INDEX OF SHEETS

SEE SHEET NO. 2

LOCATION NO.	HIGHWAY	C.S.J.	LIMITS	RDWY LENGTH (MI)
1	IH 45	0500-03-652	IH 10 TO W CANINO RD	8.00
2	IH 45	0110-06-162	W CANINO RD TO SOUTH OF KUYKENDAHL RD	5.61
3	IH 45	0110-05-134	SOUTH OF KUYKENDAHL RD TO HARRIS CL	10.54
4	IH 45	0110-04-208	HARRIS CL TO SL 336 S	11.82
5	IH 45	0675-08-115	SL 336 S TO NORTH OF LEAGUE LINE RD	8.00

STATE OF TEXAS
DEPARTMENT OF TRANSPORTATION

TDLR INSPECTION NOT REQUIRED

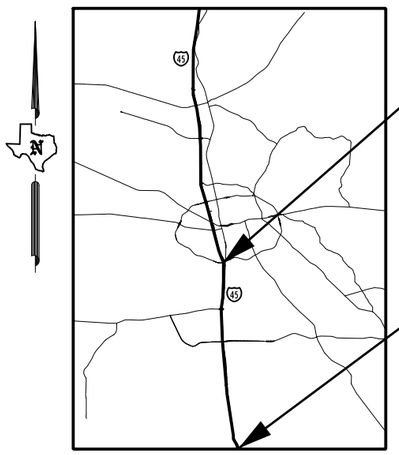
FED. RD. DIV. NO.	STATE	PROJECT NO.			HIGHWAY
6	TEXAS	F 2B24(055)			IH 45
STATE DISTRICT	COUNTY	CONTROL	SECTION	JOB	SHEET NO.
HOU	MONTGOMERY,ETC	0110	04	208, ETC	1

PLANS OF PROPOSED
STATE HIGHWAY IMPROVEMENT

PROJECT NO.: F 2B24(055)
CSJ: 0110-04-208, ETC
COUNTY: MONTGOMERY
ROADWAY: IH 45
PROJECT LENGTH: 43.97 MILES

AREA OF DISTURBED SOIL = N/A
FUNCTIONAL CLASS = N/A
DESIGN SPEED = N/A

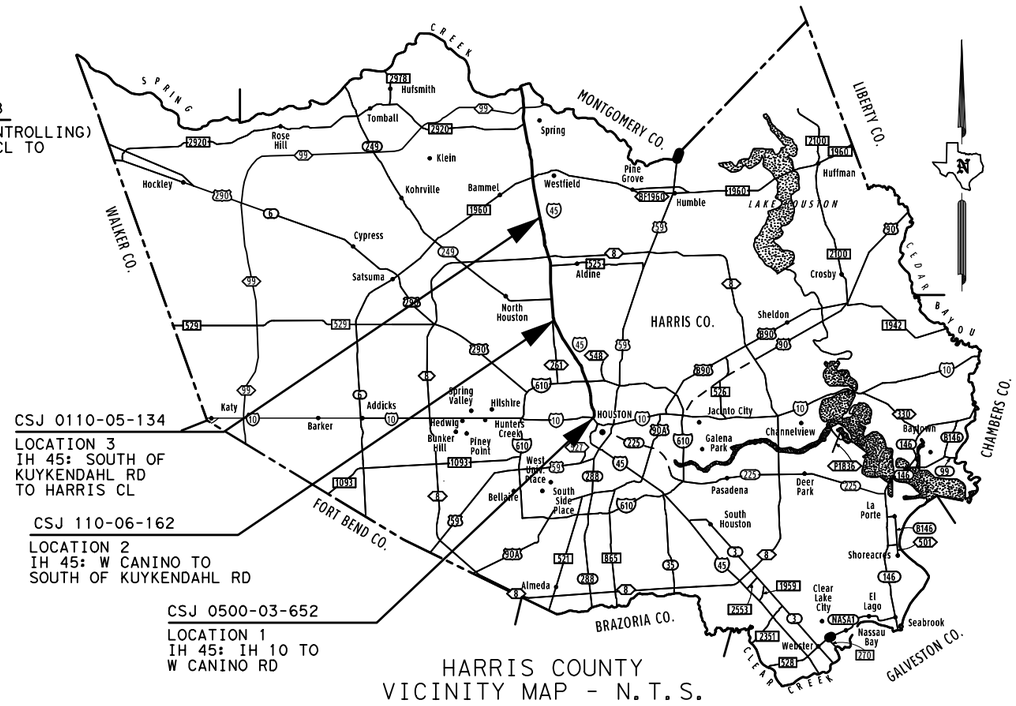
ADT:	2023	2043
IH 45 MAIN LANES	238,438	333,813



MONTGOMERY COUNTY
VICINITY MAP - N.T.S.

LIMITS: IH 45 - IH 10 TO NORTH OF LEAGUE LINE RD

PROJECT DESCRIPTION: WORK CONSISTING OF HIGH MAST AND UNDERPASS ILLUMINATION UPGRADES



HARRIS COUNTY
VICINITY MAP - N.T.S.

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

2. SPECIFICATIONS ADOPTED BY THE TEXAS DEPARTMENT OF TRANSPORTATION, NOVEMBER 1, 2014, AND SPECFICATION ITEMS LISTED AND DATED AS FOLLOWS SHALL GOVERN ON THIS PROJECT: REQUIRED CONTRACT PROVISIONS FOR ALL FEDERAL-AID CONSTRUCTION CONTRACTS. (FORM FHWA 1273, OCTOBER 23, 2023)

NO EXCEPTIONS
NO RAILROAD CROSSINGS
NO EQUATIONS

STATE OF TEXAS
CHARLES R. STEVENS, JR
101286
PROFESSIONAL ENGINEER

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
8131 JACKRABBIT RD PHONE: (713) 828-4742
Houston, TX. 77095

TEXAS DEPARTMENT OF TRANSPORTATION

SUBMITTED FOR LETTING 05/03/2024

For _____
DISTRICT TRAFFIC ENGINEER

APPROVED FOR LETTING 5/6/2024

DocuSigned by:
_____ , P.E.
For DISTRICT ENGINEER

...\0110-04-208_IH45_ILLUM_TITLE SHEET.dgn

3/21/2024 3:58:16 PM

SHEET NO.		DESCRIPTION
		I. GENERAL
1		TITLE SHEET/VICINITY MAP
2		INDEX OF SHEETS
3, 3A - 3C		GENERAL NOTES
4 & 4A		ESTIMATE AND QUANTITY SHEET
5		SUMMARY OF ILLUMINATION QUANTITIES
		II. TRAFFIC CONTROL PLAN
6		TCP NARRATIVE
		TCP STANDARDS
7-18	*	BC(1)-21 THRU BC(12)-21
19	*	WZ (TD)-17
20	*	WZ (RCD)-13
21	*	WZ (BRK)-13
22	*	TCP(1-5)-18
23	*	TCP(2-6)-18
24	*	TCP(3-2)-13
25	*	TCP(5-1)-18
26-32	*	TCP(6-1)-12 THRU TCP(6-7)-12
33-34	*	TCP(6-8)-14 THRU TCP(6-9)-14
		III. ILLUMINATION
		IH 45 - IH 10 TO W CANINO RD (CSJ 0500-03-652)
35-38		HIGH MAST ILLUMINATION LAYOUTS
39-58		UNDERPASS ILLUMINATION LAYOUTS
		IH 45 - W CANINO RD TO SOUTH OF KUYKENDAHL RD (CSJ 0110-06-162)
59-61		HIGH MAST ILLUMINATION LAYOUTS
62-76		UNDERPASS ILLUMINATION LAYOUTS
		IH 45 - SOUTH OF KUYKENDAHL RD TO HARRIS CL (CSJ 0110-05-134)
77-81		HIGH MAST ILLUMINATION LAYOUTS
82-91		UNDERPASS ILLUMINATION LAYOUTS
		IH 45 - HARRIS CL TO SL 336 S (CSJ 0110-04-208)
92-96		HIGH MAST ILLUMINATION LAYOUTS
97-106		UNDERPASS ILLUMINATION LAYOUTS
		IH 45 - SL 336 S TO NORTH OF LEAGUE LINE RD (CSJ 0675-08-115)
107-110		HIGH MAST ILLUMINATION LAYOUTS
111-118		UNDERPASS ILLUMINATION LAYOUTS
		IH 45 - SPECIAL DETAILS
119		CONVERT Z-PATTERN HIGH MAST DETAIL
		IV. STANDARDS
		ILLUMINATION STANDARDS
120-126	*	ED(1 THRU 7) - 14
127-129	*	ED(9 THRU 11) - 14
130-138	*	HMID(1 THRU 9) - 03
139-140	*	HMIP(1 THRU 2) - 16
141-143	*	RID(1 THRU 3) - 20
		ENVIRONMENTAL STANDARDS
144		EPIC - ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS
145-146		SW3P3A-23 - TXDOT STORM WATER POLLUTION PREVENTION PLAN

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

STATE OF TEXAS
CHARLES R. STEVENS, JR.
101286
LICENSED PROFESSIONAL ENGINEER

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

PRINT DATE	REVISION DATE
3/21/2024	

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
8131 JACKRABITT RD
Houston, TX. 77095
PHONE: (713) 828-4742

Texas Department of Transportation®

IH 45 ILLUMINATION

INDEX OF SHEETS

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		2
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

Area Engineer contact information for this project follows:

Reza Molaei, PE
Traffic Engineering-Illumination
Email: mohammadreza.molaei@txdot.gov

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

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

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

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

Index of /pub/txdot-info/Pre-Letting Responses/Houston District (state.tx.us) or

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

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

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

Tolls incurred by the Contractor are incidental to the various bid items.

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

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

General: Roadway Illumination and Electrical

For roadway illumination and electrical items, use materials from pre-qualified producers as shown on the Construction Division (CST) of the Department's material producers list. Check the latest link on the Department's website for this list. The category/item is "Roadway Illumination and Electrical Supplies." No substitutions will be allowed for materials found on this list.

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

County: Houston District **Control:** 0110-04-208, ETC

Highway: IH 45

The Contractor may make the electrical grounding connections and permissible splices using the thermal fusion process, Cadweld, ThermOweld, or approved equal, instead of bolted connections and splices.

The Area Engineer will arrange with the Contractor, an inspection of the completed electrical systems for the highway lighting systems before final acceptance for compliance with plans and specifications. The inspection will be made with personnel from the electrical section of the Department's District Transportation Operations Office. The city's electrical division personnel will also inspect lighting systems within the city limits. Portions of the work found to be deficient during this inspection will not be accepted.

General: Site Management

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

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

General: Traffic Control and Construction

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

General: Utilities

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

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

Be aware that an operational Computerized Transportation Management System (CTMS) exists within the limits of this project and that the system must remain operational throughout construction. If the Contractor damages or causes damage to this system, repair such damage within 8 hours of occurrence at no cost to the Department. In the event of system damage, notify the Director of Traffic Management Systems at 713-881-3283 within one hour of occurrence. Failure of the Contractor to repair damage to the main fiber optic cable and CCTV cable trunk lines, which convey all corridor information to TranStar, will result in the Contractor being billed for the full cost of emergency repairs.

At least 72 hours before starting work, make arrangements for locating existing Department-owned above ground and underground fiber optic, communications, power, illumination, and traffic signal cabling and conduit. Do this by calling the Department's Houston District Traffic Signal Operations Office at 713-802-5662, or by e-mailing the Department's Houston District Traffic Signal Operations Office at: HOU-LocateRequest@txdot.gov,

to schedule marking of underground lines on the ground. Use caution if working in these areas to avoid damaging or interfering with existing facilities.

Install or remove poles and luminaires located near overhead or underground electrical lines using established industry and utility safety practices. Consult the appropriate utility company before beginning such work.

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

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

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

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

Item 5: Control of Work

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

Table 2
2014 Construction Specification Required Shop/Working Drawing Submittals - Consultant Generated Plans

Spec Item No.'s	Product	Submittal Required	Approval Required (Y/N)	Contractor/ Fabricator P.E. Seal Required	Reviewing Party	Shop or Working Drawing (Note 1)
610	Roadway Illumination Supports (Non-Standard only, calcs reqd.)	Y	Y	Y	D, TEI	SD
613	High Mast Illumination Poles (Non-standard only, calcs reqd.)	Y	Y	Y	D, TEI	SD
644	Special Non-Standard Supports (Bridge Mounts, Barrier Mounts, Etc.)	Y	Y	Y	D, TEI	SD
SS	High Mast Illumination Assemblies	Y	Y	Y	D, TEI	SD

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

Key to Reviewing Party

D – Consultant: Submit to Engineer of Record at charlie@stevens-technical.com
TMS – Traffic Management System
Computerized Traffic Management Systems (CTMS) — HOU-CTMSShpDrwgs@txdot.gov
TEI – Traffic Engineering – Illumination: Submit to District at Mohammadreza.molaei@tdot.gov

Item 7: Legal Relations and Responsibilities

This project does not require a U.S. Army Corps of Engineers (USACE) Section 404 Permit before letting, but if a permit is needed during construction, assume responsibility for preparing the permit application. Submit the permit application to the Department's District Environmental Section for approval. Once the permit application is approved, the Department will submit it to the USACE. Assume responsibility for the requested revisions, in coordination with the Department's District Environmental Section.

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

During the hurricane season (June 1 through November 30), do not close any travel lanes except when the Contractor can demonstrate that he/she can provide labor, equipment, material, a work plan, and quality of work to satisfactorily return all lanes to an open, all-weather travel surface within 3 days of receiving written or verbal notice but no later than 3 days before the predicted hurricane landfall. Construction of temporary lanes to an all-weather surface will be paid for in accordance with Article 9.7, "Payment for Extra Work and Force Account Method."

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

Roadway closures during the following key dates and special events are prohibited: *(list dates here, such as)*

January 1, 2018

March 3-20, 2018 – Houston Livestock Show and Rodeo

Item 8: Prosecution and Progress

Working days will be computed and charged based on a standard workweek in accordance with Section 8.3.1.4. The Lane Closure Assessment Fee for this project shall be as follows:

1. IH 45 (One Direction Only)
    a. Main Lanes: $2,500
    b. Frontage Roads: $500

This fee applies to the Contractor for closures or obstructions that overlap into restricted hour traffic for each hour or portion thereof, per lane, regardless of the length of lane closure or obstruction. For Restricted Hours subject to Lane Assessment Fee refer to the Item, "Barricades, Signs, and Traffic Handling." The time increment for the Lane Closure Assessment fee for this project is one hour.

Item 502: Barricades, Signs, and Traffic Handling

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

Submit changes to the traffic control plan to the Area Engineer. Provide a layout showing the construction phasing, signs, striping, and signalizations for changes to the original traffic control plan.

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

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

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

Erect temporary signs when exit ramps are closed or moved to new locations during construction.

Coordinate and schedule the work with the appropriate Metro representative if requiring access to the High Occupancy Vehicle lanes.

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

Use traffic cones for daytime work only. Replace the cones with plastic drums during nighttime hours.
Do not reduce the existing number of lanes open to traffic except as shown on the following time schedule:

One Lane Closure

County: Houston District **Control:** 0110-04-208, ETC

Highway: IH 45

Day	Daytime Closure Hours	Nighttime Closure Hours	Restricted Hours Subject to Lane Assessment Fee
Monday	9:00 AM - 3:00 PM	12:00 AM - 5:00 AM 8:00 PM - 11:59 PM	5:00 AM - 9:00 AM 3:00 PM - 8:00 PM
Tuesday	9:00 AM - 3:00 PM	12:00 AM - 5:00 AM 8:00 PM - 11:59 PM	5:00 AM - 9:00 AM 3:00 PM - 8:00 PM
Wednesday	9:00 AM - 3:00 PM	12:00 AM - 5:00 AM 8:00 PM - 11:59 PM	5:00 AM - 9:00 AM 3:00 PM - 8:00 PM
Thursday	9:00 AM - 3:00 PM	12:00 AM - 5:00 AM 8:00 PM - 11:59 PM	5:00 AM - 9:00 AM 3:00 PM - 8:00 PM
Friday	9:00 AM - 3:00 PM	12:00 AM - 5:00 AM 8:00 PM - 11:59 PM	5:00 AM - 9:00 AM 3:00 PM - 8:00 PM
Saturday	N/A	N/A	N/A
Sunday	N/A	N/A	N/A

Full Closure (Roadway / Ramps / Direct Connector)

Day	Daytime Closure Hours	Nighttime Closure Hours	Restricted Hours Subject to Lane Assessment Fee
Monday	9:00 AM - 3:00 PM	12:00 AM - 5:00 AM 8:00 PM - 11:59 PM	5:00 AM - 9:00 AM 3:00 PM - 8:00 PM
Tuesday	9:00 AM - 3:00 PM	12:00 AM - 5:00 AM 8:00 PM - 11:59 PM	5:00 AM - 9:00 AM 3:00 PM - 8:00 PM
Wednesday	9:00 AM - 3:00 PM	12:00 AM - 5:00 AM 8:00 PM - 11:59 PM	5:00 AM - 9:00 AM 3:00 PM - 8:00 PM
Thursday	9:00 AM - 3:00 PM	12:00 AM - 5:00 AM 8:00 PM - 11:59 PM	5:00 AM - 9:00 AM 3:00 PM - 8:00 PM
Friday	9:00 AM - 3:00 PM	12:00 AM - 5:00 AM 8:00 PM - 11:59 PM	5:00 AM - 9:00 AM 3:00 PM - 8:00 PM
Saturday	N/A	N/A	N/A
Sunday	N/A	N/A	N/A

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

Before closing any City of Houston sidewalk, one or more city street lanes, or entire city streets during construction, obtain a permit to do so from the City. Obtain the required permit in person at the City of Houston Permit Office or apply online at http://www.gims.houstontx.gov.

Special Specification 6000: Illumination Maintenance

Verify existing luminaire type, performance, photometric data, and warranty. Furnish and install only luminaires that meet or exceed the performance and photometrics data of the existing luminaire when initially installed and according to the original manufacturer cut sheets and photometric reports.

Furnish all luminaires and materials needed to remove, install, and/or replace existing high mast and underpass luminaire fixtures according to Item 610 Roadway Illumination Assemblies and Special Specification 6156 LED High Mast Illumination Assemblies.

Where an existing luminaire type, performance, and/or photometric data exceeds that found in Special Specification 6156 LED High Mast Illumination Assemblies, the type, performance, and/or photometric data of the existing luminaire when initially installed and according to the original manufacturer cut sheets and photometric reports shall be the minimum threshold of the replacement.

High Mast Fixtures/Luminaires/Assemblies: the cost of removing, salvaging, disassembling, and stockpiling existing luminaires; furnishing and installing new luminaires, connections, conductors, and conduit on the ring; rewiring circuits on the ring; replacing damaged components; disposal of unsalvageable materials; conducting system performance testing; and materials, equipment, labor, tools, and incidentals is subsidiary to SS 6000.

Convert Z-Pattern High Mast Illumination Assembly to LED: The cost of removing, salvaging, disassembling, and stockpiling existing luminaires; furnishing and installing mounting tenons, new luminaires, connections, conductors, and conduit on the ring; rewiring circuits on the ring; furnishing and installing transformer, terminal boards, cord connectors, connector bodies, plugs, flanged inlets, junction boxes, circuit breaker(s) and enclosure; removing counterweights and balancing the ring; furnishing and installing grounding system components; replacing damaged components; disposal of unsalvageable materials; conducting system performance testing; and materials, equipment, labor, tools, and incidentals is subsidiary to SS 6000.

Conventional and Underpass Fixtures/Luminaires/Illumination: the cost of removing, salvaging, disassembling, and stockpiling existing luminaires; furnishing and installing new luminaires, connections, and conductors internal to the pole; replacing damaged components; disposing of unsalvageable materials; and materials, equipment, labor, tools, and incidentals is subsidiary to ss 6000.

Troubleshooting Items: Coordinate with the state prior to troubleshooting work (shown in the summary of quantities) and submit proposed repairs and replacements to the Area Engineer for approval.

Furnish light fixtures from new materials that are in accordance with DMS-11010, “Roadway Illumination Light Fixtures”.

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

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

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

For electrical licensing and electrical certification requirements for this project, see Item 7 of the Standard Specifications and any applicable special provisions to Item 7.

County: Houston District **Control:** 0110-04-208, ETC

Highway: IH 45

Lane Closures (SS 7148) are subsidiary to Item 502 Barricades and not a separate pay item.

When applicable, refer to Houston District Master General Notes for Items:

Item 416: Drilled Shaft Foundations
Item 432: Riprap
Item 610: Roadway Illumination Assemblies
Item 613: High Mast Illumination Poles
Item 614: High Mast Illumination Assemblies
Item 616: Performance Testing of Lighting Systems
Item 618: Conduit
Item 620: Electrical Conductors
Item 624: Ground Boxes
Item 628: Electrical Services

Item 6185: Truck Mounted Attenuator (TMA) and Trailer Attenuator (TA)

A shadow vehicle with Truck Mounted Attenuators (TMA) is required as shown on the appropriate Traffic Control Plan (TCP) sheets. Truck Mounted Attenuators must meet the requirements of the Compliant Work Zone Traffic Control Device List.

Level 3 Compliant TMAs are required for this project. A total of one (1) shadow vehicle with a TMA/TA is required for the work with the exception of Pavement Marking Operations. The Contractor is responsible for determining if one or more of these operations will be ongoing at the same time to determine the total number of TMA’s/TA’s needed on the project.

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0110-04-208 **DISTRICT** Houston **COUNTY** Harris, Montgomery
HIGHWAY IH 45

				0110-04-208		0110-05-134		0110-06-162		0500-03-652		0675-08-115		TOTAL EST.	TOTAL FINAL
		CONTROL SECTION JOB													
		PROJECT ID		A00138128		A00138127		A00196951		A00196950		A00138129			
		COUNTY		Montgomery		Harris		Harris		Harris		Montgomery			
		HIGHWAY		IH 45		IH 45		IH 45		IH 45		IH 45			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL	EST.	FINAL	EST.	FINAL	EST.	FINAL	EST.	FINAL		
	500-6001	MOBILIZATION	LS	1.000										1.000	
	502-6001	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	8.000		8.000		5.000		7.000		3.000		31.000	
	6000-6003	REPLACE ABOVE-GROUND CONDUIT	LF	7,500.000		7,500.000		15,000.000		15,000.000		7,500.000		52,500.000	
	6000-6006	REPLACE UNDERGROUND CONDUIT	LF	2,500.000		2,500.000		5,000.000		5,000.000		2,500.000		17,500.000	
	6000-6009	REPLACE CONDUCTOR	LF	15,000.000		15,000.000		30,000.000		30,000.000		15,000.000		105,000.000	
	6000-6016	INSTALL ELECTRICAL SPLICE	EA	75.000		75.000		100.000		100.000		75.000		425.000	
	6000-6028	REMOVE UNDERPASS LUMINAIRE (HPS)	EA	3.000		30.000		280.000		140.000				453.000	
	6000-6030	INSTALL UNDERPASS LUMINAIRE (LED)	EA	3.000		30.000		280.000		140.000				453.000	
	6000-6032	REPLACE UNDERPASS LUMINAIRE (LED)	EA	125.000		120.000				8.000		72.000		325.000	
	6000-6034	REMOVE INDUCTION FLUORESCENT FIXTURE	EA	20.000		20.000		20.000		20.000		20.000		100.000	
	6000-6052	REPLACE ELECTRICAL SERVICE	EA	5.000		5.000		5.000		5.000		5.000		25.000	
	6000-6054	REPLACE STEEL SERVICE POLE	EA	5.000		5.000		5.000		5.000		5.000		25.000	
	6000-6057	INSTALL GROUND BOX W/APRON	EA	10.000		10.000		30.000		30.000		10.000		90.000	
	6000-6058	REMOVE GROUND BOX	EA	10.000		10.000		30.000		30.000		10.000		90.000	
	6000-6063	REPLACE HAND HOLE COVER	EA	12.000		12.000		25.000		25.000		12.000		86.000	
	6000-6064	INSTALL GROUND ROD	EA	10.000		10.000		25.000		25.000		10.000		80.000	
	6000-6068	REPLACE FUSED DISCONNECT	EA	10.000		10.000		25.000		25.000		10.000		80.000	
	6000-6076	REPLACE WALL PACK LUMINAIRE	EA							102.000				102.000	
	6000-6085	REPLACE STARTING AID	EA	10.000		10.000		25.000		25.000		10.000		80.000	
	6000-6086	REPLACE PHOTOCELL AND BRACKET	EA	10.000		10.000		25.000		25.000		10.000		80.000	
	6000-6087	REPLACE CONTROL TRANS (HIGH MAST)	EA	10.000		10.000		25.000		25.000		10.000		80.000	
	6000-6088	REPLACE CONTROL TRANS (ELECT SERVICE)	EA	10.000		10.000		10.000		10.000		10.000		50.000	
	6000-6089	REPLACE CONTROL CIRCUIT (HIGH MAST)	EA	10.000		10.000		25.000		25.000		10.000		80.000	
	6000-6090	REPLACE CONTROL CIRCUIT (ELECT SERVICE)	EA	6.000		6.000		10.000		10.000		6.000		38.000	
	6000-6093	REPLACE HAND-OFF-AUTO SWITCH	EA	10.000		10.000		25.000		25.000		10.000		80.000	
	6000-6094	REPLACE CONTACTOR	EA	10.000		10.000		25.000		25.000		10.000		80.000	
	6000-6095	REPLACE METER BASE	EA	10.000		10.000		25.000		25.000		10.000		80.000	
	6000-6096	REPLACE TIME CLOCK	EA	15.000		15.000		25.000		25.000		15.000		95.000	
	6000-6097	REPLACE BREAKER PANEL	EA	10.000		10.000		25.000		25.000		10.000		80.000	
	6000-6099	REPLACE CIRCUIT BREAKER	EA	25.000		25.000		50.000		50.000		25.000		175.000	
	6000-6100	REPLACE FLEX POWER CABLE OR CORD	LF	1,000.000		1,000.000		2,000.000		2,000.000		1,000.000		7,000.000	
	6000-6101	REPLACE TWIST LOCK CONNECTOR	EA	10.000		10.000		25.000		25.000		10.000		80.000	
	6000-6102	REPLACE SAFETY LANYARD	LF	40.000		40.000		180.000		180.000		40.000		480.000	
	6000-6103	RAISE AND LOWER RING (HIGH MAST LIGHT)	EA	74.000		71.000		16.000		18.000		33.000		212.000	
	6000-6104	RE-STRAP EXISTING CONDUIT	EA	25.000		25.000		50.000		50.000		25.000		175.000	
	6000-6105	REPLACE NUTS, WASHERS & OTHER HARDWARE	EA	100.000		100.000		250.000		250.000		100.000		800.000	
	6000-6106	TROUBLESHOOT FOR REPAIRS	HR	500.000		500.000		1,500.000		1,500.000		500.000		4,500.000	

Estimate & Quantity Sheet

CONTROLLING PROJECT ID 0110-04-208 **DISTRICT** Houston **COUNTY** Harris, Montgomery
HIGHWAY IH 45

				0110-04-208		0110-05-134		0110-06-162		0500-03-652		0675-08-115		TOTAL EST.	TOTAL FINAL
		CONTROL SECTION JOB													
		PROJECT ID		A00138128		A00138127		A00196951		A00196950		A00138129			
		COUNTY		Montgomery		Harris		Harris		Harris		Montgomery			
		HIGHWAY		IH 45		IH 45		IH 45		IH 45		IH 45			
ALT	**BID CODE**	**DESCRIPTION**	**UNIT**	EST.	FINAL	EST.	FINAL	EST.	FINAL	EST.	FINAL	EST.	FINAL		
	6000-6115	REPLACE SAFETY SWITCH	EA	10.000		10.000		50.000		50.000		10.000		130.000	
	6000-6147	REPLACE 5/16" WIRE ROPE	EA	10.000		10.000		50.000		50.000		10.000		130.000	
	6000-6148	REPLACE 3/8" WIRE ROPE	EA	10.000		10.000		50.000		50.000		10.000		130.000	
	6000-6149	REPLACE HIGH MAST WINCH	EA	10.000		10.000		50.000		50.000		10.000		130.000	
	6000-6150	REPLACE WIRE ROPE PULLEY	EA	10.000		10.000		50.000		50.000		10.000		130.000	
	6000-6151	REPLACE ELECTRICAL CABLE PULLEY	EA	10.000		10.000		50.000		50.000		10.000		130.000	
	6000-6153	REPLACE ACCESS HOLE COVER	EA	10.000		10.000		50.000		50.000		10.000		130.000	
	6000-6154	REPLACE HIGH MAST SPRINGS	EA	10.000		10.000		50.000		50.000		10.000		130.000	
	6000-6155	REMOVE/REINSTL HI MAST POLE FOR REPAIR	EA	10.000		10.000		25.000		25.000		10.000		80.000	
	6000-6157	REPL ALUMINUM CABLE STRAP	EA	125.000		125.000		500.000		500.000		125.000		1,375.000	
	6000-6160	REPLACE HIGH MAST LUMINAIRES (LED)	EA	444.000		360.000		30.000		62.000		198.000		1,094.000	
	6000-6161	INSTL HIGH MAST FIXTURE (LED)	EA			66.000		66.000		46.000				178.000	
	6000-6162	REMOVE HIGH MAST ILLUM FIXTURE	EA			132.000		132.000		60.000				324.000	
	6000-6165	LED SHIELDS FOR HIGH MAST FIXTURES	EA	400.000		400.000		120.000		120.000		400.000		1,440.000	
	6000-6167	REPLACE AVIATION WARNING FIXTURE (LED)	EA	222.000		213.000		48.000		48.000		99.000		630.000	
	6000-6168	REMOVE LED SHIELDS	EA	400.000		400.000		120.000		120.000		400.000		1,440.000	
	6000-6169	REMOVE HPS SHIELDS	EA	400.000		400.000		400.000		400.000		400.000		2,000.000	
	6000-6171	CONVERT Z-PAT TO LED	EA					34.000		43.000				77.000	
	6185-6002	TMA (STATIONARY)	DAY	126.000		121.000		85.000		104.000		55.000		491.000	
	18	SAFETY CONTINGENCY: CONTRACTOR FORCE ACCOUNT WORK (PARTICIPATING)	LS	1.000										1.000	
		EROSION CONTROL MAINTENANCE: CONTRACTOR FORCE ACCOUNT WORK (PART)	LS	1.000										1.000	
		LAW ENFORCEMENT: CONTRACTOR FORCE ACCOUNT WORK (PARTICIPATING)	LS	1.000										1.000	

ILLUMINATION QUANTITIES AND TOTALS									
ITEM NO.	DESC CODE	ITEM		0110-04-208	0110-05-134	0110-06-162	0500-03-652	0675-08-115	PROJECT TOTALS
6000	6028	REMOVE UNDERPASS LUMINAIRE (HPS)	EA	3	30	280	140		453
6000	6030	INSTALL UNDERPASS LUMINAIRE (LED)	EA	3	30	280	140		453
6000	6032	REPLACE UNDERPASS LUMINAIRE (LED)	EA	125	120	0	8	72	325
6000	6076	REPLACE WALLPACK LUMINAIRE (LED)	EA			0	102		102
6000	6103	RAISE AND LOWER RING (HIGH MAST LIGHT)	EA	74	71	16	18	33	212
6000	6160	REPLACE HIGH MAST LUMINAIRES (LED)	EA	444	360	30	62	198	1094
6000	6161	INSTL HIGH MAST FIXTURE (LED)	EA		66	66	46		178
6000	6162	REMOVE HIGH MAST ILLUM FIXTURE	EA		132	132	60		324
6000	6167	REPLACE AVIATION WARNING FIXTURE (LED)	EA	222	213	48	48	99	630
6000	6171	CONVERT Z-PAT (LED)	EA			34	43		77

ILLUMINATION TROUBLESHOOTING QUANTITIES AND TOTALS									
ITEM NO.	DESC CODE	ITEM		0110-04-208	0110-05-134	0110-06-162	0500-03-652	0675-08-115	PROJECT TOTALS
6000	6003	REPLACE ABOVE-GROUND CONDUIT	LF	7500	7500	15000	15000	7500	52500
6000	6006	REPLACE UNDERGROUND CONDUIT	LF	2500	2500	5000	5000	2500	17500
6000	6009	REPLACE CONDUCTOR	LF	15000	15000	30000	30000	15000	105000
6000	6016	INSTALL ELECTRICAL SPLICE	EA	75	75	100	100	75	425
6000	6034	REMOVE INDUCTION FLUORESCENT FIXTURE	EA	20	20	20	20	20	100
6000	6052	REPLACE ELECTRICAL SERVICE	EA	5	5	5	5	5	25
6000	6054	REPLACE STEEL SERVICE POLE	EA	5	5	5	5	5	25
6000	6057	INSTALL GROUND BOX W/APRON	EA	10	10	30	30	10	90
6000	6058	REMOVE GROUND BOX	EA	10	10	30	30	10	90
6000	6063	REPLACE HAND HOLE COVER	EA	12	12	25	25	12	86
6000	6064	INSTALL GROUND ROD	EA	10	10	25	25	10	80
6000	6068	REPLACE FUSED DISCONNECT	EA	10	10	25	25	10	80
6000	6085	REPLACE STARTING AID	EA	10	10	25	25	10	80
6000	6086	REPLACE PHOTOCELL AND BRACKET	EA	10	10	25	25	10	80
6000	6087	REPLACE CONTROL TRANS (HIGH MAST)	EA	10	10	25	25	10	80
6000	6088	REPLACE CONTROL TRANS (ELECT SERVICE)	EA	10	10	10	10	10	50
6000	6089	REPLACE CONTROL CIRCUIT (HIGH MAST)	EA	10	10	25	25	10	80
6000	6090	REPLACE CONTROL CIRCUIT (ELECT SERVICE)	EA	6	6	10	10	6	38
6000	6093	REPLACE HAND-OFF-AUTO SWITCH	EA	10	10	25	25	10	80
6000	6094	REPLACE CONTACTOR	EA	10	10	25	25	10	80
6000	6095	REPLACE METER BASE	EA	10	10	25	25	10	80
6000	6096	REPLACE TIME CLOCK	EA	15	15	25	25	15	95
6000	6097	REPLACE BREAKER PANEL	EA	10	10	25	25	10	80
6000	6099	REPLACE CIRCUIT BREAKER	EA	25	25	50	50	25	175
6000	6100	REPLACE FLEX POWER CABLE OR CORD	LF	1000	1000	2000	2000	1000	7000
6000	6101	REPLACE TWIST LOCK CONNECTOR	EA	10	10	25	25	10	80
6000	6102	REPLACE SAFETY LANYARD	LF	40	40	180	180	40	480
6000	6104	RE-STRAP EXISTING CONDUIT	EA	25	25	50	50	25	175
6000	6105	REPLACE NUTS, WASHERS & OTHER HARDWARE	EA	100	100	250	250	100	800
6000	**6106**	**TROUBLESHOOT FOR REPAIRS**	**HR**	**500**	**500**	**1500**	**1500**	**500**	4500
6000	6115	REPLACE SAFETY SWITCH	EA	10	10	50	50	10	130
6000	6147	REPLACE 5/16" WIRE ROPE	EA	10	10	50	50	10	130
6000	6148	REPLACE 3/8" WIRE ROPE	EA	10	10	50	50	10	130
6000	6149	REPLACE HIGH MAST WINCH	EA	10	10	50	50	10	130
6000	6150	REPLACE WIRE ROPE PULLEY	EA	10	10	50	50	10	130
6000	6151	REPLACE ELECTRICAL CABLE PULLEY	EA	10	10	50	50	10	130
6000	6153	REPLACE ACCESS HOLE COVER	EA	10	10	50	50	10	130
6000	6154	REPLACE HIGH MAST SPRINGS	EA	10	10	50	50	10	130
6000	6155	REMOVE/REINSTL HI MAST POLE FOR REPAIR	EA	10	10	25	25	10	80
6000	6157	REPL ALUMINUM CABLE STRAP	EA	125	125	500	500	125	1375
6000	6165	LED SHIELDS FOR HIGH MAST FIXTURES	EA	400	400	120	120	400	1440
6000	6168	REMOVE LED SHIELDS	EA	400	400	120	120	400	1440
6000	6169	REMOVE HPS SHIELDS	EA	400	400	400	400	400	2000

TRAFFIC CONTROL QUANTITIES AND TOTALS									
ITEM NO.	DESC CODE	ITEM		0110-04-208	0110-05-134	0110-06-162	0500-03-652	0675-08-115	PROJECT TOTALS
502	6001	BARRICADES, SIGNS, AND TRAFFIC HANDLING	MO	8	8	5	7	3	31
6185	6002	TMA (STATIONARY)	DAYS	126	121	85	104	55	491
18	SAFETY CONTINGENCY CONTRACTOR		LS						
18	LAW ENFORCEMENT CONTRACTOR		LS						
18	EROSION CONTROL MAINTENANCE CONTRACTOR		LS						

PRINT DATE	REVISION DATE
4/30/2024	

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TEXAS REGISTERED ENGINEERING FIRM F-13097
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Texas Department of Transportation®

IH 45 ILLUMINATION

SUMMARY OF ILLUMINATION QUANTITIES

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	5

STATE	DIST.	COUNTY
TEXAS	HOU	MONTGOMERY,ETC

CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

DETOURS, BARRICADE, WARNING SIGNS, SEQUENCE OF WORK, ETC.

THE CONTRACTOR'S ATTENTION IS DIRECTED TO THE REQUIREMENTS OF ITEM 7, "LEGAL RELATIONS AND RESPONSIBILITIES TO THE PUBLIC", OF THE STANDARD SPECIFICATIONS. IN ADDITION TO THESE REQUIREMENTS, THE FOLLOWING PROVISIONS SHALL ALSO GOVERN ON THIS CONTRACT:

GENERAL

(1) TRAFFIC MUST BE HANDLED THROUGHOUT THE PROJECT DURING CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING A SAFE AND COMFORTABLE PASSAGE FOR VEHICULAR AND PEDESTRIAN TRAFFIC WITH MINIMAL INCONVENIENCE TO THE PUBLIC, AS SHOWN IN THE PLANS OR AS DIRECTED/APPROVED BY THE ENGINEER.

(2) DO NOT STORE ANY CONSTRUCTION MATERIAL OR EQUIPMENT AT ANY LOCATION THAT WILL CONSTITUTE A HAZARD AND WILL ENDANGER TRAFFIC.

(3) THE CONTRACTOR WILL PROVIDE ADVANCE NOTIFICATION TO THE ENGINEER OF IMPENDING/UPCOMING LANE CLOSURES OR DETOURS FOR ALL TEMPORARY AND/OR PERMANENT LANE, RAMP, CONNECTOR, FRONTAGE, SHOULDER, ETC. SEE GENERAL NOTES FOR NOTIFICATION REQUIREMENTS.

(4) ACCESS TO ADJOINING PROPERTY MUST BE MAINTAINED AT ALL TIMES.

(5) AT NO TIME SHALL TWO CONSECUTIVE INTERSECTING ROADWAYS BE CLOSED CONCURRENTLY DURING CONSTRUCTION.

(6) AT NO TIME SHALL TWO CONSECUTIVE RAMPS BE CLOSED AT ONE TIME DURING CONSTRUCTION.

(7) UNLESS OTHERWISE NOTED IN THE PLANS AND/OR AS DIRECTED BY THE ENGINEER, DAILY LANE CLOSURES SHALL BE LIMITED ACCORDING TO THE FOLLOWING RESTRICTIONS:

WEEKDAY DAY TIME: 9:00 AM - 3:00 PM.
WEEKDAY NIGHT TIME: 8:00 PM - 11:59 PM AND 12:00 AM - 5:00 AM (WITH UNIFORMED OFF DUTY LAW ENFORCEMENT OFFICERS).
WEEKEND: N/A.
WEEKDAY RESTRICTED HOURS SUBJECT TO LANE ASSESSMENT FEE: 5:00 AM - 9:00 AM AND 3:00 PM - 8:00 PM.
NO LANE CLOSURES WILL BE PERMITTED FOR THE FOLLOWING DATES:

HOUSTON LIVESTOCK SHOW AND RODEO.
ELECTION DAYS (HARRIS COUNTY ONLY).

(8) COORDINATE WITH ADJACENT PROJECTS.

SEQUENCE OF WORK

(1) DAILY LANE CLOSURES WILL BE USED IN ACCORDANCE WITH STATE TCP STANDARDS.

(2) PREPARING ROW/REMOVAL OF EXISTING ITEMS TO BE DONE ONLY IN AREAS WHERE WORK IS OCCURRING.

SAFETY

(1) THE CONTRACTOR WILL PROVIDE, CONSTRUCT, AND MAINTAIN BARRICADES AND SIGNS IN ACCORDANCE WITH STATE STANDARDS BC(1-12)-21. ANY SIGNS REQUIRED THAT ARE NOT DETAILED IN THE STANDARD SHEETS SHALL BE IN CONFORMANCE WITH THE TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES AND THE STANDARD HIGHWAY SIGN DESIGNS FOR TEXAS.

(2) BARRICADES AND WARNING SIGNS SHALL BE PLACED AS INDICATED ON THE PLANS. THIS SHALL BE CONSIDERED THE MINIMUM REQUIRED TO PROVIDE FOR THE SAFETY OF TRAFFIC DURING CONSTRUCTION. THE CONTRACTOR SHALL PROVIDE AND MAINTAIN OTHER SUCH BARRICADES AND SIGNS DEEMED NECESSARY BY THE ENGINEER, OR AS DIRECTED BY FIELD CONDITIONS, TO PROVIDE FOR THE SAFE PASSAGE OF TRAFFIC AT ALL TIMES.

(3) THE CONTRACTOR SHALL PROVIDE AND MAINTAIN FLAGGERS AS DIRECTED/APPROVED BY THE ENGINEER, AT SUCH POINTS AND FOR SUCH PERIODS OF TIME AS MAY BE REQUIRED, TO PROVIDE FOR THE SAFETY OF THE TRAVELING PUBLIC AND THE CONTRACTOR'S PERSONNEL.

(4) THE CONTRACTOR SHALL KEEP THE ROADWAY CLEAN AND FREE OF DIRT OR OTHER MATERIALS DURING HAULING OPERATIONS. IF THE CONTRACTOR DOES NOT MAINTAIN A CLEAN ROADWAY, THEY SHALL CEASE ALL CONSTRUCTION OPERATIONS, WHEN DIRECTED BY THE ENGINEER, TO CLEAN THE ROADWAY TO THE SATISFACTION OF THE ENGINEER.

HAULING EQUIPMENT

(1) THE USE OF RUBBER-TIRED EQUIPMENT WILL BE REQUIRED FOR MOVING DIRT OR OTHER MATERIALS ALONG OR ACROSS PAVEMENTED SURFACES. WHERE THE CONTRACTOR DESIRES TO MOVE ANY EQUIPMENT NOT LICENSED FOR OPERATION ON PUBLIC HIGHWAYS ON OR ACROSS PAVEMENT, THEY SHALL PROTECT THE PAVEMENT FROM DAMAGE AS DIRECTED/APPROVED BY THE ENGINEER.

FINAL CLEANUP

(1) UPON COMPLETION OF THE WORK AND BEFORE FINAL ACCEPTANCE AND FINAL PAYMENT IS MADE, THE CONTRACTOR SHALL CLEAR AND REMOVE FROM THE SITE ALL SURPLUS AND DISCARDED MATERIALS AND DEBRIS OF EVERY KIND AND LEAVE THE ENTIRE PROJECT IN A SMOOTH, NEAT, AND SIGHTLY CONDITION.

STATE OF TEXAS
CHARLES R. STEVENS, JR.
101286
PROFESSIONAL LICENSED ENGINEER

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

PRINT DATE	REVISION DATE
3/21/2024	

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
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Texas Department of Transportation®

IH 45 ILLUMINATION

TRAFFIC CONTROL PLAN NARRATIVE

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		6
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

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BARRICADE AND CONSTRUCTION (BC) STANDARD SHEETS GENERAL NOTES:

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

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

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

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

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

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

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

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

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

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

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

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

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

WORKER SAFETY NOTES:

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

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

COMPLIANT WORKZONE TRAFFIC CONTROL DEVICES

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

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

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION GENERAL NOTES AND REQUIREMENTS

BC(1)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-03 7-13	0110	04	208, ETC	IH 45
9-07 8-14	DIST	COUNTY		SHEET NO.
5-10 5-21	HOU	MONTGOMERY, ETC		7

DATE: 3/21/2024 8:09:27 PM
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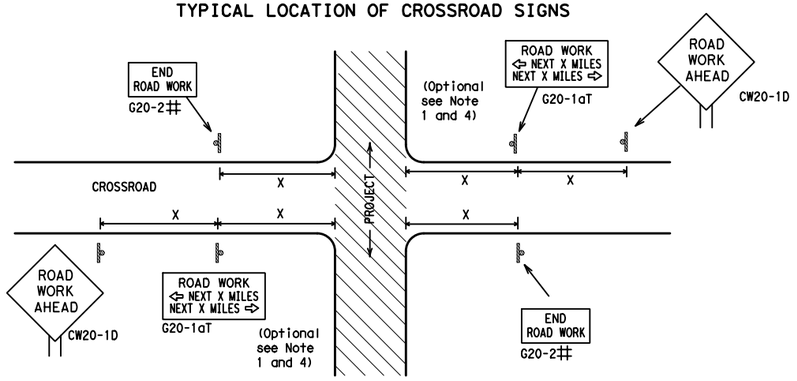
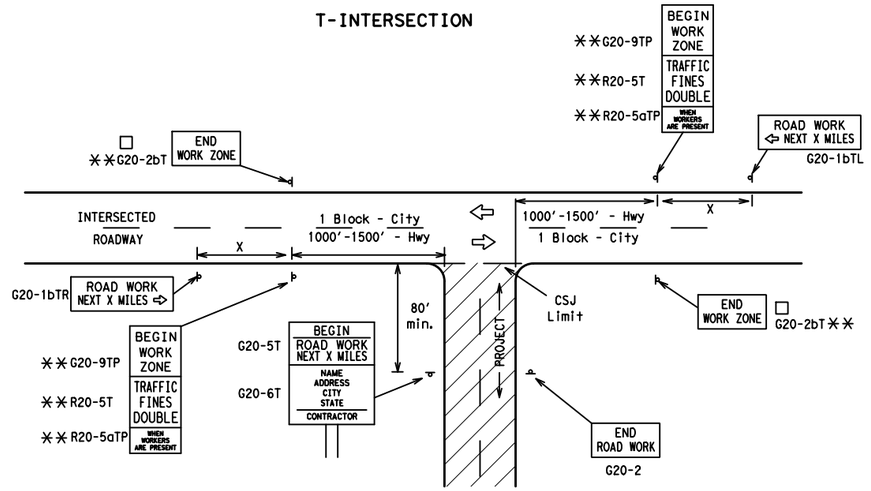
TYPICAL LOCATION OF CROSSROAD SIGNS



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

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

T-INTERSECTION



CSJ LIMITS AT T-INTERSECTION

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

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

SIZE

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

SPACING

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

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

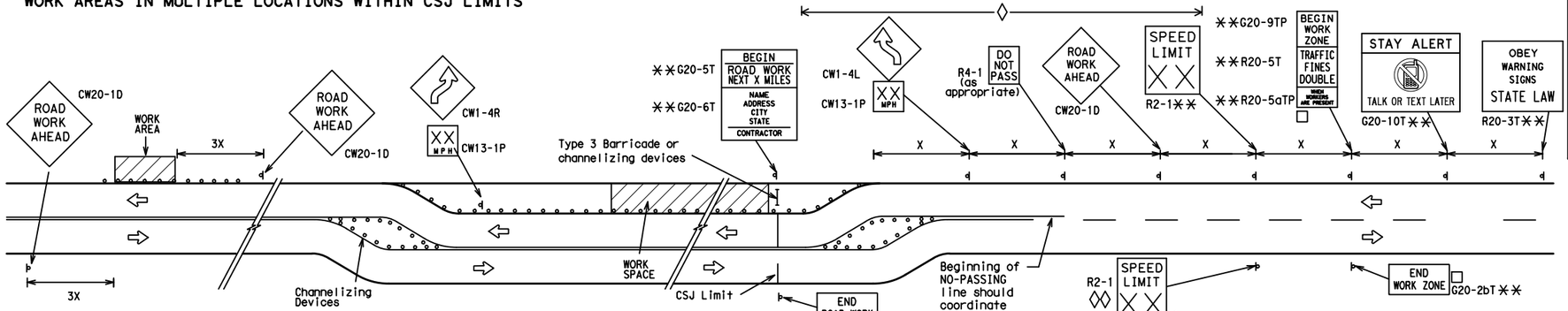
△ Minimum distance from work area to first Advance Warning sign nearest the work area and/or distance between each additional sign.

GENERAL NOTES

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

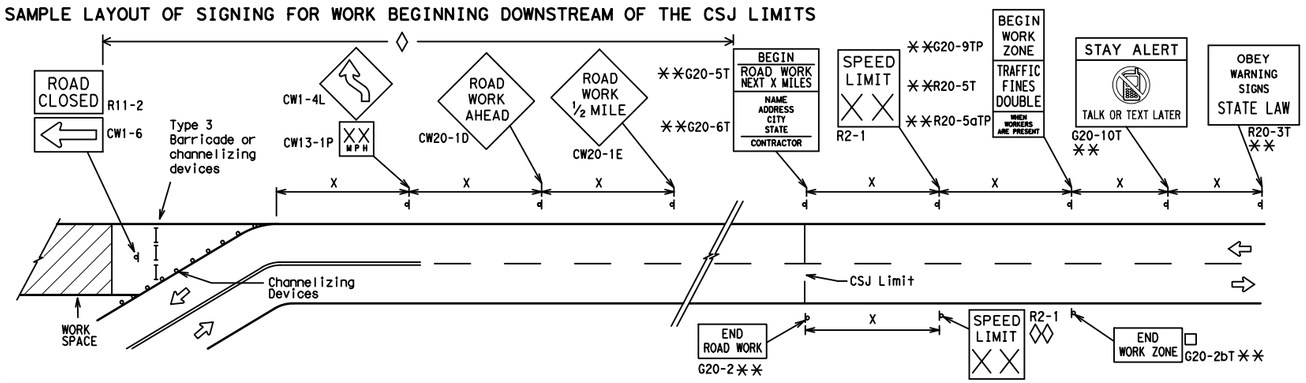
WORK AREAS IN MULTIPLE LOCATIONS WITHIN CSJ LIMITS

SAMPLE LAYOUT OF SIGNING FOR WORK BEGINNING AT THE CSJ LIMITS



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

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



NOTES

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

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

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

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

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

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

SHEET 2 OF 12

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PROJECT LIMIT

BC(2)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	04	208, ETC	IH 45
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	HOU	MONTGOMERY, ETC		8

DATE: 3/21/2024 8:09:27 PM
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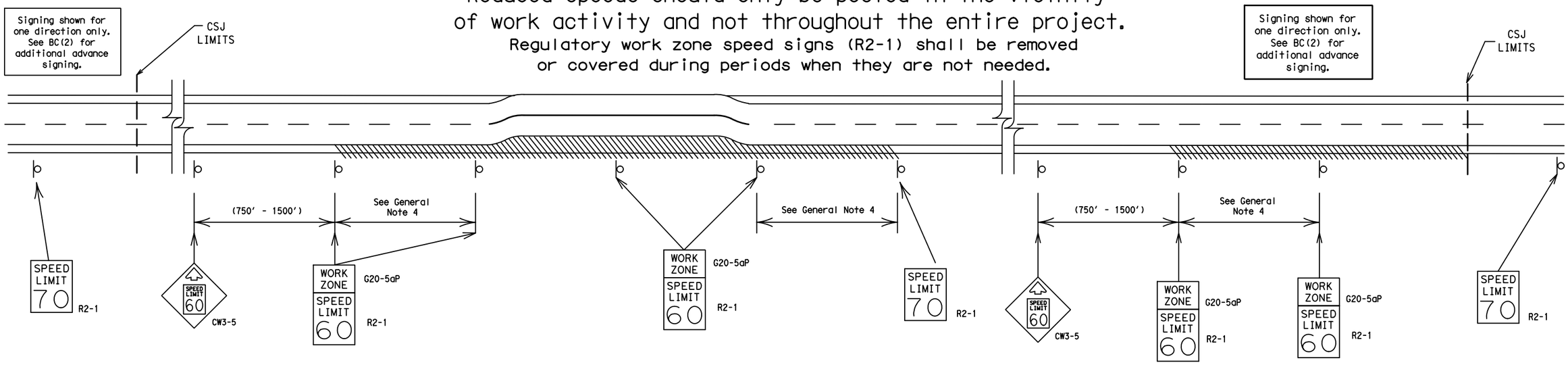
TYPICAL APPLICATION OF WORK ZONE SPEED LIMIT SIGNS

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

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

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



GUIDANCE FOR USE:

LONG/INTERMEDIATE TERM WORK ZONE SPEED LIMITS

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

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

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

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

SHORT TERM WORK ZONE SPEED LIMITS

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

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

GENERAL NOTES

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION WORK ZONE SPEED LIMIT

BC(3)-21

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REVISIONS 9-07 8-14 7-13 5-21	0110	04	208, ETC	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY, ETC		9

DATE: 3/21/2024 8:09:28 PM
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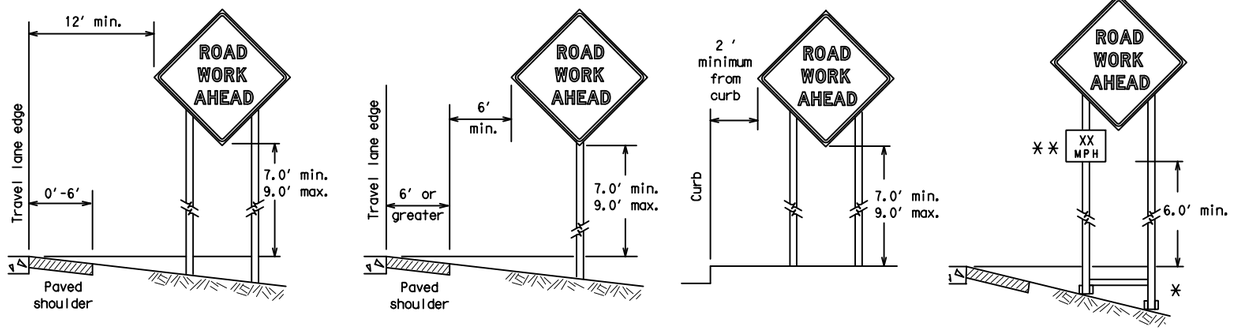
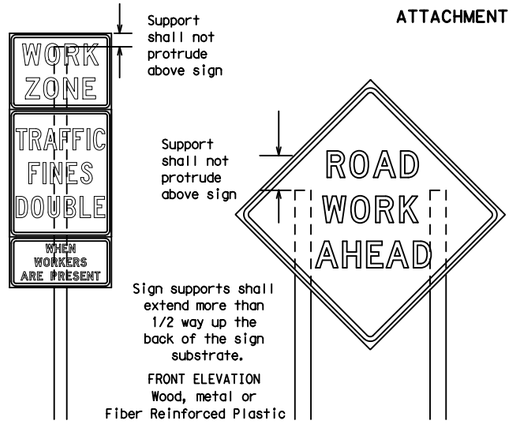
TYPICAL MINIMUM CLEARANCES FOR LONG TERM AND INTERMEDIATE TERM SIGNS

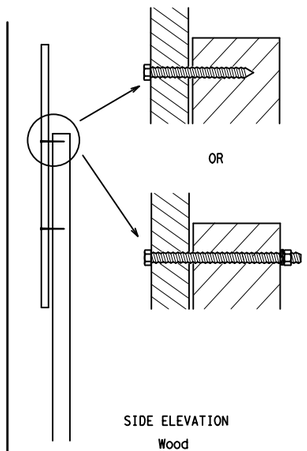


⁎ When placing skid supports on unlevel ground, the leg post lengths must be adjusted so the sign appears straight and plumb. Objects shall NOT be placed under skids as a means of leveling.

