FED. ROAD DIV. NO.	STATE	STATE PROJECT NO.	SHEET NO.
6	TEXAS	C 902-90-108	1
STATE DIST. NO.	COUNTY	STATE CONTROL NO.	HIGHWAY NO.
2	TARRANT	0902-90-108	VA

STATE OF TEXAS
DEPARTMENT OF TRANSPORTATION

PLANS OF PROPOSED
STATE HIGHWAY IMPROVEMENT

STATE PROJECT NO.: C 902-90-108

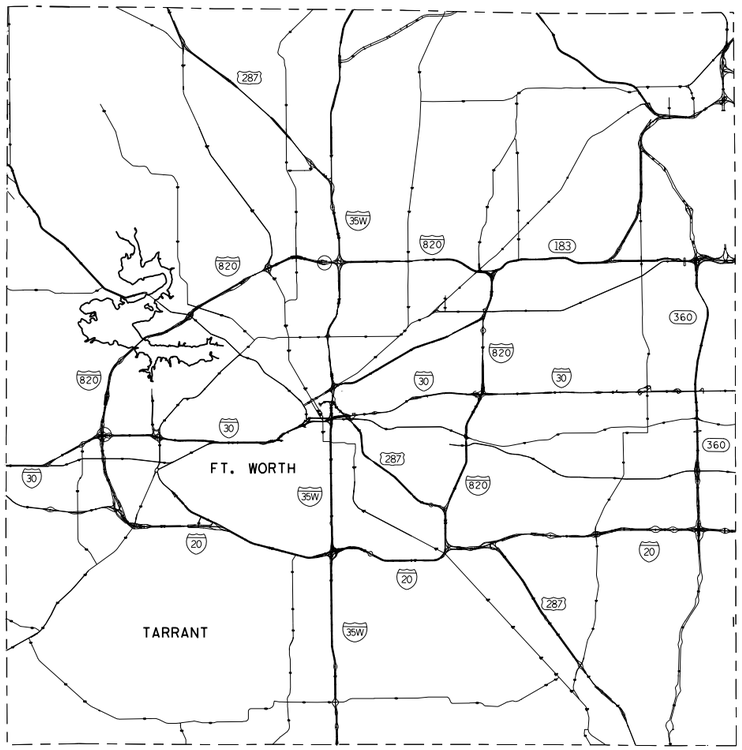
PROJECT LENGTH: NO PROJECT LENGTH

TARRANT COUNTY

VA

LIMITS OF WORK: VARIOUS LOCATIONS WITHIN FORT WORTH DISTRICT

FOR THE CONSTRUCTION OF TRAFFIC CONTROL DEVICES
CONSISTING OF: NON SITE SPECIFIC ITS



FINAL PLANS

LETTING DATE: _____

DATE CONTRACTOR BEGAN WORK: _____

DATE WORK WAS COMPLETED : _____

DATE WORK WAS ACCEPTED: _____

FINAL CONTRACT COST: $_____

CONTRACTOR : _____

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

NO EQUATIONS
NO EXCEPTIONS
NO RAILROAD CROSSINGS

TEXAS DEPARTMENT OF TRANSPORTATION

SUBMITTED FOR LETTING: 4/23/2021 — 20—
DocuSigned by:
Theresa Poer
DIRECTOR OF TRANSPORTATION OPERATIONS
7645C0CD25274F3...

RECOMMENDED FOR LETTING: 4/29/2021 — 20—
DocuSigned by:
DIRECTOR, TP & D
7879B0B92E5D403...

APPROVED FOR LETTING: 4/30/2021 — 20—
DocuSigned by:
Carl L. Johnson, PE
DISTRICT ENGINEER
2FE36139F0614C3...

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DATE: 4/20/2021 4:58:24 PM

INDEX OF SHEETS

THE STANDARD SHEETS SPECIFICALLY IDENTIFIED ON THIS SHEET WITH AN ## HAVE BEEN ISSUED BY ME AND ARE APPLICABLE TO THIS PROJECT.

STATE OF TEXAS
CARLOS E. MOLINA
97237
LICENSED PROFESSIONAL ENGINEER

Carlos E. Molina

June 4, 2021

Texas Department of Transportation

INDEX OF SHEETS

Sheet 1 of 1 Sheets

DIST.	COUNTY		SHEET NO.
FTW	TARRANT		2
CONTROL	SECT.	JOB	HIGHWAY NO.
0902	90	108	VA

DATE: 6/4/2021 4:08:24 PM
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General Notes – Intelligent Transportation Systems (ITS)

Contractor questions on this project are to be addressed to the following individual(s):

Theresa Poer, P.E. theresa.poer@txdot.gov
Carlos Molina, P.E. carlos.molina@txdot.gov

Contractor questions will be accepted through email, phone, and in person by the above individuals.

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

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

Basis of Estimate

Item	Description	Rate	Unit
166	Fertilizer (16-8-8)	600 lb./acre**	ton
168	Vegetative Watering	169,400 gal./acre	1,000 gal.

** Non-Pay, for Contractor's Information Only.

This is a Non-Site-Specific Contract containing multiple work orders. Project locations and plan details will be incorporated into the contract by individual work order over the life of the contract.

The work contained within this contract will consist of the installation or upgrading of the different ITS systems and associated equipment within the Fort Worth District. Exact work locations will be provided within the work orders issued after the contract has been awarded.

The estimated quantities in the project proposal are estimates only to be used in the determination of the low bidder. They should not be used to determine the quantity of materials to be ordered for work in the contract.

For each individual work order issued within the project, working days will be defined in accordance with Article 8.3.1.1 'Five-Day Workweek.'

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Liquidated damages will be determined and applied on a work order basis. Each work order will be treated separately and independently in the assessment of liquidated damages. Failure to complete work assigned within the number of working days specified in the work order, including any approved additional working days, will result in liquidated damages for each working day charged over the number of working days allowed for the work order. The amount assessed for liquidated damages will be based on the amount of the original contract, not the estimated amount on individual work orders.

This contract has time charges assessed by individual work order.

There is no guaranteed amount of work under this contract.

The contractor is responsible for picking up materials furnished by the State at 2501 SW Loop 820, Fort Worth, TX 76133. Contact the TxDOT Signal Shop at 817-370-3664 forty-eight (48) hours in advance.

For dimensions of right of way not shown on the plans, see right of way map on file at the TxDOT District Office.

A pre-construction/conference meeting between the contractor and TxDOT will be held prior to beginning operations. This meeting will outline the proposed work procedures, sequence of work to be followed, and discuss the required traffic control. Plans, specifications, unusual conditions, and other pertinent items regarding the work will be discussed. The Contractor's job superintendent is requested to attend this meeting.

An onsite tailgate meeting between TxDOT and the contractor shall occur at the start of each work order.

The Contractor shall notify the TxDOT inspector no later than 8 AM each day and advise work locations for the day, number of workers, and equipment used on work site.

Provide pre-approved safety vests, hard hats, and protective toe footwear and insure that all these safety items are worn at all times when outside vehicles within the work area.

The conduit and fiber optic cables are the main backbone of the TxDOT ITS network. Communications Systems (wireless or fiber) shall remain in operation throughout the project. A 4-hour window for switchover will be allowed at each location. The Contractor shall provide a 72-hour advance notice and receive approval for any outages from the TxDOT Signal Shop at 817-370-3664.

Furnish and install all incidental work, material and services not explicitly called for in the specifications or not shown in the plans, which may be necessary for a complete and properly functioning ITS system.

Perform all work in this project in a manner acceptable to and approved by the Engineer.

Contact Texas excavation safety system at 1-800-dig-tess or 1-800-344-8377, and TxDOT Signal Shop at 817-370-3664 prior to beginning any excavation work in the area of existing utilities, to prevent any damage or interference with present facilities.

Contact the local Cities within the limits and vicinity of the project for their utility locates including their water, electrical/ illumination, and Traffic Department before any construction work. The City of Fort Worth Illumination group number is 817-392-8100.

Provide TxDOT with confirmation tickets of utility and line locates.

Contact the utility companies or the utility coordinating committee for exact locations prior to any work that might interfere with or damage present facilities. Verify the locations of all existing underground installations that would be in conflict with the new conduit prior to construction to avoid conflict or damage to utilities. Contact the respective utility company 48 hours prior to excavating. Coordinate with the respective utility company for any adjustment necessary to the utility. Contractor shall pothole the locations that conflict with utilities. Contractor is responsible for utility coordination, locates, and potholing at no additional expense to the State.

Replace within 48 hours all existing underground and above ground installations damaged by Contractor’s forces during construction at no cost to the State. If the damaged installation belongs to the Department and has not been repaired within 48 hours, the Contractor will be responsible to pay a third party or the Department for the repair.

Procure all permits and licenses.

The electrical work will be inspected by the State.

Deliver all cabinets to be furnished and installed in this project to TxDOT Fort Worth District Headquarters located at 2501 Southwest Loop 820, Fort Worth, Texas, 76133, for specification compliance testing’s by the Traffic Management personnel before any cabinet is installed.

Correct and re-test cabinet(s) failing to comply with the specifications prior to being released for transportation to and installation in the field. Transport the cabinet(s) to the field for installation after successfully completing the testing.

No payment shall be made directly for the transportation of the cabinet(s) to and from the District for testing or other incidentals required to complete the work. This work shall be considered subsidiary to the type of cabinet called for in the project.

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The Engineer shall approve the starting date for system acceptance testing and, if required, shall terminate the system testing because of malfunctions or obvious unsuitability of the equipment.

Do not remove or relocate existing equipment in existing cabinets without the Engineer's approval.

Install all necessary shelves, terminal panels, wiring, cabling, harnesses, etc. where new equipment is to be installed in existing cabinets. All costs associated with these cabinet modifications shall be considered subsidiary to the various bid items.

The locations of all ground boxes shall be as shown on the plans and may be moved only as approved by the Engineer in writing.

Maintain the median of the freeway in a serviceable condition, free of obstructions, and acceptable to the Engineer. Take special care to eliminate hazards to the traveling public.

Remove any obstructions to existing drainage due to the Contractor's operation as required at the Contractor's entire expense.

Do not mix materials, store materials, store equipment, or repair equipment on top of concrete pavement or bridge decks.

Remove daily all construction related debris from the R. O. W. to a dump site approved by the Engineer in writing.

Replace all pavement, shoulders and metal beam guard fence damaged by Contractor’s forces during construction at no cost to the state.

Ensure existing curb, and curb and gutter is not discolored or damaged during construction operations. In the event of discoloration or damage, clean, replace, or repair as directed, at no cost to the State.

All Contractor’s vehicles shall be clearly identified with company name plates when working on the project.

Item 5. Control of the Work

When supplementary shop drawings, shop details, erection drawings, working drawings, forming plans, or other drawings are required, the drawings will be prepared and submitted on sheets 8-1/2 by 11 inches, 17 by 22 inches, or full size drawings reduced to half scale if completely legible. If, in the opinion of the Engineer, the drawings are not completely legible, they will be prepared and submitted on sheets 22 by 34 inches, with a 1-1/2 inch left margin, and 1/2 inch top, right, and bottom margins.

Submit all sheets with a title in the lower right hand corner. The title must include the sheet index data shown on the lower right corner of the project plans, name of the structure or element or stream, sheet numbering for the shop drawings, name of the fabricator and the name of the Contractor.

Item 7. Legal Relations and Responsibilities

No significant traffic events identified.

Item 8. Prosecution and Progress

Working days will be computed and charged in accordance with article 8.3.1.1. 'Five-Day Workweek.'

The start of work will be delayed 90 calendar days after the authorization date to begin work to allow time for the procurement of materials.

Night work is allowed with approval.

Item 8.5. Project Schedules

Contractor shall submit the schedule as a bar chart, include all planned work activities and sequences and show Contract completion within the number of working days specified for each Work Order. Submit an updated hard copy when changes to the schedule occur or when requested. The Estimate will be held if schedule is not submitted.

Item 8.6. Failure to Complete Work on Time

The amount assessed for liquidated damages will be based on the total value of original contract, in accordance with Special Provision 000-658, not the estimated amount on individual work orders.

Item 164. Seeding for Erosion Control

Apply seeding required between December 1 and January 31 using seed types and mixtures as shown in Item 164.2.1, Table 3. If, in the opinion of the Engineer, this does not provide an effective vegetative cover, apply "straw or hay mulch" as specified in Article 164.3.2, "Straw or Hay Mulch Seeding" as soon as possible. After February 1 apply warm season seeding in order to establish a permanent protective vegetative cover.

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Item 166. Fertilizer

Fertilize all areas of project to be seeded.

Item 168. Vegetative Watering

Furnish and install an approved rain gauge at the project site, as directed. Furnishing and installation of the rain gauge will not be paid for directly, but will be subsidiary to Item 168.

Apply vegetative watering for an establishment period of thirteen weeks following installation of seed, at a rate of 1/2 inch of water depth per week (approximately 13,030 gallons per acre). During the first four weeks after seeding, apply water twice per week, on non-consecutive days, each at half the weekly application rate. For the remainder of the establishment period, apply vegetative watering once per week during the months of January through June or September through December, at the weekly application rate; apply watering twice per week, on non-consecutive days during the months of July and August, each at one-half the weekly application rate.

Average weekly rainfall rates for the District are:

January—0.39"	April—0.86"	July—0.48"	October—0.68"
February—0.46"	May—1.00"	August—0.47"	November—0.46"
March—0.48"	June—0.63"	September—0.74"	December—0.37"

Item 400. Excavation and Backfill for Structures

Drilling, boring, and trenching through any type of rock or soil is subsidiary to the various bid items. No additional compensation will be paid to the contractor for the removal of rock or any other obstruction during excavation, trenching, jacking, boring, or drilling and for any additional equipment, materials, labor, tools, or incidentals required to complete the work.

Item 416. Drilled Shaft Foundations

Contractor shall stake foundations as shown on plans. Engineer or Engineers designee will verify and approve staked locations before installing foundations.

Item 421. Hydraulic Cement Concrete

Notify the Engineer 48 hours in advance of placing concrete. Do not place concrete without an inspector present unless approved.

Contractor personnel performing job-control (QC) testing on concrete must be ACI certified and maintain certification. Provide a copy of all personnel certification papers to the Engineer at the

preconstruction meeting. The Engineer may require the Contractor's testers to provide the certification papers upon arrival and before testing at the job site. Certified testers will be required to participate with certified TxDOT personnel annually for slump (Tex-415-A), air content (Tex-416-A), compression testing (Tex-418-A), and capping cylinders (Tex-450-A) to retain their certification on TxDOT projects.

Furnish a hard copy of all testing equipment calibration reports at the preconstruction meeting when non-TxDOT equipment is used to test concrete. Furnish updated reports as equipment is calibrated through the project contract. The calibration frequency will match TxDOT's and will apply for each piece of equipment as follows:

Slump Cone - Annual
Air Meter - Every 3 months
Compression Tester - Annual
Beam breaker - Annual

The Engineer may allow the use of local commercial laboratories under contract to provide these services. The Commercial Laboratory must fulfill requirements listed above prior to performing any work.

Item 502. Barricades, Signs and Traffic Handling

The total quantity for Barricades, Signs, and Traffic Handling in the proposal is not guaranteed. Quantities for Barricades, Signs, and Traffic Handling will be determined and applied on a work order basis.

Do not close a lane, shoulder, or ramp during the peak hours of 6:00 a.m. to 9:00 a.m. and 3:00 p.m. to 7:00 p.m. weekdays.

Provide minimal interference to traffic during construction operations.

One week prior to any ramp or roadway lane closures, place message boards or sign panels, as shown on the plans or as directed by the Engineer, to inform the public of such closure.

The following Holiday/Event lane closure restriction requirements apply to this project:

No work that restricts or interferes with traffic shall be allowed between 3 PM on the day preceding a Holiday or Event and 9 AM on the day after the Holiday or Event.

Holiday Lane Closure Restrictions	
New Year's Eve and New Year's Day (December 31 through January 1)	3 PM December 30 through 9 AM January 2

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Easter Holiday Weekend (Friday through Sunday)	3PM Thursday through 9 AM Monday
Memorial Day Weekend (Friday through Monday)	3 PM Thursday through 9 AM Tuesday
Independence Day (July 3 through July 5)	3 PM July 2 through 9 AM July 6
Labor Day Weekend (Friday through Monday)	3 PM Thursday through 9 AM Tuesday
Thanksgiving Holiday (Wednesday through Sunday)	3 PM Tuesday through 9 AM Monday
Christmas Holiday (December 23 through December 26)	3 PM December 22 through 9 AM December 27

Plan work schedules around the appropriate dates above to ensure productive work is performed without lane closures.

Do not leave excavation open overnight.

Do not reduce existing number of lanes open to traffic. Exceptions will only be made during off-peak hours as shown on the plans, or as approved by the Engineer.

The Engineer may direct that operations be curtailed or halted out of consideration for traffic expected to and from public gatherings, which in his opinion may result in undue traffic congestion and delays to the traveling public.

Two weeks prior to any alterations of traffic patterns, provide the Engineer, for his approval, a layout showing all signs, barricades, striping and signalization.

The Engineer may request additional signing not shown and this will be considered subsidiary to the pertinent bid items.

A qualified flagger may be required during certain phases of construction, and shall be equipped with the proper reflective clothing and two-way radios, as directed by the Engineer. Notify the proper city traffic and transportation Department officials when major traffic changes are to be made. The notification must be made three days prior to the change. Use plastic drums in accordance with the plans and manufacturer's recommendations as approved by the Engineer.

Close one adjacent lane in both directions, as directed by the Engineer, at locations where the Contractor is required to replace DMS signs in the center median.

Existing signs are to remain as long as they do not interfere with construction and they do not conflict with the traffic control plan.

Any sign not detailed in the plans but called for in the layout shall be as shown in the current “Standard Highway Sign Designs for Texas”.

When traffic is obstructed, arrange warning devices in accordance with arrangements indicated in the latest edition of the "Texas Manual on Uniform Traffic Control Devices”.

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.

Item 506. Temporary Erosion, Sedimentation, and Environmental Controls

The SW3P for this project shall consist of using the following items as directed:

- Temporary Sediment Control Fence
- Biodegradable Erosion Control Logs

Remove accumulated sediment and/or replace SW3P controls when the capacity has been reduced by 50% or when the depth of sediment at the control structure exceeds one foot.

Item 618. Conduit

Use materials from prequalified producer list as shown on the Texas Department of Transportation (TxDOT) materials producer list, category “Roadway Illumination and Electrical Supplies.”

Place conduit runs behind curbs at all locations where curbs exist. Place conduit along the frontage road a minimum clearance of six (6) feet from the back of curbs, unless such clearance shall interfere with "straight through" conduit placement, conflict with retaining walls or utilities, or introduce additional or unnecessary right angle bends into the cable path. Adjust, with Engineer's approval, the placement of conduit and ground boxes to ensure the "straight through" conduit concept and avoid the aforementioned interference; conflict, or introduction of additional, unnecessary bends.

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Refer to TxDOT standard ITS(27)-16 for trenching of ITS conduit regarding depth of conduit, spacing of conduit, flowable backfill, and concrete encasement. Flowable backfill shall be subsidiary to Item 618.

Install a continuous bare or green insulated copper wire no. 8 AWG or larger in every conduit throughout the electrical system in accordance with the electrical detail sheets, and the latest edition of the National Electrical Code.

For power carrying conduit, provide a continuous grounded system. If PVC or HDPEC is used, the continuous system shall be accomplished by running 1 - #8 AWG bare copper wire in conduit between foundations and grounding it at each foundation ground rod. If rigid metal conduit is used, it shall be bonded to form a continuous system.

After installing conduit and pulling conductor or communication cable, leave a high tensile strength polyester fiber pull tape in the conduit for future use. Subsidiary to Item 618.

All conduit elbows and rigid metal extensions required to be installed on PVC conduit systems will not be paid for separately, but will be considered subsidiary to various bid items.

High-density polyethylene (HDPE) pipe may be threaded and used with threaded PVC connectors or couplings.

PVC conduit systems that snap or lock together without glue that are designed and UL listed to be used for bored PVC electrical conduit applications will be allowed for bored PVC Schedule 80, when approved by the Engineer. No additional compensation will be paid to the Contractor when these specific purpose conduit systems are substituted for this purpose.

Conduit entry to all ITS ground boxes shall be perpendicular to the perforated sidewall. Do not use 90 degree or right angle fittings to achieve perpendicular conduit alignment. Where approved by the Engineer, use 3 foot minimum long radius bends. Where conduit is placed by jacking or boring, adjust the conduit placement to accommodate perpendicular entry and long sweep bends.

Seal all conduits in the cabinets with expandable urethane foam.

Place cables in conduit to provide maximum use of each conduit’s capacity, as defined by the NEC. Each conduit shall be completely filled, according to NEC guidelines, before cables may be placed in another conduit; however, the Contractor is still responsible for mandated cable separations as directed by the Engineer (e.g., placing power cables in separate conduit from communications cables).

Backfill all open trench/excavation by dusk. Do not leave any open trench/excavation overnight.

The plans show the conduit runs numbered and specific cables in specific conduit runs. The purpose of these notes is to instruct the Contractor on how to group the cables in the conduit runs and not to specify the exact conduit that is to carry the cables i.e., the numbering system used is arbitrary and may be set by the Contractor with Engineer's approval.

Drilling, boring, and trenching through any type of rock or soil is subsidiary to the various bid items. No additional compensation will be paid to the contractor for the removal of rock or any other obstruction during excavation, trenching, jacking, boring, or drilling and for any additional equipment, materials, labor, tools, or incidentals required to complete the work.

Item 620. Electrical Conductors

Do not use non-certified persons to perform electrical work. Electrical certification for this project will be as per Item 7 of the current Texas Standard Specifications and any Special Provisions to Item 7.

All cable ties shall be securely fastened by rivet or other mechanical means. Do not use double-sided adhesive stick-ons or pressure clamps.

Include extra cable length in each run to provide adequate slack at each ground box or cabinet, as determined by the Engineer.

All electrical work shall be in conformance with latest edition of the National Electrical Code (NEC), and TxDOT Standards.

All power conductors, shielded twisted wire pair cables, coax cables, and control cables, shall be color-coded consistently or permanently labeled between all connections and splices to ensure immediate identification. Submit a chart or list identifying all cables and conductors in a logical and sequential manner prior to installation for the Engineer's approval.

When pulling cables, conductors or innerducts through conduit, lubricate the cables, conductors or innerducts with a lubricant generally used for this purpose. The lubricant shall be non-aqueous, non-toxic and non-conductive and shall not harm the conduit or the insulation of cable.

Bond the grounding conductors that share the same conduit, junction box, ground box or structure together at every accessible point in accordance with the electrical detail sheets, and the latest edition of the National Electrical Code, and as per TxDOT Standards.

Item 627. Treated Timber Poles

Use timber heights, as shown on the plans and in the material summary, for bidding purposes only. Coordinate pole locations, and make field measurements before construction to ensure a vertical clearance of 19 feet from the highest point on the roadway surface to the span.

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Determine the field measurements and elevations from the actual field location of the poles, considering all above and below ground utilities and existing roadway elevations.

Item 628. Electrical Services

Locations of service poles as shown on the layouts are approximate. Contact the electric provider for electric service and for exact locations. Locations of the service poles are subject to approval by the Engineer. The service pole for each location shall supply 120/240v/ 3 wire single phase circuit.

The street address of the electrical service and "Surveillance" will be stenciled in one inch high black letters on the cover of the service enclosure.

Do not apply power to service poles until approved by the Engineer. Verify all power locations. Place a decal stating "Danger/High Voltage ARC Flash" on the cover of the enclosure above the street address of the electrical service and surveillance lettering. The size of the decal and lettering shall be as approved by the Engineer.

No photo-electric control, lighting contactor and control unit- "manual-off-automatic" shall be needed in the service pole.

Before installing any electrical service, verify all metering equipment requirements with the electric service provider. The Contractor shall provide a commercial grade, meter base with by-pass switch as part of this item when required by the electric provider.

Verify existing service or activate the service, if necessary, as directed by the Engineer.

All work and incidentals performed, as described, shall not be paid for directly but shall be considered subsidiary to Item 628.

Item 6001. Portable Changeable Message Signs

Provide all portable changeable message signs and arrow panels with a photoelectric device to allow for automatic dimming of operations to approximately 50% of their normal brightness when ambient light drops to approximately five footcandles, and then increase back again for daytime operations.

Two electronic portable changeable message sign unit(s) will be required. Individual or collective use of signs will be required by the Engineer when deemed necessary to supplement the traffic control plan.

Each sign must have programmed in its permanent memory the following 15 messages:

1. Exit Closed Ahead
2. Use Other Routes
3. Right Lane
4. Left Lane
5. Closed Ahead
6. Two Lane
7. Detour Ahead
8. Thru Traffic
9. Prepare To Stop
10. Merging Traffic
11. Expect 15 Minute Delay
12. Max Speed ** MPH
13. Merge Right
14. Merge Left
15. No Exit Next ** Miles

Item 6005. Testing, Training, Documentation, Final Acceptance and Warranty

It is the policy of the Department to require performance testing of all materials and equipment not previously tested and approved. If technical data is not considered adequate for approval, samples may be requested for test by the Engineer. The contract period will not be extended for time lost or delays caused by testing prior to final Department approval of any items.

Four (4) complete sets of operation and maintenance manuals shall be provided prior to the installation of the equipment. Schematics shall be updated at the end of the job to show "as-built" condition.

Item 6007. Intelligent Transportation System (ITS) Fiber Optic Cable

Furnish and install Corning fiber optic cable or approved equal.

Individually and uniquely identify the fiber optic cable in ground boxes and cabinets with durable, permanent, high visibility marking, such as reflective tape or label. This marking must identify the type of fiber optic cable (i.e. single-mode and fiber counts).

Document the designation of each connector on labels and charts for the preterminated patch panels. Place charts in the cabinet in a heavy plastic envelope approved by the Engineer.

Maintain the integrity of the existing fiber optic and other cable systems. If the cables are damaged during construction, replace or repair the damaged cables, as directed by the Engineer, at Contractor's own expense. The replacement or repair method must be approved by the Engineer, prior to implementation. If the fiber optic cable is damaged, repair the damaged cable within 4 hours with Contractor's own force or be responsible to pay a third party or the

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Department for the repair. Depending on the severity of the damage, replace the damaged fiber, as directed by the engineer, at Contractor's own expense. Maintaining the integrity of the existing fiber optic and other cable systems during the construction shall be subsidiary to this Item.

When shown in the plans and as directed by the Engineer, provide a single continuous 1/C #8 AWG bare copper wire (tracing cable) per conduit run, pulled in the same conduit where fiber optic cable is installed. It is not to be connected or bonded to the equipment grounding conductors (EGC) or equipment grounding system or to be joined together in the ground or junction boxes. Ensure that a 5-foot service loop of the #8 AWG bare copper wire is pulled up, coiled and tied in each ITS cabinet to provide conduit trace capability. Coil 10 feet of #8 AWG bare copper wire in the base of each DMS pole.

Furnish and install all necessary fiber optic jumpers with ST connectors, fiber optic jumpers with ST to LC connectors at locations as shown in the plans and as directed by the Engineer. Fiber optic jumpers will be paid by each jumper furnished and installed.

Install or replace Department furnished SFPs at locations as shown in the plans and as directed by the Engineer. Installation or replacement of SFPs is subsidiary to this item.

Removal of cables shall be paid by the length of the conduit run regardless of number of cables in the conduit run, and shall not be paid by each cable removed. In addition, removal of #8 AWG electrical conductor (trace cable) shall be paid subsidiary to "Remove Fiber Optic Cable."

All materials, which are deemed salvageable by the Engineer, shall be the property of the Department and shall be transported to, and stored at TxDOT's Signal Shop Section, 2501 SW Loop 820, Fort Worth, TX 76133.

No payment shall be made directly for all the above mentioned work, or other incidentals required to complete the work, but shall be considered subsidiary to this item.

Item 6010. Closed Circuit Television (CCTV) Field Equipment

This item shall also include, but is not limited to the following subsidiary items:

- Connecting harnesses of appropriate length and terminated with matching connectors for interconnection with communications system equipment
- Removal of CCTV Multiconductor Cable or Cat cables (Regardless of the number of cables)
- Cat6 cables
- PoE++ Injectors

No payment shall be made directly for all the above mentioned work and for the subsidiary items furnished and installed, materials, or other incidentals required to complete the work, but shall be considered subsidiary to this item.

The furnishing and installation of Cat6 PoE cable will be paid under Item 6004 6031 ITS COM CBL (ETHERNET).

Item 6016. ITS Multi-Duct Conduit System

After installing conduit and pulling cable, leave a high tensile strength polyester fiber pull tape in the conduit for future use. Also install pull tape in all empty conduits, including empty inner ducts.

Refer to TxDOT standard ITS(27)-16 for trenching of ITS conduit regarding depth of conduit, spacing of conduit, flowable backfill, and concrete encasement. Flowable backfill shall be subsidiary to Item 6016.

Drilling, boring, and trenching through any type of rock or soil is subsidiary to the various bid items. No additional compensation will be paid to the contractor for the removal of rock or any other obstruction during excavation, trenching, jacking, boring, or drilling and for any additional equipment, materials, labor, tools, or incidentals required to complete the work.

Item 6027. Preparation of Existing Conduits, Ground Boxes, or Manholes

The existing ground boxes are welded shut, buried, or sealed with a concrete pad. The Contractor shall be responsible for access to the existing ground boxes and restoring to original photographically documented conditions (by the Contractor). This includes any removals necessary to access the ground box as well as concrete, welding, and repairing galvanized welded areas in accordance with Item 445 “Galvanizing,” etc., to establish the ground box lid to original conditions after conduit and cable work is complete. The Contractor is responsible for the security of both new and existing ground boxes and ground box contents such as wiring, fiber optic cables, splice closures, etc. while they are uncovered or not welded. Seal ITS ground boxes by tack welding two corners for at least two inches on each side after work is completed and the seals galvanized.

Fill around conduit the voids or abandoned concrete openings with concrete grout in all ground boxes with concrete walls.

No payment shall be made directly for all the above mentioned work, or other incidentals required to complete the work, but shall be considered subsidiary to this item.

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Item 6028. Installation of Dynamic Message Sign System

The subsidiary items shall consist of, but is not limited to the following:

- DMS mounting supports
- DMS ground mounted cabinets installation
- Concrete foundation for DMS ground mounted cabinets
- DMS cabinet supports
- Installation of pole mounted DMS cabinets, LB connectors, Rigid Metal Conduit.
- LFMC conduits
- Junction boxes
- J-Bolts, Bolts, Nuts, Washers, and all the hardware needed for the installation of the DMS and cabinets
- Cat 6 Cables
- Installation of MM Fiber Optic Jumpers from the cabinet controller to the DMS sign (MM Fiber Optic Jumpers are provided by TxDOT)

Quantities for subsidiary items will be shown on the plans for each work order.

The Contractor is responsible for all DMS signs, DMS cabinets, and their components during receiving, storage, transportation, and final installation. If any of the DMS signs, DMS cabinets, or their components are damaged, the Contractor will be required to repair or replace the damaged DMS signs, DMS cabinets, or their components at the Contractor’s expense

Furnish and install all items, materials, hardware, and incidentals, whether or not specifically shown on the plans which may be necessary for the installation of the DMS and DMS cabinets including but not limited to DMS mounting supports, Concrete Foundations, DMS cabinet supports, junction boxes, and Liquidtight Flexible Metal Conduit (LFMC).

For the DMS foundation mounted cabinet, furnish and install the cabinet foundation according to ITS(21)-15 Type 4 cabinet with maintenance pad for dual-door cabinets.

No payment shall be made directly for all the above mentioned work and for the subsidiary items furnished and installed, materials, or other incidentals required to complete the work, but shall be considered subsidiary to this item.

Item 6062. Intelligent Transportation System (ITS) Radio

This item shall also include, but is not limited to the following subsidiary items:

- Connecting harnesses of appropriate length and terminated with matching connectors for interconnection with communications system equipment.

- Removal or relocation of power/signal cable(s) (regardless of number of cables required).
- Removal or relocation of antennas.
- Cat 6 cables
- PoE++ 56 V injectors
- Omni Antenna for single 900 MHz radio Connectorized Omnidirectional
- Yagi Antenna for single 900 MHz radio Connectorized Unidirectional
- Parabolic Kit Antenna (Dual Polarity) for single 5 GHz radio Connectorized Parabolic
- Additional Flat Panel Kit Antenna (Dual Polarity) for dual 5 GHz radio Integrated Unidirectional
- Parabolic Kit Antenna (Dual Polarity) and Additional Parabolic Kit Antenna (Dual Polarity) for dual 5 GHz radio Connectorized Parabolic

Quantities for subsidiary items will be shown on the plans for each work order.

No payment shall be made directly for all the above mentioned work and for the subsidiary items furnished and installed, or other incidentals required to complete the work, but shall be considered subsidiary to this Item.

The furnishing and installation of Cat6 PoE cable will be paid under Item 6004 6031 ITS COM CBL (ETHERNET).

All materials, which are deemed salvageable by the Engineer, shall be the property of the Department and shall be transported to, and stored at TxDOT's Traffic Management Maintenance Section, 2501 SW Loop 820, Fort Worth, TX 76133.

Item 6163. Remove Existing Cables

Removal of existing cables (power) and removal of existing cables (communication) shall be paid by the length of the conduit run regardless of type or number of cables in the conduit run, and shall not be paid by each cable removed.

Item 6185. Truck Mounted Attenuators (TMA)

No additional shadow vehicle(s) with TMA other than those shown in the TCP Standard Sheets and as detailed on the General Note(s) of these Standard Sheets.

Therefore, 1 total shadow vehicle with TMA will be required for this type of work. The contractor will be responsible for determining if one or more of these operations will be ongoing at the same time to determine the total number of TMAs needed for the project.

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Item 6186. Intelligent Transportation System (ITS) Ground Box

The Department requires all ground boxes be properly drained. If the engineer determines a ground box is not properly drained because it is placed to match the slope of the existing grade, reconstruct and/or relocate the drain hole and cushion (washed gravel or crushed stones), as required, to ensure efficient evacuation of fluids from the ground box. The contractor is advised, therefore, to make any adjustments required for efficient drainage prior to initial placement, to avoid any necessary re-work.

The Contractor is responsible for the security of the new ground boxes and ground box contents such as wiring, fiber optic cables, splice closures, etc. while they are uncovered or not welded. New ground boxes will be sealed by tack welding two corners for at least two inches on each side after work. Repair galvanized welded areas in accordance with Item 445 "Galvanizing,"

No payment shall be made directly for all the above mentioned work, or other incidentals required to complete the work, but shall be considered subsidiary to this item.

Class "A" concrete design shall be a Fort Worth District concrete approved design.

Item 6304. Radar Vehicle Sensing Device (RVSD)

This item shall also include, but is not limited to, the following subsidiary items:

- Connecting harnesses of appropriate length and terminated with matching connectors for interconnection with communications system equipment
- RVSD cable(s) (regardless of number of cables required)
- Removal of RVSD cable(s)(regardless of number of cables)

Quantities for subsidiary items will be shown on the plans for each work order.

No payment shall be made directly for all the above mentioned work and for the subsidiary items furnished and installed, materials, or other incidentals required to complete the work, but shall be considered subsidiary to this item.

Item 6305. Lane-Use Control Signal System Equipment

This item shall also include, but is not limited to, the following subsidiary items:

- Removal of mounting brackets and hardware

Quantities for subsidiary items will be shown on the plans for each work order.

When removing the LCS Signal Unit, care needs to be taking to ensure that no piece of equipment or hardware can fall onto traffic.

No payment shall be made directly for all the above mentioned work or other incidentals required to complete the work, but shall be considered subsidiary to this Item.

Item 6331. Remove Dynamic Message Sign System

This item shall also include, but is not limited to, the following subsidiary items:

- Removal of pole mounted cabinets
- Removal of power and communication cables from pole mounted cabinet to DMS sign
- Removal of flexible metal conduit

Quantities for subsidiary items will be shown on the plans for each work order.

No payment shall be made directly for all the above mentioned work or other incidentals required to complete the work, but shall be considered subsidiary to this Item.

Removal of Overhead Sign Support (Balance Tee) will be paid under Item 650, “Overhead Sign Supports.”

Item 6366. Installation of Wrong Way Driver System Equipment

A 3 inch strip of red reflective sheeting shall be placed on all Wrong Way Driver System Equipment posts. This sheeting shall be placed directly below the signs for the entire length of the sign post facing wrong way traffic. Sheeting shall conform to the requirements of Item 636. Clean posts with Isopropyl Alcohol and let it dry before sheeting installation.

Furnish and install single pole non-fused watertight breakaway electrical connectors for frangible pedestal pole bases, as shown on TxDOT's MPL in the file "Roadway Illumination and Electrical Supplies." Approved models are listed under Item 685. For ungrounded (hot) conductors, install a breakaway connector with a dummy fuse (slug). For grounded (neutral) conductors, install a breakaway connector with a white colored marking and a permanently installed dummy fuse (slug).

No payment shall be made directly for all the above mentioned work and the material furnished and installed, or other incidentals required to complete the work, but shall be considered subsidiary to this item.

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Miscellaneous

TxDOT personnel will verify network communications to the work site from an appropriate ITS cabinet, satellite building, or from TransVision. If network communications fail, the Contractor will correct the fault so that successful communication is established. The Contractor will correct all problems related to his work which develop during the test at no additional cost to the state.

Reference to any specific manufacturer's name, make or number for any item of equipment or material necessary to meet the requirements of the specifications and the plans is intended to be descriptive but not mandatory and is intended to indicate the type of equipment or materials that will be acceptable. The type of equipment or materials that will be acceptable shall be subject to acceptable test results, by the Engineer or his named representative, at the time of product installation. However, provide all like items on this contract to be identical and from the same manufacturer.

Provide four copies of descriptive manuals and brochures for each type of electronic equipment and apparatus proposed for this project. These documents shall contain sufficient technical data for complete evaluation. Incomplete submittals will not be accepted. Describe the quality, function and capability of each deliverable item. Submit originals or copies equal in quality to the originals manuals or brochures. Where a brochure describes several similar items, highlight the specific item being submitted. Where an item has several options or accessories, highlight the options or accessories he intends to deliver. Bond all manuals, brochures, and data sheets relating to a bid item together in a folder. Identify on the cover with the TxDOT contract number, title and bid item number.

Submit four copies of detailed equipment submittals and shop drawings for each fabricated item proposed for this project within thirty days after the authorization to begin work. Submit these equipment submittals and drawings to contain all information required for complete evaluation and fabrication in accordance with the plans and specifications. Submit shop drawings on sheets that are 11 inches in height and 17 inches long and ensure that they are completely clear and legible. Stamp the drawings with Contractor's approval, sequentially numbered and identified as to TxDOT contract number, title and bid item number.

The Engineer, upon approval of the above submittals, will indicate any correction to the details in the submittals.

Correct any errors in the submittals, as directed by the Engineer, and if required, shall resubmit to the Engineer four copies of the same. Begin work upon approval of the corrected drawings and equipment. No change will be permitted in the list of equipment or shop drawings once approved, unless authorized by the Engineer in writing.

Equipment will not be accepted for delivery or any payment made until the equipment, materials lists and shop drawings have been approved by the Engineer. Approval by the Engineer does not

relieve the Contractor of his responsibilities to meet the requirements of the specifications and plans.

The TxDOT, through its authorized representative, retains the right to inspect all structures, equipment and materials used in the project before, during and after installation, also the right to inspect the work during the process of fabrication or manufacture for the purpose of determining if the plans and specifications upon which the award was made are being complied with and being satisfied as to quality of the material and workmanship. Such inspection will not release the manufacturer from strict compliance with specifications when the work is finally completed and offered for acceptance.

Provide each field cabinet with three copies of the final as-built cabinet wiring diagrams. Deliver a Mylar reproducible of the cabinet wiring diagrams showing all field changes incorporated by the Contractor to the Engineer.

Provide system support during the entire project. This includes any required design reviews, complete "parts and labor" on-site maintenance until final acceptance by the state, operational support during system integration and manufacturer's warranties and guarantees at no additional cost to the state.

Conduct design reviews of the ITS system within the scope of the project as required. Provide review comments within five business days to the Engineer, at no additional cost to the State. The Engineer will review and make recommendations and/or corrections as needed.

The Contractor is responsible for all new materials and equipment furnished and installed, as well as existing equipment modified as part of this contract, until final acceptance of the system. The Contractor is responsible for the replacement of equipment, wire, and fiber optic cable that fails due to all causes including theft, vandalism and "knock downs" at no cost to the State.

Designate an ITS supervisor who shall be responsible for the ITS project and serve as the Contractor's official contact with the Department. This ITS supervisor shall be on-site from the beginning of the ITS construction until final system acceptance. Supplement the ITS supervisor's support with the services of qualified Engineers and the services of vendor technical representatives for the duration of the project.

Upon final system acceptance, furnish a set of as-built plans which shall show the actual equipment installation and construction details.

Provide complete on-site parts and labor support for the furnishing and the installation of the Intelligent Transportation Systems for the duration of the entire project and during the warranty period. During the project, make any adjustments or repairs which may be required and correct any defects or damages that may occur at Contractor expense.

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During the warranty period, furnish parts and labor required to repair (including Traffic Control if needed), on-site, any manufacturer's defects (materials or workmanship), damage caused by manufacturer's defects and damage caused by the Contractor during the performance of warranty work. Natural disasters or other events not directly controllable by the Contractor are specifically exempted from warranty.

During the test period, make any adjustments or repairs which may be required and remedy any defects or damages that may occur at Contractor expense.

No time charges will be assessed during the 90 days test period for each work order, provided all other work is completed to the satisfaction of the Engineer.

QUANTITY SHEET

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HIGHWAY Various

		CONTROL SECTION JOB		**0902-90-108**		TOTAL EST.	TOTAL FINAL
		PROJECT ID		**A00064302**			
		COUNTY		**Tarrant**			
		HIGHWAY		**Various**			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	164-6027	CELL FBR MLCH SEED(PERM)(URBAN)(CLAY)	SY	1,000.000		1,000.000	
	164-6031	CELL FBR MLCH SEED(TEMP)(COOL)	SY	1,000.000		1,000.000	
	168-6001	VEGETATIVE WATERING	MG	300.000		300.000	
	416-6004	DRILL SHAFT (36 IN)	LF	40.000		40.000	
	416-6005	DRILL SHAFT (42 IN)	LF	30.000		30.000	
	416-6006	DRILL SHAFT (48 IN)	LF	300.000		300.000	
	416-6007	DRILL SHAFT (54 IN)	LF	75.000		75.000	
	416-6008	DRILL SHAFT (60 IN)	LF	60.000		60.000	
	416-6030	DRILL SHAFT (TRF SIG POLE) (24 IN)	LF	24.000		24.000	
	432-6005	RIPRAP (CONC) (CL A)	CY	8.750		8.750	
	432-6045	RIPRAP (MOW STRIP)(4 IN)	CY	10.000		10.000	
	500-6001	MOBILIZATION	LS	100.00%		100.00%	
	502-6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	36.000		36.000	
	506-6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	250.000		250.000	
	506-6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	250.000		250.000	
	506-6042	BIODEG EROSN CONT LOGS (INSTL) (18")	LF	250.000		250.000	
	506-6043	BIODEG EROSN CONT LOGS (REMOVE)	LF	250.000		250.000	
	540-6001	MTL W-BEAM GD FEN (TIM POST)	LF	300.000		300.000	
	540-6006	MTL BEAM GD FEN TRANS (THRIE-BEAM)	EA	1.000		1.000	
	540-6016	DOWNSTREAM ANCHOR TERMINAL SECTION	EA	3.000		3.000	
	540-6041	MTL W-BEAM GD FEN (NESTED)(TIM POST)	LF	25.000		25.000	
	544-6001	GUARDRAIL END TREATMENT (INSTALL)	EA	3.000		3.000	
	613-6005	HI MST IL POLE (150 FT)(80 MPH)	EA	2.000		2.000	
	618-6023	CONDT (PVC) (SCH 40) (2")	LF	50.000		50.000	
	618-6024	CONDT (PVC) (SCH 40) (2") (BORE)	LF	50.000		50.000	
	618-6025	CONDT (PVC) (SCH 40) (2") (CONC ENCSE)	LF	50.000		50.000	
	618-6026	CONDT (PVC) (SCH 40) (2") (STL ENCSE)	LF	25.000		25.000	
	618-6029	CONDT (PVC) (SCH 40) (3")	LF	1,000.000		1,000.000	
	618-6030	CONDT (PVC) (SCH 40) (3") (BORE)	LF	100.000		100.000	
	618-6031	CONDT (PVC) (SCH 40) (3") (CONC ENCSE)	LF	50.000		50.000	
	618-6032	CONDT (PVC) (SCH 40) (3") (STL ENCSE)	LF	25.000		25.000	
	618-6033	CONDT (PVC) (SCH 40) (4")	LF	50.000		50.000	
	618-6034	CONDT (PVC) (SCH 40) (4") (BORE)	LF	50.000		50.000	
	618-6035	CONDT (PVC) (SCH 40) (4") (CONC ENCSE)	LF	50.000		50.000	
	618-6036	CONDT (PVC) (SCH 40) (4") (STL ENCSE)	LF	50.000		50.000	
	618-6046	CONDT (PVC) (SCH 80) (2")	LF	50.000		50.000	
	618-6047	CONDT (PVC) (SCH 80) (2") (BORE)	LF	50.000		50.000	

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HIGHWAY Various

		CONTROL SECTION JOB		**0902-90-108**		TOTAL EST.	TOTAL FINAL
		PROJECT ID		**A00064302**			
		COUNTY		**Tarrant**			
		HIGHWAY		**Various**			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	618-6049	CONDT (PVC) (SCH 80) (2") (CONC ENCSE)	LF	50.000		50.000	
	618-6053	CONDT (PVC) (SCH 80) (3")	LF	50.000		50.000	
	618-6054	CONDT (PVC) (SCH 80) (3") (BORE)	LF	100.000		100.000	
	618-6056	CONDT (PVC) (SCH 80) (3") (CONC ENCSE)	LF	50.000		50.000	
	618-6058	CONDT (PVC) (SCH 80) (4")	LF	50.000		50.000	
	618-6059	CONDT (PVC) (SCH 80) (4") (BORE)	LF	50.000		50.000	
	618-6070	CONDT (RM) (2")	LF	50.000		50.000	
	618-6071	CONDT (RM) (2") (BORE)	LF	50.000		50.000	
	618-6074	CONDT (RM) (3")	LF	50.000		50.000	
	618-6075	CONDT (RM) (3") (BORE)	LF	50.000		50.000	
	618-6078	CONDT (RM) (4")	LF	50.000		50.000	
	618-6079	CONDT (RM) (4") (BORE)	LF	50.000		50.000	
	620-6007	ELEC CONDR (NO.8) BARE	LF	1,000.000		1,000.000	
	620-6008	ELEC CONDR (NO.8) INSULATED	LF	300.000		300.000	
	620-6009	ELEC CONDR (NO.6) BARE	LF	100.000		100.000	
	620-6010	ELEC CONDR (NO.6) INSULATED	LF	300.000		300.000	
	620-6011	ELEC CONDR (NO.4) BARE	LF	100.000		100.000	
	620-6012	ELEC CONDR (NO.4) INSULATED	LF	300.000		300.000	
	620-6015	ELEC CONDR (NO.2) BARE	LF	100.000		100.000	
	620-6016	ELEC CONDR (NO.2) INSULATED	LF	300.000		300.000	
	620-6017	ELEC CONDR (NO.1) BARE	LF	100.000		100.000	
	620-6018	ELEC CONDR (NO.1) INSULATED	LF	300.000		300.000	
	620-6019	ELEC CONDR (NO.1/0) BARE	LF	100.000		100.000	
	620-6020	ELEC CONDR (NO.1/0) INSULATED	LF	300.000		300.000	
	620-6021	ELEC CONDR (NO.2/0) BARE	LF	100.000		100.000	
	620-6022	ELEC CONDR (NO.2/0) INSULATED	LF	300.000		300.000	
	620-6023	ELEC CONDR (NO.3/0) BARE	LF	100.000		100.000	
	620-6024	ELEC CONDR (NO.3/0) INSULATED	LF	300.000		300.000	
	624-6010	GROUND BOX TY D (162922)W/APRON	EA	10.000		10.000	
	624-6028	REMOVE GROUND BOX	EA	10.000		10.000	
	625-6003	ZINC-COAT STL WIRE STRAND (3/8")	LF	1,000.000		1,000.000	
	627-6002	TIMBER POLE (CL 2) 40 FT	EA	10.000		10.000	
	627-6003	TIMBER POLE (CL 2) 50 FT	EA	5.000		5.000	
	628-6002	REMOVE ELECTRICAL SERVICES	EA	1.000		1.000	
	628-6194	ELC SRV TY D 120/240 070(NS)SS(N)SP(O)	EA	12.000		12.000	
	628-6195	ELC SRV TY D 120/240 070(NS)SS(N)SP(U)	EA	2.000		2.000	
	628-6250	ELC SRV TY D 120/240 100(NS)SS(N)SP(O)	EA	1.000		1.000	

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HIGHWAY Various

		CONTROL SECTION JOB		**0902-90-108**		TOTAL EST.	TOTAL FINAL
		PROJECT ID		**A00064302**			
		COUNTY		**Tarrant**			
		HIGHWAY		**Various**			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	628-6251	ELC SRV TY D 120/240 100(NS)SS(N)SP(U)	EA	1.000		1.000	
	644-6076	REMOVE SM RD SN SUP&AM	EA	4.000		4.000	
	650-6035	INS OH SN SUP(35 FT BAL TEE)	EA	3.000		3.000	
	650-6204	REMOVE OVERHD SIGN SUP	EA	1.000		1.000	
	654-6006	SIGN WALKWAY (48 IN) WITH HNDRL	LF	138.000		138.000	
	654-6007	REMOVE SIGN WALKWAY	EA	1.000		1.000	
	658-6061	INSTL DEL ASSM (D-SW)SZ 1(BRF)GF2	EA	6.000		6.000	
	672-6008	REFL PAV MRKR TY I-R	EA	56.000		56.000	
	677-6008	ELIM EXT PAV MRK & MRKS (ARROW)	EA	4.000		4.000	
	678-6033	PAV SURF PREP FOR MRK (RPM)	EA	56.000		56.000	
	690-6021	REMOVAL OF TIMBER POLES	EA	10.000		10.000	
	6000-6098	INSTALL CIRCUIT BREAKER	EA	1.000		1.000	
	6000-6099	REPLACE CIRCUIT BREAKER	EA	1.000		1.000	
	6001-6001	PORTABLE CHANGEABLE MESSAGE SIGN	DAY	100.000		100.000	
	6004-6031	ITS COM CBL (ETHERNET)	LF	1,000.000		1,000.000	
	6007-6028	FO CBL (6 SMF)	LF	50.000		50.000	
	6007-6030	FO CBL (6 SMF)(AERIAL)	LF	50.000		50.000	
	6007-6034	FO CBL (6 SMF)(PIGTAIL)	LF	50.000		50.000	
	6007-6036	FO CBL (12 SMF)	LF	50.000		50.000	
	6007-6038	FO CBL (12 SMF)(AERIAL)	LF	50.000		50.000	
	6007-6042	FO CBL (12 SMF)(PIGTAIL)	LF	2,000.000		2,000.000	
	6007-6044	FO CBL (24 SMF)	LF	200.000		200.000	
	6007-6046	FO CBL (24 SMF)(AERIAL)	LF	100.000		100.000	
	6007-6050	FO CBL (36 SMF)	LF	35,000.000		35,000.000	
	6007-6052	FO CBL (36 SMF)(AERIAL)	LF	1,000.000		1,000.000	
	6007-6058	FO CBL (48 SMF)(AERIAL)	LF	100.000		100.000	
	6007-6062	FO CBL (72 SMF)	LF	100,000.000		100,000.000	
	6007-6064	FO CBL (72 SMF)(AERIAL)	LF	2,000.000		2,000.000	
	6007-6068	FO CBL (96 SMF)	LF	100.000		100.000	
	6007-6070	FO CBL (96 SMF)(AERIAL)	LF	50.000		50.000	
	6007-6074	FO CBL (144 SMF)	LF	100.000		100.000	
	6007-6076	FO CBL (144 SMF)(AERIAL)	LF	100.000		100.000	
	6007-6087	FO SPLICE ENCLOSURE (TYPE 1)	EA	50.000		50.000	
	6007-6088	FO SPLICE ENCLOSURE (TYPE 1)(AERIAL)	EA	1.000		1.000	
	6007-6089	FO SPLICE ENCLOSURE (TYPE 2)	EA	5.000		5.000	
	6007-6090	FO SPLICE ENCLOSURE (TYPE 2)(AERIAL)	EA	1.000		1.000	
	6007-6091	FO SPLICE ENCLOSURE (TYPE 3)	EA	1.000		1.000	

QUANTITY SHEET

CONTROLLING PROJECT ID 0902-90-108 **DISTRICT** Fort Worth **COUNTY** Tarrant
HIGHWAY Various

		CONTROL SECTION JOB		**0902-90-108**		TOTAL EST.	TOTAL FINAL
		PROJECT ID		**A00064302**			
		COUNTY		**Tarrant**			
		HIGHWAY		**Various**			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	6007-6092	FO SPLICE ENCLOSURE (TYPE 3)(AERIAL)	EA	1.000		1.000	
	6007-6093	RACK MOUNTED FO SPLICE ENCLOSURE	EA	5.000		5.000	
	6007-6094	FIBER OPTIC FUSION SPLICE	EA	1,000.000		1,000.000	
	6007-6095	FIBER OPTIC PATCH PANEL (6 POSITION)	EA	1.000		1.000	
	6007-6096	FIBER OPTIC PATCH PANEL (12 POSITION)	EA	1.000		1.000	
	6007-6097	FIBER OPTIC PATCH PANEL (24 POSITION)	EA	1.000		1.000	
	6007-6098	FIBER OPTIC PATCH PANEL (36 POSITION)	EA	1.000		1.000	
	6007-6099	FIBER OPTIC PATCH PANEL (48 POSITION)	EA	1.000		1.000	
	6007-6100	FIBER OPTIC PATCH PANEL (72 POSITION)	EA	10.000		10.000	
	6007-6101	FIBER OPTIC PATCH PANEL (96 POSITION)	EA	1.000		1.000	
	6007-6102	RELOCATE FIBER OPTIC CABLE	LF	1,000.000		1,000.000	
	6007-6103	REMOVE FIBER OPTIC CABLE	LF	50,000.000		50,000.000	
	6007-6104	FO CBL (24 SMF)(PIGTAIL)	LF	2,000.000		2,000.000	
	6007-6105	PRETERM FIBER PATCH PANEL (6 POSITION)	EA	5.000		5.000	
	6007-6106	PRETERM FIBER PATCH PANEL (12 POSITION)	EA	50.000		50.000	
	6007-6107	PRETERM FIBER PATCH PANEL (24 POSITION)	EA	50.000		50.000	
	6007-6108	FIBER OPTIC PATCH PANEL UNIT	EA	5.000		5.000	
	6007-6109	FIBER OPTIC JUMPERS	EA	40.000		40.000	
	6008-6046	ITS GRND MNT CAB (TY 6) (CONF 2) (REM)	EA	10.000		10.000	
	6010-6002	CCTV FIELD EQUIPMENT (DIGITAL)	EA	12.000		12.000	
	6010-6004	CCTV MOUNT (POLE)	EA	12.000		12.000	
	6010-6012	RELOCATE CCTV FIELD EQUIPMENT	EA	1.000		1.000	
	6010-6013	REMOVE CCTV FIELD EQUIPMENT	EA	1.000		1.000	
	6016-6006	ITS MULTI-DUCT CND (PVC-40)	LF	5,000.000		5,000.000	
	6016-6007	ITS MULTI-DUCT CND (PVC-40)(BORE)	LF	100.000		100.000	
	6016-6008	ITS MULTI-DUCT CND (PVC-40)(CONC ENCSE)	LF	100.000		100.000	
	6016-6009	ITS MULTI-DUCT CND (PVC-40)(STL ENCSE)	LF	50.000		50.000	
	6016-6010	ITS MULTI-DUCT CND (PVC-80)	LF	100.000		100.000	
	6016-6011	ITS MULTI-DUCT CND (PVC-80)(BORE)	LF	100.000		100.000	
	6016-6012	ITS MULTI-DUCT CND (PVC-80)(CONC ENCSE)	LF	50.000		50.000	
	6016-6013	ITS MULTI-DUCT CND (RMC)	LF	50.000		50.000	
	6016-6015	FIBER OPTIC CABLE ROAD MARKER	EA	100.000		100.000	
	6027-6002	CABLE RACK ASSEMBLY (INSTALL)	EA	10.000		10.000	
	6027-6003	CONDUIT (PREPARE)	LF	100,000.000		100,000.000	
	6027-6004	JUNCTION BOX (INSTALL)	EA	5.000		5.000	
	6027-6008	GROUND BOX (PREPARE)	EA	100.000		100.000	
	6028-6001	INSTALL DMS (POLE MTD CABINET)	EA	2.000		2.000	

QUANTITY SHEET

CONTROLLING PROJECT ID 0902-90-108 **DISTRICT** Fort Worth **COUNTY** Tarrant
HIGHWAY Various

		CONTROL SECTION JOB	0902-90-108		TOTAL EST.	TOTAL FINAL
		PROJECT ID	A00064302			
		COUNTY	Tarrant			
		HIGHWAY	Various			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST. FINAL		
	6028-6002	INSTALL DMS (FOUNDATION MTD CABINET)	EA	1.000	1.000	
	6062-6005	ITS RADIO (SNGL)(900 MHZ)-C-O	EA	1.000	1.000	
	6062-6006	ITS RADIO (SNGL)(900 MHZ)-C-U	EA	1.000	1.000	
	6062-6018	ITS RADIO (SNGL)(5 GHZ)-I-U	EA	4.000	4.000	
	6062-6024	ITS RADIO (SNGL)(5 GHZ)-C-P	EA	1.000	1.000	
	6062-6034	ITS RADIO (DUAL)(5 GHZ/5 GHZ)-I-U	EA	1.000	1.000	
	6062-6040	ITS RADIO (DUAL)(5 GHZ/5 GHZ)-C-P	EA	1.000	1.000	
	6062-6042	RELOCATE ITS RADIO	EA	10.000	10.000	
	6062-6043	REMOVE ITS RADIO	EA	10.000	10.000	
	6064-6010	ITS POLE (30 FT)(90 MPH)	EA	1.000	1.000	
	6064-6017	ITS POLE (30 FT)(REL)	EA	1.000	1.000	
	6064-6018	ITS POLE (30 FT)(REM)	EA	1.000	1.000	
	6064-6019	ITS POLE (40 FT)(90 MPH)	EA	1.000	1.000	
	6064-6037	ITS POLE (50 FT)(90 MPH)	EA	1.000	1.000	
	6064-6055	ITS POLE (60 FT)(90 MPH)	EA	12.000	12.000	
	6064-6062	ITS POLE (60 FT)(REL)	EA	1.000	1.000	
	6064-6063	ITS POLE (60 FT)(REM)	EA	1.000	1.000	
	6064-6076	ITS POLE MNT CAB (TY 1)(CONF 2)	EA	1.000	1.000	
	6064-6077	ITS POLE MNT CAB (TY 1)(CONF 2)(INS)	EA	1.000	1.000	
	6064-6078	ITS POLE MNT CAB (TY 1)(CONF 2)(REL)	EA	1.000	1.000	
	6064-6079	ITS POLE MNT CAB (TY 1)(CONF 2)(REM)	EA	1.000	1.000	
	6064-6084	ITS POLE MNT CAB (TY 2)(CONF 2)	EA	2.000	2.000	
	6064-6086	ITS POLE MNT CAB (TY 2)(CONF 2)(REL)	EA	1.000	1.000	
	6064-6087	ITS POLE MNT CAB (TY 2)(CONF 2)(REM)	EA	1.000	1.000	
	6064-6092	ITS POLE MNT CAB (TY 3)(CONF 2)	EA	12.000	12.000	
	6064-6094	ITS POLE MNT CAB (TY 3)(CONF 2)(REL)	EA	1.000	1.000	
	6064-6095	ITS POLE MNT CAB (TY 3)(CONF 2)(REM)	EA	1.000	1.000	
	6163-6002	REMOVE EXISTING CABLES (POWER)	LF	1,000.000	1,000.000	
	6163-6003	REMOVE EXISTING CABLES (COMMUNICATION)	LF	1,000.000	1,000.000	
	6185-6002	TMA (STATIONARY)	DAY	100.000	100.000	
	6186-6002	ITS GND BOX(PCAST) TY 1 (243636)W/APRN	EA	20.000	20.000	
	6186-6008	ITS GND BOX(PCAST) TY 2 (366036)W/APRN	EA	20.000	20.000	
	6186-6025	REMOVE ITS GROUND BOX	EA	10.000	10.000	
	6280-6001	HIGH MAST ASSEMBLY FOR ITS	EA	2.000	2.000	
	6304-6002	ITS RVSD (DATA COLLECT & WWA) SYS	EA	12.000	12.000	
	6304-6006	ITS RVSD (DC & WWA) (RELOCATE)	EA	1.000	1.000	
	6304-6008	ITS RVSD (DC & WWA) (REMOVE)	EA	1.000	1.000	

QUANTITY SHEET

CONTROLLING PROJECT ID 0902-90-108 **DISTRICT** Fort Worth **COUNTY** Tarrant
HIGHWAY Various

		CONTROL SECTION JOB		**0902-90-108**		TOTAL EST.	TOTAL FINAL
		PROJECT ID		**A00064302**			
		COUNTY		**Tarrant**			
		HIGHWAY		**Various**			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL		
	6305-6008	LCS SIGNAL UNIT (REMOVE)	EA	55.000		55.000	
	6327-6003	INSTALL OF HARD ETHERNET SWITCH	EA	20.000		20.000	
	6331-6001	REMOVE DYNAMIC MESSAGE SIGN SYSTEM	EA	1.000		1.000	
	6366-6001	INST WRONG WAY DRIVER SYSTEM EQUIPMENT	EA	2.000		2.000	
	6399-6001	CELLULAR ROUTER	EA	1.000		1.000	
	06	MATERIAL FURNISHED BY STATE	LS	1.000		1.000	
	08	EROSION CONTROL MAINTENANCE (NON-PART)	LS	1.000		1.000	
		SAFETY CONTINGENCY (NON-PART)	LS	1.000		1.000	

QUANTITY SUMMARY

ITEM	DESCRIPTION	UNIT	QUANTITY
0164 6027	CELL FBR MLCH SEED(PERM)(URBAN)(CLAY)	SY	1,000
0164 6031	CELL FBR MLCH SEED(TEMP)(COOL)	SY	1,000
0168 6001	VEGETATIVE WATERING	MG	300
0416 6004	DRILL SHAFT (36 IN)	LF	40
0416 6005	DRILL SHAFT (42 IN)	LF	30
0416 6006	DRILL SHAFT (48 IN)	LF	300
0416 6007	DRILL SHAFT (54 IN)	LF	75
0416 6008	DRILL SHAFT (60 IN)	LF	60
0416 6030	DRILL SHAFT (TRF SIG POLE) (24 IN)	LF	24
0432 6005	RIPRAP (CONC) (CL A)	CY	8.75
0432 6045	RIPRAP (MOW STRIP) (4 IN)	CY	10
0500 6001	MOBILIZATION	LS	1
0502 6001	BARRICADES, SIGNS AND TRAFFIC HANDLIN	MO	36
0506 6038	TEMP SEDMT CONT FENCE (INSTALL)	LF	250
0506 6039	TEMP SEDMT CONT FENCE (REMOVE)	LF	250
0506 6042	BIODEG EROSN CONT LOGS (INSTL) (18")	LF	250
0506 6043	BIODEG EROSN CONT LOGS (REMOVE)	LF	250
0540 6001	MTL W-BEAM GD FEN (TIM POST)	LF	300
0540 6006	MTL BEAM GD FEN TRANS (THRIE-BEAM)	EA	1
0540 6016	DOWNSTREAM ANCHOR TERMINAL SECTION	EA	3
0540 6041	MTL W-BEAM GD FEN (NESTED)(TIM POST)	LF	25
0544 6001	GUARDRAIL END TREATMENT (INSTALL)	EA	3
0613 6005	HI MST IL POLE (150 FT)(80 MPH)	EA	2
0618 6023	CONDT (PVC) (SCH 40) (2")	LF	50
0618 6024	CONDT (PVC) (SCH 40) (2")(BORE)	LF	50
0618 6025	CONDT (PVC) (SCH 40) (2")(CONC ENCSE)	LF	50
0618 6026	CONDT (PVC) (SCH 40) (2")(STL ENCSE)	LF	25
0618 6029	CONDT (PVC) (SCH 40) (3")	LF	1,000
0618 6030	CONDT (PVC) (SCH 40) (3") (BORE)	LF	100
0618 6031	CONDT (PVC) (SCH 40) (3") (CONC ENCSE)	LF	50
0618 6032	CONDT (PVC) (SCH 40) (3") (STL ENCSE)	LF	25
0618 6033	CONDT (PVC) (SCH 40) (4")	LF	50
0618 6034	CONDT (PVC) (SCH 40) (4") (BORE)	LF	50
0618 6035	CONDT (PVC) (SCH 40) (4") (CONC ENCSE)	LF	50
0618 6036	CONDT (PVC) (SCH 40) (4") (STL ENCSE)	LF	50
0618 6046	CONDT (PVC) (SCH 80) (2")	LF	50
0618 6047	CONDT (PVC) (SCH 80) (2") (BORE)	LF	50
0618 6049	CONDT (PVC) (SCH 80) (2") (CONC ENCSE)	LF	50
0618 6053	CONDT (PVC) (SCH 80) (3")	LF	50
0618 6054	CONDT (PVC) (SCH 80) (3") (BORE)	LF	100
0618 6056	CONDT (PVC) (SCH 80) (3") (CONC ENCSE)	LF	50
0618 6058	CONDT (PVC) (SCH 80) (4")	LF	50
0618 6059	CONDT (PVC) (SCH 80) (4") (BORE)	LF	50
0618 6070	CONDT (RM) (2")	LF	50
0618 6071	CONDT (RM) (2") (BORE)	LF	50
0618 6074	CONDT (RM) (3")	LF	50
0618 6075	CONDT (RM) (3") (BORE)	LF	50
0618 6078	CONDT (RM) (4")	LF	50
0618 6079	CONDT (RM) (4") (BORE)	LF	50
0620 6007	ELEC CONDR (NO. 8) BARE	LF	1,000
0620 6008	ELEC CONDR (NO. 8) INSULATED	LF	300
0620 6009	ELEC CONDR (NO. 6) BARE	LF	100
0620 6010	ELEC CONDR (NO. 6) INSULATED	LF	300
0620 6011	ELEC CONDR (NO. 4) BARE	LF	100
0620 6012	ELEC CONDR (NO. 4) INSULATED	LF	300
0620 6015	ELEC CONDR (NO. 2) BARE	LF	100
0620 6016	ELEC CONDR (NO. 2) INSULATED	LF	300
0620 6017	ELEC CONDR (NO. 1) BARE	LF	100
0620 6018	ELEC CONDR (NO. 1) INSULATED	LF	300
0620 6019	ELEC CONDR (NO. 1/0) BARE	LF	100

QUANTITY SUMMARY

ITEM	DESCRIPTION	UNIT	QUANTITY
0620 6020	ELEC CONDR (NO. 1/0) INSULATED	LF	300
0620 6021	ELEC CONDR (NO. 2/0) BARE	LF	100
0620 6022	ELEC CONDR (NO. 2/0) INSULATED	LF	300
0620 6023	ELEC CONDR (NO. 3/0) BARE	LF	100
0620 6024	ELEC CONDR (NO. 3/0) INSULATED	LF	300
0624 6010	GROUND BOX TY D (162922)W/APRON	EA	10
0624 6028	REMOVE GROUND BOX	EA	10
0625 6003	ZINC-COAT STL WIRE STRAND (3/8")	LF	1,000
0627 6002	TIMBER POLE (CL 2) 40 FT	EA	10
0627 6003	TIMBER POLE (CL 2) 50 FT	EA	5
0628 6002	REMOVE ELECTRICAL SERVICES	EA	1
0628 6194	ELC SRV TY D 120/240 070(NS)SS(N)SP(O)	EA	12
0628 6195	ELC SRV TY D 120/240 070(NS)SS(N)SP(U)	EA	2
0628 6250	ELC SRV TY D 120/240 100(NS)SS(N)SP(O)	EA	1
0628 6251	ELC SRV TY D 120/240 100(NS)SS(N)SP(U)	EA	1
0644 6076	REMOVE SM RD SN SUP&AM	EA	4
0650 6035	INS OH SN SUP(35 FT BAL TEE)	EA	3
0650 6204	REMOVE OVERHD SIGN SUP	EA	1
0654 6006	SIGN WALKWAY (48 IN) WITH HNDRL	LF	138
0654 6007	REMOVE SIGN WALKWAY	EA	1
0658 6061	INSTL DEL ASSM (D-SW)SZ 1(BRF)GF2	EA	6
0672 6008	REFL PAV MARKR TY I-R	EA	56
0677 6008	ELIM EXT PAV MRK & MRKS (ARROW)	EA	4
0678 6033	PAV SURF PREP FOR MRK (RPM)	EA	56
0690 6021	REMOVAL OF TIMBER POLES	EA	10
6000 6098	INSTALL CIRCUIT BREAKER	EA	1
6000 6099	REPLACE CIRCUIT BREAKER	EA	1
6001 6001	PORTABLE CHANGEABLE MESSAGE SIGN	DAY	100
6004 6031	ITS COM CBL (ETHERNET)	LF	1,000
6007 6028	FO CBL (6 SMF)	LF	50
6007 6030	FO CBL (6 SMF)(AERIAL)	LF	50
6007 6034	FO CBL (6 SMF)(PIGTAIL)	LF	50
6007 6036	FO CBL (12 SMF)	LF	50
6007 6038	FO CBL (12 SMF)(AERIAL)	LF	50
6007 6042	FO CBL (12 SMF)(PIGTAIL)	LF	2,000
6007 6044	FO CBL (24 SMF)	LF	200
6007 6046	FO CBL (24 SMF)(AERIAL)	LF	100
6007 6050	FO CBL (36 SMF)	LF	35,000
6007 6052	FO CBL (36 SMF)(AERIAL)	LF	1,000
6007 6058	FO CBL (48 SMF)(AERIAL)	LF	100
6007 6062	FO CBL (72 SMF)	LF	100,000
6007 6064	FO CBL (72 SMF)(AERIAL)	LF	2,000
6007 6068	FO CBL (96 SMF)	LF	100
6007 6070	FO CBL (96 SMF)(AERIAL)	LF	50
6007 6074	FO CBL (144 SMF)	LF	100
6007 6076	FO CBL (144 SMF)(AERIAL)	LF	100
6007 6087	FO SPLICE ENCLOSURE (TYPE 1)	EA	50
6007 6088	FO SPLICE ENCLOSURE (TYPE 1)(AERIAL)	EA	1
6007 6089	FO SPLICE ENCLOSURE (TYPE 2)	EA	5
6007 6090	FO SPLICE ENCLOSURE (TYPE 2)(AERIAL)	EA	1
6007 6091	FO SPLICE ENCLOSURE (TYPE 3)	EA	1
6007 6092	FO SPLICE ENCLOSURE (TYPE 3)(AERIAL)	EA	1
6007 6093	RACK MOUNTED FO SPLICE ENCLOSURE	EA	5
6007 6094	FIBER OPTIC FUSION SPLICE	EA	1,000
6007 6095	FIBER OPTIC PATCH PANEL (6 POSITION)	EA	1
6007 6096	FIBER OPTIC PATCH PANEL (12 POSITION)	EA	1
6007 6097	FIBER OPTIC PATCH PANEL (24 POSITION)	EA	1
6007 6098	FIBER OPTIC PATCH PANEL (36 POSITION)	EA	1
6007 6099	FIBER OPTIC PATCH PANEL (48 POSITION)	EA	1
6007 6100	FIBER OPTIC PATCH PANEL (72 POSITION)	EA	10

ONLY PAY ITEM QUANTITIES ARE SHOWN IN THIS TABLE. REFER TO LAYOUT SHEETS, GENERAL NOTES AND SPECIAL SPECIFICATIONS FOR SUBSIDIARY MATERIAL AND LABOR ITEMS.

STATE OF TEXAS
CARLOS E. MOLINA
97237
LICENSED PROFESSIONAL ENGINEER

Carlos E. Molina

June 4, 2021

QUANTITY SUMMARY

Sheet 1 of 2 Sheets

DIST.	COUNTY		SHEET NO.
FTW	TARRANT		5
CONTROL	SECT.	JOB	HIGHWAY NO.
0902	90	108	VA

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QUANTITY SUMMARY

ITEM	DESCRIPTION	UNIT	QUANTITY
6007 6101	FIBER OPTIC PATCH PANEL (96 POSITION)	EA	1
6007 6102	RELOCATE FIBER OPTIC CABLE	LF	1,000
6007 6103	REMOVE FIBER OPTIC CABLE	LF	50,000
6007 6104	FO CBL (24 SMF)(PIGTAIL)	LF	2,000
6007 6105	PRETERMINATED FIBER PATCH PANEL (6 POSITION)	EA	5
6007 6106	PRETERMINATED FIBER PATCH PANEL (12 POSITION)	EA	50
6007 6107	PRETERMINATED FIBER PATCH PANEL (24 POSITION)	EA	50
6007 6108	FIBER OPTIC PATCH PANEL UNIT	EA	5
6007 6109	FIBER OPTIC JUMPERS	EA	40
6008 6046	ITS GRND MNT CAB (TY 6) (CONF 2) (REM)	EA	10
6010 6002	CCTV FIELD EQUIPMENT (DIGITAL)	EA	12
6010 6004	CCTV MOUNT (POLE)	EA	12
6010 6012	RELOCATE CCTV FIELD EQUIPMENT	EA	1
6010 6013	REMOVE CCTV FIELD EQUIPMENT	EA	1
6016 6006	ITS MULTI-DUCT CND (PVC-40)(4")	LF	5,000
6016 6007	ITS MULTI-DUCT CND (PVC-40)(BORE)	LF	100
6016 6008	ITS MULTI-DUCT CND (PVC-40)(CONC ENCSE)	LF	100
6016 6009	ITS MULTI-DUCT CND (PVC-40)(STL ENCSE)	LF	50
6016 6010	ITS MULTI-DUCT CND (PVC-80)	LF	100
6016 6011	ITS MULTI-DUCT CND (PVC-80)(BORE)	LF	100
6016 6012	ITS MULTI-DUCT CND (PVC-80)(CONC ENCSE)	LF	50
6016 6013	ITS MULTI-DUCT CND (RMC)	LF	50
6016 6015	FIBER OPTIC CABLE ROAD MARKER	EA	100
6027 6002	CABLE RACK ASSEMBLY (INSTALL)	EA	10
6027 6003	CONDUIT (PREPARE)	LF	100,000
6027 6004	JUNCTION BOX (INSTALL)	EA	5
6027 6008	GROUND BOX (PREPARE)	EA	100
6028 6001	INSTALL DMS (POLE MTD CABINET)	EA	2
6028 6002	INSTALL DMS (FOUNDATION MTD CABINET)	EA	1
6062 6005	ITS RADIO (SNGL)(900 MHZ)-C-O	EA	1
6062 6006	ITS RADIO (SNGL)(900 MHZ)-C-U	EA	1
6062 6018	ITS RADIO (SNGL)(5 GHZ)-I-U	EA	4
6062 6024	ITS RADIO (SNGL)(5 GHZ)-C-P	EA	1
6062 6034	ITS RADIO (DUAL)(5 GHZ/5 GHZ)-I-U	EA	1
6062 6040	ITS RADIO (DUAL)(5 GHZ/5 GHZ)-C-P	EA	1
6062 6042	RELOCATE ITS RADIO	EA	10
6062 6043	REMOVE ITS RADIO	EA	10
6064 6010	ITS POLE (30 FT)(90 MPH)	EA	1
6064 6017	ITS POLE (30 FT)(REL)	EA	1
6064 6018	ITS POLE (30 FT)(REM)	EA	1
6064 6019	ITS POLE (40 FT)(90 MPH)	EA	1
6064 6037	ITS POLE (50FT)(90 MPH)	EA	1
6064 6055	ITS POLE (60 FT)(90 MPH)	EA	12
6064 6062	ITS POLE (60 FT)(REL)	EA	1
6064 6063	ITS POLE (60 FT)(REM)	EA	1
6064 6076	ITS POLE MNT CAB (TY 1)(CONF 2)	EA	1
6064 6077	ITS POLE MNT CAB (TY 1)(CONF 2)(INS)	EA	1
6064 6078	ITS POLE MNT CAB (TY 1)(CONF 2)(REL)	EA	1
6064 6079	ITS POLE MNT CAB (TY 1)(CONF 2)(REM)	EA	1
6064 6084	ITS POLE MNT CAB (TY 2)(CONF 2)	EA	2
6064 6086	ITS POLE MNT CAB (TY 2)(CONF 2)(REL)	EA	1
6064 6087	ITS POLE MNT CAB (TY 2)(CONF 2)(REM)	EA	1
6064 6092	ITS POLE MNT CAB (TY 3)(CONF 2)	EA	12
6064 6094	ITS POLE MNT CAB (TY 3)(CONF 2)(REL)	EA	1
6064 6095	ITS POLE MNT CAB (TY 3)(CONF 2)(REM)	EA	1
6163 6002	REMOVE EXISTING CABLES (POWER)	LF	1,000
6163 6003	REMOVE EXISTING CABLES (COMMUNICATION)	LF	1,000
6185 6002	TMA (STATIONARY)	DAY	100
6186 6002	ITS GND BOX(PCAST) TY 1 (243636)W/APRN	EA	20

QUANTITY SUMMARY

ITEM	DESCRIPTION	UNIT	QUANTITY
6186 6008	ITS GND BOX(PCAST) TY 2 (366036)W/APRN	EA	20
6186 6025	REMOVE ITS GROUND BOX	EA	10
6280 6001	HIGH MAST ASSEMBLY FOR ITS	EA	2
6304 6002	ITS RVSD (DATA COLLECT & WWA) SYS	EA	12
6304 6006	ITS RVSD (DC & WWA)(RELOCATE)	EA	1
6304 6008	ITS RVSD (DC & WWA)(REMOVE)	EA	1
6305 6008	LCS SIGNAL UNIT(REMOVE)	EA	55
6327 6003	INSTALL OF HARD ETHERNET SWITCH	EA	20
6331 6001	REMOVE DYNAMIC MESSAGE SIGN SYSTEM	EA	1
6366 6001	INST WRONG WAY DRIVER SYSTEM EQUIPMENT	EA	2
6399 6001	CELLULAR ROUTER	EA	1
06	MATERIAL FURNISHED BY STATE	LS	1
08	SAFETY CONTINGENCY (NON-PART)	LS	1
08	EROSION CONTROL MAINTENANCE (NON-PART)	LS	1

ONLY PAY ITEM QUANTITIES ARE SHOWN IN THIS TABLE. REFER TO LAYOUT SHEETS, GENERAL NOTES AND SPECIAL SPECIFICATIONS FOR SUBSIDIARY MATERIAL AND LABOR ITEMS.

STATE OF TEXAS
CARLOS E. MOLINA
97237
LICENSED
PROFESSIONAL ENGINEER

Carlos E. Molina

May 4, 2021

QUANTITY SUMMARY

Sheet 2 of 2 Sheets

DIST.	COUNTY		SHEET NO.
FTW	TARRANT		6
CONTROL	SECT.	JOB	HIGHWAY NO.
0902	90	108	VA

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THIS SHEET SHOWS A TYPICAL TRAFFIC CONTROL PLAN AND IS NOT MEANT TO REFER TO A SPECIFIC LOCATION, BUT IS AN **EXAMPLE** TO ILLUSTRATE THE USE AND LOCATIONS OF CONSTRUCTION SIGNS.

N

LEGEND

- EXISTING CLOSED CIRCUIT TELEVISION CAMERA
- EXISTING DYNAMIC MESSAGE SIGN
- EXISTING WIRELESS ETHERNET RADIO
- EXISTING RADAR VEHICLE SENSING DEVICE
- PROPOSED SIGN POST

NOTE:
TRAFFIC SHALL BE HANDLED BY DAILY SIGNING DEPENDING UPON EACH WORK LOCATION OR AS DIRECTED BY THE ENGINEER.
CW20-1D (48X48) & G20-2a (48X24) SHALL BE PLACED IN BOTH DIRECTIONS AT ALL TIMES AND AT ALL ACCESS POINTS TO/FROM THE ACTIVE CONSTRUCTION SITE (FOR EXAMPLE: ENTRANCE/EXIT RAMPS ALLOWING TRAFFIC TO ENTER/EXIT THE WORK ZONE), OR AS DIRECTED BY THE ENGINEER.
DUPLICATE SIGNS SHALL BE ERECTED ON BOTH INSIDE AND OUTSIDE SHOULDERS OF THE FREEWAY OR AS DIRECTED BY THE ENGINEER. ALL SIGN PLACEMENT SHALL BE IN ACCORDANCE WITH BC AND TCP STANDARD SHEETS.

20
SEE DETAIL "A"
287
CW20-1D (48X48)
G20-2(48X24)
SUBLETT RD
CW20-1D (48X48)
G20-2(48X24)
CW20-1D (48X48)
G20-2(48X24)
EDEN RD
RUSSELL CURRY RD
G20-2(48X24)
CW20-1D (48X48)
CW20-1D (48X48)
G20-2(48X24)
TURNER WARNELL RD
G20-2(48X24)
CW20-1D (48X48)
CALLENDER RD
CW20-1D (48X48)
G20-2(48X24)
CW20-1D (48X48)
DEBBIE LN
FM 157
CW20-1D (48X48)

287
CW20-1D (48X48)
WALNUT CREEK DR
G20-2(48X24)
G20-2(48X24)
CW20-1D (48X48)
287
CW20-1D (48X48)
BROAD ST
G20-2(48X24)
CW20-1D (48X48)
G20-2(48X24)
UPRR
CW20-1D (48X48)
G20-2(48X24)
HERITAGE PKWY
TARRANT COUNTY
JOHNSON COUNTY
CW20-1D (48X48)
G20-2(48X24)
ELLIS COUNTY
CW20-1D (48X48)
G20-2(48X24)
LONE STAR RD
G20-2(48X24)
360
CW20-1D (48X48)
287
CW20-1D (48X48)
G20-2(48X24)
PROJECT LIMIT
R20-3T (48X42),
G20-10T (60X48),
G20-5aP (36X24),
R20-5T (36X36),
R20-5aTP (36X18),
G20-5T (48X24),
G20-6T (48X30),
CW20-1D (48X48)

DETAIL "A"
PLAN VIEW

PROJECT LIMIT
R20-3T (48X42),
G20-10T (60X48),
G20-5aP (36X24),
R20-5T (36X36),
R20-5aTP (36X18),
G20-5T (48X24),
G20-6T (48X30),
CW20-1D (48X48)

20
LITTLE RD
G20-2(48X24)
G20-2(48X24)
CW20-1D (48X48)
G20-2(48X24)
287

STATE OF TEXAS
CARLOS E. MOLINA
97237
LICENSED PROFESSIONAL ENGINEER

Carlos E. Molina

May 4, 2021

TYPICAL TRAFFIC CONTROL PLAN

Sheet 1 of 1 Sheets

DIST.	COUNTY		SHEET NO.
FTW	TARRANT		7
CONTROL	SECT.	JOB	HIGHWAY NO.
902	90	108	VA

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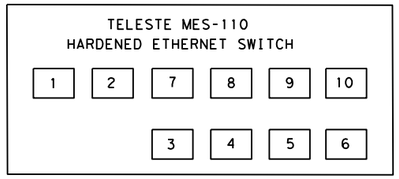
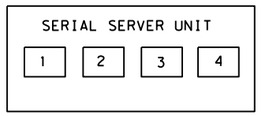


PORT ASSIGNMENTS:

1. TO NEXT CABINET AWAY FROM SATELLITE/MAIN NETWORK
2. BACK TO SATELLITE/MAIN NETWORK
3. DMS CONTROLLER
4. SWITCH TO SWITCH COPPER CONNECTION OR RADIO TO NEXT CABINET AWAY FROM SATELLITE/MAIN NETWORK
5. ENCODER OR RADIO TO NEXT CABINET AWAY FROM SATELLITE/MAIN NETWORK
6. SERIAL SERVER UNIT
7.
8. ENCODER OR RADIO TO NEXT CABINET AWAY FROM SATELLITE/MAIN NETWORK
9. RADIO BACK TO SATELLITE/MAIN NETWORK
10. CCTV POE ++



PORT ASSIGNMENTS:

1. CCTV
2. SENSOR#1 OR DMS#3
3. SENSOR#2 OR DMS#2
4. SENSOR#3 OR DMS#1

NOTES:

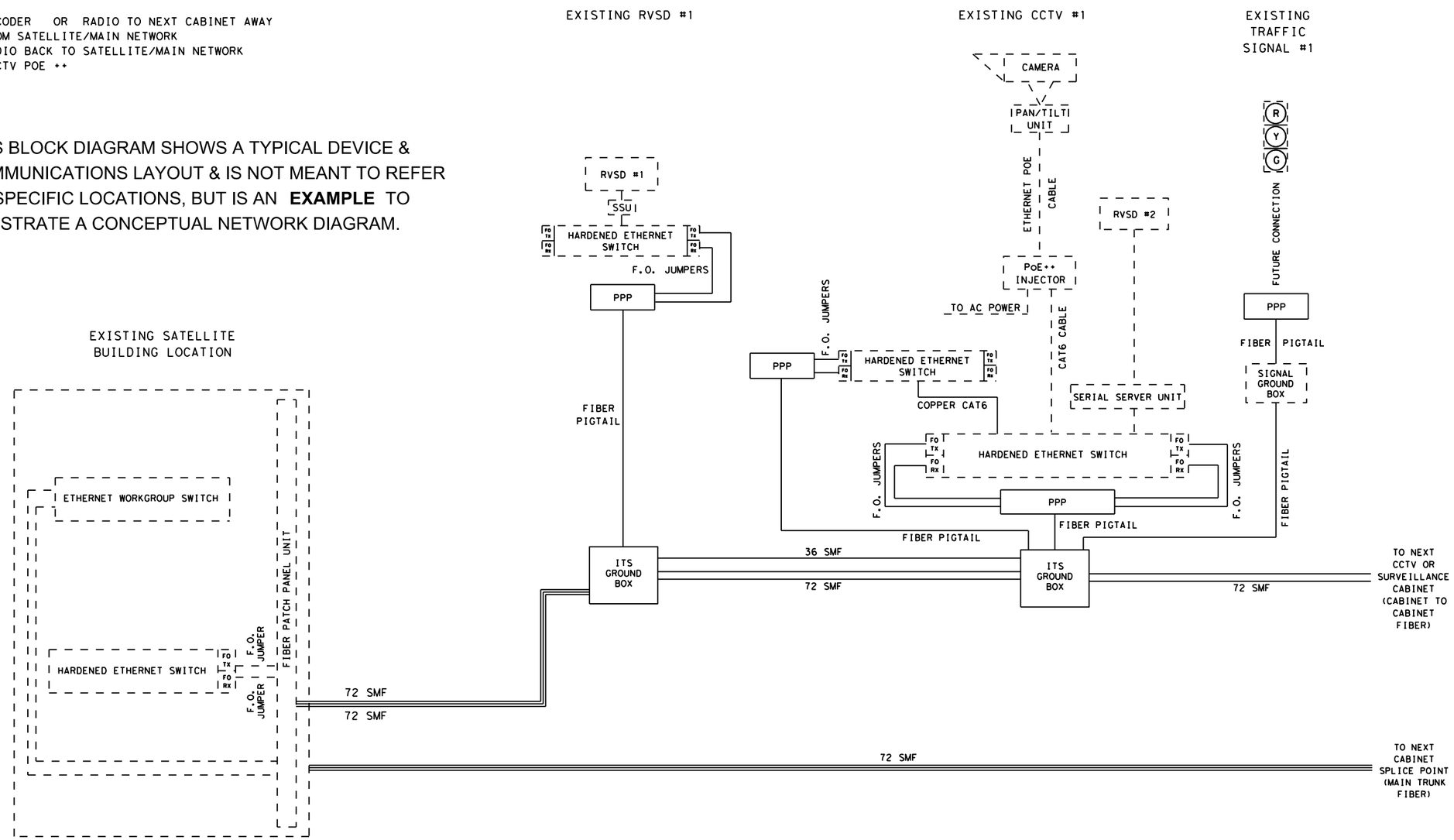
1. ALL FUNCTIONAL ELECTRONIC EQUIPMENT FOR THE SATELLITE MAY NOT BE SHOWN ON THIS PLAN SHEET.
2. THE CONTRACTOR SHALL MAINTAIN THE INTEGRITY OF THE EQUIPMENT PROVIDED. IF THE EQUIPMENT IS DAMAGED DURING TRANSPORTATION OR WORK THE CONTRACTOR SHALL REPLACE THE EQUIPMENT AT THE CONTRACTOR'S EXPENSE. CONTACT THE SIGNAL SHOP AT 817-370-3664 AT LEAST 48 HOURS IN ADVANCE TO COORDINATE PICK-UP AND INSTALLATION OF EQUIPMENT PROVIDED BY TxDOT.
3. CONTRACTOR SHALL FURNISH AND INSTALL ALL CABLING AND CONNECTORS NEEDED TO COMPLETE A FULLY FUNCTIONAL SYSTEM, INCLUDING BUT NOT LIMITED TO CAT6 CABLES FOR ETHERNET CONNECTION AND FIBER OPTIC JUMPERS.
4. WHEN REMOVAL OF FIBER OPTIC CABLES ARE CALLED FOR IN THE PLANS, REMOVE THE #8 AWG BARE COPPER WIRE (TRACE CABLE) ALONG WITH THE FIBER OPTIC CABLES. THIS SHALL BE CONSIDERED SUBSIDIARY TO ITEM 6007, "REMOVE FIBER OPTIC CABLE".

LEGEND

PoE	POWER OVER ETHERNET
DMS	DYNAMIC MESSAGE SIGN
DVE	DIGITAL VIDEO ENCODER
EWS	ETHERNET WORKGROUP SWITCH
F.O.	FIBER OPTIC
RVSD	RADAR VEHICLE SENSING DEVICE
SSU	SERIAL SERVER UNIT
PPP	PRETERMINATED PATCH PANEL
SMF	SINGLE MODE FIBER

———— PROPOSED
– – – – EXISTING

THIS BLOCK DIAGRAM SHOWS A TYPICAL DEVICE & COMMUNICATIONS LAYOUT & IS NOT MEANT TO REFER TO SPECIFIC LOCATIONS, BUT IS AN **EXAMPLE** TO ILLUSTRATE A CONCEPTUAL NETWORK DIAGRAM.



STATE OF TEXAS
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Carlos E. Molina

May 4, 2021

TYPICAL CONCEPTUAL DESIGN LAYOUT

Sheet 1 of 2 Sheets

DIST.	COUNTY		SHEET NO.
FTW	TARRANT		8
CONTROL	SECT.	JOB	HIGHWAY NO.
0902	90	108	VA

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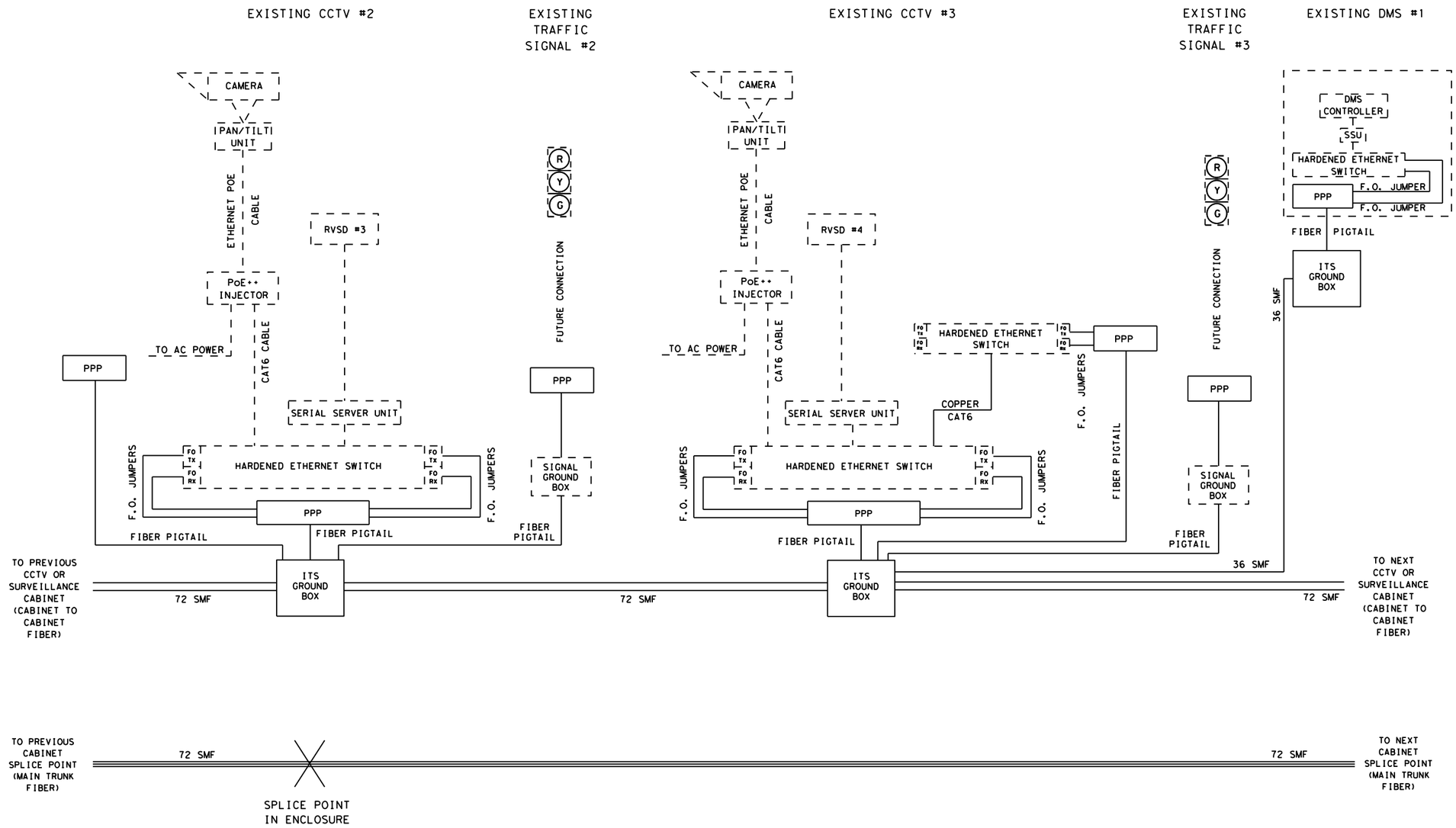
THIS BLOCK DIAGRAM SHOWS A TYPICAL DEVICE & COMMUNICATIONS LAYOUT & IS NOT MEANT TO REFER TO SPECIFIC LOCATIONS, BUT IS AN **EXAMPLE** TO ILLUSTRATE A CONCEPTUAL NETWORK DIAGRAM.

LEGEND

PoE	POWER OVER ETHERNET
DMS	DYNAMIC MESSAGE SIGN
DVE	DIGITAL VIDEO ENCODER
EWS	ETHERNET WORKGROUP SWITCH
F.O.	FIBER OPTIC
RVSD	RADAR VEHICLE SENSING DEVICE
SSU	SERIAL SERVER UNIT
PPP	PRETERMINATED PATCH PANEL
SMF	SINGLE MODE FIBER
———	PROPOSED
- - - -	EXISTING



STATE OF TEXAS
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May 4, 2021

TYPICAL CONCEPTUAL DESIGN LAYOUT

Sheet 2 of 2 Sheets

DIST.	COUNTY		SHEET NO.
FTW	TARRANT		9
CONTROL	SECT.	JOB	HIGHWAY NO.
0902	90	108	VA

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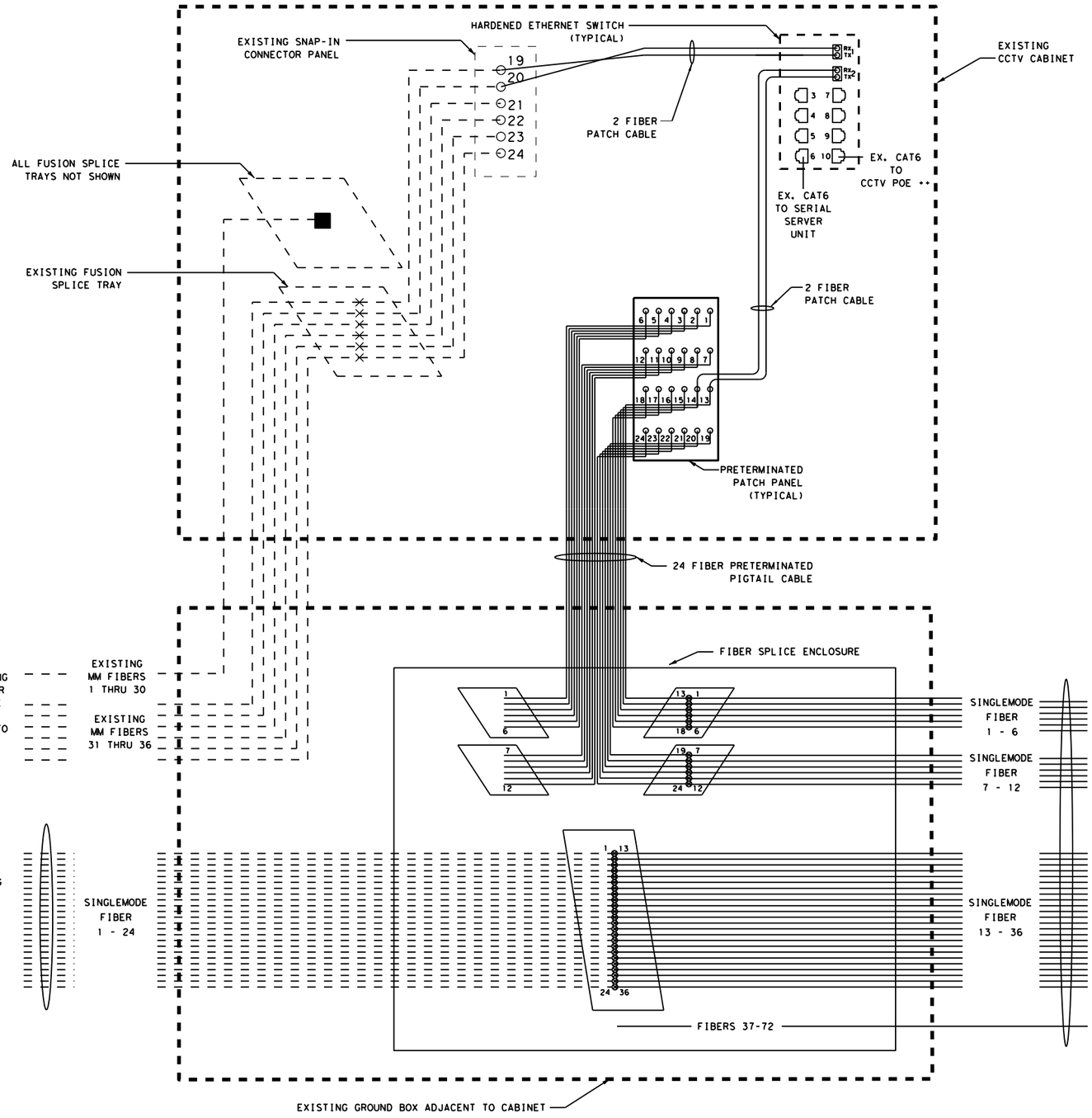

EXISTING FIBER OPTIC CABLE TO GROUND BOX NEAR CCTV CABINET OR SURVEILLANCE CABINET, THEN SPLICED TO AERIAL FIBER OPTIC CABLE.

CABINET TO CABINET
AERIAL FIBER OPTIC CONNECTIONS SCHEMATIC FOR:

ITS CABINET LOCATION

NOTES:

THE PRETERMINATED SIMPLEX CONNECTOR PATCH PANEL MODULE SHALL INCLUDE CONNECTOR SLEEVES AND DUST CAPS AND SHALL BE SUPPLIED FROM THE MANUFACTURER WITH SUFFICIENT CABLE LENGTH TO EXTEND FROM THE CABINET TO THE GROUND BOX PLUS 50 FEET COILED IN THE GROUND BOX.

THE CONNECTOR SHALL BE AN ST CONNECTOR.

THE SPLICE IS A FUSION SPLICE CONNECTING THE INCOMING AND OUTGOING FIBERS OF THE SAME COLOR EXCEPT AS INDICATED.

THE CONTRACTOR SHALL CONTACT THE ENGINEER PRIOR TO THE TERMINATING AND SPLICING OF FIBER OPTIC CABLES.

THE TERMINATING AND SPLICING OF FIBER OPTIC CABLES SHALL BE AS DIRECTED BY THE ENGINEER.

APPROVED REMOVABLE DUST COVERS SHALL BE USED AT ALL EMPTY PATCH PANEL CONNECTORS.

LEGEND:

- PROPOSED
- EXISTING
- PROPOSED FUSION SPLICE
- EXISTING FUSION SPLICE
- SPLICE TRAY (SPLICE TRAYS SHOWN FOR DIAGRAMATIC PURPOSES ONLY AND MAY NOT BE THE ACTUAL NUMBER REQUIRED)

THIS SHEET SHOWS TYPICAL FIBER OPTIC CONNECTIONS AND IS NOT MEANT TO REFER TO A SPECIFIC SCHEMATIC, BUT IS AN **EXAMPLE** TO ILLUSTRATE FIBER OPTIC DIAGRAMS.

STATE OF TEXAS
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May 4, 2021

 Texas Department of Transportation

TYPICAL TEMPORARY FIBER OPTIC CONNECTIONS

Sheet 1 of 3 Sheets

DIST.	COUNTY		SHEET NO.
FTW	TARRANT		10
CONTROL	SECT.	JOB	HIGHWAY NO.
0902	90	108	VA

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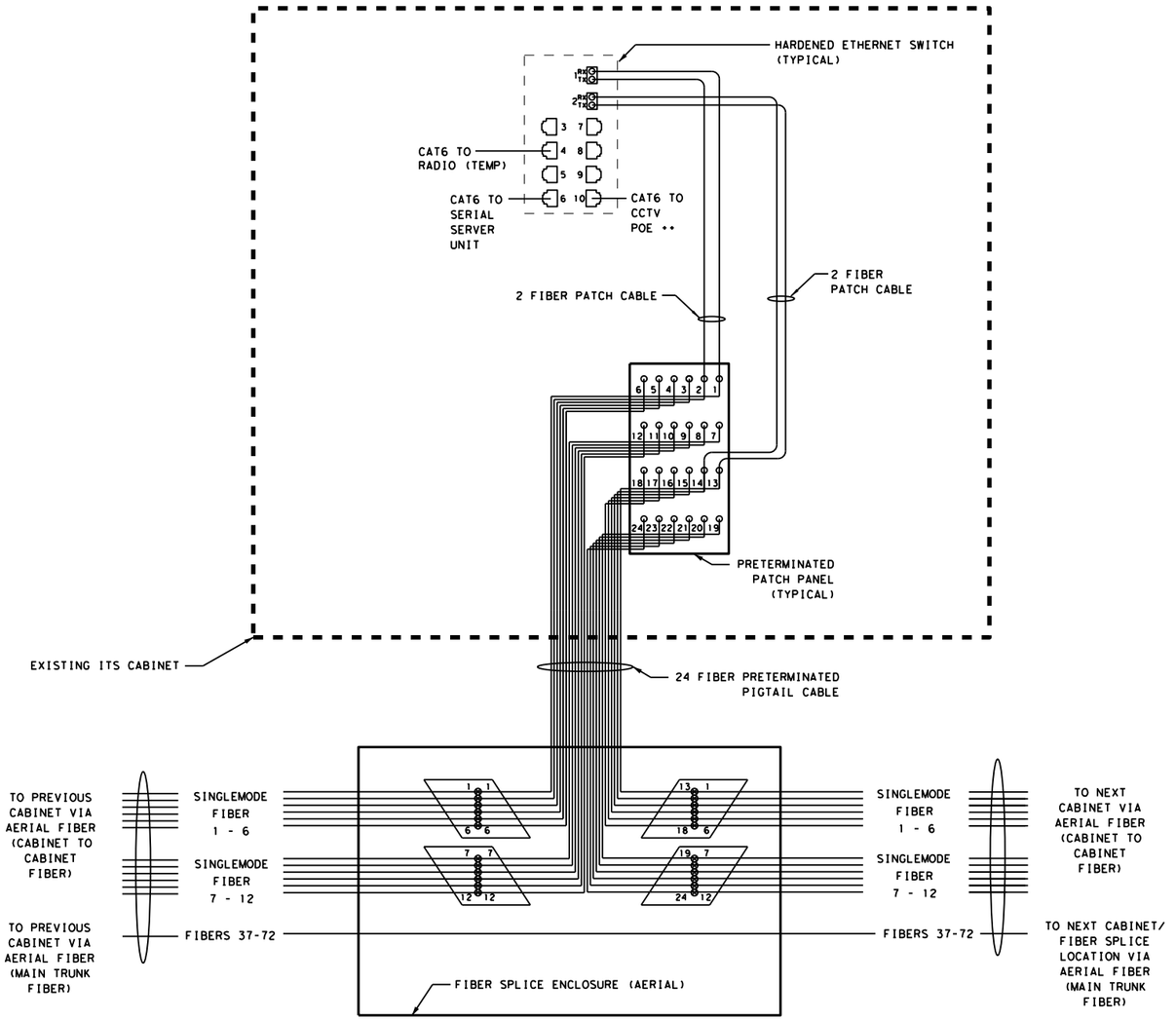

AERIAL FIBER OPTIC CABLE TO ITS CABINET LOCATION, THEN SPLICED TO FIBER OPTIC PIGTAIL CABLE USING AERIAL SPLICE ENCLOSURE.

CABINET TO CABINET
AERIAL FIBER OPTIC CONNECTIONS SCHEMATIC FOR:

ITS CABINET LOCATION

NOTES:

THE PRETERMINATED SIMPLEX CONNECTOR PATCH PANEL MODULE SHALL INCLUDE CONNECTOR SLEEVES AND DUST CAPS AND SHALL BE SUPPLIED FROM THE MANUFACTURER WITH SUFFICIENT CABLE LENGTH TO EXTEND FROM THE CABINET TO THE GROUND BOX PLUS 50 FEET COILED IN THE GROUND BOX.

THE CONNECTOR SHALL BE AN ST CONNECTOR.

THE SPLICE IS A FUSION SPLICE CONNECTING THE INCOMING AND OUTGOING FIBERS OF THE SAME COLOR EXCEPT AS INDICATED.

THE CONTRACTOR SHALL CONTACT THE ENGINEER PRIOR TO THE TERMINATING AND SPLICING OF FIBER OPTIC CABLES.

THE TERMINATING AND SPLICING OF FIBER OPTIC CABLES SHALL BE AS DIRECTED BY THE ENGINEER.

APPROVED REMOVABLE DUST COVERS SHALL BE USED AT ALL EMPTY PATCH PANEL CONNECTORS.

LEGEND:

- PROPOSED
- EXISTING
- PROPOSED FUSION SPLICE
- EXISTING FUSION SPLICE
- SPLICE TRAY (SPLICE TRAYS SHOWN FOR DIAGRAMATIC PURPOSES ONLY AND MAY NOT BE THE ACTUAL NUMBER REQUIRED)

THIS SHEET SHOWS TYPICAL FIBER OPTIC CONNECTIONS AND IS NOT MEANT TO REFER TO A SPECIFIC SCHEMATIC, BUT IS AN **EXAMPLE** TO ILLUSTRATE FIBER OPTIC DIAGRAMS.

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May 4, 2021

TYPICAL TEMPORARY FIBER OPTIC CONNECTIONS

Sheet 2 of 3 Sheets

DIST.	COUNTY		SHEET NO.
FTW	TARRANT		11
CONTROL	SECT.	JOB	HIGHWAY NO.
0902	90	108	VA

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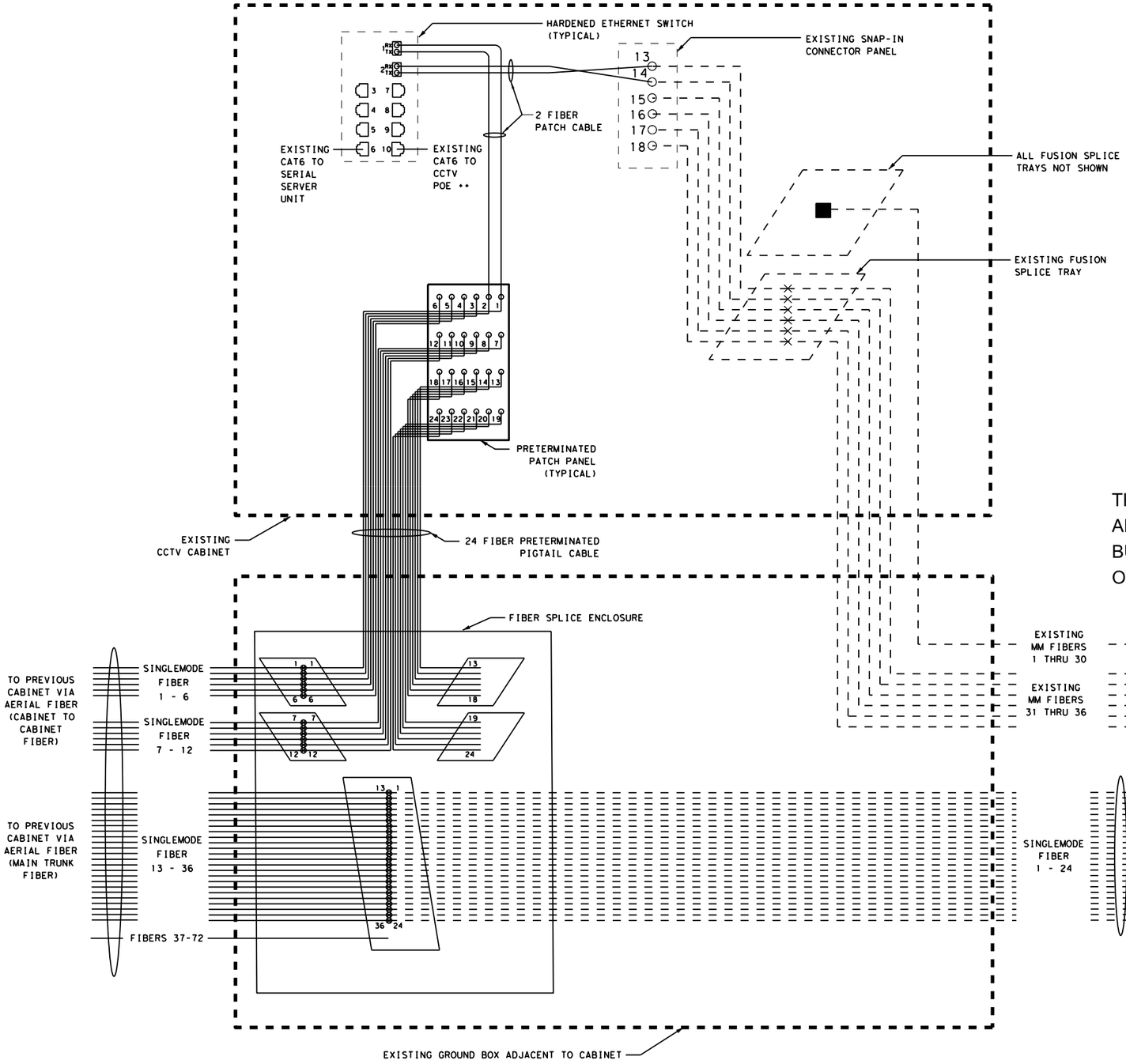

NOTES:

THE PRETERMINATED SIMPLEX CONNECTOR PATCH PANEL MODULE SHALL INCLUDE CONNECTOR SLEEVES AND DUST CAPS AND SHALL BE SUPPLIED FROM THE MANUFACTURER WITH SUFFICIENT CABLE LENGTH TO EXTEND FROM THE CABINET TO THE GROUND BOX PLUS 50 FEET COILED IN THE GROUND BOX.

THE CONNECTOR SHALL BE AN ST CONNECTOR.

THE SPLICE IS A FUSION SPLICE CONNECTING THE INCOMING AND OUTGOING FIBERS OF THE SAME COLOR EXCEPT AS INDICATED.

THE CONTRACTOR SHALL CONTACT THE ENGINEER PRIOR TO THE TERMINATING AND SPLICING OF FIBER OPTIC CABLES.

THE TERMINATING AND SPLICING OF FIBER OPTIC CABLES SHALL BE AS DIRECTED BY THE ENGINEER.

APPROVED REMOVABLE DUST COVERS SHALL BE USED AT ALL EMPTY PATCH PANEL CONNECTORS.

LEGEND:

- PROPOSED
- EXISTING
- ⊗ PROPOSED FUSION SPLICE
- × EXISTING FUSION SPLICE
- SPLICE TRAY (SPLICE TRAYS SHOWN FOR DIAGRAMATIC PURPOSES ONLY AND MAY NOT BE THE ACTUAL NUMBER REQUIRED)

THIS SHEET SHOWS TYPICAL FIBER OPTIC CONNECTIONS AND IS NOT MEANT TO REFER TO A SPECIFIC SCHEMATIC, BUT IS AN **EXAMPLE** TO ILLUSTRATE FIBER OPTIC DIAGRAMS.

CABINET TO CABINET
AERIAL FIBER OPTIC CONNECTIONS SCHEMATIC FOR:

ITS CABINET LOCATION

AERIAL FIBER OPTIC CABLE FROM PREVIOUS CCTV CABINET OR SURVEILLANCE CABINET THEN SPLICED TO PERMANENT FIBER OPTIC CABLE IN GROUND BOX

STATE OF TEXAS
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Carlos E. Molina

May 4, 2021

TYPICAL TEMPORARY FIBER OPTIC CONNECTIONS

Sheet 3 of 3 Sheets

DIST.	COUNTY		SHEET NO.
FTW	TARRANT		12
CONTROL	SECT.	JOB	HIGHWAY NO.
0902	90	108	VA

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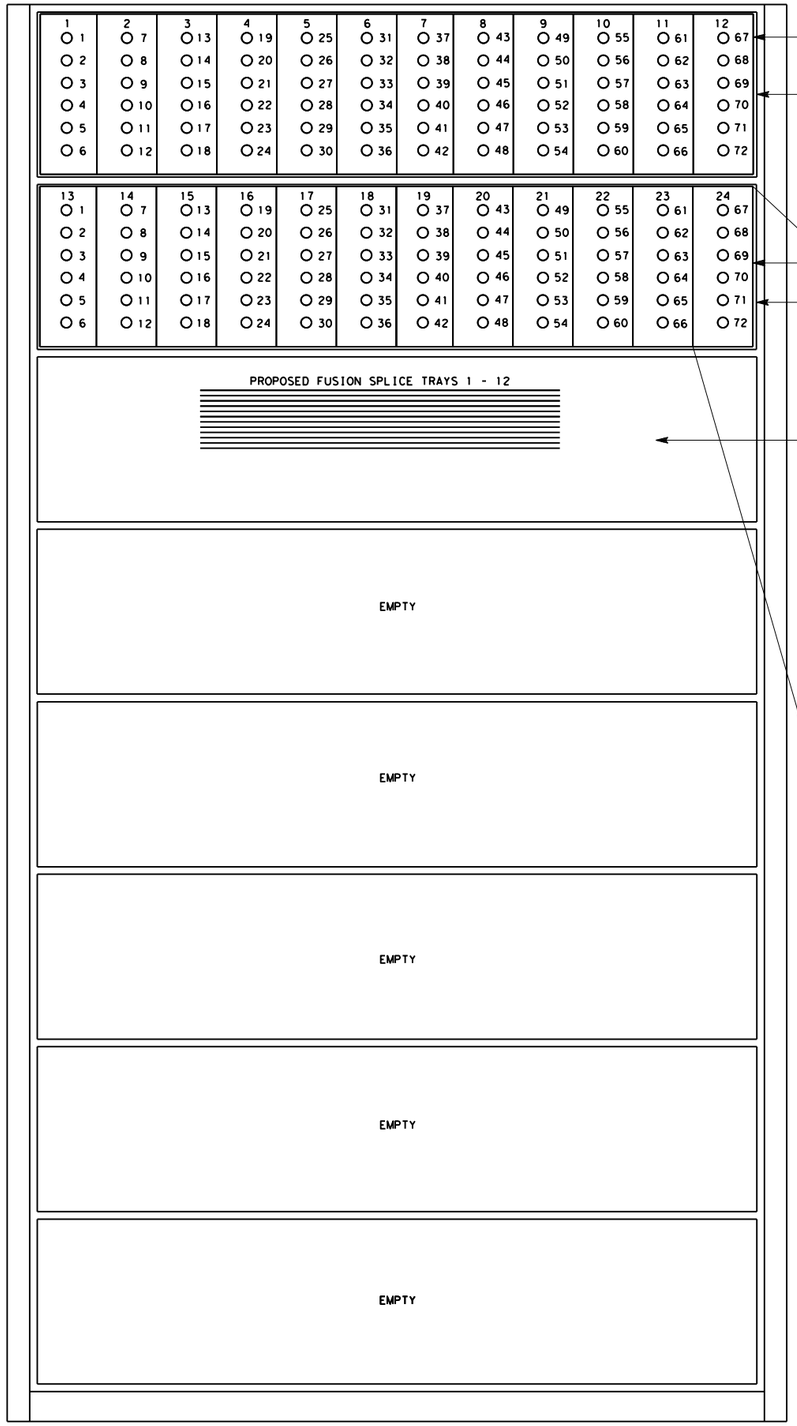


SNAP-IN SIMPLEX
CONNECTOR PANEL MODULES 1 - 12

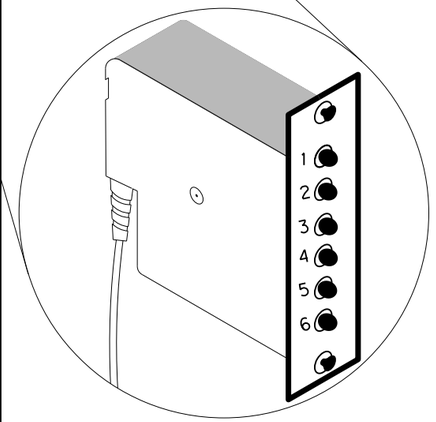
FIBER OPTIC PATCH PANEL (72 POSITION)

SNAP-IN SIMPLEX
CONNECTOR PANEL MODULES 13 - 24

FIBER OPTIC PATCH PANEL (72 POSITION)

RACK MOUNTED
SPLICE ENCLOSURE

FIBER PATCH PANEL UNIT
LOCATED AT:
SATELLITE BLDG. NUMBER, HIGHWAY LOCATION, HIGHWAY STATION
(SPECIFIC CROSSING ROADWAYS)



SNAP-IN SIMPLEX
CONNECTOR PANEL MODULE
(CORNING OR APPROVED EQUAL)

NOTE: THE SNAP-IN SIMPLEX CONNECTOR PANEL MODULE SHALL INCLUDE PIGTAILS, CONNECTOR SLEEVES AND DUST CAPS. THE CONNECTOR SHALL BE AN ST CONNECTOR. THE SPLICE IS A FUSION SPLICE CONNECTING THE INCOMING AND OUTGOING FIBERS OF THE SAME COLOR. THE CONTRACTOR SHALL CONTACT THE ENGINEER PRIOR TO THE TERMINATING AND SPLICING OF FIBER OPTIC CABLES. THE TERMINATING AND SPLICING OF FIBER OPTIC CABLES SHALL BE AS DIRECTED BY THE ENGINEER.

