2195 for all custom electrical enclosures. Installing Contractor is to provide Master Lock #2195 Type 2 with brass tumblers for "off the shelf" enclosures. Master Lock #2195 keys and locks become property of the State. Unless otherwise approved, do not energize electrical service equipment until locks are installed.
- Enclosures with external disconnects that de-energize all equipment inside the enclosure do not need a dead front trim. Protect incoming line terminations from incidental contact as required by the NEC.
- When galvanized is specified for nuts, screws, bolts or miscellaneous hardware, stainless steel may be used.
- Provide wiring and electrical components rated for 75°C. Provide red, black, and white colored XHHW service entrance conductors of minimum size 6 American Wire Gauge (AWG). Identify size 6 AWG conductors by continuous color jacket. Identify electrical conductors sized 4 AWG and larger by continuous color jacket or by colored tape. Mark at least 6 inches of the conductor's insulation with half laps of colored tape, when identifying conductors. Ensure each service entrance conductor exits through a separately bushed non-metallic opening in the weatherhead. The lengths of the conductors outside the weatherhead are to be 12 inches minimum, 18 inches maximum, or as required by utility.
- All electrical service conduit and conductors attached to the electrical service including the riser or the elbow below ground are subsidiary to the electrical service. For an underground utility feed, all service conduit and conductors after the elbow, including service conduit and conductors for the utility pole riser when furnished by the Contractor, will be paid for separately.
- Provide rigid metal conduit (RMC) for all conduits on service, except for the 1/2 in. PVC conduit containing the electrical service grounding electrode conductor. Size the service entrance conduit as shown in the plans. Ensure conduit for branch circuit entry to enclosure is the same size as that shown on the layout sheets for branch circuit conduit. Extend all rigid metal conduits a minimum of 6 inches underground and then couple to the type and schedule of the conduit shown on the layout for that particular branch circuit. Install a grounding bushing on the RMC where it terminates in the service enclosure.
- Use of liquidtight flexible metal conduit (LFMC) is allowed between the meter and service enclosure when they are mounted 90 to 180 degrees to each other. Size the LFMC the same size as service entrance conduit. LFMC must not exceed 3 feet in length. Strap LFMC within 1 foot of each end. LFMC less than 12 inches in length need not be strapped. Each end of LFMC must have a grounding bushing or be terminated with a grounding fitting. The LFMC must contain a grounded (neutral) conductor. Ensure any bend in LFMC never exceeds 180 degrees. A pull test is required on all installed conductors, with at least six inches of free conductor movement demonstrated to the satisfaction of the Engineer.
- Ensure all mounting hardware and installation details of services conform to utility company specifications.
- For all electrical service enclosures listed under Item 628 on the MPL, the UL 508 enclosure manufacturers will prepare and submit a schematic drawing unique to each service. Before shipment to the job site, place the applicable laminated schematic drawings and the laminated plan sheet showing the electrical service data chart used to build the enclosure in the enclosure's data pocket. The installing contractor will copy and laminate the actual project plan sheets detailing all equipment and branch circuits supplied by that service. The laminated plan sheets are to be placed in the service enclosure's document pocket. Reduce 11 in. x 17 in. plan sheets to 8 1/2 in. x 11 in. before laminating. If the installation differs from the plan sheets, the installing contractor is to redline plan sheets before laminating.
- When providing an "Off The Shelf" Type D or Type T service, provide laminated plan sheets detailing equipment and branch circuits supplied by that service. Reduce 11 in. x 17 in. plan sheets to 8 1/2 in. x 11 in. before laminating. Deliver these drawings before completion of the work to the Engineer, instead of placing in enclosure that has no door pocket.
- Do not install conduit in the back wall of a service enclosure where it would penetrate the equipment mounting panel inside the enclosure. Provide grounding bushings on all metal conduits, and terminate bonding jumpers to grounding bus. Grounding bushings are not required when the end of the metal conduit is fitted with a conduit sealing hub or threaded boss, such as a meter base hub.

SERVICE ASSEMBLY ENCLOSURE

- Provide threaded hub for all conduit entries into the top of enclosure.
- Type galvanized steel (GS) enclosures may be used for Type C panelboards and for Type D and T services that do not use an enclosure mounted photoceII or lighting contactor. Provide GS enclosures in accordance with DMS 11080, 11082, 11083, and 11084.
- Provide aluminum (AL) and stainless steel (SS) enclosures for Types A, C, and D in accordance with DMS 11080, 11081, 11082, 11083, and 11084. Do not paint stainless steel.
- Provide pedestal service (PS) enclosures in accordance with ED(9) and DMS 11080 and 11085. Do not provide GS pedestal services. If GS is shown in the PS descriptive code, provide an AL enclosure.

MAIN DISCONNECT & BRANCH CIRCUIT BREAKERS

- Field drill flange-mounted remote operator handle if needed, to ensure handle is lockable in both the "On" and "Off" positions.
- When the utility company provides a transformer larger than 50 KVA, verify that the available fault current is less than the circuit breaker's ampere interrupting capacity (AIC) rating and provide documentation from the electric utility provider to the Engineer.

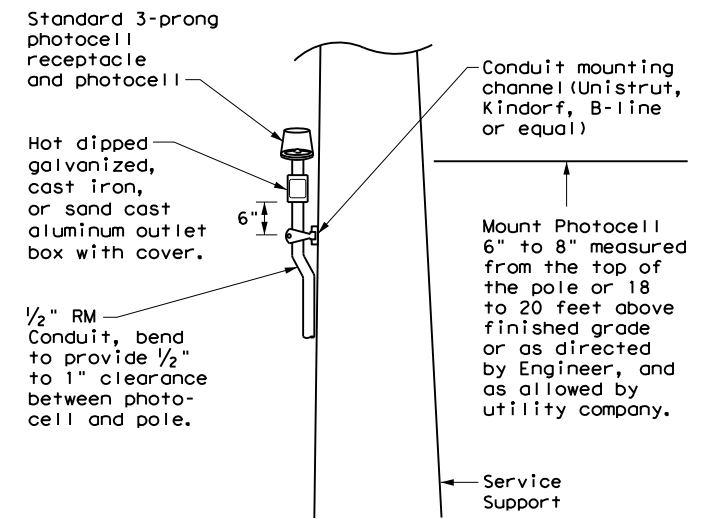
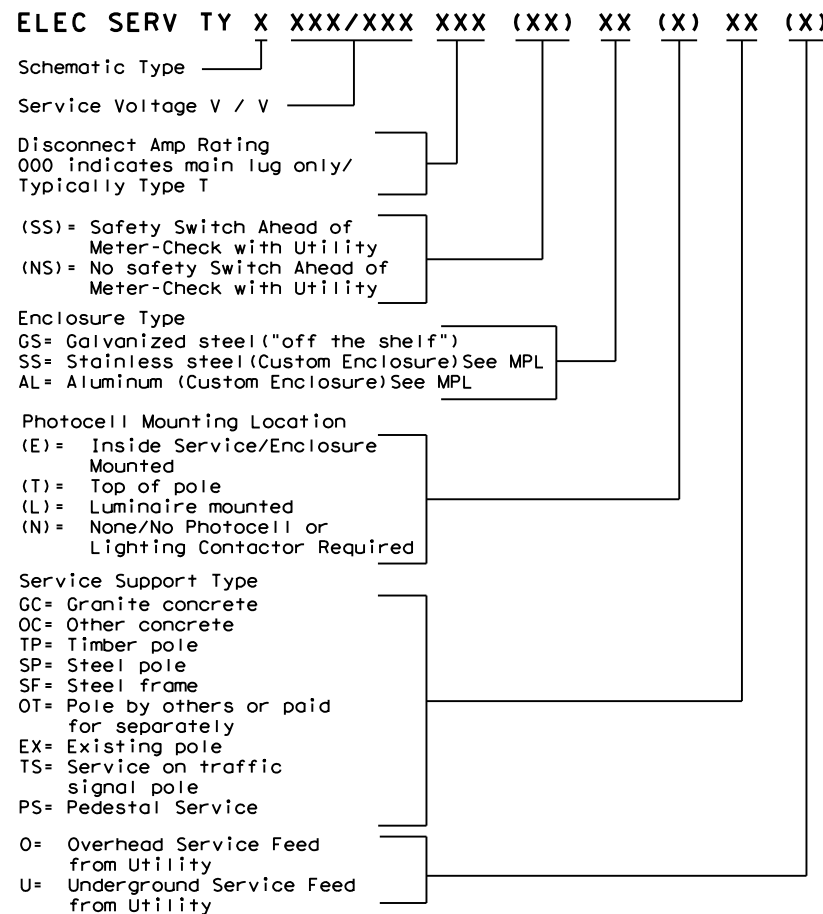
PHOTOELECTRIC CONTROL

- Provide photocell as listed on the MPL. Move, adjust, or shield the photocell from stray or ambient night time light to ensure proper operation. Mount photocell facing north when practical. Mount top of pole photocells as shown on Top Mounted Photocell Detail.

* ELECTRICAL SERVICE DATA												
Elec. Service ID	Plan Sheet Number	Electrical Service Description	Service Conduit *xSize	Service Conductors No./Size	Safety Switch Amps	Main Ckt. Bkr. Pole/Amps	Two-Pole Contractor Amps	Panelbd/ Loadcenter Amp Rating	Branch Circuit ID	Branch Ckt. Bkr. Pole/Amps	Branch Circuit Amps	KVA Load
SB 183	289	ELC SRV TY A 240/480 100(SS)AL(E)SF(U)	2"	3/#2	100	2P/100	100	N/A	Lighting NB	2P/40	26	28.1
									Lighting SB	2P/40	25	
									Underpass	1P/20	15	
NB Access	30	ELC SRV TY D 120/240 060(NS)SS(E)TS(O)	1 1/4"	3/#6	N/A	2P/60		100	Sig. Controller	1P/30	23	5.3
							30		Luminaires	2P/20	9	
									CCTV	1P/20	3	
2nd & Main	58	ELC SRV TY T 120/240 000(NS)GS(N)SP(O)	1 1/4"	3/#6	N/A	N/A	N/A	70	Flashing Beacon 1	1P/20	4	1.0
									Flashing Beacon 2	1P/20	4	

* Example only, not for construction. All new electrical services must have electrical service data chart specific to that service as shown in the plans.
 ** Verify service conduit size with utility. Size may change due to utility meter requirements. Ensure conduit size meets the National Electrical Code.

EXPLANATION OF ELECTRICAL SERVICE DESCRIPTIVE CODE



TOP MOUNTED PHOTOCELL

Install conduit strap maximum 3 feet from box. 5 foot maximum spacing between straps supporting conduit.

Texas Department of Transportation
 Traffic Operations Division Standard

ELECTRICAL DETAILS SERVICE NOTES & DATA

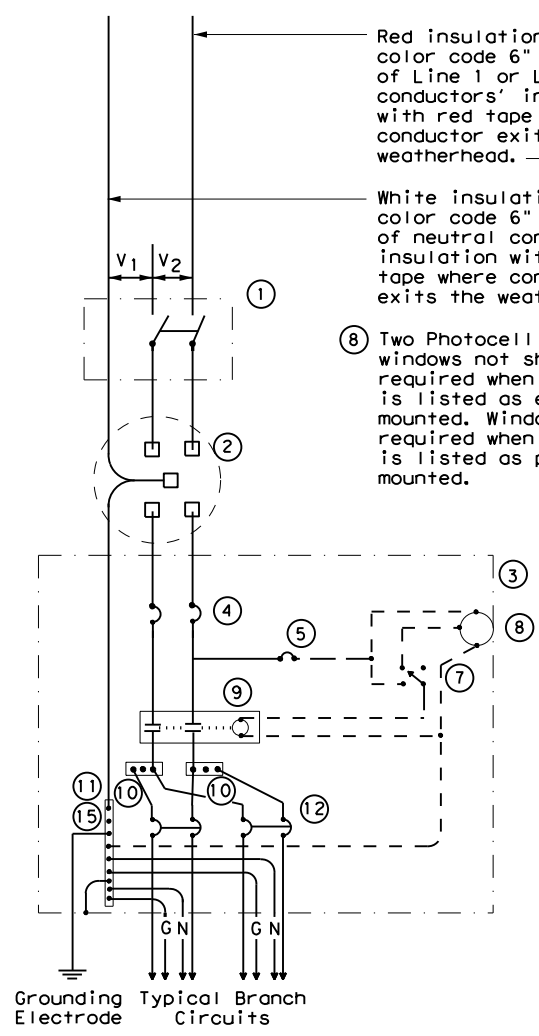
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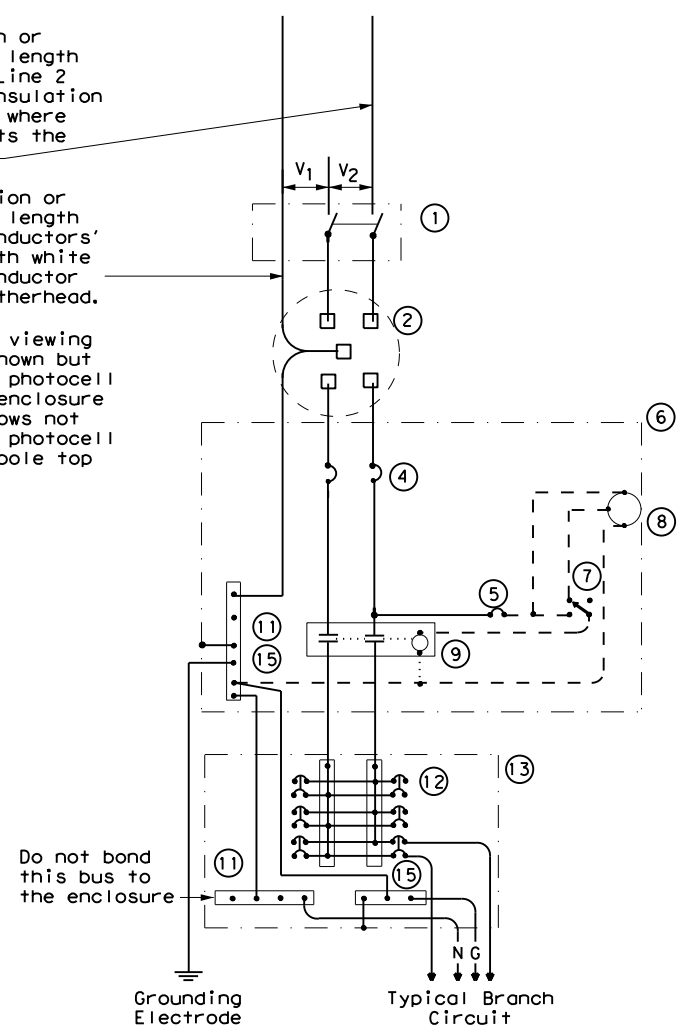
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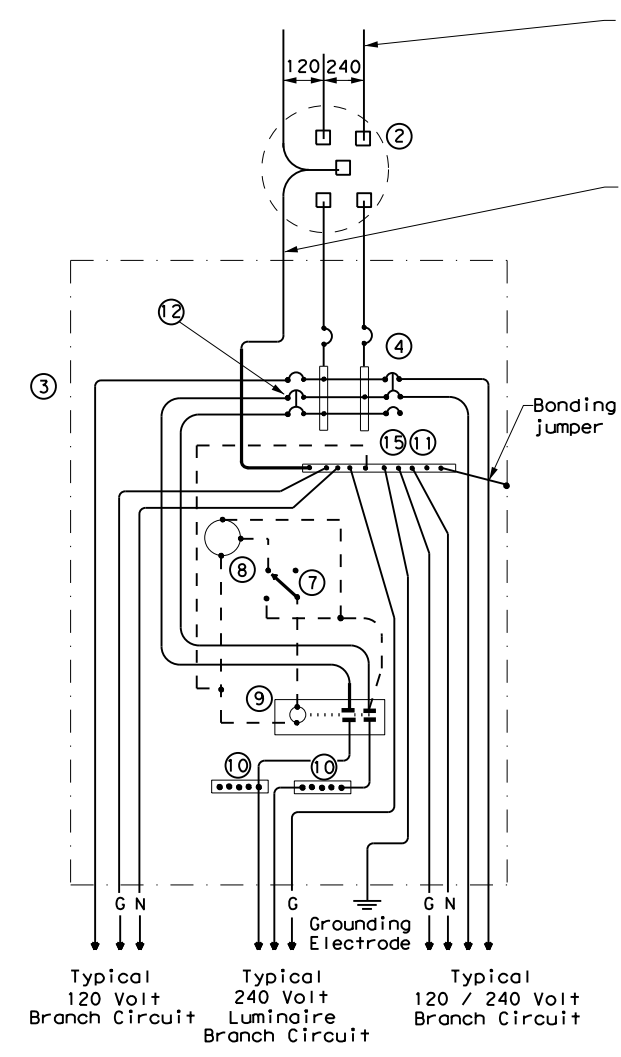
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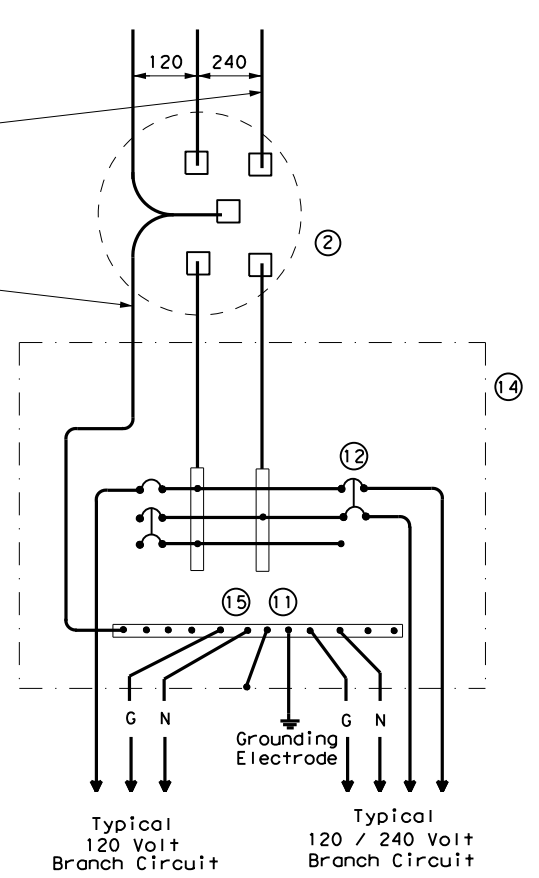
**SCHEMATIC TYPE A
THREE WIRE**



**SCHEMATIC TYPE C
THREE WIRE**



**SCHEMATIC TYPE D - CUSTOM
120/240 VOLTS - THREE WIRE**



**SCHEMATIC TYPE T
120/240 VOLTS - THREE WIRE**
 Galvanized steel - "Buy Off The Shelf" only. When required install photocell top of the pole or on luminaire only, no lighting contractor will be installed.

WIRING LEGEND	
————	Power Wiring
- - - -	Control Wiring
—N—	Neutral Conductor
—G—	Equipment grounding conductor-always required

SCHEMATIC LEGEND	
1	Safety Switch (when required)
2	Meter (when required-verify with electric utility provider)
3	Service Assembly Enclosure
4	Main Disconnect Breaker (See Electrical Service Data)
5	Circuit Breaker, 15 Amp (Control Circuit)
6	Auxiliary Enclosure
7	Control Station ("H-O-A" Switch)
8	Photo Electric Control (enclosure-mounted shown)
9	Lighting Contactor
10	Power Distribution Terminal Blocks
11	Neutral Bus
12	Branch Circuit Breaker (See Electrical Service Data)
13	Separate Circuit Breaker Panelboard
14	Load Center
15	Ground Bus

				Traffic Operations Division Standard	
ELECTRICAL DETAILS SERVICE ENCLOSURE AND NOTES ED(6) - 14					
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REVISIONS		JOB:	237	HIGHWAY:	SH 225
DIST:	HOU	COUNTY:	HARRIS	SHEET NO.:	046

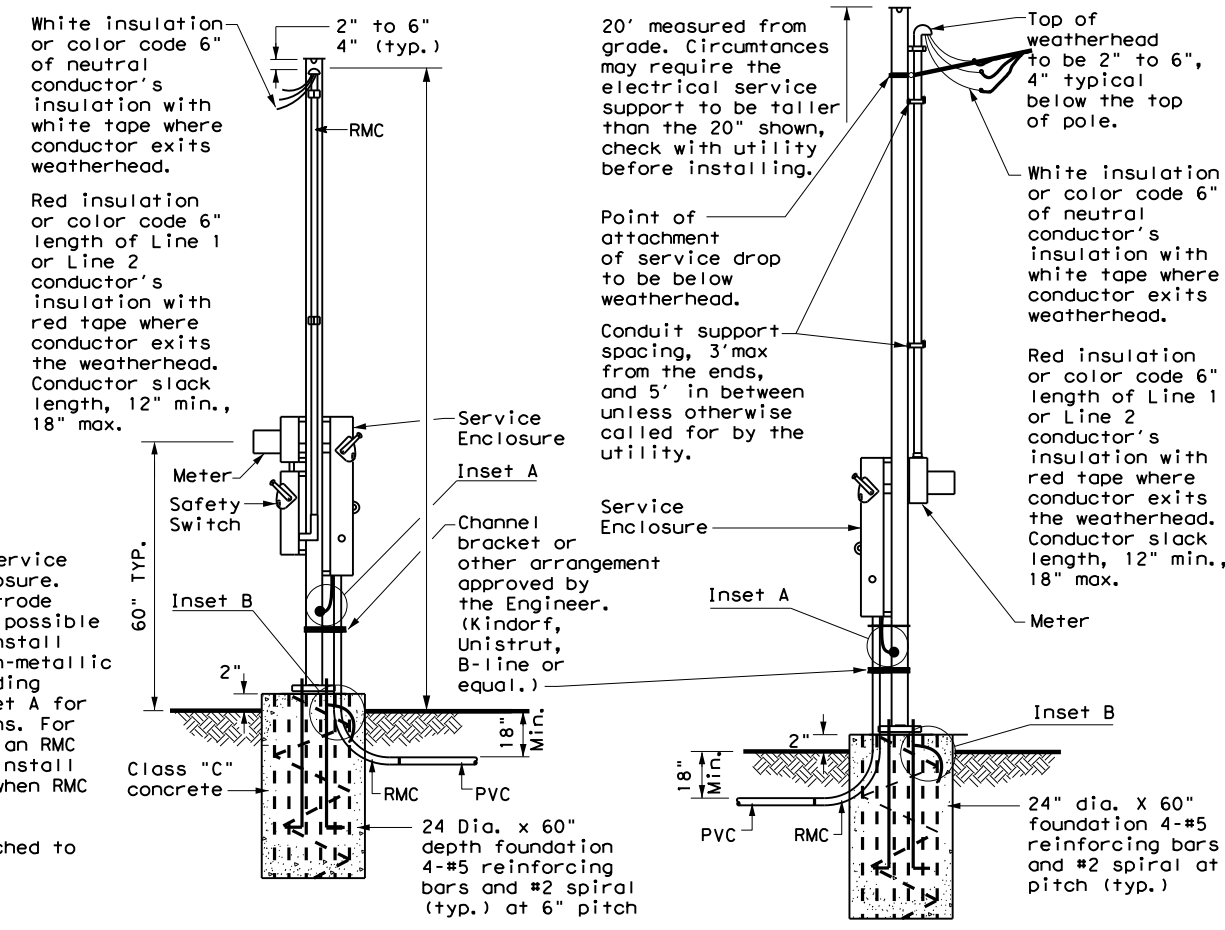
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 FILE: K:\HOU_TPTO\068928203 - TxDOT_HOU_TRF_WA_3_Misc_Study-Signal-FON\Task of the Engineering Practice Act - No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this drawing to a different format or for any errors or omissions.

SUPPORT TYPE STEEL POLE (SP) AND STEEL FRAME (SF)

1. Provide steel pole and steel frame supports as per TxDOT Departmental Material Specification (DMS)11080 "Electrical Services." Mount all equipment and conduit on 12 gauge galvanized steel or stainless steel channel strut, 1 1/2 in. or 1 3/8 in. wide by 1 in. up to 3 3/4 in. deep Unistrut, Kindorf, B-line or equal. Bolt or weld all channel and hardware to vertical members as approved. Do not stack channel. File smooth and paint field cut ends of all channel with zinc-rich paint before installing.
2. Provide poles for overhead service with an eyebolt or similar fitting for attachment of the service drop to the pole in conformance with the electric utility provider's specifications.
3. Provide and install galvanized 3/4 in. x 18 in. x 4 in. (dia. x length x hook length) anchor bolts for underground service supports. Provide and install galvanized 3/4 in. x 56 in. x 4 in. anchor bolts for overhead service supports. Ensure anchor bolts have 3 in of thread, with 3 1/4 in. to 3 1/2 in. of the exposed anchor bolt projecting above finished foundation. Provide and install leveling nuts for all anchor bolts.
4. Bond one of the anchor bolts to the rebar cage with 6 AWG bare stranded copper conductor. Use listed mechanical connectors rated for embedment in concrete. See Inset B.
5. Furnish and install rigid metallic ellis in all steel pole and steel frame foundations for all conduits entering the service from underground.
6. Use class C concrete for foundations. Ensure reinforcing steel is Grade 60 with 3" of unobstructed concrete cover.
7. Drill and tap steel poles and frames for 1/2 in. X 13 UNC tank ground fitting. For steel pole service supports, provide and install tank ground fitting 4 in. to 6 in. below electrical service enclosure. Provide properly sized hole through the bottom of the enclosure for the service grounding electrode conductor. Ensure electrical service grounding electrode conductor is as short and straight as possible from the enclosure to the tank ground fitting. For steel frame service supports, provide and install tank ground fitting on steel frame post. Install service grounding electrode conductor in a non-metallic conduit or tubing from the enclosure to the steel frame post. Connect electrical service grounding electrode conductor to the tank ground fitting. See steel frame and steel pole details and Inset A for more information. Size service entrance conduit and branch circuit conduit as shown in the plans. For underground conduit runs from the electrical service, extend RMC from the service enclosure to an RMC elbow, and then connect the schedule type and size of conduit shown in the plans. Provide and install grounding bushings where RMC terminates in the enclosure. Grounding bushings are not required when RMC is fitted into a sealing hub or threaded boss.
8. If Steel pole or frame is painted, bond each separate painted piece with a bonding jumper attached to a tapped hole.
9. Provide 1/4" - 20 machine screws for bonding. Do not use sheet metal screws. Remove all non-conductive material at contact points. Terminate bonding jumpers with listed devices. Install minimum size 6 AWG stranded copper bonding jumpers. Make up all threaded bonding connections wrench tight.
10. Avoid contact of the service drop and service entrance conductors with the metal pole to prevent abrasion of the insulated conductors.
11. Shop drawings are not required for service support structure unless specifically stated elsewhere or directed by the Engineer.

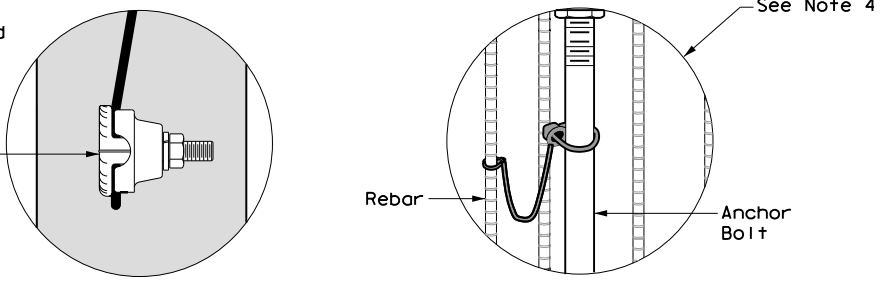
White insulation or color code 6" of neutral conductor's insulation with white tape where conductor exits weatherhead.

Red insulation or color code 6" length of Line 1 or Line 2 conductor's insulation with red tape where conductor exits the weatherhead. Conductor slack length, 12" min., 18" max.

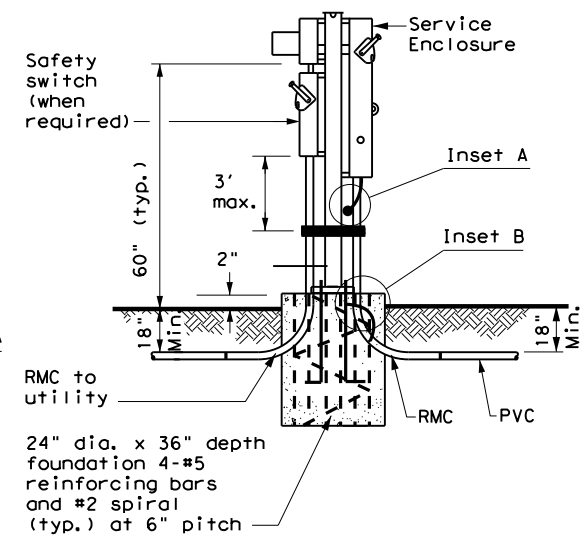


WITH SAFETY SWITCH WITHOUT SAFETY SWITCH
SERVICE SUPPORT TYPE SP (O) - OVERHEAD SERVICE

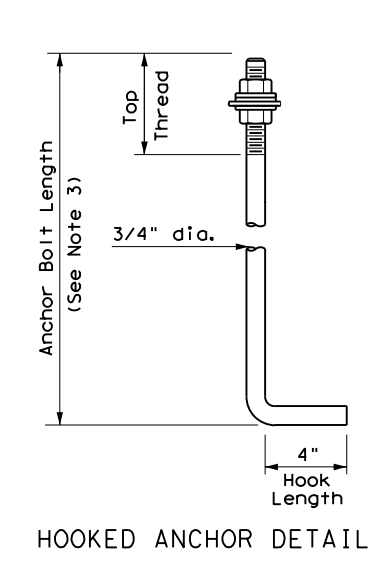
Drill, tap, and thread 1/2" X 13 UNC. Install tank ground fitting, connect electrical service grounding electrode conductor. See Note 7.