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

ATTACHMENT FOR SIGN SUPPORTS





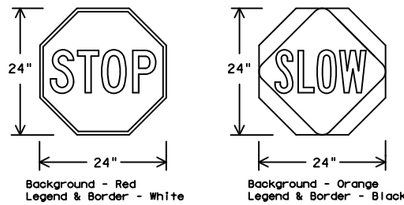
Attachment to wooden supports will be by bolts and nuts or screws. Use TxDOT's or manufacturer's recommended procedures for attaching sign substrates to other types of sign supports

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

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

STOP/SLOW PADDLES

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



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

CONTRACTOR REQUIREMENTS FOR MAINTAINING PERMANENT SIGNS WITHIN THE PROJECT LIMITS

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

GENERAL NOTES FOR WORK ZONE SIGNS

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

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

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

SIGN MOUNTING HEIGHT

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

SIZE OF SIGNS

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

SIGN SUBSTRATES

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

REFLECTIVE SHEETING

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

SIGN LETTERS

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

REMOVING OR COVERING

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

SIGN SUPPORT WEIGHTS

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

FLAGS ON SIGNS

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

Texas Department of Transportation | Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES

BC(4)-21

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9-07 8-14	DIST	COUNTY		SHEET NO.
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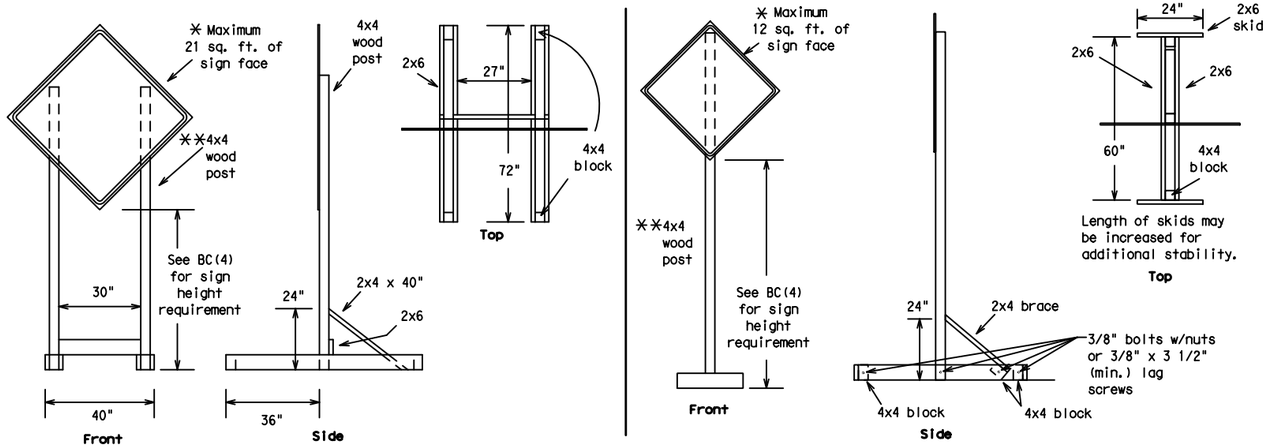
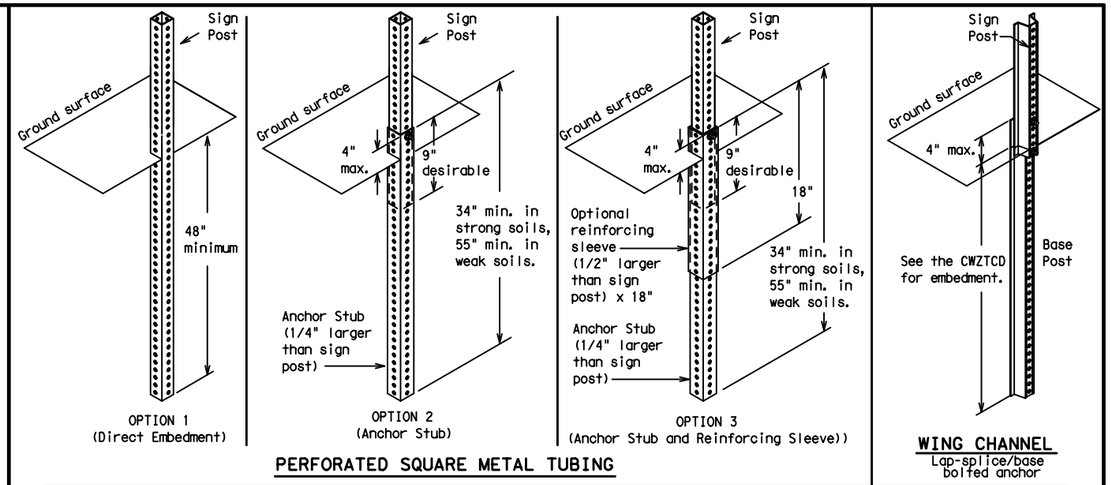


SKID MOUNTED WOOD SIGN SUPPORTS

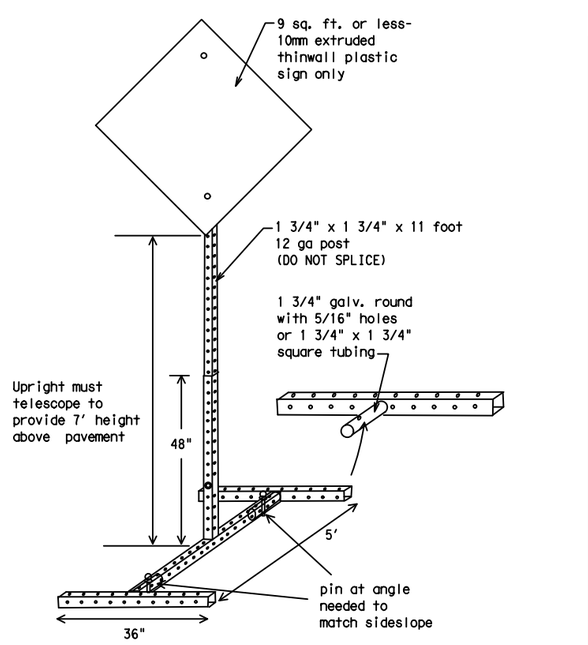
* LONG/INTERMEDIATE TERM STATIONARY - PORTABLE SKID MOUNTED SIGN SUPPORTS

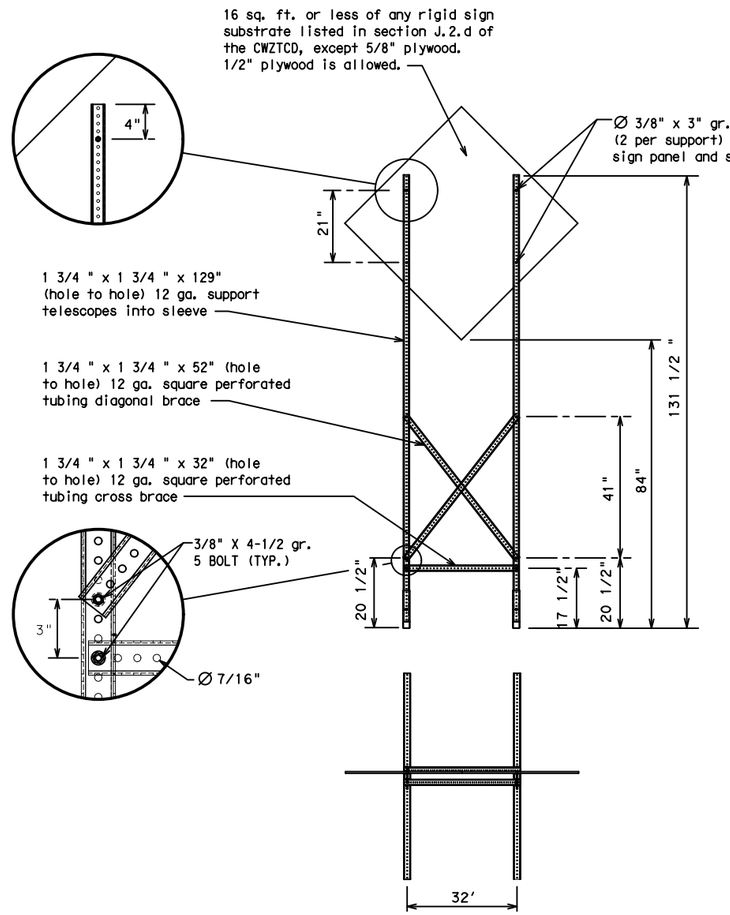


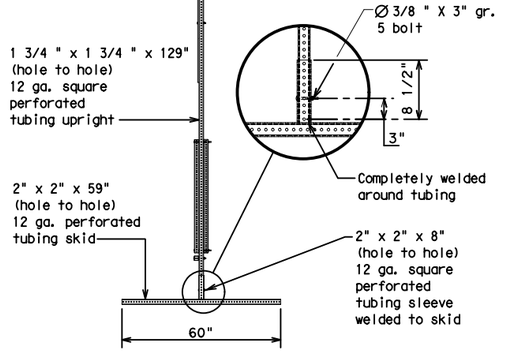
PERFORATED SQUARE METAL TUBING

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.







SKID MOUNTED PERFORATED SQUARE STEEL TUBING SIGN SUPPORTS

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

WEDGE ANCHORS

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

OTHER DESIGNS

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

GENERAL NOTES

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

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

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

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT

BC(5)-21

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7-13 5-21	HOU	MONTGOMERY, ETC		11

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

PORTABLE CHANGEABLE MESSAGE SIGNS

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

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

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

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

RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

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

Phase 1: Condition Lists

Road/Lane/Ramp Closure List

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

Other Condition List

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

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

Phase 2: Possible Component Lists

Action to Take/Effect on Travel List

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

Location List

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

Warning List

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

** Advance Notice List

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

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

** See Application Guidelines Note 6.

APPLICATION GUIDELINES

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

WORDING ALTERNATIVES

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

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

FULL MATRIX PCMS SIGNS

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

Texas Department of Transportation

Traffic Safety Division Standard

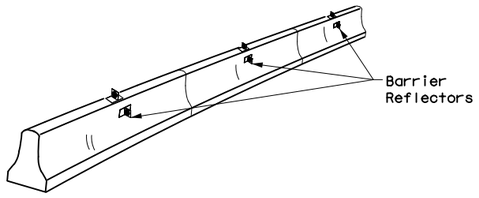
BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

BC(6)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	04	208, ETC	IH 45
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	HOU	MONTGOMERY, ETC		12

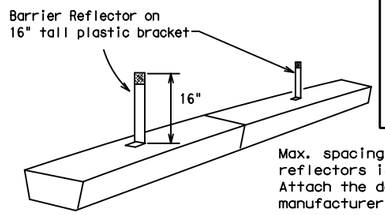
DATE: 3/21/2024 8:09:29 PM
FILE: ...\STANDARDS\bc-21.dgn

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



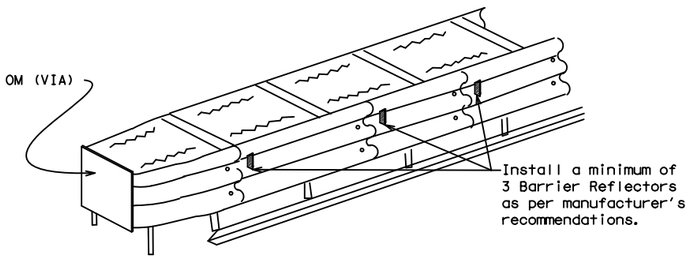
CONCRETE TRAFFIC BARRIER (CTB)

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



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

LOW PROFILE CONCRETE BARRIER (LPCB)



DELINEATION OF END TREATMENTS

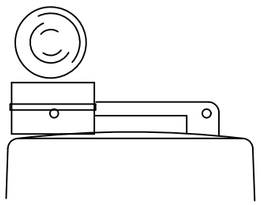
LOW PROFILE CONCRETE BARRIER (LPCB) USED IN WORK ZONES

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

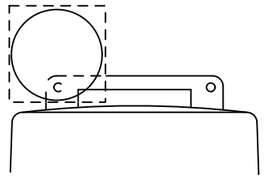
END TREATMENTS FOR CTB'S USED IN WORK ZONES

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

BARRIER REFLECTORS FOR CONCRETE TRAFFIC BARRIER AND ATTENUATORS



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

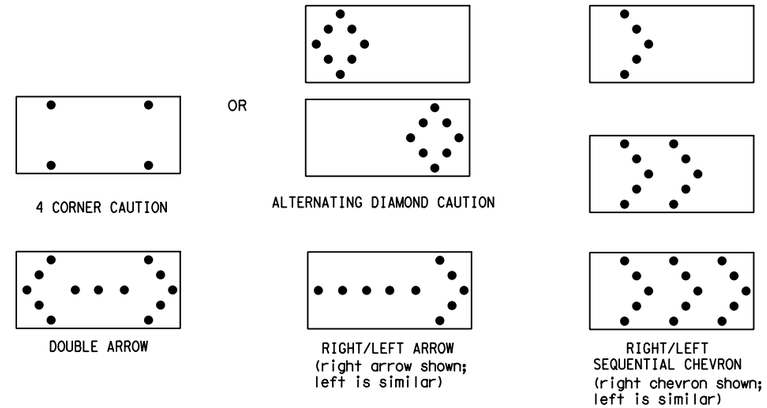
1. Type A flashing warning lights are intended to warn drivers that they are approaching or are in a potentially hazardous area.
2. Type A random flashing warning lights are not intended for delineation and shall not be used in a series.
3. A series of sequential flashing warning lights placed on channelizing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

SHEET 7 OF 12

Texas Department of Transportation

Traffic Safety Division Standard

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

BC(7)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT November 2002	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	04	208, ETC	IH 45
9-07 8-14	DIST	COUNTY		SHEET NO.
7-13 5-21	HOU	MONTGOMERY, ETC		13

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GENERAL NOTES

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

GENERAL DESIGN REQUIREMENTS

Pre-qualified plastic drums shall meet the following requirements:

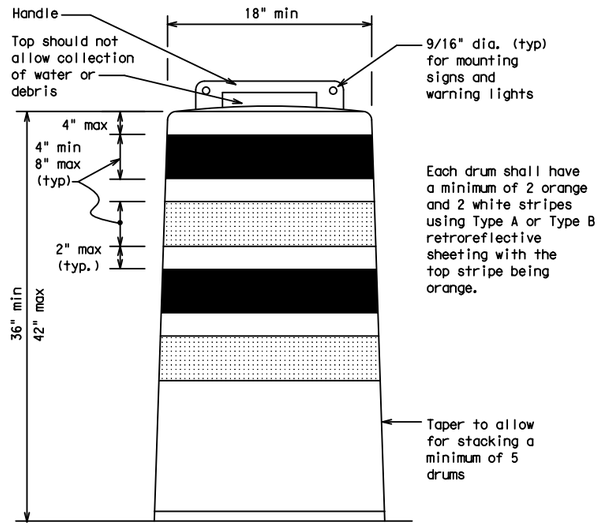
1. Plastic drums shall be a two-piece design; the "body" of the drum shall be the top portion and the "base" shall be the bottom.
2. The body and base shall lock together in such a manner that the body separates from the base when impacted by a vehicle traveling at a speed of 20 MPH or greater but prevents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

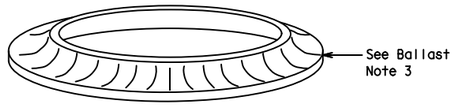
RETROREFLECTIVE SHEETING

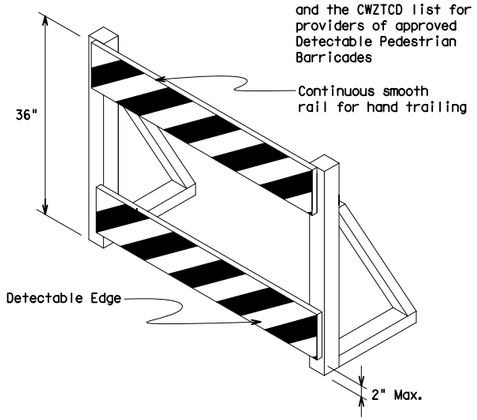
1. The stripes used on drums shall be constructed of sheeting meeting the color and retroreflectivity requirements of Departmental Materials Specification DMS-8300, "Sign Face Materials." Type A or Type B reflective sheeting shall be supplied unless otherwise specified in the plans.
2. The sheeting shall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

BALLAST

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

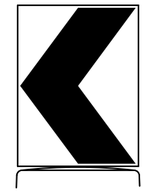




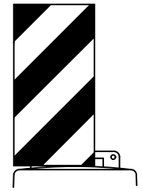


DETECTABLE PEDESTRIAN BARRICADES

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



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



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

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

SIGNS, CHEVRONS, AND VERTICAL PANELS MOUNTED ON PLASTIC DRUMS

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(8)-21

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REVISIONS	0110	04	208, ETC	IH 45
4-03 8-14	DIST	COUNTY		SHEET NO.
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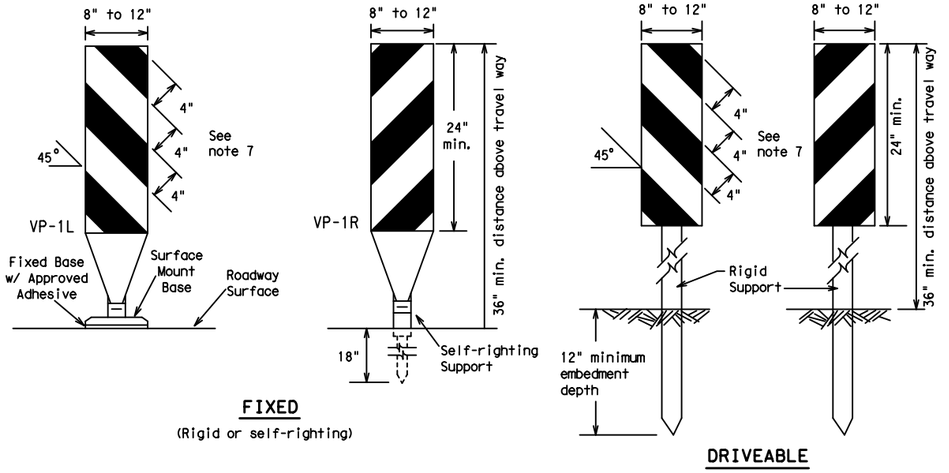
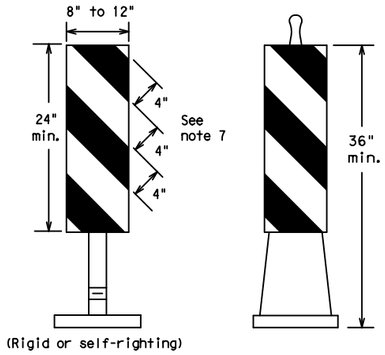


FIXED
(Rigid or self-righting)

DRIVEABLE

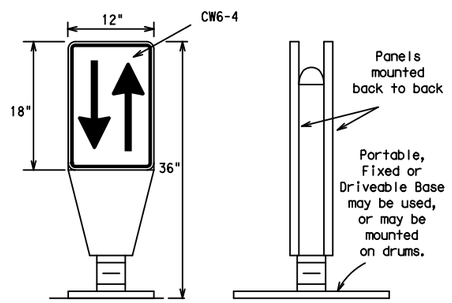


(Rigid or self-righting)

PORTABLE

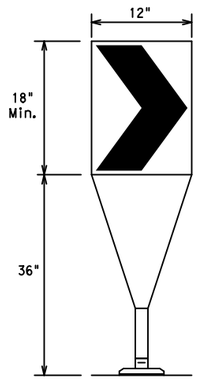
1. Vertical Panels (VP's) are normally used to channelize traffic or divide opposing lanes of traffic.
2. VP's may be used in daytime or nighttime situations. They may be used at the edge of shoulder drop-offs and other areas such as lane transitions where positive daytime and nighttime delineation is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

VERTICAL PANELS (VPs)



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

OPPOSING TRAFFIC LANE DIVIDERS (OTLD)



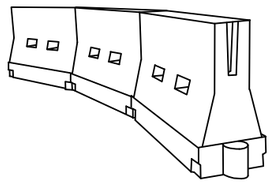
Fixed Base w/ Approved Adhesive (Driveable Base, or Flexible Support can be used)

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

CHEVRONS

GENERAL NOTES

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



LONGITUDINAL CHANNELIZING DEVICES (LCD)

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

WATER BALLASTED SYSTEMS USED AS BARRIERS

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

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

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

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

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

SUGGESTED MAXIMUM SPACING OF CHANNELIZING DEVICES AND MINIMUM DESIRABLE TAPER LENGTHS

SHEET 9 OF 12

Texas Department of Transportation — Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(9)-21

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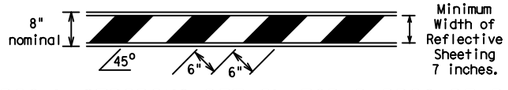
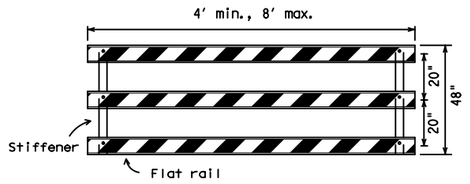
TYPE 3 BARRICADES

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

Barricades shall NOT be used as a sign support.



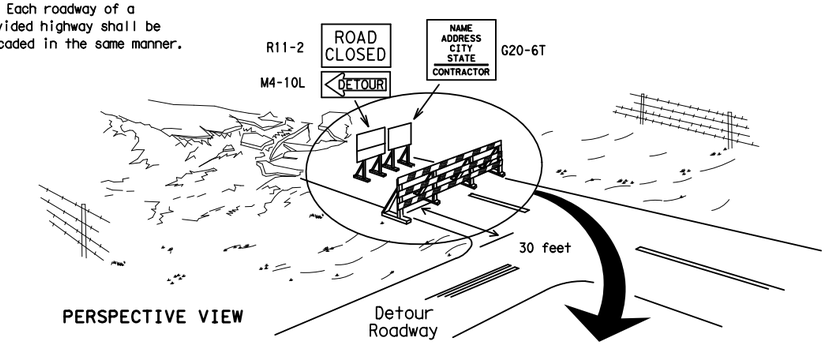
TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



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

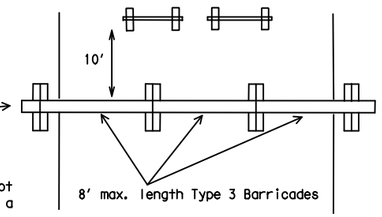
TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES

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



PERSPECTIVE VIEW

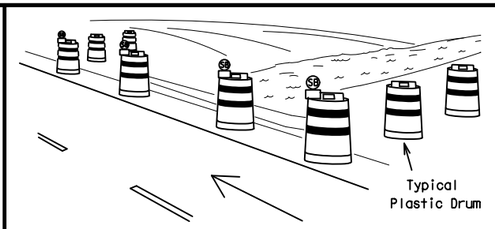
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic.
Barricade striping should slant downward in the direction of detour.



PLAN VIEW

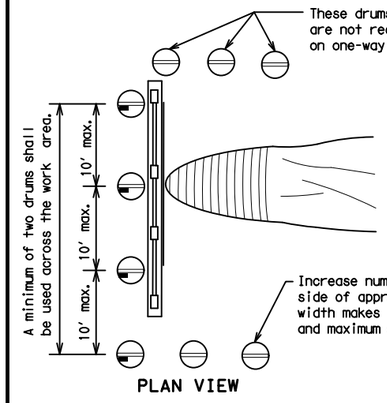
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION



PERSPECTIVE VIEW

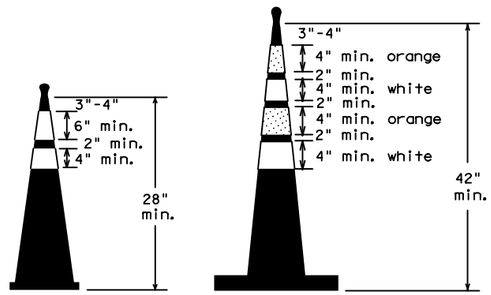
1. Where positive redirectional capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder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



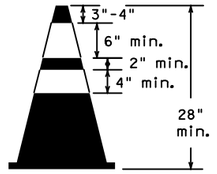
PLAN VIEW

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

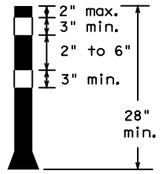
CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS



Two-Piece cones



One-Piece cones

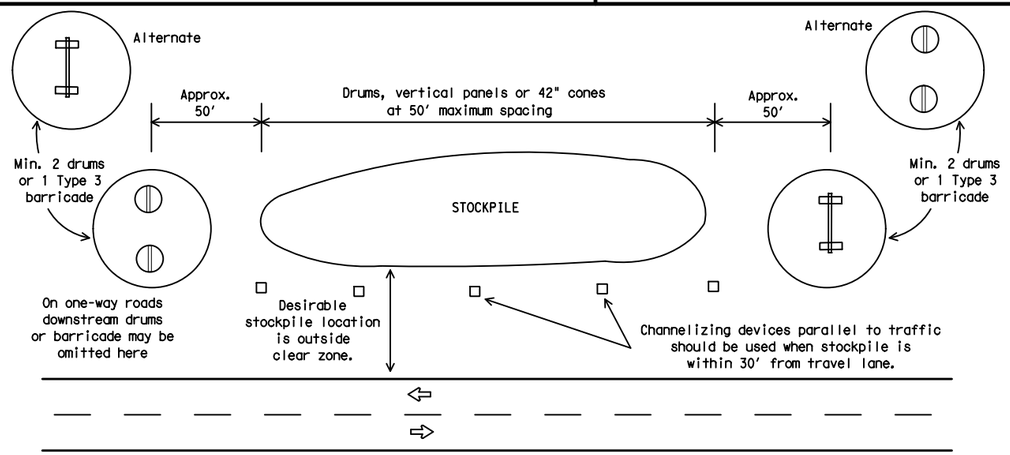


Tubular Marker

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

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

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



TRAFFIC CONTROL FOR MATERIAL STOCKPILES

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Texas Department of Transportation — Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(10)-21

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REVISIONS 9-07 8-14 7-13 5-21	0110	04	208, ETC	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY, ETC		16

WORK ZONE PAVEMENT MARKINGS

GENERAL

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

RAISED PAVEMENT MARKERS

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

PREFABRICATED PAVEMENT MARKINGS

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

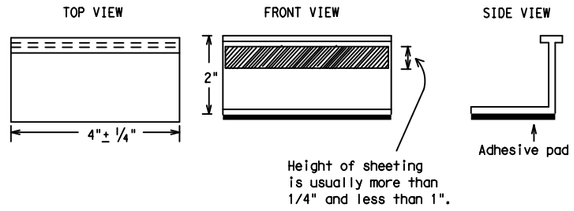
MAINTAINING WORK ZONE PAVEMENT MARKINGS

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

REMOVAL OF PAVEMENT MARKINGS

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

Temporary Flexible-Reflective Roadway Marker Tabs



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

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

RAISED PAVEMENT MARKERS USED AS GUIDEMARKS

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

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

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

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PAVEMENT MARKINGS

BC(11)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	04	208, ETC	IH 45
2-98 9-07 5-21	DIST	COUNTY		SHEET NO.
1-02 7-13	HOU	MONTGOMERY, ETC		17
11-02 8-14				

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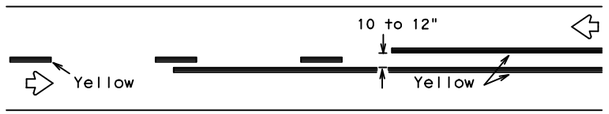
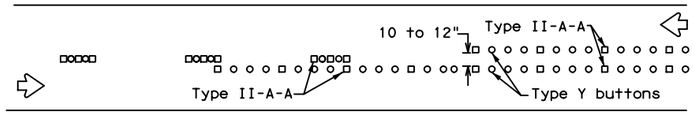
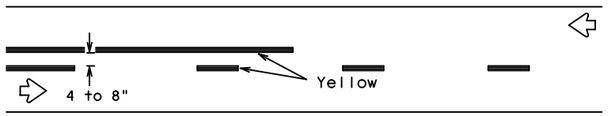
PAVEMENT MARKING PATTERNS



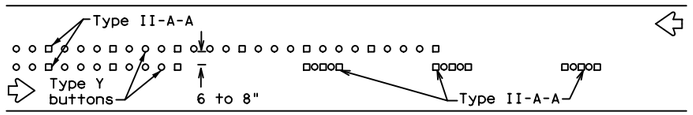
REFLECTORIZED PAVEMENT MARKINGS - PATTERN A



RAISED PAVEMENT MARKERS - PATTERN A



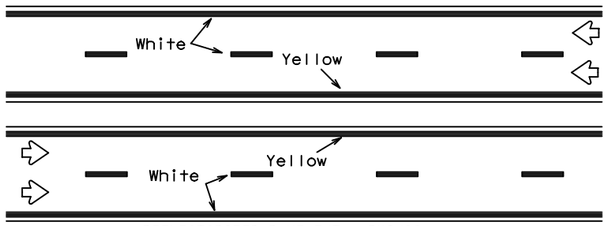
REFLECTORIZED PAVEMENT MARKINGS - PATTERN B



RAISED PAVEMENT MARKERS - PATTERN B

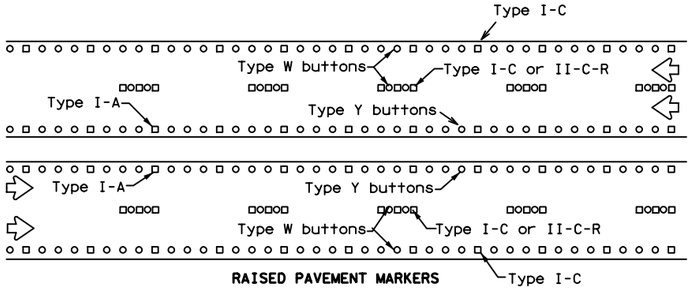
Pattern A is the TXDOT Standard, however Pattern B may be used if approved by the Engineer.
Prefabricated markings may be substituted for reflectorized pavement markings.

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



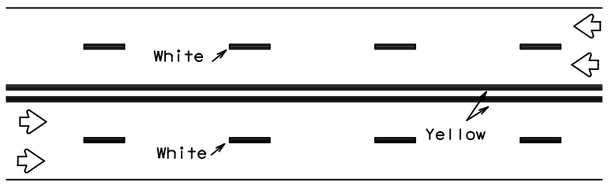
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectorized pavement markings.



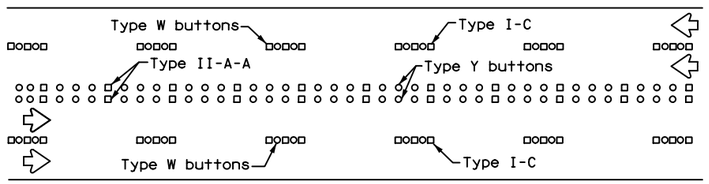
RAISED PAVEMENT MARKERS

EDGE & LANE LINES FOR DIVIDED HIGHWAY



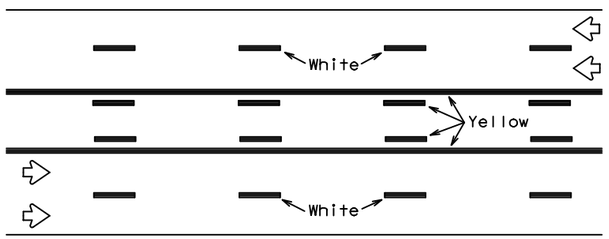
REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectorized pavement markings.



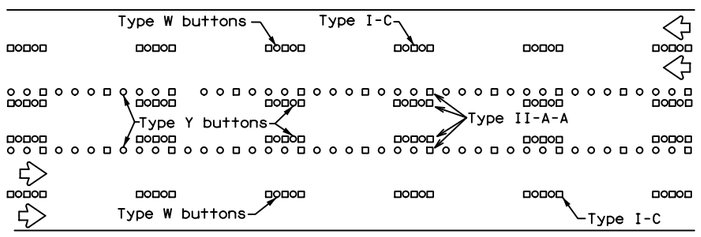
RAISED PAVEMENT MARKERS

LANE & CENTER LINES FOR MULTILANE UNDIVIDED HIGHWAYS



REFLECTORIZED PAVEMENT MARKINGS

Prefabricated markings may be substituted for reflectorized pavement markings.



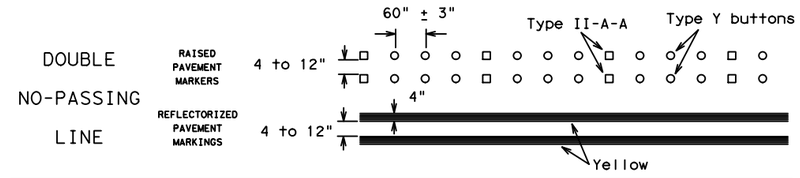
RAISED PAVEMENT MARKERS

TWO-WAY LEFT TURN LANE

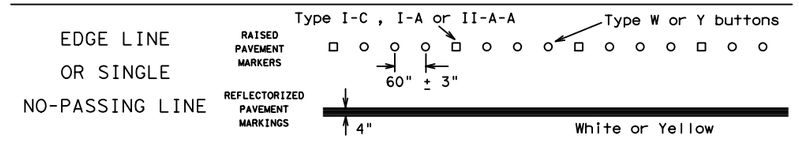
STANDARD WORK ZONE PAVEMENT MARKINGS DETAILS

SOLID LINES

DOUBLE NO-PASSING LINE

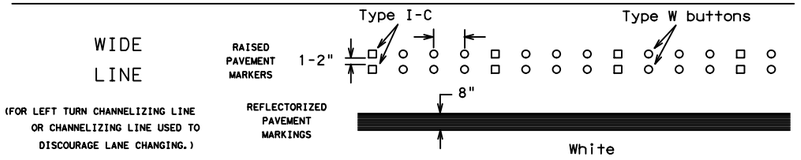


EDGE LINE OR SINGLE NO-PASSING LINE



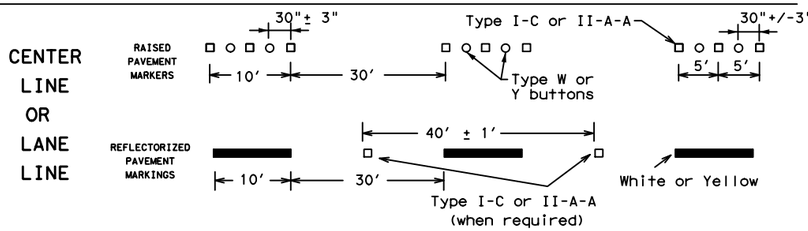
WIDE LINE

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

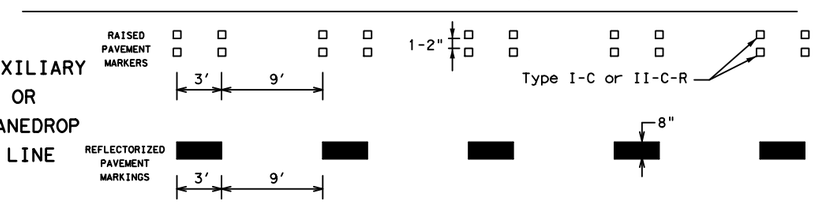


BROKEN LINES

CENTER LINE OR LANE LINE

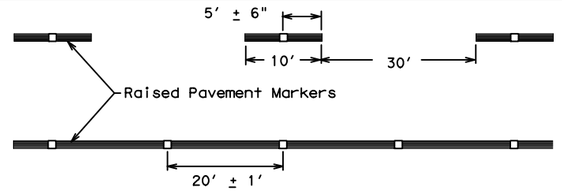


AUXILIARY OR LANEDROP LINE



REMOVABLE MARKINGS WITH RAISED PAVEMENT MARKERS

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



Centerline only - not to be used on edge lines

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

Texas Department of Transportation

Traffic Safety Division Standard

BARRICADE AND CONSTRUCTION PAVEMENT MARKING PATTERNS

BC(12)-21

FILE: bc-21.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS 1-97 9-07 5-21 2-98 7-13 11-02 8-14	0110	04	208, ETC	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY, ETC		18

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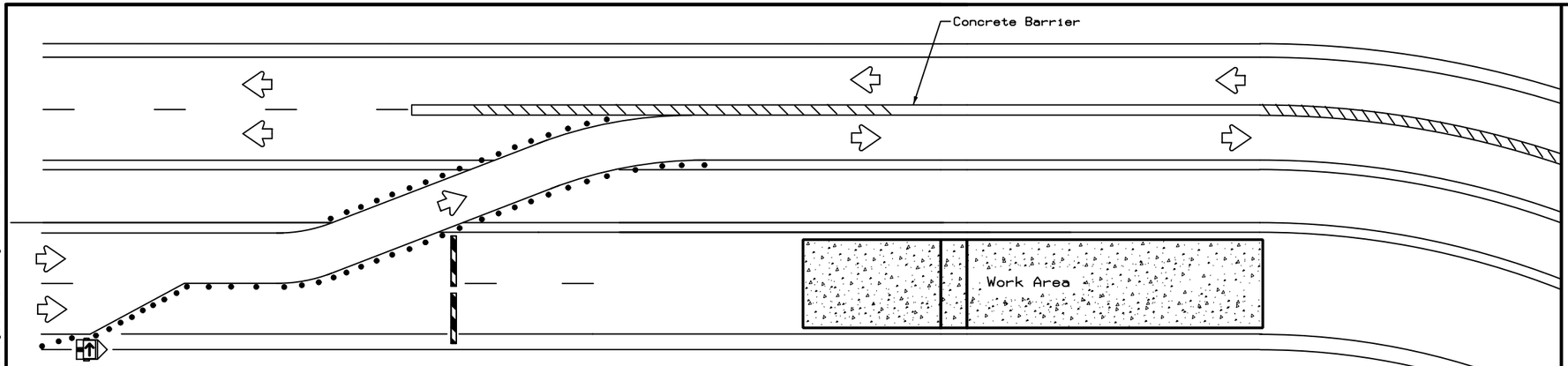


BARRIER DELINEATION WITH MODULAR GLARE SCREENS

NOTES:

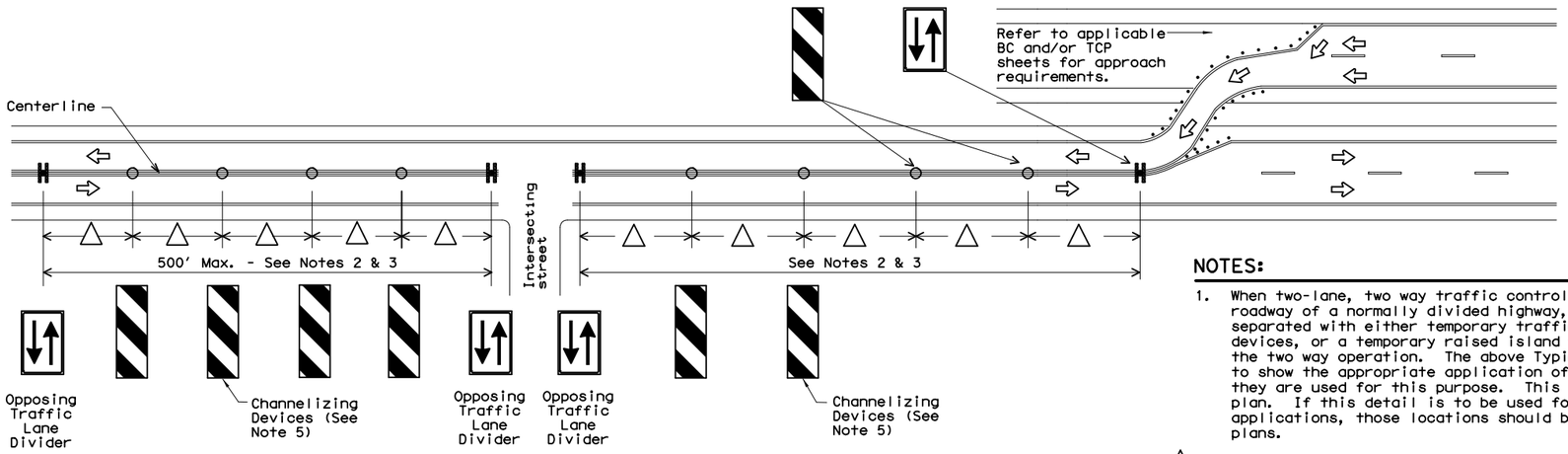
1. Length of Safety Glare screen will be specified elsewhere in the plans.
2. The cumulative nominal length of the modular safety glare screen units shall equal the length of the individual sections of temporary concrete traffic barrier on which they are installed so the joint between barrier sections will not be spanned by any one safety glare screen unit.
3. Screen Panel/blades will be designed such that reflective sheeting conforming with Departmental Material Specification DMS-8300, Sign Face Materials, Type B or C Yellow, minimum size of 2 inches by 12 inches can be attached to the edge of the panel/blade. The sheeting shall be attached to one glare screen panel/blade per section of concrete barrier not to exceed a spacing of 30 feet. Barrier reflectors are not necessary when panel/blades are installed with reflective sheeting as described.
4. Payment for these devices will be under statewide Special Specification "Modular Glare Screens for Headlight Barrier."
5. This detail is only intended to show types of locations where Glare Screens would be appropriate. Required signing and other devices shall be as shown elsewhere in the plans.

LEGEND	
	Type 3 Barricade
• • •	Channelizing Devices
	Trailer Mounted Flashing Arrow Board
	Sign
\\\\	Safety glare screen

DEPARTMENTAL MATERIAL SPECIFICATIONS	
SIGN FACE MATERIALS	DMS-8300
DELINEATORS AND OBJECT MARKERS	DMS-8600
MODULAR GLARE SCREENS FOR HEADLIGHT BARRIER	DMS-8610

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/business/resources/producer-list.html



VERTICAL PANELS & OPPOSING TRAFFIC LANE DIVIDERS (OTLD)
SEPARATING TWO-WAY TRAFFIC ON NORMALLY DIVIDED HIGHWAYS

NOTES:

1. When two-lane, two way traffic control must be maintained on one roadway of a normally divided highway, opposing traffic shall be separated with either temporary traffic barriers, channelizing devices, or a temporary raised island throughout the length of the two way operation. The above Typical Application is intended to show the appropriate application of channelizing devices when they are used for this purpose. This is not a traffic control plan. If this detail is to be used for other types of roads or applications, those locations should be stated elsewhere in the plans.

△2. Space devices according to the Tangent Spacing shown on the Device Spacing table on BC(9) but not exceeding 100′.

3. Every fifth device should be an OTLD except when spaced closer to accommodate an intersection. An OTLD should be the first device on each side of intersecting streets or roads.
4. Locations where surface mount bases with adhesives or self-righting devices will be required in order to maintain them in their proper position should be noted elsewhere in the plans.
5. Channelizing devices are to be vertical panels, 42" cones or tubular markers that are at least 36" tall. Tubular markers used to separate traffic should have a rubber base weighing at least 30 pounds. Tubular markers that are 42" tall or more shall have four bands of reflective material as detailed for 42" cones on BC(10). Tubular markers less than 42" but at least 36" tall shall have three bands of 3" wide white reflective material spaced 2" apart. Reflective material shall meet DMS-8300, Type A.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN TYPICAL DETAILS

WZ(TD)-17

FILE: wztd-17.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS 4-98 2-17 3-03 7-13	0110	04	208, ETC	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY, ETC		19

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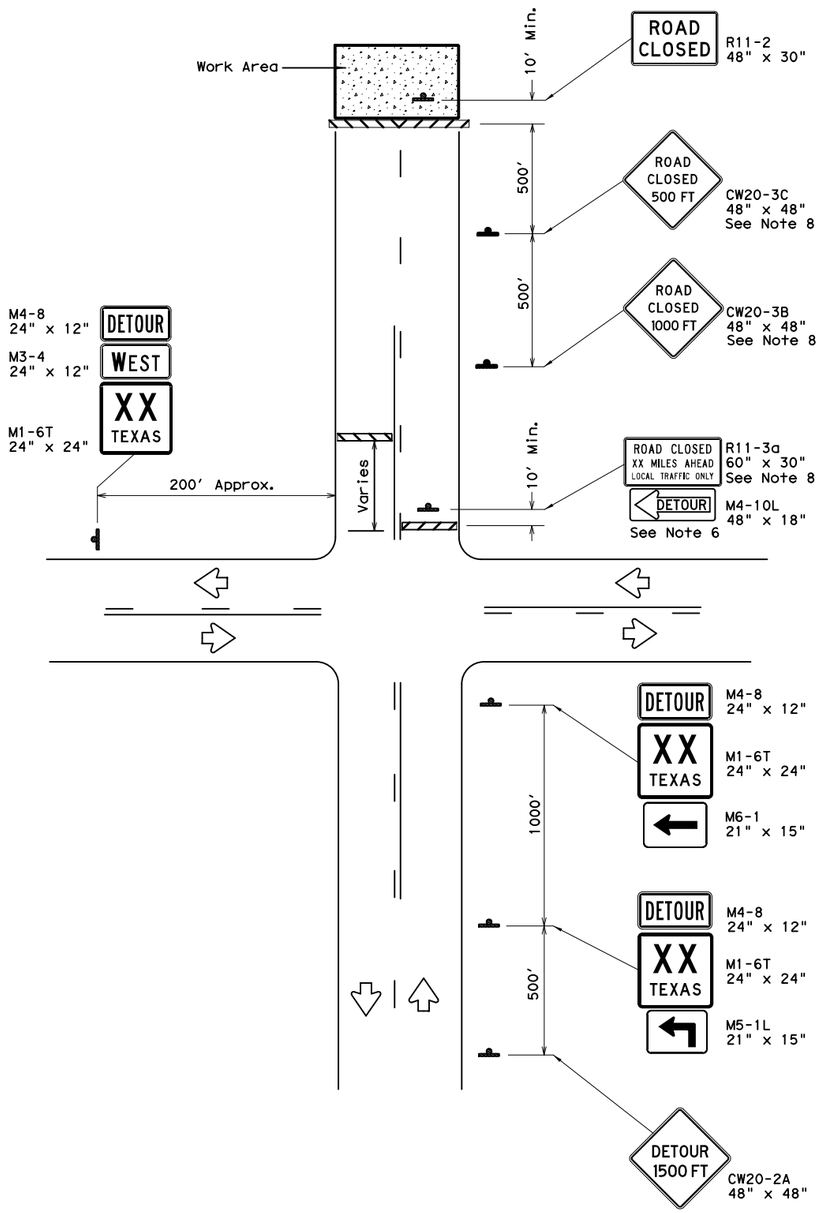
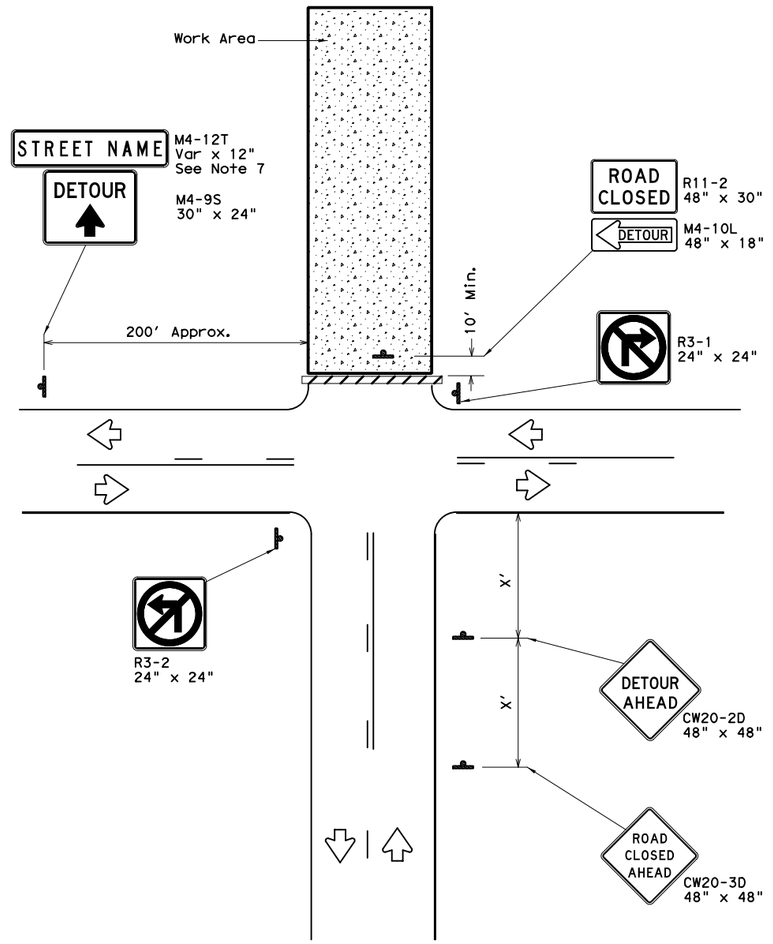


ROAD CLOSURE BEYOND THE INTERSECTION

Signing for a Numbered Route with an Off-Site Detour



ROAD CLOSURE AT THE INTERSECTION

Signing for an Un-numbered Route with an Off-Site Detour

LEGEND	
	Type 3 Barricade
	Sign

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

* Conventional Roads Only

GENERAL NOTES

1. This sheet is intended to provide details for temporary work zone road closures. For permanent road closure details see the D&OM standards.
2. Barricades used shall meet the requirements shown on Barricade and Construction Standard BC(10) and listed on the Compliant Work Zone Traffic Control Devices list (CWZTCD).
3. Stockpiled materials shall not be placed on the traffic side of barricades.
4. Barricades at the road closure should extend from pavement edge to pavement edge.
5. Detour signing shown is intended to illustrate the type of signing that is appropriate for numbered routes or un-numbered routes as labeled. It does not indicate the full extent of detour signing required. Detour routes should be signed as shown elsewhere in the plans.
6. If the road is open for a significant distance beyond the intersection or there are significant origin/destination points beyond the intersection, the signs and barricades at this location should be located at the edge of the traveled way.
7. The Street Name (M4-12T) sign is to be placed above the DETOUR (M4-9S) sign.
8. For urban areas where there is a shorter distance between the intersection and the actual closure location, the ROAD CLOSED XX MILES AHEAD (R11-3a) sign may be replaced with a ROAD CLOSED TO THRU TRAFFIC (R11-4) sign. If adequate space does not exist between the intersection and the closure a single ROAD CLOSED AHEAD (CW20-3D) sign spaced as per the table above may replace the ROAD CLOSED 1000 FT (CW20-3B) and ROAD CLOSED 500 FT (CW20-3C) signs.
9. Signs and barricades shown shall be subsidiary to Item 502. Locations where these details will be required shall be as shown elsewhere in the plans.