LEGEND:

———— = PROPOSED

– – – · = EXISTING

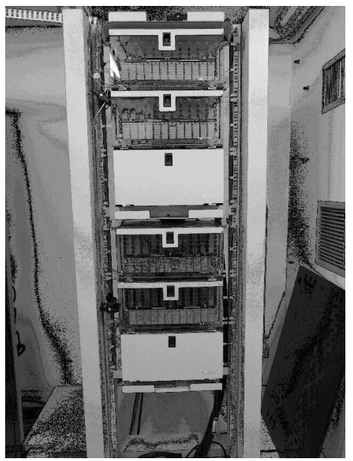
CONNECTOR PANEL MODULES ASSIGNMENT TABLE

CONNECTOR MODULE #	TYPE, FUNCTION OF CONNECTOR PANEL MODULE
1-12	SINGLE MODE ST CONNECTOR MODULE FOR SPECIFIED HIGHWAY (MAIN TRUNK)
13-24	SINGLE MODE ST CONNECTOR MODULE FOR SPECIFIED HIGHWAY (CABINET TO CABINET)

FUSION SPLICE TRAYS ASSIGNMENT TABLE

FUSION SPLICE TRAY #	TYPE, FUNCTION OF FUSION SPLICE TRAY
1 - 6	SINGLE MODE FIBER SPLICE TRAY FOR SPECIFIED HIGHWAY (MAIN TRUNK)
7-12	SINGLE MODE FIBER SPLICE TRAY FOR SPECIFIED HIGHWAY (CABINET TO CABINET)

THIS SHEET SHOWS TYPICAL FIBER OPTIC CONNECTIONS AND IS NOT MEANT TO REFER TO A SPECIFIC SCHEMATIC, BUT IS AN **EXAMPLE** TO ILLUSTRATE FIBER OPTIC DIAGRAMS AND A FIBER PATCH PANEL UNIT.



FIBER PATCH PANEL UNIT,PATCH PANELS, AND SPLICE ENCLOSURE
(CORNING OR APPROVED EQUAL)

STATE OF TEXAS
CARLOS E. MOLINA
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LICENSED
PROFESSIONAL ENGINEER

Carlos E. Molina

May 4, 2021

Texas Department of Transportation

TYPICAL FIBER OPTIC CONNECTIONS

Sheet 1 of 5 Sheets

DIST.	COUNTY	SHEET NO.
FTW	TARRANT	13

CONTROL	SECT.	JOB	HIGHWAY NO.
0902	90	108	VA

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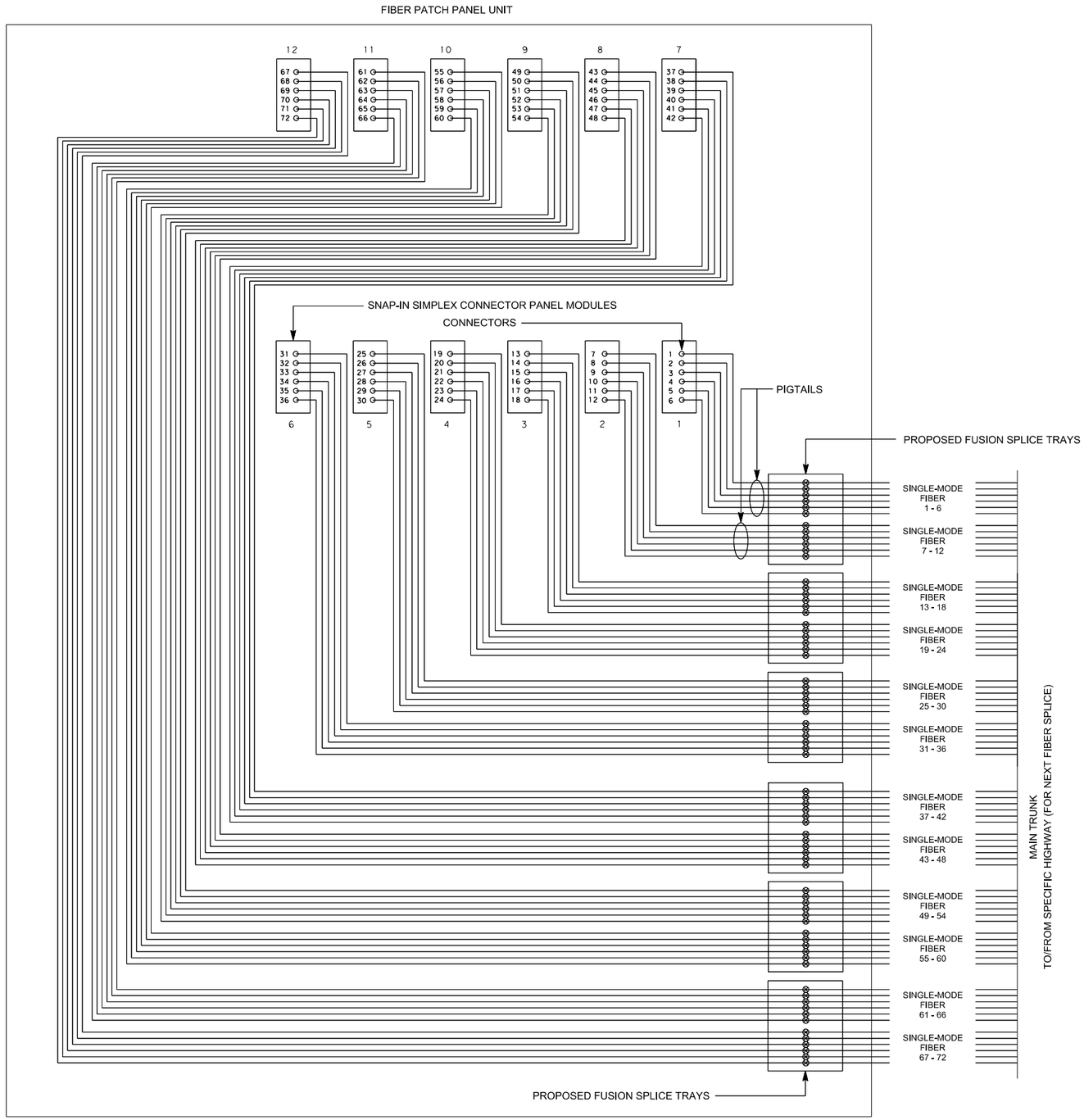

FIBER OPTIC CONNECTIONS SCHEMATIC AT:

SATELLITE BLDG. NUMBER
HIGHWAY LOCATION
HIGHWAY STATION
(SPECIFIC CROSSING ROADWAYS)

LEGEND:

———— = PROPOSED
– – – – = EXISTING
⊗ = PROPOSED FUSION SPLICE

NOTE: THE SNAP-IN SIMPLEX CONNECTOR PANEL MODULE SHALL INCLUDE PIGTAILS, CONNECTOR SLEEVES AND DUST CAPS. THE CONNECTOR SHALL BE AN ST CONNECTOR. THE SPLICE IS A FUSION SPLICE CONNECTING THE INCOMING AND OUTGOING FIBERS OF THE SAME COLOR. THE CONTRACTOR SHALL CONTACT THE ENGINEER PRIOR TO THE TERMINATING AND SPLICING OF FIBER OPTIC CABLES. THE TERMINATING AND SPLICING OF FIBER OPTIC CABLES SHALL BE AS DIRECTED BY THE ENGINEER.

CONNECTOR MODULE #	TYPE, FUNCTION OF CONNECTOR PANEL MODULE
1-12	SINGLE MODE ST CONNECTOR MODULE FOR SPECIFIED HIGHWAY (MAIN TRUNK)

FIBER #	CONNECTOR #	FUNCTION OF FIBER/CONNECTOR
1	1	FUTURE
2	2	FUTURE
3	3	FUTURE
4	4	FUTURE
5	5	FUTURE
6	6	FUTURE
7	7	FUTURE
8	8	FUTURE
9	9	FUTURE
10	10	FUTURE
11	11	FUTURE
12	12	FUTURE
13	13	DATA COMMUNICATION TO/FROM SATELLITE BUILDING
14	14	DATA COMMUNICATION TO/FROM SATELLITE BUILDING
↓	↓	FUTURE
72	72	FUTURE

THIS SHEET SHOWS TYPICAL FIBER OPTIC CONNECTIONS AND IS NOT MEANT TO REFER TO A SPECIFIC SCHEMATIC, BUT IS AN **EXAMPLE** TO ILLUSTRATE FIBER OPTIC DIAGRAMS.

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May 4, 2021

TYPICAL FIBER OPTIC CONNECTIONS

Sheet 2 of 5 Sheets

DIST.	COUNTY		SHEET NO.
FTW	TARRANT		14
CONTROL	SECT.	JOB	HIGHWAY NO.
0902	90	108	VA

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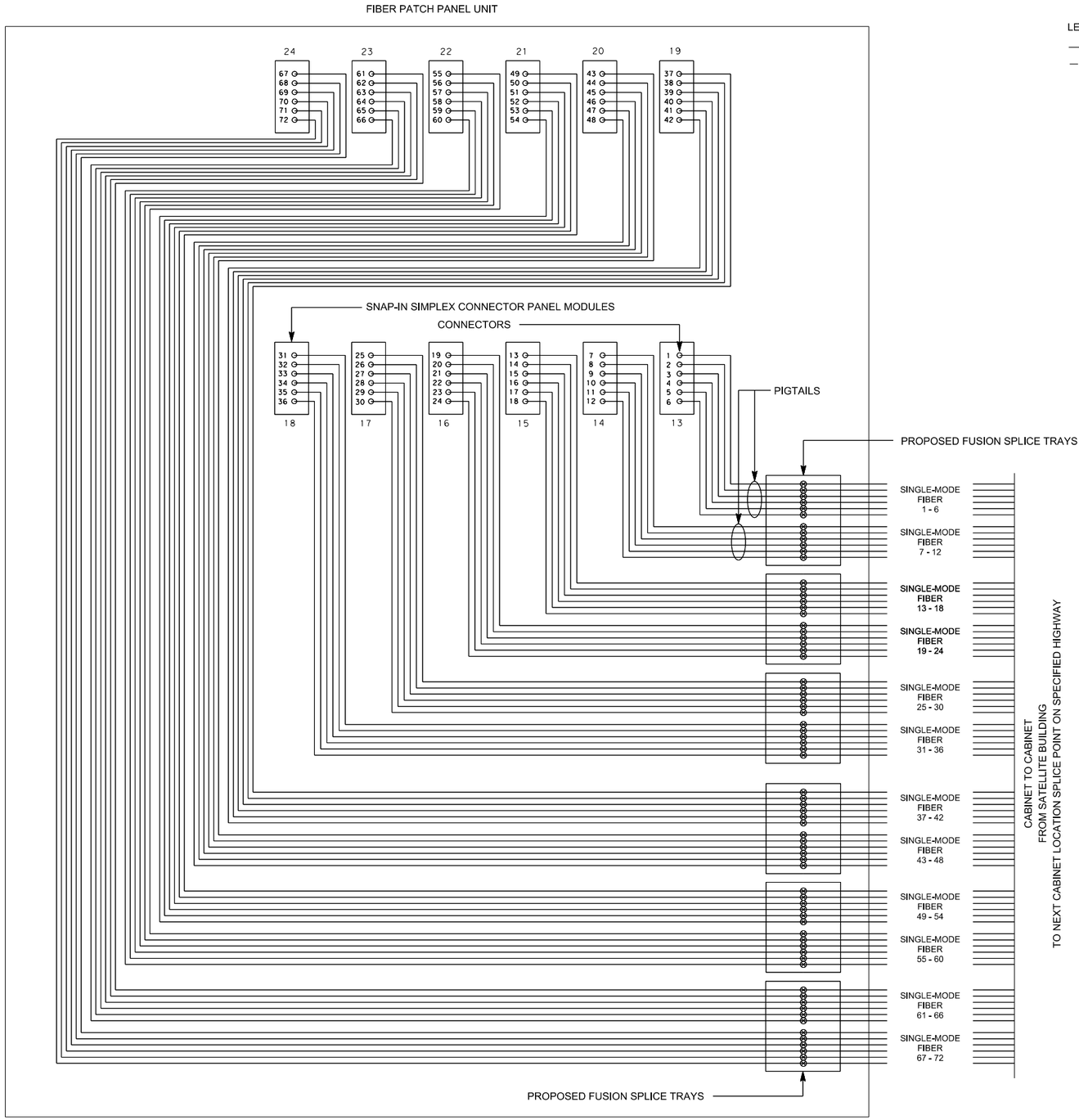

FIBER OPTIC CONNECTIONS SCHEMATIC AT:

SATELLITE BLDG. NUMBER
HIGHWAY LOCATION
HIGHWAY STATION
(SPECIFIC CROSSING ROADWAYS)

LEGEND:

———— = PROPOSED
– – – – = EXISTING
⊗ = PROPOSED FUSION SPLICE

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CONNECTOR MODULE #	TYPE, FUNCTION OF CONNECTOR PANEL MODULE
13-24	SINGLE MODE ST CONNECTOR MODULE FOR SPECIFIED HIGHWAY (CABINET TO CABINET)

FIBER #	CONNECTOR #	FUNCTION OF FIBER/CONNECTOR
1	1	DATA COMMUNICATION TO/FROM SPECIFIED HIGHWAY
2	2	DATA COMMUNICATION TO/FROM SPECIFIED HIGHWAY
3	3	FUTURE
4	4	FUTURE
5	5	FUTURE
6	6	FUTURE
7	7	FUTURE
8	8	FUTURE
9	9	FUTURE
10	10	FUTURE
11	11	FUTURE
12	12	FUTURE
13	13	FUTURE
14	14	FUTURE
↓	↓	FUTURE
72	72	FUTURE

THIS SHEET SHOWS TYPICAL FIBER OPTIC CONNECTIONS AND IS NOT MEANT TO REFER TO A SPECIFIC SCHEMATIC, BUT IS AN **EXAMPLE** TO ILLUSTRATE FIBER OPTIC DIAGRAMS.

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May 4, 2021

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TYPICAL FIBER OPTIC CONNECTIONS

Sheet 3 of 5 Sheets

DIST.	COUNTY		SHEET NO.
FTW	TARRANT		15
CONTROL	SECT.	JOB	HIGHWAY NO.
0902	90	108	VA

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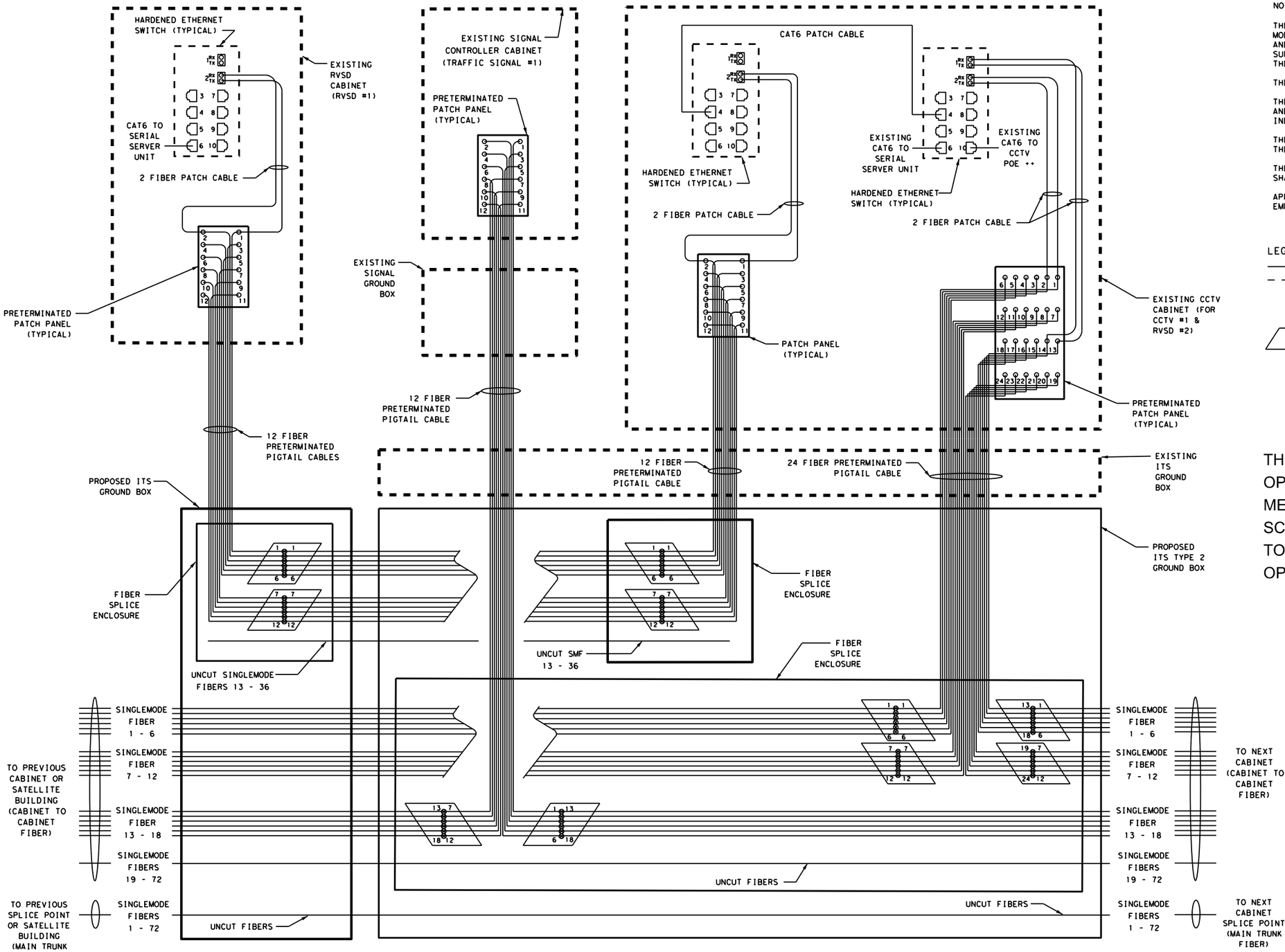

CABINET TO CABINET FIBER OPTIC CONNECTIONS SCHEMATIC FOR:

RVSD POLE LOCATION

CABINET TO CABINET FIBER OPTIC CONNECTIONS SCHEMATIC FOR:

SIGNAL CABINET

CABINET TO CABINET FIBER OPTIC CONNECTIONS SCHEMATIC FOR:

CCTV CABINET LOCATION

NOTES:

THE PRETERMINATED SIMPLEX CONNECTOR PATCH PANEL MODULE SHALL INCLUDE CONNECTOR SLEEVES AND DUST CAPS AND SHALL BE SUPPLIED FROM THE MANUFACTURER WITH SUFFICIENT CABLE LENGTH TO EXTEND FROM THE CABINET TO THE GROUND BOX PLUS 50 FEET COILED IN THE GROUND BOX.

THE CONNECTOR SHALL BE AN ST CONNECTOR.

THE SPLICE IS A FUSION SPLICE CONNECTING THE INCOMING AND OUTGOING FIBERS OF THE SAME COLOR EXCEPT AS INDICATED.

THE CONTRACTOR SHALL CONTACT THE ENGINEER PRIOR TO THE TERMINATING AND SPLICING OF FIBER OPTIC CABLES.

THE TERMINATING AND SPLICING OF FIBER OPTIC CABLES SHALL BE AS DIRECTED BY THE ENGINEER.

APPROVED REMOVABLE DUST COVERS SHALL BE USED AT ALL EMPTY PATCH PANEL CONNECTORS.

LEGEND:

- PROPOSED
- EXISTING
- PROPOSED FUSION SPLICE
- EXISTING FUSION SPLICE
- SPLICE TRAY (SPLICE TRAYS SHOWN FOR DIAGRAMATIC PURPOSES ONLY AND MAY NOT BE THE ACTUAL NUMBER REQUIRED)

THIS SHEET SHOWS TYPICAL FIBER OPTIC CONNECTIONS AND IS NOT MEANT TO REFER TO A SPECIFIC SCHEMATIC, BUT IS AN **EXAMPLE** TO ILLUSTRATE FIBER OPTIC DIAGRAMS.

STATE OF TEXAS
CARLOS E. MOLINA
97237
LICENSED PROFESSIONAL ENGINEER

Carlos E. Molina

May 4, 2021

TYPICAL FIBER OPTIC CONNECTIONS

Sheet 4 of 5 Sheets

DIST.	COUNTY		SHEET NO.
FTW	TARRANT		16
CONTROL	SECT.	JOB	HIGHWAY NO.
0902	90	108	VA

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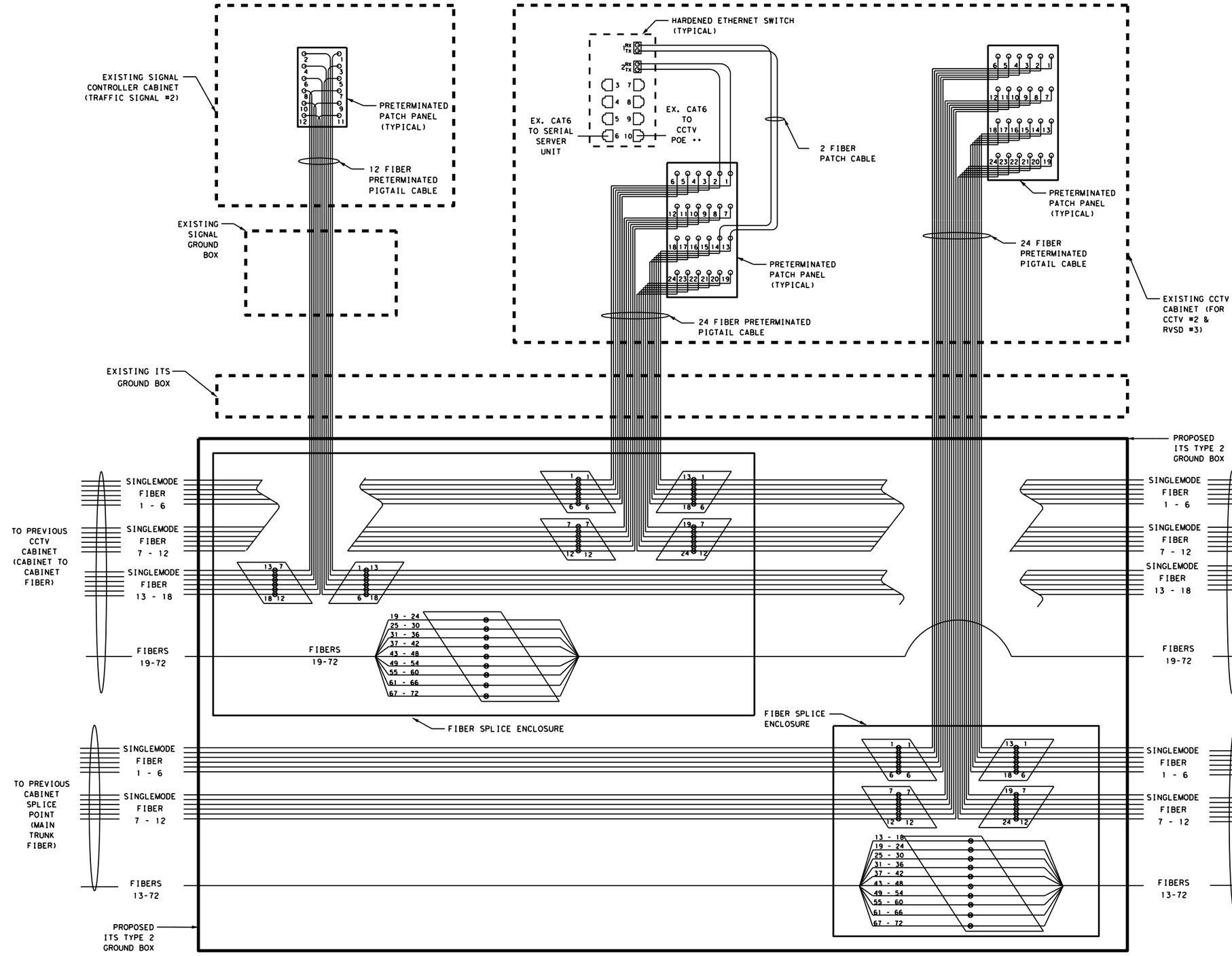

CABINET TO CABINET FIBER OPTIC CONNECTIONS SCHEMATIC FOR:

SIGNAL CABINET

CABINET TO CABINET FIBER OPTIC CONNECTIONS SCHEMATIC FOR:

CCTV CABINET LOCATION

NOTES:

THE PRETERMINATED SIMPLEX CONNECTOR PATCH PANEL MODULE SHALL INCLUDE CONNECTOR SLEEVES AND DUST CAPS AND SHALL BE SUPPLIED FROM THE MANUFACTURER WITH SUFFICIENT CABLE LENGTH TO EXTEND FROM THE CABINET TO THE GROUND BOX PLUS 50 FEET COILED IN THE GROUND BOX.

THE CONNECTOR SHALL BE AN ST CONNECTOR.

THE SPLICE IS A FUSION SPLICE CONNECTING THE INCOMING AND OUTGOING FIBERS OF THE SAME COLOR EXCEPT AS INDICATED.

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LEGEND:

- PROPOSED
- EXISTING
- PROPOSED FUSION SPLICE
- EXISTING FUSION SPLICE
- SPLICE TRAY (SPLICE TRAYS SHOWN FOR DIAGRAMATIC PURPOSES ONLY AND MAY NOT BE THE ACTUAL NUMBER REQUIRED)

THIS SHEET SHOWS TYPICAL FIBER OPTIC CONNECTIONS AND IS NOT MEANT TO REFER TO A SPECIFIC SCHEMATIC, BUT IS AN **EXAMPLE** TO ILLUSTRATE FIBER OPTIC DIAGRAMS.

STATE OF TEXAS
CARLOS E. MOLINA
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LICENSED PROFESSIONAL ENGINEER

Carlos E. Molina

May 4, 2021

TYPICAL FIBER OPTIC CONNECTIONS

Sheet 5 of 5 Sheets

DIST.	COUNTY		SHEET NO.
FTW	TARRANT		17
CONTROL	SECT.	JOB	HIGHWAY NO.
0902	90	108	VA

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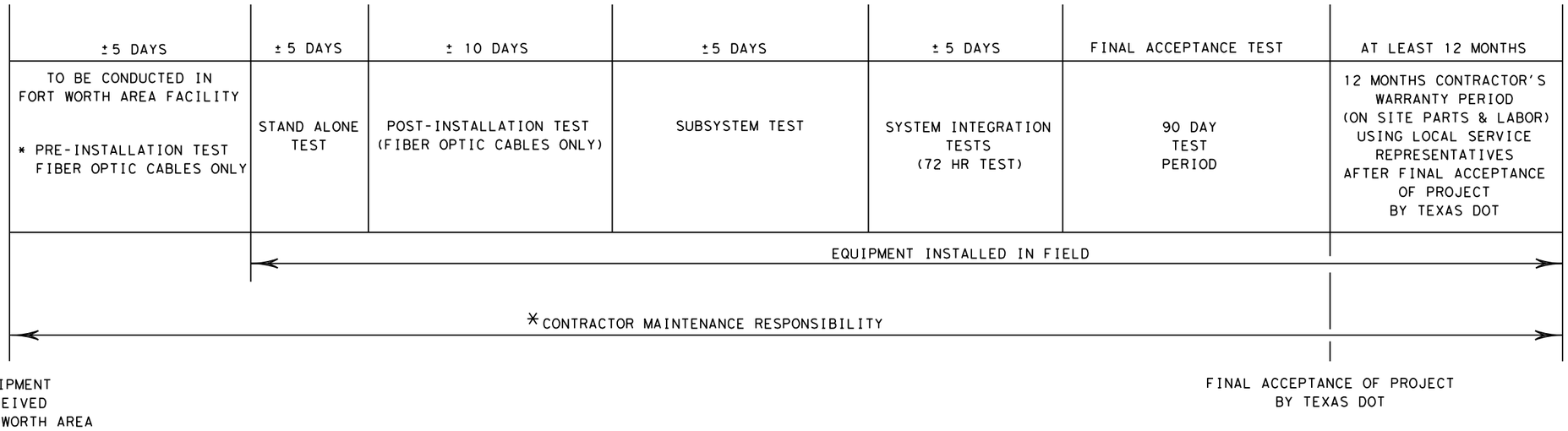

* THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING COMPLETE ON SITE PARTS AND LABOR SUPPORT FOR THE INSTALLATION OF THE INTELLIGENT TRANSPORTATION SYSTEM FOR THE DURATION OF THE ENTIRE PROJECT AND FOR 12 MONTHS AFTER FINAL PROJECT ACCEPTANCE BY TEXAS DOT.

STATE OF TEXAS
CARLOS E. MOLINA
97237
LICENSED PROFESSIONAL ENGINEER

Carlos E. Molina

May 4, 2021

TIMELINE DESCRIPTION OF TESTING PROCEDURES

Sheet 1 of 1 Sheets

DIST.	COUNTY		SHEET NO.
FTW	TARRANT		18
CONTROL	SECT.	JOB	HIGHWAY NO.
0902	90	108	VA

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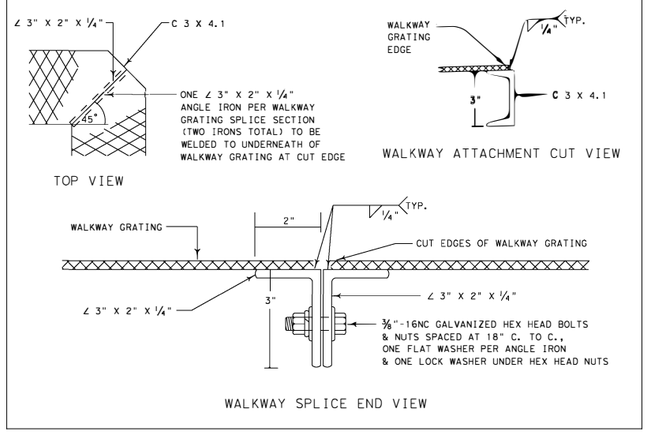
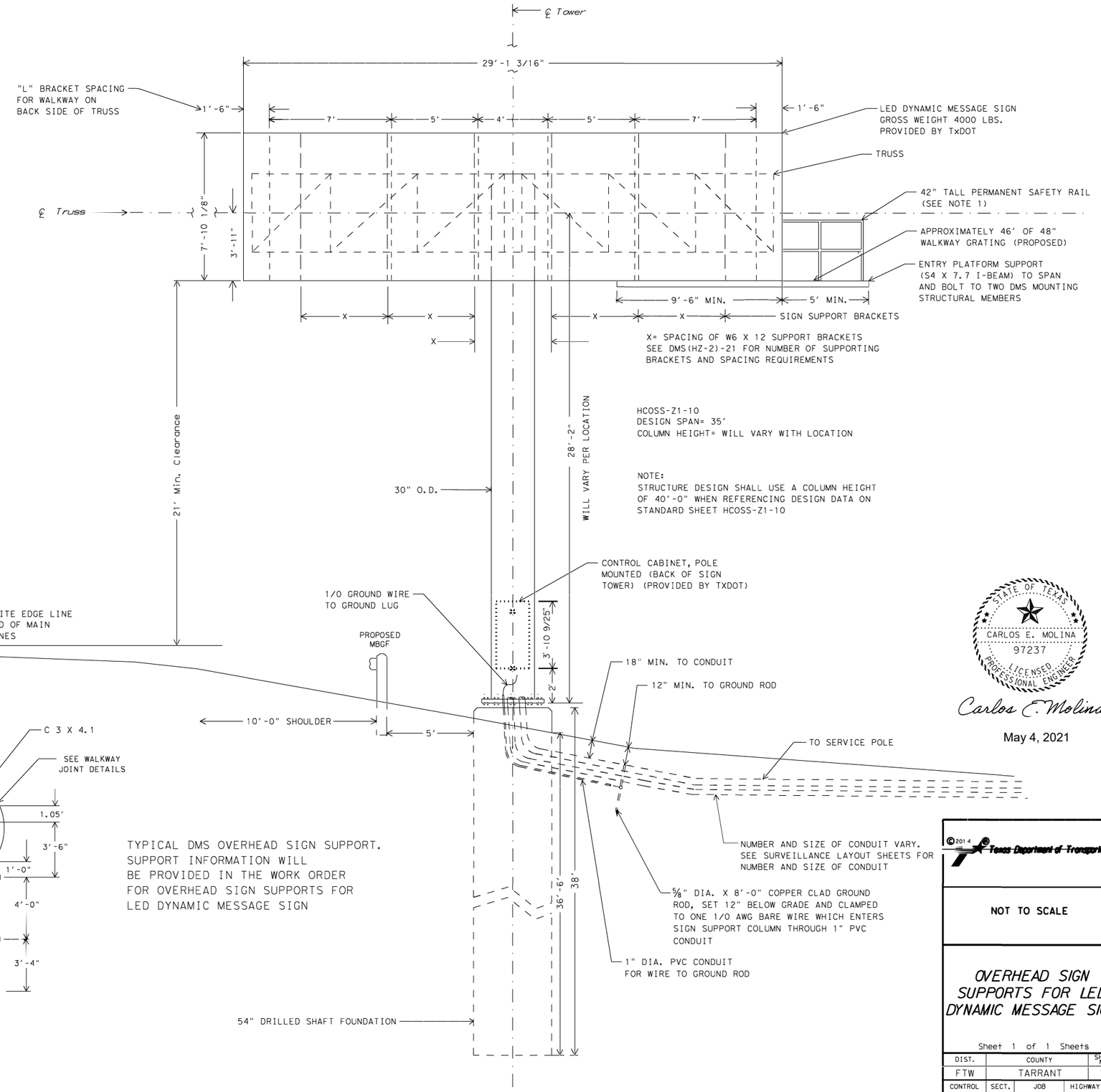
DATE: 4/29/2021 11:05:00 AM

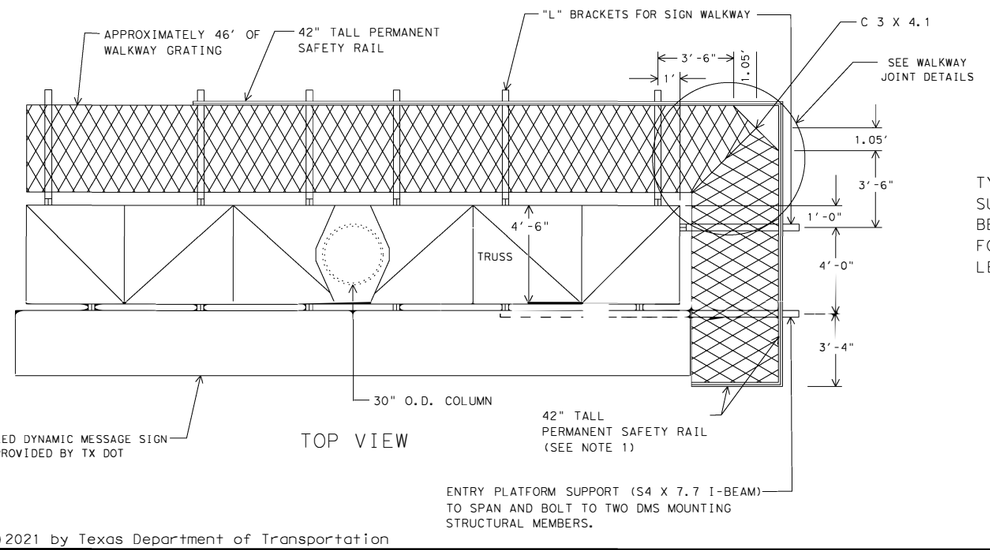
NOTES:

1. THE CONTRACTOR SHALL SUBMIT THE STRUCTURAL DESIGN, MOUNTING DETAILS FOR THE DMS WALKWAY PLATFORM WITH 42" TALL PERMANENT SAFETY RAIL, AND DMS TO TRUSS-MOUNTING DESIGN DETAILS TO THE ENGINEER FOR APPROVAL PRIOR TO FABRICATION. THE SUBMITTED DRAWINGS FOR THE STRUCTURAL DESIGN, MOUNTING DETAILS OF THE DMS WALKWAY PLATFORM WITH 42" TALL PERMANENT SAFETY RAIL, AND DMS TO TRUSS-MOUNTING DESIGN SHALL BE DONE BY A TEXAS REGISTERED PROFESSIONAL ENGINEER, SHALL BE DATED AND SHALL BEAR THE ENGINEER'S SEAL AND SIGNATURE. SPACING OF HANDRAIL UPRIGHTS (VERTICAL MEMBERS) SHALL NOT EXCEED 24" CENTER TO CENTER.
2. PRIOR TO DRILLING SHAFT, THE DEPARTMENT WILL PROVIDE THE CONTRACTOR WITH THE VIEW ANGLE OFFSET FOR THE DMS LOCATION. THIS OFFSET WILL BE REQUIRED BY THE CONTRACTOR TO COORDINATE DRILL SHAFT ORIENTATION WITH THE SIGN MANUFACTURER FOR OPTIMUM DMS VIEW AXIS ALIGNMENT. THE NAME, ADDRESS AND CONTACT PERSON FOR THE DMS MANUFACTURER SHALL BE PROVIDED BY THE DEPARTMENT. PAYMENT SHALL NOT BE MADE DIRECTLY FOR SUCH COORDINATION, OR OTHER INCIDENTALS REQUIRED TO COMPLETE THIS WORK, BUT SHALL BE CONSIDERED SUBSIDIARY TO THE ITEM 416 "DRILLED SHAFT FOUNDATION".
3. THE FURNISHING AND INSTALLING OF 1" PVC CONDUIT, GROUND ROD, 1/0 AWG GROUND WIRE, GROUND ROD CLAMP, AND ALL OTHER MATERIALS, LABOR, TOOLS, EQUIPMENT, AND INCIDENTALS NECESSARY TO COMPLETE THE GROUNDING OF THE STRUCTURE AS PER NEC SHALL BE SUBSIDIARY TO ITEM 650.
4. DMS AND CABINET WILL BE STORED BY THE DEPARTMENT FOR PICKUP AT THE TxDOT SIGNAL SHOP. 2501 SW LOOP 820, FORT WORTH, TX 76133.

WALKWAY JOINT DETAILS







TYPICAL DMS OVERHEAD SIGN SUPPORT. SUPPORT INFORMATION WILL BE PROVIDED IN THE WORK ORDER FOR OVERHEAD SIGN SUPPORTS FOR LED DYNAMIC MESSAGE SIGN

STATE OF TEXAS
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LICENSED PROFESSIONAL ENGINEER

Carlos E. Molina

May 4, 2021

NOT TO SCALE

OVERHEAD SIGN SUPPORTS FOR LED DYNAMIC MESSAGE SIGN

Sheet 1 of 1 Sheets

DIST.	COUNTY		SHEET NO.
FTW	TARRANT		19
CONTROL	SECT.	JOB	HIGHWAY NO.
0902	90	108	VA

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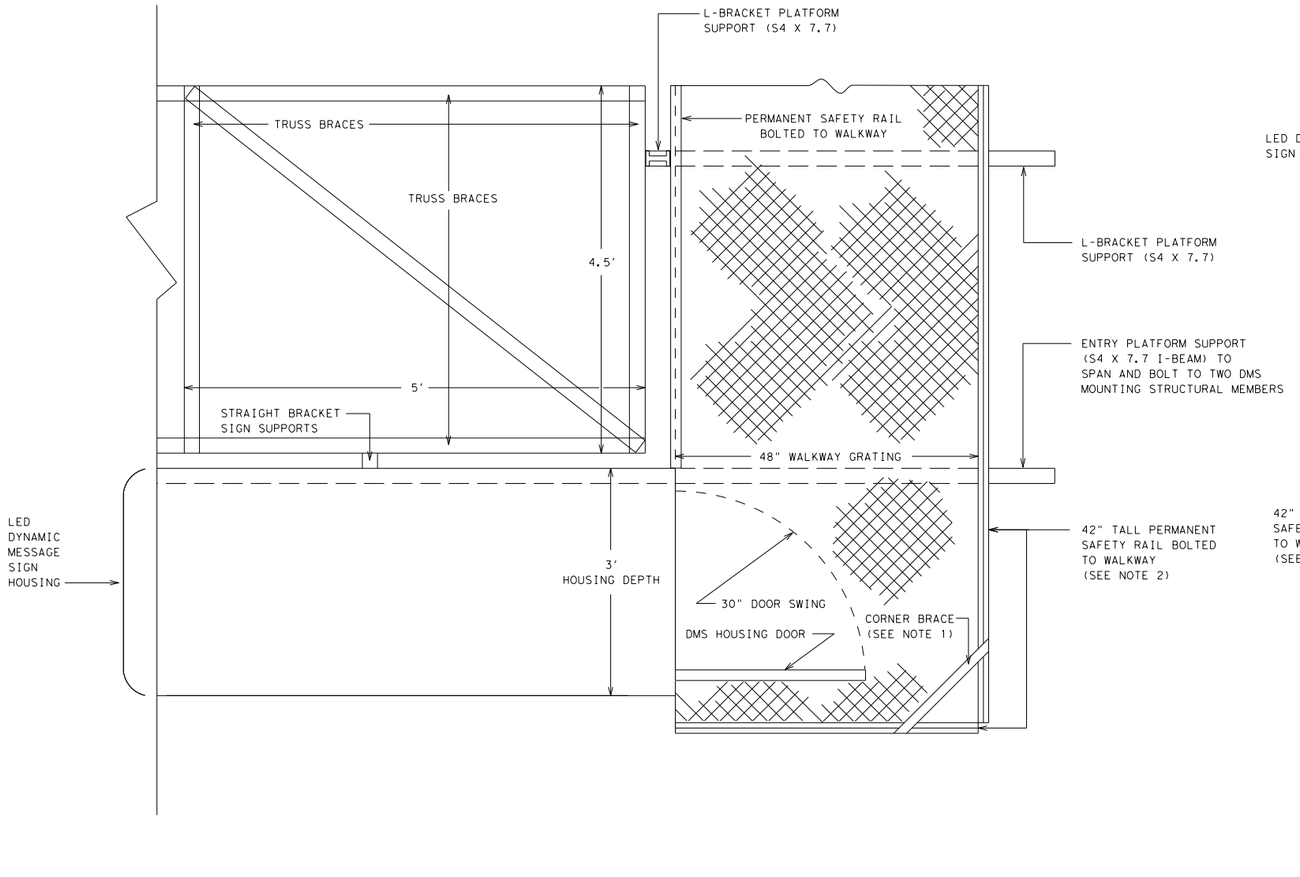
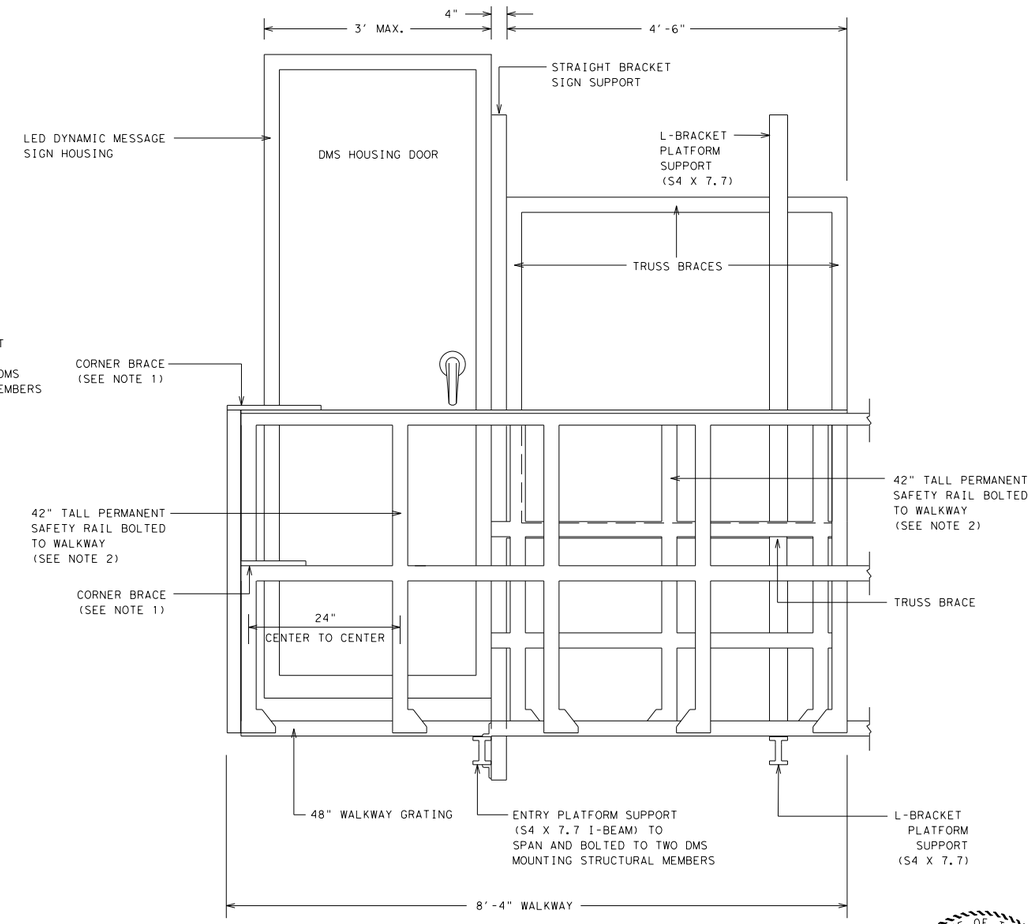


TOP VIEW
(TYPICAL)



FRONT VIEW
(TYPICAL)

NOTES:

1. TWO CORNER BRACES SHALL BE BOLTED AT A 45° ANGLE TO THE FRONT & SIDE PERMANENT SAFETY RAILS. ONE BRACE SHALL BE MOUNTED TO THE TOP RAILS & THE OTHER TO THE SECOND RAILS.

2. THE CONTRACTOR SHALL SUBMIT THE STRUCTURAL DESIGN, MOUNTING DETAILS FOR THE DMS WALKWAY PLATFORM WITH 42" TALL PERMANENT SAFETY RAIL, AND DMS TO TRUSS-MOUNTING DESIGN DETAILS TO THE ENGINEER FOR APPROVAL PRIOR TO FABRICATION. THE SUBMITTED DRAWINGS FOR THE STRUCTURAL DESIGN AND MOUNTING DETAILS OF THE DMS WALKWAY PLATFORM WITH 42" TALL PERMANENT SAFETY RAIL AND DMS TO TRUSS-MOUNTING DESIGN SHALL BE DONE BY A TEXAS REGISTERED PROFESSIONAL ENGINEER, SHALL BE DATED AND SHALL BEAR THE ENGINEER'S SEAL AND SIGNATURE. SPACING OF HANDRAIL UPRIGHTS (VERTICAL MEMBERS) SHALL NOT EXCEED 24" CENTER TO CENTER.

TYPICAL WALKWAY PLATFORM DETAILS
FOR SINGLE DYNAMIC MESSAGE SIGN

STATE OF TEXAS
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LICENSED PROFESSIONAL ENGINEER

Carlos E. Molina

May 4, 2021

Texas Department of Transportation

LED
DYNAMIC MESSAGE SIGN
WALKWAY PLATFORM DETAILS
FOR SINGLE SIGN

Sheet 1 of 1 Sheets

DIST.	COUNTY		SHEET NO.
FTW	TARRANT		20
CONTROL	SECT.	JOB	HIGHWAY NO.
0902	90	108	VA

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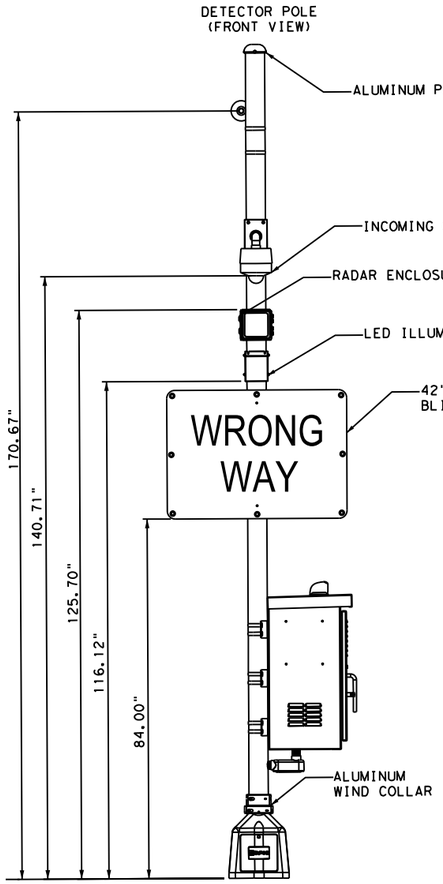

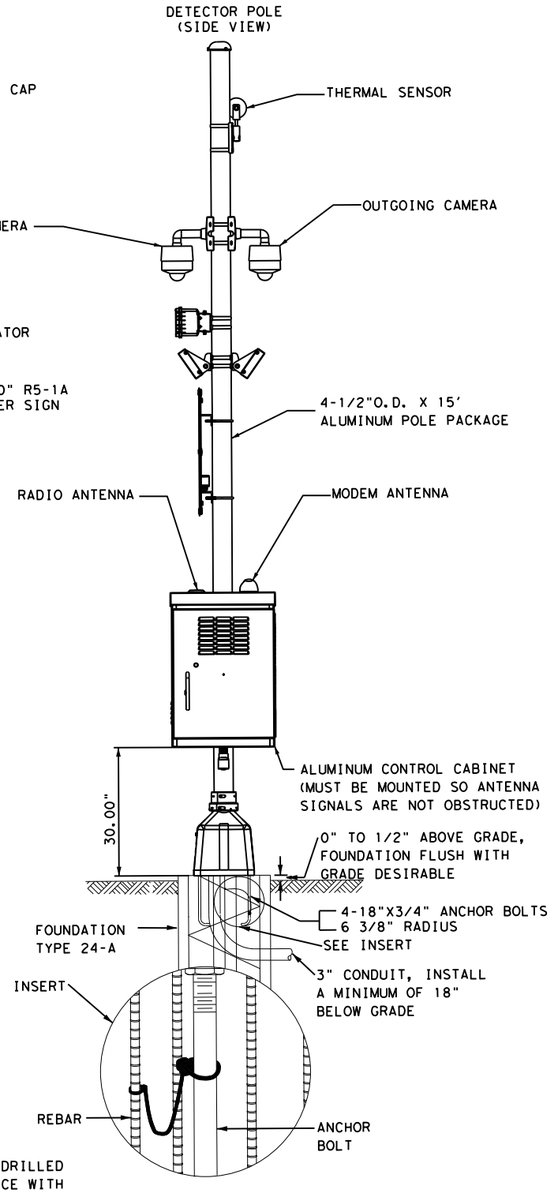

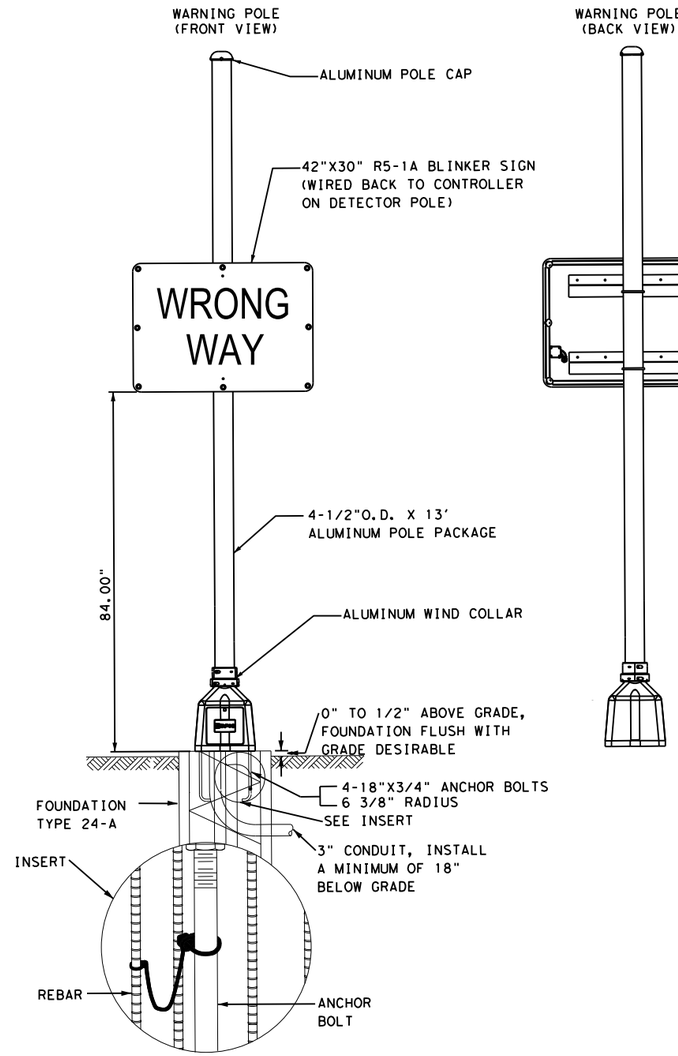

NOTE:

1. PAY FOR THE PEDESTAL POLE FOUNDATION USING ITEM 416, "DRILLED SHAFT FOUNDATIONS". INSTALL THE FOUNDATION IN ACCORDANCE WITH THE TS-FD-12 STANDARD SHEET.
2. BOND ANCHOR BOLTS TO REBAR CAGE, TWO LOCATIONS USING #3 BAR OR #6 AWG COPPER JUMPER. MECHANICAL CONNECTORS SHALL BE UL LISTED FOR CONCRETE ENCASEMENT. MECHANICAL CONNECTORS NOT SHOWN.
3. PER MANUFACTURER'S RECOMMENDATIONS, ENGAGE ALL THREADS ON THE PEDESTAL POLE BASE AND PIPE UNLESS THE PIPE IS FULLY SEATED INTO THE BASE. USE A POLE AND BASE COLLAR ASSEMBLY TO ADD STRENGTH AND PREVENT LOOSENING THE CONNECTION.
4. SEE FOUNDATION TYPE 24-A ON STANDARD SHEET TS-FD-12 FOR FOUNDATION STRUCTURE DESIGN DETAILS.
5. CONTROL CABINET HEIGHT MAY VARY.
6. SNAP LOCKS ARE PROVIDED, STANDARD 3/4" S/S BANDING IS RECOMMENDED.
7. J-BOLTS NOT SHOWN.
8. ALL DIMENSIONS ARE FOR REFERENCE ONLY.

STATE OF TEXAS
CARLOS E. MOLINA
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LICENSED
PROFESSIONAL ENGINEER

Carlos E. Molina

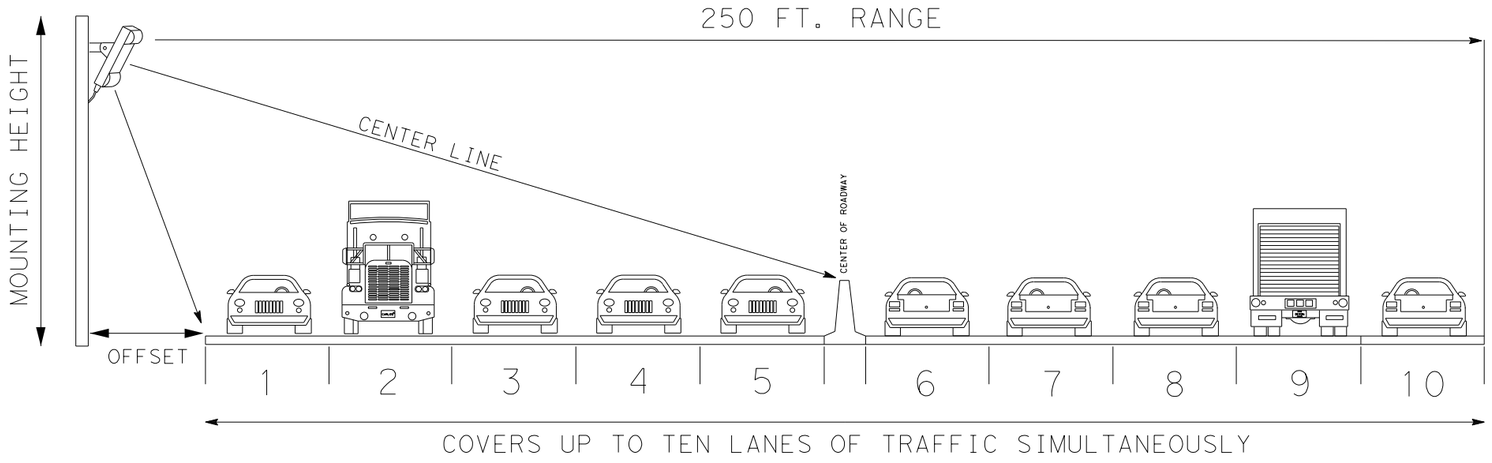
May 28, 2021

Texas Department of Transportation

TYPICAL WRONG WAY DRIVER SYSTEM EQUIPMENT

Sheet 1 of 1 Sheets

DIST.	COUNTY		SHEET NO.
FTW	TARRANT		21
CONTROL	SECT.	JOB	HIGHWAY NO.
0902	90	108	VA



MOUNTING GUIDELINES	
Offset (feet)	Mounting Height (feet)
15	15
20	18
25	26
30	29
35	30
40	33

Recommended Offset

STATE OF TEXAS
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LICENSED PROFESSIONAL ENGINEER

Carlos E. Molina

May 4, 2021

RADAR VEHICLE SENSING DEVICE

Sheet 1 of 1 Sheets

DIST.	COUNTY		SHEET NO.
FTW	TARRANT		22
CONTROL	SECT.	JOB	HIGHWAY NO.
0902	90	108	VA

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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 ½ 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.

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS CONDUITS & NOTES

ED(1)-14

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© TxDOT	October 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS		0902	90	108	VA
		DIST	COUNTY		SHEET NO.
		FTW	TARRANT		23

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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 splice. 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.

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.

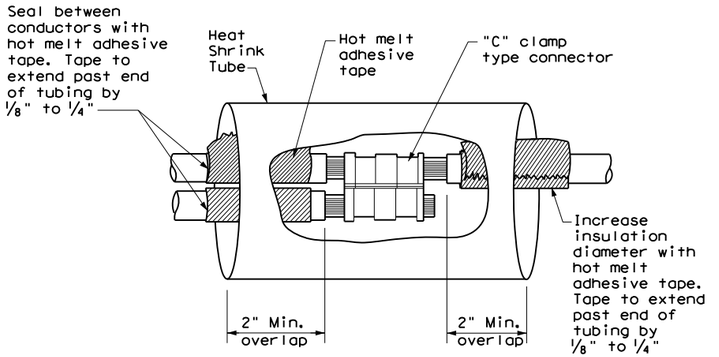
3. Install ground rods so the imprinted part number is at the upper end of the rod.

4. Remove all non-conductive coatings such as concrete splatter from the rod at the clamp location.

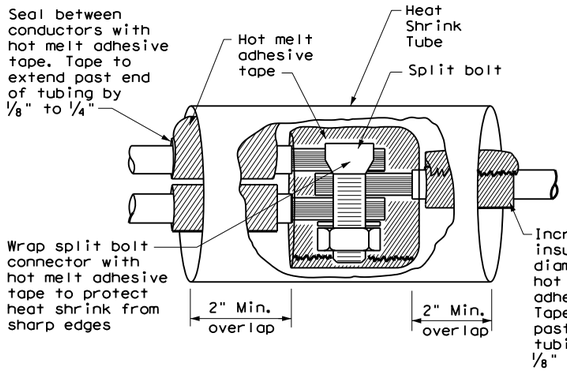
5. Route all conductors as short and straight as possible for connection to lightning protection ground rods. When a bend is required, ensure a minimum radius bend of four inches for these conductors.

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.

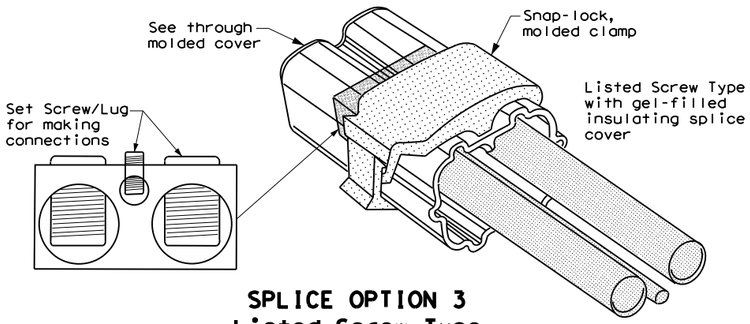
7. Written authorization is required before installing a ground rod in a horizontal trench for rocky soil or a solid rock bottom.



SPLICE OPTION 1
Compression Type



SPLICE OPTION 2
Split Bolt Type



SPLICE OPTION 3
Listed Screw Type

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Traffic Operations Division Standard

ELECTRICAL DETAILS CONDUCTORS

ED(3)-14

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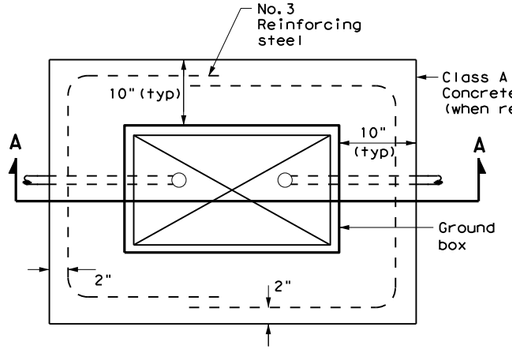
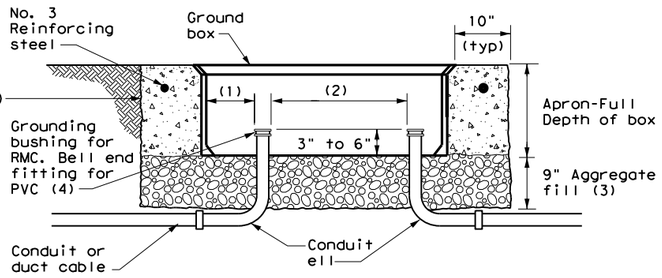


PLAN VIEW



SECTION A - A

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.

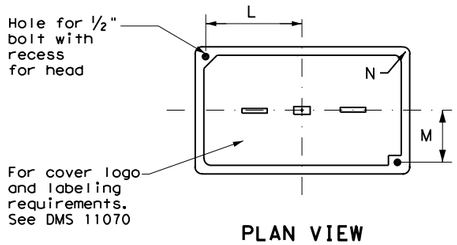
(2) Maintain sufficient space between conduits to allow for proper installation of bushing.

(3) Place aggregate under the box, not in the box. Aggregate should not encroach on the interior volume of the box.

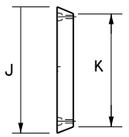
(4) Install a grounding bushing on the upper end of all RMC terminating in a ground box. Ground RMC elbows when any part of the elbow is less than 18 in. below the bottom of the ground box. Install a PVC bushing or bell end fitting on the upper end of all PVC conduits terminating in a ground box.

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



PLAN VIEW



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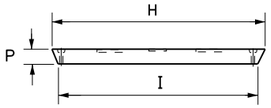

SIDE

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.

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS GROUND BOXES

ED(4)-14

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ELECTRICAL SERVICES NOTES

1. 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.

2. 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.

3. Provide all work, materials, services, and any incidentals needed to install a complete electrical service as specified in the plans.

4. 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.

5. 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.

6. 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.

7. When galvanized is specified for nuts, screws, bolts or miscellaneous hardware, stainless steel may be used.

8. 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.

9. 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.

10. Provide rigid metal conduit (RMC) for all conduits on service, except for the ½ 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.

11. 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.

12. Ensure all mounting hardware and installation details of services conform to utility company specifications.

13. 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 ½ in. x 11 in. before laminating. If the installation differs from the plan sheets, the installing contractor is to redline plan sheets before laminating.

14. 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 ½ 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.

15. 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

1. Provide threaded hub for all conduit entries into the top of enclosure.

2. 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 photocell or lighting contactor. Provide GS enclosures in accordance with DMS 11080, 11082, 11083, and 11084.

3. 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.

4. 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

1. Field drill flange-mounted remote operator handle if needed, to ensure handle is lockable in both the "On" and "Off" positions.

2. 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

1. 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 **Size	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 ¼"	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 ¼"	3/#6	N/A	N/A	N/A	70	Flashing Beacon 1	1P/20	4	1.0
									Flashing Beacon 2	1P/20	4	

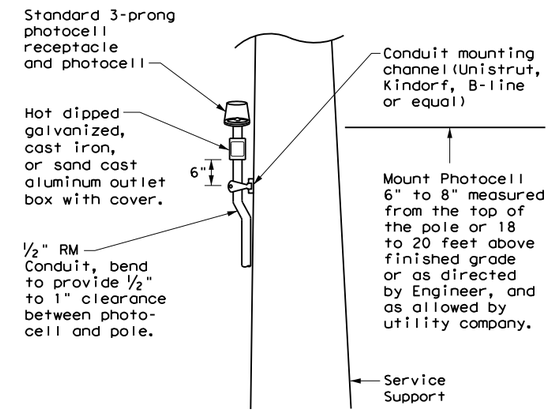
* Example only, not for construction. All new electrical services must have electrical service data chart specific to that service as shown in the plans.

** 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

ELEC SERV TY X XXX/XXX XXX (XX) XX (X) XX (X)

- Schematic Type
- Service Voltage V / V
- Disconnect Amp Rating
  000 indicates main lug only/
  Typically Type T
- (SS)= Safety Switch Ahead of Meter-Check with Utility
  (NS)= No safety Switch Ahead of Meter-Check with Utility
- Enclosure Type
  GS= Galvanized steel("off the shelf")
  SS= Stainless steel(Custom Enclosure)See MPL
  AL= Aluminum (Custom Enclosure)See MPL
- Photocell Mounting Location
  (E)= Inside Service/Enclosure Mounted
  (T)= Top of pole
  (L)= Luminaire mounted
  (N)= None/No Photocell or Lighting Contactor Required
- Service Support Type
  GC= Granite concrete
  OC= Other concrete
  TP= Timber pole
  SP= Steel pole
  SF= Steel frame
  OT= Pole by others or paid for separately
  EX= Existing pole
  TS= Service on traffic signal pole
  PS= Pedestal Service
- O= Overhead Service Feed from Utility
  U= Underground Service Feed from Utility



TOP MOUNTED PHOTOCELL

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

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Traffic Operations Division Standard

ELECTRICAL DETAILS SERVICE NOTES & DATA

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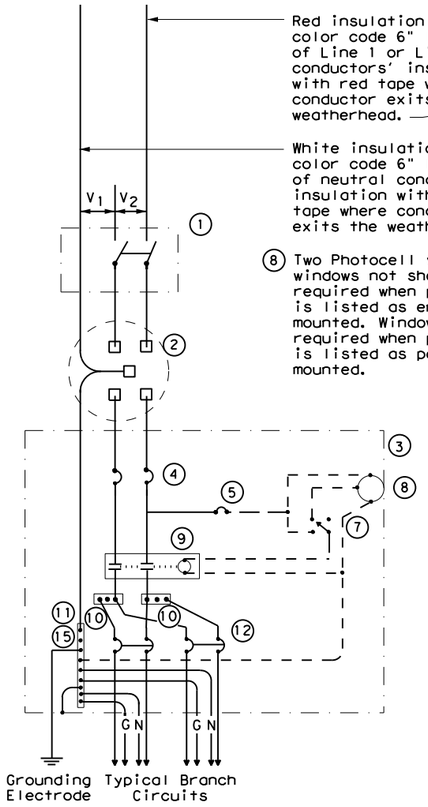
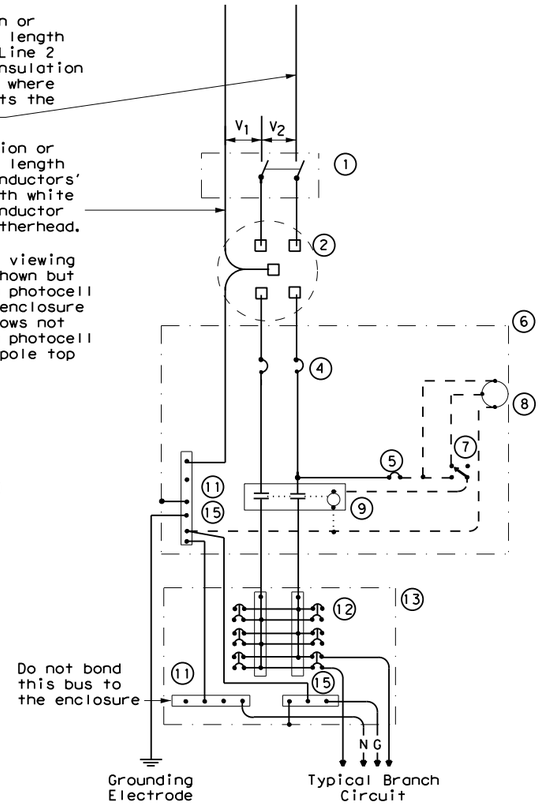
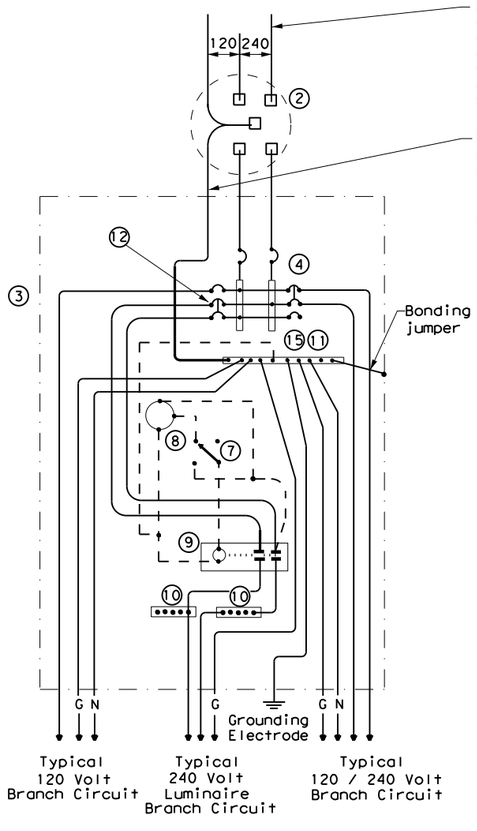


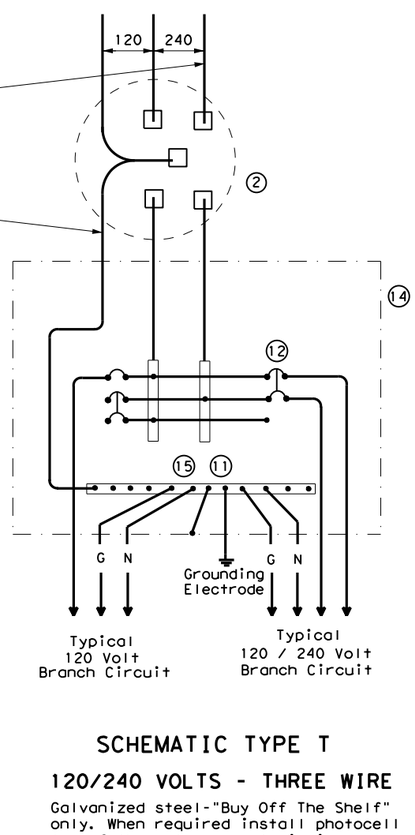
SCHEMATIC TYPE A THREE WIRE



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

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS SERVICE ENCLOSURE AND NOTES

ED(6)-14

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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 ½ in. or 1 5/8 in. wide by 1 in. up to 3 ¾ 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 ¾ in. x 18 in. x 4 in. (dia. x length x hook length) anchor bolts for underground service supports. Provide and install galvanized ¾ in. x 56 in. x 4 in. anchor bolts for overhead service supports. Ensure anchor bolts have 3 in of thread, with 3 ¼ in. to 3 ½ 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 ells 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.

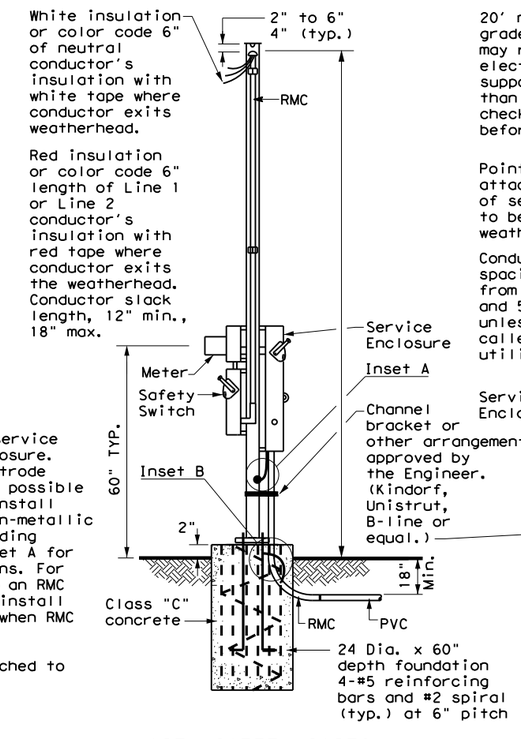
7. Drill and tap steel poles and frames for ½ in. X 13 UNC tank ground fitting. For steel pole service supports, provide and install tank ground fitting 4 in. to 6 in. below electrical service enclosure. Provide properly sized hole through the bottom of the enclosure for the service grounding electrode 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.

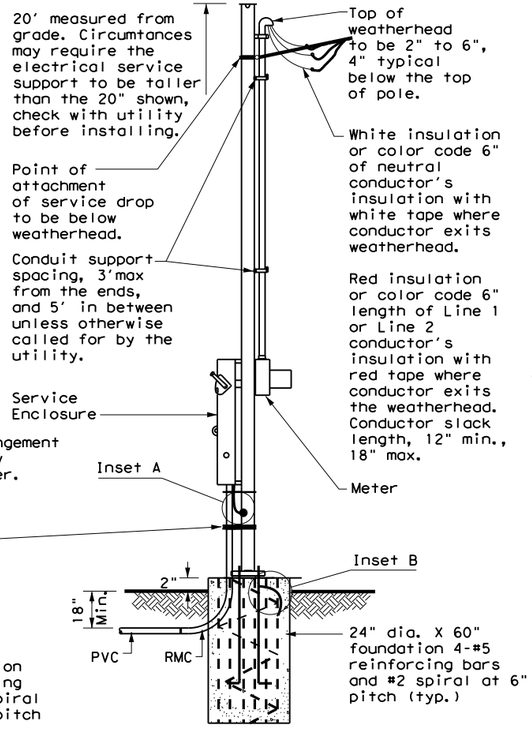
9. Provide ¼" - 20 machine screws for bonding. Do not use sheet metal screws. Remove all non-conductive material at contact points. Terminate bonding jumpers with listed devices. Install minimum size 6 AWG stranded copper bonding jumpers. Make up all threaded bonding connections wrench tight.

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.

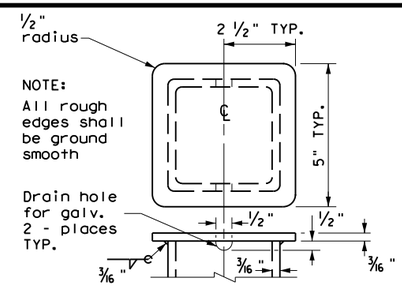


WITH SAFETY SWITCH

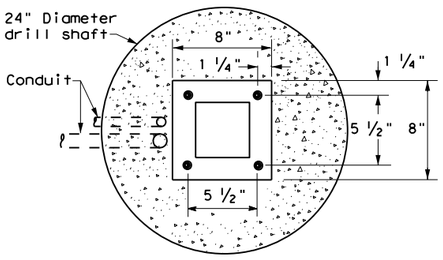


WITHOUT SAFETY SWITCH

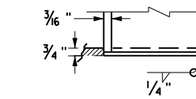
SERVICE SUPPORT TYPE SP (O) - OVERHEAD SERVICE



POLE TOP PLATE

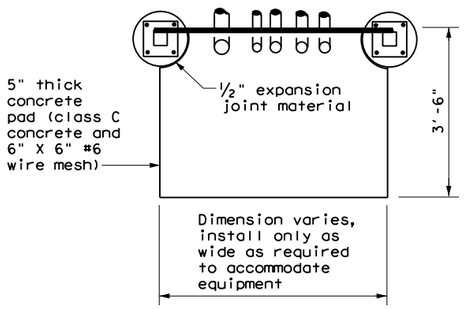


BASE PLATE DETAIL



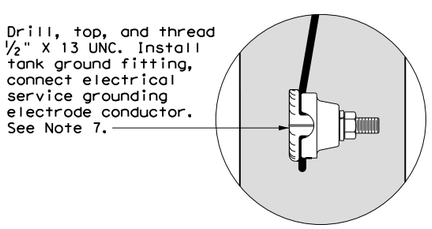
BOTTOM OF POLE

SERVICE SUPPORT TYPE SF & SP



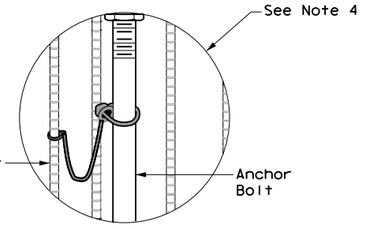
TOP VIEW

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

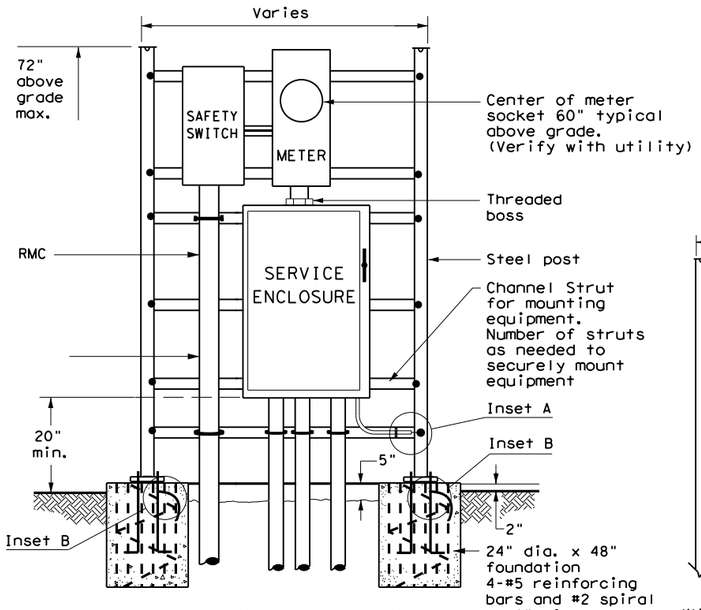


FRONT VIEW

INSET A

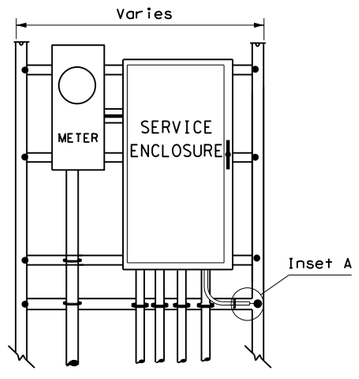


INSET B



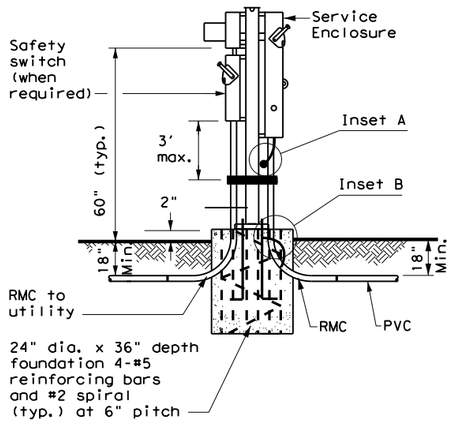
WITH SAFETY SWITCH

FRONT VIEW

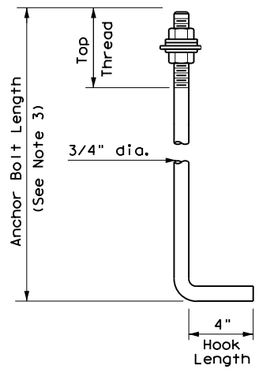


WITHOUT SAFETY SWITCH

SERVICE SUPPORT TYPE SF(U) - UNDERGROUND SERVICE



WITH SAFETY SWITCH



HOOKED ANCHOR DETAIL

SERVICE SUPPORT TYPE SP(U) - UNDERGROUND SERVICE

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS SERVICE SUPPORT TYPES SF & SP

ED(7)-14

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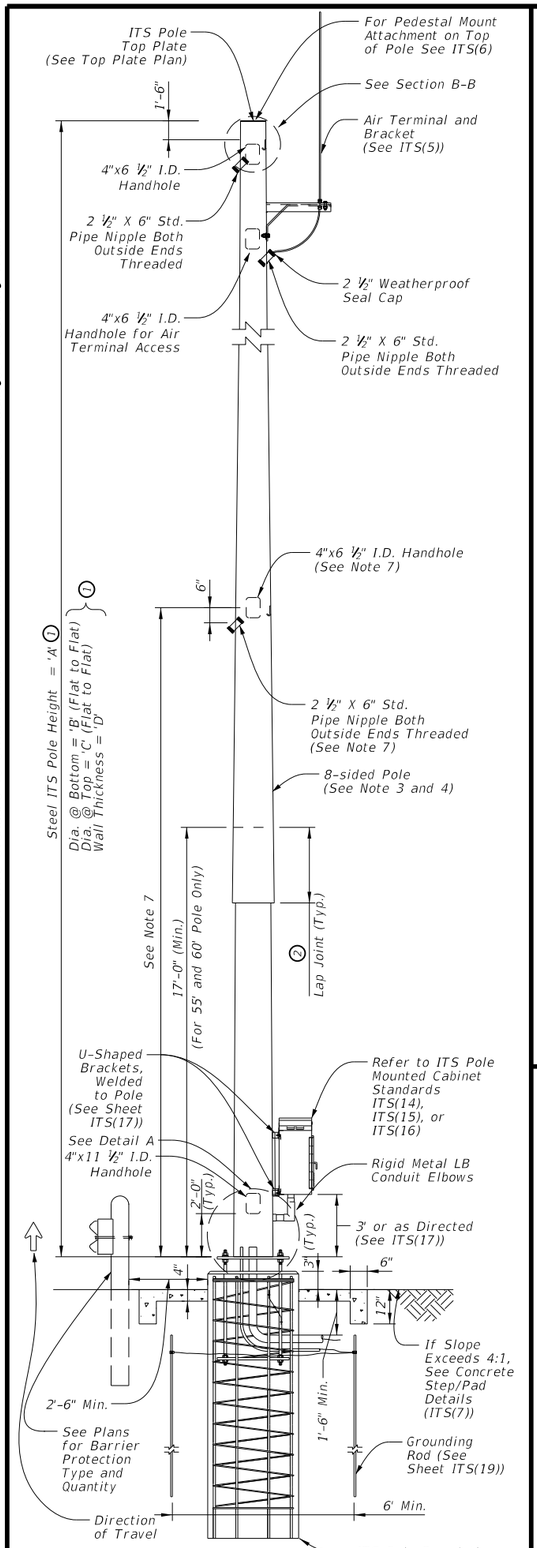
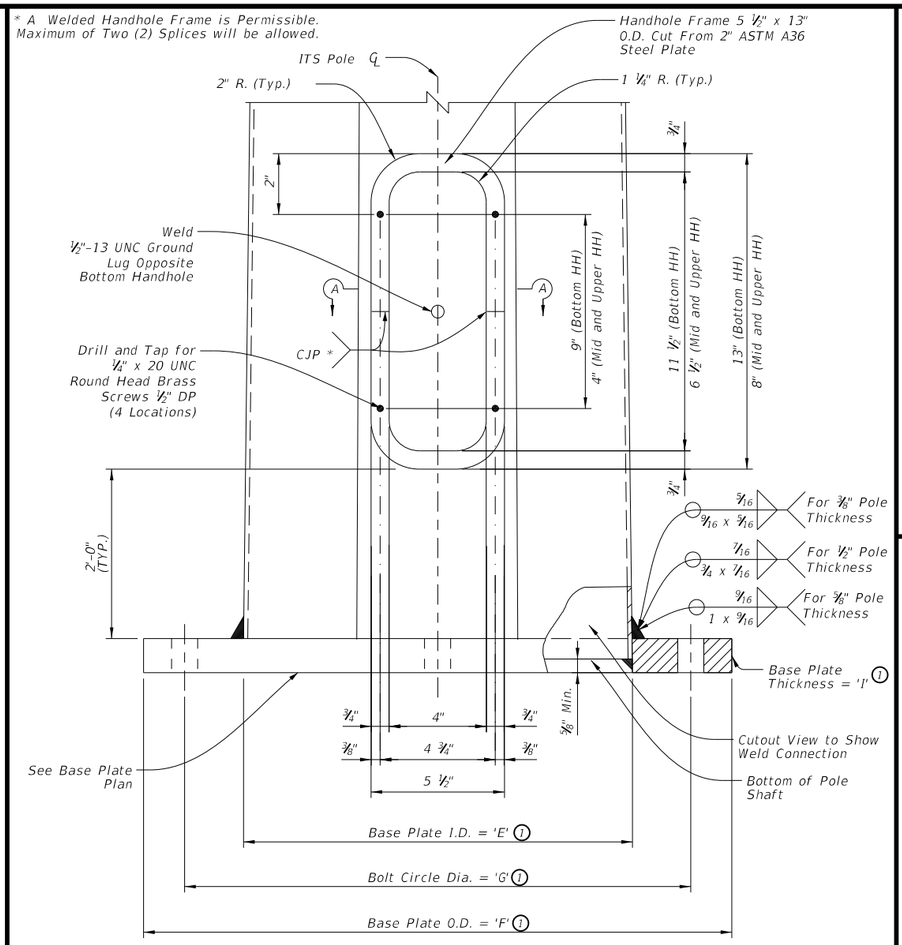
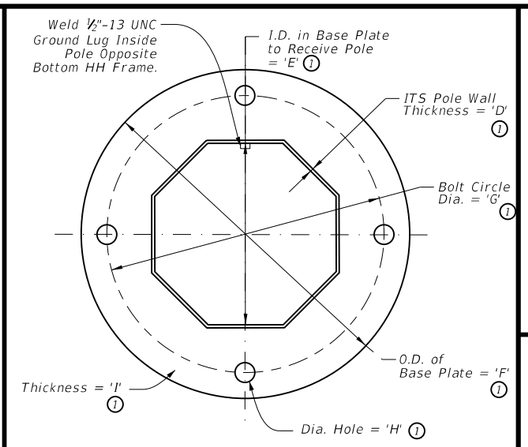


ITS Pole with Cabinet

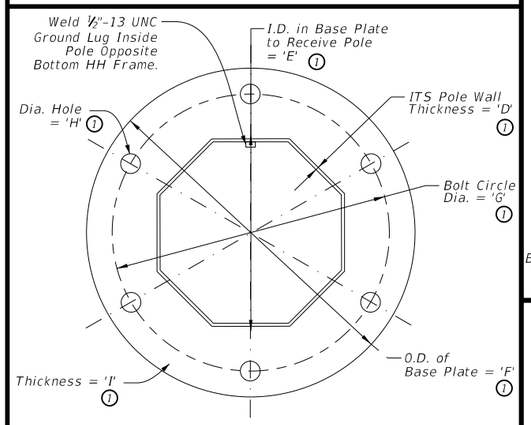


Detail A



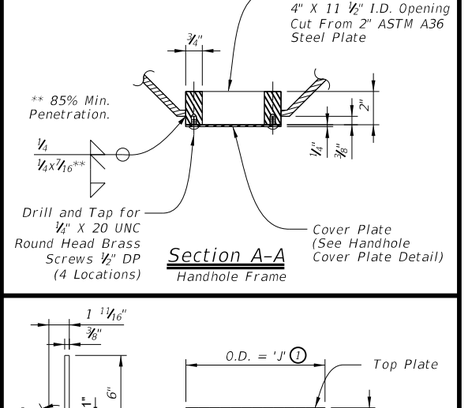
Base Plate Plan

4 Bolt Base Plate (ASTM A36)



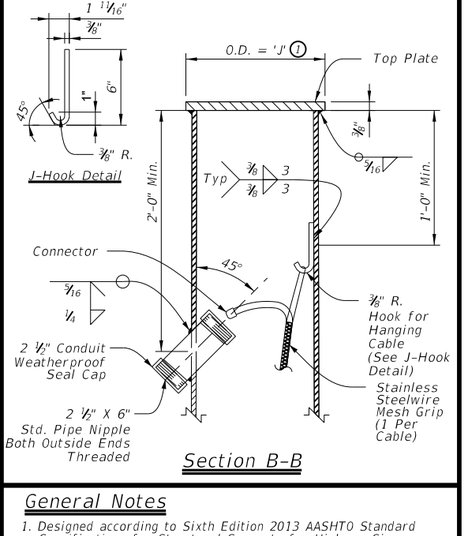
Base Plate Plan

6 Bolt Base Plate (ASTM A36)



Section A-A

Handhole Frame



Section B-B

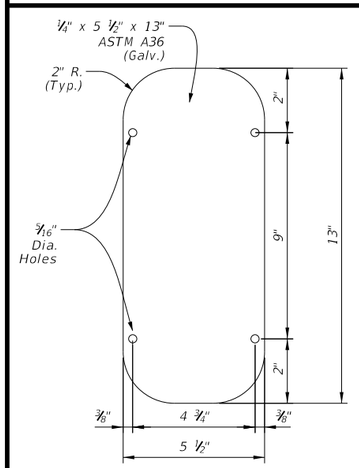
General Notes

1. Designed according to Sixth Edition 2013 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and Interim Specifications.
2. Unless otherwise noted, all parts shall be galvanized after fabrication in accordance with Item 445, "Galvanizing."
3. Deviation from the design criteria, values, and dimensions shown herein and on ITS(4), constitutes an alternative design and will require submission of shop drawings and calculations for approval, sealed by a Texas Professional Engineer.
4. Direct substitution of twelve sided or round poles, matching the design criteria, values, and dimensions shown herein, require submission of shop drawings for approval to confirm design criteria and values on ITS(4) is met.
5. Locate handholes opposite of the direction of travel.
6. Appropriate number of anchor bolts for base plate determined by height of pole. See 'L' on sheet ITS(4).
7. Location for ITS equipment mount may vary by device. Locate mid span handhole and pipe nipple to accommodate location for ITS equipment as identified in the plans or per manufacturer recommendations. Identify location for mid span handhole and pipe nipple on shop drawings for approval.

Reference Notes:

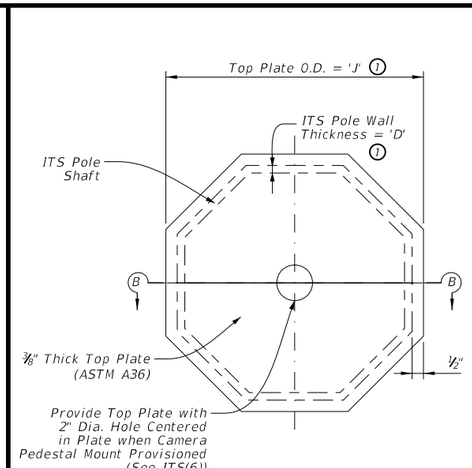
(1) See tables on Sheet ITS(4) for values of dimension variables.

(2) See lap joint note for 55' and 60' pole heights on ITS(4) at the bottom of each table.

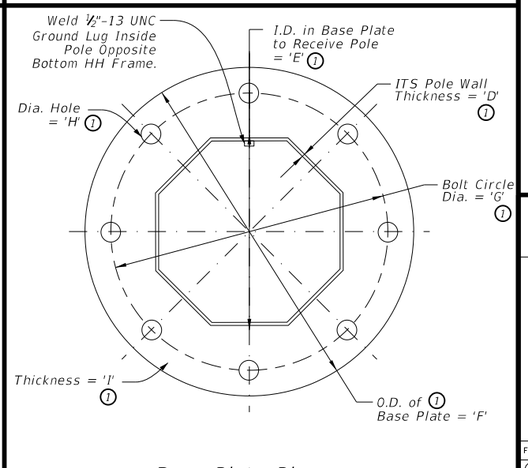


Handhole Cover Plate Detail

(Bottom Handhole)



Top Plate Plan



Base Plate Plan

8 Bolt Base Plate (ASTM A36)

Texas Department of Transportation

Traffic Operations Division Standard

ITS POLE DETAILS OCTAGONAL POLE (EIGHT SIDED POLE)

ITS(1)-15

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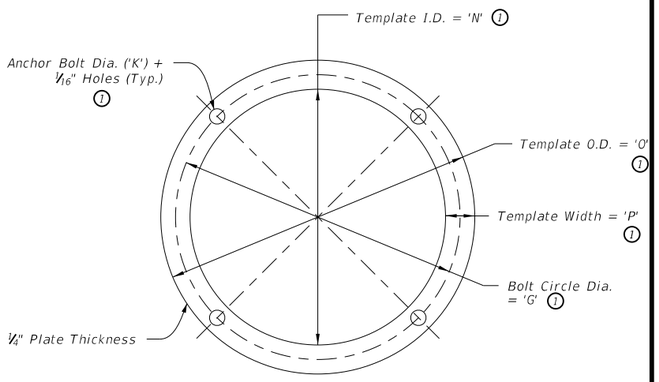
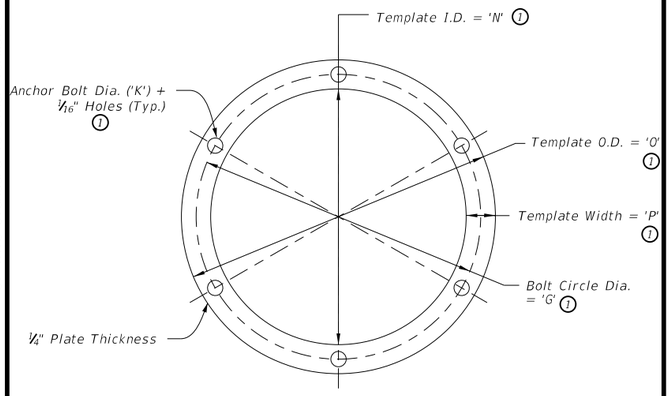
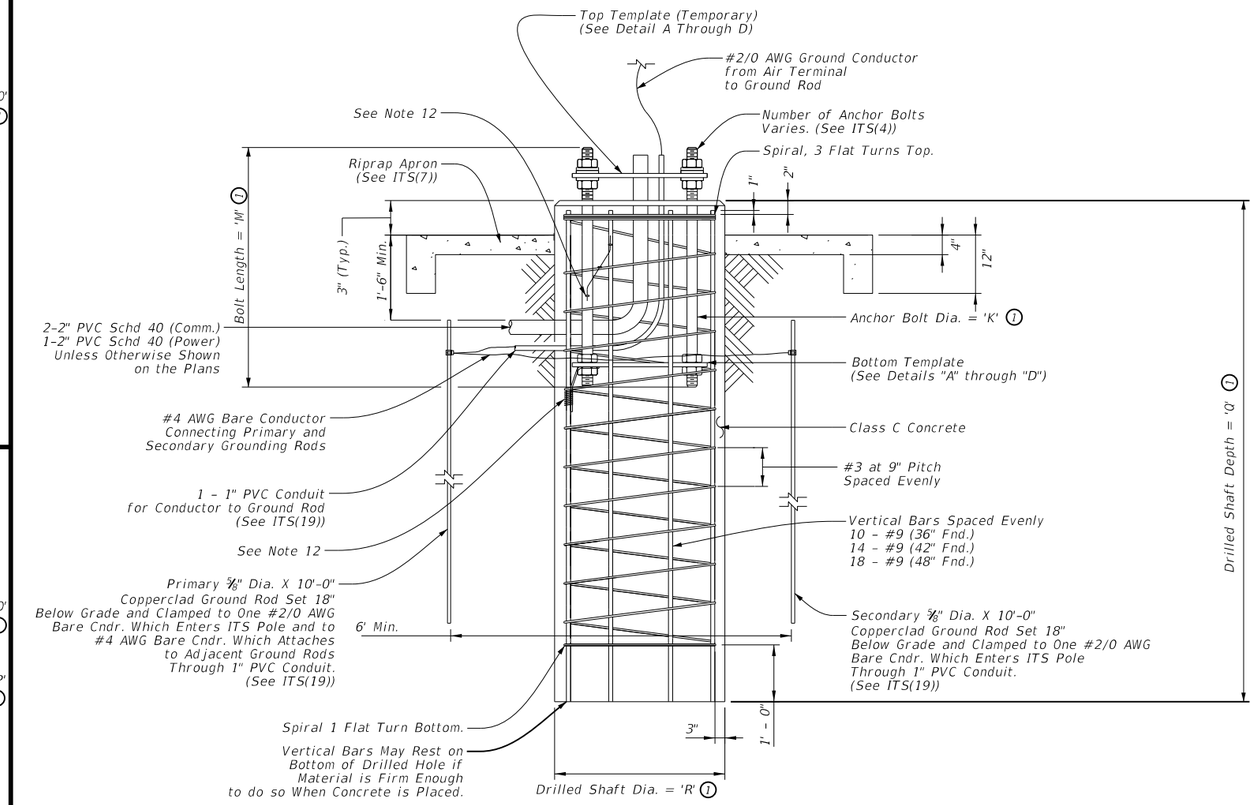


Top and Bottom Template (Four Bolt)
Detail A



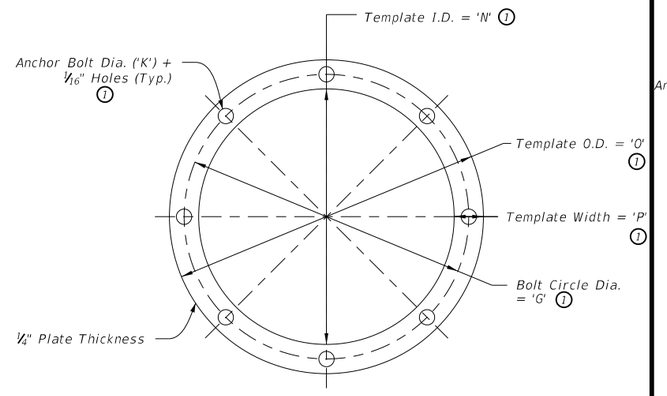
Top and Bottom Template (Six Bolt)
Detail B



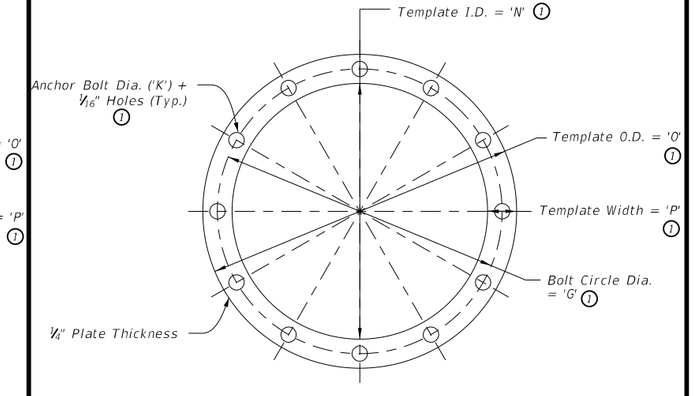
Foundation Details (Typical)
Elevation
Not to Scale

General Notes:

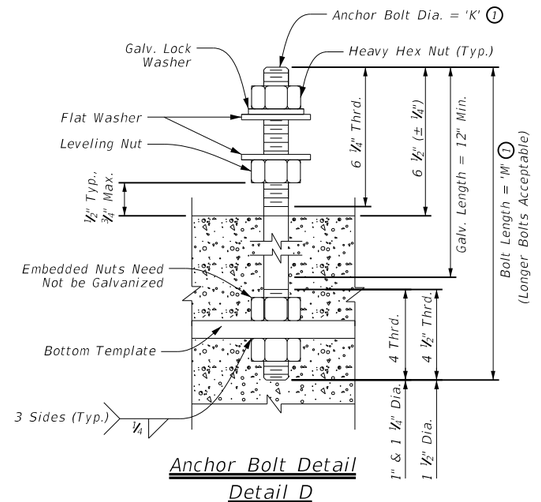
1. Drilled shaft concrete shall be Class "C" (f'c = 3,600 PSI) in accordance with Item 416, "Drilled Shaft Foundations."
2. Reinforcing bars shall be Grade 60 (Fy = 60 KSI) and conform to ASTM A-615. All reinforcing shall conform to Item 440, "Reinforcing Steel."
3. Provide ASTM A-36 steel for templates. Top and bottom templates need not be galvanized.
4. Anchor bolts shall be rigidly held in position during concrete placement using steel templates at the top and bottom. Top templates shall remain in place until the concrete has cured in place beyond initial set time.
5. Lubricate and tighten anchor bolts, when erecting pole, in accordance with Item 449, "Anchor Bolts."
6. Anchor bolts shall conform to ASTM F1554 Grade 55, or ASTM A193 B7 with ASTM A194 Grade 2H or A563 heavy hex nuts with F436 washers. Galvanize a minimum of the top end thread length plus 6 inches for all anchor bolts unless otherwise noted. Exposed washers and exposed nuts shall be galvanized. All galvanizing shall be in accordance with Item 445, "Galvanizing."
7. All vertical reinforcement shall be carried to the bottom of the drilled shaft.
8. Place three flat turns of the spiral bar at the top and one flat turn at the bottom of the drilled shaft.
9. Drilled shaft shall be measured by the linear foot and paid under Item 416, "Drill Shaft Foundations."
10. If rock is encountered, the drilled shaft to extend a minimum of two diameters into solid rock.
11. Location for conduit entering foundation may vary. Orient conduit entering foundation to coincide with location of ground boxes and primary ground rod.
12. Bond anchor bolts to rebar with #2/0 AWG jumper and two mechanical connectors or by bending No. 3 bar on bottom template as shown and wire tightly with ten turns of No. 10 wire or one mechanical connector. Mechanical connectors shall be UL Listed for concrete encasement.



Top and Bottom Template (Eight Bolt)
Detail C



Top and Bottom Template (Twelve Bolt)
Detail D



Anchor Bolt Detail
Detail D

Reference Notes:

(1) See tables on Sheet ITS(4) for values of dimension variables.

Texas Department of Transportation

Traffic Operations Division Standard

ITS POLE FOUNDATION DETAILS

ITS(3)-16

FILE: its(3)-16.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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TABLE 1: ITS POLE – 90 MPH (W/ 2 SOLAR PANELS) (4)

POLE TYPE (1)	POLE HEIGHT (FT)	POLE SHAFT (1)(10)			BASE PLATE (1)					TOP PLATE (2)	ANCHOR BOLT (3)						FOUNDATION (3)			
		BOTTOM OUTSIDE DIA. (IN)	TOP OUTSIDE DIA. (IN)	WALL THICKNESS (IN)	INSIDE DIA. (IN)	OUTSIDE DIA. (IN)	BOLT CIRCLE DIA. (IN)	BOLT HOLE DIA. (IN)	THICKNESS (IN)	OUTSIDE DIA. (IN)	DIA. (IN)	NO. OF BOLTS	LENGTH OF BOLT MIN. (IN)	TEMPLATE INSIDE DIA. (IN)	TEMPLATE OUTSIDE DIA. (IN)	TEMPLATE WIDTH (IN)	DRILL SHAFT DEPTH – TEXAS CONE PENETROMETER (N – BLOWS/FT.) (SEE NOTE 5)			DRILLED SHAFT DIA. (IN)
																	N = 10	N = 15	N = 40	
		'A'	'B'	'C'	'D'	'E'	'F'	'G'	'H'	'I'	'J'	'K'	'L'	'M'	'N'	'O'	'P'	'Q'			'R'
8 SIDED	20	10	8	1/2	10-1/16	21	16	1-1/4	1-1/2	9	1	4	29	14	18	2	12	11	10	36
	30	13	9	1/2	13-1/16	24	19	1-9/16	1-1/2	10	1-1/4	4	35	16-1/2	21-1/2	2-1/2	15	13	10	36
	40	15	9	1/2	15-1/16	26	21	1-9/16	1-1/2	10	1-1/4	6	35	18-1/2	23-1/2	2-1/2	17	14	11	42
	45	16	10	1/2	16-1/16	27	22	1-9/16	1-1/2	11	1-1/4	6	35	19-1/2	24-1/2	2-1/2	18	16	12	42
	50	17	10	1/2	17-1/16	28	23	1-9/16	1-1/2	11	1-1/4	6	35	20-1/2	25-1/2	2-1/2	19	16	12	42
	55 (6)(7)	19	11	5/8	19-1/16	30	25	1-13/16	2	12	1-1/2	6	40	22	28	3	21	18	13	42
	60 (6)(7)	20	11	5/8	20-1/16	31	26	1-13/16	2	12	1-1/2	6	40	23	29	3	21	19	14	48

TABLE 2: ITS POLE – 110 MPH (W/ 2 SOLAR PANELS) (4)

POLE TYPE (1)	POLE HEIGHT (FT)	POLE SHAFT (1)(10)			BASE PLATE (1)					TOP PLATE (2)	ANCHOR BOLT (3)						FOUNDATION (3)			
		BOTTOM OUTSIDE DIA. (IN)	TOP OUTSIDE DIA. (IN)	WALL THICKNESS (IN)	INSIDE DIA. (IN)	OUTSIDE DIA. (IN)	BOLT CIRCLE DIA. (IN)	BOLT HOLE DIA. (IN)	THICKNESS (IN)	OUTSIDE DIA. (IN)	DIA. (IN)	NO. OF BOLTS	LENGTH OF BOLT MIN. (IN)	TEMPLATE INSIDE DIA. (IN)	TEMPLATE OUTSIDE DIA. (IN)	TEMPLATE WIDTH (IN)	DRILL SHAFT DEPTH – TEXAS CONE PENETROMETER (N – BLOWS/FT.) (SEE NOTE 5)			DRILLED SHAFT DIA. (IN)
																	N = 10	N = 15	N = 40	
		'A'	'B'	'C'	'D'	'E'	'F'	'G'	'H'	'I'	'J'	'K'	'L'	'M'	'N'	'O'	'P'	'Q'			'R'
8 SIDED	20	10	8	1/2	10-1/16	21	16	1-1/4	1-1/2	9	1	4	29	14	18	2	14	12	10	36
	30	13	9	1/2	13-1/16	24	19	1-9/16	1-3/4	10	1-1/4	6	35	16-1/2	21-1/2	2-1/2	18	15	11	36
	40	15	9	1/2	15-1/16	25	21	1-9/16	1-3/4	10	1-1/4	6	35	18-1/2	23-1/2	2-1/2	20	17	12	42
	45	16	10	1/2	17-1/16	27	22	1-9/16	1-3/4	11	1-1/4	8	35	19-1/2	24-1/2	2-1/2	21	18	13	42
	50	17	10	1/2	18-1/16	28	23	1-9/16	1-3/4	11	1-1/4	8	35	20-1/2	25-1/2	2-1/2	22	19	14	42
	55 (7)	19	11	5/8	19-1/16	30	25	1-9/16	2	12	1-1/4	8	35	22-1/2	27-1/2	2-1/2	24	20	14	42
	60 (7)	20	11	5/8	20-1/16	31	26	1-13/16	2	12	1-1/2	6	40	23	29	3	25	21	15	48

TABLE 3: ITS POLE – 130 MPH (W/ 1 SOLAR PANEL) (5)

POLE TYPE (1)	POLE HEIGHT (FT)	POLE SHAFT (1)(10)			BASE PLATE (1)					TOP PLATE (2)	ANCHOR BOLT (3)						FOUNDATION (3)			
		BOTTOM OUTSIDE DIA. (IN)	TOP OUTSIDE DIA. (IN)	WALL THICKNESS (IN)	INSIDE DIA. (IN)	OUTSIDE DIA. (IN)	BOLT CIRCLE DIA. (IN)	BOLT HOLE DIA. (IN)	THICKNESS (IN)	OUTSIDE DIA. (IN)	DIA. (IN)	NO. OF BOLTS	LENGTH OF BOLT MIN. (IN)	TEMPLATE INSIDE DIA. (IN)	TEMPLATE OUTSIDE DIA. (IN)	TEMPLATE WIDTH (IN)	DRILL SHAFT DEPTH – TEXAS CONE PENETROMETER (N – BLOWS/FT.) (SEE NOTE 5)			DRILLED SHAFT DIA. (IN)
																	N = 10	N = 15	N = 40	
		'A'	'B'	'C'	'D'	'E'	'F'	'G'	'H'	'I'	'J'	'K'	'L'	'M'	'N'	'O'	'P'	'Q'			'R'
8 SIDED	20	10	8	1/2	10-1/16	21	16	1-9/16	1-3/4	9	1-1/4	4	35	13-1/2	18-1/2	2-1/2	16	14	10	36
	30	13	9	1/2	15-1/16	24	19	1-9/16	1-3/4	10	1-1/4	6	35	16-1/2	21-1/2	2-1/2	18	16	11	36
	40	15	9	1/2	15-1/16	26	21	1-9/16	1-3/4	10	1-1/4	6	35	18-1/2	23-1/2	2-1/2	21	18	13	42
	45	16	10	1/2	16-1/16	27	22	1-9/16	1-3/4	11	1-1/4	8	35	19-1/2	24-1/2	2-1/2	23	19	14	42
	50	17	10	1/2	17-1/16	28	23	1-9/16	2	11	1-1/2	8	40	20	26	3	24	20	14	42
	55 (7)	19	11	5/8	19-1/16	30	25	1-13/16	2	12	1-1/2	8	40	22	28	3	27	22	15	42
	60 (7)	20	11	5/8	20-1/16	31	26	1-13/16	2	12	1-1/2	8	40	23	29	3	28	23	16	48

TABLE 4: ITS POLE WITH STIFFENERS – 90 MPH (W/ 4 SOLAR PANELS) (8)

POLE TYPE (1)	POLE HEIGHT (FT)	POLE SHAFT (1)			BASE PLATE (1)					TOP PLATE (2)	ANCHOR BOLT (3)						FOUNDATION (3)			
		BOTTOM OUTSIDE DIA. (IN)	TOP OUTSIDE DIA. (IN)	WALL THICKNESS (IN)	INSIDE DIA. (IN)	OUTSIDE DIA. (IN)	BOLT CIRCLE DIA. (IN)	BOLT HOLE DIA. (IN)	THICKNESS (IN)	OUTSIDE DIA. (IN)	DIA. (IN)	NO. OF BOLTS	LENGTH OF BOLT MIN. (IN)	TEMPLATE INSIDE DIA. (IN)	TEMPLATE OUTSIDE DIA. (IN)	TEMPLATE WIDTH (IN)	DRILL SHAFT DEPTH – TEXAS CONE PENETROMETER (N – BLOWS/FT.) (SEE NOTE 5)			DRILLED SHAFT DIA. (IN)
																	N = 10	N = 15	N = 40	
		'A'	'B'	'C'	'D'	'E'	'F'	'G'	'H'	'I'	'J'	'K'	'L'	'M'	'N'	'O'	'P'	'Q'			'R'
8 SIDED	30	13	9	3/8	13-1/16	28	22	1-1/4	1-3/4	10	1	8	29	20	24	2	17	15	11	42
	40	15	9	1/2	15-1/16	30	24	1-1/4	2	10	1	8	29	22	26	2	20	17	12	42
	45	16	10	1/2	16-1/16	31	25	1-9/16	2	11	1-1/4	8	35	22-1/2	27-1/2	2-1/2	21	18	13	42
	50	17	10	1/2	17-1/16	32	26	1-9/16	2	11	1-1/4	8	35	23-1/2	28-1/2	2-1/2	21	18	13	42
12 sided	55 (7)	19	11	5/8	19-1/16	34	27	1-9/16	2	12	1-1/4	12	35	24-1/2	29-1/2	2-1/2	21	18	13	48
	60 (7)	20	12	5/8	20-1/16	35	28	1-9/16	2	13	1-1/4	12	35	25-1/2	30-1/2	2-1/2	22	19	14	48

TABLE 5: ITS POLE WITH STIFFENERS – 110 MPH (W/ 4 SOLAR PANELS) (8)

POLE TYPE (1)	POLE HEIGHT (FT)	POLE SHAFT (1)			BASE PLATE (1)					TOP PLATE (2)	ANCHOR BOLT (3)						FOUNDATION (3)			
		BOTTOM OUTSIDE DIA. (IN)	TOP OUTSIDE DIA. (IN)	WALL THICKNESS (IN)	INSIDE DIA. (IN)	OUTSIDE DIA. (IN)	BOLT CIRCLE DIA. (IN)	BOLT HOLE DIA. (IN)	THICKNESS (IN)	OUTSIDE DIA. (IN)	DIA. (IN)	NO. OF BOLTS	LENGTH OF BOLT MIN. (IN)	TEMPLATE INSIDE DIA. (IN)	TEMPLATE OUTSIDE DIA. (IN)	TEMPLATE WIDTH (IN)	DRILL SHAFT DEPTH – TEXAS CONE PENETROMETER (N – BLOWS/FT.) (SEE NOTE 5)			DRILLED SHAFT DIA. (IN)
																	N = 10	N = 15	N = 40	
		'A'	'B'	'C'	'D'	'E'	'F'	'G'	'H'	'I'	'J'	'K'	'L'	'M'	'N'	'O'	'P'	'Q'			'R'
8 SIDED	30	13	9	1/2	13-1/16	28	22	1-9/16	2-1/4	10	1-1/4	8	35	19-1/2	24-1/2	2-1/2	20	17	12	42
	40	16	10	1/2	16-1/16	31	25	1-9/16	2-1/4	11	1-1/4	8	35	22-1/2	27-1/2	2-1/2	24	20	14	42
	45	17	11	1/2	17-1/16	32	26	1-9/16	2-1/4	12	1-1/4	8	35	23-1/2	28-1/2	2-1/2	25	21	15	42
	50	18	11	1/2	18-1/16	32	26	1-13/16	2-1/2	12	1-1/2	8	40	23	29	3	25	21	15	48
12 SIDED	55 (7)	19	11	5/8	19-1/16	34	27	1-9/16	2-1/4	12	1-1/4	12	35	24-1/2	29-1/2	2-1/2	24	21	15	48
	60 (7)	20	12	5/8	20-1/16	35	28	1-9/16	2-1/4	13	1-1/4	12	35	25-1/2	30-1/2	2-1/2	25	22	15	48

TABLE 6: ITS POLE WITH STIFFENERS – 130 MPH (W/ 3 SOLAR PANELS) (9)

POLE TYPE (1)	POLE HEIGHT (FT)	POLE SHAFT (1)			BASE PLATE (1)					TOP PLATE (2)	ANCHOR BOLT (3)						FOUNDATION (3)			
		BOTTOM OUTSIDE DIA. (IN)	TOP OUTSIDE DIA. (IN)	WALL THICKNESS (IN)	INSIDE DIA. (IN)	OUTSIDE DIA. (IN)	BOLT CIRCLE DIA. (IN)	BOLT HOLE DIA. (IN)	THICKNESS (IN)	OUTSIDE DIA. (IN)	DIA. (IN)	NO. OF BOLTS	LENGTH OF BOLT MIN. (IN)	TEMPLATE INSIDE DIA. (IN)	TEMPLATE OUTSIDE DIA. (IN)	TEMPLATE WIDTH (IN)	DRILL SHAFT DEPTH – TEXAS CONE PENETROMETER (N – BLOWS/FT.) (SEE NOTE 5)			DRILLED SHAFT DIA. (IN)
																	N = 10	N = 15	N = 40	
		'A'	'B'	'C'	'D'	'E'	'F'	'G'	'H'	'I'	'J'	'K'	'L'	'M'	'N'	'O'	'P'	'Q'			'R'
8 SIDED	30	13	9	1/2	13-1/16	28	22	1-9/16	2-1/2	10	1-1/4	8	35	19-1/2	24-1/2	2-1/2	23	19	14	42
	40	16	10	1/2	16-1/16	31	25	1-9/16	2-1/2	11	1-1/2	8	40	22	28	3	25	21	14	42
	45	17	11	1/2	17-1/16	32	26	1-13/16	2-1/2	12	1-1/2	8	40	23	29	3	26	22	16	48
	50	18	11	1/2	18-1/16	33	27	1-13/16	2-1/2	12	1-1/2	8	40	24	30	3	27	23	16	48
12 SIDED	55 (7)	19	11	5/8	19-1/16	34	27	1-9/16	2-1/4	12	1-1/4	12	35	24-1/2	29-1/2	2-1/2	26	22	16	48
	60 (7)	20	12	5/8	20-1/16	35	28	1-9/16	2-1/4	13	1-1/4	12	35	25 1/2	30 1/2	2-1/2	27	23	16	48

General Notes:

1. Designed according to Sixth Edition 2013 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and Interim Specifications thereto.
2. Table 1 and Table 4 design wind speed equals 90 MPH (3-Second Wind Gusts) with a 1.14 gust factor. A wind importance factor of 1.00 is applied to adjust the wind speed to a 50 year recurrence interval at 33 FT above the ground for Exposure C category in accordance with TxDOT WV&IZ(LTS2013). Design values listed in the table allow the base of the pole to be elevated above the surrounding ground level no more than 20 FT.
3. Table 2 and Table 5 design wind speed equals 110 MPH (3-Second Wind Gusts) with a 1.14 gust factor. A wind importance factor of 1.00 is applied to adjust the wind speed to a 50 year recurrence interval at 33 FT above the ground for Exposure C category in accordance with TxDOT WV&IZ(LTS2013). Design values listed in the table allow the base of the pole to be elevated above the surrounding ground level no more than 20 FT.
4. Table 3 and Table 6 design wind speed equals 130 MPH (3-Second Wind Gusts) with a 1.14 gust factor. A wind importance factor of 1.00 is applied to adjust the wind speed to a 50 year recurrence interval at 33 FT above the ground for Exposure C category in accordance with TxDOT WV&IZ(LTS2013). Design values listed in the table allow the base of the pole to be elevated above the surrounding ground level no more than 20 FT.
5. Recommended embedment lengths are for information purposes only. Foundation embedment depth is based off Texas Cone Penetrometer Value N = 10 blows/ft. for soft soils and up to 40 blows/ft. for hard soils. Foundation lengths shall be as shown on the plans, or as directed by the Engineer. Foundations will be paid for under Item 416, "Drilled Shaft Foundations" unless otherwise shown on the plans.
6. Deviation from the design criteria and values contained in the tables above constitute and alternative design and will require submission of shop drawings and calculations for approval, sealed by a Texas Professional Engineer.
7. 12-sided or round poles as a direct substitution for 8-sided and round poles as a direct substitution for 12-sided poles, meeting the design criteria and values contained in the tables above, require submission of shop drawings for approval.