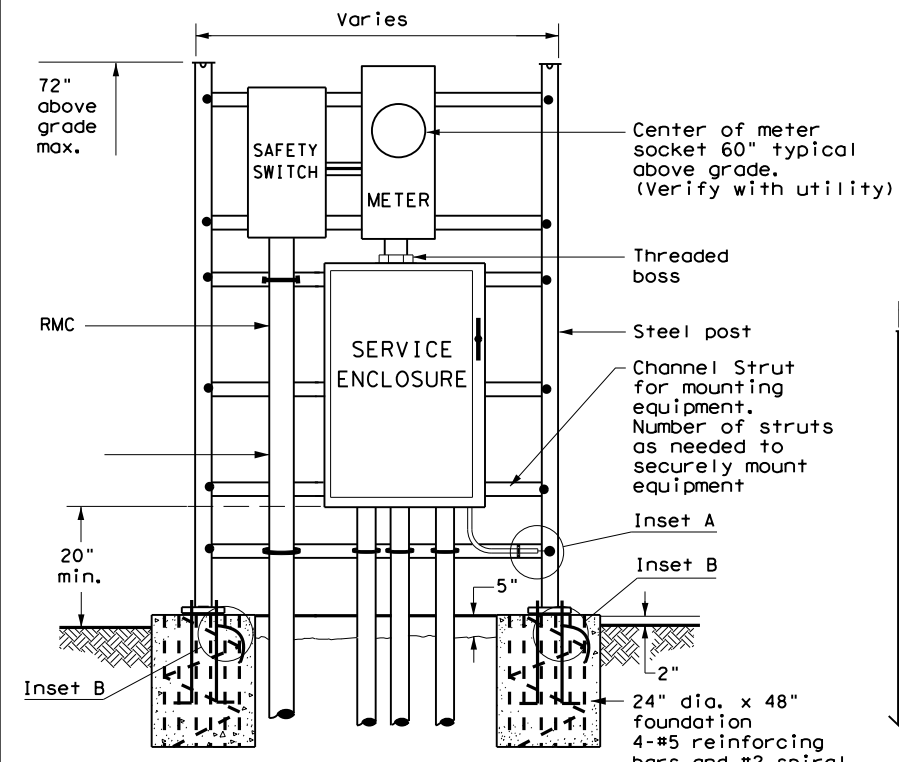
FRONT VIEW INSET A INSET B



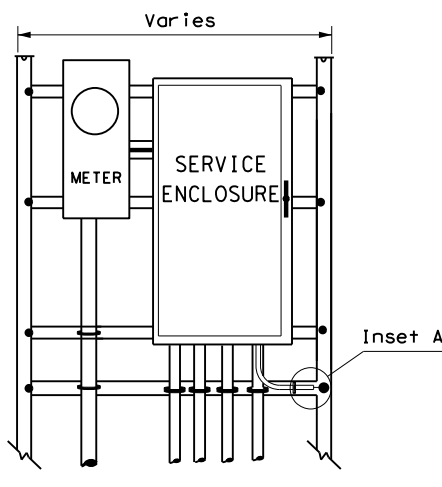
WITH SAFETY SWITCH
SERVICE SUPPORT TYPE SP (U) - UNDERGROUND SERVICE



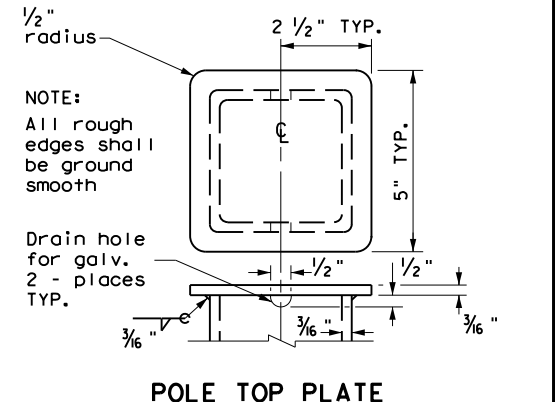
HOOKED ANCHOR DETAIL



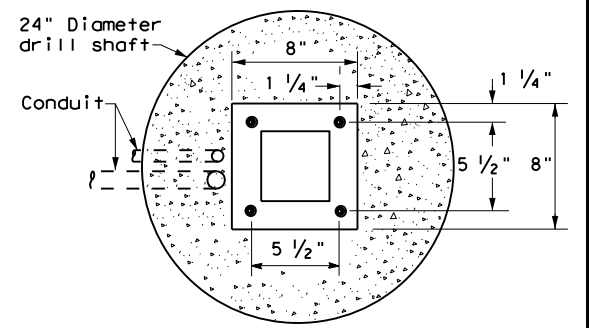
WITH SAFETY SWITCH
FRONT VIEW
SERVICE SUPPORT TYPE SF (U) - UNDERGROUND SERVICE



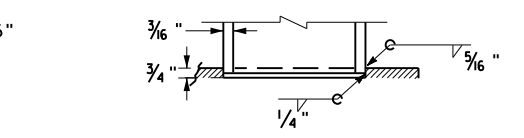
WITHOUT SAFETY SWITCH



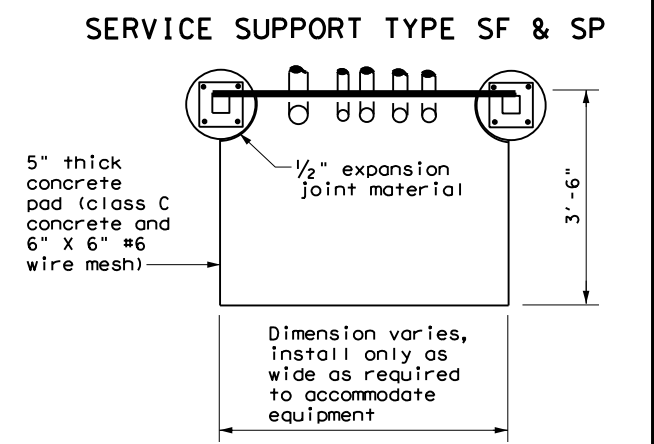
POLE TOP PLATE



BASE PLATE DETAIL



BOTTOM OF POLE



TOP VIEW
SERVICE SUPPORT TY SF (O) & SF (U)

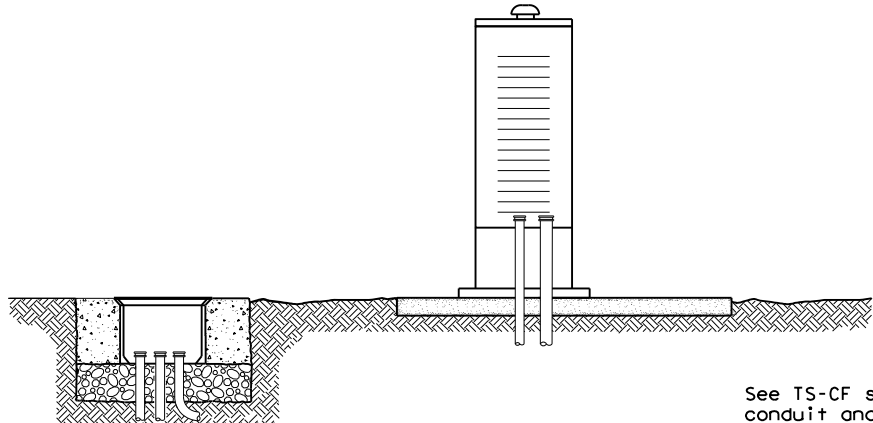
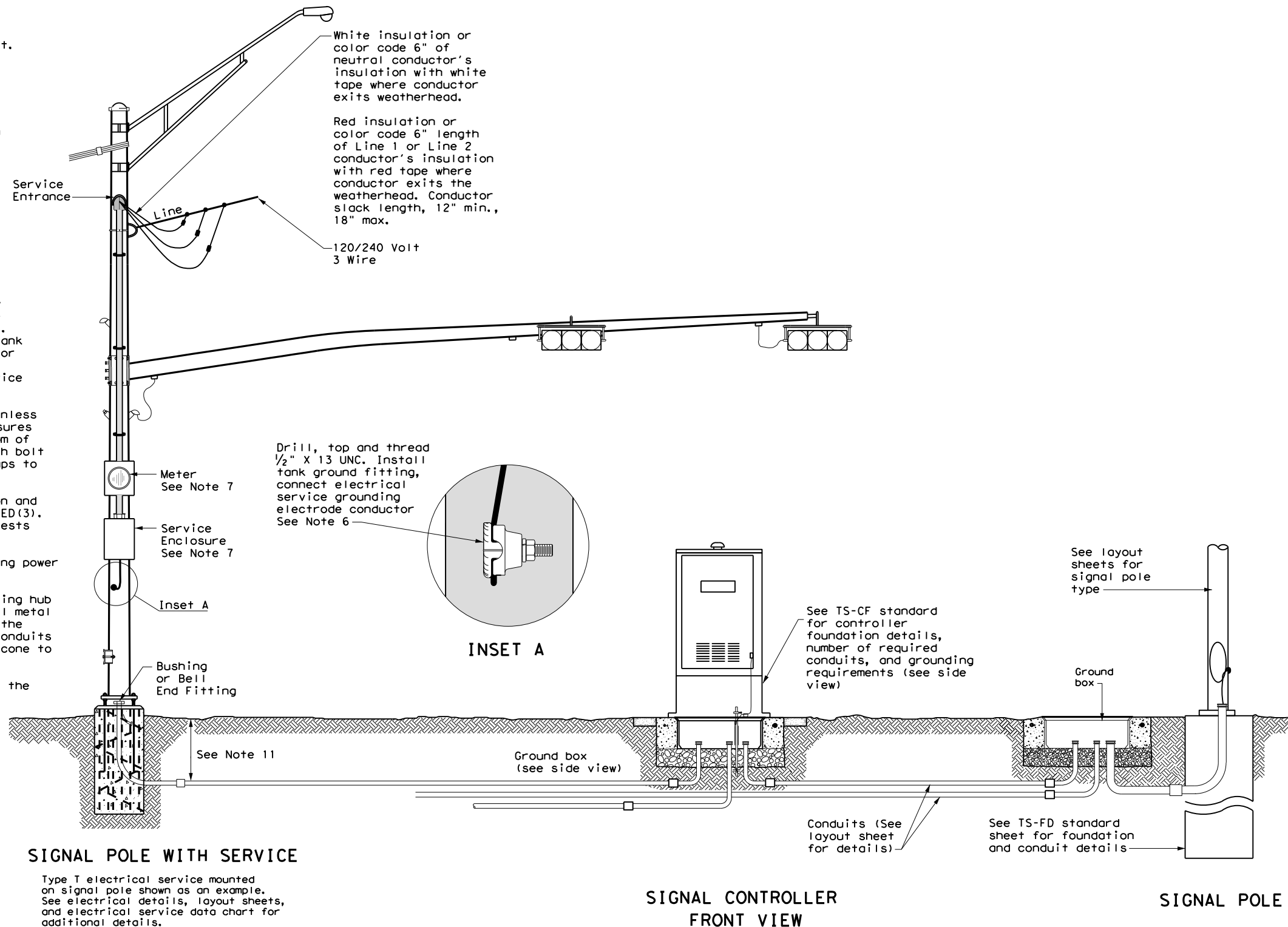
		Traffic Operations Division Standard	
ELECTRICAL DETAILS SERVICE SUPPORT TYPES SF & SP ED(7)-14			
FILE: ed7-14.dgn	DW: TxDOT	CK: TxDOT	DW: TxDOT
© TxDOT October 2014	CONT: 01	SECT: 0502	JOB: 237
REVISIONS	0502	01	SH 225
DIST: HOU	COUNTY: HARRIS	SHEET NO. 047	

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TRAFFIC SIGNAL NOTES

- Do not pass luminaire conductors through the signal controller cabinet.
- Include an equipment grounding conductor in all conduits throughout the electrical system. Bond all exposed metal parts to the grounding conductor.
- Provide roadway luminaires, when required, in accordance with the material and construction sections of Item 610, "Roadway Illumination Assemblies," except for performance testing of luminaires. Test installed roadway luminaires for proper operation as a part of the associated traffic signal system test.
- If internally illuminated street name signs are approved for use, ground the fixture to the pole with a 12 AWG green XHHW conductor.
- Bond anchor bolts to rebar cage in two locations using #3 bars or 6 AWG stranded copper conductors. Use listed mechanical connectors rated for embedment in concrete. See TxDOT standard TS-FD for further details.
- Drill and tap signal poles for 1/2 in. X 13 UNC tank ground fitting. Provide and install tank ground fitting 4 in. to 6 in. directly below electrical service enclosure. Provide properly sized hole through the bottom of the enclosure for the service grounding electrode conductor. Connect the electrical service grounding electrode conductor to the tank ground fitting. Ensure electrical service grounding electrode conductor is as short and straight as possible from the enclosure to the tank ground fitting. See Inset A detail for further information. Size service entrance conduit and branch circuit conduit as shown in the plans.
- Mount electrical service enclosure and meter to signal pole with stainless steel bands. Ensure bands are a minimum width of 3/4 in. Secure enclosures to bands using two-bolt brackets. Install brackets near top and bottom of each enclosure. Install properly sized stainless steel washers on each bolt in the enclosure. Band or drill and tap properly sized stand-off straps to signal pole for attaching conduit.
- Conduct pull tests and insulation resistance tests on all illumination and power conductors as required in Item 620 "Electrical Conductors" and ED(3). To prevent electronics damage, do not conduct insulation resistance tests on traffic signal cables after termination.
- Lock all enclosures and bolt down all ground box covers before applying power to the signal installation.
- Terminate conduits entering the top of enclosures with a conduit-sealing hub or threaded boss such as meter hub. Install a grounding bushing on all metal conduits not connected to conduit-sealing hub or threaded boss. Bond the grounding bushing to the ground bus with a bonding jumper. Seal all conduits entering enclosures with duct seal or expanding foam. Do not use silicone to seal conduit ends.
- For all conduits, ensure the burial depth is a minimum of 18". Ensure the minimum burial depth for conduit placed under a roadway is 24".



SIGNAL CONTROLLER SIDE VIEW

See TS-CF standard for conduit and grounding requirements. See layout sheets for ground box locations and any additional conduits that are required.

SIGNAL POLE WITH SERVICE

Type T electrical service mounted on signal pole shown as an example. See electrical details, layout sheets, and electrical service data chart for additional details.

SIGNAL CONTROLLER FRONT VIEW

SIGNAL POLE

		Texas Department of Transportation		Traffic Operations Division Standard	
<h2>ELECTRICAL DETAILS</h2> <h2>TYPICAL TRAFFIC SIGNAL</h2> <h2>SYSTEM DETAILS</h2> <h3>ED(8) - 14</h3>					
FILE:	ed8-14.dgn	DN:	TxDOT	CK:	TxDOT
© TxDOT	October 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS		0502	01	237	SH 225
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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:

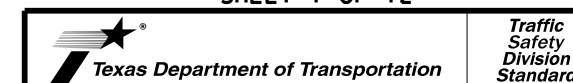
1. Workers on foot who are exposed to traffic or to construction equipment within the right-of-way shall wear high-visibility safety apparel meeting the requirements of ISEA "American National Standard for High-Visibility Apparel," or equivalent revisions, and labeled as ANSI 107-2004 standard performance 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



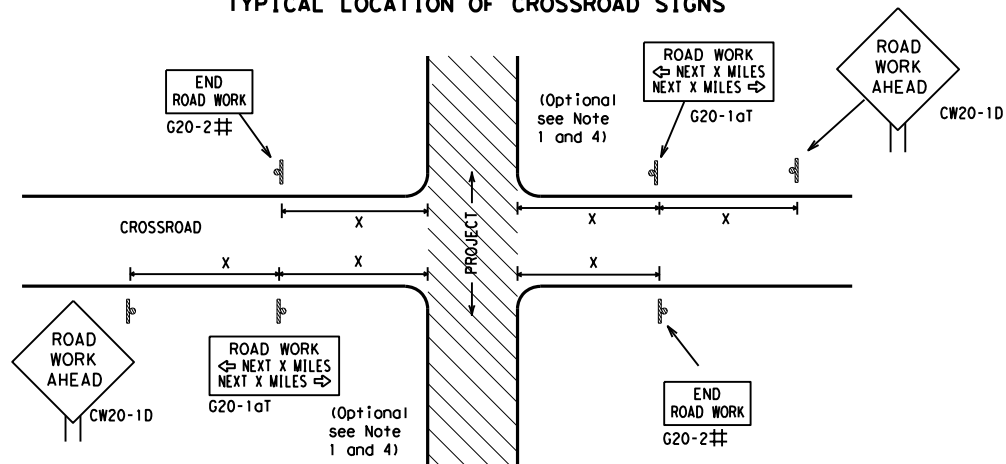
**BARRICADE AND CONSTRUCTION
GENERAL NOTES
AND REQUIREMENTS**

BC (1) -21

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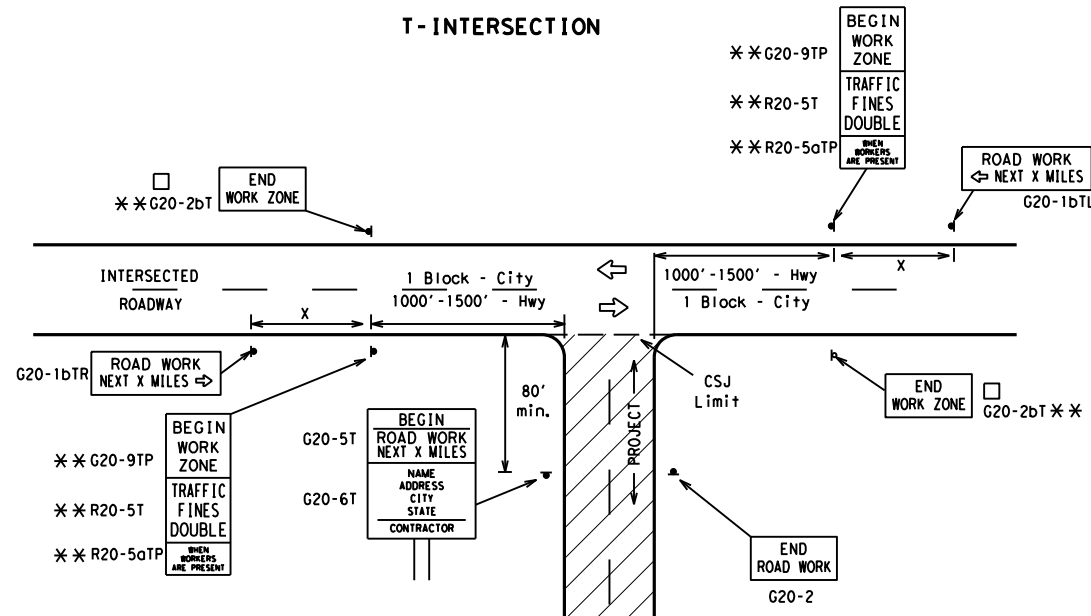
TYPICAL LOCATION OF CROSSROAD SIGNS



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

- 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.
- 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.
- 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.
- 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.
- Additional traffic control devices may be shown elsewhere in the plans for higher volume crossroads.
- 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

- 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.
- 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}

Sign Number or Series	SIZE		SPACING	
	Conventional Road	Expressway/Freeway	Posted Speed MPH	Sign Δ Spacing "x" Feet (Apprx.)
CW20 ⁴	48" x 48"	48" x 48"	30	120
CW21			35	160
CW22			40	240
CW23			45	320
CW25			50	400
CW1, CW2, CW7, CW8, CW9, CW11, CW14	36" x 36"	48" x 48"	55	500 ²
CW3, CW4, CW5, CW6, CW8-3, CW10, CW12	48" x 48"	48" x 48"	60	600 ²
			65	700 ²
			70	800 ²
			75	900 ²
			80	1000 ²
			*	* ³

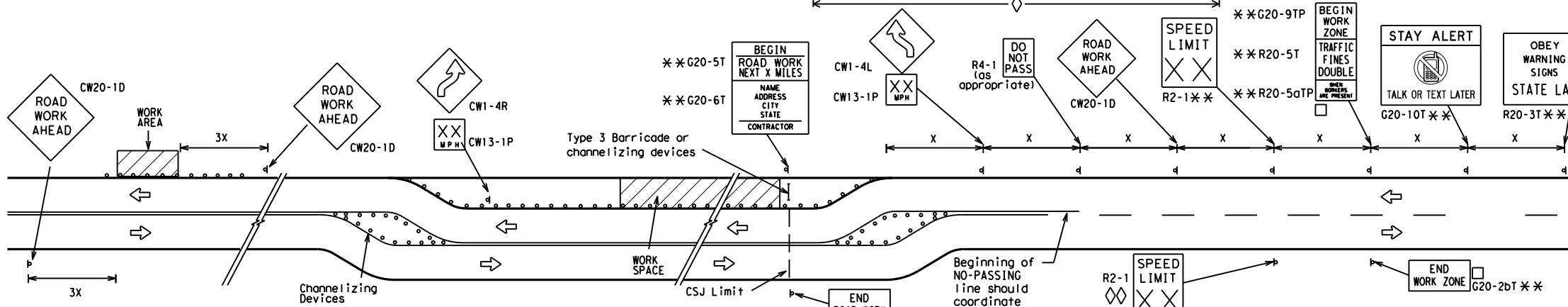
* For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

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

GENERAL NOTES

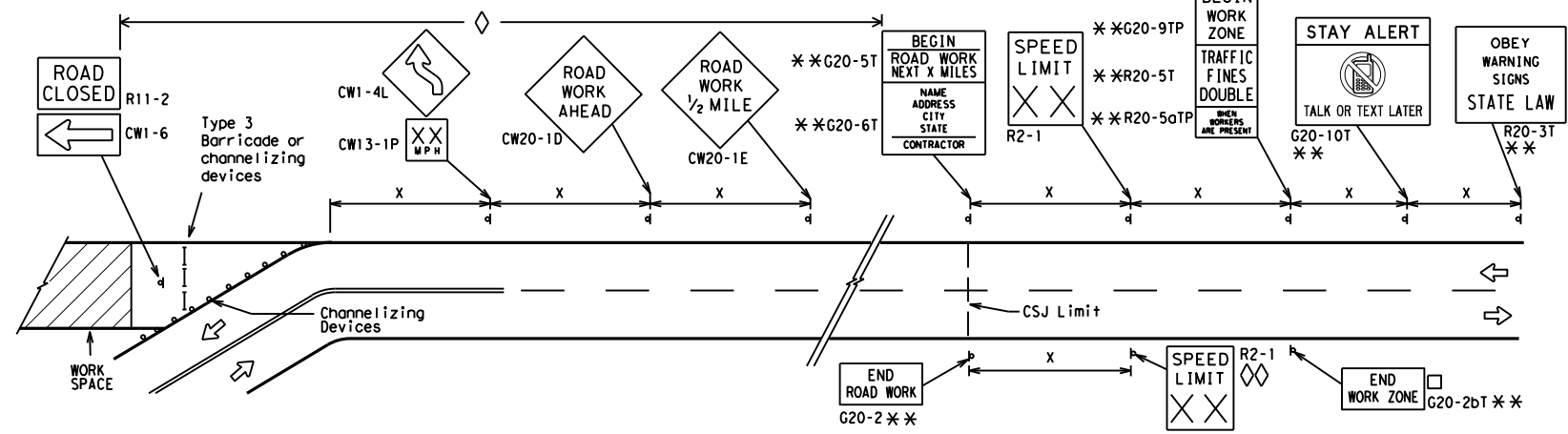
- Special or larger size signs may be used as necessary.
- Distance between signs should be increased as required to have 1500 feet advance warning.
- Distance between signs should be increased as required to have 1/2 mile or more advance warning.
- 36" x 36" "ROAD WORK AHEAD" (CW20-1D) signs may be 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".
- Only diamond shaped warning sign sizes are indicated.
- See sign size listing in "TMUTCD", Sign Appendix or the "Standard Highway Sign Designs for Texas" manual for complete list of available sign design sizes.

WORK AREAS IN MULTIPLE LOCATIONS WITHIN CSJ LIMITS

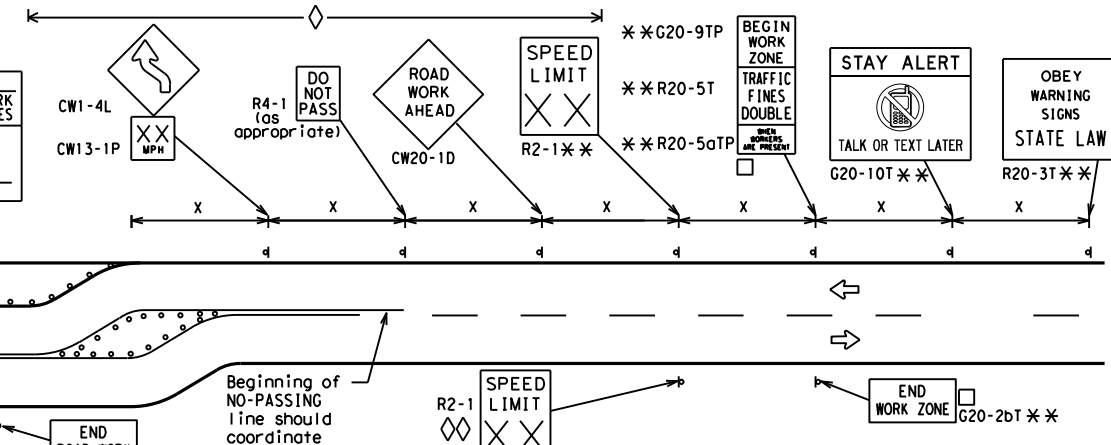


When extended distances occur between minimal work spaces, the Engineer/Inspector should ensure additional "ROAD WORK AHEAD" (CW20-1D) signs are placed in advance of these work areas to remind drivers they are still within the project limits. See the applicable TCP sheets for exact location and spacing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

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



SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING AT 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.

SHEET 2 OF 12



BARRICADE AND CONSTRUCTION PROJECT LIMIT

BC(2)-21

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TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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

Reduced speeds should only be posted in the vicinity of work activity and not throughout the entire project. Regulatory work zone speed signs (R2-1) shall be removed or covered during periods when they are not needed.



GUIDANCE FOR USE:

LONG/INTERMEDIATE TERM WORK ZONE SPEED LIMITS

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

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

- rough road or damaged pavement surface
- substantial alteration of roadway geometrics (diversions)
- construction detours
- grade
- width
- 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

- Regulatory work zone speed limits should be used only for sections of construction projects where speed control is of major importance.
- Regulatory work zone speed limit signs shall be placed on supports at a 7 foot minimum mounting height.
- Speed zone signs are illustrated for one direction of travel and are normally posted for each direction of travel.
- 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
- Regulatory speed limit signs shall have black legend and border on a white reflective background (See "Reflective Sheeting" on BC(4)).
- 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.
- Turning signs from view, laying signs over or down will not be allowed, unless as otherwise noted under "REMOVING OR COVERING" on BC(4).
- Techniques that may help reduce traffic speeds include but are not limited to:
 - Law enforcement.
 - Flagger stationed next to sign.
 - Portable changeable message sign (PCMS).
 - Low-power (drone) radar transmitter.
 - Speed monitor trailers or signs.
- Speeds shown on details above are for illustration only. Work Zone Speed Limits should only be posted as approved for each project.
- 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.

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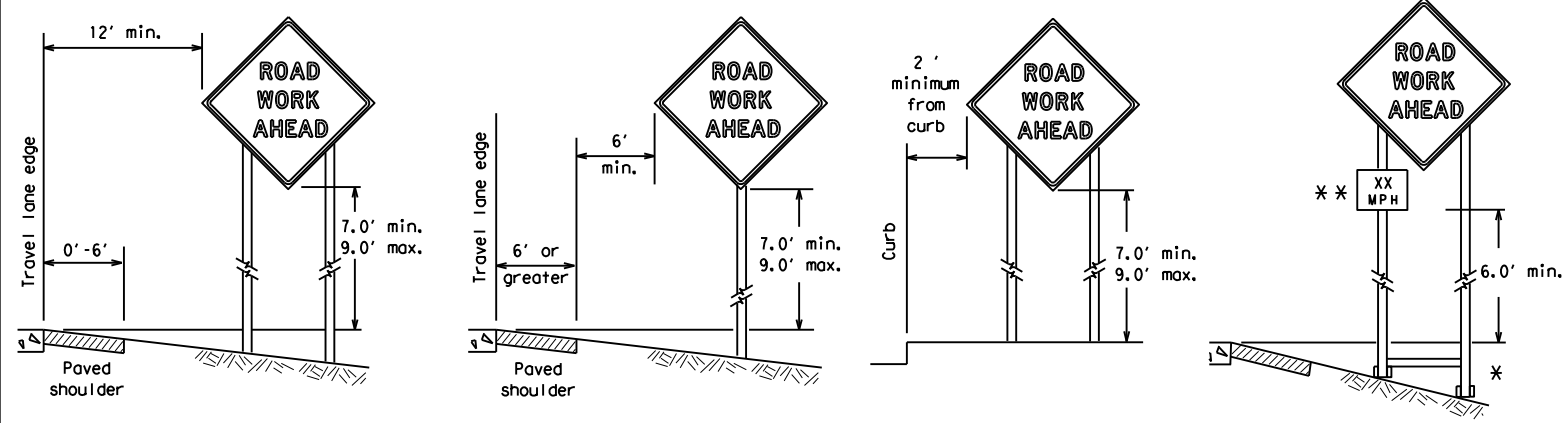
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SHEET 3 OF 12

		Traffic Safety Division Standard	
<h2>BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT</h2>			
<h3>BC (3) -21</h3>			
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© TxDOT	November 2002	CON:	0502
REVISIONS		SECT:	01
9-07	8-14	JOB:	237
7-13	5-21	HIGHWAY:	SH 225
		DIST:	HARRIS
		COUNTY:	
		SHEET NO.:	051

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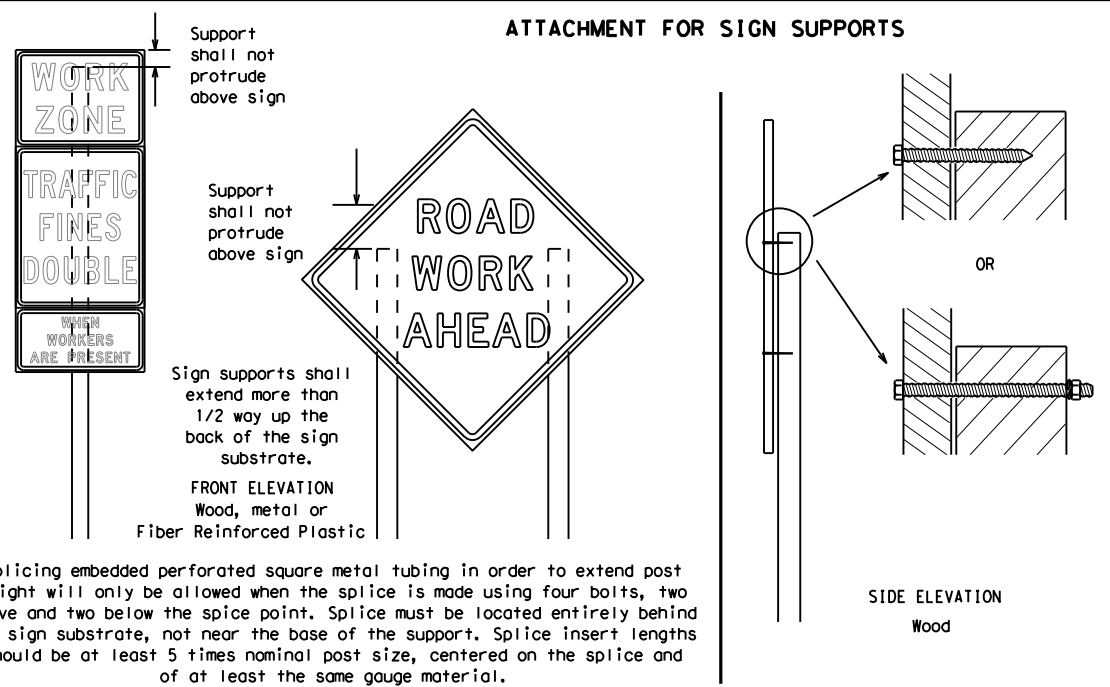
TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS



* 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



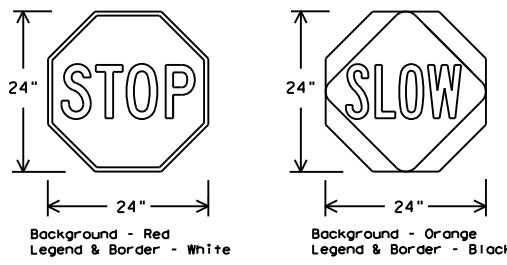
Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

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 splice 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 retroreflective 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 CWZTC 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" (CWZTC) 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 CWZTC 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 CWZTC 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.