Texas Department of Transportation

Traffic Operations Division Standard

WORK ZONE ROAD CLOSURE DETAILS

WZ(RCD)-13

FILE: wzrcd-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT August 1995	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	04	208, ETC	IH 45
1-97 4-98 7-13	DIST	COUNTY		SHEET NO.
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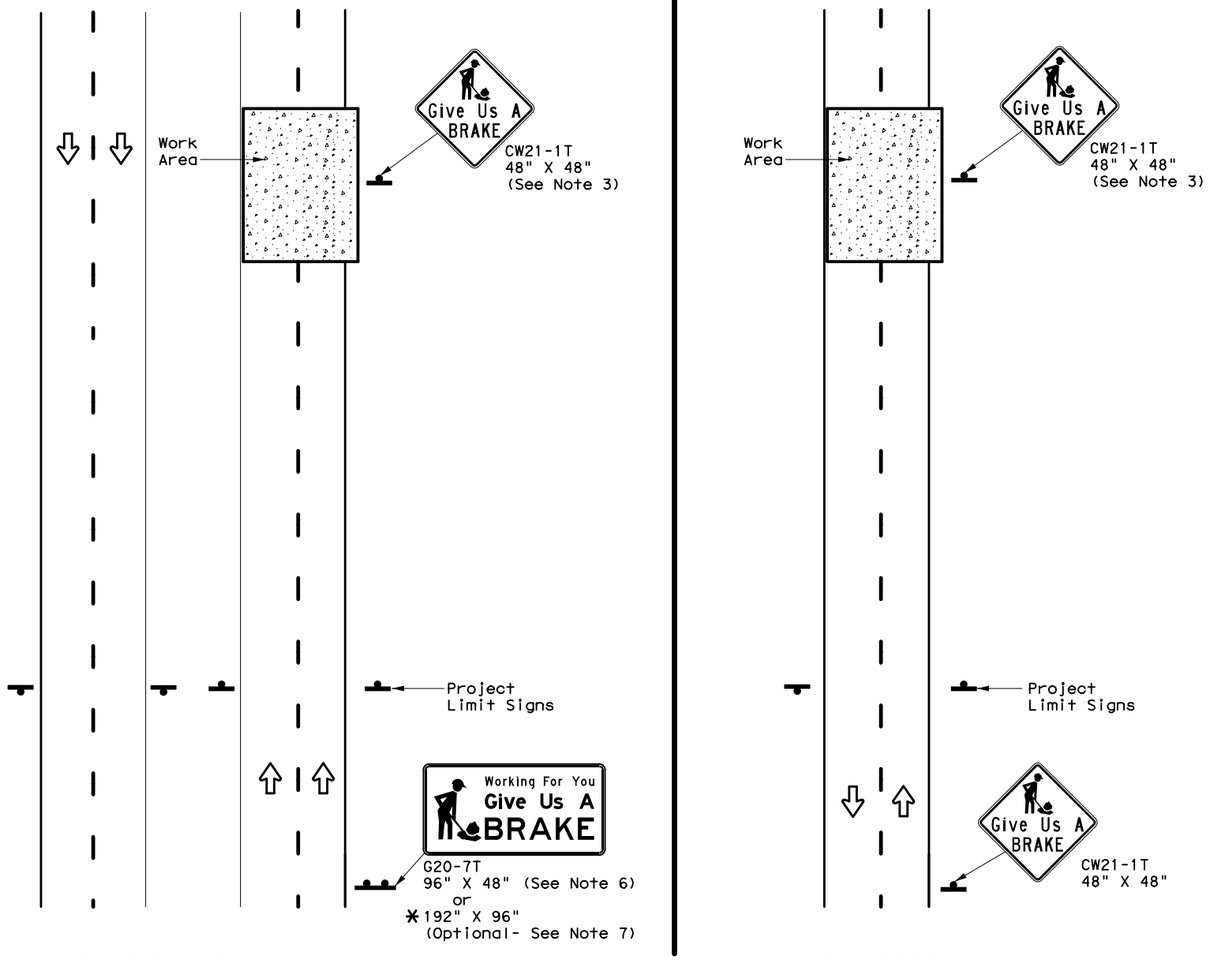

DIVIDED HIGHWAY

UNDIVIDED HIGHWAY

SIGNS ARE SHOWN FOR ONE DIRECTION OF TRAVEL

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

SUMMARY OF LARGE SIGNS

BACKGROUND COLOR	SIGN DESIGNATION	SIGN	SIGN DIMENSIONS	REFLECTIVE SHEETING	SQ FT	GALVANIZED STRUCTURAL STEEL			DRILLED SHAFT
						Size	(LF) ①	(LF) ②	24" DIA. (LF)
Orange	G20-7T	Working For You Give Us A BRAKE	96" X 48"	Type B_{FL} or C_{FL}	32	▲	▲	▲	▲
Orange	G20-7T	Working For You Give Us A BRAKE	192" X 96"	Type B_{FL} or C_{FL}	128	W8x18	16	17	12

▲ See Note 6 Below

LEGEND	
	Sign
	Large Sign
	Traffic Flow

DEPARTMENTAL MATERIAL SPECIFICATIONS	
PLYWOOD SIGN BLANKS	DMS-7100
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

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

GENERAL NOTES

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

Texas Department of Transportation

Traffic Operations Division Standard

WORK ZONE "GIVE US A BRAKE" SIGNS

WZ(BRK)-13

FILE: wzbrk-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT August 1995	CONT	SECT	JOB	HIGHWAY
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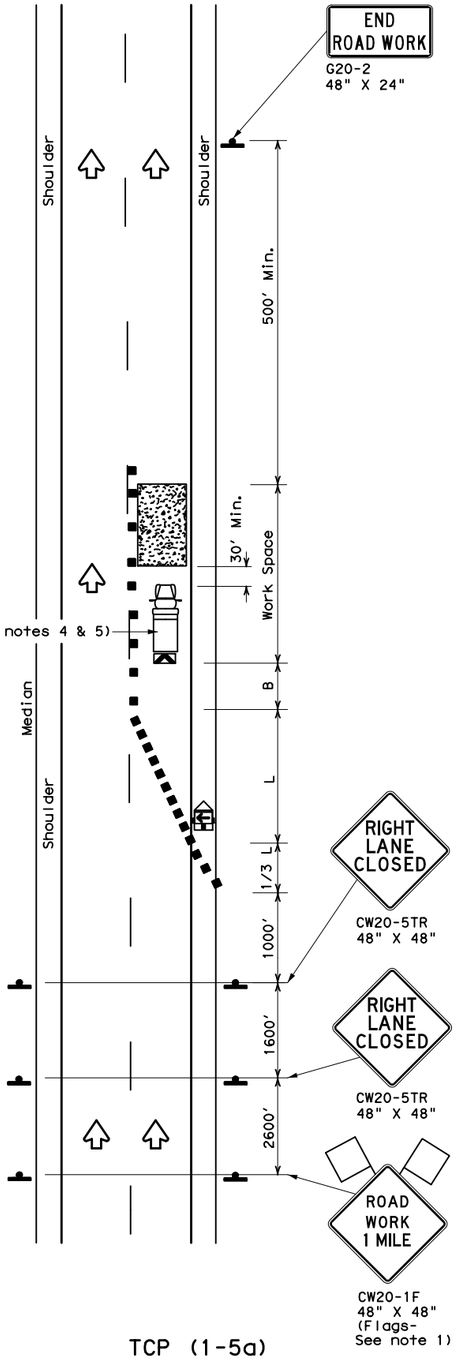
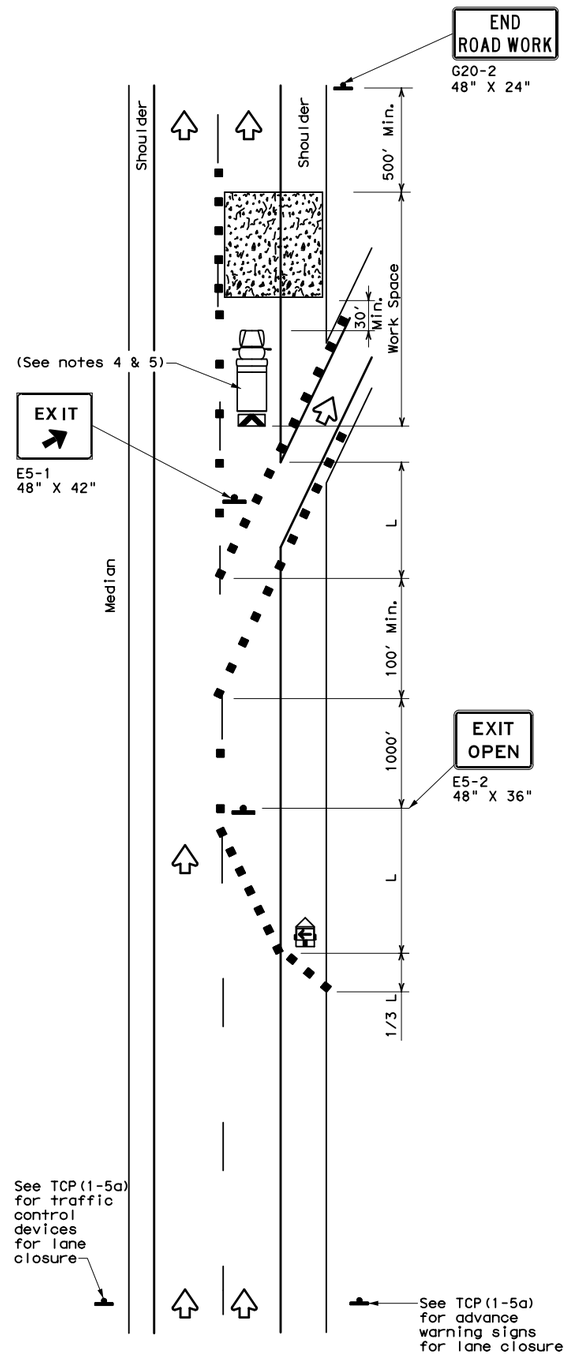


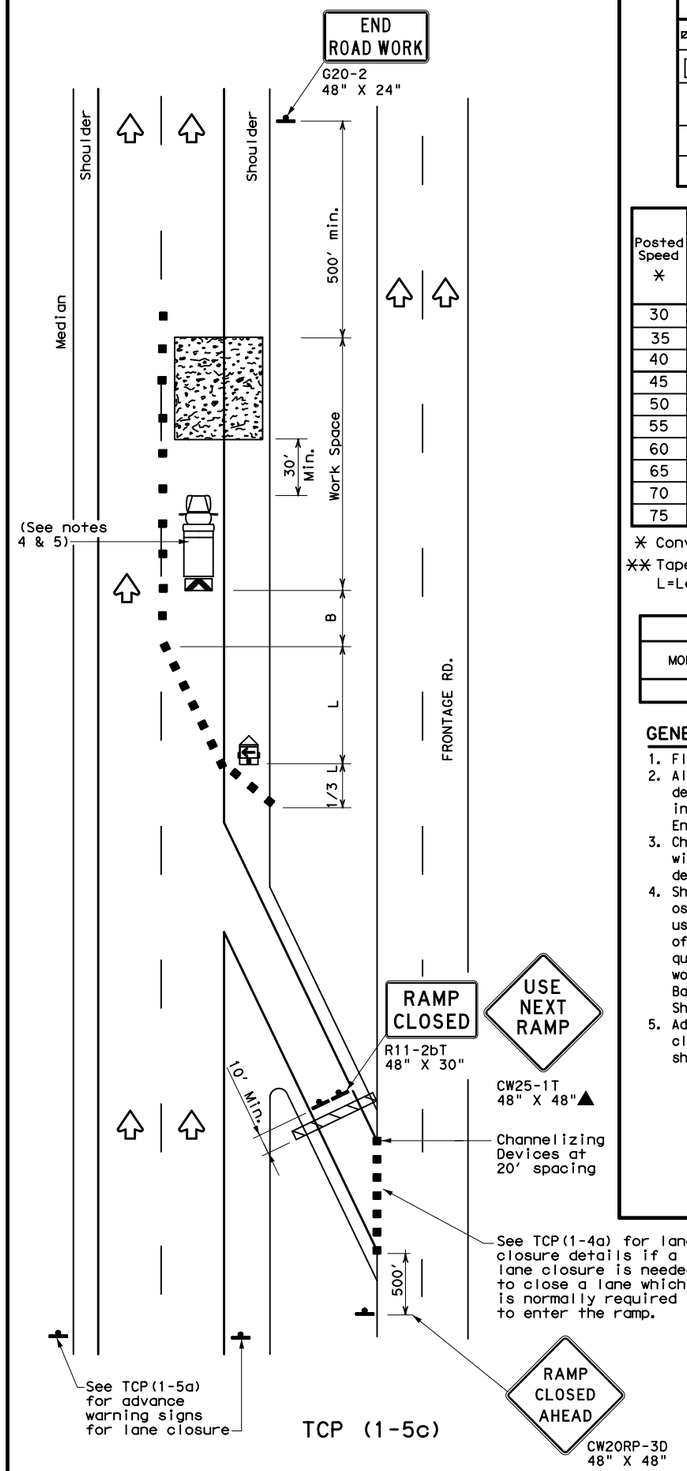
TCP (1-5a)

ONE LANE CLOSURE



TCP (1-5b)

LANE CLOSURE NEAR EXIT RAMPS



TCP (1-5c)

LANE CLOSURE NEAR ENTRANCE RAMPS

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. Channelizing devices used to close lanes may be supplemented with the Chevron Alignment Sign placed on every other channelizing device. Chevrons may be attached to plastic drums as per BC Standards.
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 in each closed lane, on the shoulder or off the paved surface, next to those shown in order to protect a wider work space.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN LANE CLOSURES FOR DIVIDED HIGHWAYS

TCP(1-5)-18

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©TxDOT February 2012	CONT	SECT	JOB	HIGHWAY
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	HOU	MONTGOMERY, ETC		22

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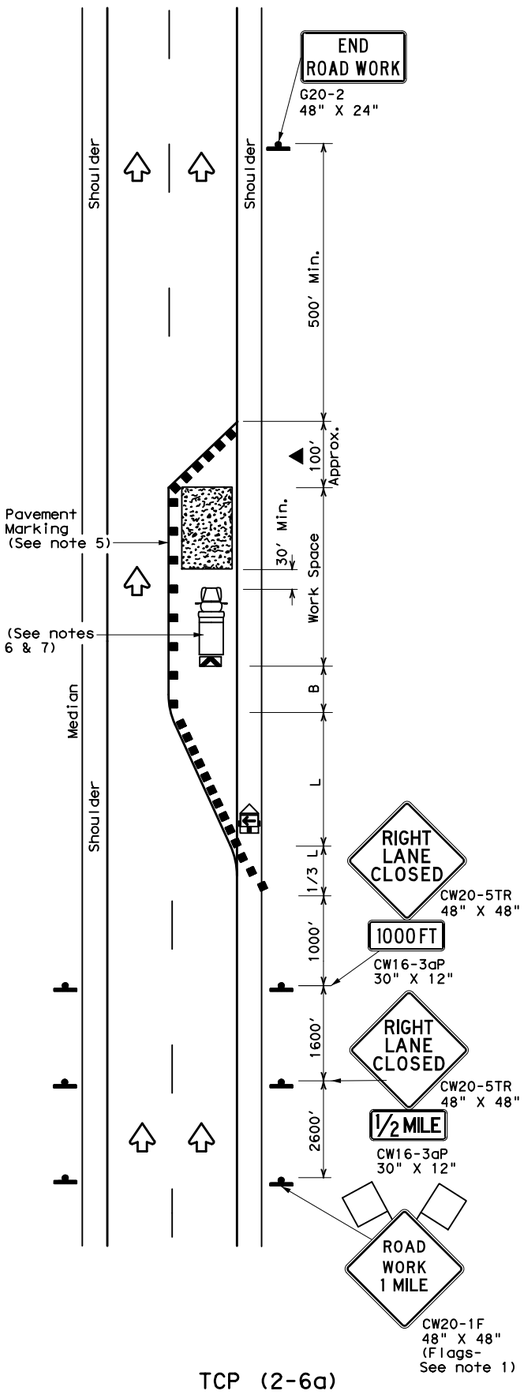
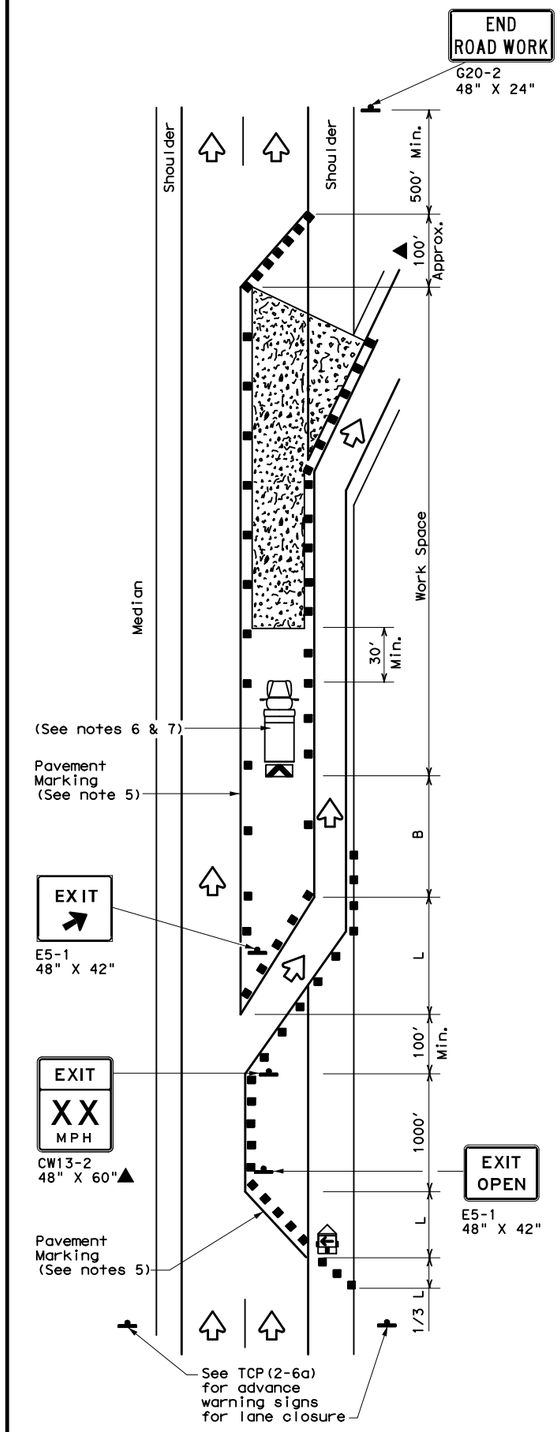


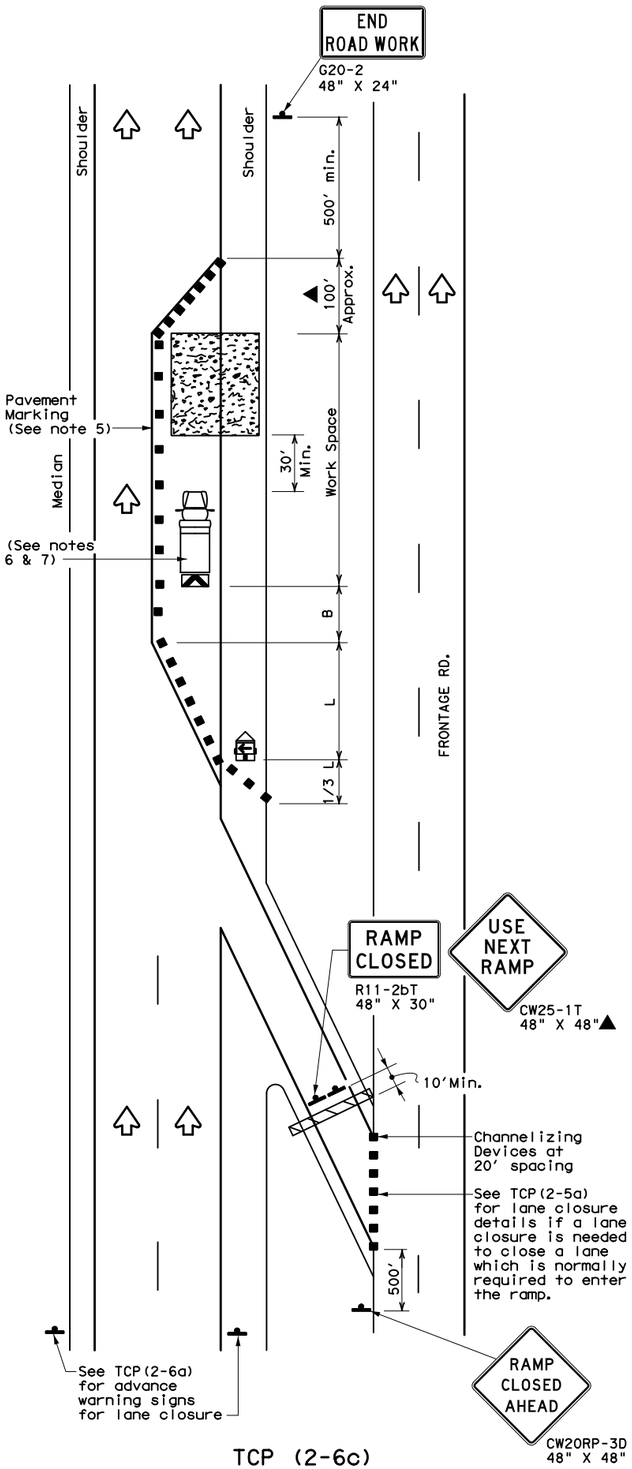
TCP (2-6a)

ONE LANE CLOSURE



TCP (2-6b)

LANE CLOSURE NEAR EXIT RAMPS



TCP (2-6c)

LANE CLOSURE NEAR ENTRANCE RAMPS

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. Channelizing devices used to close lanes may be supplemented with the Chevron Alignment Sign placed on every other channelizing device. Chevrons may be attached to plastic drums as per BC Standards.
4. Channelizing devices used along the work space or along tangent sections may be supplemented with vertical panels (VP) placed on everyother channelizing device. If night time conditions make it difficult to see at least two VPs, the VPs may be placed on each channelizing device.
5. The placement of pavement markings may be omitted on Intermediate-term stationary work zones with the approval of the Engineer.
6. Shadow Vehicle with TMA and high intensity rotating, flashing,oscillating or strobe lights. 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.
7. Additional Shadow Vehicles with TMAs may be positioned in each closed lane, on the shoulder or off the paved surface, next to those shown in order to protect a wider work space.

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN LANE CLOSURES ON DIVIDED HIGHWAYS

TCP(2-6)-18

FILE: tcp2-6-18.dgn	DN:	CK:	DW:	CK:
© TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS 2-94 4-98 8-95 2-12 1-97 2-18	0110	04	208, ETC	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY, ETC		23

DATE: 3/21/2024 8:09:33 PM
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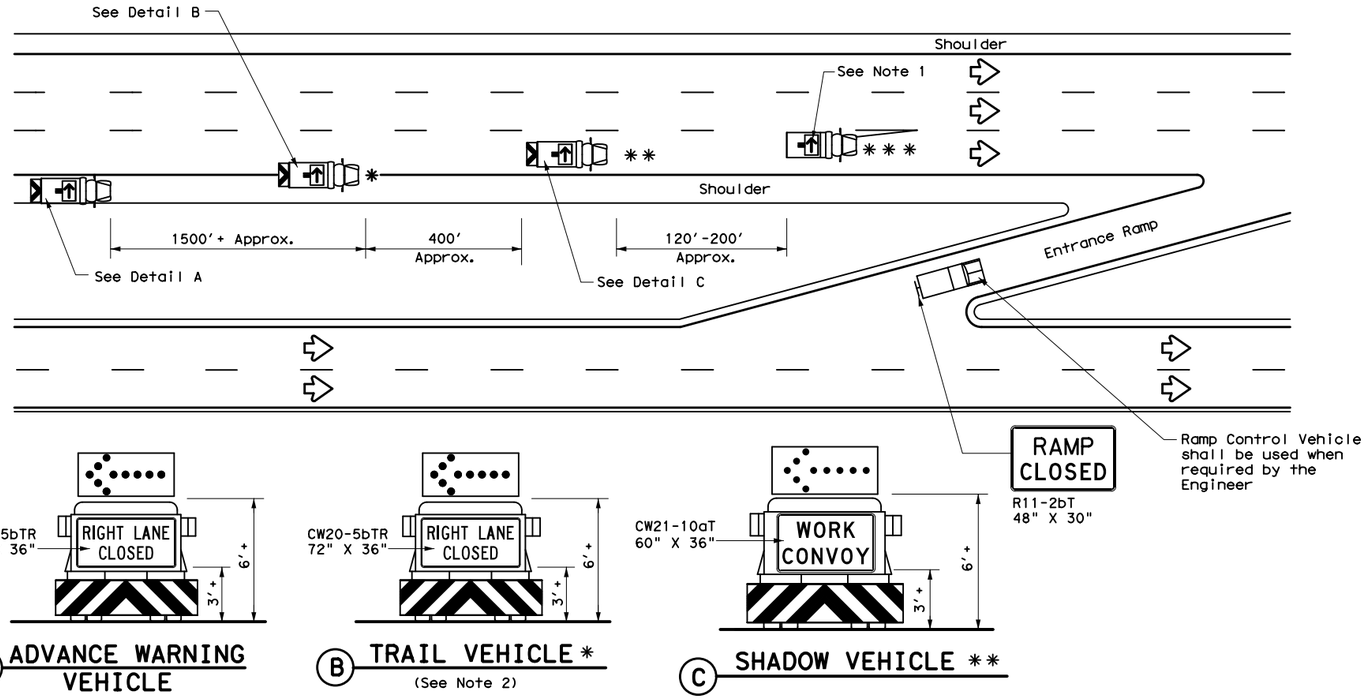
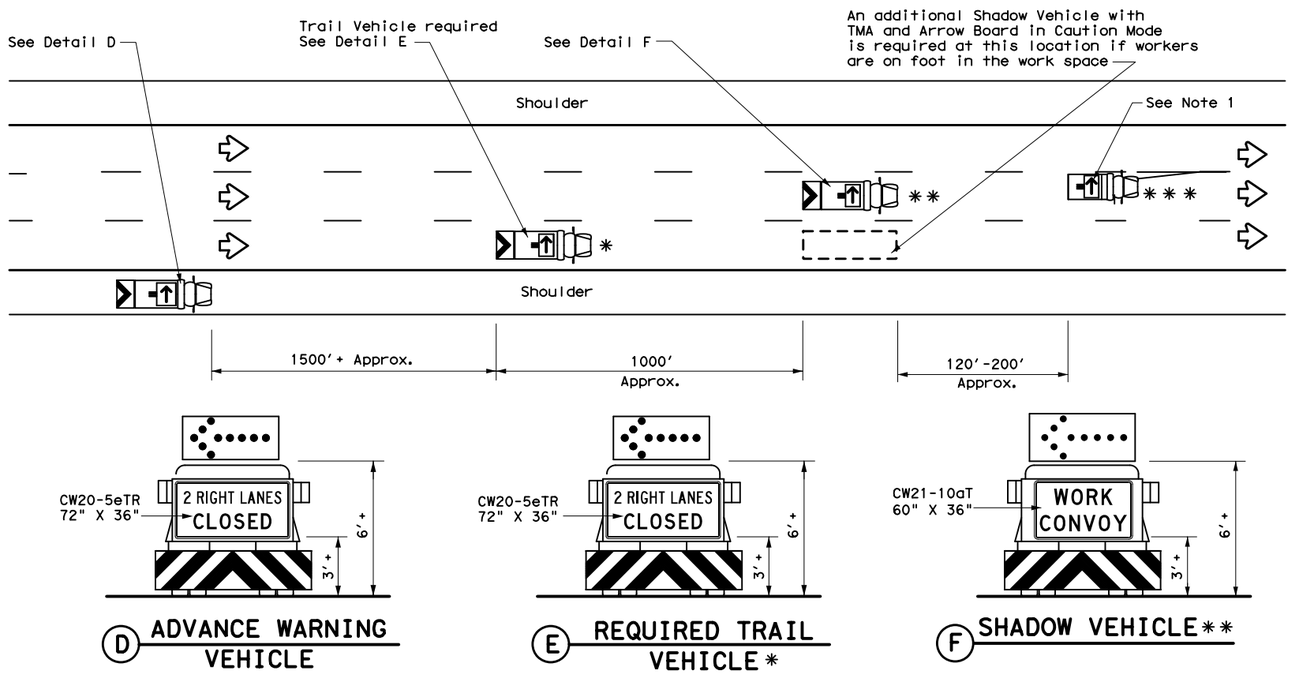


RIGHT LANE CLOSURE ON DIVIDED HIGHWAY - TCP(3-2a)



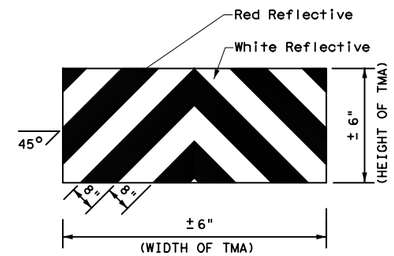
INTERIOR LANE CLOSURE ON MULTI-LANE DIVIDED HIGHWAY - TCP(3-2b)

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

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

GENERAL NOTES

1. ADVANCE WARNING, TRAIL and SHADOW vehicles shall be equipped with Type B or Type C flashing arrow boards as per the Barricade and Construction (BC) standards. Arrow boards on WORK vehicles will be optional based on the type of work being performed. The arrow boards shall be operated from inside the vehicle.
2. For TCP(3-2a) the Engineer will determine if the TRAIL VEHICLE is required based on prevailing roadway conditions, traffic volume, and sight distance restrictions. All other vehicles shown for both TCP(3-2a) and TCP(3-2b) are required.
3. The use of amber high intensity rotating, flashing, oscillating, or strobe lights on vehicles are required. Blue high intensity rotating, flashing, oscillating or strobe lights when mounted on the driver's side of the vehicle may be operated simultaneously with the amber beacons or strobe lights.
4. The use of truck mounted attenuators (TMA) on the ADVANCE WARNING, SHADOW, and TRAIL vehicles are required.
5. Reflective sheeting on the rear of the TMA shall meet or exceed the reflectivity and color requirements of DMS 8300, Type A.
6. Each vehicle shall have two-way radio communication capability.
7. When work convoys must change lanes, the TRAIL VEHICLE should change lanes first to shadow the other convoy vehicles.
8. Vehicle spacing between the TRAIL VEHICLE and the SHADOW VEHICLE will vary depending on sight distance restrictions. Motorists approaching the work convoy should be able to see the TRAIL VEHICLE in time to slow down and/or change lanes as they approach the TRAIL VEHICLE. Vehicle spacing between the WORK VEHICLE and SHADOW VEHICLE may vary according to terrain, work activity and other factors.
9. Standard 48" X 48" diamond shaped warning signs with the same message as those shown may be used where adequate mounting space exists.
10. The signs shown should be used on the Advance Warning Vehicle. As an option, a portable changeable message sign (PCMS) or a truck mounted changeable message sign (TMCMS) with a minimum character height of 12", and displaying the same legend may be substituted for these signs. An appropriate directional arrow display, simulating the size and legibility of the flashing arrow board, must be used in the second phase of the PCMS/TMCMS message. When this is done, the arrow board will not be required on the Advance Warning Vehicle.
11. Standard diamond shape versions of the CW20-5 series signs may be used as an option if the rectangular signs shown are not available.
12. The principles on this sheet may be used to close lanes from the left side of the roadway considering the number of lanes, shoulder width, sight distance, and ramp frequency.
13. Signs and flashing arrow board modes shall be appropriately altered when implementing left lane closures or interior closures which close the left lanes.
14. The Advance Warning Vehicle may straddle the edgeline when shoulder width makes it necessary.



STRIPING FOR TMA

Texas Department of Transportation

Traffic Operations Division Standard

TRAFFIC CONTROL PLAN MOBILE OPERATIONS DIVIDED HIGHWAYS

TCP(3-2)-13

FILE: tcp3-2.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT December 1985	CONT	SECT	JOB	HIGHWAY
REVISIONS 2-94 4-98 8-95 7-13 1-97	0110	04	208, ETC	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY, ETC		24

176

DATE: 3/21/2024 8:09:34 PM
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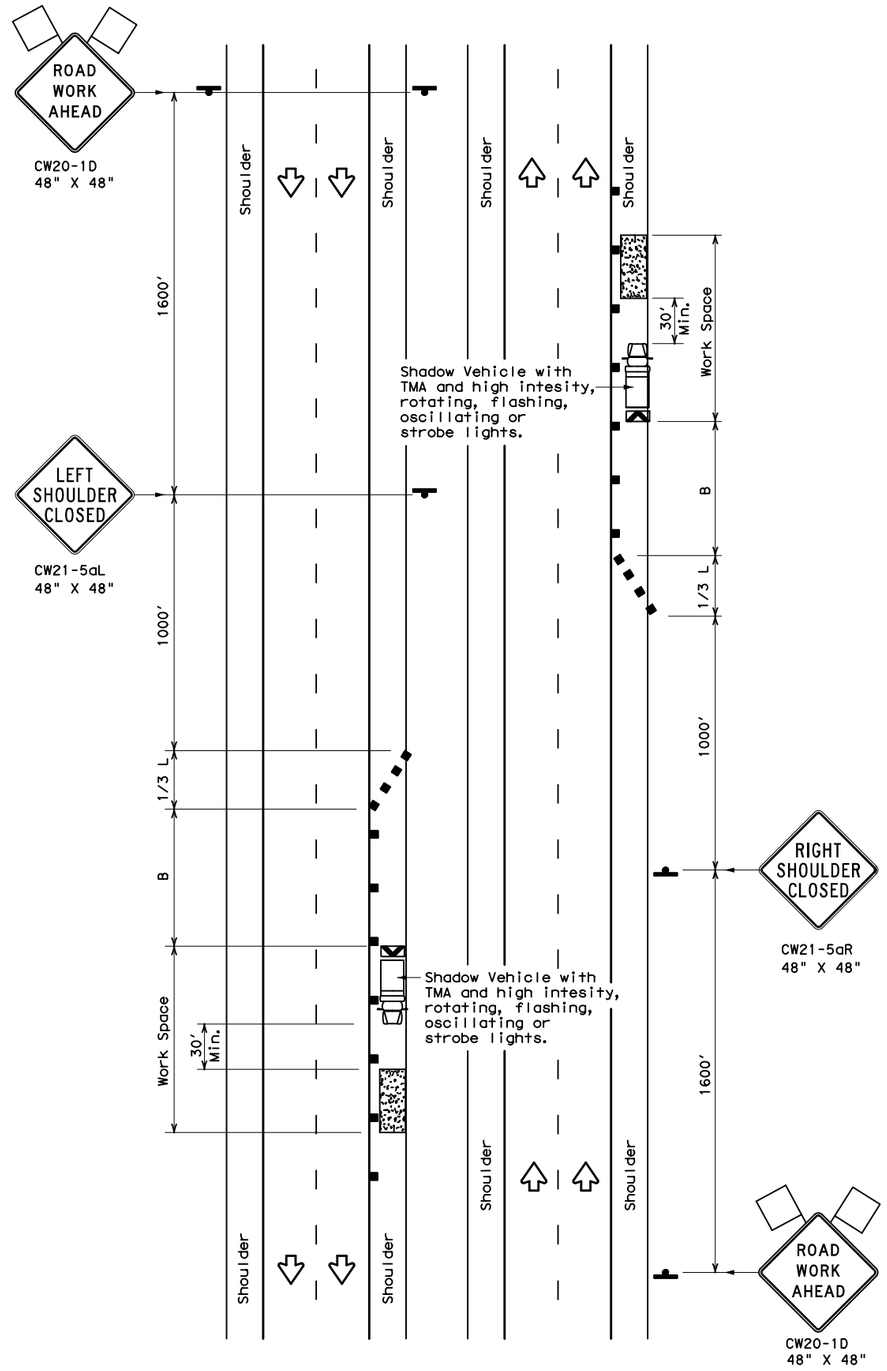
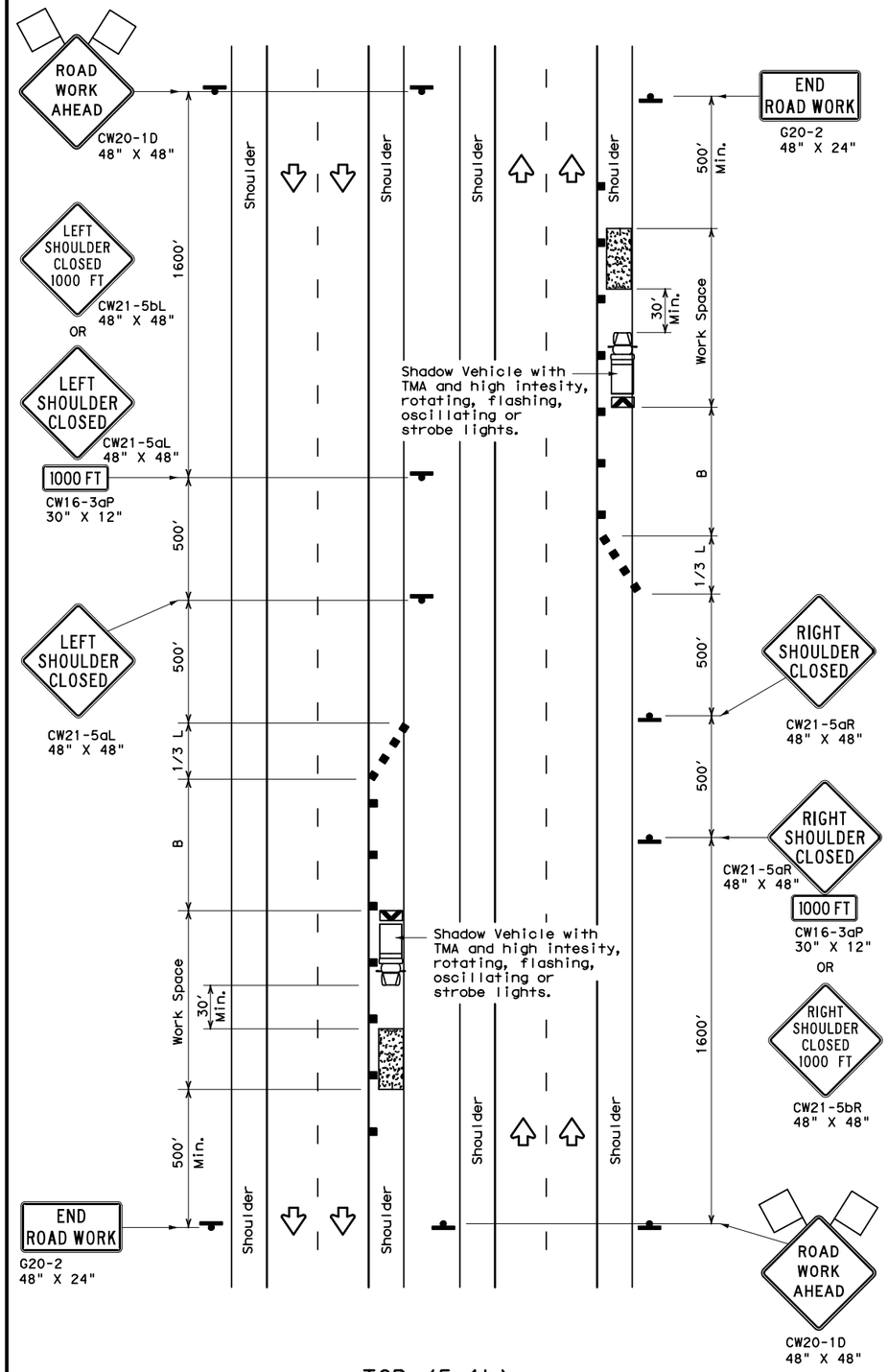


TCP (5-1a)

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 2-18	0110	04	208, ETC	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY, ETC		25

DATE: 3/21/2024 8:09:34 PM
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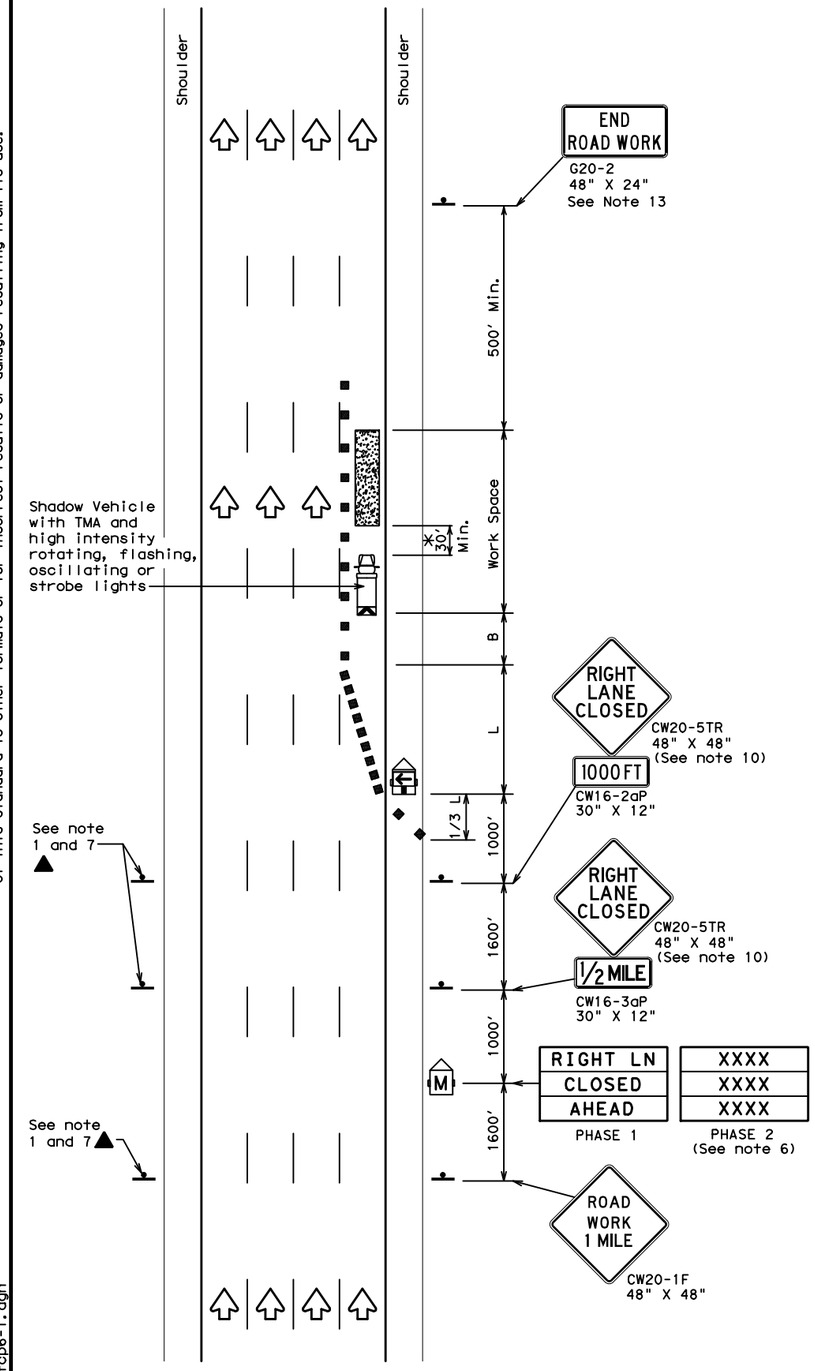
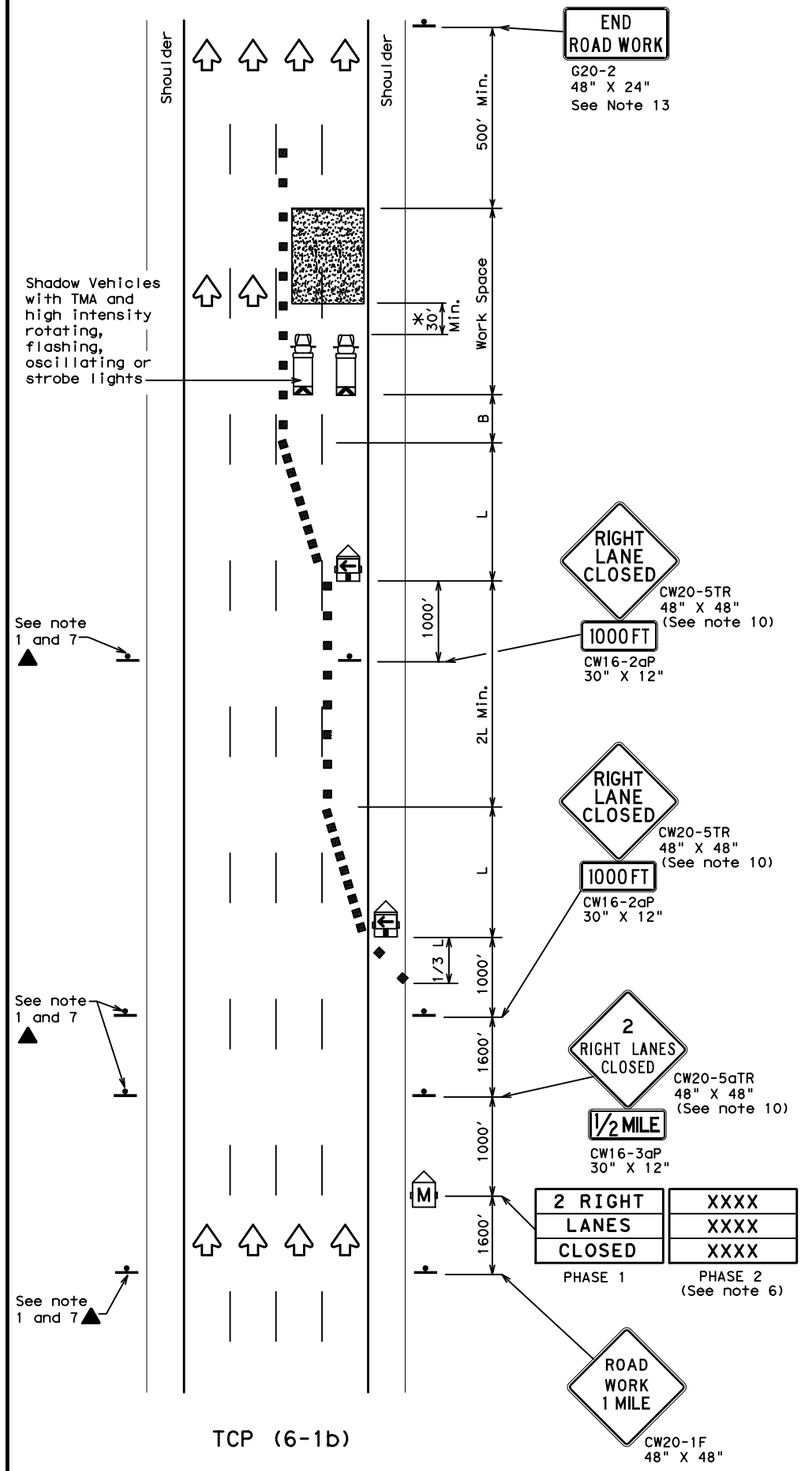


TCP (6-1a)

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
REVISIONS	0110	04	208, ETC	IH 45
8-12	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY, ETC		26

DATE: 3/21/2024 8:09:34 PM
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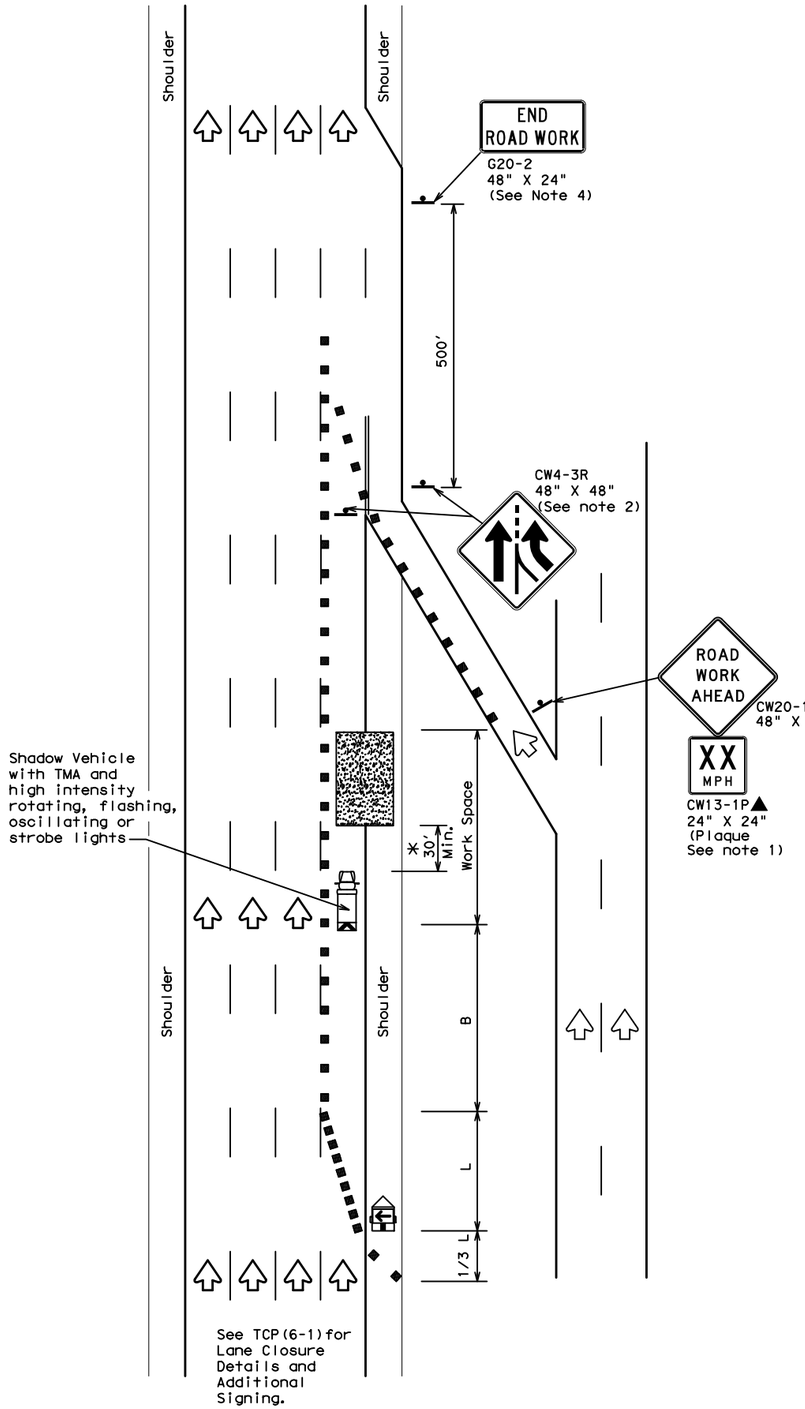
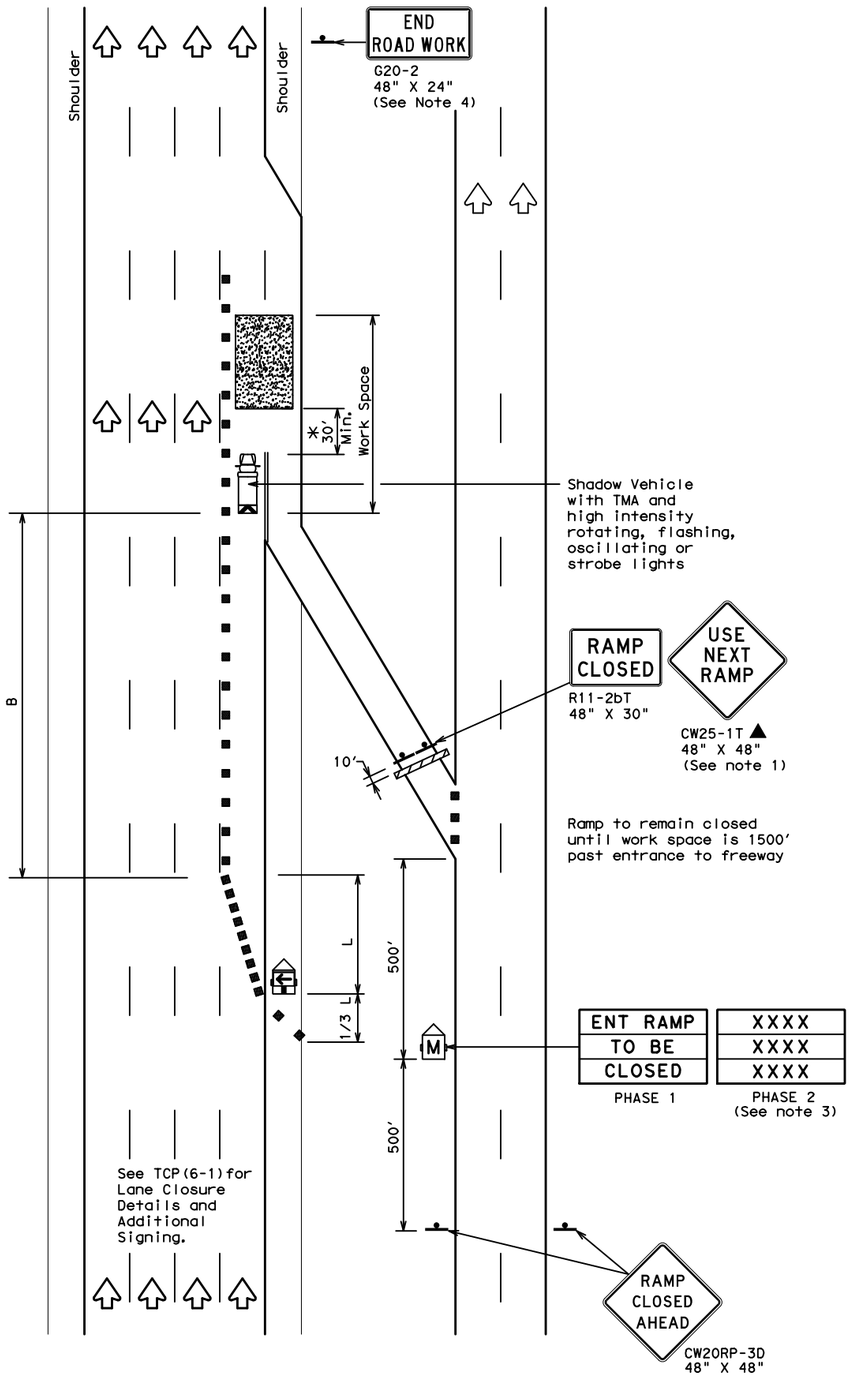


TCP (6-2a)

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" ** 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. 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	0110	04	208, ETC	IH 45
1-97 8-98	DIST	COUNTY		SHEET NO.
4-98 8-12	HOU	MONTGOMERY, ETC		27

DATE: 3/21/2024 8:09:35 PM
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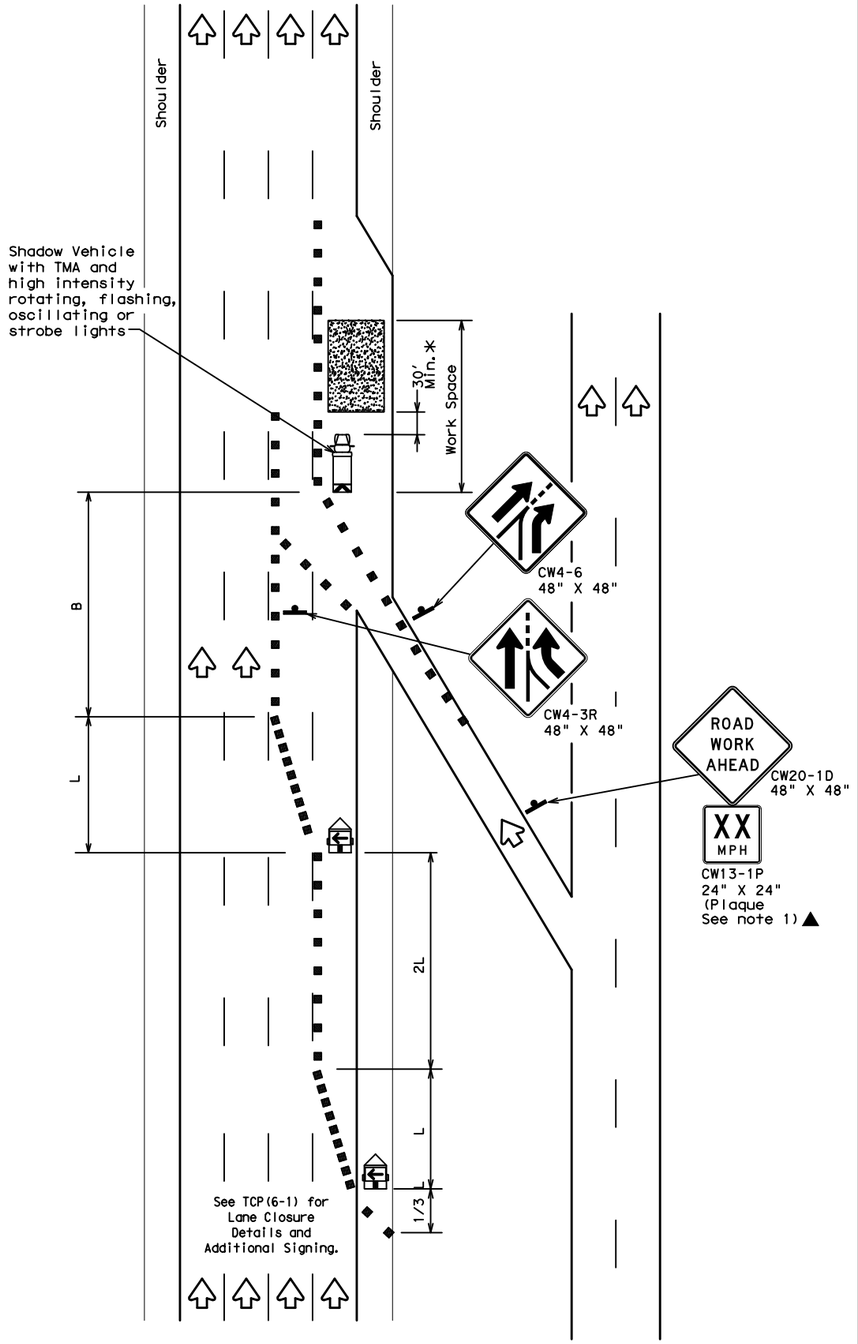
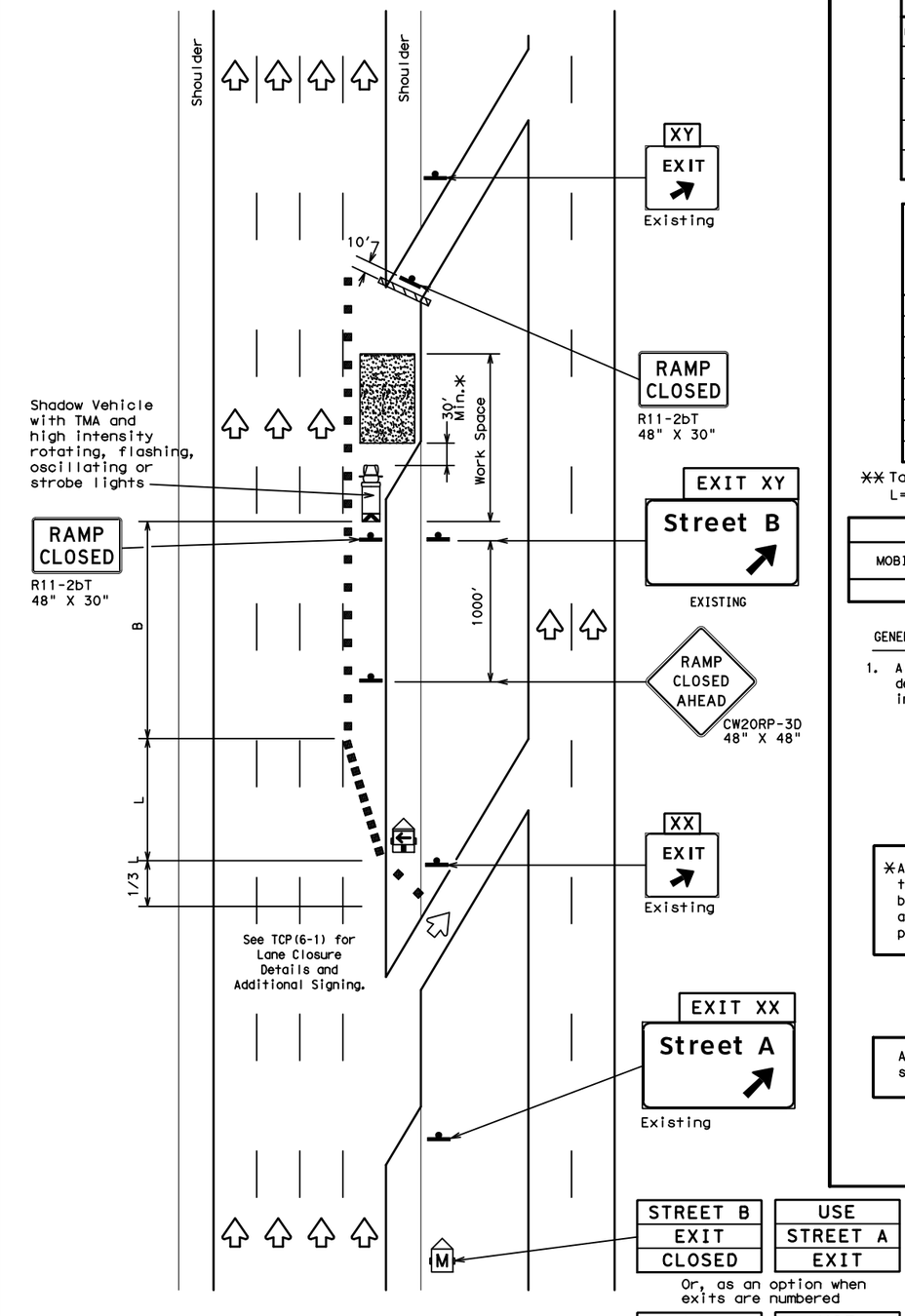


TCP (6-3a)

ENTRANCE RAMP OPEN



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" ** 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.