Reference Notes

(1) See the following ITS Pole Standard sheets:
- 8-sided Pole – ITS(1)
- 12-sided Pole – ITS(2)

(2) Provision for 2" Dia. opening in top plate for poles requiring cameras mounted on top.
- See ITS Pole Mounting Details – ITS(6)

(3) See ITS Pole Foundation Details – ITS(3)

(4) Designed to support the following:
- Two Type 3 ITS pole mounted cabinets (280 LBS/EA and EPA = 14.50 sq. ft. per cabinet). See ITS(16).
- Two 250 W (50 LBS/EA and EPA = 30.70 sq. ft. per panel) solar panels (see ITS(24) "Solar Panel Matrix Table")
- Combined ITS equipment dead load of 170 LBS with an EPA = 6 sq. ft.

(5) Designed to support the following:
- Two Type 3 ITS pole mounted cabinets (280 LBS/EA and EPA = 14.50 sq. ft. per cabinet). See ITS(16).
- One 250 W (50 LBS/EA and EPA = 30.70 sq. ft. per panel) solar panels (see ITS(24) "Solar Panel Matrix Table")
- Combined ITS equipment dead load of 170 LBS with an EPA = 6 sq. ft.

(6) Pole heights at 55 Ft. and 60 Ft. located in the AMA, CHS, and LBB Districts, will require special design and design values shown shall not be used. Submit shop drawings for pole design and supporting calculations for 55 Ft. and 60 Ft. pole heights signed and sealed by a Texas Professional Engineer for approval.

(7) Ensure minimum nominal splice length is 1.5 times the average pole diameter at the splice to the nearest inch. Ensure longitudinal seam welds that will be in contact at a slip joint splice are ground smooth for the length of splice plus a minimum of six inches. Ensure a 100% longitudinal seam weld for a length of 1.5 pole diameter plus a minimum of 6 inches in outer sections at splices and at base plate. Provide 85% penetration in longitudinal seam welds at other pole sections.

(8) Designed to support the following:
- Two Type 3 ITS pole mounted cabinets (280 LBS/EA and EPA = 14.50 sq. ft. per cabinet). See ITS(16).
- Four 250 W (50 LBS/EA and EPA = 30.70 sq. ft. per panel) solar panels (see ITS(24) "Solar Panel Matrix Table")
- Combined ITS equipment dead load of 170 LBS with an EPA = 6 sq. ft.

Refer to ITS(4A) for stiffening plate details at the pole to base plate connection.

(9) Designed to support the following:
- Two Type 3 ITS pole mounted cabinets (280 LBS/EA and EPA = 14.50 sq. ft. per cabinet). See ITS(16).
- Three 250 W (50 LBS/EA and EPA = 30.70 sq. ft. per panel) solar panels (see ITS(24) "Solar Panel Matrix Table")
- Combined ITS equipment dead load of 170 LBS with an EPA = 6 sq. ft.

Refer to ITS(4A) for stiffening plate details at the pole to base plate connection.

(10) When solar panels are not provisioned in the plans, ITS pole wall thickness may be reduced by 1/2".

Texas Department of Transportation

Traffic Operations Division Standard

ITS POLE DESIGN DETAILS DATA LOOKUP TABLE

ITS(4)-15

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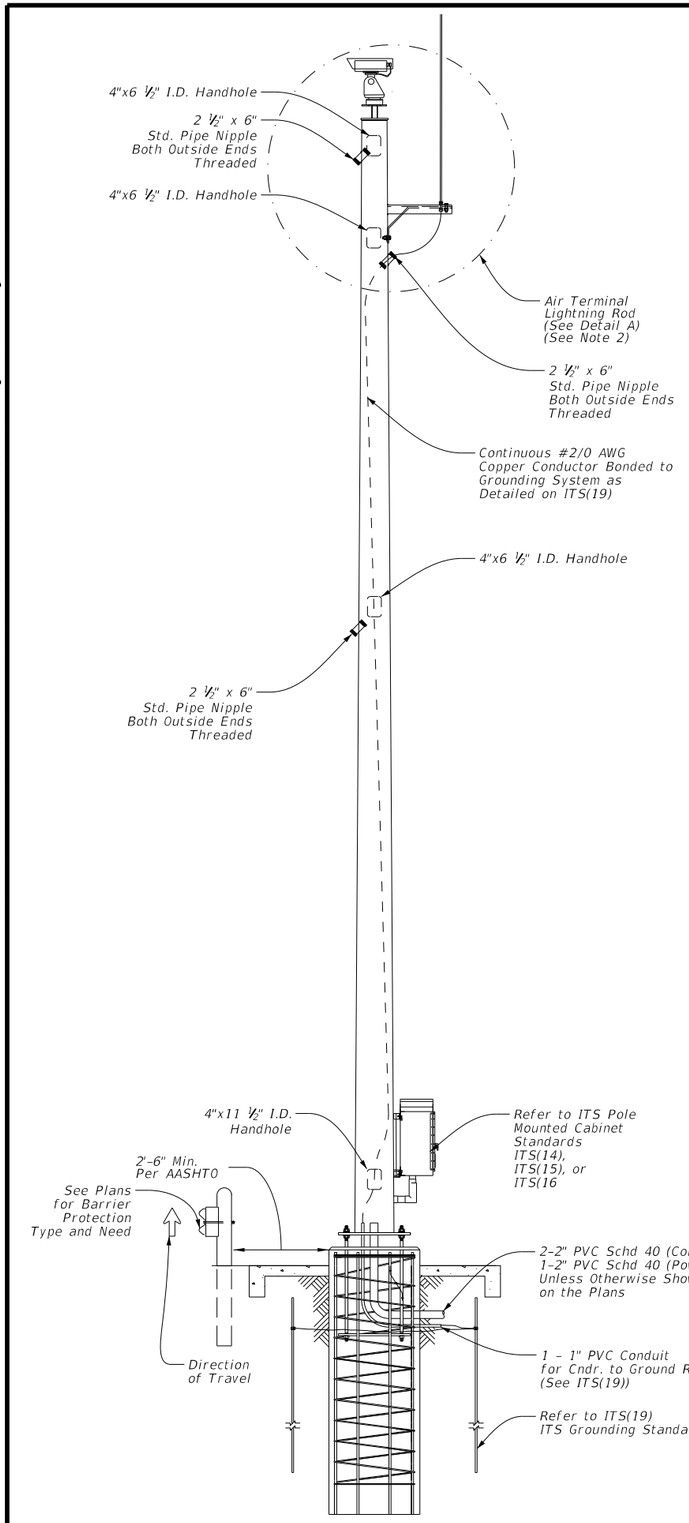
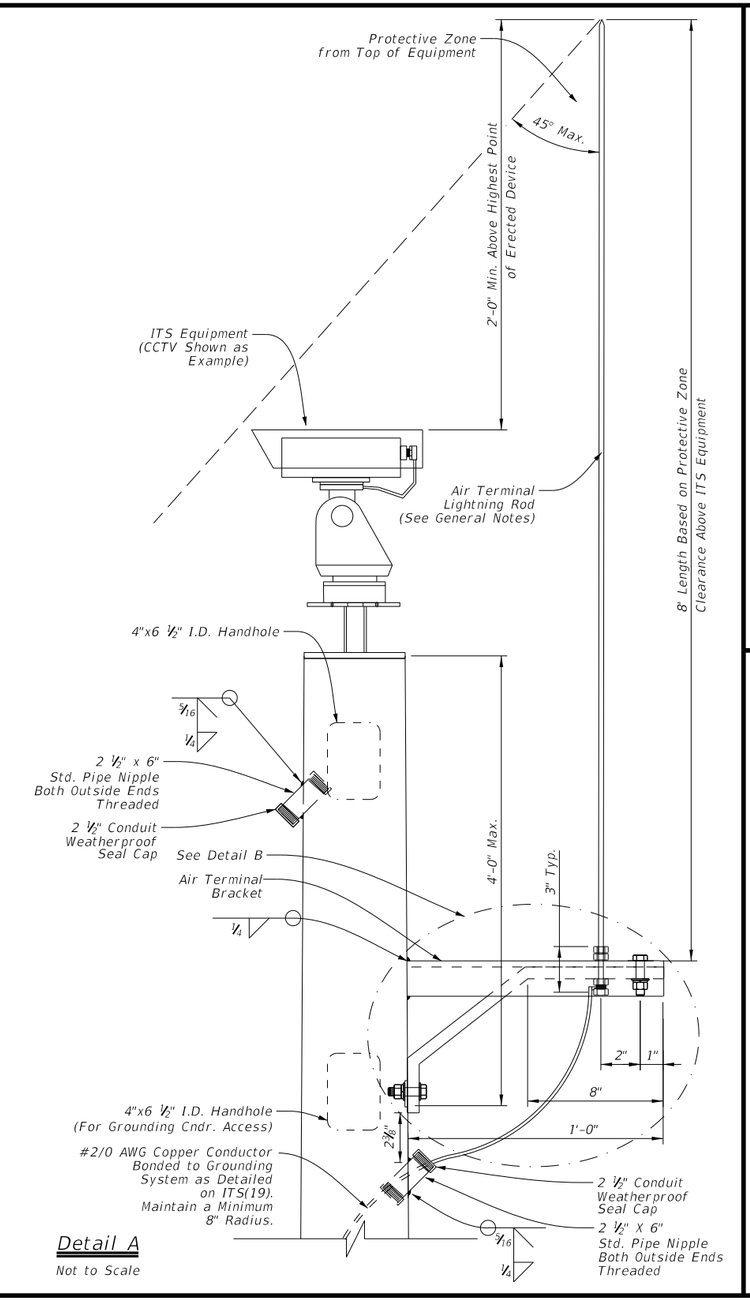
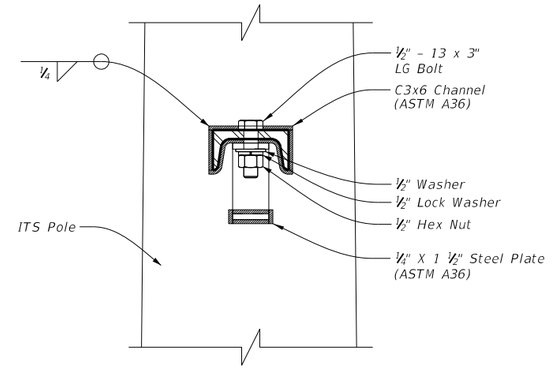


ITS Pole with Cabinet



Detail A

Not to Scale



Section A-A

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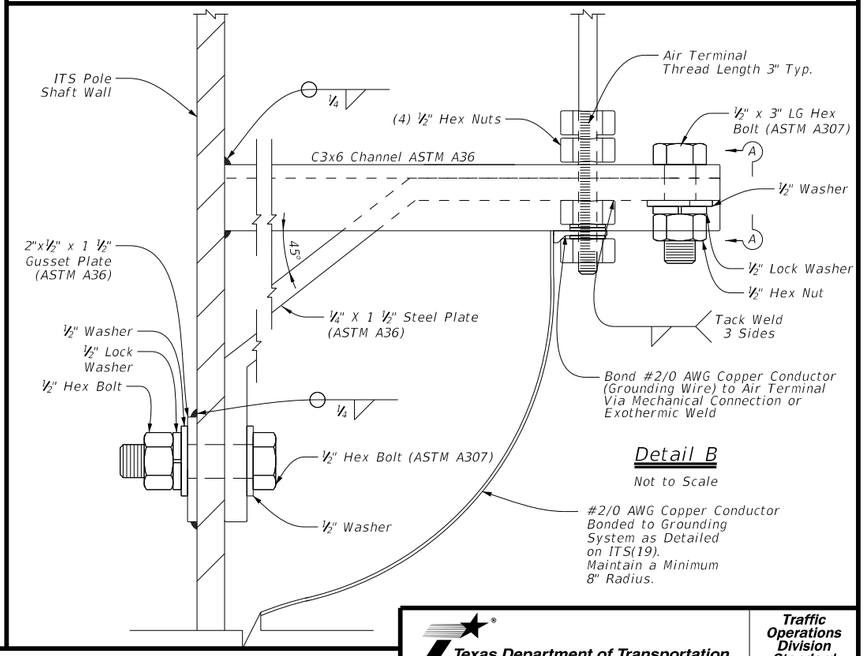

Detail B

Not to Scale

General Notes:

1. Provide lightning protection using air terminals on structures utilizing the rolling sphere method. Provide lightning protection system consisting of air terminals, down conductor, and grounding system installed in accordance with NFPA 780 and tested in accordance with IEEE 142. Meet the following requirements:
   A. Position - in center of least utilized field of view.
   B. Height - camera equipment to be within 45 degree protective zone of air terminal.
   C. Material - ½" ETP alloy 110 copper air terminal (Class II)
   D. Clearance - 24" minimum height above highest point of ITS equipment.
   E. Bonding - attach air terminal to bracket by exothermic weld or with approved clamping.
   F. Structure wind rating in accordance with TxDOT WV & IZ (LTS2013).
   G. Galvanize air terminal bracket in accordance with Item 445, "Galvanizing."
2. Alternative orientation for air terminal and pole mounted cabinet due to project specific needs to be indicated on the plans and detailed in shop drawing submittal for approval.
3. Weld air terminal bracket to ITS pole in accordance with Item 448 "Structural Field Welding." Bracket may be welded by the fabricator in the shop prior to delivery. A bolted connection for the air terminal bracket is acceptable in lieu of a welded connection with approval by the Engineer and detailed in the shop drawings.

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Traffic Operations Division Standard

ITS POLE AIR TERMINAL DETAILS

ITS(5)-15

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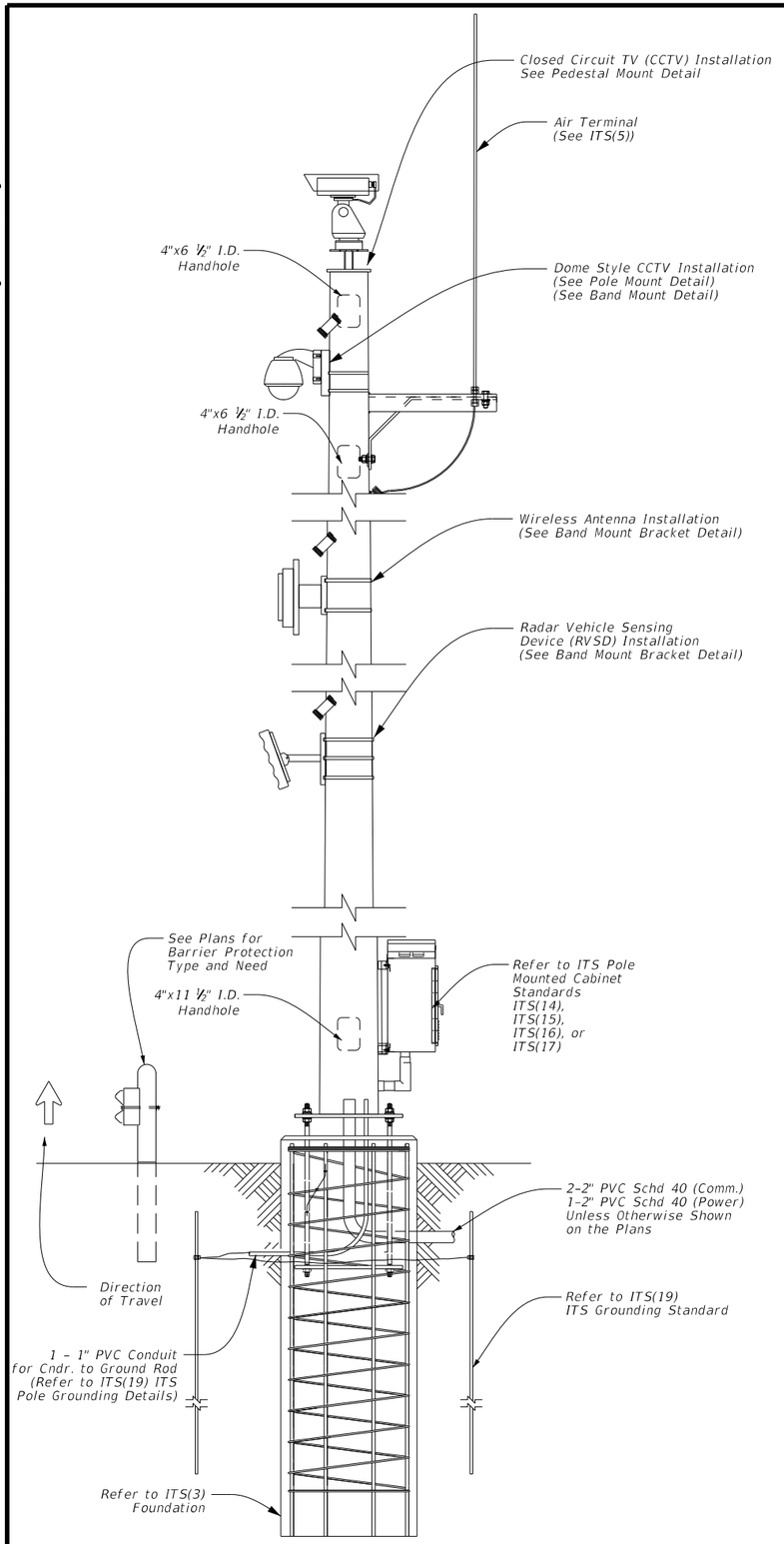
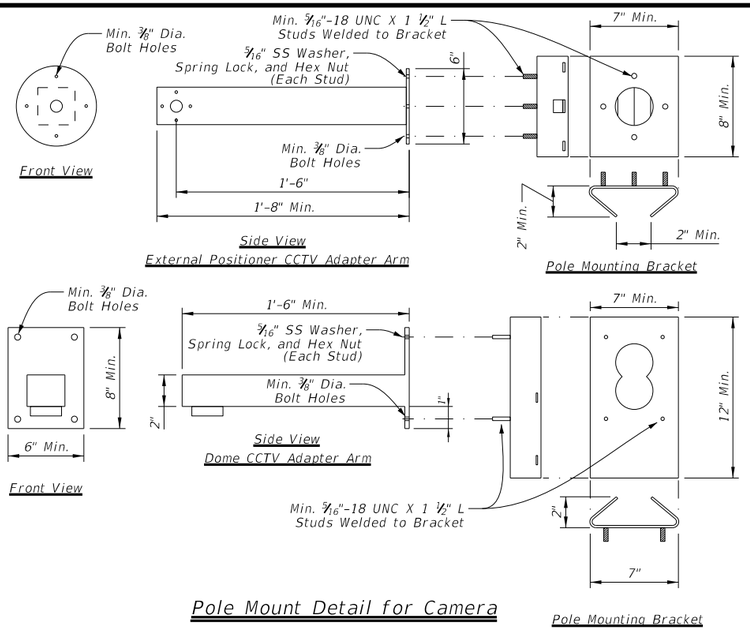
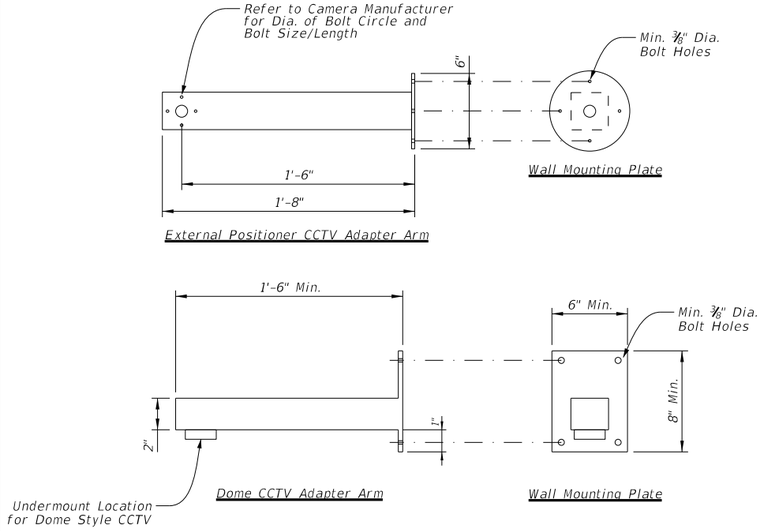


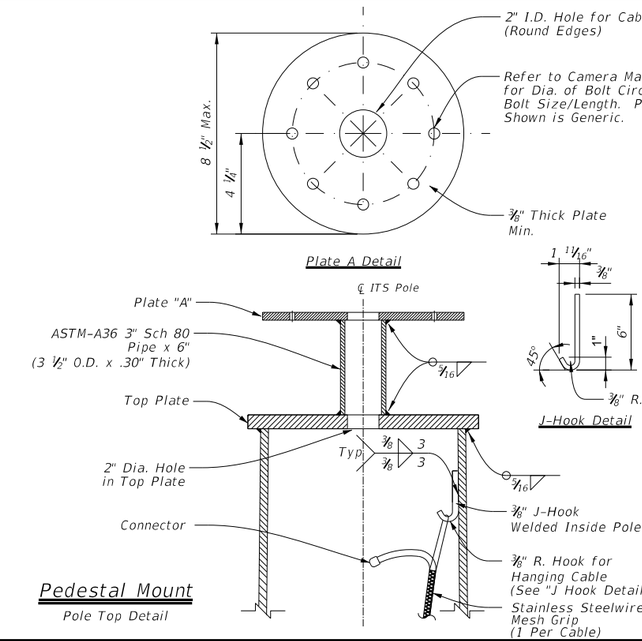
ITS Pole with Cabinet



Pole Mount Detail for Camera

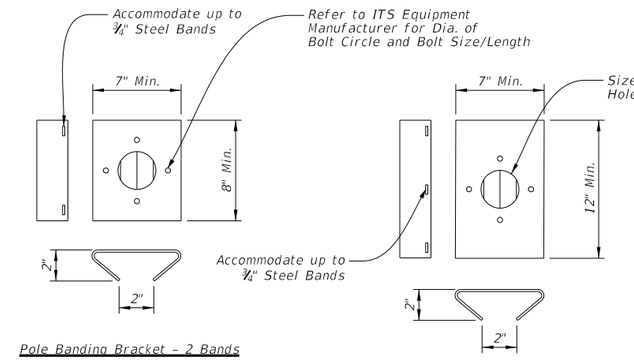


Wall Mount Detail



Pedestal Mount

Pole Top Detail



Band Mount Bracket Details

General Notes:

1. Designed according to Sixth Edition AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and Interim Specifications.
2. Hang all cabling inside ITS pole structure with stainless steel wire mesh grips.
3. Bolt positioning in the pedestal top plate (Plate "A") for the pan/tilt base must be determined in the field per camera manufacturers recommendations. This will allow positioning of the camera to maximize coverage area. The Engineer will determine the camera's blind zone at each location.
4. Provide pedestal top plate and Plate "A" that conform to ASTM A36.
5. Make all welds conform to Item 441 and AWSD 1.1 (Structural Welding). Repair damaged galvanized coating per Item 445, "Galvanizing."
6. Galvanize parts in accordance with Item 445, "Galvanizing" unless otherwise noted.
7. The type of ITS equipment shown to be mounted to the ITS pole is intended to represent the most common ITS equipment applications and should not be treated as all inclusive. Other ITS equipment applications may exist that are project specific.
8. Mounting brackets are intended to be diagrammatic and for information only, and are not all inclusive. Contractor responsible for submitting mounting bracket design for approval by the Engineer prior to fabrication. Mounting bracket designed to support a maximum 35 Lbs. Off-the-shelf mounting brackets are acceptable and shall be submitted by shop drawing for approval.
9. Mounting heights to be determined in the field based on manufacturer recommendations.

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ITS POLE EQUIPMENT MOUNTING DETAILS

ITS(6)-15

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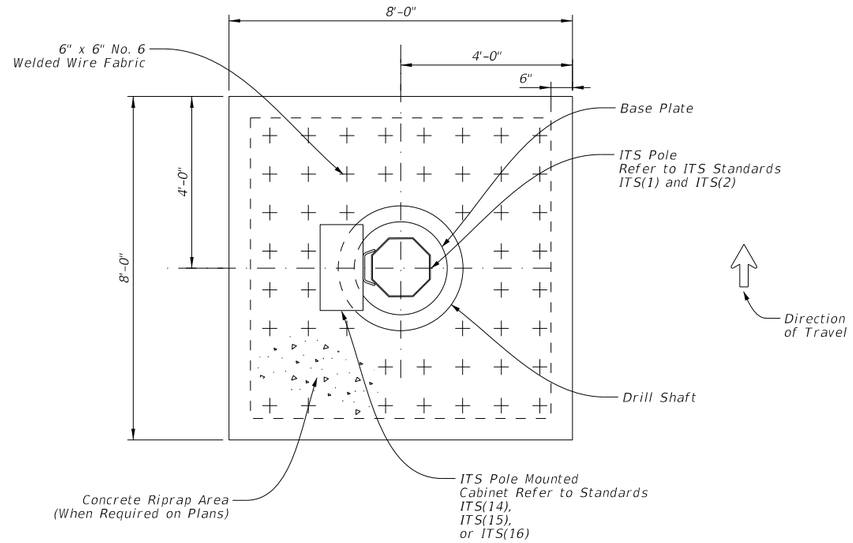
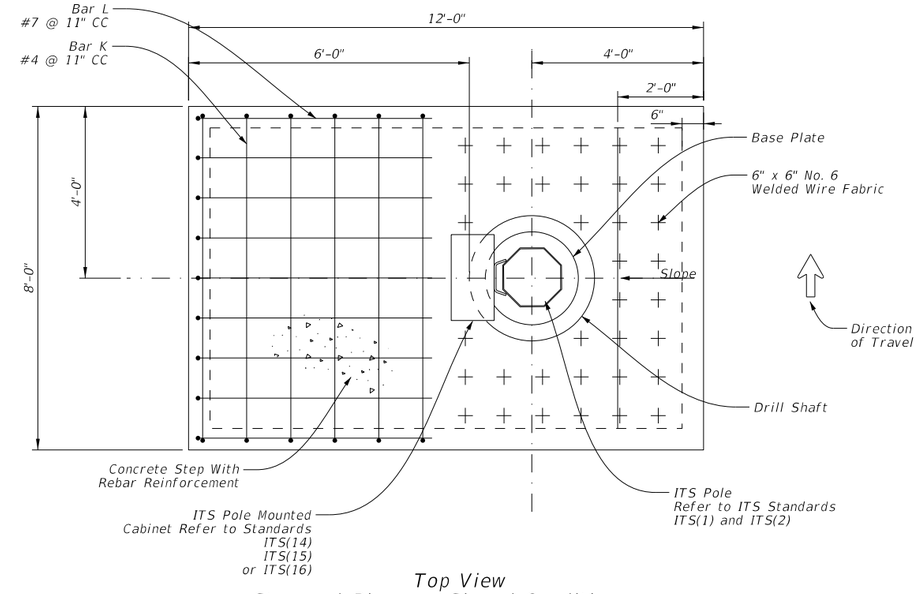
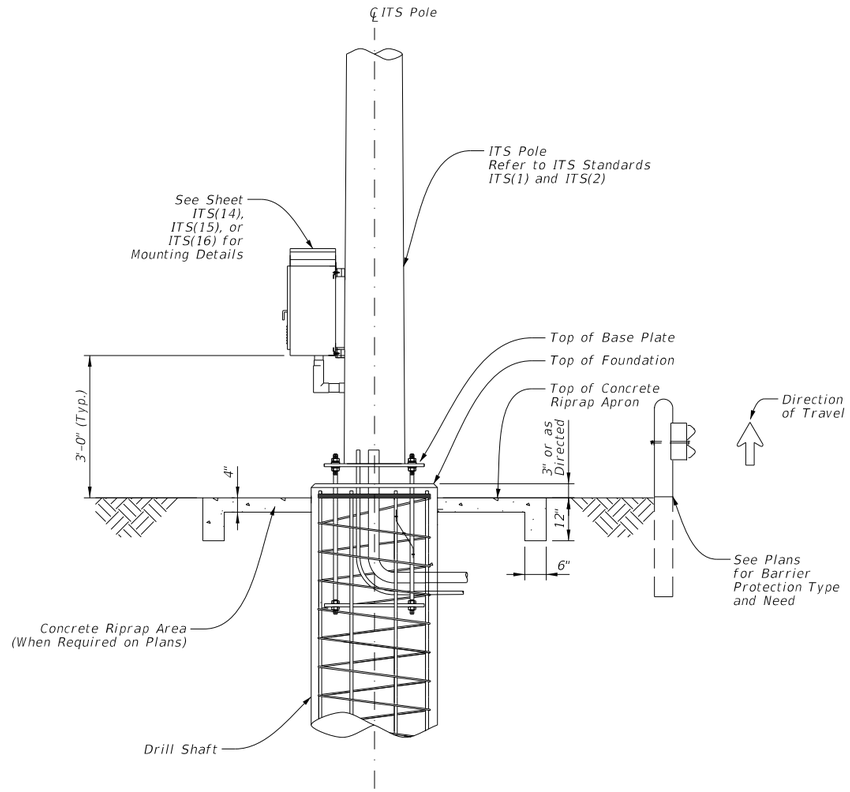


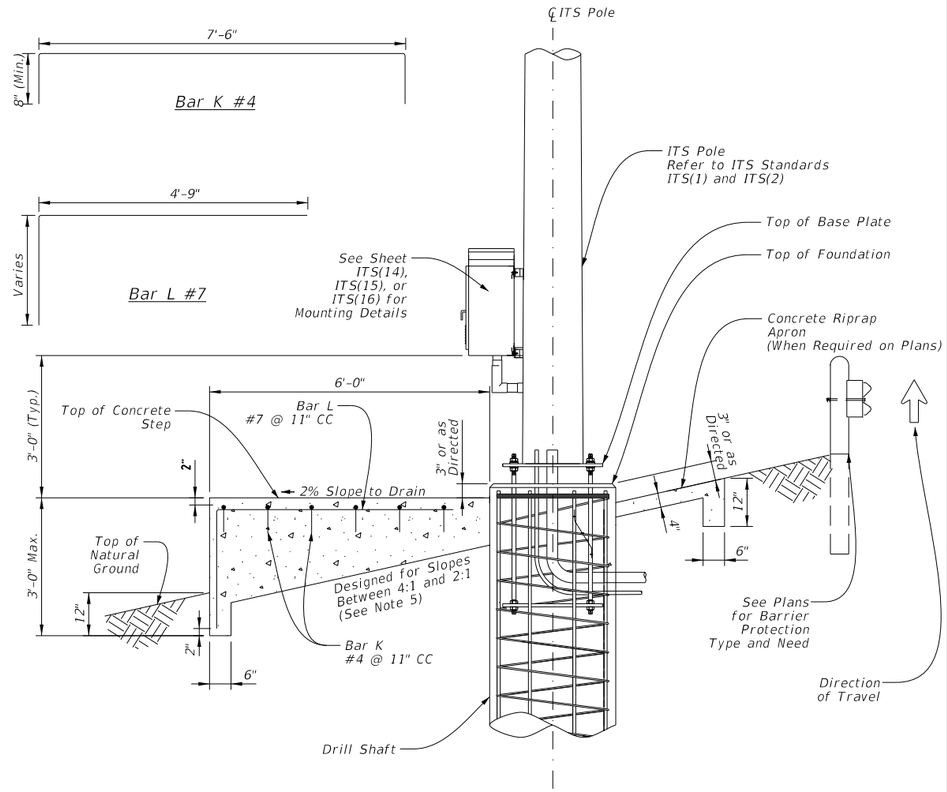
Top View
Riprap - Non-Sloped Conditions



Top View
Step and Riprap - Sloped Conditions



Elevation View
Riprap Apron Detail - Non-Sloped Conditions



Elevation View
Riprap Apron/Step Detail - Sloped Conditions
(Slopes Exceeding 4:1)

General Notes:

1. For non-sloped grassy areas, an 8' x 8' concrete riprap apron shall be poured around ITS pole foundations (see detail on this sheet), estimated at 1.25 CY per site, paid for under Item 432 "Riprap."
2. For sloped grassy areas, a concrete "step" (for maintenance personnel to access cabinet) shall be poured as part of the riprap apron. The step shall vary in height depending on slope, but shall extend 6' horizontally from ITS pole drilled shaft foundation and be the same width as riprap apron (8'). Step shall be poured at same time as riprap apron (see detail on this sheet). Any additional concrete necessary to fabricate step (over and above the 1.25 CY) shall be considered subsidiary to the various bid items and no direct payment shall be made.
3. For sloped areas where riprap exists, a 6' (horizontal from drilled shaft foundation) x 4' wide step shall be installed (see detail this sheet). Concrete for step shall be considered subsidiary to the various bid items and no direct payment shall be made.
4. Cabinet orientation may vary depending on field conditions or project constraints. Accommodate configuration of platform according to cabinet orientation.
5. Slopes greater than a 2:1 or when 3'-0" Max. step wall height is exceeded, an alternative design with safety railing is required and shall be detailed in the shop drawings for approval.

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Traffic Operations Division Standard

ITS POLE RIPRAP DETAILS

ITS(7)-15

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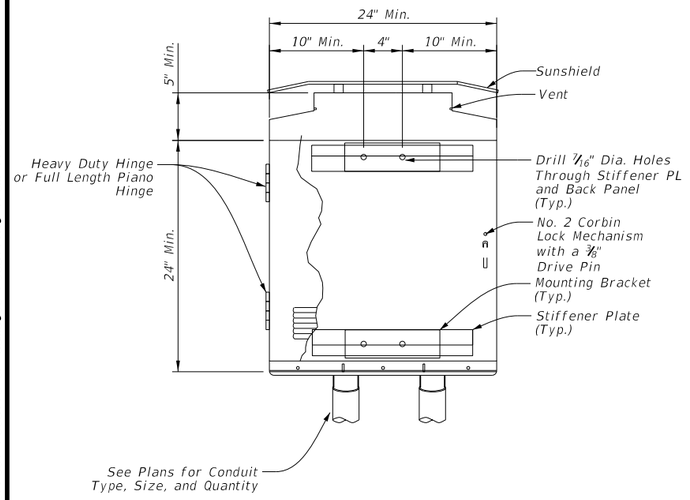
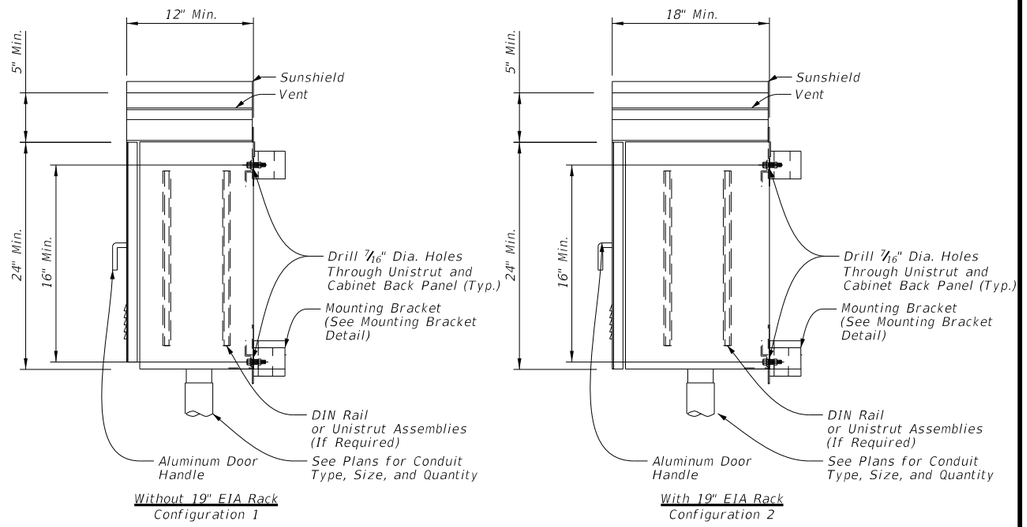


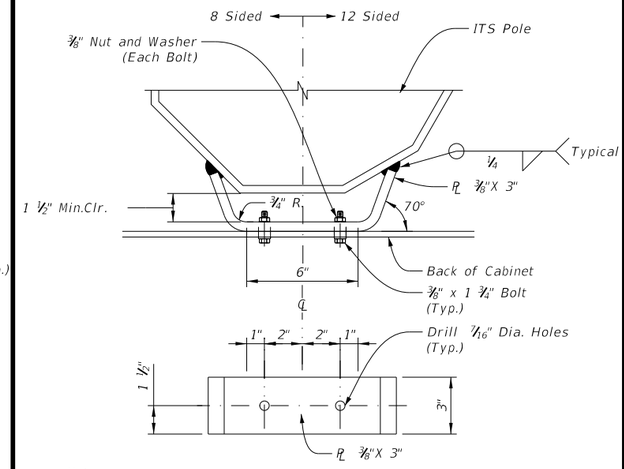
Pole Mounted Cabinet – Type 1 Front View

Not to Scale



Pole Mounted Cabinet – Type 1 Side View

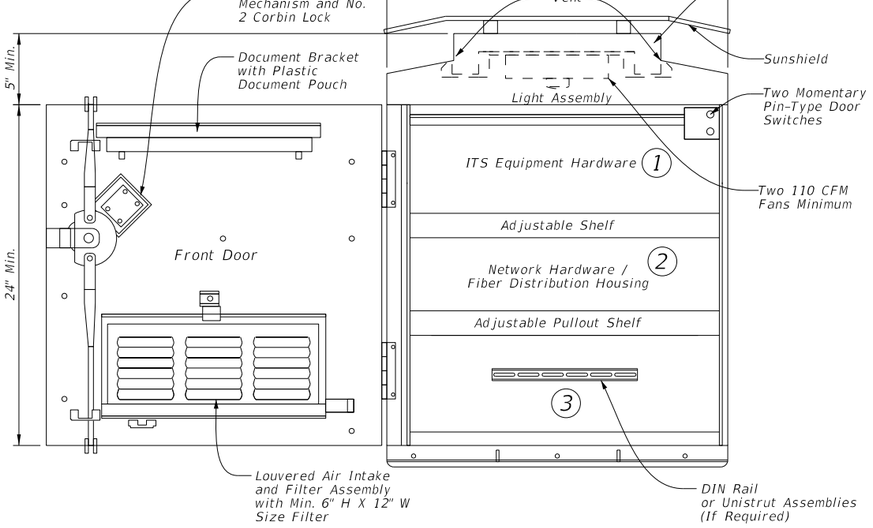
Not to Scale



Note:
ITS Pole May be Round, Octagonal (8 Sided), or Dodecahedron (12 Sided).
See ITS(1), and ITS(2) for Details.

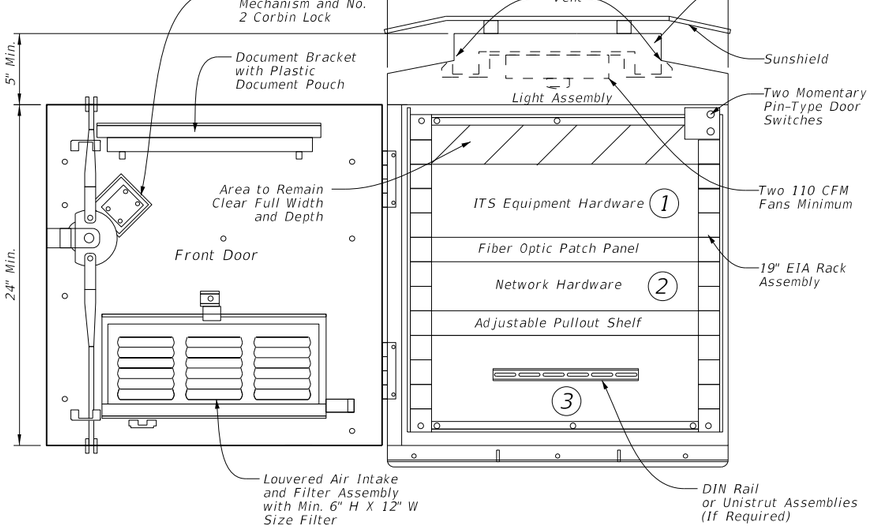
Mounting Bracket Detail

Not to Scale



Interior – Type 1 Without 19" EIA Rack – Front View

Not to Scale



Interior – Type 1 With 19" EIA Rack – Front View

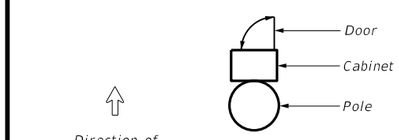
Not to Scale

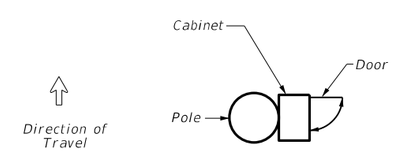
Typical Equipment Layout Legend

	Example Equipment
1	CCTV Interface Panel, Radar Vehicle Sensing Device (RVSD) Equipment, Environmental Sensor Station (ESS) Equipment, Bluetooth Equipment, or ITS Radio Equipment (See General Note 1)
2	Ethernet Switch, Video Encoder, Terminal Server, Fiber Optic Transceivers, or Media Conversion Equipment (See General Note 1)
3	Power Distribution Assembly, Service Entrance Breakers, Primary AC Power, Auxiliary Power Strip, Ground Bus Bar Surge Protection Equipment

General Notes:

1. Layout of hardware equipment and configuration shown is diagrammatic in nature and intended to represent a preferred Type 1 pole mounted cabinet setup. Hardware needed for each Type 1 cabinet varies and not all cabinet equipment may be shown. The contractor will be responsible for configuring cabinets with all appropriate ITS hardware and power supplies in accordance with the plans and specifications. The contractor may alter the cabinet configuration shown to maximize space and ensure easy access for maintenance.
2. Mount cabinet as detailed on ITS(14) or ITS(17). Orientation of cabinet on ITS pole may vary depending on field conditions. Mount the pole mounted cabinet to the backside of the ITS pole, to allow maintenance personnel to access the cabinet while being able to view oncoming traffic.
3. For ITS pole sites located on slopes greater than 4H:1V, mount the cabinet to the backside of the ITS pole as detailed on ITS(7). Mounting height to accommodate maintenance pad for easy access.
4. All dimensions are approximate and represent minimum cabinet dimensions.
5. Provide conduit entrances at the bottom of the cabinet.
6. Paid under Special Specification "ITS Pole with Cabinet" (Configuration 1) without 19" EIA rack. Paid under Special Specification "ITS Pole with Cabinet" (Configuration 2) with 19" EIA rack.





Orientation of Type 1 Cabinet on ITS Pole (Typical)

Not to Scale

Texas Department of Transportation

Traffic Operations Division Standard

ITS POLE MOUNTED CABINET TYPE 1 DETAILS

ITS(14)-15

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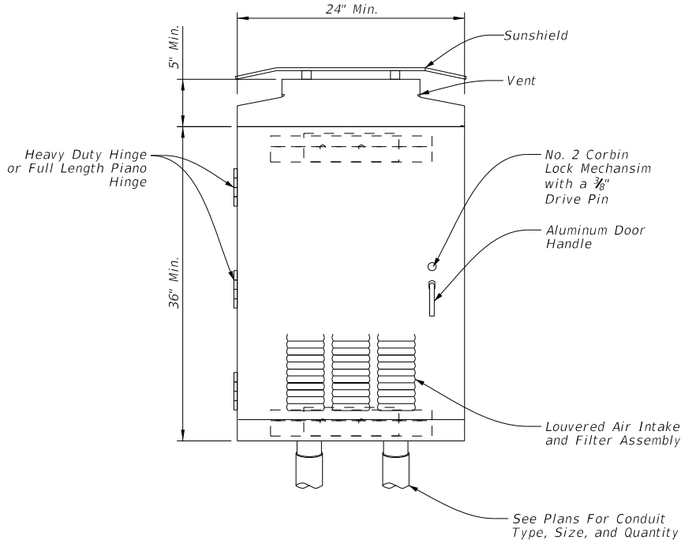
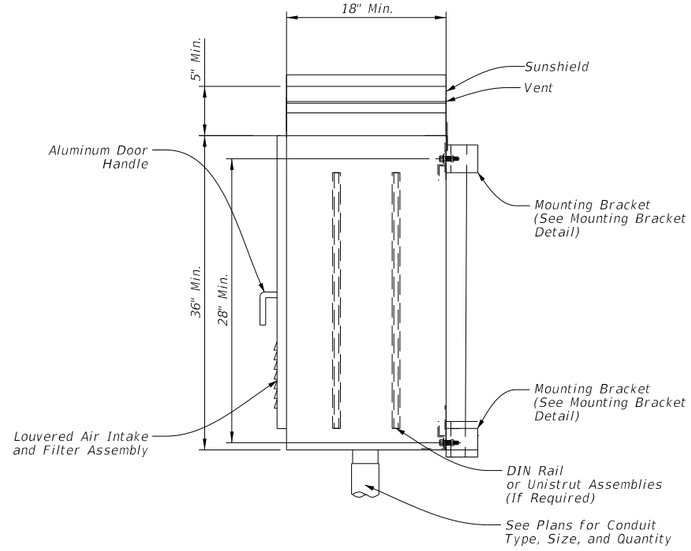


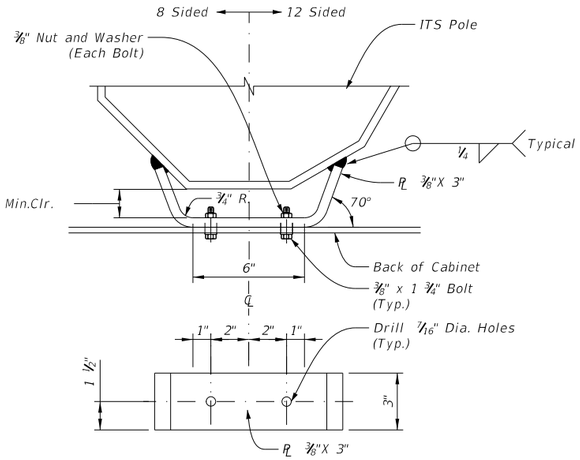
Pole Mounted Cabinet – Type 2 Front View

Not to Scale



Pole Mounted Cabinet – Type 2 Side View

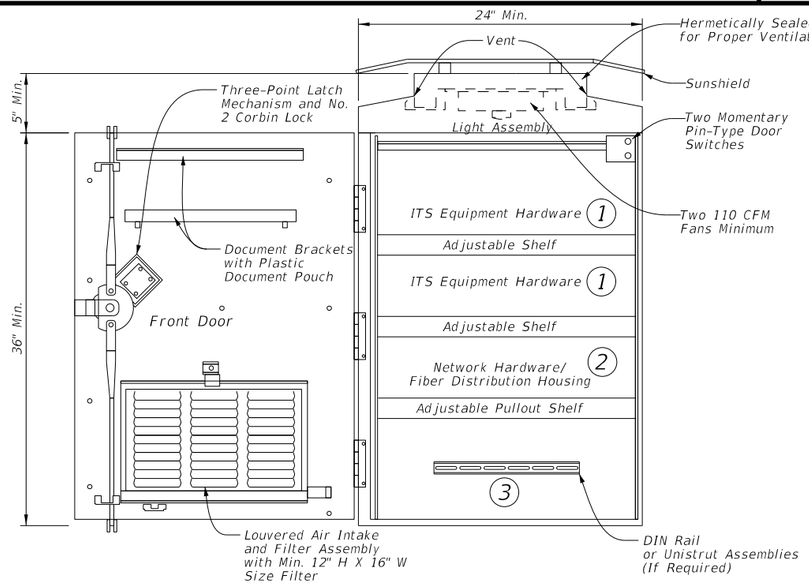
Not to Scale



Note:
ITS Pole May be Round, Octagonal (8 Sided), or Dodecahedron (12 Sided).
See ITS(1), and ITS(2) for Details.

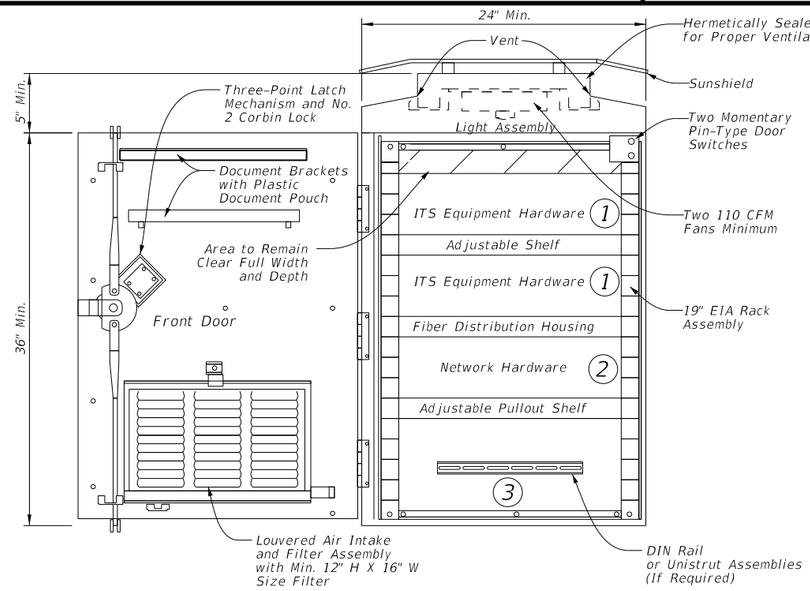
Mounting Bracket Detail

Not to Scale



Interior – Type 2 Without 19" EIA Rack – Front View

Not to Scale



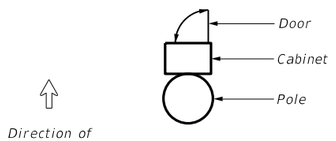
Interior – Type 2 With 19" EIA Rack – Front View

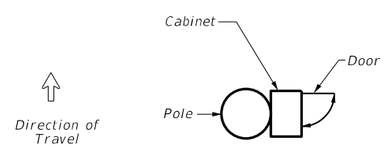
Not to Scale

Typical Equipment Layout Legend	
	Example Equipment
1	CCTV Interface Panel, Radar Vehicle Sensing Device (RVSD) Equipment, DMS/LCS Controller Environmental Sensor Station (ESS) Equipment, Bluetooth Equipment, or ITS Radio Equipment (See General Note 1)
2	Ethernet Switch, Video Encoder, Terminal Server, Fiber Optic Transceivers, or Media Conversion Equipment (See General Note 1)
3	Power Distribution Assembly, Service Entrance Breakers, Primary AC Power, Auxiliary Power Strip, Ground Bus Bar Surge Protection Equipment

General Notes:

1. Layout of hardware equipment and configuration shown is diagrammatic in nature and intended to represent a preferred Type 2 pole mounted cabinet setup. Hardware needed for each Type 2 cabinet varies and not all cabinet equipment may be shown. The contractor will be responsible for configuring cabinets with all appropriate ITS hardware and power supplies in accordance with the plans and specifications. The contractor may alter the cabinet configuration shown to maximize space and ensure easy access for maintenance.
2. Mount cabinet as detailed on ITS(15) or ITS(17). Orientation of cabinet on ITS pole may vary depending on field conditions. Mount the pole mounted cabinet to the backside of the ITS pole, to allow maintenance personnel to access the cabinet while being able to view oncoming traffic.
3. For ITS pole sites located on slopes greater than 4H:1V, mount the cabinet to the backside of the ITS pole as detailed on ITS(7). Mounting height to accommodate maintenance pad for easy access.
4. All dimensions are approximate and represent minimum cabinet dimensions.
5. Provide conduit entrances at the bottom of the cabinet.
6. Paid under Special Specification "ITS Pole with Cabinet" (Configuration 1) without 19" EIA rack. Paid under Special Specification "ITS Pole with Cabinet" (Configuration 2) with 19" EIA rack.





Orientation of Type 2 Cabinet on ITS Pole (Typical)

Not to Scale

Texas Department of Transportation

Traffic Operations Division Standard

ITS POLE MOUNTED CABINET TYPE 2 DETAILS

ITS(15)-15

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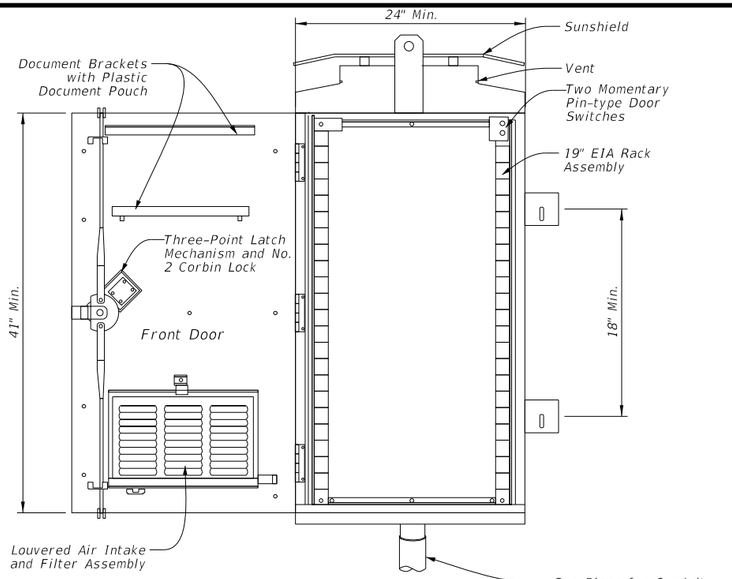
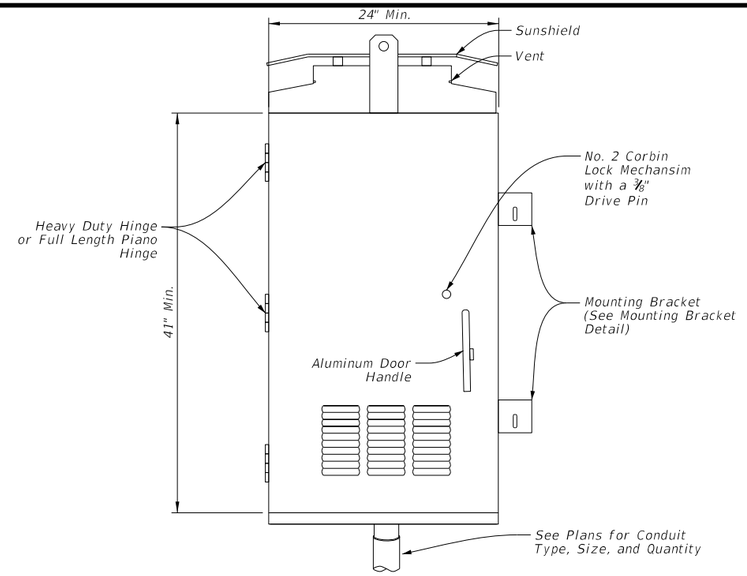


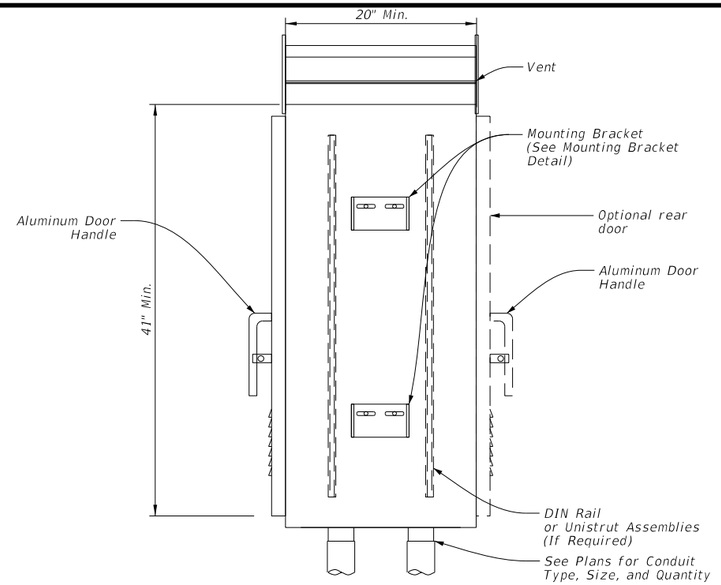
Interior – Type 3 Front View

Not to Scale



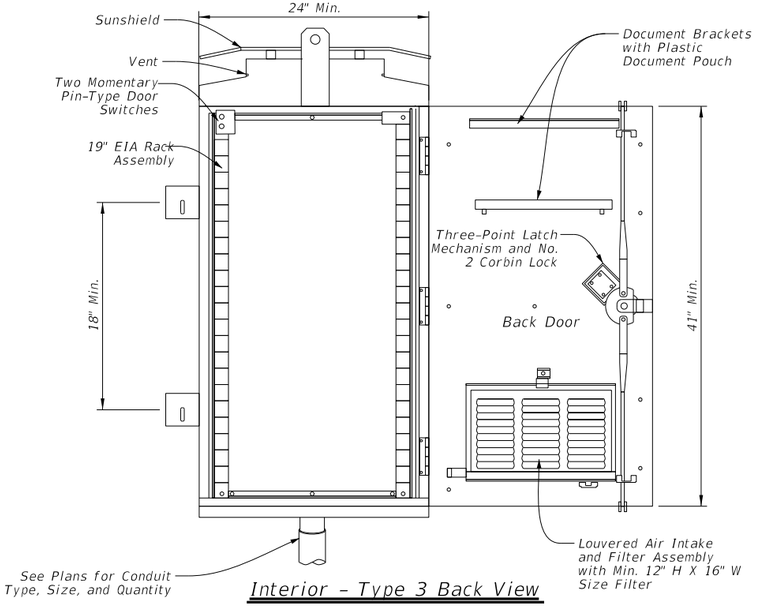
Pole Mounted Cabinet – Type 3 Front View

Not to Scale



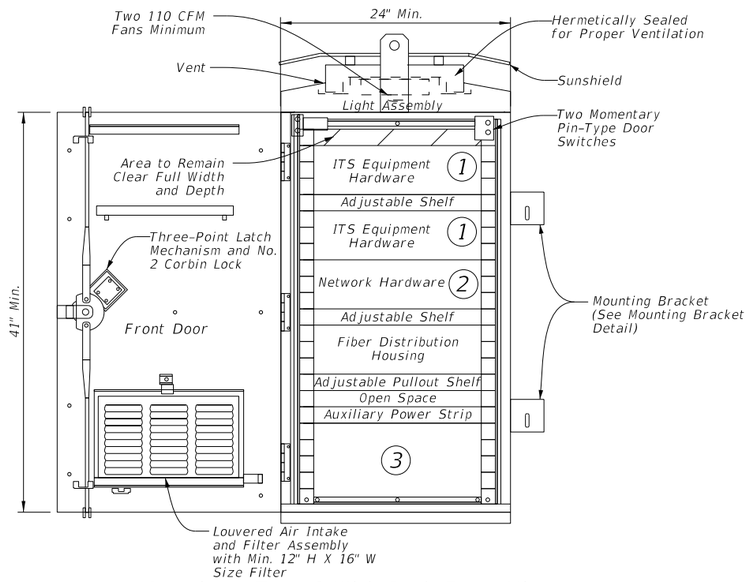
Pole Mounted Cabinet – Type 3 Side View

Not to Scale



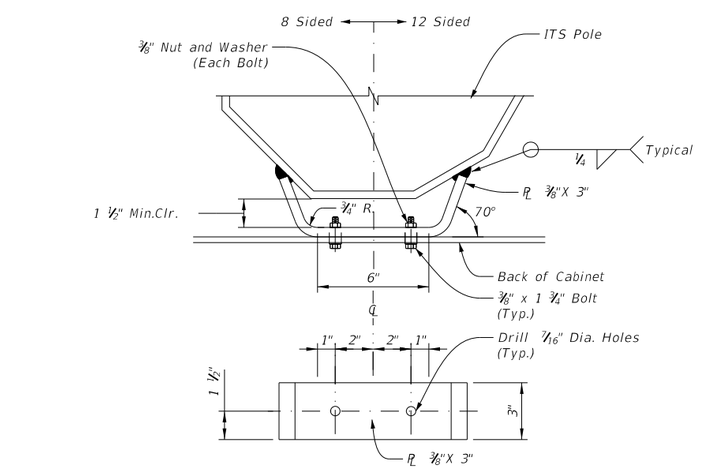
Interior – Type 3 Back View

Not to Scale



Interior – Type 3 With Rack Front View

Not to Scale



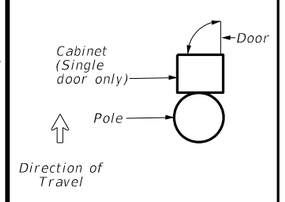
Note:
ITS Pole May be Round, Octagonal (8 Sided), or Dodecahedron (12 Sided).
See ITS(1), and ITS(2) for Details.

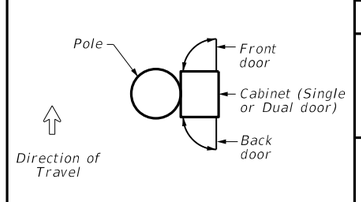
Mounting Bracket Detail

Not to Scale

General Notes:

1. Layout of hardware equipment and configuration shown is diagrammatic in nature and intended to represent a preferred Type 3 pole mounted cabinet setup. Hardware needed for each Type 3 cabinet varies and not all cabinet equipment may be shown. The contractor will be responsible for configuring cabinets with all appropriate ITS hardware and power supplies in accordance with the plans and specifications. The contractor may alter the cabinet configuration shown to maximize space and ensure easy access for maintenance.
2. Mount cabinet as detailed on ITS(16) or ITS(17). Orientation of cabinet on ITS pole may vary depending on field conditions. Mount the pole mounted cabinet to the backside of the ITS pole, to allow maintenance personnel to access the cabinet while being able to view oncoming traffic. A dual door configuration (configuration 2) is detailed above.
3. For ITS pole sites located on slopes greater than 4H:1V, Mount the cabinet to the backside of the ITS pole as detailed on ITS(7). Mounting height to accommodate maintenance pad for easy access.
4. All dimensions are approximate and represent minimum cabinet dimensions.
5. Provide conduit entrances at the bottom of the cabinet.
6. Paid under Special Specification "ITS Pole with Cabinet" (Configuration 1) with single door. Paid under Special Specification "ITS Pole with Cabinet" (Configuration 2) with dual door





Orientation of Type 3 Cabinet on ITS Pole (Typical)

Not to Scale

Typical Equipment Layout Legend

	Example Equipment
1	CCTV Interface Panel, Radar Vehicle Sensing Device (RVSD) Equipment, DMS/LCS Controller Environmental Sensor Station (ESS) Equipment, Bluetooth Equipment, or ITS Radio Equipment (See General Note 1)
2	Ethernet Switch, Video Encoder, Terminal Server, Fiber Optic Transceivers, or Media Conversion Equipment (See General Note 1)
3	Power Distribution Assembly, Service Entrance Breakers, Primary AC Power, Auxiliary Power Strip, Ground Bus Bar Surge Protection Equipment

Texas Department of Transportation

Traffic Operations Division Standard

ITS POLE MOUNTED CABINET TYPE 3 DETAILS

ITS(16)-15

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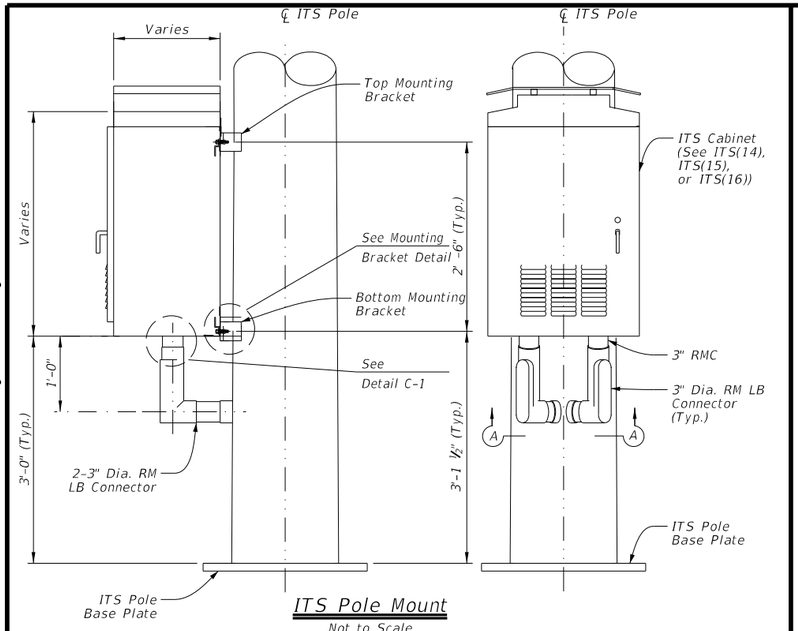
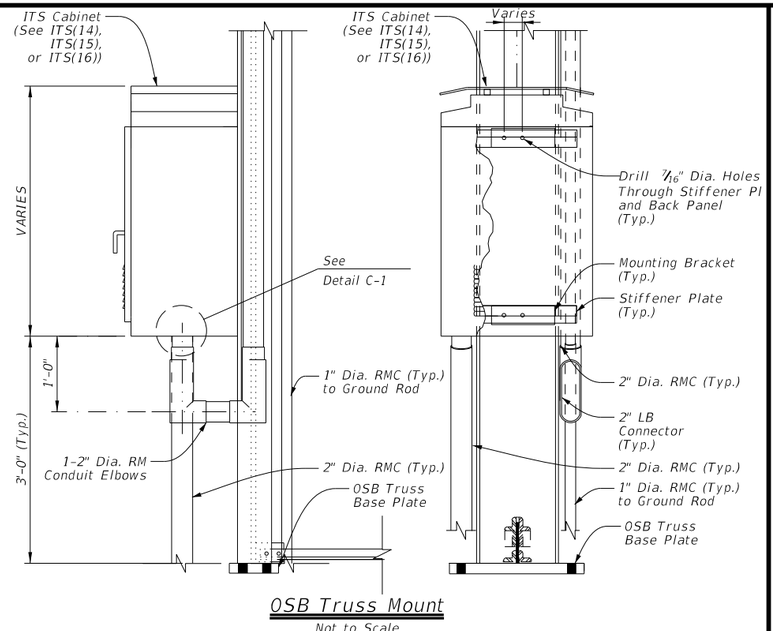


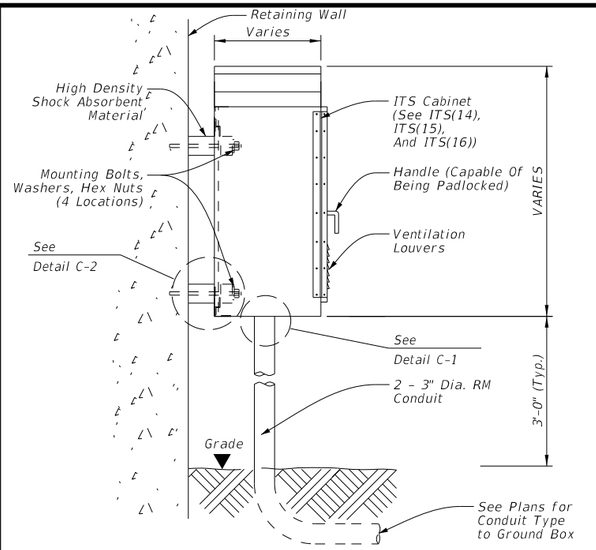
ITS Pole Mount

Not to Scale



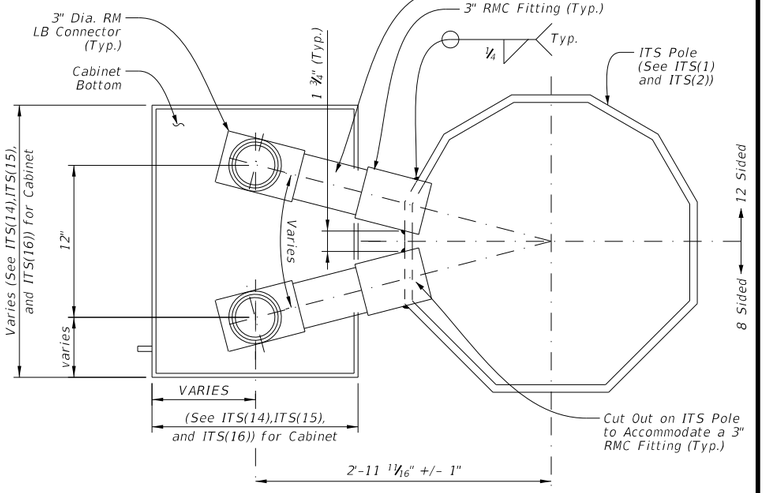
OSB Truss Mount

Not to Scale



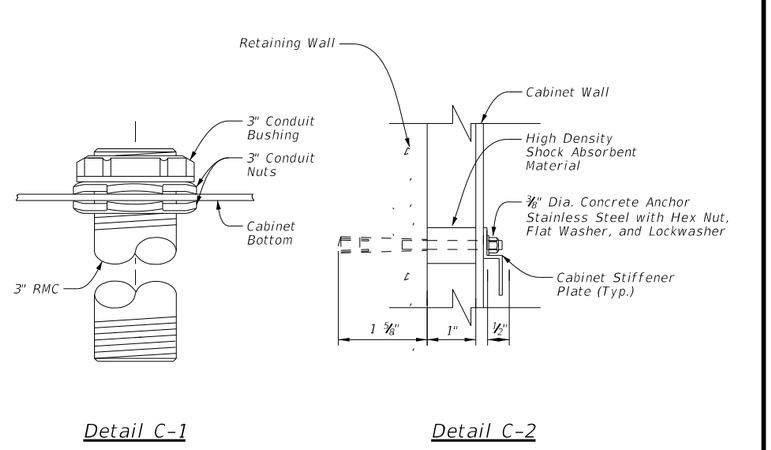
Retaining Wall Mount

Not to Scale



Section A-A

Not to Scale

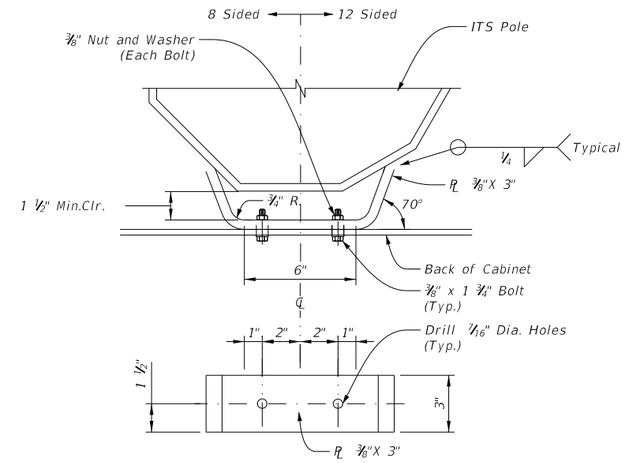


Detail C-1

Detail C-2

Detail C-1 and C-2

Not to Scale



Note:
ITS Pole May be Round, Octagonal (8 Sided), or Dodecahedron (12 Sided).
See ITS(1), and ITS(2) for Details.

Mounting Bracket Detail

Not to Scale

General Notes:

1. Mount cabinet as detailed on ITS(14), ITS(15), ITS(16), or ITS(17). Orientation of cabinet on ITS pole may vary depending on field conditions. Mount the pole mounted cabinet to the backside of the ITS pole, to allow maintenance personnel to access the cabinet while being able to view oncoming traffic.
2. For ITS pole sites located on slopes greater than 4V:1H, mount the cabinet to the backside of the ITS pole as detailed on ITS(7). Mounting height to accommodate maintenance pad for easy access.
3. All dimensions are approximate and represent minimum dimensions.
4. Provide conduit entrances at the bottom of the cabinet.

Texas Department of Transportation

Traffic Operations Division Standard

ITS POLE MOUNTED CABINET MISC. MOUNTING DETAILS

ITS(17)-15

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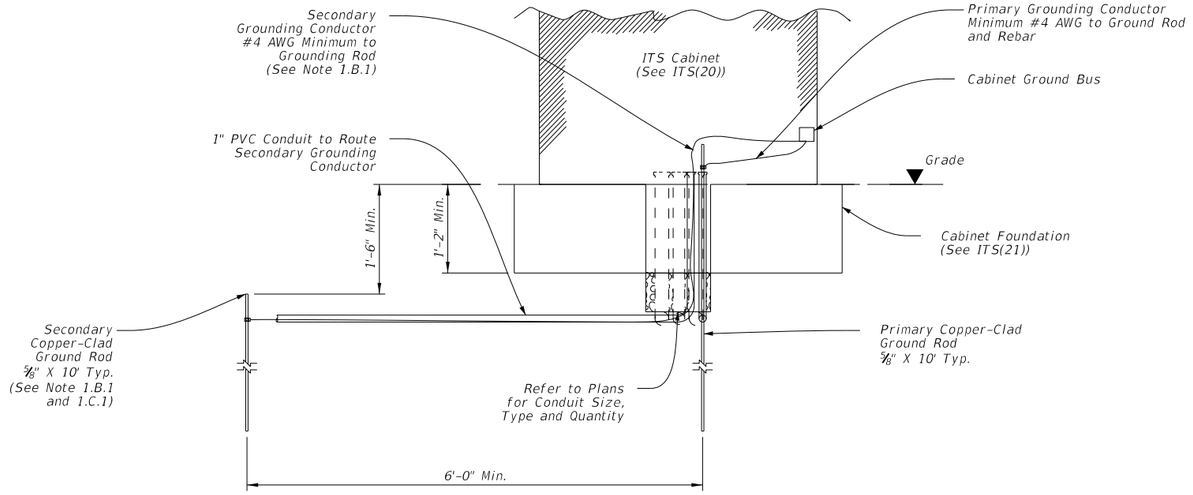
General Notes:

1. Grounding System:
   - A. Description:
     1. Provide ground system consisting of copper wires, ground rods, and concrete-encased grounding electrodes (Ufers), of the configuration shown to minimize potential gradient irregularities, drain leakage, and fault currents to earth.
   - B. Performance:
     1. Provide a grounding system, consisting of a minimum one ground rod, having a resistance not greater than 5 Ohms to ground. Additional ground rods may be added to the system to achieve less than 5 Ohms resistance.
   - C. Design Criteria:
     1. The combined ground resistance of separate systems bonded together below grade may be used to meet the specified ground resistance, but the minimum number of rods indicated shall still be provided.
     2. Measure the resistance of systems requiring separate ground resistance separately before bonding below grade.
     3. Only provide UL-approved materials listed for grounding systems.
     4. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture, unless moisture is permanently excluded from the junction of such materials.
     5. Submit product data for the materials and products used to perform the work of this section.
   - D. Materials:
     1. Conductors:
        a. Bare Ground Conductor:
           1) For No. 8 AWG or larger bare ground wire sizes, provide soft drawn copper, Class A or Class B, stranded wire meeting the requirements of ASTM B 8.
     2. Ground Compression Connectors:
        a. Provide molds, thermite packages, and other material for ground compression connectors that are full-rated to carry 100% of the cable rating and which meet IEEE 837.
           1) Provide the compression materials from a single manufacturer throughout the project.
        b. Provide the items necessary for connecting cable to ground rods.
     3. Ground Rods:
        a. Provide copper-clad steel ground rods conforming to the requirements specified in UL 467.
           1) Diameter: ⅝ in.
           2) Length: 10 Ft.

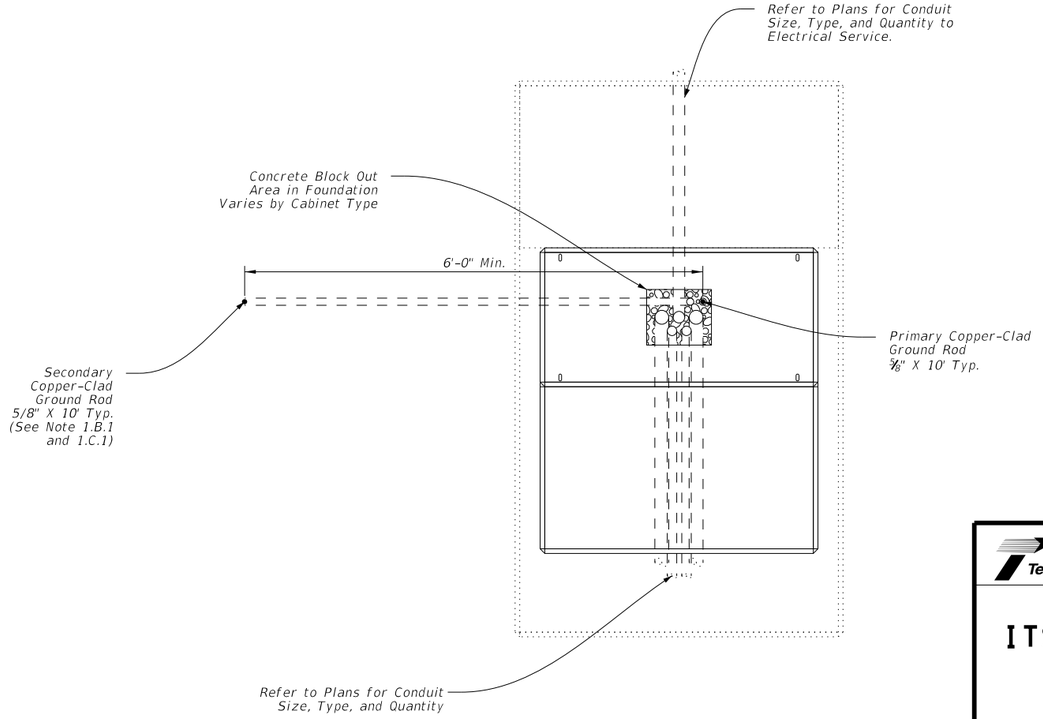
2. Installation:
   - A. Install grounding components and systems in accordance with the requirements specified in UL 467, IEEE 81, and IEEE 142.
   - B. System Grounding:
     1. Ground Rods:
        a. Drive ground rods into the ground until the tops of the rods are approximately 18 in. below finished grade.
        b. If multiple ground rods are needed to meet the minimum resistance of 5 Ohms, space ground rods as evenly as possible, at least 6 feet apart, and so conductors will be connected below grade.
     2. Conductors:
        a. Provide minimum No. 4 AWG ground wire for system and equipment grounding.
        b. Using suitable fasteners, securely attach exposed ground wires to structural supports at not more than 2 ft. intervals, where applicable.
        c. Bends in ground wires greater than 45 degrees are unacceptable.
     3. Cable Connections:
        a. Use approved exothermic-welded connections for conductor splices and connections between conductors and other components.

3. Testing:
   - A. Resistance Test:
     1. Test Procedure:
        a. The ground-resistance measurements of each ground Rod shall be taken.
           1) The resistance to ground shall be measured in accordance with the fall-of-potential method specified in IEEE 81 and IEEE 142.
           2) Ground-resistance measurements shall be made in normally dry weather, not less than 48 hours after rainfall, and with the ground under test isolated from other grounds.
        b. Test reports shall be prepared that indicate the location of the ground rod, the grounding system, and the resistance and soil conditions at the time the test was performed.
     2. Acceptance Criteria:
        a. The grounding system must have a resistance not greater than 5 Ohms.
        b. Do not energize any part of the electrical distribution system prior to the resistance testing of that system's ground rods and grounding system, and submission of the test results for approval.
     3. Inspections:
        a. Prepare and submit as-built record drawings of the grounding system as installed and test reports for approval.



Ground Mounted Cabinet - Side View

(Slab & Base)
Not to Scale



Ground Mounted Cabinet - Top View

(Slab & Base)
Not to Scale

Texas Department of Transportation

Traffic Operations Division Standard

ITS CABINET GROUNDING DETAILS

ITS(18)-15

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DATE:
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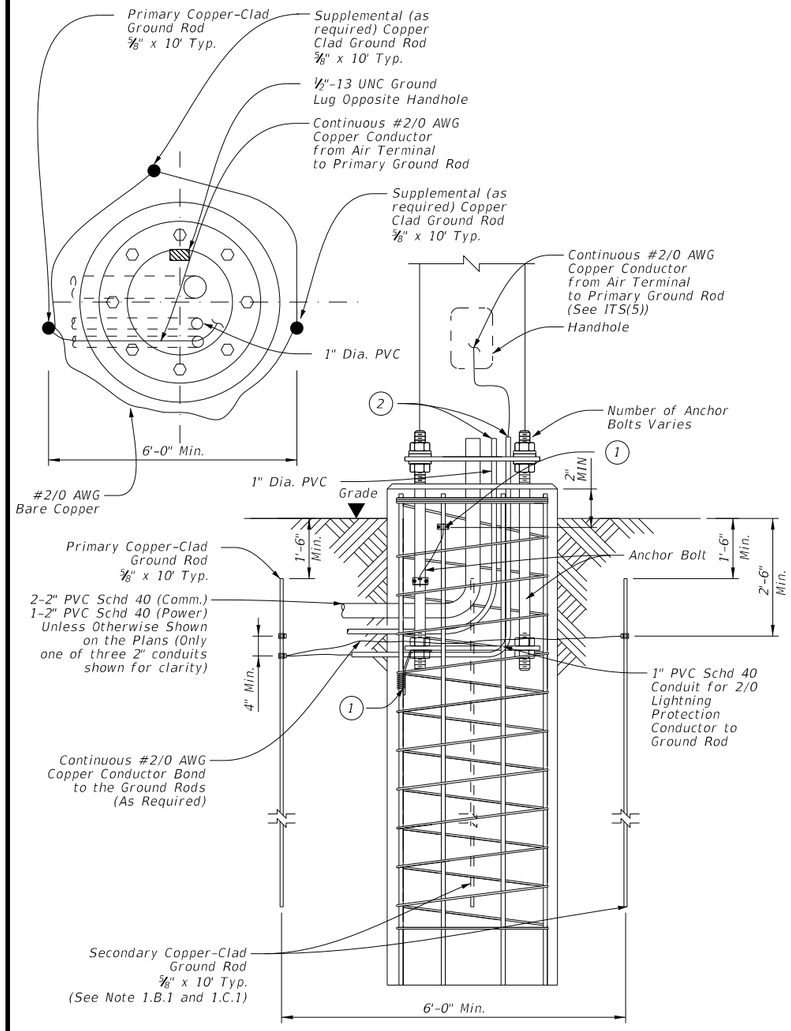
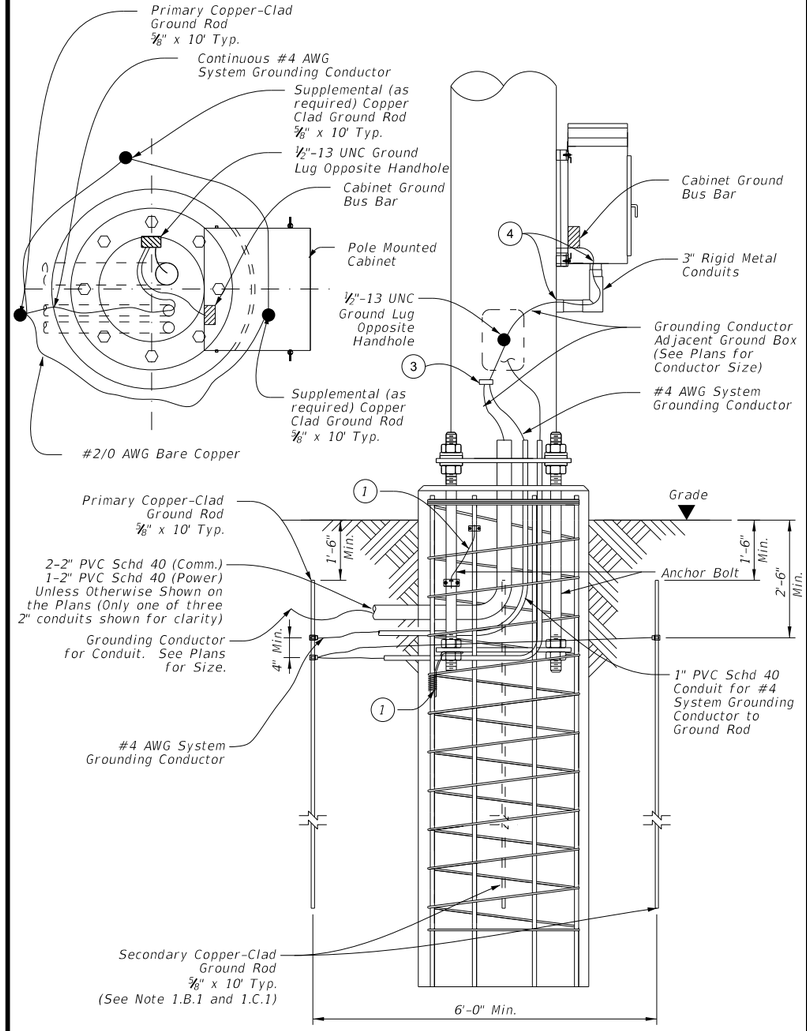
General Notes:

1. Grounding System:
   - A. Description:
     1. Provide ground system consisting of copper wires, ground rods, and concrete-encased grounding electrodes (Ufers), of the configuration shown to minimize potential gradient irregularities, drain leakage, and fault currents to earth.
   - B. Performance:
     1. Provide a grounding system, consisting of a minimum one ground rod, having a resistance not greater than 5 Ohms to ground. Provide up to 2 additional supplemental ground rods if necessary to achieve a resistance not greater than 5 Ohms to ground. If a total of 3 ground rods is needed then install as as part of a ground ring.
     2. If a ground ring is required, provide a minimum conductor length of 20 ft. placed at a minimum depth of 30 in..
   - C. Design Criteria:
     1. The grounding system of the ITS pole may be bonded below grade to the grounding systems of other nearby equipment to meet the specified grounding resistance. A minimum of one ground rod for the ITS pole is still required.
     2. Separately measure the grounding resistance of each system before bonding together below grade.
     3. Only provide UL-approved materials listed for grounding systems.
     4. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture, unless moisture is permanently excluded from the junction of such materials.
     5. Submit product data for the materials and products used to perform the work of this section.
   - D. Materials:
     1. Conductors:
        - a. Bare Ground Conductor:
          1) Provide prequalified copper conductors appearing on the Material Producers List according to Item 618.
     2. Ground Compression Connectors:
        - a. Provide molds, thermite packages, and other material for exothermic welding of grounding connections.
        - b. Provide listed compression connectors fully rated to carry 100% of the cable rating and that meet IEEE 837. Provide compression materials from a single manufacturer througout the project.
     3. Ground Rods:
        - a. Provide copper-clad steel ground rods conforming to the requirements specified in DMS 11040.
          1) Diameter: ⅝ in.
          2) Length: 10 ft.
2. Installation:
   - A. Install grounding components and systems in accordance with the requirements specified in IEEE 142.
   - B. System Grounding:
     1. Ground Rods:
        - a. Drive ground rods into the ground until the tops of the rods are a minimum of 18 in. below finished grade.
        - b. If multiple ground rods are needed to meet the minimum resistance of 5 Ohms, space ground rods as evenly as possible, at least 6 feet apart, so conductors will be connected below grade.
     2. Conductors:
        - a. Provide minimum No. 2/0 AWG ground wire for lightning protection from air terminal.
        - b. Provide minimum No. 4 AWG ground wire for system and equipment grounding.
        - c. Using suitable fasteners, securely attach exposed ground wires to structural supports at not more than 2 ft. intervals, where applicable.
        - d. Bends in ground wires greater than 45 degrees are unacceptable.
     3. Cable Connections:
        - a. Use exothermic-welded connections or listed compression connectors for conductor splices and connections between conductors and other components.
3. Testing:
   - A. Resistance Test:
     1. Test Procedure:
        - a. The ground-resistance measurements of each ground Rod shall be taken.
          1) The resistance to ground shall be measured in accordance with the fall-of-potential method specified in IEEE 81 and IEEE 142.
          2) Ground-resistance measurements shall be made in normally dry weather, not less than 48 hours after rainfall, and with the ground under test isolated from other grounds.
        - b. Test reports shall be prepared that indicate the location of the ground rod, the grounding system, and the resistance and soil conditions at the time the test was performed.
     2. Acceptance Criteria:
        - a. The grounding system must have a resistance not greater than 5 Ohms.
        - b. Do not energize any part of the electrical distribution system prior to the resistance testing of that system's ground rods and grounding system, and submission of the test results for approval.
     3. Inspections:
        - a. Prepare and submit as-built record drawings of the grounding system as installed and test reports for approval.



Grounding System

Not to Scale



Grounding System with Pole Mounted Cabinet

Not to Scale

Reference Notes:

1. Bond anchor bolts to rebar with #2/0 AWG jumper and two mechanical connectors or by bending No. 3 bar on bottom template as shown and wire tightly with ten turns of No. 10 wire or one mechanical connector. Mechanical connectors shall be UL Listed for concrete encasement.
2. Cut PVC approximately 1 in. above concrete and install bell or bushing. Align conduit as close as possible to point of attachment to base plate to minimize bends in #2/0 wire.
3. Bond grounding conductors via cadweld or mechanical connector, rated for size and number of conductors.
4. Provide and install a grounding type bushing on metal conduit terminations. 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.

Texas Department of Transportation

Traffic Operations Division Standard

ITS POLE GROUNDING DETAILS

ITS(19)-17

FILE: its(19)-17.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT June 2015	CONT	SECT	JOB	HIGHWAY
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7-17	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		40

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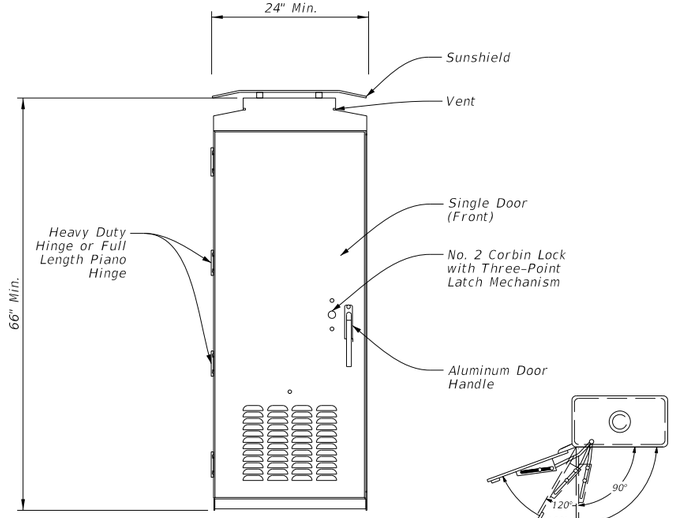
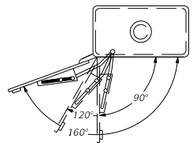
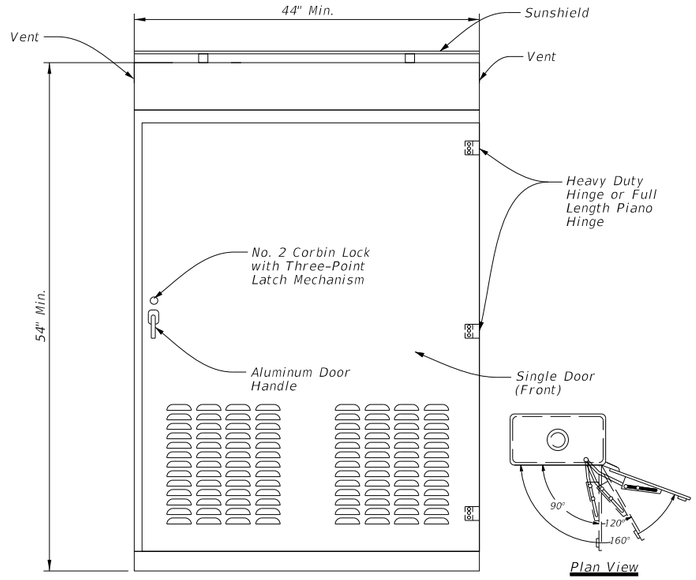




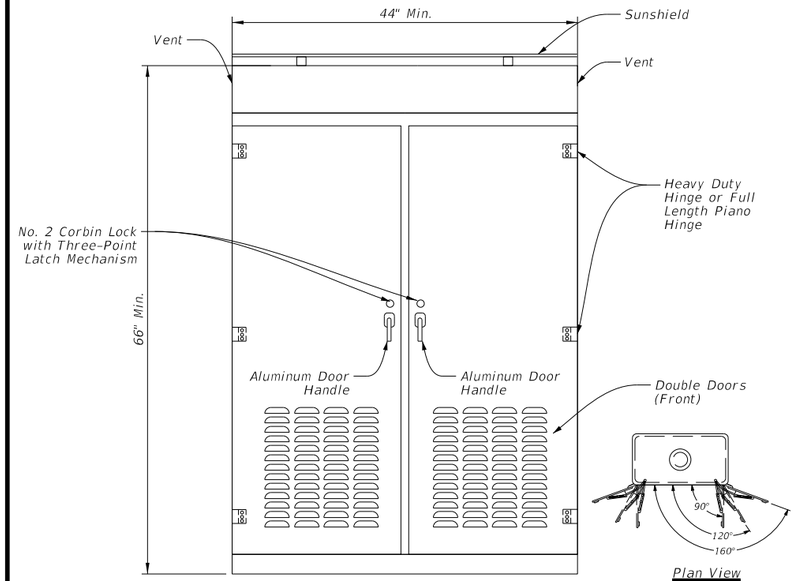
Plan View
Door Stop Detail
(3 Positions)

Type 4 (Small) Cabinet
Front View



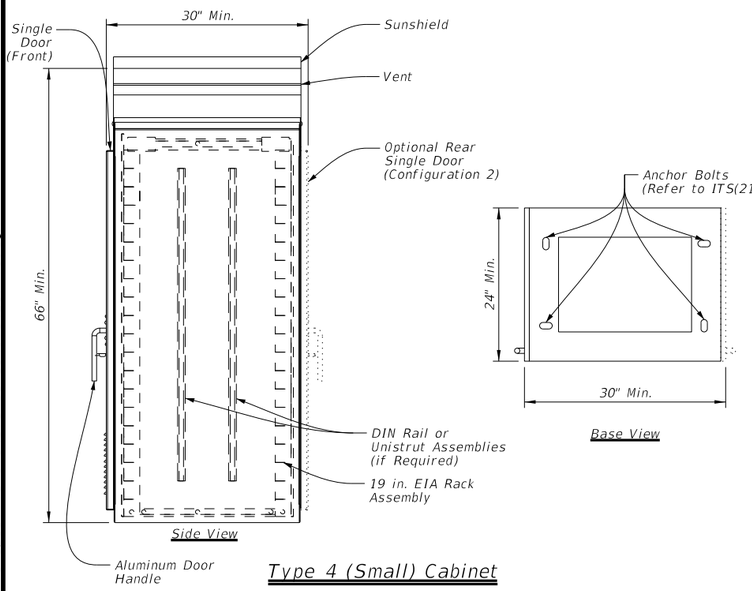
Plan View
Door Stop Detail
(3 Positions)

Type 5 (Medium) Cabinet
Front View



Plan View
Door Stop Detail
(3 Positions)

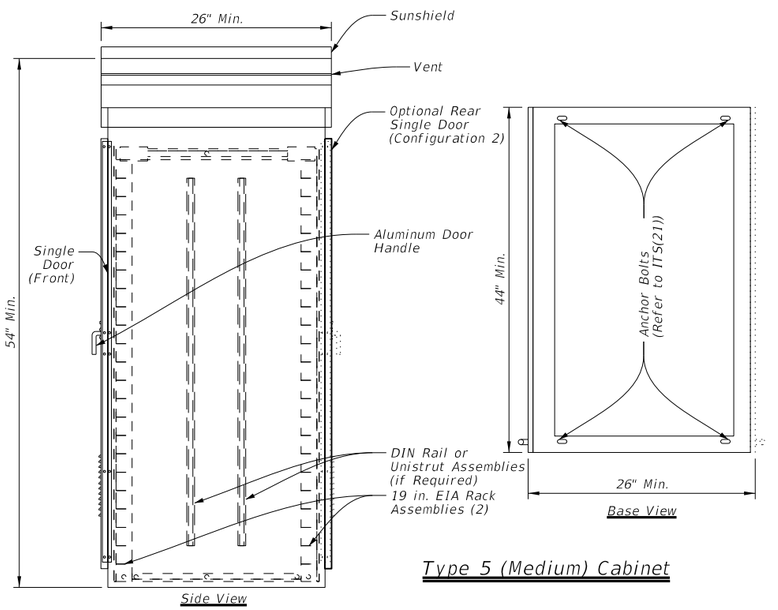
Type 6 (Large) Cabinet
Front View



Side View

Base View

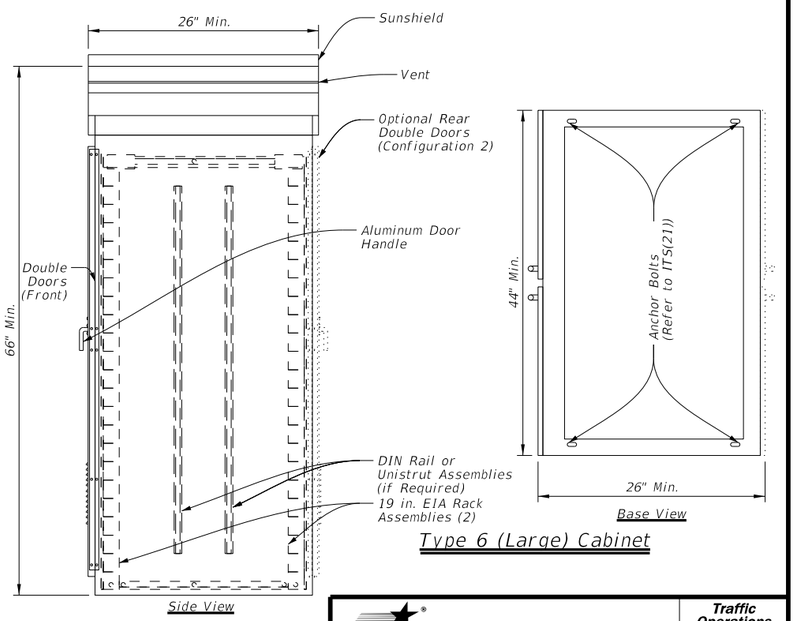
Type 4 (Small) Cabinet



Side View

Base View

Type 5 (Medium) Cabinet



Side View

Base View

Type 6 (Large) Cabinet

General Notes:

1. Cabinet hardware equipment and door configuration shown is diagrammatic in nature and intended to represent a preferred ground mounted cabinet setup. Door orientation may vary and will be noted in the plans. The contractor will be responsible for configuring cabinets with all appropriate ITS hardware and power supplies in accordance with the plans and specifications. The contractor may alter the cabinet configuration shown to maximize space and ensure easy access for maintenance.
2. All dimensions are approximate and represent minimum dimensions.
3. Provide conduit entrances at the bottom of the cabinet.
4. Paid under Special Specification "ITS Ground Mounted Cabinet" (Configuration 1) with single door. Paid under Special Specification "ITS Ground Mounted Cabinet" (Configuration 2) for rear door option.
5. Sunshield to be mounted to cabinet using nuts, bolts, and spacers. Water proof sealant to be used at cabinet surface/bolt contact points.

Texas Department of Transportation

Traffic Operations Division Standard

ITS GROUND MOUNTED CABINET ELEVATION DETAILS

ITS(20)-15

FILE: its(20)-15.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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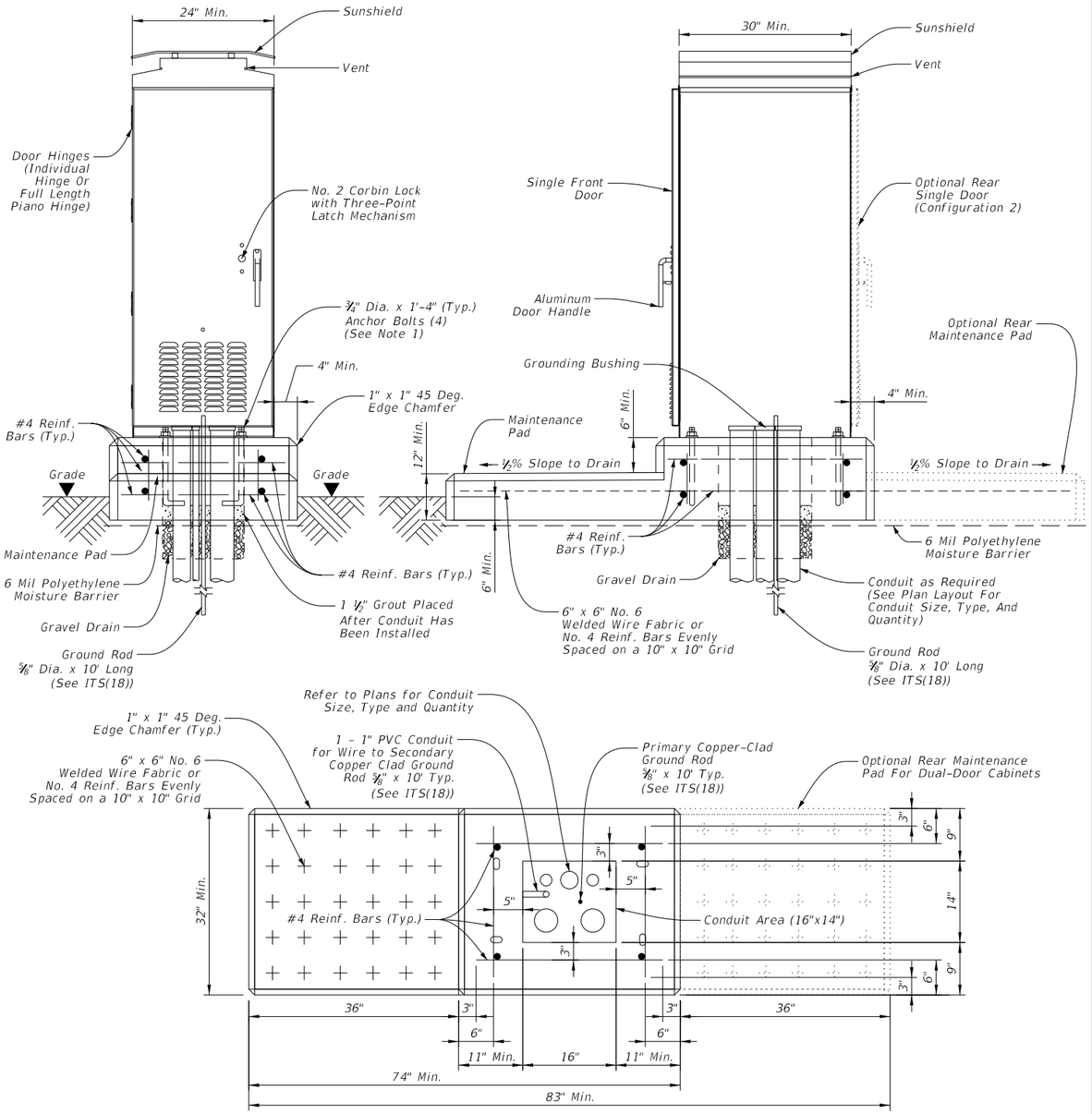
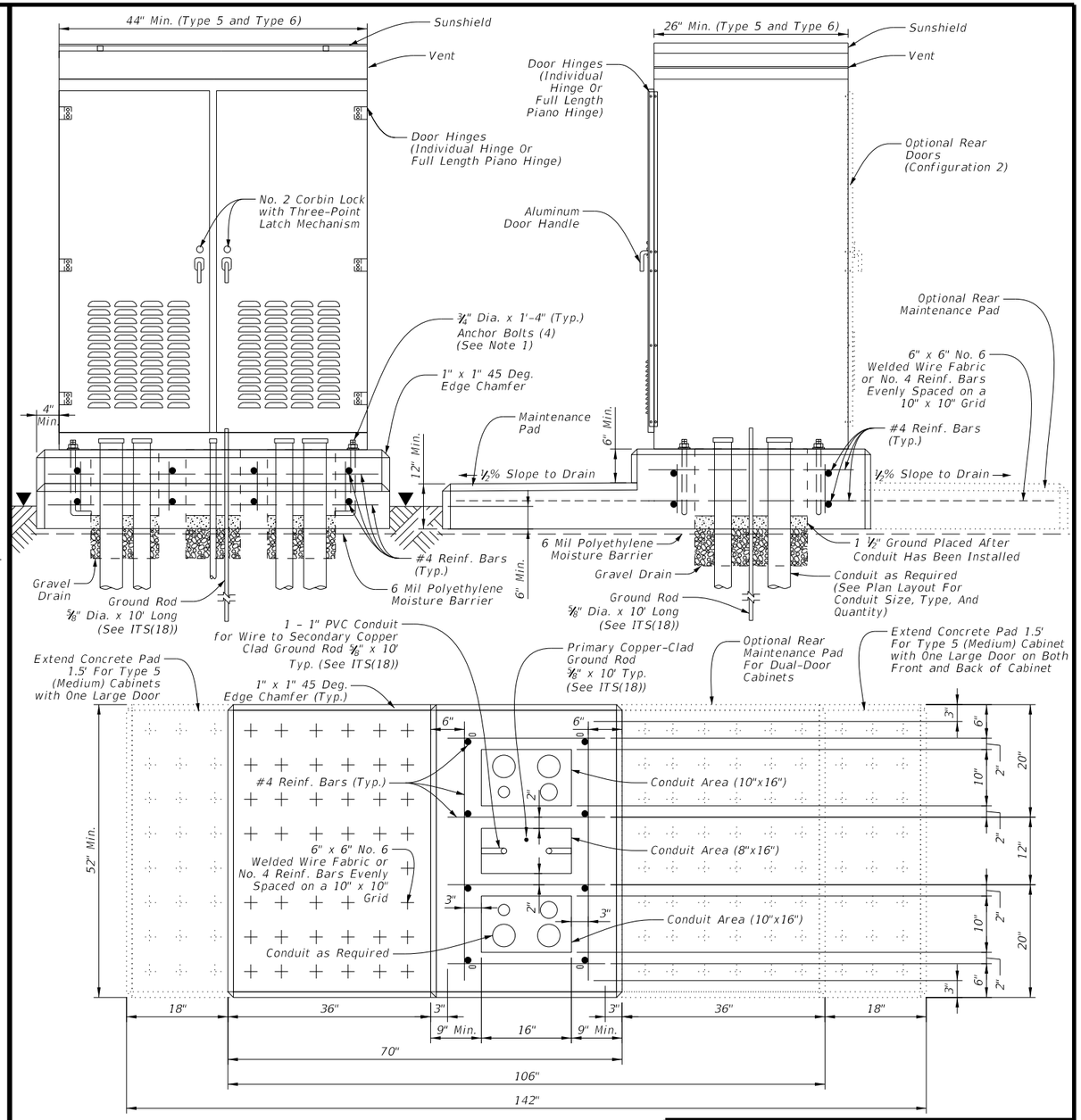


Type 4 (Small) Cabinet



Type 5 (Medium) & Type 6 (Large) Cabinet

General Notes:

1. Details of anchor bolt location to be furnished by the cabinet manufacturer. Size and length of anchor bolts shown in details may vary by manufacturer.
2. Modify concrete base dimensions to fit required cabinet type.
3. Ensure conduit area has gravel drain, 12" depth, course aggregate, grade No. 1.
4. All concrete to be Class "A" in accordance with Item 421.
5. Set the cabinet foundation level with the pavement surface, in unpaved area. The foundation shall be a minimum of 4" above surrounding grade, or as approved by the Engineer.
6. Furnish any additional concrete which may be necessary to stabilize foundation at unusual locations.
7. Foundation will be subsidiary to Special Specification "ITS Ground Mounted Cabinet.
8. Ground cabinet as required in cabinet specifications and as detailed on ITS(18) in accordance with the National Electric Code (NEC).
9. Treat cabinet foundation with moisture sealant.
10. Type 5 cabinet foundation will have a slightly larger foundation than Type 6. See foundation notes on details.
11. Drain pipe shall be screened for drainage portion below foundation in gravel.

Texas Department of Transportation

Traffic Operations Division Standard

ITS GROUND MOUNTED CABINET FOUNDATION DETAILS

ITS(21)-15

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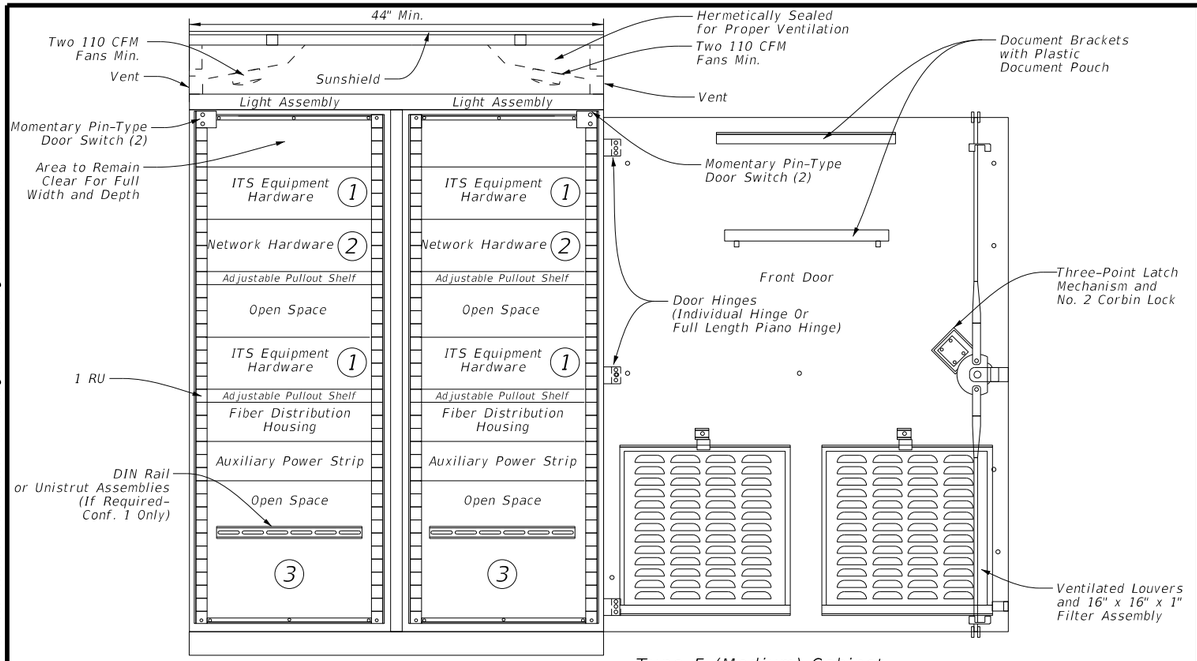
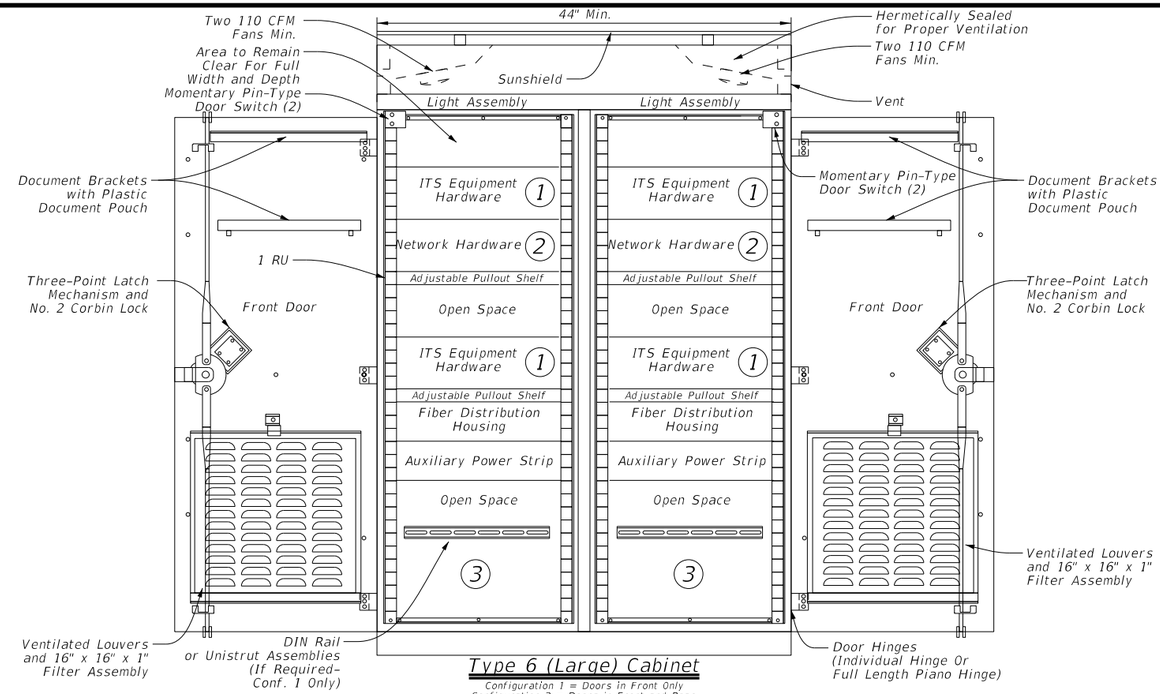


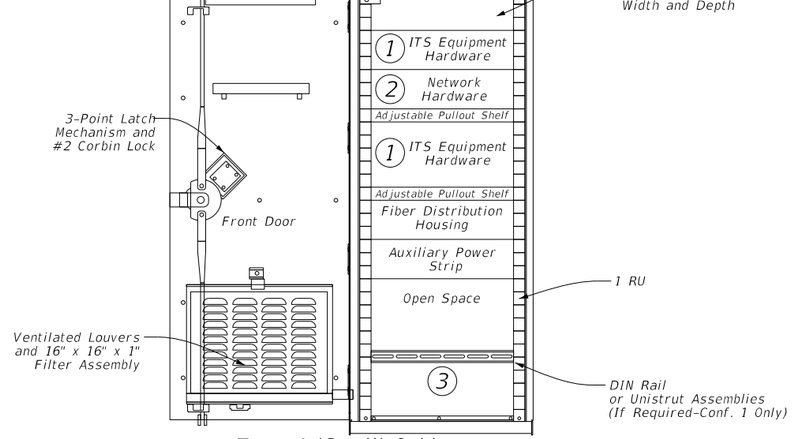
Type 5 (Medium) Cabinet

Configuration 1 = Doors in Front Only
Configuration 2 = Doors in Front and Rear.