SHEET 4 OF 12



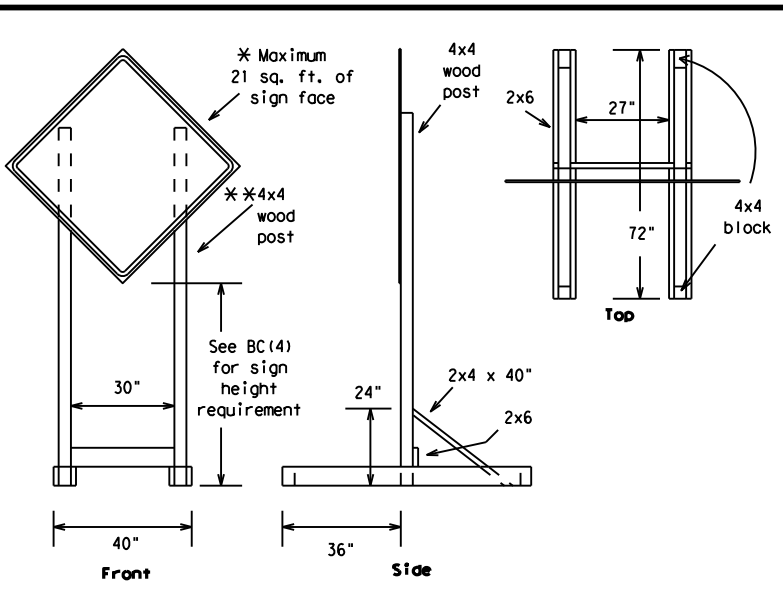
BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES

BC (4) - 21

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© TxDOT	November 2002	CONT	SECT	JOB	HIGHWAY				
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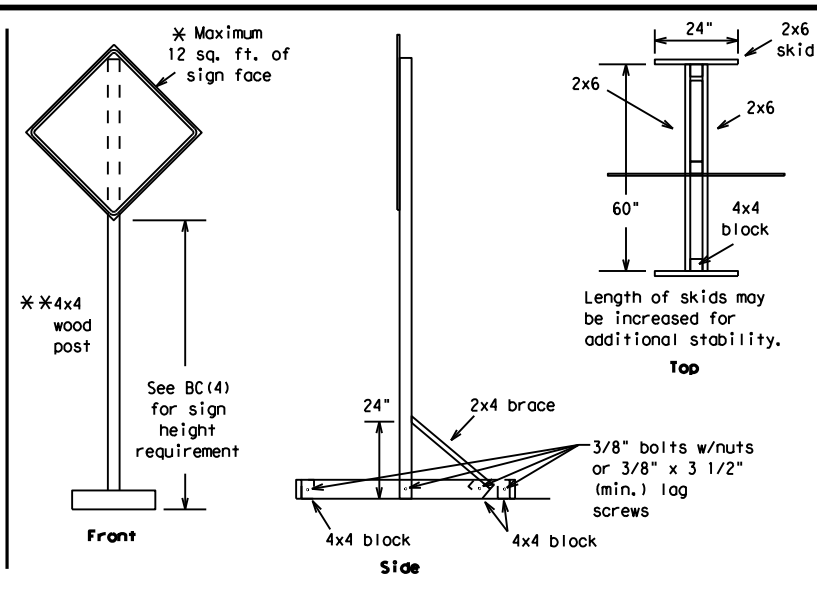
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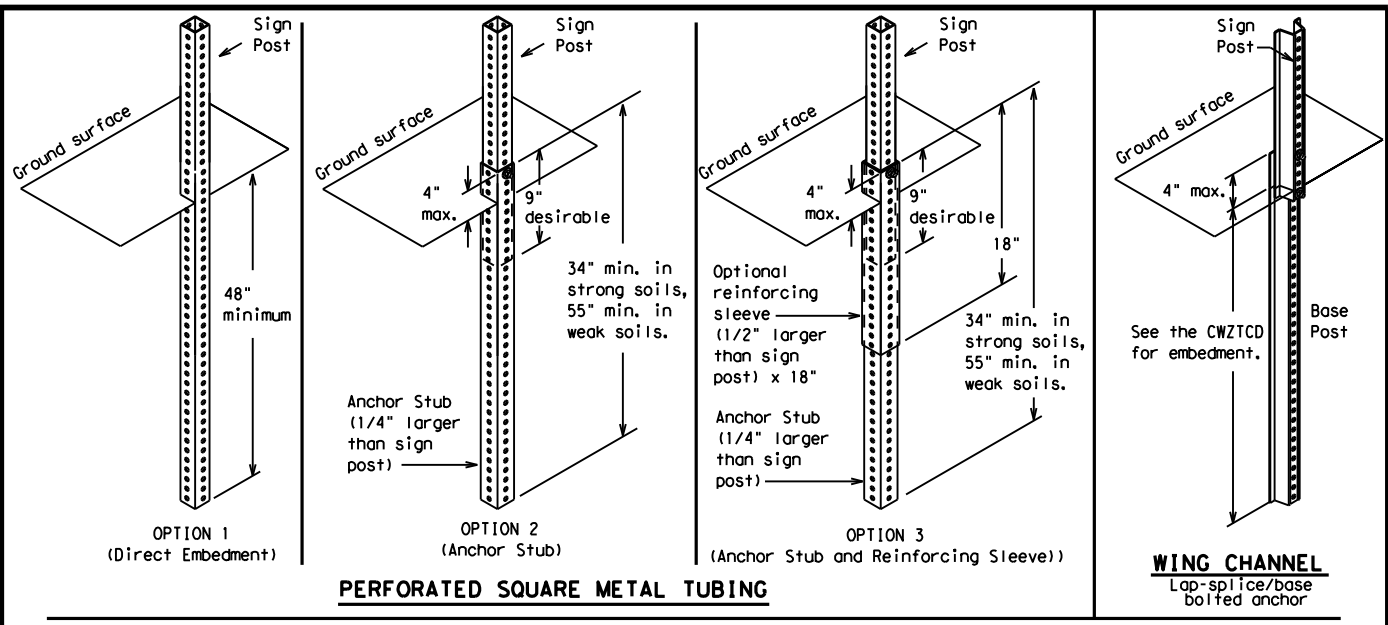
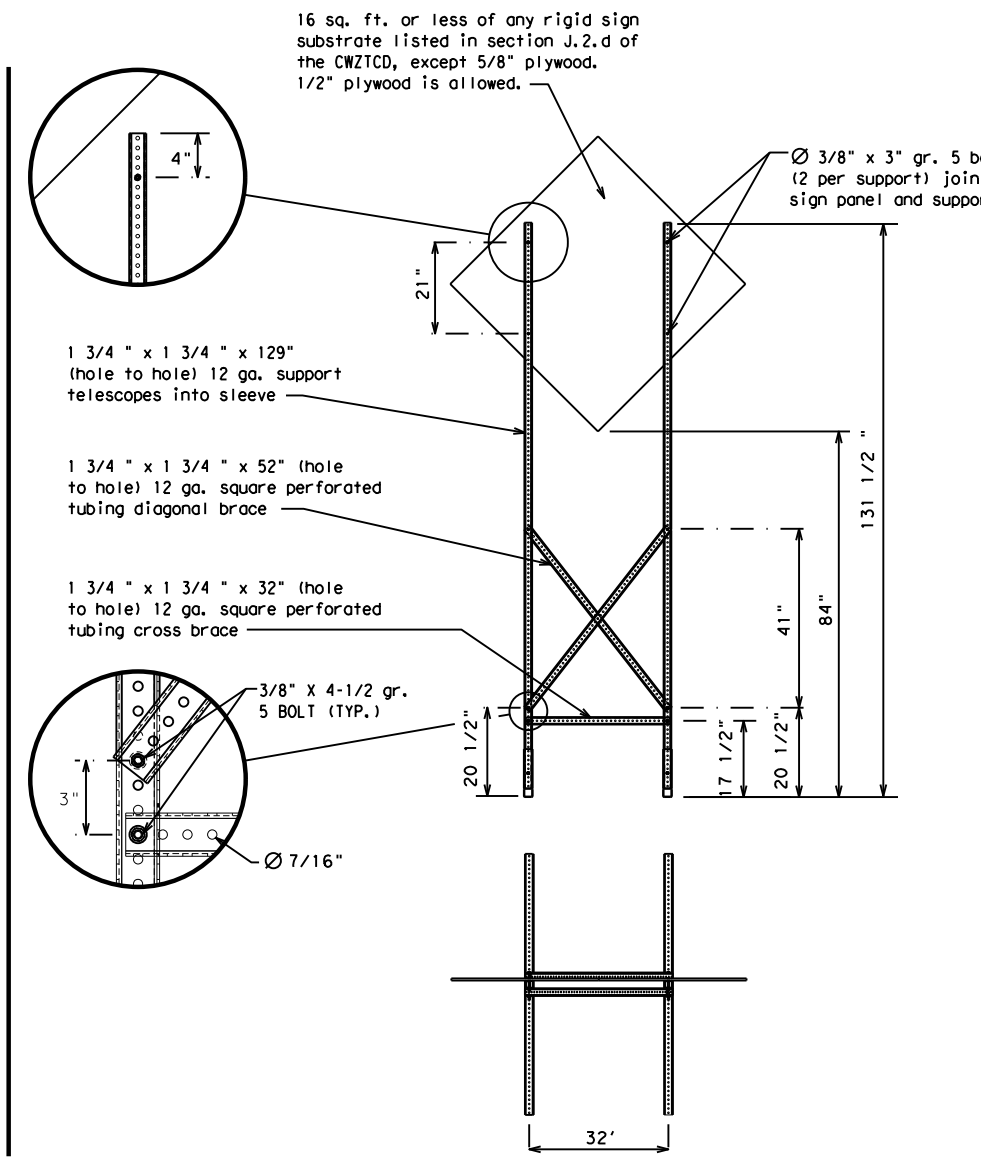
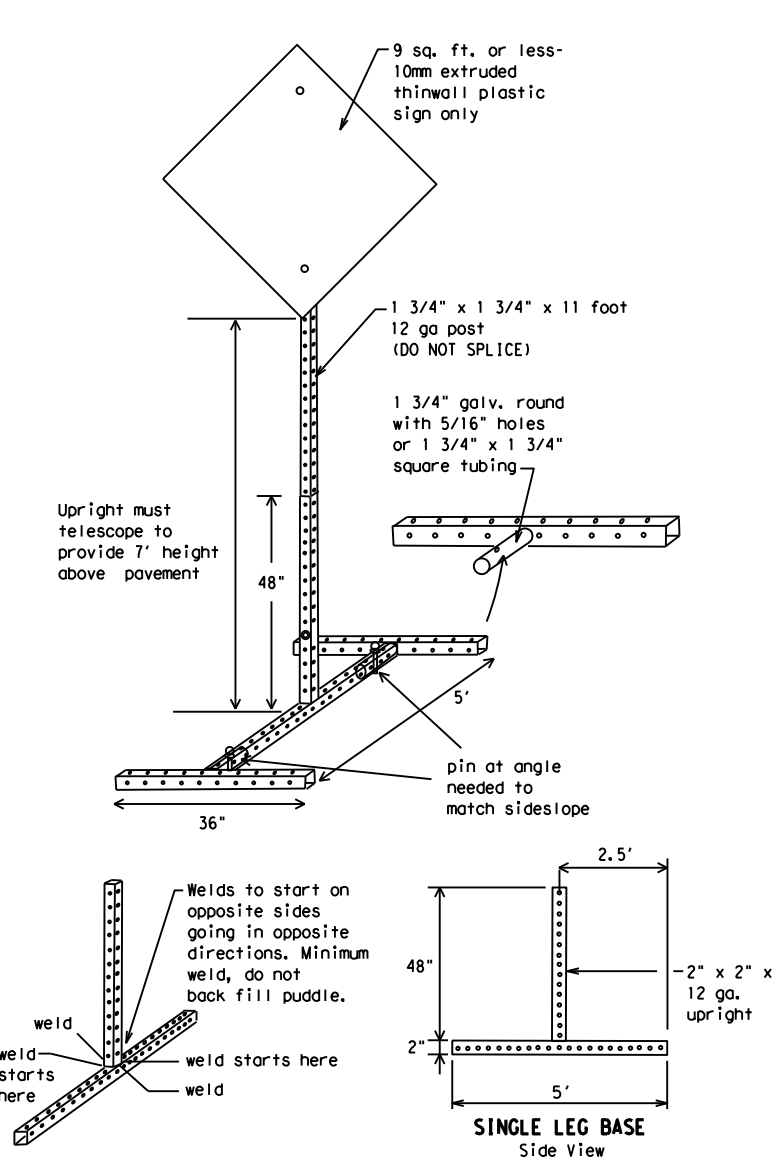
SKID MOUNTED WOOD SIGN SUPPORTS

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



SKID MOUNTED PERFORATED SQUARE STEEL TUBING 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.

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**
- 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.
 - No more than 2 sign posts shall be placed within a 7 ft. circle, except for specific materials noted on the CWZTCD List.
 - 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.

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

RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

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

PORTABLE CHANGEABLE MESSAGE SIGNS

- The Engineer/Inspector shall approve all messages used on portable changeable message signs (PCMS).
- 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.
- 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.
- Use the word "EXIT" to refer to an exit ramp on a freeway; i.e., "EXIT CLOSED." Do not use the term "RAMP."
- Always use the route or interstate designation (IH, US, SH, FM) along with the number when referring to a roadway.
- When in use, the bottom of a stationary PCMS message panel should be a minimum 7 feet above the roadway, where possible.
- 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.
- 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.
- Do not "flash" messages or words included in a message. The message should be steady burn or continuous while displayed.
- 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.
- Do not use the word "Danger" in message.
- Do not display the message "LANES SHIFT LEFT" or "LANES SHIFT RIGHT" on a PCMS. Drivers do not understand the message.
- Do not display messages that scroll horizontally or vertically across the face of the sign.
- 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.
- 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.
- Each line of text should be centered on the message board rather than left or right justified.
- 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.

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
XXXXXXXX TO XXXXXX
US XXX TO FM XXXX

Warning List

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

** Advance Notice List

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

** See Application Guidelines Note 6.

APPLICATION GUIDELINES

- Only 1 or 2 phases are to be used on a PCMS.
- The 1st phase (or both) should be selected from the "Road/Lane/Ramp Closure List" and the "Other Condition List".
- A 2nd phase can be selected from the "Action to Take/Effect on Travel, Location, General Warning, or Advance Notice Phase Lists".
- A Location Phase is necessary only if a distance or location is not included in the first phase selected.
- 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.
- 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

- The words RIGHT, LEFT and ALL can be interchanged as appropriate.
- Roadway designations IH, US, SH, FM and LP can be interchanged as appropriate.
- EAST, WEST, NORTH and SOUTH (or abbreviations E, W, N and S) can be interchanged as appropriate.
- Highway names and numbers replaced as appropriate.
- ROAD, HIGHWAY and FREEWAY can be interchanged as needed.
- AHEAD may be used instead of distances if necessary.
- FT and MI, MILE and MILES interchanged as appropriate.
- AT, BEFORE and PAST interchanged as needed.
- 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

- 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.
- 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.
- 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.
- 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.

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WORD OR PHRASE	ABBREVIATION	WORD OR PHRASE	ABBREVIATION
Access Road	ACCS RD	Major	MAJ
Alternate	ALT	Miles	MI
Avenue	AVE	Miles Per Hour	MPH
Best Route	BEST RTE	Minor	MNR
Boulevard	BLVD	Monday	MON
Bridge	BRDG	Normal	NORM
Cannot	CANT	North	N
Center	CTR	Northbound	(route) N
Construction Ahead	CONST AHD	Parking	PKING
CROSSING	XING	Road	RD
Detour Route	DETOUR RTE	Right Lane	RT LN
Do Not	DONT	Saturday	SAT
East	E	Service Road	SERV RD
Eastbound	(route) E	Shoulder	SHLDR
Emergency	EMER	Slippery	SLIP
Emergency Vehicle	EMER VEH	South	S
Entrance, Enter	ENT	Southbound	(route) S
Express Lane	EXP LN	Speed	SPD
Expressway	EXPWY	Street	ST
XXXX Feet	XXXX FT	Sunday	SUN
Fog Ahead	FOG AHD	Telephone	PHONE
Freeway	FRWY, FWY	Temporary	TEMP
Freeway Blocked	FWY BLKD	Thursday	THURS
Friday	FRI	To Downtown	TO DWNTN
Hazardous Driving	HAZ DRIVING	Traffic	TRAF
Hazardous Material	HAZMAT	Travelers	TRVLR
High-Occupancy Vehicle	HOV	Tuesday	TUES
Hour(s)	HR, HRS	Time Minutes	TIME MIN
Information	INFO	Upper Level	UPR LEVEL
It Is	ITS	Vehicles (s)	VEH, VEHS
Junction	JCT	Warning	WARN
Left	LFT	Wednesday	WED
Left Lane	LFT LN	Weight Limit	WT LIMIT
Lane Closed	LN CLOSED	West	W
Lower Level	LWR LEVEL	Westbound	(route) W
Maintenance	MAINT	Wet Pavement	WET PVMT
		Will Not	WONT

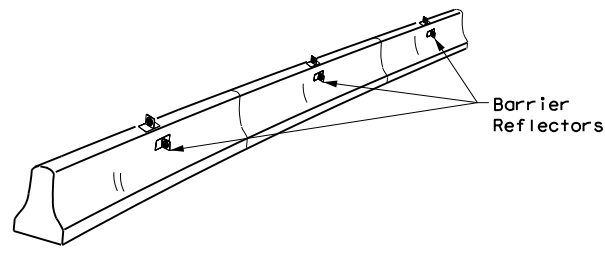
Roadway designation # IH-number, US-number, SH-number, FM-number

<h3>BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)</h3>			
<h2>BC (6) - 21</h2>			
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© TxDOT	November 2002	CK:	TxDOT
REVISIONS	0502	OW:	TxDOT
9-07	8-14	CR:	TxDOT
7-13	5-21	HWY:	SH 225
		DIST:	COUNTY
		HOU:	HARRIS
		SHEET NO.:	054

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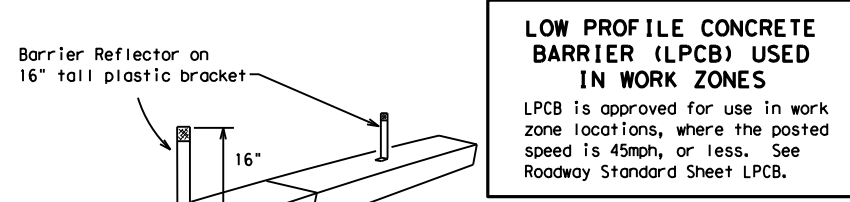
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- Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
- Color of Barrier Reflectors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



CONCRETE TRAFFIC BARRIER (CTB)

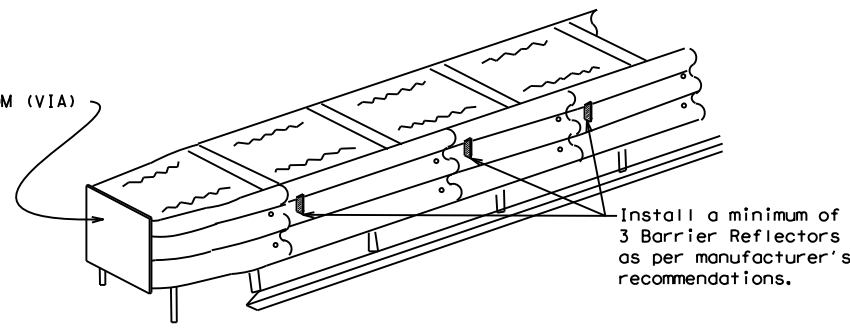
- Where traffic is on one side of the CTB, two (2) Barrier Reflectors shall be mounted in approximately the midsection of each section of CTB. An alternate mounting location is uniformly spaced at one end of each CTB. This will allow for attachment of a barrier grapple without damaging the reflector.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



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.

LOW PROFILE CONCRETE BARRIER (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 appropriate 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

WARNING LIGHTS

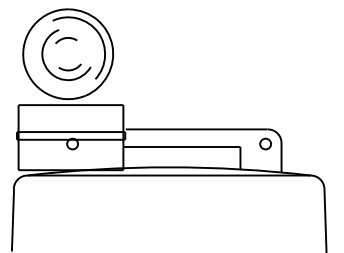
- Warning lights shall meet the requirements of the TMUTCD.
- Warning lights shall NOT be installed on barricades.
- Type A-Low Intensity Flashing Warning Lights are commonly used with drums. They are intended to warn of or mark a potentially hazardous area. Their use shall be as indicated on this sheet 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.
- 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".
- The Engineer/Inspector or the plans shall specify the location and type of warning lights to be installed on the traffic control devices.
- 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.
- 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.
- The location of warning lights and warning reflectors on drums shall be as shown elsewhere in the plans.

WARNING LIGHTS MOUNTED ON PLASTIC DRUMS

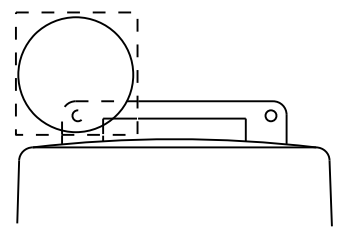
- Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
- Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
- A series of sequential flashing warning lights placed on channelizing 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.
- 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.
- Type A, Type C and Type D warning lights shall be installed at locations as detailed on other sheets in the plans.
- Warning lights shall not be installed on a drum that has a sign, chevron or vertical panel.
- 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

- 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.
- 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.
- The warning reflector shall have a minimum retroreflective surface area (one-side) of 30 square inches.
- Round reflectors shall be fully reflectorized, including the area where attached to the drum.
- 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.
- 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.
- When used near two-way traffic, both sides of the warning reflector shall be reflectorized.
- The warning reflector should be mounted on the side of the handle nearest approaching traffic.
- The maximum spacing for warning reflectors should be identical to the channelizing device spacing requirements.



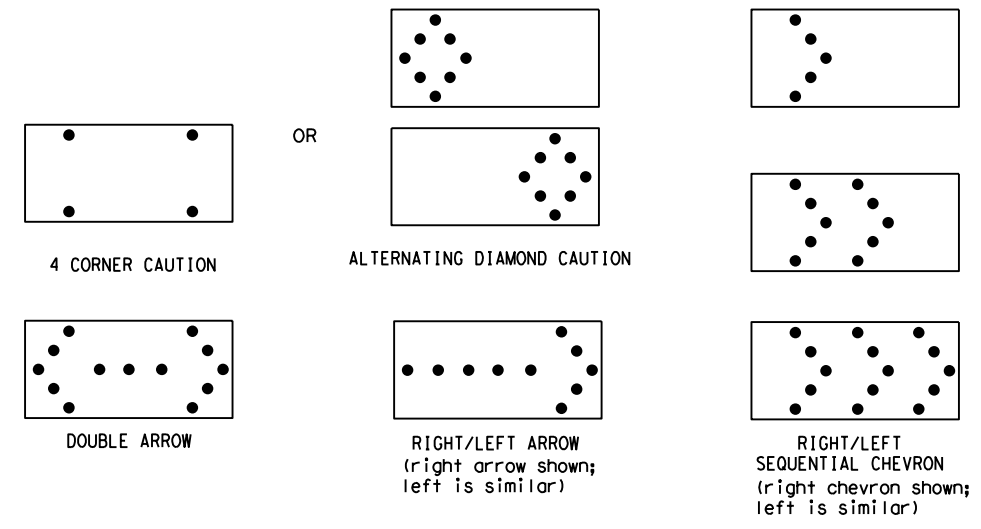
Type C Warning Light or approved substitute mounted on a drum adjacent to the travel way.



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

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.

- 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.
- 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.
- 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.
- The Flashing Arrow Board should be able to display the following symbols:



- The "CAUTION" display consists of four corner lamps flashing simultaneously, or the Alternating Diamond Caution mode as shown.
- The straight line caution display is NOT ALLOWED.
- 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.
- 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.
- The sequential arrow display is NOT ALLOWED.
- The flashing arrow display is the TxDOT standard; however, the sequential chevron display may be used during daylight operations.
- The Flashing Arrow Board shall be mounted on a vehicle, trailer or other suitable support.
- A Flashing Arrow Board SHALL NOT BE USED to laterally shift traffic.
- 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.
- 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

SHEET 7 OF 12

TRUCK-MOUNTED ATTENUATORS

- Truck-mounted attenuators (TMA) used on TxDOT facilities must meet the requirements outlined in the Manual for Assessing Safety Hardware (MASH).
- Refer to the CWZTCD for the requirements of Level 2 or Level 3 TMAs.
- Refer to the CWZTCD for a list of approved TMAs.
- TMAs are required on freeways unless otherwise noted in the plans.
- 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.
- 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.



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

BC (7) -21

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9-07	8-14	DIST	COUNTY	SHEET NO.					
7-13	5-21	HOU	HARRIS	055					

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GENERAL NOTES

- For long term stationary work zones on freeways, drums shall be used as the primary channelizing device.
- 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.
- 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.
- 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).
- 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.
- 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

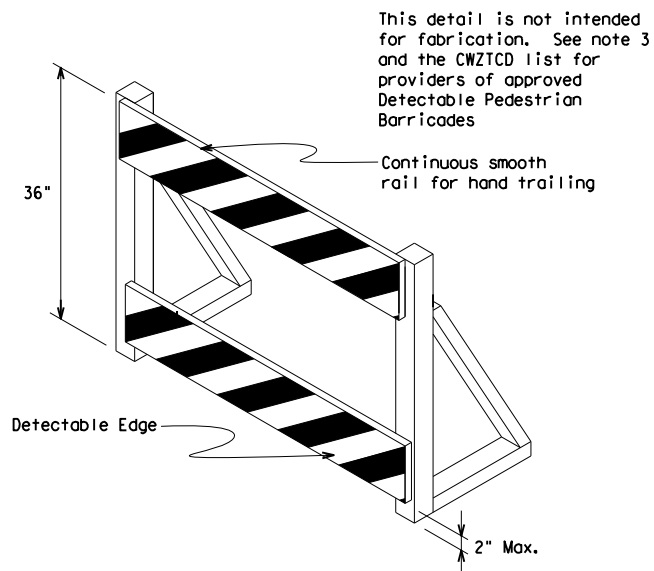
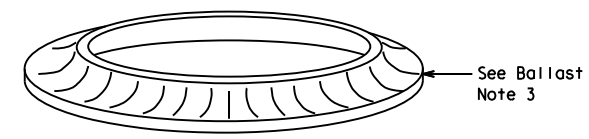
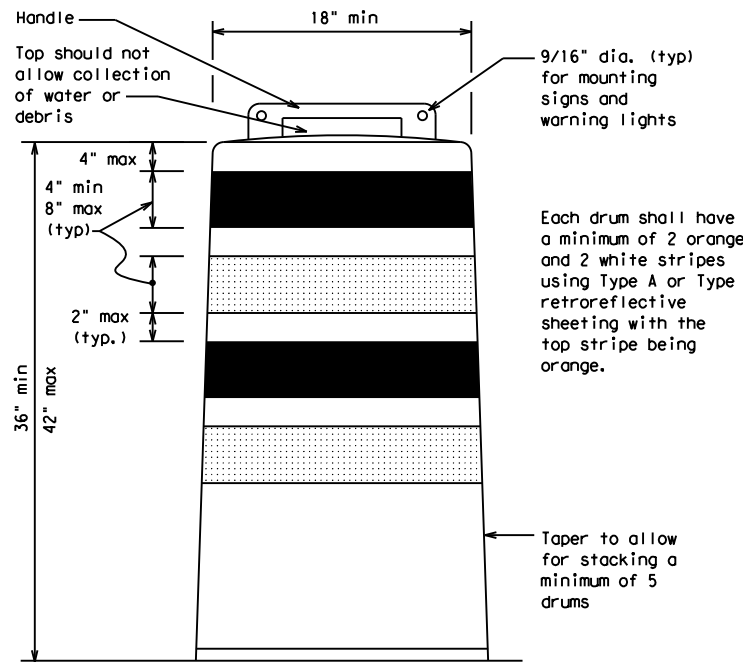
- Pre-qualified plastic drums shall meet the following requirements:
- Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
 - The body and base shall lock together in such a manner that the body separates from the base when impacted 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.
 - 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.
 - 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.
 - 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.
 - 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.
 - 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.
 - Plastic drums shall be constructed of ultra-violet stabilized, orange, high-density polyethylene (HDPE) or other approved material.
 - Drum body shall have a maximum unballasted weight of 11 lbs.
 - Drum and base shall be marked with manufacturer's name and model number.

RETROREFLECTIVE SHEETING

- 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.
- 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

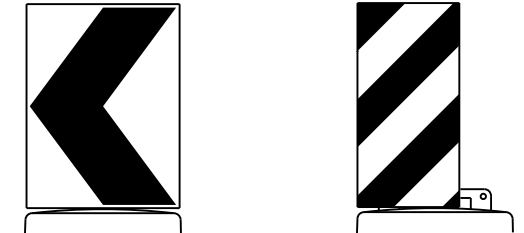
- Unballasted bases shall be large enough to hold up to 50 lbs. of sand. This base, when filled with the ballast material, should weigh between 35 lbs (minimum) and 50 lbs (maximum). The ballast may be sand in one to three sandbags separate from the base, sand in a sand-filled plastic base, or other 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.
- 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.
- Recycled truck tire sidewalls may be used for ballast on drums approved for this type of ballast on the CWZTCD list.
- 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.
- 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.
- Ballast shall not be placed on top of drums.
- Adhesives may be used to secure base of drums to pavement.



This detail is not intended for fabrication. See note 3 and the CWZTCD list for providers of approved Detectable Pedestrian Barricades

DETECTABLE PEDESTRIAN BARRICADES

- 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.
- 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.
- 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.
- 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.
- Warning lights shall not be attached to detectable pedestrian barricades.
- 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

- Signs used on plastic drums shall be manufactured using substrates listed on the CWZTCD.
- 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.
- 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.
- 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.
- Signs shall be installed using a 1/2 inch bolt (nominal) and nut, two washers, and one locking washer for each connection.
- Mounting bolts and nuts shall be fully engaged and adequately torqued. Bolts should not extend more than 1/2 inch beyond nuts.
- 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.
- 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.

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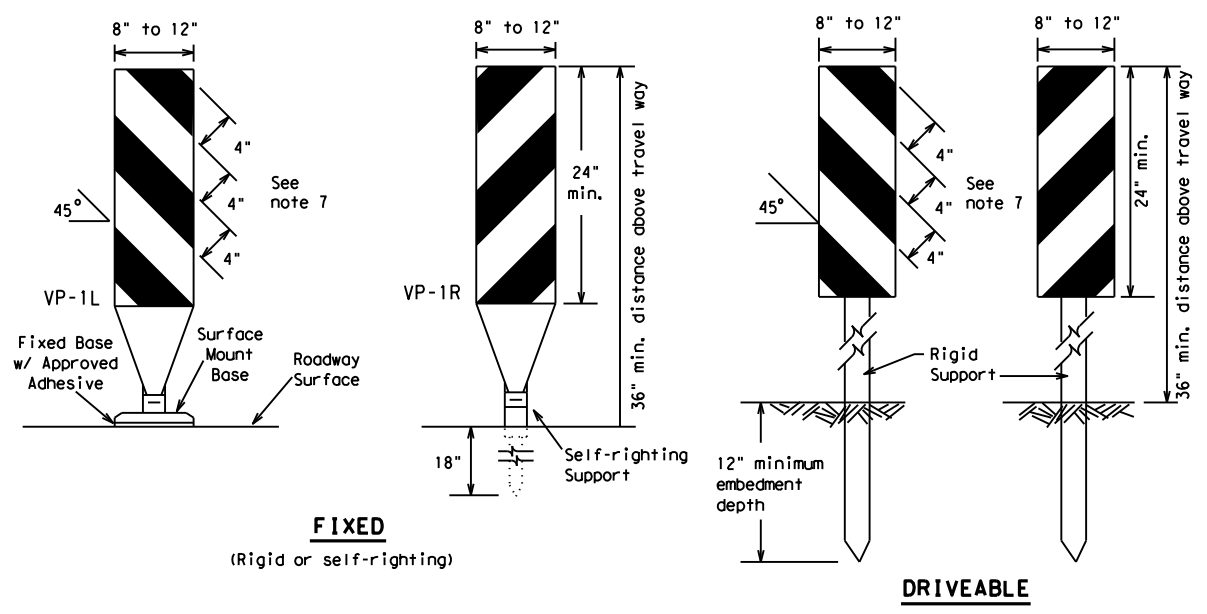
BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC (8) - 21

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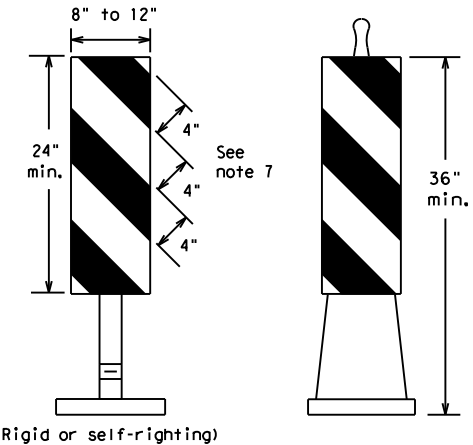
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FIXED
(Rigid or self-righting)

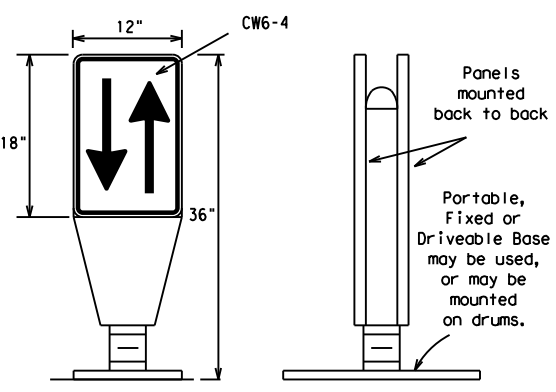
DRIVEABLE



PORTABLE

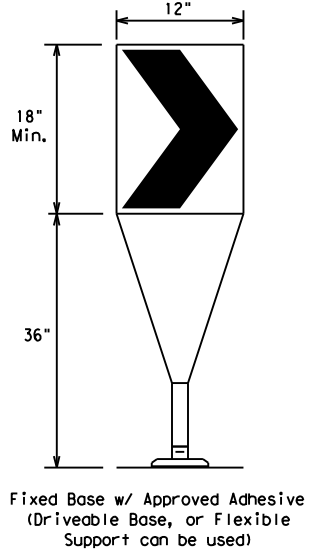
VERTICAL PANELS (VPs)

- Vertical Panels (VP's) are normally used to channelize traffic or divide opposing lanes of traffic.
- 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.
- 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.
- VP's used on expressways and freeways or other high speed roadways, may have more than 270 square inches of retroreflective area facing traffic.
- Self-righting supports are available with portable base. See "Compliant Work Zone Traffic Control Devices List" (CWZTCD).
- Sheeting for the VP's shall be retroreflective Type A or Type B conforming to Departmental Material Specification DMS-8300, unless noted otherwise.
- Where the height of reflective material on the vertical panel is 36 inches or greater, a panel stripe of 6 inches shall be used.



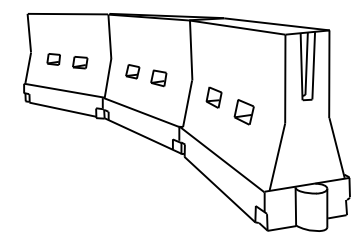
OPPOSING TRAFFIC LANE DIVIDERS (OTLD)

- 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.
- The OTLD may be used in combination with 42" cones or VPs.
- Spacing between the OTLD shall not exceed 500 feet. 42" cones or VPs placed between the OTLD's should not exceed 100 foot spacing.
- 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.