*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	0110	04	208, ETC	IH 45
1-97 8-98	DIST	COUNTY		SHEET NO.
4-98 8-12	HOU	MONTGOMERY, ETC		28

DATE: 3/21/2024 8:09:35 PM
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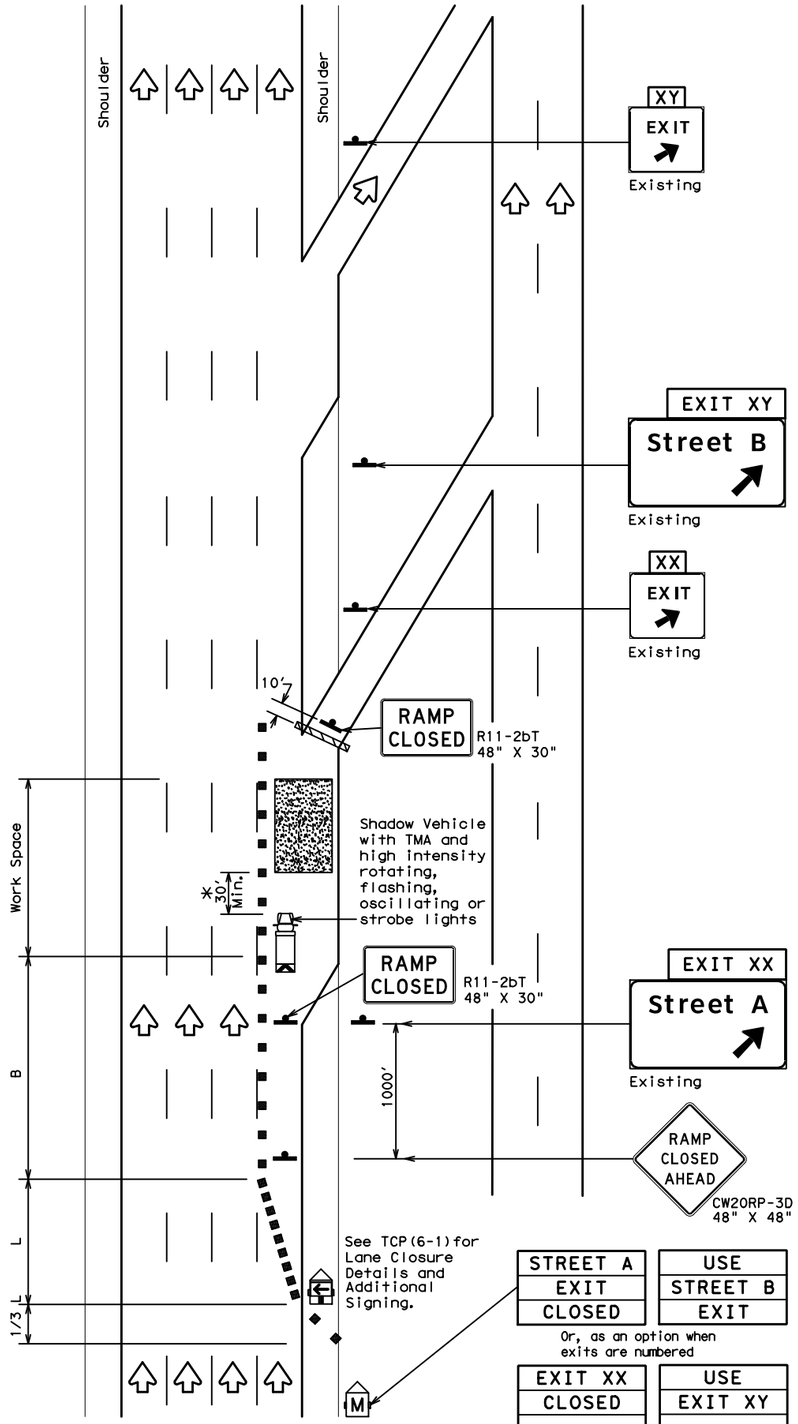
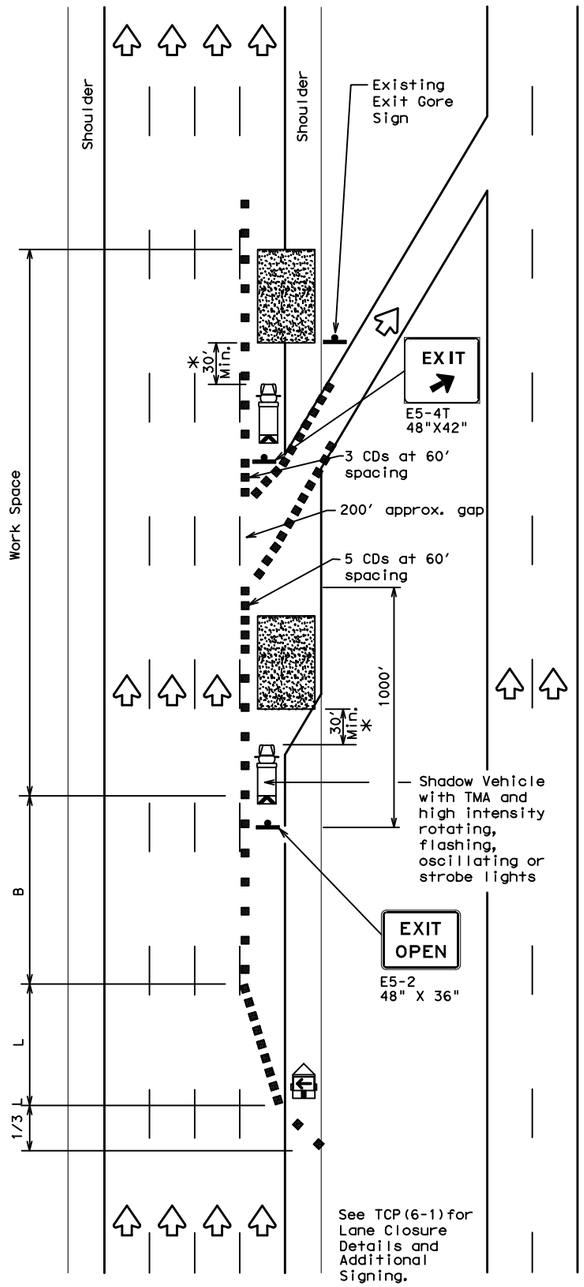


TCP (6-4a)

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.

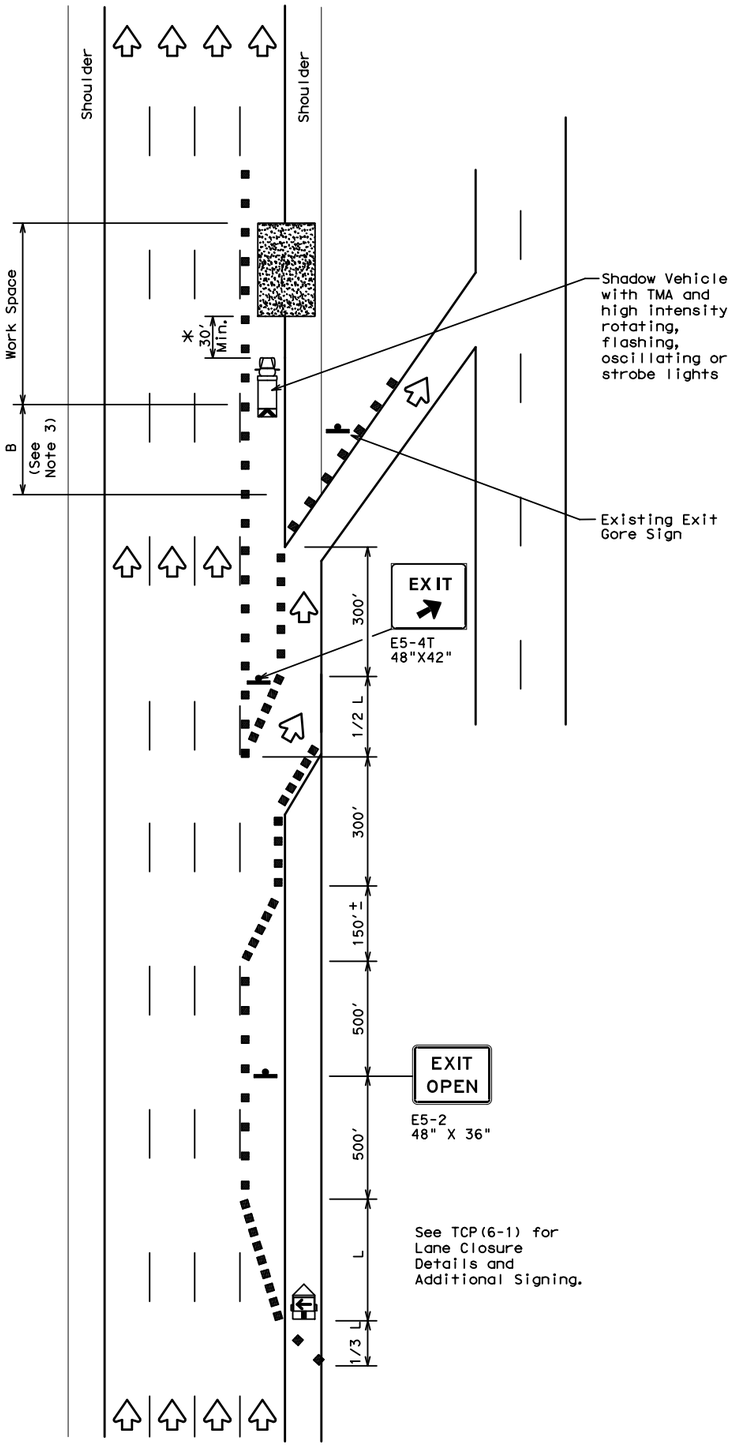
Texas Department of Transportation
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN
WORK AREA AT EXIT RAMP

TCP(6-4)-12

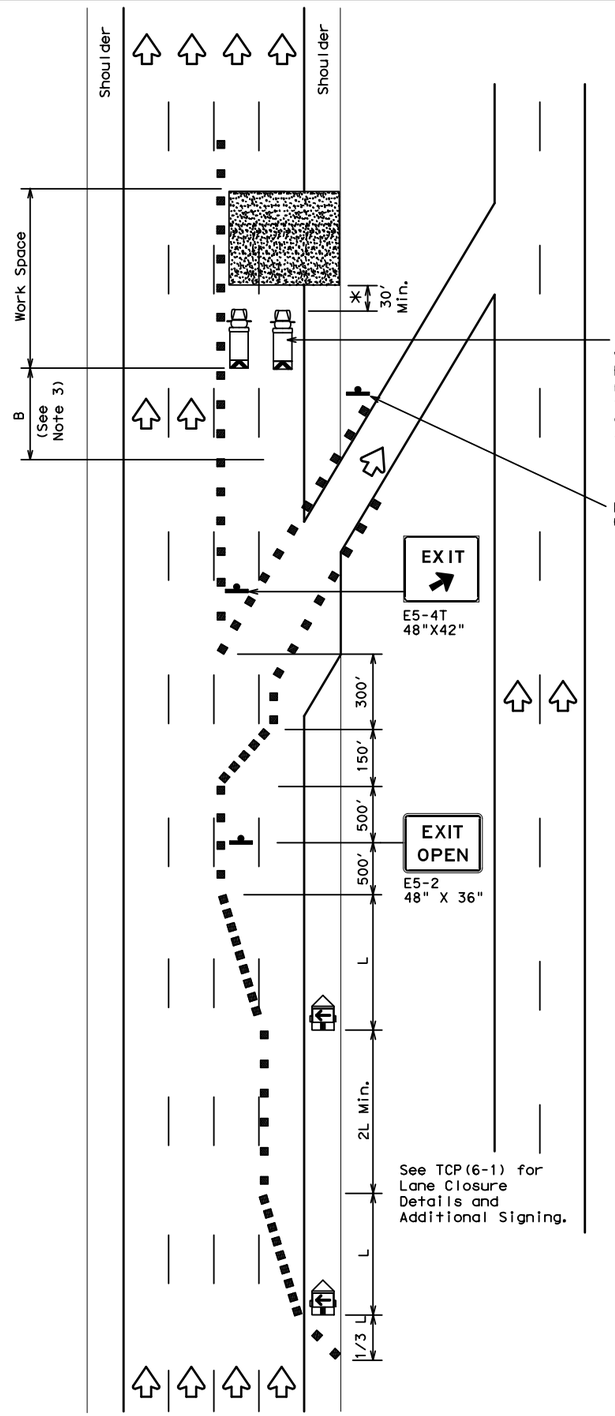
FILE: tcp6-4.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT Feburary 1994	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	04	208, ETC	IH 45
1-97 8-98	DIST	COUNTY		SHEET NO.
4-98 8-12	HOU	MONTGOMERY, ETC		29

DATE: 3/21/2024 8:09:35 PM
FILE: ...\STANDARDS\tcp6-4.dgn



TCP (6-5a)

EXIT RAMP OPEN



TCP (6-5b)

EXIT RAMP OPEN
TWO LANE CLOSURE WITHIN 1500' PAST EXIT 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" ** 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.
3. If adequate longitudinal buffer length "B" does not exist between the work space and the exit ramp, consideration should be given to closing the ramp.

* 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 EXIT RAMP

TCP(6-5)-12

FILE: tcp6-5.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT Feburary 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	04	208, ETC	IH 45
1-97 8-98	DIST	COUNTY		SHEET NO.
4-98 8-12	HOU	MONTGOMERY, ETC		30

DATE: 3/21/2024 8:09:36 PM
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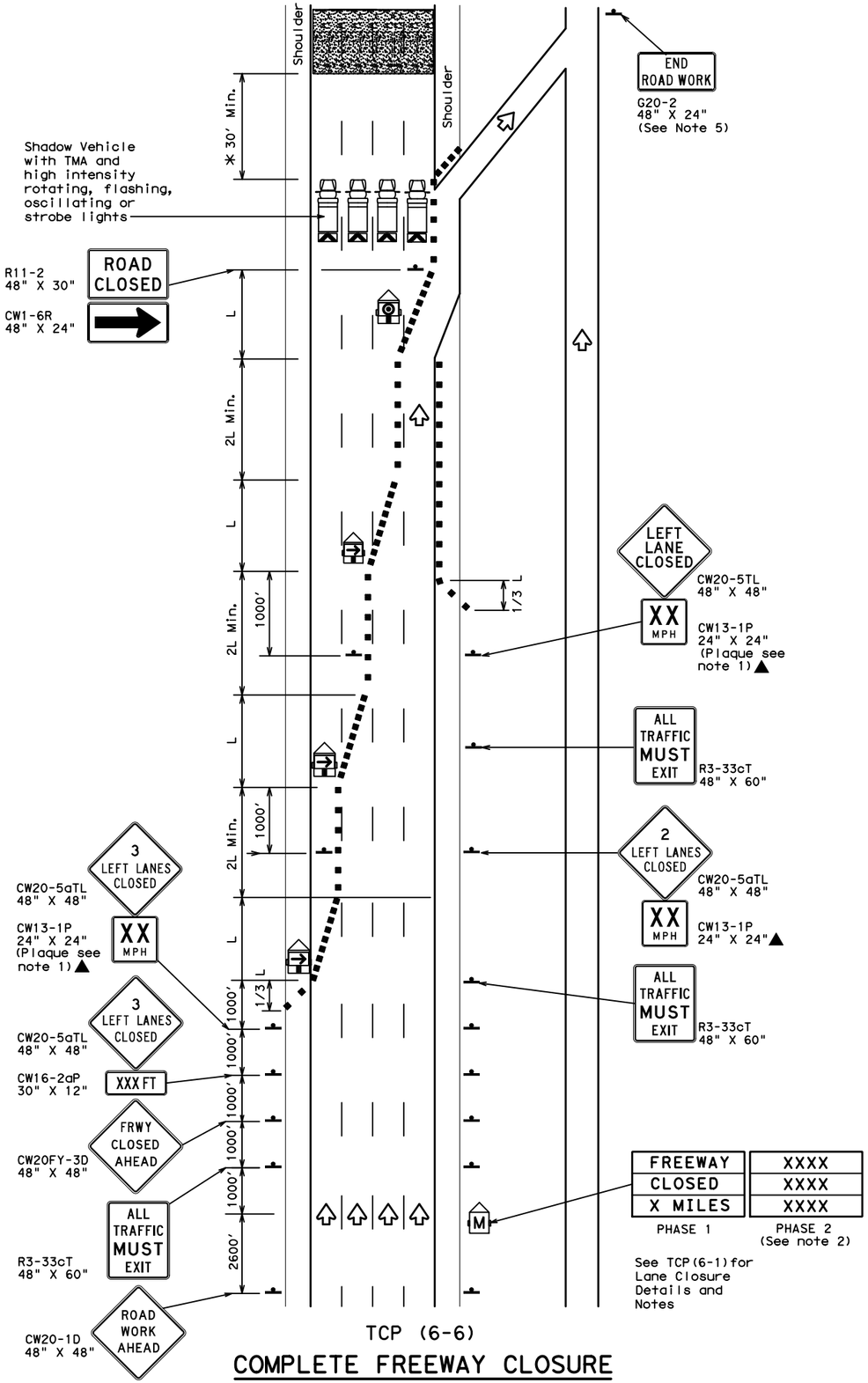


TCP (6-6)

COMPLETE FREEWAY 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)
	Flashing Arrow Board in Caution Mode		Traffic Flow
	Sign		

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. Phase 2 of the PCMS message should include appropriate information formatted as shown on BC(6), such as "MERGE RIGHT," recommended speed, delay, exit information, or other specific warnings.
3. Where queuing is anticipated beyond signing shown, additional PCMS signs, other warning signs, devices or Law Enforcement Officers should be available to warn approaching high speed traffic of the end of the queue, as directed by the Engineer.
4. Entrance ramps located from the advance warning area to the exit ramp should be closed whenever possible.
5. 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.

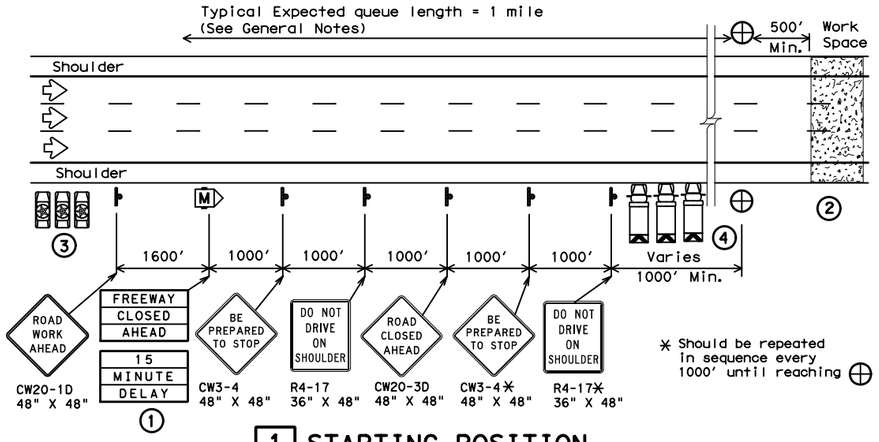
Additional requirements for lane closures and advance signing shall be as shown on TCP (6-1) or as directed by the Engineer.

Texas Department of Transportation
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN FREEWAY CLOSURE

TCP(6-6)-12

FILE: tcp6-6.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1994	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	04	208, ETC	IH 45
1-97 8-98	DIST	COUNTY		SHEET NO.
4-98 8-12	HOU	MONTGOMERY, ETC		31



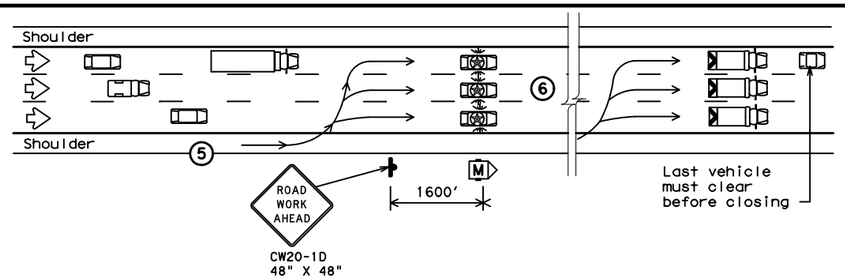
1 STARTING POSITION

(1) Traffic control devices should be installed or located near their intended position prior to beginning temporary roadway closure sequence. Duplicate signs should be erected on the median side of the roadway when median width permits. Warning signs should not be placed on the paved shoulders that will be used by the WARNING LEOV, or where movement of the LEOVs or barrier vehicles will be impeded.

(2) Prior to beginning the roadway closure sequence, all equipment, materials, personnel, and other items necessary to complete the work should be gathered near the work area. Entrance ramps located in the area where a queue is expected to build should be closed.

(3) There should be one LEOV for every lane to be controlled, plus a minimum of one to warn traffic approaching a queue. An additional lead law enforcement officer is desirable to remain with the Engineer's or Contractor's point of contact (POC) during the operation in order to improve communication with all LEOVs involved.

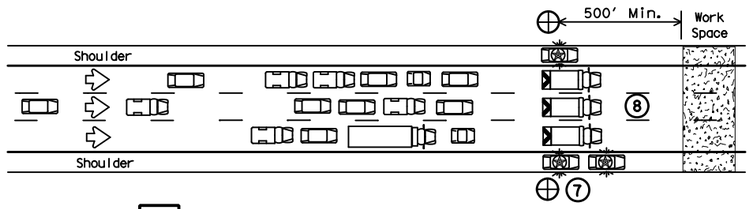
(4) One barrier vehicle with a Truck Mounted Attenuator and amber or blue and amber high intensity flashing/oscillating/strobe lighting shall be used for each lane to be closed.



2 REDUCING SPEED OPERATION

(5) Starting position of the LEOVs should be in advance of the most distant warning signs.

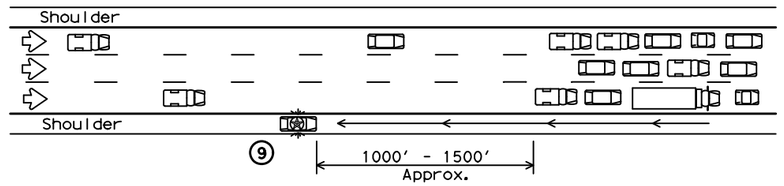
(6) Once the LEOVs have achieved an abreast blocking formation while traveling toward the CP, emergency lights and headlights should be turned "ON". The LEOVs should maintain formation, not allow traffic to pass, and begin to decelerate. The LEOVs should continue to decelerate, giving the barrier vehicles opportunity to be staged upstream of the work space after traffic has cleared. The LEOVs should then continue to decelerate slowly until bringing traffic to a stop near the barrier vehicles.



3 ALL TRAFFIC STOPPED AT CP

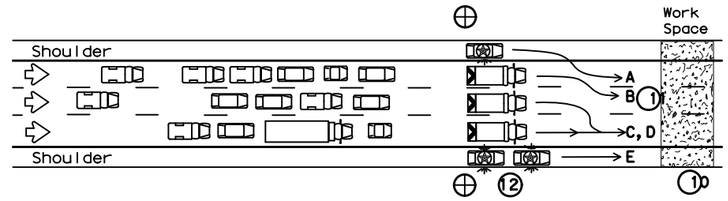
(7) Once traffic is stopped the LEOVs should park on the shoulders with emergency lighting "ON" in order to provide law enforcement presence at the closure and keep shoulders blocked ahead of the work space. They should stay in radio contact with the WARNING LEOV.

(8) The barrier vehicles should be parked, one in each lane, the parking brake set, with the high visibility flashing/oscillating/strobe lighting "ON," and the transmission in gear.



4 WARNING THE TRAFFIC QUEUE

(9) The WARNING LEOV should proceed to the right shoulder of the roadway, with emergency lights on approximately 1000' in advance of the traffic queue (stopped traffic) as the queue develops. When determined that limited sight distance situations (crest of hills, sharp roadway curvature, etc.) may occur to motorists approaching the queue, the WARNING LEOV may proceed 1/4 mile or more in advance of the queue.



5 RELEASING STOPPED TRAFFIC

(10) All equipment, materials, personnel, and other items should be removed from the roadway and maintain an adequate clear zone.

(11) When the roadway is clear for traffic, the LEOV should proceed forward from the left shoulder followed by the barrier vehicles, from left to right, as shown alphabetically in the plan view.

(12) The LEOV or LEOVs on the right shoulder may remain on the shoulder until satisfied that traffic is moving satisfactorily before merging or proceeding.

(13) LEOVs and barrier vehicles should re-group at their respective starting positions if necessary.

LEGEND			
■ ■	Channelizing Devices	⊕	Control Position (CP)
M	Portable Changeable Message Sign (PCMS)		Barrier Vehicle with Truck Mounted Attenuator
	Law Enforcement Officer's Vehicle(LEOV)		Traffic Flow

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

GENERAL NOTES

1. All traffic control devices shall conform with the latest edition of the Texas Manual on Uniform Traffic Control Devices (TMUTCD). Additional guidelines for traffic control devices may be found in the TMUTCD. Signs conflicting with the roadway closure sequence should be completely removed or covered. Additional traffic control devices may be required for closure of access roads, cross streets, exit and entrance ramps as directed by the Engineer.

2. Law enforcement officers and all workers involved should review and understand all procedures before the roadway closure sequence begins. Pre-work meetings may be held for this purpose. Local emergency services and media should have advance notification of roadway closure, expected dates and approximate times of closures.

3. Law enforcement officers shall be in uniform and have jurisdiction in the locale of the work area. An additional WARNING Law Enforcement Officer's Vehicle (LEOV) may be used on the median side of the roadway where median shoulder width permits (See sequence #9).

4. The roadway closure should be during off-peak hours, as shown in the plans, or as directed by the Engineer.

5. Work should be limited to approximately 15 minutes maximum duration unless otherwise directed by the Engineer based on existing roadway conditions. If the work is not complete within 15 minutes, or if the end of the traffic queue extends past the most distant advance warning signs, the work area should be cleared of all equipment, materials, personnel, and other items, and the roadway reopened. When the queue has dissipated and the traffic flow appears normal the roadway closure sequence may be repeated.

6. For traffic volumes greater than 1000 Passenger Cars Per Hour Per Lane (PCPHPL), or for roadway closures that exceed 15 minutes, see details elsewhere in the plan.

7. If traffic queues beyond the advance warning signs during one road closure sequence, the advance warning should be extended prior to repeating the road closure sequence. When possible, PCMS signs should be located in advance of the last available exit prior to the closure to allow motorists the choice of an alternate route.

THIS PLAN IS INTENDED TO BE USED AT LOCATIONS/TIMES WHEN TRAFFIC VOLUMES ARE LESS THAN 1000 PASSENGER CARS PER HOUR PER LANE.

Texas Department of Transportation
Traffic Operations Division Standard

TRAFFIC CONTROL PLAN SHORT DURATION FREEWAY CLOSURE SEQUENCE

TCP(6-7)-12

FILE: tcp6-7.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 1998	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	04	208, ETC	IH 45
1-97 8-12	DIST	COUNTY		SHEET NO.
4-98	HOU	MONTGOMERY, ETC		32

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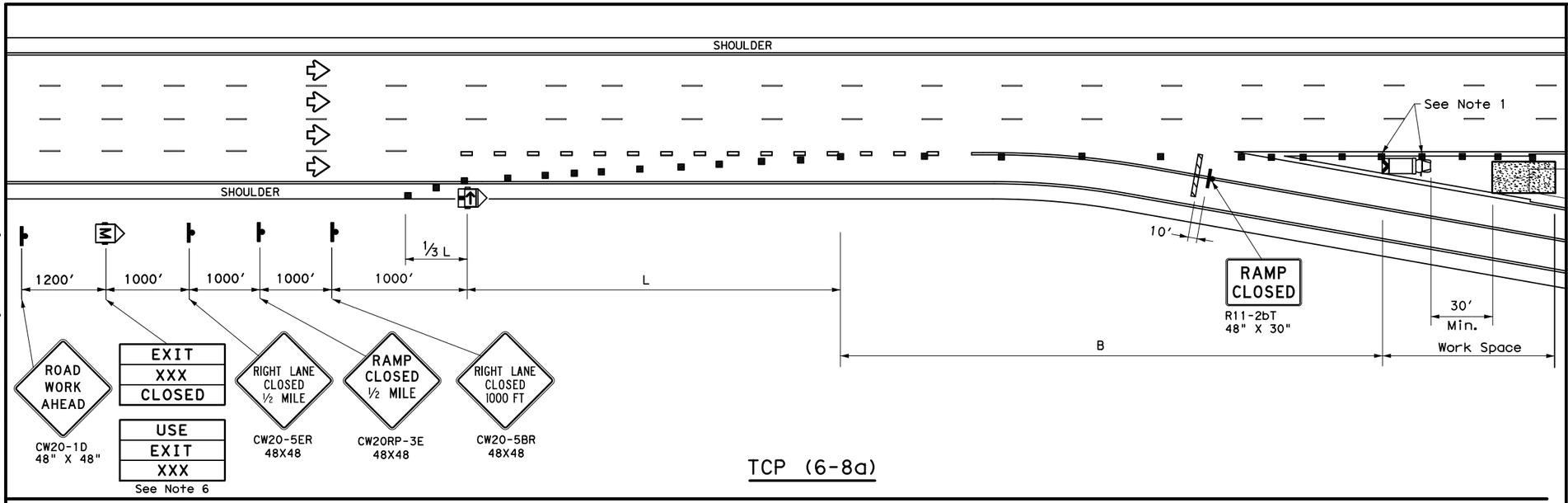
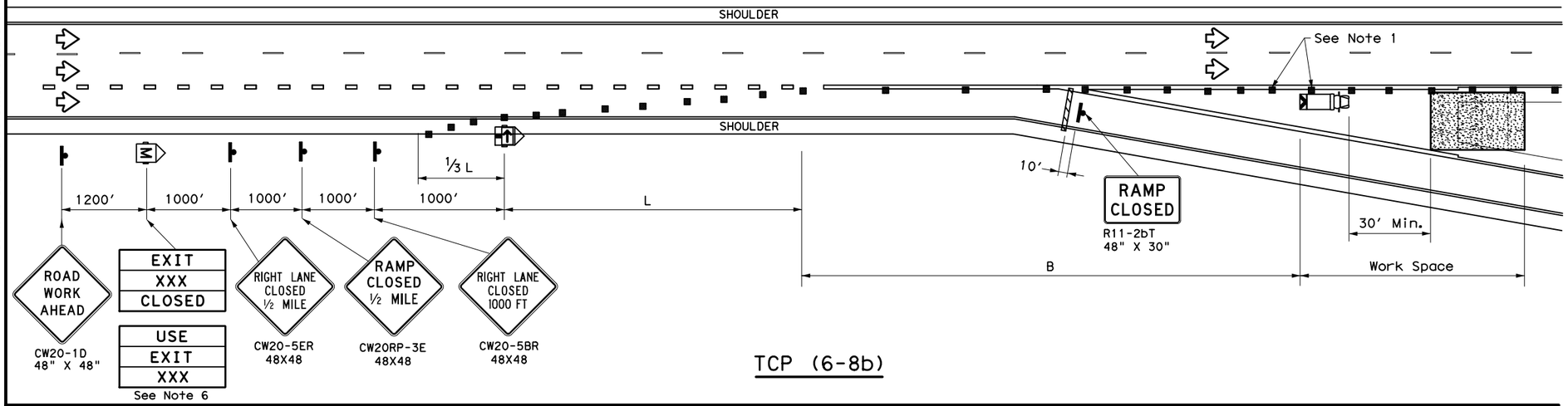
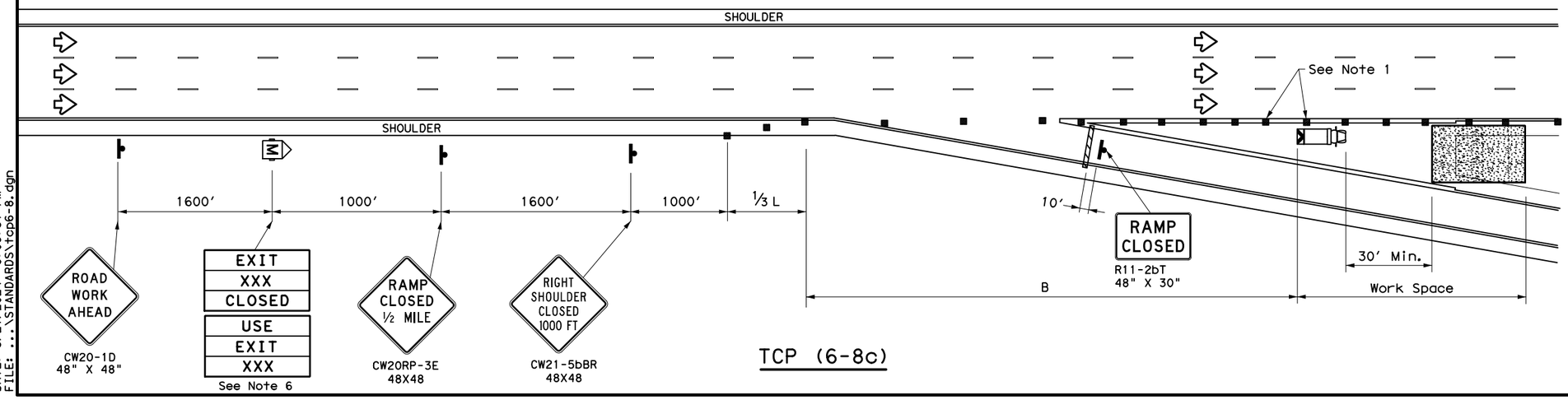


TCP (6-8a)



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

FILE: tcp6-8.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	04	208, ETC	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY, ETC		33

208

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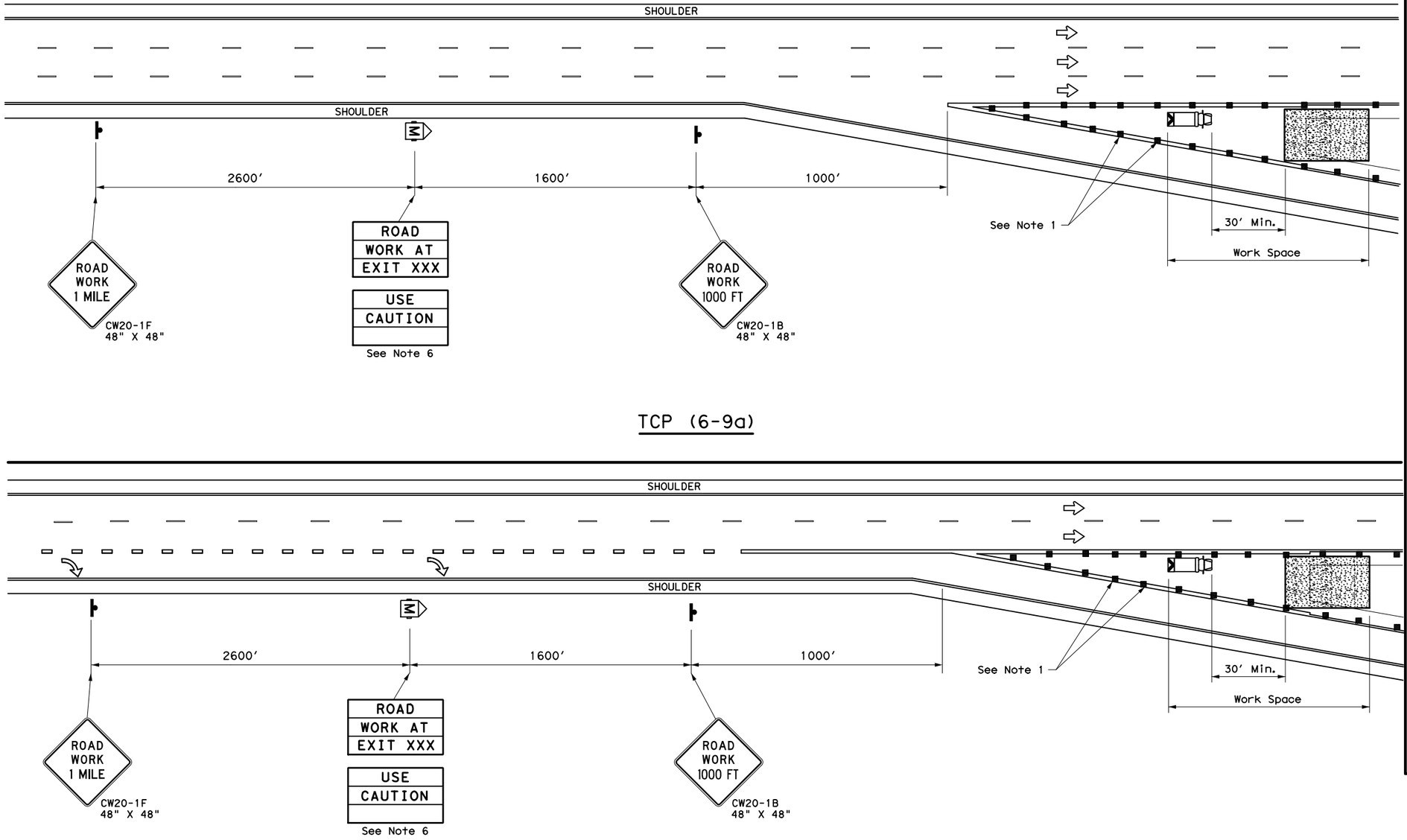


TCP (6-9a)

TCP (6-9b)

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) and TCP(6-8)for traffic control details.
5. Truck mounted attenuators are required.
6. The PCMS may be omitted if replaced with a "ROAD WORK ½ MILE" (CW20-1E).
7. Roadway ADT should be less than 10,000.

Texas Department of Transportation

Traffic Operations Division Standard

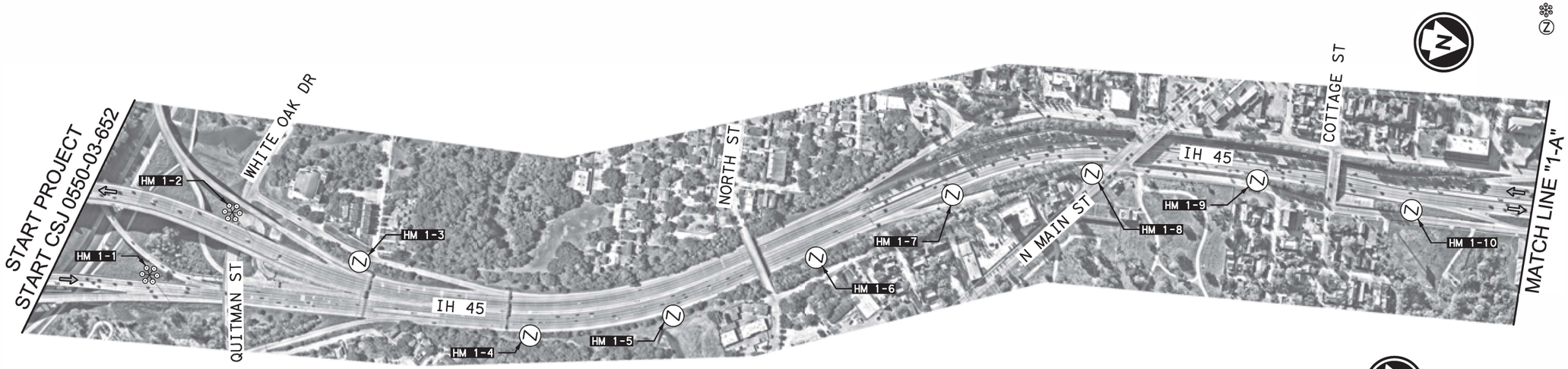
WORK IN EXIT GORE FOR ADT LESS THAN 10,000

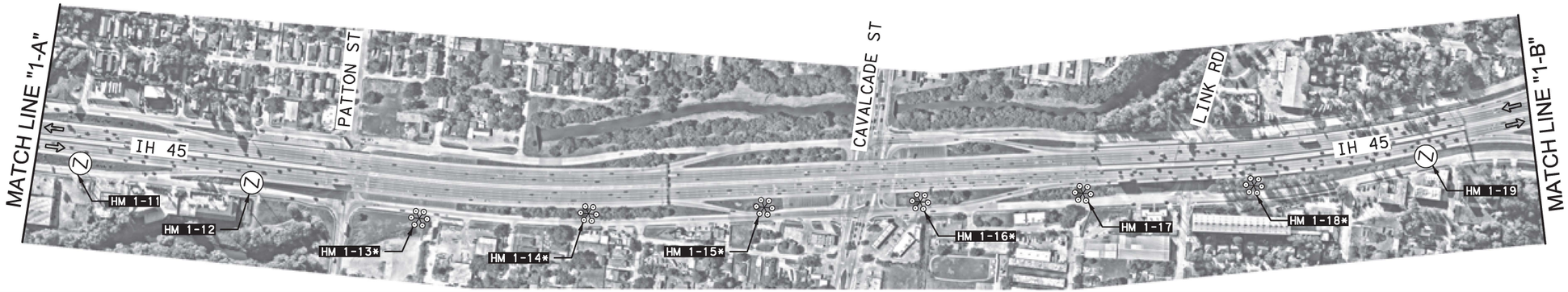
TCP(6-9)-14

FILE: tcp6-9.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT February 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	04	208, ETC	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY, ETC		34

DATE: 3/21/2024 8:09:38 PM
FILE: ...\STANDARDS\tcp6-9.dgn

LEGEND:
- DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Z-PAT HIGH MAST UPGRADE





SCALE: 1" = 500'
250 0 250

100% SUBMITTAL

STATE OF TEXAS
CHRISTINA M. SMITH
139122
LICENSED
PROFESSIONAL ENGINEER

PRINT DATE	REVISION DATE
3/21/2024	

NOTES:
1. ALL WORK MUST BE PERFORMED WITHIN TXDOT RIGHT OF WAY.
2. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE UTILITIES WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD; KNOWN OR UNKNOWN; PRIVATE OR PUBLIC (INCLUDING TXDOT OWNED).
3. CONTRACTOR TO VERIFY LUMINAIRE TYPE, PERFORMANCE, PHOTOMETRIC DATA, & ORIENTATION PRIOR TO REPLACEMENT.
4. THE COST OF REMOVING, SALVAGING, DISASSEMBLING, AND STOCKPILING EXISTING LUMINAIRES; FURNISHING AND INSTALLING NEW LUMINAIRES, CONNECTIONS, CONDUCTORS, AND CONDUIT ON THE RING; REWIRING CIRCUITS ON THE RING; REPLACING DAMAGED COMPONENTS; DISPOSAL OF UNSALVAGEABLE MATERIALS; CONDUCTING SYSTEM PERFORMANCE TESTING; AND MATERIALS, EQUIPMENT, LABOR, TOOLS, AND INCIDENTALS IS SUBSIDIARY TO ITEM 6000.
5. CONTRACTOR TO FOLLOW STATE AND LOCAL ENVIRONMENTAL REGULATIONS FOR FIXTURE DISPOSAL.
6. ALL ELECTRICAL WORK SHALL MEET THE NATIONAL ELECTRIC CODE.
7. AERIAL AND SCALE FOR VISUAL REFERENCE ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION OR BIDDING. LUMINAIRE LOCATIONS ARE APPROXIMATE.

HM ID	LOCATION		LAMP DETAILS		HIGH MAST QUANTITIES ILLUMINATION MAINTENANCE 6000 RAISE LOWER RING	REPLACE HM LED LUM	HPS TO LED UPGRADE		AVIATION	Z-PATTERN
							REMOVE HM HPS FIXTURE	INSTALL HM LED FIXTURE	REPLACE FIX (LED)	CONVERT Z-PAT (LED)
	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6103) EA	(6160) EA	(6162) EA	(6161) EA	(6167) EA	(6171) EA
HM 1-1	29.7784	-95.3684	600	LED	1	6				
HM 1-2	29.7792	-95.3693	600	LED	1	6				
HM 1-3	29.7808	-95.3689	600	LED						1
HM 1-4	29.7830	-95.3682	600	LED						1
HM 1-5	29.7846	-95.3687	600	LED						1
HM 1-6	29.7862	-95.3697	600	LED						1
HM 1-7	29.7878	-95.3708	600	LED						1
HM 1-8	29.7894	-95.3714	600	LED						1
HM 1-9	29.7914	-95.3715	600	LED						1
HM 1-10	29.7932	-95.3714	600	LED						1
HM 1-11	29.7951	-95.3714	600	LED						1
HM 1-12	29.7971	-95.3715	600	LED						1
HM 1-13*	29.7990	-95.3713	600	LED	1	6			3	
HM 1-14*	29.8009	-95.3716	600	LED	1	6			3	
HM 1-15*	29.8028	-95.3720	600	LED	1	6			3	
HM 1-16*	29.8046	-95.3723	600	LED	1	6			3	
HM 1-17	29.8064	-95.3726	600	LED	1	6			3	
HM 1-18*	29.8083	-95.3730	600	LED	1	6			3	
HM 1-19	29.8101	-95.3737	600	LED						1
TOTAL (THIS SHEET ONLY)					8	48	0	0	18	11

*PREVIOUS Z-PATTERN ASSEMBLY, ADDITIONAL BRACKETS AND/OR MODIFICATIONS MAY BE REQUIRED.