Type 6 (Large) Cabinet

Configuration 1 = Doors in Front Only
Configuration 2 = Doors in Front and Rear.



Type 4 (Small) Cabinet

Configuration 1 = Doors in Front Only
Configuration 2 = Doors In Front and Rear.

Typical Equipment Layout Legend

	Example Equipment
1	CCTV Interface Panel, Radar Vehicle Sensing Device (RVSD) Equipment, DMS/LCS Controller Environmental Sensor Station (ESS) Equipment, Bluetooth Equipment, Highway Advisory Radio (HAR), Ramp Meter or Inductive Loop Card Rack, Automatic Vehicle Identification (AVI) Equipment, or ITS Radio Equipment (See General Note 1)
2	Ethernet Switch, Video Encoder, Terminal Server, Fiber Optic Transceivers, or Media Conversion Equipment (See General Note 1)
3	Power Distribution Assembly, Service Entrance Breakers, Primary AC Power, Auxiliary Power Strip, Ground Bus Bar Surge Protection Equipment, Solar Power System (If Required)

General Notes:

1. Layout of hardware equipment and configuration shown is diagrammatic in nature and intended to represent a preferred ground mounted cabinet setup. Hardware needed for each cabinet varies and not all cabinet equipment may be shown. The contractor will be responsible for configuring cabinets with all appropriate ITS hardware and power supplies in accordance with the plans and specifications. The contractor may alter the cabinet configuration shown to maximize space and ensure easy access for maintenance.
2. All dimensions are approximate and represent minimum dimensions.
3. Provide conduit entrances at the bottom of the cabinet.
4. Paid under Special Specification "ITS Ground Mounted Cabinet" (Configuration 1) with single door. Paid under Special Specification "ITS Ground Mounted Cabinet" (Configuration 2) for rear door option.
5. RU = rack unit.
6. Contractor to remove the cabinet removable center support, which ensures cabinet rigidity during shipping, during installation.

Texas Department of Transportation

Traffic Operations Division Standard

ITS GROUND MOUNTED CABINET INTERIOR DETAILS

ITS(23)-15

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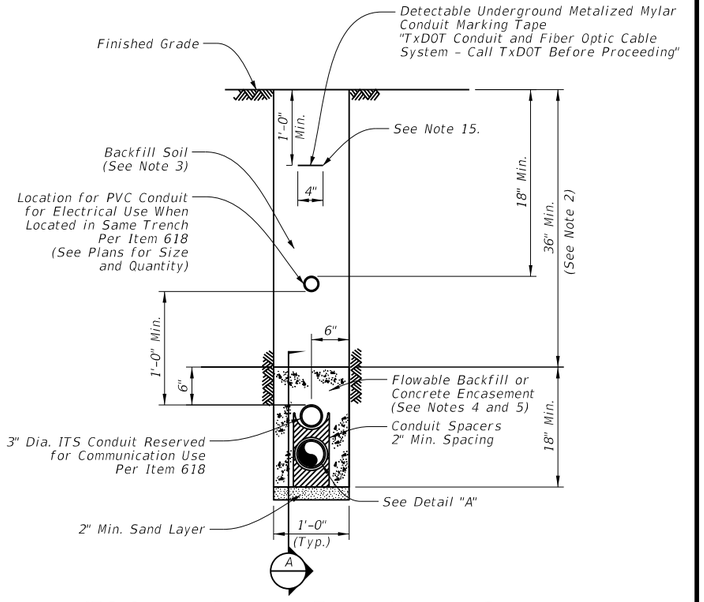
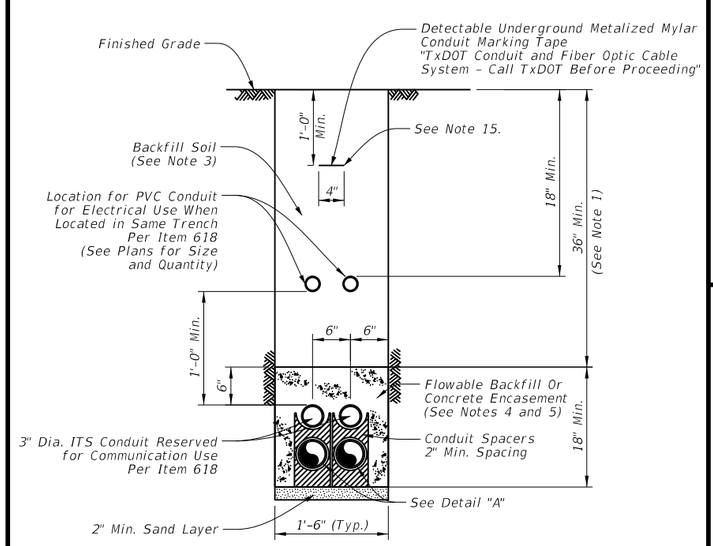


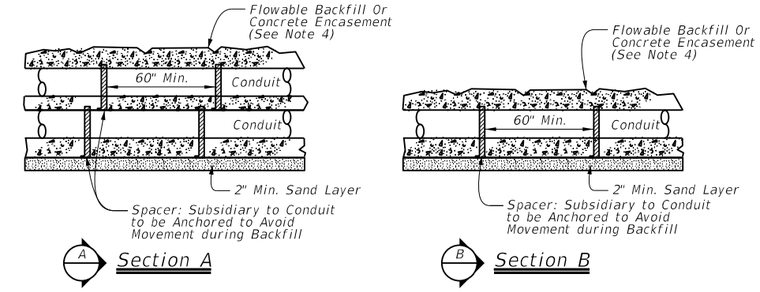
ITS Conduit Backbone Trench Vertical Spacing

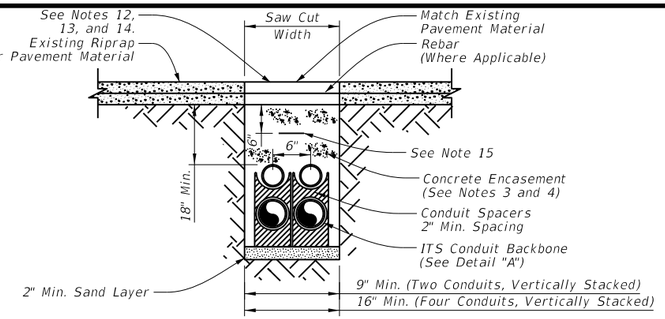
Two Conduit System



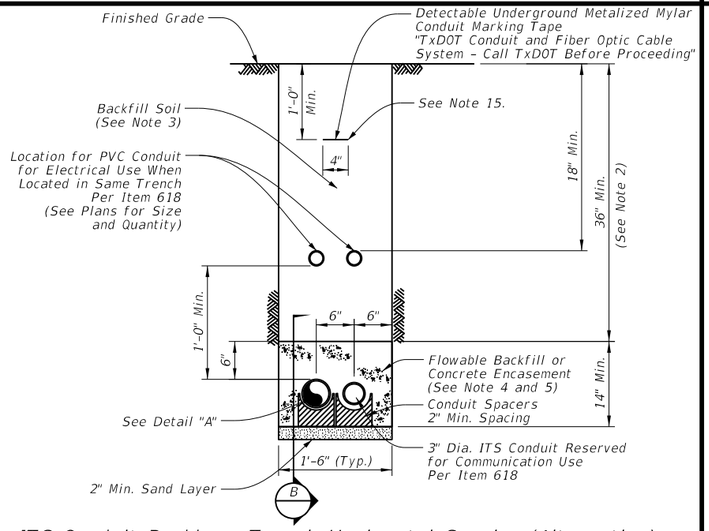
ITS Conduit Backbone Trench Vertical Spacing

Four Conduit System



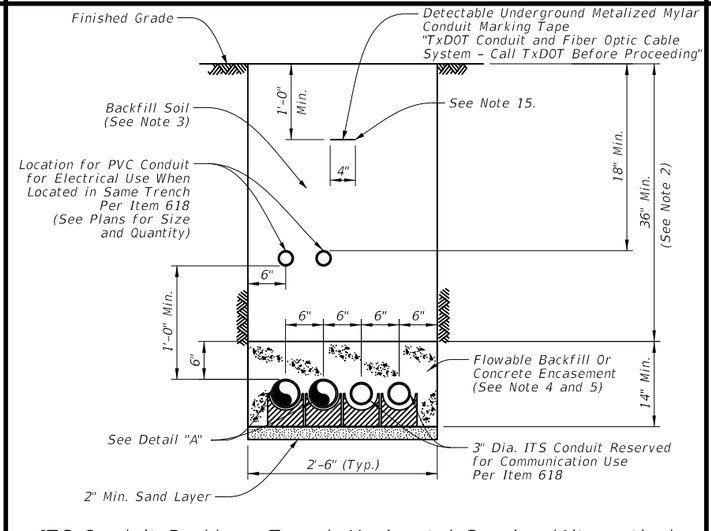


Open Cut Trenching Details



ITS Conduit Backbone Trench Horizontal Spacing (Alternative)

Two Conduit System

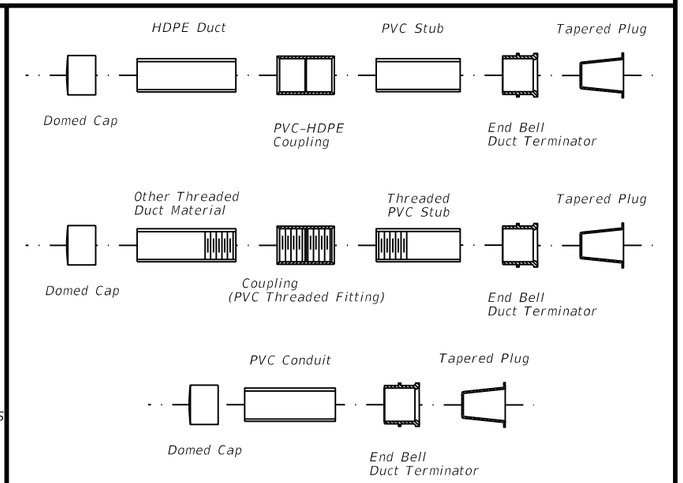


ITS Conduit Backbone Trench Horizontal Spacing (Alternative)

Four Conduit System

Detail "A"

Conduit Types
(See Plans for Type and Quantity)



Typical Conduit Fitting Combinations

2 Conduit and Single Conduit Configuration

SHEET 1 OF 2

General Notes:

1. 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.
2. 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.
3. Perform trench excavation and backfilling in accordance with Item 400, "Excavation and Backfill for Structures."
4. 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.
5. 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."
6. Concrete encasement will be paid for under Special Specification "ITS Multi-Duct Conduit" or as shown on the plans.
7. Provide ITS PVC conduit identified for electrical and communication use in accordance with Item 618, "Conduit."
8. Provide ITS multi-duct conduit identified for fiber optic communication use in accordance with Special Specification "ITS Multi-Duct Conduit."
9. Conduit per Item 618, "Conduit" (See Plans for Material Type and Quantity).
10. 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."
11. 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.
12. Remove saw cut width to accommodate conduit installation.
13. Replace rebar as necessary, lapped and tied a minimum of 3 inches to existing rebar.
14. Replace broken pavement materials with similar materials to exact shape, and thickness of existing.
15. 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.
16. 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 Details
Not to Scale

Texas Department of Transportation

Traffic Operations Division Standard

ITS CONDUIT TRENCH DETAILS

ITS(27)-16

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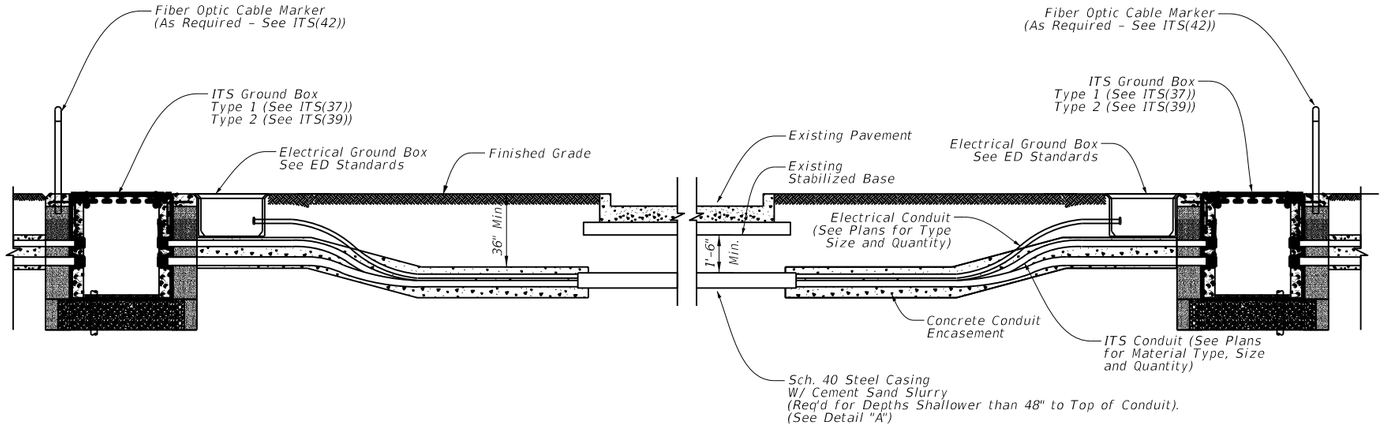
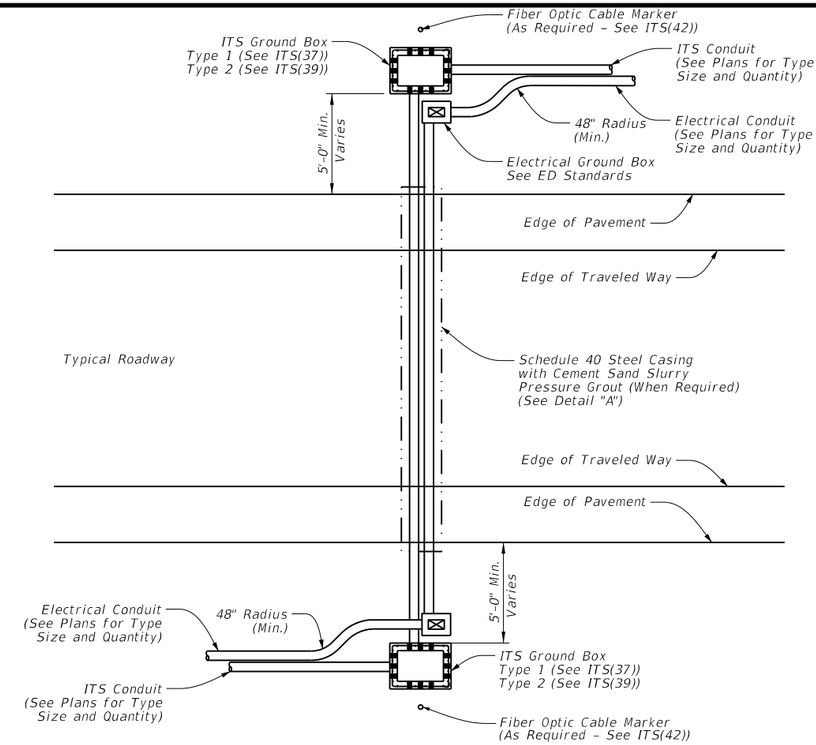
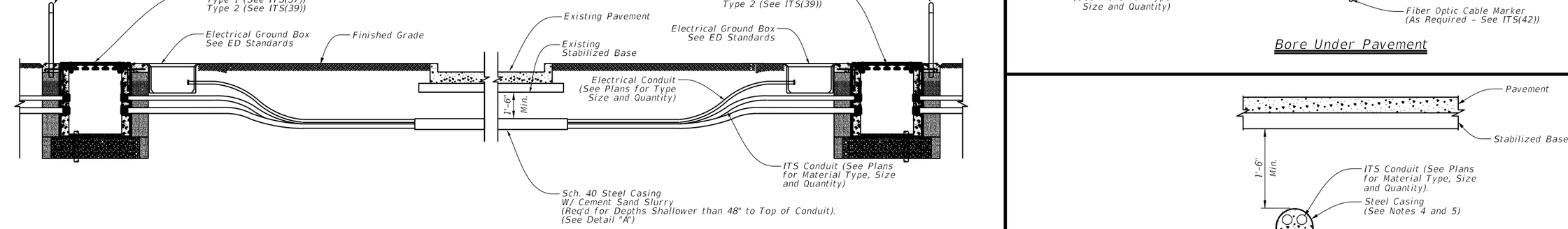


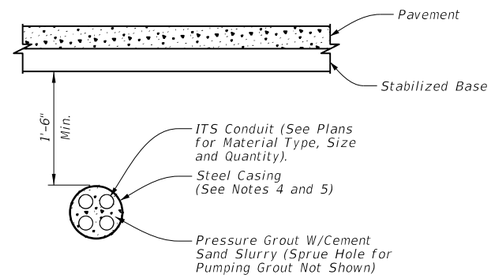
Typical Conduit Installation Jacking or Boring Beneath Existing Roadway



Bore Under Pavement



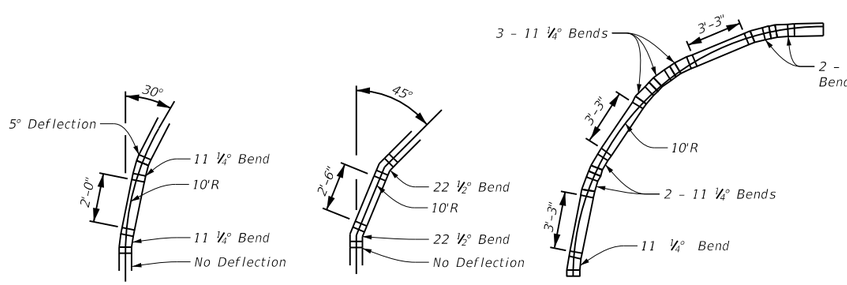
Typical Conduit Installation Jacking or Boring Beneath Existing Roadway (Where Concrete Encasement Not Required)



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
Not to Scale

SHEET 2 OF 2

Texas Department of Transportation

Traffic Operations Division Standard

ITS CONDUIT BORE AND STEEL CASING DETAILS

ITS(28)-16

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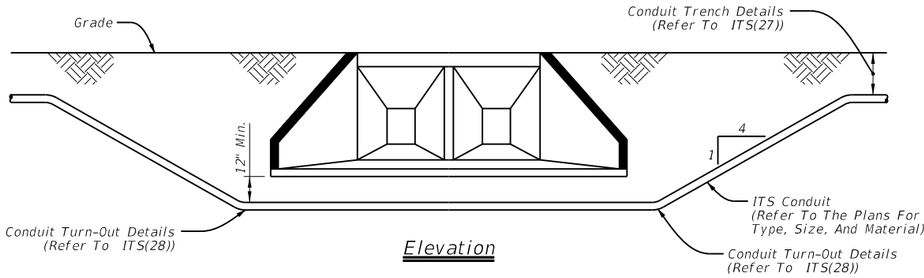

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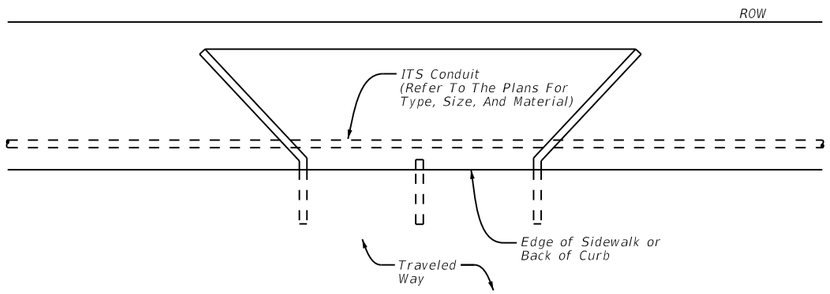
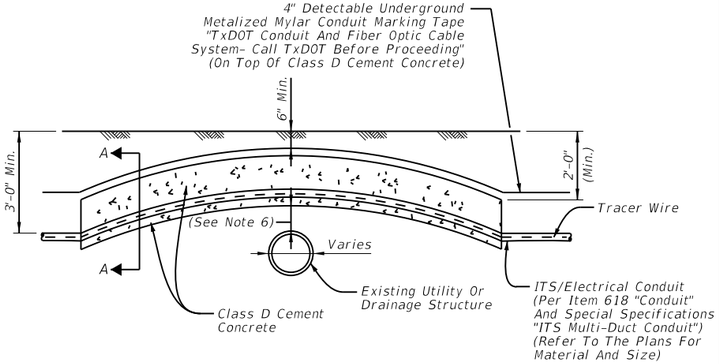
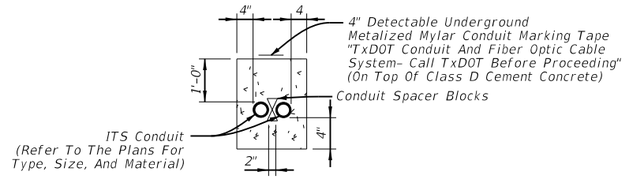


Plan View

Conduit Bored Under Culvert



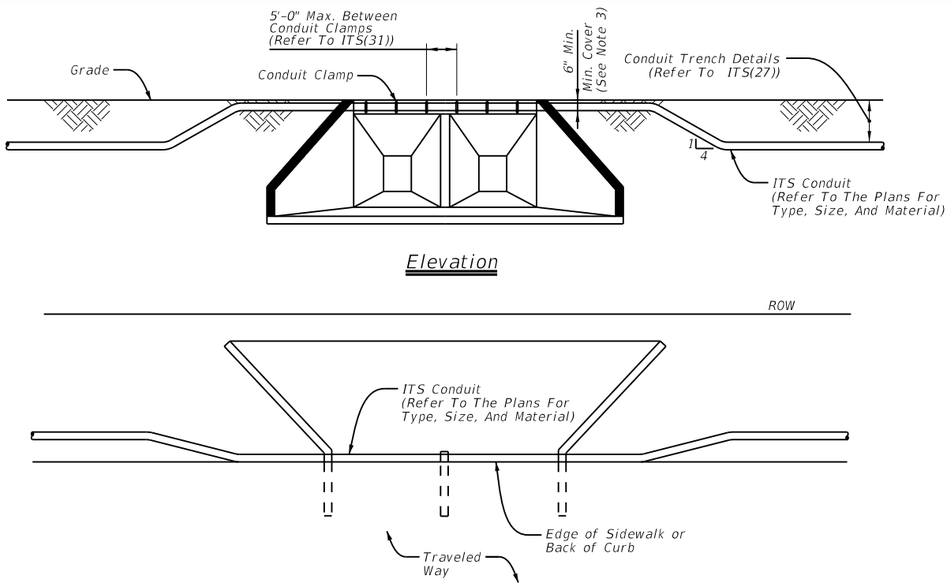


Section A-A

Conduit Installation Detail Above
Existing Drain Pipes Or Utilities

General Notes:

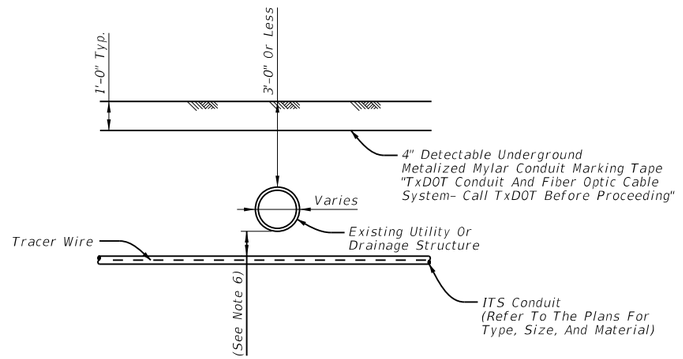
1. With approval from the field engineer adjust the final burial depth of conduit(s) in circumstances requiring traversal of non-movable object conflicts.
2. Where conduits are to be installed over existing underground infrastructure (i.e., existing utility or drainage structure) which are less than 3'-0" deep, encase conduit in Class D cement concrete in accordance with Item 421, "Hydraulic Cement Concrete", for the entire length of the conduit that is installed at a depth of less than 3'-0".
3. If depth of cover over encasement is less than 6", install the conduit to pass beneath the underground infrastructure.
4. Refer to the plans for type, size and configuration of all conduits. Refer to ITS(27) and ITS(28) for further installation details.
5. It is the responsibility of the contractor to verify all existing underground infrastructure. The contractor is responsible for any damage to any underground infrastructure during construction. Verify all utility locations at least 100' in advance of trenches, plowing or boring, and make changes in conduit placement in the event of conflict.
6. If proposed conduit is crossing or in close proximity to an existing underground utility, maintain a minimum clearance of 1'-6" vertical, 1'-6" horizontal or a clearance dictated by municipal code and or utility owner.
7. Install underground warning tape directly above all conduits per ITS(27) standard.
8. Do not install communications and electric cables in the same conduit. Separate conduits installed within the same trench based on NFPA 70, National Electrical Code. Refer to ITS(27) for additional conduit installation details.
9. Ensure all work is in compliance with the latest edition of NFPA 70, National Electrical Code.
10. Utilize PVC conduit for all underground applications as required by design. Transition with a conduit coupling to RMC conduit or other as required by design that is approved for above ground applications.
11. Do not exceed a rise:run ratio of 1:4 for conduit sloped through increases or decreases in elevation.



Elevation

Plan View

Conduit Attached To Culvert Headwall



Conduit Installation Detail Below
Existing Drain Pipes Or Utilities

Sheet Details
Not to Scale

Texas Department of Transportation

Traffic Operations Division Standard

ITS CONDUIT OBSTRUCTION CROSSING

ITS(35)-16

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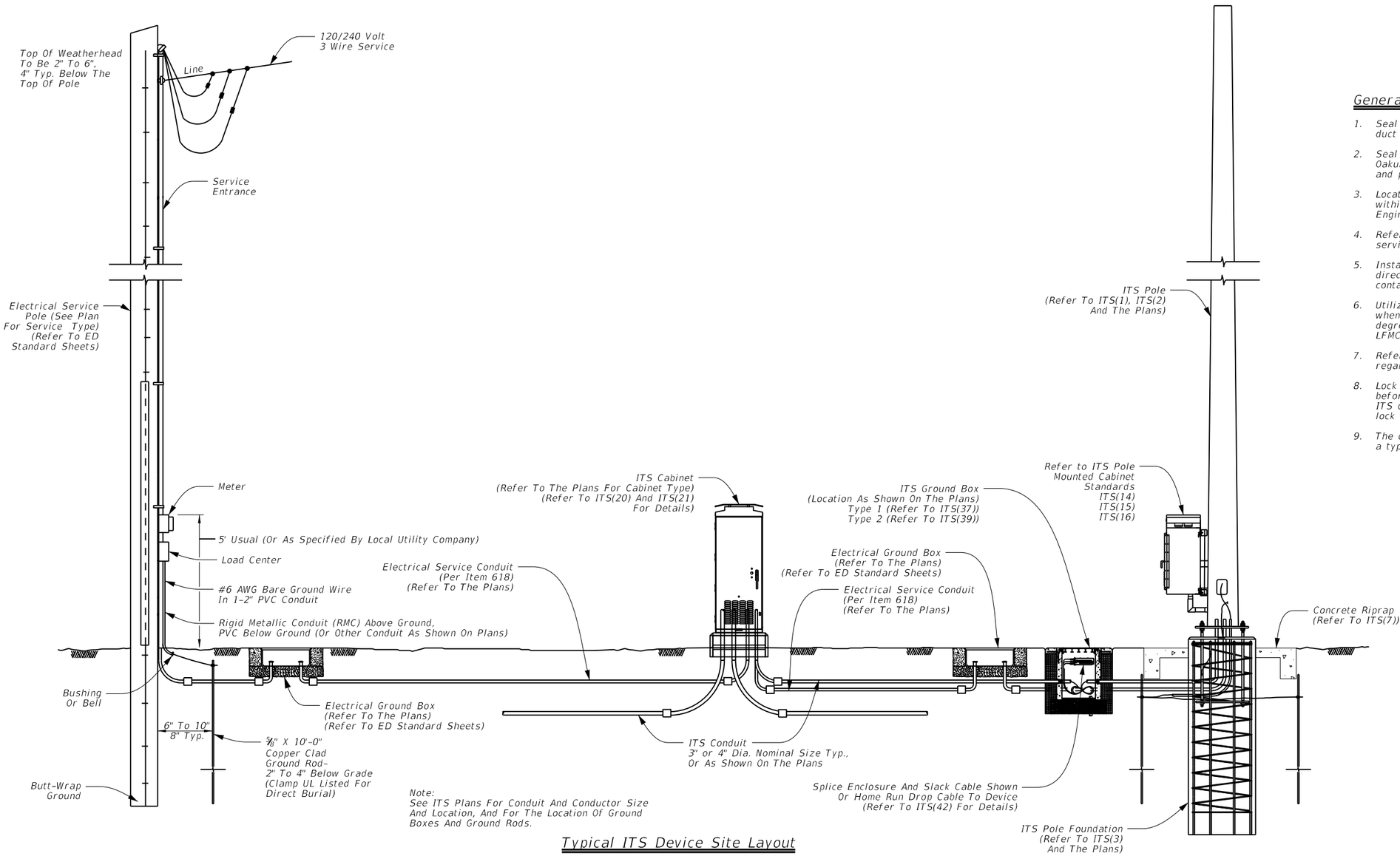

Note:
See ITS Plans For Conduit And Conductor Size And Location, And For The Location Of Ground Boxes And Ground Rods.

Typical ITS Device Site Layout

General Notes:

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.

Texas Department of Transportation

Traffic Operations Division Standard

TYPICAL ITS DEVICE SITE LAYOUT

ITS(36)-16

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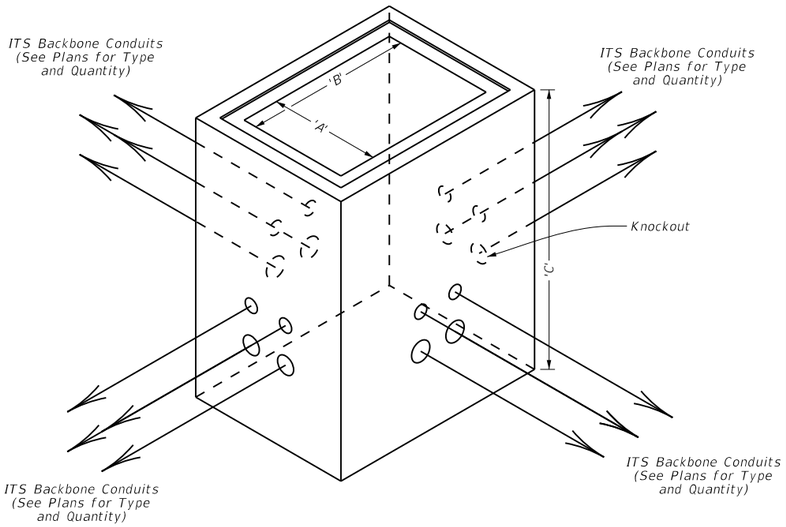
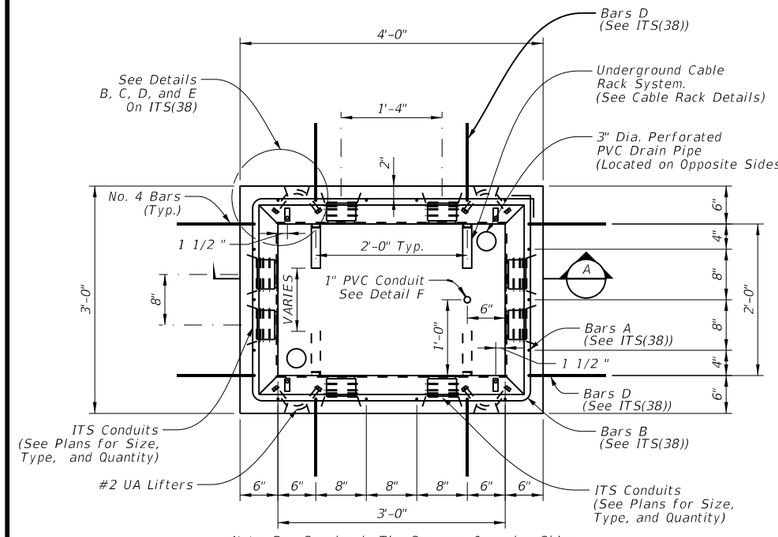


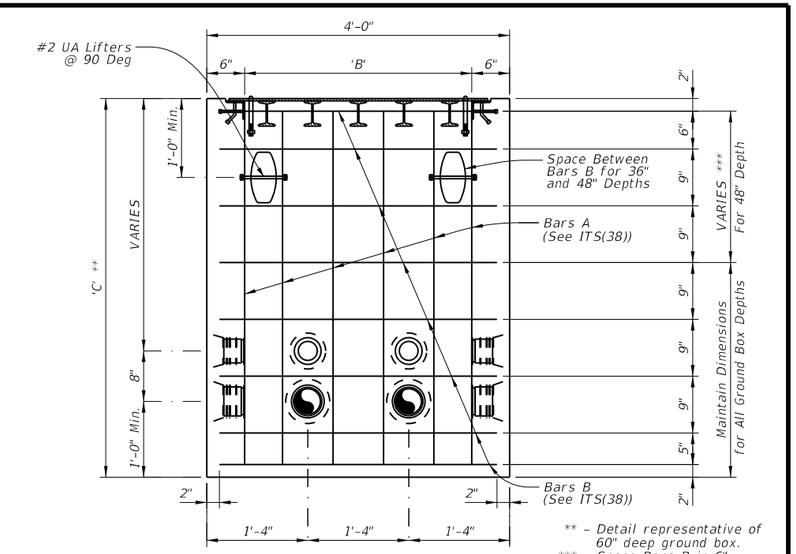
See Ground Box Schedule for A, B, and C Dimensions

Type 1 Ground Box Isometric View



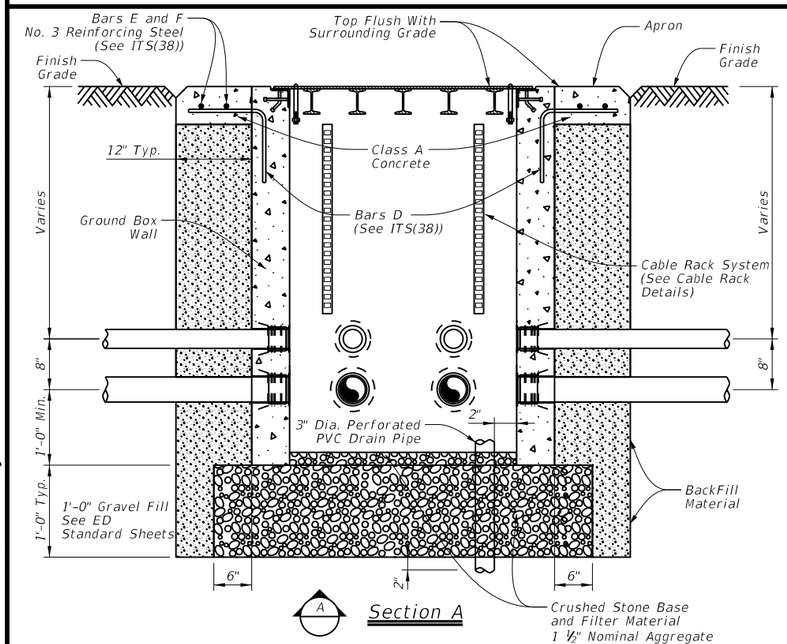
Note: Bar Spacing is The Same on Opposing Sides.

Type 1 Ground Box Plan View

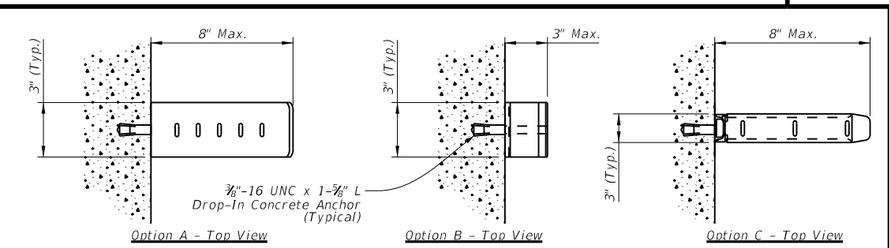


** – Detail representative of 60" deep ground box.
*** – Space Bars B in 6" Intervals for 48" Depth

Type 1 Ground Box Elevation View

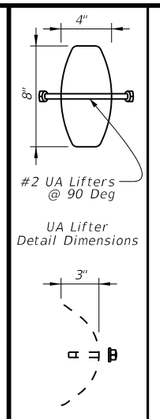


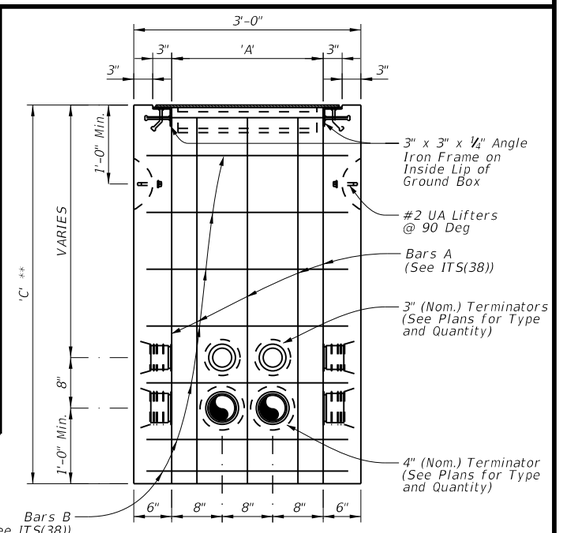
Section A



Note: Options Shown for Cable Racks and Attachment Methods. Furnish Shop Drawings of Cable Rack for Engineer Approval Prior to Installation.

Type 1 Cable Rack Details





Type 1 Ground Box Side View

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

SHEET 1 OF 2

General Notes:

1. 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.
2. Provide Class A concrete for Type "1" ground boxes.
3. 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.
4. Provide terminators appropriately sized for the conduits indicated on the plans. Provide terminators with an air tight and water tight connection.
5. 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 base of crushed stone which extends 6 inches in all directions from the perimeter of the box for closed bottom boxes. Crushed stone will be subsidiary to Special Specification, "ITS Ground Box."
6. Install all open bottom Type "1" 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."
7. Cap and seal terminators that do not have conduits attached.
8. 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.
9. Provide a bell fitting on the end of each conduit to ensure a flush fit inside the ground box.
10. 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.
11. 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.
12. 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 Details
Not to Scale

Texas Department of Transportation

Traffic Operations Division Standard

ITS GROUND BOX DETAILS TYPE "1" WITH STEEL COVER

ITS(37)-16

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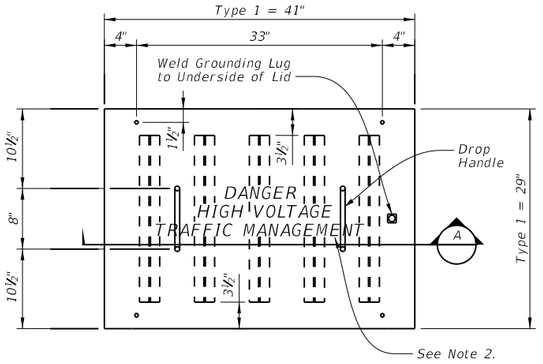
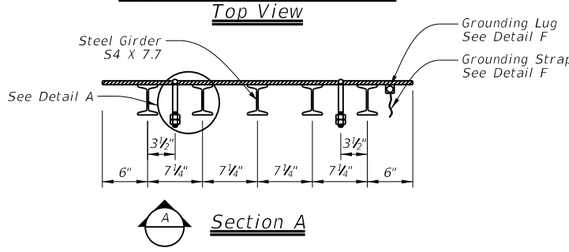
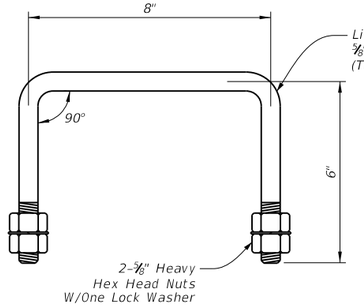


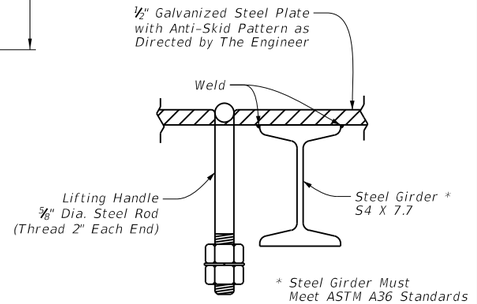
Type 1 Steel Cover Details
Top View



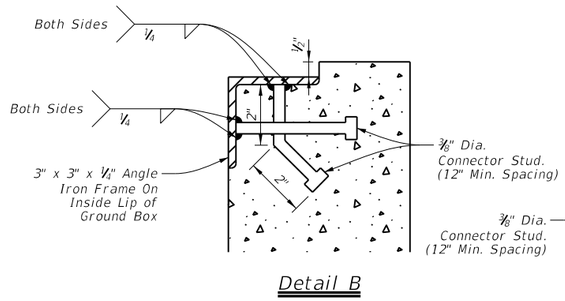
Section A



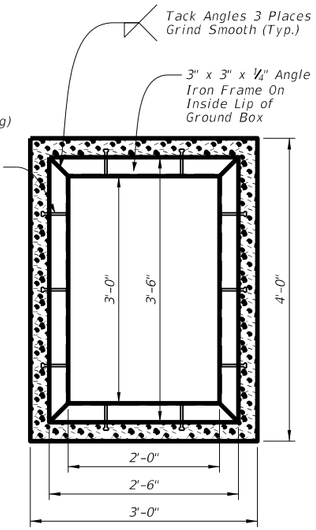
Drop Handle Detail



Detail A



Detail B



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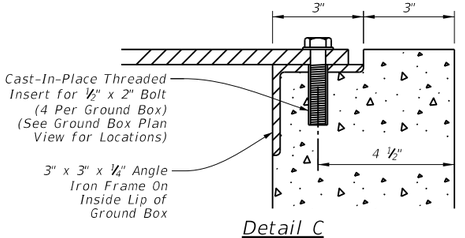
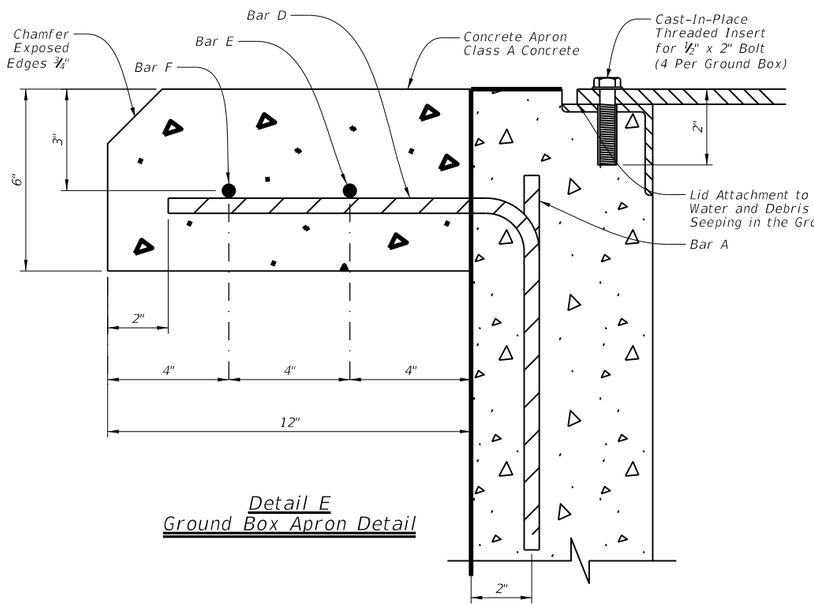


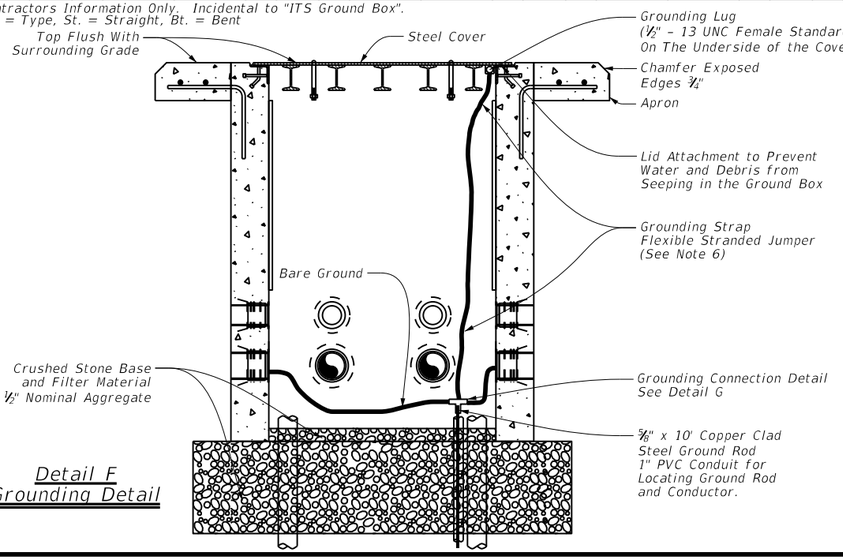
Detail C
Lid Attachment Detail



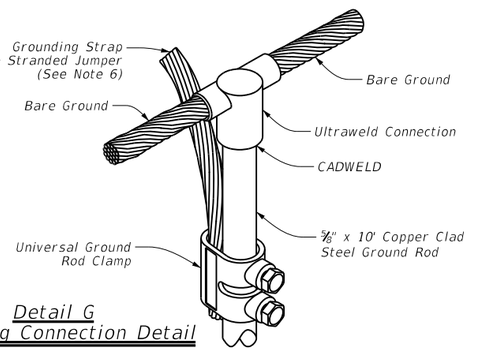
Detail E
Ground Box Apron Detail

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	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	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	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	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:

1. See ITS(37) for additional Type "1" ground box details.
2. Hot-dip galvanized steel covers after all welds are made.
3. 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.
4. Provide all Type "1" ground boxes with a securable, tamper-proof cover equipped with a bolting system that positively secures the cover in place.
5. Ground steel covers in accordance with the National Electrical Code.
6. 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.
7. 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.
8. 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.
9. 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.
10. Fabricate cover so to fits properly on the ground box, and no undue noise results when traffic contacts the cover.

Sheet Details
Not to Scale

SHEET 2 OF 2

Texas Department of Transportation

Traffic Operations Division Standard

ITS GROUND BOX DETAILS TYPE "1" WITH STEEL COVER

ITS(38)-17

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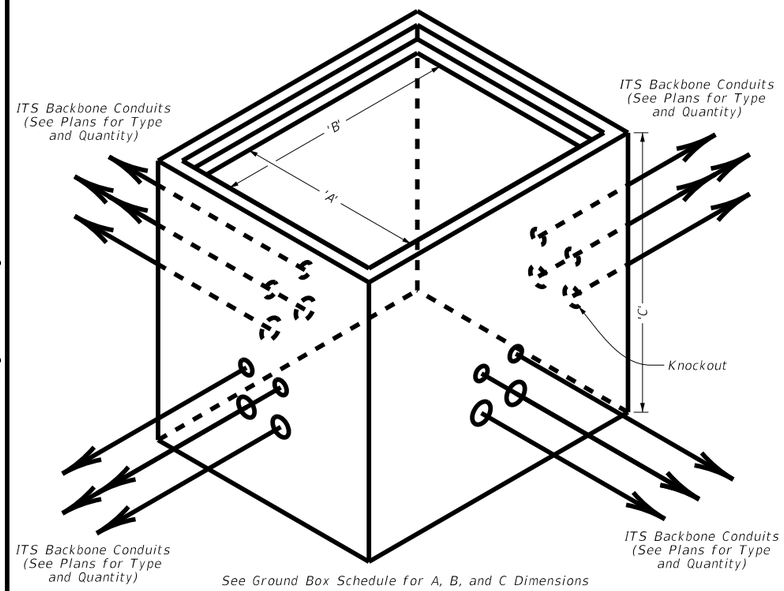
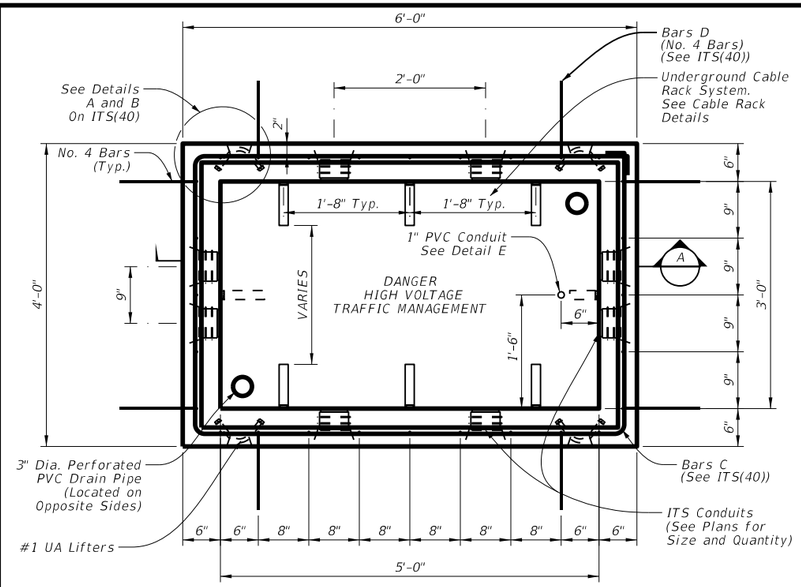


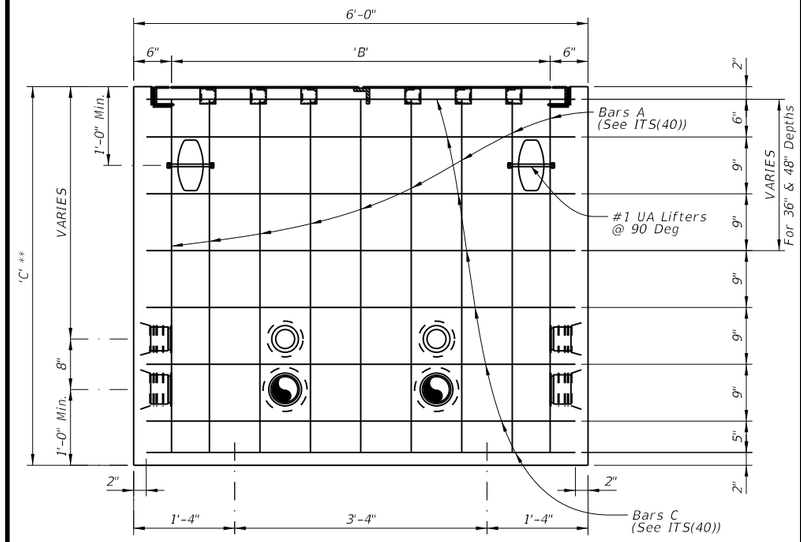
See Ground Box Schedule for A, B, and C Dimensions

Type 2 Ground Box Isometric View



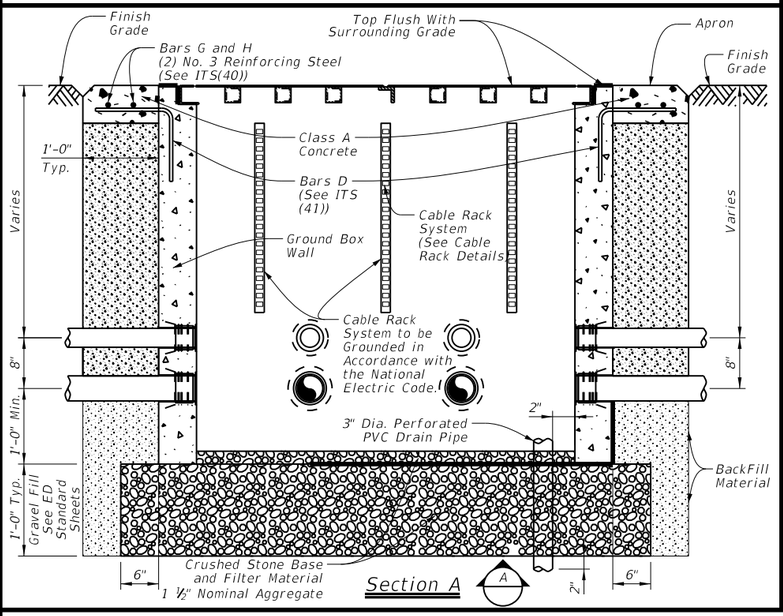
Note: Bar Spacing is The Same on Opposing Sides.

Type 2 Ground Box Plan View

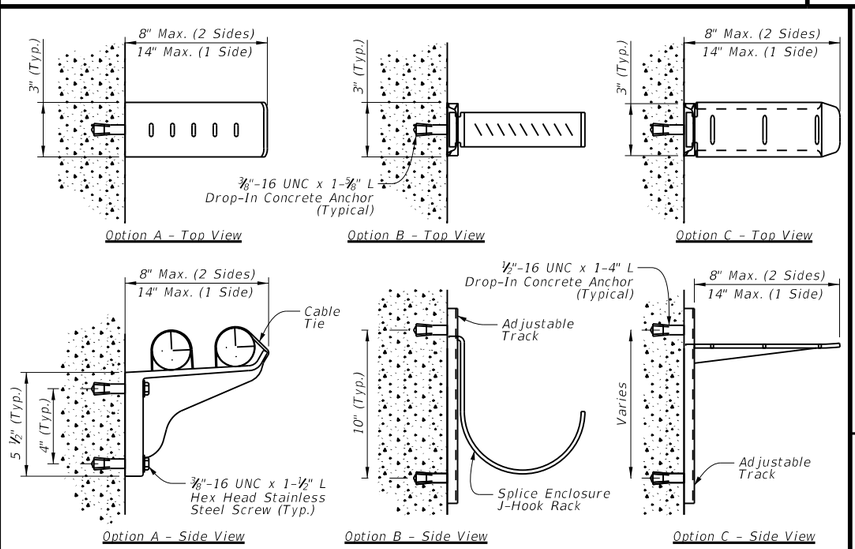


** - Detail representative of 60" deep ground box.

Type 2 Ground Box Elevation View

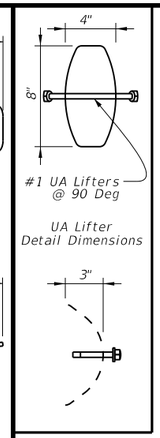


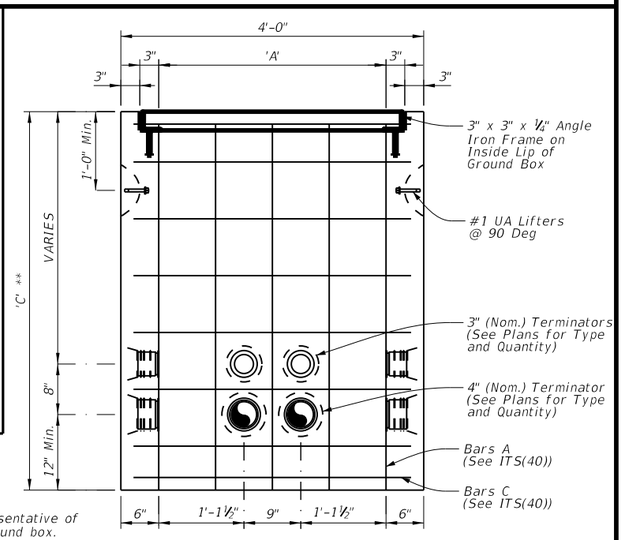
Section A



Note: Options Shown for Cable Racks and Attachment Methods Contractor to Supply Shop Drawings of Cable Rack and Cable Rack Grounding System (If Applicable) for Engineer Approval Prior to Installation.

Type 2 Cable Rack Details





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

Type 2 Ground Box Side View

SHEET 1 OF 2

General Notes:

1. 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.
2. Provide Class "A" concrete for Type "2" ground boxes.
3. 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.
4. Provide terminators appropriately sized for the conduits indicated on the plans. Provide terminators with an air tight and water tight connection.
5. 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."
6. 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.
7. Provide a bell fitting on the end of each conduit to ensure a flush fit inside the ground box.
8. 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.
9. 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.
10. 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."
11. Cap and seal terminators that do not have conduits attached.
12. Backfill in accordance with Item 400, "Excavation and Backfill for Structures."
13. 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
Not to Scale

Texas Department of Transportation

Traffic Operations Division Standard

ITS GROUND BOX DETAILS TYPE "2" WITH STEEL COVER

ITS(39)-16

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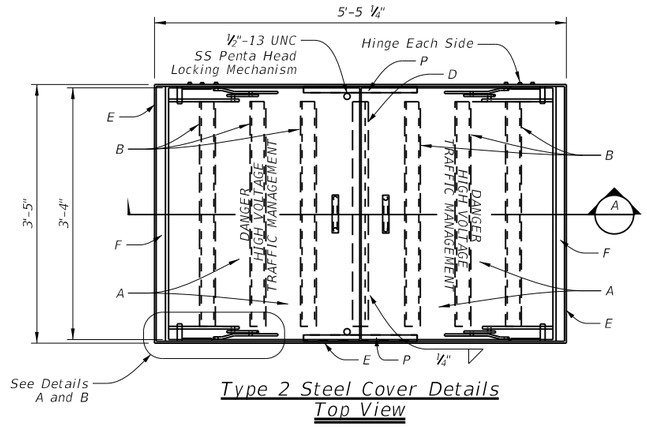
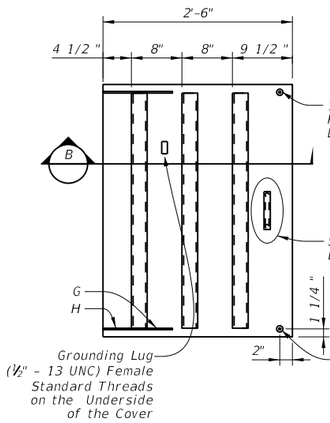
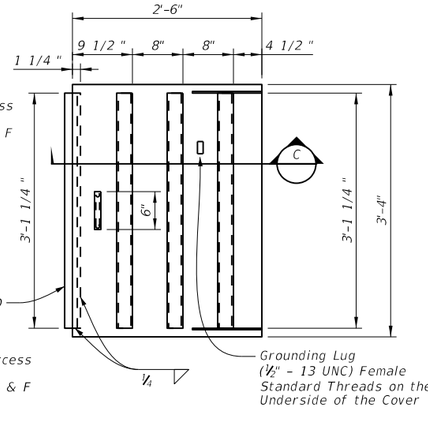


Type 2 Steel Cover Details
Top View

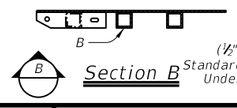
Section A



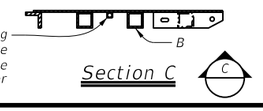
Type 2 Steel Cover Details
Bottom View (Left)



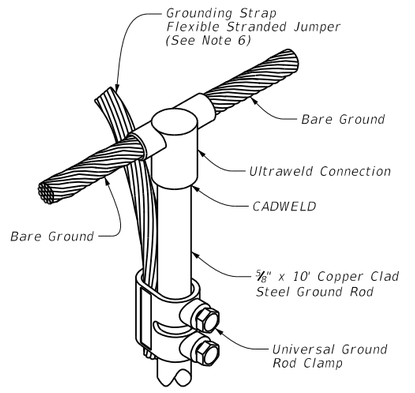
Type 2 Steel Cover Details
Bottom View (Right)



Section B



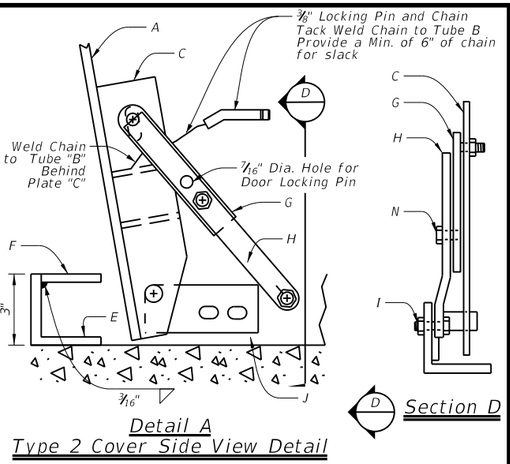
Section C



Detail G
Grounding Connection Detail

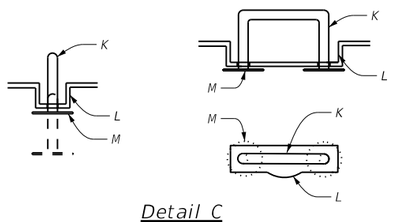
Note - All grounding connections to be CADWELD or approved equal. This work will not be paid for directly, but is considered incidental to ITS ground box.

Item	Qty	Incidental "ITS Ground Box" Material
A	2	¼" Floor Plate 40" x 30"
B	6	2 ½" x 2 ½" x 37 ¼" Tube
C	4	11" x 2 ½" x ¼" Plate
D	1	2 ½" x 2 ½" x ½" x 37" ¼ Angle
E	4	3" x 3" x ¼" Angle
F	2	40 ½" x 2" x ¼" Plate
G	4	6 ½" x 1 ¼" x ¼" Plate
H	4	10 ½" x 1 ¼" x ¼" Plate
I	12	½" Bolt/Nut
J	4	4 ¾ x 2" x ¾" Plate
K	2	⅝" Drop Handle
L	2	1 ½" x ⅝" x 3/16" Channel x 7"
M	4	1 ½" x ⅛" P Disk
N	8	½" x ⅜" Bolt
P	2	1" x 1" x ⅛" Angle x 18"

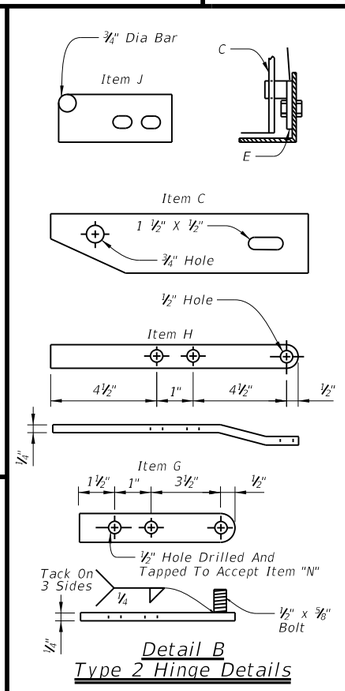


Detail A
Type 2 Cover Side View Detail

Section D



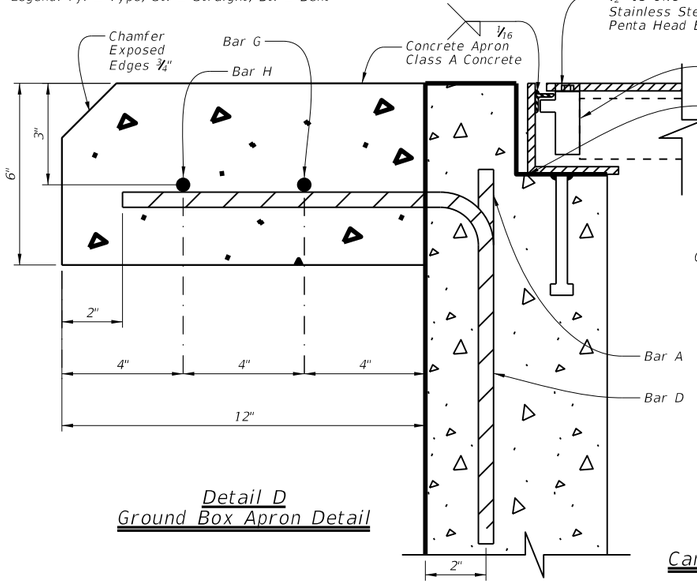
Detail C
Type 2 Drop Handle Details



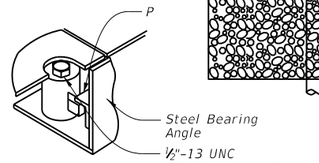
Detail B
Type 2 Hinge Details

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



Detail D
Ground Box Apron Detail



Detail F
Cam Locking Mechanism

Detail E
Grounding Detail

SHEET 2 OF 2

General Notes:

1. See ITS(39) for additional Type "2" ground box details.
2. Hot-dip galvanized steel covers after all welds are made.
3. 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.
4. Provide all Type "2" ground boxes with a securable, tamper-proof cover equipped with a bolting system that positively secures the cover in place.
5. Ground steel covers in accordance with the National Electrical Code.
6. 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.
7. 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.
8. 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.
9. 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.
10. Fabricate cover so to fits properly on the ground box, and no undue noise results when traffic contacts the cover.

Sheet Details
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Texas Department of Transportation

Traffic Operations Division Standard

ITS GROUND BOX DETAILS TYPE "2" WITH STEEL COVER

ITS(40)-17

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	FTW	TARRANT		51

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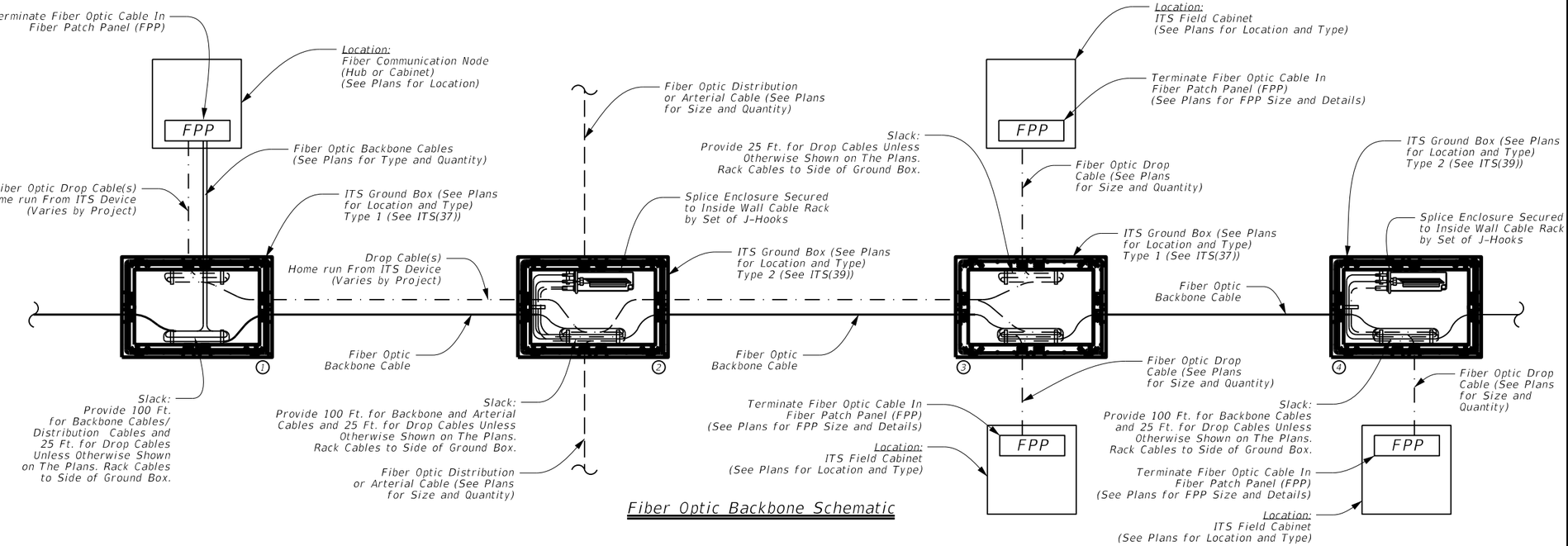
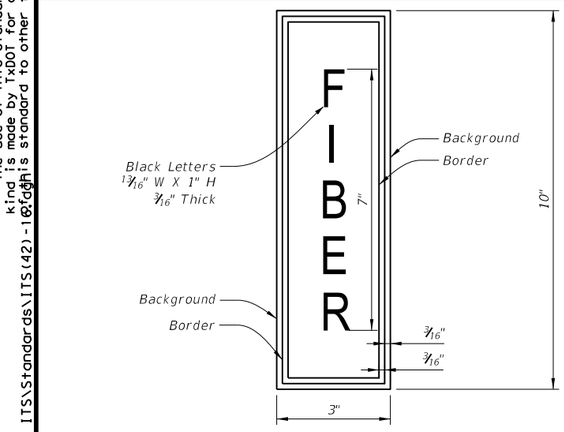
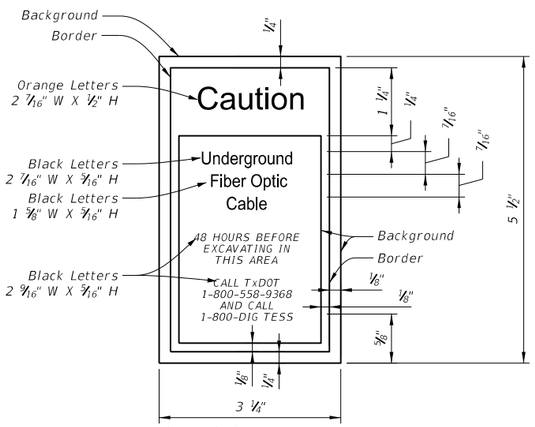


Fiber Optic Backbone Schematic



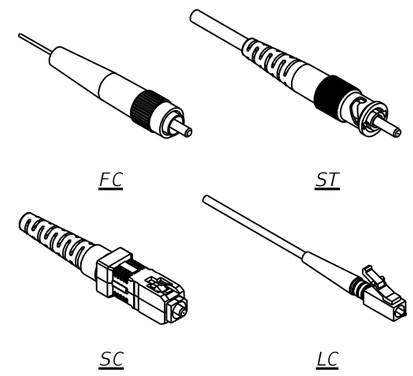
Border – Black
Background – Orange Reflective

Fiber Decal Details



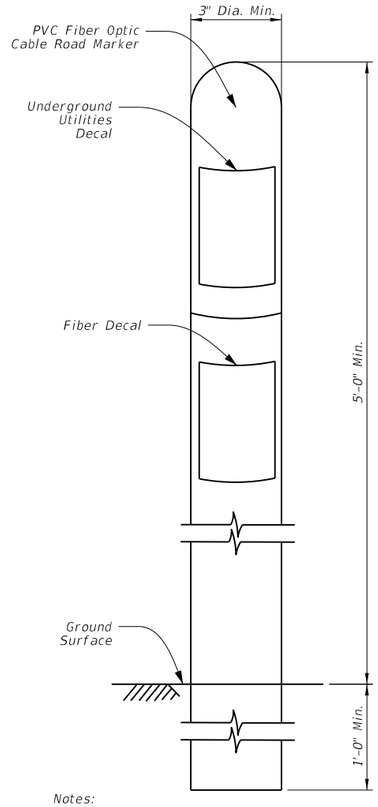
Border – Black
Symbol – Black
Background – Orange Reflective

Underground Utilities Decal Details



Fiber Optic Connectors

Note – Details are diagrammatic and may vary by manufacturer.



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

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.

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/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."
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.

Sheet Details
Not to Scale

SHEET 1 OF 2

Texas Department of Transportation

Traffic Operations Division Standard

ITS FIBER OPTIC CABLE MISCELLANEOUS DETAILS

ITS(42)-16

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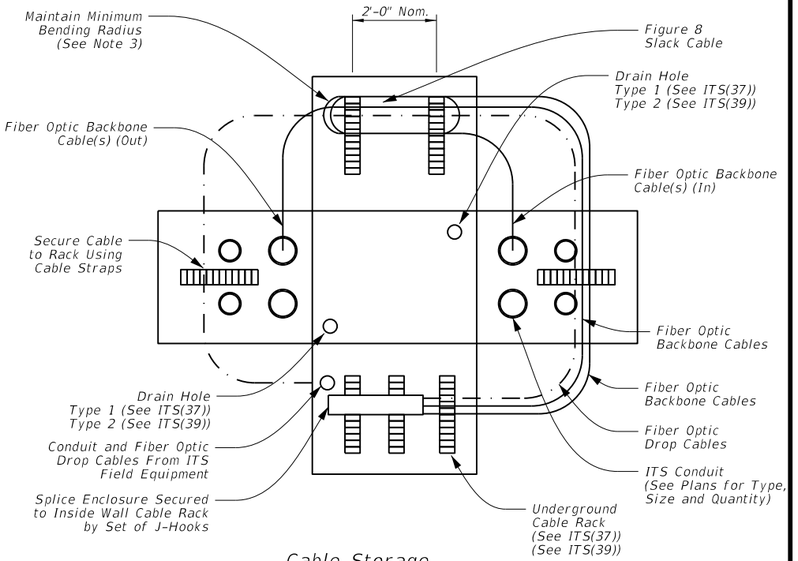
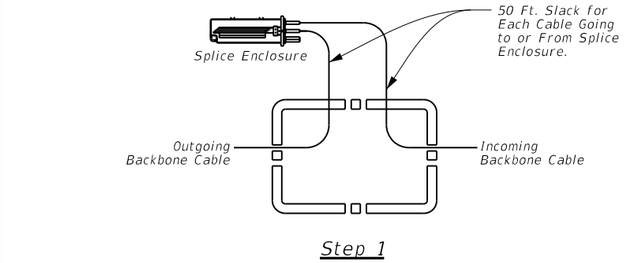
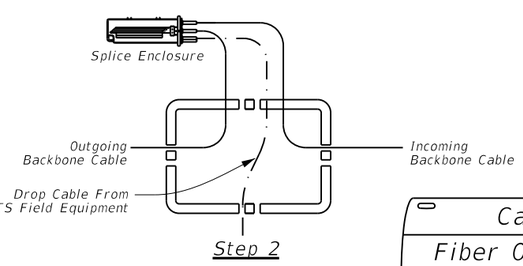


Cable Storage

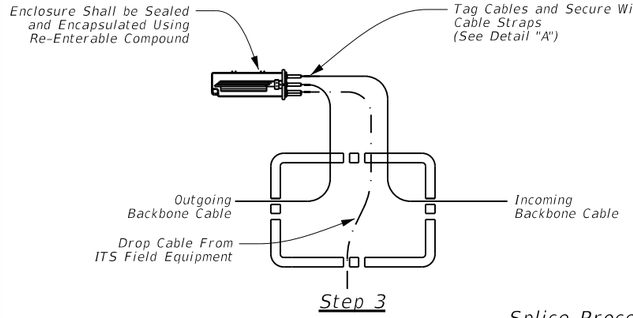
Top View - Ground Box Walls Folded Down for Clarity



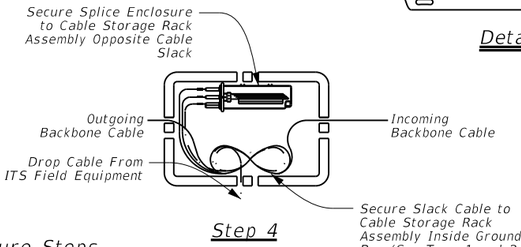
Step 1



Step 2

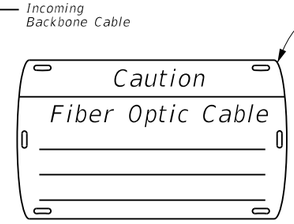


Step 3



Step 4

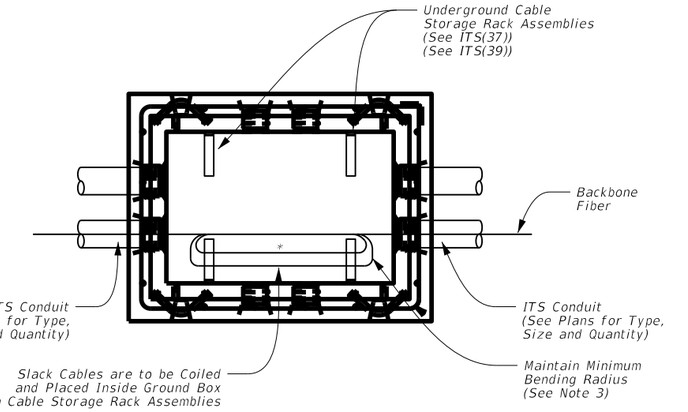
Splice Procedure Steps



Fiber Optic Cable Tag

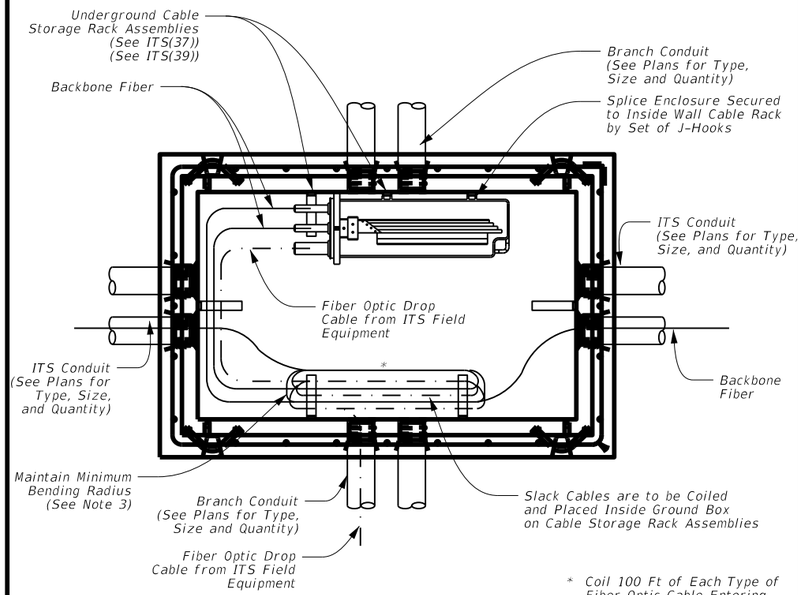
Panduit Inc. No. PST-FO
Hellerman-Tyton No. CST2003x2
Self-Lam Tag or Approved Equal

Detail "A"



Type "1" Ground Box

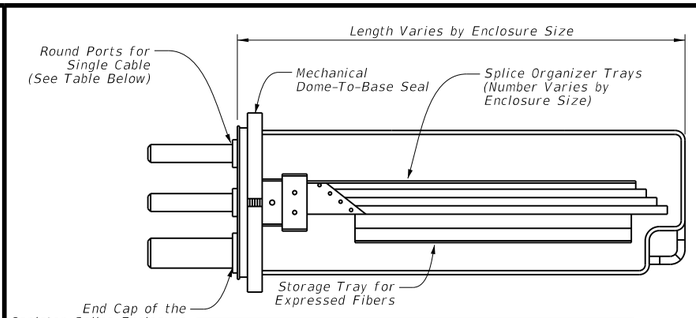
* Coil 25 Ft of Fiber Optic Cable for Slack



Type "2" Ground Box

with Splice

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



Splice Enclosure Sizes			
Type	No. of Ports	Port Capacity	Fiber Use
1	4	2 - Up to 144 Sm	Backbone
		2 - Up to 48 Sm	Drop
2	6	4 - Up to 144 Sm	Backbone/Arterial
		2 - Up to 48 Sm	Drop
3	8	4 - Up to 144 Sm	Backbone/Arterial
		4 - Up to 48 Sm	Drop

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 Details
Not to Scale

SHEET 2 OF 2

Texas Department of Transportation

Traffic Operations Division Standard

ITS FIBER OPTIC CABLE MISCELLANEOUS DETAILS

ITS(43)-16

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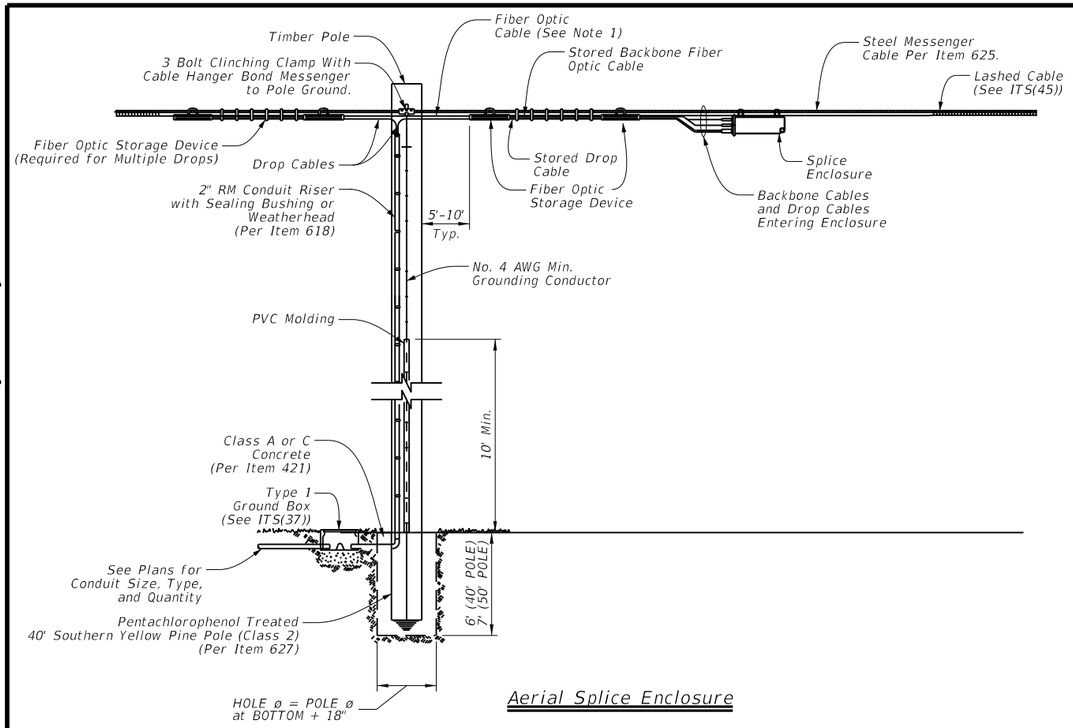
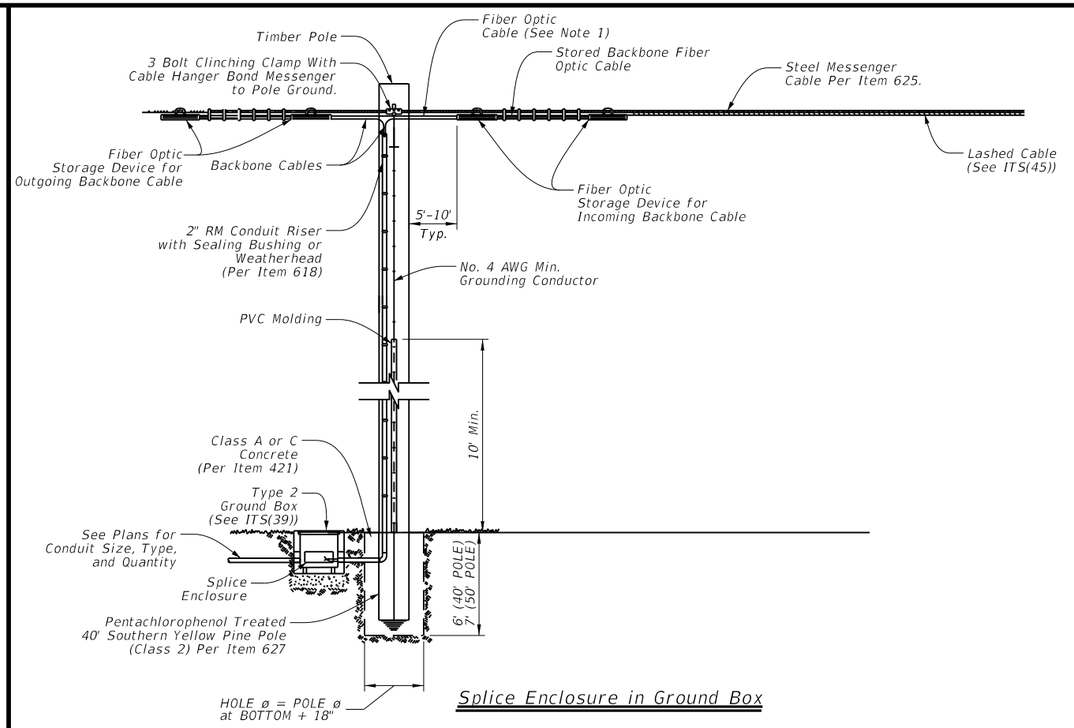
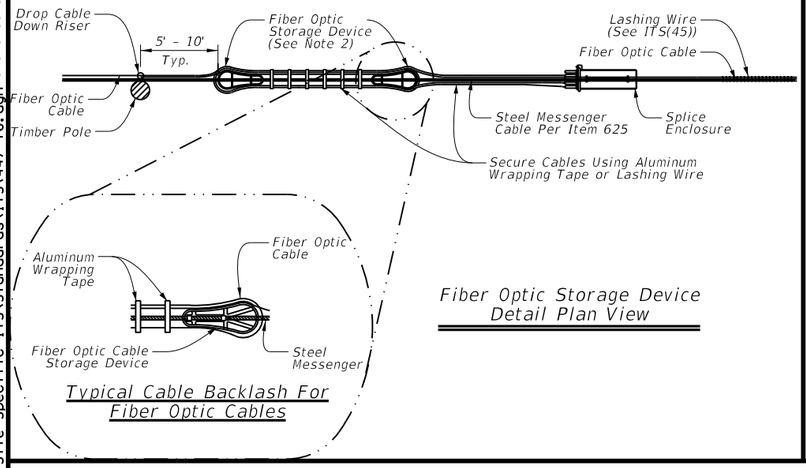


Aerial Splice Enclosure

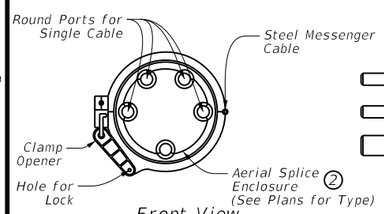


Splice Enclosure in Ground Box

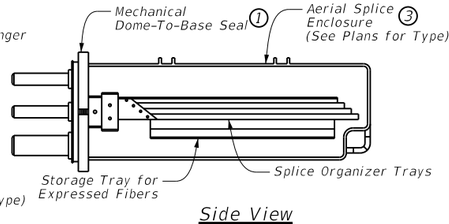


Fiber Optic Storage Device Detail Plan View

Typical Cable Backlash For Fiber Optic Cables



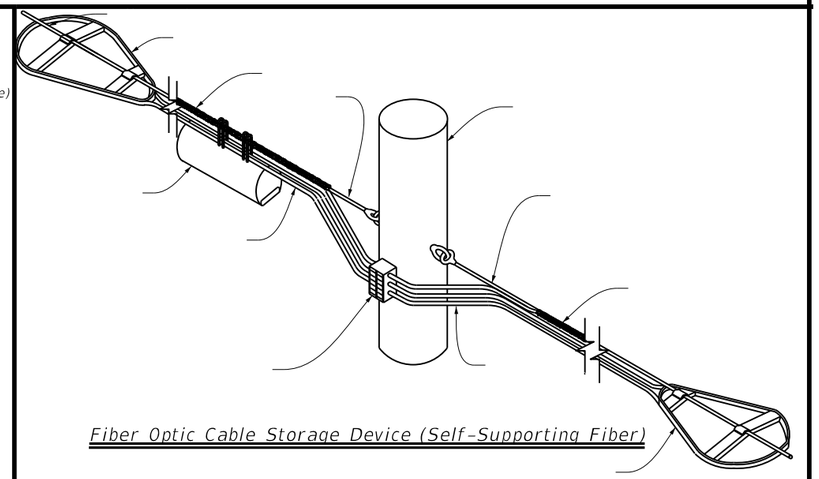
Front View



Side View

Fiber Optic Splice Enclosure

1. Apply a heat source, as recommended by the manufacturer, to shrink the heat shrinkable tubing to provide a secure fit around the cables and ports.
2. Perform a pressurization flash test upon conclusion of the splicing and prior to the final placement of the enclosure.
3. Refer to ITS(45) for splice enclosure type and size.



Fiber Optic Cable Storage Device (Self-Supporting Fiber)

SHEET 1 OF 2

General Notes:

1. Provide outdoor rated non-armored all-dielectric (requires steel messenger support) or non-armored all-dielectric self-supporting fiber optic cable designed for aerial installation. Fiber optic cable constructed with integrated steel messenger cable is acceptable.
2. See plans for location and amount of spare fiber optic cable slack. Determine the quantity of cable storage racks necessary to secure fiber optic cable slack identified and to accommodate the number of fiber optic cable drops as shown on the plans.
3. Do not store spare cable slack over roadways, driveways, railroads, or buildings.
4. Provide required clearance from electrical power lines and other cables in accordance with Section 23 of the National Electric Safety Code (NESC).
5. Use the lashing wire method for lashing non self-supporting fiber optic cable requiring lashing to a steel messenger cable.
6. Use a lasher to secure the fiber optic cable to the steel wire strand by wrapping the strand and cable in a spiral manner. The fiber optic cable must be installed without loose lashing, twisting, or weaving along the strand. Rippling, kinking, or any kind of deformation of the cable will lead to a required replacement of the cable by the contractor.
7. Ensure at least one wrap of lashing wire per linear foot is provided when lashing the fiber optic cable to the steel messenger cable.
8. Provide lasher of sufficient size to lash the fiber optic cable without damaging the cable.

Sheet Details
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Texas Department of Transportation

Traffic Operations Division Standard

ITS FIBER OPTIC CABLE AERIAL INSTALLATION DETAILS

ITS(44)-16

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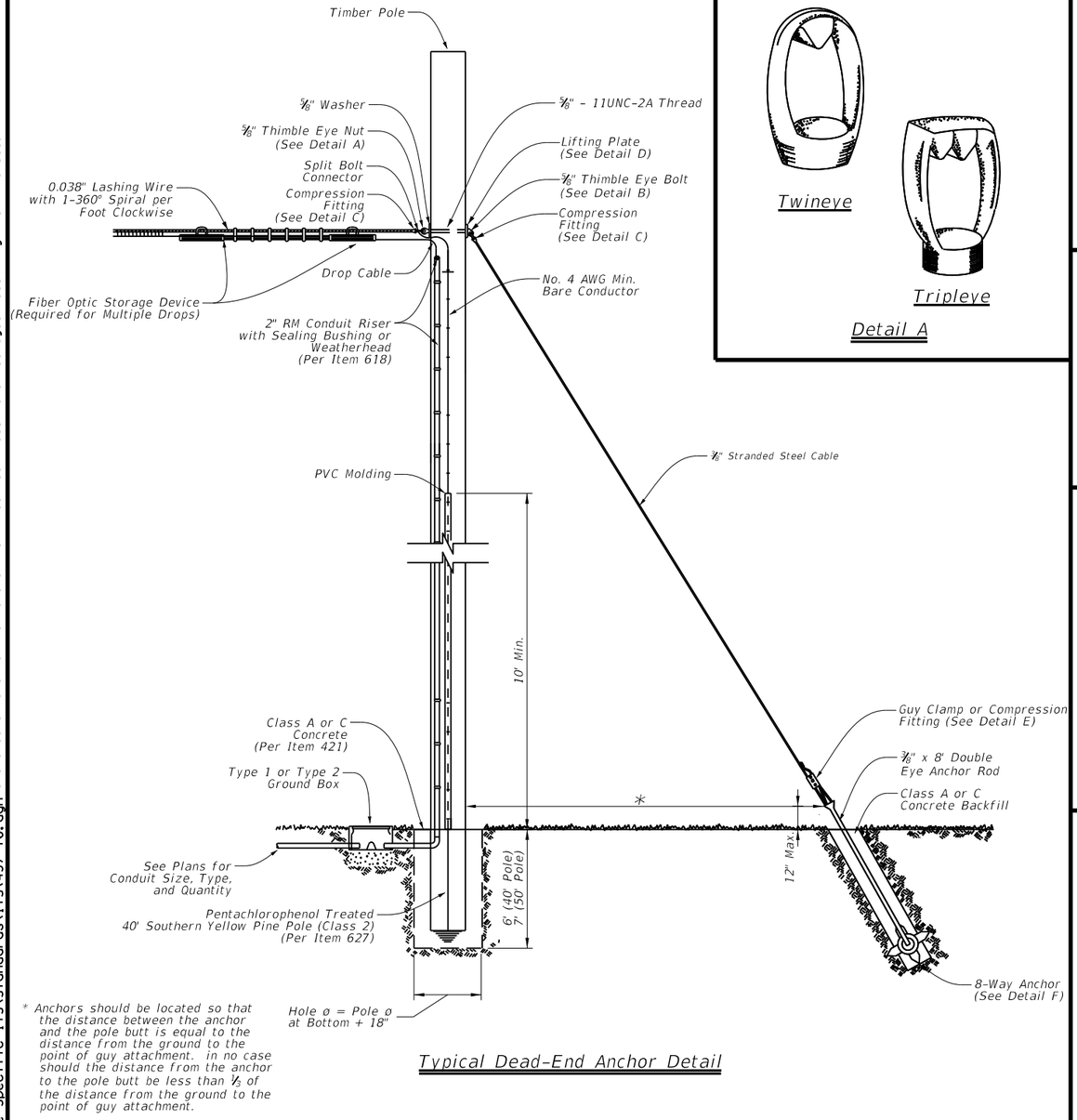
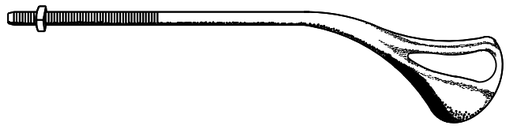


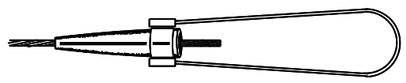
* Anchors should be located so that the distance between the anchor and the pole butt is equal to the distance from the ground to the point of guy attachment. in no case should the distance from the anchor to the pole butt be less than ½ of the distance from the ground to the point of guy attachment.

Typical Dead-End Anchor Detail

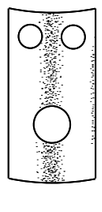
Detail A



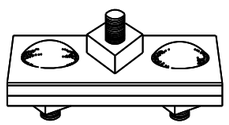
Detail B



Detail C



Detail D



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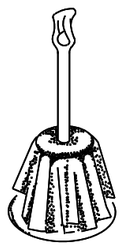
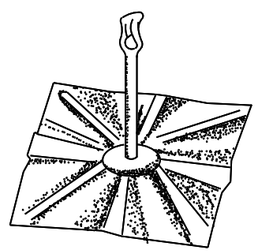
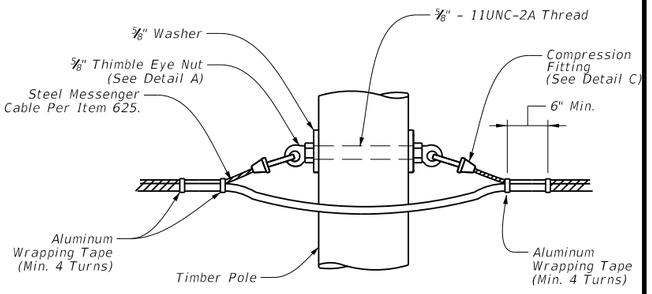
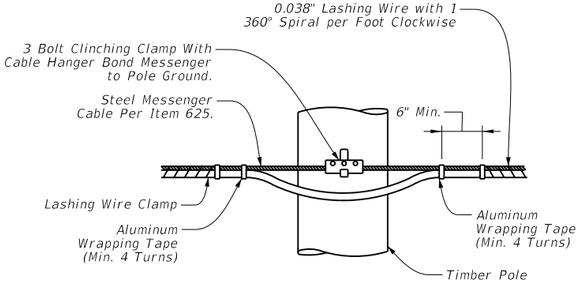




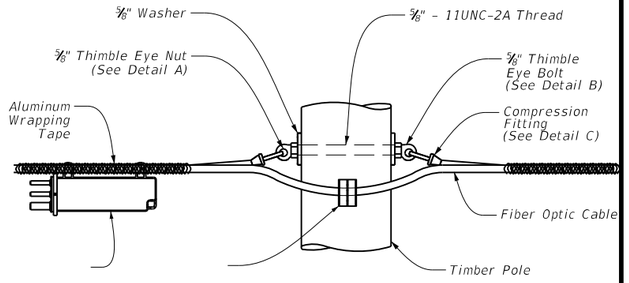
Detail F



Thimble Eye Bolt Method



Clinching Clamp Method



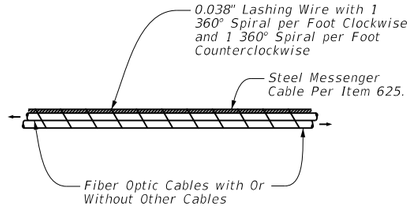
Typical Self Supporting Cable Method

Typical False Dead-End Details

SHEET 2 OF 2

General Notes:

1. Provide outdoor rated non-armored all-dielectric (requires steel messenger support) or non-armored all-dielectric self-supporting fiber optic cable designed for aerial installation. Fiber optic cable constructed with integrated steel messenger cable is acceptable.
2. See plans for location and amount of fiber optic cable slack. Contractor to determine the quantity of cable storage racks necessary to secure fiber optic cable slack identified and to accommodate the number of fiber optic cable drops as shown on the plans.
3. Do not store spare cable over roadways, driveways, railroads, or buildings.
4. Provide required clearance from electrical power lines and other cables in accordance with Section 23 of the National Electric Safety Code (NESC).
5. Use the lashing wire method for lashing non self-supporting fiber optic cable requiring lashing to a steel messenger cable.
6. Use a lasher to secure the fiber optic cable to the steel wire strand by wrapping the strand and cable in a spiral manner. The fiber optic cable must be installed without loose lashing, twisting, or weaving along the strand. Rippling, kinking, or any kind of deformation of the cable will lead to a required replacement of the cable by the contractor.
7. Ensure at least one wrap of lashing wire per linear foot is provided when lashing the fiber optic cable to the steel messenger cable.
8. Provide lasher of sufficient size to lash the fiber optic cable without damaging the cable.



Typical Cable Lashing Detail Double Lashing For Railroad Crossings

Sheet Details
Not to Scale

Texas Department of Transportation

Traffic Operations Division Standard

ITS FIBER OPTIC CABLE AERIAL INSTALLATION DETAILS

ITS(45)-16

FILE: its(45)-16.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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℄ 4 Permissible 1" Dia assembly holes 180° apart. (Typ each splice)

4 additional 1" Dia holes are permissable 12" from assembly holes

6" Min
12" Max

12"

12"

SPLICE DETAIL

⅞" Dia Holes equally spaced on 15" Dia Bolt Circle

85 Percent Minimum Penetration

¾"

⅜"

HM-6

7 ¼" Dia

Match Mark

Reference Line

VIEW C

8"

¼" Plate

1"

5 ¼"

1"

3 ½"

7 ¼"

1" 6" 1"

Provide 3~ ½" Dia x1 ¼" bolts

WINCH DRIVE ACCESS COVER

Reference Line

O.D. of Base Plate

Match marks

C 8x18.75 for mounting winch (See Detail)

VIEW E (2 opposite corners)

℄ 2 ~ 1 ⅜" Dia holes 24" above Base Plate

2 ¾" Dia Bolt Holes equally spaced on Bolt circle

℄ Pole

2"

2"

I.D. Base Plate

T

Galvanizing drain slots are not permitted in base plate. Drain to small end.

SECTION A-A

℄ Winch Drive

Reference Line

U

Cut channel to fit for 100' & 125' 12 Sided Poles

4 ½" 4" 5 ⅞" 100',125' & 150' Poles

10 ⅞" 175' Pole

6 ~ ½" Heavy Hex Nuts welded under 9/16" Dia holes. Tap nuts after galvanizing.

2 5/16"

2 5/16"

℄ Channel

2"2"

6 ~ 1"x2" Slots 2"2" 10 ⅜" 100',125' & 150' Poles

15 ⅜" 175' Pole

WINCH MOUNTING CHANNEL

Nominal Pole Height

Taper 0.1600 in/ft(for 80 MPH) and 0.1900 in/ft(for 100 MPH)

Splice Length

A B C D E F

Taper 0.1750 in/ft(for 80 MPH) and 0.1850 in/ft(for 100 MPH)

Section Length

A B C D

8 SIDED

12 SIDED

POLE ELEVATIONS

(Showing 175 Ft Poles)

VIEW C

T

½"

Handhole Frame

HM-3

¼

¾"x ⅜

¼

HM-7

Winch Drive Access Cover

VIEW F

VIEW D

Tang

Channel

8"

6"

HM-8

⅜

½"x2 ½"x3 ¾" Tang, A36 Min, 1 ¼" R, 1 ¼" Dia chamfered hole. Place Tang on flat adjacent to handhole.

SECTION B-B

1'-0"

B

Access Cover to be ¼" Plate

Drill and tap for ½"x1" cap screw (4 req'd)

A

Ground Sleeve

R=3 ½"

A

¼"

Typ

S

1'-6"

Drill and Tap for 3 ½" bolts.

1 ½" Dia Hole

5 ¼"

5 5/16"

3"

3"

8 7/8"

8 7/8"

1'-0"

1'-7"

See HMIF for Anchor Bolt Detail

⅜" U

6"

VIEW G

B

ELEV OF POLE BASE

U

Reference Line

6 ~ ⅝"x1 ¼" Slots 4 ½" 4" 5 ⅞" 100',125' & 150' Poles

10 ⅞" 175' Pole

2 ½"

1 ¼"

2"2"2"

2 ½"

1 ¼"

1 11/16"

8"

4 5/8"

2"

4"

2"

1 11/16"

½" Plate

6 ~ ⅝" Dia holes 2"2" 10 ⅜" 100',125' & 150' Poles

15 ⅜" 175' Pole

WINCH MOUNTING PLATE

G

HM-9

G

S

A bent and welded handhole frame is permissable. Heating, bending, and finish grinding must be approved with the HM-9 weld procedure.

OPTIONAL HANDHOLE FRAME

t

⅜"

¼

t x ⅜

HM-1

+

STANDARD WELD

¼

Chip & Grind

OPTIONAL WELD STEP 1

(a) Prepare Shaft and ground sleeve.
(b) Weld shaft to base plate, chip and grind flush (1/8 " max radius.)

t

⅜"

¼

t x ⅜

HM-2

+

OPTIONAL WELD STEP 2

(c) Positiion ground sleeve.
(d) Weld to base plate with tapered reinforcement.

VIEWS D

85% Minimum penetration

HM-5

Ground sleeve to be same thickness as lower pole section, except shall not be less than 0.375 inch

Provide 100% penetration in outer sections at splices and at base plates for 1.5 pole diameters plus 6". Also provide 100% penetration for ground sleeve seam welds.

VIEW E

t

HM-4

7/8xt

⅞"

VIEW F

℄ Winch Drive

1 ⅜" Min

G

Provide welded and ground filler or cover plate where winch drive conflicts with bend line in ground sleeve for the 8 sided, 80 mph, 100' pole, the 12 sided, 100 mph, 100' pole, and the 12 sided, 80 mph, 175', 125' and 100' poles.

VIEW G

SHEET 1 OF 2

Texas Department of Transportation

Traffic Operations Division Standard

HIGH MAST ILLUMINATION POLES 100' - 125' - 150' - 175'

HMIP(1)-16

FILE: hmip-16.dgn	DN:	CK:	DW:	CK:
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TABLE OF VARIABLE POLE DIMENSIONS

			8 SIDED POLE					12 SIDED POLE				
	Ht (ft)	Section	Diameter (Inches) Bottom	Diameter (Inches) Top	Thickness (inches)	Length (feet)	Splice (inches)	Diameter (Inches) Bottom	Diameter (Inches) Top	Thickness (inches)	Length (feet)	Splice (inches)
80 MPH DESIGNS	175	A	13.083	7.750	.250	33.33	19	16.792	7.750	.250	51.67	24
		B	17.792	12.205	.375	34.92	25	24.858	15.817	.313	51.67	36
		C	22.250	16.583	.375	35.42	32	32.625	23.583	.313	51.67	48
		D	25.375	20.948	.438	27.67	36	36.250	31.175	.375	29.00	~
		E	28.375	23.895	.500	28.00	41					
		F	31.250	26.703	.500	28.42	~					
	150	A	13.083	7.750	.250	33.33	19	16.792	7.750	.250	51.67	24
		B	17.792	12.205	.375	34.92	25	24.858	15.817	.313	51.67	36
		C	22.250	16.583	.375	35.42	32	32.625	23.583	.313	51.67	~
		D	25.375	20.948	.438	27.67	36					
		E	28.375	23.895	.500	28.00	~					
	125	A	13.083	7.750	.250	33.33	19	16.792	7.750	.250	51.67	24
		B	17.792	12.205	.375	34.92	25	24.858	15.817	.313	51.67	36
		C	22.250	16.583	.375	35.67	32	28.250	23.583	.313	26.67	~
		D	25.375	20.948	.438	27.67	~					
	100	A	13.083	7.750	.250	33.33	19	16.792	7.750	.250	51.67	24
		B	17.792	12.205	.375	34.67	25	24.625	15.817	.313	50.33	~
		C	22.250	16.583	.375	35.67	~					
100 MPH DESIGNS	175	A	14.208	7.875	.313	33.33	20	17.433	7.875	.375	51.67	25
		B	19.792	13.142	.375	35.00	28	25.747	16.173	.438	51.75	37
		C	25.250	18.473	.438	35.67	36	33.750	24.176	.438	51.75	49
		D	29.000	23.680	.500	28.00	42	37.375	31.995	.500	29.08	~
		E	32.625	27.210	.563	28.50	47					
		F	36.125	30.631	.563	28.92	~					
	150	A	14.208	7.875	.313	33.33	20	17.433	7.875	.375	51.67	25
		B	19.792	13.142	.375	35.00	28	25.747	16.173	.438	51.75	37
		C	25.250	18.473	.438	35.67	36	33.750	24.176	.438	51.75	~
		D	29.00	23.680	.500	28.00	42					
		E	32.625	27.210	.563	28.50	~					
	125	A	14.208	7.785	.313	33.33	20	17.433	7.875	.375	51.67	25
		B	19.792	13.142	.375	35.00	28	25.747	16.173	.438	51.75	37
		C	25.250	18.473	.438	35.67	36	29.125	24.176	,438	26.75	~
		D	29.00	23.680	.500	28.00	~					
	100	A	14.208	7,875	.313	33.33	20	17.433	7.875	.375	51.67	25
		B	19.792	13.142	.375	35.00	28	25.500	16.173	.375	50.42	~
		C	25.250	18.473	.438	35.67	~					

Diameters are measured across the flats.

TABLE OF VARIABLE BASE DIMENSIONS

	Ht (ft)	O.D. (inches)	I.D. (inches)	Bolt Cir (inches)	No. Bolts	S (inches)	T (inches)	U (inches)
	8 SIDED POLE							
80 MPH DESIGNS	175'	47	22	41	16	2.00	3.75	4.50
	150'	44	18	38	12	2.00	4.00	3.50
	125'	41	16	35	8	2.00	4.50	3.50
	100'	37	14	31	6	2.00	5.00	3.50
	12 SIDED POLE							
	175'	50	24	44	12	1.75	3.50	3.50
	150'	47	22	41	10	1.75	3.50	2.50
	125'	42	18	36	8	1.75	3.75	2.50
	100'	38	13	32	6	1.75	4.00	2.50
	8 SIDED POLE							
100 MPH DESIGNS	175'	52	27	46	20	1.75	3.50	4.50
	150'	49	23	43	16	1.75	4.00	3.50
	125'	45	21	39	12	1.75	4.50	3.50
	100'	40	17	34	10	1.75	4.50	3.50
	12 SIDED POLE							
	175'	52	27	46	16	1.75	3.25	3.50
	150'	50	25	44	12	1.75	3.50	2.50
	125'	46	22	40	10	1.75	3.75	2.50
	100'	42	19	36	6	1.75	4.00	2.50

NOTE: Base Plate may be round or with 8 or 12 equal segments matching the pole.

MATERIALS

Polygonal Shafts Ground Sleeves	ASTM A709 Grade 50 A572 Grade 50 (1) (2)
Base Plate and Handhole Frame	ASTM A709 Grade 50 A572 Grade 50 (1) A633 Grade C (1)
Miscellaneous Steel	ASTM A36 or equal

(1) ASTM A572 and A633 may have higher yield strength but shall not have less elongation than the grade indicated.

(2) The silicon content of all steel shall be controlled to ensure high quality galvanizing and to avoid discoloration.

GENERAL NOTES:

1. Design conforms to AASHTO 1994 Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals and Interim Revisions thereto. The Design Wind Speed is 80 mph or 100 mph.

2. The required design height and wind speed shall be as shown elsewhere in the plans.

3. Each pole section, top flange plate and base plate shall be permanently marked on the reference line. The required mark locations are shown on the baseplate, top plate, and foundation plan details. These marks shall be used in pole assembly and erection alignment. The reference line and anchor bolt orientation shall be parallel to roadway centerline unless otherwise shown on Lighting Layouts.

Texas Department of Transportation

Traffic Operations Division Standard

HIGH MAST ILLUMINATION POLES 100' - 125' - 150' - 175'

HMIP(2)-16

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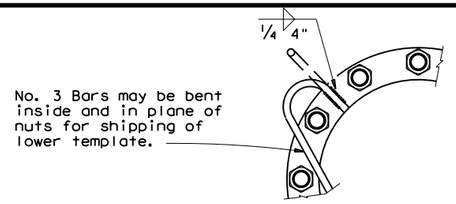
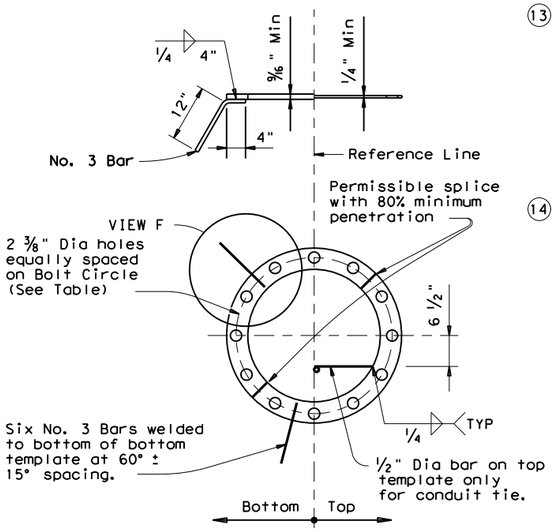
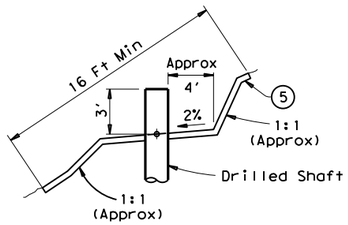


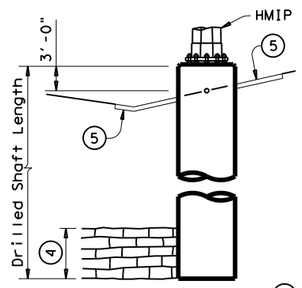
VIEW F



ANCHOR BOLT TEMPLATES

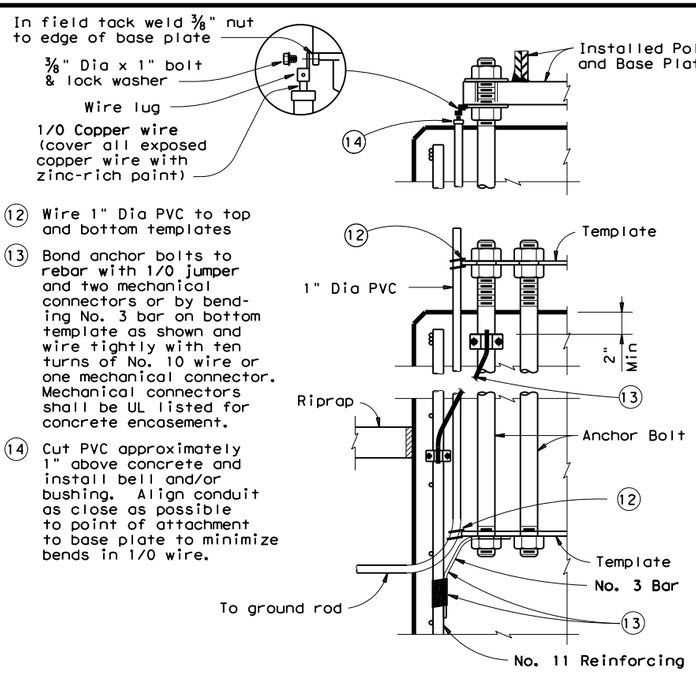


RIPRAP ON SLOPES



(5) Match slope of finished ground if slope is less than approx 4 to 1. For steeper slopes, bench to provide work area with approx 2 % slope around pole base. Other configurations may be shown elsewhere on the plans.

(4) If rock is encountered, the Drilled Shaft shall extend a minimum of two diameters into solid rock.

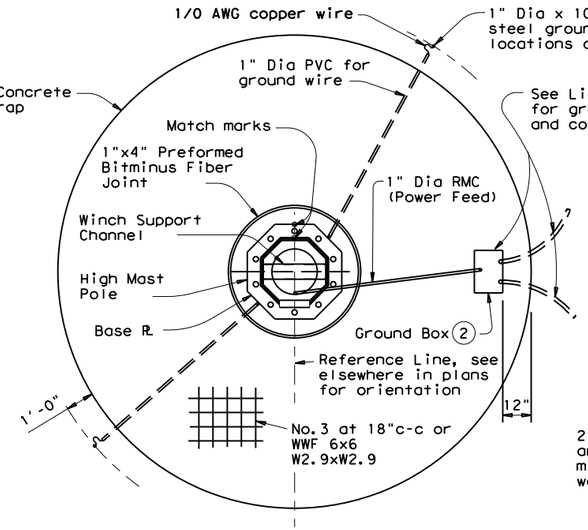


(12) Wire 1" Dia PVC to top and bottom templates

(13) Bond anchor bolts to rebar with 1/0 jumper and two mechanical connectors or by bending No. 3 bar on bottom template as shown and wire tightly with ten turns of No. 10 wire or one mechanical connector. Mechanical connectors shall be UL listed for concrete encasement.

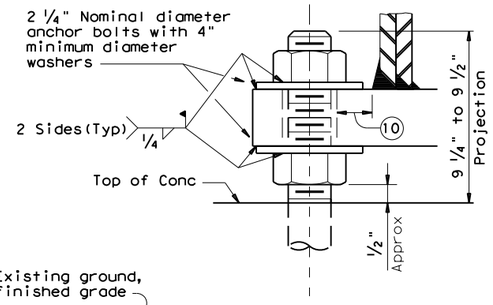
(14) Cut PVC approximately 1" above concrete and install bell and/or bushing. Align conduit as close as possible to point of attachment to base plate to minimize bends in 1/0 wire.

LIGHTNING PROTECTION SYSTEM



(2) Place ground box cover flush with riprap.