- The chevron shall be a vertical rectangle with a minimum size of 12 by 18 inches.
- 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.
- 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.
- To be effective, the chevron should be visible for at least 500 feet.
- 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.
- 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



LONGITUDINAL CHANNELIZING DEVICES (LCD)

- 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.
- LCDs may be used instead of a line of cones or drums.
- LCDs shall be placed in accordance to application and installation requirements specific to the device, and used only when shown on the CWZTCD list.
- LCDs should not be used to provide positive protection for obstacles, pedestrians or workers.
- LCDs shall be supplemented with retroreflective delineation as required for temporary barriers on BC(7) when placed roughly parallel to the travel lanes.
- 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

- 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.
- 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.
- 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.
- 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.
- 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

GENERAL NOTES

- 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).
- 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.
- 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).
- 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.
- Portable bases shall be fabricated from virgin and/or recycled rubber. The portable bases shall weigh a minimum of 30 lbs.
- 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.
- 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.

Posted Speed	Formula	Minimum Desirable Taper Lengths **			Suggested Maximum Spacing of Channelizing Devices	
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent
30	L = 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

SHEET 9 OF 12



BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC (9) - 21

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 DISCLAIMER:

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.

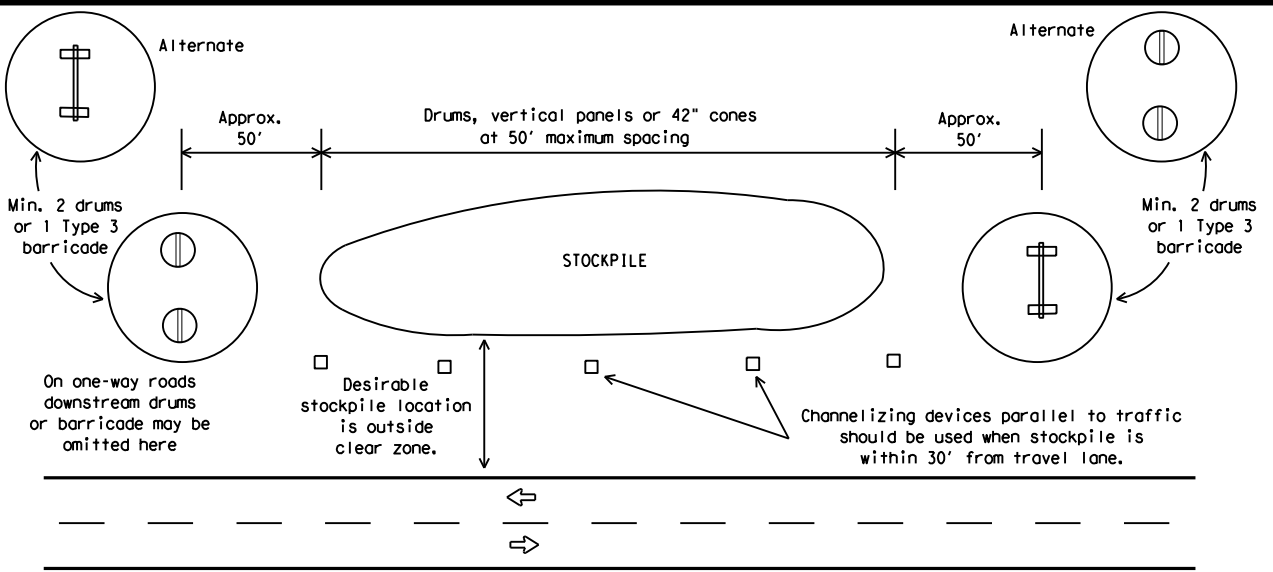


TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



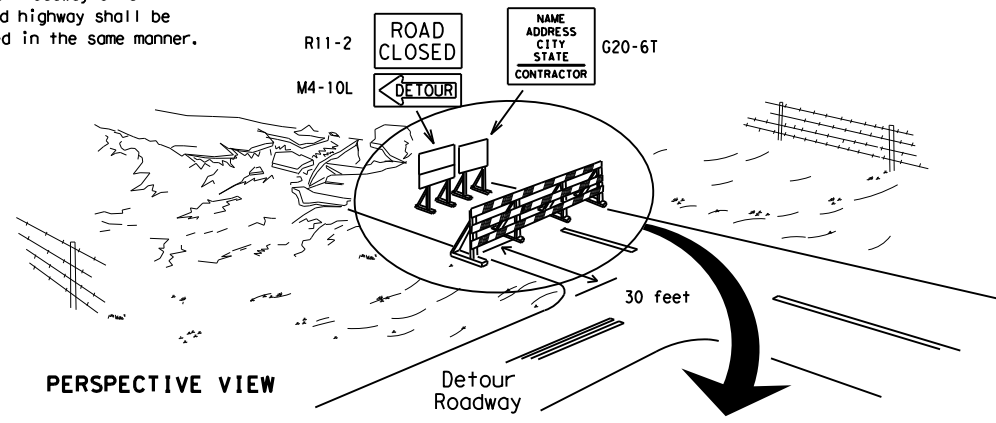
Stiffener may be inside or outside of support, but no more than 2 stiffeners shall be allowed on one barricade.

TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES



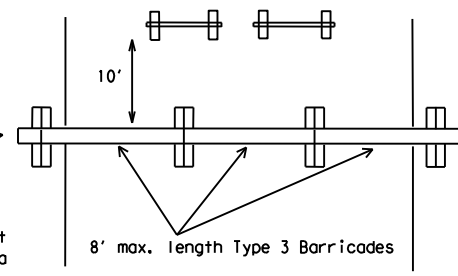
TRAFFIC CONTROL FOR MATERIAL STOCKPILES

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



PERSPECTIVE VIEW

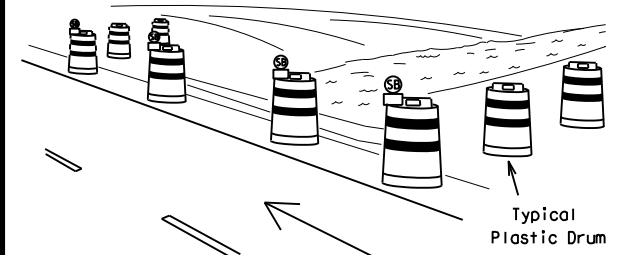
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic. Barricade striping should slant downward in the direction of detour.



PLAN VIEW

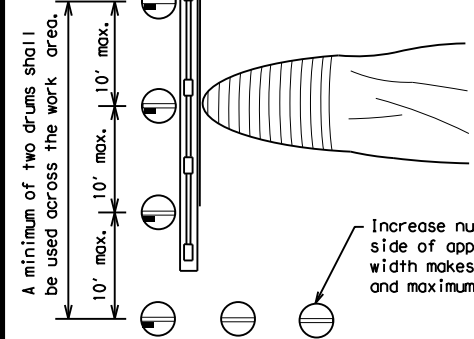
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION



PERSPECTIVE VIEW

These drums are not required on one-way roadway



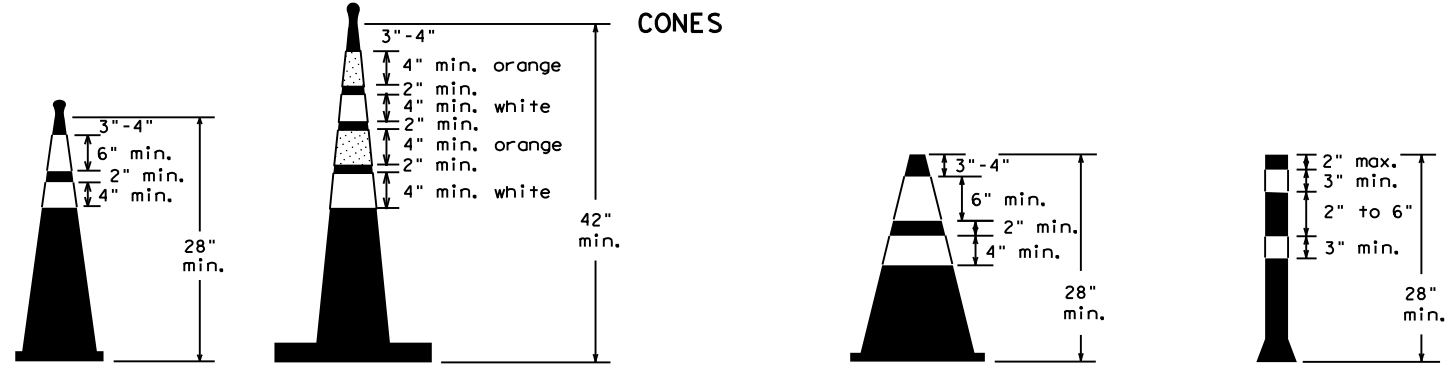
PLAN VIEW

Increase number of plastic drums on the side of approaching traffic if the crown width makes it necessary. (minimum of 2 and maximum of 4 drums)

1. Where positive redirection 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.

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

CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS



Two-Piece cones

One-Piece cones

Tubular Marker

28" Cones shall have a minimum weight of 9 1/2 lbs.
 42" 2-piece cones shall have a minimum weight of 30 lbs. including base.

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



BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC (10) - 21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	OW: TxDOT	CR: TxDOT
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REVISIONS	0502	01	237	SH 225
9-07 8-14	DIST	COUNTY	SHEET NO.	
7-13 5-21	HOU	HARRIS	058	

WORK ZONE PAVEMENT MARKINGS

GENERAL

- 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.
- Color, patterns and dimensions shall be in conformance with the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD).
- Additional supplemental pavement marking details may be found in the plans or specifications.
- Pavement markings shall be installed in accordance with the TMUTCD and as shown on the plans.
- 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).
- 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.
- All work zone pavement markings shall be installed in accordance with Item 662, "Work Zone Pavement Markings."

RAISED PAVEMENT MARKERS

- Raised pavement markers are to be placed according to the patterns on BC(12).
- 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

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

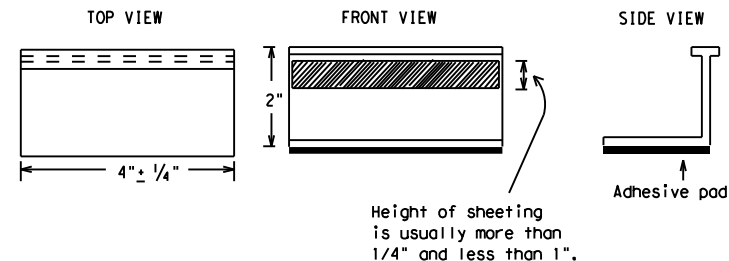
MAINTAINING WORK ZONE PAVEMENT MARKINGS

- The Contractor will be responsible for maintaining work zone pavement markings within the work limits.
- 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.
- 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.
- 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

- 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.
- 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.
- 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".
- The removal of pavement markings may require resurfacing or seal coating portions of the roadway as described in Item 677.
- Subject to the approval of the Engineer, any method that proves to be successful on a particular type pavement may be used.
- Blast cleaning may be used but will not be required unless specifically shown in the plans.
- Over-painting of the markings SHALL NOT BE permitted.
- Removal of raised pavement markers shall be as directed by the Engineer.
- 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.
- 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**

- Temporary flexible-reflective roadway marker tabs used as guidemarks shall meet the requirements of DMS-8242.
- 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.
 - 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.
 - 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.
- Small design variances may be noted between tab manufacturers.
- 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

- Raised pavement markers used as guidemarks shall be from the approved product list, and meet the requirements of DMS-4200.
- All temporary construction raised pavement markers provided on a project shall be of the same manufacturer.
- 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).

SHEET 11 OF 12



BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

BC(11)-21

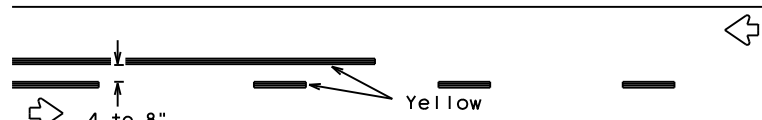
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© TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
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2-98 9-07 5-21	DIST	COUNTY	SHEET NO.	
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11-02 8-14				

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PAVEMENT MARKING PATTERNS

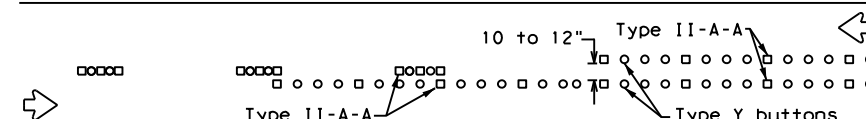


REFLECTORIZED PAVEMENT MARKINGS - PATTERN A

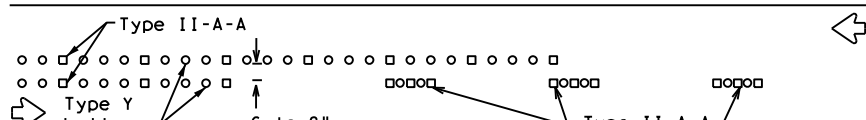


REFLECTORIZED PAVEMENT MARKINGS - PATTERN B

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.



RAISED PAVEMENT MARKERS - PATTERN A



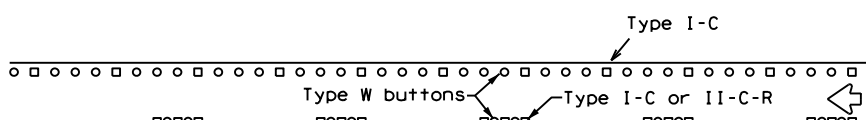
RAISED PAVEMENT MARKERS - PATTERN B

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



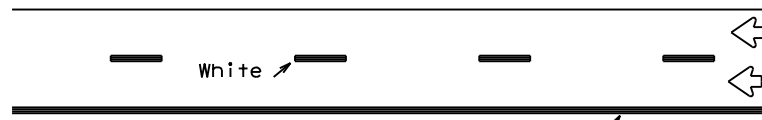
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectORIZED pavement markings.



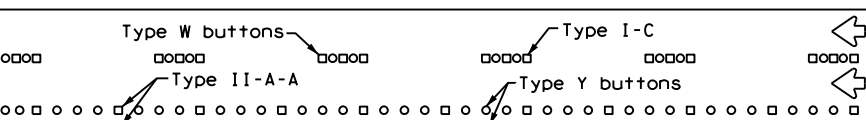
RAISED PAVEMENT MARKERS

EDGE & LANE LINES FOR DIVIDED HIGHWAY



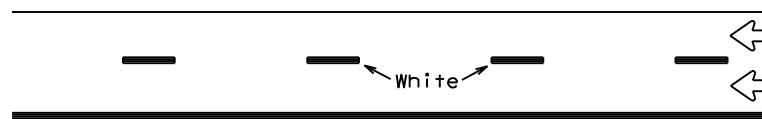
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectORIZED pavement markings.



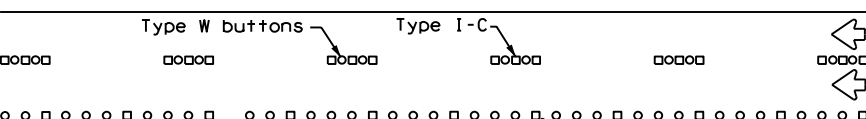
RAISED PAVEMENT MARKERS

LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS

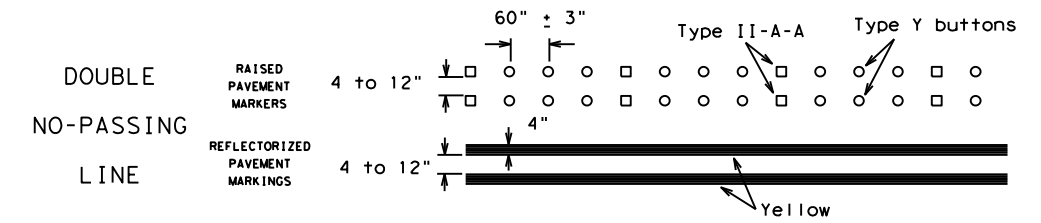
Prefabricated markings may be substituted for reflectORIZED pavement markings.



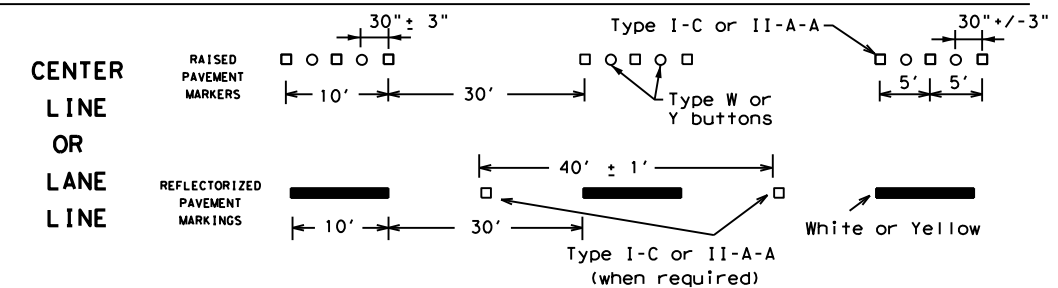
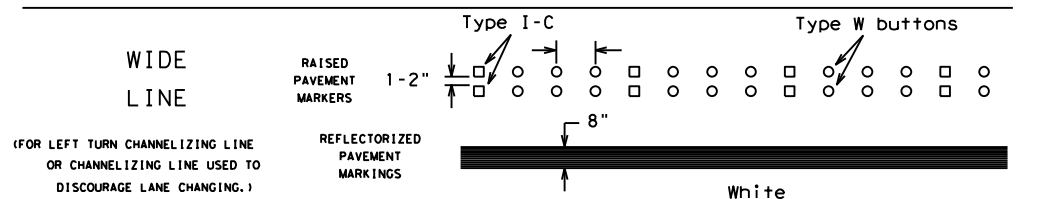
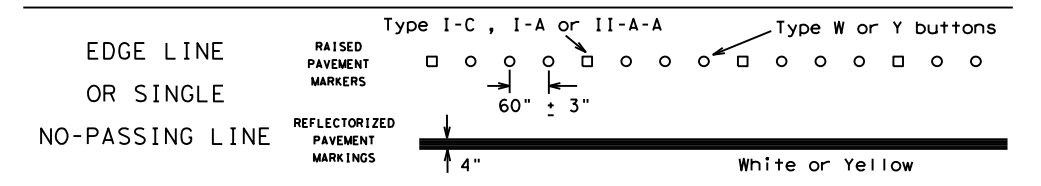
RAISED PAVEMENT MARKERS

TWO-WAY LEFT TURN LANE

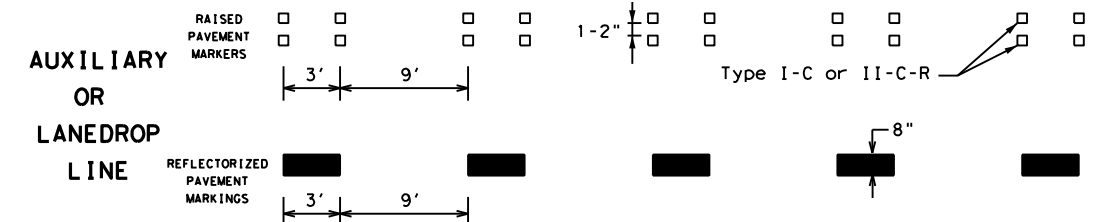
STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS



SOLID LINES

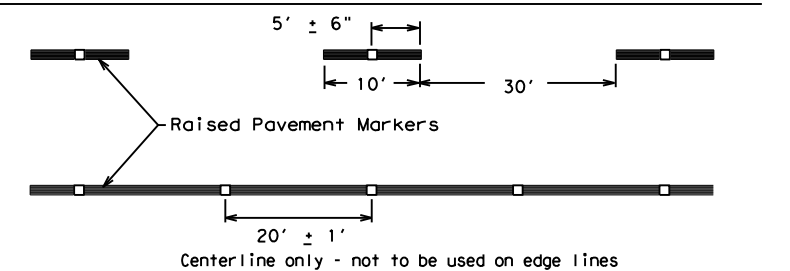


BROKEN LINES



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.



SHEET 12 OF 12



BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

BC (12) - 21

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."

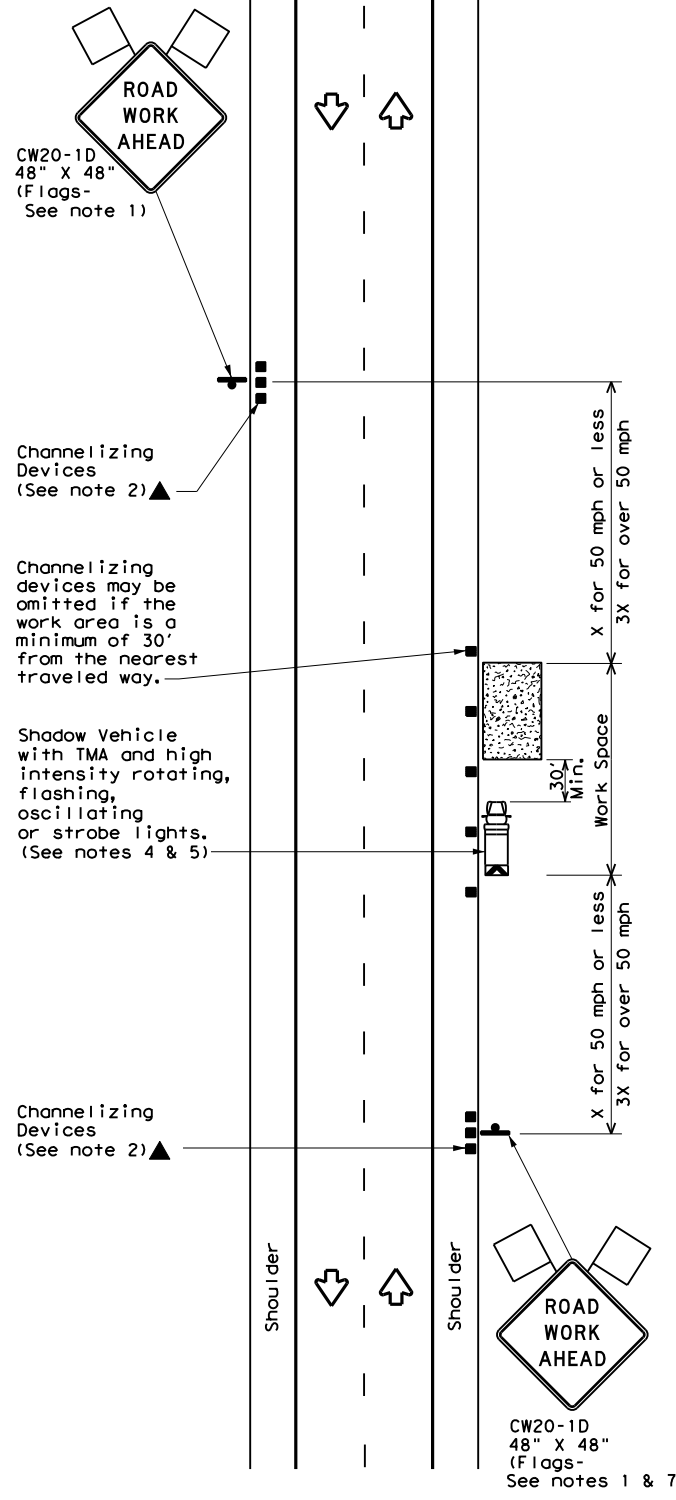
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©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	0502	01	237	SH 225
1-97 9-07 5-21	DIST	COUNTY	SHEET NO.	
2-98 7-13	HOU	HARRIS	060	
11-02 8-14				

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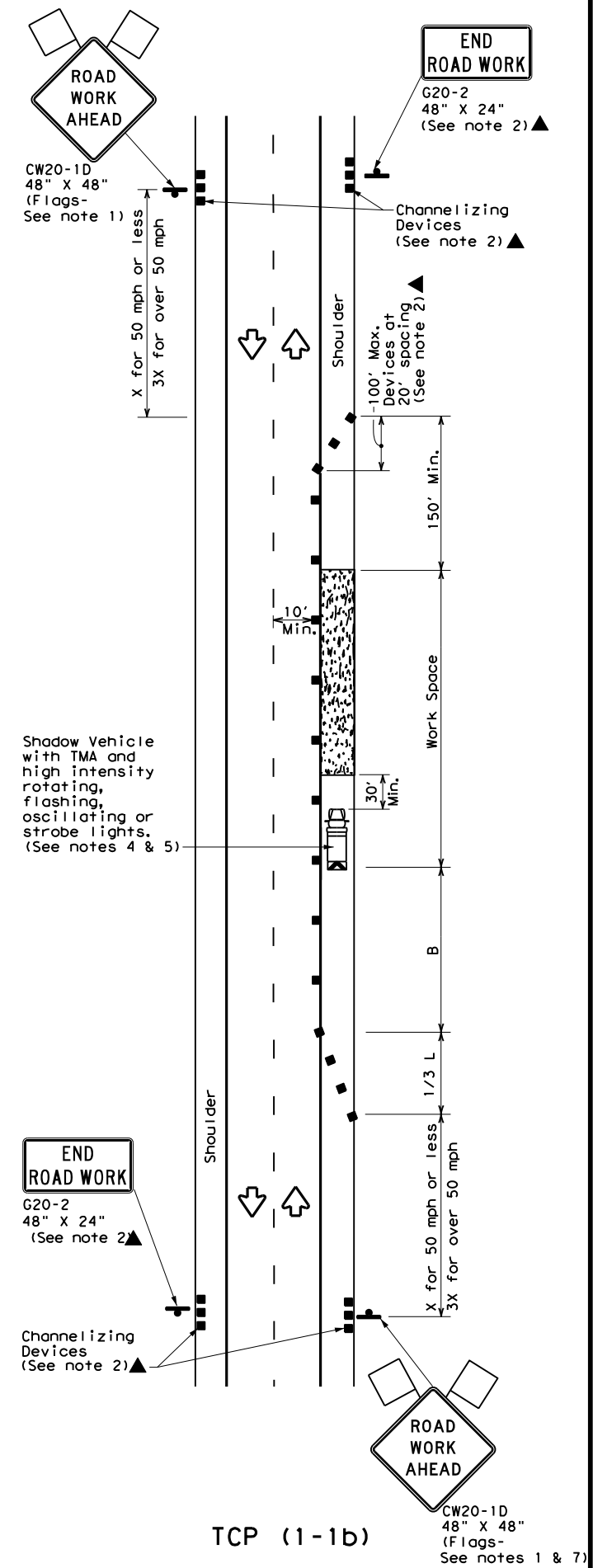
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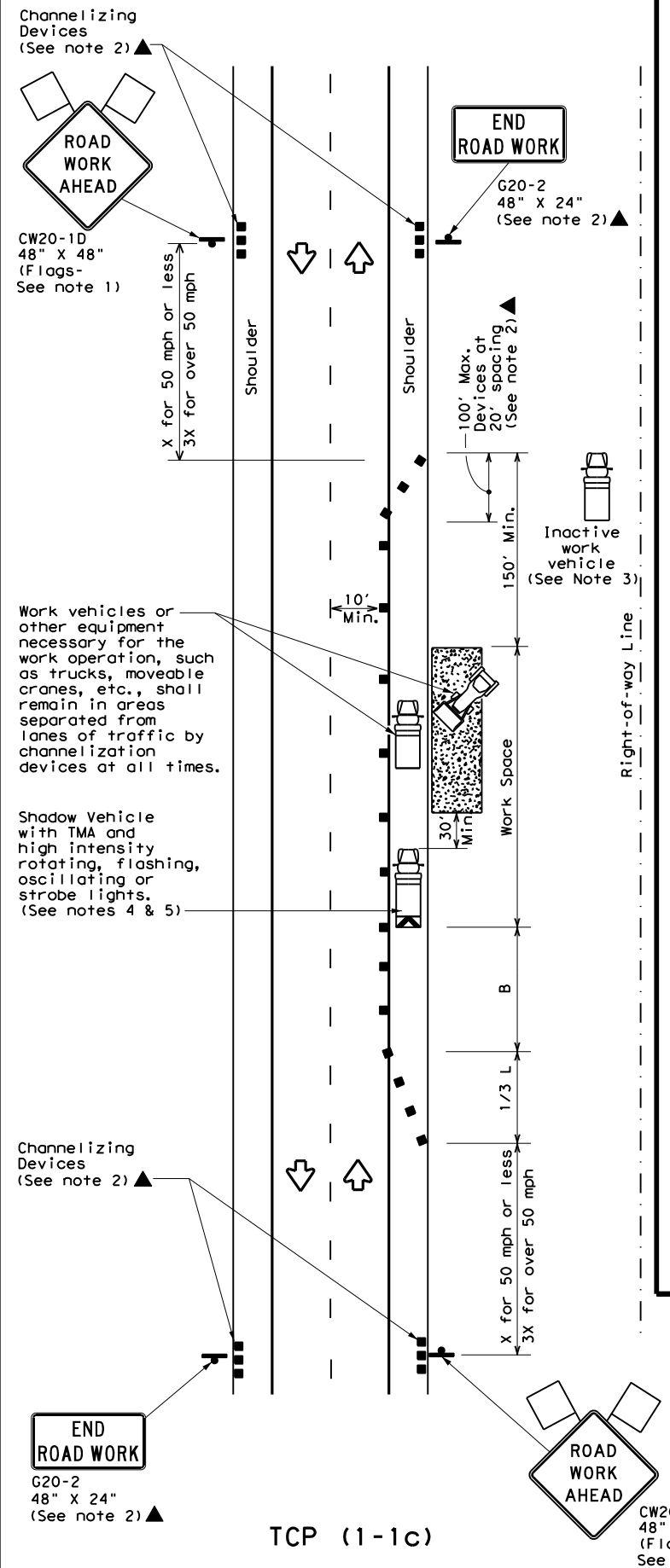
TCP (1-1a)

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**
- Flags attached to signs where shown are REQUIRED.
 - 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.
 - Inactive work vehicles or other equipment should be parked near the right-of-way line and not parked on the paved shoulder.
 - 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.
 - Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect wider work spaces.
 - See TCP(5-1) for shoulder work on divided highways, expressways and freeways.
 - CW21-5 "SHOULDER WORK" signs may be used in place of CW20-1D "ROAD WORK AHEAD" signs for shoulder work on conventional roadways.