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TBPE Registration No. F-1046

IH 45 ILLUMINATION

HIGHMAST ILLUMINATION LAYOUT

START PROJECT TO ML 1-B

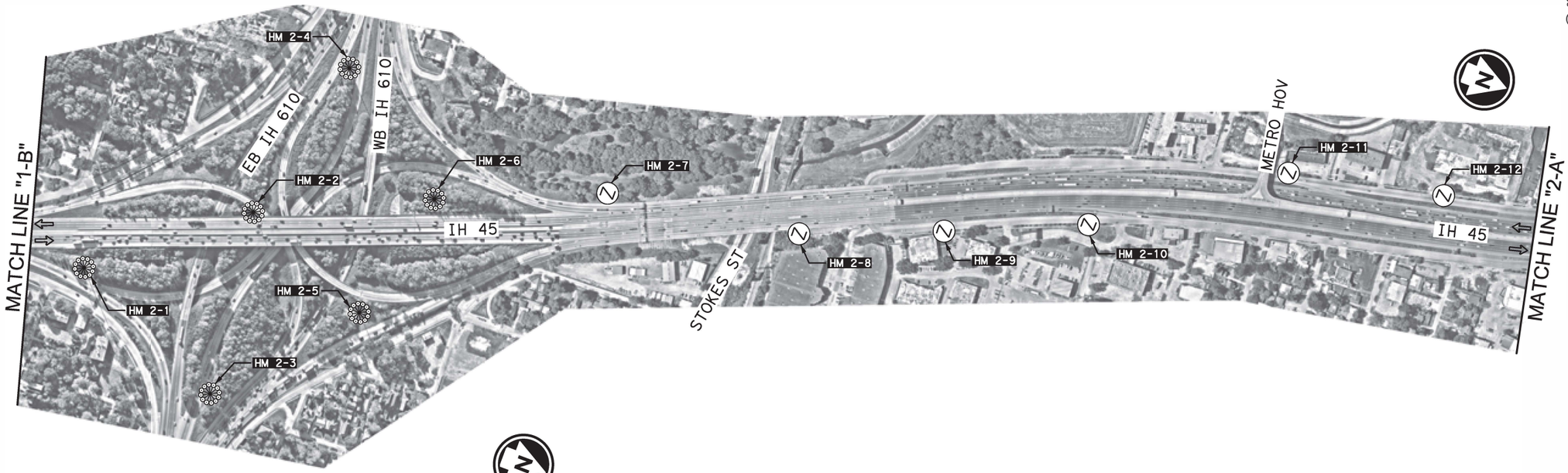
CSJ: 0500-03-652 SHEET 1 OF 4

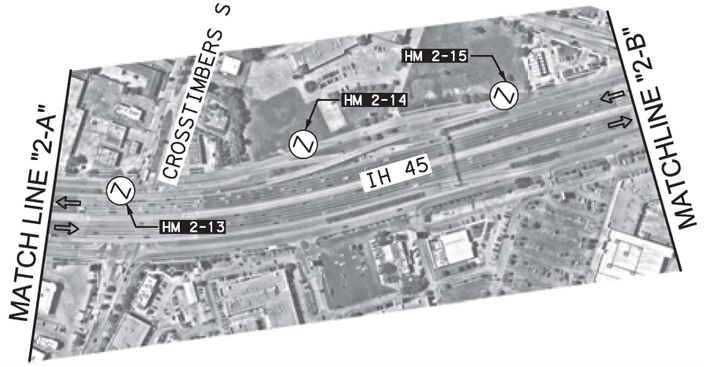
FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	35

STATE	DIST.	COUNTY
TEXAS	HOU	MONTGOMERY, ETC

CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208,ETC	IH 45

LEGEND:
- DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Z-PAT HIGH MAST UPGRADE





SCALE: 1" = 500'
250 0 250

100% SUBMITTAL

STATE OF TEXAS
CHRISTINA M. SMITH
139122
LICENSED PROFESSIONAL ENGINEER

PRINT DATE	REVISION DATE
3/21/2024	

NOTES:
1. ALL WORK MUST BE PERFORMED WITHIN TXDOT RIGHT OF WAY.
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3. CONTRACTOR TO VERIFY LUMINAIRE TYPE, PERFORMANCE, PHOTOMETRIC DATA, & ORIENTATION PRIOR TO REPLACEMENT.
4. THE COST OF REMOVING, SALVAGING, DISASSEMBLING, AND STOCKPILING EXISTING LUMINAIRES; FURNISHING AND INSTALLING NEW LUMINAIRES, CONNECTIONS, CONDUCTORS, AND CONDUIT ON THE RING; REWIRING CIRCUITS ON THE RING; REPLACING DAMAGED COMPONENTS; DISPOSAL OF UNSALVAGEABLE MATERIALS; CONDUCTING SYSTEM PERFORMANCE TESTING; AND MATERIALS, EQUIPMENT, LABOR, TOOLS, AND INCIDENTALS IS SUBSIDIARY TO ITEM 6000.
5. CONTRACTOR TO FOLLOW STATE AND LOCAL ENVIRONMENTAL REGULATIONS FOR FIXTURE DISPOSAL.
6. ALL ELECTRICAL WORK SHALL MEET THE NATIONAL ELECTRIC CODE.
7. AERIAL AND SCALE FOR VISUAL REFERENCE ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION OR BIDDING. LUMINAIRE LOCATIONS ARE APPROXIMATE.

HM ID	LOCATION		LAMP DETAILS		HIGH MAST QUANTITIES ILLUMINATION MAINTENANCE 6000					
					RAISE LOWER RING	REPLACE HM LED LUM	HPS TO LED UPGRADE: REMOVE HM HPS FIXTURE	HPS TO LED UPGRADE: INSTALL HM LED FIXTURE	AVIATION: REPLACE FIX (LED)	Z-PATTERN: CONVERT Z-PAT (LED)
	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6103)	(6160)	(6162)	(6161)	(6167)	(6171)
					EA	EA	EA	EA	EA	EA
HM 2-1	29.8119	-95.3742	600	LED	1		10	6	3	
HM 2-2	29.8136	-95.3756	600	LED	1		9	6	3	
HM 2-3	29.8139	-95.3729	600	LED	1		10	6	3	
HM 2-4	29.8141	-95.3779	600	LED	1		10	6	3	
HM 2-5	29.8152	-95.3748	600	LED	1		6	6	3	
HM 2-6	29.8156	-95.3766	600	LED	1		9	6	3	
HM 2-7	29.8175	-95.3774	600	LED						1
HM 2-8	29.8198	-95.3777	600	LED						1
HM 2-9	29.8214	-95.3784	600	LED						1
HM 2-10	29.8229	-95.3791	600	LED						1
HM 2-11	29.8250	-95.3806	600	LED						1
HM 2-12	29.8268	-95.3810	600	LED						1
HM 2-13	29.8285	-95.3813	600	LED						1
HM 2-14	29.8299	-95.3824	600	LED						1
HM 2-15	29.8315	-95.3835	600	LED						1
TOTAL (THIS SHEET ONLY)					6	0	54	36	18	9

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Texas Department of Transportation®

IH 45 ILLUMINATION

HIGHMAST ILLUMINATION LAYOUT

ML 1-B TO ML 2-B

CSJ: 0500-03-652 SHEET 2 OF 4

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	36

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY, ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208,ETC	IH 45

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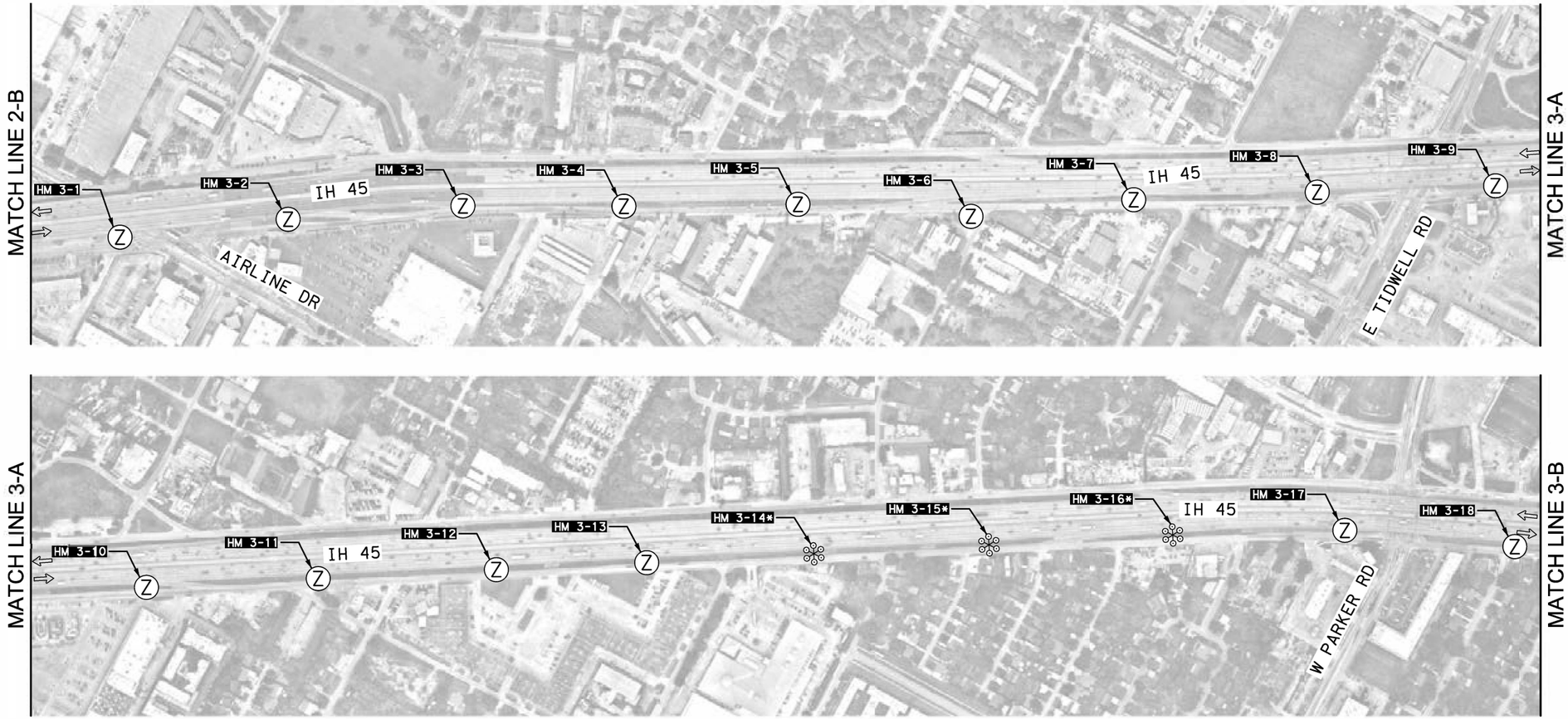

LEGEND:

- DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Z-PAT HIGH MAST UPGRADE

SCALE: 1" = 500'

250 0 250

NOTES:

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4. THE COST OF REMOVING, SALVAGING, DISASSEMBLING, AND STOCKPILING EXISTING LUMINAIRES; FURNISHING AND INSTALLING NEW LUMINAIRES, CONNECTIONS, AND INTERNAL CONDUCTORS; REPLACING DAMAGED COMPONENTS; DISPOSING OF UNSALVAGEABLE MATERIALS; AND MATERIALS, EQUIPMENT, LABOR, TOOLS, AND INCIDENTALS IS SUBSIDIARY TO ITEM 6000.
5. CONTRACTOR TO FOLLOW STATE AND LOCAL ENVIRONMENTAL REGULATIONS FOR FIXTURE DISPOSAL.
6. ALL ELECTRICAL WORK SHALL MEET THE NATIONAL ELECTRIC CODE.
7. AERIAL AND SCALE FOR VISUAL REFERENCE ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION OR BIDDING. LUMINAIRE LOCATIONS ARE APPROXIMATE.

					HIGH MAST QUANTITIES					
					ILLUMINATION MAINTENANCE 6000					
							HPS TO LED UPGRADE		AVIATION	Z-PATTERN
					RAISE LOWER RING	REPLACE HM LED LUM	REMOVE HM HPS FIXTURE	INSTALL HM LED FIXTURE	REPLACE FIX (LED)	CONVERT Z-PAT (LED)
HM ID	LOCATION		LAMP DETAILS		(6103)	(6160)	(6162)	(6161)	(6167)	(6171)
	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA	EA	EA
HM 3-1	29.833396	-95.384180	600	LED						1
HM 3-2	29.834914	-95.385390	600	LED						1
HM 3-3	29.836517	-95.386594	600	LED						1
HM 3-4	29.838061	-95.387562	600	LED						1
HM 3-5	29.839719	-95.388635	600	LED						1
HM 3-6	29.841440	-95.386546	600	LED						1
HM 3-7	29.842912	-95.390712	600	LED						1
HM 3-8	29.844635	-95.391903	600	LED						1
HM 3-9	29.846310	-95.393052	600	LED						1
HM 3-10	29.847805	-95.394100	600	LED						1
HM 3-11	29.849404	-95.395232	600	LED						1
HM 3-12	29.851062	-95.396406	600	LED						1
HM 3-13	29.852464	-95.397394	600	LED						1
HM 3-14*	29.854017	-95.398498	600	LED	1	6			3	
HM 3-15*	29.855655	-95.399655	600	LED	1	5		1	3	
HM 3-16*	29.857359	-95.400871	600	LED	1	3		3	3	
HM 3-17	29.858992	-95.401965	600	LED						1
HM 3-18	29.860696	-95.402808	600	LED						1
				TOTALS	3	14		4	9	15

* PREVIOUS Z-PATTERN ASSEMBLY, ADDITIONAL BRACKETS AND/OR MODIFICATION MAY BE REQUIRED

STATE OF TEXAS
LAUREN P. SCHINDLER
150500
LICENSED PROFESSIONAL ENGINEER
3/15/2024

PRINT DATE	REVISION DATE
3/15/2024	

Kimley»Horn F-928
11700 Katy Freeway, Suite 800
Houston, Texas 77079
Tel. No. (281) 597-9300
Fax No. (281) 597-8032

IH 45 ILLUMINATION

HIGHMAST ILLUMINATION LAYOUT

ML 2-B TO 3-B

CSJ: 0500-03-652 SHEET 3 OF 4

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		37
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

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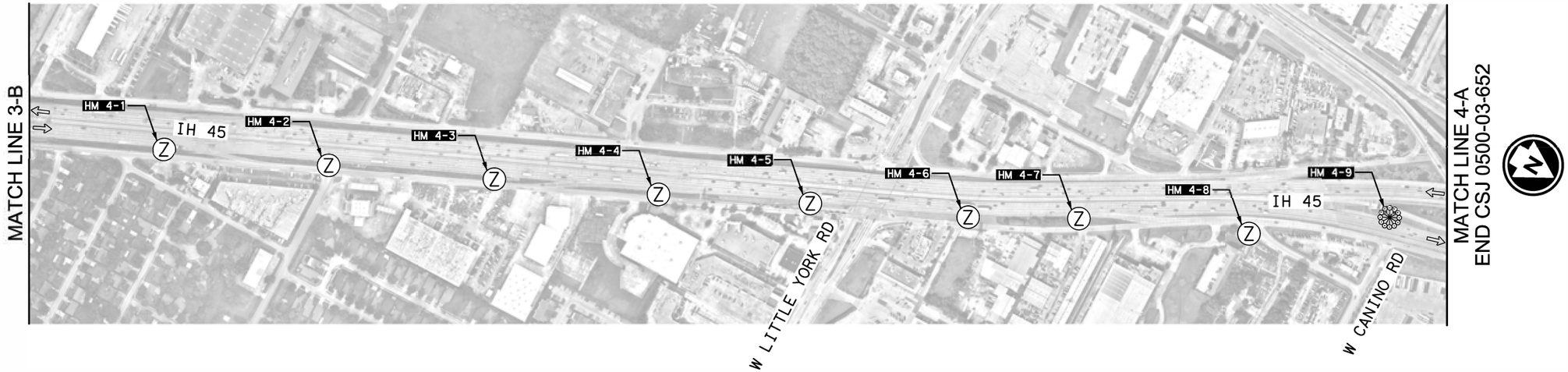

LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Ⓩ Z-PAT HIGH MAST UPGRADE

SCALE: 1" = 500'

250 0 250

NOTES:

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HIGH MAST QUANTITIES

ILLUMINATION MAINTENANCE 6000

HM ID	LOCATION		LAMP DETAILS		RAISE LOWER RING (6103)	REPLACE HM LED LUM (6160)	HPS TO LED UPGRADE: REMOVE HM HPS FIXTURE (6162)	HPS TO LED UPGRADE: INSTALL HM LED FIXTURE (6161)	AVIATION: REPLACE FIX (LED) (6167)	Z-PATTERN: CONVERT Z-PAT (LED) (6171)
	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA	EA	EA
HM 4-1	29.862380	-95.403695	600	LED						1
HM 4-2	29.864153	-95.404569	600	LED						1
HM 4-3	29.865918	-95.405472	600	LED						1
HM 4-4	29.867672	-95.406350	600	LED						1
HM 4-5	29.869289	-95.407223	600	LED						1
HM 4-6	29.870966	-95.408082	600	LED						1
HM 4-7	29.872099	-95.408755	600	LED						1
HM 4-8	29.873917	-95.409696	600	LED						1
HM 4-9	29.875263	-95.410787	600	LED	1		6	6	3	
				TOTALS	1		6	6	3	8

STATE OF TEXAS
LAUREN P. SCHINDLER
150500
LICENSED PROFESSIONAL ENGINEER
Lauren Schindler
3/15/2024

PRINT DATE	REVISION DATE
3/15/2024	

Kimley»Horn F-928
11700 Katy Freeway, Suite 800
Houston, Texas 77079
Tel. No. (281) 597-9300
Fax No. (281) 597-9032

IH 45 ILLUMINATION

HIGHMAST ILLUMINATION LAYOUT

ML 3-B TO END CSJ 0500-03-652

CSJ: 0500-03-652 SHEET 4 OF 4

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	38

STATE	DIST.	COUNTY
TEXAS	HOU	MONTGOMERY,ETC

CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

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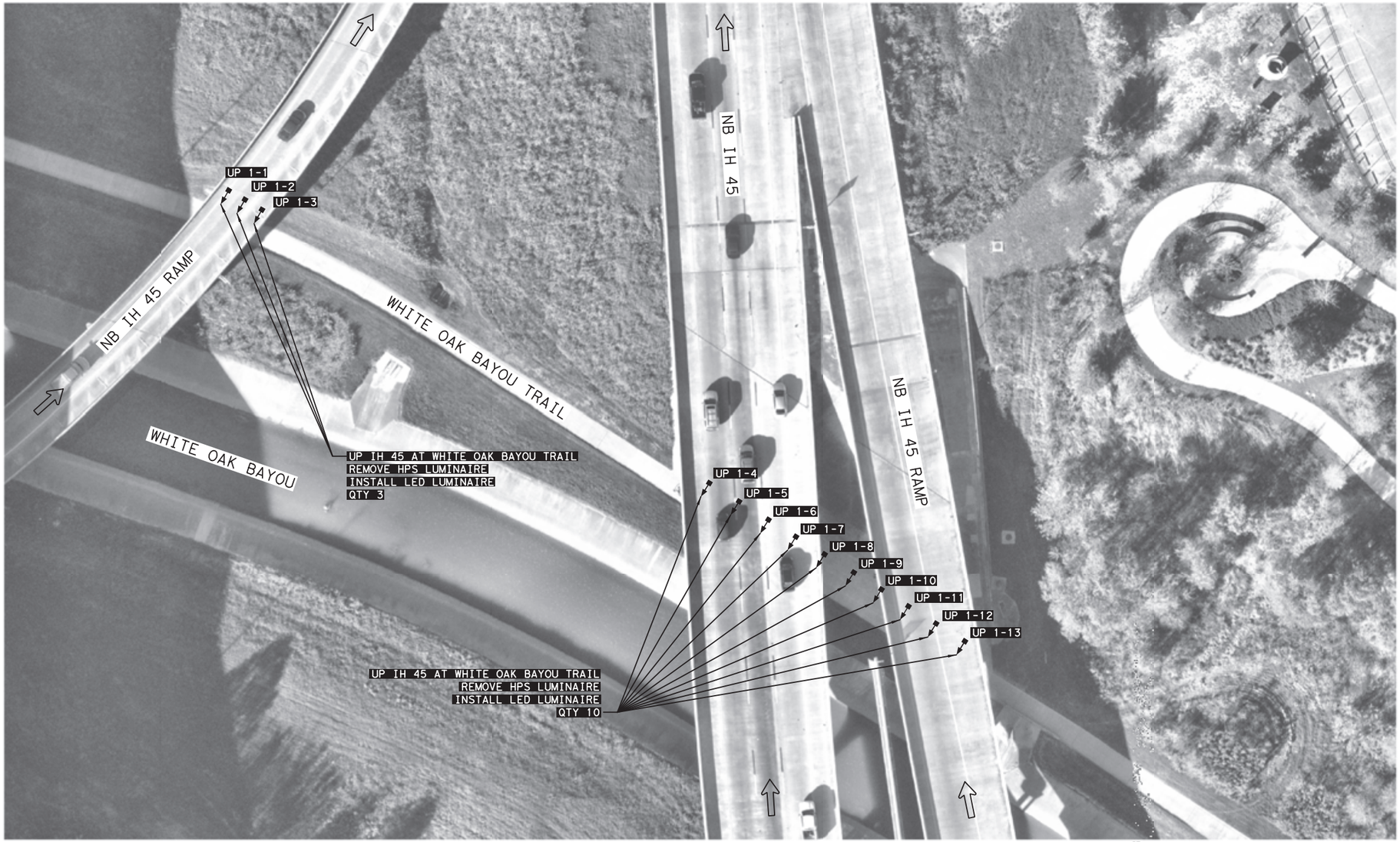

LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE

SCALE: 1" = 50'

25 0 25

100% SUBMITTAL

STATE OF TEXAS
CHRISTINA M. SMITH
139122
LICENSED
PROFESSIONAL ENGINEER

PRINT DATE	REVISION DATE
3/21/2024	

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						UNDERPASS QUANTITIES			
						ILLUMINATION MAINTENANCE 6000			
UP ID		UP LUM LOC*		LAMP DETAILS		REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)	REPLACE WALL PACK LUM
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)	(6076)
						EA	EA	EA	EA
UP 1-1	UP 1-13	29.77803	-95.36884	250	LED	13	13	0	0
TOTAL (THIS SHEET ONLY)						13	13	0	0

* REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

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TBPE Registration No. F-1046

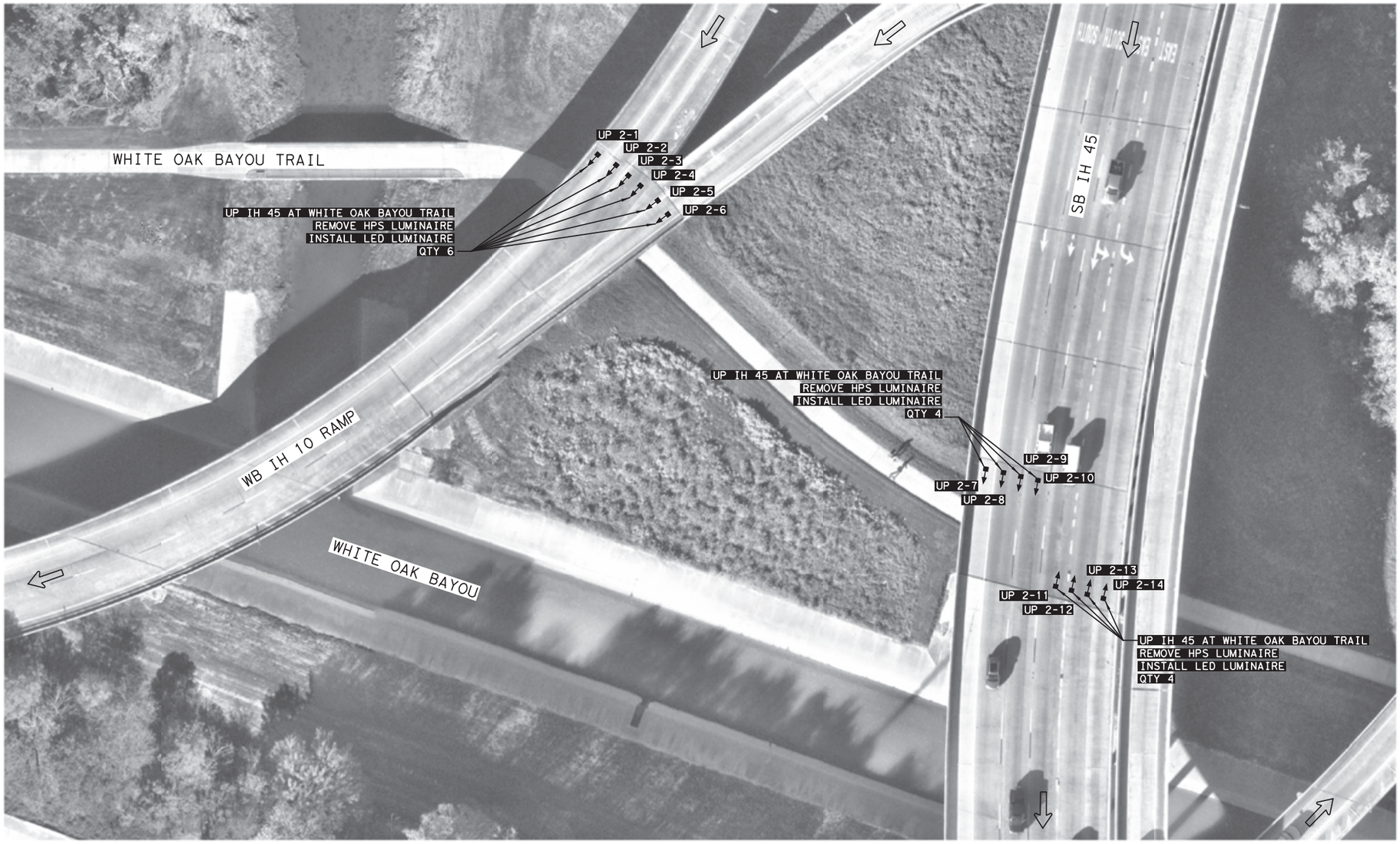
IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

WHITE OAK BAYOU TRAIL BRIDGE

CSJ: 0500-03-652 SHEET 1 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		39
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY, ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45



LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- ◄■ HPS UNDERPASS UPGRADE
- ●■ LED UNDERPASS UPGRADE

SCALE: 1" = 50'

25 0 25

100% SUBMITTAL

STATE OF TEXAS
CHRISTINA M. SMITH
139122
LICENSED PROFESSIONAL ENGINEER

PRINT DATE	REVISION DATE
3/21/2024	

NOTES:

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QUANTITIES ILLUMINATION MAINTENANCE 6000			
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)	REPLACE WALL PACK LUM
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)	(6076)
UP 2-1	UP 2-14	29.77868	-95.36999	250	LED	EA	EA	EA	EA
TOTAL (THIS SHEET ONLY)						14	14	0	0

* REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

BGE, Inc.
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TBPE Registration No. F-1046

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

WHITE OAK BAYOU TRAIL BRIDGE

CSJ: 0500-03-652 SHEET 2 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		40
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY, ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

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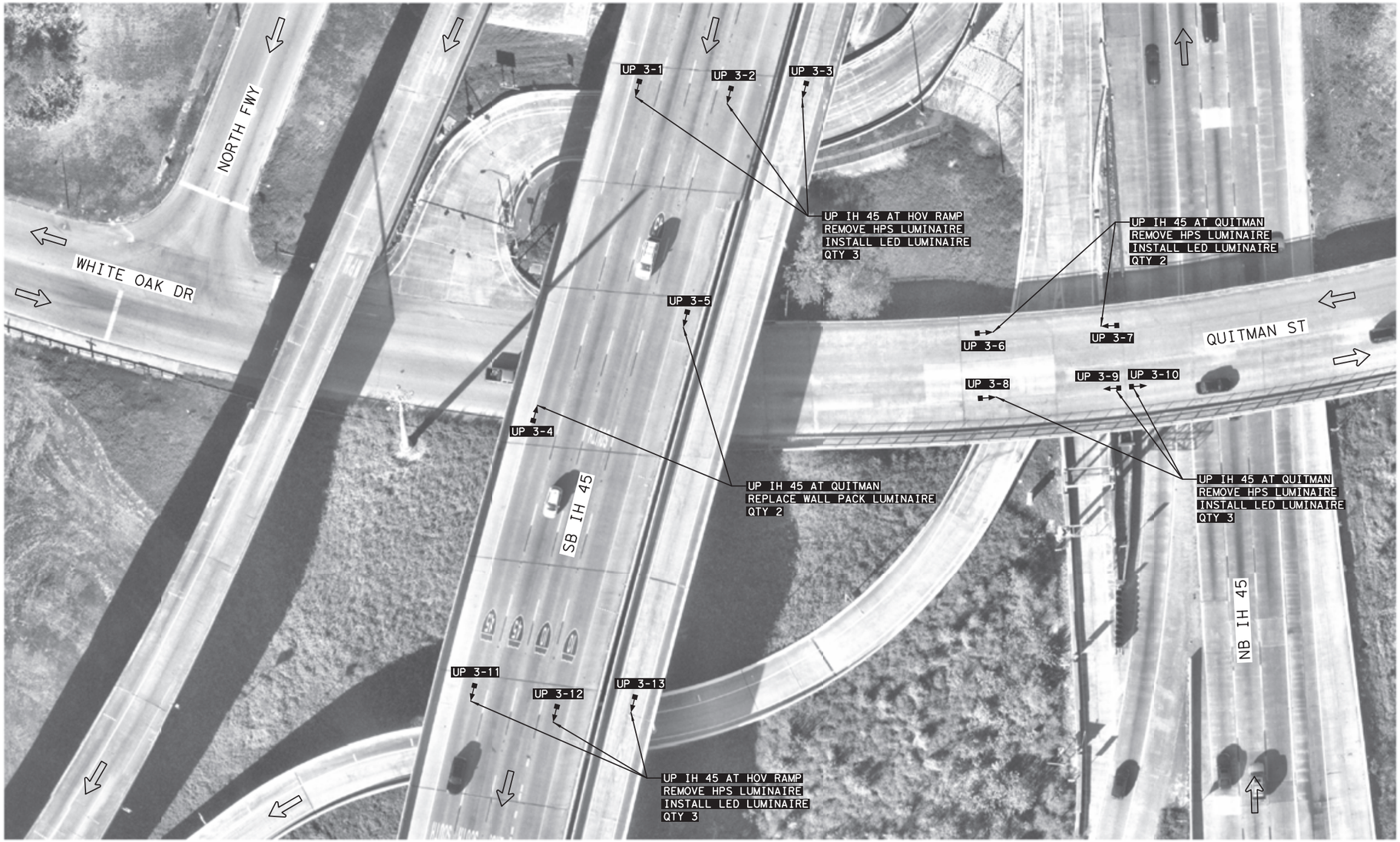

LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- HPS UNDERPASS UPGRADE
- LED UNDERPASS UPGRADE

SCALE: 1" = 50'

25 0 25

100% SUBMITTAL

STATE OF TEXAS
CHRISTINA M. SMITH
139122
LICENSED
PROFESSIONAL ENGINEER

PRINT DATE	REVISION DATE
3/21/2024	

NOTES:

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						UNDERPASS QUANTITIES ILLUMINATION MAINTENANCE 6000			
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)	REPLACE WALL PACK LUM
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)	(6076)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA
UP 3-1	UP 3-13	29.77969	-95.36894	250	LED	11	11	0	2
TOTAL (THIS SHEET ONLY)						11	11	0	2

* REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

BGE, Inc.
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TBPE Registration No. F-1046

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

QUITMAN ST BRIDGE

CSJ: 0500-03-652 SHEET 3 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	41

STATE	DIST.	COUNTY
TEXAS	HOU	MONTGOMERY, ETC

CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

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LEGEND:
- ⇦ DIRECTION OF TRAFFIC FLOW
- ◄■ HPS UNDERPASS UPGRADE
- ●■ LED UNDERPASS UPGRADE

SCALE: 1" = 50'
25 0 25

100% SUBMITTAL

STATE OF TEXAS
CHRISTINA M. SMITH
139122
LICENSED
PROFESSIONAL ENGINEER

PRINT DATE	REVISION DATE
3/21/2024	

NOTES:

1. ALL WORK MUST BE PERFORMED WITHIN TXDOT RIGHT OF WAY.
2. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE UTILITIES WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD; KNOWN OR UNKNOWN; PRIVATE OR PUBLIC (INCLUDING TXDOT OWNED).
3. CONTRACTOR TO VERIFY LUMINAIRE TYPE, PERFORMANCE, PHOTOMETRIC DATA, & ORIENTATION PRIOR TO REPLACEMENT.
4. THE COST OF REMOVING, SALVAGING, DISASSEMBLING, AND STOCKPILING EXISTING LUMINAIRES; FURNISHING AND INSTALLING NEW LUMINAIRES, CONNECTIONS, AND INTERNAL CONDUCTORS; REPLACING DAMAGED COMPONENTS; DISPOSING OF UNSALVAGEABLE MATERIALS; AND MATERIALS, EQUIPMENT, LABOR, TOOLS, AND INCIDENTALS IS SUBSIDIARY TO ITEM 6000.
5. CONTRACTOR TO FOLLOW STATE AND LOCAL ENVIRONMENTAL REGULATIONS FOR FIXTURE DISPOSAL.
6. ALL ELECTRICAL WORK SHALL MEET THE NATIONAL ELECTRIC CODE.
7. AERIAL AND SCALE FOR VISUAL REFERENCE ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION OR BIDDING. LUMINAIRE LOCATIONS ARE APPROXIMATE.

UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QUANTITIES ILLUMINATION MAINTENANCE 6000			
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)	REPLACE WALL PACK LUM
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)	(6076)
UP 4-1	UP 4-3	29.78542	-95.36982	250	LED	EA	EA	EA	EA
TOTAL (THIS SHEET ONLY)						2	2	0	1
						2	2	0	1

* REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

BGE, Inc.
10777 Westheimer, Suite 400, Houston, TX 77042
Tel: 281-558-8700 • www.bgeinc.com
TBPE Registration No. F-1046

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

NORTH ST BRIDGE

CSJ: 0500-03-652 SHEET 4 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		42
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY, ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 3:30:17 PM
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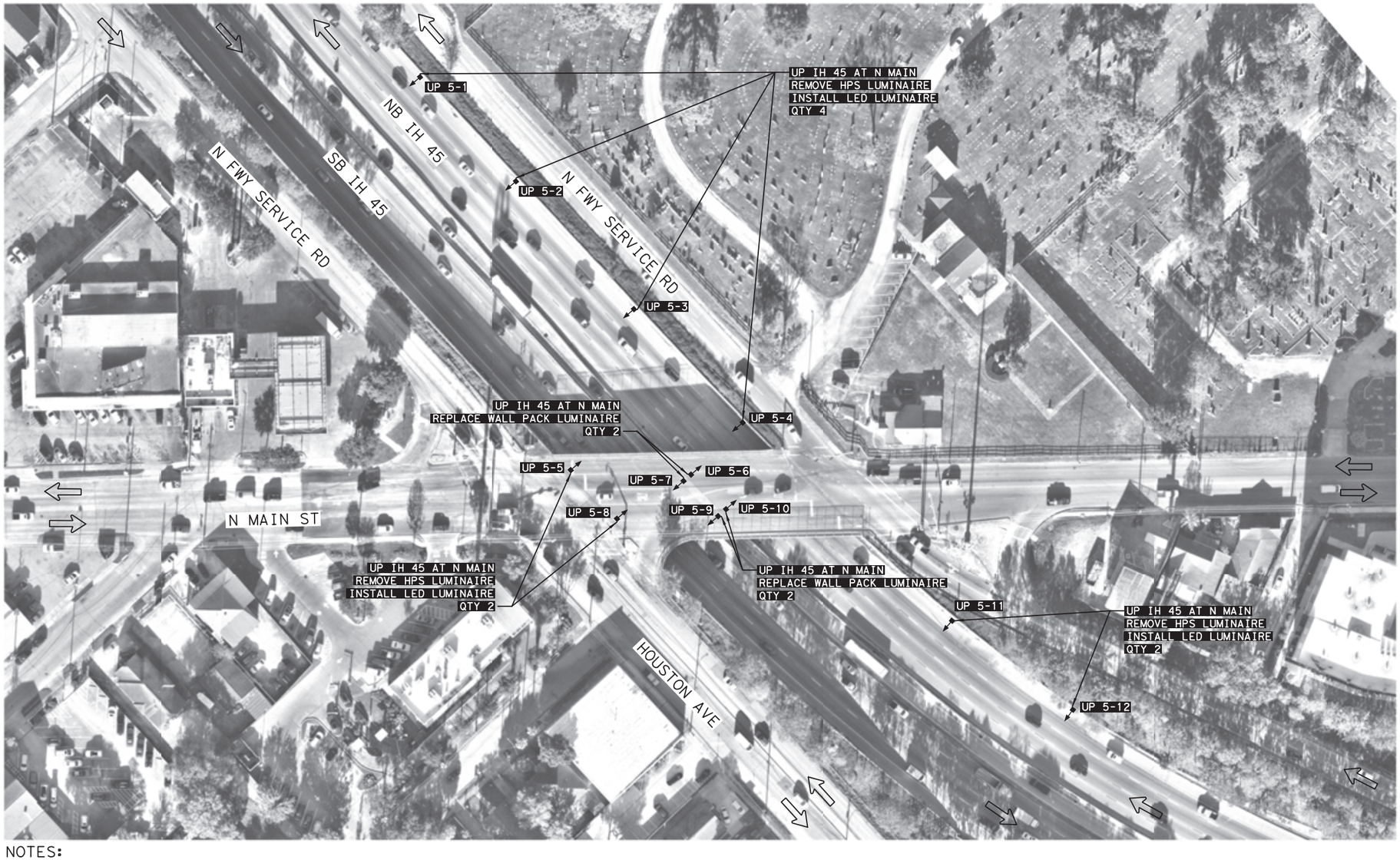

LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- ◄■ HPS UNDERPASS UPGRADE
- ●■ LED UNDERPASS UPGRADE

SCALE: 1" = 100'

50 0 50

100% SUBMITTAL

STATE OF TEXAS
CHRISTINA M. SMITH
139122
LICENSED
PROFESSIONAL ENGINEER

PRINT DATE	REVISION DATE
3/21/2024	

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7. AERIAL AND SCALE FOR VISUAL REFERENCE ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION OR BIDDING. LUMINAIRE LOCATIONS ARE APPROXIMATE.

						UNDERPASS QUANTITIES			
						ILLUMINATION MAINTENANCE 6000			
UP ID		UP LUM LOC*		LAMP DETAILS		REMOVE UP LUM (HPS) (6028)	INSTALL UP LUM (LED) (6030)	REPLACE UP LUM (LED) (6032)	REPLACE WALL PACK LUM (6076)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA
UP 5-1	UP 5-12	29.79012	-95.37196	250	LED	8	8	0	4
TOTAL (THIS SHEET ONLY)						8	8	0	4

* REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

N MAIN ST BRIDGE

CSJ: 0500-03-652 SHEET 5 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	43

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY, ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

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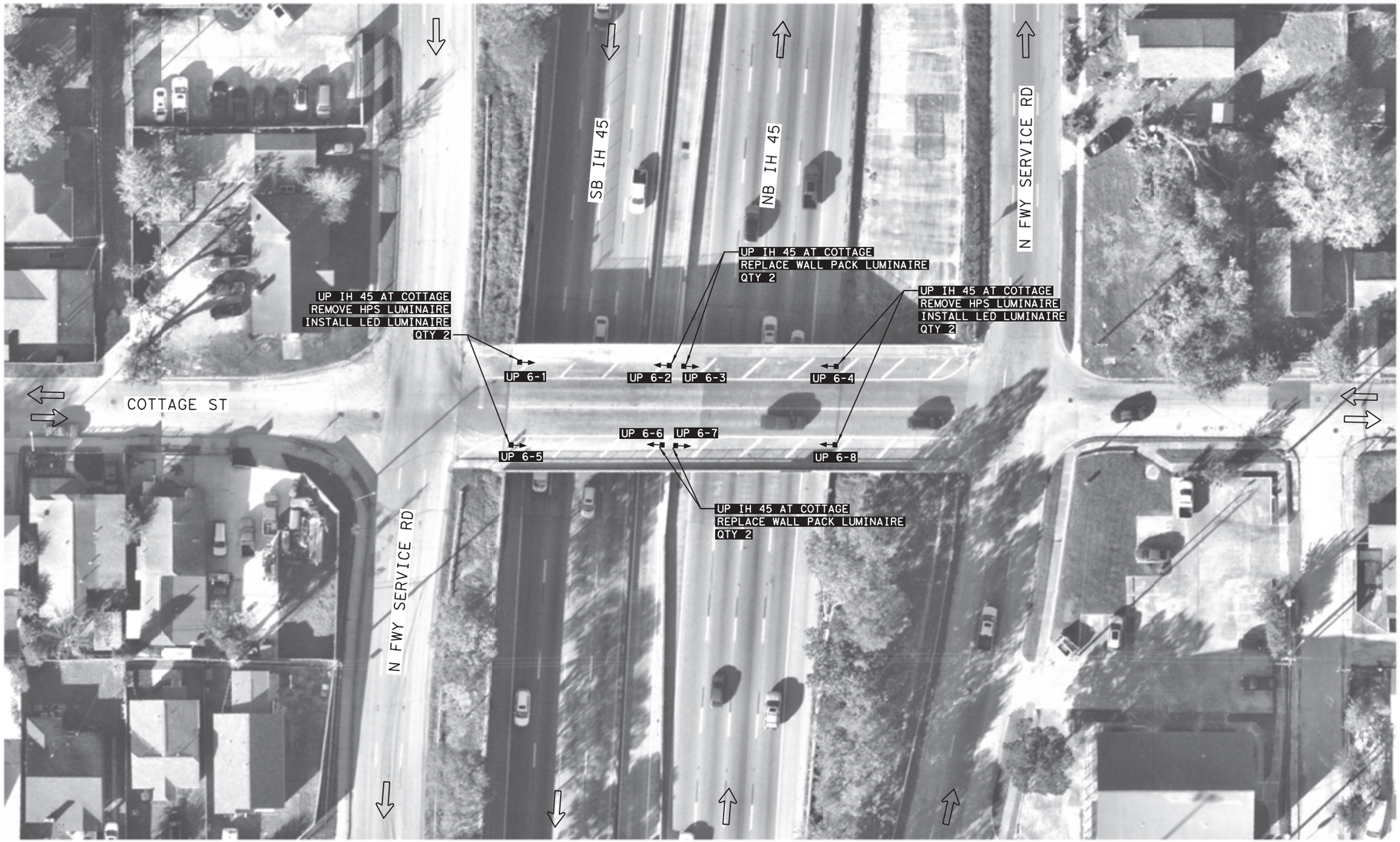

LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- ◄■ HPS UNDERPASS UPGRADE
- ●■ LED UNDERPASS UPGRADE

SCALE: 1" = 50'

25 0 25

100% SUBMITTAL

STATE OF TEXAS
CHRISTINA M. SMITH
139122
LICENSED
PROFESSIONAL ENGINEER

PRINT DATE	REVISION DATE
3/21/2024	

NOTES:

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QUANTITIES ILLUMINATION MAINTENANCE 6000			
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)	REPLACE WALL PACK LUM
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028) EA	(6030) EA	(6032) EA	(6076) EA
UP 6-1	UP 6-8	29.79225	-95.37185	250	LED	4	4	0	4
TOTAL (THIS SHEET ONLY)						4	4	0	4

* REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

BGE, Inc.
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Tel: 281-558-8700 • www.bgeinc.com
TBPE Registration No. F-1046

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

COTTAGE ST BRIDGE

CSJ: 0500-03-652 SHEET 6 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		44
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY, ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

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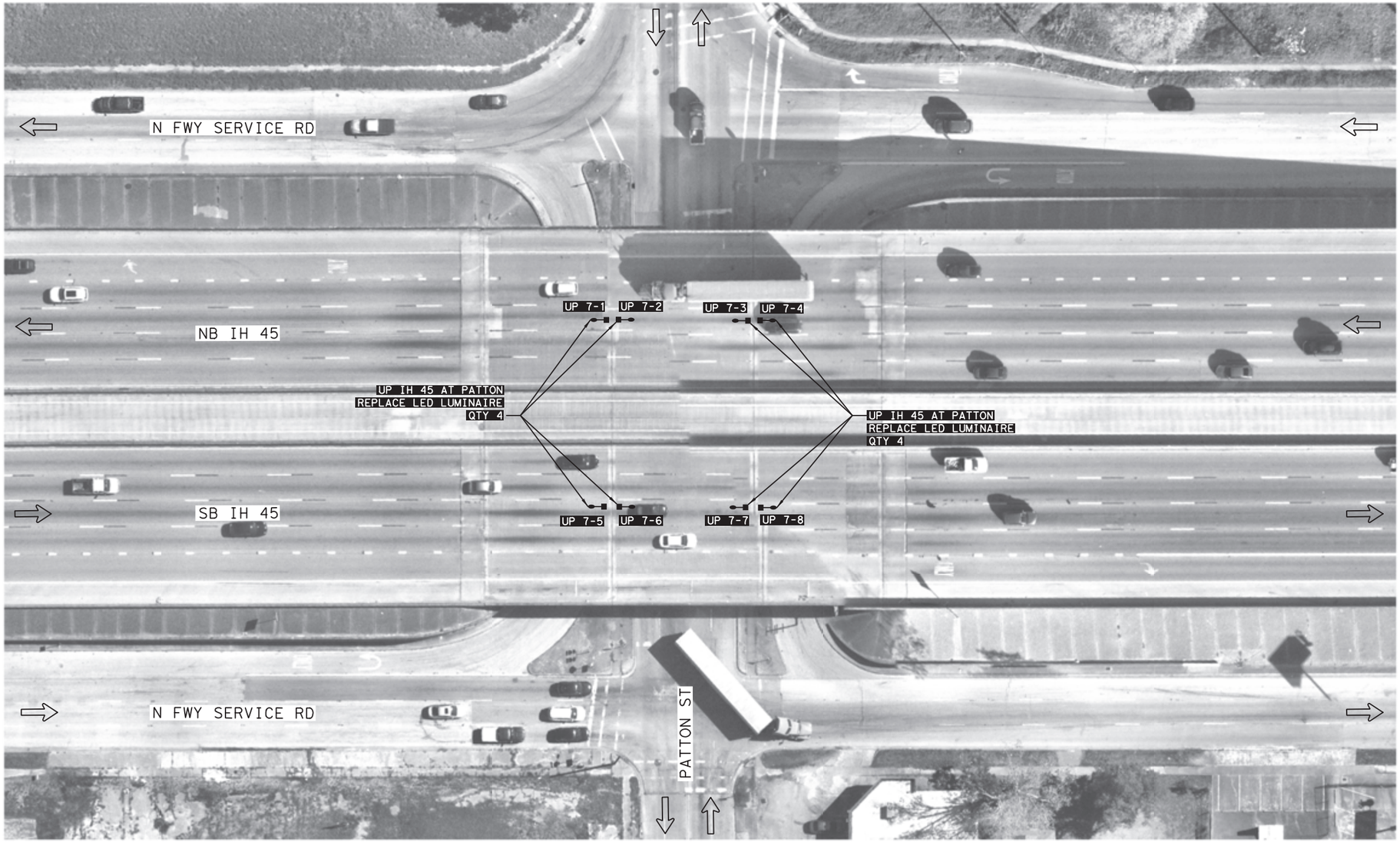
LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



NOTES:

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						UNDERPASS QUANTITIES ILLUMINATION MAINTENANCE 6000			
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)	REPLACE WALL PACK LUM
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)	(6076)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA
UP 7-1	UP 7-8	29.79823	-95.37189	250	LED	0	0	8	0
TOTAL (THIS SHEET ONLY)						0	0	8	0

* REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

SCALE: 1" = 50'

25 0 25

100% SUBMITTAL

STATE OF TEXAS
CHRISTINA M. SMITH
139122
LICENSED
PROFESSIONAL ENGINEER

PRINT DATE	REVISION DATE
3/21/2024	

BGE, Inc.
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TBPE Registration No. F-1046

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

PATTON ST BRIDGE

CSJ: 0500-03-652 SHEET 7 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		45
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY, ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

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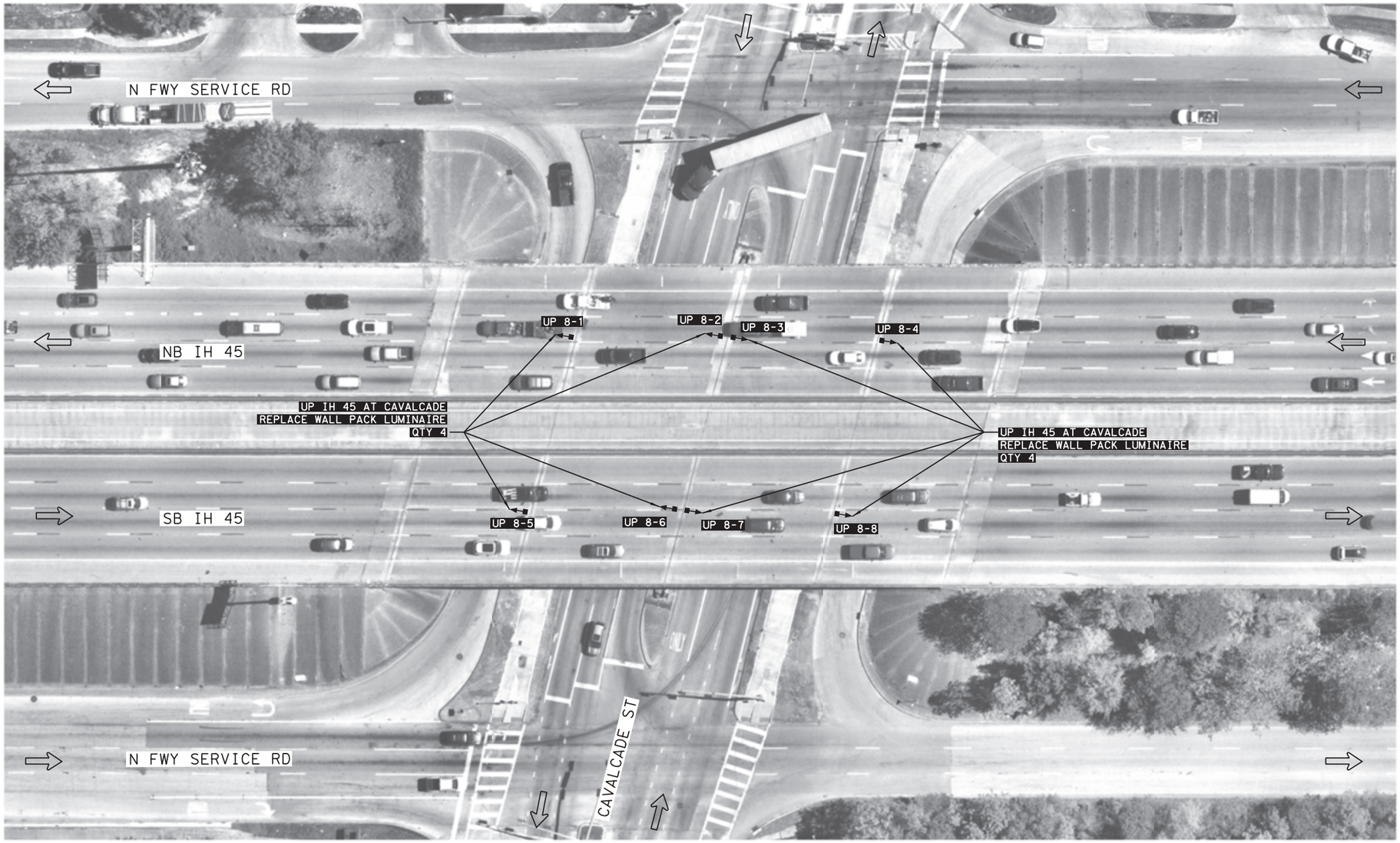
LEGEND:
⇦ DIRECTION OF TRAFFIC FLOW
HPS UNDERPASS UPGRADE
LED UNDERPASS UPGRADE



SCALE: 1" = 50'
25 0 25

100% SUBMITTAL

STATE OF TEXAS
CHRISTINA M. SMITH
139122
LICENSED
PROFESSIONAL ENGINEER

PRINT DATE	REVISION DATE
3/21/2024	

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QUANTITIES ILLUMINATION MAINTENANCE 6000			
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)	REPLACE WALL PACK LUM
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)	(6076)
						EA	EA	EA	EA
UP 8-1	UP 8-8	29.80408	-95.37266	250	LED	0	0	0	8
TOTAL (THIS SHEET ONLY)						0	0	0	8

* REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

BGE, Inc.
10777 Westheimer, Suite 400, Houston, TX 77042
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TBPE Registration No. F-1046

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

CAVALCADE ST BRIDGE

CSJ: 0500-03-652 SHEET 8 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	46