(10) If, due to tolerances in fabrication, the anchor bolt hole to ground sleeve weld is less than approx 3/8", clipped 1/2" thick washers shall be supplied at those



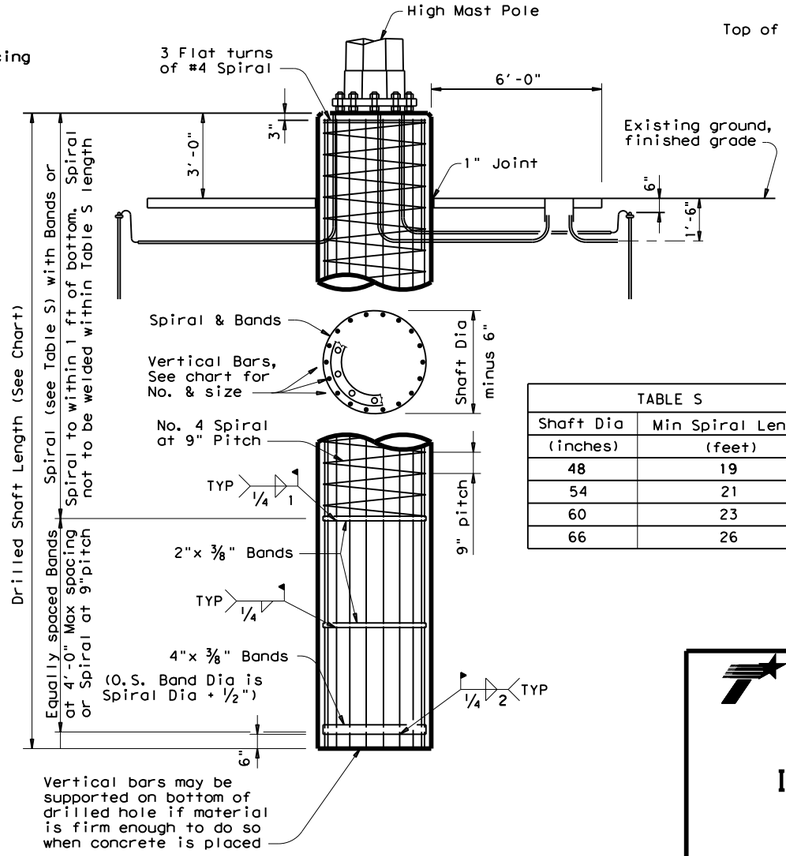
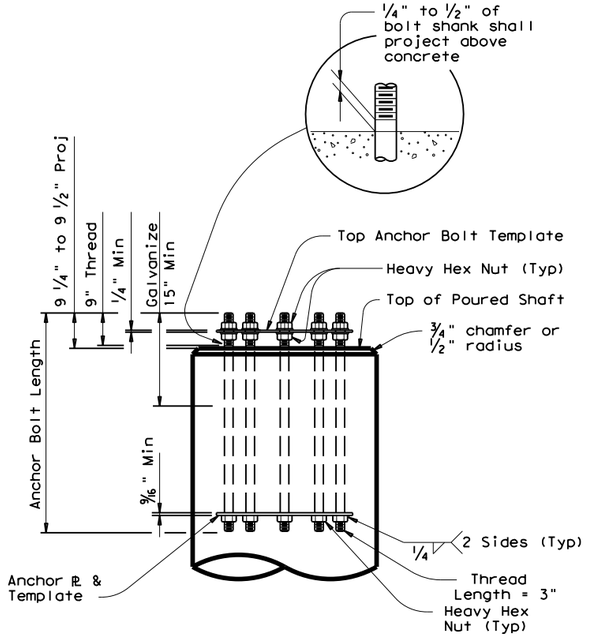


TABLE S	
Shaft Dia (inches)	Min Spiral Length (feet)
48	19
54	21
60	23
66	26



ANCHOR BOLT ASSEMBLY

(See Anchor Bolt Table for number of bolts required)

DRILLED SHAFT FOUNDATION DETAIL

Texas Department of Transportation
Traffic Operations Division

HIGH MAST ILLUMINATION POLE FOUNDATIONS

SHEET 1 OF 2 HMIF(1)-98

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REVISIONS
11-97
5-98 ~ Anchor Bolt Circle Dia

CONT	SECT	JOB	HIGHWAY
0902	90	108	VA
DIST	COUNTY		SHEET NO.
FTW	TARRANT		58

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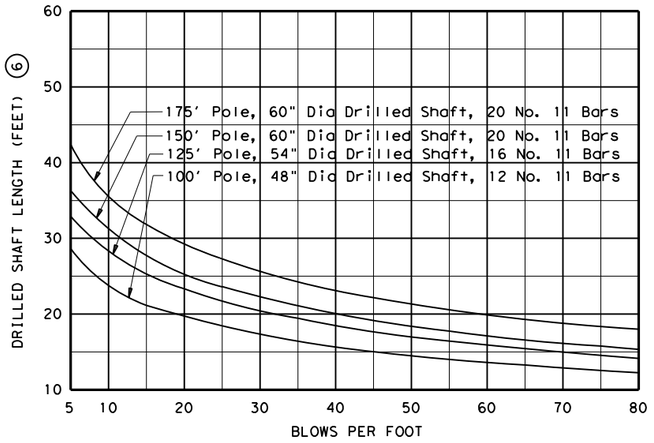
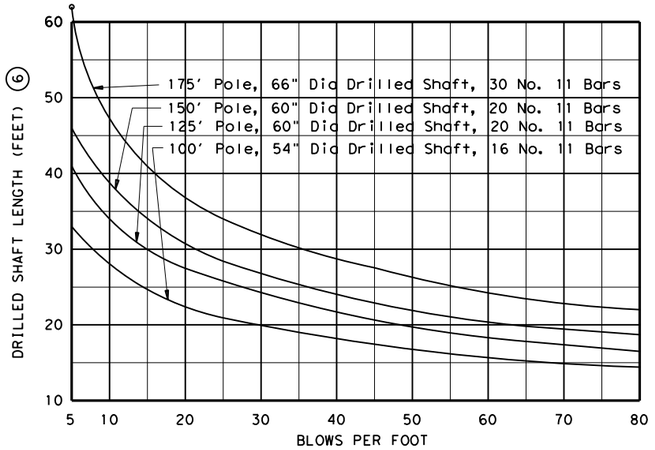
⑥ Includes normal 3 Ft exposure. Shafts with more than 3 Ft exposure must have additional length.



80 MPH POLES

Do not extrapolate below 5 Blows/Ft. A special design will be required for soil less than 5 Blows/Ft.



100 MPH POLES

Do not extrapolate below 5 Blows/Ft. A special design will be required for soil less than 5 Blows/Ft.

TEXAS CONE PENETROMETER TEST TABLES

NOTE: Use average "N" value over the top third of the embedded shaft. Ignore the top 2' of soil.

ANCHOR BOLT TABLE

	Pole Height	Bolt Diameter	Bolt Length	Bolt Templates O D	Bolt Templates I D	No. of Bolts	Bolt Cir Dia
	(feet)	(inches)	(feet)	(inches)	(inches)	~	(inches)
80 MPH DESIGNS	8 SIDED POLE						
	175	2.25	4.83	45.5	36.5	16	41
	150	2.25	4.83	42.5	33.5	12	38
	125	2.25	4.83	39.5	30.5	8	35
	100	2.25	4.83	35.5	26.5	6	31
	12 SIDED POLE						
	175	2.25	4.83	48.5	39.5	12	44
	150	2.25	4.83	45.5	36.5	10	41
	125	2.25	4.83	40.5	31.5	8	36
	100	2.25	4.83	36.5	27.5	6	32
100 MPH DESIGNS	8 SIDED POLE						
	175	2.25	4.83	50.5	41.5	20	46
	150	2.25	4.83	47.5	38.5	16	43
	125	2.25	4.83	43.5	34.5	12	39
	100	2.25	4.83	38.5	29.5	10	34
	12 SIDED POLE						
	175	2.25	4.83	50.5	41.5	16	46
	150	2.25	4.83	48.5	39.5	12	44
	125	2.25	4.83	44.5	35.5	10	40
	100	2.25	4.83	40.5	31.5	6	36

MISCELLANEOUS QUANTITIES - ONE HMIF

Shaft Diameter	(in) ⑦	48	54	60
Concrete Riprap	(CY)	2.33	2.44	2.56
Reinforcing	(Lbs) ⑧	94	99	103
Ground Box	(ea)	1	1	1
R O W Marker	(ea) ⑨	1	1	1

⑦ See elsewhere on plans for length of Drilled Shaft required.
⑧ For Contractors information only.
⑨ Designated elsewhere on plans if required.

GENERAL NOTES:

Unless otherwise noted, the welded steel bands may be replaced with spiral as shown on the foundation details.

Anchor bolts shall be placed in foundation so there are always two bolts on reference line.

Drilled shaft lengths as determined from the foundation design chart or other acceptable methods are to be as shown elsewhere on the plans.

ODSR may not be used for HMIF drilled shafts.

Concrete for drilled shafts shall be Class C.

Repair welded areas with zinc-rich paint.

All Anchor Bolts, Nuts and Washers shall be galvanized in accordance with Item 445, "Galvanizing".

Texas Department of Transportation
Traffic Operations Division

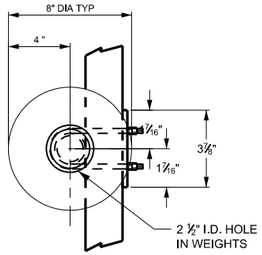
HIGH MAST ILLUMINATION POLE FOUNDATIONS

SHEET 2 OF 2 HMIF(2)-98

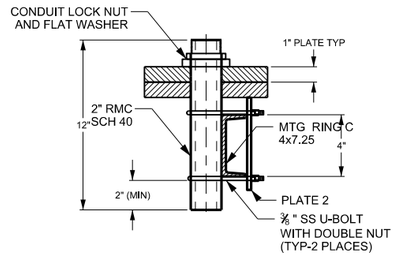
DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

REVISIONS
5-98 - Anchor Bolt Circle Dia

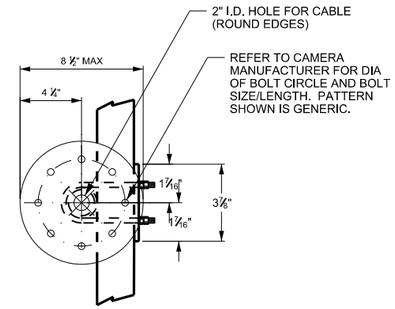
CONT	SECT	JOB	HIGHWAY
0902	90	108	VA
DIST	COUNTY		SHEET NO.
FTW	TARRANT		59



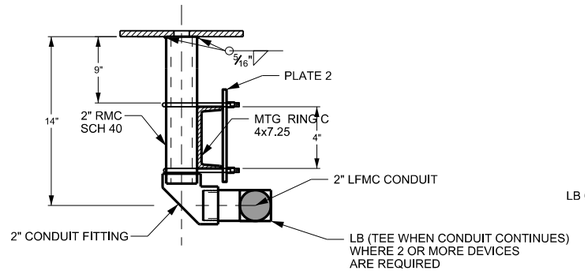
COUNTER WEIGHT MOUNTING DETAIL
TOP VIEW



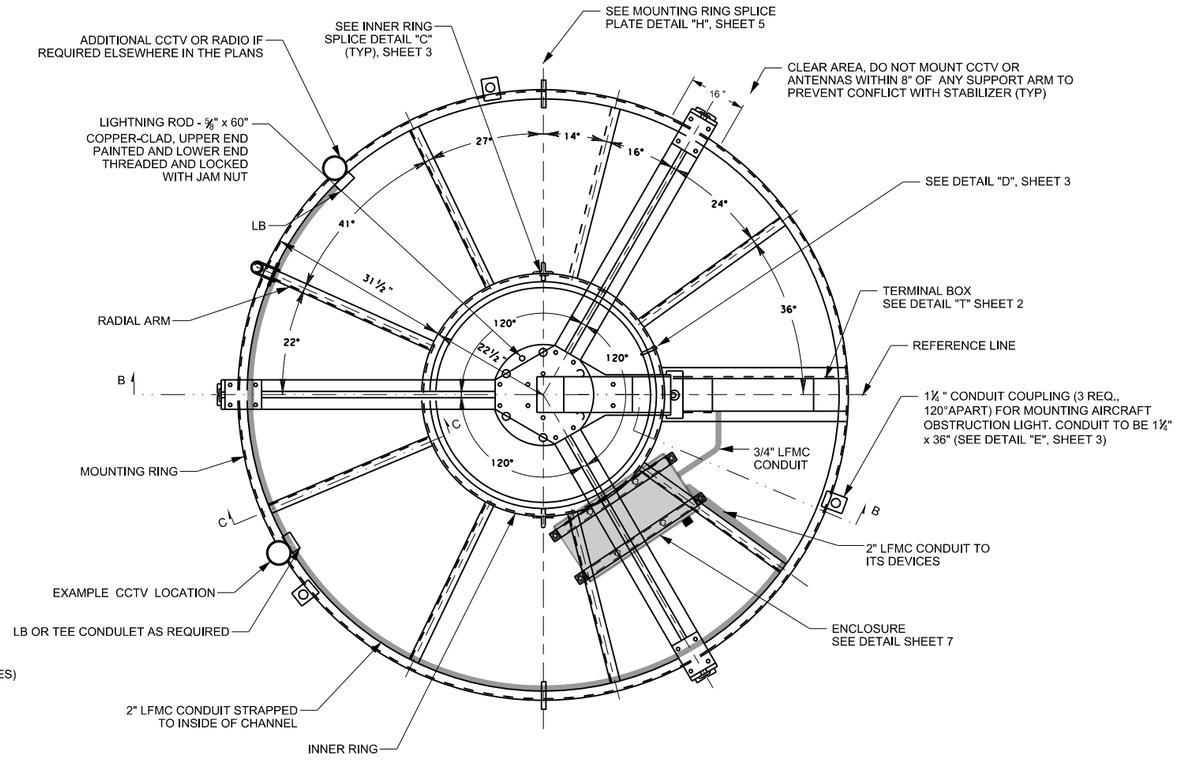
COUNTER WEIGHT MOUNTING DETAIL
SIDE VIEW



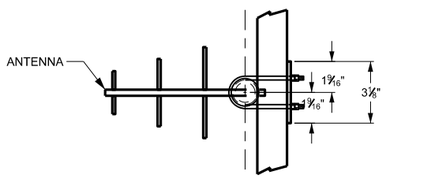
CAMERA MOUNTING DETAIL
TOP VIEW



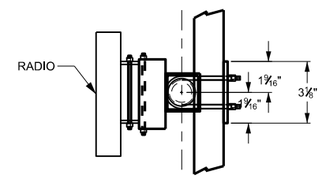
CAMERA MOUNTING DETAIL
SIDE VIEW
INSTALL AT LOCATIONS SHOWN ON PLANS,
INVERT FOR UNDERSLUNG CAMERAS



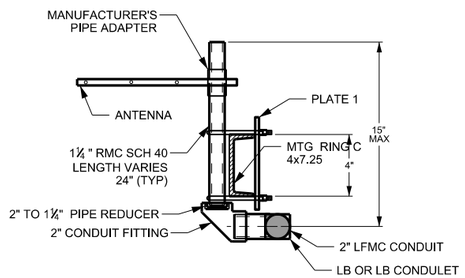
MOUNTING RING & SUPPORT ASSEMBLY



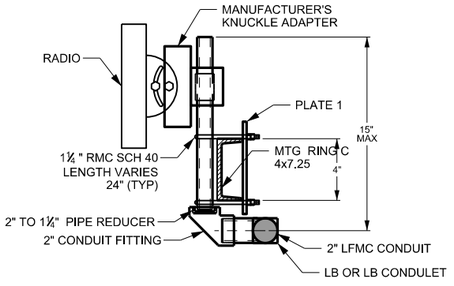
ANTENNA(S) MOUNTING DETAIL
TOP VIEW



ETHERNET RADIO ANTENNA MOUNTING DETAIL
TOP VIEW



ANTENNA(S) MOUNTING DETAIL
SIDE VIEW



ETHERNET RADIO ANTENNA MOUNTING DETAIL
SIDE VIEW
INSTALL AT LOCATIONS SHOWN ON THE PLANS

NOTES:

1. POLE, RING, AND RING SUPPORT SHALL BE ASSEMBLED AND ERECTED WITH HAND HOLE OPPOSITE SIDE FROM TRAFFIC SO THAT REFERENCE LINE IS PARALLEL TO CENTER LINE OF ROADWAY.
2. CCTV EQUIPMENT IS GENERALLY LIGHT WEIGHT AND NOT EXPECTED TO PRESENT IMBALANCE ISSUES. ADJUST SPRING SWAGE TERMINAL NUTS TO COMPENSATE FOR UNEQUAL WIRE ROPE LENGTHS AND ENSURE SPRINGS ARE EQUALLY COMPRESSED AND STABILIZERS FULLY SEATED. USE COUNTER WEIGHTS ONLY WHEN RING STABILIZERS WILL NOT SEAT PROPERLY, OR SPRINGS ARE NOT EQUALLY COMPRESSED. ALL COUNTER WEIGHTS SHALL BE HOT DIPPED GALVANIZED, 1" THICK PLATES, 2 1/2" I.D. x 8" O.D., WEIGHING APPROXIMATELY 12.9 LBS EACH. ADD WEIGHTS AS REQUIRED TO BALANCE RING NOT TO EXCEED 100 LBS. TOTAL (ALTERNATIVE WEIGHT ATTACHMENT METHODS MAY BE SUBMITTED FOR APPROVAL).
3. INSTALL ALL EQUIPMENT IN MANNER THAT THE WEIGHT DISTRIBUTION IS APPROXIMATELY BALANCED. ENSURE CCTV VIEW IS NOT BLOCKED BY ADJACENT EQUIPMENT.
4. ALTERNATE ANTENNA & CCTV ATTACHMENT METHODS MAY BE SUBMITTED FOR APPROVAL.
5. INSTALL LIGHTNING ROD ⅝" x 60" COPPER-CLAD STEEL. LOCK WITH JAM NUT. SEE DETAIL "G" SHEET 4.
6. ALL U BOLTS DOUBLE NUT, WITH FLAT WASHER AND LOCK WASHER.
7. LOCATE ANTENNAS AND CCTV AT RADIAL ARMS TO ALLOW FOR CONDUIT ATTACHMENTS AS SHOWN. DO NOT ALLOW FLEX CONDUIT TO DROOP. DO NOT USE DRIP LOOPS IN CONDUIT THAT WILL CREATE HIGHER WIND LOADING. USE CONDUIT BODIES AS SHOWN.
8. STRAP LIQUID-TIGHT FLEXIBLE METAL CONDUIT (LFMC) TO THE CHANNEL TO KEEP FLEX CONDUIT AS CLOSE TO RING WEB AS POSSIBLE. SEE DETAIL "E", SHEET 3.

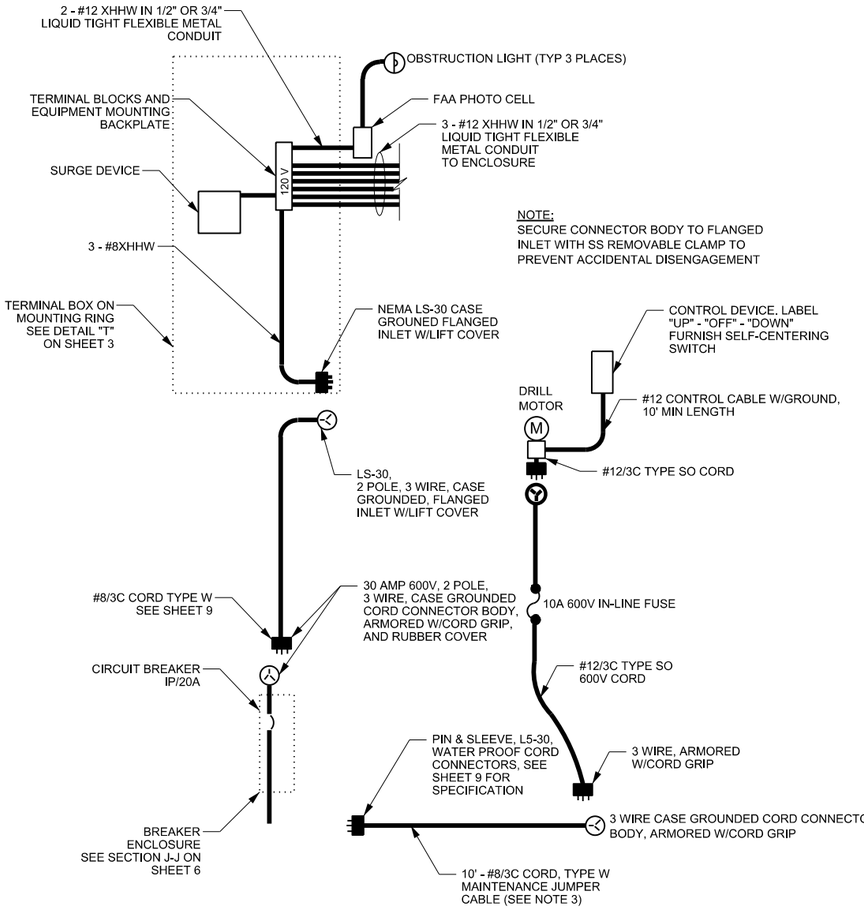
LEVELS DISPLAYED
1 2

Texas Department of Transportation
Fort Worth District

HIGH MAST CCTV MOUNTING ASSEMBLIES

HM-ITS (1)-21 (FTW)

FILE: TP80.DGN	DN: KAB	CK: MBY	DW: PDA	CK:
©TxDOT APRIL 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		60

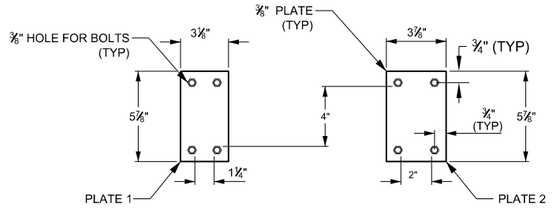


ONE-LINE SCHEMATIC

SUPPLY HIGH MAST POLE FOR ITS WITH A 30A/120 VOLT BRANCH CIRCUIT

NOTES:

1. SEE GENERAL NOTES 1.D, SHEET 9 FOR PIN AND SLEEVE CONNECTORS.
2. NO CONDUITS SHALL ENTER THE TOP OF ENCLOSURES.
3. A MINIMUM OF ONE (1) MAINTENANCE JUMPER CABLE SHALL BE SUPPLIED FOR EACH PROJECT. SUPPLY ONE (1) PORTABLE TRANSFORMER FOR EACH POWER DRIVE UNIT REQUIRED FOR PROJECT. ENSURE RECEPTACLES FIT TOGETHER PROPERLY TO POWER DRILL MOTOR FROM BREAKER ENCLOSURE.
4. DRILL ⅛" DRAIN HOLES ON THE BOTTOM OF THE TERMINAL BOX.



MOUNTING PLATE DETAIL

LEVELS DISPLAYED
1 2

Texas Department of Transportation
Fort Worth District

HIGH MAST CCTV MOUNTING ASSEMBLIES

HM-ITS (2)-21 (FTW)

FILE: TP80.DGN	DN: KAB	CK: MBY	DW: PDA	CK:	
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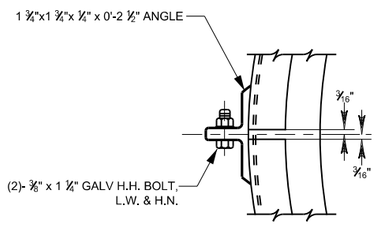
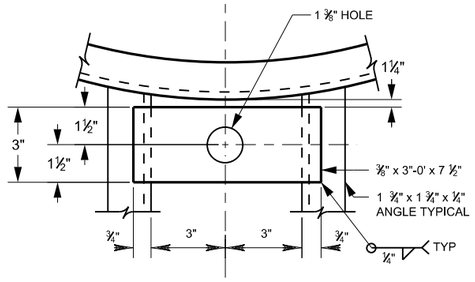
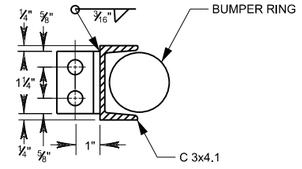
REVISIONS	0902	90	108	VA	
	DIST	COUNTY		SHEET NO.	
	FTW	TARRANT		61	



PLAN VIEW

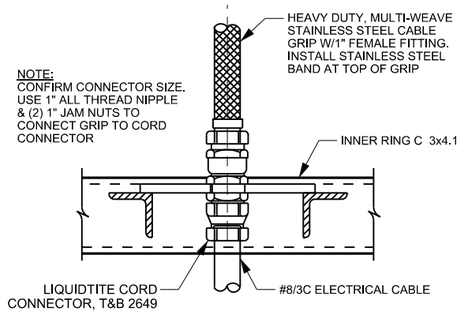


PLAN VIEW



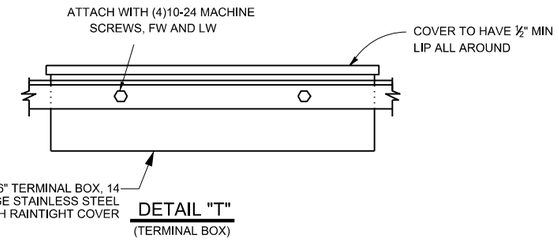
DETAIL "C"

INNER RING SPLICE



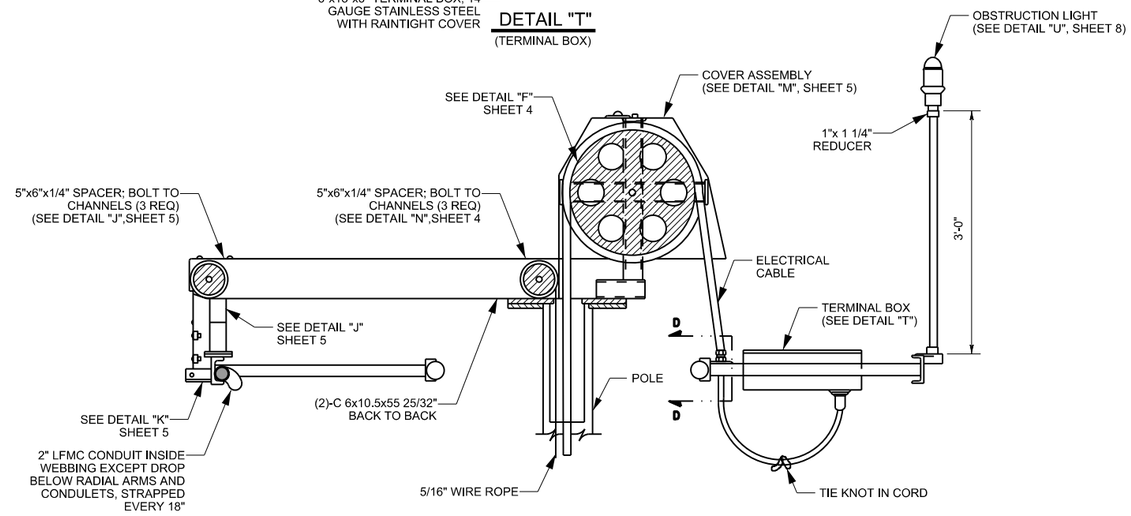
SECTION D-D

COVER CORD WITH HEAT SHRINK TUBING FROM CABLE GRIP TO WITHIN ONE INCH OF GRIP TO CONNECTOR TRANSITION PRIOR TO INSTALLING CABLE GRIP

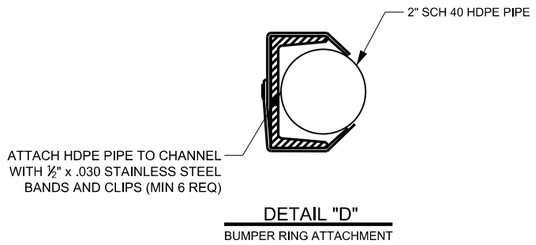


DETAIL "T"

(TERMINAL BOX)

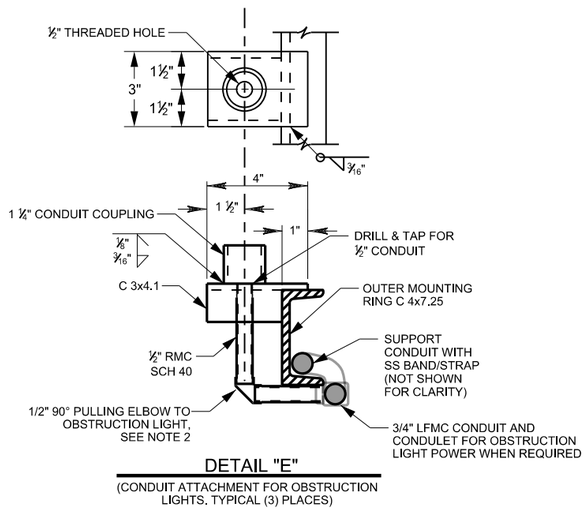


SECTION B-B



DETAIL "D"

BUMPER RING ATTACHMENT



DETAIL "E"

(CONDUIT ATTACHMENT FOR OBSTRUCTION LIGHTS. TYPICAL (3) PLACES)

NOTES:

1. ALUMINUM, STEEL, OR ZINC DIE CAST 90° PULLING ELBOW "JAKE ELL", 2" FOR CCTV AND ANTENNA.
2. ALUMINUM, STEEL, OR ZINC DIE CAST 90° PULLING ELBOW "JAKE ELL" 1/2" FOR OBSTRUCTION LIGHT. STRAP TO MOUNTING RING AND RING RADIALS.

LEVELS DISPLAYED

1 2

Texas Department of Transportation
Fort Worth District

HIGH MAST CCTV MOUNTING ASSEMBLIES

HM-ITS (3)-21 (FTW)

FILE: TP80.DGN	DN: KAB	CK: MBY	DW: PDA	CK:	
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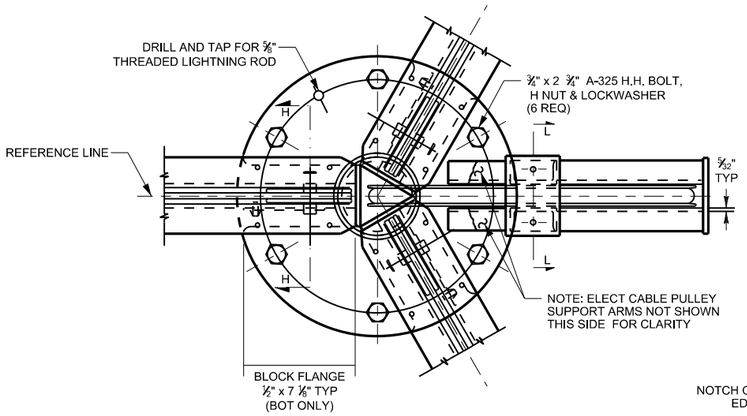
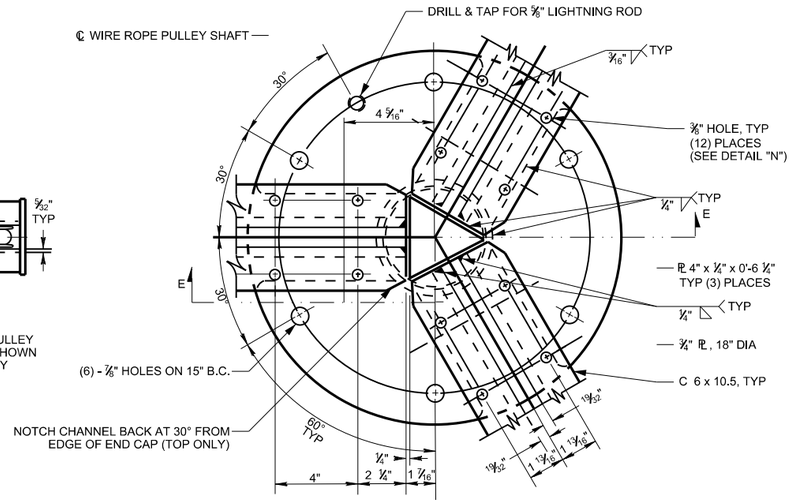
REVISIONS	0902	90	108		VA
	DIST	COUNTY			SHEET NO.
	FTW	TARRANT			62

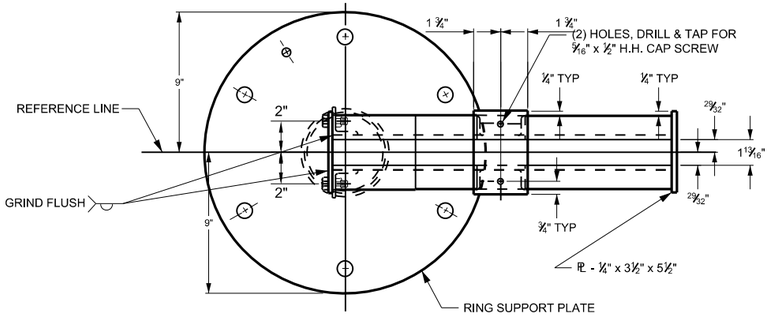


PLAN VIEW

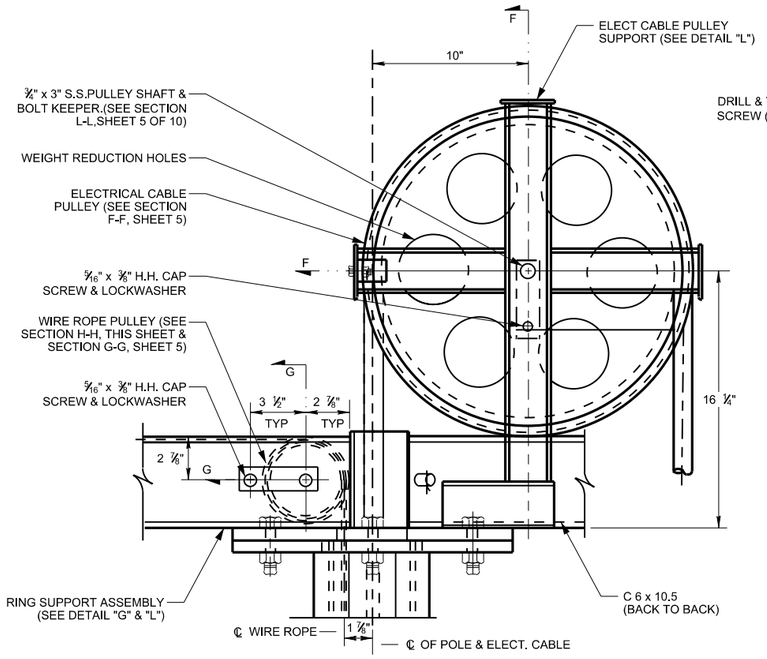


DETAIL "G"

TOP PLATE CONNECTION (LESS ELECT CABLE PULLEY SUPPORT) (SEE DETAIL "L")

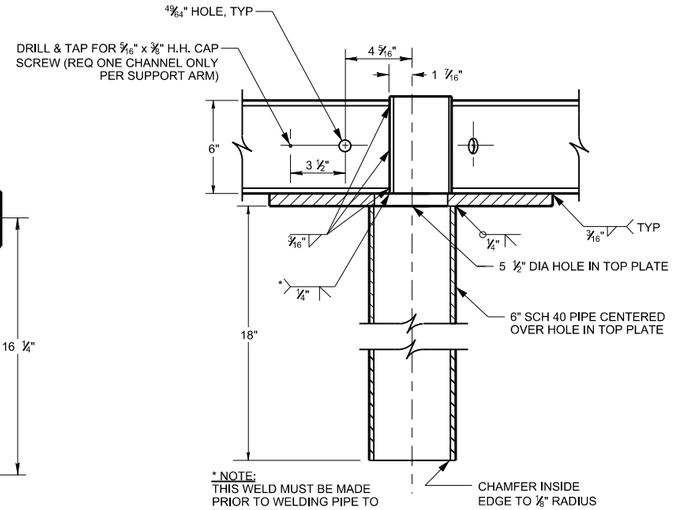


PLAN VIEW

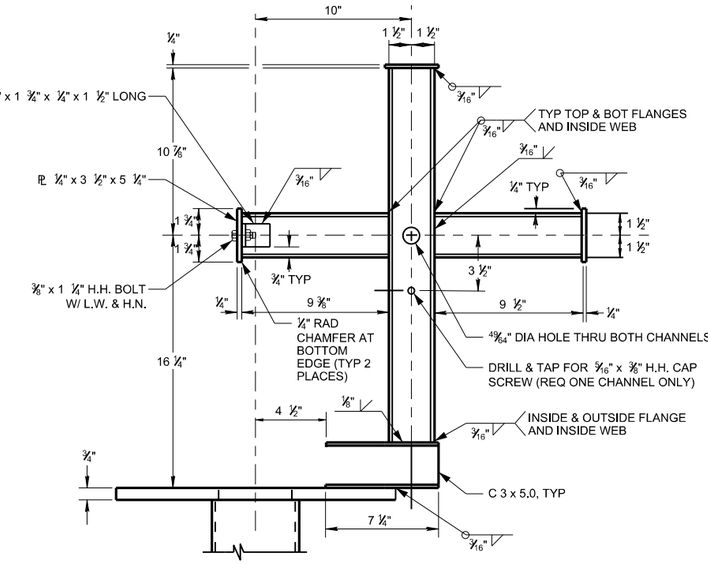


DETAIL "F"

RING SUPPORT ASSEMBLY (NEAR SIDE SUPPORT ARM & ELECT. CABLE PULLEY COVER NOT SHOWN FOR CLARITY)



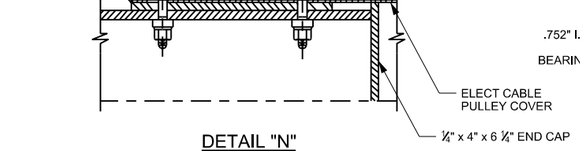
SECTION E-E



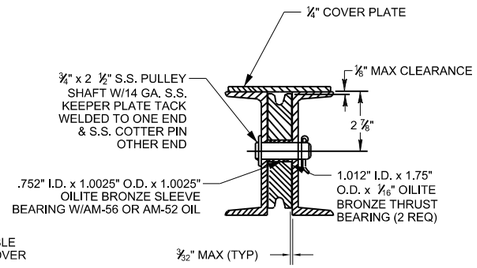
DETAIL "L"

ELECT. CABLE PULLEY SUPPORT (RING SUPPORT ARMS NOT SHOWN FOR CLARITY)

NOTE:
SECURE CONNECTOR BODY TO FLANGED INLET WITH SS REMOVABLE CLAMP TO PREVENT ACCIDENTAL DISENGAGEMENT



DETAIL "N"



SECTION H-H

PULLEY MOUNTING FOR RING SUPPORT ARMS

LEVELS DISPLAYED
1 2

Texas Department of Transportation
Fort Worth District

HIGH MAST CCTV MOUNTING ASSEMBLIES

HM-ITS (4)-21 (FTW)

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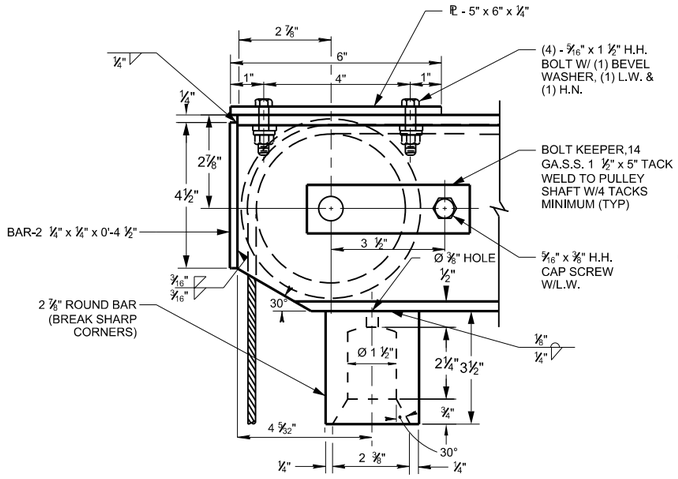
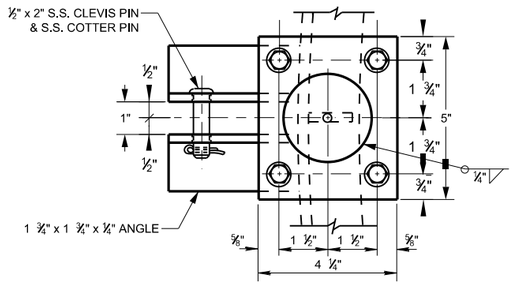
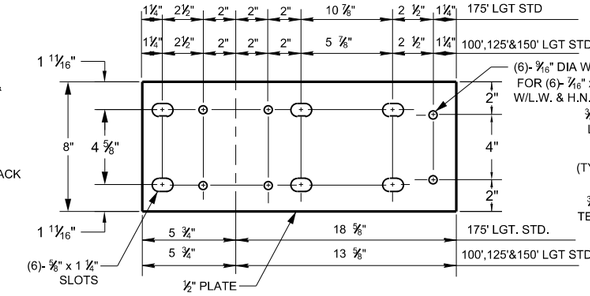
REVISIONS	0902	90	108		VA
	DIST	COUNTY			SHEET NO.
	FTW	TARRANT			63



DETAIL "J"

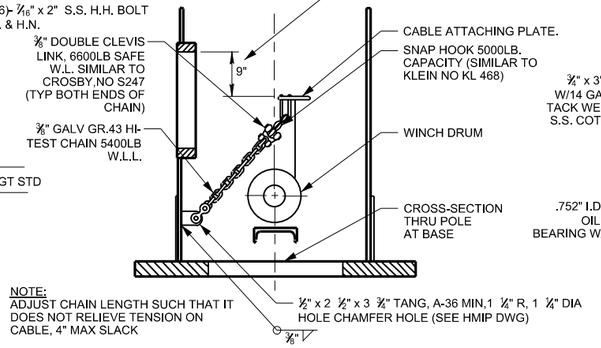


PLAN VIEW



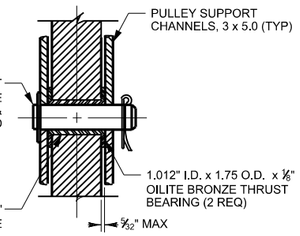
DETAIL "V"

WINCH MOUNTING PLATE
NOTE: DIMENSIONS MAY VARY-VERIFY WITH WINCH MANUFACTURER



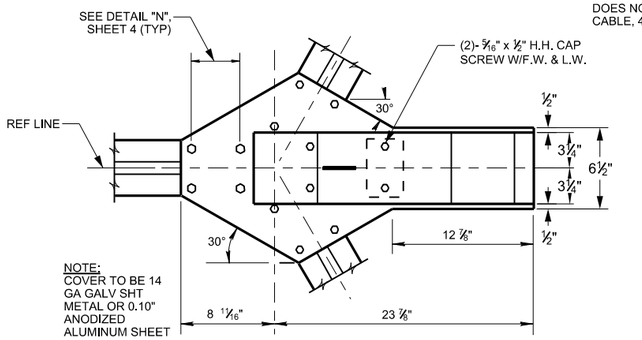
NOTE:
ADJUST CHAIN LENGTH SUCH THAT IT DOES NOT RELIEVE TENSION ON CABLE, 4" MAX SLACK

SAFETY LANYARD DETAIL



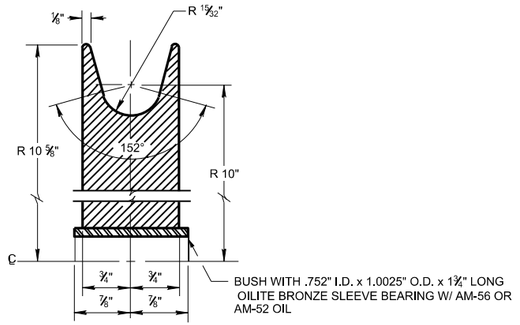
SECTION L-L

ELECTRICAL CABLE PULLEY MOUNTING



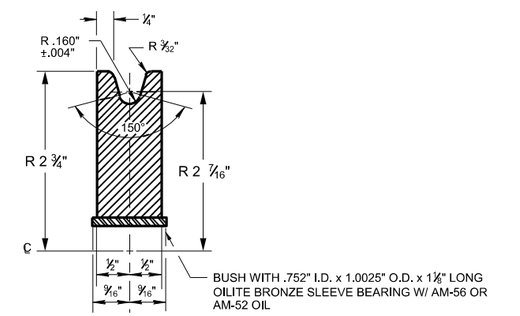
NOTE:
COVER TO BE 14 GA GALV SHT METAL OR 0.10" ANODIZED ALUMINUM SHEET

PLAN VIEW



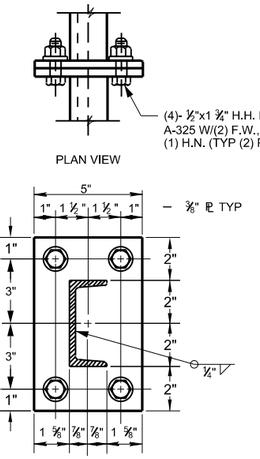
SECTION F-F

ELECTRICAL CABLE PULLEY (PULLEY MATERIAL TO BE ALUMINUM ALLOY, TYPE 356-T6 OR EQUAL)



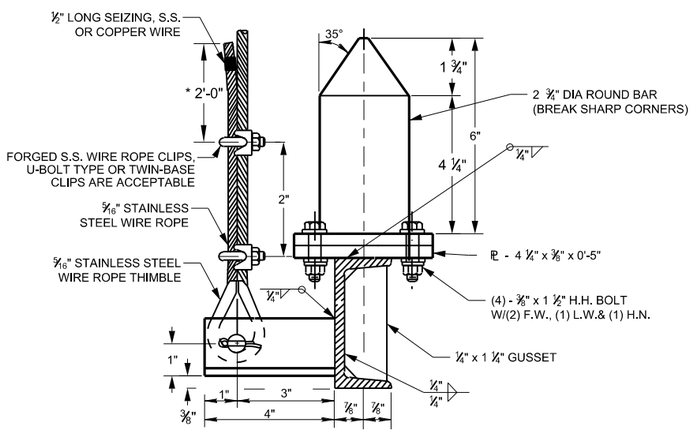
SECTION G-G

WIRE ROPE PULLEY (PULLEY MATERIAL TO BE PLATED STEEL OR STAINLESS STEEL)



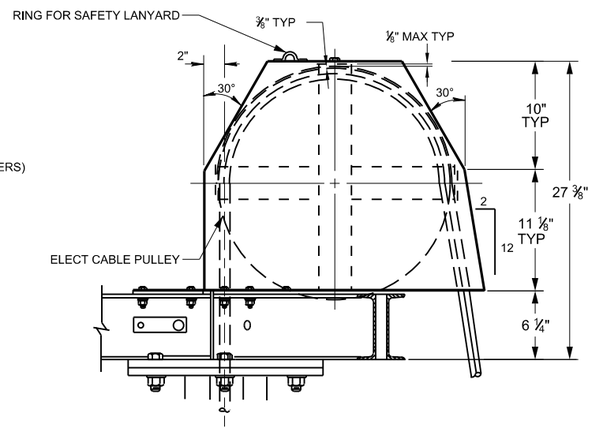
DETAIL "H"

MOUNTING RING SPLICE PLATE



DETAIL "K'

MOUNTING RING CONNECTION & STABILIZER
* EXTRA 2'-0" OF WIRE CABLE TO BE ATTACHED TO RING WITH SS BANDS AS DIRECTED BY ENGINEER



DETAIL "M"

COVER CAP ASSEMBLY
NOTE: COVER TO BE 14 GA. GALV SHT METAL OR 0.10" ANODIZED ALUMINUM SHEET

LEVELS DISPLAYED
1 2

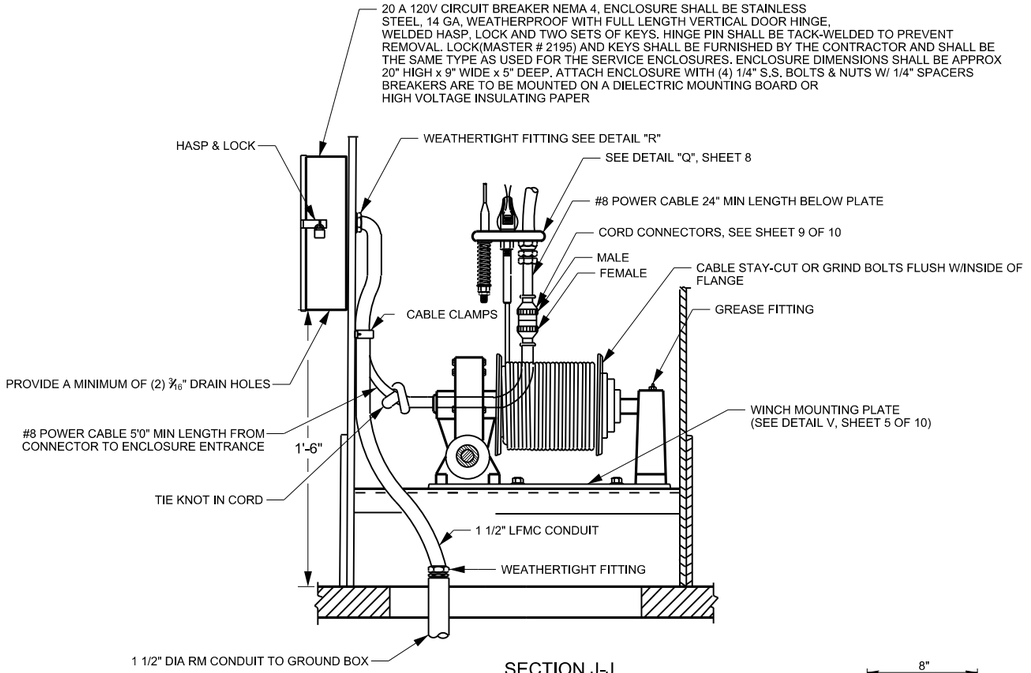
SHEET 5 OF 11 (N.T.S.)

Texas Department of Transportation
Fort Worth District

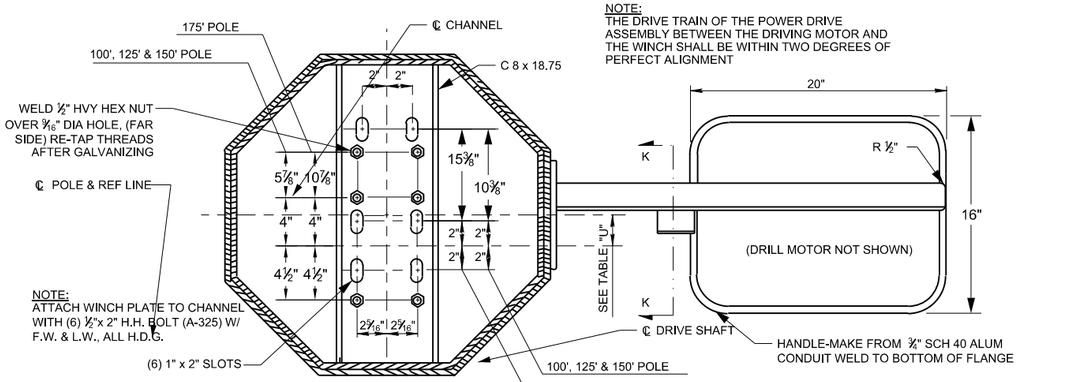
HIGH MAST CCTV MOUNTING ASSEMBLIES

HM-ITS (5)-21 (FTW)

FILE: TP80.DGN	DN: KAB	CK: MBY	DW: PDA	CK:
©TxDOT APRIL 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		64



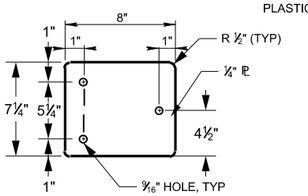
SECTION J-J
(WINCH ASSEMBLY)



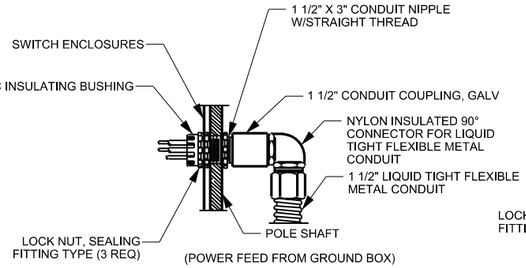
DETAIL "P"
(WINCH MOUNTING CHANNEL)
DIMENSIONS MAY VARY-VERIFY WITH WINCH MANUFACTURER

TABLE OF "U" DIMENSIONS

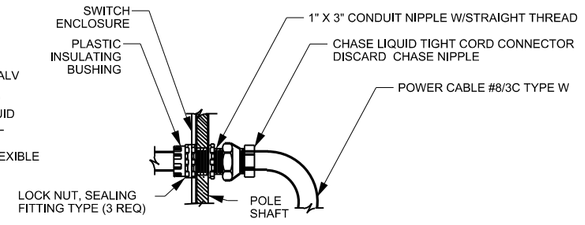
POLE HT. FT.	8 SIDED 80 MPH	8 SIDED 100 MPH	12 SIDED 80 MPH	12 SIDED 100 MPH
100	3½"	3½"	2½"	2½"
125	3½"	3½"	2½"	2½"
150	3½"	3½"	2½"	2½"
175	4½"	4½"	3½"	3½"



DETAIL "S"
(WINCH DRIVE ACCESS COVER)

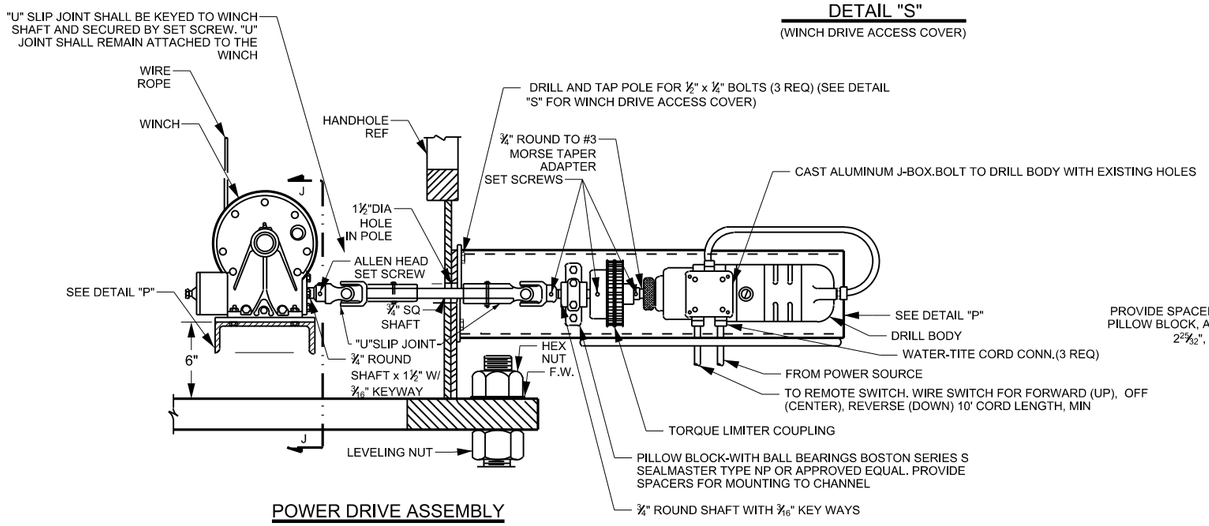


(POWER FEED FROM GROUND BOX)

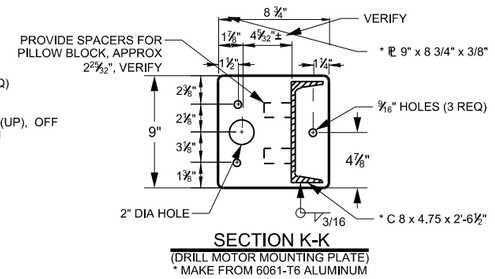


(POWER OUT TO RING)

DETAIL "R"
ENCLOSURE ENTRANCES



POWER DRIVE ASSEMBLY



SECTION K-K
(DRILL MOTOR MOUNTING PLATE)
* MAKE FROM 6061-T6 ALUMINUM

LEVELS DISPLAYED
1 2

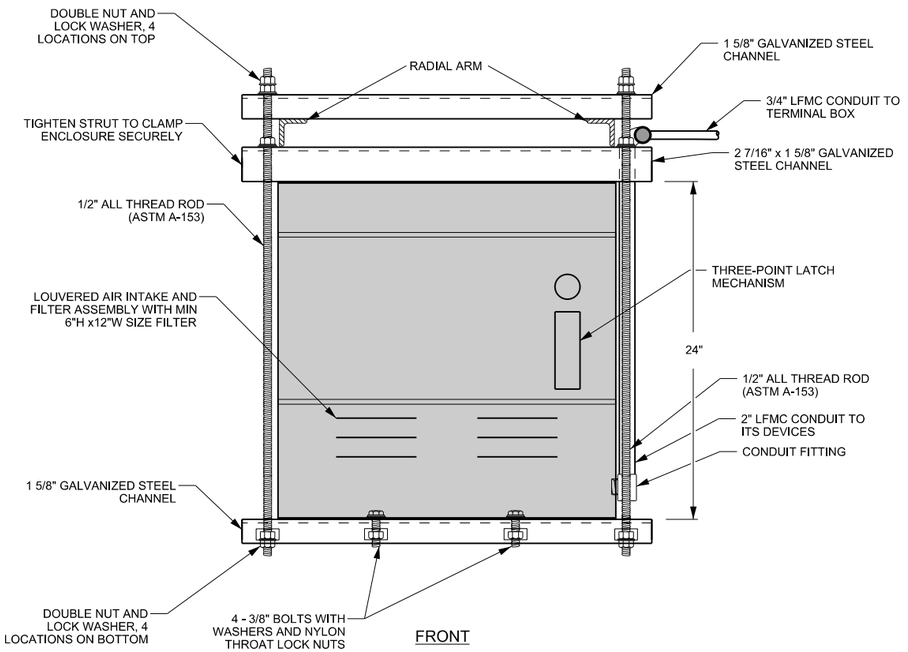
SHEET 6 OF 11 (N.T.S.)

Texas Department of Transportation
Fort Worth District

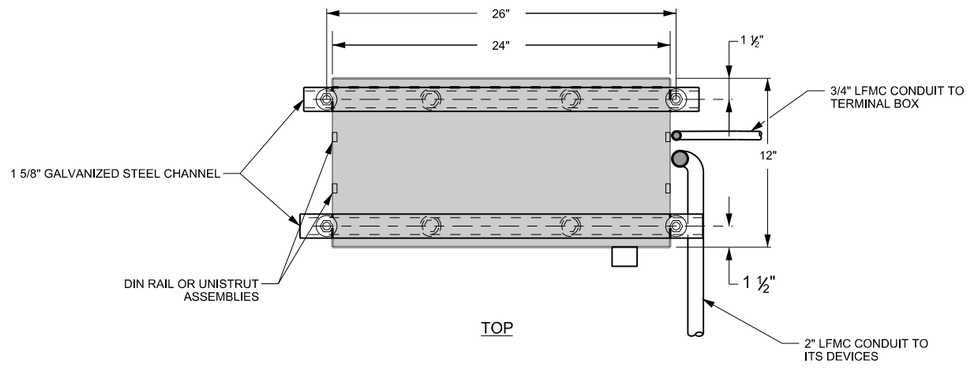
HIGH MAST CCTV MOUNTING ASSEMBLIES

HM-ITS (6)-21 (FTW)

FILE: TP80.DGN	DN: KAB	CK: MBY	DW: PDA	CK:	
©TxDOT APRIL 2017	CONT	SECT	JOB		HIGHWAY
REVISIONS	0902	90	108		VA
	DIST	COUNTY			SHEET NO.
	FTW	TARRANT			65



FRONT

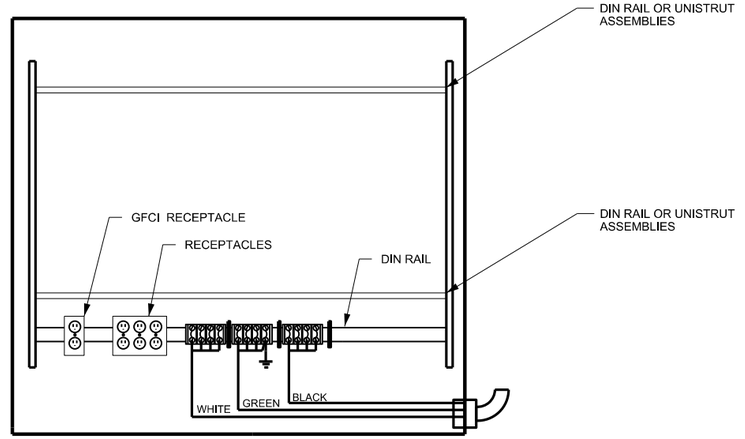


TOP

ENCLOSURE DETAILS

EFFECTIVE PROJECTED AREA (EPA) ALLOCATION (APPLIES TO 80MPH OR 100MPH)	EPA
STANDARD MOUNTING RING, SUPPORT ASSEMBLY, COVER, OBSTRUCTION LIGHTS, AND EXPOSED POWER CABLE	18 SF
HM-ITS ENCLOSURE AND MOUNTING HARDWARE	10 SF
MAXIMUM EPA AVAILABLE FOR MOUNTED ITEMS INCLUDING ALLOWANCE FOR EXPOSED CONDUIT, CCTV, ANTENNAS, FITTINGS, SUPPORT PIPES, AND HARDWARE	29 SF
TOTAL	57 SF

EPA ALLOCATION



ENCLOSURE ARRANGEMENT
INTERNAL WIRING NOT SHOWN

NOTES:

1. SEE SHEET 11 OF 11 FOR ENCLOSURE, INTERNAL COMPONENTS, AND WIRING REQUIREMENTS.
2. ENCLOSURE SHALL BE MOUNTED TO STRUT WITH 1/2" BOLTS FW AND LW.

LEVELS DISPLAYED
1 2

Texas Department of Transportation
Fort Worth District

HIGH MAST CCTV MOUNTING ASSEMBLIES

HM-ITS (7)-21 (FTW)

FILE: TP80.DGN	DN: KAB	CK: MBY	DW: PDA	CK:	
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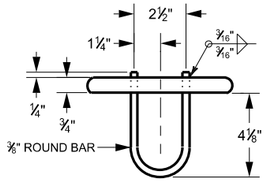
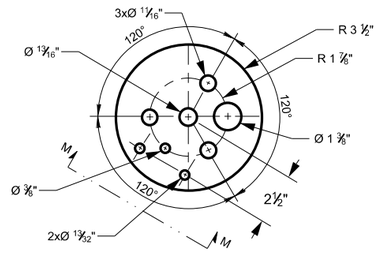
REVISIONS	0902	90	108		VA
	DIST	COUNTY			SHEET NO.
	FTW	TARRANT			66

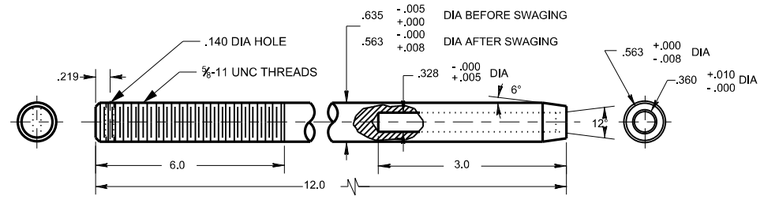


SECTION M-M



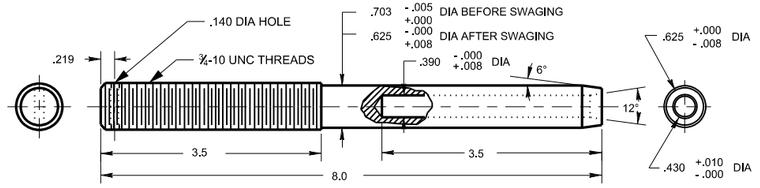
PLAN VIEW

NOTE:
MIN SWAGE LENGTH = 2.06
MAX SWAGE LENGTH = 2.94



TERMINAL FOR ⅝" WIRE ROPE
MATERIAL: STAINLESS STEEL, TYPE 303SE OR 304
WITH 115,000 P.S.I. MAX ULTIMATE TENSILE STRENGTH

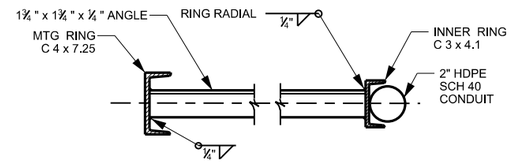
NOTE:
MIN SWAGE LENGTH = 3.12
MAX SWAGE LENGTH = 3.44



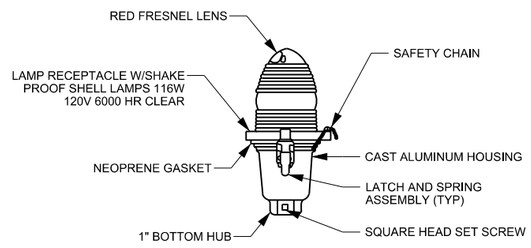
TERMINAL FOR ⅜" WIRE ROPE
MATERIAL: STAINLESS STEEL, TYPE 303SE OR 304
WITH 115,000 P.S.I. MAX. ULTIMATE TENSILE STRENGTH

SWAGE TERMINALS

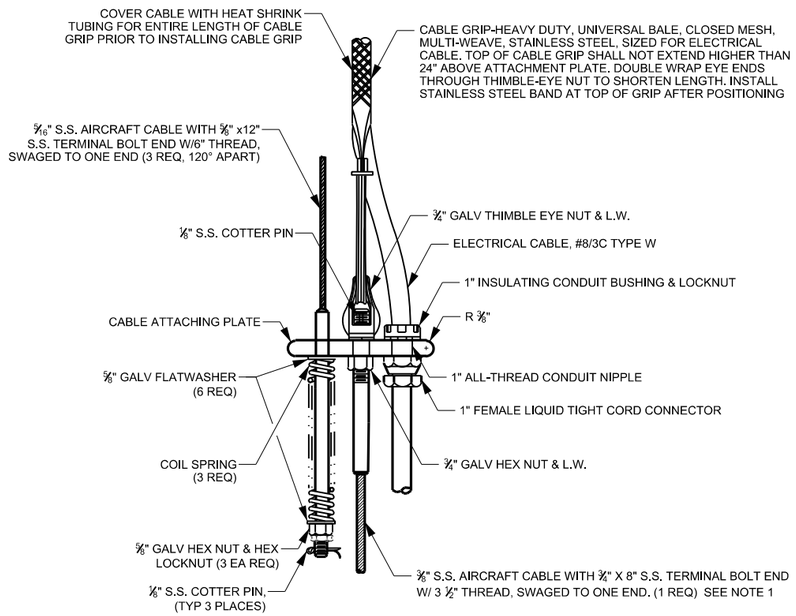
ALL DIMENSION IN INCHES



SECTION C-C



DETAIL "U"
(OBSTRUCTION LIGHT)
USE FAA APPROVED LED OBSTRUCTION
LIGHT. DETAILS MAY VARY



DETAIL "Q"
(CABLE ATTACHING PLATE)

NOTES:

1. ⅜" CABLE SHALL BE ROTATION RESISTANT SEE GENERAL NOTES SHEET 9.

LEVELS DISPLAYED
1 2

Texas Department of Transportation
Fort Worth District

HIGH MAST CCTV MOUNTING ASSEMBLIES

HM-ITS (8)-21 (FTW)

FILE: TP80.DGN	DN: KAB	CK: MBY	DW: PDA	CK:
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REVISIONS	0902	90	108	VA
	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		67

GENERAL NOTES:

1. GENERAL

A. All material shall be in accordance with the applicable sections of the NEC. All conduit and conductors shall be in accordance with the materials and construction methods requirements of items 618 and 620. Heat shrink tubing for use with cable grips and cable splicing shall meet the requirements of item 620. Alternates for minor components and arrangements may be used when approved by the Engineer in writing. Make brochure submittal for approvals.

B. Where stainless steel bands are called for on the HM-ITS sheets, stainless steel hose clamps may be provided. Stainless steel bands and stainless steel hose clamps shall be provided with stainless steel clips or stainless steel screws.

C. Obstruction lights

1. When obstruction lights are required by layout sheets, summary sheets or general notes, obstruction lights shall be controlled by an FAA approved photocell mounted on the ring. Photocells shall meet the following requirements:

a) All photocells shall consist of a photoelectric cell, an internal lightning arrestor, and a relay or bimetallic switch mounted inside a weather proof enclosure with standard 3-prong twist lock photocell plug and receptacle. The enclosure shall be made of poly-acrylic with clear acrylic window. Enclosure chassis shall be molded thermosetting plastic. The photocell shall have an arrestor rated 2.0kV sparkover with 5000 amps, and the photocell shall be rated a minimum of 1800 VA.

b) Photocell (FAA photocell) shall turn on at light levels below 35 foot-candles and off at levels above 58 foot-candles, in accordance with FAA requirements. This photocell shall be rated for operation at 120 volts.

2. When obstruction lights are not required, eliminate the 3 obstruction light fixtures.

D. The male cord connector on the lower end of the type W cord running up the pole, the female cord connector for the type W cord running to the circuit breaker enclosure, the male connector on the maintenance jumper, and flange receptacle in the ring mounted enclosure and the cord connector at the top end of the TYPE W cord shall meet the following or approved equal specifications:

1. Arrow Hart pin and sleeve watertight connectors UL listed, catalog numbers AH330C7W and AH330P6W.

2. Bryant watertight pin and sleeve connectors UL listed, catalog numbers 330C6W and 330P6W.

3. Hubble pin and sleeve connectors UL listed, catalog numbers HBL330C7W and HBL330P7W.

4. The male connector for use with the type W maintenance jumper shall be a pin and sleeve connector of one of the above types. The contractor shall attach a twist lock receptacle to the opposite end of the maintenance jumper to match the flange mounted plug on the ring.

5. Suitable for use at 30A, 125VAC

6. The contractor shall make a brochure submittal on the cord connectors.

2. TESTING

After High Mast Assembly for ITS has been completely assembled, the Engineer may require Contractor to fully lower and raise each high mast ring one time to demonstrate proper operation of the lowering mechanism, or may require the ring to be lowered for ring camera, cabinet, wiring, and radio inspection. If any malfunction occurs, the problem shall be corrected at the Contractor's expense and the lowering test will be repeated.

3. MOUNTING RING AND SUPPORT ASSEMBLY

A. Ring and support assembly shall be fabricated from steel having a minimum yield strength of 36 KSI.

B. Cover assemblies, fittings and miscellaneous parts shall be as outlined on the plans.

C. All hardware shall be hot-dipped galvanized per ASTM A153 or shall be stainless steel, unless noted otherwise on the plans.

4. WINCH

A. Housing shall be high tensile strength die-cast silicon aluminum. Cable drum shall be fabricated from seamless steel tubing with stamped steel flanges and shall be hot-dipped galvanized. Drum shall have a minimum diameter of 4.5 inches. Drum shall be keyed to drum shaft. Drum and flanges shall be sized so that, when the fixture mounting ring is in the raised position, the cable including one full layer will fill the drum to no more than two-thirds of full capacity. Drum shaft shall be ground from stainless steel and mounted on lubricated bronze bearings with seals. Wormgear shall be made of nickel-bronze and worm shaft shall be high-strength stress-proofed steel, ground and polished and supported by tapered roller bearings.

B. Gear ratio shall be 36:1 with safe hoisting capacity of not less than 4000 pounds.

C. Winch shall incorporate adjustable automatic brake to assure positive load suspension. Brake shall be multiple disc with friction plates running in oil bath and one-direction clutch which operates only when load is suspended or lowered. Winch shall not have throw-out clutch.

D. Any winch that is operated without oil shall be considered damaged and shall be replaced by the Contractor at the Contractor's expense.

5. WIRE ROPE AND TERMINALS

A. 5/16" and 3/8" wire rope shall be 19x7 Rotation Resistant IWRC stainless steel. 19x7 rotation resistant wire rope shall meet the construction requirements of Fed. Spec. RR-W-41OD, Type IV, class 2, modified for stainless steel with a nominal breaking strength of 11,100 lbs. All wire rope shall be pre-formed and factory lubricated. Wire rope shall meet the requirements of the applicable specification except where modified by this specification. Quality Assurance testing shall be the responsibility of the manufacturer and shall meet recognized wire rope industry standards. No special tensile or torsion testing will be required. Mill Test Reports shall be furnished.

B. Winch cable shall be of sufficient length to leave a minimum of one full layer of cable on the drum when the fixture mounting ring is in the full down position.

C. Wire rope terminals shall be stainless steel, solid stud type as shown on Sheet 8. All terminals shall be drilled for cotter pin. Material to be 303 SE or 304 stainless steel with a maximum tensile strength of 115,000 p.s.i. Mill Test Reports shall be furnished.

D. All terminals shall be proof-tested by the manufacturer to 40% of rated strength of the wire rope. Each terminal shall be identified by manufacturer's logo permanently incised on terminal. Manufacturer shall furnish certification of tests. Contractor shall also furnish one sample of each size of terminal with 5 ft. Of wire rope for load tests by the state. Samples tested must withstand test load not less than 100% of rated breaking strength of wire rope. If sample fails test, all terminals of same size will be rejected.

E. Wire rope shall be delivered from the manufacturer on a reel.

LEVELS DISPLAYED
1 2

Texas Department of Transportation
Fort Worth District

HIGH MAST CCTV MOUNTING ASSEMBLIES

HM-ITS (9)-21 (FTW)

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REVISIONS	0902	90	108	VA
	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		68

GENERAL NOTES (CONTINUED):

6. SPRINGS

A. Provide three steel springs as shown on plans.

B. Springs shall have an uncompressed length of approximately 8 inches and shall compress 3 inches under 700-pound load.

C. Springs shall contain approximately 19 total coils with ID of 0.875 and OD of 1.375 inches. Ends shall be closed and ground. Springs shall be zinc-plated.

D. Springs shall be made from ¼" diameter oil-tempered MB steel treated for overstress. Springs shall not develop permanent set from 3-inch compression.

7. ELECTRICAL POWER CABLE

A. Power cable shall be No. 8 awg three-conductor round Type W, rated 90 degrees C, 600 volt or 2000 volt. Each conductor shall be tinned copper and shall consist of 133 strands. Insulation shall be ethylene propylene rubber. Jacket shall be chlorosulfonated polyethylene (CSPE), with glass fiber or nylon reinforcing mesh between two layers of CSPE. Nominal diameter shall be 0.91". Filler shall be rubber compound or other approved non-hygroscopic compound. Jacket shall be Hypalon Power Flex 90, with no substitutions allowed.

8. POWER DRIVE ASSEMBLY (ONE ONLY REQUIRED THIS CONTRACT UNLESS OTHERWISE SHOWN ELSEWHERE ON THE PLANS)

A. Drive motor

1. Drive motor shall be 1¼" heavy-duty reversible portable electric drill modified as shown on plans.

2. Shall have a minimum of 6 radial ball bearings, one thrust bearing, and one needle bearing.

3. Shall have No. 3 Morse Taper socket.

4. Shall be designed for 115 volt 60 hertz single phase operation 250 RPM at no load.

5. Shall be designed for continuous rated duty of 160 RPM and 15 amperes at 115 volts with delivery of 33-pound-feet of torque. Drill motor to be operated only at low speed range. (i.e. 150 to 160 RPM)

6. Shall develop 240 pound-feet of torque at stalled rotor condition.

B. Torque limiter coupling

1. Torque limiter coupling shall consist of standard torque limiter with Type A sprocket center member coupled to a Type B sprocket by an ASA double strand roller chain. Type A sprocket shall be chrome-plated.

2. Coupling shall have torque capacity minimum of 15 pound-feet and a maximum of 55 pound-feet.

3. Limiter section of coupling shall consist of integral hub and pressure plate, two friction facings, sintered iron bushing, pilot plate, disk spring, lock washer and hex adjustment nut. All major components except spring and friction facings shall be cadmium plated with dichromate treatment.

4. Type A center sprocket shall have ground face (63 micro-inch) and shall be run-in for 4 minutes at approximately 60 RPM at a torque setting 70% to 80% of spring rating. Contractor shall provide written certification that run-in has been accomplished.

5. The torque limiter coupling shall, after run-in, be set to a torque limit of 35 pound-feet or as directed by the Engineer. The proper setting of the coupling shall be demonstrated to the Engineer.

C. Universal joints

1. Shall be slip-type with 4-inch barrel. A grease fitting shall be so located in the spider that all caps and needle bearings may be adequately serviced. The assembly shall be disassembled and zinc-plated, then reassembled and properly lubricated.

2. Shall have a minimum torque rating of 1270 inch-pounds at 200 RPM.

3. Shall have set screw and keyed coupling as shown on plans.

9. CONSTRUCTION METHODS

A. Fabrication

1. Fabrication and welding shall be in accordance with Item 441, "Steel Structures".

2. All holes supporting pulley shafts shall be drilled (not punched) prior to galvanizing.

3. All component parts shall be galvanized, where galvanizing is applicable, after fabrication.

4. Galvanizing on all parts which have become scratched, chipped or otherwise damaged shall be thoroughly cleaned and the cleaned area painted with two coats of zinc dust-zinc oxide paint conforming to the requirements of repair compounds meeting federal specification TT-P-641 b.

5. Mounting rings and ring support assemblies shall be fabricated with the use of jigs that have been inspected and approved by material and Test Division personnel prior to their usage.

6. The fabricator shall submit his proposed welding procedures in accordance with Item 441, "Steel Structures".

B. Installing wire rope

1. Extreme care shall be used to prevent wire rope from kinking, nicking, or from sustaining other damage during installation. Rope shall not be installed by pulling from flat coil, but shall be carefully unrolled its full length or placed on a horizontal axis and unreeled according to wire rope industry standards.

2. For right lay rope, the rope shall be attached to the drum on the end opposite the winch gear train, and wound on drum so that the free end of the rope comes off the backside of the drum during normal operation of the winch. Rope must be unreeled carefully as stated above. Care must be taken to insure that all layers lay full and tight on drum.

3. Installation of all wire rope shall be accomplished only under direct supervision of the engineer or his authorized representative. Contractor shall not remove wire rope from manufacturer's reel until authorized by the Engineer. Installation of wire rope on winch shall be in accordance with the above and accepted industry practice. Installation of the three hoist cables shall be made from the top end of the pole and as directed by the engineer or his representative.

C. Installing wire rope clips

1. Turn back approx. 2' 3" of rope, measured from the top of thimble. Apply seizing to pigtail end of wire rope prior to cutting to length. See detail "K", Sheet 5. Apply first clip approx. 3" from the dead end of the wire rope with u-bolt over dead end and live end in clip saddle. Tighten nuts evenly to 30 pound-feet of torque, or as recommended by manufacturer.

2. Install second clip as near loop as possible, take out slack and torque nuts evenly to 30 pound-feet or as recommended by manufacturer.

3. After final erection and assembly of the pole and high mast assembly, retighten nuts to required torque.

D. Installing Mounting Ring and Equipment

1. Prior to mounting equipment to the mounting ring, contractor shall ensure the ring is level.

LEVELS DISPLAYED
1 2

Texas Department of Transportation
Fort Worth District

HIGH MAST CCTV MOUNTING ASSEMBLIES

HM-ITS (10)-21 (FTW)

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REVISIONS	0902	90	108		VA
	DIST	COUNTY			SHEET NO.
	FTW	TARRANT			69

GENERAL NOTES (CONTINUED):

10. ENCLOSURE CABINET SPECIFICATIONS

A. Requirements.

1. Place all terminals and panel facilities on the lower portion of the enclosure walls below all shelves.

2. **Duplex Receptacles**. Provide three 120 VAC NEMA type 5-20R duplex receptacles, or as shown on the plans. Permanently label duplex receptacles "For Internal ITS Equipment Only". Install duplex receptacle non-metallic covers.

3. **Ground Fault Circuit Interrupter (GFCI) duplex receptacles**. Provide at least one 120 VAC NEMA type 5-20R GFCI duplex receptacle, or as shown on the plans, protected by a circuit breaker. This GFCI duplex receptacle is intended for maintenance personnel and is not to be used to serve equipment inside the enclosure. Permanently label GFCI duplex receptacles "For Personnel Use". Install GFCI duplex receptacles in a readily accessible location.

4. **CIrcuit Breakers.** Install 1P/20A circuit breaker at the base of the pole. Provide Underwriters Laboratories (UL) listed circuit breakers rated for 120/240 VAC operation. Provide circuit breakers with a minimum interrupt capacity of 10,000 A.

5. **Power Line Surge Protection.** Provide and install power line surge protection devices in terminal box and in enclosure as shown below.

6. **Power Cable Input Junction Terminals.** Provide power distribution blocks suitable for use as a power feed and junction points for 2 and 3 wire circuits. Accommodate up to No. 10 AWG conductors on the line side of each circuit. Electrically isolate the AC neutral and equipment ground wiring from the line wiring by an insulation resistance of at least 10 megohms when measured at the AC neutral. Color code the AC neutral and equipment grounding wiring white and green respectively in accordance with the most current version of the NEC. Utilize the back panel to distribute and properly interconnect all enclosure wiring related to the specific complement of equipment called out on the plans. Each item of equipment including any furnished by the department must have the cable harness properly terminated at terminal boards on the back panel. Ensure all functions available at the equipment connector are carried in the connector cable harness to the terminal blocks from the power distribution panel mounted on the left side panel of the enclosure.

7. **Wiring.** Ensure all enclosure wiring identified by the use of insulated pre-printed sleeving slipped over the wire before attachment of the lug or making the connection. Supply enough text on wire markers in plain words or abbreviations with sufficient level of detail so that a translating sheet will not be required to identify the type and size of wire. Cut all wires to the proper length before assembly. Ensure no wires are doubled back to take up slack. Ensure harnesses to connectors are covered with braided cable sleeves. Secure cables with nylon cable clamps. Provide service loops to facilitate removal and replacement of assemblies, panels and modules. Use insulated parts and wire rated for at least 600 V. Color-code harnesses and wiring. Route and bundle all wiring containing line voltage ac separately and shield from all low voltage, i.e., control circuits. Cover all conductors and live terminals or parts, which could be hazardous to maintenance personnel, with suitable insulating material. Provide AC internal enclosure wiring identified in accordance with the most current version of the NEC. Provide white insulated conductors for ac neutral. Provide green insulated conductors for equipment ground. Provide any color different from the foregoing on other conductors in accordance with the most current version of the NEC. For equipment that requires grounding, provide grounding conductors and do not use conduit for grounding. provide conductors that are UL-listed THNN least size no. 14 AWG. no strands of any conductor may be trimmed to fit the wiring into the breaker or terminal block.

8. **Terminal Strips.** Provide terminal strips located on the back panel that are accessible to the extent that it is not necessary to remove the electronic equipment from the enclosure to make an inspection or connection. Ensure terminal blocks are 2 position, multiple pole barrier type. Provide shorting bars in each of the positions provided along with an integral marking strip. Arrange terminal blocks such that they will not upset the entrance, training and connection of incoming field conductors. Identify all terminals with legends permanently affixed and attached to the terminal blocks. Ensure no electrically energized components or connectors extend beyond the protection afforded by the barriers. Locate all terminal blocks below the shelves. Ensure terminals used for field connections are secure conductors by means of a No. 10-32 nickel or cadmium plated brass binder head screw. Ensure terminals used for interwiring connections, but not for field connections, are secure conductors by means of a No. 5-32 nickel plated brass binder head screw. Terminate all connections to and from the electronic equipment to an interwiring type block. These blocks will act as intermediate connection points for all electronic equipment input and output. Provide termination panels that are used to distribute and properly interconnect all enclosure wiring related to the specific complement of equipment as shown on the plans. Provide properly terminated cable harnesses for each item including any furnished by the department. Provide all functions available at the equipment terminals that are carried in the connector cable harness.

9. **Enclosure internal grounding.** The enclosure internal ground consists of at least 1 ground bus-bar permanently affixed to the enclosure and connected to the grounding electrode. Return ac neutral and equipment ground wiring to these bus-bars.

10. **Door switch.** Provide door switch meeting the following requirements:

- Momentary, pin-type door switch,
- Installed in the enclosure or on the door, and
- Connected to a terminal so that the equipment installed in the enclosure can confirm input is connected to logic ground when the enclosure door is open.

Provide 2 momentary, pin type door switches for each door provided with the enclosure. Wire 1 switch to turn on the enclosure lights when the door is open and off when the door is closed. Wire the other in parallel to a terminal block to detect an enclosure intrusion condition.

11. **Size and construction.** Provide its enclosure as detailed herein and as shown on the plans.

TABLE 1
MINIMUM ENCLOSURE INTERNAL DIMENSIONS

	WIDTH (IN.)	HEIGHT (IN.)	LENGTH (IN.)
TYPE HM	12 [1]	24	24

1. Minimum dimension for enclosure provided without EIA 19 in. rack assembly.

12. **Ventllatlon.** Provide the enclosure with vent openings to allow cooling of electronic components. Locate louvered air intake vent openings on the lower portion of the enclosure doors and covered fully on the inside with a commercially available disposable 3 layer graded pleated type filter of minimum size 6 in. (high) x 12 in. (wide) for type HM enclosure. Size the louvered intake area and filter to allow maximum filtered air flow and cooling, securely mounted so that any air entering the enclosure must pass through the filter. Ensure the enclosure opening for intake of air is large enough to accommodate filter size. Screen the exhaust to prevent entry of insects. Provide the screen openings no larger than 0.0125-sq. In. Provide a, minimum of 2, thermostatically controlled fans that are adjustable with an adjustment range of 70 to 110°F. Provide a press-to-test switch to test the operation of the fan. Provide a fan with a capacity of at least 110 cfm each. There is no opening on the roof of the enclosure.

13. **Exterior finish.** Provide enclosures with a smooth aluminum finish and the exterior in its unpainted natural color.

14. **Serial number.** Provide the enclosures with a serial number unique to the manufacturer, preceded by an assigned 2 letter manufacturer's code. Provide at least a 0.2 in. Letter height. Stamp the entire identification code and number on a metal plate which is riveted to the enclosure, stamp directly on the enclosure wall, or engrave on a metalized mylar plate that is epoxied on the upper right hand enclosure side wall.

15. **Modular design.** Provide enclosures that have a modular design and allows its equipment to be installed in a variety of mounting configurations as detailed on the plans or as directed.

16. **Shelves.** Provide adjustable shelves in each enclosure as required to support the equipment as specified on the plans. Ensure shelf adjustment at 2 inch intervals in the vertical position. Provide shelves that are removable and capable of supporting the electronic equipment. Provide a minimum of 2 in. between the back and front edge of the shelf to back inside wall and door of the enclosure respectively to allow room for the equipment cables and connectors.

17 **Mounting hardware.** Provide enclosures with the appropriate channel mounting brackets, stiffening plates, anchor bolts, and any other necessary hardware to mount the enclosure on the ITS pole structure as shown on the plans. Provide mounting brackets made of 0.250 in. Thick steel. Do not band the enclosure or mounting plates to the pole. Alternate mounting details may be submitted for approval. Reducing overall wind loading will be a primary consideration for alternative detail approvals.

18. **Environmental design requirements.** Provide enclosures that meet the functional requirements of this item during and after subjection to any combination of the following requirements:

- Ambient temperature range of -30 to 165°F,
- Temperature shock not to exceed 30° F per hour, during which the relative humidity does not exceed 95%,
- Relative humidity range not to exceed 95% over the temperature range of 40 to 110°F, and
- Moisture condensation on all surfaces caused by temperature changes.

19. **Vibration.** Material used must show no degradation of mechanical structure, soldered components, plug in components or satisfactory operation in accordance with the manufacturer's equipment specifications after being subjected to the vibration test as described in the nema standard TS2, section 2.2.8, vibration test or the latest revision.

B. Fabrication

1. **Enclosure.** Continuously weld all exterior seams for enclosure and doors. Fill edges to a radius of 0.03125 in. Minimum. Smooth exterior welds. Welding on aluminum enclosures are done by the gas metal arc (MIG) or gas tungsten arc (TIG) process using bare aluminum welding electrodes. Ensure electrodes conform to the requirements of the American Welding Society (AWS) A5.10 for ER5356 aluminum alloy bare welding electrodes. Procedures, welding machines and welding machine operators for welding on aluminum must be qualified and conform with the requirements of AWS B3.0, "Welding Procedures and Performance Qualification", and to the practices recommended in AWS C5.6. Construct all enclosures of welded sheet aluminum with a thickness of at least 0.125 in. Meeting NEMA 3R standards. Do not allow wood, wood fiber product, or flammable products in the enclosure. Seal enclosure structure to prevent the entry of rain, dust, and dirt.

2. **Door.** Provide sturdy and torsionally rigid enclosure doors that substantially cover the full area of the enclosure access opening. Attach enclosure doors by a minimum of 2 heavy duty hinges or full length hinge. provide stainless steel hinge pins. Fabricate the doors and hinges to withstand a 100 lb. per vertical ft. force applied to the outer edge of the door when open without permanent deformation or impairment of the door or enclosure body when the load is removed. Fit the enclosure doors with number 2 corbin locks and aluminum or chrome plated handles with a minimum 3/8 in. drive pin and a 3 point latch. Design the lock and latch so that the handles cannot be released until the lock is released. Provide a locking ring for a padlock along with a padlock. provide 2 keys for the door and 2 keys for the padlock with each enclosure. Locate the lock clear of the arc of the handle. Keys must be removable in the locked position only. Mount locks with 2 stainless steel machine screws. P rovide enclosure doors with a catch mechanism to hold the door open at 2 positions: 90°and 120°. Fabricate the door and door stop mechanism to withstand a simulated wind load of 5 lb. per sq. ft. applied to both inside and outside surfaces without failure, permanent deformation, or compromising of door position. Provide enclosures without auxiliary police doors. Provide a gasket to act as a permanent and weather resistant seal at the enclosure door facing. The gasket material must be of a non-absorbent material and maintain its resiliency after long term exposure to the outdoor environment. Provide a gasket with a minimum thickness of 0.25 in. Locate the gasket in a channel provided for this purpose either on the enclosure or on the door. An "L" bracket is acceptable instead of this channel if the gasket is fitted snugly against the bracket to insure a uniformly dust and weather resistant seal around the entire door facing.

3. **Environmental design requirements.** The enclosure must meet all functional requirements during and after subjection to any combination of the following requirements:

- Ambient temperature range of 0°F to 158°F.
- Temperature shock not to exceed 30°F per hr., during which the relative humidity must not exceed 95%.
- Relative humidity range not to exceed 95% over the temperature range of 40°F to 110°F.
- Moisture condensation on all surfaces caused by temperature changes.

LEVELS DISPLAYED
1 2

Texas Department of Transportation
Fort Worth District

HIGH MAST CCTV MOUNTING ASSEMBLIES

HM-ITS (11)-21 (FTW)

FILE: TP80.DGN	DN: KAB	CK: MBY	DW: PDA	CK:	
©TxDOT APRIL 2017	CONT	SECT	JOB		HIGHWAY
REVISIONS	0902	90	108		VA
	DIST	COUNTY			SHEET NO.
	FTW	TARRANT			70

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.

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NOTE: Structures north of ice line to be designed for ice.

ZONE 2
(90 MPH WIND)

ZONE 3
(80 MPH WIND)

ZONE 4
(70 MPH WIND)

ICE LINE

ZONE 4
(70 MPH WIND)

ICE LINE

ZONE 3
(80 MPH WIND)

ZONE 1
(100 MPH WIND)

LEGEND

ZONE 1 - = (100 MPH WIND)
ZONE 2 - = (90 MPH WIND)
ZONE 3 - = (80 MPH WIND)
ZONE 4 - = (70 MPH WIND)
= (ICE LINE)
= (DISTRICT LINES)

APPLICABLE STANDARDS SHEETS

OVERHEAD SIGN BRIDGE STANDARDS:

OSB-SE
OSB-Z#
OSB-Z#1
HOSB-Z#
HOSB-Z1L
HOSB-Z#1
OSBT
OSBC
OSBC-SC-Z#
OSBS-SC
OSB-FD
OSB-FD-SC

CANTILEVER OVERHEAD SIGN SUPPORT STANDARDS:

COSS-SE
COSS-Z#-10
HCOSS-Z#-10
COSS-Z21-10
COSS-Z#&Z#1-10
COSSD
COSSF
COSS-FD

Note: # = Wind Zone number 1, 2, 3 or 4

HIGH MAST ILLUMINATION POLE STANDARDS:

HMIP-98
HMIF-98

WALKWAYS AND BRACKETS STANDARDS:

SWW
SB(SWL-1)

TRAFFIC SIGNAL POLE STANDARDS:

SP-80
SP-100
SMA-80
SMA-100
DMA-80
DMA-100
MA-C
MAC(ILSN)
MAD-D
TS-FD
LUM-A
CFA
LMA
TS-C
MA-DPD

FOR HARRIS CO. ONLY
Zone line is just North of US 90, around on the North, West and South sides of IH 610 and down the West side of SH 288.

FOR JACKSON CO. ONLY
Zone line is just North of SH 616.

WIND VELOCITY & ICE ZONES FOR APPLICABLE OVERHEAD SIGN SUPPORTS, HIGH MAST POLES, AND TRAFFIC SIGNAL POLES

Based on 50 Year Mean Recurrence Interval of Fastest Mile Wind Velocity at 33 feet height.

THIS SHEET TO BE INCLUDED IN ALL P.S.&E. PACKAGES CONTAINING ONE OR MORE OF THE APPLICABLE STANDARD SHEETS LISTED HEREON

Texas Department of Transportation

Traffic Operations Division Standard

WIND VELOCITY AND ICE ZONES

WV & IZ-14

FILE: windice.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT April 1996	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
8-14-Added list of applicable standards, restricting use to structures designed for Fastest Mile wind speeds.	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		71

DATE: 4/29/2021 11:07:16 AM
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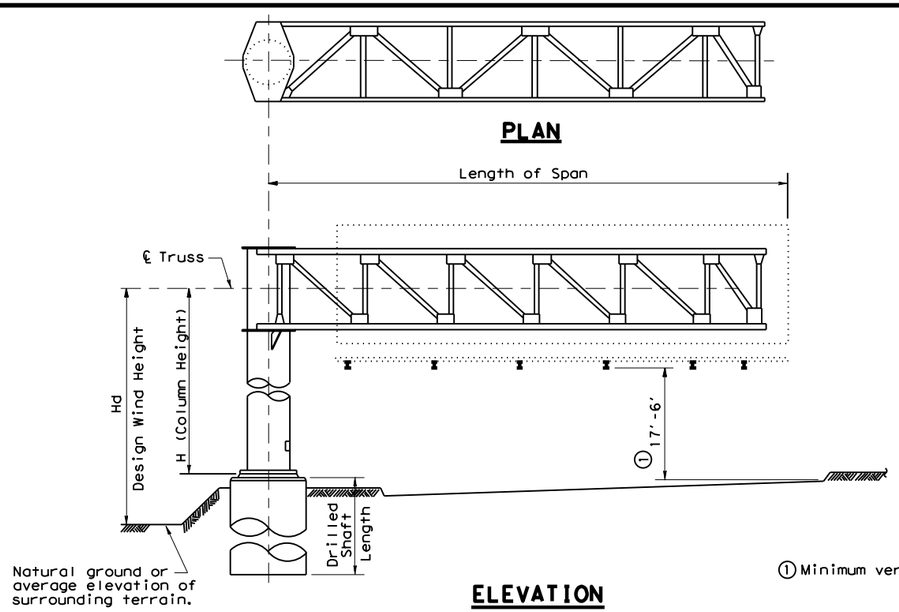
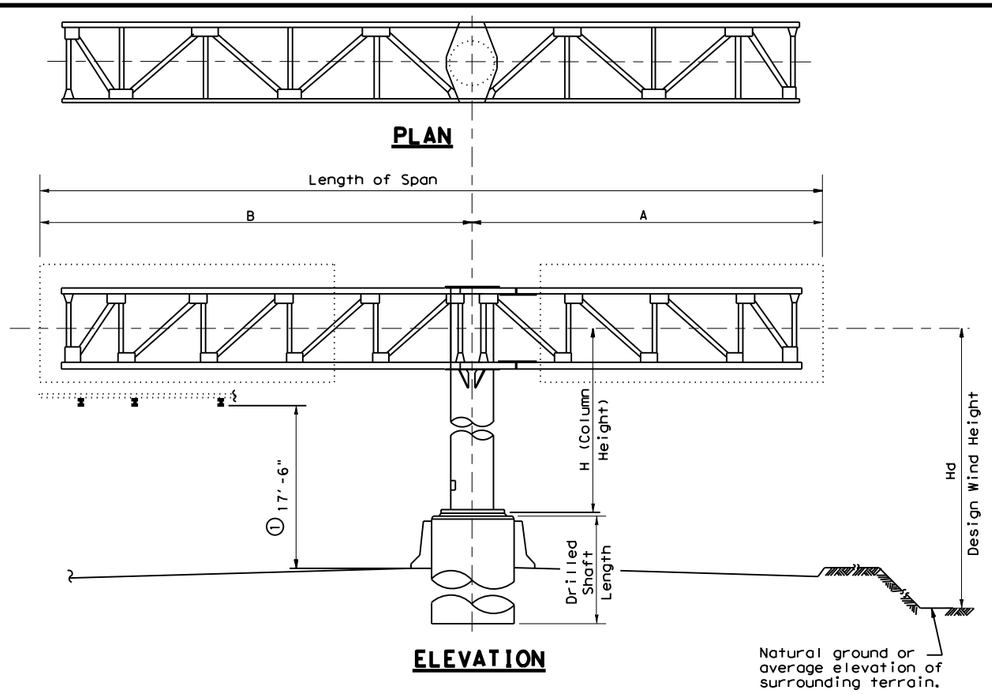


① Minimum vertical clearance



SELECTION EXAMPLE CANTILEVER SPAN

Given: Cantilever Span = 33′; Column Height, H = 23.3.′; Design Wind Height, Hd = 27′; Avg. Penetrometer Value, N = 15 (clay type soil); Hill County

Step 1: Select applicable COSS standard.
From Wind Velocity and Ice Zone sheet (WV & IZ-96) determine that Hill County is in Zone 4 (70 mph) and is above the ice line. Since Design Wind Height is less than 30′, use standard COSS-Z4 & Z4I. If Design Wind Height is more than 30′, use COSS-Z3 & Z3I. NOTE: In Zone 1 if Design Wind Height is greater than 30′ use HCOSS-Z1.

Step 2: Determine tower details from COSS-Z4 & Z4I. Use column height to nearest tabulated value' i.e., 23′. Round span length up to the nearest tabulated value, i.e., 35′.
Tower details are:
Tower pipe 24" Dia with min. wall thickness = 0.312"
Base plate 33 ¾" Dia x 1 ¾"
Anchor bolts 8~1 ¾" Dia on 29 ⅜" bolt circle
Horizontal deflection of tower at ℄ truss = 0.889". During installation, double nuts at base plate may be used to plumb tower to compensate for horizontal deflection.
Design Moment = 244 Kip-ft
Design Torsion = 162 Kip-ft

Step 3: Determine truss details from COSS-Z4 & Z4I.
Read from small table at bottom of sheet for span = 35′.
Truss design width, W and depth, D = 4.0′x 4.0′.
Chord L 3 x 3 x 5/16 (HYC) with 6 bolt connection at tower
D.L. Diag. L 2 x 2 x 5/16 (HYC) with 2 bolt connection
W. L. Diag. L 3 x 3 x 5/16 (HYC) with 2 bolt connection
D. L. Vert. L 2 x 2 x 5/16 (HYC) with 2 bolt connection
W. L. Strut. L 2 x 2 x 5/16 (HYC) with 1 bolt connection
Bolts are ⅝" Dia high strength with 5~¾" Dia bolt alternate for chord connection at tower.
D.L. of truss = 50 lb/ft
Truss deflection at free end = 3.2". The fabricator shall compensate for this deflection by offsetting bolt holes between the upper and lower chords at the truss-to-tower connection.

Step 4: Determine foundation details. Use standard COSSF.
From COSSF with 24" Dia pipe and 1 ¾" Dia anchor bolts:
Anchor Bolts 1 ¾" Dia x 3′-10"
Drilled Shaft Dia 42"
Vertical Reinforcing 12 ~ #10 bars
Spiral C = #4 at 6" pitch Grade 60.
Misc. handhole, base plate, anchor bolt, and foundation details are shown on COSSF.

Step 5: Determine drilled shaft length from COSS-FD.
Enter the appropriate graph (for 42" Dia drilled shaft in clay soil) from the bottom with N = 15. Proceed upward interpolating moment curves (solid lines) to locate 244 Kip-ft. Project to the left side of the graph to determine the required embedment length, i.e., 12′.
Repeat the procedure for torsion curves (dashed lines) to locate 162 Kip-ft. The embedment length required to satisfy torsion is 14′. Add 3′-0" to the longer length to obtain a required drilled shaft length of 17′.

SELECTION EXAMPLE DOUBLE CANTILEVER SPAN

Given: Short span, A = 9′; Long Span, B = 25′; Total Cantilever Span = 34′; Column Height, H = 24′; Design Wind Height, Hd = 26′; Avg. Penetrometer Value, N = 20 (clay type soil); Wheeler County.

Step 1: Select applicable COSS standard.
From Wind Velocity and Ice Zone sheet determine that Wheeler County is in Zone 2 (90 mph) and is above the ice line. Since Design Wind Height is less than 30′ use standard COSS-Z2I. If Design Wind Height is more than 30′, use HCOSS-Z1.

Step 2: Determine tower details from COSS-Z2I.
Use column height = 24′. Round total span length up to the next longer tabulated length span, i.e., 35′. If total span length is greater than 40′, a special design would be required.
Tower details are:
Tower pipe 30" Dia with min. wall thickness = 0.310"
Base Plate 40 ½" Dia x 1 ¾"
Anchor bolts 8 ~ 2" Dia on 35 ¾" bolt circle
Horizontal deflection of tower at ℄ truss = 0.574-0.316 = 0.26".
During installation, double nuts at base plate may be used to plumb tower and compensate for horizontal deflection.
Design Moment = 403 Kip-ft (use total span = 35′)
Design Torsion = 136 Kip-ft (use long span = 25′)

Step 3: Determine truss details from COSS-Z2I.
Read from small table at bottom of sheet 2 of 2 for Span A = 9′ (use 10′):
Chord L 3 x 3 x 3/16 (HYC) with 3 bolt connection at splice
D.L. Diag. L 2 x 2 x 3/16 (HYC) with 2 bolt connection
W.L. Diag. L 3 x 3 x 3/16 (HYC) with 2 bolt connection
D.L. Vert. L 2 x 2 x 3/16 (HYC) with 2 bolt connection
W.L. Strut. L 2 x 2 x 3/16 (HYC) with 1 bolt connection
Bolts are ⅝" Dia high strength.
D.L. of truss = 42 lb/ft.
Span B = 25′:
Chord L 3 x 3 x 1/4 (HYC) with 4 bolt connection at tower
D.L. Diag. L 2 x 2 x 3/16 (HYC) with 2 bolt connection
W.L. Diag. L 3 x 3 x 3/16 (HYC) with 2 bolt connection
D.L. Vert. L 2 x 2 x 3/16 (HYC) with 2 bolt connection
W.L. Strut. L 2 x 2 x 3/16 (HYC) with 1 bolt connection
Bolts are ⅝" Dia high strength with 3 ~ ¾" Dia bolt alternate for chord connection at tower.
D.L. of truss = 47 lb/ft.
Truss defl. at free end = 0.2" for Span A, = 1.3" for Span B.
The fabricator shall compensate for deflections by offsetting bolt holes between upper and lower chords at splice and at truss-to-tower connection. Top chord shall be shortened between the tower and the splice to achieve the required offset.

Step 4: Determine foundation details. Use standard COSSF.
From COSSF with 30" Dia pipe and 2" Dia anchor bolts:
Anchor bolts 2" Dia x 4′-3"
Drilled shaft Dia 54"
Vertical Reinforcing 18 ~ #10 bars
Spiral C = #4 at 6" pitch Grade 60
Misc. handhole, base plate, anchor bolt, and foundation details are shown on COSSF.

Step 5: Determine drilled shaft length from COSS-FD.
Enter the appropriate graph (for 54" Dia drilled shaft in clay type soil) from the bottom with N = 20. Proceed upward interpolating moment curves (solid lines) to locate 403 Kip-ft. Project to the left side of graph to determine required embedment length, i.e., 13′.
Repeat the procedure for the torsion curves (dashed lines) to locate 136 Kip-ft. Embedment length required to satisfy torsion is 9′.
Add 3′ to the longer length to obtain required drilled shaft length of 16′.

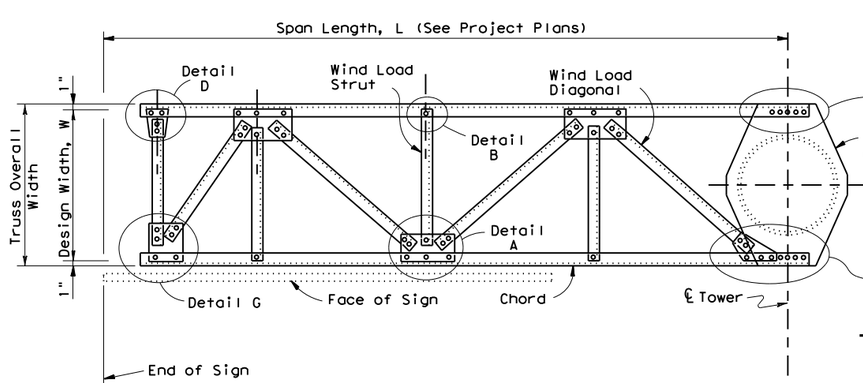
Texas Department of Transportation
Traffic Operations Division

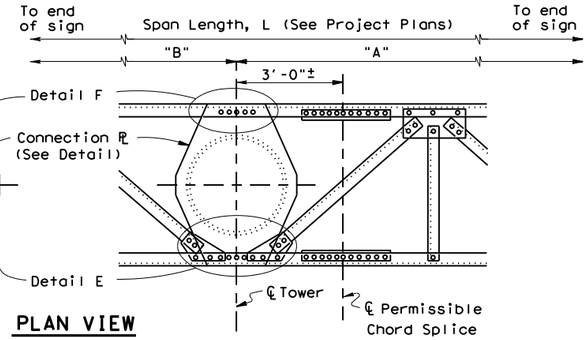
CANTILEVER OVERHEAD SIGN SUPPORTS SELECTION EXAMPLES

COSS-SE

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
REVISIONS			

CONT	SECT	JOB	HIGHWAY
0902	90	108	VA
DIST	COUNTY		SHEET NO.
FTW	TARRANT		72



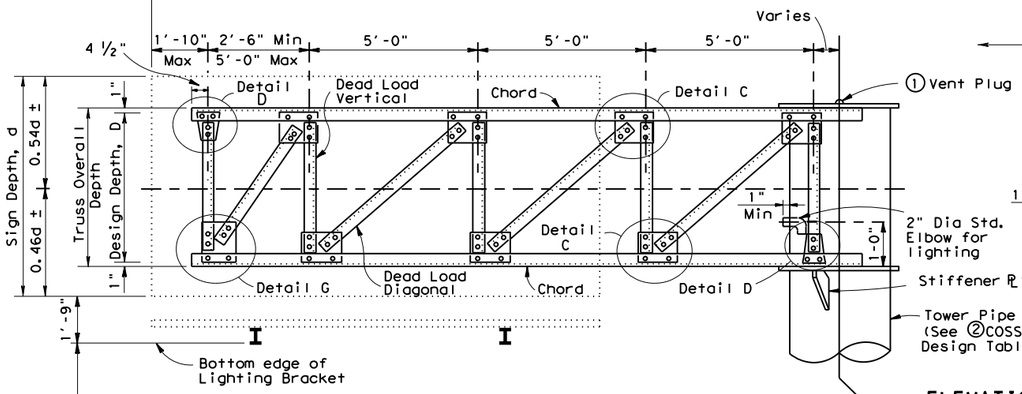


PLAN VIEW

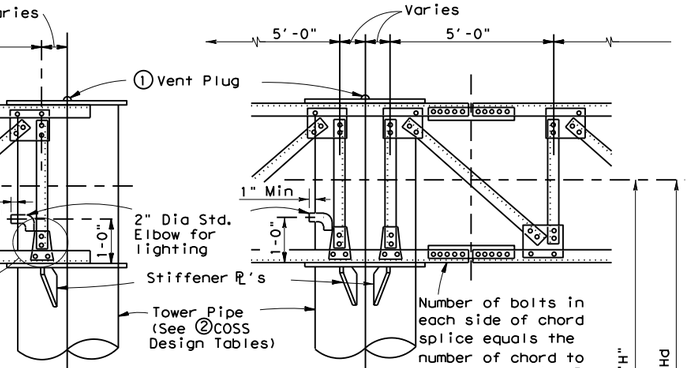
GENERAL NOTES:

Design conforms to 1975 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals and Interim revisions thereto. Connection details are typical only. Actual size of member and number of bolts will vary. The details on this sheet are intended as a guide only. See "Cantilever Overhead Sign Supports" or "High Level Cantilever Overhead Sign Supports" sheets for number of bolts and size of members.

Gusset plates to be same thickness as thickest web member in connection.

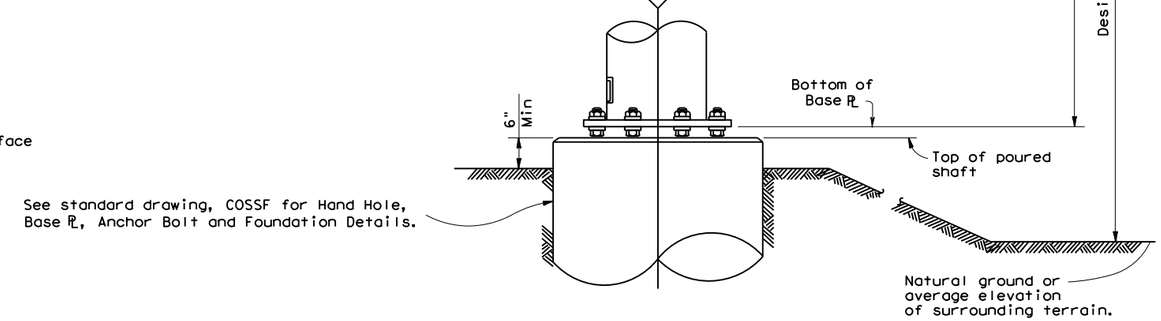


SINGLE CANTILEVER



ELEVATION

DOUBLE CANTILEVER



① Note: Cap shall be solid steel sheet ⅜" nominal thickness. Drill, tap and plug galvanizing vent. Weld plate to pipe with ⅜" weld all around.

② For COSS design tables see standard drawing, "Cantilever Overhead Sign Supports" or "High Level Cantilever Overhead Sign Supports".

Texas Department of Transportation
Traffic Operations Division

CANTILEVER OVERHEAD SIGN SUPPORT DETAILS

COSSD

REVISIONS

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

CONT	SECT	JOB	HIGHWAY
0902	90	108	VA

DIST	COUNTY	SHEET NO.
FTW	TARRANT	73

66A

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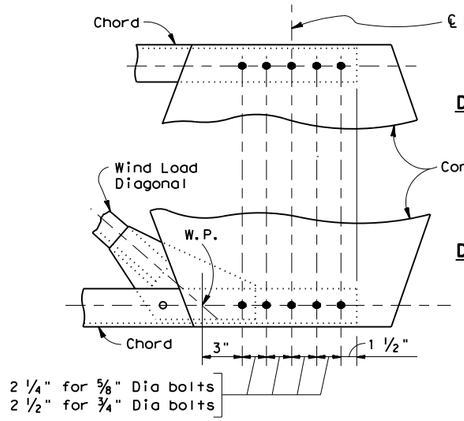
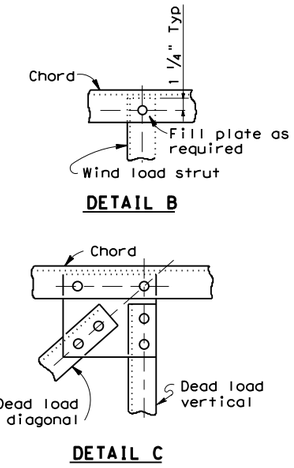
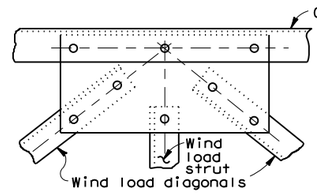


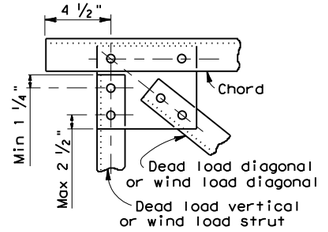
SINGLE CANTILEVER

DOUBLE CANTILEVER

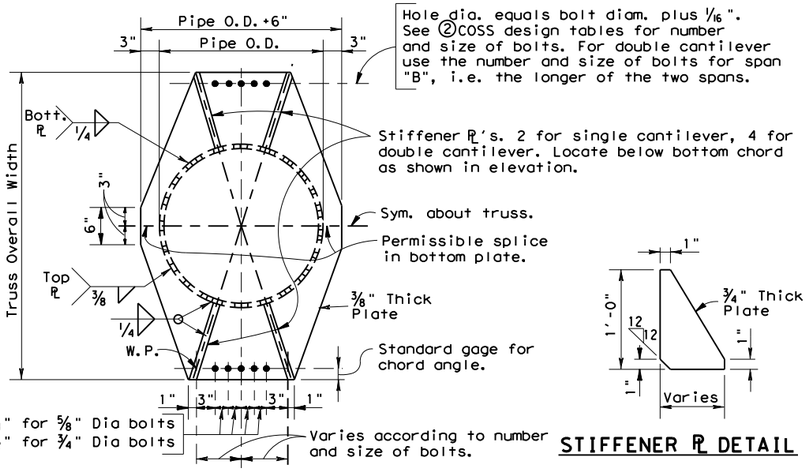


CONNECTION DETAILS



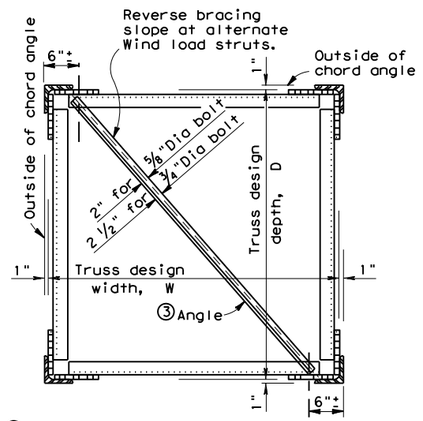


TOTAL NO. OF BOLTS IN DIAG'S. IN JOINT	NUMBER OF BOLTS REQD. IN GUSSET ℄ TO CHORD CONNECTION
0	2
2	2
3	3
4	3
5	4
6	4
8	5
10	6



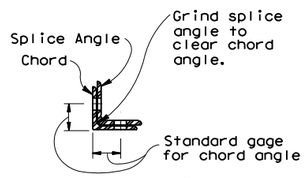
CONNECTION PLATE DETAIL

STIFFENER ℄ DETAIL

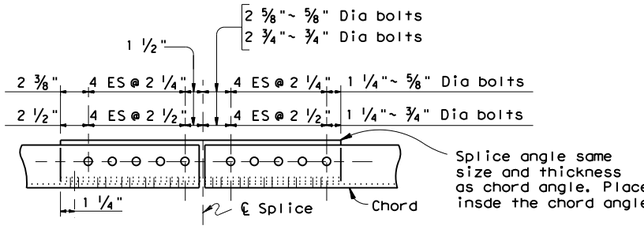


③2" x 2" x 3/16" angle for ⅝" Dia bolts [1]
2½" x 2" x 3/16" angle for ¾" Dia bolts [1]

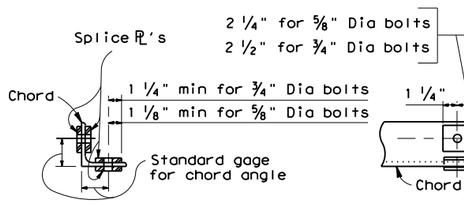
TRUSS SECTION
(DIAGONALS NOT SHOWN)



SECTION ON ℄ SPLICE



SINGLE SHEAR CHORD SPLICE



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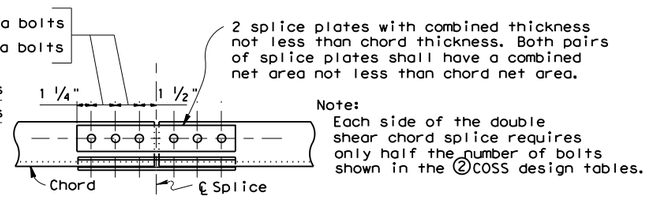
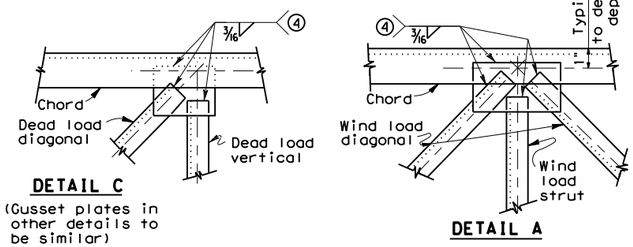


DOUBLE SHEAR CHORD SPLICE

SPLICE DETAILS



ALTERNATE WELDED CONNECTION DETAILS

④MINIMUM LENGTH OF 3/16" FILLET WELD REQUIRED		
NUMBER OF BOLTS	TO REPLACE ⅝" DIA BOLTS	TO REPLACE ¾" DIA BOLTS
1	2"	3"
2	4"	6"
3	6"	9"
4	8"	11 ½"
5	10"	14 ½"
6	12"	17 ½"
7	14"	20"

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SHEET 2 OF 2

Texas Department of Transportation
Traffic Operations Division

CANTILEVER OVERHEAD SIGN SUPPORT DETAILS

COSSD

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
REVISIONS			

CONT	SECT	JOB	HIGHWAY
0902	90	108	VA
DIST	COUNTY		SHEET NO.
FTW	TARRANT		74

Washers shall conform to ASTM F436.