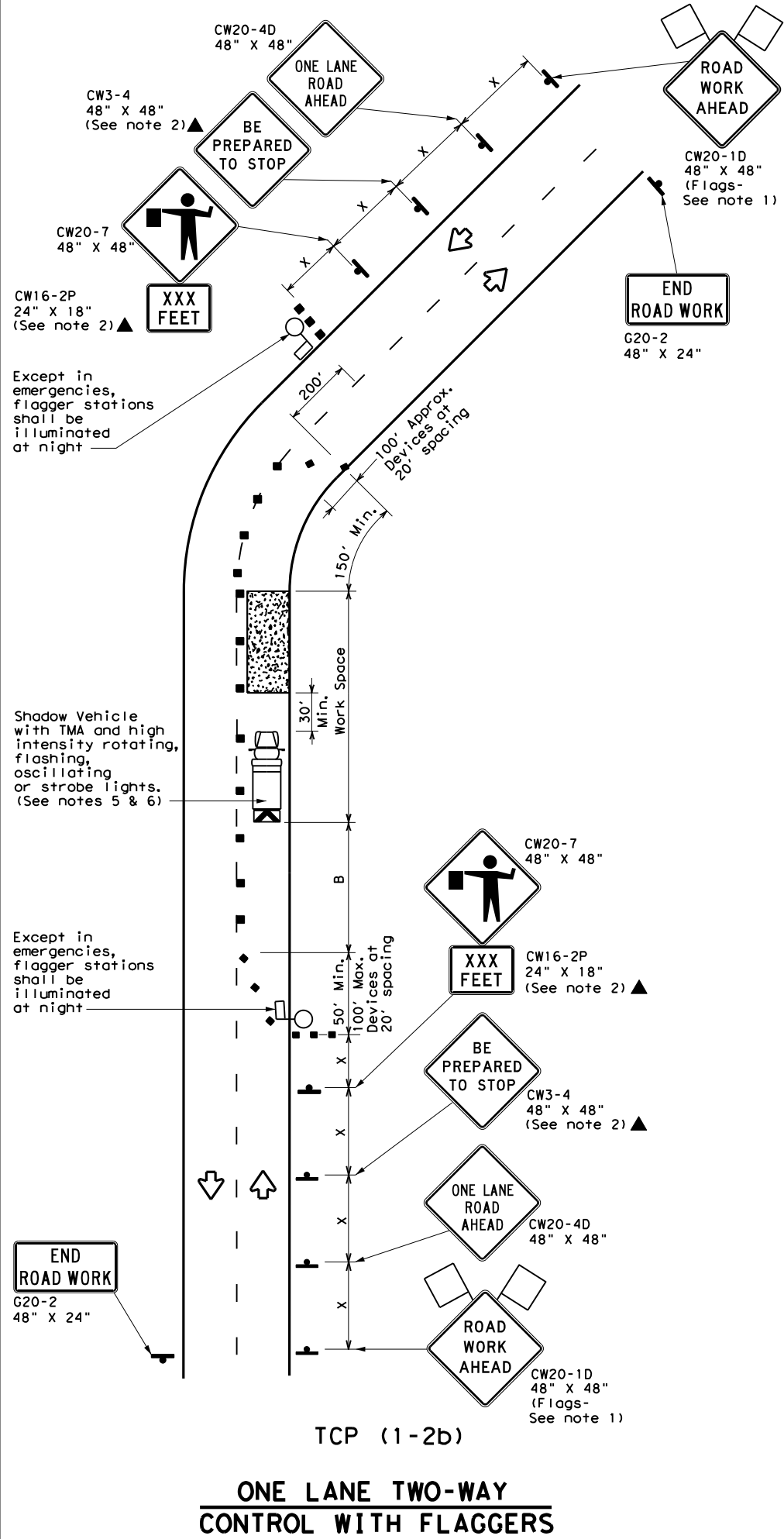
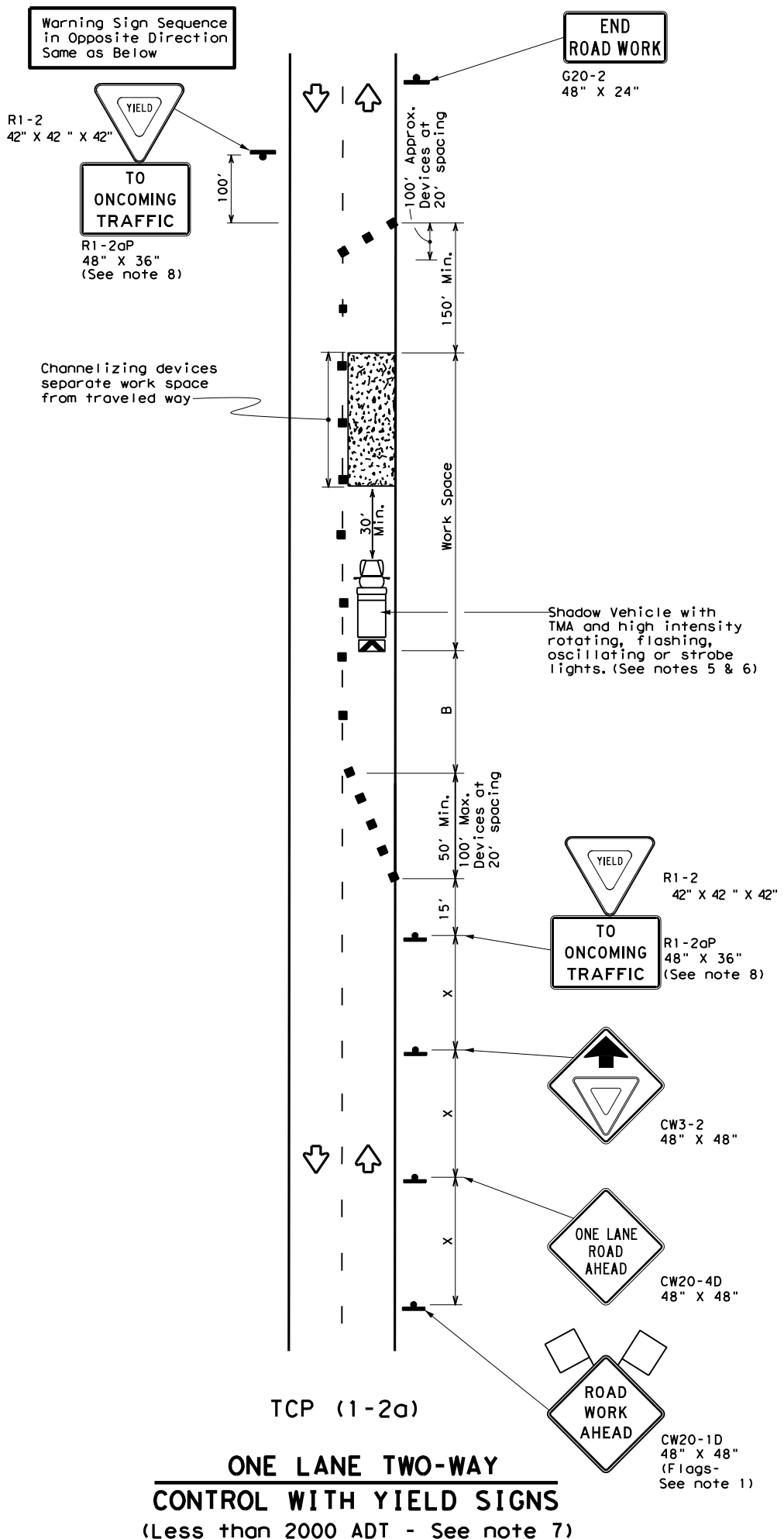
TRAFFIC CONTROL PLAN
CONVENTIONAL ROAD
SHOULDER WORK

TCP (1-1) - 18

FILE: tcp1-1-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	0502	01	237	SH 225
2-94 4-98	DIST	COUNTY	SHEET NO.	
8-95 2-12	HOU	HARRIS	061	
1-97 2-18				

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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 * X	Formula L = WS ² / 60	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		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		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

- Flags attached to signs where shown are REQUIRED.
 - 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.
 - 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.
 - 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 150 feet.
 - 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.
 - 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)**
- 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.
 - 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)**
- Flaggers should use two-way radios or other methods of communication to control traffic.
 - Length of work space should be based on the ability of flaggers to communicate.
 - 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).
 - Channelizing devices on the center-line may be omitted when a pilot car is leading traffic and approved by the Engineer.
 - Flaggers should use 24" STOP/SLOW paddles to control traffic. Flags should be limited to emergency situations.

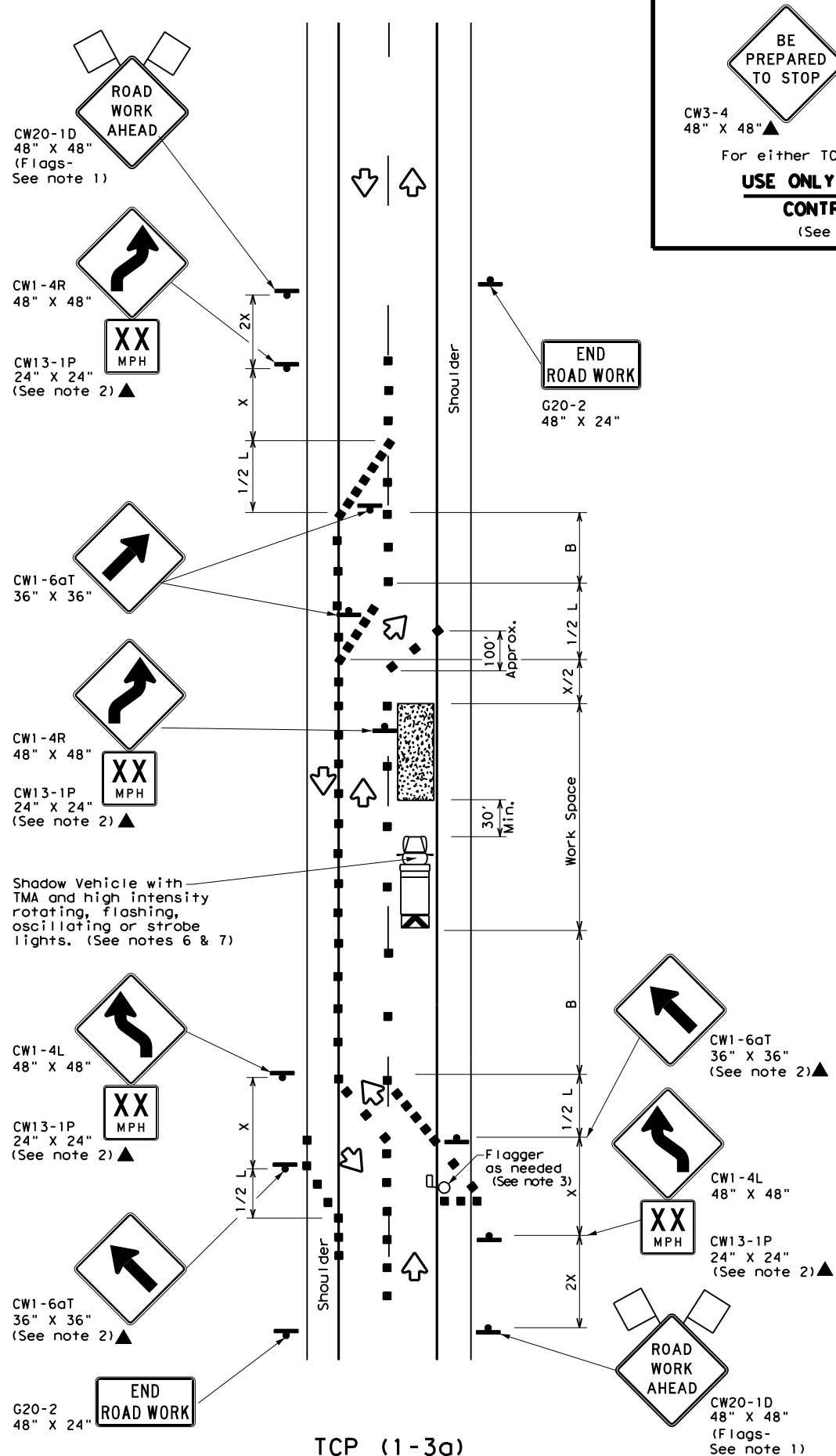
Texas Department of Transportation Traffic Operations Division Standard

TRAFFIC CONTROL PLAN
ONE-LANE TWO-WAY
TRAFFIC CONTROL

TCP (1-2) - 18

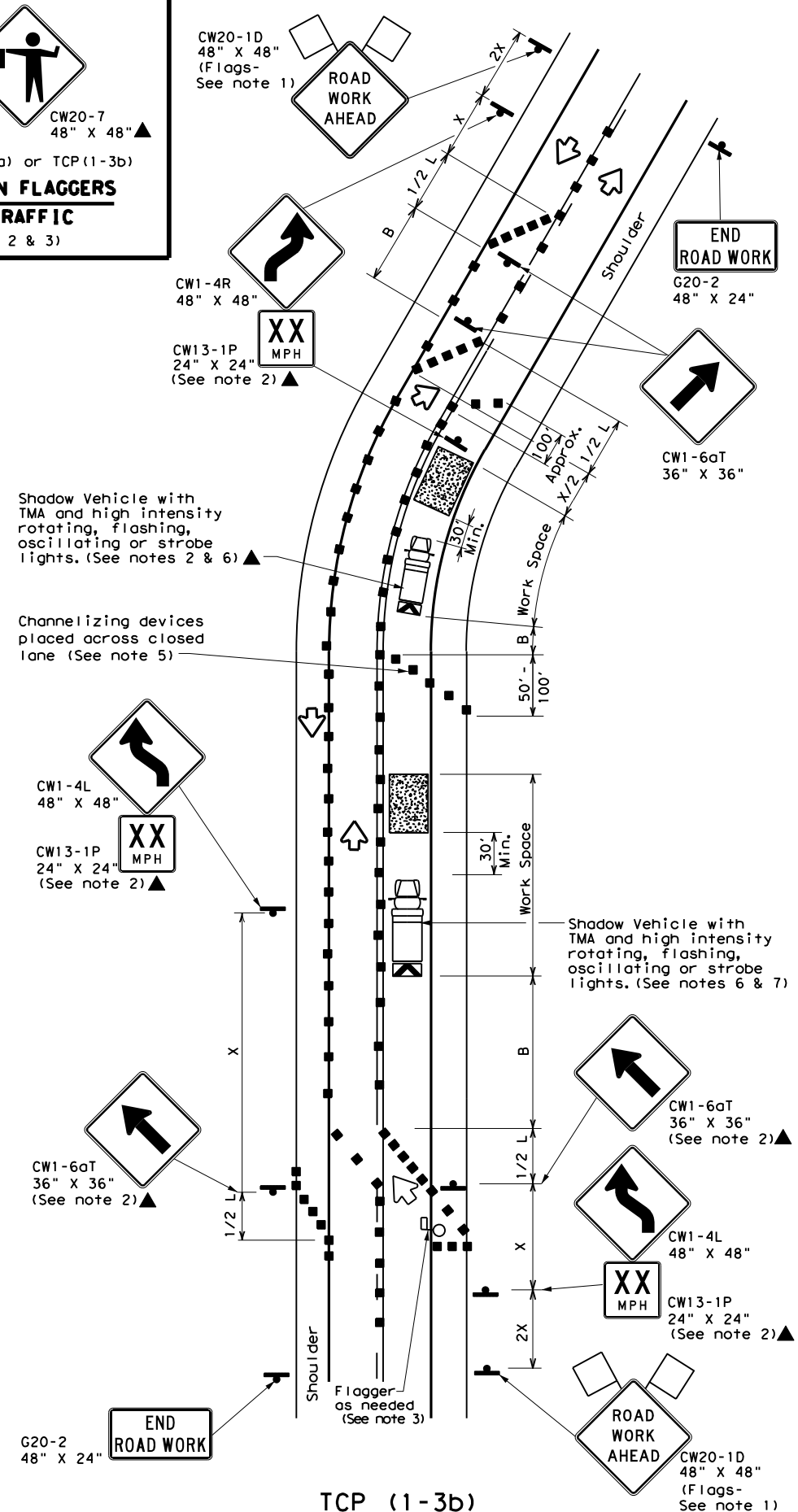
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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
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4-90 4-98	DIST	COUNTY	SHEET NO.	
2-94 2-12	HOU	HARRIS	062	
1-97 2-18				

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TCP (1-3a)
2-LANE ROADWAY WITH PAVED SHOULDERS
ONE LANE CLOSED
ADEQUATE FIELD OF VIEW

BE PREPARED TO STOP
CW3-4 48" X 48"
CW20-7 48" X 48"
For either TCP(1-3a) or TCP(1-3b)
USE ONLY WHEN FLAGGERS CONTROL TRAFFIC
(See Notes 2 & 3)



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 **			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 = WS / 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**
- Flags attached to signs where shown are REQUIRED.
 - 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.
 - 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.
 - DO NOT PASS, PASS WITH CARE and construction regulatory speed zone signs may be installed downstream of the ROAD WORK AHEAD signs.
 - 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.
 - 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.
 - Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect wider work spaces.
 - 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.

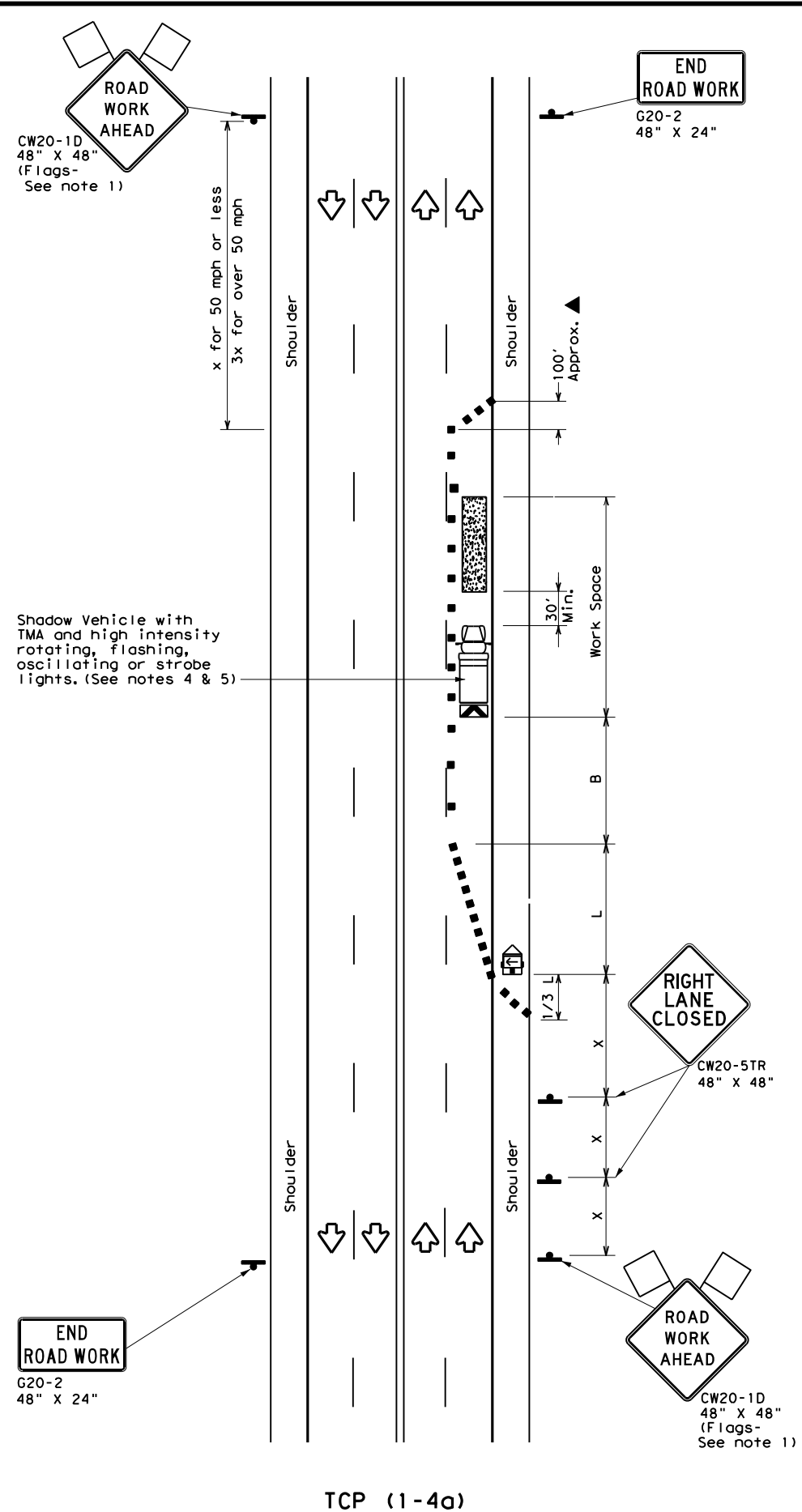
Texas Department of Transportation
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN
TRAFFIC SHIFTS ON
TWO LANE ROADS
TCP(1-3)-18

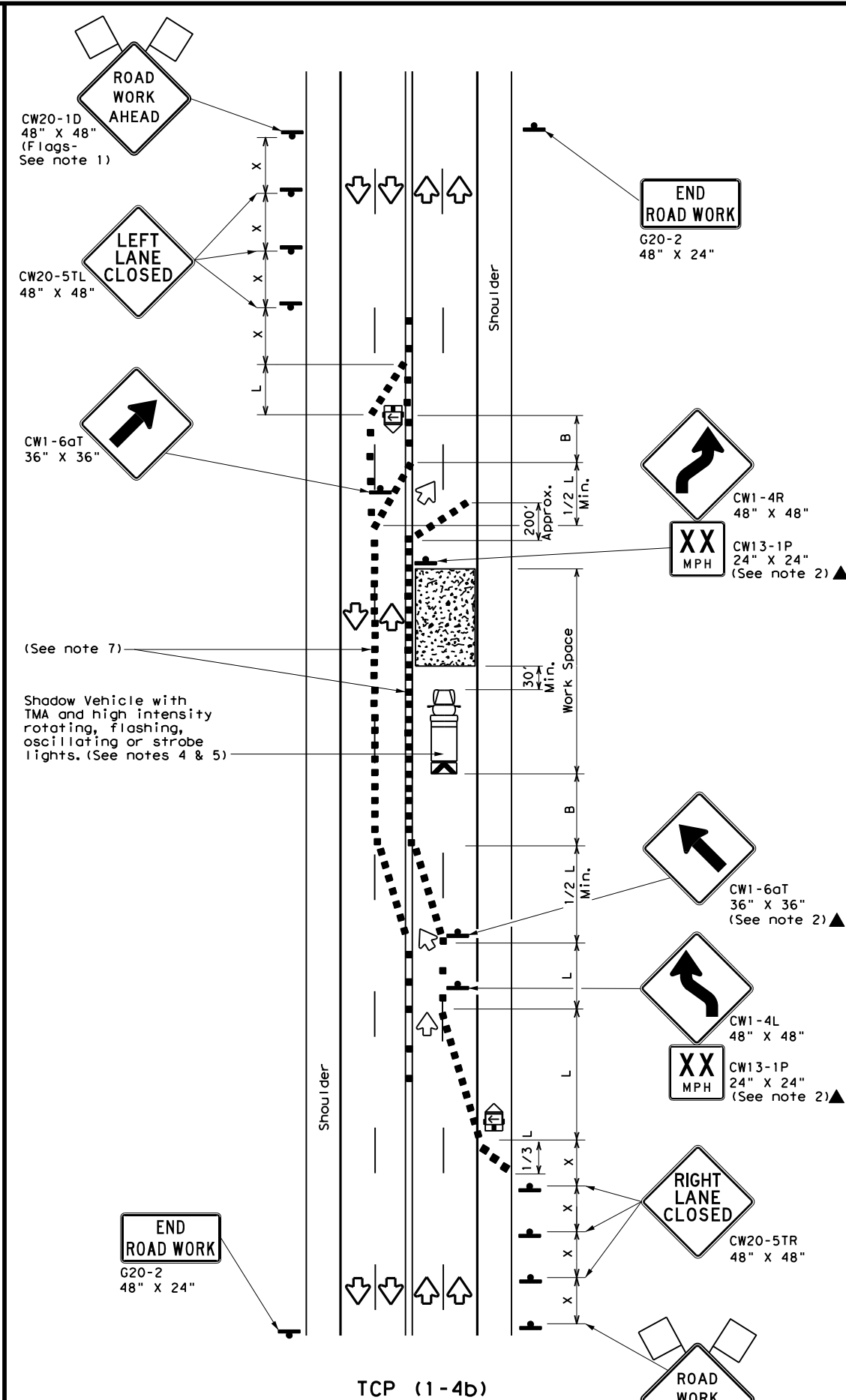
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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	0502	01	237	SH 225
2-94 4-98				
8-95 2-12				
1-97 2-18				
	DIST	COUNTY	SHEET NO.	
	HOU	HARRIS	063	

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ONE LANE CLOSED



TWO LANES CLOSED

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**
- Flags attached to signs where shown are REQUIRED.
 - 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.
 - The CW20-1D "ROAD WORK AHEAD" sign may be repeated if the visibility of the work zone is less than 1500 feet.
 - 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.
 - Additional Shadow Vehicles with TMAs may be positioned off the paved surface, next to those shown in order to protect wider work spaces.

TCP (1-4a)

- If this TCP is used for a left lane closure, CW20-5TL "LEFT LANE CLOSED" signs shall be used and channelizing devices shall be placed on the centerline where needed to protect the work space from opposing traffic with the arrow panel placed in the closed lane near the end of the merging taper.

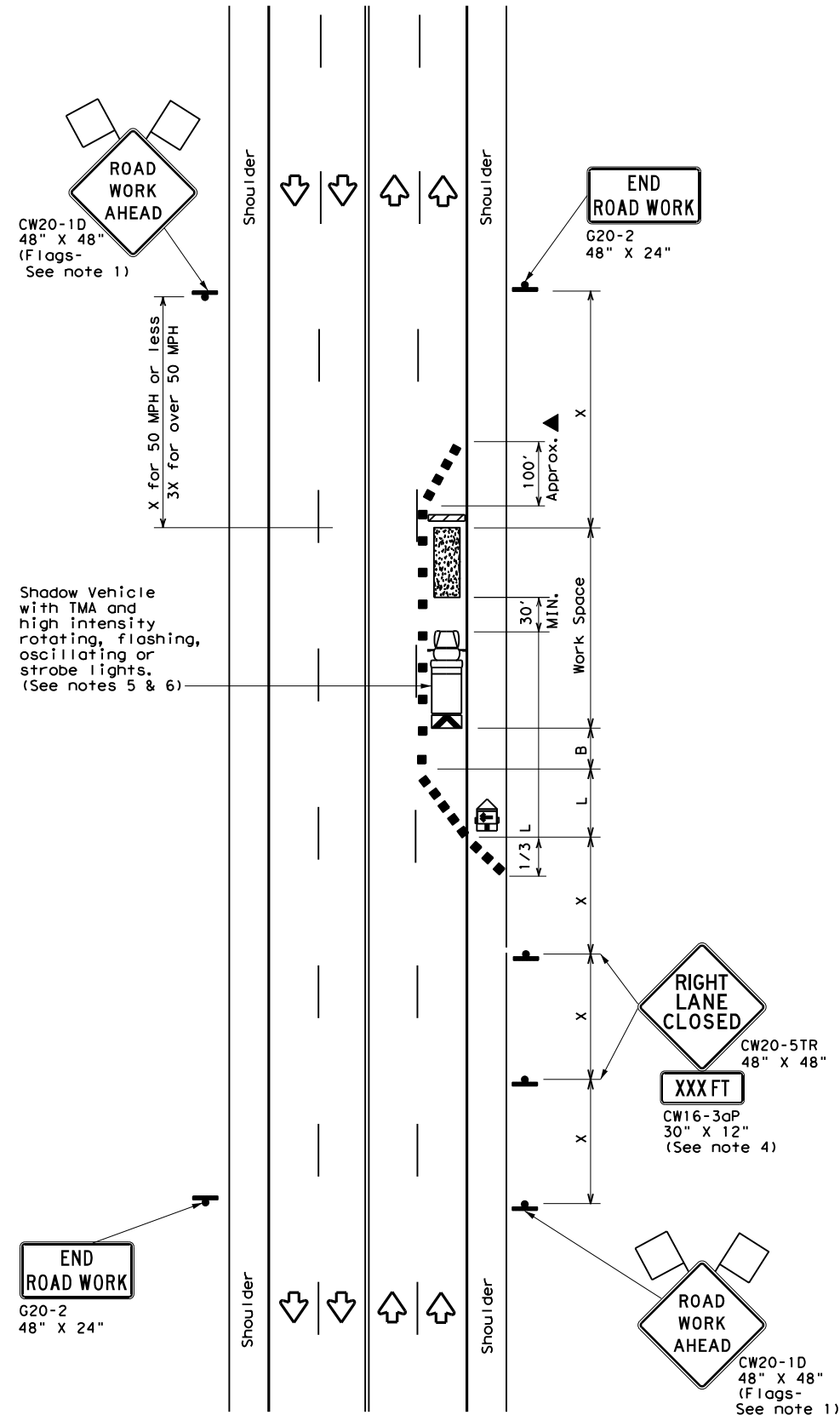
TCP (1-4b)

- 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 1/2S where S is the speed in mph. This tighter device spacing is intended for the areas of conflicting markings, not the entire work zone.

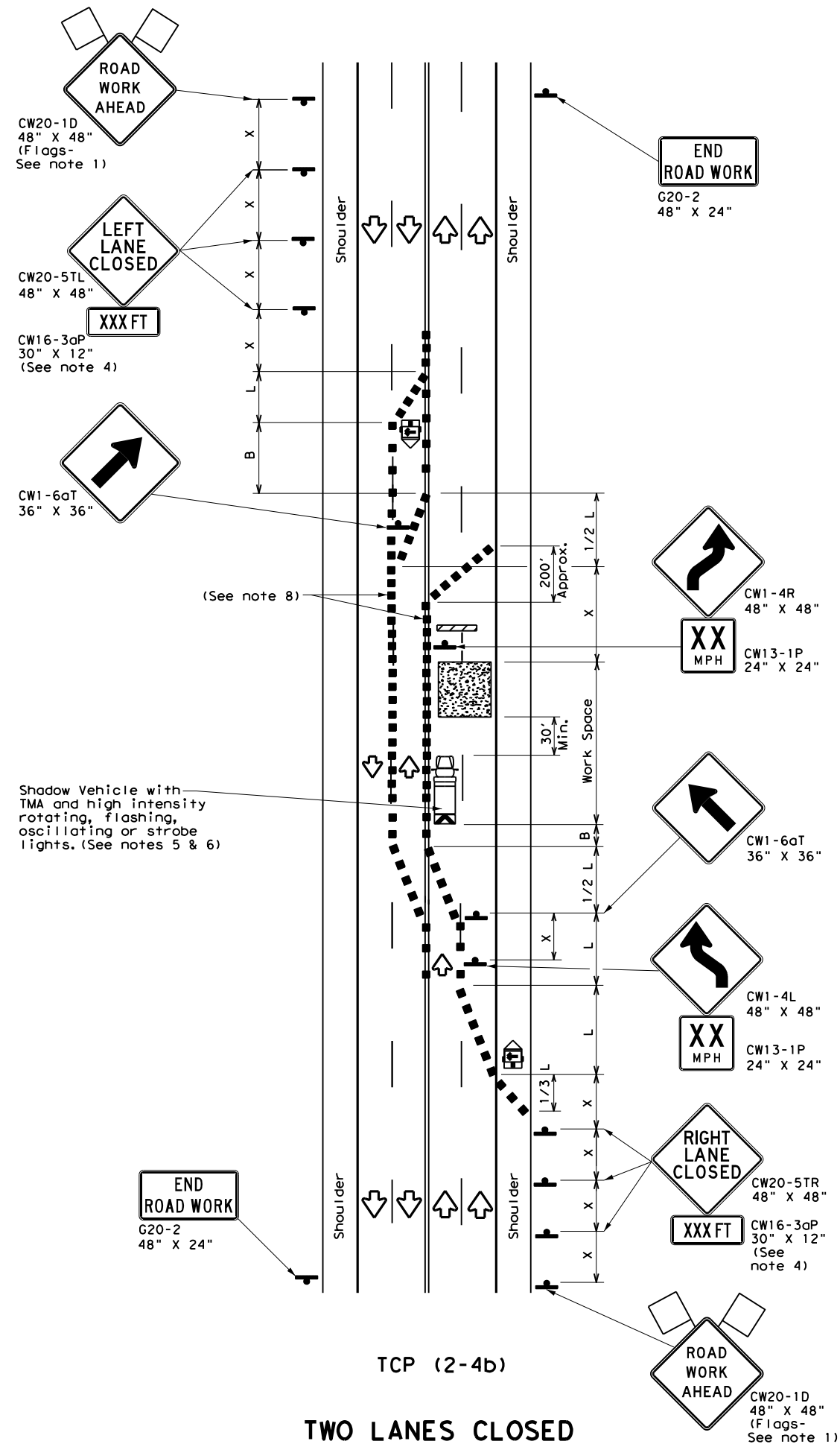
		Traffic Operations Division Standard	
TRAFFIC CONTROL PLAN LANE CLOSURES ON MULTILANE CONVENTIONAL ROADS			
TCP (1-4) - 18			
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© TxDOT	December 1985	CONT	SECT
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2-94	4-98		
8-95	2-12		
1-97	2-18		
		JOB	237
		HIGHWAY	SH 225
		DIST	HOU
		COUNTY	HARRIS
		SHEET NO.	064

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TCP (2-4a)
ONE LANE CLOSED



TCP (2-4b)
TWO LANES CLOSED

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 = 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

- Flags attached to signs where shown, are REQUIRED.
- 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.
- The downstream taper is optional. When used, it should be 100 feet minimum length per lane.
- For short term applications, when post mounted signs are not used, the distance legend may be shown on the sign face rather than on a CW16-3aP supplemental plaque.
- 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.
- Additional Shadow Vehicles with TMAs may be positioned in each closed lane, on the shoulder or off the paved surface, next to those shown in order to protect a wider work space.

TCP (2-4a)

- If this TCP is used for a left lane closure, CW20-5TL "LEFT LANE CLOSED" signs shall be used and channelizing devices shall be placed on the centerline to protect the work space from opposing traffic with the arrow board placed in the closed lane near the end of the merging taper.

TCP (2-4b)

- 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 devices spacing is intended for the area of conflicting markings, not the entire work zone.