STATE	DIST.	COUNTY
TEXAS	HOU	MONTGOMERY, ETC

CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

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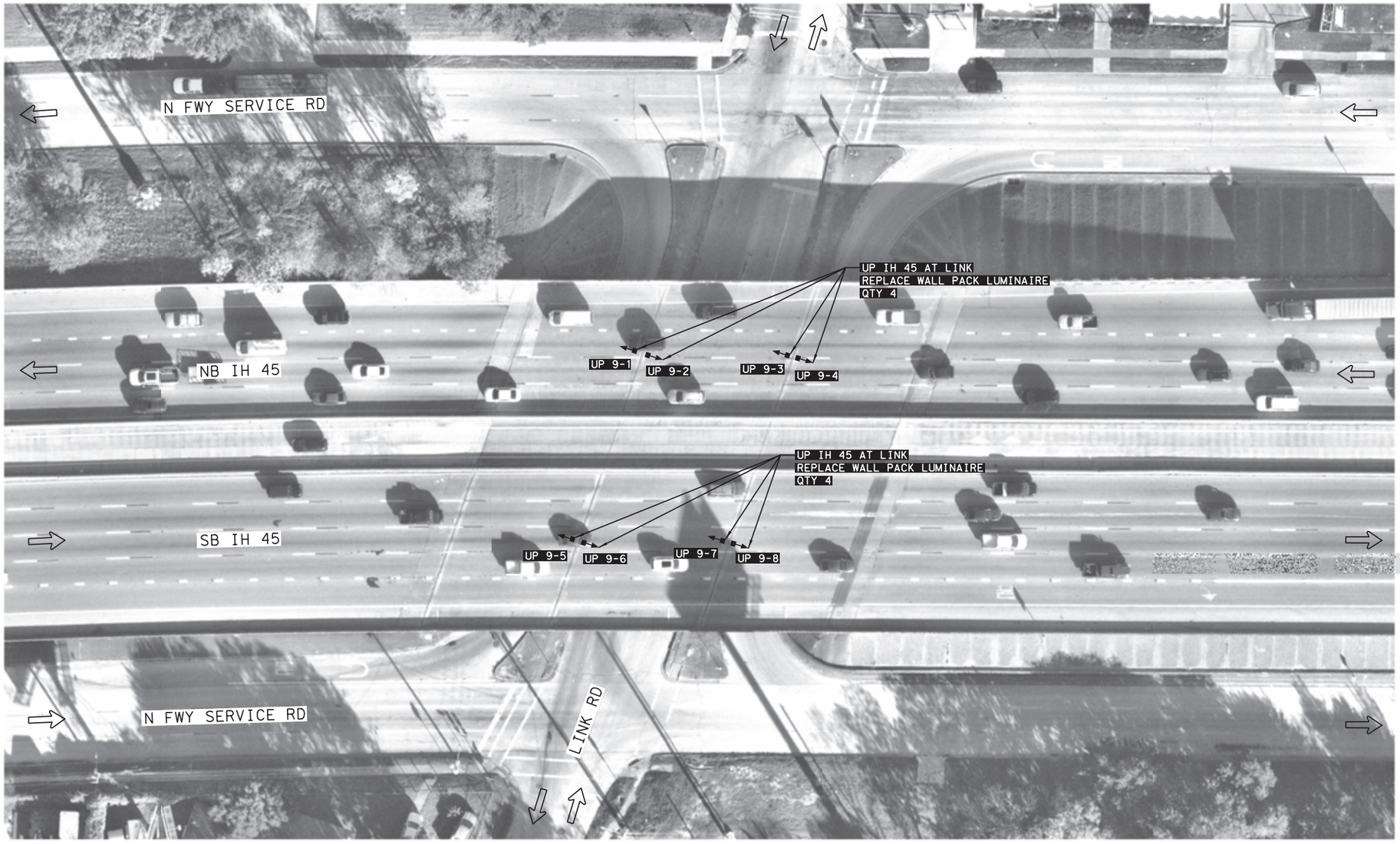

LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- ◄■ HPS UNDERPASS UPGRADE
- ●■ LED UNDERPASS UPGRADE

SCALE: 1" = 50'

25 0 25

100% SUBMITTAL

STATE OF TEXAS
CHRISTINA M. SMITH
139122
LICENSED PROFESSIONAL ENGINEER

PRINT DATE	REVISION DATE
3/21/2024	

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						UNDERPASS QUANTITIES ILLUMINATION MAINTENANCE 6000			
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)	REPLACE WALL PACK LUM
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)	(6076)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA
UP 9-1	UP 9-8	29.80768	-95.37338	250	LED	0	0	0	8
TOTAL (THIS SHEET ONLY)						0	0	0	8

* REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

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TBPE Registration No. F-1046

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

LINK RD BRIDGE

CSJ: 0500-03-652 SHEET 9 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		47
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY, ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

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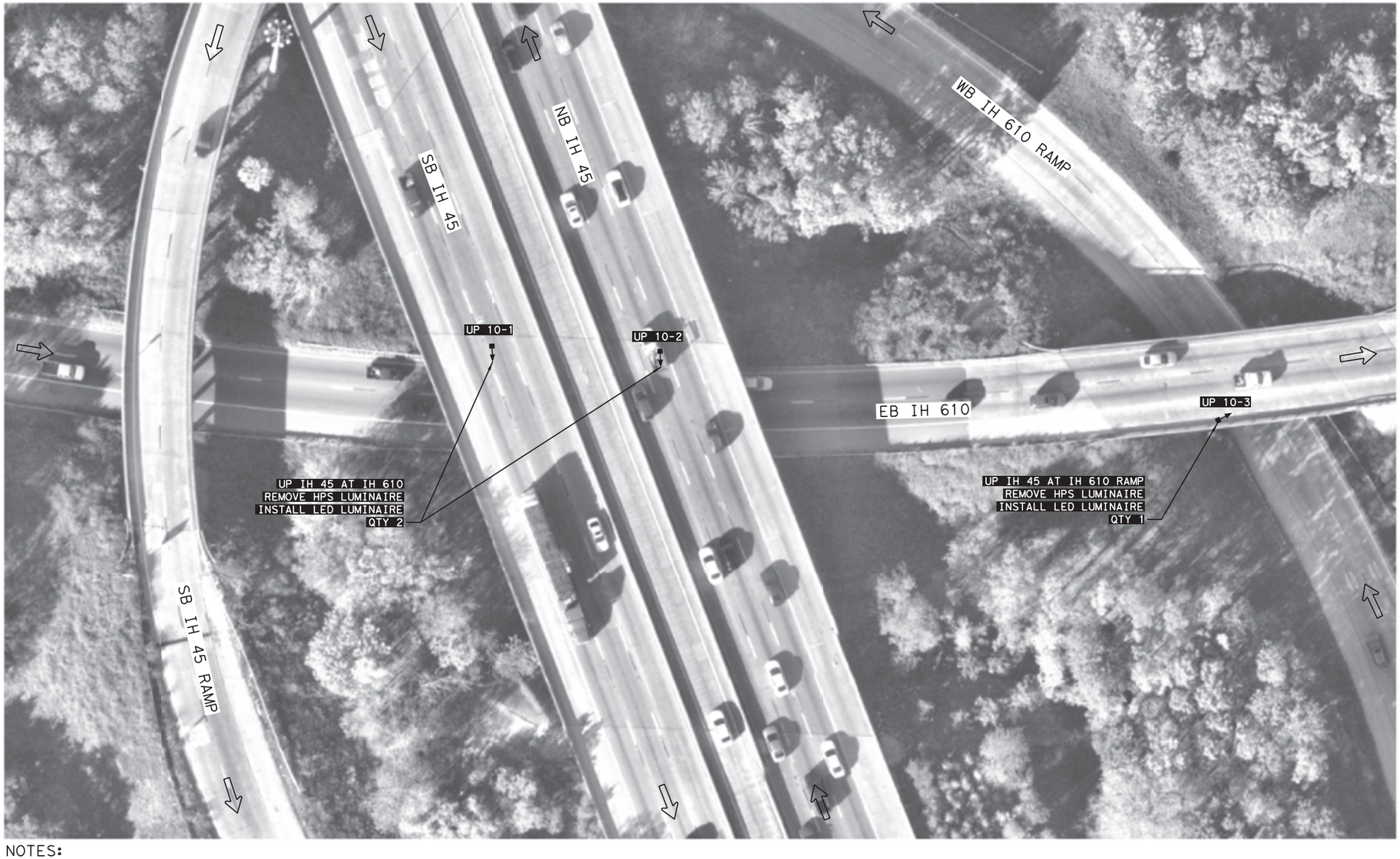
LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



SCALE: 1" = 50'

25 0 25

100% SUBMITTAL

STATE OF TEXAS
CHRISTINA M. SMITH
139122
LICENSED PROFESSIONAL ENGINEER

PRINT DATE	REVISION DATE
3/21/2024	

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QUANTITIES ILLUMINATION MAINTENANCE 6000			
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)	REPLACE WALL PACK LUM
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)	(6076)
						EA	EA	EA	EA
UP 10-1	UP 10-3	29.8133	-95.37532	250	LED	3	3	0	0
TOTAL (THIS SHEET ONLY)						3	3	0	0

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IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

EB IH 610 BRIDGE

CSJ: 0500-03-652 SHEET 10 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		48
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY, ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 3:31:20 PM

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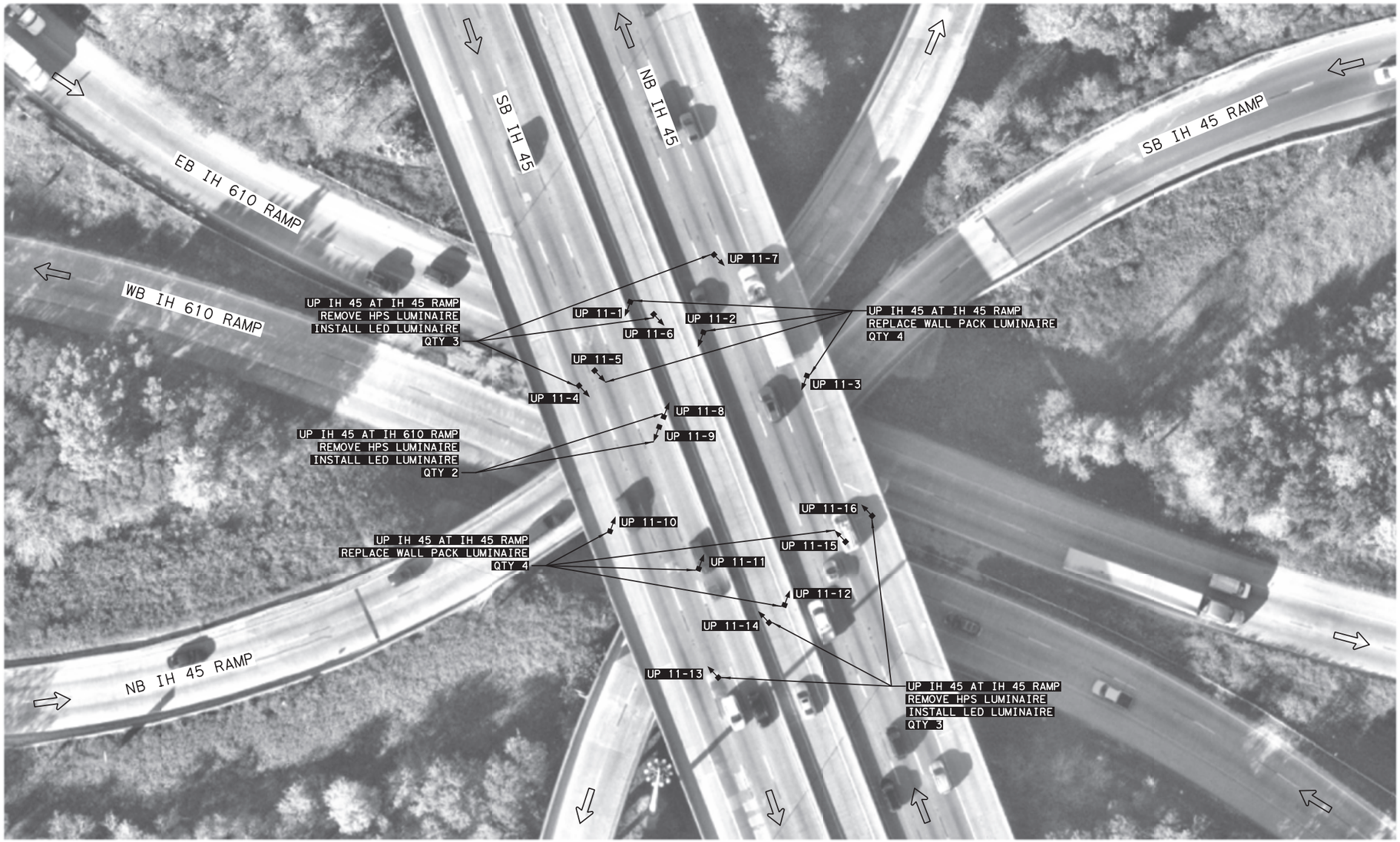
LEGEND:
- ⇦ DIRECTION OF TRAFFIC FLOW
- ◄■ HPS UNDERPASS UPGRADE
- ●■ LED UNDERPASS UPGRADE



SCALE: 1" = 50'
25 0 25

100% SUBMITTAL

STATE OF TEXAS
CHRISTINA M. SMITH
139122
LICENSED
PROFESSIONAL ENGINEER

PRINT DATE	REVISION DATE
3/21/2024	

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						UNDERPASS QUANTITIES ILLUMINATION MAINTENANCE 6000			
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)	REPLACE WALL PACK LUM
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)	(6076)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA
UP 11-1	UP 11-16	29.81426	-95.3757	250	LED	8	8	0	8
TOTAL (THIS SHEET ONLY)						8	8	0	8

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IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

IH 610 INTERCHANGE BRIDGE

CSJ: 0500-03-652 SHEET 11 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		49
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY, ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 3:31:29 PM

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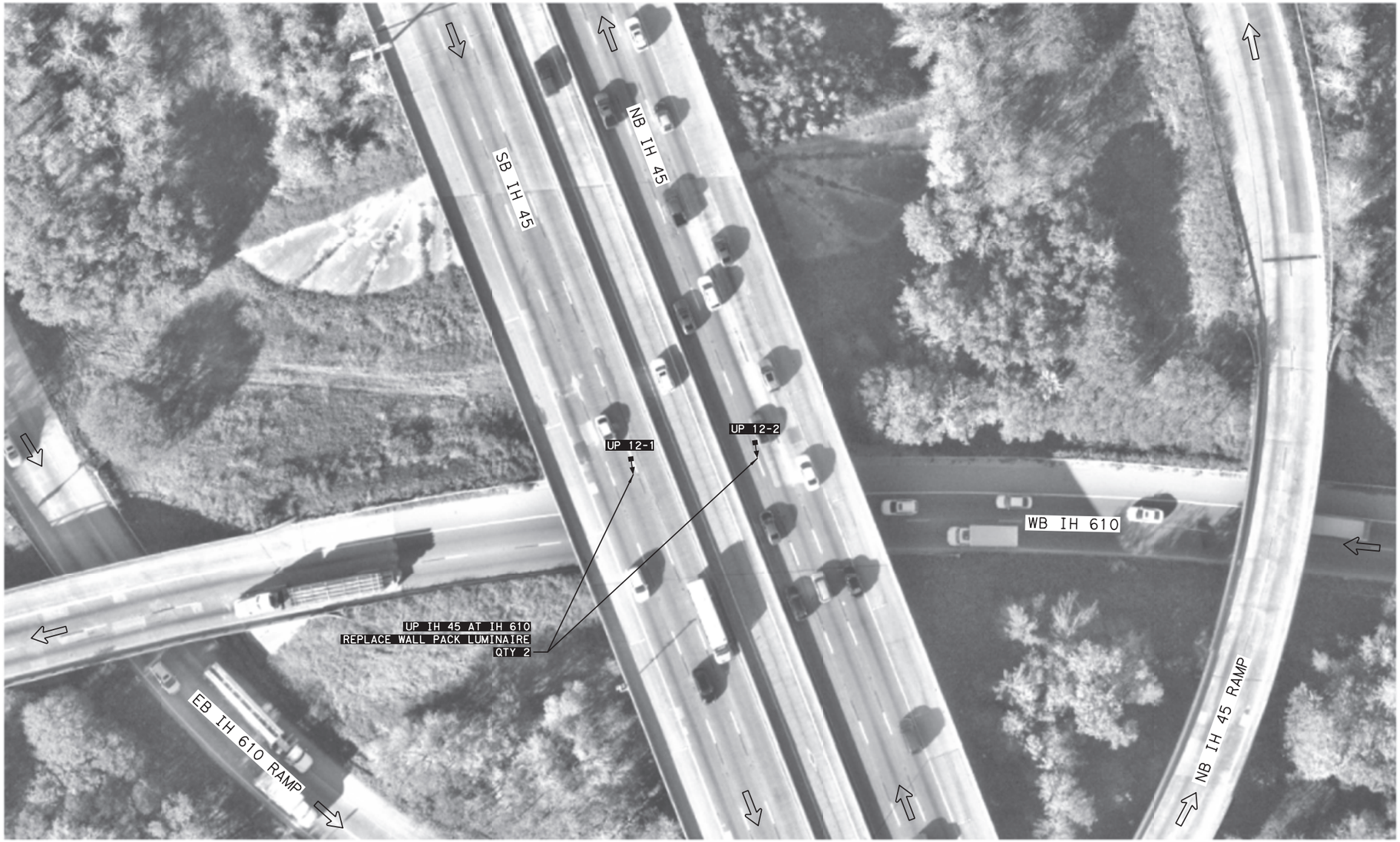
LEGEND:
- ⇦ DIRECTION OF TRAFFIC FLOW
- ◄■ HPS UNDERPASS UPGRADE
- ●■ LED UNDERPASS UPGRADE



NOTES:

1. ALL WORK MUST BE PERFORMED WITHIN TXDOT RIGHT OF WAY.
2. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE UTILITIES WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD; KNOWN OR UNKNOWN; PRIVATE OR PUBLIC (INCLUDING TXDOT OWNED).
3. CONTRACTOR TO VERIFY LUMINAIRE TYPE, PERFORMANCE, PHOTOMETRIC DATA, & ORIENTATION PRIOR TO REPLACEMENT.
4. THE COST OF REMOVING, SALVAGING, DISASSEMBLING, AND STOCKPILING EXISTING LUMINAIRES; FURNISHING AND INSTALLING NEW LUMINAIRES, CONNECTIONS, AND INTERNAL CONDUCTORS; REPLACING DAMAGED COMPONENTS; DISPOSING OF UNSALVAGEABLE MATERIALS; AND MATERIALS, EQUIPMENT, LABOR, TOOLS, AND INCIDENTALS IS SUBSIDIARY TO ITEM 6000.
5. CONTRACTOR TO FOLLOW STATE AND LOCAL ENVIRONMENTAL REGULATIONS FOR FIXTURE DISPOSAL.
6. ALL ELECTRICAL WORK SHALL MEET THE NATIONAL ELECTRIC CODE.
7. AERIAL AND SCALE FOR VISUAL REFERENCE ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION OR BIDDING. LUMINAIRE LOCATIONS ARE APPROXIMATE.

						UNDERPASS QUANTITIES			
						ILLUMINATION MAINTENANCE 6000			
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)	REPLACE WALL PACK LUM
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)	(6076)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA
UP 12-1	UP 12-2	29.81491	-95.37591	250	LED	0	0	0	2
TOTAL (THIS SHEET ONLY)						0	0	0	2

* REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

SCALE: 1" = 50'
25 0 25

100% SUBMITTAL

STATE OF TEXAS
CHRISTINA M. SMITH
139122
LICENSED PROFESSIONAL ENGINEER

PRINT DATE	REVISION DATE
3/21/2024	

BGE, Inc.
10777 Westheimer, Suite 400, Houston, TX 77042
Tel: 281-558-8700 • www.bgeinc.com
TBPE Registration No. F-1046

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

WB IH 610 BRIDGE

CSJ: 0500-03-652 SHEET 12 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	50

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY, ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

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3/21/2024
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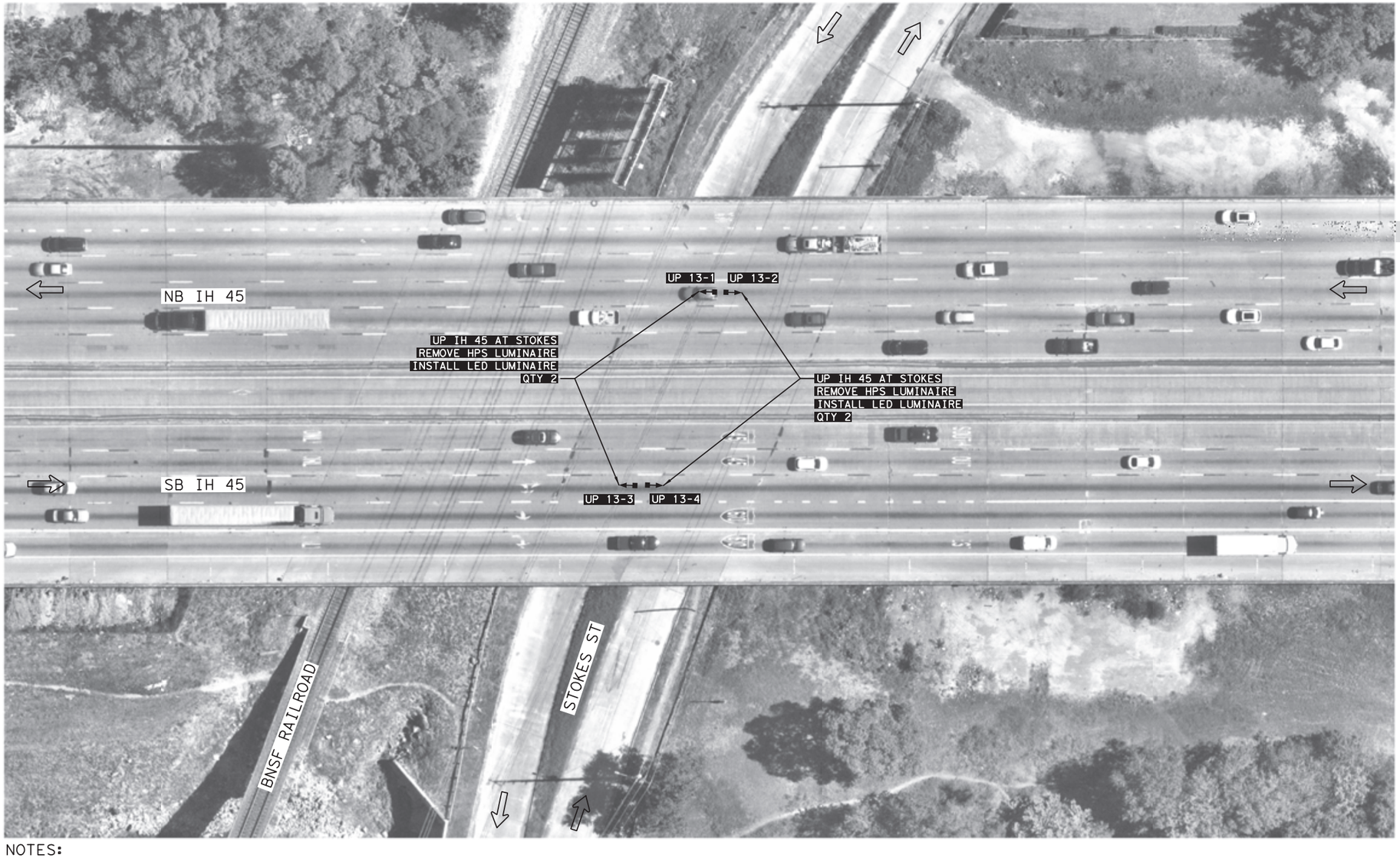
LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



NOTES:

1. ALL WORK MUST BE PERFORMED WITHIN TXDOT RIGHT OF WAY.
2. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE UTILITIES WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD; KNOWN OR UNKNOWN; PRIVATE OR PUBLIC (INCLUDING TXDOT OWNED).
3. CONTRACTOR TO VERIFY LUMINAIRE TYPE, PERFORMANCE, PHOTOMETRIC DATA, & ORIENTATION PRIOR TO REPLACEMENT.
4. THE COST OF REMOVING, SALVAGING, DISASSEMBLING, AND STOCKPILING EXISTING LUMINAIRES; FURNISHING AND INSTALLING NEW LUMINAIRES, CONNECTIONS, AND INTERNAL CONDUCTORS; REPLACING DAMAGED COMPONENTS; DISPOSING OF UNSALVAGEABLE MATERIALS; AND MATERIALS, EQUIPMENT, LABOR, TOOLS, AND INCIDENTALS IS SUBSIDIARY TO ITEM 6000.
5. CONTRACTOR TO FOLLOW STATE AND LOCAL ENVIRONMENTAL REGULATIONS FOR FIXTURE DISPOSAL.
6. ALL ELECTRICAL WORK SHALL MEET THE NATIONAL ELECTRIC CODE.
7. AERIAL AND SCALE FOR VISUAL REFERENCE ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION OR BIDDING. LUMINAIRE LOCATIONS ARE APPROXIMATE.

						UNDERPASS QUANTITIES ILLUMINATION MAINTENANCE 6000			
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)	REPLACE WALL PACK LUM
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)	(6076)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA
UP 13-1	UP 13-4	29.81915	-95.37787	250	LED	4	4	0	0
TOTAL (THIS SHEET ONLY)						4	4	0	0

* REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

SCALE: 1" = 50'

25 0 25

100% SUBMITTAL

STATE OF TEXAS
CHRISTINA M. SMITH
139122
LICENSED
PROFESSIONAL ENGINEER

PRINT DATE	REVISION DATE
3/21/2024	

BGE, Inc.
10777 Westheimer, Suite 400, Houston, TX 77042
Tel: 281-558-8700 • www.bgeinc.com
TBPE Registration No. F-1046

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

STOKES ST BRIDGE

CSJ: 0500-03-652 SHEET 13 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	51

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY, ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024

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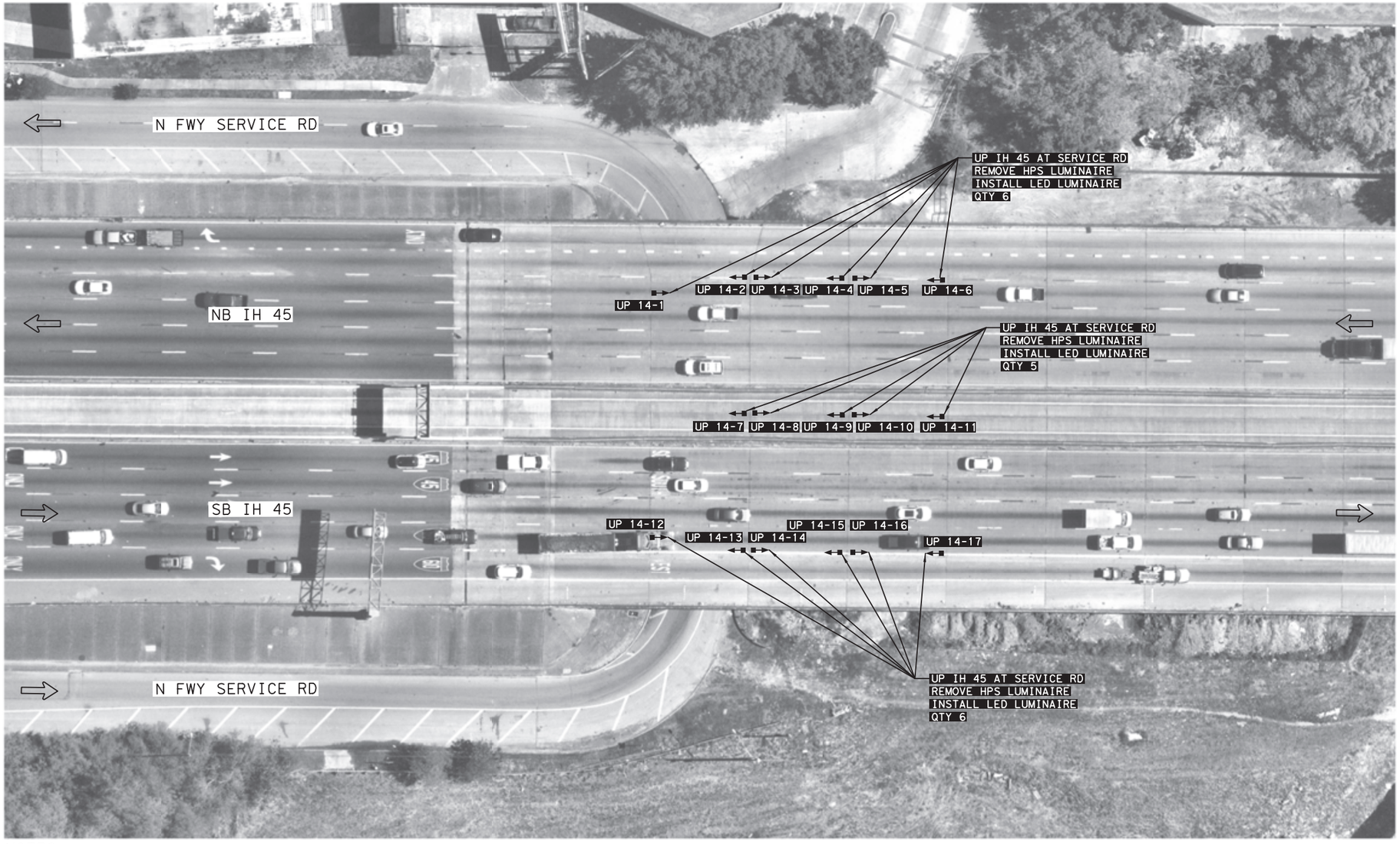
LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



SCALE: 1" = 50′

25 0 25

100% SUBMITTAL

STATE OF TEXAS
CHRISTINA M. SMITH
139122
LICENSED
PROFESSIONAL ENGINEER

PRINT DATE	REVISION DATE
3/21/2024	

NOTES:

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						UNDERPASS QUANTITIES			
						ILLUMINATION MAINTENANCE 6000			
UP ID		UP LUM LOC*		LAMP DETAILS		REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)	REPLACE WALL PACK LUM
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)	(6076)
						EA	EA	EA	EA
UP 14-1	UP 14-17	29.82042	-95.37854	250	LED	17	17	0	0
TOTAL (THIS SHEET ONLY)						17	17	0	0

* REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

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IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

N FWY SERVICE RD BRIDGE

CSJ: 0500-03-652 SHEET 14 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		52
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY, ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

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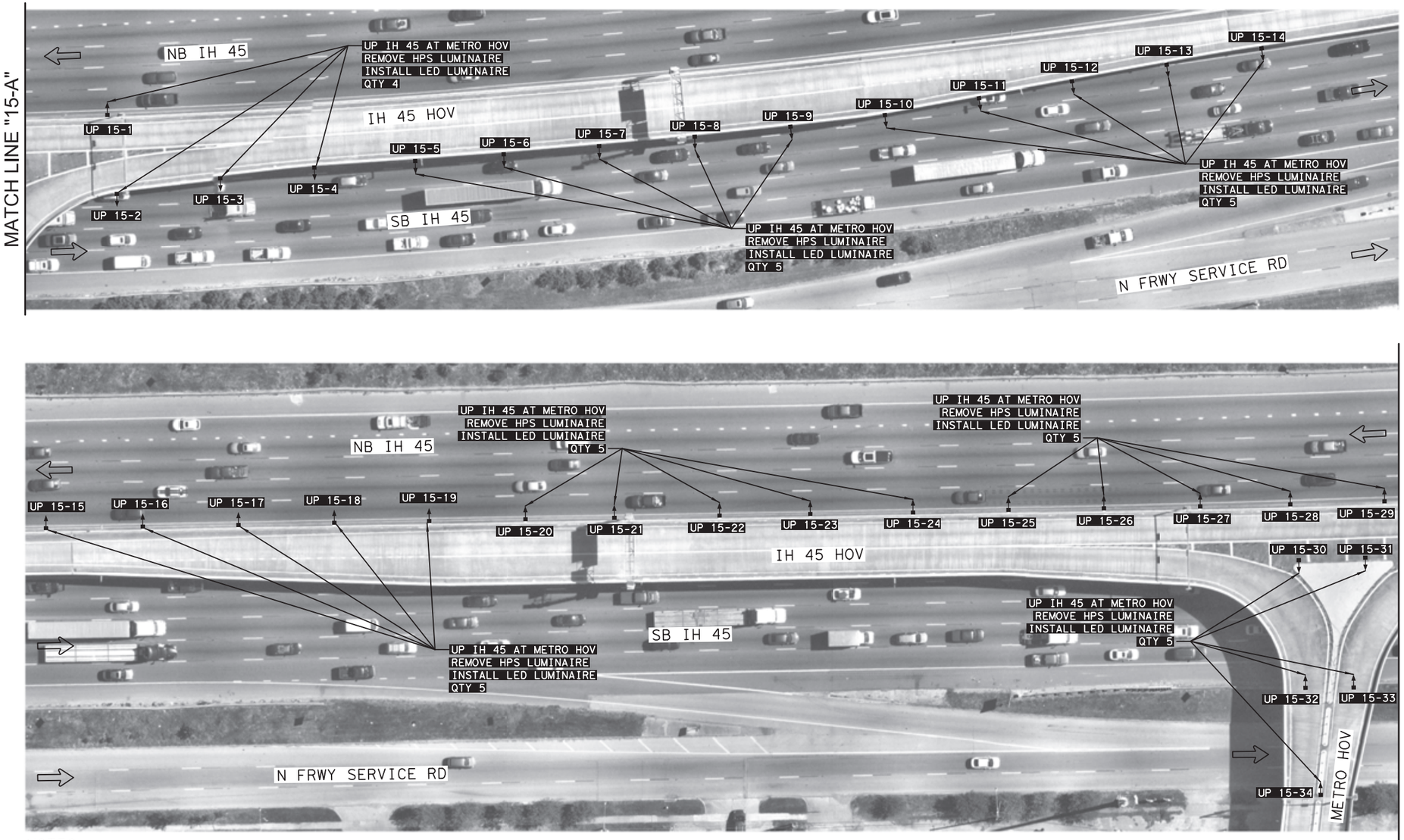

LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- HPS UNDERPASS UPGRADE
- LED UNDERPASS UPGRADE

NOTES:

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						UNDERPASS QUANTITIES ILLUMINATION MAINTENANCE 6000			
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)	REPLACE WALL PACK LUM
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)	(6076)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA
UP 15-1	UP 15-34	29.82469	-95.38044	250	LED	34	34	0	0
TOTAL (THIS SHEET ONLY)						34	34	0	0

* REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

SCALE: 1" = 60'
30 0 30

100% SUBMITTAL

STATE OF TEXAS
CHRISTINA M. SMITH
139122
LICENSED
PROFESSIONAL ENGINEER

PRINT DATE	REVISION DATE
3/21/2024	

BGE, Inc.
10777 Westheimer, Suite 400, Houston, TX 77042
Tel: 281-558-8700 • www.bgeinc.com
TBPE Registration No. F-1046

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

METRO HOV BRIDGE

CSJ: 0500-03-652 SHEET 15 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		53
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY, ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

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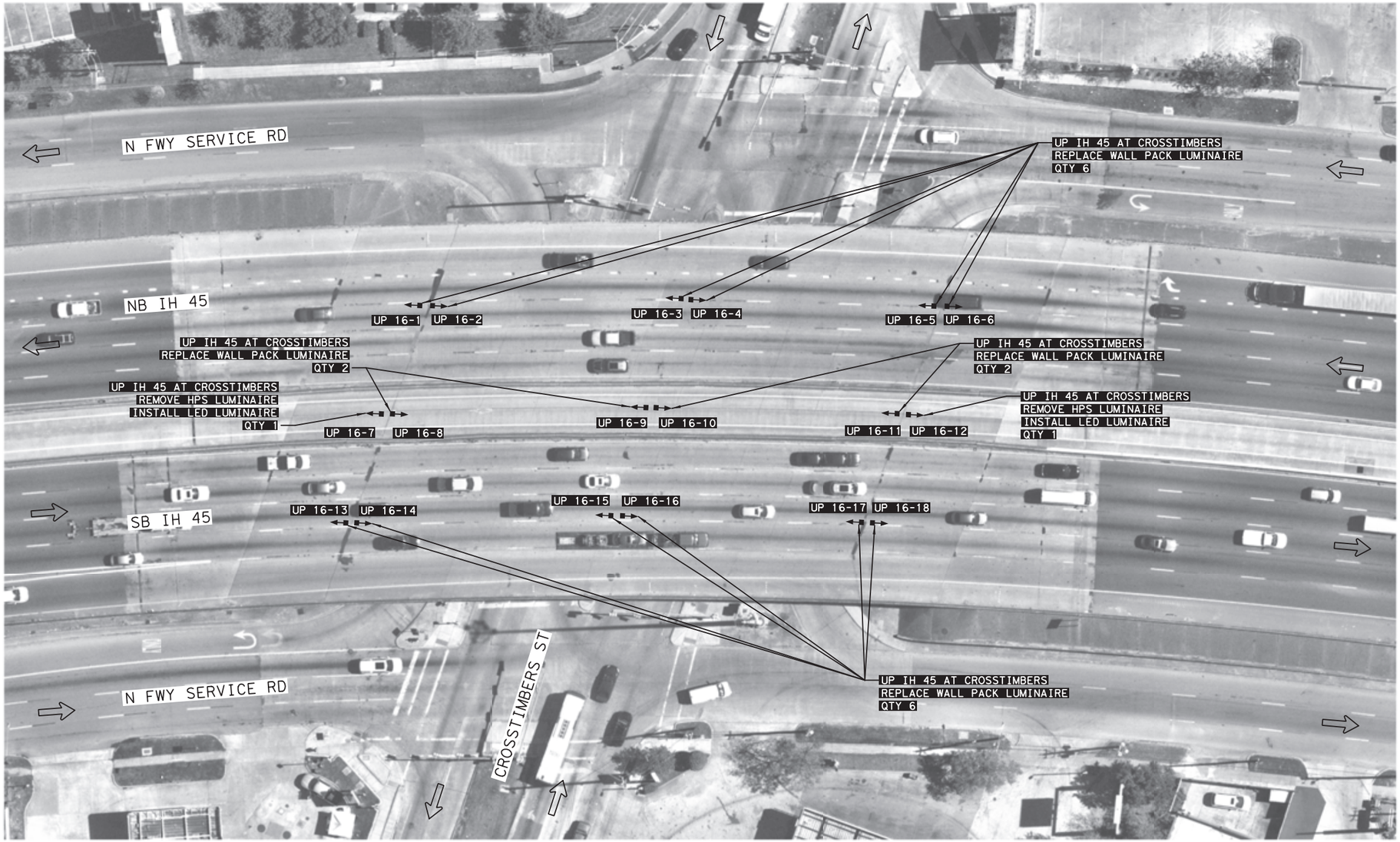

LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- ◄■ HPS UNDERPASS UPGRADE
- ●■ LED UNDERPASS UPGRADE

SCALE: 1" = 50'

25 0 25

100% SUBMITTAL

STATE OF TEXAS
CHRISTINA M. SMITH
139122
LICENSED
PROFESSIONAL ENGINEER

PRINT DATE	REVISION DATE
3/21/2024	

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						UNDERPASS QUANTITIES ILLUMINATION MAINTENANCE 6000			
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)	REPLACE WALL PACK LUM
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)	(6076)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA
UP 16-1	UP 16-18	29.82885	-95.3813	250	LED	2	2	0	16
					TOTAL (THIS SHEET ONLY)	2	2	0	16

* REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

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10777 Westheimer, Suite 400, Houston, TX 77042
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TBPE Registration No. F-1046

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

CROSSTIMBERS ST BRIDGE

CSJ: 0500-03-652 SHEET 16 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		54
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY, ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

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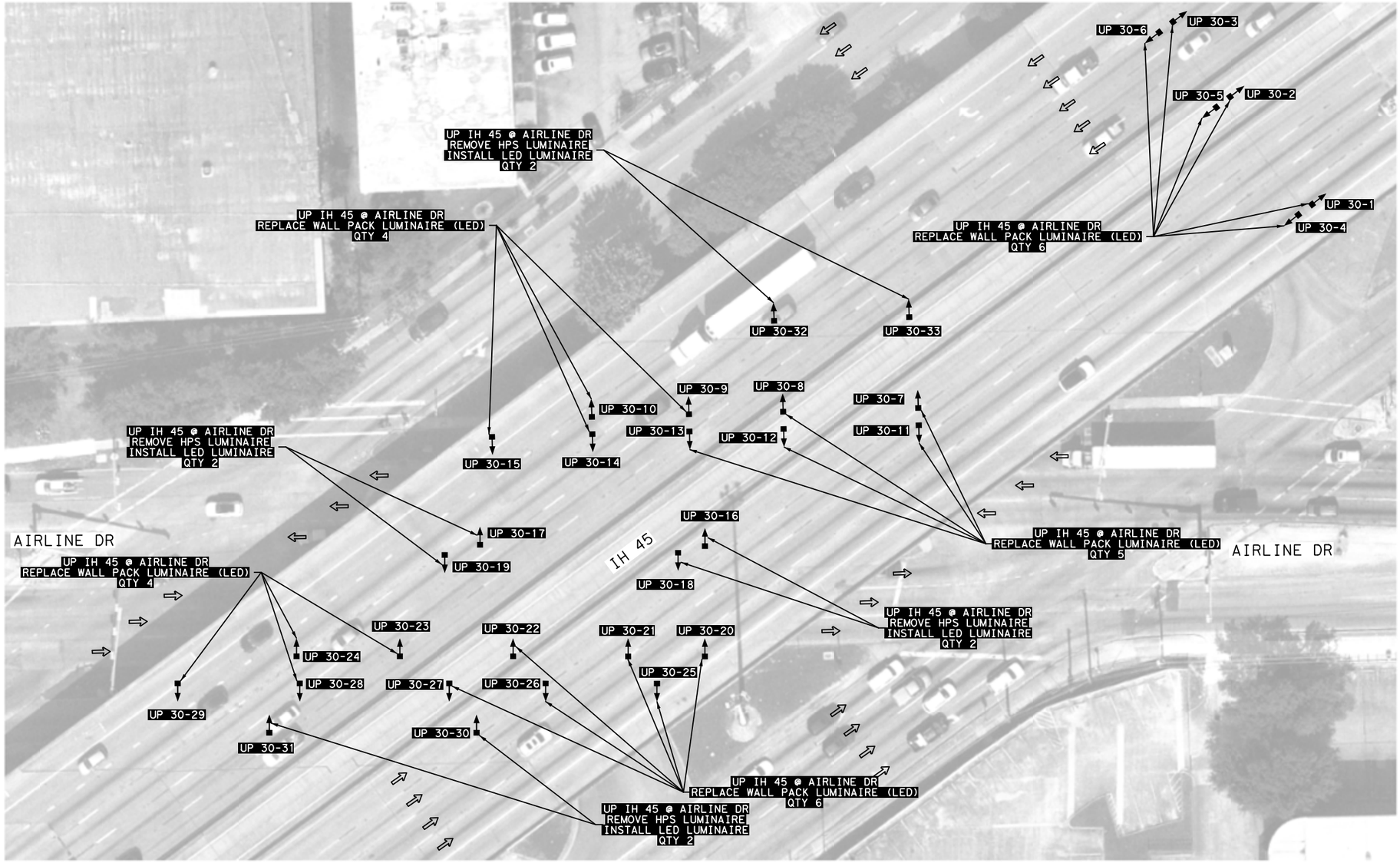

LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- HPS UNDERPASS UPGRADE
- LED UNDERPASS UPGRADE

SCALE: 1" = 50'
25 0 25

STATE OF TEXAS
LAUREN P. SCHINDLER
150500
LICENSED PROFESSIONAL ENGINEER
3/15/2024

NOTES:

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7. AERIAL AND SCALE FOR VISUAL REFERENCE ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION OR BIDDING. LUMINAIRE LOCATIONS ARE APPROXIMATE.
8. UP 30-32 & 30-33 ARE USED TO ILLUMINATE TXDOT SATELLITE BUILDING.

UP ID		UP LUM LOCATION*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000			
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)	REPLACE WALL PACK LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA
UP 30-1	UP 30-33	29.83393	-95.38507	250	LED	8	8		25
					TOTALS	8	8		25

* REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE

PRINT DATE	REVISION DATE
3/15/2024	

Kimley»Horn F-928
11700 Katy Freeway, Suite 800
Houston, Texas 77079
Tel. No. (281) 597-9300
Fax No. (281) 597-8032

Texas Department of Transportation®

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

AIRLINE DR BRIDGE

CSJ: 0500-03-652 SHEET 17 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	55

STATE	DIST.	COUNTY
TEXAS	HOU	MONTGOMERY,ETC

CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

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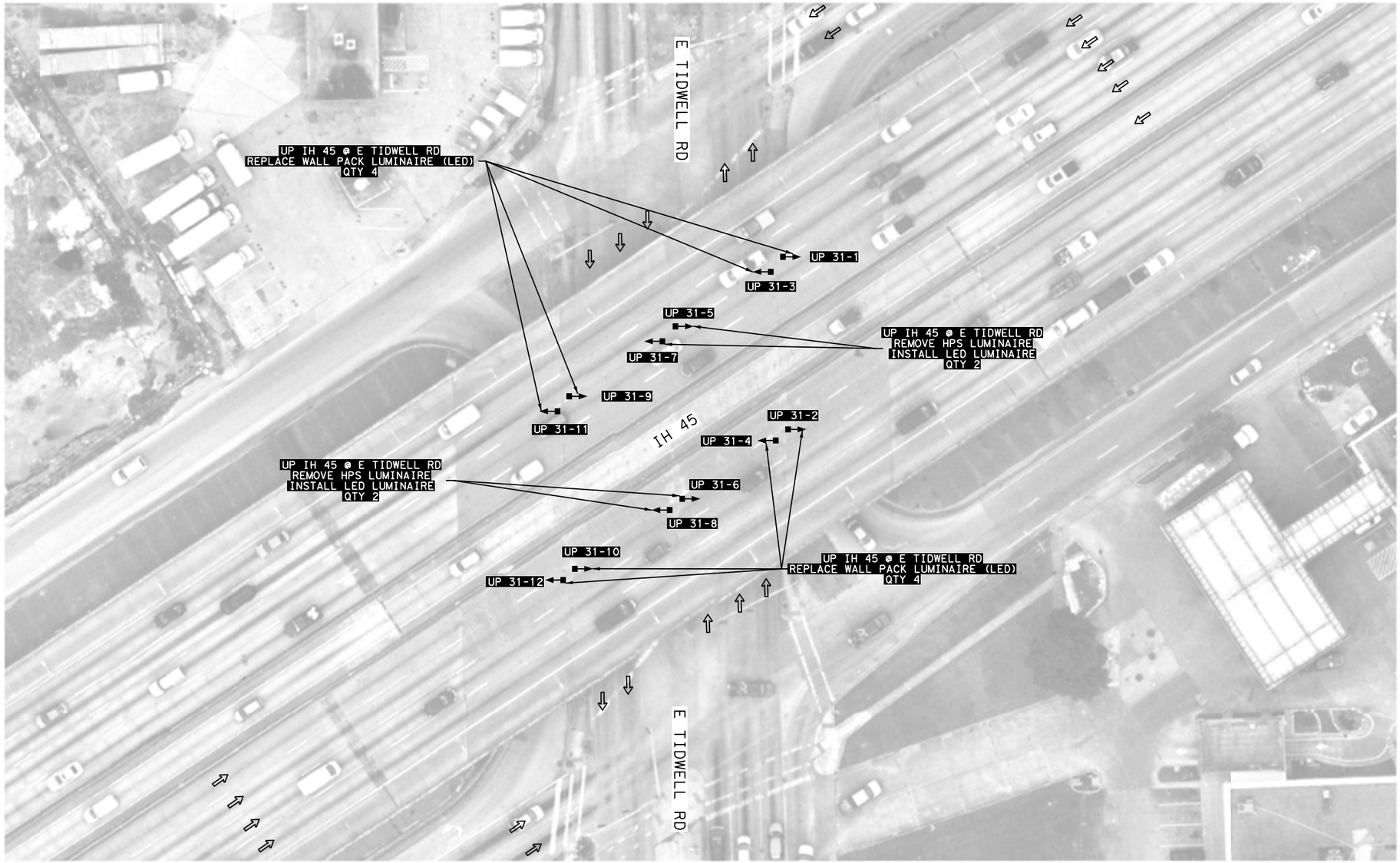

LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- HPS UNDERPASS UPGRADE
- LED UNDERPASS UPGRADE

SCALE: 1" = 50'
25 0 25

STATE OF TEXAS
LAUREN P. SCHINDLER
150500
LICENSED
PROFESSIONAL ENGINEER
3/15/2024

NOTES:

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UP ID		UP LUM LOCATION*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000			
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)	REPLACE WALL PACK LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)	(6076)
						EA	EA	EA	EA
UP 31-1	UP 31-12	29.84563	-95.39301	250	LED	4	4		8
					TOTALS	4	4		8

* REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE

PRINT DATE	REVISION DATE
3/15/2024	

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11700 Katy Freeway, Suite 800
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Fax No. (281) 597-8032

Texas Department of Transportation®

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

E TIDWELL RD BRIDGE

CSJ: 0500-03-652 SHEET 18 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		56
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

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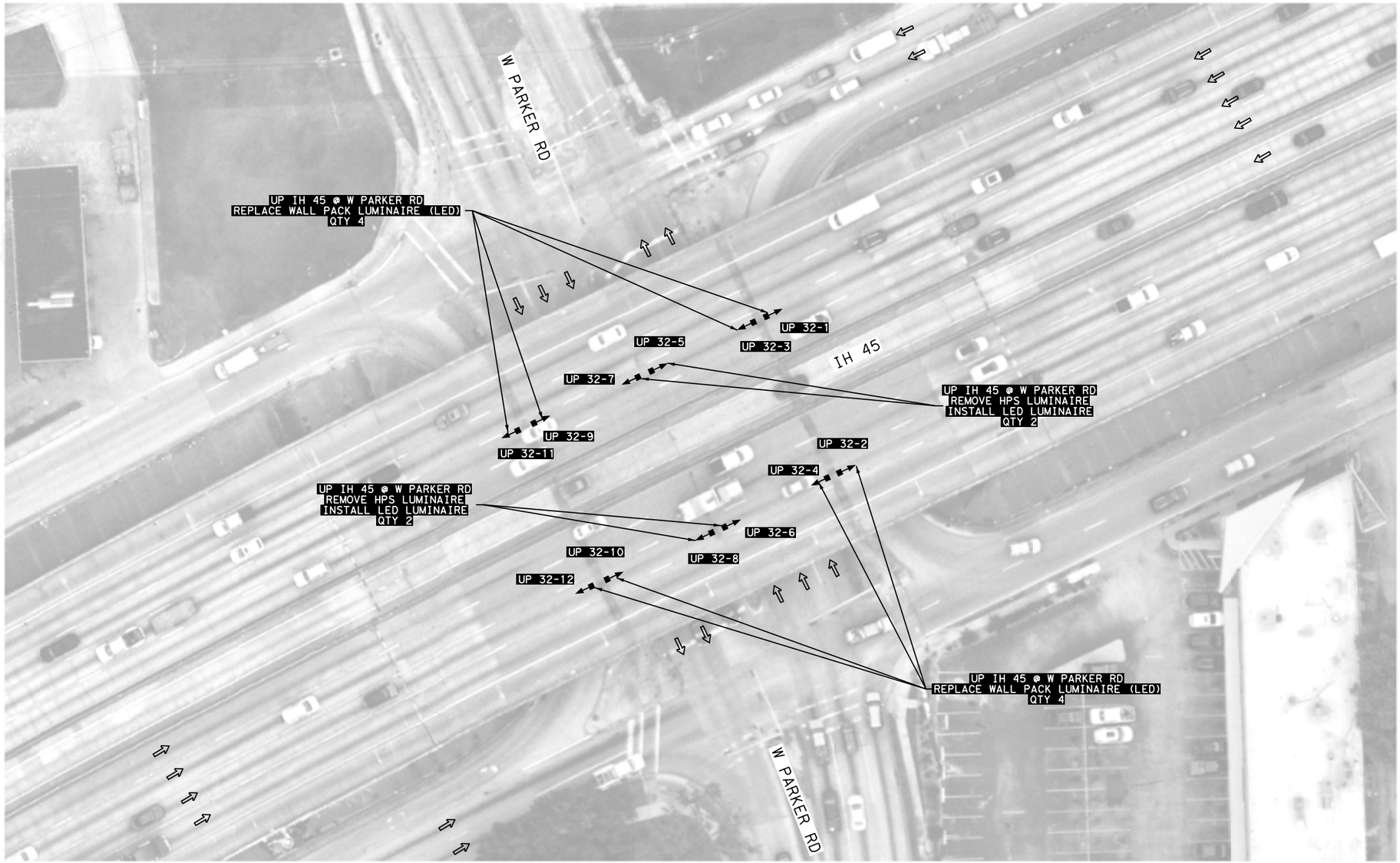

LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- HPS UNDERPASS UPGRADE
- LED UNDERPASS UPGRADE

SCALE: 1" = 50'
25 0 25

STATE OF TEXAS
LAUREN P. SCHINDLER
150500
LICENSED PROFESSIONAL ENGINEER
Lauren Schindler
3/15/2024

NOTES:

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UP ID		UP LUM LOCATION*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000			
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)	REPLACE WALL PACK LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028) EA	(6030) EA	(6032) EA	(6076) EA
UP 32-1	UP 32-12	29.85956	-95.40265	250	LED	4	4		8
					TOTALS	4	4		8

* REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE

PRINT DATE	REVISION DATE
3/15/2024	

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Fax No. (281) 597-8032

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

W PARKER RD BRIDGE

CSJ: 0500-03-652 SHEET 19 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		57
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/15/2024 9:12:58 AM
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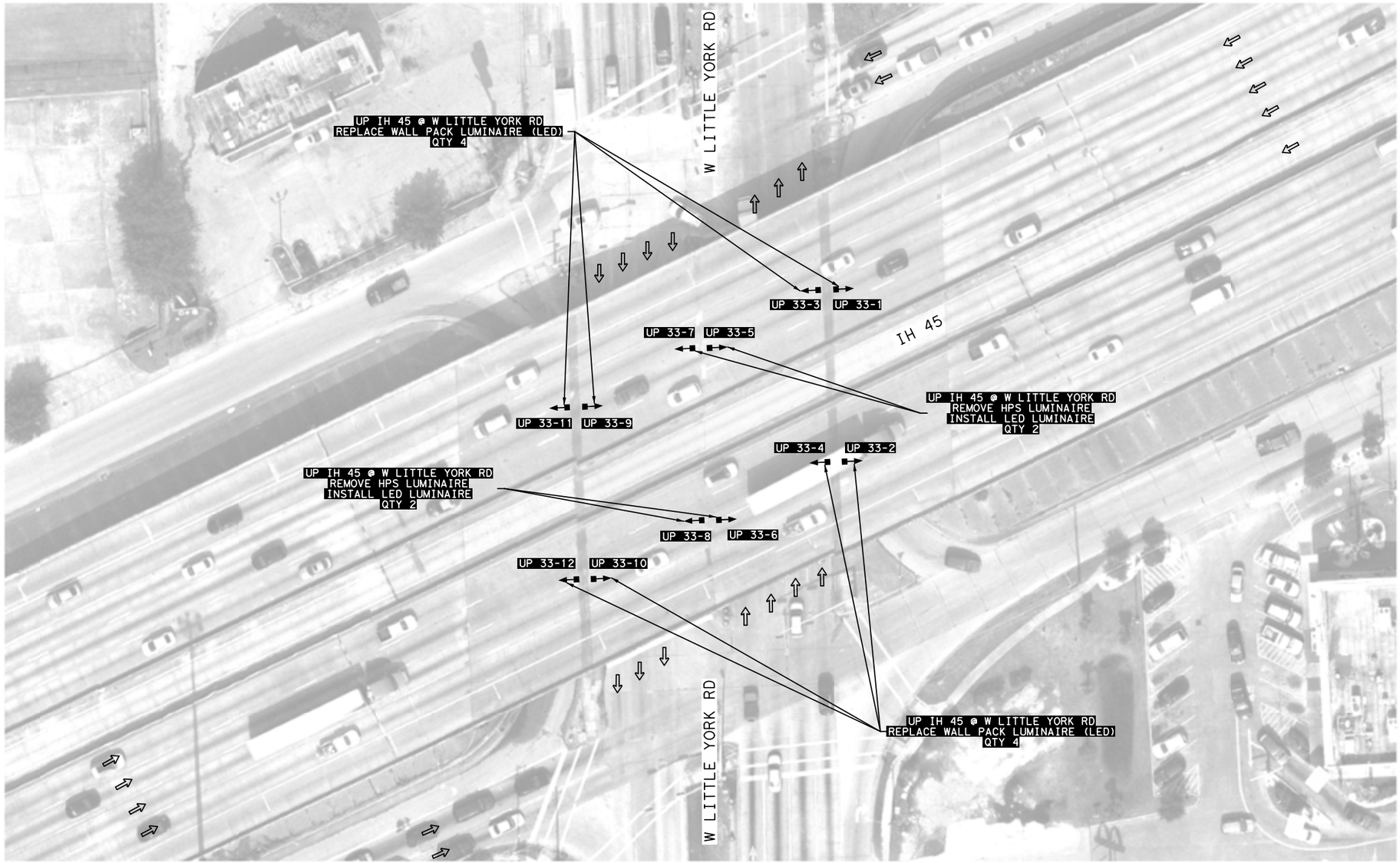

LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- HPS UNDERPASS UPGRADE
- LED UNDERPASS UPGRADE

SCALE: 1" = 50'
25 0 25

STATE OF TEXAS
LAUREN P. SCHINDLER
150500
LICENSED PROFESSIONAL ENGINEER
3/15/2024

NOTES:

1. ALL WORK MUST BE PERFORMED WITHIN TXDOT RIGHT OF WAY.
2. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE UTILITIES WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD; KNOWN OR UNKNOWN; PRIVATE OR PUBLIC (INCLUDING TXDOT OWNED).
3. CONTRACTOR TO VERIFY LUMINAIRE TYPE, PERFORMANCE, PHOTOMETRIC DATA, & ORIENTATION PRIOR TO REPLACEMENT.
4. THE COST OF REMOVING, SALVAGING, DISASSEMBLING, AND STOCKPILING EXISTING LUMINAIRES; FURNISHING AND INSTALLING NEW LUMINAIRES, CONNECTIONS, AND INTERNAL CONDUCTORS; REPLACING DAMAGED COMPONENTS; DISPOSING OF UNSALVAGEABLE MATERIALS; AND MATERIALS, EQUIPMENT, LABOR, TOOLS, AND INCIDENTALS IS SUBSIDIARY TO ITEM 6000.
5. CONTRACTOR TO FOLLOW STATE AND LOCAL ENVIRONMENTAL REGULATIONS FOR FIXTURE DISPOSAL.
6. ALL ELECTRICAL WORK SHALL MEET THE NATIONAL ELECTRIC CODE.
7. AERIAL AND SCALE FOR VISUAL REFERENCE ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION OR BIDDING. LUMINAIRE LOCATIONS ARE APPROXIMATE.