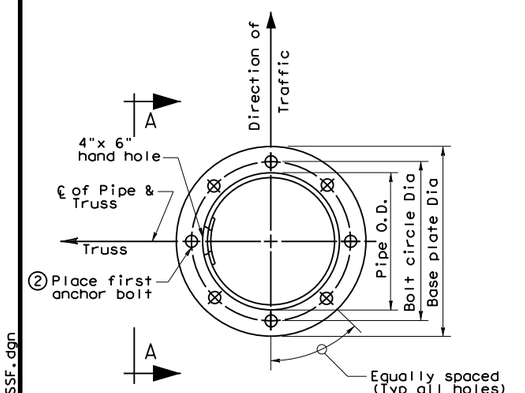
ANCHOR BOLT DIA. d	WASHER DIMENSIONS: OUTSIDE DIAMETER	HOLE DIAMETER	THICKNESS MIN.	THICKNESS MAX.	HOLE IN BASE PLATE
1 ½" or less	2d	d + ⅛"	0.136"	0.177"	d + ¼"
1 ¾"	2d - ⅛"	d + ⅛"	0.178"	0.280"	d + 5/16"
2"	2d - ¼"	d + ⅛"	0.178"	0.280"	d + 5/16"
Over 2"	2d - ½"	d + ⅛"	0.240"	0.340"	d + 5/16"

ANCHOR BOLT SIZE: DIA	BOLT ① LENGTH	THREAD ① LENGTH	PROJECTION LENGTH	GALVAN. ① LENGTH
1 ¼"	2'-11"	5"	5 ¼"	11 ¼"
1 ⅜"	3'-1"	5 ½"	5 ¾"	11 ¾"
1 ½"	3'-4"	6"	6 ¼"	1'-0 ¼"
1 ¾"	3'-10"	7"	7 ¼"	1'-1 ¼"
2"	4'-3"	8"	8 ¼"	1'-2 ¼"
2 ¼"	4'-9"	9"	9 ¼"	1'-3 ¼"
2 ½"	5'-2"	10"	10 ¼"	1'-4 ¼"
2 ¾"	5'-8"	11"	11 ¼"	1'-5 ¼"
3"	6'-1"	1'-0"	1'-0 ¼"	1'-6 ¼"

① Anchor Bolt Fabrication Tolerances:
Bolt Length ~ ±½"
Thread Length ~ ±½"
Galvanized Length ~ -¼"

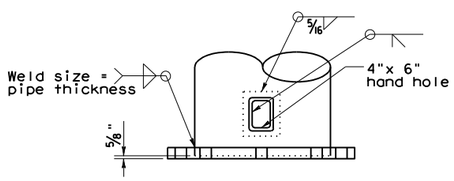
ANCHOR BOLT SIZE	PIPE OUTSIDE DIAMETER 16": BOLT CIRCLE DIA	16": DRILLED SHAFT SIZE	16": DRILLED SHAFT REINF	20": BOLT CIRCLE DIA	20": DRILLED SHAFT SIZE	20": DRILLED SHAFT REINF	24": BOLT CIRCLE DIA	24": DRILLED SHAFT SIZE	24": DRILLED SHAFT REINF	30": BOLT CIRCLE DIA	30": DRILLED SHAFT SIZE	30": DRILLED SHAFT REINF
1 ¼"Dia x 2'-11"	20 ½"	36" Dia	14-#8 (A)	24 ½"	36" Dia	14-#8 (A)						
1 ⅜"Dia x 3'-1"	20 ¾"	36" Dia	12-#9 (A)	24 ¾"	36" Dia	12-#9 (A)						
1 ½"Dia x 3'-4"	21"	36" Dia	12-#9 (A)	25"	42" Dia	14-#9 (A)	29"	42" Dia	14-#9 (C)			
1 ¾"Dia x 3'-10"	21 ½"	36" Dia	10-#10(A)	25 ⅜"	42" Dia	12-#10(B)	29 ⅜"	42" Dia	12-#10(C)	35 ⅜"	48" Dia	16-#10(C)
2"Dia x 4'-3"	22"	36" Dia	12-#10(A)	25 ¾"	42" Dia	12-#10(B)	29 ¾"	48" Dia	16-#10(C)	35 ¾"	54" Dia	18-#10(C)
2 ¼"Dia x 4'-9"	22 ½"	36" Dia	10-#11(A)	26"	42" Dia	10-#11(B)	30"	48" Dia	14-#11(C)	36"	54" Dia	14-#11(D)
2 ½"Dia x 5'-2"				26 ½"	42" Dia	12-#11(B)	30 ½"	48" Dia	16-#11(C)	36 ½"	54" Dia	16-#11(D)
2 ¾"Dia x 5'-8"							31 ½"	48" Dia	18-#11(D)	37"	54" Dia	20-#11(D)
3"Dia x 6'-1"										37 ½"	54" Dia	24-#11(D)

A = #3 Plain spiral at 6" pitch (Grade 40)
B = #4 Plain spiral at 6" pitch (Grade 40)
C = #4 Plain spiral at 6" pitch (Grade 60)
D = #4 Plain spiral at 3 ½" pitch (Grade 60)



PLAN

② See "Cantilever Overhead Sign Support" or "High Lever Cantilever Overhead Sign Support" sheets for number and size.

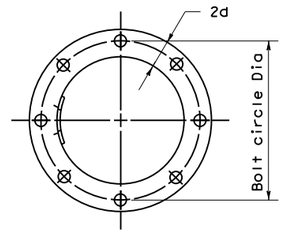


Cut 5" x 7" hole in pipe. Center 4" x 6" hand hole in ⅜" x 8" x 10" back up plate. Provide attachable cover made from section cut from pipe.

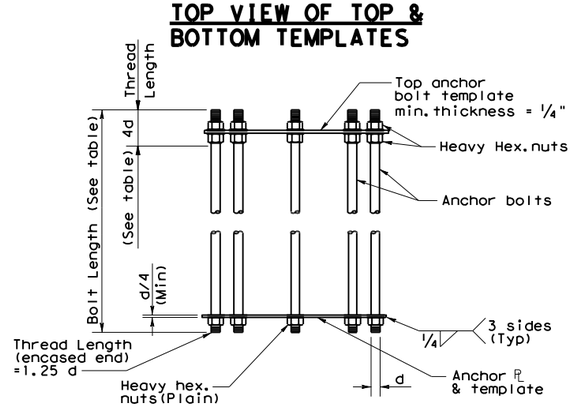
VIEW A-A

③ BASE PLATE & HANDHOLE DETAILS

③ See "Cantilever Overhead Sign Support" or "High Level Cantilever Overhead Sign Support" sheets for Diameter and thickness of base plate.

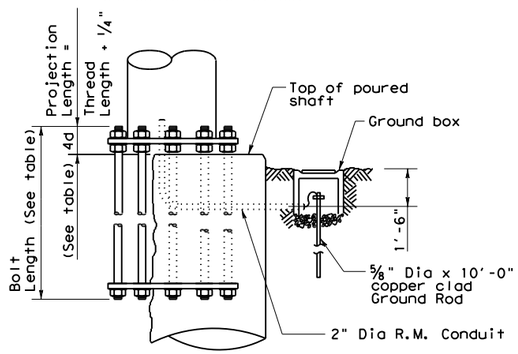


TOP VIEW OF TOP & BOTTOM TEMPLATES

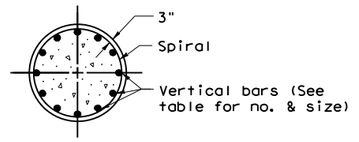


ANCHOR BOLT ASSEMBLY

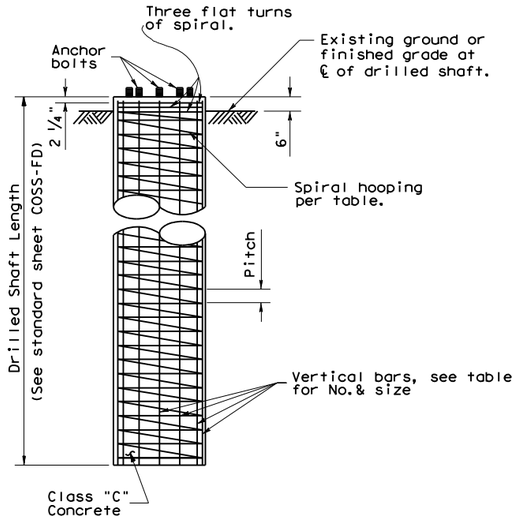
(PRIOR TO INSTALLATION)



BEARING SEAT ELEVATION



SECTION



FOUNDATION DETAIL

GENERAL NOTES:

Concrete shall be Class "C".
Reinforcing shall conform to Item 440, "Reinforcing Steel".
Anchor bolts and nuts for anchor bolts shall be "Alloy Steel" per Item 449, "Anchor Bolts".
Anchor bolts shall be rigidly held in position during concrete placement using steel templates at the top and bottom. The top templates shall be removed after the concrete has set.
Lubricate and tighten anchor bolts when erecting the structure per Item 449, "Anchor Bolts". After the structure has been aligned in its final position and the anchor bolts have been properly tightened, tack weld anchor bolt nuts to washer, and tack weld washers to base plate. Galvanizing in tack welded areas shall be repaired in accordance with Item 445, "Galvanizing".
All vertical reinforcing shall be carried to the bottom of the Drilled Shaft.

Texas Department of Transportation
Traffic Operations Division

CANTILEVER OVERHEAD SIGN SUPPORT FOUNDATION

COSSF

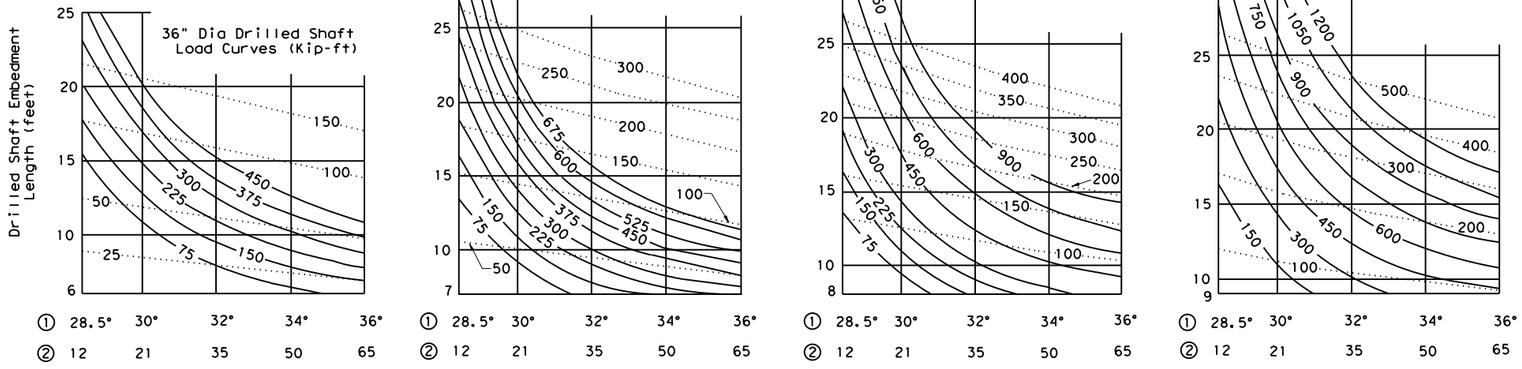
REVISIONS

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

CONT	SECT	JOB	HIGHWAY
0902	90	108	VA

DIST	COUNTY	SHEET NO.
FTW	TARRANT	75

DATE: 4/29/2021 11:07:21 AM
FILE: T:\TRAFFIC\ITS\0902-90-108 Non-Site Specific ITS\Standards\COSSF.dgn



① Ø = Angle of internal friction of soil (degrees)

② N = Texas cone penetrometer value (blows per ft)

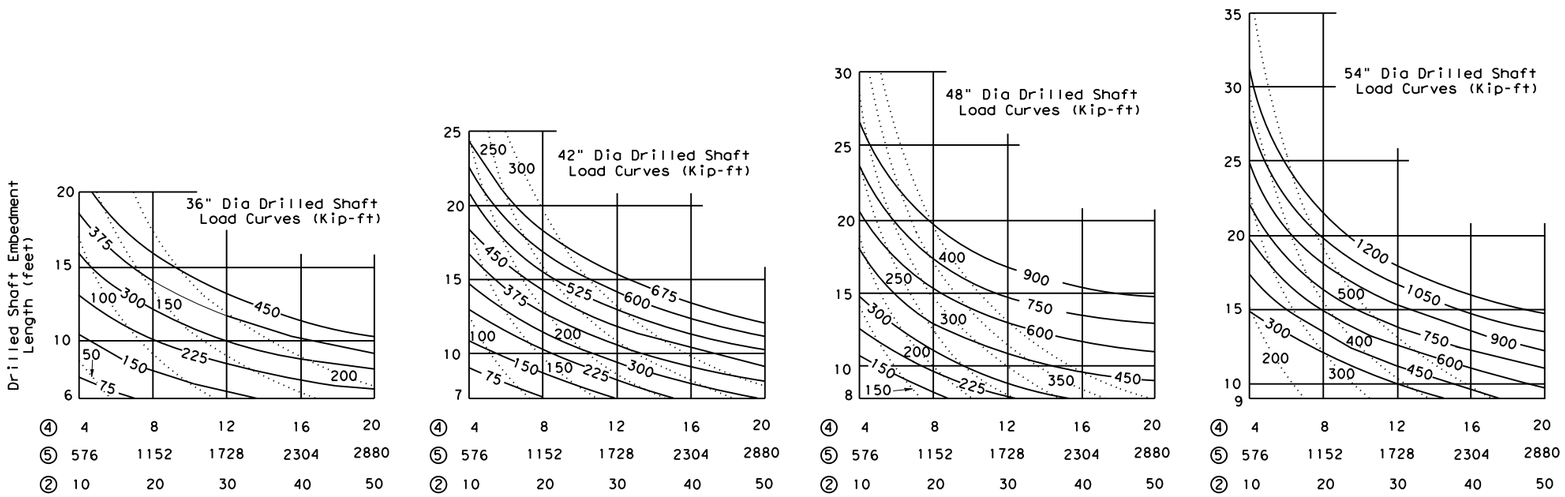
④ C(psi) = Cohesive shear strength of soil (psi)

⑤ C(psf) = Cohesive shear strength of soil (psf)

③ SUBMERGED SAND SOIL (COHESIONLESS)

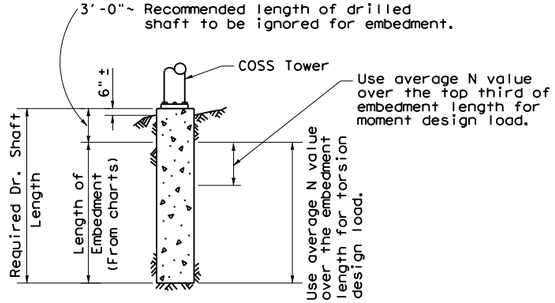
Moment ——————
Torsion ·····

③ Note:
For unsubmerged sands and clayey sands the charts for clay soil will give a conservative foundation design.



CLAY SOIL (COHESIVE)

Moment ——————
Torsion ·····



PROCEDURE:

1. Determine design moment and torsion, and the required drilled shaft diameter as outlined in the selection example sheet COSS-SE.
2. Make an initial estimate of the required embedment length.
3. From soil exploration data determine type of soil and average N value or soil property along the upper third of the drilled shaft.
4. Enter chart (for the correct shaft diameter and soil type) from the bottom at the average N value or soil property determined in step 3.
5. Proceed vertically into chart and locate intersection with design moment. Interpolate between moment curves (solid lines) as needed.
6. From intersection point turn 90° to left and read embedment length along vertical scale.
7. If embedment length differs significantly from estimated value return to step 3 with the embedment length determined in step 6.
8. From soil exploration data determine average N value or soil property over the entire length of the embedment.
9. Enter chart (for correct shaft diameter and soil type) from the bottom at the average N value or soil property determined in step 8.
10. Proceed vertically into chart and locate intersection with design torsion. Interpolate between torsion curves (dashed lines) as needed.
11. From intersection point turn 90° to left and read embedment length along vertical scale.
12. Compute the required length of drilled shaft by adding 3'-0" to longer embedment length required for moment or torsion.

GENERAL NOTES:

These charts are for use with Cantilever Overhead Sign Supports with one shaft per tower.
Solid curves are base moment in Kip-ft.
Dash curves are base torsion in Kip-ft.
Minimum embedment of drilled shaft is two diameters.
Add 3'-0" to the required embedment length to determine the required length of drilled shaft.

Texas Department of Transportation
Traffic Operations Division

FOUNDATION EMBEDMENT SELECTION CHARTS

COSS-FD

REVISIONS

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

CONT	SECT	JOB	HIGHWAY
0902	90	108	VA
DIST	COUNTY		SHEET NO.
FTW	TARRANT		76

DATE: 4/29/2021 11:07:23 AM
FILE: T:\TRAFFIC\ITS\0902-90-108 Non-Site Specific ITS\Standards\COSS-FD.dgn

ZONE 1 100 MPH WIND

TOWER HEIGHT (ft)	10' SPAN TOWER PIPE O.D. (in)	WALL THICK (in)	DEFL ΔH (in)	ANCHOR BOLTS SIZE DIA (in)	NO.	BOLT CIR DIA	BASE PLATE SIZE (in)	TRUSS DEFL ΔV (in)	DESIGN LOADS SHEAR V (Kips)	TORSION T (K-ft)	MOMENT M (K-ft)	15' SPAN TOWER PIPE O.D. (in)	WALL THICK (in)	DEFL ΔH (in)	ANCHOR BOLTS SIZE DIA (in)	NO.	BOLT CIR DIA	BASE PLATE SIZE (in)	TRUSS DEFL ΔV (in)	DESIGN LOADS SHEAR V (Kips)	TORSION T (K-ft)	MOMENT M (K-ft)	20' SPAN TOWER PIPE O.D. (in)	WALL THICK (in)	DEFL ΔH (in)	ANCHOR BOLTS SIZE DIA (in)	NO.	BOLT CIR DIA	BASE PLATE SIZE (in)	TRUSS DEFL ΔV (in)	DESIGN LOADS SHEAR V (Kips)	TORSION T (K-ft)	MOMENT M (K-ft)	25' SPAN TOWER PIPE O.D. (in)	WALL THICK (in)	DEFL ΔH (in)	ANCHOR BOLTS SIZE DIA (in)	NO.	BOLT CIR DIA	BASE PLATE SIZE (in)	TRUSS DEFL ΔV (in)	DESIGN LOADS SHEAR V (Kips)	TORSION T (K-ft)	MOMENT M (K-ft)	TOWER HEIGHT (ft)
25'	16	0.375	0.240	1 ½	8	21"	25 x1 ¾	0.2	6.46	27.82	153.70	16	0.531	0.384	1 ¾	8	21 ½"	26 x2 ¼	0.5	9.30	62.60	225.51	20	0.438	0.411	2	8	25 ¾"	30½x2 ⅛	0.8	12.34	111.29	300.38	24	0.469	0.356	2	8	29 ¾"	34½x2 ⅛	0.9	15.37	173.89	375.94	25'
26'	↑	0.375	0.250	↑	↑	↑	25 x1 ¾	↑	6.49	↑	160.15	↑	0.531	0.415	1 ¾	↑	21 ½"	26 x2 ¼	↑	9.33	↑	234.80	↑	0.438	0.444	↑	↑	↑	30½x2 ⅛	↑	12.37	↑	312.67	↑	0.469	0.385	2	↑	29 ¾"	34½x2 ⅛	↑	15.41	↑	391.21	26'
27'	↑	0.406	0.260	↑	↑	↑	25 x1 ¾	↑	6.52	↑	166.65	↑	0.531	0.448	1 ¾	↑	21 ½"	26 x2 ¼	↑	9.36	↑	244.12	↑	0.469	0.449	↑	↑	↑	30½x2 ¼	↑	12.41	↑	325.01	↑	0.500	0.391	2	↑	29 ¾"	34½x2 ¼	↑	15.46	↑	406.54	27'
28'	↑	0.438	0.260	↑	↑	↑	25 x1 ⅞	↑	6.55	↑	173.18	↑	0.656	0.400	2	↑	22"	27 x2 ⅜	↑	9.39	↑	253.47	↑	0.500	0.455	↑	↑	↑	↑	↑	12.44	↑	337.38	↑	0.500	0.421	2 ¼	↑	30"	35 x2 ¼	↑	15.50	↑	421.92	28'
29'	↑	0.469	0.260	1 ½	↑	21"	25 x1 ⅞	↑	6.58	↑	179.73	↑	0.656	0.429	↑	↑	↑	27 x2 ⅜	↑	9.42	↑	262.85	↑	0.500	0.488	↑	↑	↑	↑	↑	12.48	↑	349.80	↑	↑	0.451	↑	↑	↑	↑	↑	15.54	↑	437.35	29'
30'	↑	↑	0.270	1 ¾	↑	21 ½"	26 x1 ⅞	↑	6.61	↑	186.32	↑	0.687	0.441	↑	↑	↑	27 x2 ½	↑	9.45	↑	272.26	↑	0.531	0.495	↑	↑	↑	30½x2 ¼	↑	12.52	↑	362.25	↑	0.500	0.483	↑	↑	↑	↑	↑	15.59	↑	452.82	30'
31'	↑	↑	0.290	↑	↑	↑	26 x 2	↑	6.64	↑	192.94	↑	↑	0.471	↑	↑	↑	↑	↑	9.48	↑	281.70	↑	0.562	0.501	2	↑	25 ¾"	30½x2 ⅜	↑	12.55	↑	374.75	↑	0.531	0.488	↑	↑	↑	↑	0.9	15.63	↑	468.35	31'
32'	↑	0.469	0.310	↑	↑	↑	26 x 2	↑	6.67	↑	199.59	↑	↑	0.502	↑	↑	↑	↑	↑	9.50	↑	291.17	↑	0.562	0.534	2 ¼	↑	26"	31 x2 ⅜	↑	12.59	↑	387.28	↑	↑	0.520	↑	↑	↑	↑	1.0	15.68	↑	483.93	32'
33'	↑	0.500	0.320	↑	↑	↑	26 x2 ⅛	↑	6.70	↑	206.26	↑	0.687	0.534	↑	↑	↑	↑	↑	9.53	↑	300.68	↑	0.562	0.568	↑	↑	↑	↑	↑	12.63	↑	399.85	↑	↑	0.553	↑	↑	↑	35 x2 ¼	↑	15.72	↑	499.55	33'
34'	↑	0.500	0.330	↑	↑	↑	↑	↑	6.73	↑	212.97	↑	0.750	0.525	2	↑	22"	27 x2 ½	↑	9.56	↑	310.21	↑	0.594	0.573	↑	↑	↑	31 x2 ⅜	↑	12.66	↑	412.46	↑	↑	0.587	2 ¼	↑	30"	35 x2 ⅜	↑	15.76	↑	515.23	34'
35'	↑	0.500	0.350	↑	↑	↑	↑	↑	6.75	↑	219.70	↑	↑	0.557	2 ¼	↑	22 ½"	28 x2 ⅝	↑	9.59	↑	319.77	↑	0.594	0.607	↑	↑	↑	31 x2 ½	↑	12.70	↑	425.11	↑	0.531	0.622	2 ½	↑	30 ½"	36 x2 ⅜	↑	15.81	↑	530.95	35'
36'	↑	0.531	0.350	↑	↑	↑	26 x2 ⅛	↑	6.78	↑	226.47	↑	↑	0.589	↑	↑	↑	28 x2 ⅝	↑	9.62	↑	329.37	↑	0.594	0.643	↑	↑	↑	31 x2 ⅝	↑	12.74	↑	437.80	↑	0.562	0.624	↑	↑	↑	36 x2 ½	↑	15.85	↑	546.71	36'
37'	↑	0.531	0.370	↑	↑	↑	26 x2 ¼	↑	6.81	↑	233.26	↑	↑	0.622	↑	↑	↑	28 x2 ¾	↑	9.65	↑	338.99	↑	0.625	0.648	↑	↑	↑	31 x2 ⅝	↑	12.77	↑	450.53	↑	0.562	0.659	↑	↑	↑	36 x2 ½	1.0	15.89	↑	562.53	37'
38'	↑	0.531	0.390	↑	↑	↑	↑	↑	6.84	↑	240.08	↑	0.750	0.656	↑	↑	↑	28 x2 ¾	↑	9.65	↑	347.49	↑	0.625	0.684	↑	↑	↑	31 x2 ⅝	↑	12.81	↑	463.29	↑	0.562	0.695	↑	↑	↑	36 x2 ½	1.1	15.94	↑	578.39	38'
39'	↑	0.656	0.350	↑	↑	↑	↑	↑	6.87	↑	246.94	↑	0.843	0.626	↑	↑	↑	28 x2 ⅞	↑	9.71	↑	358.32	↑	0.656	0.689	↑	↑	↑	31 x2 ¾	↑	12.84	↑	476.09	↑	0.594	0.696	↑	↑	↑	36 x2 ⅝	↑	15.98	↑	594.30	39'
40'	↑	0.656	0.360	1 ¾	↑	21 ½"	26 x2 ¼	↑	6.90	↑	253.82	↑	0.843	0.658	↑	↑	↑	28 x2 ⅞	↑	9.74	↑	368.03	↑	0.656	0.725	2 ¼	↑	26"	31 x2 ¾	↑	12.88	↑	488.93	↑	0.594	0.732	↑	↑	↑	36 x2 ⅝	↑	16.03	↑	610.25	40'
42'	↑	0.656	0.400	2	↑	22"	27 x2 ⅜	↑	6.96	↑	267.67	↑	0.843	0.726	↑	↑	↑	28 x 3	↑	9.80	↑	387.55	↑	0.719	0.736	2 ½	↑	26 ½"	31½x2 ¾	↑	12.95	↑	514.72	↑	0.625	0.770	↑	↑	↑	36 x2 ¾	↑	16.11	↑	642.29	42'
44'	↑	0.687	0.420	2	↑	22"	27 x2 ⅜	↑	7.02	↑	281.64	↑	1.031	0.675	↑	↑	↑	28 x 3	↑	9.85	↑	407.18	↑	0.750	0.779	2 ½	↑	26 ½"	31½x2 ⅞	↑	13.03	↑	540.66	↑	0.656	0.808	↑	↑	↑	36 x2 ¾	↑	16.20	↑	674.52	44'
45'	16	0.687	0.440	2	8	22"	27 x2 ⅜	0.2	7.05	27.82	288.67	16	1.218	0.619	2 ¼	8	22 ½"	28 x 3	0.5	9.88	62.60	417.04	20	0.750	0.814	2 ½	8	26 ½"	31½x2 ⅞	0.8	13.06	111.29	553.68	24	0.688	0.809	2 ½	8	30 ½"	36 x2 ¾	1.1	16.24	173.89	690.71	45'

ZONE 1 100 MPH WIND

TOWER HEIGHT (ft)	30' SPAN TOWER PIPE O.D. (in)	WALL THICK (in)	DEFL ΔH (in)	ANCHOR BOLTS SIZE DIA (in)	NO.	BOLT CIR DIA	BASE PLATE SIZE (in)	TRUSS DEFL ΔV (in)	DESIGN LOADS SHEAR V (Kips)	TORSION T (K-ft)	MOMENT M (K-ft)	35' SPAN TOWER PIPE O.D. (in)	WALL THICK (in)	DEFL ΔH (in)	ANCHOR BOLTS SIZE DIA (in)	NO.	BOLT CIR DIA	BASE PLATE SIZE (in)	TRUSS DEFL ΔV (in)	DESIGN LOADS SHEAR V (Kips)	TORSION T (K-ft)	MOMENT M (K-ft)	40' SPAN TOWER PIPE O.D. (in)	WALL THICK (in)	DEFL ΔH (in)	ANCHOR BOLTS SIZE DIA (in)	NO.	BOLT CIR DIA	BASE PLATE SIZE (in)	TRUSS DEFL ΔV (in)	DESIGN LOADS SHEAR V (Kips)	TORSION T (K-ft)	MOMENT M (K-ft)	TOWER HEIGHT (ft)
25'	24	0.531	0.475	2 ¼	8	30"	35 x2 ¼	1.4	18.21	250.41	449.85	30	0.406	0.442	2 ¼	8	36"	41 x 2	1.6	21.34	340.83	529.13	30	0.500	0.502	2 ½	8	36 ½"	42 x2 ¼	2.1	24.18	445.17	606.83	25'
26'	↑	0.531	0.514	↑	↑	↑	35 x2 ¼	↓	18.25	↑	467.86	↑	0.406	0.478	↑	↑	↑	41 x 2	1.7	21.40	↑	550.13	↑	0.500	0.543	↑	↑	↑	42 x2 ¼	2.2	24.23	↑	630.43	26'
27'	↑	0.562	0.526	↑	↑	↑	35 x2 ⅜	↑	18.29	↑	485.93	↑	0.438	0.479	↑	↑	↑	41 x2 ⅛	↑	21.45	↑	571.21	↑	0.500	0.586	↑	↑	↑	42 x2 ⅜	2.3	24.29	↑	654.13	27'
28'	↑	0.562	0.566	↑	↑	↑	35 x2 ⅜	1.4	18.34	↑	504.07	↑	↑	0.515	↑	↑	↑	41 x2 ⅛	↑	21.50	↑	592.37	↑	0.531	0.595	↑	↑	↑	42 x2 ⅜	↑	24.34	↑	677.92	28'
29'	↑	0.562	0.607	2 ¼	↑	30"	35 x2 ⅜	1.5	18.38	↑	522.25	↑	↑	0.552	2 ¼	↑	36"	41 x2 ⅛	↑	21.56	↑	613.61	↑	0.531	0.638	↑	↑	↑	42 x2 ⅜	↓	24.40	↑	701.81	29'
30'	↑	0.594	0.617	2 ½	↑	30 ½"	36 x2 ½	1.5	18.43	↑	540.50	↑	0.438	0.591	2 ½	↑	36 ½"	42 x2 ¼	↓	21.61	↑	634.92	↑	0.531	0.683	↑	↑	↑	42 x2 ½	2.3	24.45	↑	725.77	30'
31'	↑	0.594	0.659	↑	↑	↑	36 x2 ½	1.5	18.47	↑	558.79	↑	0.469	0.591	↑	↑	↑	42 x2 ¼	1.7	21.67	↑	656.31	↑	0.562	0.691	2 ½	↑	36 ½"	42 x2 ½	2.4	24.51	↑	749.82	31'
32'	↑	0.594	0.702	↑	↑	↑	36 x2 ⅝	1.6	18.51	↑	577.14	↑	0.469	0.630	↑	↑	↑	42 x2 ¼	1.8	21.72	↑	677.76	↑	0.562	0.737	2 ¾	↑	37"	43 x2 ½	↑	24.56	↑	773.96	32'
33'	↑	0.625	0.712	↑	↑	↑	36 x2 ⅝	↑	18.56	↑	595.54	↑	0.469	0.670	↑	↑	↑	42 x2 ⅜	↑	21.78	↑	699.28	↑	0.562	0.783	↑	↑	↑	43 x2 ⅝	↑	24.61	↑	798.17	33'
34'	↑	0.625	0.756	↑	↑	↑	36 x2 ⅝	↑	18.60	↑	614.00	↑	0.500	0.669	↑	↑	↑	42 x2 ⅜	↑	21.83	↑	720.87	↑	0.594	0.789	↑	↑	↑	43 x2 ⅝	↓	24.67	↑	822.45	34'
35'	↑	0.656	0.766	↑	↑	↑	36 x2 ¾	↑	18.64	↑	632.50	↑	0.500	0.709	↑	↑	↑	42 x2 ½	↑	21.89	↑	742.53	↑	0.594	0.836	↑	↑	↑	43 x2 ⅝	2.4	24.72	↑	846.81	35'
36'	↑	0.656	0.811	↑	↑	↑	36 x2 ¾	↑	18.69	↑	651.05	↑	0.500	0.750	↓	↑	↑	42 x2 ½	↑	21.94	↑	764.25	↑	0.594	0.885	↑	↑	↑	43 x2 ¾	2.5	24.78	↑	871.25	36'
37'	↑	0.688	0.820	↑	↑	↑	36 x2 ¾	↑	18.73	↑	669.66	↑	0.531	0.749	2 ½	↑	36 ½"	42 x2 ½	↑	22.00	↑	786.04	↑	0.625	0.891	↑	↑	↑	43 x2 ¾	↑	24.83	↑	895.75	37'
38'	↑	0.688	0.865	↑	↑	↑	36 x2 ¾	↑	18.78	↑	688.31	↑	0.531	0.790	2 ¾	↑	37"	43 x2 ⅝	↑	22.05	↑	807.89	↑	0.625	0.940	↑	↑	↑	43 x2 ¾	↓	24.89	↑	920.33	38'
39'	↑	0.719	0.875	2 ½	↑	30 ½"	36 x2 ⅞	↑	18.82	↑	707.01	↑	0.562	0.788	↑	↑	↑	43 x2 ⅝	↑	22.10	↑	829.80	↑	0.656	0.946	↑	↑	↑	43 x2 ¾	↑	24.94	↑	944.97	39'
40'	↑	0.719	0.920	2 ¾	↑	31 ½"	38 x2 ⅞	↑	18.86	↑	725.76	↑	0.562	0.829	↑	↑	↑	43 x2 ¾	↑	22.16	↑	851.78	↑	0.656	0.995	2 ¾	↑	37"	43 x2 ⅞	2.5	25.00	↑	969.68	40'
42'	↑	0.750	0.977	↑	↑	↑	38 x 3	↑	18.95	↑	763.41	↑	0.594	0.868	↑	↑	↑	43 x2 ¾	↓	22.27	↑	895.92	↑	0.688	1.150	3	↑	37 ½"	44 x 3	2.7	25.11	↑	1019.30	42'
44'	↑	0.937	0.877	↑	↑	↑	38 x 3	↓	19.04	↑	801.24	↑	0.625	0.905	↓	↑	↑	43 x2 ¾	1.8	22.38	↑	940.31	↑	0.719	1.106	3	↑	37 ½"	44 x 3	2.6	25.22	↑	1069.19	44'
45'	24	0.937	0.918	2 ¾	8	31 ½"	38 x3 ⅛	1.6	19.08	250.41	820.23	30	0.625	0.947	2 ¾	8	37"	43 x2 ¾	1.9	22.43	340.83	962.59	30	0.719	1.157	3	8	37 ½"	44 x 3	2.6	25.27	445.17	1094.23	45'

GENERAL NOTES :

Design conforms to AASHTO 1994 Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and Interim Revisions thereto.

Steel for tower pipe shall conform to ASTM A53 Grade B or to ASTM A501. Tower pipe wall thickness shown is the minimum allowable. Fabricator may use the wall thickness shown or pipe of the same diameter with greater wall thickness.

All connection bolts shall conform to Item 447, "Structural Bolting". All structural steel, connection bolts, nuts and washers shall be galvanized in accordance with the Specifications.

Compensate for truss deflection at free end by offsetting upper and lower bolt holes at truss-to-tower connection.

For truss details see standard drawing COSSD.

For base and foundation details see standard drawing COSSF.

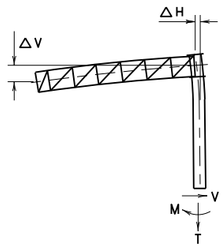
For cantilever truss lengths falling between those shown use sizes called for in the next longer span.

Truss and towers for cantilever sign supports are designed for the equivalent area of a 10'-0" deep sign panel over 100% of the span length. Design includes 3 pounds per foot squared for sign panel and 20 pounds per foot for lights and 50 pounds per foot for walkways all placed as specified for the design sign panel.

Details called for hereon are applicable for Design Wind Heights of 30' to 50' inclusive.

Number of High Strength bolts required in truss connection or splice are indicated in brackets, e.g. [3], after the member size.

Deflections shown include the design loads for Truss, Sign Panel, Lights and Walkways.



ELEVATION

(SHOWING DESIGN LOADS AND DEAD LOAD DEFLECTIONS)

TRUSS DETAILS

SPAN	10', 15', & 20'	25'	30'	35'	40'
W x D = WIDTH x DEPTH	4.5 x 4.5	4.5 x 4.5	4.5 x 4.5	4.5 x 4.5	4.5 x 4.5
CHORD-①, Unless Otherwise Shown	L 3 x 3 x 3/16 ② [3]	L 3 x 3 x 1/4 ② [4]	L 3 ½x3 ½x 5/16 [8]	L 3 ½x3 ½x 5/16 [9]	L 3 ½x3 ½x 3/8 [8]
DEAD LOAD DIAGONAL-②	L 2 x 2 x 3/16 [2]	L 2 x 2 x 3/16 [2]	L 2 x 2 x 3/16 [2]	L 2 x 2 x 3/16 [2]	L 3 x 2 x 3/16 [2]
WIND LOAD DIAGONAL-②	L 3 x 3 x 3/16 [3]	L 3 x 3 x 3/16 [3]	L 3 x2 ½x 1/4 [3]	L 3 x2 ½x 1/4 [4]	L 3 x 3 x 1/4 [3]
DEAD LOAD VERTICAL-②	L 2 x 2 x 3/16 [2]	L 2 x 2 x 3/16 [2]	L 2 x 2 x 3/16 [2]	L 2 x 2 x 3/16 [2]	L 3 x 2 x 3/16 [2]
WIND LOAD STRUT-②	L 2 x 2 x 3/16 [1]	L 2 x 2 x 3/16 [1]	L 2 x 2 x 3/16 [1]	L 2 x 2 x 3/16 [1]	L 2 ½x2 ½x 3/16 [1]
TRUSS DEAD LOAD	42 lb/ft	47 lb/ft	59 lb/ft	60 lb/ft	70 lb/ft
SIZE H. S. BOLTS IN CONNECTION	5/8" DIA	5/8" DIA	5/8" DIA	5/8" DIA	3/4" DIA
NO. & SIZE OF H. S. BOLTS IN CHORD ANGLE TO TOWER CONNECTION PLATE	3 ~ 5/8" DIA ea	5 ~ 5/8" DIA or 3 ~ 3/4" DIA ea	8 ~ 5/8" DIA or 6 ~ 3/4" DIA ea	9 ~ 5/8" DIA or 7 ~ 3/4" DIA ea	8 ~ 3/4" DIA ea

① "Low-Alloy Steel" for non-bridge structures per Item 442, "Metal For Structures".

② "Carbon Steel" for non-bridge structures per Item 442, "Metal For Structures".

Texas Department of Transportation
Traffic Operations Division

HIGH LEVEL CANTILEVER OVERHEAD SIGN SUPPORTS

HCOSS-Z1-10

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

REVISIONS
4-10

CONT	SECT	JOB	HIGHWAY
0902	90	108	VA
DIST	COUNTY		SHEET NO.
FTW	TARRANT		77

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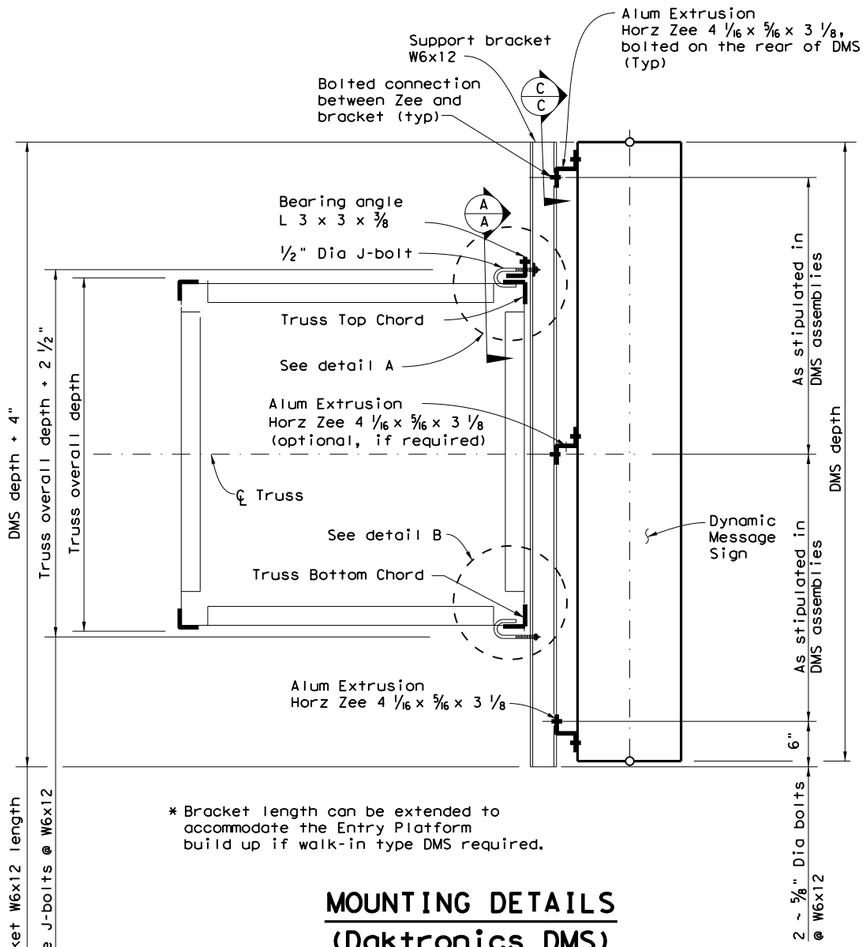
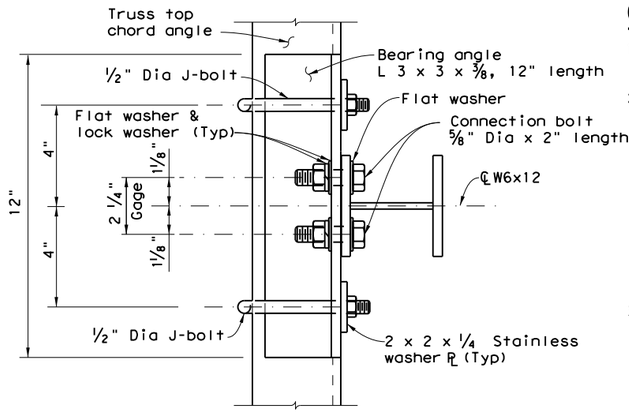
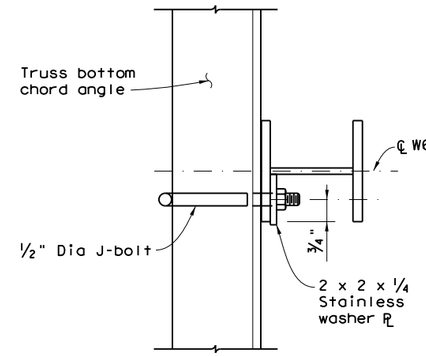


* Bracket length can be extended to accommodate the Entry Platform build up if walk-in type DMS required.

MOUNTING DETAILS (Daktronics DMS)



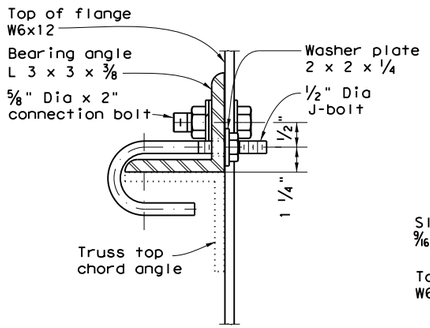
TOP VIEW TRUSS TOP CONNECTION



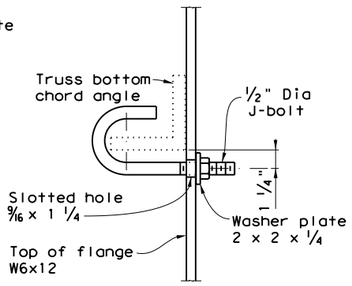
TOP VIEW TRUSS BOTTOM CONNECTION

GENERAL NOTES:

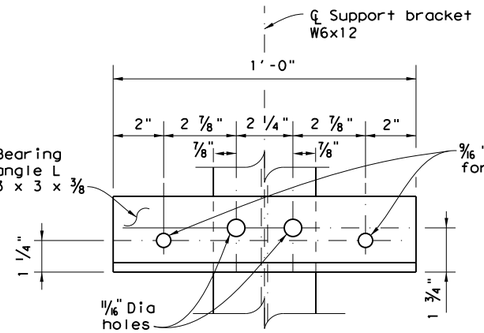
1. Determine the adequacy of the overhead sign support structure to support the dynamic message sign (DMS) prior to attaching the sign to the truss.
2. Designed according to the 1994 edition of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals and Interim Revisions. Designed for a Sustained (Fastest Mile) Wind Velocity of 100 mph with a gust factor of 1.3. Connections are designed for a DMS weight of 3800 lbs. The structural support is designed for an Effective Projected Area (EPA) of 399 sq. ft. based on a DMS nominal width of 29.1 feet and nominal depth of 7.8 feet, with a drag coefficient of 1.7 applied, plus four 1'-8" square flashing beacons with a drag coefficient of 1.2. DMS attachment is designed for a horizontal eccentricity of 2.4 ft. from the face of the truss to the center of gravity of the DMS. Provide an even number of sign supporting brackets (6 minimum), W6x12, spaced at 5'-6" max. The maximum distance between the sign edge to the nearest supporting bracket is 2'-3".
3. Verify applicable field dimensions before fabrication. Determine the required number and spacing of sign support brackets, along with the Aluminum Extrusion Horizontal Zees provided by the DMS manufacturer, to connect the DMS to the truss. For the J-bolt connection of DMS to overhead sign structure, align each arranged sign bracket with its bearing angle to avoid conflict with the truss connection bolts at the point of attachment.
4. Provide structural steel meeting the requirements of ASTM A36, A572 Gr 50 or A588. Provide connection bolts meeting the requirements of ASTM F3125, Grade A325 or A449 with 1 heavy hex nut, 2 flat washers, and 1 lock washer. Provide Type 304 stainless steel J bolt and washer plate, with bolt minimum yield strength of 50 ksi and an elongation of 16 percent in 2 inches. Galvanize all parts except stainless steel
5. Prior to the initialization of DMS mounting, the DMS manufacturer must provide and install the 6061-T6 Aluminum Extrusion Horizontal Zees, 4 1/16 x 5/16 x 3 1/8.
6. The sign support bracket attached to the truss shown here is an example only. Adjust the bracket position along the truss depth to achieve the required vertical clearance to be confirmed by the Engineer.
7. When the structure is to be exposed to a highly corrosive environment, provide elastomeric spacer to separate aluminum alloy parts from direct contact with steel.



DETAIL A

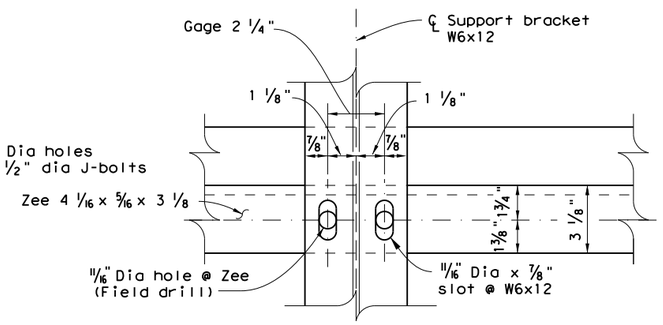


DETAIL B

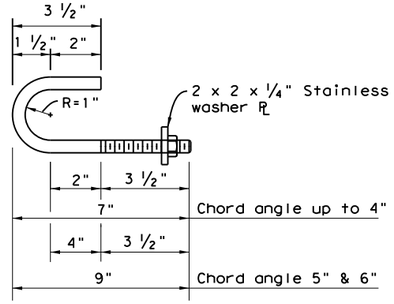


SECTION A-A

(Truss chord angle not shown)



SECTION C-C



1/2" Dia J-BOLT

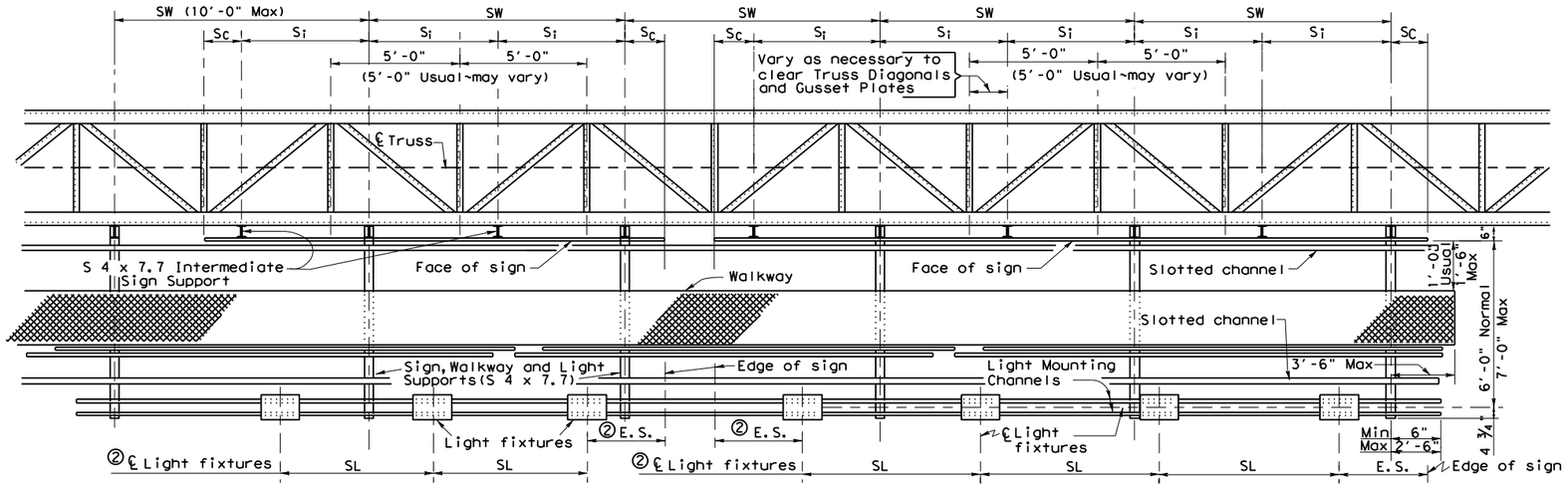
Texas Department of Transportation

Traffic Safety Division Standard

DMS-TO-TRUSS MOUNTING WITH HORIZONTAL ZEE EXTRUSIONS

DMS(HZ-2)-21

FILE: dms(hz-2)-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2021	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		78

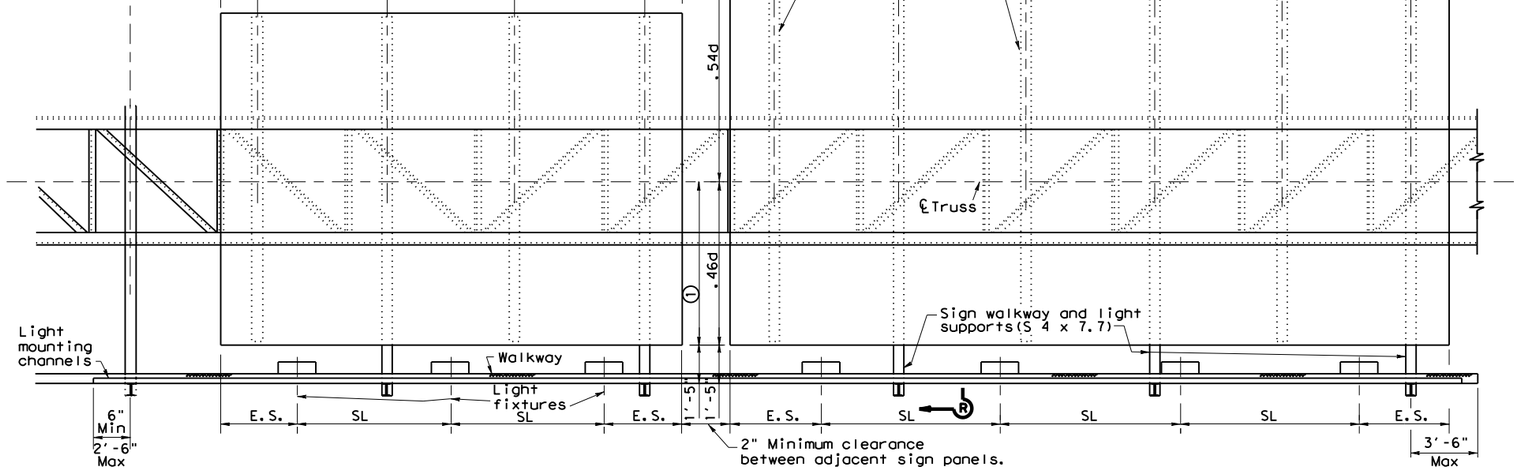


Sc=6" Min and .25 Si Max

② See SL(MV) for light fixture spacing.

PART PLAN

(Showing Truss, Signs, Walkways and Lights)

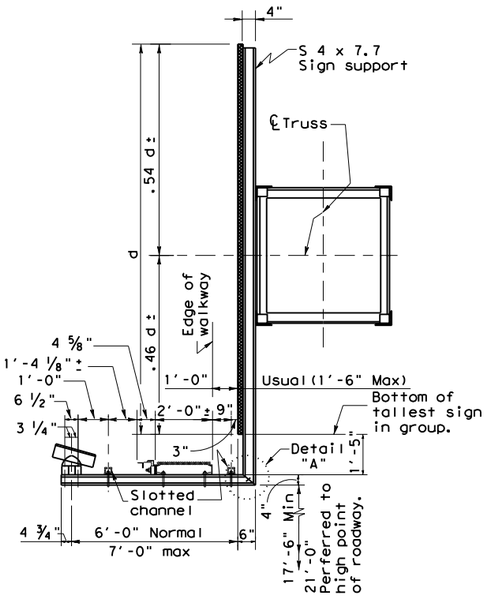


PART ELEVATION

① Where signs of different depths are used, the bottom edge of all signs may be placed in line. Where this is done, all signs should be so positioned that the bottom edges are approximately 0.46 of the depth of the deepest sign below the ℄ of the truss. When signs are spaced thus, Si is determined by the deepest sign.

See sheet SL(MV) for Lighting Details & Spa.S.L. & E.S.
See sheet SWW(1) for Walkway Details.
See sheet SMD(2-4) for Extruded Aluminum Sign Details & Max. Spa. for Si.
Sc = 6" min, .25 Si max.

Note: Exit Number Panel may be supported by sign support brackets as shown hereon, or may be supported as shown on sheet SMD(2-4). Regardless of method used spacing of supports shall not exceed Si.



SECTION R-R

SHEET 1 OF 2

Texas Department of Transportation

Traffic Operations Division Standard

SUPPORT BRACKETS FOR SIGNS, WALKWAYS & LIGHTS

SB(SWL-1)-14

FILE: swl-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT April 2014	CONT	SECT	JOB	HIGHWAY
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	FTW	TARRANT		79

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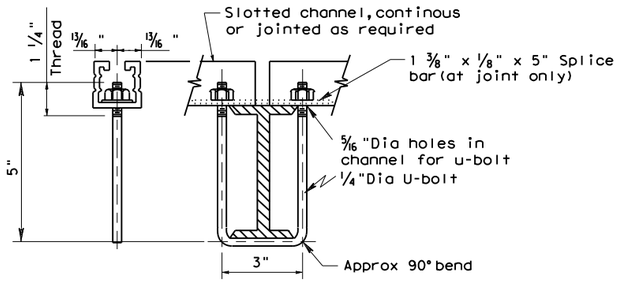
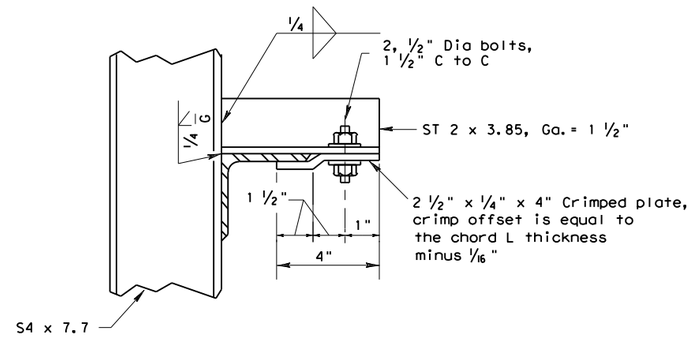
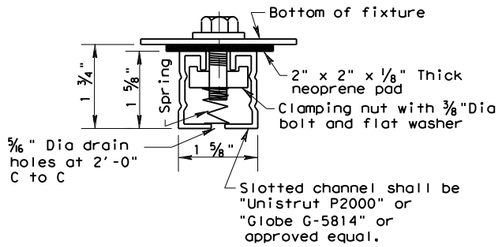


SECTION A-A

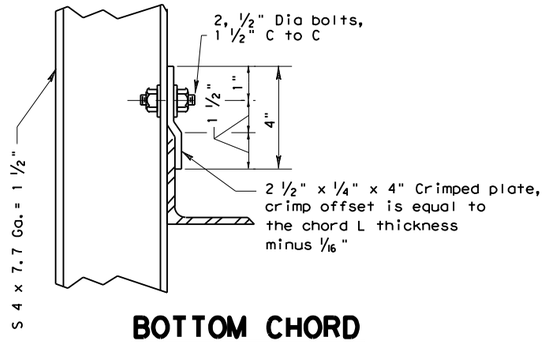


TOP CHORD



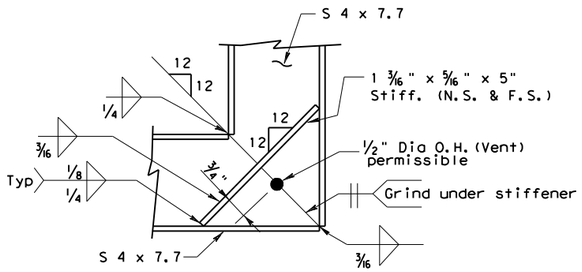
TYPICAL SLOTTED CHANNEL

CONNECTED TO LIGHTING FIXTURE



BOTTOM CHORD

SUPPORT TO TRUSS CONNECTION



DETAIL "A"

GENERAL NOTES:

Design conforms to 1994 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals and Interim revisions thereto.

Materials, fabrication, construction and erection shall conform to Item 654, "Sign Walkways" and with details, dimensions, and weld procedures shown herein. Structural steel shall conform with ASTM A36 unless noted otherwise.

Bolts shall have hexagon heads and nuts and conform with ASTM A307.

All parts shall be galvanized after fabrication per Item 445, "Galvanizing".

Texas Department of Transportation

Traffic Operations Division Standard

SUPPORT BRACKETS FOR SIGNS, WALKWAYS & LIGHTS

SB(SWL-1)-14

FILE: swl-14.DGN	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT April 2014	CONT	SECT	JOB	HIGHWAY
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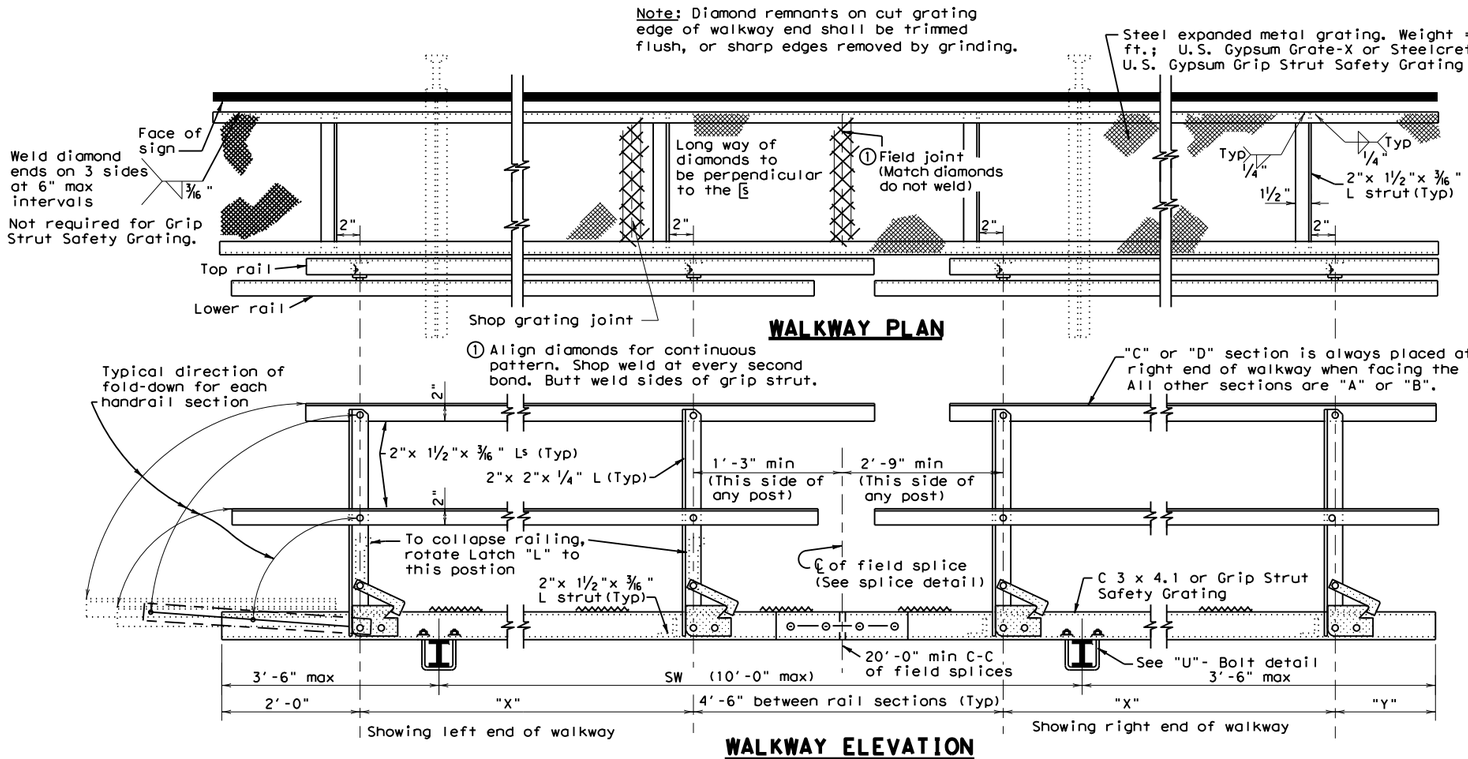
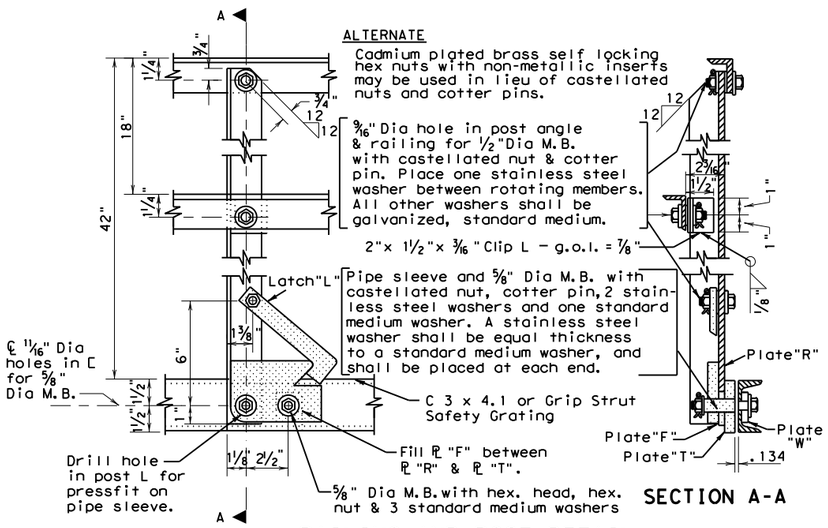
	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		80



10'-0" maximum spacing for Walkway, Lights and Sign Support Bracket spacing, see sheets SL(2), SL(MV), SMD(P-1) PLYWOOD & SMD(A-1) ALUMINUM for other limitations to spacing.

Note: Eliminate C 3 x 4.1 when Grip Strut Safety Grating is used. All other details and materials apply unless otherwise noted.



RAILING AND POST DETAIL

After erection, adjust all castellated nuts to remove only excess play in rotation parts then lock in position with cotter pins. Adjust nut on latch "L" for free latch operation.

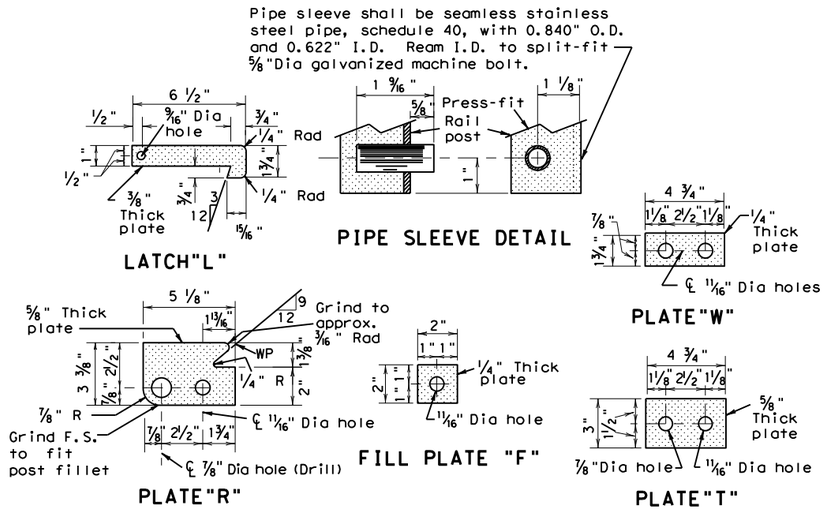


PLATE AND MISCELLANEOUS DETAILS

GENERAL NOTES

Design conforms to AASHTO Specifications for the design and construction of Structural Supports for Highway Signs. Materials, fabrication, construction, and erection shall conform with the specifications.

Structural steel shall conform with ASTM Specification A36. Bolts shall have hexagon heads and nuts and conform with ASTM Specification A307. Stainless steel pipe bushings shall conform with ASTM Specification A312 Type TP 304. Stainless steel washers shall conform with ASTM Specification A167 Type 302. All parts, except stainless steel shall be galvanized after fabrication.

The stainless steel bushings shall be pressed in the rail posts after posts are galvanized.

The walkway and railing shall be shop assembled to check fabrication.

Carlos E. Molina

May 4, 2021

STANDARD PLANS
TEXAS DEPARTMENT OF TRANSPORTATION
Traffic Operations Division

SIGN WALKWAY AND HANDRAIL

SHEET 1 OF 2 — SWW(1)(MOD.)

ORIG DRAW DATE: 2-82	DN: -	CK: -	DW: -	CK: -	NEG NO.:

REVISIONS	STATE DISTRICT	FEDERAL REGION	PROJECT NO.			SHEET
	FTW	6	SEE TITLE SHEET			81
	COUNTY		CONTROL	SECTION	JOB	HIGHWAY
	TARRANT		0902	90	108	VA

DN:	DATE:
CK:	
DW:	ACC:
CK:	FILE:

LEVELS DISPLAYED

1	2	3	4	5	6	7	8	9	10	11	21	31	41	51	61	62
7	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	63
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	64
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63		

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4/29/2021
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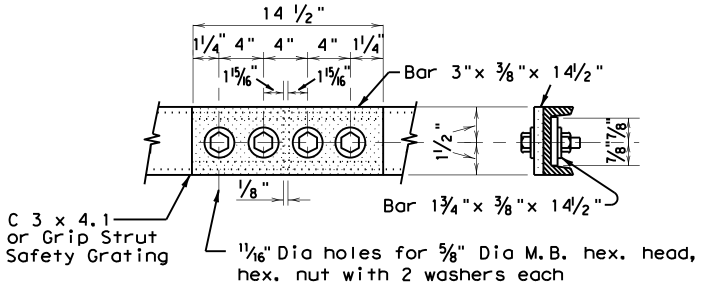
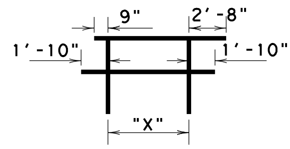
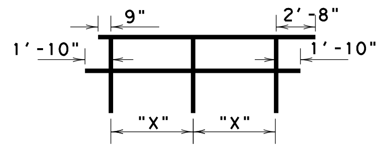


FIELD SPLICE DETAIL

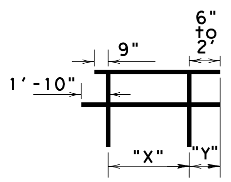
(See WALKWAY ELEVATION for location; sheet 1 of 2)



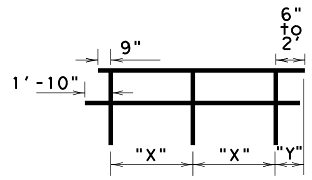
"A" SECTION



"B" SECTION



"C" SECTION

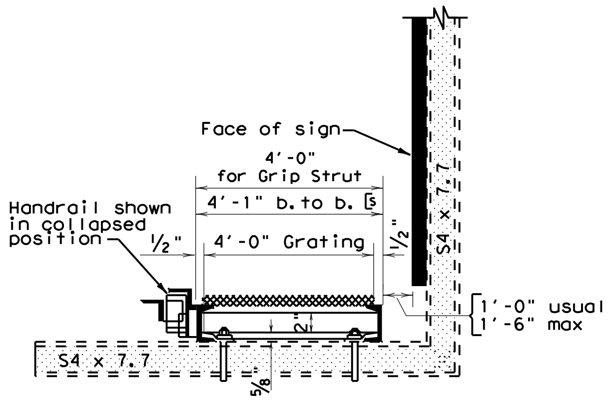


"D" SECTION

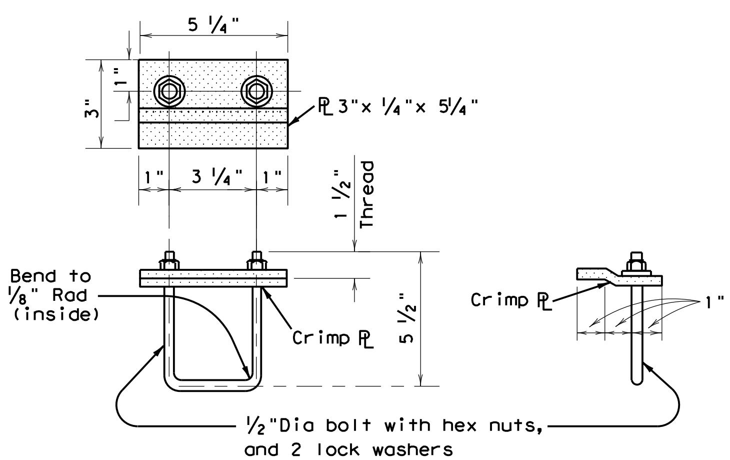
"X" dimension = 8'-0" max. See table for min dimension "X".
"X" shall be the same for all sections in any one walkway.
"Y" dimension = 6" usual, but variable between 6" and 2'-0" to obtain maximum dimension for "X" in even inches.

TYPICAL OF HANDRAIL SECTION

WALKWAY LENGTH	MINIMUM "X" DIMENSION	REQUIRED NO. OF SECTIONS			
		"A"	"B"	"C"	"D"
7'-6" to 12'-0"	1 @ 5'-0"	~	~	1	~
12'-6" to 20'-0"	2 @ 5'-0"	~	~	~	1
20'-6" to 24'-6"	2 @ 6'-9"	1	~	1	~
25'-0" to 32'-6"	3 @ 6'-0"	~	1	1	~
33'-0" to 40'-6"	4 @ 6'-6"	~	1	~	1
41'-0" to 45'-0"	4 @ 7'-4 1/2"	1	1	1	~
45'-6" to 53'-0"	5 @ 6'-9"	~	2	1	~
53'-6" to 61'-0"	6 @ 7'-0"	~	2	~	1
61'-6" to 73'-6"	7 @ 6'-6"	~	3	1	~
74'-0" to 81'-6"	8 @ 7'-3"	~	3	~	1
82'-0" to 94'-0"	9 @ 6'-10"	~	4	1	~
94'-6" to 102'-0"	10 @ 7'-4"	~	4	~	1
102'-6" to 114'-6"	11 @ 7'-0"	~	5	1	~
115'-0" to 122'-6"	12 @ 7'-6"	~	5	~	1



END VIEW OF WALKWAY



U-BOLT AND CLAMP DETAIL

STATE OF TEXAS
CARLOS E. MOLINA
97237
LICENSED PROFESSIONAL ENGINEER

Carlos E. Molina

May 4, 2021

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STANDARD PLANS
TEXAS DEPARTMENT OF TRANSPORTATION
Traffic Operations Division

SIGN WALKWAY AND HANDRAIL

SHEET 2 OF 2

SWW(1) (MOD.)

ORIG DRAW DATE: 2-82	DN:	CK:	DW:	CK:	REG NO.:

REVISIONS	STATE DISTRICT	FEDERAL REGION	PROJECT NO.		SHEET
	FTW	6	SEE TITLE SHEET		82
	COUNTY		CONTROL	SECTION	JOB	HIGHWAY
	TARRANT		0902	90	108	VA

DN: CK: DW: CK:
DATE: ACC: FILE:

FOUNDATION DESIGN TABLE

FDN TYPE	DRILLED SHAFT DIA	REINFORCING STEEL		EMBEDDED DRILLED SHAFT LENGTH-ft ④, ⑤, ⑥			ANCHOR BOLT DESIGN ①				FOUNDATION DESIGN LOAD ②		TYPICAL APPLICATION
		VERT BARS	SPIRAL & PITCH	TEXAS CONE PENETROMETER N blows/ft			ANCHOR BOLT DIA	Fy (ksi)	BOLT CIR DIA	ANCHOR TYPE	MOMENT K-ft	SHEAR Kips	
				10	15	40							
24-A	24"	4- #5	#2 at 12"	5.7	5.3	4.5	¾"	36	12 ¾"	1	10	1	Pedestal pole, pedestal mounted controller.
30-A	30"	8- #9	#3 at 6"	11.3	10.3	8.0	1 ½"	55	17"	2	87	3	Mast arm assembly. (see Selection Table)
36-A	36"	10- #9	#3 at 6"	13.2	12.0	9.4	1 ¾"	55	19"	2	131	5	Mast arm assembly. (see Selection Table) 30' strain pole with or without luminaire.
36-B	36"	12- #9	#3 at 6"	15.2	13.6	10.4	2"	55	21"	2	190	7	Mast arm assembly. (see Selection Table) Strain pole taller than 30' & strain pole with mast arm
42-A	42"	14- #9	#3 at 6"	17.4	15.6	11.9	2 ¼"	55	23"	2	271	9	Mast arm assembly. (see Selection Table)

NOTES:

① Anchor bolt design develops the foundation capacity given under Foundation Design Loads.

② Foundation Design Loads are the allowable moments and shears at the base of the structure.

③ Foundations may be listed separately or grouped according to similarity of location and type. Quantities are for the Contractor's information only.

④ Field Penetrometer readings at a depth of approximately 3 to 5 feet may be used to adjust shaft lengths.

⑤ If rock is encountered, the Drilled Shaft shall extend a minimum of two diameters into solid rock.

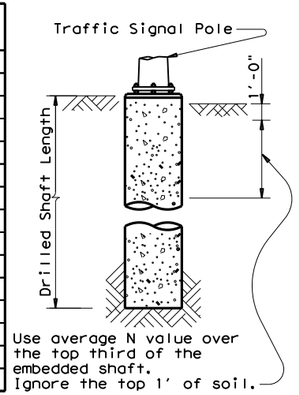
⑥ Decimal lengths in Design Table are to allow interpolation for other penetrometer values. Round to nearest foot for entry into Summary Table.

FOUNDATION SUMMARY TABLE ③

LOCATION IDENTIFICATION	AVG. N BLOW /ft.	FDN TYPE	NO. EA	DRILLED SHAFT LENGTH ⑥ (FEET)				
				24-A	30-A	36-A	36-B	42-A
TOTAL DRILLED SHAFT LENGTHS								

FOUNDATION SELECTION TABLE FOR STANDARD MAST ARM PLUS ILSN SUPPORT ASSEMBLIES (ft)

		FDN 30-A	FDN 36-A	FDN 36-B	FDN 42-A
80 MPH DESIGN WIND SPEED	MAX SINGLE ARM LENGTH	32'	48'		
	MAXIMUM DOUBLE ARM LENGTH COMBINATIONS	24' X 24'			
		28' X 28'			
		32' X 28'	32' X 32'		
			36' X 36'		
			40' X 36'		
			44' X 28'	44' X 36'	
100 MPH DESIGN WIND SPEED	MAX SINGLE ARM LENGTH		36'	44'	
	MAXIMUM DOUBLE ARM LENGTH COMBINATIONS		24' X 24'		
			28' X 28'		
			32' X 24'	32' X 32'	
				36' X 36'	
				40' x24'	40' X 36'
					44' x 36'



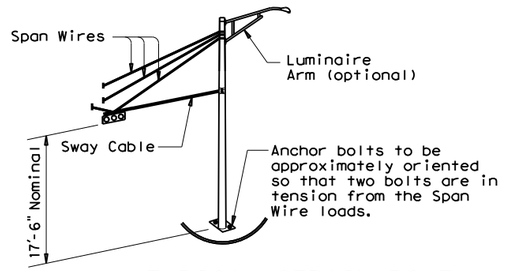
Use average N value over the top third of the embedded shaft. Ignore the top 1' of soil.

ANCHOR BOLT & TEMPLATE SIZES

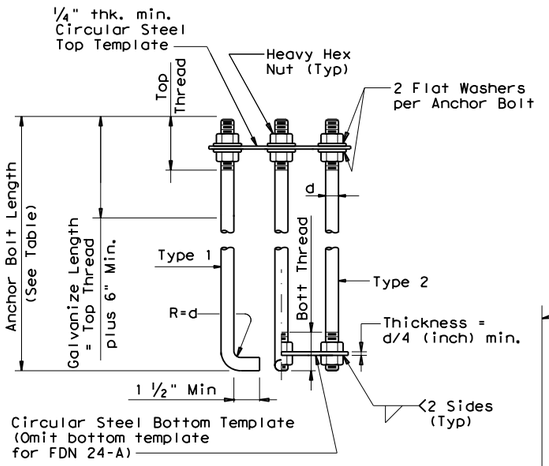
BOLT DIA IN.	⑦ BOLT LENGTH	TOP THREAD	BOTTOM THREAD	BOLT CIRCLE	R2	R1
¾"	1'-6"	3"	—	12 ¾"	7 ⅛"	5 ⅝"
1 ½"	3'-4"	6"	4"	17"	10"	7"
1 ¾"	3'-10"	7"	4 ½"	19"	11 ¼"	7 ¾"
2"	4'-3"	8"	5"	21"	12 ½"	8 ½"
2 ¼"	4'-9"	9"	5 ½"	23"	13 ¾"	9 ¼"

⑦ Min dimensions given, longer bolts are acceptable.

EXAMPLE:
1. For 80mph design wind speed, foundation 30-A can support up to a 32' arm with another arm up to 28'
2. For 100mph design wind speed, foundation 36-A can support a single 36' mast arm.

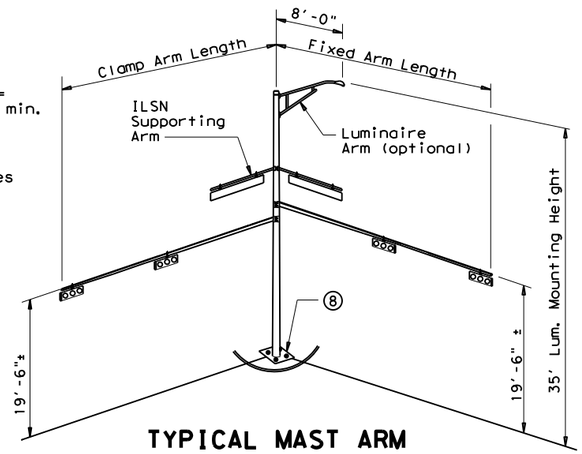


TYPICAL STRAIN POLE ASSEMBLY



HOOKED ANCHOR (TYPE 1) NUT ANCHOR (TYPE 2)

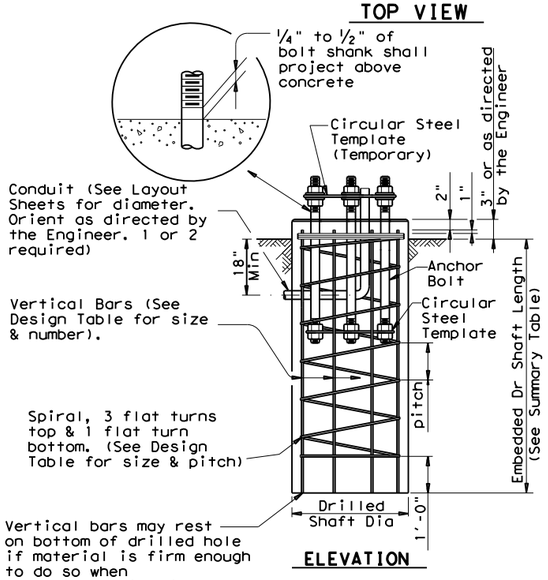
ANCHOR BOLT ASSEMBLY



TYPICAL MAST ARM ASSEMBLY

⑧ Orient anchor bolts orthogonal with the fixed arm direction to ensure that two bolts are in tension under dead load.

TOP VIEW



ELEVATION

FOUNDATION DETAILS

GENERAL NOTES:

Design conforms to 1994 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals and interim revisions thereto.

Reinforcing steel shall conform to Item 440, "Reinforcing Steel".

Concrete shall be Class "C".

Threads for anchor bolts and nuts shall be rolled or cut threads of 8UN series up to 2" in diameter or UNC series for all sizes. Bolts and nuts shall have Class 2A and 2B fit tolerances. Galvanized nuts shall be tapped after galvanizing.

Anchor bolts that are larger than 1" in diameter shall conform to "alloy steel" or "medium-strength mild steel" per Item 449, "Anchor Bolts". Anchor bolts that are 1" in diameter or less shall conform to ASTM A36. Galvanize a minimum of the top end thread length plus 6" for all anchor bolts unless otherwise noted. Exposed washers and exposed nuts shall be galvanized. All galvanizing shall be in accordance with Item 445, "Galvanizing".

Templates and embedded nuts need not be galvanized. Lubricate and tighten anchor bolts when erecting the structure in accordance with Item 449, "Anchor Bolts".

Texas Department of Transportation
Traffic Operations Division

TRAFFIC SIGNAL POLE FOUNDATION

TS-FD-12

REVISIONS	DN: MS	CK: JSY	DW: MAO/MMF	CK: JSY/TEB
5-96 11-98 1-12	CONT	SECT	JOB	HIGHWAY
	0902	90	108	VA
	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		83

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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. As shown on BC(2), the OBEY WARNING SIGNS STATE LAW sign, STAY ALERT TALK OR TEXT LATER (see Sign Detail G20-10T) and the WORK ZONE TRAFFIC FINES DOUBLE sign with plaque shall be erected in advance of the CSJ limits. However, the TRAFFIC FINES DOUBLE sign will not be required on projects consisting solely of mobile operation work, such as striping or milling edgeline rumble strips. The BEGIN ROAD WORK NEXT X MILES, CONTRACTOR and END ROAD WORK signs shall be erected at or near the CSJ limits.

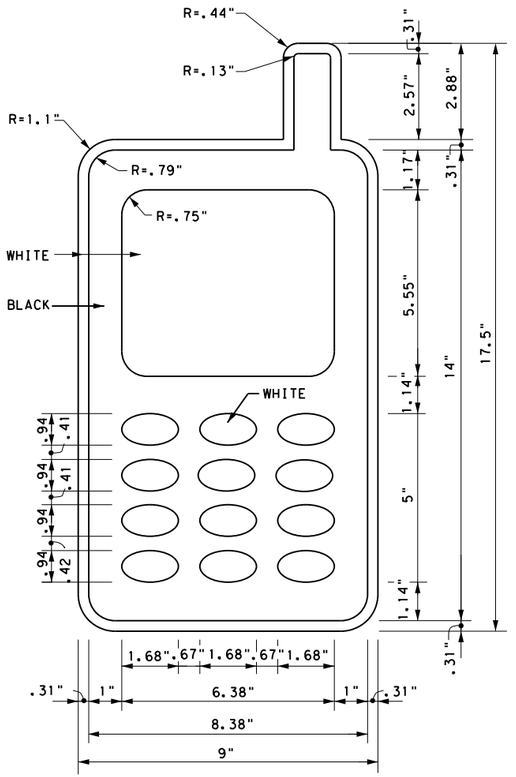
11. Except for devices required by Note 10, traffic control devices should be in place only while work is actually in progress or a definite need exists.

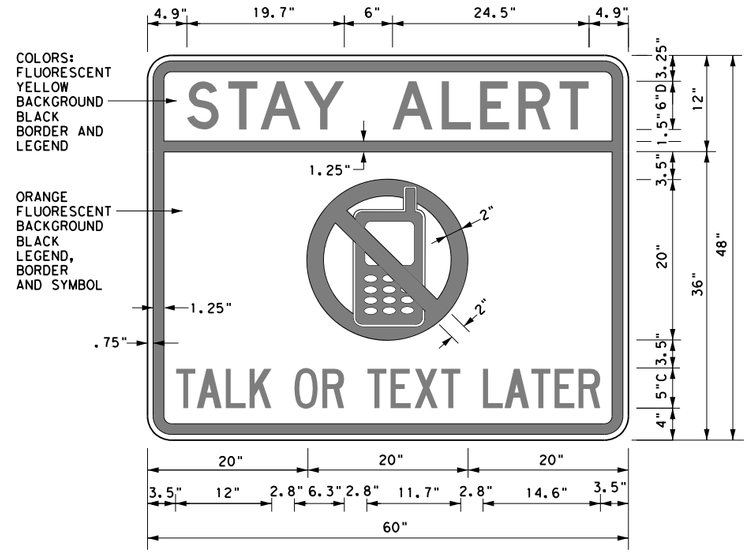
12. The Engineer has the final decision on the location of all traffic control devices.

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 APPAREL 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.





3.0" Radius, 1.25" Border, 0.75" Indent, Black on Yellow;
[STAY ALERT] Font: D
3.0" Radius, 1.25" Border, 0.75" Indent, Black on Orange;
[TALK OR TEXT LATER] Font: C specified length;

SIGN DETAIL (G20-10T)

Only pre-qualified products shall be used. The "Compliant Work Zone Traffic Control Devices List" (CWZTCD) describes pre-qualified products and their sources and may be found on-line at the web address given below or by contacting:

Texas Department of Transportation
Traffic Operations Division - TE
Phone (512) 416-3118

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

Texas Department of Transportation | Traffic Operations Division Standard

BARRICADE AND CONSTRUCTION GENERAL NOTES AND REQUIREMENTS

BC(1)-14

FILE: bc-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
4-03 5-10 8-14	DIST	COUNTY		SHEET NO.
9-07 7-13	FTW	TARRANT		84

DATE: 4/29/2021 11:07:42 AM
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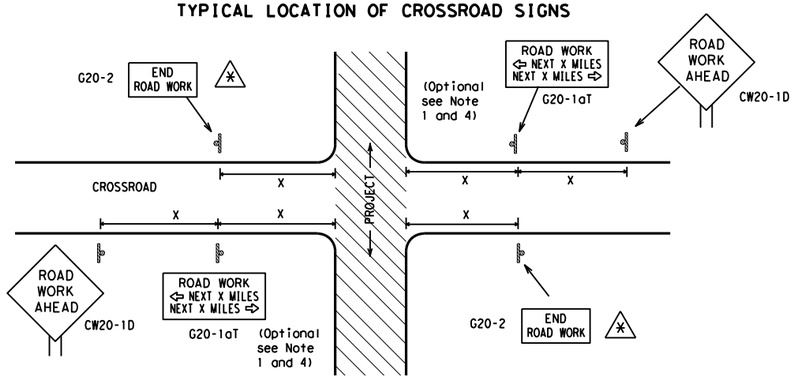
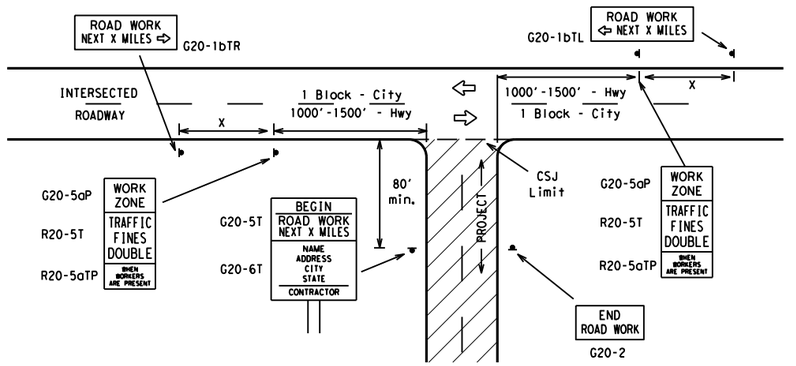
TYPICAL LOCATION OF CROSSROAD SIGNS



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

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

T-INTERSECTION



CSJ LIMITS AT T-INTERSECTION

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

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

SIZE

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

SPACING

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

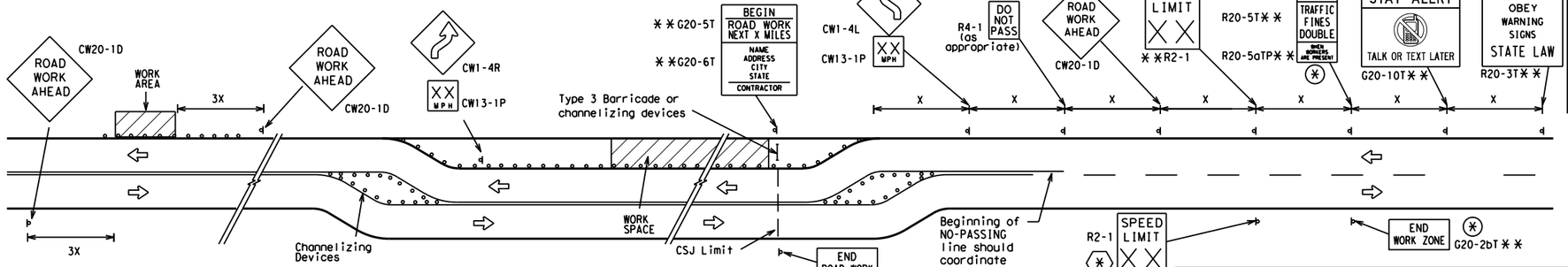
✱ For typical sign spacings on divided highways, expressways and freeways, see Part 6 of the "Texas Manual on Uniform Traffic Control Devices" (TMUTCD) typical application diagrams or TCP Standard Sheets.

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

GENERAL NOTES

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

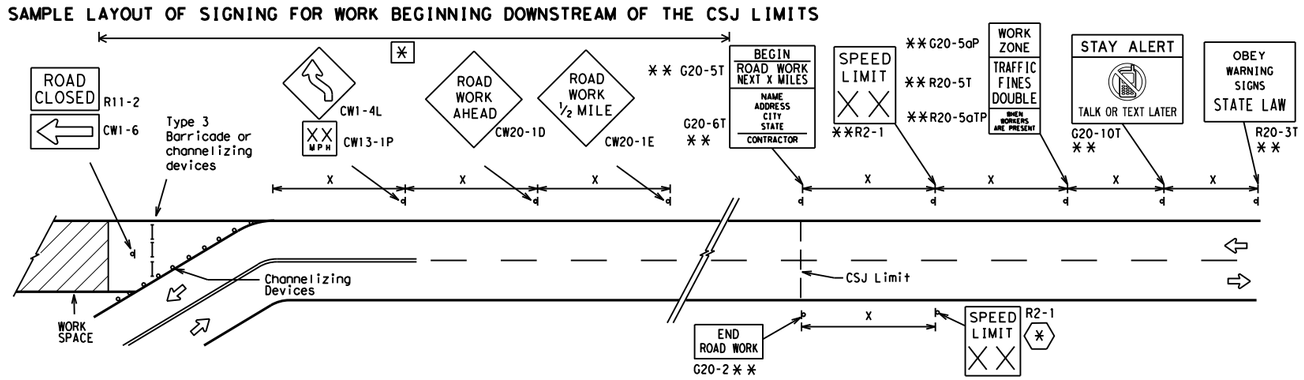
WORK AREAS IN MULTIPLE LOCATIONS WITHIN CSJ LIMITS



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

SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING AT THE CSJ LIMITS

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



NOTES

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

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

✱✱ Required CSJ Limit signing. See Note 10 on BC(1). TRAFFIC FINES DOUBLE signs will not be required on projects consisting solely of mobile operations work.

[✱] 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

Texas Department of Transportation

Traffic Operations Division Standard

BARRICADE AND CONSTRUCTION PROJECT LIMIT

BC(2)-14

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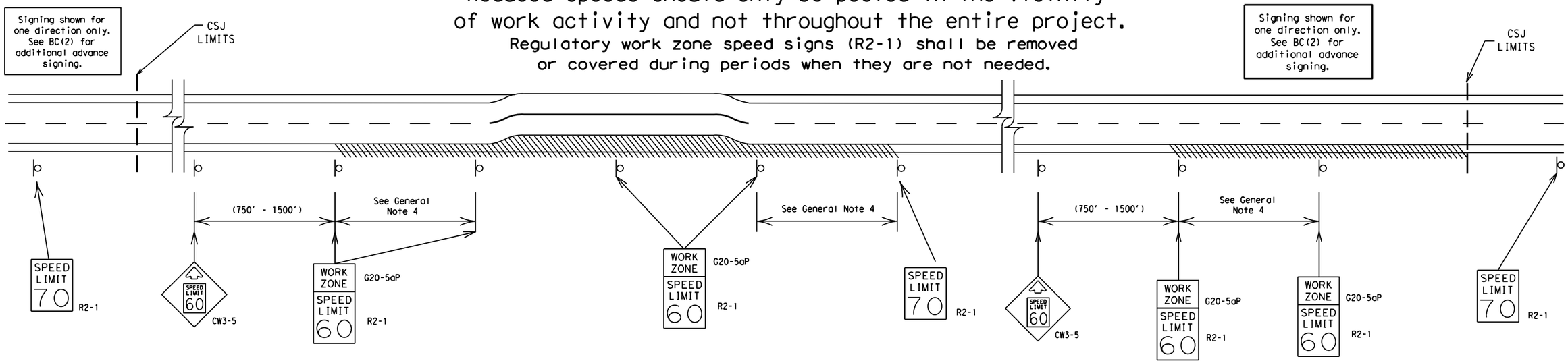
TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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

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

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



GUIDANCE FOR USE:

LONG/INTERMEDIATE TERM WORK ZONE SPEED LIMITS

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

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

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

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

SHORT TERM WORK ZONE SPEED LIMITS

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

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

GENERAL NOTES

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

Texas Department of Transportation

Traffic Operations Division Standard

BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT

BC(3)-14

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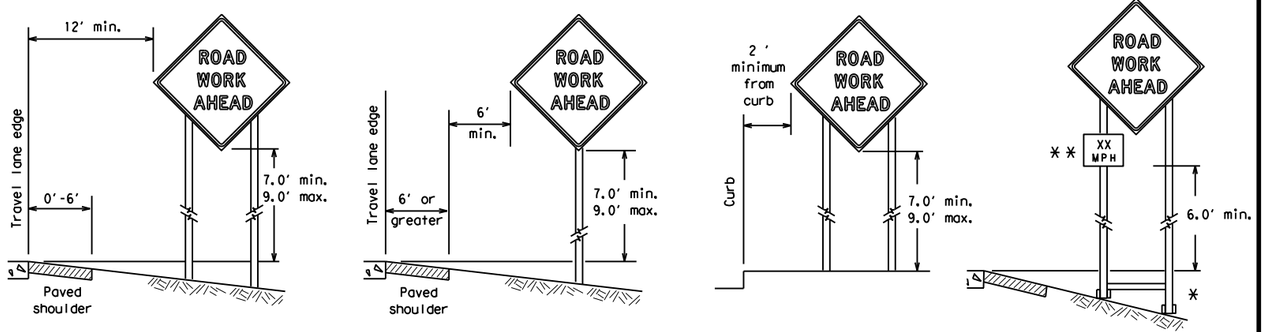
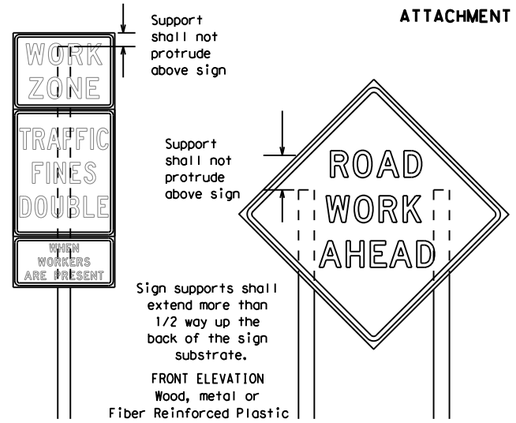
TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS



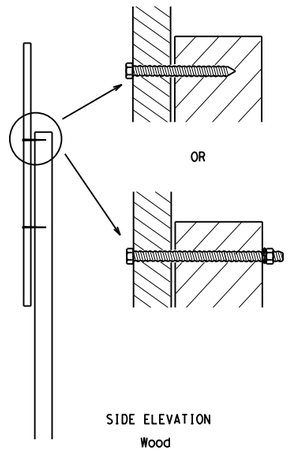
* When placing skid supports on unlevel ground, the leg post lengths must be adjusted so the sign appears straight and plumb. Objects shall NOT be placed under skids as a means of leveling.

** 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



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

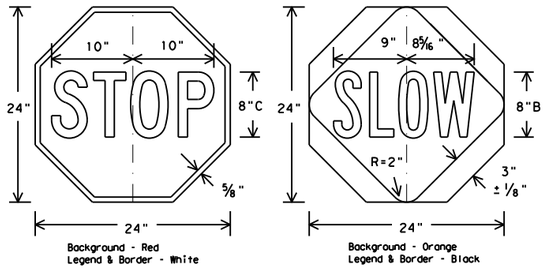


Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

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.

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" as detailed below.
2. When used at night, the STOP/SLOW paddle shall be retroreflectorized.
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.



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, 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.
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 sheets or the CWZTCD. The signs shall meet the required mounting heights shown on the BC Sheets or the SMD Standards during construction. This work should be paid for under the appropriate pay item for relocating existing signs.
6. Any sign or traffic control device that is struck or damaged by the Contractor or his/her construction equipment shall be replaced as soon as possible by the Contractor to ensure proper guidance for the motorists. This will be subsidiary to Item 502.

GENERAL NOTES FOR WORK ZONE SIGNS

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

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

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

SIGN MOUNTING HEIGHT

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

SIZE OF SIGNS

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

SIGN SUBSTRATES

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

REFLECTIVE SHEETING

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

SIGN LETTERS

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

REMOVING OR COVERING

1. When sign messages may be confusing or do not apply, the signs shall be removed or completely covered.
2. Long-term stationary or intermediate stationary signs installed on square metal tubing may be turned away from traffic 90 degrees when the sign message is not applicable. This technique may not be used for signs installed in the median of divided highways or near any intersections where the sign may be seen from approaching traffic.
3. Signs installed on wooden skids shall not be turned at 90 degree angles to the roadway. These signs should be removed or completely covered when not required.
4. When signs are covered, the material used shall be opaque, such as heavy mil black plastic, or other materials which will cover the entire sign face and maintain their opaque properties under automobile headlights at night, without damaging the sign sheeting.
5. Burlap shall NOT be used to cover signs.
6. Duct tape or other adhesive material shall NOT be affixed to a sign face.
7. Signs and anchor stubs shall be removed and holes backfilled upon completion of work.

SIGN SUPPORT WEIGHTS

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

FLAGS ON SIGNS

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

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BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES

BC(4)-14

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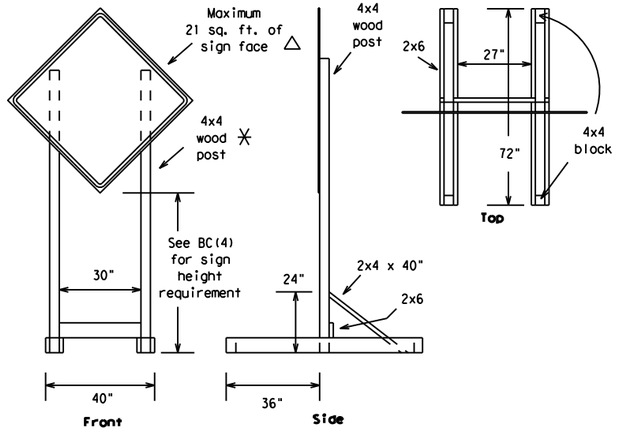
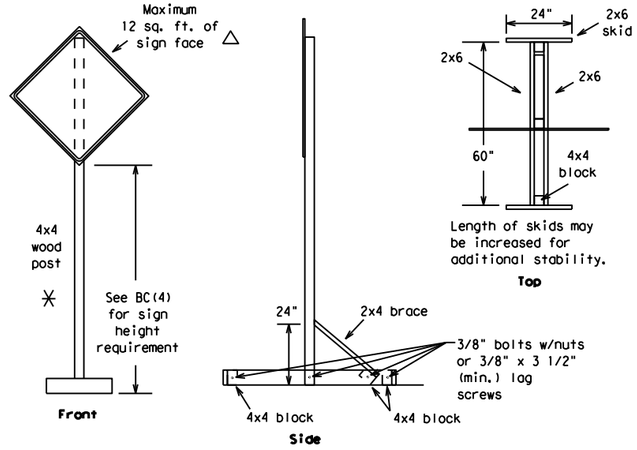
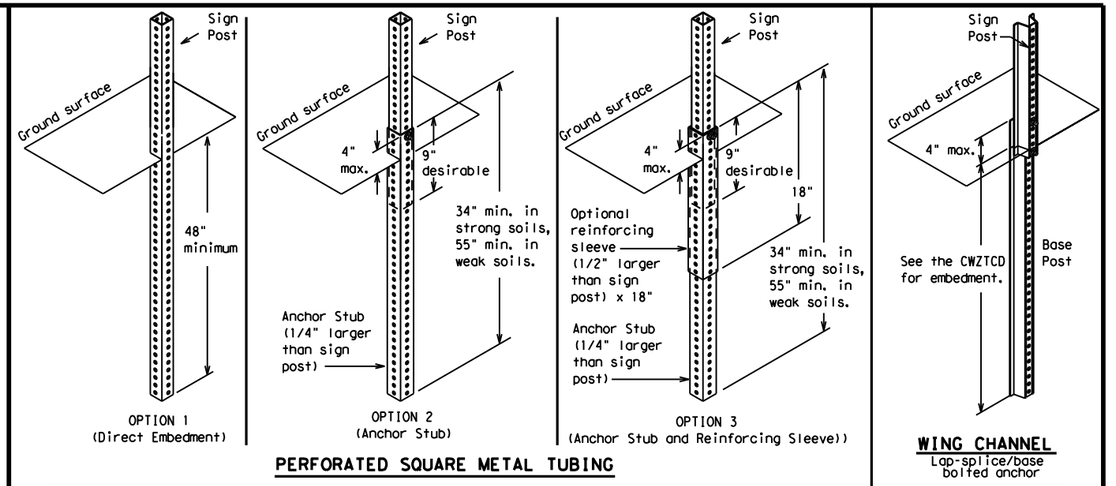




SKID MOUNTED WOOD SIGN SUPPORTS

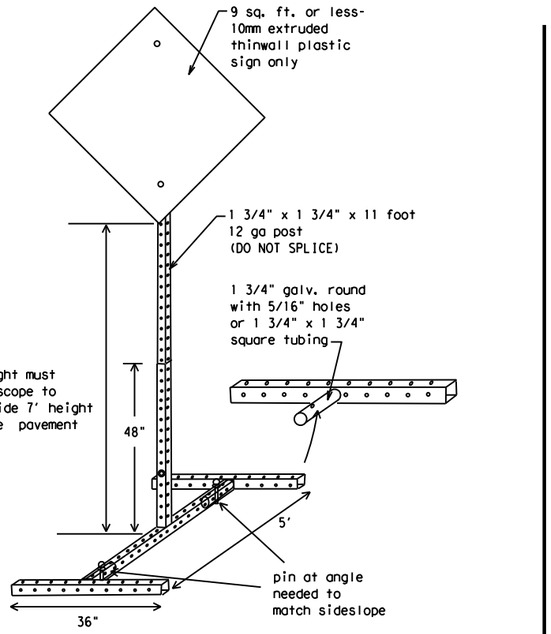
LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS □

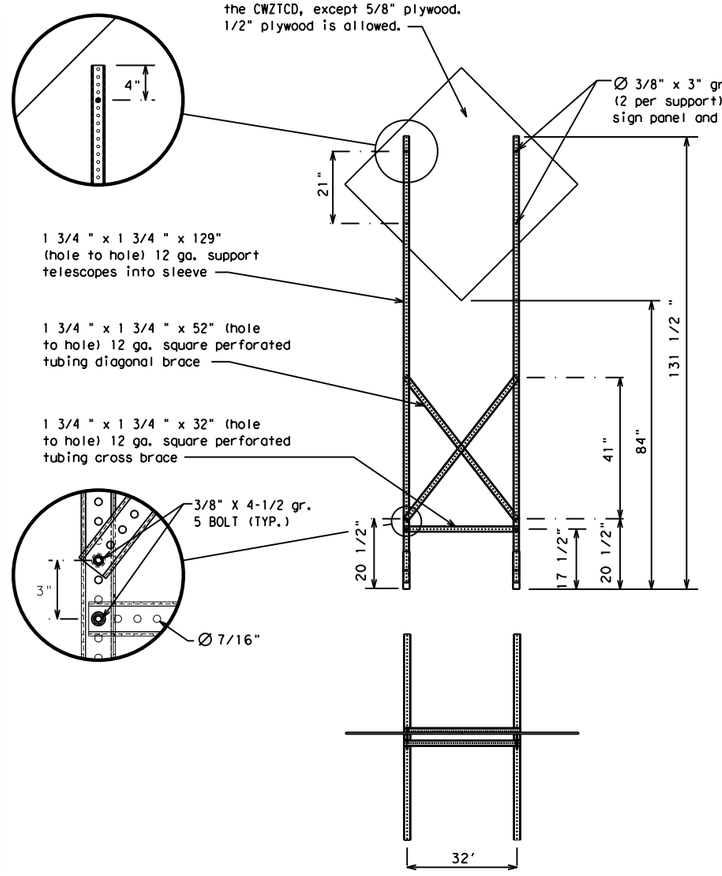


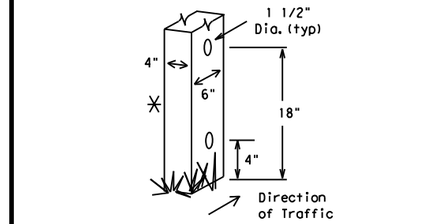
PERFORATED SQUARE METAL TUBING

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.

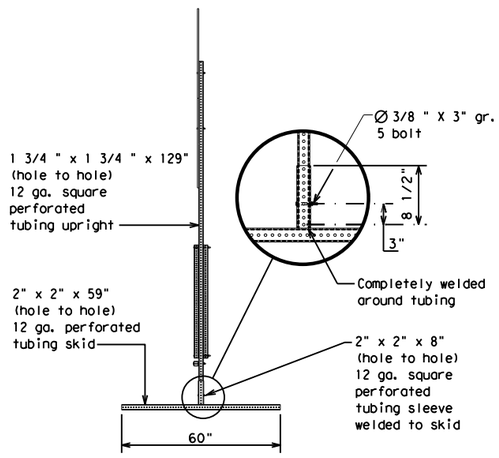






Nominal Post Size	Number of Posts	Maximum Sq. feet of Sign Face	Minimum Soil Embedment	Drilled Hole(s) Required
4 x 4	1	12	36"	NO
4 x 4	2	21	36"	NO
4 x 6	1	21	36"	YES
4 x 6	2	36	36"	YES

WOOD POST SYSTEM FOR GROUND MOUNTED SIGN SUPPORTS



WEDGE ANCHORS

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

OTHER DESIGNS

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

GENERAL NOTES

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

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

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

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

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BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT

BC(5)-14

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SKID MOUNTED PERFORATED SQUARE STEEL TUBING SIGN SUPPORTS

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

PORTABLE CHANGEABLE MESSAGE SIGNS

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

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

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

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

RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

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

Phase 1: Condition Lists

Road/Lane/Ramp Closure List

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

Other Condition List

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

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

Phase 2: Possible Component Lists

Action to Take/Effect on Travel List

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

Location List

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

Warning List

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

** Advance Notice List

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

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

** See Application Guidelines Note 6.

APPLICATION GUIDELINES

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

WORDING ALTERNATIVES

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

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

FULL MATRIX PCMS SIGNS

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

Texas Department of Transportation

Traffic Operations Division Standard

BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

BC(6)-14

FILE: bc-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13	FTW	TARRANT		89

100

DATE: 4/29/2021 11:07:52 AM
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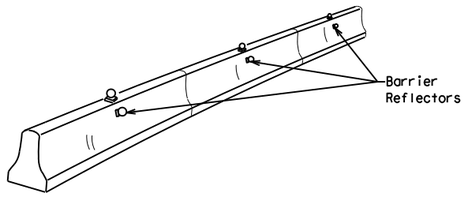
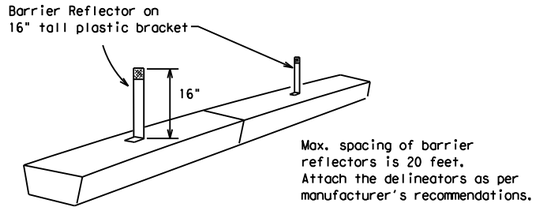
1. Barrier Reflectors shall be pre-qualified, and conform to the color and reflectivity requirements of DMS-8600. A list of prequalified Barrier Reflectors can be found at the Material Producer List web address shown on BC(1).
2. Color of Barrier Reflectors shall be as specified in the TMUTCD. The cost of the reflectors shall be considered subsidiary to Item 512.

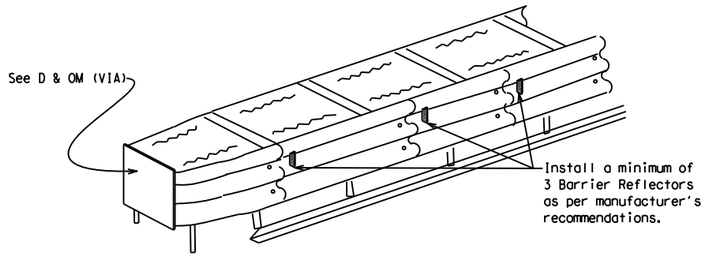


CONCRETE TRAFFIC BARRIER (CTB)

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



LOW PROFILE CONCRETE BARRIER (LPCB)

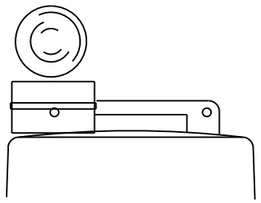


DELINEATION OF END TREATMENTS

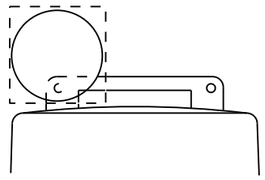
END TREATMENTS FOR CTB'S USED IN WORK ZONES

End treatments used on CTB's in work zones shall meet crashworthy standards as defined in the National Cooperative Highway Research Report 350. Refer to the CWZTCD List for approved end treatments and manufacturers.

BARRIER REFLECTORS FOR CONCRETE TRAFFIC BARRIER AND ATTENUATORS



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



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

WARNING LIGHTS

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

WARNING LIGHTS MOUNTED ON PLASTIC DRUMS

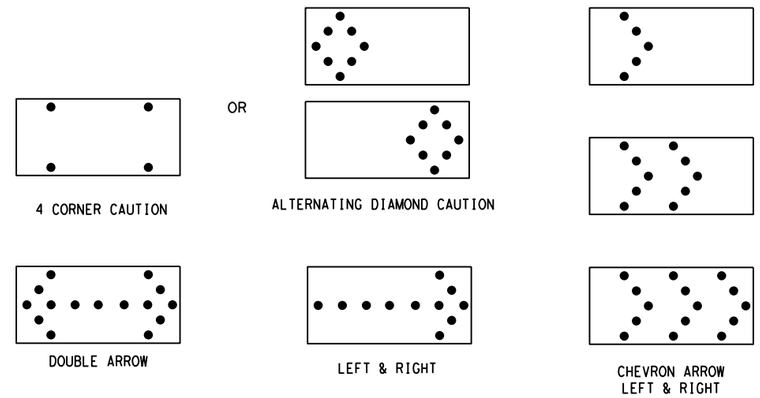
1. Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
2. Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
3. A series of sequential flashing warning lights placed on channelizing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

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

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

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

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



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

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

ATTENTION

Flashing Arrow Boards shall be equipped with automatic dimming devices.

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

FLASHING ARROW BOARDS

TRUCK-MOUNTED ATTENUATORS

1. Truck-mounted attenuators (TMA) used on TxDOT facilities must meet the requirements outlined in the National Cooperative Highway Research Report No. 350 (NCHRP 350) or the Manual for Assessing Safety Hardware (MASH).
2. Refer to the CWZTCD for the requirements of Level 2 or Level 3 TMAs.
3. Refer to the CWZTCD for a list of approved TMAs.
4. TMAs are required on freeways unless otherwise noted in the plans.
5. A TMA should be used anytime that it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the work performance.
6. The only reason a TMA should not be required is when a work area is spread down the roadway and the work crew is an extended distance from the TMA.

Texas Department of Transportation

Traffic Operations Division Standard

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

BC(7)-14

FILE: bc-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS 9-07 8-14 7-13	0902	90	108	VA
	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		90

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GENERAL NOTES

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

GENERAL DESIGN REQUIREMENTS

Pre-qualified plastic drums shall meet the following requirements:

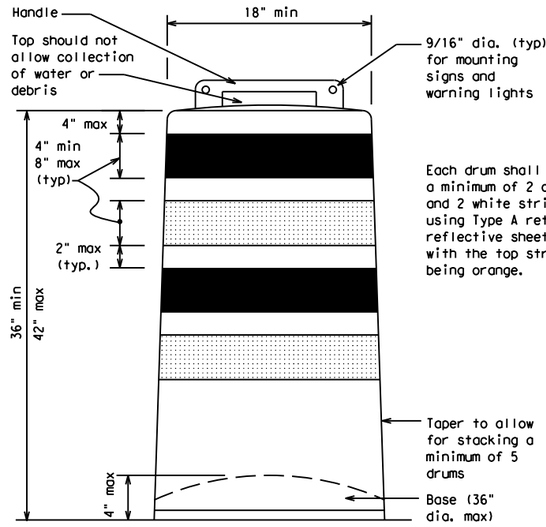
1. Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
2. The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents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

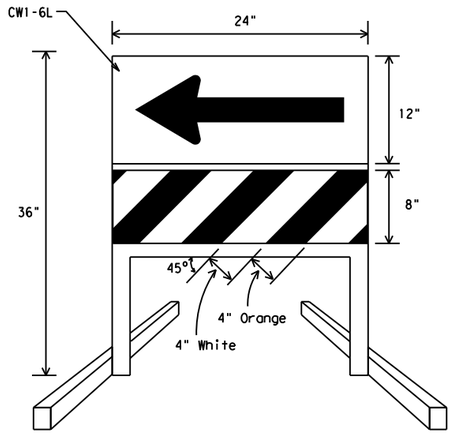
RETROREFLECTIVE SHEETING

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

BALLAST

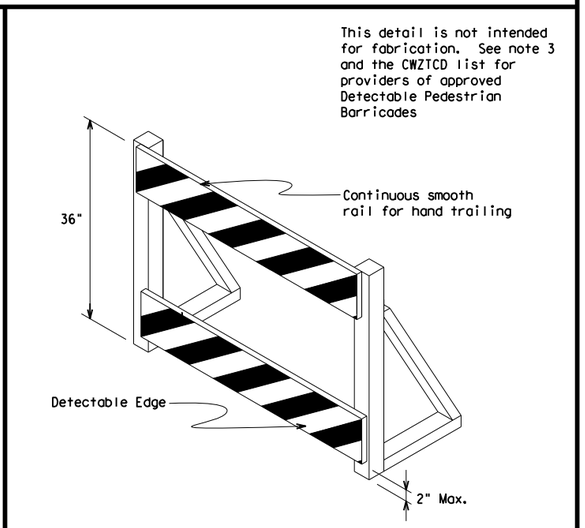
1. Unballasted bases shall be large enough to hold up to 50 lbs. of sand. This base, when filled with the ballast material, should weigh between 35 lbs (minimum) and 50 lbs (maximum). The ballast may be sand in one to three sandbags separate from the base, sand in a sand-filled plastic base, or other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





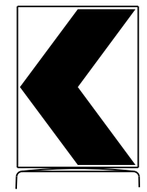
DIRECTION INDICATOR BARRICADE

1. The Direction Indicator Barricade may be used in tapers, transitions, and other areas where specific directional guidance to drivers is necessary.
2. If used, the Direction Indicator Barricade should be used in series to direct the driver through the transition and into the intended travel lane.
3. The Direction Indicator Barricade shall consist of One-Direction Large Arrow (CW1-6) sign in the size shown with a black arrow on a background of Type B_{FL} or Type C_{FL} Orange retroreflective sheeting above a rail with Type A retroreflective sheeting in alternating 4" white and orange stripes sloping downward at an angle of 45 degrees in the direction road users are to pass. Sheeting types shall be as per DMS 8300.
4. Double arrows on the Direction Indicator Barricade will not be allowed.
5. Approved manufacturers are shown on the CWZTCD List. Ballast shall be as approved by the manufacturers instructions.