Texas Department of Transportation
 Traffic Operations Division Standard

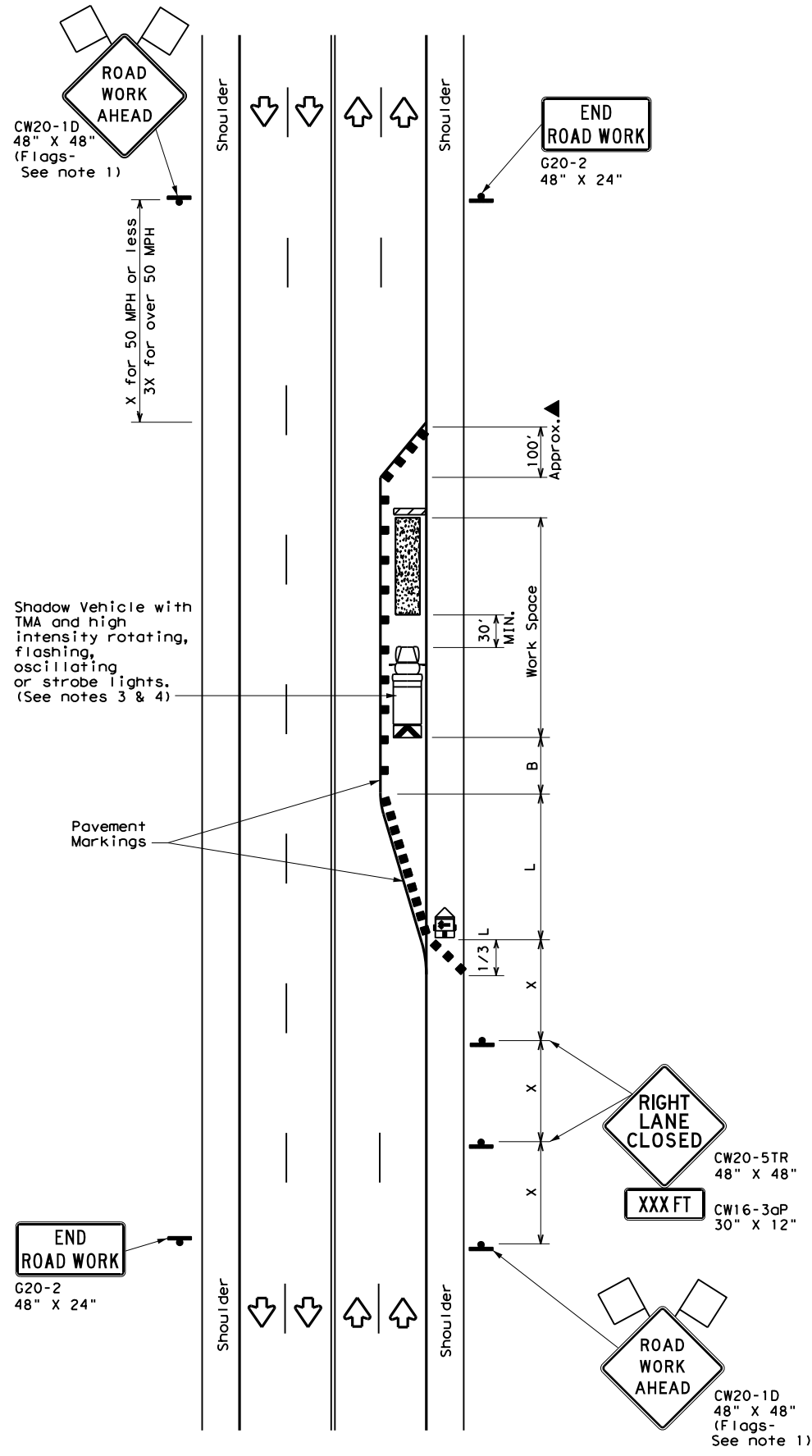
**TRAFFIC CONTROL PLAN
 LANE CLOSURES ON MULTILANE
 CONVENTIONAL ROADS**

TCP (2-4) - 18

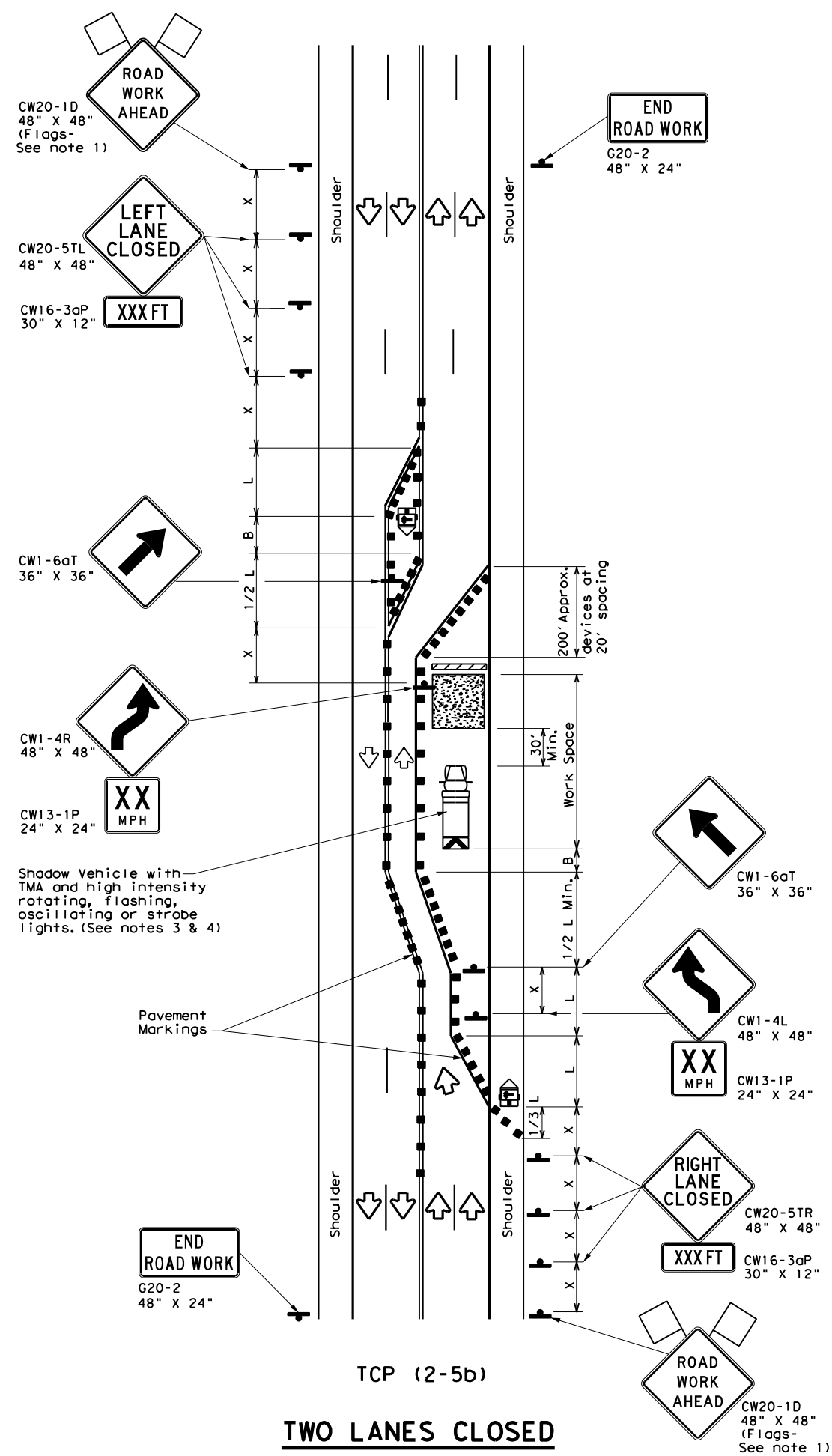
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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
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8-95 3-03	DIST	COUNTY	SHEET NO.	
1-97 2-12	HOU	HARRIS	065	
4-98 2-18				

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TCP (2-5a)
ONE LANE CLOSED



TCP (2-5b)
TWO LANES CLOSED

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 X*			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 = 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**
- Flags attached to signs where shown, are REQUIRED.
 - 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.
 - 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.
 - Additional Shadow Vehicles with TMAs may be positioned in each closed lane, on the shoulder or off the paved surface, next to those shown in order to protect a wider work space.
 - The downstream taper is optional. When used, it should be 100 feet approximately per lane, with channelizing devices spaced at 20 feet.
- TCP (2-5a)**
- If this TCP is used for a left lane closure, CW20-5TL "LEFT LANE CLOSED" signs shall be used and channelizing devices shall be placed on the centerline to protect the work space from opposing traffic, with the arrow board placed in the closed lane near the end of the merging taper.
- TCP (2-5b)**
- Conflicting pavement markings shall be removed for long-term projects.

Texas Department of Transportation
 Traffic Operations Division Standard

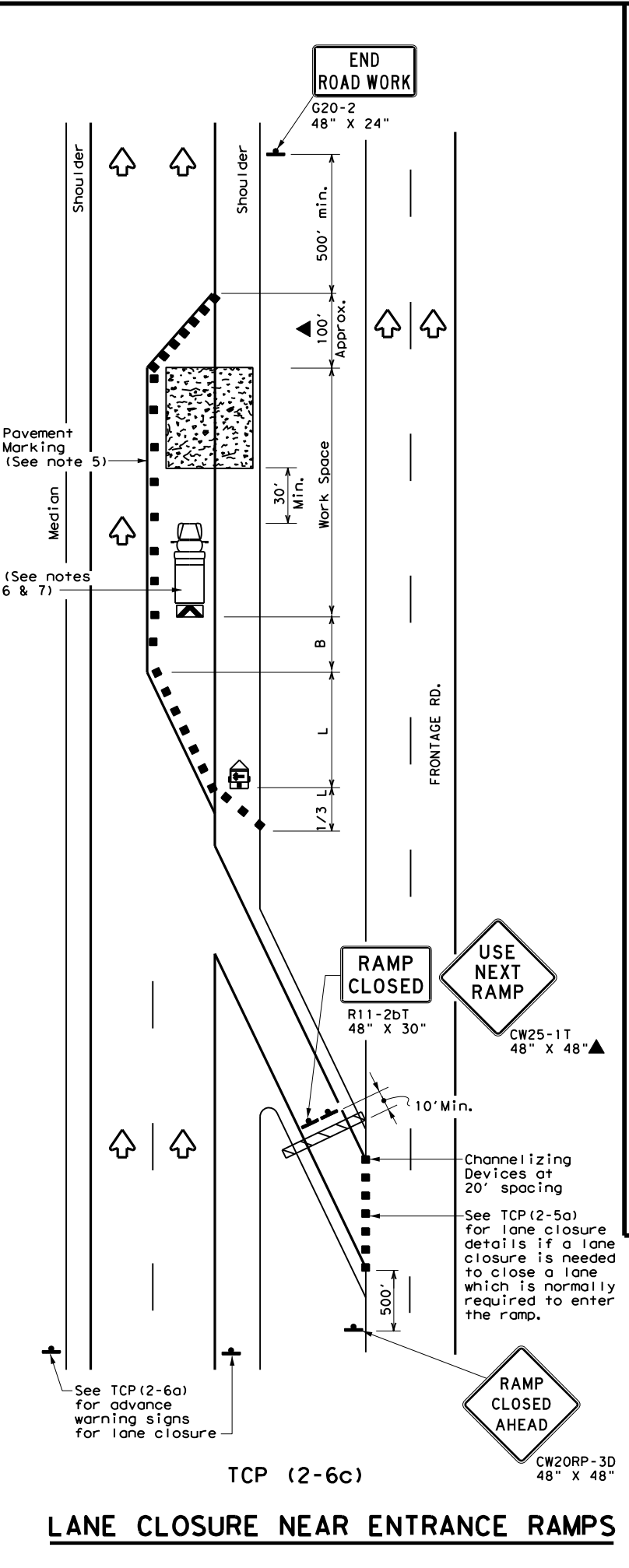
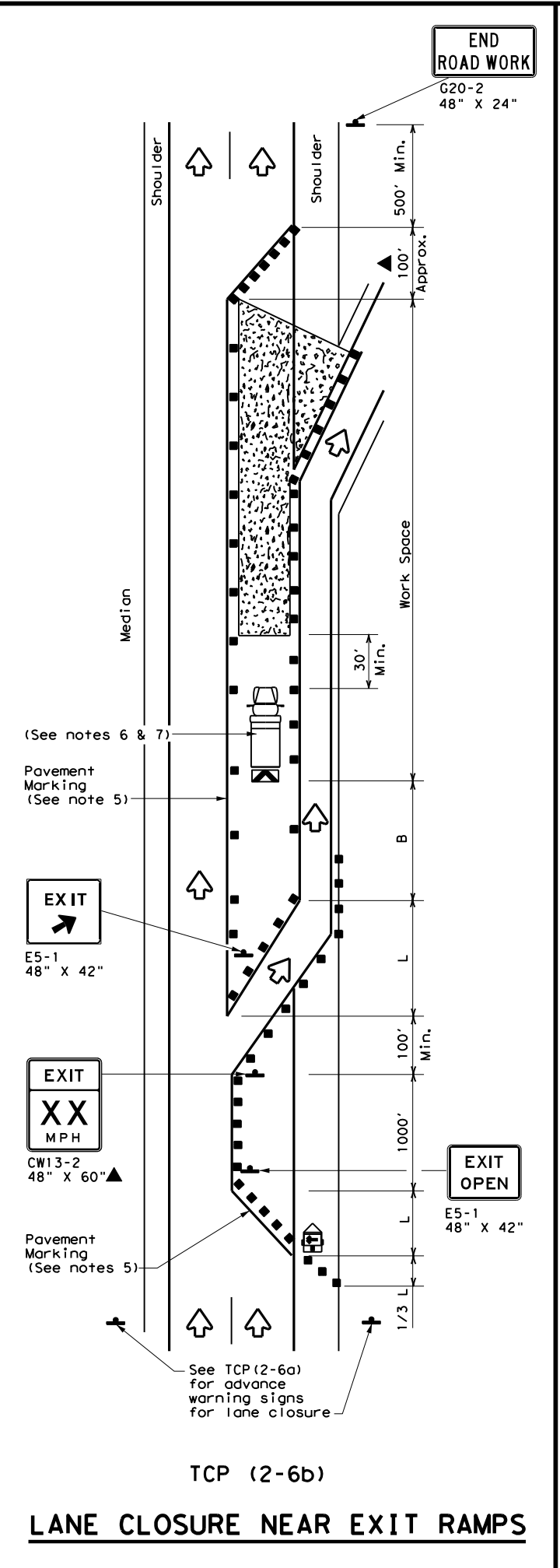
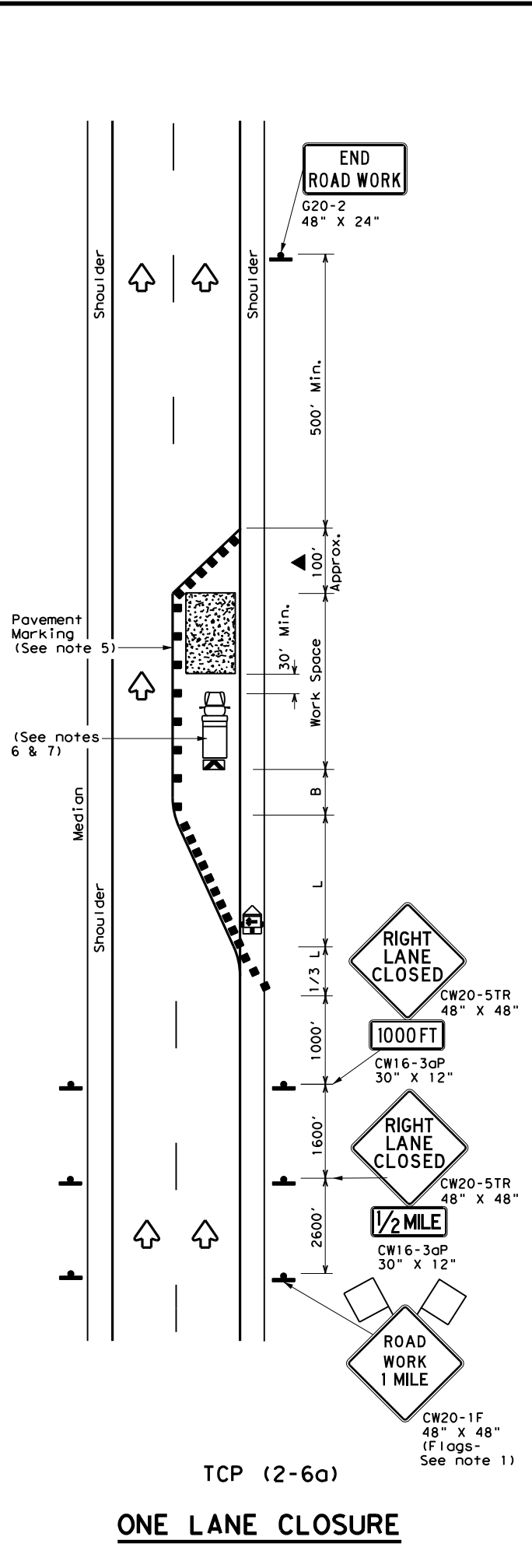
TRAFFIC CONTROL PLAN
LONG TERM LANE CLOSURES
MULTILANE CONVENTIONAL RDS.

TCP (2-5) - 18

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1-97 3-03	DIST COUNTY	SHEET NO.
4-98 2-18	HOU HARRIS	066

165

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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**
- Flags attached to signs where shown, are REQUIRED.
 - 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.
 - Channelizing devices used to close lanes may be supplemented with the Chevron Alignment Sign placed on every other channelizing device. Chevrons may be attached to plastic drums as per BC Standards.
 - Channelizing devices used along the work space or along tangent sections may be supplemented with vertical panels (VP) placed on every other channelizing device. If night time conditions make it difficult to see at least two VPs, the VPs may be placed on each channelizing device.
 - The placement of pavement markings may be omitted on intermediate-term stationary work zones with the approval of the Engineer.
 - 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.
 - Additional Shadow Vehicles with TMAs may be positioned in each closed lane, on the shoulder or off the paved surface, next to those shown in order to protect a wider work space.

Texas Department of Transportation
 Traffic Operations Division Standard

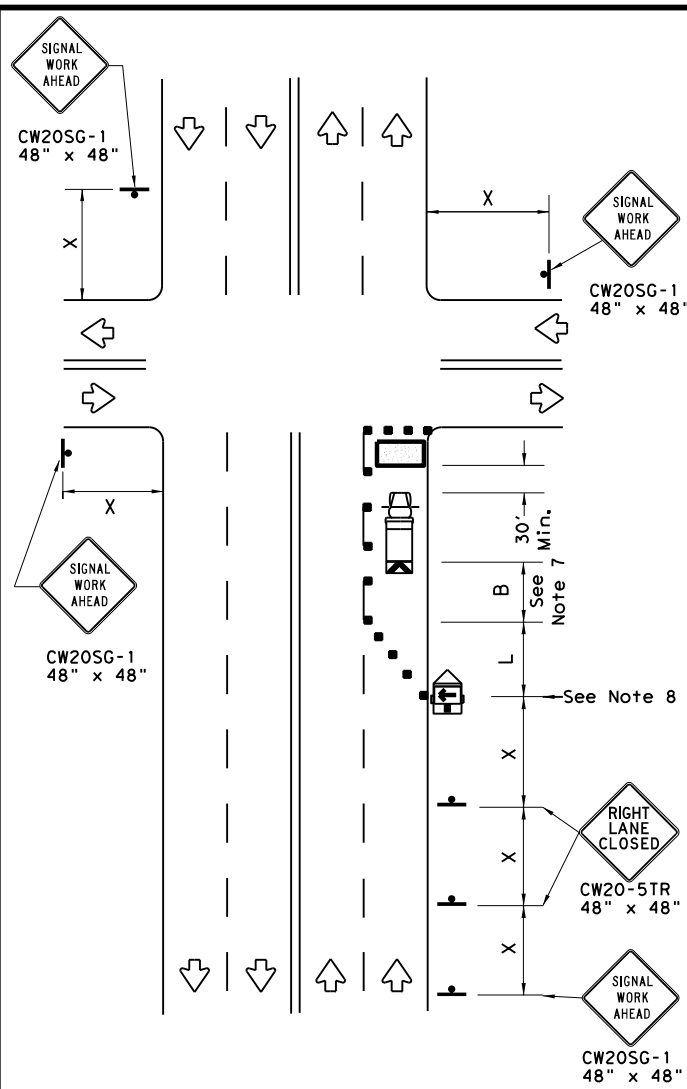
TRAFFIC CONTROL PLAN
LANE CLOSURES ON
DIVIDED HIGHWAYS
TCP (2-6) - 18

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© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
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8-95 2-12	HOU	HARRIS	067	
1-97 2-18				

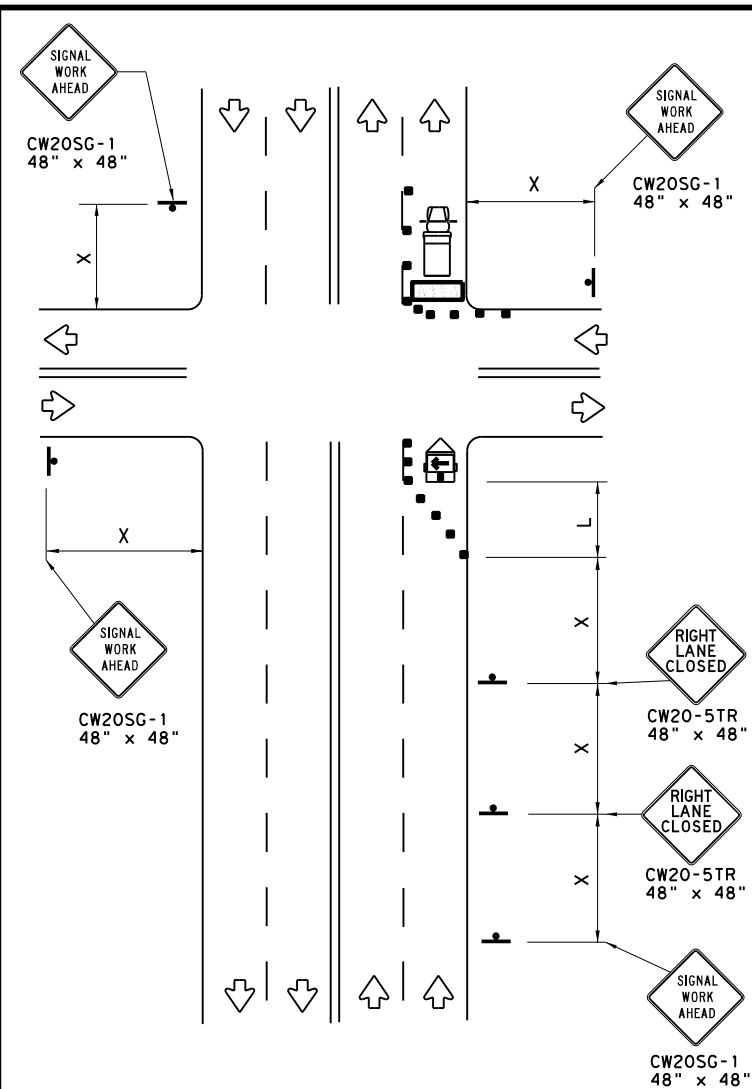
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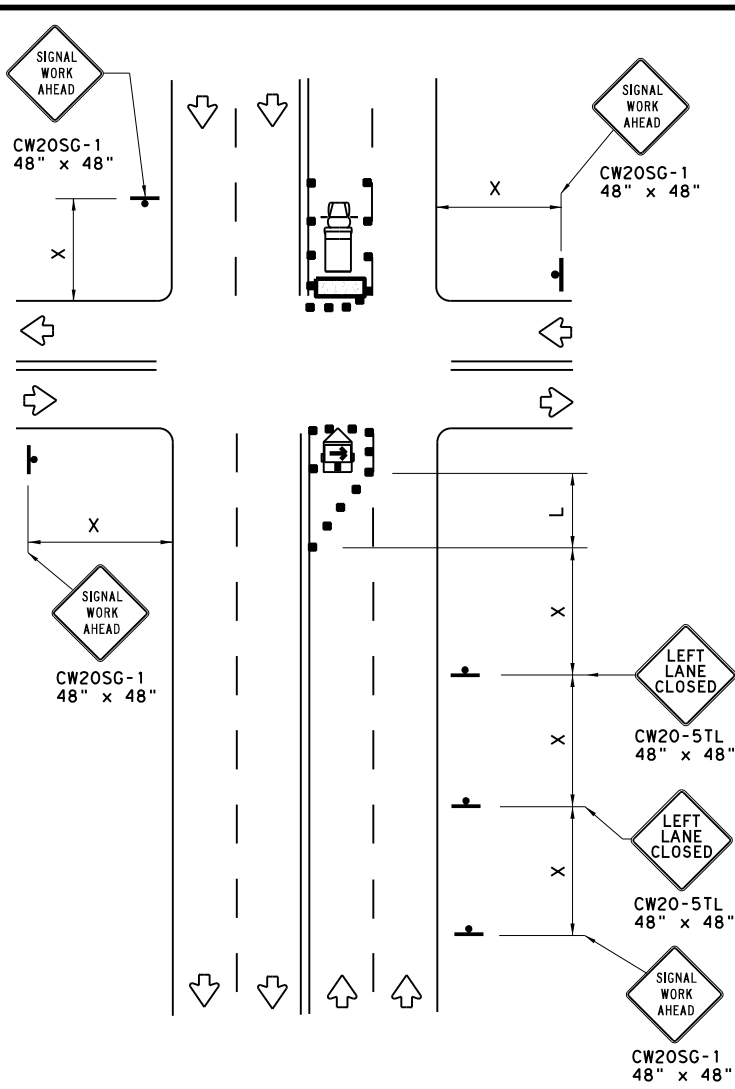
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NEAR SIDE LANE CLOSURE
 SHORT DURATION OR SHORT TERM STATIONARY



FAR SIDE RIGHT LANE CLOSURE
 SHORT DURATION OR SHORT TERM STATIONARY



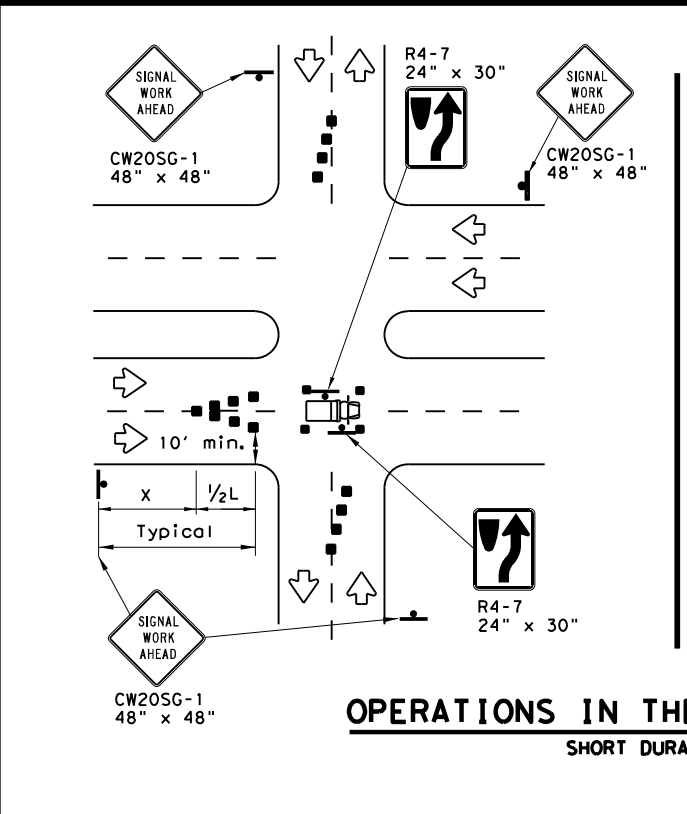
FAR SIDE LEFT LANE CLOSURE
 SHORT DURATION OR SHORT TERM STATIONARY

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

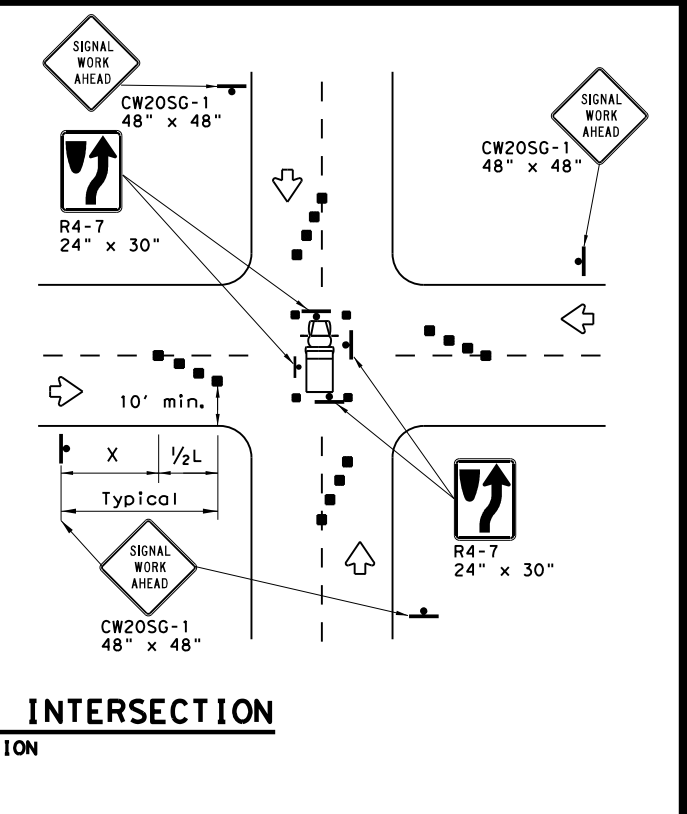
Posted Speed *	Formula	Minimum Desirable Taper Lengths **			Suggested Maximum Spacing of Channelizing Devices		Minimum Sign Spacing "X" Distance	Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent		
30	$L = \frac{WS^2}{60}$	150'	165'	180'	30'	60'	120'	90'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

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

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



OPERATIONS IN THE INTERSECTION
 SHORT DURATION



GENERAL NOTES

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

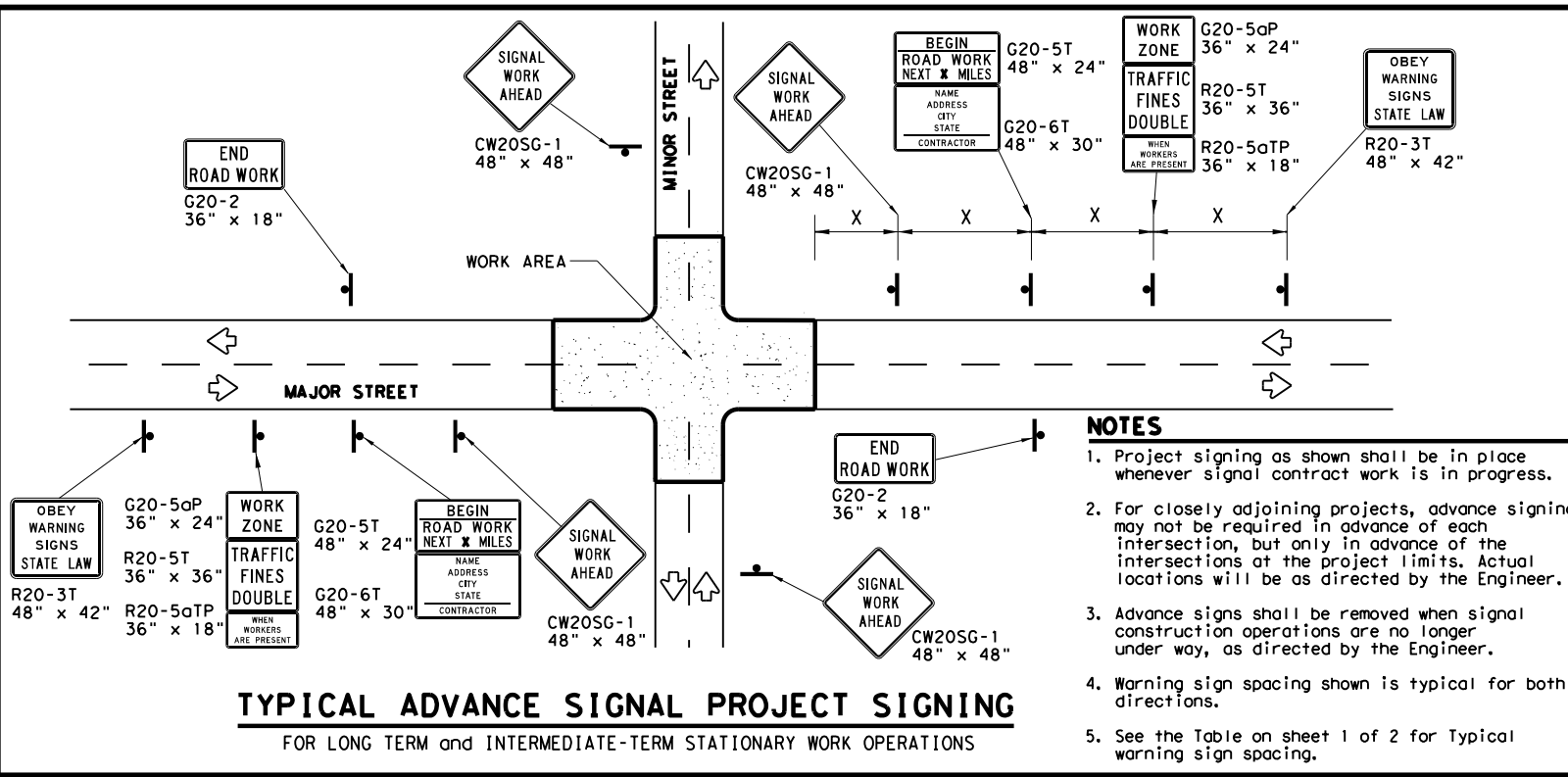
TRAFFIC SIGNAL WORK TYPICAL DETAILS

WZ(BTS-1)-13

FILE: wzbt13.dgn	DN: TxDOT	CR: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT April 1992	CONT	SECT	JOB	HIGHWAY
REVISIONS	0502	01	237	SH 225
2-98 10-99 7-13	DIST	COUNTY	SHEET NO.	
4-98 3-03	HOU	HARRIS	068	

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

GENERAL NOTES FOR WORK ZONE SIGNS

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

DURATION OF WORK

1. Work zone durations are defined in Part 6, Section 60.02 of the Texas Manual on Uniform Traffic Control Devices (TMUTCD).