UP ID		UP LUM LOCATION*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000			
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)	REPLACE WALL PACK LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)	(6076)
						EA	EA	EA	EA
UP 33-1	UP 33-12	29.87002	-95.40801	250	LED	4	4		8
					TOTALS	4	4		8

* REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE

PRINT DATE	REVISION DATE
3/15/2024	

Kimley»Horn F-928
11700 Katy Freeway, Suite 800
Houston, Texas 77079
Tel. No. (281) 597-9300
Fax No. (281) 597-8032

Texas Department of Transportation®

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

W LITTLE YORK RD BRIDGE

CSJ: 0500-03-652 SHEET 20 OF 20

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		58
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/15/2024 9:13:28 AM
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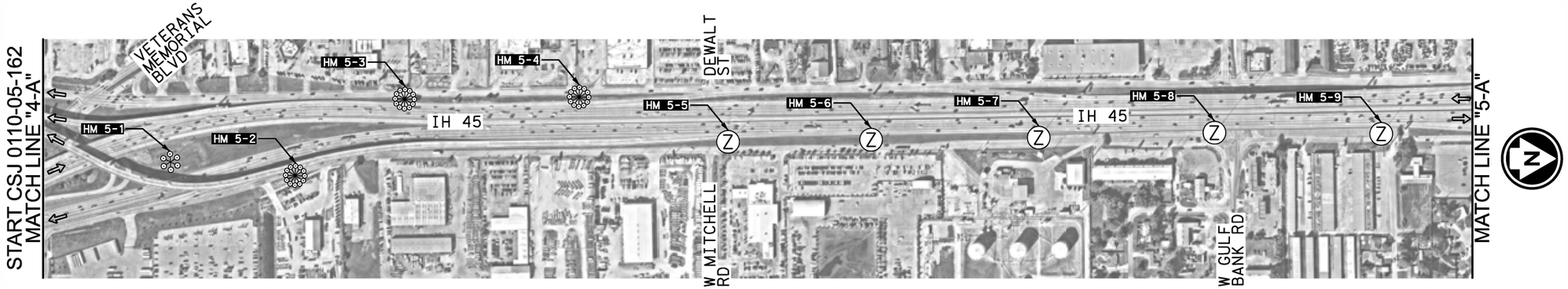
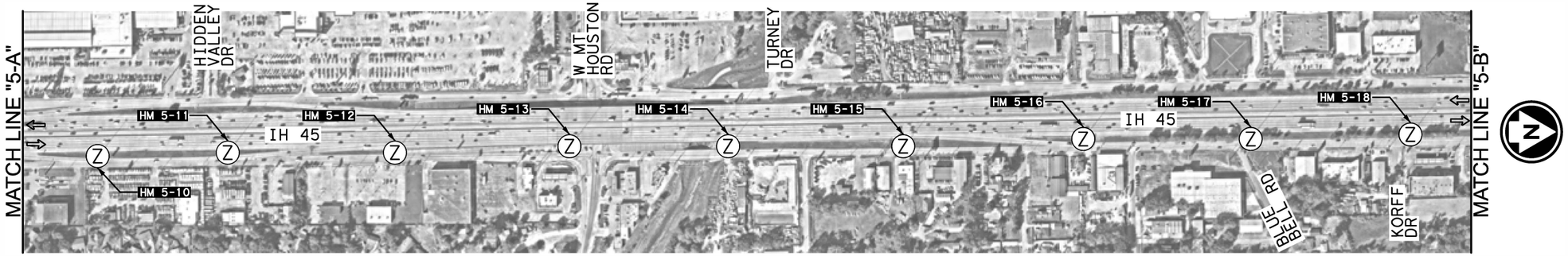
LEGEND:
- DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Z-PAT HIGH MAST UPGRADE





SCALE: 1" = 500'
250 0 250

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HIGH MAST QUANTITIES
ILLUMINATION MAINTENANCE 6000

HM ID	LOCATION		LAMP DETAILS		RAISE LOWER RING (6103)	REPLACE HM LED LUM (6160)	HPS TO LED UPGRADE: REMOVE HM HPS FIXTURE (6162)	HPS TO LED UPGRADE: INSTALL HM LED FIXTURE (6161)	AVIATION: REPLACE FIX (LED) (6167)	Z-PATTERN: CONVERT Z-PAT (LED) (6171)
	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA	EA	EA
HM 5-1	29.876830	-95.411418	600	LED	1	6			3	
HM 5-2	29.878275	-95.411238	600	LED	1		12	6	3	
HM 5-3	29.879533	-95.412249	600	LED	1		12	6	3	
HM 5-4	29.881538	-95.412285	600	LED	1		12	6	3	
HM 5-5	29.883255	-95.411693	600	LED						1
HM 5-6	29.884887	-95.411718	600	LED						1
HM 5-7	29.886816	-95.411739	600	LED						1
HM 5-8	29.888853	-95.411824	600	LED						1
HM 5-9	29.890745	-95.411777	600	LED						1
HM 5-10	29.892673	-95.411851	600	LED						1
HM 5-11	29.894141	-95.411889	600	LED						1
HM 5-12	29.896049	-95.411910	600	LED						1
HM 5-13	29.898033	-95.411988	600	LED						1
HM 5-14	29.899806	-95.411956	600	LED						1
HM 5-15	29.901820	-95.411985	600	LED						1
HM 5-16	29.903839	-95.412065	600	LED						1
HM 5-17	29.905754	-95.412090	600	LED						1
HM 5-18	29.907557	-95.412123	600	LED						1
				TOTALS	4	6	36	18	12	14

STATE OF TEXAS
CHARLES R. STEVENS, JR.
101286
PROFESSIONAL LICENSED ENGINEER

CHARLES R. STEVENS, JR., P.E. — DATE 3/21/2024

PRINT DATE	REVISION DATE
3/21/2024	

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
6131 JACKRABBIT RD
Houston, TX. 77095
PHONE: (713) 828-4742

Texas Department of Transportation®

IH 45 ILLUMINATION

HIGHMAST ILLUMINATION LAYOUT

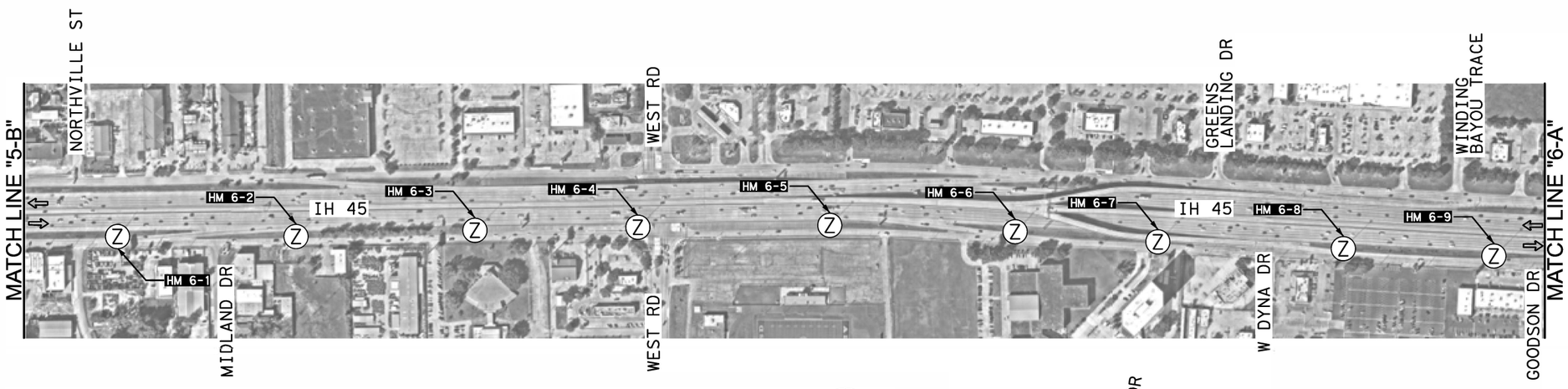
START CSJ/ML 4-B TO ML 5-B

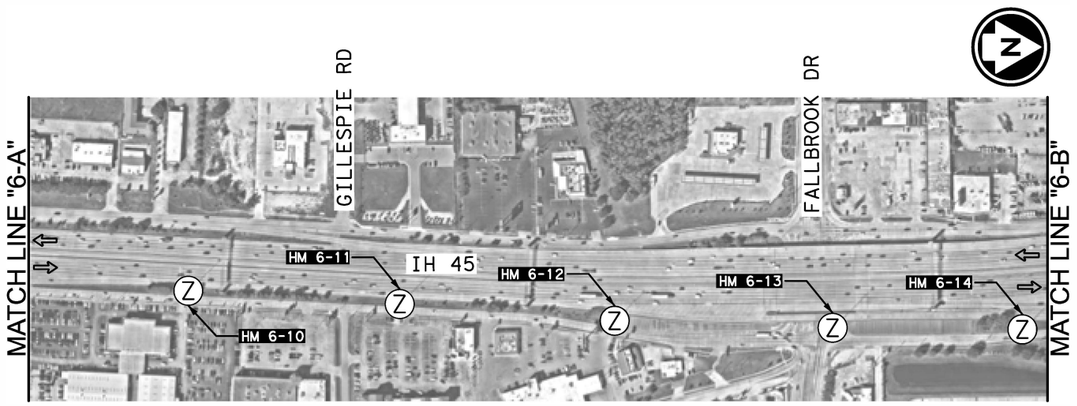
CSJ: 0110-06-162 SHEET 1 OF 3

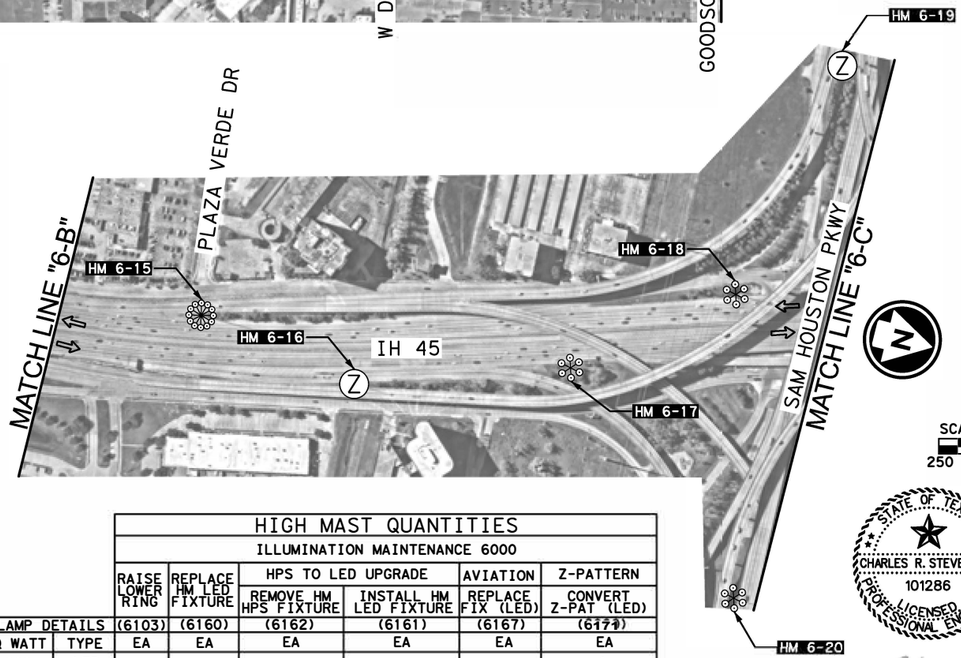
FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	59

STATE	DIST.	COUNTY
TEXAS	HOU	MONTGOMERY,ETC

CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45







LEGEND:
- DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Z-PAT HIGH MAST UPGRADE

SCALE: 1" = 500'
250 0 250

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HIGH MAST QUANTITIES

ILLUMINATION MAINTENANCE 6000

HM ID	LOCATION		LAMP DETAILS		RAISE LOWER RING (6103)	REPLACE HM LED FIXTURE (6160)	HPS TO LED UPGRADE: REMOVE HM HPS FIXTURE (6162)	HPS TO LED UPGRADE: INSTALL HM LED FIXTURE (6161)	AVIATION: REPLACE FIX (LED) (6167)	Z-PATTERN: CONVERT Z-PAT (LED) (6177)
	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA	EA	EA
HM 6-1	29.909285	-95.412161	600	LED						1
HM 6-2	29.911195	-95.412155	600	LED						1
HM 6-3	29.913132	-95.412231	600	LED						1
HM 6-4	29.914918	-95.412293	600	LED						1
HM 6-5	29.916956	-95.412285	600	LED						1
HM 6-6	29.918973	-95.412221	600	LED						1
HM 6-7	29.920505	-95.412085	600	LED						1
HM 6-8	29.922515	-95.412008	600	LED						1
HM 6-9	29.924139	-95.411905	600	LED						1
HM 6-10	29.926140	-95.411737	600	LED						1
HM 6-11	29.928061	-95.411623	600	LED						1
HM 6-12	29.929980	-95.411423	600	LED						1
HM 6-13	29.932009	-95.411413	600	LED						1
HM 6-14	29.933683	-95.411358	600	LED						1
HM 6-15	29.935248	-95.412490	600	LED	1		12	6	3	
HM 6-16	29.936697	-95.412171	600	LED						1
HM 6-17	29.938539	-95.412897	600	LED	1	6			3	
HM 6-18	29.939876	-95.414035	600	LED	1	6			3	
HM 6-19	29.940248	-95.416641	600	LED						1
HM 6-20	29.940483	-95.410963	600	LED	1	6			3	
				TOTALS	4	18	12	6	12	16

STATE OF TEXAS
CHARLES R. STEVENS, JR.
101286
PROFESSIONAL ENGINEER

CHARLES R. STEVENS, JR., P.E.

3/21/2024
DATE

PRINT DATE	REVISION DATE
3/21/2024	

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
8131 JAGKRABTT RD
Houston, TX. 77095
PHONE: (713) 828-4742

IH 45 ILLUMINATION

HIGHMAST ILLUMINATION LAYOUT

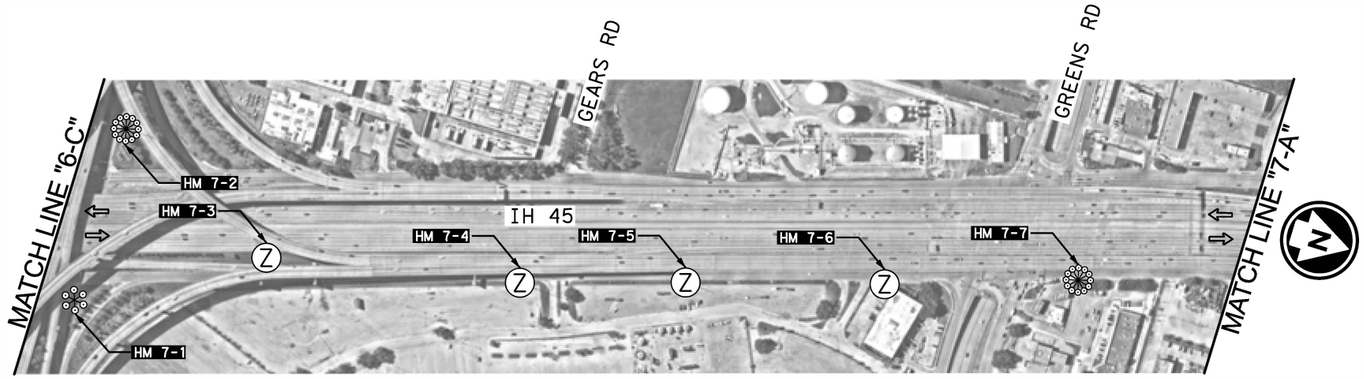
ML 5-B TO ML 6-C

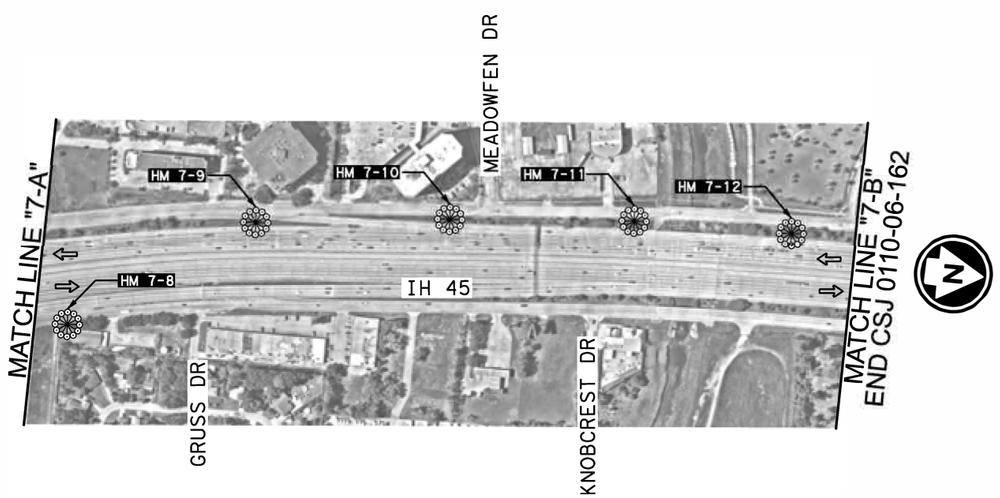
CSJ: 0110-06-162 SHEET 2 OF 3

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	60

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

LEGEND:
- DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Z-PAT HIGH MAST UPGRADE





SCALE: 1" = 500'
250 0 250

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ILLUMINATION MAINTENANCE 6000

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	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA	EA	EA
HM 7-1	29.941080	-95.413324	600	LED	1	6			3	
HM 7-2	29.941076	-95.415171	600	LED	1		12	6	3	
HM 7-3	29.942616	-95.414322	600	LED						1
HM 7-4	29.944866	-95.414842	600	LED						1
HM 7-5	29.946307	-95.415355	600	LED						1
HM 7-6	29.948017	-95.412221	600	LED						1
HM 7-7	29.949681	-95.416572	600	LED	1		12	6	3	
HM 7-8	29.951365	-95.417121	600	LED	1		12	6	3	
HM 7-9	29.952937	-95.418372	600	LED	1		12	6	3	
HM 7-10	29.954687	-95.418627	600	LED	1		12	6	3	
HM 7-11	29.956335	-95.418810	600	LED	1		12	6	3	
HM 7-12	29.957770	-95.418849	600	LED	1		12	6	3	
				TOTALS	8	6	84	42	24	4

STATE OF TEXAS
CHARLES R. STEVENS, JR.
101286
PROFESSIONAL ENGINEER

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

PRINT DATE	REVISION DATE
3/21/2024	

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
8131 JACKRABBIT RD
Houston, TX. 77065
PHONE: (713) 828-4742

IH 45 ILLUMINATION

HIGHMAST ILLUMINATION LAYOUT

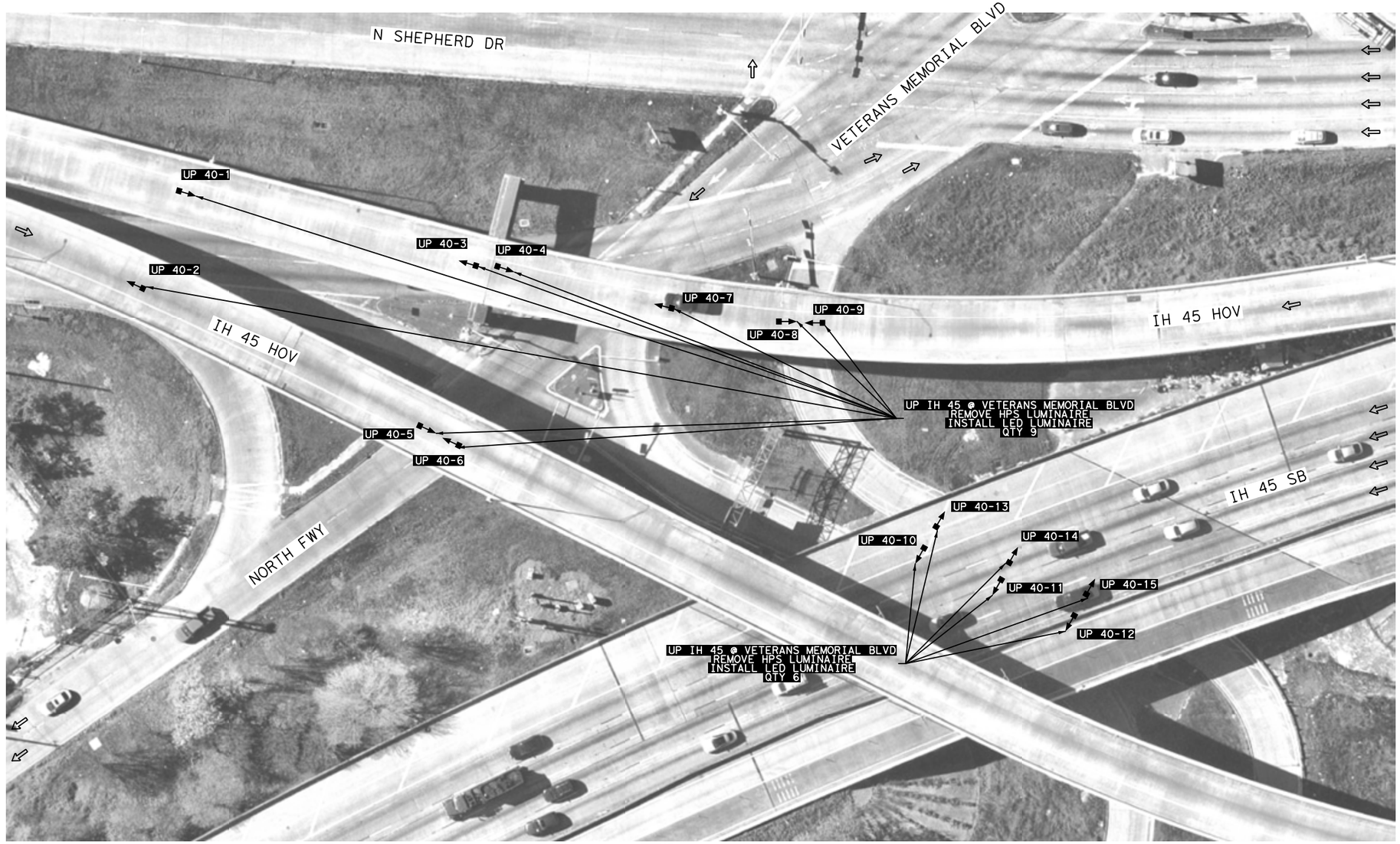
ML 6-C TO ML 7-B END CSJ 0110-06-162

CSJ: 0110-06-162 SHEET 3 OF 3

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	61

STATE	DIST.	COUNTY
TEXAS	HOU	MONTGOMERY,ETC

CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45



LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- ◄■ HPS UNDERPASS UPGRADE
- ●■ LED UNDERPASS UPGRADE

SCALE: 1" = 50'

25 0 25

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						UNDERPASS QTY		
						ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA
UP 40-1	UP 40-15	29.875087	-95.412132	250	LED	15	15	
					TOTALS	15	15	

*LUMINAIRE UP 40-1.

CHARLES R. STEVENS, JR. 101286 LICENSED PROFESSIONAL ENGINEER STATE OF TEXAS

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

PRINT DATE	REVISION DATE
3/21/2024	

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
8131 MONRBITT RD
Houston, TX. 77095
PHONE: (713) 828-4742

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

VETERANS MEMORIAL BLVD BRIDGE

CSJ: 0110-06-162 SHEET 1 OF 15

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		62
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 5:48:32 PM

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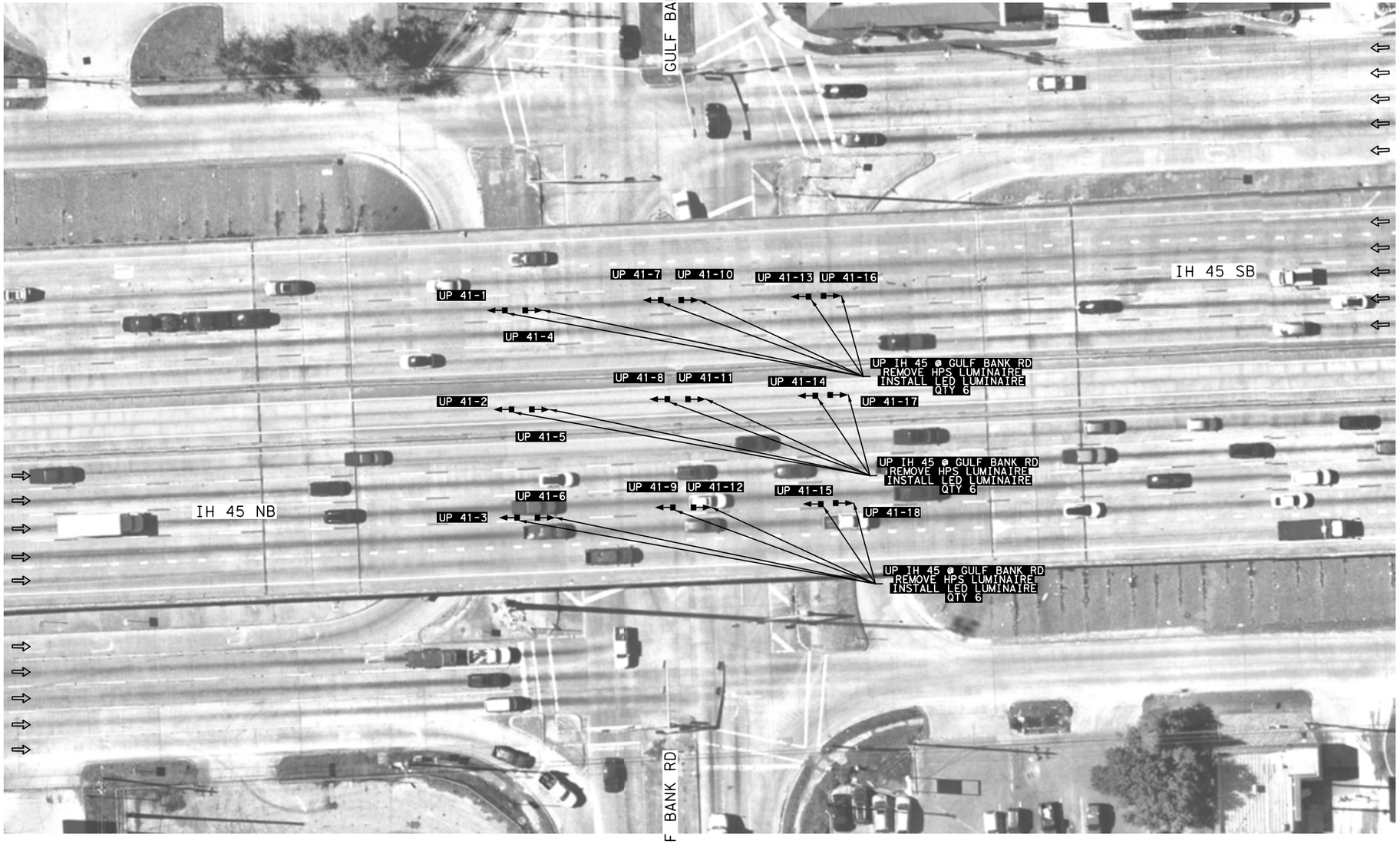

LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- ◄■ HPS UNDERPASS UPGRADE
- ●■ LED UNDERPASS UPGRADE

SCALE: 1" = 50'
25 0 25

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						REMOVE UP LUM (HPS) (6028)	INSTALL UP LUM (LED) (6030)	REPLACE UP LUM (LED) (6032)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA
UP 41-1	UP 41-18	29.889247	-95.412254	250	LED	18	18	
					TOTALS	18	18	

*REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

CHARLES R. STEVENS, JR.
101286
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

PRINT DATE	REVISION DATE
3/21/2024	

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
8131 JACKRABITT RD
Houston, TX. 77095
PHONE: (713) 828-4742

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

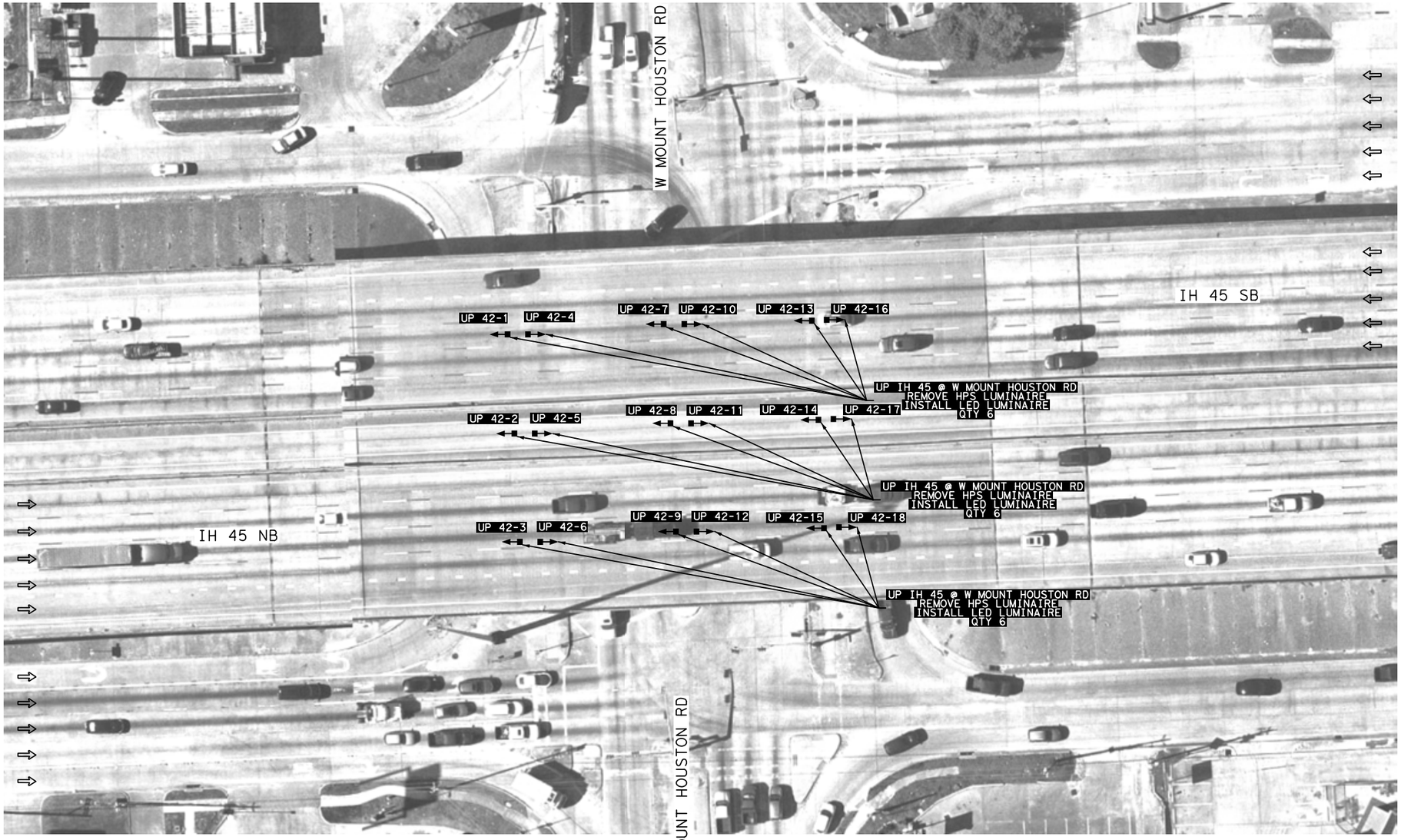
GULF BANK RD BRIDGE

CSJ: 0110-06-162 SHEET 2 OF 15

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	63

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 5:48:37 PM
...\063 UP IH45 0110-06-162 GULF BANK RD BRIDGE.dgn



LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- HPS UNDERPASS UPGRADE
- LED UNDERPASS UPGRADE

SCALE: 1" = 50′

25 0 25

NOTES:

1. ALL WORK MUST BE PERFORMED WITHIN TXDOT RIGHT OF WAY.
2. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE UTILITIES WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD; KNOWN OR UNKNOWN; PRIVATE OR PUBLIC (INCLUDING TXDOT OWNED).
3. CONTRACTOR TO VERIFY LUMINAIRE TYPE, PERFORMANCE, PHOTOMETRIC DATA, & ORIENTATION PRIOR TO REPLACEMENT.
4. THE COST OF REMOVING, SALVAGING, DISASSEMBLING, AND STOCKPILING EXISTING LUMINAIRES; FURNISHING AND INSTALLING NEW LUMINAIRES, CONNECTIONS, AND INTERNAL CONDUCTORS; REPLACING DAMAGED COMPONENTS; DISPOSING OF UNSALVAGEABLE MATERIALS; AND MATERIALS, EQUIPMENT, LABOR, TOOLS, AND INCIDENTALS IS SUBSIDIARY TO ITEM 6000.
5. CONTRACTOR TO FOLLOW STATE AND LOCAL ENVIRONMENTAL REGULATIONS FOR FIXTURE DISPOSAL.
6. ALL ELECTRICAL WORK SHALL MEET THE NATIONAL ELECTRIC CODE.
7. AERIAL AND SCALE FOR VISUAL REFERENCE ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION OR BIDDING. LUMINAIRE LOCATIONS ARE APPROXIMATE.

UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
UP 42-1	UP 42-18	29.898452	-95.412427	250	LED	EA	EA	EA
					TOTALS	18	18	

*REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

CHARLES R. STEVENS, JR.
101286
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

PRINT DATE	REVISION DATE
3/21/2024	

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
8131 JACKRABBIT RD
Houston, TX. 77095
PHONE: (713) 828-4742

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

W MOUNT HOUSTON RD BRIDGE

CSJ: 0110-06-162 SHEET 3 OF 15

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		64
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 5:48:41 PM

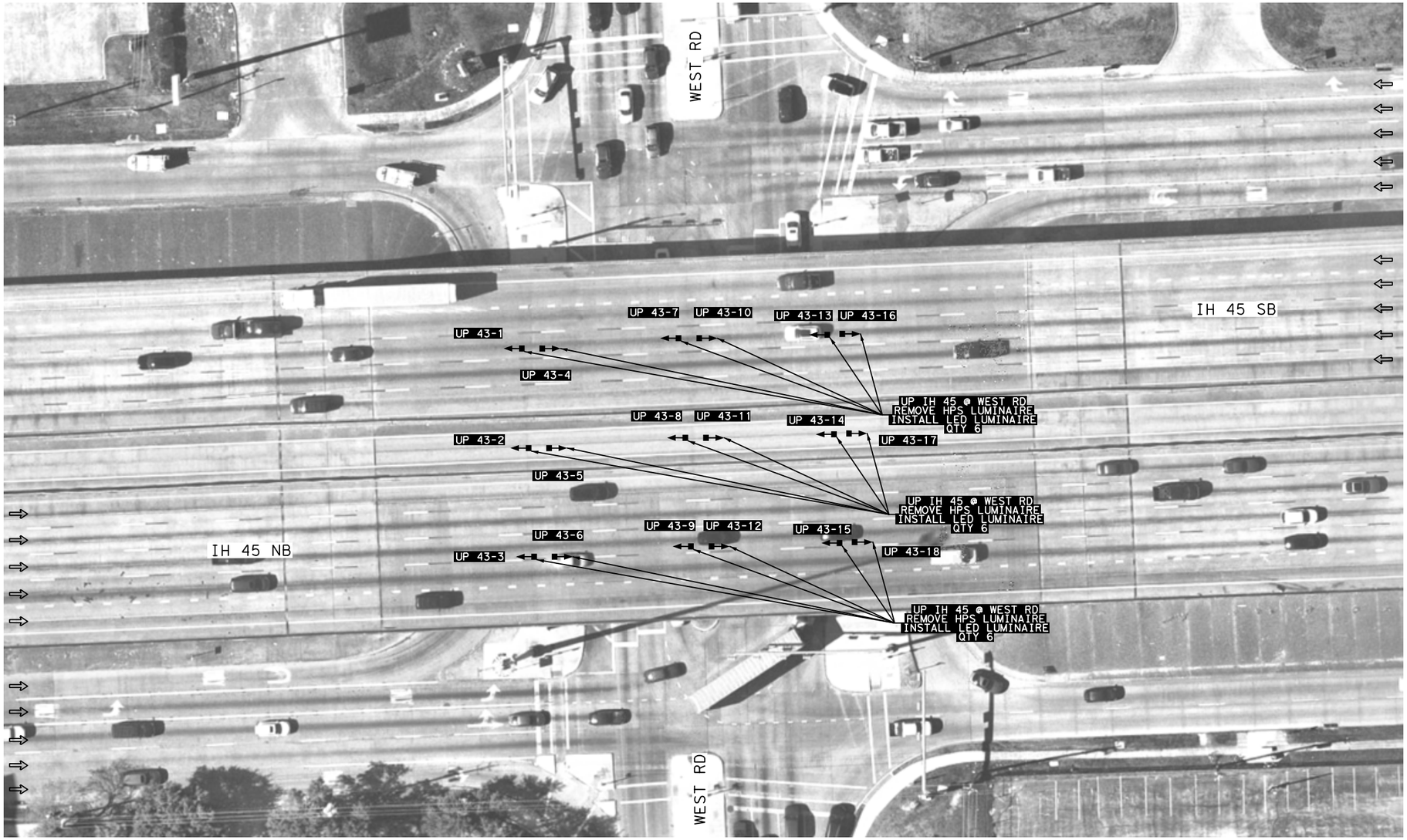
...\064 UP IH45 0110-06-162 W MOUNT HOU BRIDGE.dgn

LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



SCALE: 1" = 50′

25 0 25

NOTES:

1. ALL WORK MUST BE PERFORMED WITHIN TXDOT RIGHT OF WAY.
2. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE UTILITIES WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD; KNOWN OR UNKNOWN; PRIVATE OR PUBLIC (INCLUDING TXDOT OWNED).
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6. ALL ELECTRICAL WORK SHALL MEET THE NATIONAL ELECTRIC CODE.
7. AERIAL AND SCALE FOR VISUAL REFERENCE ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION OR BIDDING. LUMINAIRE LOCATIONS ARE APPROXIMATE.

						UNDERPASS QTY		
						ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA
UP 43-1	UP 43-18	29.785164	-95.412735	250	LED	18	18	
					TOTALS	18	18	

*REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

STATE OF TEXAS
CHARLES R. STEVENS, JR
101286
LICENSED PROFESSIONAL ENGINEER

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

PRINT DATE	REVISION DATE
3/21/2024	

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
8131 JACKRABITT RD
Houston, TX. 77095
PHONE: (713) 828-4742

Texas Department of Transportation®

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

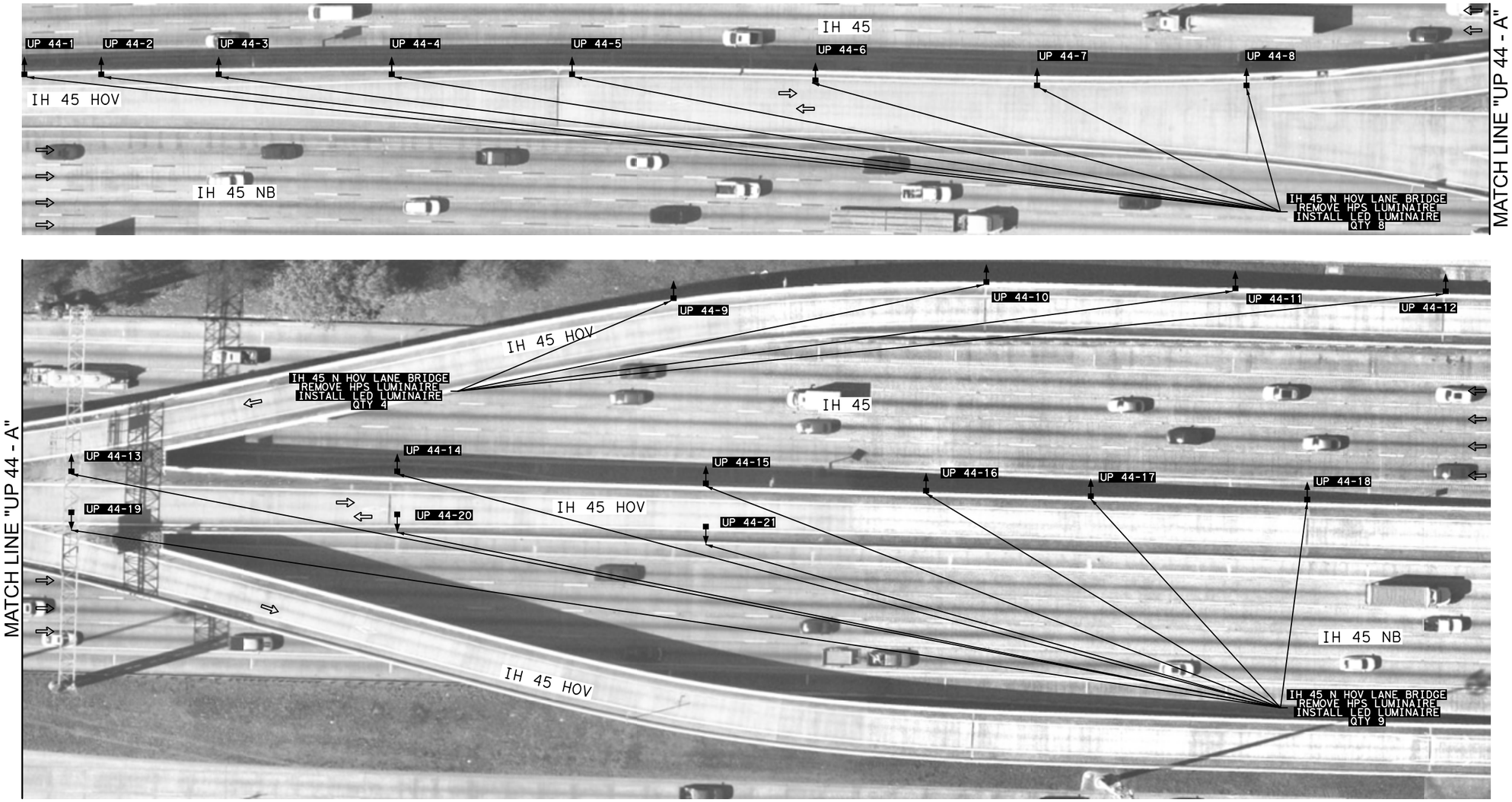
WEST RD BRIDGE

CSJ: 0110-06-162 SHEET 4 OF 15

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		65
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 5:48:45 PM

...\065 UP IH45 0110-06-162 WEST RD BRIDGE.dgn



LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- ◄■ HPS UNDERPASS UPGRADE
- ●■ LED UNDERPASS UPGRADE

SCALE: 1" = 50'

25 0 25

STATE OF TEXAS
CHARLES R. STEVENS, JR.
101286
LICENSED PROFESSIONAL ENGINEER

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

PRINT DATE	REVISION DATE
3/21/2024	

NOTES:

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS) (6028)	INSTALL UP LUM (LED) (6030)	REPLACE UP LUM (LED) (6032)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA
UP 44-1	UP 44-21	29.920927	-95.412740	250	LED	21	21	
					TOTALS	21	21	

*LUMINAIRE UP 44-12.