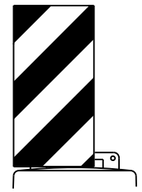


DETECTABLE PEDESTRIAN BARRICADES

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



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



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

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

SIGNS, CHEVRONS, AND VERTICAL PANELS MOUNTED ON PLASTIC DRUMS

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

Texas Department of Transportation

Traffic Operations Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(8)-14

FILE: bc-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
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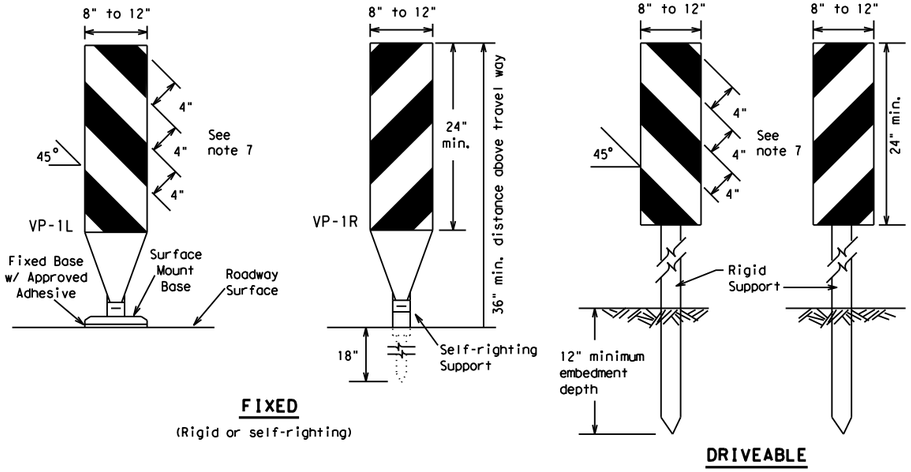
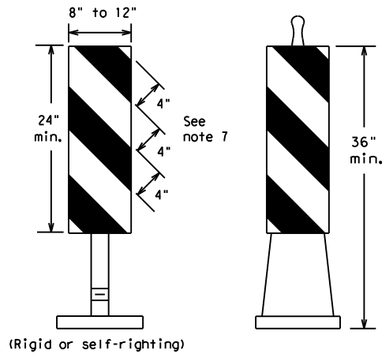
4-03 7-13	DIST	COUNTY		SHEET NO.
9-07 8-14	FTW	TARRANT		91



FIXED
(Rigid or self-righting)

DRIVEABLE

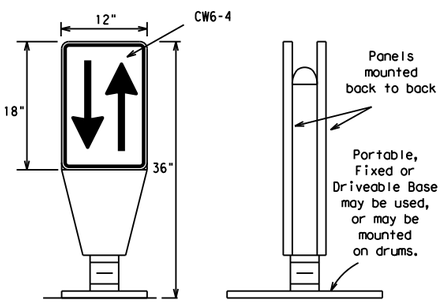


(Rigid or self-righting)

PORTABLE

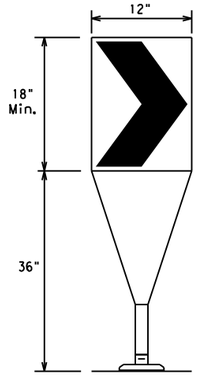
VERTICAL PANELS (VPs)

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



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

OPPOSING TRAFFIC LANE DIVIDERS (OTLD)



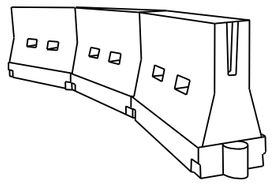
Fixed Base w/ Approved Adhesive (Driveable Base, or Flexible Support can be used)

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

CHEVRONS

GENERAL NOTES

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



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LONGITUDINAL CHANNELIZING DEVICES (LCD)

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

WATER BALLASTED SYSTEMS USED AS BARRIERS

1. Water ballasted systems used as barriers shall not be used solely to channelize road users, but also to protect the work space per the appropriate NCHRP 350 crashworthiness requirements based on roadway speed and barrier application.
2. Water ballasted systems used to channelize vehicular traffic shall be supplemented with retroreflective delineation or channelizing devices to improve daytime/nighttime visibility. They may also be supplemented with pavement markings.
3. Water ballasted systems used as barriers shall be placed in accordance to application and installation requirements specific to the device, and used only when shown on the CWZTCD list.
4. Water ballasted systems used as barriers should not be used for a merging taper except in low speed (less than 45 MPH) urban areas. When used on a taper in a low speed urban area, the taper shall be delineated and the taper length should be designed to optimize road user operations considering the available geometric conditions.
5. When water ballasted systems used as barriers have blunt ends exposed to traffic, they should be attenuated as per manufacturer recommendations or flared to a point outside the clear zone.

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

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

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

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

SUGGESTED MAXIMUM SPACING OF CHANNELIZING DEVICES AND MINIMUM DESIRABLE TAPER LENGTHS

SHEET 9 OF 12

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BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(9)-14

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	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		92

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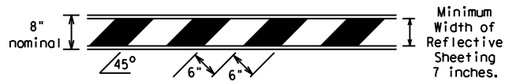
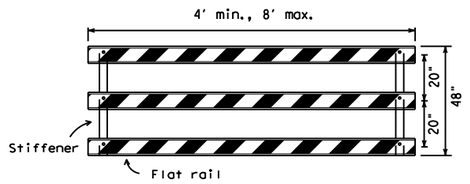
TYPE 3 BARRICADES

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

Barricades shall NOT be used as a sign support.



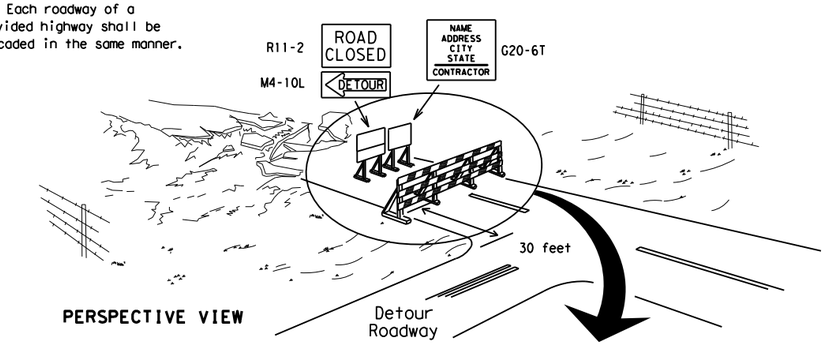
TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



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

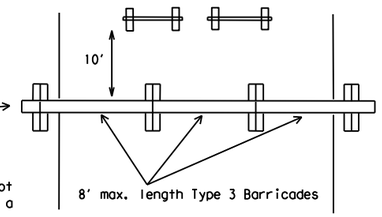
TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES

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



PERSPECTIVE VIEW

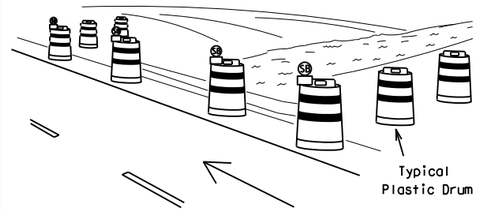
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic.
Barricade striping should slant downward in the direction of detour.



PLAN VIEW

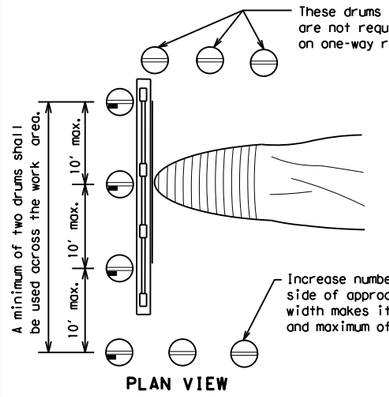
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION



PERSPECTIVE VIEW

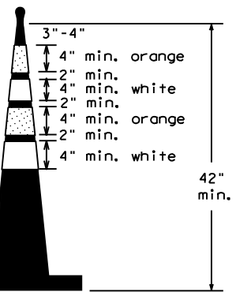
1. Where positive redirectional capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder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



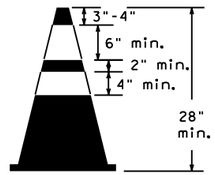
PLAN VIEW

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

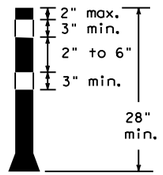
CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS



Two-Piece cones



One-Piece cones

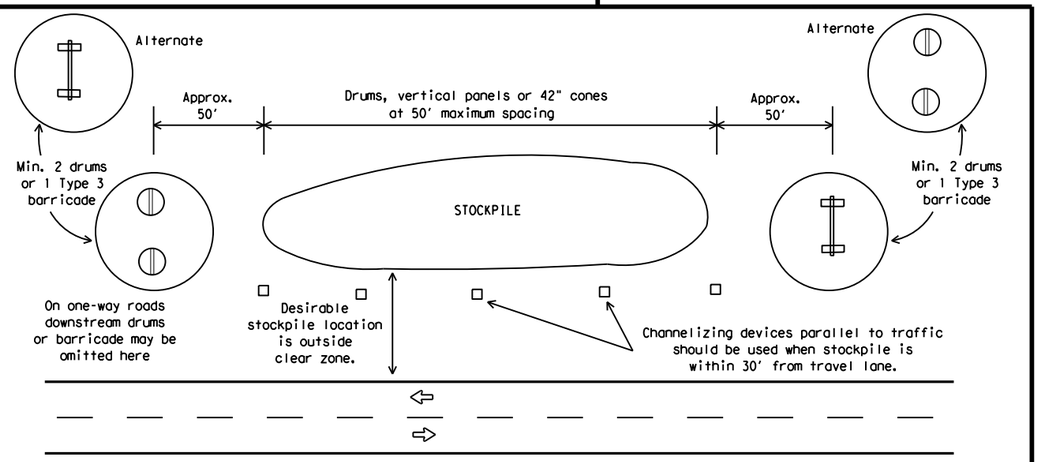


Tubular Marker

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

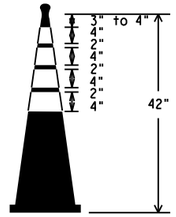
42" 2-piece cones shall have a minimum weight of 30 lbs. including base.

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



TRAFFIC CONTROL FOR MATERIAL STOCKPILES

THIS DEVICE SHALL NOT BE USED ON PROJECTS LET AFTER MARCH 2014.



EDGELINE CHANNELIZER

1. This device is intended only for use in place of a vertical panel to channelize traffic by indicating the edge of the travel lane. It is not intended to be used in transitions or tapers.
2. This device shall not be used to separate lanes of traffic (opposing or otherwise) or warn of objects.
3. This device is based on a 42 inch, two-piece cone with an alternate striping pattern: four 4 inch retroreflective bands, with an approximate 2 inch gap between bands. The color of the band should correspond to the color of the edgeline (yellow for left edgeline, white for right edgeline) for which the device is substituted or for which it supplements. The reflectorized bands shall be retroreflective Type A conforming to Departmental Material Specification DMS-8300, unless otherwise noted.
4. The base must weigh a minimum of 30 lbs.

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BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(10)-14

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7-13	FTW	TARRANT		93

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WORK ZONE PAVEMENT MARKINGS

GENERAL

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

RAISED PAVEMENT MARKERS

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

PREFABRICATED PAVEMENT MARKINGS

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

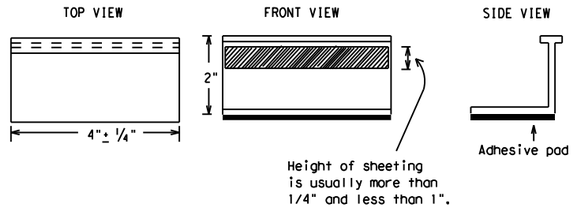
MAINTAINING WORK ZONE PAVEMENT MARKINGS

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

REMOVAL OF PAVEMENT MARKINGS

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

Temporary Flexible-Reflective Roadway Marker Tabs



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

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

RAISED PAVEMENT MARKERS USED AS GUIDEMARKS

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

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

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

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

Texas Department of Transportation

Traffic Operations Division Standard

BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

BC(11)-14

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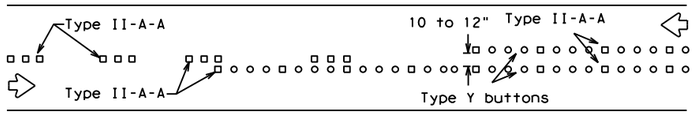
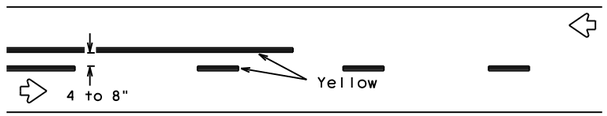
PAVEMENT MARKING PATTERNS

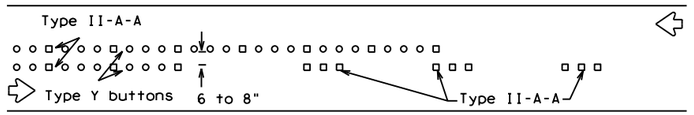
REFLECTORIZED PAVEMENT MARKINGS - PATTERN A



RAISED PAVEMENT MARKERS - PATTERN A



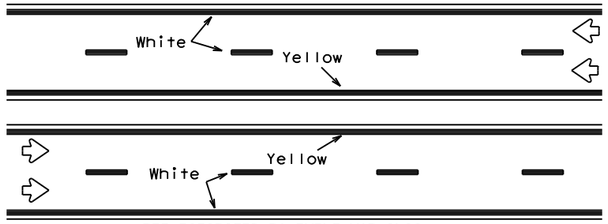
REFLECTORIZED PAVEMENT MARKINGS - PATTERN B



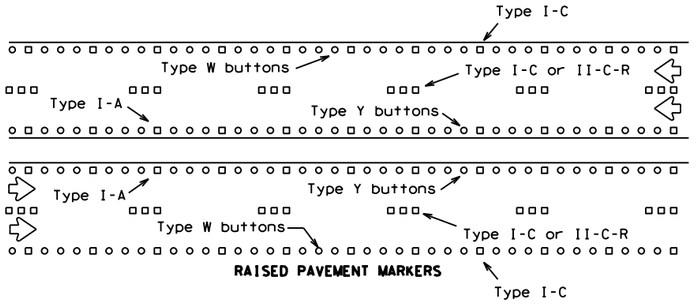
RAISED PAVEMENT MARKERS - PATTERN B

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

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



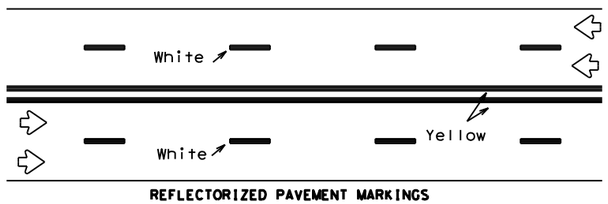
REFLECTORIZED PAVEMENT MARKINGS



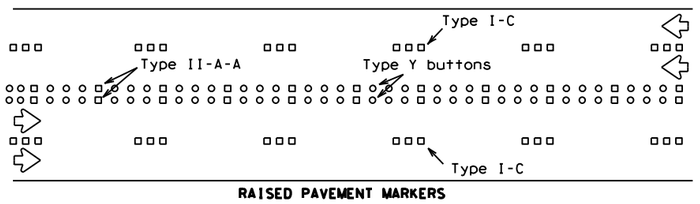
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

EDGE & LANE LINES FOR DIVIDED HIGHWAY



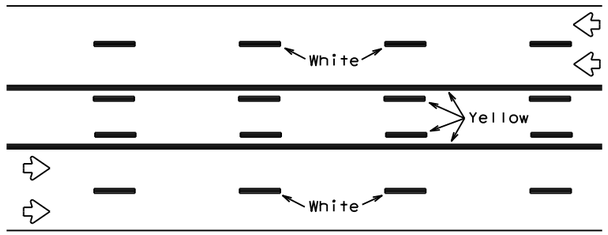
REFLECTORIZED PAVEMENT MARKINGS



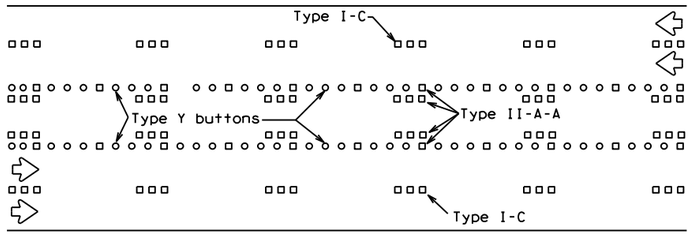
RAISED PAVEMENT MARKERS

Prefabricated markings may be substituted for reflectorized pavement markings.

LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS



RAISED PAVEMENT MARKERS

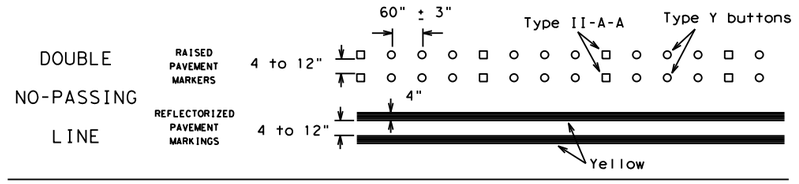
Prefabricated markings may be substituted for reflectorized pavement markings.

TWO-WAY LEFT TURN LANE

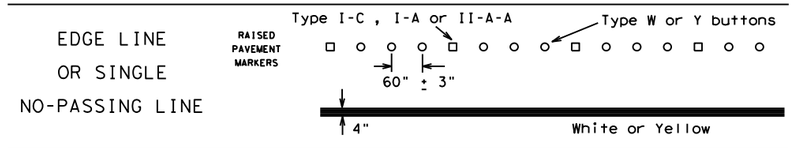
STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS

SOLID LINES

DOUBLE NO-PASSING LINE

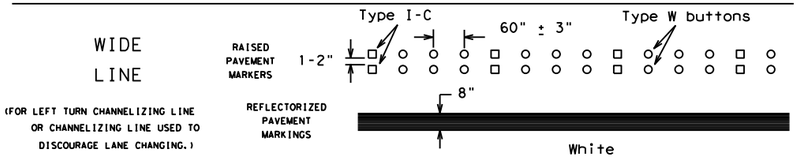


EDGE LINE OR SINGLE NO-PASSING LINE



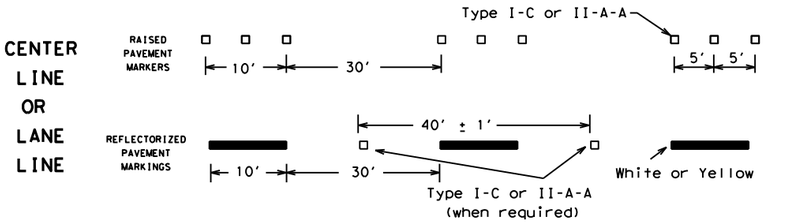
WIDE LINE

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

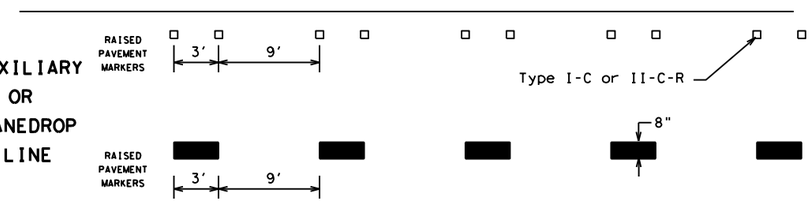


BROKEN LINES

CENTER LINE OR LANE LINE

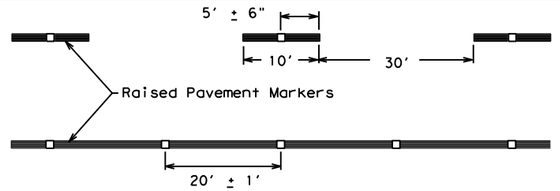


AUXILIARY OR LANEDROP LINE



REMOVABLE MARKINGS WITH RAISED PAVEMENT MARKERS

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



Centerline only - not to be used on edge lines

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

Texas Department of Transportation

Traffic Operations Division Standard

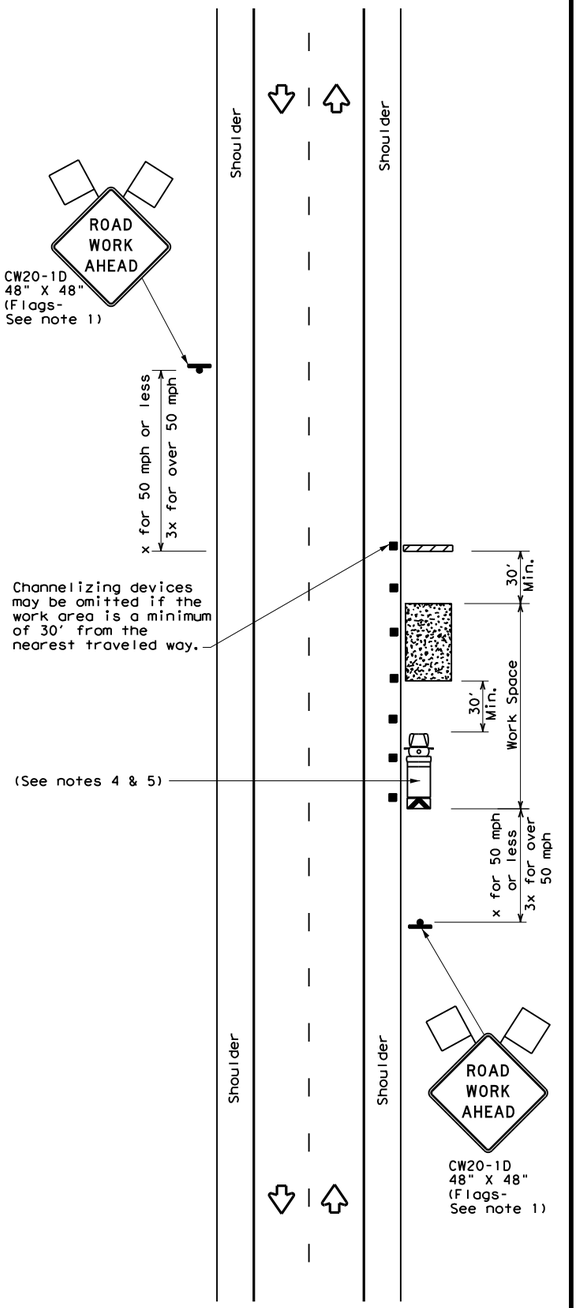
BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

BC(12)-14

FILE: bc-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
1-97 9-07	DIST	COUNTY		SHEET NO.
2-98 7-13	FTW	TARRANT		95
11-02 8-14				

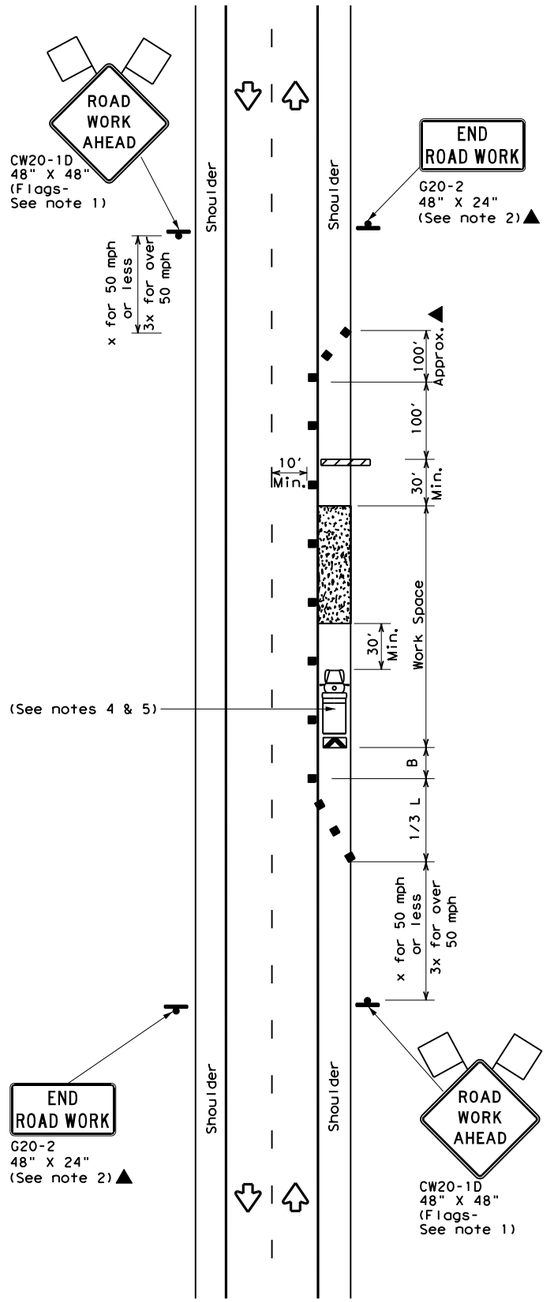
106

DATE: 4/29/2021 11:08:04 AM
FILE: T:\TRAFFIC\ITS\0902-90-108 Non-Site Specific ITS\Typical Traffic Control Plans\tcp2-1-18.dgn



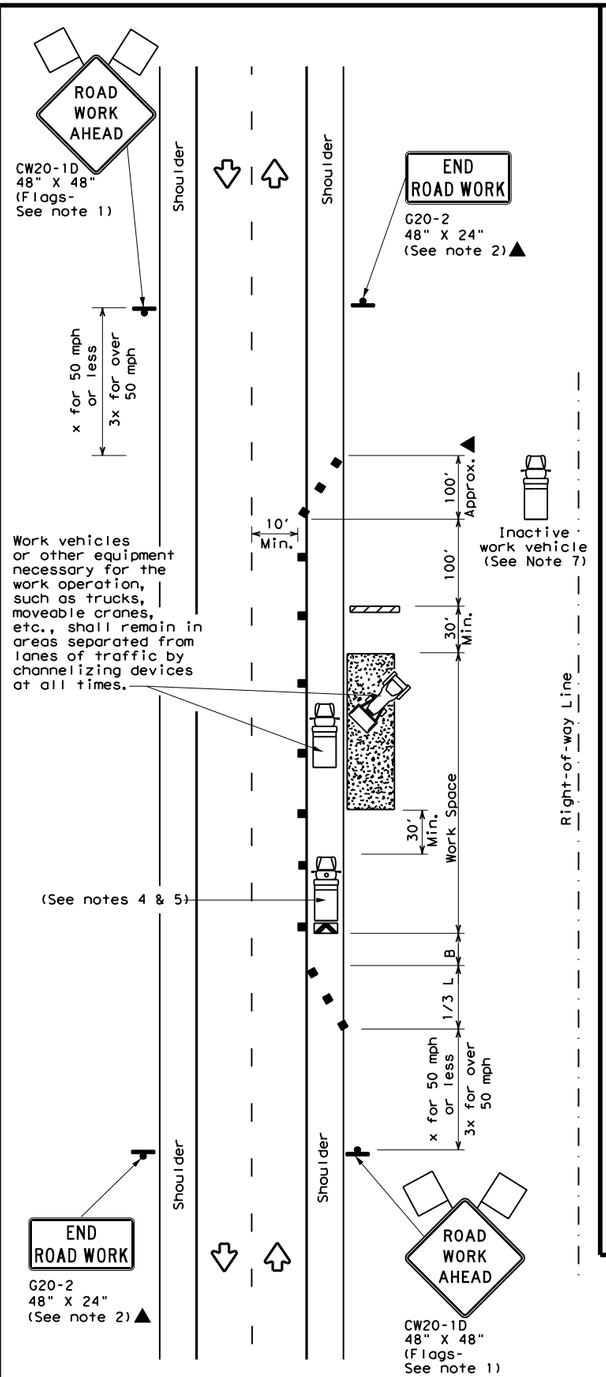
TCP (2-1a)

WORK SPACE NEAR SHOULDER
Conventional Roads



TCP (2-1b)

WORK SPACE ON SHOULDER
Conventional Roads



TCP (2-1c)

WORK VEHICLES ON SHOULDER
Conventional Roads

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

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

* Conventional Roads Only

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

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

GENERAL NOTES

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

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN CONVENTIONAL ROAD SHOULDER WORK

TCP(2-1)-18

FILE: tcp2-1-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
2-94 4-98	DIST	COUNTY		SHEET NO.
8-95 2-12	FTW	TARRANT		96
1-97 2-18				

DATE: 4/29/2021 11:08:10 AM
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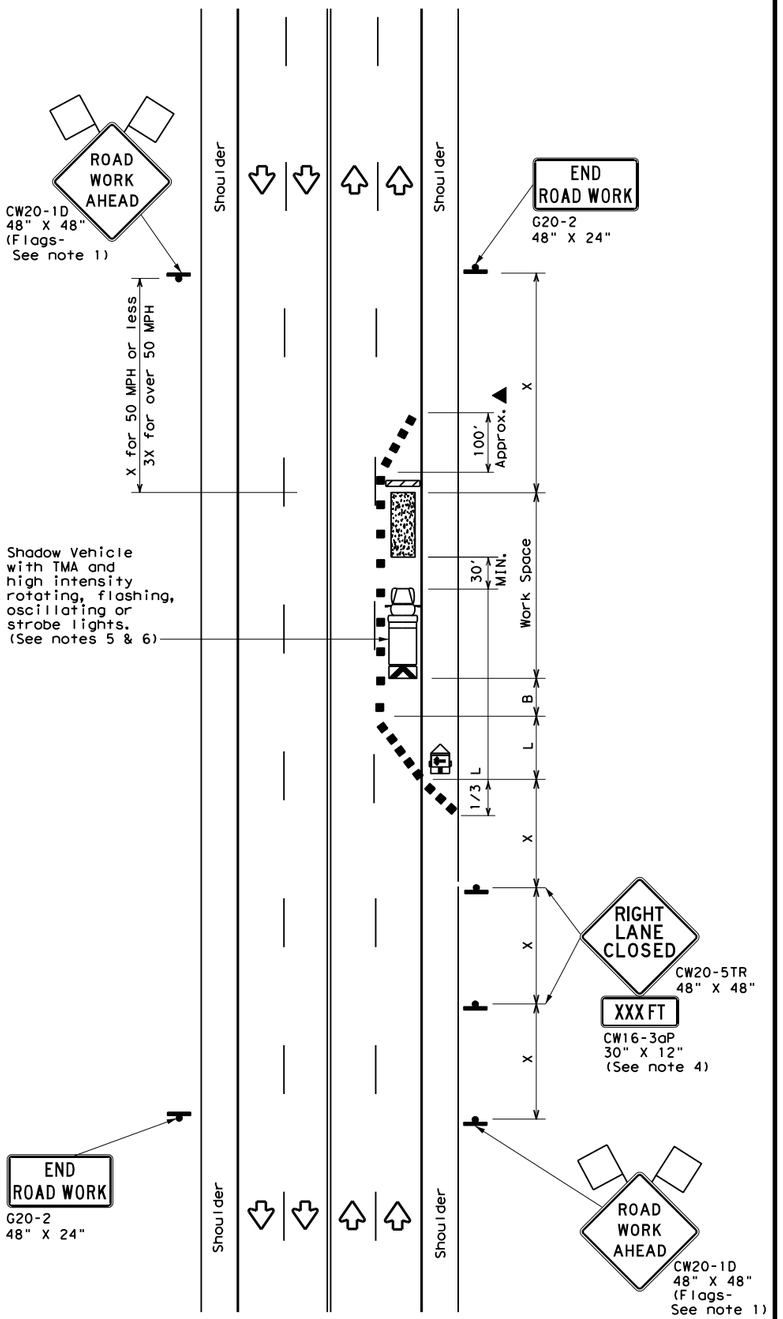
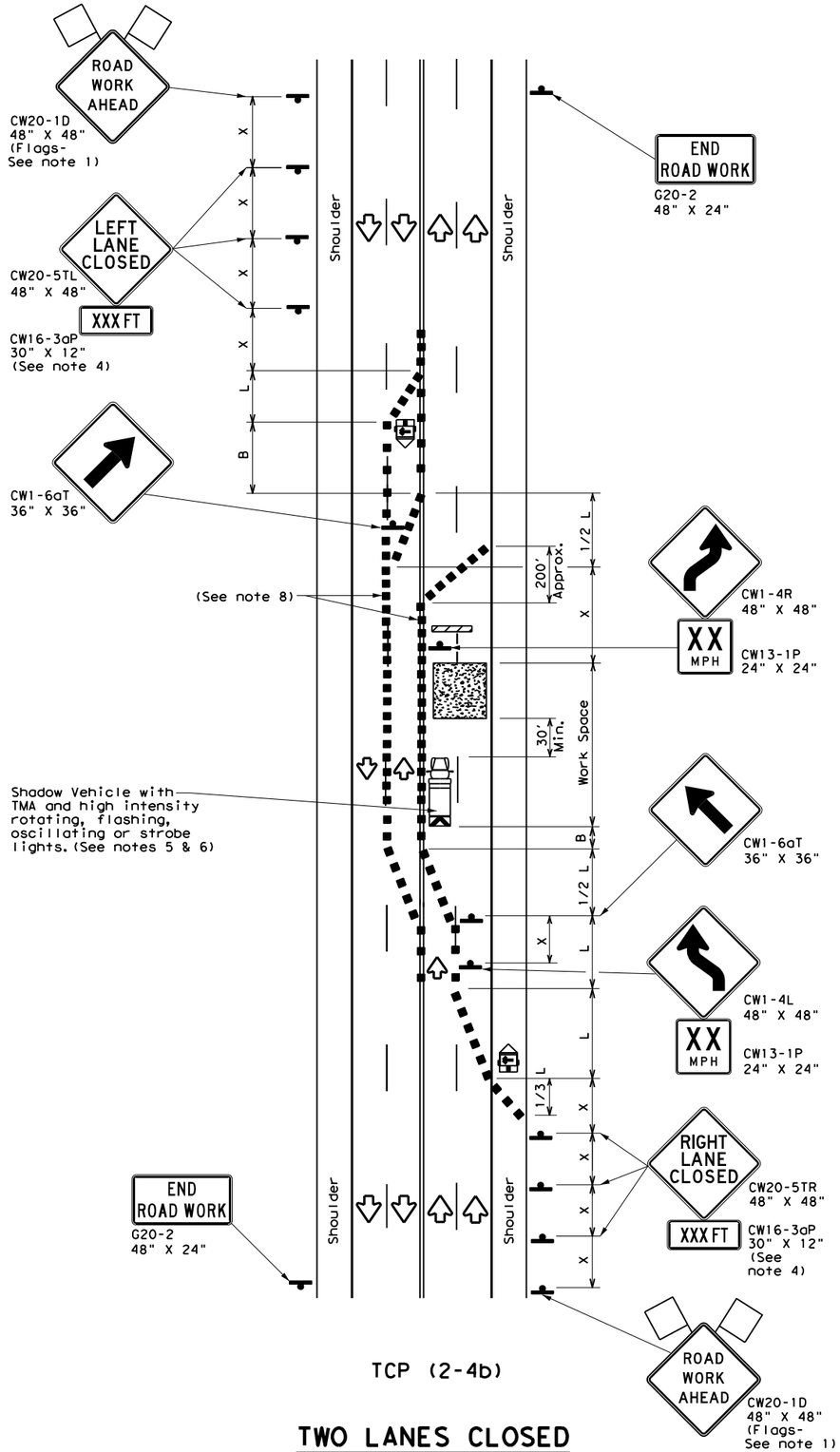


TCP (2-4a)

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	M	Portable Changeable Message Sign (PCMS)
	Sign		Traffic Flow
	Flag		Flagger

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

* Conventional Roads Only

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

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

GENERAL NOTES

1. Flags attached to signs where shown, are REQUIRED.
2. All traffic control devices illustrated are REQUIRED, except those denoted with the triangle symbol may be omitted when stated elsewhere in the plans, or for routine maintenance work, when approved by the Engineer.
3. The downstream taper is optional. When used, it should be 100 feet minimum length per lane.
4. 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.
5. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30 to 100 feet in advance of the area of crew exposure without adversely affecting the performance or quality of the work. If workers are no longer present but road or work conditions require the traffic control to remain in place, Type 3 Barricades or other channelizing devices may be substituted for the Shadow Vehicle and TMA.
6. Additional Shadow Vehicles with TMAs may be positioned 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)

7. 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)

8. 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

FILE: tcp2-4-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS 8-95 3-03	0902	90	108	VA
1-97 2-12	DIST	COUNTY		SHEET NO.
4-98 2-18	FTW	TARRANT		97

DATE: 4/29/2021 11:08:13 AM
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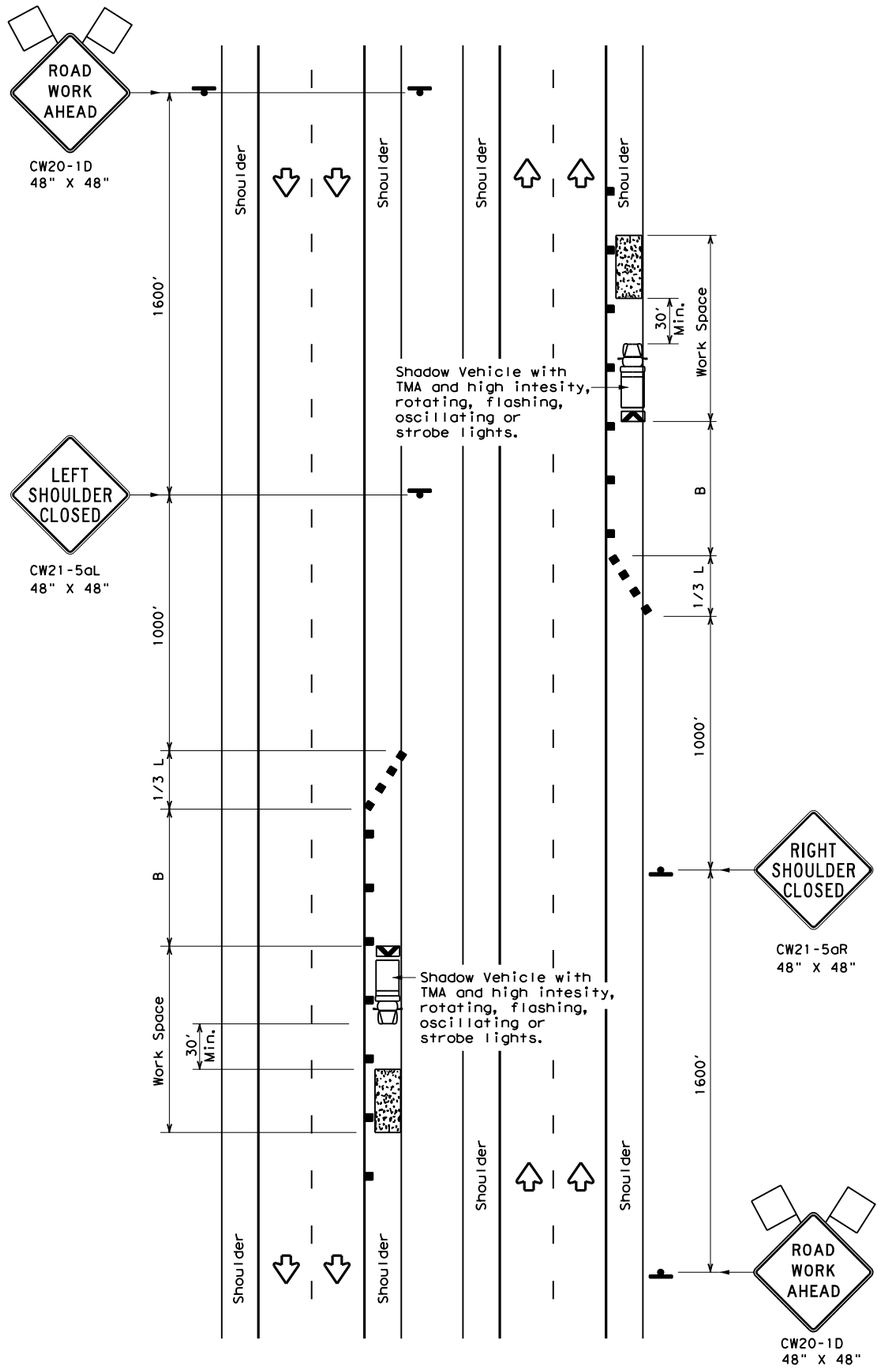
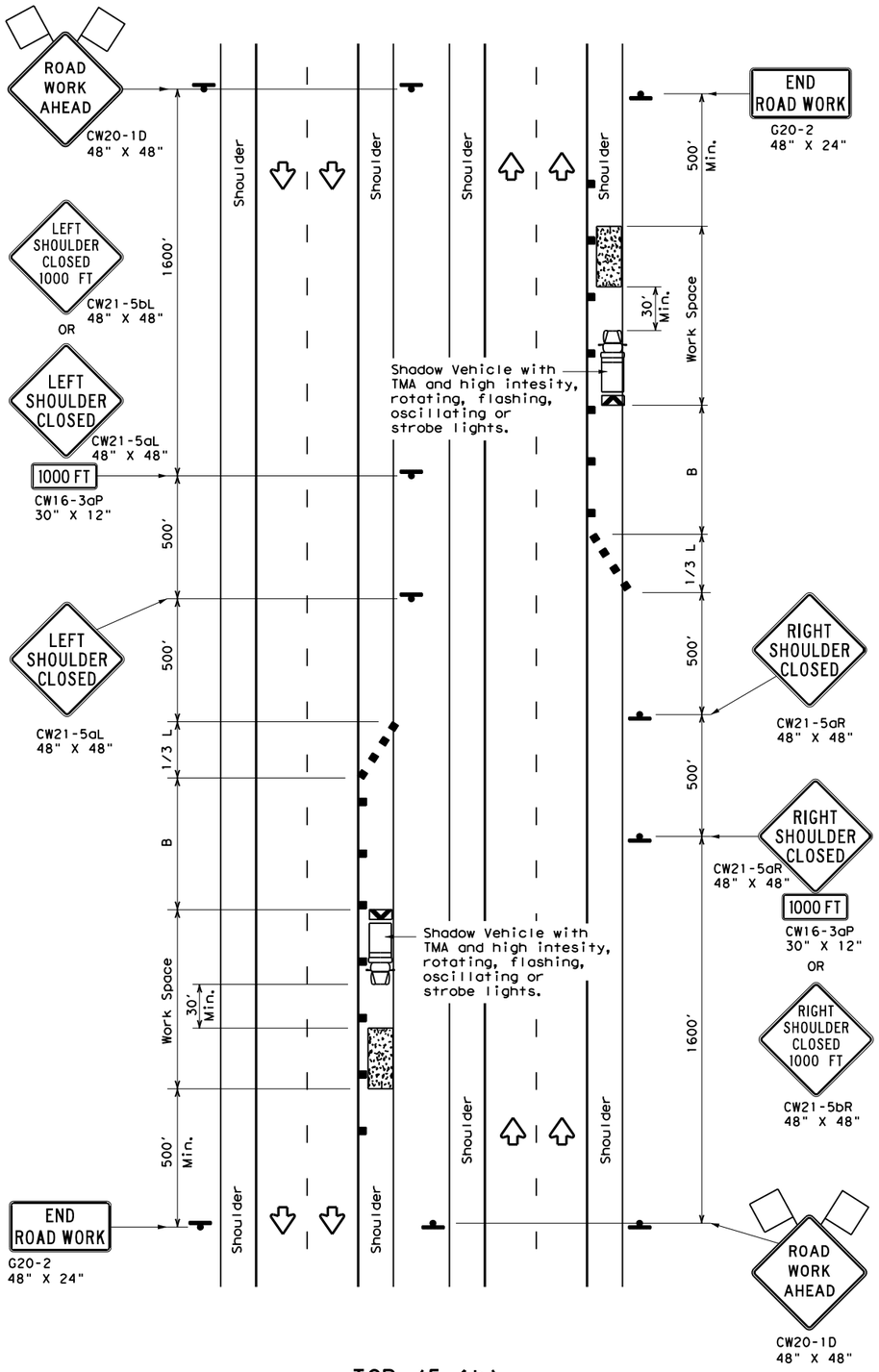


TCP (5-1a)

WORK AREA ON SHOULDER



TCP (5-1b)

WORK AREA ON SHOULDER

LEGEND

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

Posted Speed *	Formula	Minimum Desirable Taper Lengths ** 10' Offset	11' Offset	12' Offset	Suggested Maximum Spacing of Channelizing Devices On a Taper	On a Tangent	Suggested Longitudinal Buffer Space "B"
30	$L=\frac{WS^2}{60}$	150'	165'	180'	30'	60'	90'
35		205'	225'	245'	35'	70'	120'
40		265'	295'	320'	40'	80'	155'
45	L=WS	450'	495'	540'	45'	90'	195'
50		500'	550'	600'	50'	100'	240'
55		550'	605'	660'	55'	110'	295'
60		600'	660'	720'	60'	120'	350'
65		650'	715'	780'	65'	130'	410'
70		700'	770'	840'	70'	140'	475'
75		750'	825'	900'	75'	150'	540'
80		800'	880'	960'	80'	160'	615'

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

TYPICAL USAGE

MOBILE	SHORT DURATION	SHORT TERM STATIONARY	INTERMEDIATE TERM STATIONARY	LONG TERM STATIONARY
	TCP(5-1a)	TCP(5-1b)	TCP(5-1b)	

GENERAL NOTES

1. A Shadow Vehicle with a TMA should be used anytime it can be positioned 30' to 100' in advance of the area of crew exposure without adversely effecting the performance or quality of the work. Type 3 barricades or drums may be substituted when workers on foot are no longer present when approved by the Engineer.
2. 28" tall or taller one-piece cones will be allowed only for Short Duration or Short Term stationary operations when workers are present to maintain the devices upright and in proper location. Intermediate Term stationary work areas should use Drums, Vertical Panels or 42" tall two-piece cones.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN SHOULDER WORK FOR FREEWAYS / EXPRESSWAYS

TCP(5-1)-18

FILE: tcp5-1-18.dgn	DN:	CK:	DW:	CK:
©TxDOT February 2012	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
2-18	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		98

DATE: 4/29/2021 11:08:15 AM
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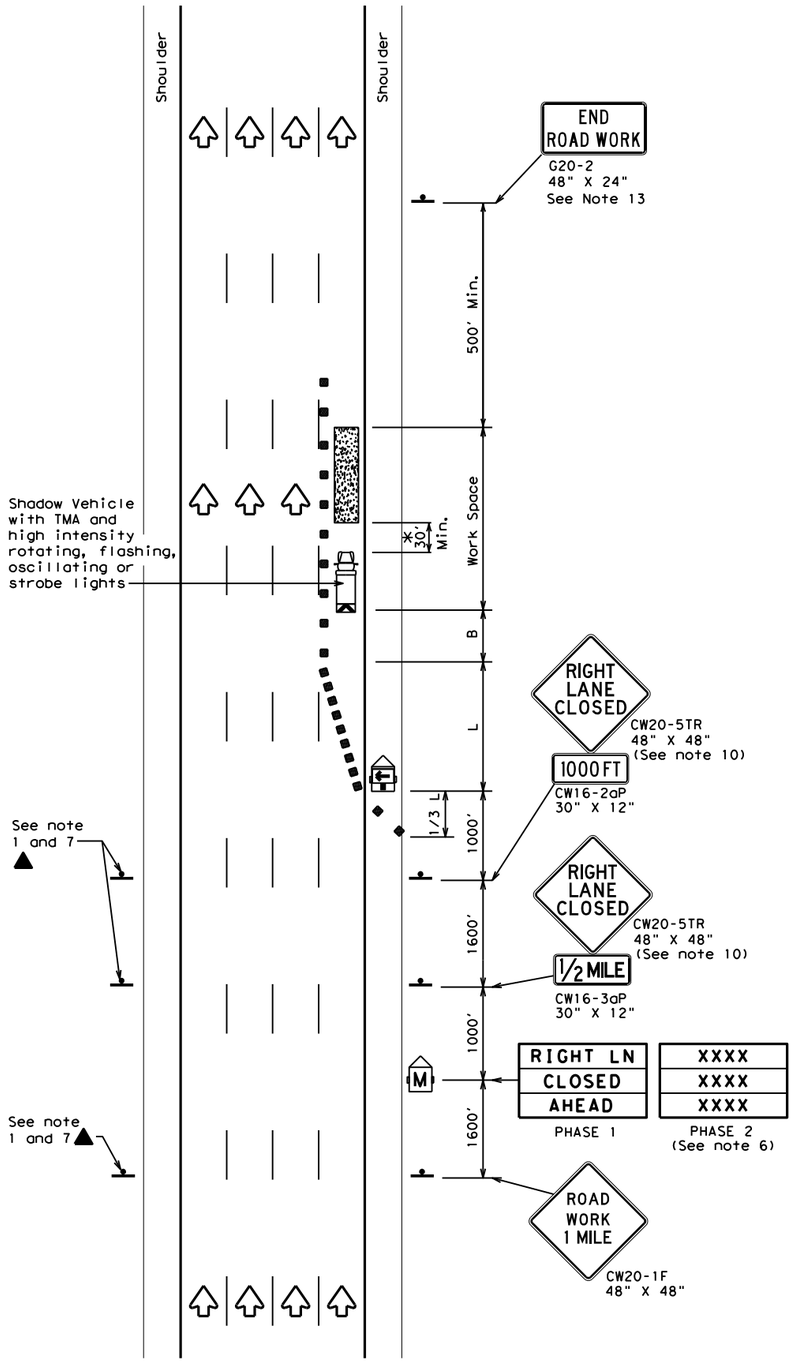
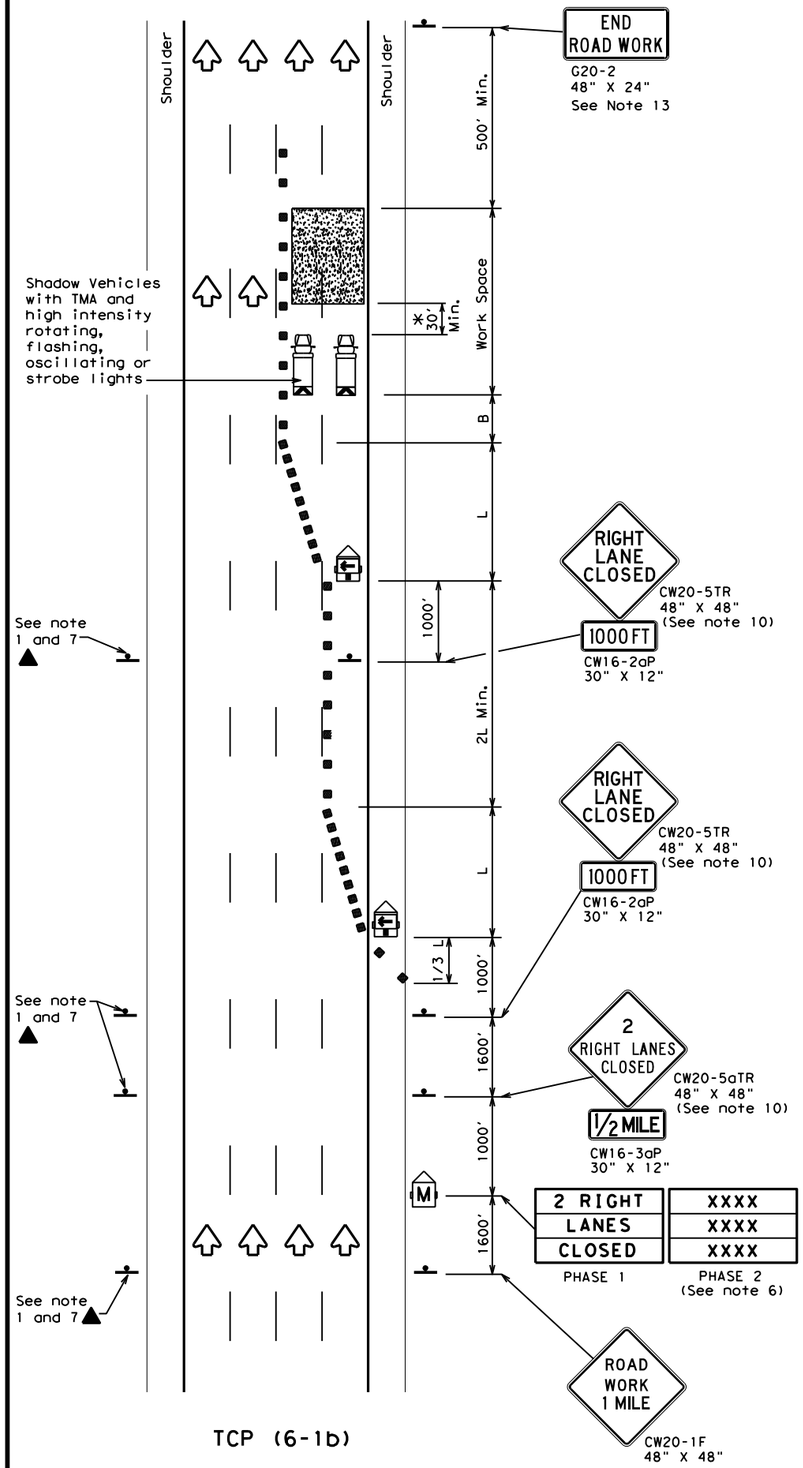


TCP (6-1a)

TYPICAL FREEWAY ONE LANE CLOSURE



TCP (6-1b)

TYPICAL FREEWAY TWO LANE CLOSURE

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

Posted Speed	Formula	Minimum Desirable Taper Lengths "L" ** 10' Offset	11' Offset	12' Offset	Suggested Maximum Spacing of Channelizing Devices: On a Taper	On a Tangent	Suggested Longitudinal Buffer Space "B"
45	L=WS	450'	495'	540'	45'	90'	195'
50		500'	550'	600'	50'	100'	240'
55		550'	605'	660'	55'	110'	295'
60		600'	660'	720'	60'	120'	350'
65		650'	715'	780'	65'	130'	410'
70		700'	770'	840'	70'	140'	475'
75		750'	825'	900'	75'	150'	540'
80		800'	880'	960'	80'	160'	615'

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

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

GENERAL NOTES

1. All traffic control devices illustrated are REQUIRED. Devices denoted with the triangle symbol may be omitted when stated elsewhere in the plans.
2. Drums or 42"cones are the typical channelizing devices. For Intermediate Term Stationary work, drums shall be used on tapers with drums or 42" cones used on tangent sections. Other channelizing devices may be used as directed by the Engineer.
3. All construction signs and barricades placed during any phase of work shall remain in place until removal is approved by the Engineer.
4. The Engineer may direct the Contractor to furnish additional signs and barricades as required to maintain traffic flow, detours and motorist safety during construction.
5. Static message boards or changeable message signs stating the date and duration of ramp or freeway lane closures shall be placed a minimum of seven (7) calendar days in advance of the actual closure.
6. Phase 2 of the PCMS message should include appropriate information formatted as shown on BC(6), such as "MERGE LEFT," recommended advisory speed, delay information, or other specific warnings.
7. Duplicate construction warning signs should be erected on the medians side of freeways where median width will permit and traffic volume justifies the signing.
8. The number of closed lanes may be increased provided the spacing of traffic control devices, taper lengths and tangent lengths meet the requirements of the TMUTCD.
9. Warning signs for intermediate term stationary work should be mounted at 7' to the bottom of the sign.
10. Warning signs shown shall be appropriately altered for left lane closures. When signs are mounted at 1' height for short term stationary or short duration work, sign versions shown in the SHSD for Texas with distances on the sign face rather than mounted on a plaque below the sign may be used.
11. When possible, PCMS units should be located in advance of the last available exit ramp prior to the lane closure to allow motorists an alternate route. They may also be relocated to improve advance warning in case of unanticipated queuing or congestion.
12. For Intermediate Term Stationary work at night, floodlights should be used to illuminate the work area and equipment crossings. Floodlights shall not produce a disabling glare condition for road users or workers.
13. The END ROAD WORK (G20-2) sign may be omitted when it conflicts with G20-2 signs already in place on the project.

* A shadow vehicle equipped with a Truck Mounted Attenuator is typically required. A shadow vehicle equipped with a TMA shall be used if it can be positioned 30' to 100' in advance of the area of crew exposure without adversely affecting the work performance.

Texas Department of Transportation
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN FREEWAY LANE CLOSURES

TCP(6-1)-12

FILE: tcp6-1.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
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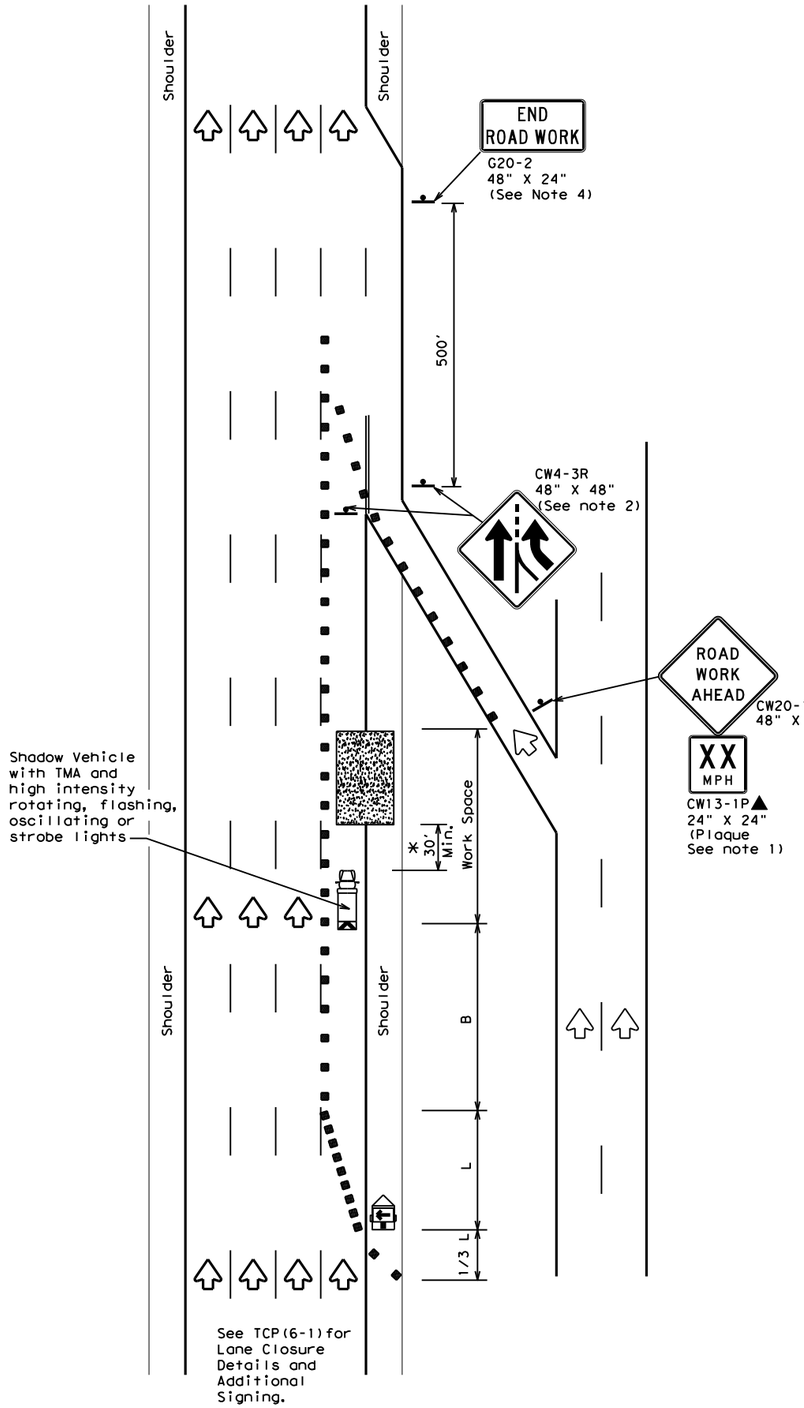
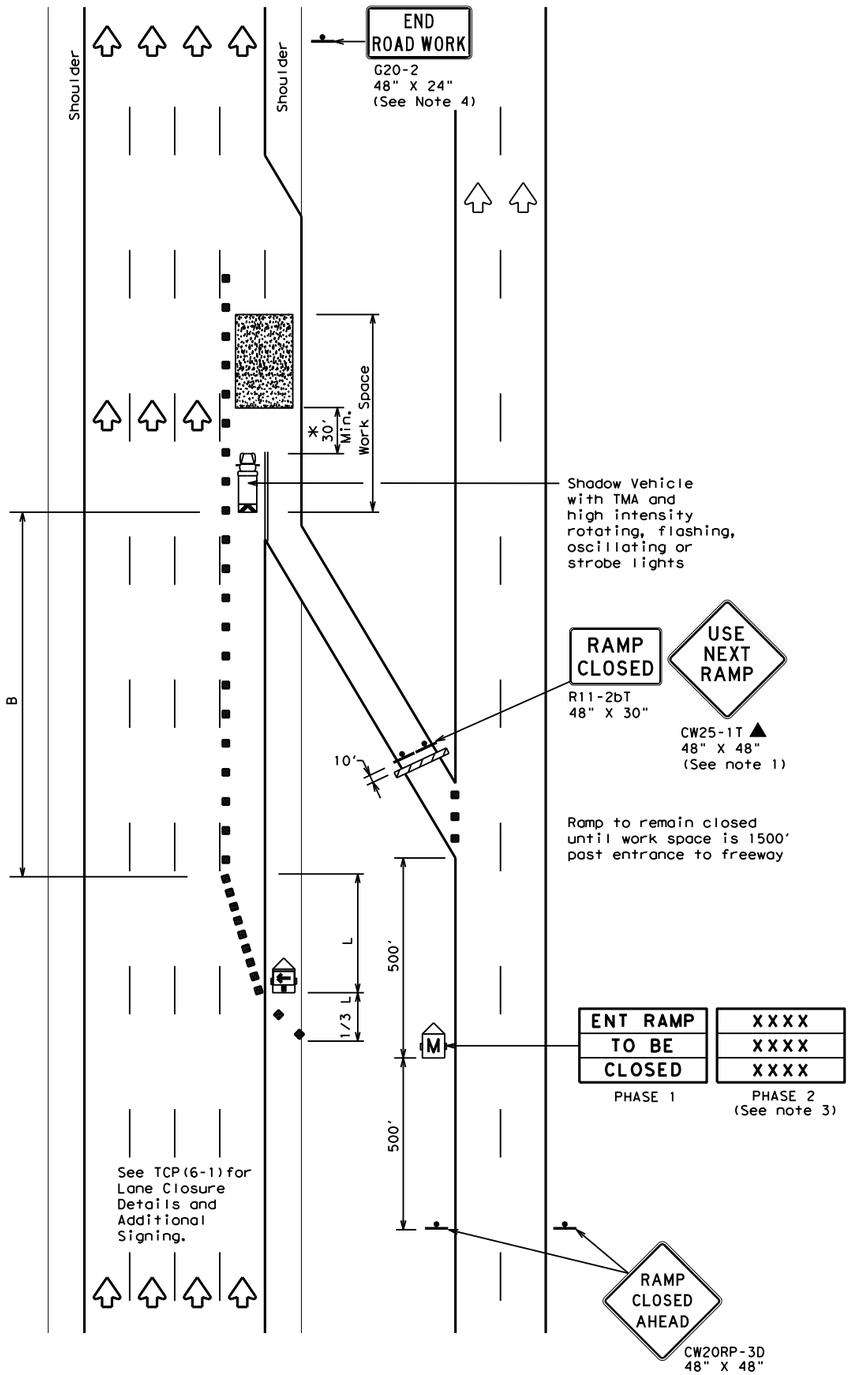
8-12	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		99



TCP (6-2a)

ENTRANCE RAMP OPEN
WORK WITHIN 500' OF RAMP



TCP (6-2b)

ENTRANCE RAMP CLOSED

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

Posted Speed	Formula	Minimum Desirable Taper Lengths "L" **			Suggested Maximum Spacing of Channelizing Devices		Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent	
45	L=WS	450'	495'	540'	45'	90'	195'
50		500'	550'	600'	50'	100'	240'
55		550'	605'	660'	55'	110'	295'
60		600'	660'	720'	60'	120'	350'
65		650'	715'	780'	65'	130'	410'
70		700'	770'	840'	70'	140'	475'
75		750'	825'	900'	75'	150'	540'
80		800'	880'	960'	80'	160'	615'

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

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

GENERAL NOTES

1. All traffic control devices illustrated are REQUIRED. Devices denoted with the triangle symbol may be omitted when stated elsewhere in the plans.
2. ADDED LANE Symbol (CW4-3) sign may be omitted when sign between ramp and mainlane can be seen from both roadways.
3. See "Advance Notice List" on BC(6) for recommended date and time formatting options for PCMS Phase 2 message.
4. The END ROAD WORK (G20-2) sign may be omitted when it conflicts with G20-2 signs already in place on the project.

*A shadow vehicle equipped with a Truck Mounted Attenuator is typically required. A shadow vehicle equipped with a TMA shall be used if it can be positioned 30' to 100' in advance of the area of crew exposure without adversely affecting the work performance.

Additional requirements for lane closures and advance signing shall be as shown on TCP (6-1) or as directed by the Engineer.

Texas Department of Transportation
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN
WORK AREA NEAR RAMP

TCP(6-2)-12

FILE: tcp6-2.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1994	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
1-97 8-98	DIST	COUNTY		SHEET NO.
4-98 8-12	FTW	TARRANT		100

DATE: 4/29/2021 11:08:17 AM
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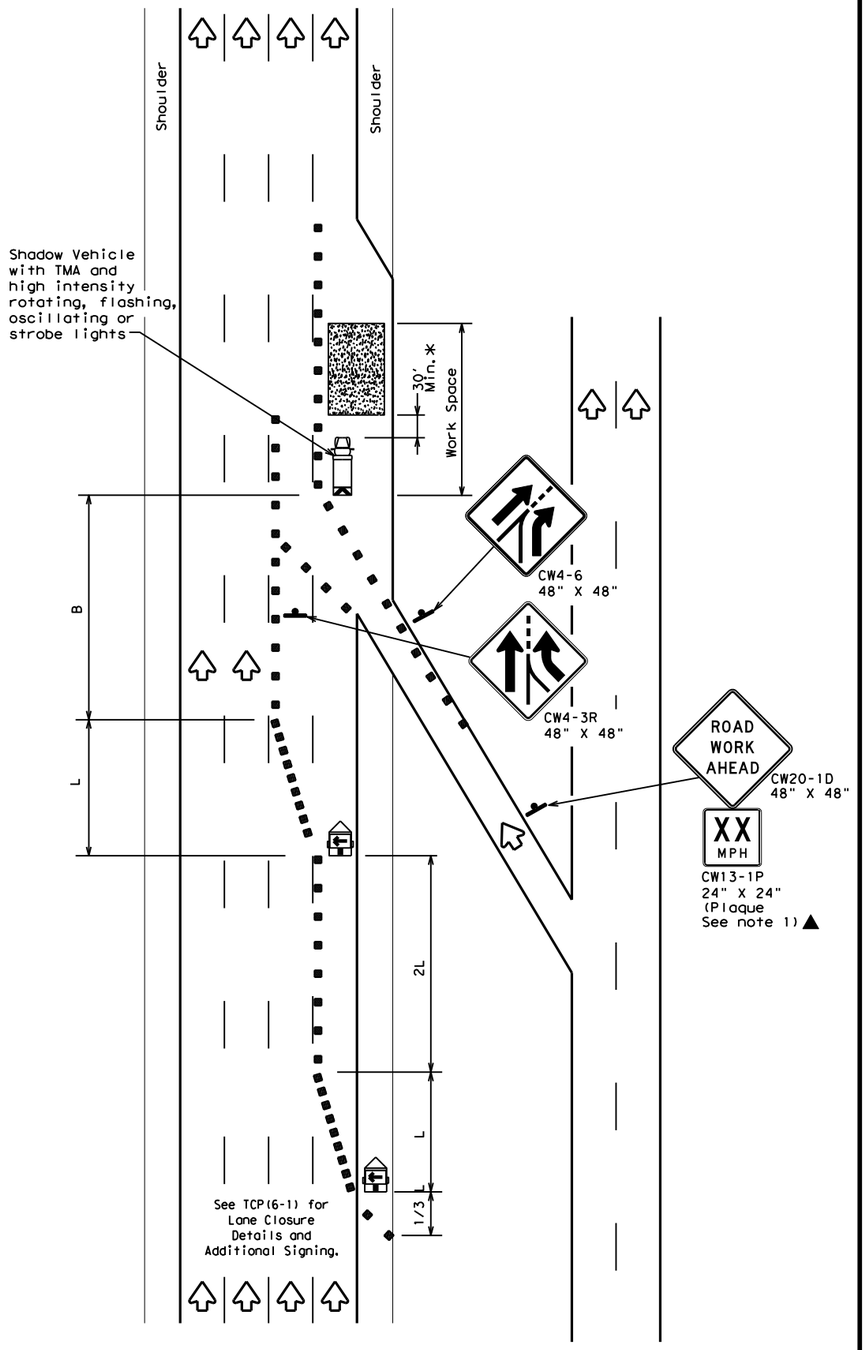
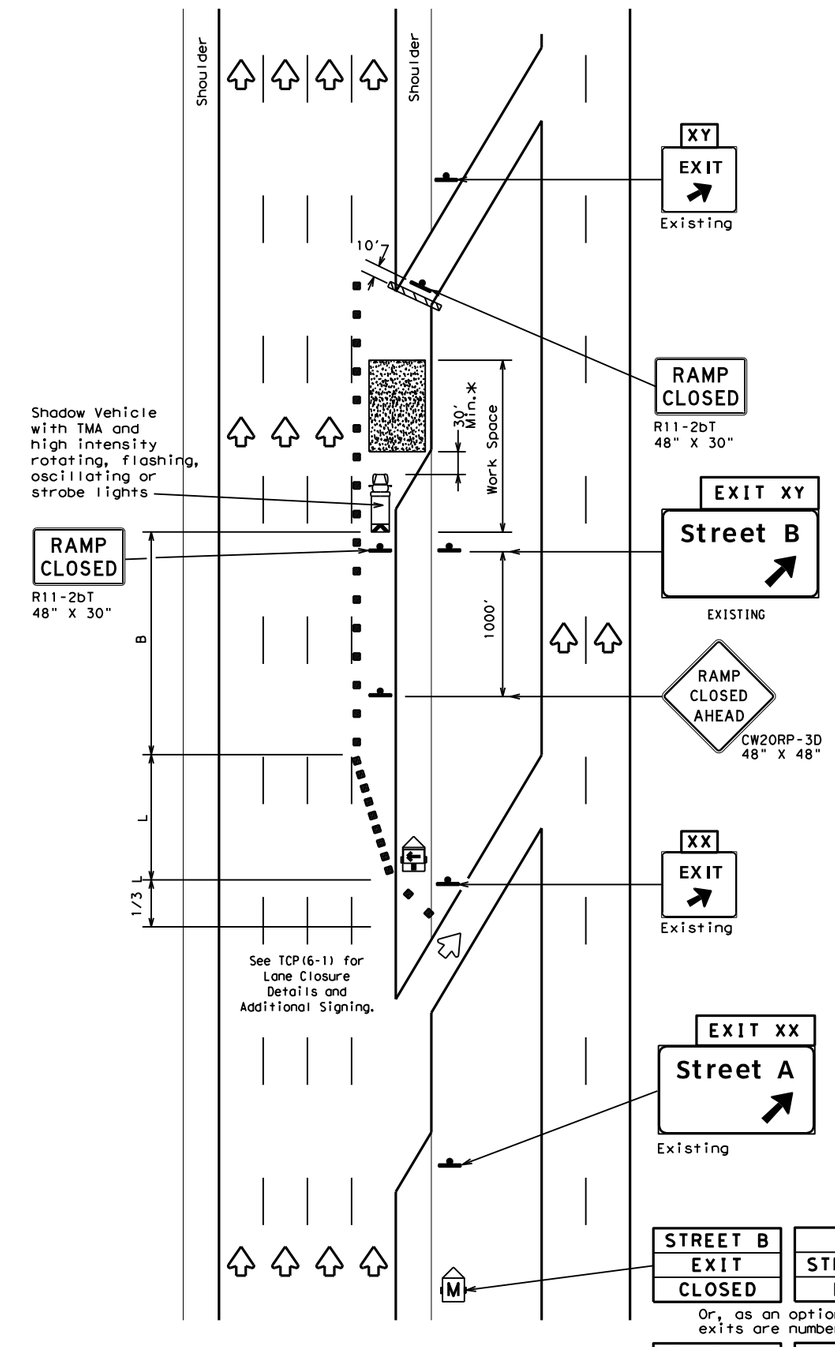


TCP (6-3a)

ENTRANCE RAMP OPEN



STREET B	USE
EXIT	STREET A
CLOSED	EXIT

Or, as an option when exits are numbered

EXIT XY	USE
CLOSED	EXIT XX

Place 1 mile (approx.) in advance of Street A exit.

TCP (6-3b)

EXIT RAMP CLOSED
TRAFFIC EXITS PRIOR TO CLOSED RAMP

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

Posted Speed	Formula	Minimum Desirable Taper Lengths "L" **			Suggested Maximum Spacing of Channelizing Devices		Suggested Longitudinal Buffer Space "B"
		10' Offset	11' Offset	12' Offset	On a Taper	On a Tangent	
45	L=WS	450'	495'	540'	45'	90'	195'
50		500'	550'	600'	50'	100'	240'
55		550'	605'	660'	55'	110'	295'
60		600'	660'	720'	60'	120'	350'
65		650'	715'	780'	65'	130'	410'
70		700'	770'	840'	70'	140'	475'
75		750'	825'	900'	75'	150'	540'
80		800'	880'	960'	80'	160'	615'

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

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

GENERAL NOTES:

1. All traffic control devices illustrated are REQUIRED. Devices denoted with the triangle symbol may be omitted when stated elsewhere in the plans.

*A shadow vehicle equipped with a Truck Mounted Attenuator is typically required. A shadow vehicle equipped with a TMA shall be used if it can be positioned 30' to 100' in advance of the area of crew exposure without adversely affecting the work performance.

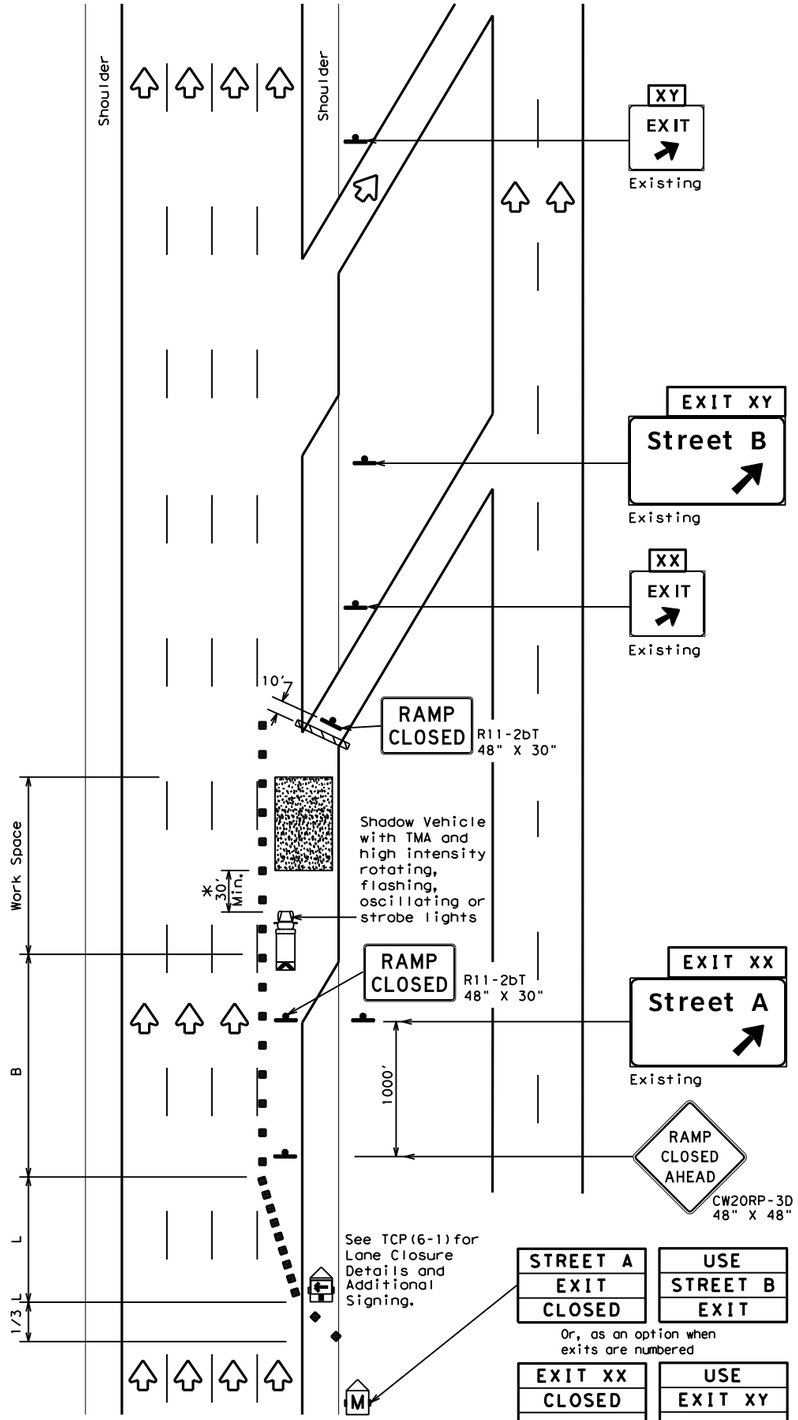
Additional requirements for lane closures and advance signing shall be as shown on TCP (6-1) or as directed by the Engineer.

Texas Department of Transportation
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN
WORK AREA BEYOND RAMP

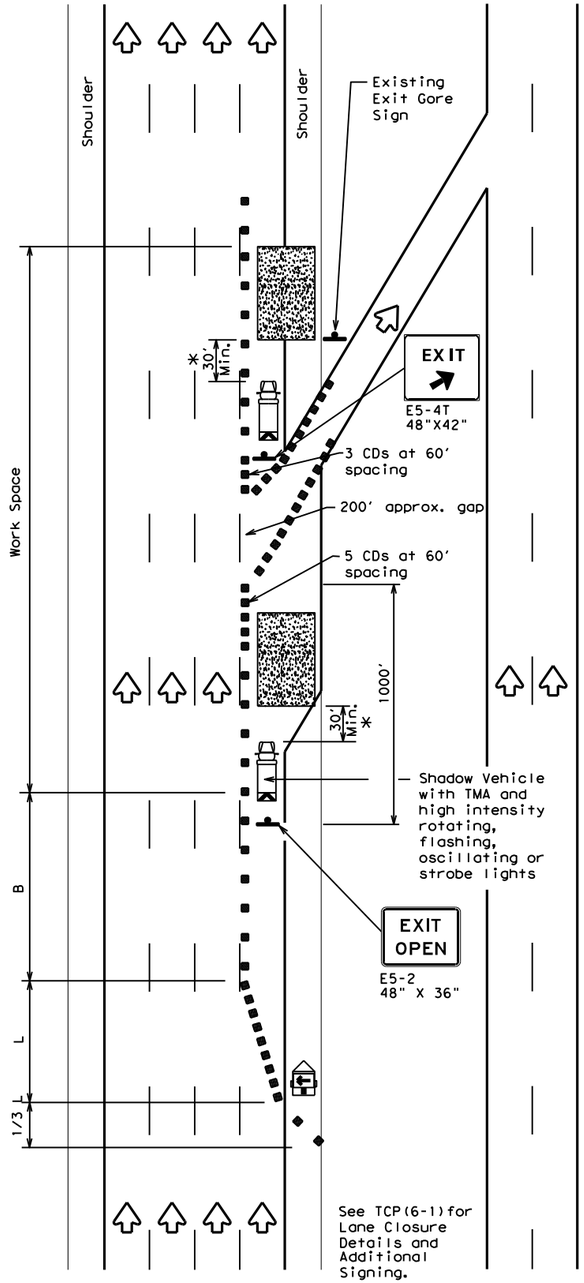
TCP(6-3)-12

FILE: tcp6-3.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1994	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
1-97 8-98	DIST	COUNTY		SHEET NO.
4-98 8-12	FTW	TARRANT		101



TCP (6-4a)

EXIT RAMP CLOSED
TRAFFIC EXITS PAST CLOSED RAMP



TCP (6-4b)

EXIT RAMP OPEN

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

Posted Speed	Formula	Minimum Desirable Taper Lengths "L" ** 10' Offset	11' Offset	12' Offset	Suggested Maximum Spacing of Channelizing Devices: On a Taper	On a Tangent	Suggested Longitudinal Buffer Space "B"
45	L=WS	450'	495'	540'	45'	90'	195'
50		500'	550'	600'	50'	100'	240'
55		550'	605'	660'	55'	110'	295'
60		600'	660'	720'	60'	120'	350'
65		650'	715'	780'	65'	130'	410'
70		700'	770'	840'	70'	140'	475'
75		750'	825'	900'	75'	150'	540'
80		800'	880'	960'	80'	160'	615'

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

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

GENERAL NOTES

1. All traffic control devices illustrated are REQUIRED. Devices denoted with the triangle symbol may be omitted when stated elsewhere in the plans.
2. See BC Standards for sign details.

*A shadow vehicle equipped with a Truck Mounted Attenuator is typically required. A shadow vehicle equipped with a TMA shall be used if it can be positioned 30' to 100' in advance of the area of crew exposure without adversely affecting the work performance.

Additional requirements for lane closures and advance signing shall be as shown on TCP (6-1) or as directed by the Engineer.

Texas Department of Transportation
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN
WORK AREA AT EXIT RAMP

TCP(6-4)-12

FILE: tcp6-4.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT Feburary 1994	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
1-97 8-98	DIST	COUNTY		SHEET NO.
4-98 8-12	FTW	TARRANT		102

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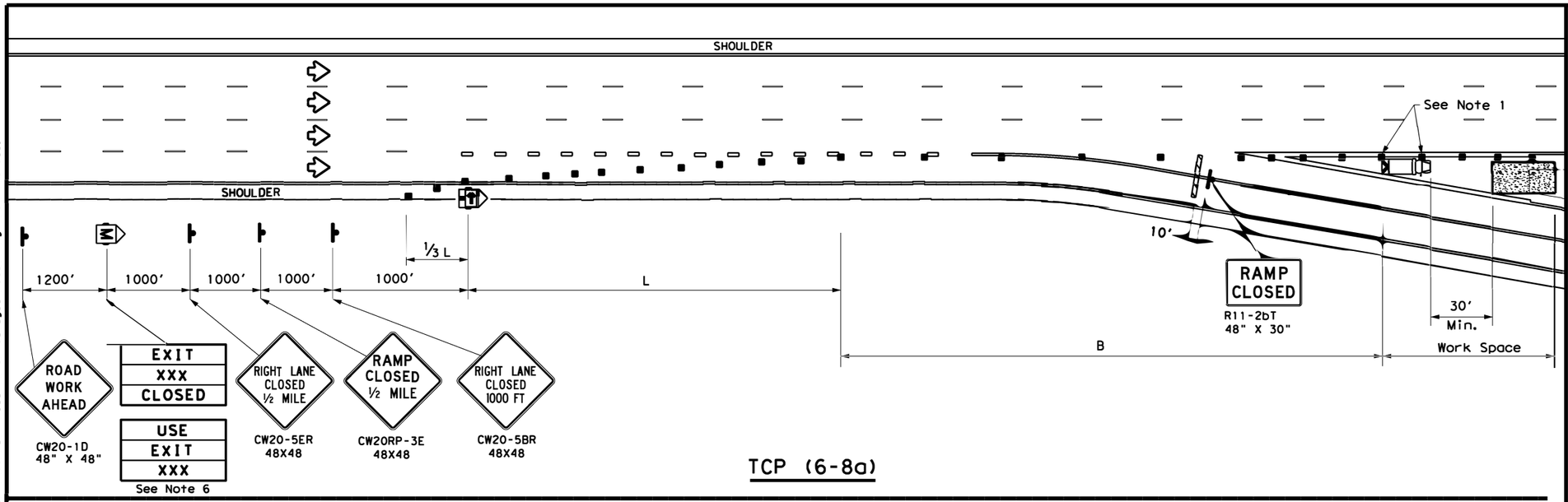
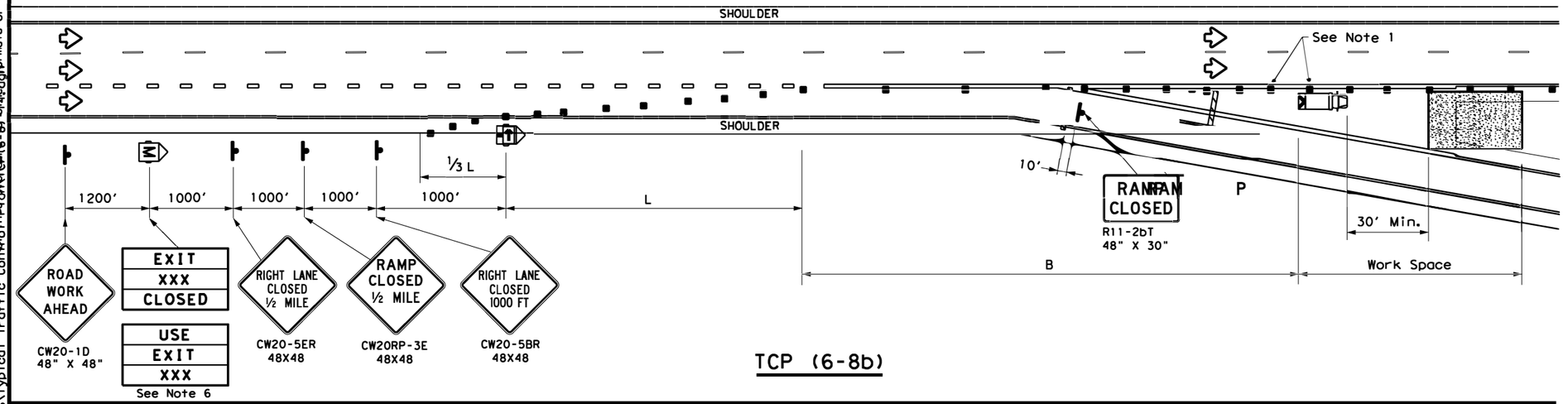
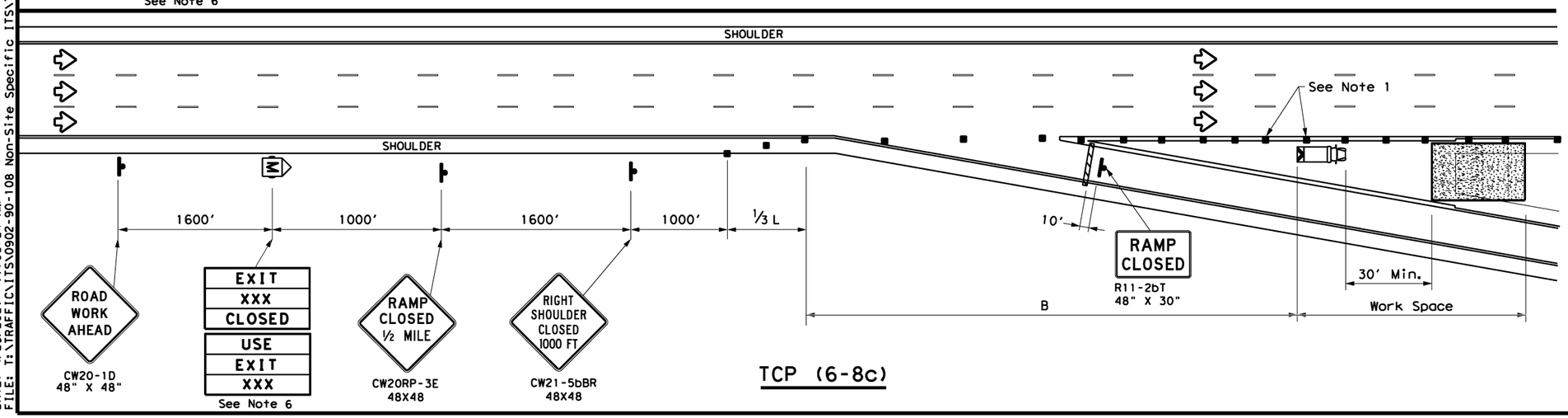


TCP (6-8a)



TCP (6-8b)



TCP (6-8c)

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

Posted Speed	Formula	Minimum Desirable Taper Lengths "L" ** 10' Offset	11' Offset	12' Offset	Suggested Maximum Spacing of Channelizing Devices On a Taper	On a Tangent	Suggested Longitudinal Buffer Space "B"
45	L=WS	450'	495'	540'	45'	90'	195'
50		500'	550'	600'	50'	100'	240'
55		550'	605'	660'	55'	110'	295'
60		600'	660'	720'	60'	120'	350'
65		650'	715'	780'	65'	130'	410'
70		700'	770'	840'	70'	140'	475'
75		750'	825'	900'	75'	150'	540'
80		800'	880'	960'	80'	160'	615'

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

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

GENERAL NOTES

1. Place channelizing devices in the gore at 20' spacing.
2. See the Standard Highway Sign Design for Texas (SHSD) for sign details.
3. The PCMS may be omitted when a permanent DMS sign is available in an appropriate location to display a similar message as called for on the PCMS.
4. When it is determined that a through lane should be closed in addition to the exit ramp, refer to TCP(6-4) for traffic control details.
5. Truck mounted attenuator is required.
6. The PCMS may be omitted if replaced with a "RAMP CLOSED" AHEAD (CW20RP-3D) Sign.
7. Roadway ADT should be greater than 10,000.

Texas Department of Transportation

Traffic Operations Division Standard

WORK IN EXIT GORE FOR ADT GREATER THAN 10,000

TCP(6-8)-14

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	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		103

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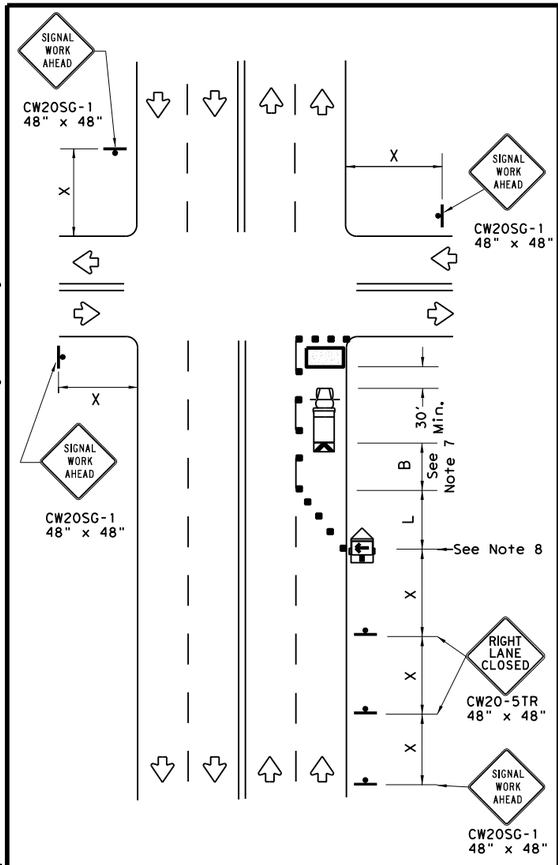
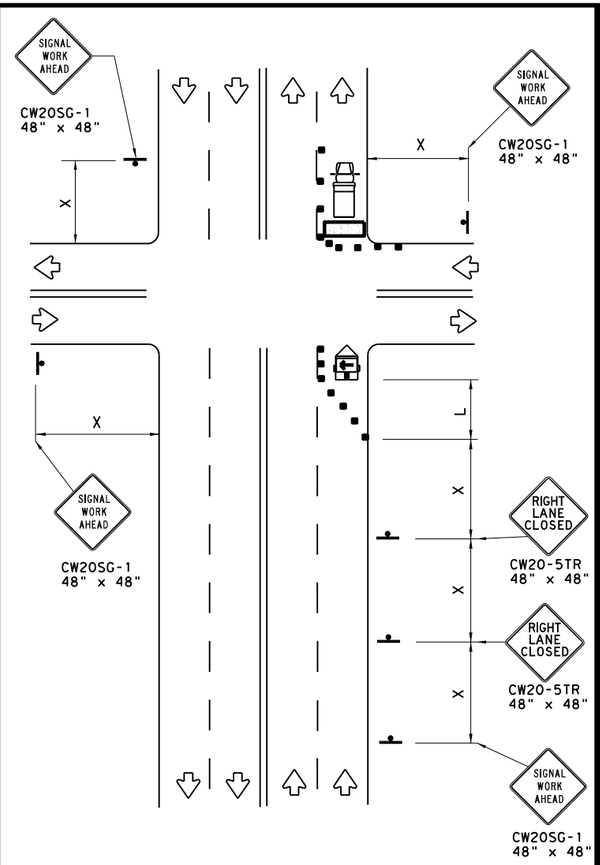


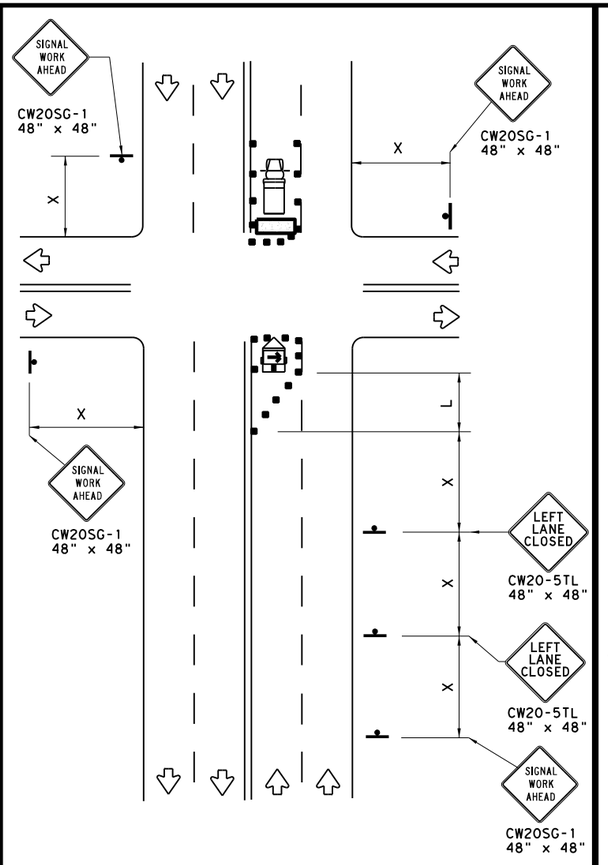
NEAR SIDE LANE CLOSURE

SHORT DURATION OR SHORT TERM STATIONARY



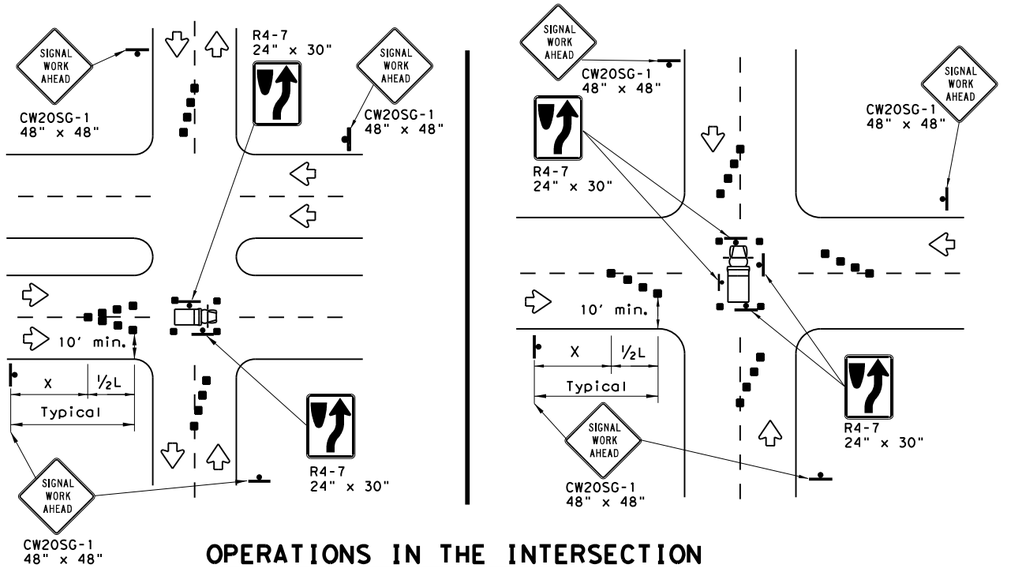
FAR SIDE RIGHT LANE CLOSURE

SHORT DURATION OR SHORT TERM STATIONARY



FAR SIDE LEFT LANE CLOSURE

SHORT DURATION OR SHORT TERM STATIONARY



OPERATIONS IN THE INTERSECTION

SHORT DURATION

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

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

* Conventional Roads Only

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

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

GENERAL NOTES

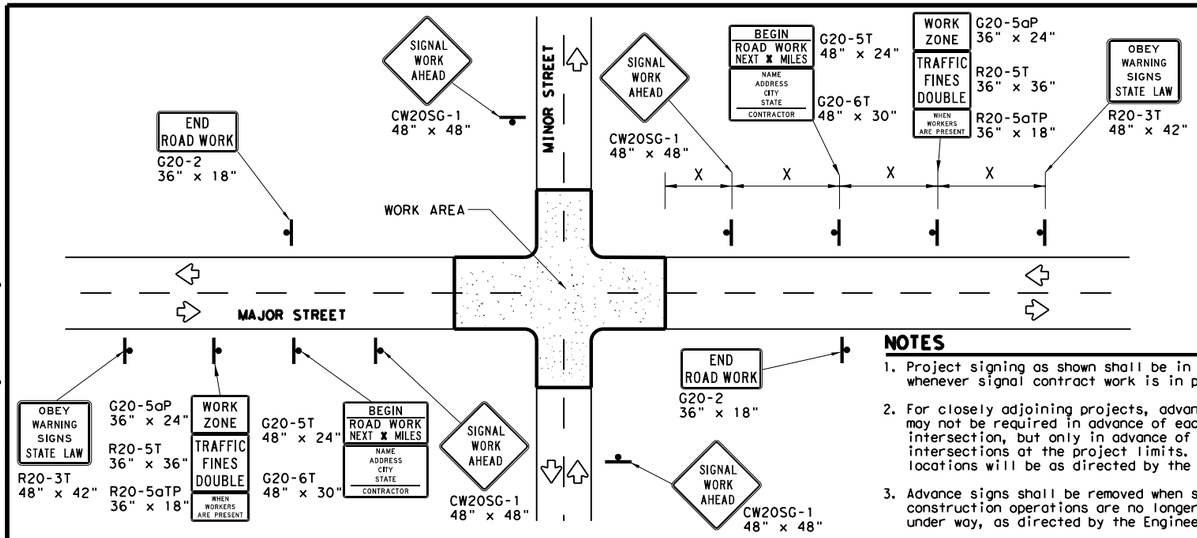
1. The minimum size channelizing device is the 28" cone. 42" Two-piece cones, drums, vertical panels or barricades will be required when the device must be left unattended at night.
2. Obstructions or hazards at the work area shall be clearly marked and delineated at all times.
3. Flaggers and Flagger Symbol (CW20-7) signs may be required according to field conditions.
4. Vehicles parked in roadway shall be equipped with at least two high intensity rotating, flashing, oscillating or strobe type lights.
5. High level warning devices (flag trees) may be used at corners of the vehicle.
6. 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.
7. 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.
8. 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.
9. Signs and devices for the NEAR SIDE LANE CLOSURE may be altered for a left lane closure by using a LEFT LANE CLOSED (CW20-5TL) and adding channelizing devices on the centerline to protect the work space from opposing traffic.

Texas Department of Transportation — Traffic Operations Division Standard

TRAFFIC SIGNAL WORK TYPICAL DETAILS

WZ(BTS-1)-13

FILE: wzbts-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT April 1992	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
2-98 10-99 7-13	DIST	COUNTY		SHEET NO.
4-98 3-03	FTW	TARRANT		104



TYPICAL ADVANCE SIGNAL PROJECT SIGNING

FOR LONG TERM and INTERMEDIATE-TERM STATIONARY WORK OPERATIONS

NOTES

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

GENERAL NOTES FOR WORK ZONE SIGNS

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

DURATION OF WORK

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

SIGN MOUNTING HEIGHT

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

REMOVING OR COVERING

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

REFLECTIVE SHEETING

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

SIGN SUPPORT WEIGHTS

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

SIDEWALK DIVERSION

SIDEWALK DETOUR

CROSSWALK CLOSURES

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: wzbts-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT	
© TxDOT April 1992	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0902	90	108	VA	
2-98 10-99 7-13 4-98 3-03	DIST	COUNTY		SHEET NO.	
	FTW	TARRANT		105	

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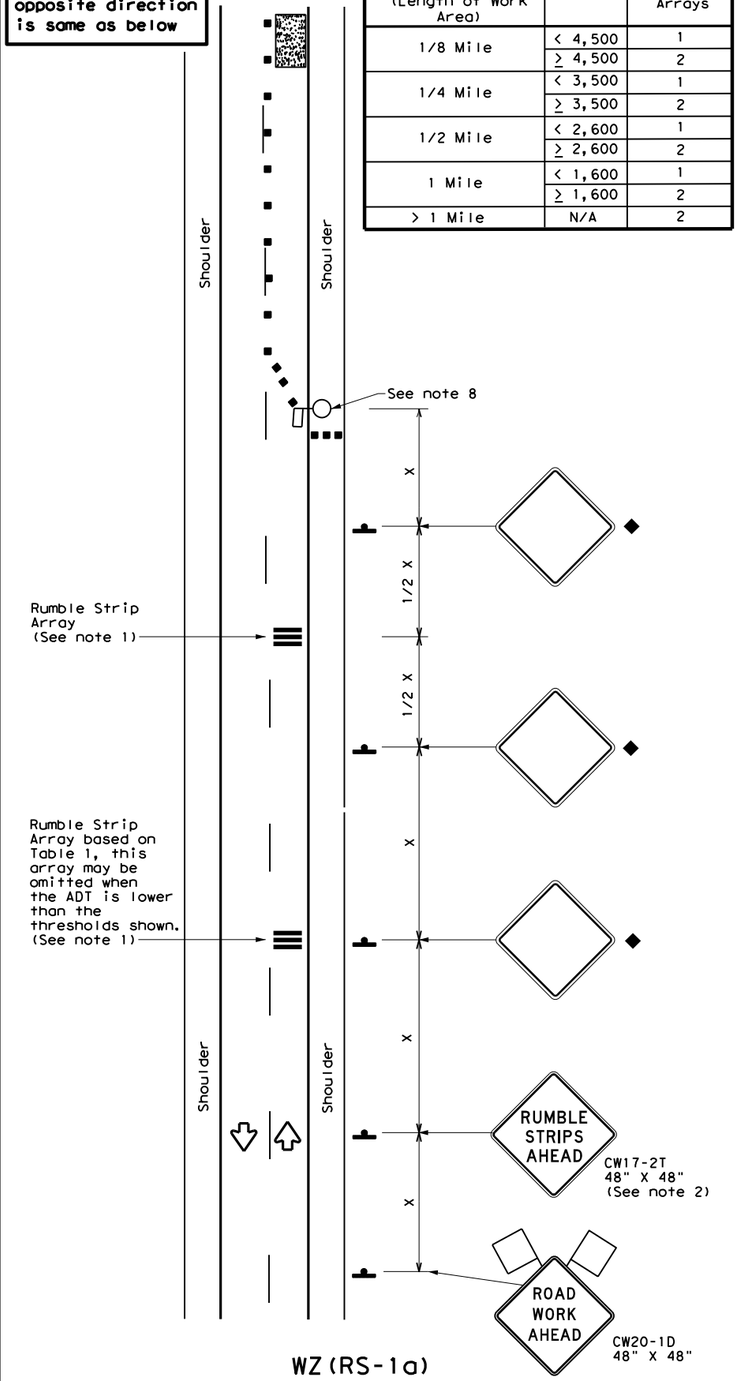
DATE: 4/29/2021 11:08:30 AM
FILE: I:\TRAFFIC\ITS\0902-90-108 Non-Site Specific ITS\Standards\WZ(RS)-16.dgn

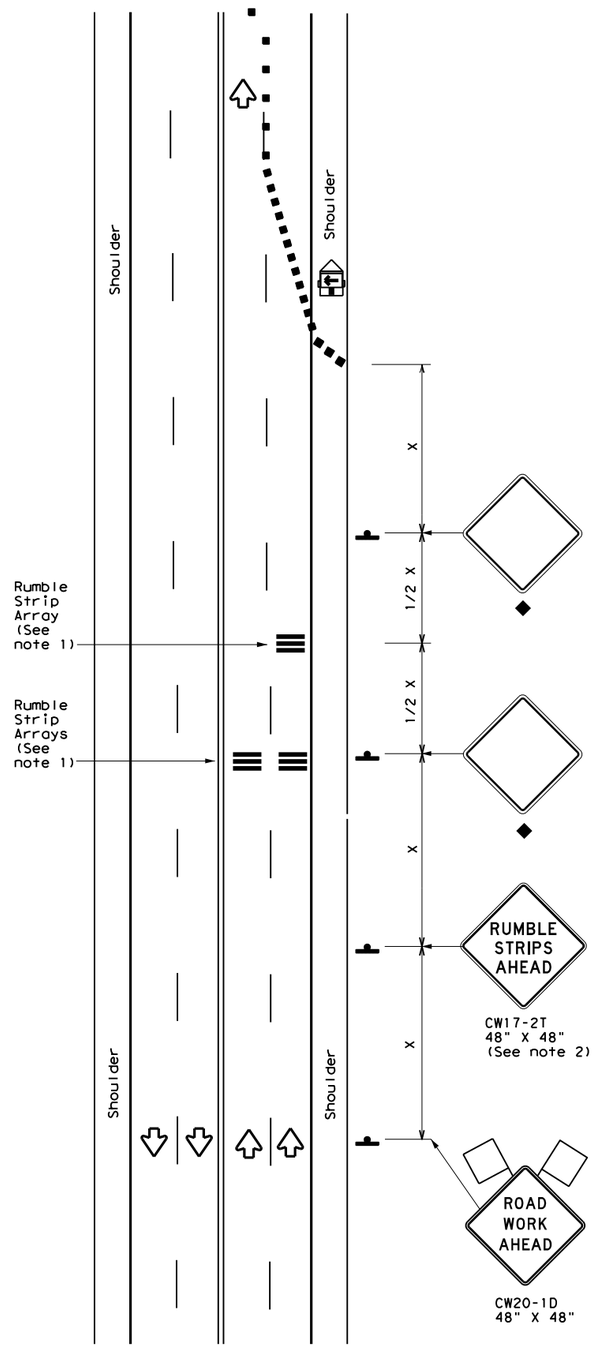
Warning sign and rumble strip sequence in opposite direction is same as below

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



WZ(RS-1a)
75 mph or Less

RUMBLE STRIPS ON ONE-LANE TWO-WAY APPLICATION



WZ(RS-1b)
75 mph or Less

RUMBLE STRIPS FOR LANE CLOSURE ON CONVENTIONAL ROADWAY

GENERAL NOTES

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

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

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

* Conventional Roads Only

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

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

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

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

Texas Department of Transportation

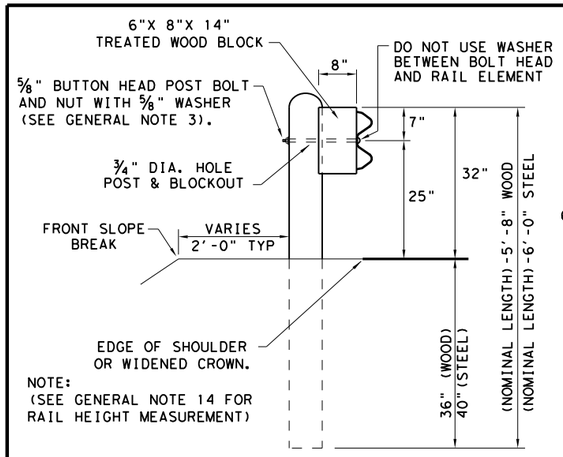
Traffic Operations Division Standard

TEMPORARY RUMBLE STRIPS

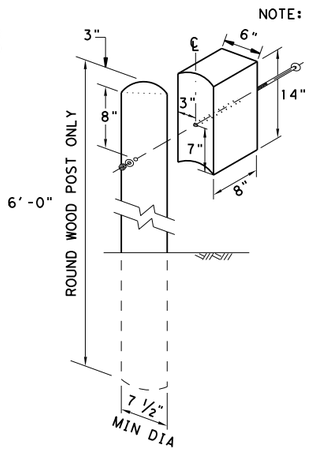
WZ(RS)-16

FILE: wzrs16.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2012	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
2-14	DIST	COUNTY		SHEET NO.
4-16	FTW	TARRANT		106

DATE: 4/29/2021
FILE: T:\TRAFFIC\ITS\0902-90-108 Non-Site Specific ITS\MBGF\GF(31)-19.dgn

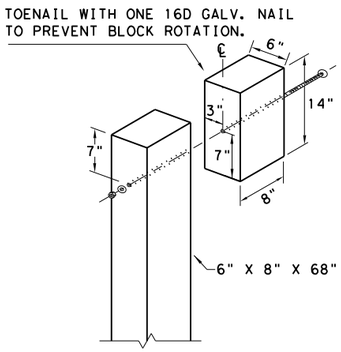


TYPICAL POST PLACEMENT

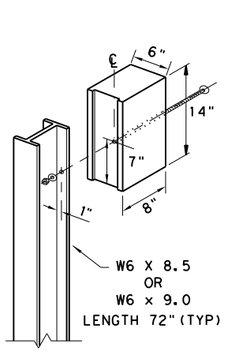


WOOD BLOCK TO ROUND WOOD POST

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

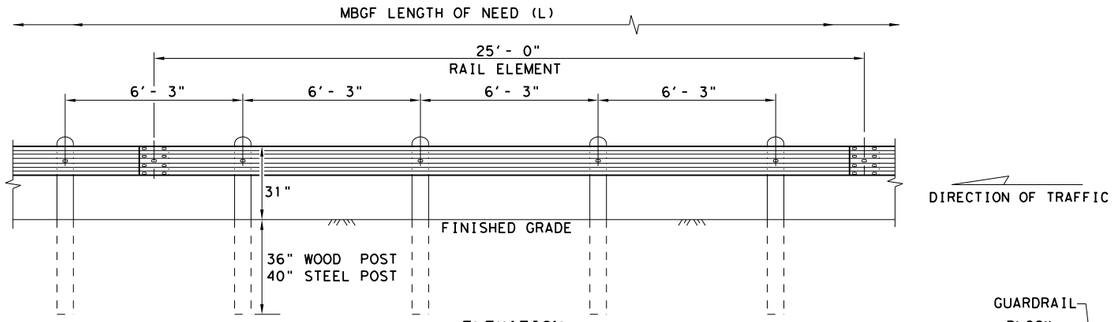


WOOD BLOCK TO RECTANGULAR WOOD POST



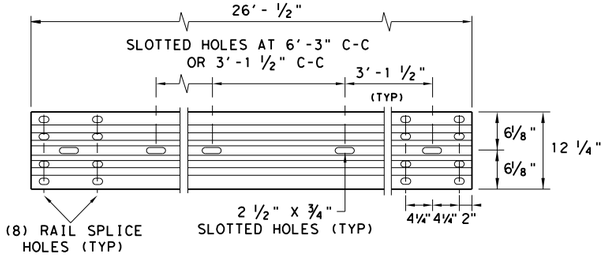
ROUTED WOOD BLOCK TO I-BEAM STEEL POST

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



ELEVATION
MID-SPAN RAIL SPLICE

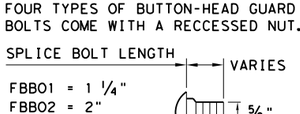
SHOWING A 25'- 0" SECTION OF W-BEAM RAIL. (SEE GENERAL NOTE 2)



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

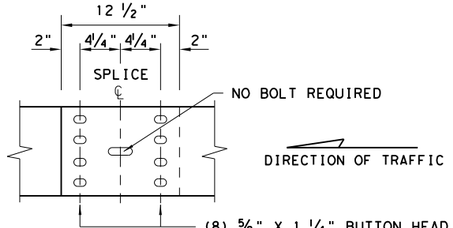
NOTES: SEE GENERAL NOTE 2 FOR ALLOWABLE RAIL TYPES.
SEE RAIL SPLICE DETAIL FOR REQUIRED HARDWARE.

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



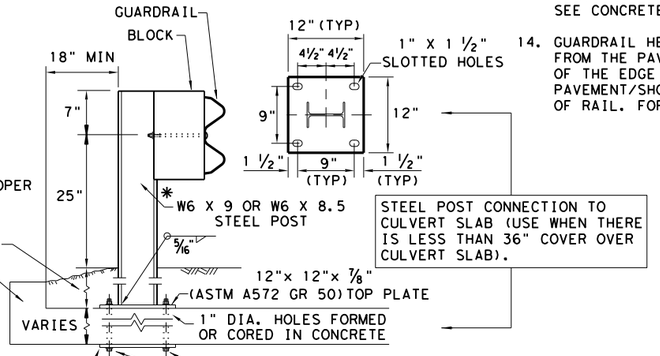
BUTTON HEAD BOLT

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



MID-SPAN RAIL SPLICE DETAIL

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



* POST(S) MAY REQUIRE FIELD MODIFICATION TO ENSURE PROPER GUARDRAIL HEIGHT.

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

LOW FILL CULVERT POST

NOTE: TWO INSTALLATION OPTIONS.