SIGN MOUNTING HEIGHT

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

REMOVING OR COVERING

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

REFLECTIVE SHEETING

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

SIGN SUPPORT WEIGHTS

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

LEGEND

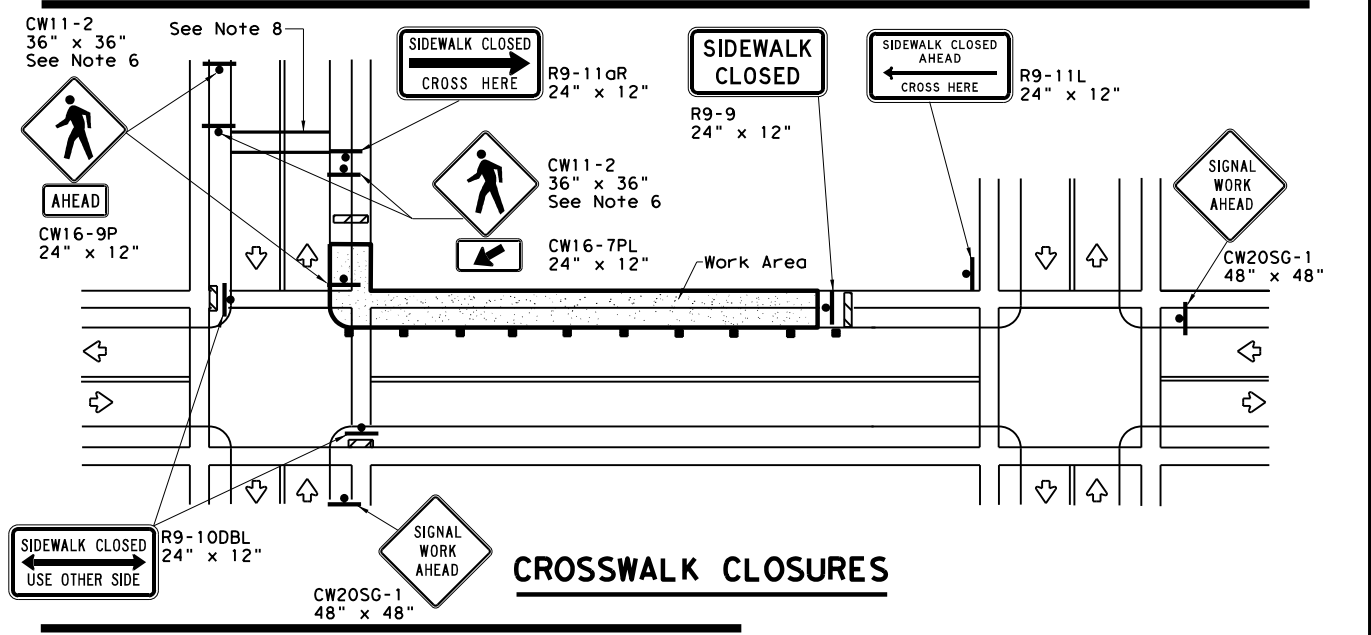
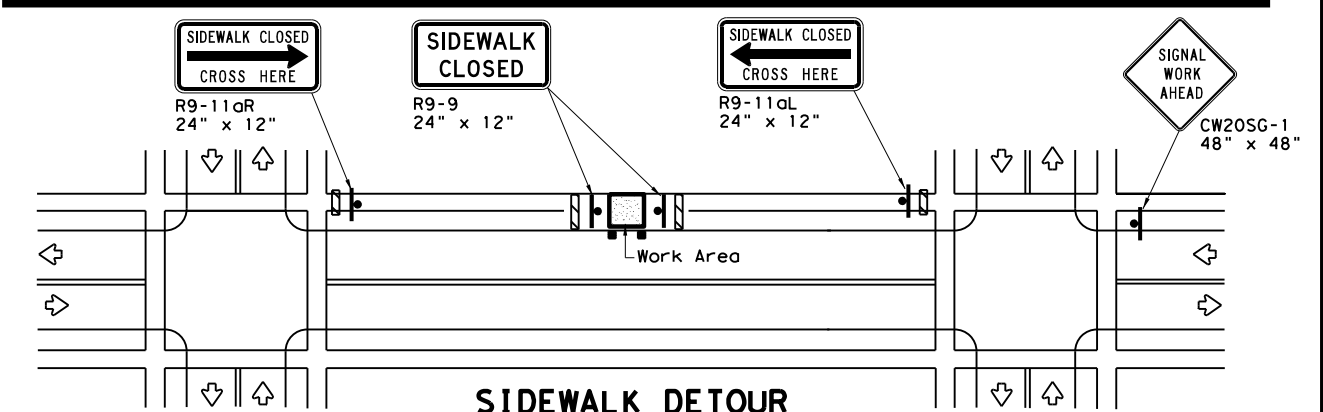
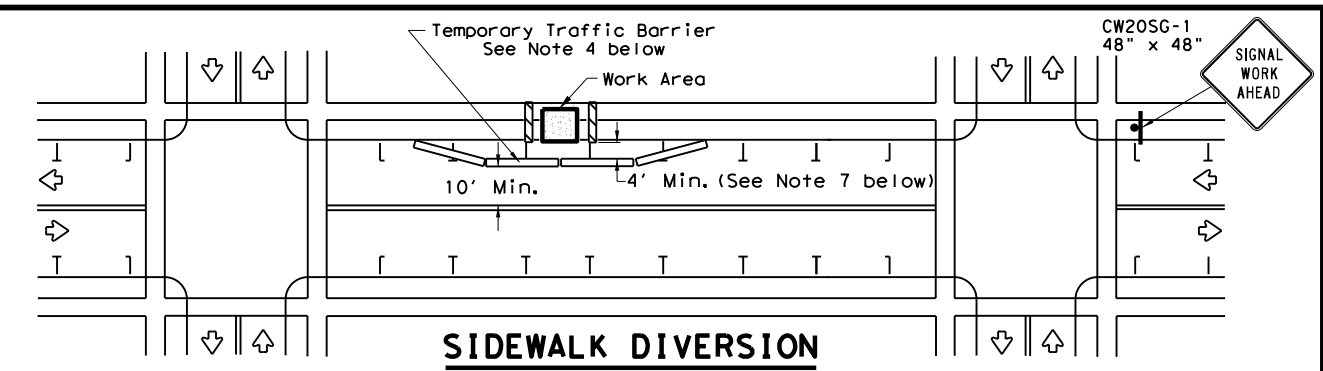
	Sign
	Channelizing Devices
	Type 3 Barricade

DEPARTMENTAL MATERIAL SPECIFICATIONS

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

COLOR	USAGE	SHEETING MATERIAL
ORANGE	BACKGROUND	TYPE B _{FL} OR TYPE C _{FL} SHEETING
WHITE	BACKGROUND	TYPE A SHEETING
BLACK	LEGEND & BORDERS	ACRYLIC NON-REFLECTIVE SHEETING

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



PEDESTRIAN CONTROL

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

SHEET 2 OF 2

Texas Department of Transportation
 Traffic Operations Division Standard

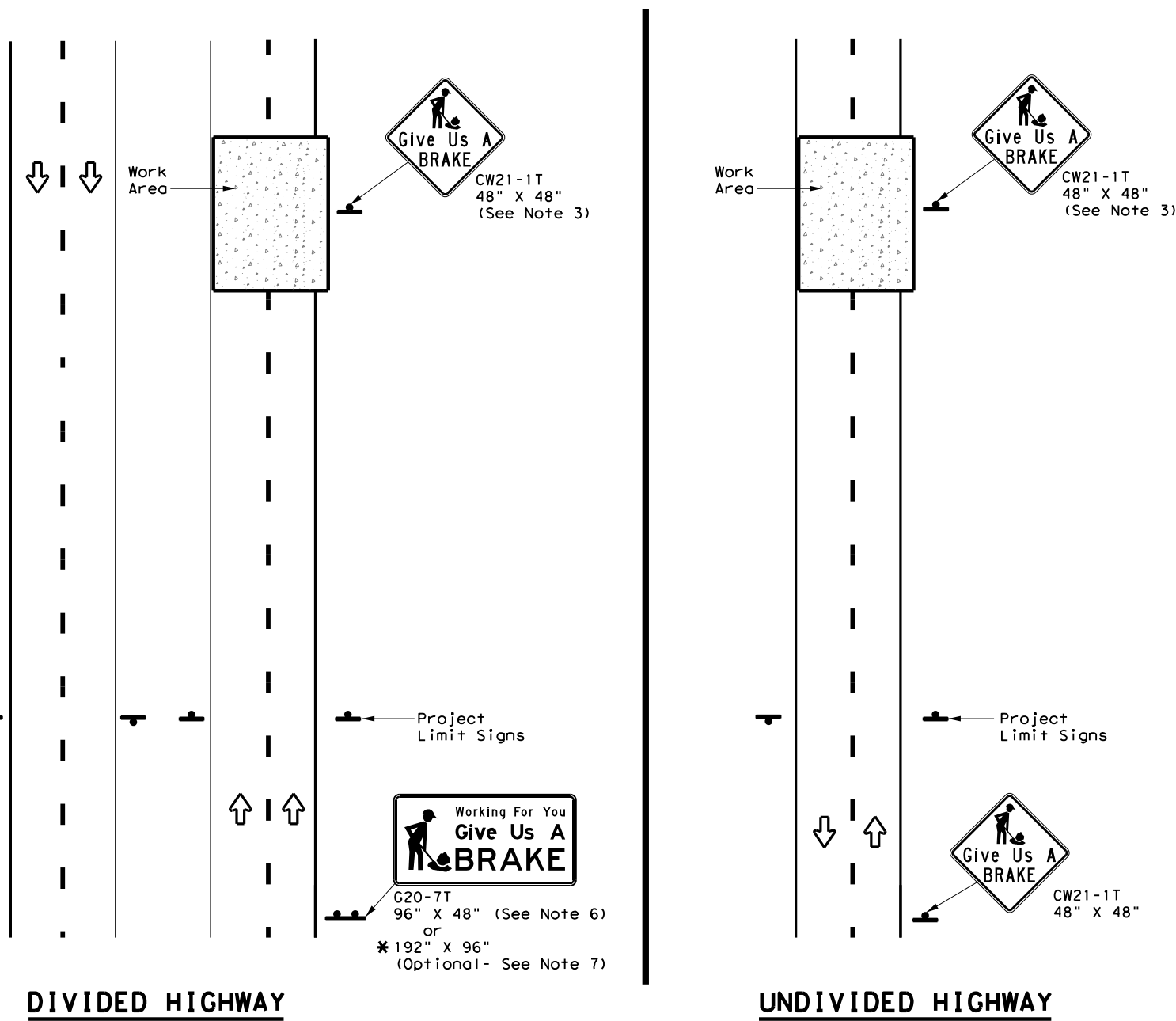
TRAFFIC SIGNAL WORK BARRICADES AND SIGNS

WZ (BTS-2) - 13

FILE: wzbt-13.dgn	DN: TxDOT	CR: TxDOT	OW: TxDOT	CK: TxDOT
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REVISIONS	0502	01	237	SH 225
2-98 10-99 7-13	DIST	COUNTY	SHEET NO.	
4-98 3-03	HOU	HARRIS	069	

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DIVIDED HIGHWAY

UNDIVIDED HIGHWAY

SIGNS ARE SHOWN FOR ONE DIRECTION OF TRAVEL

* When the optional larger WORKING FOR YOU GIVE US A BRAKE (G20-7T) 192" x 96" sign is required, the locations shall be noted elsewhere in the plans.

SUMMARY OF LARGE SIGNS

BACKGROUND COLOR	SIGN DESIGNATION	SIGN	SIGN DIMENSIONS	REFLECTIVE SHEETING	SQ FT	GALVANIZED STRUCTURAL STEEL		DRILLED SHAFT
						Size	(LF)	
							① ②	24" DIA. (LF)
Orange	G20-7T		96" X 48"	Type B _{FL} or C _{FL}	32	▲	▲ ▲	▲
Orange	G20-7T		192" X 96"	Type B _{FL} or C _{FL}	128	W8x18	16 17	12

▲ See Note 6 Below

LEGEND

	Sign
	Large Sign
	Traffic Flow

DEPARTMENTAL MATERIAL SPECIFICATIONS

PLYWOOD SIGN BLANKS	DMS-7100
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

COLOR	USAGE	SHEETING MATERIAL
ORANGE	BACKGROUND	TYPE B _{FL} OR TYPE C _{FL}
BLACK	LEGEND & BORDERS	NON-REFLECTIVE ACRYLIC FILM

GENERAL NOTES

- See BC and SMD sheets for additional sign support details.
- Sign locations shall be approved by the Engineer.
- For projects more than two miles in length, Give Us a BRAKE signs should be repeated halfway through the project. The Give Us a Brake (CW21-1T) may be used for this purpose.
- Work zone speed limits are sometimes used in conjunction with GIVE US A BRAKE signing. See BC(3) for location and spacing of construction speed zone signing when required.
- Give Us a Brake (CW21-1T) signs and supports shall be considered subsidiary to Item 502, "Barricades, Signs and Traffic Handling."
- The 96" X 48" Working For You Give Us A BRAKE (G20-7T) may use a 1/2" or 5/8" plywood substrate or 0.125" aluminum sheeting substrate and may be supported by two 4" x 6" wood posts with drilled holes for breakaway as per BC(5) and will be subsidiary to Item 502.
- The Working For You Give Us A BRAKE (G20-7T) 192" X 96" sign shall be paid for under the following specification items:
 Item 636 - Aluminum Signs
 Item 647 - Large Roadside Sign Supports and Assemblies.
 Item 416 - Drilled Shaft Foundations
- 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.

				Traffic Operations Division Standard	
WORK ZONE "GIVE US A BRAKE" SIGNS					
WZ (BRK) - 13					
FILE:	wzbrk-13.dgn	DN:	TxDOT	CK:	TxDOT
©TxDOT	August 1995	CONT	SECT	JOB	HIGHWAY
REVISIONS		0502	01	237	SH 225
6-96	5-98	7-13	DIST	COUNTY	SHEET NO.
8-96	3-03		HOU	HARRIS	070

TYPE OF WORK

ITEMS AND REQUIREMENTS FOR EACH TYPE OF WORK

SODDING	PERMANENT SEEDING	TEMPORARY SEEDING	Reference Item 161, 162, 164, 166, 168 of the Texas Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges 2014 for specifications, dimensions, volumes and measurements that are not shown. Use latest Houston District, Special Provisions for those items indicated.		
	✓		161-6017 COMPOST MANUF TOPSOIL (BIP) (4") SY	APPLICATION RATE Item 161.2.1. Compost Manufactured Topsoil (CMT)	Item 161.2. Materials. Submit quality control (QC) documentation to the Engineer. Compost producer's STA certification must be dated to meet STA requirements (certification must be within 30 or 90 days per STA requirements). Lab analysis performed by an STA-certified lab must be dated within 30 days before delivery of the compost.
✓			162-6002 BLOCK SODDING SY	GRASS SPECIES Item 162.2. Materials. Common Bermuda (Cynodon Dactylon)	Item 162.2.1. Block Sod. Use block palletized or roll type sod. REMOVE PLASTIC BACKING FROM ROLL TYPE SOD. Place sod within 48 hours of delivery to site. No exceptions. Place sod with joints alternating on each row to prevent continuous joint lines. Peg sod as needed with wood pegs to hold sod in place. Pegging sod is subsidiary to Item 162.
	✓		164-6066 DRILL SEEDING (PERM) (WARM OR COOL) SY Item 164.1. Description Provide and install seeding as shown on District Standard	PLANTING MONTH SEED MIX March, April, May, June, July, August, September, October Hulled - Bermudagrass (Cynodon dactylon) - 40.0 lbs PLS/acre Foxtail Millet (Setaria italica) - 34.0 lbs PLS/acre Green Sprangletop (Leptochloa dubia) - 4.0 lbs PLS/acre Sideoats Grama (Bouteloua curtipendula) - 3.2 lbs PLS/acre Little Bluestem (Schizachyrium scoparium) - 1.4 lbs PLS/acre	PLS (Pure Live Seed) Provide documentation of PLS requirements per Item 164.2.1. CONSTRUCTION. Cultivate the area to a depth of 4 inches before placing the seed unless otherwise directed. When performing permanent seeding after an established temporary seeding, cultivate the seedbed to a depth of 4 inches or mow the area before placement of the permanent seed. Plant the seed and place the straw or hay mulch after the area has been completed to lines and grades as shown on the plans.
	✓		164-6052 BROADCAST SEED (PERM) (SPECIAL MIX) SY Item 164.1. Description Provide and install seeding as shown on District Standard	November, December, January, February Unhulled - Bermudagrass (Cynodon dactylon) - 40.0 lbs PLS/acre Oats (Avena sativa) - 72.0 lbs PLS/acre Green Sprangletop (Leptochloa dubia) - 4.0 lbs PLS/acre Sideoats Grama (Bouteloua curtipendula) - 3.2 lbs PLS/acre Little Bluestem (Schizachyrium scoparium) - 1.4 lbs PLS/acre	Drill Seeding. Plant seed or seed mixture uniformly over the area shown on the plans at a depth of 1/4 to 1/3 inch using a cultipacker (turfgrass) type seeder. Plant seed along the contour of the slopes.
		✓	164-6051 DRILL SEED (TEMP) (WARM OR COOL) SY Item 164.1. Description Provide and install seeding as shown on District Standard	PLANTING MONTH SEED MIX March, April, May, June, July, August, September, October Foxtail Millet (Setaria italica) - 34.0 lbs PLS/acre	Use broadcast seeding method where site conditions prevent drill seeding method.
		✓	164-6009 BROADCAST SEED (TEMP) (WARM) SY Item 164.1. Description Provide and install seeding as shown on District Standard	November, December, January, February Oats (Avena sativa) - 72.0 lbs PLS/acre	Broadcast Seeding. Distribute the dry seed or dry seed mixture uniformly over the areas shown on the plans using hand or mechanical distribution on top of soil.
	✓	✓	162-6003 STRAW OR HAY MULCH SY	APPLICATION RATE Immediately after planting the seed or seed mixture, apply straw or hay mulch uniformly over the seeded area. Apply straw or hay mulch at 2 tons per acre. Use tacking agent with straw or hay mulch as described on this sheet.	Use straw or hay mulch in conformance with Article 162.2.5, "Mulch." Use biodegradable tacking agents only applied at a rate in accordance with manufacturer's recommendations. Use the following products or an approved equal (see note this sheet): Conweb/Contac Guar Gum, Profile Products Corporation, (307) 655-9565, Ramtec/Procol/Viscol Guar Gum, Ramtec Corporation, (800) 366-1180
✓	✓	✓	166-6001 FERTILIZER AC Item 166.2. Materials Use fertilizer as shown on District Standard	APPLICATION RATE Deliver and evenly distribute fertilizer at a rate of 4000 lbs/acre.	Use a NON-CHEMICAL fertilizer which meets all the following criteria: (1) BRAND NAME must be registered with the Texas State Chemist as a commercial fertilizer. (2) Meets USEPA guidelines for unrestricted use. (3) Derived from biological sources such as, but not limited to: sewage sludge, manures, vegetation, etc. (4) In granular form and essentially dust free. Submit proof of registration and nutrient source to Engineer. Use the following products or an approved equal (see note this sheet): Sigma, SIGMA AgriScience, 281-851-6749 Sustanite-standard grade, Automation Nation, Inc., 713-675-4999 Milorganite, MMSD, 800-287-9645 Agricultural Organic P/L, Ag Org, INC., 713-523-4396
✓	✓	✓	168-6001 VEGETATIVE WATERING MG	APPLICATION RATE Item 168.3 Construction. 6000 gallons/acre x 20 consecutive working days = 120,000 gallons total/acre	Begin watering immediately after installation of seed or sod. Replace, fertilize, and water any seed or sod in poor condition due to the failure to apply the specified amount of water within the time allowed at no expense to the Department.

SEQUENCE OF WORK

BLOCK SOD	PERMANENT SEEDING	TEMPORARY SEEDING
1. FERTILIZER 2. CULTIVATE SOIL (ITEM 162.3) 3. SOD 4. VEGETATIVE WATERING	1. FERTILIZER 2. COMPOST MANUFACTURED TOPSOIL 3. CULTIVATE SOIL (ITEMS 164.3 AND 161.3.1) 4. PERMANENT SEEDING 5. STRAW OR HAY MULCH 6. VEGETATIVE WATERING	1. FERTILIZER 2. CULTIVATE SOIL (PER ITEM 164.3) 3. TEMPORARY SEEDING 4. STRAW OR HAY MULCH 5. VEGETATIVE WATERING



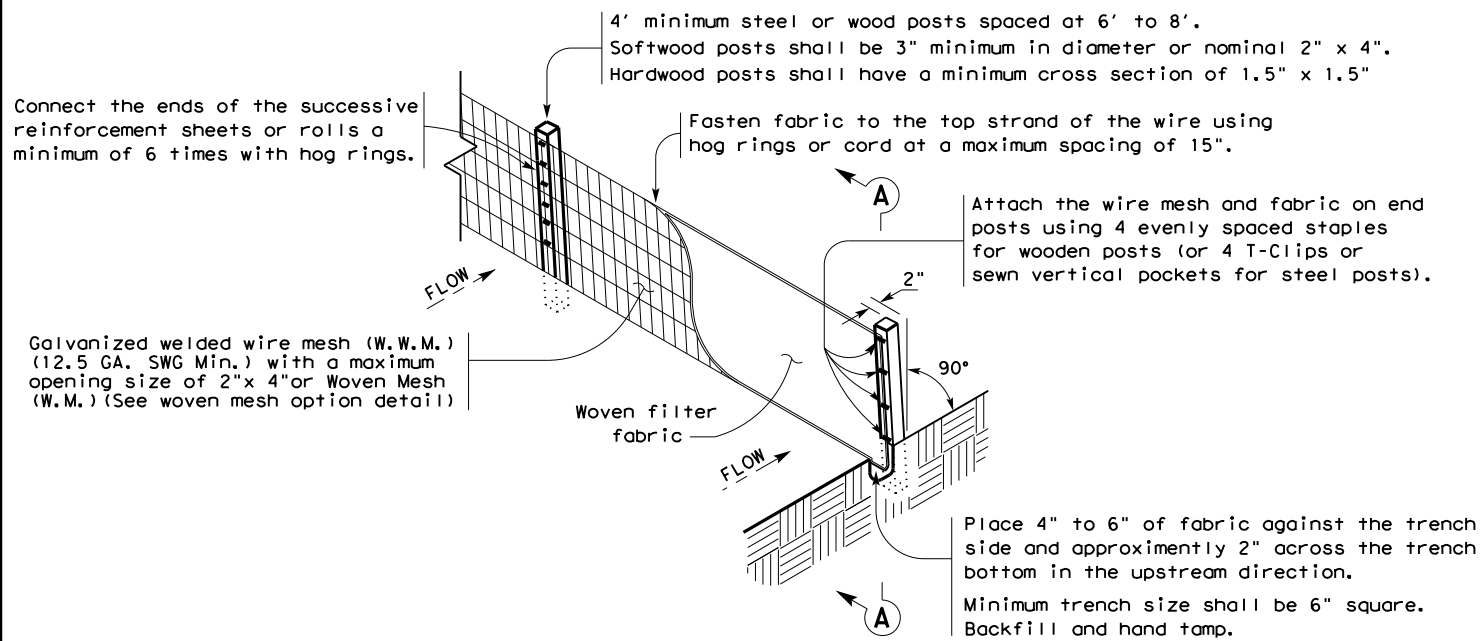
FERTILIZER, SEED, SOD, STRAW, COMPOST, AND WATER

FSSCW-15

REVISIONS		FILE:	FED	STATE	PROJECT NUMBER			SHEET
10/2014	UPDATED TO 2014 SPECS	OCT 2014	6	TEXAS	-			071
3/2015	MINOR CORRECTIONS							
3/2023	ADDED SHEET ABBREVIATION							
ORIGINAL:		DIS	COUNTY	CONTROL	SECT	JOB	HIGHWAY	
		12	HARRIS	0502	01	237	SH 225	

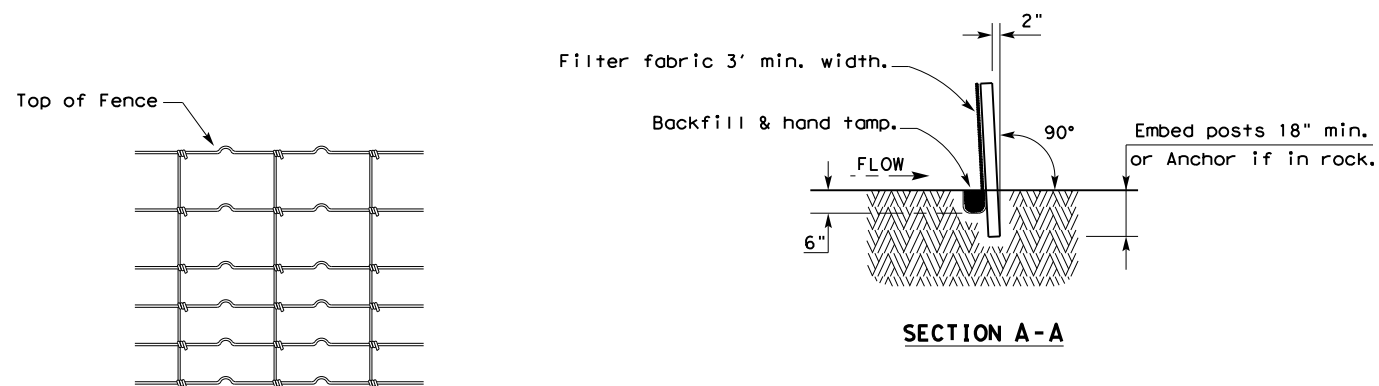
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DATE
FILE



TEMPORARY SEDIMENT CONTROL FENCE

SCF



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/FT². Sediment control fence is not recommended to control erosion from a drainage area larger than 2 acres.

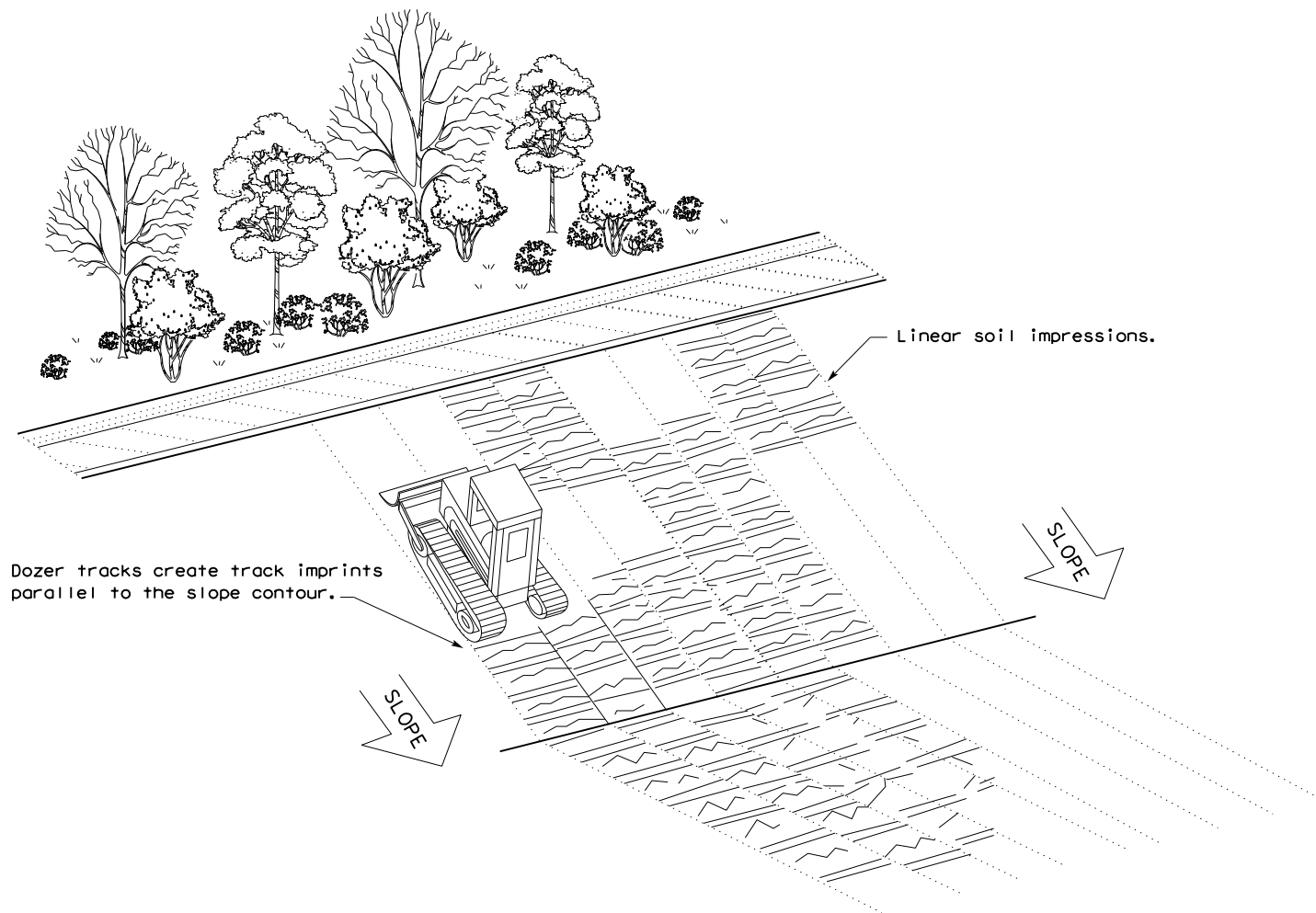
LEGEND

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 continuous linear track impressions where the minimum 12" length impressions are perpendicular to the slope or direction of water flow.