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

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

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

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

GENERAL NOTES

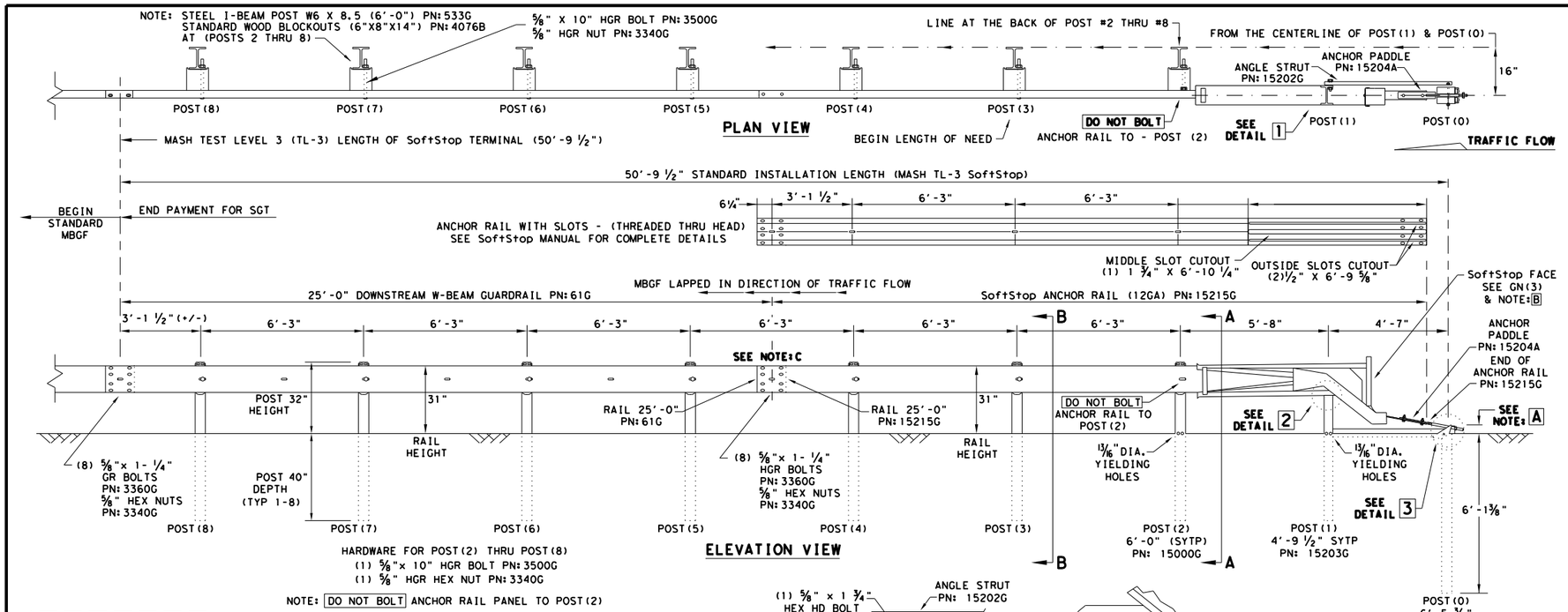
1. THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST, OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. THE EXACT POSITION OF MBGF SHALL BE SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER. STEEL POSTS TO BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING."
2. RAIL ELEMENTS SHALL MEET THE REQUIREMENTS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

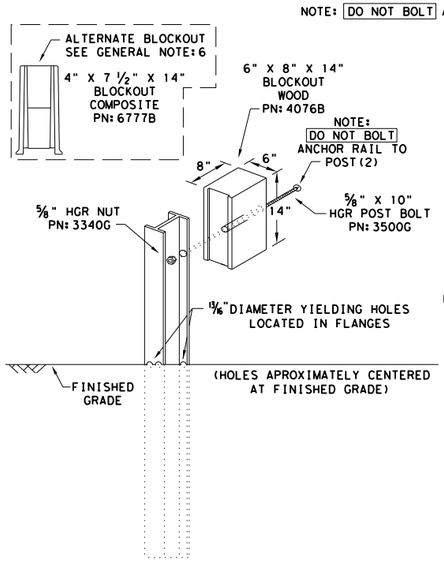
Texas Department of Transportation

Design Division Standard

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

FILE: gf3119.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG
©TxDOT: NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		107

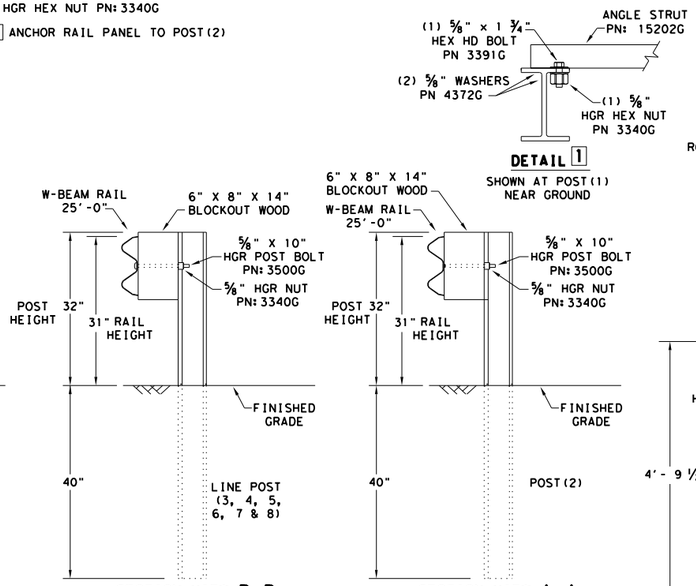




ISOMETRIC VIEW POST(1 & 2)

W6 X 8.5 I-BEAM POST SHOWING STANDARD WOOD BLOCKOUT

NOTE: NO BLOCKOUT INSTALLED AT POST(1)



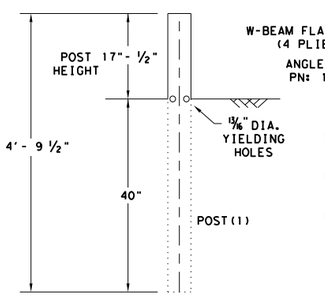
SECTION VIEW B-B

6'-0" (W6 X 8.5)
I-BEAM POST PN: 533G

SECTION VIEW A-A

6'-0" (W6 X 8.5)
(SYTP) I-BEAM POST PN: 15000G

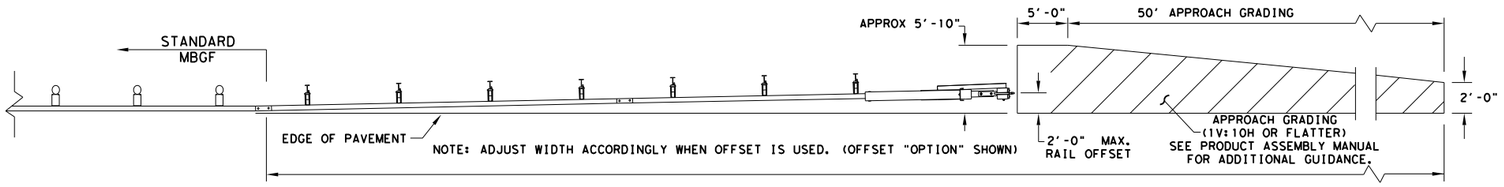
NOTE: DO NOT BOLT ANCHOR RAIL PANEL TO POST(2)



FRONT VIEW POST(1)

4'-9 1/2" (W6 X 8.5)
(SYTP) I-BEAM POST PN: 15203G

NOTE: NO BLOCKOUT INSTALLED AT POST(1)



APPROACH GRADING AT GUARDRAIL END TREATMENTS

GENERAL NOTES

1. FOR SPECIFIC INFORMATION REGARDING INSTALLATION AND TECHNICAL GUIDANCE OF THE SYSTEM, CONTACT: TRINITY HIGHWAY AT 1(888)323-6374. 2525 N. STEMMONS FREEWAY, DALLAS, TX 75207
2. FOR INSTALLATION, REPAIR AND MAINTENANCE REFER TO THE; SoftStop END TERMINAL, PRODUCT DESCRIPTION ASSEMBLY MANUAL. PN: 620237B
3. APPLY HIGH INTENSITY REFLECTIVE SHEETING, "OBJECT MARKER" ON THE FRONT FACE OF THE DEVICE PER MANUFACTURER'S RECOMMENDATIONS. OBJECT MARKER SHALL CONFORM TO THE STANDARDS REQUIRED IN TEXAS MUTCD.
4. FOR POST (LEAVE-OUT) INSTALLATION AND GUIDANCE SEE TXDOT'S LATEST ROADWAY MOW STRIP STANDARD.
5. HARDWARE (BOLTS, NUTS, & WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
6. A COMPOSITE MATERIAL BLOCKOUT THAT MEETS THE REQUIREMENTS OF DMS-7210, MAY BE SUBSTITUTED FOR BLOCKOUTS OF SIMILAR DIMENSIONS. SEE CONSTRUCTION DIVISION MATERIAL PRODUCER LIST (MPL) FOR CERTIFIED PRODUCERS.
7. IF SOLID ROCK IS ENCOUNTERED SEE THE MANUFACTURER'S INSTALLATION MANUAL AND REFER TO THE LATEST ROADWAY MBGF STANDARD FOR INSTALLATION GUIDANCE.
8. POSTS SHALL NOT BE SET IN CONCRETE.
9. IT IS ACCEPTABLE TO INSTALL THE SoftStop IMPACT HEAD PARALLEL TO THE GRADE LINE OR WITH AN UPWARD TILT.
10. DO NOT ATTACH THE SoftStop SYSTEM DIRECTLY TO A RIGID BARRIER.
11. UNDER NO CIRCUMSTANCES SHALL THE GUARDRAIL WITHIN THE SoftStop SYSTEM BE CURVED.
12. A FLARE RATE OF UP TO 25:1 MAY BE USED TO PREVENT THE TERMINAL HEAD FROM ENCROACHING ON THE SHOULDER. THE FLARE MAY BE DECREASED OR ELIMINATED FOR SPECIFIC INSTALLATIONS, IF DIRECTED BY THE ENGINEER.

NOTE:A	THE INSTALLATION HEIGHT OF FULLY ASSEMBLED ANCHOR POST WILL VARY FROM 3-3/4" MIN. TO 4" MAX. ABOVE FINISHED GRADE.
NOTE:B	PART PN: 5852B RIGHT-SIDE (HIGH INTENSITY REFLECTIVE SHEETING) PART PN: 5851B LEFT-SIDE (HIGH INTENSITY REFLECTIVE SHEETING)
NOTE:C	W-BEAM SPLICE LOCATED BETWEEN LINE POST(4) AND LINE POST(5) GUARDRAIL PANEL 25'-0" PN: 61G ANCHOR RAIL 25'-0" PN: 15215G LAP GUARDRAIL IN DIRECTION OF TRAFFIC FLOW.

PART	QTY	MAIN SYSTEM COMPONENTS
620237B	1	PRODUCT DESCRIPTION ASSEMBLY MANUAL (LATEST REV.)
15208A	1	SoftStop HEAD (SEE MANUAL FOR RIGHT-LEFT APPROACH)
15215G	1	SoftStop ANCHOR RAIL (12GA) WITH CUTOUT SLOTS
61G	1	SoftStop DOWNSTREAM W-BEAM RAIL (12GA) (25'- 0")
15205A	1	POST #0 - ANCHOR POST (6'- 5 3/8")
15203G	1	POST #1 - (SYTP) (4'- 9 1/2")
15000G	1	POST #2 - (SYTP) (6'- 0")
533G	6	POST #3 THRU #8 - I-BEAM (W6 x 8.5) (6'- 0")
4076B	7	BLOCKOUT - WOOD (ROUTED) (6" x 8" x 14")
6777B	7	BLOCKOUT - COMPOSITE (4" x 7 1/2" x 14")
15204A	1	ANCHOR PADDLE
15207G	1	ANCHOR KEEPER PLATE (24 GA)
15206G	1	ANCHOR PLATE WASHER (1/2" THICK)
15201G	2	ANCHOR POST ANGLE (10" LONG)
15202G	1	ANGLE STRUT
		HARDWARE
4902G	1	1" ROUND WASHER F436
3908G	1	1" HEAVY HEX NUT A563 GR.DH
3717G	2	3/4" x 2 1/2" HEX BOLT A325
3701G	4	3/4" ROUND WASHER F436
3704G	2	3/4" HEAVY HEX NUT A563 GR.DH
3360G	16	5/8" x 1 1/4" W-BEAM RAIL SPLICE BOLTS HGR
3340G	25	5/8" W-BEAM RAIL SPLICE NUTS HGR
3500G	7	5/8" x 10" HGR POST BOLT A307
3391G	1	5/8" x 1 3/4" HEX HD BOLT A325
4489G	1	5/8" x 9" HEX HD BOLT A325
4372G	4	5/8" WASHER F436
105285G	2	5/8" x 2 1/2" HEX HD BOLT GR-5
105286G	1	5/8" x 1 1/2" HEX HD BOLT GR-5
3240G	6	5/8" ROUND WASHER (WIDE)
3245G	3	5/8" HEX NUT A563 GR.DH
5852B	1	HIGH INTENSITY REFLECTIVE SHEETING - SEE NOTE:B

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

Texas Department of Transportation

Design Division Standard

TRINITY HIGHWAY
SOFTSTOP END TERMINAL
MASH - TL-3
SGT(10S)31-16

FILE: sgt10s3116	DN: TxDOT		CK: KM	DW: VP		CK: MB/VP
©TxDOT: JULY 2016	CONT	SECT	JOB		HIGHWAY	
REVISIONS	0902	90	108		VA	
	DIST	COUNTY			SHEET NO.	
	FTW	TARRANT			108	

DATE:
FILE:

DATE: 5/27/2021
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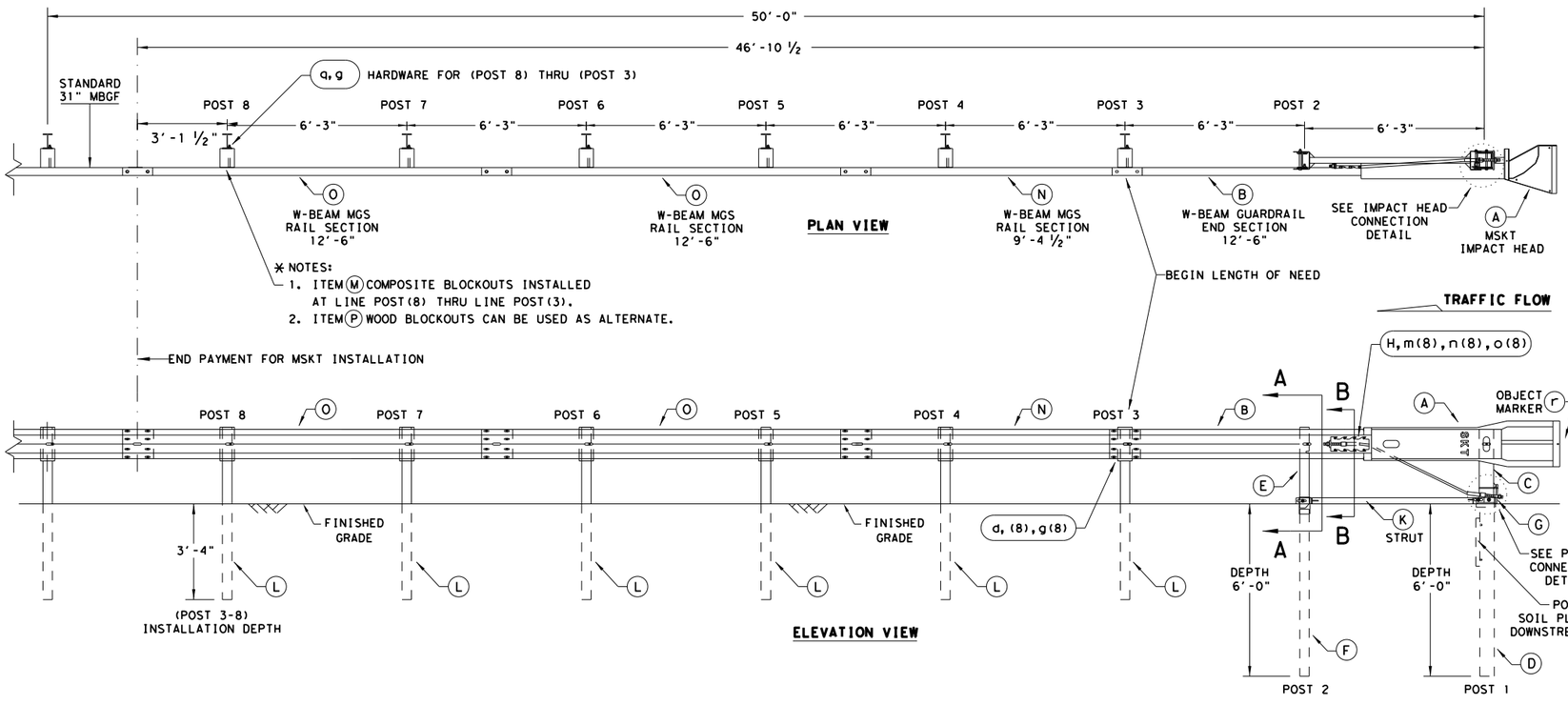


NOTE: SEE (GENERAL NOTE 14) FOR DRIVING CAP INFORMATION.

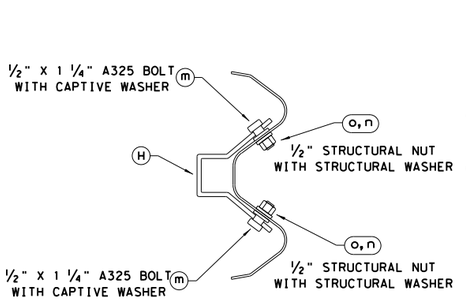
GENERAL NOTES

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

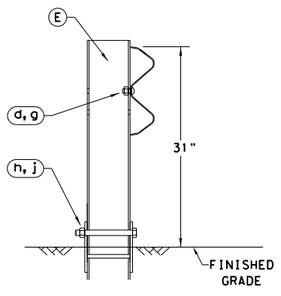
ITEM	QTY	MAIN SYSTEM COMPONENTS	ITEM NUMBERS
A	1	MSKT IMPACT HEAD	MS3000
B	1	W-BEAM GUARDRAIL END SECTION, 12 Ga.	SF1303
C	1	POST 1 - TOP (6" X 6" X 1/8" TUBE)	MTPHP1A
D	1	POST 1 - BOTTOM (6' W6X15)	MTPHP1B
E	1	POST 2 - ASSEMBLY TOP	UHP2A
F	1	POST 2 - ASSEMBLY BOTTOM (6' W6X9)	HP2B
G	1	BEARING PLATE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

SEE NOTES: *

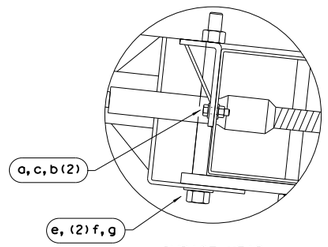
ALTERNATIVE ITEMS NOT SHOWN. **
* ITEM(P) 8" WOOD-BLOCKOUT
** ITEM(Q) 25'GUARD FENCE PANEL



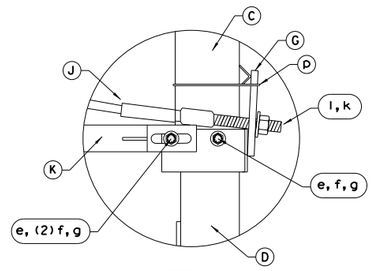
SECTION B-B
ANCHOR BRACKET



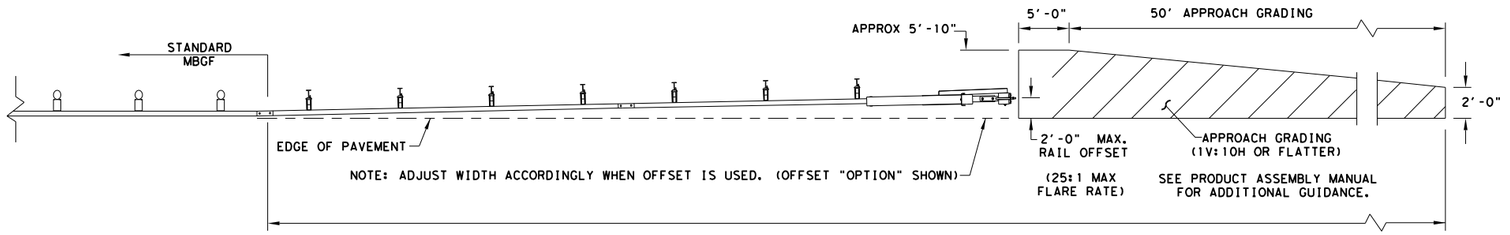
POST 2
SECTION A-A



IMPACT HEAD
CONNECTION DETAIL



POST 1
CONNECTION DETAIL



NOTE: ADJUST WIDTH ACCORDINGLY WHEN OFFSET IS USED. (OFFSET "OPTION" SHOWN)

APPROACH GRADING AT GUARDRAIL END TREATMENTS

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

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

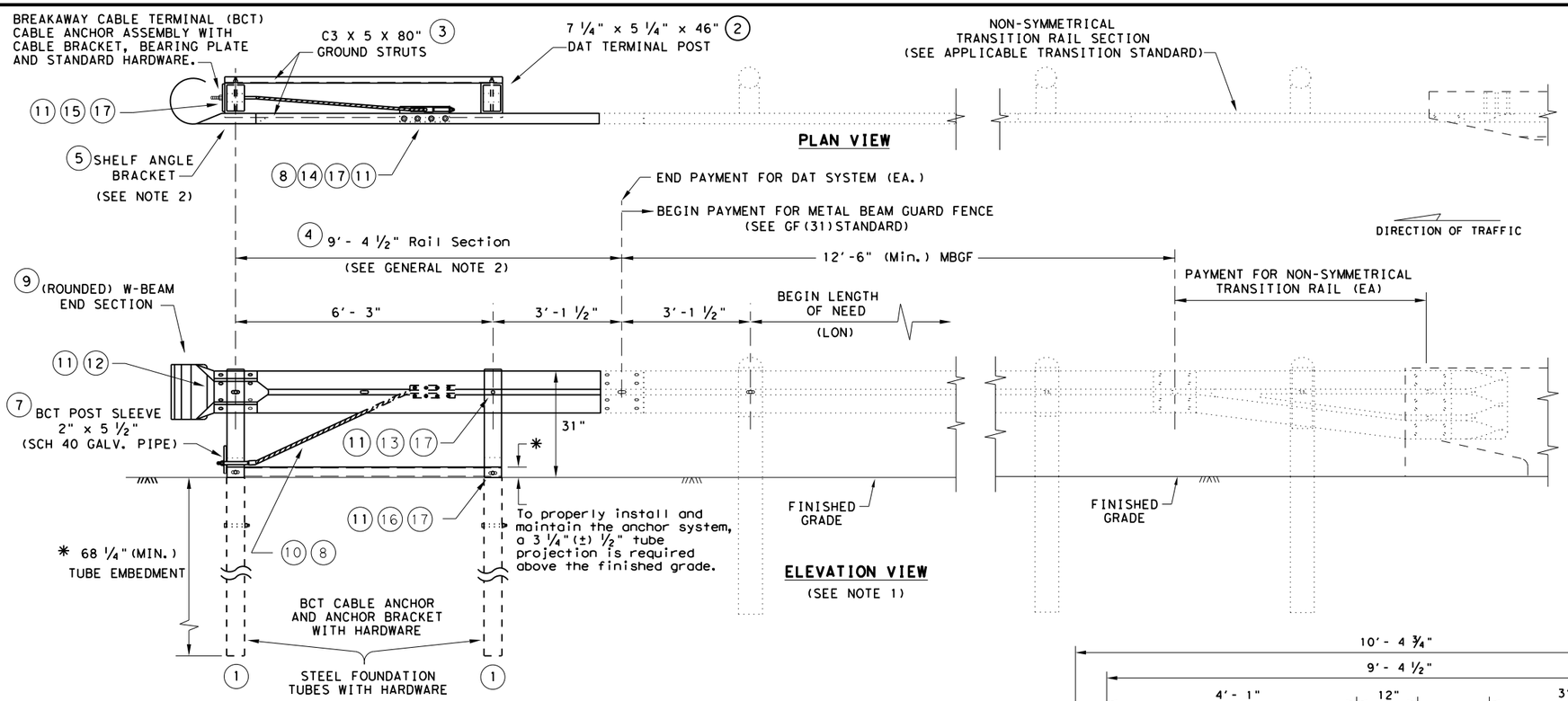
Texas Department of Transportation

Design Division Standard

SINGLE GUARDRAIL TERMINAL
MSKT-MASH-TL-3
SGT(12S)31-18

FILE: sgt12s3118.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CL	
© TxDOT: APRIL 2018	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0902	90	108	VA	
	DIST	COUNTY		SHEET NO.	
	FTW	TARRANT		109	

DATE: 5/27/2021
FILE: T:\TRAFFIC\ITS\0902-90-108 Non-Site Specific ITS\MBGF\GF(31)DAT-19.dgn



DOWNSTREAM ANCHOR TERMINAL (DAT)

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

GENERAL NOTES

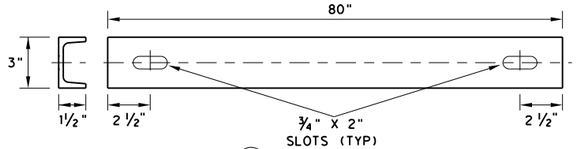
1. THE DETAIL SHOWN IS THE MINIMUM LENGTH OF NEED (LON) FOR A DOWNSTREAM ANCHOR TERMINAL (DAT) CONNECTED TO A CONCRETE RAIL.
2. THE RAIL SECTION AT THE END POST IS SUPPORTED BY THE SHELF ANGLE BRACKET. THE RAIL ELEMENT IS NOT ATTACHED TO THE END POST.
3. THE FOUNDATION TUBES SHALL NOT PROJECT MORE THAN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

MOW STRIP INSTALLATION

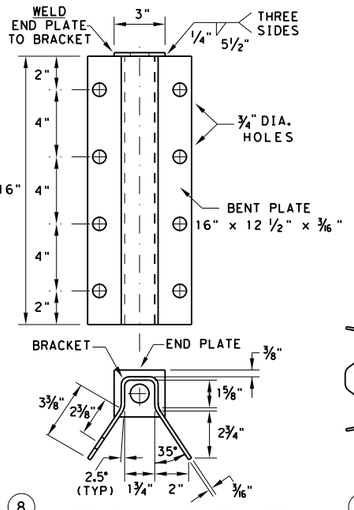
IF A MOW STRIP IS REQUIRED WITH THE DAT INSTALLATION THE LEAVE-OUT AREA AROUND THE STEEL FOUNDATION TUBES AND THE TWO CHANNEL STRUTS MAY BE OMITTED. THIS WILL REQUIRE A FULL POUR AT THE FOUNDATION TUBES.

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

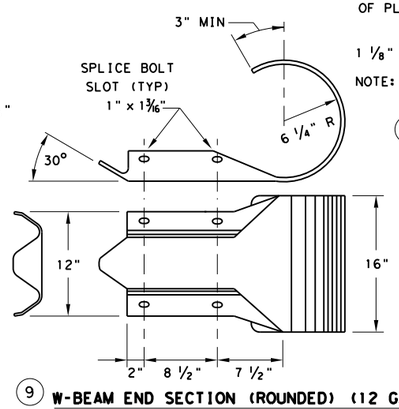
(4) TERMINAL RAIL ELEMENT FOR DAT



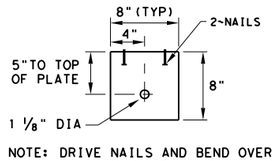
(3) CHANNEL STRUT
C3 X 5 X 80", GRADE A36



(8) GUARDRAIL ANCHOR BRACKET

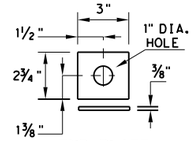


(9) W-BEAM END SECTION (ROUNDED) (12 GA.)

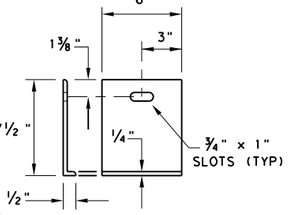


NOTE: DRIVE NAILS AND BEND OVER TO PREVENT PLATE ROTATION

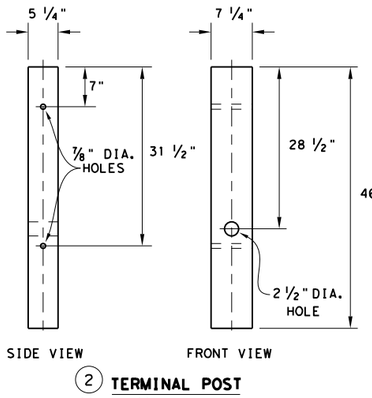
(6) BEARING PLATE
8"x 8"x 5/8" R



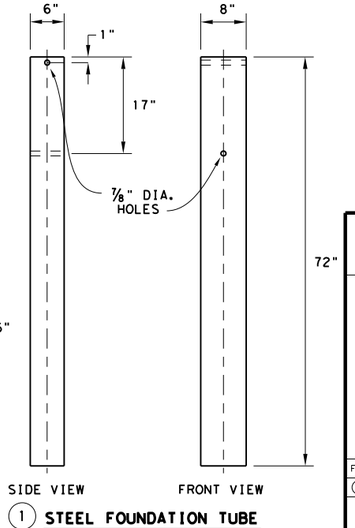
END PLATE



(5) SHELF ANGLE BRACKET



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



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

Texas Department of Transportation — Design Division Standard

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

GF(31)DAT-19

FILE: gf31dat19.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG
©TxDOT: NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		110

DATE: 5/27/2021
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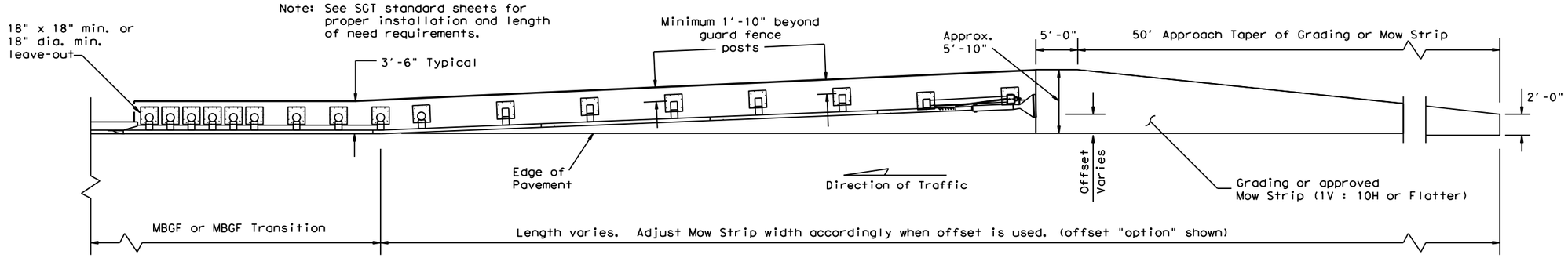
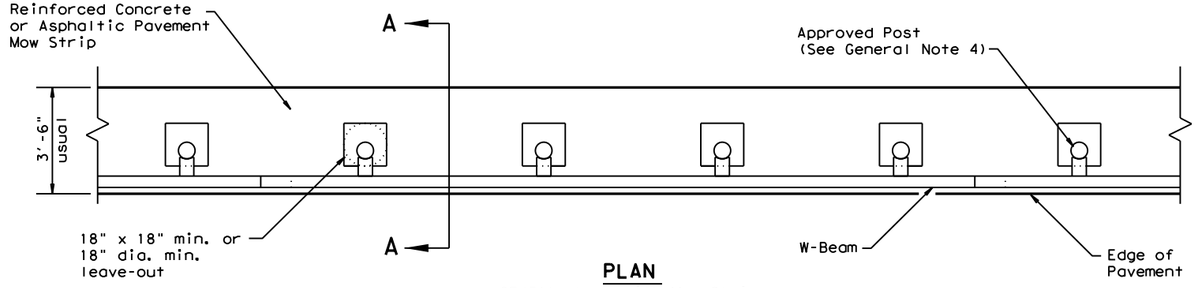
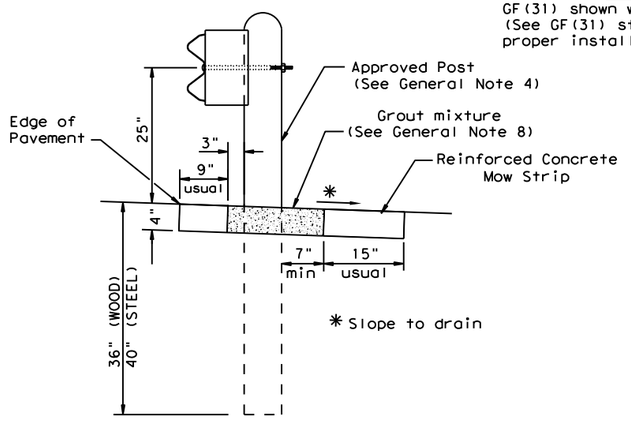


GRADING AND MOW STRIP AT GUARDRAIL END TREATMENTS



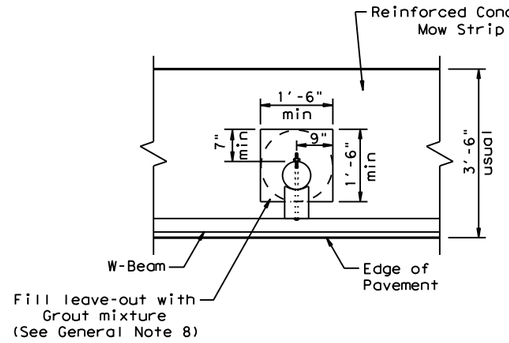
PLAN

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



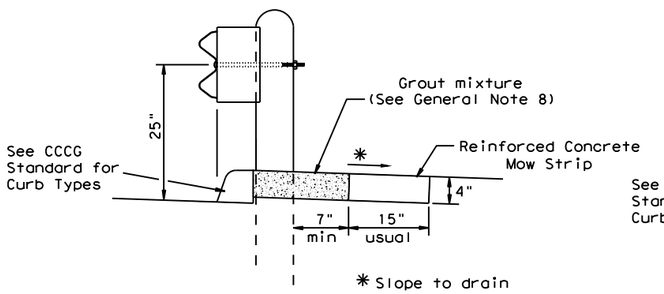
SECTION A-A

Typical



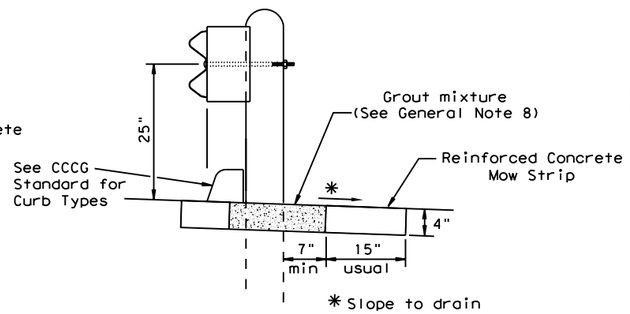
MOW STRIP DETAIL

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



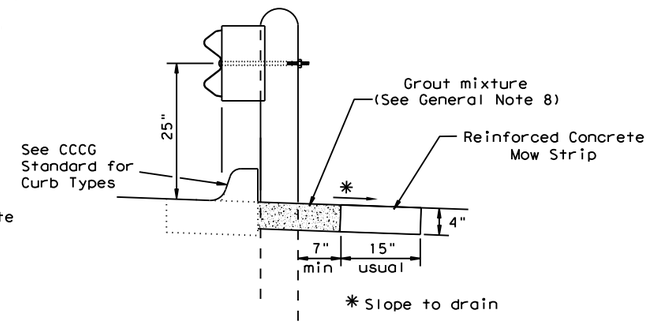
CURB OPTION (1)

This option will increase the post embedment throughout the system.



CURB OPTION (2)

Curb shown on top of mow strip



CURB OPTION (3)

Note: Site Condition(s)

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

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

GENERAL NOTES

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

Texas Department of Transportation

Design Division Standard

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

GF(31)MS-19

FILE: gf31ms19.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG
©TxDOT: NOVEMBER 2019	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		111

DATE: 6/4/2021
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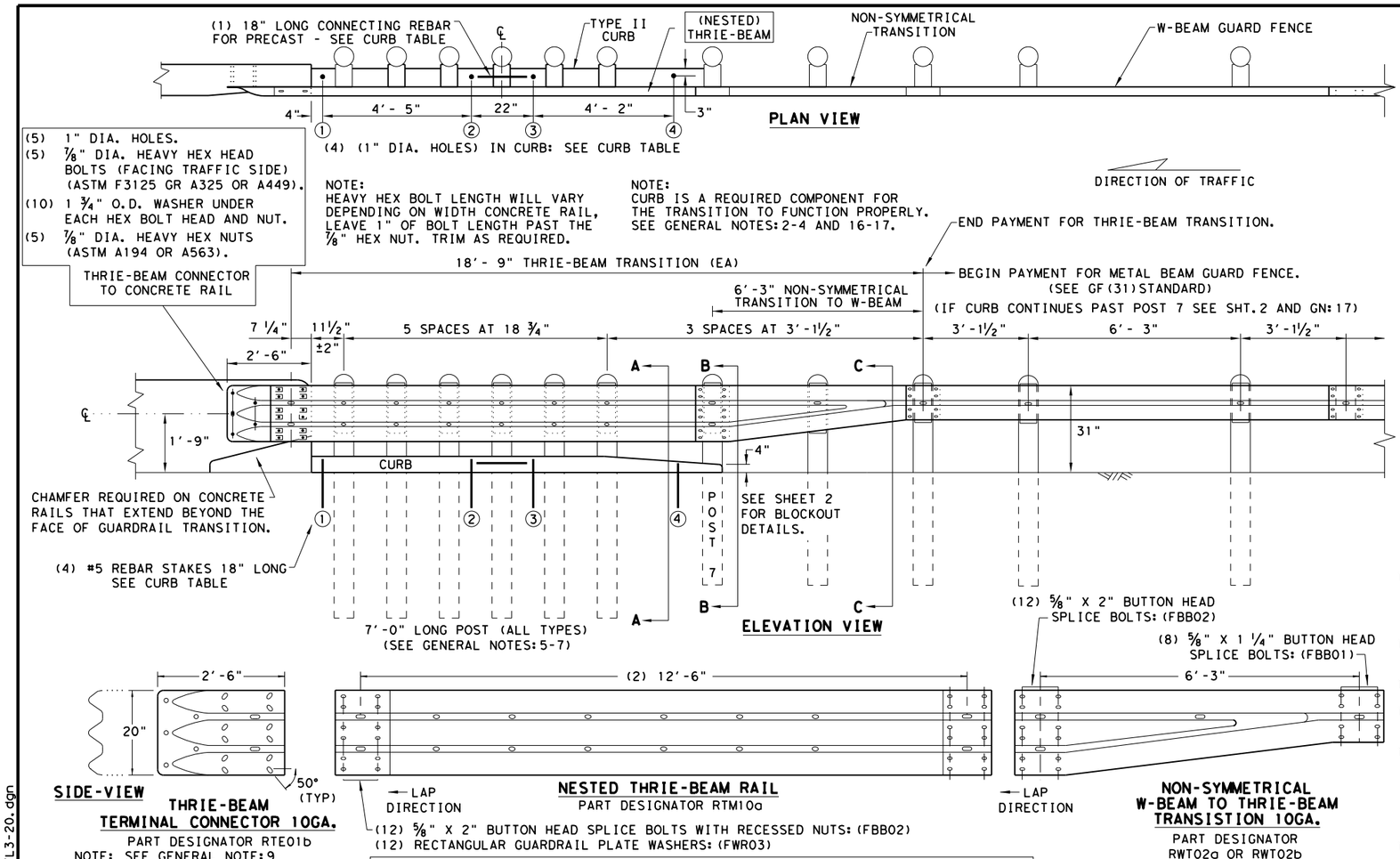


GENERAL NOTES

1. CONTACT THE DESIGN DIVISION FOR DRAINAGE CUT OUT OPTIONS NEEDED WITHIN THE CURB SECTION OF THE THRIE-BEAM TRANSITION. (512) 416-2678
2. CONCRETE CURB MAY BE CAST-IN-PLACE OR PRECAST AS SHOWN ON THIS SHEET. WHEN USED IN CONJUNCTION WITH THE THRIE-BEAM TRANSITIONS, CURB SHALL BE TYPE II (5- 3/4" HEIGHT); SEE CURRENT CCCG STANDARD SHEET FOR FURTHER DETAILS. IF OTHER CURB HEIGHTS ARE SHOWN IN THE PLANS IN CONJUNCTION WITH THE TRANSITION, THE CURB HEIGHT MAY BE FROM 4" TO 8" WITH A RELATIVELY VERTICAL FACE. CONCRETE CURB SHALL BE CONTINUOUS TO THE SEVENTH POST UNLESS OTHERWISE SHOWN IN THE PLANS. SEE GENERAL NOTE: 17 FOR CIRCUMSTANCES WHERE CURB CONTINUES PAST POST 7.
3. CONCRETE CURB TYPE II SUBSIDIARY TO "METAL BEAM GUARD FENCE TRANSITION". IF NO ADDITIONAL CURB IS INDICATED BEYOND THE TRANSITION, THEN ANY CURB HEIGHT GREATER THAN 4" WILL BE TAPERED DOWN BEGINNING AT THE LAST 7 FT. POST TO A MAXIMUM HEIGHT OF 4" AT POST 7. IF SHOWN ELSEWHERE IN THE PLANS, ADDITIONAL CURB UNDERNEATH GUARDRAIL WILL BE PAID FOR BY THE LINEAR FOOT.
4. UNLESS OTHERWISE SHOWN IN THE PLANS, TRANSITIONS SHALL BE PLACED WITH THE BLOCKOUT FACE IN FRONT OF OR DIRECTLY ABOVE THE CURB FACE. SEE SECTION A-A.
5. FOR ROUND WOOD POST SYSTEMS, ALL ROUND WOOD POSTS SHALL BE 7 1/2" DIA. MINIMUM THROUGHOUT THE THRIE-BEAM TRANSITION.
6. THE TYPE OF POST (ROUND WOOD POST, RECTANGULAR WOOD POST OR STEEL POST) WILL BE AS SHOWN IN THE PLANS. REFER TO GF(31) STANDARD SHEET.
7. THE POST LENGTH SHALL BE MARKED ON ALL 7'- 0" LONG POSTS BY THE MANUFACTURER. THE MARK SHALL BE LOCATED WITHIN THE TOP 1 FT. REGION OF THE POST, AT LEAST 5/8" IN HEIGHT, AND VISIBLE AFTER INSTALLATION. WOODEN POSTS SHALL BE MARKED WITH A BRAND, AND STEEL POSTS WITH A STENCIL BEFORE GALVANIZING.
8. POSTS SHALL NOT BE SET IN CONCRETE, OF ANY DEPTH.
9. RAIL ELEMENTS SHALL MEET THE REQUIREMENTS OF ITEM 540, "METAL BEAM GUARD FENCE" EXCEPT AS MODIFIED ON THE PLANS. THE THRIE-BEAM TERMINAL CONNECTOR AND THE THRIE-BEAM TRANSITION TO W-BEAM SHALL BE OF THE SAME MATERIAL, BUT SHALL NOT BE LESS THAN 10 GAUGE. CONTRACTOR SHALL VERIFY THAT THE LOCATIONS OF BOLT HOLES MATCH THOSE IN THE THRIE-BEAM TERMINAL CONNECTOR PRIOR TO ORDERING MATERIALS.
10. BUTTON HEAD "POST BOLTS & NUTS" SHALL MEET THE REQUIREMENTS OF (ASTM A307), AND SHALL BE OF SUFFICIENT LENGTH TO EXTEND THROUGH THE FULL THICKNESS OF THE NUT AND 5/8" WASHER (FWC16a) AND NOT MORE THAN 1" BEYOND IT. TRIM REMAINING BOLT LENGTH TO MEET REQUIRED LENGTH.
11. FITTINGS (BOLTS, NUTS, AND WASHERS) SHALL BE GALVANIZED IN ACCORDANCE WITH ITEM 445, "GALVANIZING". FITTINGS SHALL BE SUBSIDIARY TO THE BID ITEM.
12. CROWN SHALL BE WIDENED TO ACCOMMODATE TRANSITIONS.
13. WHERE SOLID ROCK IS ENCOUNTERED, CONTACT THE DESIGN DIVISION FOR ADDITIONAL GUIDANCE. (512) 416-2678
14. UNLESS OTHERWISE SHOWN IN THE PLANS, A COMPOSITE MATERIAL BLOCK THAT MEETS THE REQUIREMENTS OF DMS-7210, "COMPOSITE MATERIAL POSTS AND BLOCKS FOR METAL BEAM GUARD FENCE" MAY BE SUBSTITUTED FOR BLOCKS OF SIMILAR DIMENSIONS. TXDOT'S MATERIALS AND TESTS DIVISION MAINTAINS A MATERIAL PRODUCER LIST (MPL) FOR PRODUCERS OF MATERIALS CONFORMING TO DMS-7210. ONLY PRODUCERS ON THE MPL CAN FURNISH COMPOSITE MATERIAL BLOCKS.
15. REFER TO GF(31) STANDARD SHEET & BRIDGE RAILING DETAILS FOR ADDITIONAL DETAILS.
16. THE INSTALLATION OF THE TYPE II CURB IS CRITICAL FOR THE PERFORMANCE OF THE THRIE-BEAM TRANSITION SYSTEM. THE CURB PREVENTS (VEHICLE WHEEL SNAGGING) AT THE CONCRETE RAIL AND IS REQUIRED TO MEET MASH CRASH TEST CRITERIA.
17. IF CURB EXTENDS BEYOND POST 7, 25' OF NESTED W-BEAM GUARDRAIL SHALL BE INSTALLED BEYOND THE PAY LIMITS OF THRIE-BEAM TRANSITION SECTION, (SEE SHT.2). PAYMENT FOR THIS 25' SECTION WILL BE BY LINEAR FOOT, PAY ITEM "0540 6XXX MTL W-BEAM GD FEN (NESTED)(TIM POST)" OR "540 6XXX MTL W-BEAM GD FEN (NESTED)(STEEL POST)" AS APPLICABLE FOR POST TYPE. SEE SHT.2 FOR ADDITIONAL INFORMATION.

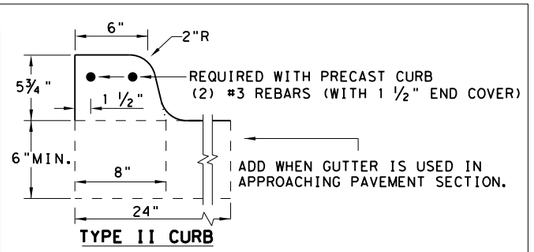
THRIE-BEAM TERMINAL - CURB TABLE

PRECAST CURB FULL LENGTH EQUALS 12'- 2"
THE PRECAST CURB MAY BE FORMED INTO TWO SECTIONS.

CURB (1) LENGTH 5'- 8"
CURB (2) LENGTH 6'- 6"
TAPER CURB (2) TO A HEIGHT OF 4" AT POST 7

CONNECTING PRECAST CURB SECTIONS (1) & (2):
FORM OR CORE 1" DIA. HOLE 9" LONG INTO EACH CURB END.
USE (1) #5 GR.60 REBAR 18" LONG TO CONNECT BOTH CURBS.

SECURING PRECAST OR CAST-IN-PLACE TO FINISHED GRADE *:
FORM OR CORE (4) 1" DIA. HOLES, SEE PLAN AND ELEVATION VIEWS FOR HOLE LOCATIONS. DRIVE (4) #5 GR.60 REBAR STAKES 18" LONG INTO THE GROUND AND 1/2" BELOW TOP OF CURB.
FILL HOLES WITH APPROVED GROUT MIXTURE.



TYPE II CURB

NOTE: OPTIONS FOR TYPE II CURB:
1. PRECAST
2. CAST-IN-PLACE

* NOTES: NOT NEEDED FOR CAST-IN-PLACE.
SEE TYPE II CURB DETAIL FOR REBAR AND COVER REQUIREMENTS.
PERCUSSION DRILLING IS NOT PERMITTED WITH:
TYPE II CURB, BRIDGE RAIL OR CONCRETE TRAFFIC RAIL.

TYPE II CURB DETAILS

HIGH-SPEED TRANSITION

SHEET 1 OF 2

Texas Department of Transportation | Design Division Standard

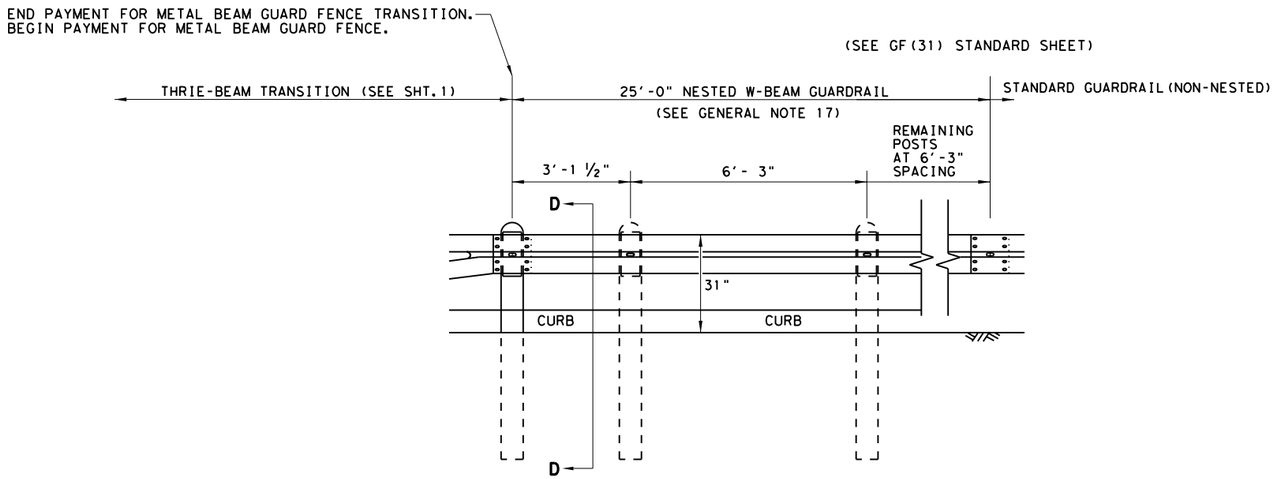
METAL BEAM GUARD FENCE THRIE-BEAM TRANSITION TL-3 MASH COMPLIANT

GF(31)TR TL3-20

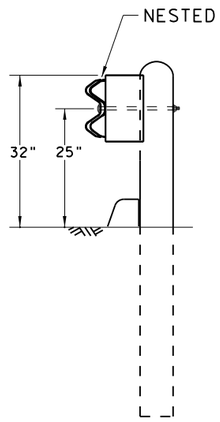
FILE: gf31trtl320.dgn	DN: TxDOT	CK: KM	DW: VP	CK: CGL/AG
©TxDOT: NOVEMBER 2020	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		112

DATE: 6/4/2021
FILE: T:\TRAFFIC\ITS\0902-90-108 Non-Site Specific ITS\MBGF\GF(31)TR TL3-20.dgn

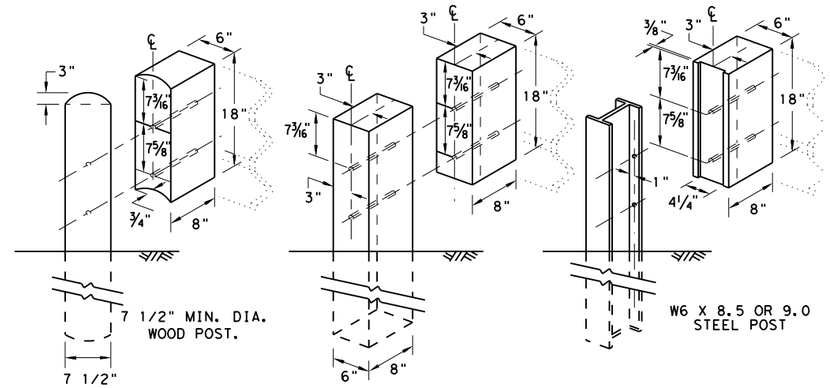
REQUIRED ALTERNATIVE FOR CONTINUOUS CURB EXTENDING PAST POST 7 (SEE SHT. 1 GENERAL NOTE 17)



ELEVATION VIEW



SECTION D-D



THRIE BEAM TRANSITION BLOCKOUT DETAILS

HIGH-SPEED TRANSITION

SHEET 2 OF 2

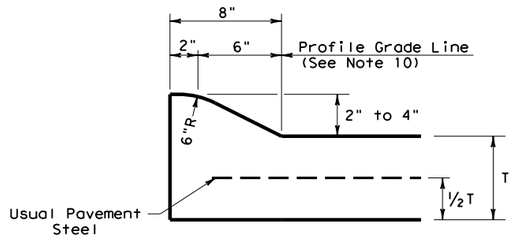
Texas Department of Transportation — Design Division Standard

METAL BEAM GUARD FENCE THRIE-BEAM TRANSITION TL-3 MASH COMPLIANT

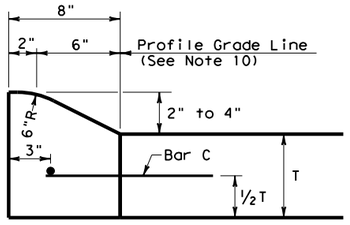
GF(31)TR TL3-20

FILE: gf31tr1320.dgn	DN: TxDOT	CK: KM	DW: KM	CK: CGL/AG		
©TxDOT: NOVEMBER 2020	CONT	SECT	JOB		HIGHWAY	
REVISIONS	0902	90	108		VA	
	DIST	COUNTY			SHEET NO.	
	FTW	TARRANT			113	

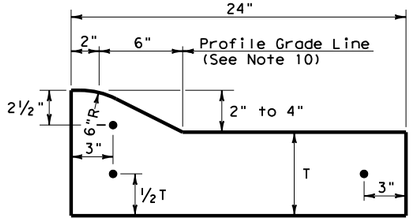
DATE:
FILE:



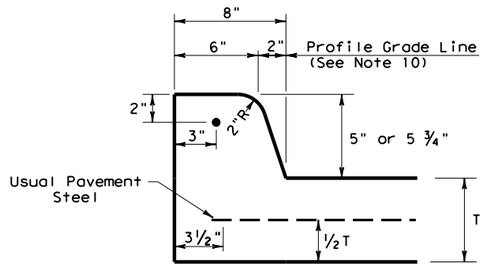
TYPE I CURB (MONOLITHIC)
2" - 4" HEIGHT



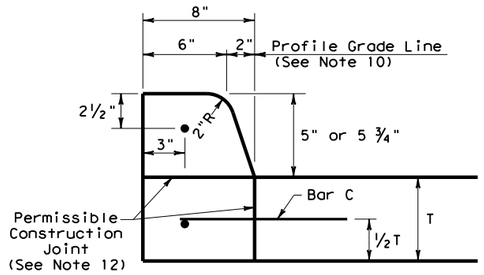
TYPE I CURB
2" - 4" HEIGHT



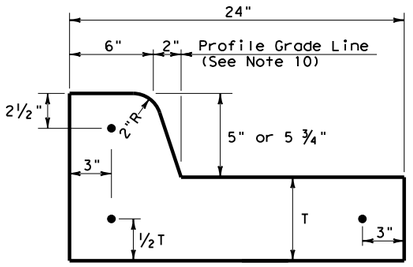
TYPE I CURB AND GUTTER
2" - 4" HEIGHT



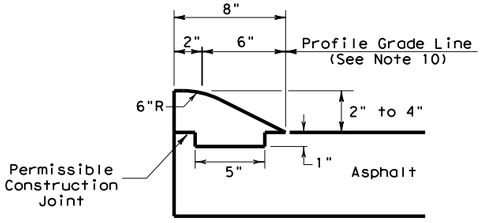
TYPE II CURB (MONOLITHIC)
5" - 5 ¾" HEIGHT



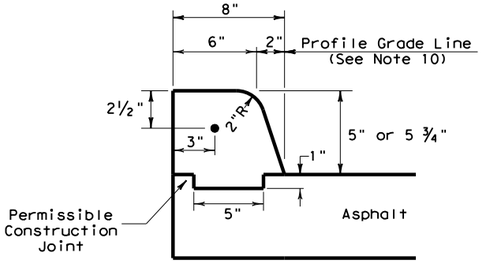
TYPE II CURB
5" - 5 ¾" HEIGHT



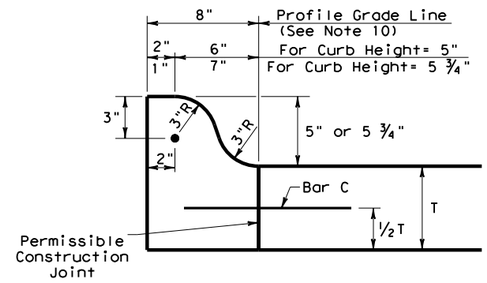
TYPE II CURB AND GUTTER
5" - 5 ¾" HEIGHT



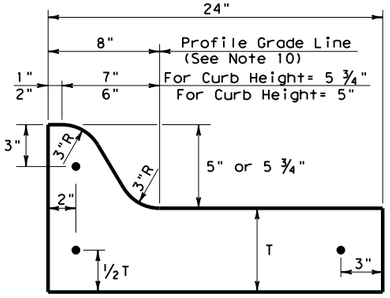
TYPE III CURB (KEYED)
2" - 4" HEIGHT



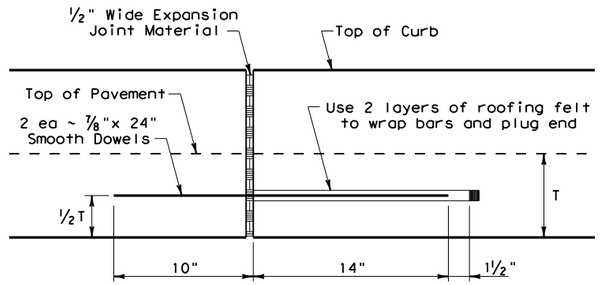
TYPE IV CURB (KEYED)
5" - 5 ¾" HEIGHT



TYPE IIa CURB
5" - 5 ¾" HEIGHT

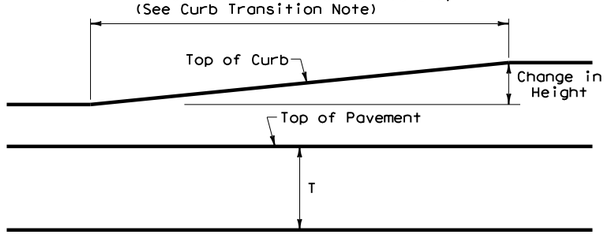


TYPE IIa CURB AND GUTTER
5" - 5 ¾" HEIGHT



EXPANSION JOINT DETAIL

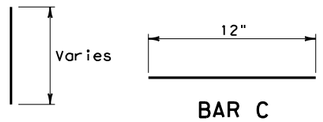
CURB TRANSITION NOTE:
Field conditions may require a longer or shorter transition, and shall be shown elsewhere in the plans, or as directed by the Engineer.



CURB TRANSITION
Note: To be paid for as Highest Curb

GENERAL NOTES

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



BAR B

BAR C

Texas Department of Transportation

Design Division Standard

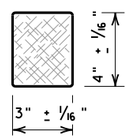
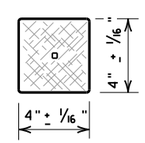
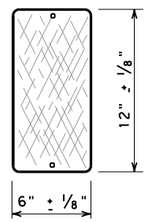
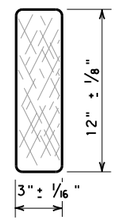
CONCRETE CURB AND CURB AND GUTTER

CCCG-21

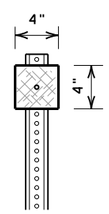
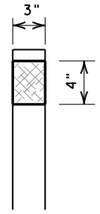
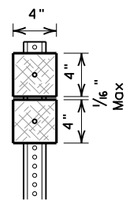
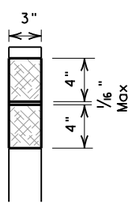
FILE: cccg21.dgn	DN: TXDOT	CK: AN	DW: SS	CK: KM
© TxDOT: FEBRUARY 2021 REVISIONS	CONT	SECT	JOB	HIGHWAY
	0902	90	108	VA
	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		114

DATE: 6/4/2021 5:02:53 PM
FILE: T:\TRAFFIC\TITS\0902-90-108 Non-Site Specific ITS\MBGF\DOM1-20.dgn

REFLECTOR UNIT SIZES FOR DELINEATORS AND OBJECT MARKERS

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

DELINEATORS

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

D & OM DESCRIPTIVE CODES

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

NUMBER OF REFLECTORS
S = Single
D = Double

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

REFLECTOR UNIT SIZE
1 or 2

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

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

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

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

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

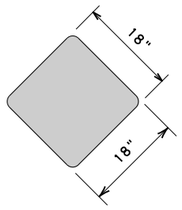
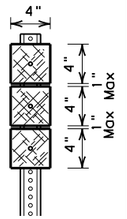
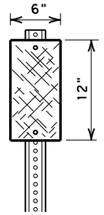
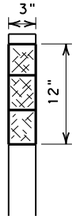
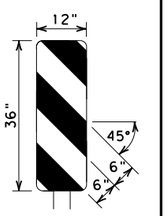
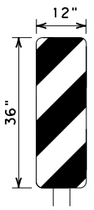
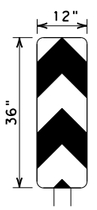
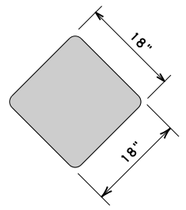
NUMBER OF REFLECTORS OR DIRECTION
X = 3-Size 2 reflector units (Type 2 only)
Y = 1-Size 3 reflector unit (Type 2 only)
Z = 3-Size 1 or 1-Size 4 reflector unit(s)(Type 2 only)
L = Left Side (Type 3 Object Marker only)
R = Right Side (Type 3 Object Marker only)
C = Center (Type 3 Object Marker only)

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

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

DIRECTION
If Required
BI = Bi-Directional

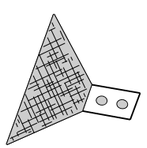
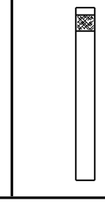
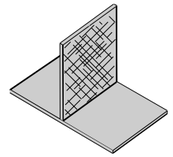
OBJECT MARKERS

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

DEPARTMENTAL MATERIAL SPECIFICATIONS

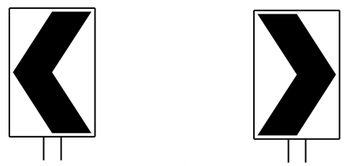
FLEXIBLE DELINEATOR & OBJECT MARKER POSTS (EMBEDDED & SURFACE MOUNT TYPES)	DMS-4400
SIGN FACE MATERIALS	DMS-8300
DELINEATORS, OBJECT MARKERS AND BARRIER REFLECTORS	DMS-8600

BARRIER REFLECTORS (BRF)

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

CHEVRONS

DEVICE

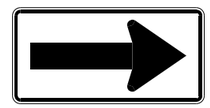


SIZE (W x L)	18"x 24" (Conventional)	24"x 30" (Conventional Oversize)	30"x 36" (Expressway)	36" x 48" (Freeway)
MOUNTING HEIGHT	4'-0" or 7'-0"		7'-0" Only	

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

ONE DIRECTION LARGE ARROW

DEVICE



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

NOTE:

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

Texas Department of Transportation

Traffic Safety Division Standard

DELINEATOR & OBJECT MARKER MATERIAL DESCRIPTION

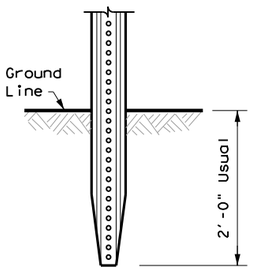
D & OM(1)-20

FILE: dom1-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
©TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
10-09 3-15	DIST	COUNTY		SHEET NO.
4-10 7-20	FTW	TARRANT		115

POST TYPE AND SUPPORT FOUNDATION DETAILS

WING CHANNEL (WC)

GND

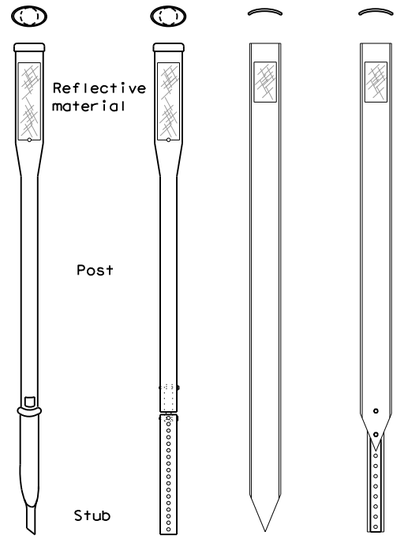


NOTES

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

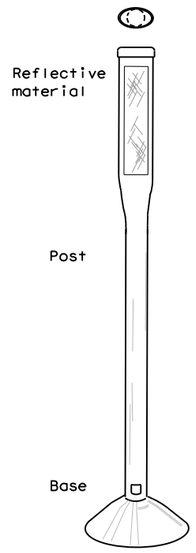
FLEXIBLE POSTS (YFLX, WFLX)

GND



EMBEDDED

SRF



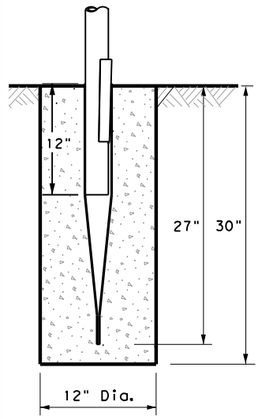
SURFACE MOUNT

NOTES

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

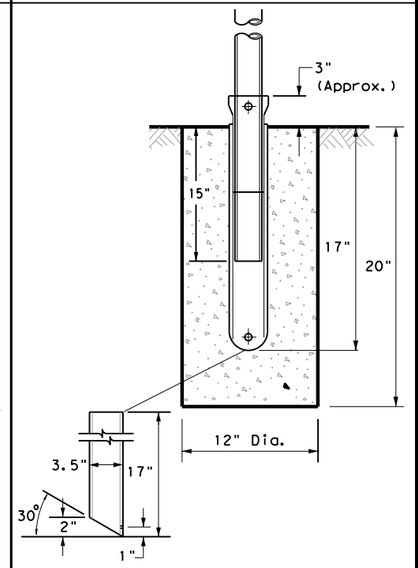
WEDGE ANCHOR SYSTEMS

WAS



STEEL

WAP



PLASTIC

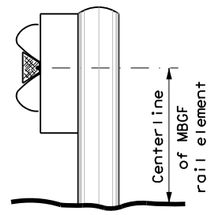
NOTE

1. Install per manufacturer's recommendations.

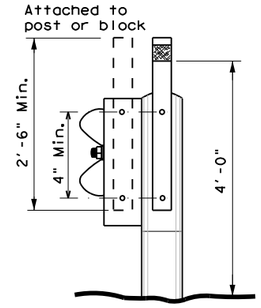
TYPE OF BARRIER MOUNTS

GUARD FENCE ATTACHMENT

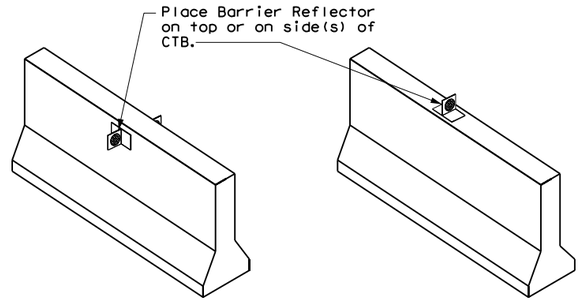
GF1



GF2



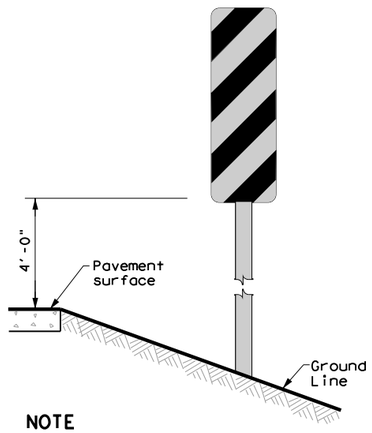
CONCRETE TRAFFIC BARRIER (CTB)



GENERAL NOTES

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

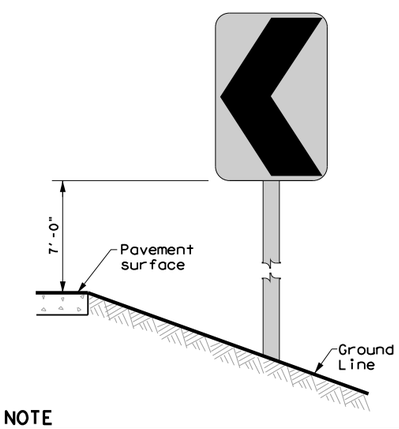
TYPES 1, 3, AND 4 OBJECT MARKERS AND CHEVRONS



NOTE

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

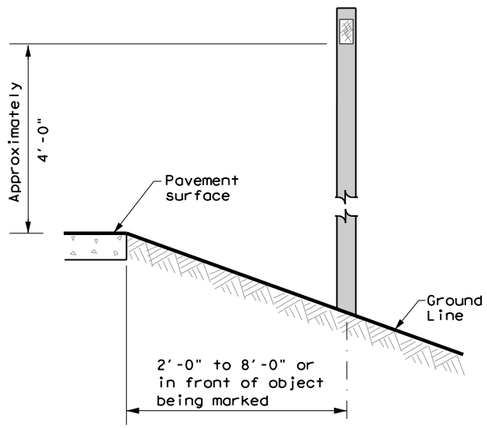
CHEVRONS AND ONE DIRECTION LARGE ARROW SIGN



NOTE

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

DELINEATORS AND TYPE 2 OBJECT MARKERS



See general notes 1, 2 and 3.

Texas Department of Transportation — Traffic Safety Division Standard

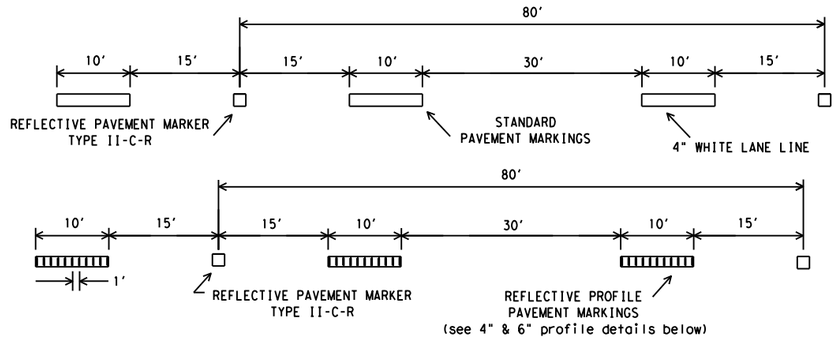
DELINEATOR & OBJECT MARKER INSTALLATION

D & OM(2)-20

FILE: dom2-20.dgn	DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
© TxDOT August 2004	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
10-09 3-15	DIST	COUNTY		SHEET NO.
4-10 7-20	FTW	TARRANT		116

20B

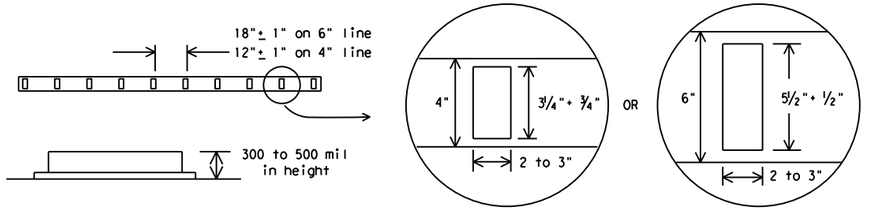
DATE: DATE TIME
FILE: DOCUMENT NAME



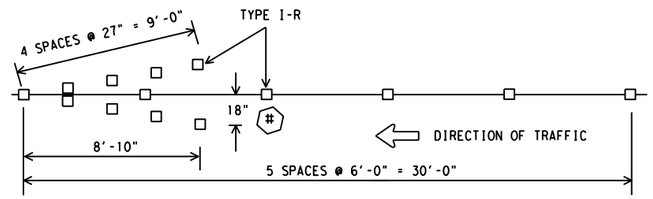
PAVEMENT MARKERS (REFL) TYPE II-C-R SHALL BE SPACED ON 80' CENTERS WITH THE CLEAR FACE TOWARD NORMAL TRAFFIC AND THE RED FACE TOWARD WRONG WAY TRAFFIC.

TRAFFIC LANE LINES PAVEMENT MARKING DETAILS

EDGELINES SHOULD TYPICALLY BE 4" WIDE AND THE MATERIALS SHALL BE AS SPECIFIED IN THE PLANS.
IF RAISED PROFILE PAVEMENT MARKINGS ARE USED SEE DETAILS BELOW.



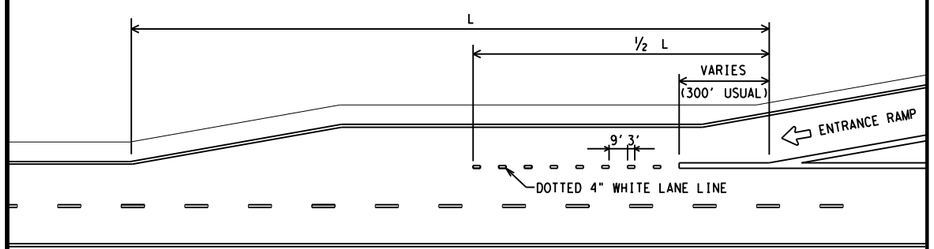
EDGELINE PAVEMENT MARKINGS



ALL RAISED MARKERS IN THE WRONG WAY ARROW SHALL BE TYPE I-R REFLECTORIZED PAVEMENT MARKERS WITH THE REFLECTORIZED SURFACE FACING THE WRONG WAY TRAFFIC. TYPE II-C-R SHALL NOT BE USED.

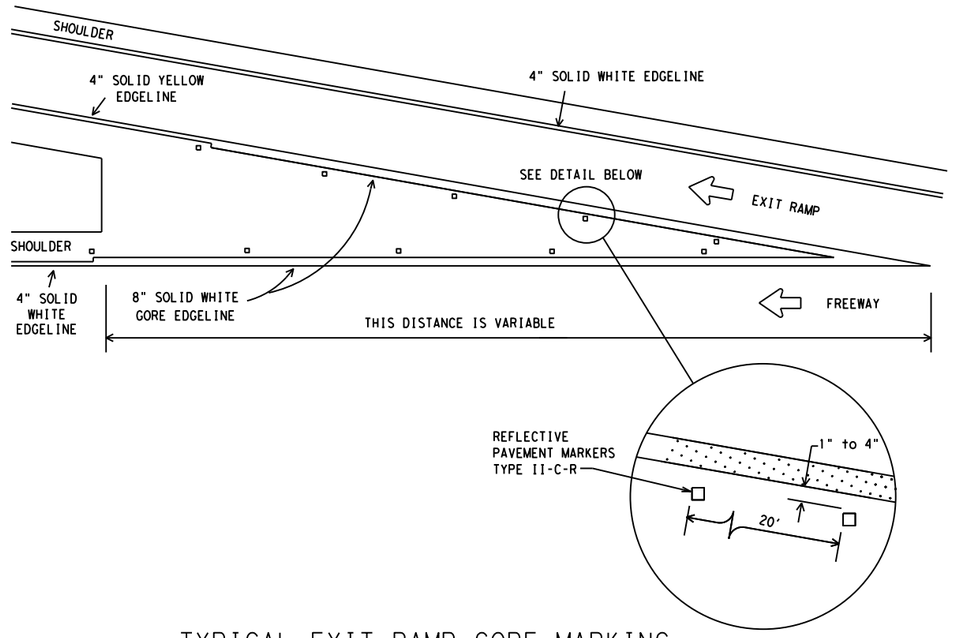
REFLECTORIZED WRONG WAY ARROWS, NOT TO EXCEED TWO, MAY BE PLACED ON EXIT RAMPS.
LOCATION OF THE ARROWS SHALL BE AS SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER.

WRONG WAY ARROW DETAIL

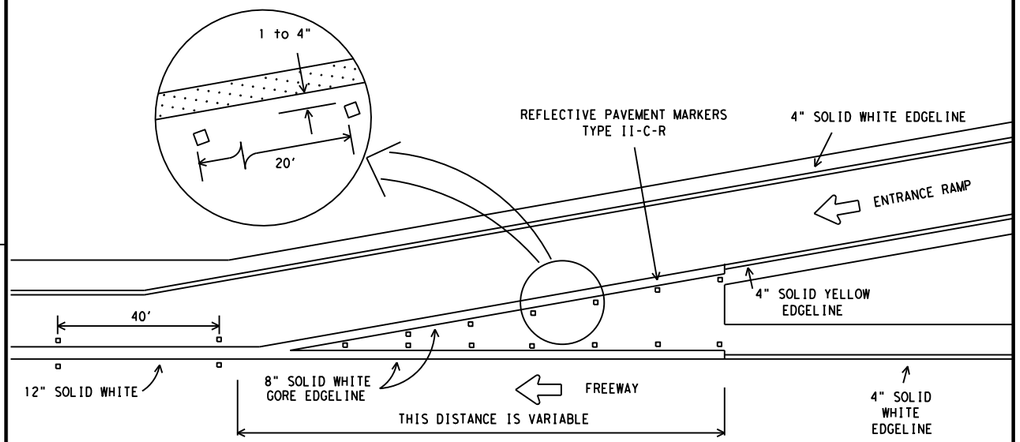


PARALLEL ACCELERATION LANE

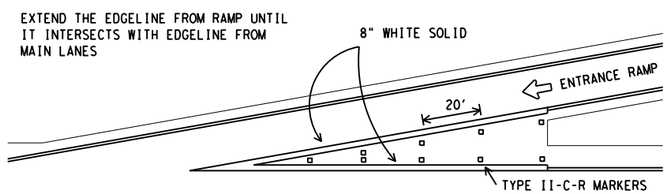
DATE:
FILE:



TYPICAL EXIT RAMP GORE MARKING



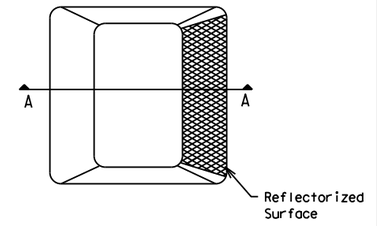
TYPICAL ENTRANCE RAMP GORE MARKING



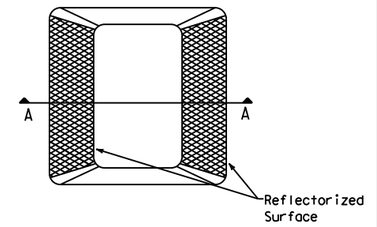
TAPERED ACCELERATION LANE

MATERIAL SPECIFICATIONS	
PAVEMENT MARKERS (REFLECTORIZED)	DMS-4200
EPOXY AND ADHESIVES	DMS-6100
BITUMINOUS ADHESIVE FOR PAVEMENT MARKERS	DMS-6130
TRAFFIC PAINT	DMS-8200
HOT APPLIED THERMOPLASTIC	DMS-8220
PERMANENT PREFABRICATED PAVEMENT MARKINGS	DMS-8240

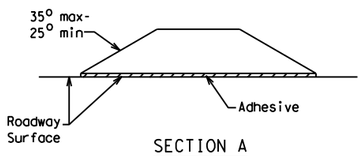
All pavement marking materials shall meet the required Departmental Material Specifications as specified by the plans.



Type I (Top View)



Type II (Top View)



SECTION A

RAISED PAVEMENT MARKERS

STATE OF TEXAS
CARLOS E. MOLINA
97237
LICENSED PROFESSIONAL ENGINEER

Carlos E. Molina

June 4, 2021

2/16 Revision
(#) Revised Arrow Width

Texas Department of Transportation
Traffic Operations Division

TYPICAL STANDARD FREEWAY PAVEMENT MARKINGS WITH RAISED PAVEMENT MARKERS

FPM(1)-12 MOD.

DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT

REVISIONS		CONT	SECT	JOB	HIGHWAY
4-92	2-10	0902	90	108	VA
5-00	2-12	DIST	COUNTY		SHEET NO.
8-00		FTW	TARRANT		117
2-08					

DATE:
FILE:

I. STORMWATER POLLUTION PREVENTION-CLEAN WATER ACT SECTION 402

TPDES TXR 150000: Stormwater Discharge Permit or Construction General Permit required for projects with 1 or more acres disturbed soil. Projects with any disturbed soil must protect for erosion and sedimentation in accordance with Item 506.

List MS4 Operator(s) that may receive discharges from this project. They may need to be notified prior to construction activities.

1.

2.

☐ No Action Required ☐ Required Action

Action No.

1. Prevent stormwater pollution by controlling erosion and sedimentation in accordance with TPDES Permit TXR 150000
2. Comply with the SW3P and revise when necessary to control pollution or required by the Engineer.
3. Post Construction Site Notice (CSN) with SW3P information on or near the site, accessible to the public and TCEQ, EPA or other inspectors.
4. When Contractor project specific locations (PSL's) increase disturbed soil area to 5 acres or more, submit NOI to TCEQ and the Engineer.

II. WORK IN OR NEAR STREAMS, WATERBODIES AND WETLANDS CLEAN WATER ACT SECTIONS 401 AND 404

USACE Permit required for filling, dredging, excavating or other work in any water bodies, rivers, creeks, streams, wetlands or wet areas.

The Contractor must adhere to all of the terms and conditions associated with the following permit(s):

☐ No Permit Required
☐ Nationwide Permit 14 - PCN not Required (less than 1/10th acre waters or wetlands affected)
☐ Nationwide Permit 14 - PCN Required (1/10 to <1/2 acre, 1/3 in tidal waters)
☐ Individual 404 Permit Required
☐ Other Nationwide Permit Required: NWP# _____

Required Actions: List waters of the US permit applies to, location in project and check Best Management Practices planned to control erosion, sedimentation and post-project TSS.

1.

2.

3.

4.

The elevation of the ordinary high water marks of any areas requiring work to be performed in the waters of the US requiring the use of a nationwide permit can be found on the Bridge Layouts.

Best Management Practices:

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

III. CULTURAL RESOURCES

Refer to TxDOT Standard Specifications in the event historical issues or archeological artifacts are found during construction. Upon discovery of archeological artifacts (bones, burnt rock, flint, pottery, etc.) cease work in the immediate area and contact the Engineer immediately.

☐ No Action Required ☐ Required Action

Action No.

1.

2.

3.

4.

IV. VEGETATION RESOURCES

Preserve native vegetation to the extent practical.
Contractor must adhere to Construction Specification Requirements Specs 162, 164, 192, 193, 506, 730, 751, 752 in order to comply with requirements for invasive species, beneficial landscaping, and tree/brush removal commitments.

☐ No Action Required ☐ Required Action

Action No.

1.

2.

3.

4.

V. FEDERAL LISTED, PROPOSED THREATENED, ENDANGERED SPECIES, CRITICAL HABITAT, STATE LISTED SPECIES, CANDIDATE SPECIES AND MIGRATORY BIRDS.

☐ No Action Required ☐ Required Action

Action No.

1.

2.

3.

4.

If any of the listed species are observed, cease work in the immediate area, do not disturb species or habitat and contact the Engineer immediately. The work may not remove active nests from bridges and other structures during nesting season of the birds associated with the nests. If caves or sinkholes are discovered, cease work in the immediate area, and contact the Engineer immediately.

LIST OF ABBREVIATIONS

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

VI. HAZARDOUS MATERIALS OR CONTAMINATION ISSUES

General (applies to all projects):

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

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

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

Contact the Engineer if any of the following are detected:
* Dead or distressed vegetation (not identified as normal)
* Trash piles, drums, canister, barrels, etc.
* Undesirable smells or odors
* Evidence of leaching or seepage of substances

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

☐ Yes ☐ No

If "No", then no further action is required.
If "Yes", then TxDOT is responsible for completing asbestos assessment/inspection.

Are the results of the asbestos inspection positive (is asbestos present)?

☐ Yes ☐ No

If "Yes", then TxDOT must retain a DSHS licensed asbestos consultant to assist with the notification, develop abatement/mitigation procedures, and perform management activities as necessary. The notification form to DSHS must be postmarked at least 15 working days prior to scheduled demolition.

If "No", then TxDOT is still required to notify DSHS 15 working days prior to any scheduled demolition.

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

Any other evidence indicating possible hazardous materials or contamination discovered on site. Hazardous Materials or Contamination Issues Specific to this Project:

☐ No Action Required ☐ Required Action

Action No.

1.

2.

3.

VII. OTHER ENVIRONMENTAL ISSUES

(includes regional issues such as Edwards Aquifer District, etc.)

☐ No Action Required ☐ Required Action

Action No.

1.

2.

3.

Texas Department of Transportation

Design Division Standard

ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS

EPIC

FILE: epic.dgn	DN: TxDOT	CK: RG	DW: VP	CK: AR	
©TxDOT: February 2015	CONT	SECT	JOB	HIGHWAY	
REVISIONS 12-12-2011 (DS) 05-07-14 ADDED NOTE SECTION IV. 01-23-2015 SECTION I (CHANGED ITEM 1122 TO ITEM 506, ADDED GRASSY SWALES.	0902	90	108	VA	
	DIST	COUNTY		SHEET NO.	
	FTW	TARRANT		118	

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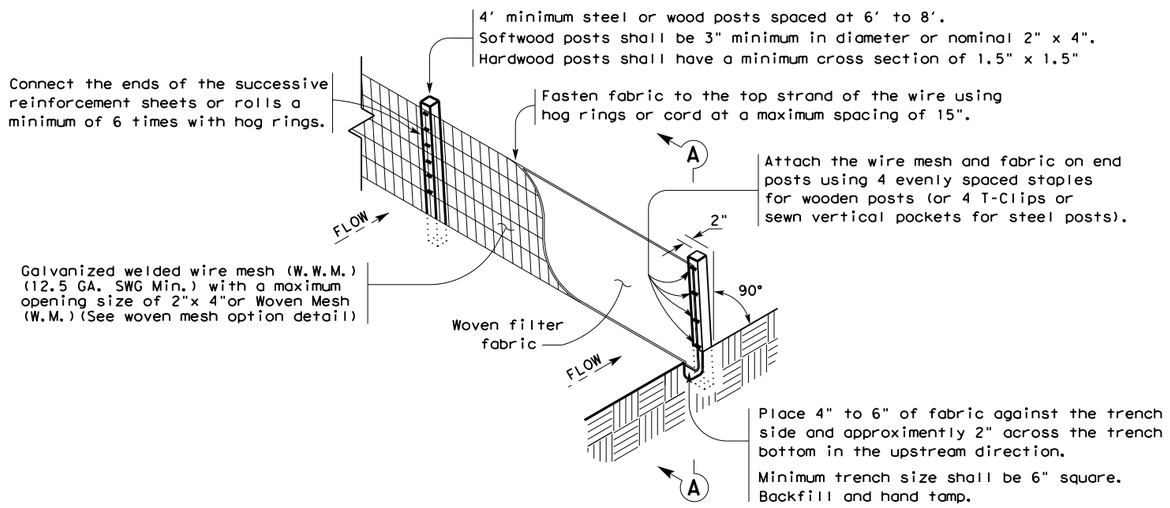
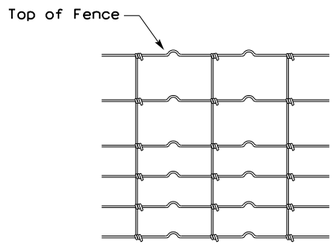
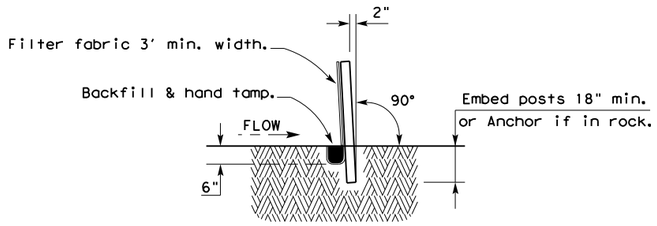


TEMPORARY SEDIMENT CONTROL FENCE

SCF





SECTION A-A

HINGE JOINT KNOT WOVEN MESH (OPTION) DETAIL

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

SEDIMENT CONTROL FENCE USAGE GUIDELINES

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

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

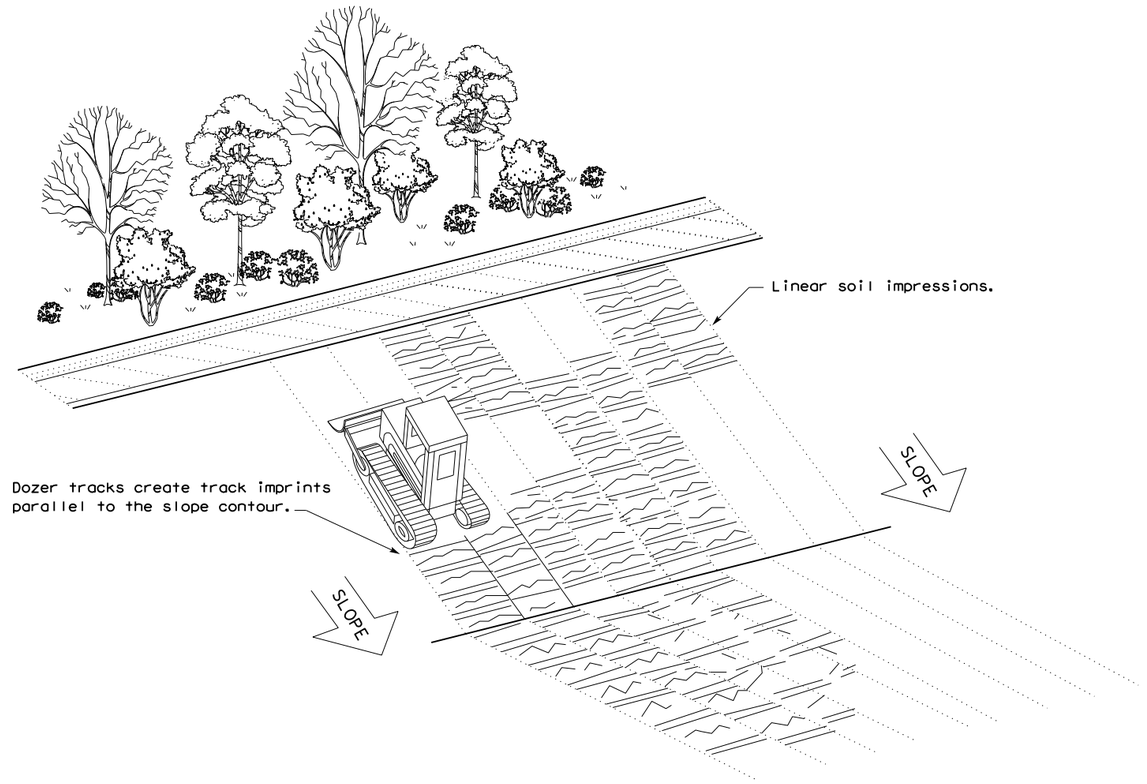
LEGEND

Sediment Control Fence

SCF

GENERAL NOTES

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



VERTICAL TRACKING

Texas Department of Transportation

Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

FENCE & VERTICAL TRACKING

EC(1)-16

FILE: ec116	DN: TxDOT	CK: KM	DW: VP	DN/CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
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	DIST	COUNTY		SHEET NO.
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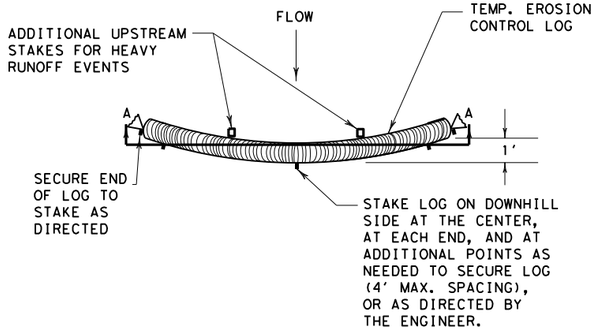
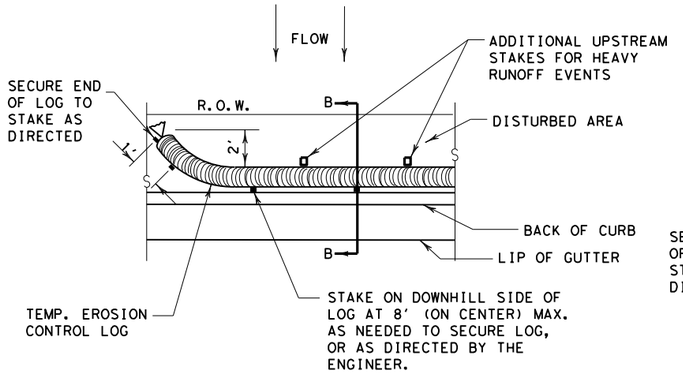
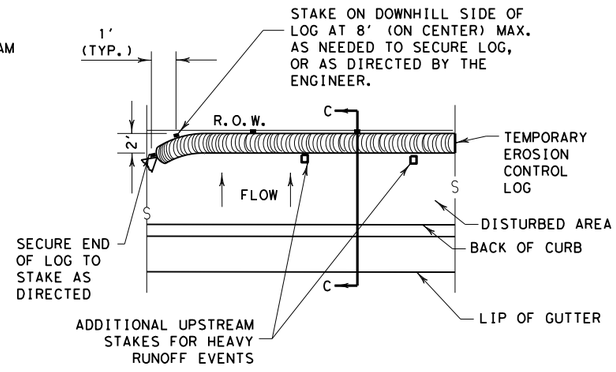


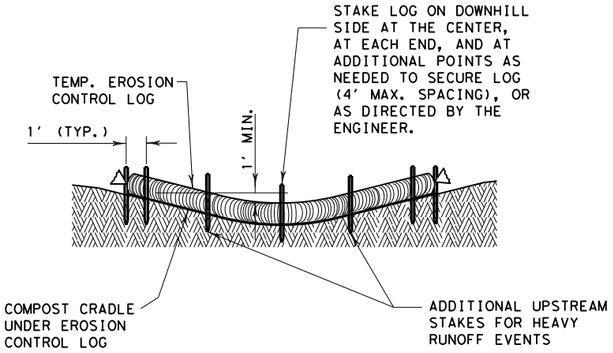
PLAN VIEW



PLAN VIEW



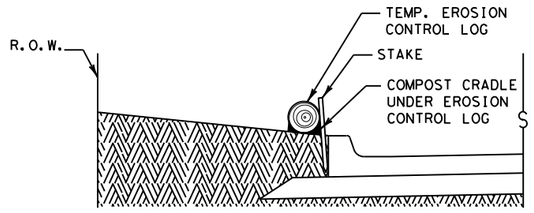
PLAN VIEW



SECTION A-A

EROSION CONTROL LOG DAM

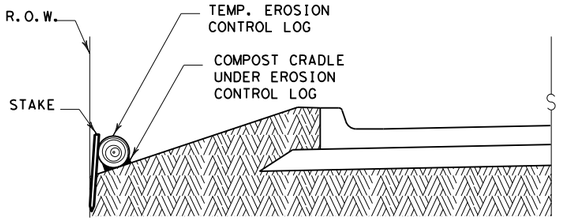
CL-D



SECTION B-B

EROSION CONTROL LOG AT BACK OF CURB

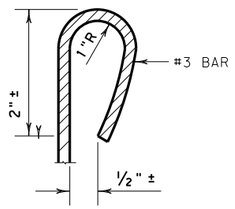
CL-BOC



SECTION C-C

EROSION CONTROL LOG AT EDGE OF RIGHT-OF-WAY

CL-ROW



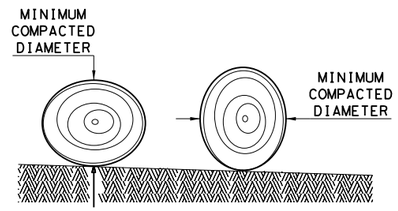
REBAR STAKE DETAIL

LEGEND

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

GENERAL NOTES:

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



DIAMETER MEASUREMENTS OF EROSION CONTROL LOGS SPECIFIED IN PLANS

SEDIMENT BASIN & TRAP USAGE GUIDELINES

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

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

Control logs should be placed in the following locations:

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

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

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

Texas Department of Transportation

Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

EROSION CONTROL LOG

EC(9)-16

FILE: ec916	DN: TxDOT	CK: KM	DW: LS/PT	CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	0902	90	108	VA
	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		120

DATE: 6/4/2021 4:12:21 PM
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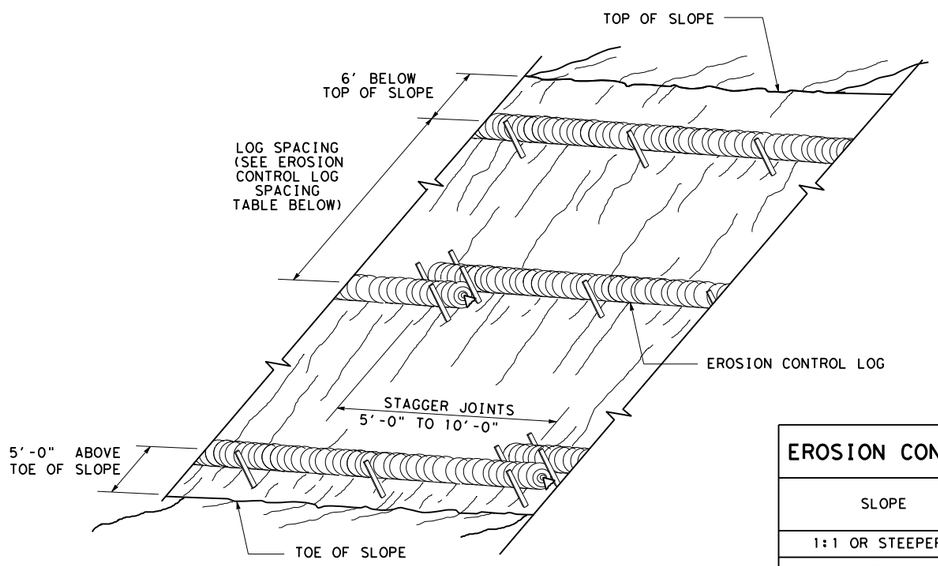
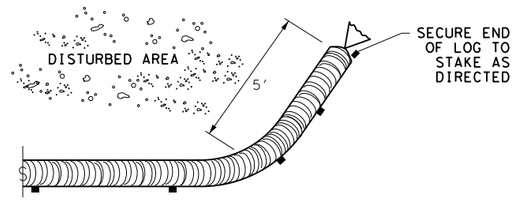


EROSION CONTROL LOGS ON SLOPES
STAKE AND TRENCHING ANCHORING

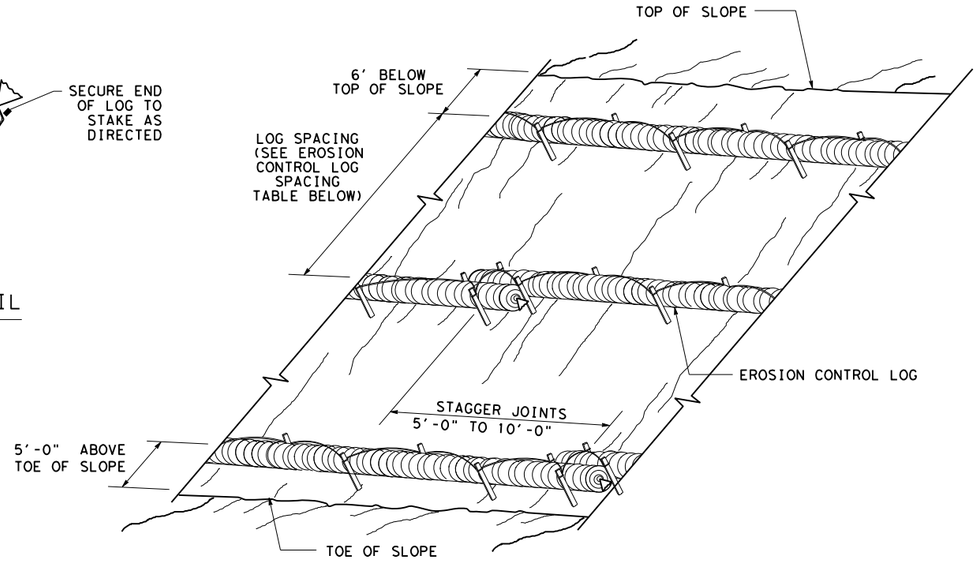
CL-SST



END SECTION RAP DETAIL

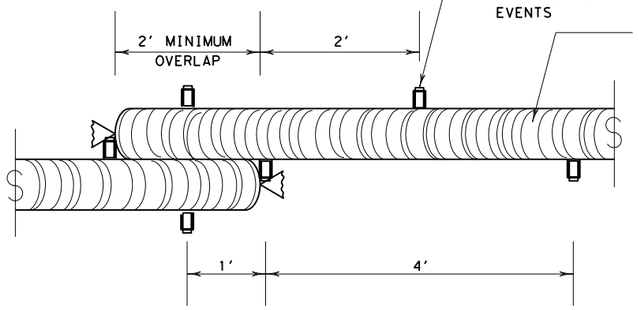
EROSION CONTROL LOG SPACING TABLE				
SLOPE	LOG DIAMETER			
	6"	8"	12"	18"
1:1 OR STEEPER	5'	10'	15'	20'
2:1	10'	20'	30'	40'
3:1	15'	30'	45'	60'
4:1 OR FLATTER	20'	40'	60'	80'

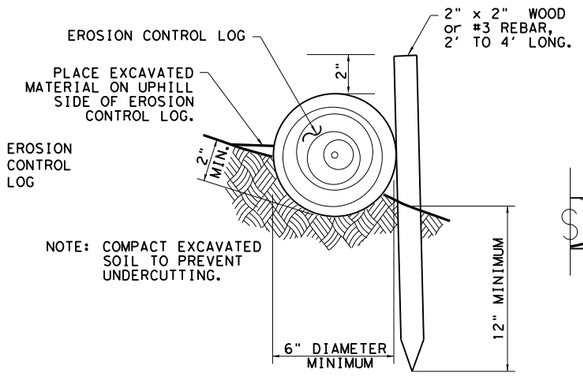
* ADJUSTMENTS CAN BE MADE FOR SOIL TYPE:
SOFT, LOAMY SOILS-ADJUST ROWS CLOSER TOGETHER;
HARD, ROCKY SOILS- ADJUST ROWS FARTHER APART



EROSION CONTROL LOGS ON SLOPES
STAKE AND LASHING ANCHORING

CL-SSL

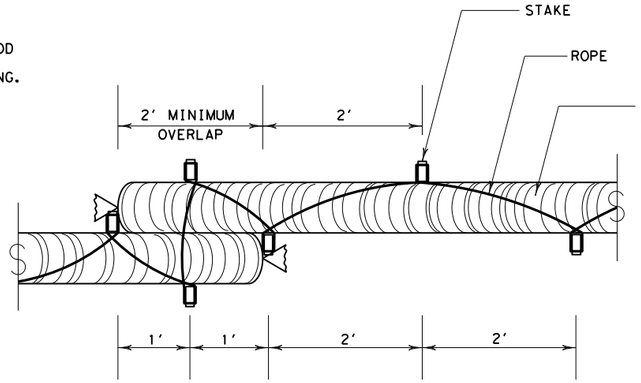


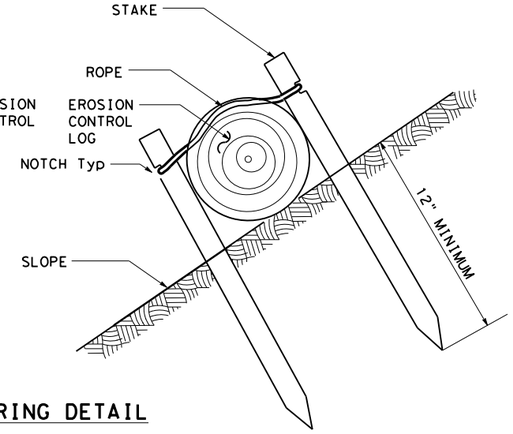


STAKE AND TRENCHING ANCHORING DETAIL

CL-SST

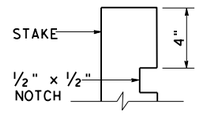
TRENCH DEPTH TABLE	
LOG DIAMETER	DEPTH
6"	2"
8"	3"
12"	4"
18"	5"





STAKE AND LASHING ANCHORING DETAIL

CL-SSL



STAKE NOTCH DETAIL

Texas Department of Transportation — Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES
EROSION CONTROL LOG
EC(9)-16

FILE: ec116	DN: TxDOT		CK: KM		DW: LS/PT	CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB		HIGHWAY	
REVISIONS	0902	90	108		VA	
	DIST	COUNTY			SHEET NO.	
	FTW	TARRANT			121	

DATE: 6/4/2021 4:12:23 PM
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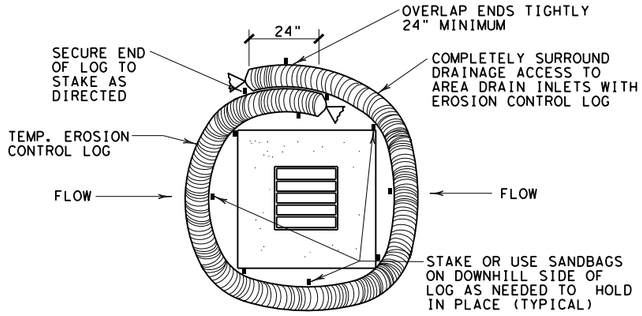
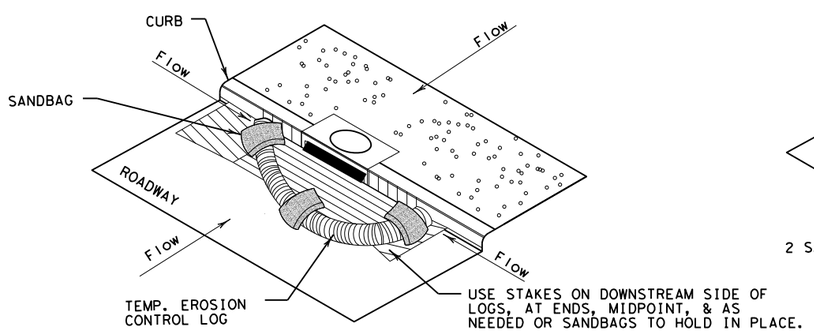


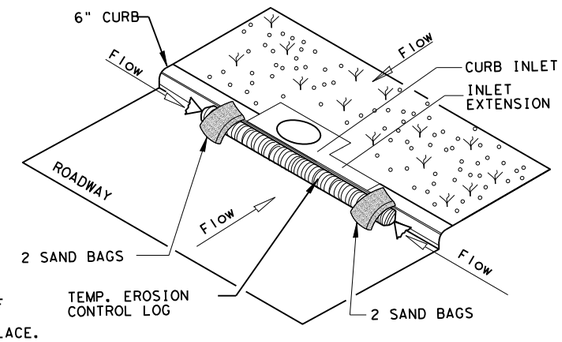
EROSION CONTROL LOG AT DROP INLET

CL-DI



EROSION CONTROL LOG AT CURB INLET

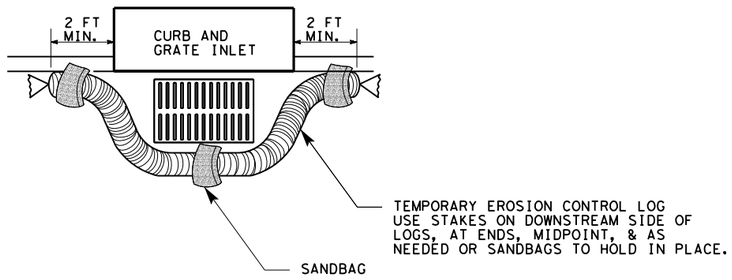
CL-CI



EROSION CONTROL LOG AT CURB INLET

CL-CI

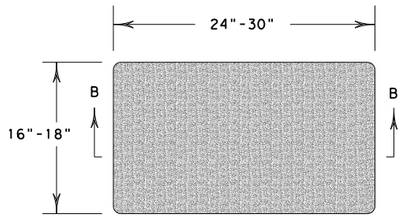
NOTE:
EROSION CONTROL LOGS USED AT CURB INLETS SHOULD ONLY BE USED IF THEY WILL NOT IMPEDE TRAFFIC OR FLOOD THE ROADWAY OR WHEN THE STORM SEWER SYSTEM IS NOT FULLY FUNCTIONAL.



EROSION CONTROL LOG AT CURB & GRADE INLET

CL-GI

SECTION B-B



SANDBAG DETAIL

SHEET 3 OF 3

Texas Department of Transportation

Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

EROSION CONTROL LOG

EC(9)-16

FILE: ec916	DN: TxDOT		CK: KM	DW: LS/PT		CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB		HIGHWAY	
REVISIONS	0902	90	108		VA	
	DIST	COUNTY				SHEET NO.
	FTW	TARRANT				122

A. GENERAL SITE DATA

1. PROJECT LIMITS: *As needed depending upon work order location*

LATTITUDE: _____ LONGITUDE: _____

2. PROJECT SITE MAPS:

- *Project Location Map: Title Sheet (Sheet I)*
- *Drainage Patterns: Drainage Area Maps (NOT APPLICABLE)*
- *Approx. Slopes Anticipated After Major Gradings and Areas of Soil Disturbance: Typical Sections (NOT APPLICABLE)*
- *Major Controls and Locations of Stabilization Practices: (NOT APPLICABLE) SW3P Site Map Sheets*
- *Project Specific Locations: To be specified by Project Field Office and located in the Project SW3P File*
- *Surface Waters and Discharge Locations: Drainage and Culvert Layout Sheets (NOT APPLICABLE)*

3. PROJECT DESCRIPTION:
FOR THE CONSTRUCTION OF MISCELLANEOUS WORK CONSISTING OF NON SITE SPECIFIC FIBER SYSTEM UPGRADES.

4. MAJOR SOIL DISTURBING ACTIVITIES:
TRENCHING AND BORING FOR CONDUIT

5. EXISTING CONDITION OF SOIL & VEGETATIVE COVER AND % OF EXISTING VEGETATIVE COVER:
GRASS WITH 100% VEGETATIVE COVER

6. TOTAL PROJECT AREA: *NUMBER OF SQUARE ACRES TO BE DETERMINED PER WORK ORDER*

7. TOTAL AREA TO BE DISTURBED: *NUMBER OF SQUARE ACRES TO BE DETERMINED PER WORK ORDER (XX % OF TOTAL PROJECT AREA)*

8. WEIGHTED RUNOFF COEFFICIENT

BEFORE CONSTRUCTION: *NOT APPLICABLE*
AFTER CONSTRUCTION: *NOT APPLICABLE*

9. NAME OF RECEIVING WATERS:

10. ENDANGERED SPECIES, DESIGNATED CRITICAL HABITAT AND HISTORIC PROPERTY:

No Endangered Species, Designated Critical Habitat or Historic Property has been found on this project site.

or

(Statement of What) has been found on this project site.

Note: Designer shall supply applicable statement.

The documentation satisfying TPDES Construction General Permit eligibility pertaining to the existence or of any protective action taken with regards to endangered species or designated critical habitat or historical property in this project area is contained in the project's Enviromental document (EA or EIS) and can be viewed under the State Open Records Act at the address shown below:

TEXAS DEPARTMENT OF TRANSPORTATION
FORT WORTH DISTRICT HEADQUARTERS
DISTRICT DESIGN SECTION
2501 SW LOOP
FORT WORTH, TX 76133
PHONE: 817-370-6500

B. EROSION AND SEDIMENT CONTROLS

1. SOIL STABILIZATION PRACTICES:

(Select T = Temporary or P = Permanent, as applicable)

T	TEMPORARY SEEDING	___	PRESERVATION OF NATURAL RESOURCES
___	MULCHING (Hay or Straw)	___	FLEXIBLE CHANNEL LINER
___	BUFFER ZONES	___	RIGID CHANNEL LINER
___	PLANTING	___	SOIL RETENTION BLANKET
P	SEEDING	___	COMPOST MANUFACTURED TOPSOIL
___	SODDING	___	OTHER: (Specify Practice)

2. STRUCTURAL PRACTICES:

(Select T = Temporary or P = Permanent, as applicable)

T	SILT FENCES	___	DIVERSION, INTERCEPTOR, OR PERIMETER DIKES
___	HAY BALES	___	DIVERSION, INTERCEPTOR, OR PERIMETER SWALES
___	ROCK FILTER DAMS	___	DIVERSION DIKE AND SWALE COMBINATIONS
___	PIPE SLOPE DRAINS	___	ROCK BEDDING AT CONSTRUCTION EXIT
___	PAVED FLUMES	___	TIMBER MATTING AT CONSTRUCTION EXIT
___	CHANNEL LINERS	___	STONE OUTLET STRUCTURES
___	SEDIMENT TRAPS	___	VELOCITY CONTROL DEVICES
___	SEDIMENT BASINS	___	CURBS AND GUTTERS
___	STORM SEWERS	___	STORM INLET SEDIMENT TRAP
T	OTHER: *(TEMPORARY EROSION CONTROL LOGS)*		
___			
___			
___			
___			

3. STORM WATER MANAGEMENT: *(Example Below - May be used as applicable, revised or expanded)*

1. Storm water drainage will be provided by the ditches, inlets and storm water systems that will carry drainage within the R.O.W. to the low points within the roadway and project site which drain to natural facilities.

2. Other permanent erosion controls include hydraulic design to limit structure outlet velocities and grading design generally consisting of 4:1 or flatter slopes with permanent vegetative cover.

4. STORM WATER MANAGEMENT ACTIVITIES: (Sequence of Construction)

(Describe Storm Water Management Activities by Phases)

5. NON-STORM WATER DISCHARGES:
Non-storm water discharges should be filtered, or held in retention basins, before being allowed to mix with storm water. These discharges consist of non-polluted ground water, spring water, foundation and/or footing drain water, and water used for dust control, pavement washing and vehicle washwater containing no detergents.

STATE OF TEXAS
CARLOS E. MOLINA
97237
LICENSED PROFESSIONAL ENGINEER

Carlos E. Molina

June 4, 2021

Texas Department of Transportation

Fort Worth District Standard

STORM WATER POLLUTION PREVENTION PLAN (SW3P)

SHEET 1 OF 2 SHEETS

ORIGINAL DRAWING: 09/2002	sw3p-ftw.dgn	FED.RD. DIV.NO.	PROJECT NO.			SHEET NO.
DATE	REVISIONS	6	C 902-90-108			123
09/2008	NPDES TO TPDES	STATE	STATE DIST. NO.	COUNTY		
01/2012	CLARIFY NOTE C.2.	TEXAS	FTW	TARRANT		
08/2013	ADDED SIGN	CONT.	SECT.	JOB	HIGHWAY NO.	
05/2019	2-SHEET FORMAT	0902	90	108	VA	

C. OTHER REQUIREMENTS & PRACTICES

1. MAINTENANCE:

All erosion and sediment controls shall be maintained in good working order. If a repair is necessary, it shall be performed at the earliest date possible but no later than 7 calendar days after the surrounding exposed ground has dried sufficiently to prevent further damage from heavy equipment. Disturbed areas on which construction activities have ceased, temporarily or permanently, shall be stabilized within 14 calendar days unless they are scheduled to and do resume within 21 calendar days. The areas adjacent to creeks and drainageways shall have priority followed by devices protecting storm sewer inlets.

2. INSPECTION:

An inspection shall be performed by a TxDOT inspector every 14 calendar days as well as within 24 hours after any rainfall of one-half inch or more is recorded on a non-freezing rain gauge to be located at the project site, or every 7 calendar days. An Inspection and Maintenance Report shall be filed for each inspection. Based on the inspection results, the controls shall be revised in accordance with the inspection report.

3. WASTE MATERIALS:

Except as noted below, all waste materials shall be collected in a metal dumpster having a secure cover. The dumpster shall meet all state and local solid waste management regulations. All trash and debris from construction shall be deposited in the dumpster. The dumpster shall be emptied, as necessary or as required by local regulation, and hauled to a local approved land fill site. The burying of construction waste on the project site shall not be permitted.

Concrete washout areas shall be required and shall consist of a pit, lined with an impervious material, of sufficient size to contain, until evaporation, all water used and washout material produced during concrete washout operations. The concrete washout locations shall be as directed by the engineer.

Lime slaking tanks shall be surrounded by an earthen berm, capable of containing any overflow.

4. HAZARDOUS WASTE (INCLUDING SPILL REPORTING):

As a minimum, any products in the following categories are considered to be hazardous: paints, acids, solvents, asphalt products, chemical additives for soil stabilization, and concrete curing compounds or additives. In the event of a spill which may be hazardous, the spill coordinator shall be contacted immediately.

5. SANITARY WASTE:

All sanitary waste shall be collected from the portable units, as necessary or as required by local regulation, by a licensed sanitary waste management contractor.

6. OFFSITE VEHICLE TRACKING:

The Contractor shall be required, on a regular basis or as may be directed by the Engineer, to dampen haul roads for dust control, stabilize construction entrances and to remove excess dirt from the roadway.

7. MANAGEMENT PRACTICES: *(Example Below - May be used as applicable, revised or expanded)*

1. Disposal areas, stockpiles and haul roads shall be constructed in a manner that will minimize and control the amount of sediment that may enter receiving waters. Disposal areas shall not be located in any wetland, waterbody or streambed.

2. Construction staging areas and vehicle maintenance areas shall be constructed by the Contractor in a manner to minimize the runoff of pollutants.

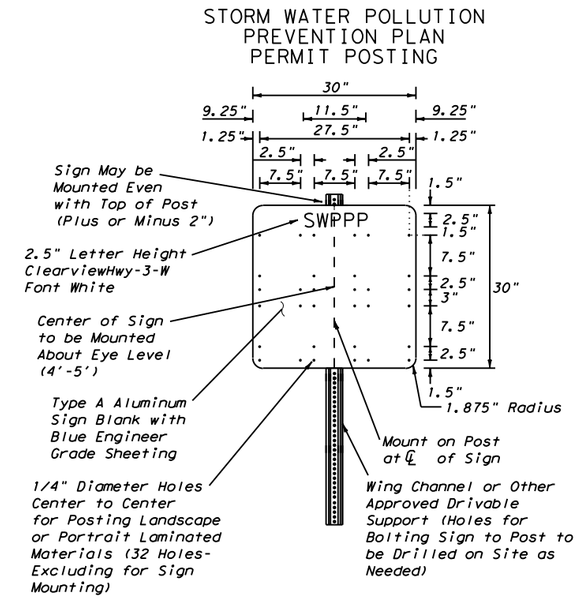
3. All temporary fills placed in waterways shall be built of erosion resistant material. (NWP 14)

4. All waterways shall be cleared as soon as practicable of temporary embankment, temporary bridges, matting, falsework, piling, debris or other obstructions placed during construction operations that are not a part of the finished work.

8. OTHER:

1. Listing of construction materials stored on site to be provided by Project Field Office.

2. The Project SW3P File located at the project field office shall contain the N.O.I., CGP Coverage Notice, TCEQ TPDES Form, Signature Authorization, Certification/Qualification Statements, Inspection Reports, Required Maps, and a copy of the TPDES General Permit No. TXR150000.



No Permanent Installation Allowed.
Sign to be Removed After Project Completion.

STATE OF TEXAS
CARLOS E. MOLINA
97237
LICENSED PROFESSIONAL ENGINEER

Carlos E. Molina

June 4, 2021

Texas Department of Transportation

Fort Worth District Standard

STORM WATER POLLUTION PREVENTION PLAN (SW3P)

SHEET 2 OF 2 SHEETS

ORIGINAL DRAWING: 09/2002	sw3p-ftw.dgn	FED.RD. DIV.NO.	PROJECT NO.	SHEET NO.
DATE	REVISIONS	6	C 902-90-108	124
09/2008	NPDES TO TPDES	STATE	STATE DIST.NO.	COUNTY
01/2012	CLARIFY NOTE C.2.	TEXAS	FTW	TARRANT
08/2013	ADDED SIGN	CONT.	SECT.	JOB / HIGHWAY NO.
05/2019	2-SHEET FORMAT	0902	90	108 / VA

http://www.dot.state.tx.us/ftw/specinfo/standard.htm
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