VERTICAL TRACKING




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
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REVISIONS	0502	01	237	SH 225
	DIST	COUNTY	SHEET NO.	
	HOU	HARRIS	072	

<p>I. STORMWATER POLLUTION PREVENTION</p> <p>Texas Pollutant Discharge Elimination System (TPDES) TXR 150000: Stormwater Discharge Permit or Construction General Permit is 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. Refer to the TxDOT SWP3 Summary Sheets, SWP3 Binder Template, and Form 2118.</p> <p style="text-align: center;">No Additional Comments</p>	<p>III. CULTURAL RESOURCES</p> <p>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 area and contact the Engineer immediately.</p> <p style="text-align: center;">No Additional Comments</p>	<p>VI. HAZARDOUS MATERIALS OR CONTAMINATION ISSUES</p> <p>Refer to TxDOT Standard Specifications in the event potentially contaminated materials are observed, such as dead or distressed vegetation, trash disposal areas, drums, canisters, barrels, leaching or seepage of substances, unusual smells or odors, or stained soil, cease work in the area and contact the Engineer immediately.</p> <p style="text-align: center;">No Additional Comments</p>
<p>II. WORK IN OR NEAR STREAMS, WATERBODIES AND WETLANDS</p> <p>United States Army Corps of Engineers (USACE) Permit is required for filling, dredging, excavating or other work in water bodies, rivers, creeks, streams, wetlands or wet areas. The Contractor must adhere to all of the terms and general conditions associated with the following permit(s). If additional work not represented in the plans is required, contact the Engineer immediately.</p> <p><input checked="" type="checkbox"/> No United States Army Corps (USACE) Permit Required</p> <p><input type="checkbox"/> Work is authorized by the United States Army Corps of Engineers (USACE) under a Nationwide Permit (NWP) without a Pre-Construction Notification (PCN). Project specific permit was not issued by USACE, therefore is not in the plan set. The USACE general conditions are in the "General Notes."</p> <p><input type="checkbox"/> Work is authorized by the United States Army Corps of Engineers (USACE) under a Nationwide Permit (NWP) with a Pre-Construction Notification (PCN). The project specific permit issued by the United States Army Corps of Engineers (USACE) is included in the plan set. The USACE general conditions are in the "General Notes."</p> <p><input type="checkbox"/> Work is authorized by the United States Army Corps of Engineers (USACE) under a Individual Permit (IP). The project specific permit issued by the United States Army Corps of Engineers (USACE) is included in the plan set.</p> <p><input type="checkbox"/> Work would be authorized by the United States Army Corps of Engineers (USACE) permit. The project specific permit issued by the USACE will be provided to the contractor.</p> <p>United States Coast Guard (USCG) Permit is required for projects that involve the construction or modification (including changes to lighting) of a bridge or causeway across a water body determined to be navigable by the United States Coast Guard (USCG) under Section 9 of the Rivers and Harbors Act. If additional work not represented in the plans is required, contact the Engineer immediately.</p> <p><input checked="" type="checkbox"/> No United States Coast Guard (USCG) Coordination Required</p> <p><input type="checkbox"/> United States Coast Guard (USCG) Permit</p> <p><input type="checkbox"/> United States Coast Guard (USCG) Exemption</p> <p style="text-align: center;">No Additional Comments</p>	<p>IV. VEGETATION RESOURCES</p> <p>Preserve native vegetation to the extent practical. Refer to TxDOT Standard Specifications in order to comply with requirements for invasive species, beneficial landscaping and tree/brush removal.</p> <p style="text-align: center;">No Additional Comments</p>	<p>V. FEDERAL LISTED, PROPOSED THREATENED, ENDANGERED SPECIES, CRITICAL HABITAT, STATE LISTED SPECIES, CANDIDATE SPECIES AND MIGRATORY BIRDS</p> <p>If any of the listed species below are observed, cease work in the area, do not disturb species or habitat and contact the Engineer immediately.</p> <p>The work may not remove active nests (from bridges, structures, or vegetation adjacent to the roadway, etc.) during nesting season (February 15 to October 1). If removal of structures or vegetation is necessary during the nesting season, the Contractor shall conduct a bird survey no more than 3 days in advance of the clearing/demolish start date. All bird surveys shall be conducted by a Field Biologist and adhere to the guidance document "Avoiding Migratory Birds and Handling Potential Violations" found in the TxDOT Environmental Compliance Toolkits at the time of the survey. (See below for Field Biologist and Ornithologist qualifications)</p> <p style="text-align: center;">No Additional Comments</p>
		<p>VII. OTHER ENVIRONMENTAL ISSUES</p> <p>Comments:</p> <p>To be used for controlling CSJ 0502-01-237.</p>

DATE: Nov 09, 2023
FILE:

		TxDOT Houston District
<p>ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS</p> <p>EPIC</p>		
FILE: EPIC Sheet.dgn	DN:	CK:
© TxDOT: March 2017	CONT SECT	JOB HIGHWAY
REVISIONS	0502 01	237 SH 225
UPDATED section V, text and added definition (10/17) ADDED USCG and USACE notes in Section VII (04/18)	DIST COUNTY	SHEET NO.
	HOU HARRIS	073

Version 2.2

STORMWATER POLLUTION PREVENTION PLAN (SWP3):

This SWP3 has been developed in accordance with TxDOT policy for projects disturbing less than 1 acre of soil, and not part of a larger common plan of development.

For projects with less than one acre of soil disturbing activity and that have Environmental, Permits, Issues, and Commitments (EPICs) dependent on stormwater controls and water quality measures TxDOT will maintain a SWP3 with all pertinent records, correspondence, environmental documents, etc. at the project field office, Area Office, or electronically.

This SWP3 is consistent with requirements specified in applicable stormwater plans, and the project's environmental permits, issues, and commitments (EPICs).

1.0 SITE/PROJECT DESCRIPTION
FIBER OPTIC INTERCONNECT AND TRAFFIC SIGNAL IMPROVEMENTS

1.1 PROJECT CONTROL SECTION JOB (CSJ):
CSJ 0502-01-237

1.2 PROJECT LIMITS:

From: ROBIN STREET

To: SENS ROAD

1.3 PROJECT COORDINATES:

BEGIN: (Lat) 29.711500°N, (Long) 95.127863°W

END: (Lat) 29.690561°N, (Long) 95.046655°W

1.4 TOTAL PROJECT AREA (Acres): 155 ACRES

1.5 TOTAL AREA TO BE DISTURBED (Acres): 0.7 ACRES

1.6 NATURE OF CONSTRUCTION ACTIVITY:

MISCELLANEOUS WORK CONSISTING OF PROPOSED FIBER OPTIC INTERCONNECT AND TRAFFIC SIGNAL MODIFICATIONS, INCLUDING INSTALLATION OF VIVDS.

1.7 MAJOR SOIL TYPES:

Soil Type	Description
GULF COAST PRAIRIE	LOAMY SURFACE TEXTURES AND LOAMY AND CLAYEY SUBSOIL HORIZONS

1.8 PROJECT SPECIFIC LOCATIONS (PSLs):

PSLs must be depicted on the Environmental Layout Sheets in Attachment 1.2 of this SWP3. PSLs may be identified during preconstruction meetings or during the construction process. Please choose from the options below:

- PSLs determined during preconstruction meeting
- PSLs determined during construction
- No PSLs planned for construction

Type	Sheet #s

All off-ROW PSLs required by the Contractor are the Contractor's responsibility. The Contractor shall secure all permits required by local, state, federal laws for off-ROW PSLs. The contractor shall provide diagrams, areas of disturbance, acreage, and BMPs for all off-ROW PSLs within one mile of the project.

1.9 CONSTRUCTION ACTIVITIES:

(Use the following list as a starting point when developing the Construction Activity Schedule and Ceasing Record in Attachment 2.3.)

- Mobilization
- Install sediment and erosion controls
- Blade existing topsoil into windrows, prep ROW, clear and grub
- Remove existing pavement
- Grading operations, excavation, and embankment
- Excavate and prepare subgrade for proposed pavement widening
- Remove existing culverts, safety end treatments (SETs)
- Remove existing metal beam guard fence (MBGF), bridge rail
- Install proposed pavement per plans
- Install culverts, culvert extensions, SETs
- Install mow strip, MBGF, bridge rail
- Place flex base
- Rework slopes, grade ditches
- Blade windrowed material back across slopes
- Revegetation of unpaved areas
- Achieve site stabilization and remove sediment and erosion control measures

Other: N/A

Other: N/A

Other: N/A

1.10 POTENTIAL POLLUTANTS AND SOURCES:

- Sediment laden stormwater from stormwater conveyance over disturbed area
- Fuels, oils, and lubricants from construction vehicles, equipment, and storage
- Solvents, paints, adhesives, etc. from various construction activities
- Transported soils from offsite vehicle tracking
- Construction debris and waste from various construction activities
- Contaminated water from excavation or dewatering pump-out water
- Sanitary waste from onsite restroom facilities
- Trash from various construction activities/receptacles
- Long-term stockpiles of material and waste
- Discharges from concrete washout activities, runoff from concrete cutting activities, and other concrete related activities

Other: N/A

Other: N/A

Other: N/A

1.11 RECEIVING WATERS:

Receiving waters must be depicted on the Environmental Layout Sheets in Attachment 1.2 of this SWP3. Include Segment # for receiving waters.

Tributaries	Classified Waterbody
BUFFALO BAYOU - SAN JACINTO RIVER	SAN JACINTO RIVER BASIN (SEGMENT 1005)

* Add (*) for impaired waterbodies with pollutant in ().

1.12 ROLES AND RESPONSIBILITIES: TxDOT

- Development of plans and specifications
- Perform SWP3 inspections
- Maintain SWP3 records and update to reflect daily operations

Other: N/A

Other: N/A

1.13 ROLES AND RESPONSIBILITIES: CONTRACTOR

- Day To Day Operational Control
- Maintain schedule of major construction activities
- Install, maintain and modify BMPs

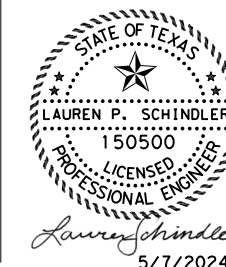
Other: N/A

Other: N/A

STORMWATER POLLUTION PREVENTION PLAN (SWP3) (Less Than 1 Acre)

© 2023 July 2023 Sheet 1 of 2

Texas Department of Transportation



FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6	-		074
STATE	STATE DIST.	COUNTY	
TEXAS	HOU	HARRIS	
CONT.	SECT.	JOB	HIGHWAY NO.
0502	01	237	SH 225

STORMWATER POLLUTION PREVENTION PLAN (SWP3):

2.0 BEST MANAGEMENT PRACTICES (BMPs) AND CONTROLS, INSPECTION, AND MAINTENANCE

The Contractor shall be the responsible party for implementing the BMPs described herein and for complying with the SWP3 for control of erosion and sedimentation during day-to-day operations. The Contractor shall implement changes to this SWP3 approved by TxDOT within the times specified in this SWP3 or the CGP.

2.1 EROSION CONTROL AND SOIL STABILIZATION BMPs:

T / P

- Protection of Existing Vegetation
- Vegetated Buffer Zones
- Soil Retention Blankets
- Geotextiles
- Mulching/ Hydromulching
- Soil Surface Treatments
- Temporary Seeding
- Permanent Planting, Sodding or Seeding
- Biodegradable Erosion Control Logs
- Rock Filter Dams/ Rock Check Dams
- Vertical Tracking
- Interceptor Swale
- Riprap
- Diversion Dike
- Temporary Pipe Slope Drain
- Embankment for Erosion Control
- Paved Flumes
- Other: N/A
- Other: N/A
- Other: N/A
- Other: N/A

2.2 SEDIMENT CONTROL BMPs:

T / P

- Biodegradable Erosion Control Logs
- Dewatering Controls
- Inlet Protection
- Rock Filter Dams/ Rock Check Dams
- Sandbag Berms
- Sediment Control Fence
- Stabilized Construction Exit
- Floating Turbidity Barrier
- Vegetated Buffer Zones
- Vegetated Filter Strips
- Other: N/A
- Other: N/A
- Other: N/A
- Other: N/A

Refer to the Environmental Layout Sheets/ SWP3 Layout Sheets located in Attachment 1.2 of this SWP3

2.3 PERMANENT CONTROLS:

(Coordinate post-construction BMPs with appropriate TxDOT maintenance sections.)

BMPs To Be Left In Place Post Construction:

Type	Stationing	
	From	To
SEEDING	ROBIN STREET	SENS ROAD

Refer to the Environmental Layout Sheets/ SWP3 Layout Sheets located in Attachment 1.2 of this SWP3

2.4 OFFSITE VEHICLE TRACKING CONTROLS:

- Excess dirt/mud on road removed daily
- Haul roads dampened for dust control
- Loaded haul trucks to be covered with tarpaulin
- Stabilized construction exit
- Daily street sweeping
- Other: N/A
- Other: N/A
- Other: N/A
- Other: N/A

2.5 POLLUTION PREVENTION MEASURES:

- Chemical Management
- Concrete and Materials Waste Management
- Debris and Trash Management
- Dust Control
- Sanitary Facilities
- Other: N/A
- Other: N/A
- Other: N/A
- Other: N/A

2.6 VEGETATED BUFFER ZONES:

Natural vegetated buffers shall be maintained as feasible to protect adjacent surface waters. If vegetated natural buffer zones are not feasible due to site geometry, the appropriate additional sediment control measures have been incorporated into this SWP3.

Type	Stationing	
	From	To

Refer to the Environmental Layout Sheets/ SWP3 Layout Sheets located in Attachment 1.2 of this SWP3

2.7 ALLOWABLE NON-STORMWATER DISCHARGES:

- Fire hydrant flushings
- Irrigation drainage
- Pavement washwater (where spills or leaks have not occurred, and detergents are not used)
- Potable water sources
- Springs
- Uncontaminated groundwater
- Water used to wash vehicles or control dust
- Other allowable non-stormwater discharges as allowed by TPDES GP TXR150000.

2.8 DEWATERING:

Dewatering discharges of accumulated stormwater, groundwater, and surface water including discharges from dewatering of trenches, excavations, foundations, vaults, and other points of accumulation are prohibited unless managed by appropriate controls to prevent and minimize the offsite discharge of sediment and other pollutants.

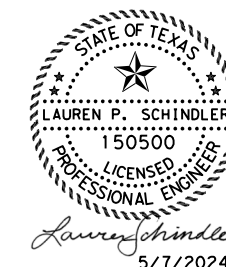
2.9 INSPECTIONS:

All disturbed areas and erosion and sediment control devices shall be inspected at least once every seven (7) days. Inspections shall be performed by TxDOT as indicated on the Field Inspection and Maintenance Report Form 2118 and retained in Attachment 2.3 of this SWP3 .

2.10 MAINTENANCE:

Control measures shall be properly installed according to specifications. If it is determined that a BMP or control measure is not operating effectively, maintenance must be accomplished as soon as possible and before the next anticipated rain event, but in no case later than 7 calendar days after being able to access the site. Maintenance shall be performed by the Contractor as indicated on the Field Inspection and Maintenance Report Form 2118 and retained in Attachment 2.3 of this SWP3.

STORMWATER POLLUTION PREVENTION PLAN (SWP3) (Less Than 1 Acre)



FED. RD. DIV. NO.	PROJECT NO.			SHEET NO.
6	-			075
STATE	STATE DIST.	COUNTY		
TEXAS	HOU	HARRIS		
CONT.	SECT.	JOB	HIGHWAY NO.	
0502	01	237	SH 225	

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.

I. WORK AT CROSSING LOCATIONS (AT GRADE, HIGHWAY OVERPASS, HIGHWAY UNDERPASS, PEDESTRIAN, OR CLOSED/ABANDONED)

This project is adjacent or parallel work, not within RR ROW:
 DOT No.: 450404L
 Crossing Type: RR UNDERPASS
 RR Company Operating Track at Crossing: UPRR
 RR Company Owning Track at Crossing: UPRR
 RR MP: 18.260
 RR Subdivision: STRANG
 City: DEER PARK
 County: HARRIS
 CSJ at this Crossing: 0502-01-237
 Latitude: 29.7038612
 Longitude: -95.0933042

Scope of Work, including any TCP, to be performed by State Contractor:

TRAFFIC SIGNAL MODIFICATION THAT IS PRIMARILY FOR RECAPLING OF THE SPAN WIRE SIGNAL ADJACENT TO RR ON HWY OVERPASS

Scope of Work to be performed by Railroad Company:

None.

II. FLAGGING & INSPECTION

No. of Days of Railroad Flagging Expected: 3
 On this project, night or weekend flagging is:
 Expected
 Not Expected

Flagging services will be provided by:

Railroad Company: 1) Txdot will pay flagging invoices. Flagging Agreement with railroad will be needed or, 2) Permitted crossing. Railroad company to provide flagging.
 Outside Party: Contractor will pay flagging invoices to be reimbursed by TxDOT

Contractor must incorporate flaggers into anticipated construction schedule. The Railroad requires a 30-day notice if their flaggers are to be utilized. If Contractor falls behind schedule due to their own negligence and is not ready for scheduled flaggers, any flagging charges will be paid by Contractor.

Contact Information for Flagging:

UPRR UP.info@railpros.com
 Call Center 877-315-0513, Select #1 for flagging
 UP.request@nrssinc.net
 Call Center 877-984-6777

BNSF BNSFinfo@railprofs.com
 Call Center 877-315-0513, Select #1 for flagging

CPKCR KCS.info@railpros.com
 Call Center 877-315-0513, Select #1 for flagging
 Bottom Line On-Track Safety Services
 bottomline076@aol.com, 903-767-7630

OTHERS:

Contractor must incorporate railroad construction inspection into anticipated construction schedule.

Not Required
 Required. Contact Information for Construction Inspection:

III. CONSTRUCTION WORK TO BE PERFORMED BY THE RAILROAD

Required.
 Not Required
 Railroad Point of Contact: _____

Coordinate with TxDOT for any work to be performed by the Railroad Company. TxDOT must issue a work order for any work done by the Railroad Company prior to the work being performed.

IV. RAILROAD INSURANCE REQUIREMENTS

The Contractor shall confirm the insurance requirements with the Railroad as the insurance limits are subject to change without notice.

Insurance policies and corresponding certificates of insurance must be issued by the contractor on behalf of the Railroad. Separate insurance policies and certificates are required when more than one Railroad Company is operating on the same right of way, or when several Railroad Companies are involved and operate on their own separate right of ways.

No direct compensation will be made to the Contractor for providing the insurance coverages shown below or any deductibles. These costs are incidental to the various bid items.

Escalated Limits	
Type of Insurance	Amount of Coverage (Minimum)
Workers Compensation	\$500,000 / \$500,000 / \$500,000
Commercial General Liability	\$2,000,000 / \$4,000,000
Business Automobile	\$2,000,000

Railroad Protective Liability Limits	
<input type="checkbox"/> Not Required	
<input checked="" type="checkbox"/> Non - Bridge/Typical Maintenance Projects. Includes repairs to overpass/underpass and culvert structures	\$2,000,000 / \$6,000,000
<input type="checkbox"/> Bridge Structure Projects. Includes new construction or replacement of overpass/underpass structures	\$5,000,000 / \$10,000,000
<input type="checkbox"/> Other: _____	

V. CONTRACTOR'S RIGHT OF ENTRY (CROE)

Not Required
 Required: UPRR Maintenance Consent Letter. TxDOT to assist
 Required: TxDOT to assist in obtaining the UPRR CROE
 Required: Contractor to obtain

- BNSF: _____
https://bnsf.railpermitting.com
- CPKCR
https://jllrpg.360works.com/fmi/webd/rpo_web_kcs.fmp12
- Other Railroads: _____

To view previously approved CROE templates agreed upon between the State and Railroad, see: <https://www.txdot.gov/business/resources/railroad-highway-crossing/sample-right-of-entry-agreements.html>

Approved CROE templates are not to be modified by the Contractor.

Contractor shall not operate within Railroad Right of Way without an executed Construction & Maintenance Agreement between the State and the Railroad and an executed CROE between the Contractor and the Railroad if required on project.

VI. RAILROAD COORDINATION MEETING

A Railroad Coordination Meeting is required. See item 5, Article 8.1, of the Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges Manual for more details.

VII. RAILROAD SAFETY ORIENTATION

A. Complete the Railroad's course "Orientation for Contractor's Safety," and maintain registration prior to working on the Railroad's property. This course is required to be completed annually by Contractor and Subcontractor personnel working on site.

UPRR, BNSF, CPKCR will not accept on-track safety training certificates from other Railroads. Refer to each Railroad's specific contractor right of entry for training information.

Know and follow the Contractor's Right of Entry Agreement EXHIBIT D, MINIMUM SAFETY REQUIREMENTS regarding clothing, personal protective equipment, and general safety requirements.

VIII. SUBCONTRACTORS

Contractor shall not subcontract work without written consent of TxDOT. Subcontractors are subject to the same insurance requirements as the Prime Contractor.

IX. EMERGENCY NOTIFICATION

In Case of Railroad Emergency

Call: UPRR _____

Railroad Emergency Line at: 800-848-8715

Location: DOT 450404L

RR Milepost: 18.260

Subdivision: STRANG



RRD Review Only

Initials: AC

Date: 06/25/2024

Rail Division

RAILROAD SCOPE OF WORK

PROJECT SPECIFIC DETAILS

FILE: rr-scope-of-work.pdf	DN: TxDOT	CK:	DW:	CK:
© TxDOT June 2014	CONT	SECT	JOB	HIGHWAY
6/2023	0502	01	237	SH 225
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		76

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I. WORK AT CROSSING LOCATIONS (AT GRADE, HIGHWAY OVERPASS, HIGHWAY UNDERPASS, PEDESTRIAN, OR CLOSED/ABANDONED)

This project is adjacent or parallel work, not within RR ROW:

DOT No.: 745014S
 Crossing Type: RR UNDERPASS
 RR Company Operating Track at Crossing: UPRR
 RR Company Owning Track at Crossing: UPRR
 RR MP: 17.670
 RR Subdivision: STRANG
 City: DEER PARK
 County: HARRIS
 CSJ at this Crossing: 0502-01-237
 Latitude: 29.7066695
 Longitude: -95.1025696

Scope of Work, including any TCP, to be performed by State Contractor:

TRAFFIC SIGNAL MODIFICATION THAT IS PRIMARILY FOR RECABLING AND ADDING VIVDS DETECTION TO THE SPAN WIRE SIGNAL ADJACENT TO RR ON HWY OVERPASS

Scope of Work to be performed by Railroad Company:

None.

II. FLAGGING & INSPECTION

No. of Days of Railroad Flagging Expected: 3

On this project, night or weekend flagging is:

- Expected
- Not Expected

Flagging services will be provided by:

- Railroad Company: 1) Txdot will pay flagging invoices. Flagging Agreement with railroad will be needed or, 2) Permitted crossing. Railroad company to provide flagging.
- Outside Party: Contractor will pay flagging invoices to be reimbursed by TxDOT

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Contact Information for Flagging:

- UPRR** UP.info@railpros.com
Call Center 877-315-0513, Select #1 for flagging
UP.request@nrssinc.net
Call Center 877-984-6777
- BNSF** BNSFinfo@railprofs.com
Call Center 877-315-0513, Select #1 for flagging
- CPKCR** KCS.info@railpros.com
Call Center 877-315-0513, Select #1 for flagging
Bottom Line On-Track Safety Services
bottomline076@aol.com, 903-767-7630

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- Not Required
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Escalated Limits	
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Commercial General Liability	\$2,000,000 / \$4,000,000
Business Automobile	\$2,000,000

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<input type="checkbox"/> Not Required	
<input checked="" type="checkbox"/> Non - Bridge/Typical Maintenance Projects. Includes repairs to overpass/underpass and culvert structures	\$2,000,000 / \$6,000,000
<input type="checkbox"/> Bridge Structure Projects. Includes new construction or replacement of overpass/underpass structures	\$5,000,000 / \$10,000,000
<input type="checkbox"/> Other: _____	

V. CONTRACTOR'S RIGHT OF ENTRY (CROE)

- Not Required
- Required: UPRR Maintenance Consent Letter. TxDOT to assist

Required: TxDOT to assist in obtaining the UPRR CROE

- Required: Contractor to obtain
 - BNSF: _____
https://bnsf.railpermitting.com
 - CPKCR
https://jllrpg.360works.com/fmi/webd/rpo_web_kcs.fmp12
 - Other Railroads: _____

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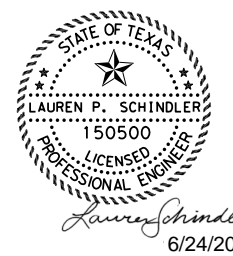
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In Case of Railroad Emergency
 Call: UPRR _____
 Railroad Emergency Line at: 800-848-8715
 Location: DOT 745014S
 RR Milepost: 17.670
 Subdivision: STRANG



RRD Review Only
 Initials: AC
 Date: 06/25/2024



**RAILROAD SCOPE OF WORK
PROJECT SPECIFIC DETAILS**

FILE: rr-scope-of-work.pdf	DN: TxDOT	CK:	DW:	CK:
© TxDOT June 2014	CONT	SECT	JOB	HIGHWAY
6/2023	0502	01	237	SH 225
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		76A

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I. WORK AT CROSSING LOCATIONS (AT GRADE, HIGHWAY OVERPASS, HIGHWAY UNDERPASS, PEDESTRIAN, OR CLOSED/ABANDONED)

This project is adjacent or parallel work, not within RR ROW:
 DOT No.: 758847D
 Crossing Type: RR UNDERPASS
 RR Company Operating Track at Crossing: UPRR
 RR Company Owning Track at Crossing: UPRR
 RR MP: 21.220
 RR Subdivision: STRANG
 City: LA PORTE
 County: HARRIS
 CSJ at this Crossing: 0502-01-237
 Latitude: 29.6899097
 Longitude: -95.0469454

Scope of Work, including any TCP, to be performed by State Contractor:

TRAFFIC SIGNAL MODIFICATION THAT IS PRIMARILY FOR RECABLING AND ADDING VIVDS DETECTION TO THE SPAN WIRE SIGNAL ADJACENT TO RR ON HWY OVERPASS

Scope of Work to be performed by Railroad Company:

None.

II. FLAGGING & INSPECTION

No. of Days of Railroad Flagging Expected: 3
 On this project, night or weekend flagging is:
 Expected
 Not Expected

Flagging services will be provided by:

Railroad Company: 1) Txdot will pay flagging invoices. Flagging Agreement with railroad will be needed or, 2) Permitted crossing. Railroad company to provide flagging.
 Outside Party: Contractor will pay flagging invoices to be reimbursed by TxDOT

Contractor must incorporate flaggers into anticipated construction schedule. The Railroad requires a 30-day notice if their flaggers are to be utilized. If Contractor falls behind schedule due to their own negligence and is not ready for scheduled flaggers, any flagging charges will be paid by Contractor.

Contact Information for Flagging:

UPRR UP.info@railpros.com
 Call Center 877-315-0513, Select #1 for flagging
 UP.request@nrssinc.net
 Call Center 877-984-6777

BNSF BNSFinfo@railprofs.com
 Call Center 877-315-0513, Select #1 for flagging

CPKCR KCS.info@railpros.com
 Call Center 877-315-0513, Select #1 for flagging
 Bottom Line On-Track Safety Services
 bottomline076@aol.com, 903-767-7630

OTHERS:

Contractor must incorporate railroad construction inspection into anticipated construction schedule.

Not Required
 Required. Contact Information for Construction Inspection:

III. CONSTRUCTION WORK TO BE PERFORMED BY THE RAILROAD

Required.
 Not Required
 Railroad Point of Contact: _____

Coordinate with TxDOT for any work to be performed by the Railroad Company. TxDOT must issue a work order for any work done by the Railroad Company prior to the work being performed.

IV. RAILROAD INSURANCE REQUIREMENTS

The Contractor shall confirm the insurance requirements with the Railroad as the insurance limits are subject to change without notice.

Insurance policies and corresponding certificates of insurance must be issued by the contractor on behalf of the Railroad. Separate insurance policies and certificates are required when more than one Railroad Company is operating on the same right of way, or when several Railroad Companies are involved and operate on their own separate right of ways.

No direct compensation will be made to the Contractor for providing the insurance coverages shown below or any deductibles. These costs are incidental to the various bid items.

Escalated Limits	
Type of Insurance	Amount of Coverage (Minimum)
Workers Compensation	\$500,000 / \$500,000 / \$500,000
Commercial General Liability	\$2,000,000 / \$4,000,000
Business Automobile	\$2,000,000

Railroad Protective Liability Limits	
<input type="checkbox"/> Not Required	
<input checked="" type="checkbox"/> Non - Bridge/Typical Maintenance Projects. Includes repairs to overpass/underpass and culvert structures	\$2,000,000 / \$6,000,000
<input type="checkbox"/> Bridge Structure Projects. Includes new construction or replacement of overpass/underpass structures	\$5,000,000 / \$10,000,000
<input type="checkbox"/> Other:	_____

V. CONTRACTOR'S RIGHT OF ENTRY (CROE)

Not Required
 Required: UPRR Maintenance Consent Letter. TxDOT to assist
 Required: TxDOT to assist in obtaining the UPRR CROE
 Required: Contractor to obtain

- BNSF: _____
https://bnsf.railpermitting.com
- CPKCR
https://jllrpg.360works.com/fmi/webd/rpo_web_kcs.fmp12
- Other Railroads: _____

To view previously approved CROE templates agreed upon between the State and Railroad, see: <https://www.txdot.gov/business/resources/railroad-highway-crossing/sample-right-of-entry-agreements.html>

Approved CROE templates are not to be modified by the Contractor.

Contractor shall not operate within Railroad Right of Way without an executed Construction & Maintenance Agreement between the State and the Railroad and an executed CROE between the Contractor and the Railroad if required on project.

VI. RAILROAD COORDINATION MEETING

A Railroad Coordination Meeting is required. See item 5, Article 8.1, of the Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges Manual for more details.

VII. RAILROAD SAFETY ORIENTATION

A. Complete the Railroad's course "Orientation for Contractor's Safety," and maintain registration prior to working on the Railroad's property. This course is required to be completed annually by Contractor and Subcontractor personnel working on site.

UPRR, BNSF, CPKCR will not accept on-track safety training certificates from other Railroads. Refer to each Railroad's specific contractor right of entry for training information.

Know and follow the Contractor's Right of Entry Agreement EXHIBIT D, MINIMUM SAFETY REQUIREMENTS regarding clothing, personal protective equipment, and general safety requirements.

VIII. SUBCONTRACTORS

Contractor shall not subcontract work without written consent of TxDOT. Subcontractors are subject to the same insurance requirements as the Prime Contractor.

IX. EMERGENCY NOTIFICATION

In Case of Railroad Emergency
 Call: UPRR _____
 Railroad Emergency Line at: 800-848-8715
 Location: DOT 758847D
 RR Milepost: 21.220
 Subdivision: STRANG



RRD Review Only
 Initials: AC
 Date: 06/25/2024

Rail Division

RAILROAD SCOPE OF WORK
PROJECT SPECIFIC DETAILS

FILE: rr-scope-of-work.pdf	DN: TxDOT	CK:	DW:	CK:
© TxDOT June 2014	CONT	SECT	JOB	HIGHWAY
6/2023	0502	01	237	SH 225
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		76B

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I. WORK AT CROSSING LOCATIONS (AT GRADE, HIGHWAY OVERPASS, HIGHWAY UNDERPASS, PEDESTRIAN, OR CLOSED/ABANDONED)

This project is adjacent or parallel work, not within RR ROW:
 DOT No.: 758856C
 Crossing Type: AT GRADE
 RR Company Operating Track at Crossing: UPRR
 RR Company Owning Track at Crossing: UPRR
 RR MP: 16.140
 RR Subdivision: STRANG
 City: DEER PARK
 County: HARRIS
 CSJ at this Crossing: 0502-01-237
 Latitude: 29.7110133
 Longitude: -95.1274781

Scope of Work, including any TCP, to be performed by State Contractor:

TRAFFIC SIGNAL MODIFICATION THAT IS PRIMARILY FOR FIBER INTERCONNECT TO SIGNAL

Scope of Work to be performed by Railroad Company:

None.

II. FLAGGING & INSPECTION

No. of Days of Railroad Flagging Expected: 0
 On this project, night or weekend flagging is:
 Expected
 Not Expected

Flagging services will be provided by:

Railroad Company: 1) Txdot will pay flagging invoices. Flagging Agreement with railroad will be needed or, 2) Permitted crossing. Railroad company to provide flagging.
 Outside Party: Contractor will pay flagging invoices to be reimbursed by TxDOT

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Contact Information for Flagging:

UPRR UP.info@railpros.com
 Call Center 877-315-0513, Select #1 for flagging
 UP.request@nrssinc.net
 Call Center 877-984-6777

BNSF BNSFinfo@railprofs.com
 Call Center 877-315-0513, Select #1 for flagging

CPKCR KCS.info@railpros.com
 Call Center 877-315-0513, Select #1 for flagging
 Bottom Line On-Track Safety Services
 bottomline076@aol.com, 903-767-7630

OTHERS:

Contractor must incorporate railroad construction inspection into anticipated construction schedule.

Not Required
 Required. Contact Information for Construction Inspection:

III. CONSTRUCTION WORK TO BE PERFORMED BY THE RAILROAD

Required.
 Not Required
 Railroad Point of Contact: _____

Coordinate with TxDOT for any work to be performed by the Railroad Company. TxDOT must issue a work order for any work done by the Railroad Company prior to the work being performed.

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Commercial General Liability	\$2,000,000 / \$4,000,000
Business Automobile	\$2,000,000

Railroad Protective Liability Limits	
<input type="checkbox"/> Not Required	
<input checked="" type="checkbox"/> Non - Bridge/Typical Maintenance Projects. Includes repairs to overpass/underpass and culvert structures	\$2,000,000 / \$6,000,000
<input type="checkbox"/> Bridge Structure Projects. Includes new construction or replacement of overpass/underpass structures	\$5,000,000 / \$10,000,000
<input type="checkbox"/> Other:	_____

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Not Required
 Required: UPRR Maintenance Consent Letter. TxDOT to assist
 Required: TxDOT to assist in obtaining the UPRR CROE
 Required: Contractor to obtain

- BNSF: _____
https://bnsf.railpermitting.com
- CPKCR
https://jllrpg.360works.com/fmi/webd/rpo_web_kcs.fmp12
- Other Railroads: _____

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IX. EMERGENCY NOTIFICATION

In Case of Railroad Emergency

Call: UPRR _____

Railroad Emergency Line at: 800-848-8715

Location: DOT 758856C

RR Milepost: 16.140

Subdivision: STRANG



RRD Review Only

Initials: AC

Date: 06/25/2024



**RAILROAD SCOPE OF WORK
PROJECT SPECIFIC DETAILS**

FILE: rr-scope-of-work.pdf	DN: TxDOT	CK:	DW:	CK:
© TxDOT June 2014	CONT	SECT	JOB	HIGHWAY
6/2023	0502	01	237	SH 225
	DIST	COUNTY		SHEET NO.
	HOU	HARRIS		76C