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
8131 JACKRABBIT RD Houston, TX. 77095 PHONE: (713) 828-4742

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

IH 45 N HOV BRIDGE

CSJ: 0110-06-162 SHEET 5 OF 15

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	66

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

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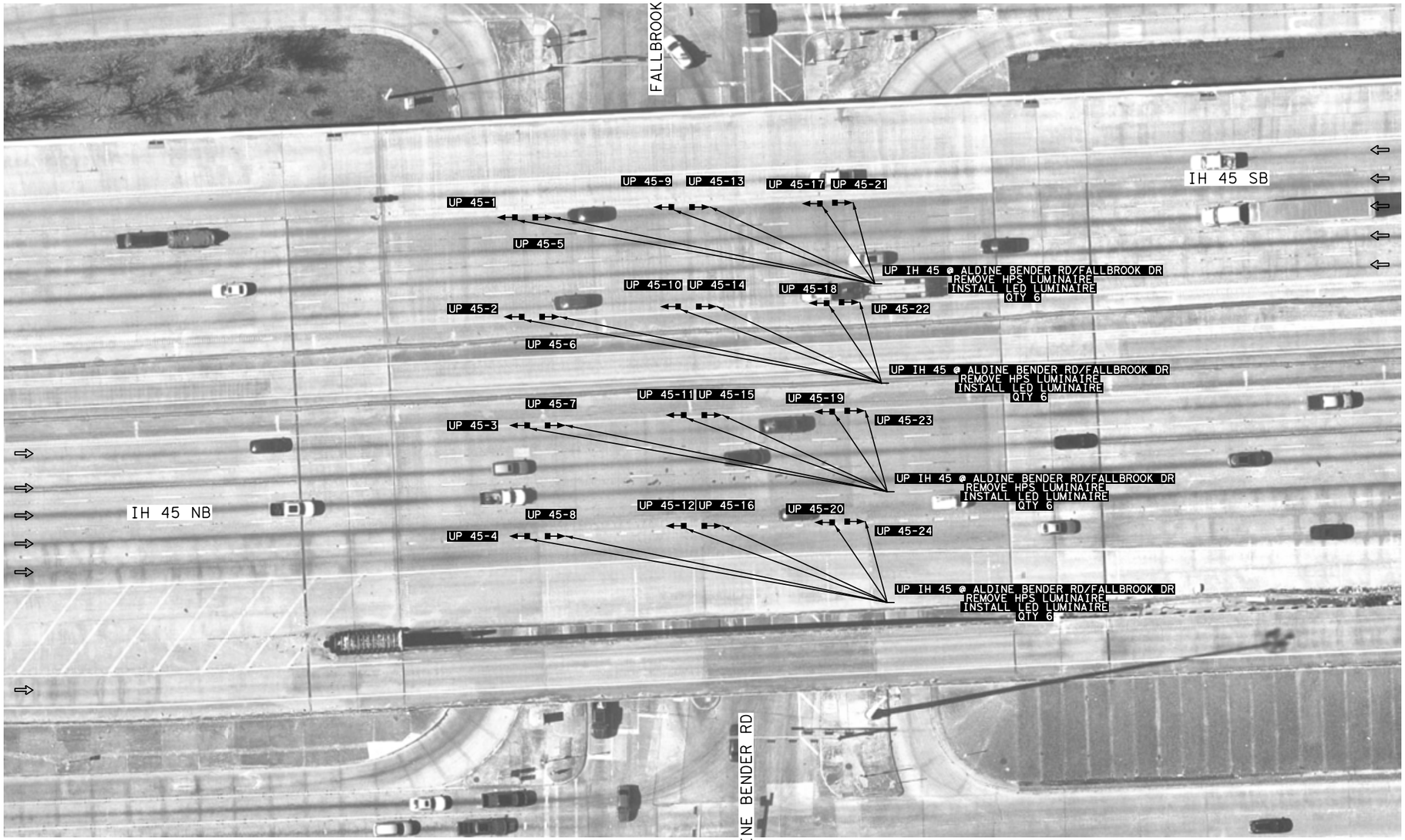

LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- HPS UNDERPASS UPGRADE
- LED UNDERPASS UPGRADE

SCALE: 1" = 50'
25 0 25

NOTES:

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028) EA	(6030) EA	(6032) EA
UP 45-1	UP 45-24	29.931998	-95.412094	250	LED	24	24	
					TOTALS	24	24	

*REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

CHARLES R. STEVENS, JR.
101286
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

PRINT DATE	REVISION DATE
3/21/2024	

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
8131 JACKRABITT RD Houston, TX. 77095
PHONE: (713) 828-4742

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

ALDINE BENDER RD/FALLBROOK DR BRIDGE

CSJ: 0110-06-162 SHEET 6 OF 15

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	67

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

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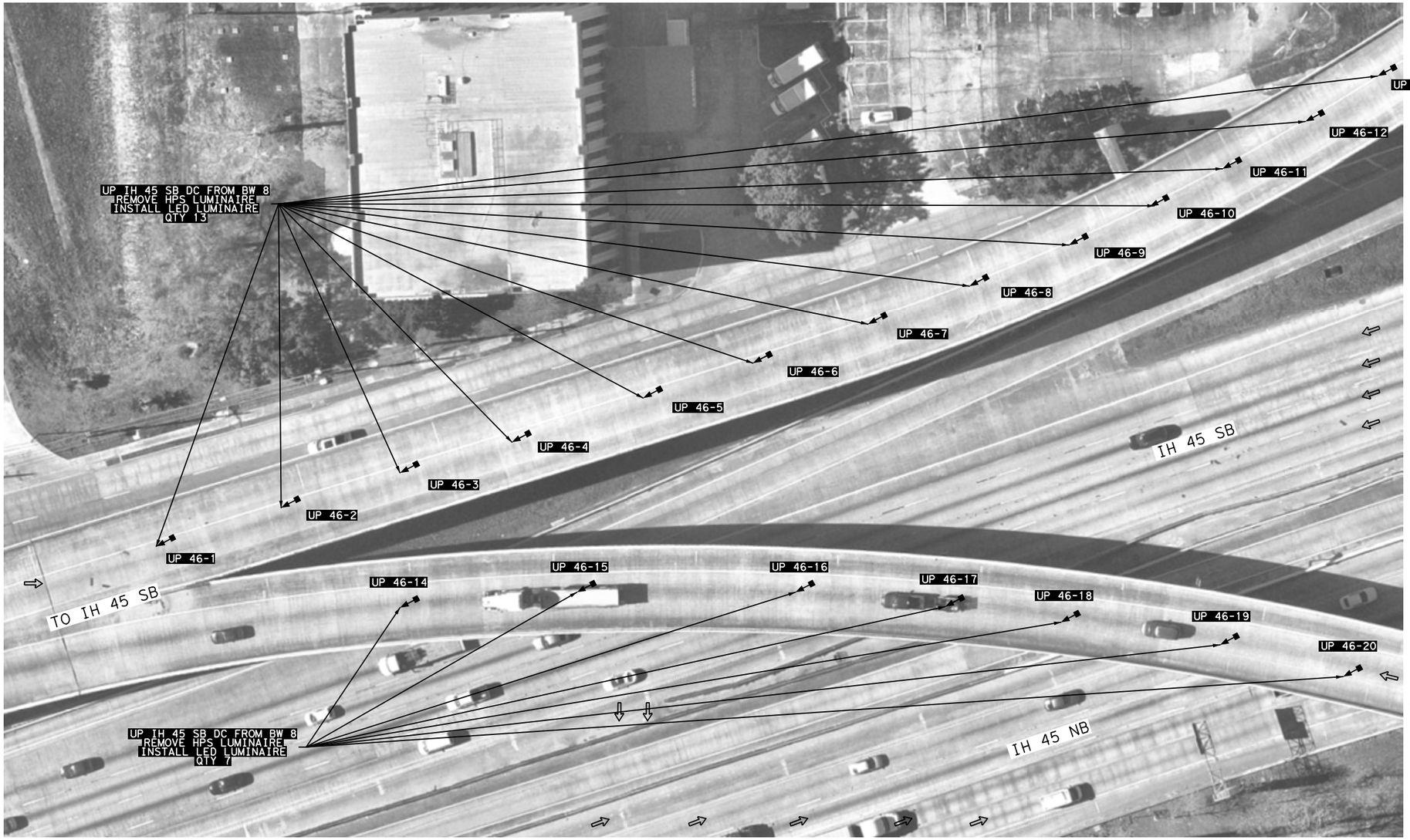

LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- HPS UNDERPASS UPGRADE
- LED UNDERPASS UPGRADE

SCALE: 1" = 50'

25 0 25

NOTES:

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						UNDERPASS QTY		
						ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA
UP 46-1	UP 46-19	29.938940	-95.413949	250	LED	20	20	
					TOTALS	20	20	

*REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

CHARLES R. STEVENS, JR. 101286 LICENSED PROFESSIONAL ENGINEER

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

PRINT DATE	REVISION DATE
3/21/2024	

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
8131 JACKRABBIT RD
Houston, TX. 77095
PHONE: (713) 828-4742

Texas Department of Transportation®

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

IH 45 SB DC FROM BW 8

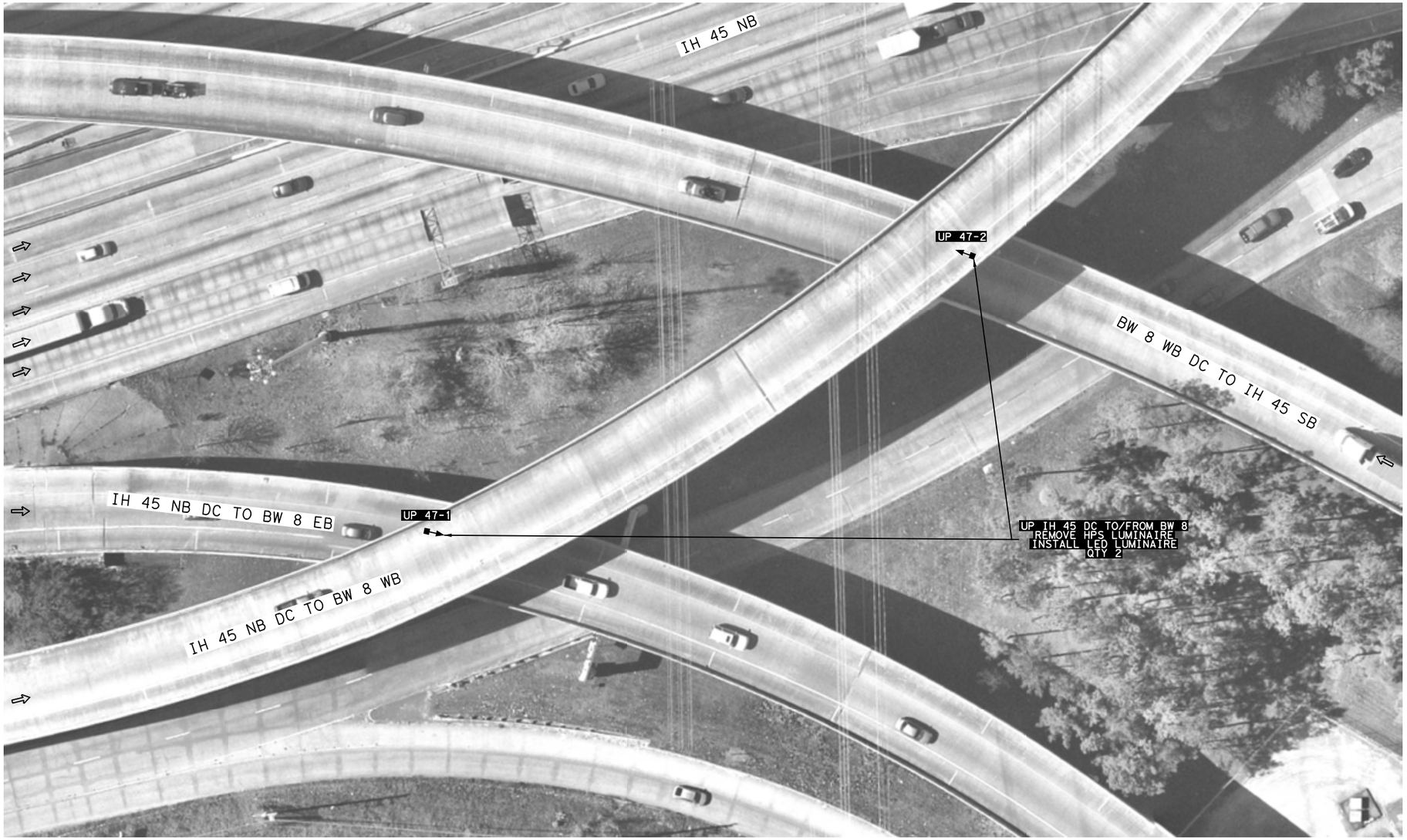
CSJ: 0110-06-162 SHEET 7 OF 15

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	68

STATE	DIST.	COUNTY
TEXAS	HOU	MONTGOMERY,ETC

CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

LEGEND:
- ⇦ DIRECTION OF TRAFFIC FLOW
- HPS UNDERPASS UPGRADE
- LED UNDERPASS UPGRADE



NOTES:

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
						EA	EA	EA
UP 47-1	UP 47-2	29.939285	-95.413015	250	LED	2	2	
					TOTALS	2	2	

*REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

SCALE: 1" = 50'
25 0 25

STATE OF TEXAS
CHARLES R. STEVENS, JR.
101286
LICENSED PROFESSIONAL ENGINEER

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

PRINT DATE	REVISION DATE
3/21/2024	

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
8131 JACKRABITT RD
Houston, TX. 77095
PHONE: (713) 828-4742

Texas Department of Transportation®

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

IH 45 DC TO/FROM BW 8

CSJ: 0110-06-162 SHEET 8 OF 15

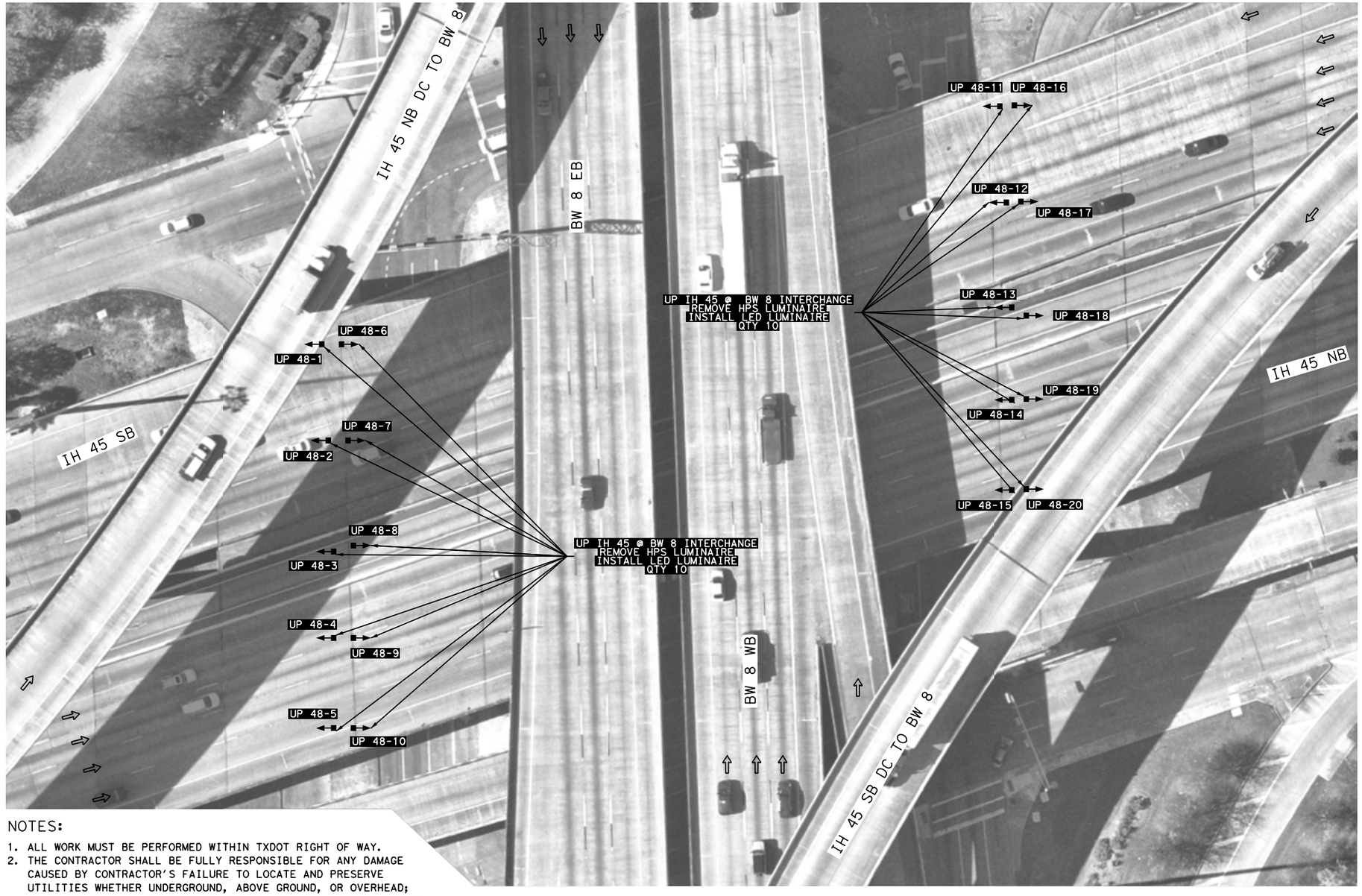
FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	69

STATE	DIST.	COUNTY
TEXAS	HOU	MONTGOMERY,ETC

CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 5:49:01 PM
...\069 UP IH45 0110-06-162 IH 45 NB DC TO BW 8.dgn

LEGEND:
- ⇦ DIRECTION OF TRAFFIC FLOW
- ◄■ HPS UNDERPASS UPGRADE
- ●■ LED UNDERPASS UPGRADE



SCALE: 1" = 50'
25 0 25

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
UP 48-1	UP 48-20	29.941071	-95.414418	250	LED	EA	EA	EA
					TOTALS	20	20	

*REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

CHARLES R. STEVENS, JR.
101286
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

PRINT DATE	REVISION DATE
3/21/2024	

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
8131 JACKRABBIT RD Houston, TX. 77095 PHONE: (713) 828-4742

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

BW 8 INTERCHANGE BRIDGE

CSJ: 0110-06-162 SHEET 9 OF 15

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	70

STATE	DIST.	COUNTY
TEXAS	HOU	MONTGOMERY,ETC

CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 5:43:05 PM
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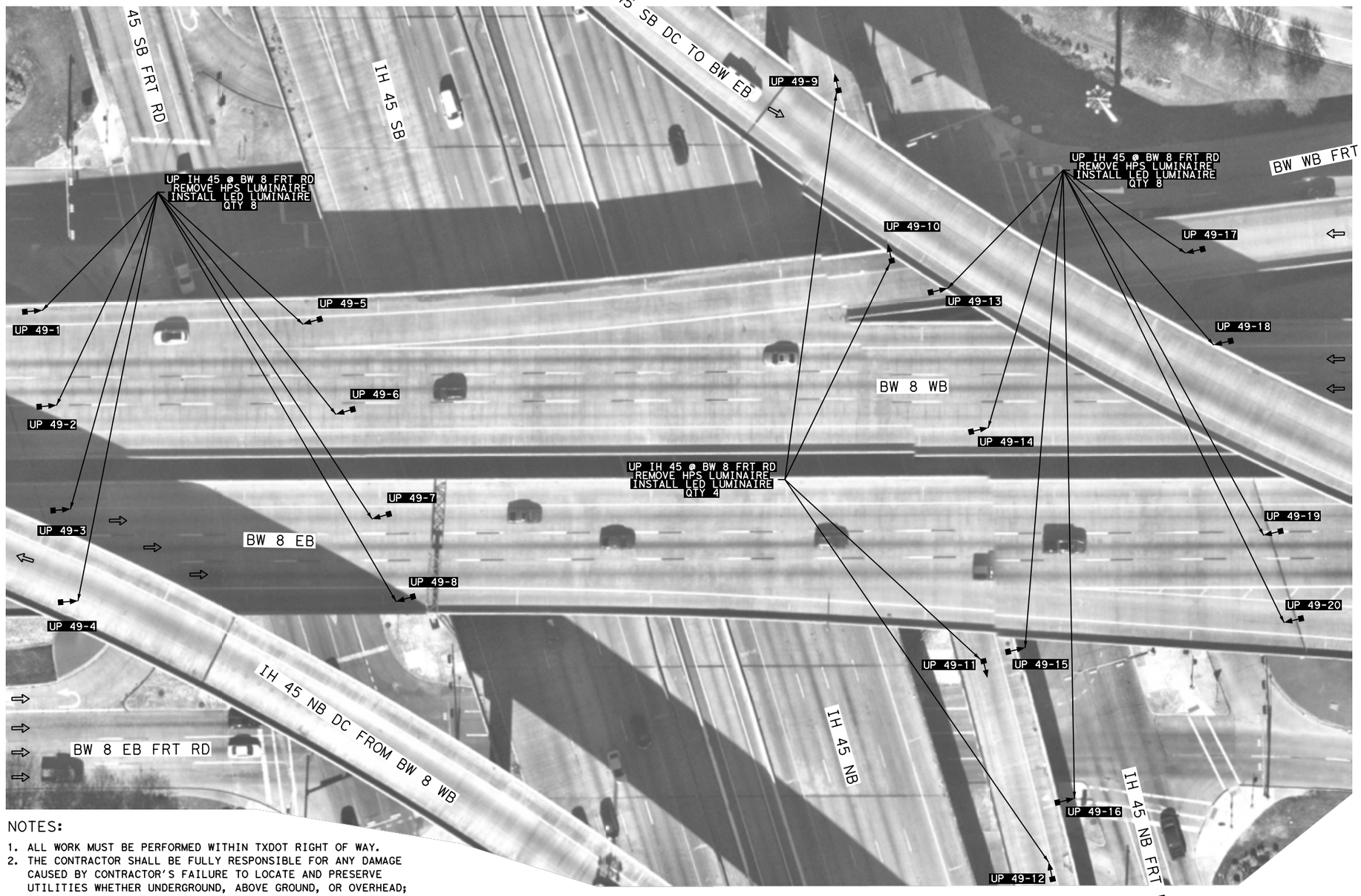

LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- HPS UNDERPASS UPGRADE
- LED UNDERPASS UPGRADE

SCALE: 1" = 50′

25 0 25

NOTES:

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
UP 49-1	UP 49-20	29.940937	-95.413255	250	LED	20	20	
					TOTALS	20	20	

*UP 49-17 LUMINAIRE.

CHARLES R. STEVENS, JR.
101286
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

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3/21/2024	

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Houston, TX. 77095
PHONE: (713) 828-4742

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

BW 8 FRT RD BRIDGES

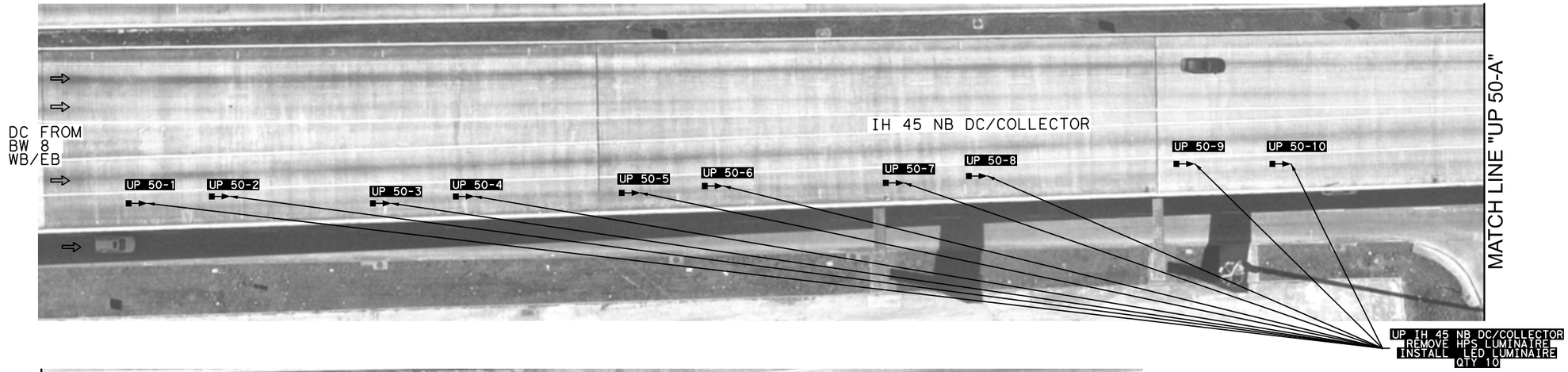
CSJ: 0110-06-162 SHEET 10 OF 15

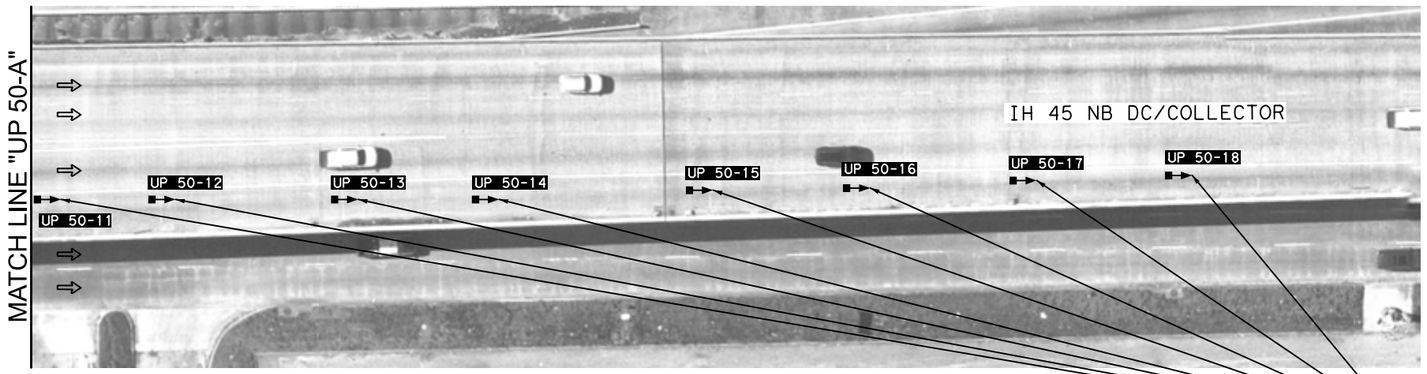
FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		71
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 5:49:10 PM

...\071 UP IH45 0110-06-162 IH 45 AT BW 8 FRT RD BRIDGES.dgn

LEGEND:
⇦ DIRECTION OF TRAFFIC FLOW
◄■ HPS UNDERPASS UPGRADE
●■ LED UNDERPASS UPGRADE





SCALE: 1" = 50'
25 0 25

STATE OF TEXAS
CHARLES R. STEVENS, JR
101286
LICENSED PROFESSIONAL ENGINEER

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

PRINT DATE	REVISION DATE
3/21/2024	

NOTES:

1. ALL WORK MUST BE PERFORMED WITHIN TXDOT RIGHT OF WAY.
2. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE UTILITIES WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD; KNOWN OR UNKNOWN; PRIVATE OR PUBLIC (INCLUDING TXDOT OWNED).
3. CONTRACTOR TO VERIFY LUMINAIRE TYPE, PERFORMANCE, PHOTOMETRIC DATA, & ORIENTATION PRIOR TO REPLACEMENT.
4. THE COST OF REMOVING, SALVAGING, DISASSEMBLING, AND STOCKPILING EXISTING LUMINAIRES; FURNISHING AND INSTALLING NEW LUMINAIRES, CONNECTIONS, AND INTERNAL CONDUCTORS; REPLACING DAMAGED COMPONENTS; DISPOSING OF UNSALVAGEABLE MATERIALS; AND MATERIALS, EQUIPMENT, LABOR, TOOLS, AND INCIDENTALS IS SUBSIDIARY TO ITEM 6000.
5. CONTRACTOR TO FOLLOW STATE AND LOCAL ENVIRONMENTAL REGULATIONS FOR FIXTURE DISPOSAL.
6. ALL ELECTRICAL WORK SHALL MEET THE NATIONAL ELECTRIC CODE.
7. AERIAL AND SCALE FOR VISUAL REFERENCE ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION OR BIDDING. LUMINAIRE LOCATIONS ARE APPROXIMATE.

						UNDERPASS QTY		
						ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA
UP 50-1	UP 50-18	29.946173	-95.415473	250	LED	18	18	
					TOTALS	18	18	

*REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

Texas Department of Transportation®

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
8131 JACKRABITT RD Houston, TX. 77095 PHONE: (713) 828-4742

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

IH 45 NB DC/COLLECTOR

CSJ: 0110-06-162 SHEET 11 OF 15

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		72
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

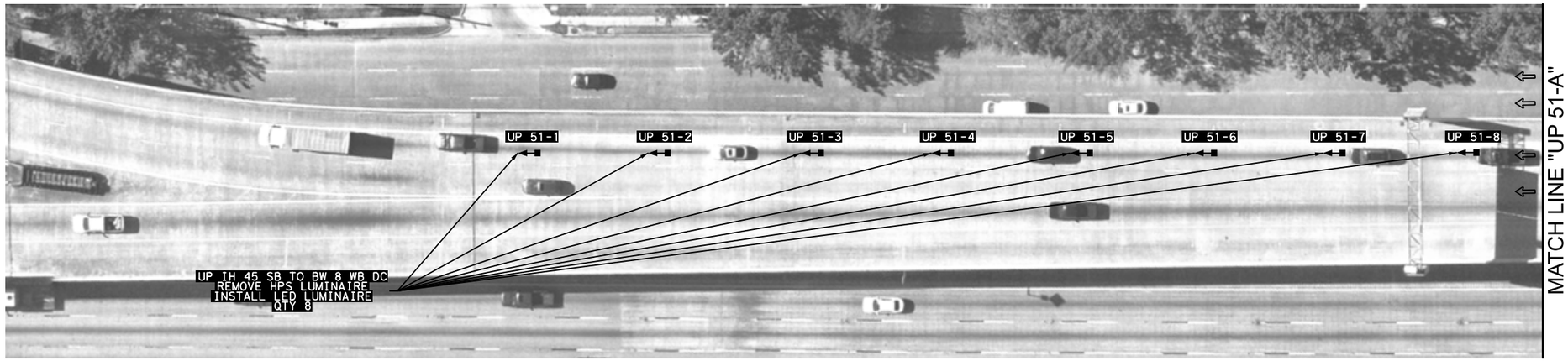
3/21/2024 5:49:17 PM
...\072 UP IH45 0110-06-162 IH 45 NB DC FROM BW 8.dgn

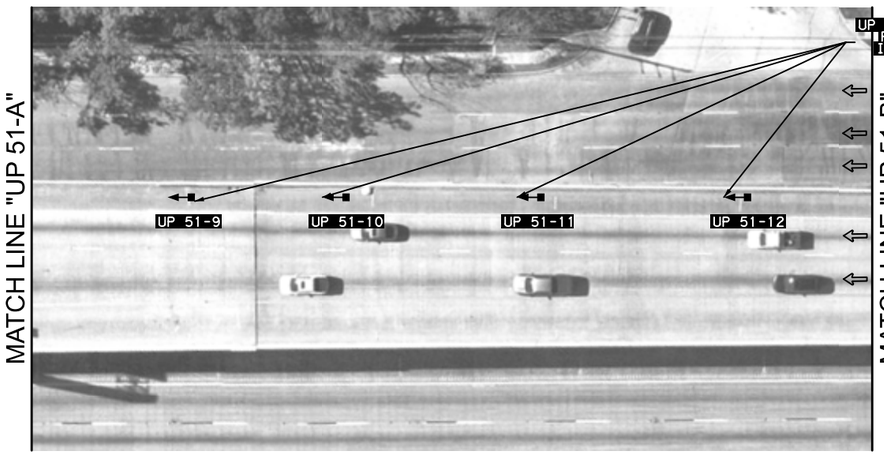
LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

◄■ HPS UNDERPASS UPGRADE

●■ LED UNDERPASS UPGRADE





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						UNDERPASS QTY		
						ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA
UP 51-1	UP 51-12	29.945217	-95.416011	250	LED	12	12	
					TOTALS	12	12	

*REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

SCALE: 1" = 50'

25 0 25

STATE OF TEXAS
CHARLES R. STEVENS, JR
101286
LICENSED PROFESSIONAL ENGINEER

CHARLES R. STEVENS, JR., P.E. — DATE 3/21/2024

PRINT DATE	REVISION DATE
3/21/2024	

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
8131 JACKRABBIT RD
Houston, TX. 77095
PHONE: (713) 828-4742

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

UP IH 45 SB TO BW 8 WB DC BRIDGE SEC 1

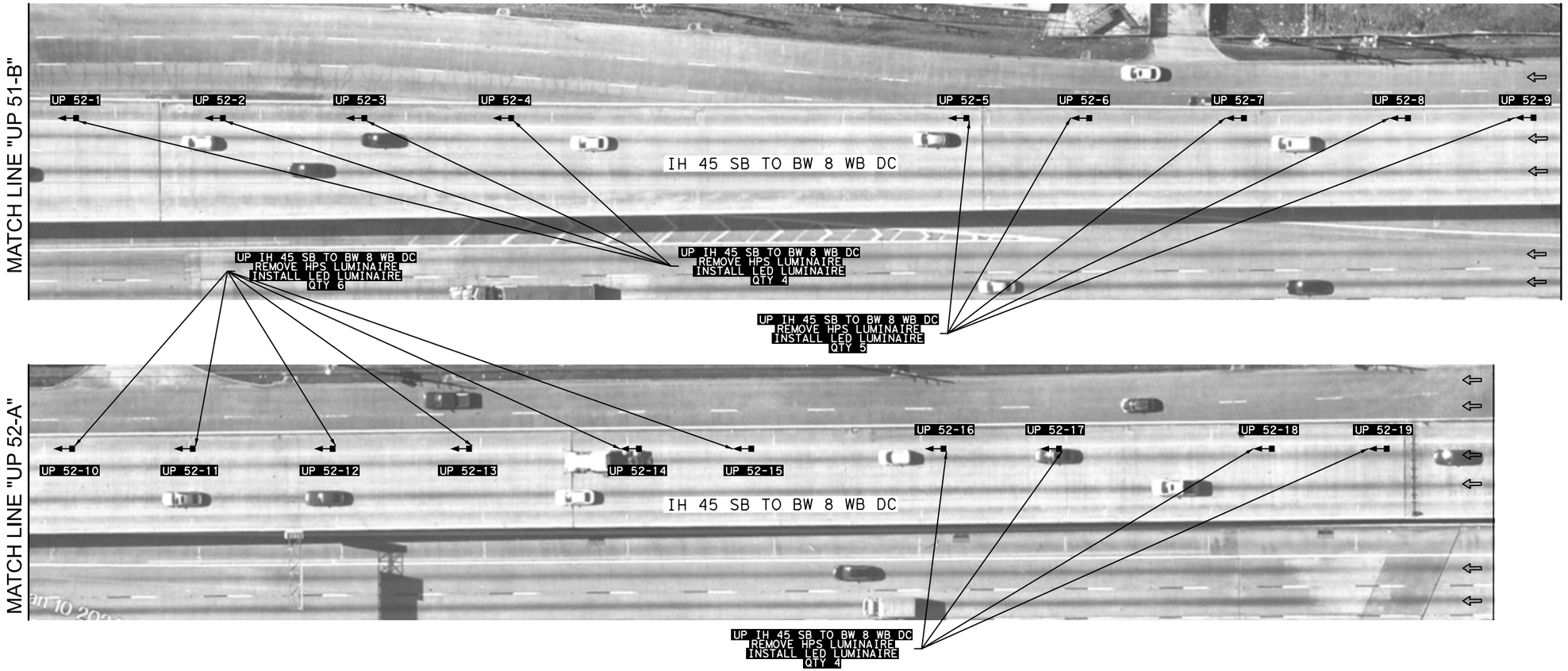
CSJ: 0110-06-162 SHEET 12 OF 15

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		73
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 5:43:22 PM

...\073 UP IH45 0110-06-162 IH 45 SB TO BW 8.dgn

LEGEND:
- ⇦ DIRECTION OF TRAFFIC FLOW
- HPS UNDERPASS UPGRADE
- LED UNDERPASS UPGRADE



SCALE: 1" = 50'
25 0 25

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028) EA	(6030) EA	(6032) EA
UP 52-1	UP 52-19	29.948316	-95.417072	250	LED	19	19	
					TOTALS	19	19	

*REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

CHARLES R. STEVENS, JR.
101286
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

PRINT DATE	REVISION DATE
3/21/2024	

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
8131 JACKRABBIT RD
Houston, TX. 77095
PHONE: (713) 828-4742

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

IH 45 SB TO BW 8 WB DC BRIDGE SEC 2

CSJ: 0110-06-162 SHEET 13 OF 15

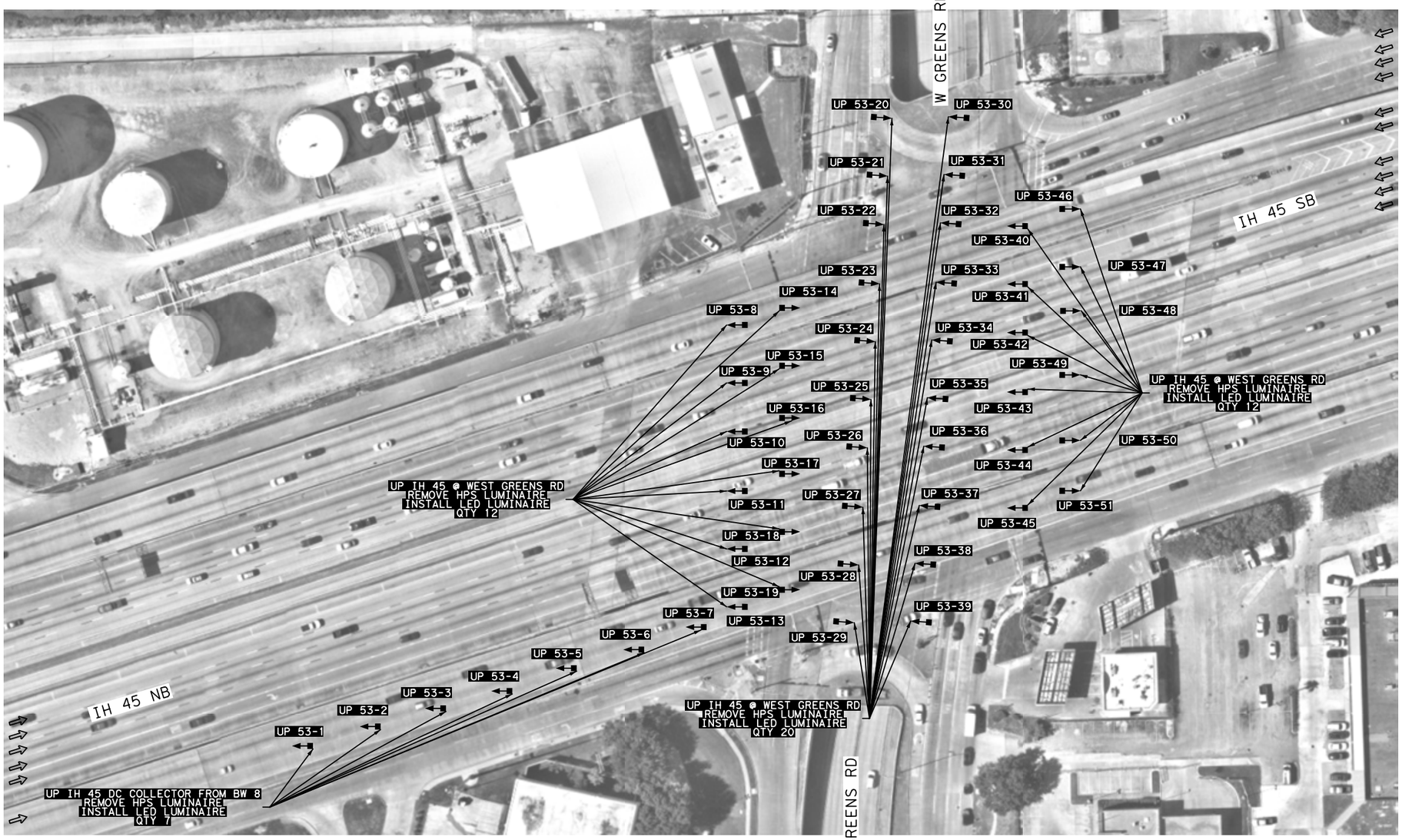
FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	74

STATE	DIST.	COUNTY
TEXAS	HOU	MONTGOMERY,ETC

CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 5:49:28 PM

...\074 UP IH45 0110-06-162 IH 45 SB TO BW 8.dgn



LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- ◄■ HPS UNDERPASS UPGRADE
- ●■ LED UNDERPASS UPGRADE

SCALE: 1" = 100'

50 0 50

NOTES:

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS) (6028)	INSTALL UP LUM (LED) (6030)	REPLACE UP LUM (LED) (6032)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA
UP 53-1	UP 53-51	29.949447	-95.417449	250	LED	51	51	
					TOTALS	51	51	

*REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

STATE OF TEXAS
CHARLES R. STEVENS, JR.
101286
LICENSED PROFESSIONAL ENGINEER

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

PRINT DATE	REVISION DATE
3/21/2024	

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
8131 JACKRABIT RD
Houston, TX. 77095
PHONE: (713) 828-4742

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

W GREENS RD BRIDGE

CSJ: 0110-06-162 SHEET 14 OF 15

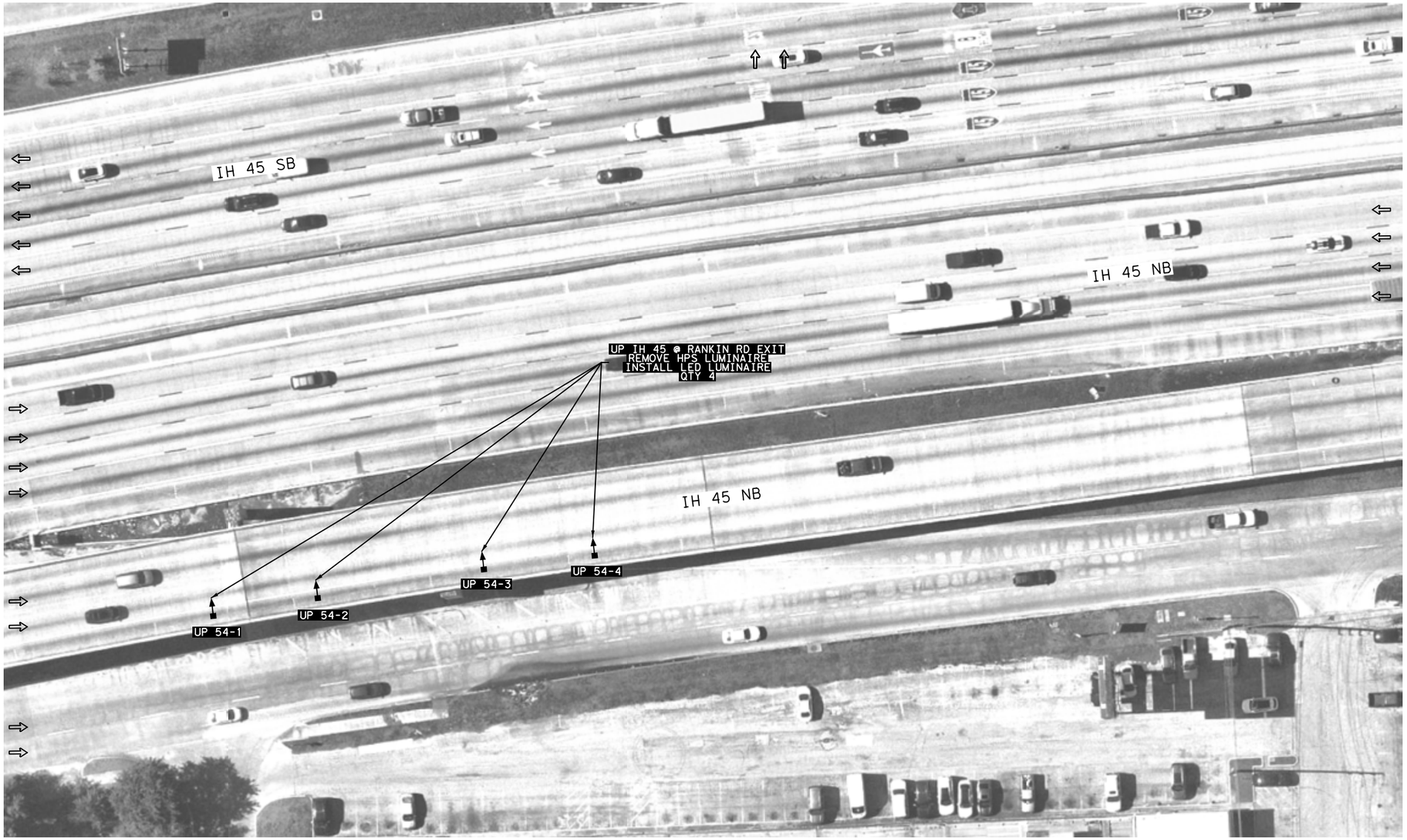
FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	75

STATE	DIST.	COUNTY
TEXAS	HOU	MONTGOMERY,ETC

CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 8:15:34 PM

...\075 UP IH45 0110-06-162 IH 45 AT WESTGREENS BRIDGE.dgn



LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- ◄■ HPS UNDERPASS UPGRADE
- ●■ LED UNDERPASS UPGRADE

SCALE: 1" = 50'

25 0 25

NOTES:

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
						EA	EA	EA
UP 54-1	UP 54-4	29.952879	-95.417603	250	LED	4	4	
					TOTALS	4	4	

*REPRESENTS THE NORTHWESTERN-MOST LUMINAIRE.

CHARLES R. STEVENS, JR.
101286
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

PRINT DATE	REVISION DATE
3/21/2024	

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
8131 JACKRABITT RD
Houston, TX. 77095
PHONE: (713) 828-4742

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

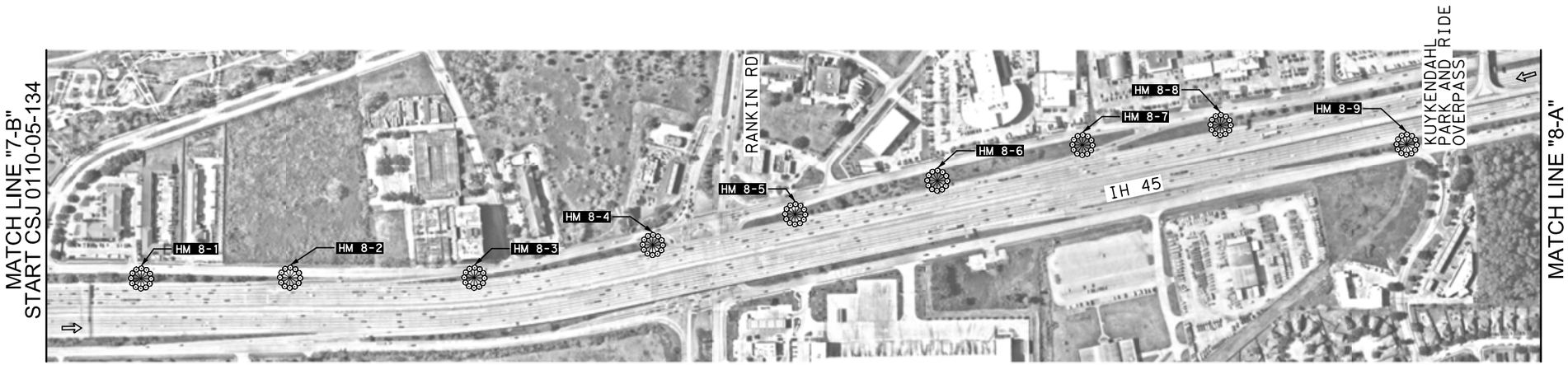
RANKIN RD EXIT BRIDGE

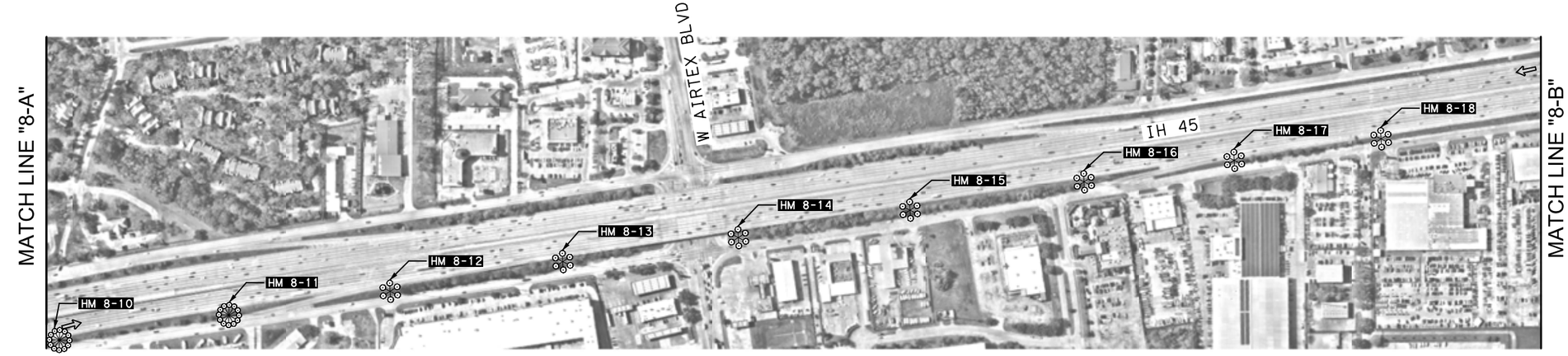
CSJ: 0110-06-162 SHEET 15 OF 15

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		76
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 5:43:41 PM

...\076 UP IH45 0110-06-162 RANKIN RD RAMP.dgn





LEGEND:
- DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Z-PAT HIGH MAST UPGRADE

SCALE: 1" = 500'
250 0 250

NOTES:
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HIGH MAST QUANTITIES										
ILLUMINATION MAINTENANCE 6000										
					RAISE LOWER RING	REPLACE HM LED LUM	HPS TO LED UPGRADE		AVIATION	Z-PATTERN
							REMOVE HM HPS FIXTURE	INSTALL HM LED FIXTURE	REPLACE FIX (LED)	MODIFY Z-PAT ASSM
HM ID	LOCATION		LAMP DETAILS		(6103)	(6160)	(6162)	(6161)	(6167)	(6000)
	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA	EA	EA
HM 8-1	29.959420	-95.418874	600	LED	1		12	6	3	
HM 8-2	29.961072	-95.418881	600	LED	1		12	6	3	
HM 8-3	29.963088	-95.418893	600	LED	1		12	6	3	
HM 8-4	29.964939	-95.419279	600	LED	1		12	6	3	
HM 8-5	29.966588	-95.419675	600	LED	1		12	6	3	
HM 8-6	29.968161	-95.420109	600	LED	1		12	6	3	
HM 8-7	29.969751	-95.420547	600	LED	1		12	6	3	
HM 8-8	29.971272	-95.420822	600	LED	1		12	6	3	
HM 8-9	29.973276	-95.420549	600	LED	1		12	6	3	
HM 8-10	29.974960	-95.420947	600	LED	1		12	6	3	
HM 8-11	29.976813	-95.421343	600	LED	1		12	6	3	
HM 8-12	29.978636	-95.421628	600	LED	1	6			3	
HM 8-13	29.980535	-95.421995	600	LED	1	6			3	
HM 8-14	29.982465	-95.422343	600	LED	1	6			3	
HM 8-15	29.984344	-95.422660	600	LED	1	6			3	
HM 8-16	29.986246	-95.423047	600	LED	1	6			3	
HM 8-17	29.987811	-95.423318	600	LED	1	6			3	
HM 8-18	29.989501	-95.423627	600	LED	1	6			3	
				TOTALS	18	42	132	66	54	

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED PROFESSIONAL ENGINEER
Victor Torres

PRINT DATE	REVISION DATE
3/21/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

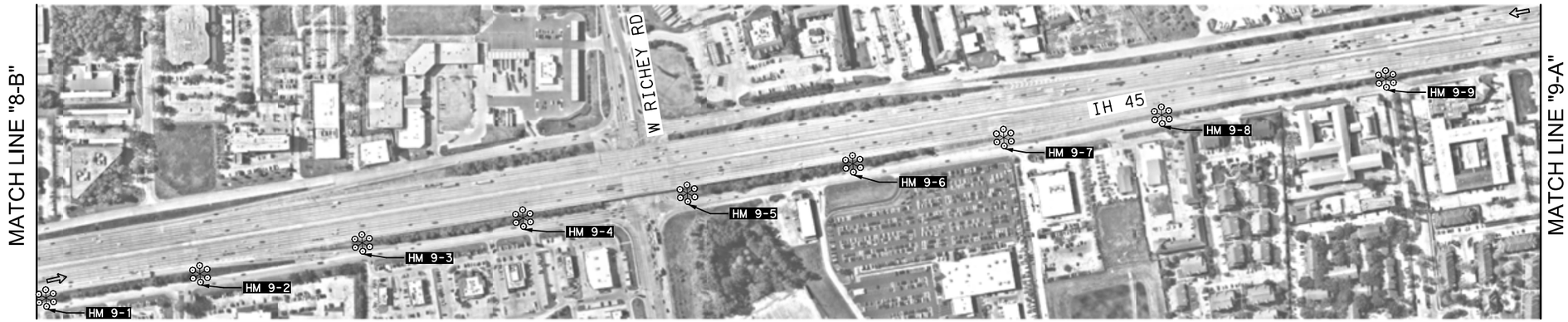
IH 45 ILLUMINATION

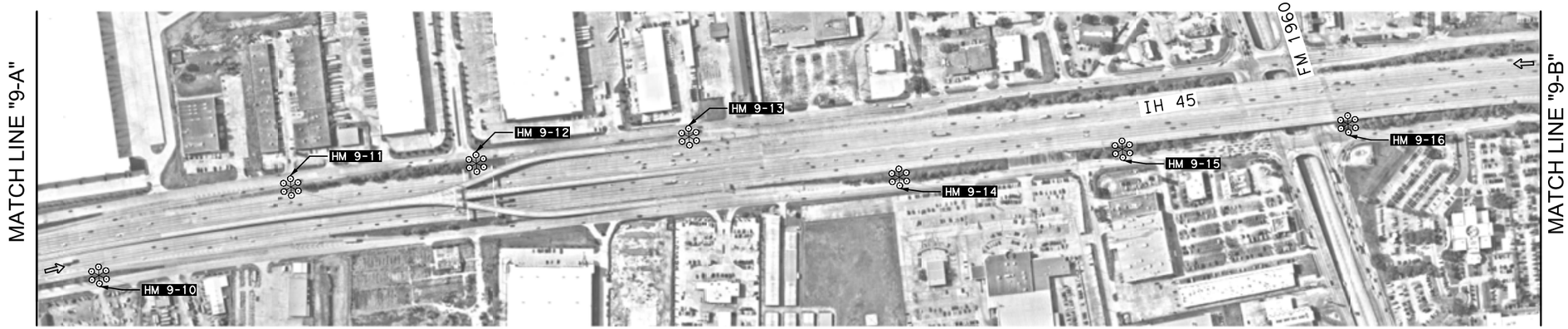
HIGHMAST ILLUMINATION LAYOUT

ML 7-B TO ML 8-B

CSJ: 0110-05-134 SHEET 1 OF 5

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		77
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45





LEGEND:
- DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Z-PAT HIGH MAST UPGRADE

SCALE: 1" = 500'
250 0 250

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HIGH MAST QUANTITIES

ILLUMINATION MAINTENANCE 6000

HM ID	LOCATION		LAMP DETAILS		RAISE LOWER RING (6103)	REPLACE HM LED LUM (6160)	HPS TO LED UPGRADE: REMOVE HM HPS FIXTURE (6162)	HPS TO LED UPGRADE: INSTALL HM LED FIXTURE (6161)	AVIATION: REPLACE FIX (LED) (6167)	Z-PATTERN: MODIFY Z-PAT ASSM (6000)
	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA	EA	EA
HM 9-1	29.991264	-95.423940	600	LED	1	6			3	
HM 9-2	29.993040	-95.424243	600	LED	1	6			3	
HM 9-3	29.994807	-95.424623	600	LED	1	6			3	
HM 9-4	29.996548	-95.424930	600	LED	1	6			3	
HM 9-5	29.998330	-95.425233	600	LED	1	6			3	
HM 9-6	30.000102	-95.425574	600	LED	1	6			3	
HM 9-7	30.001771	-95.425907	600	LED	1	6			3	
HM 9-8	30.003515	-95.426170	600	LED	1	6			3	
HM 9-9	30.005949	-95.426629	600	LED	1	6			3	
HM 9-10	30.008395	-95.427062	600	LED	1	6			3	
HM 9-11	30.010541	-95.428105	600	LED	1	6			3	
HM 9-12	30.012500	-95.428357	600	LED	1	6			3	
HM 9-13	30.014733	-95.428627	600	LED	1	6			3	
HM 9-14	30.017115	-95.428038	600	LED	1	6			3	
HM 9-15	30.019570	-95.428319	600	LED	1	6			3	
HM 9-16	30.022037	-95.428577	600	LED	1	6			3	
				TOTALS	16	96			48	

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER
Victor Torres

PRINT DATE	REVISION DATE
3/21/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

HIGHMAST ILLUMINATION LAYOUT

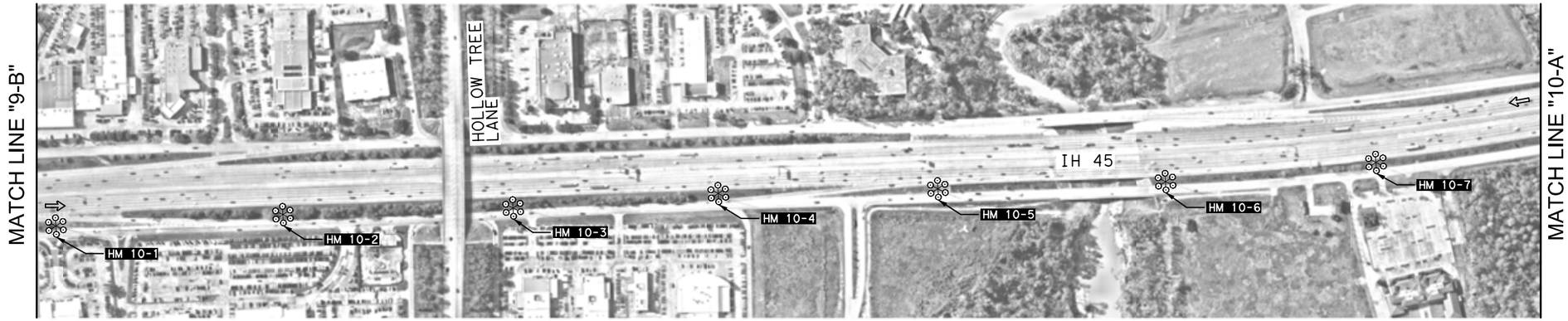
ML 8-B TO ML 9-B

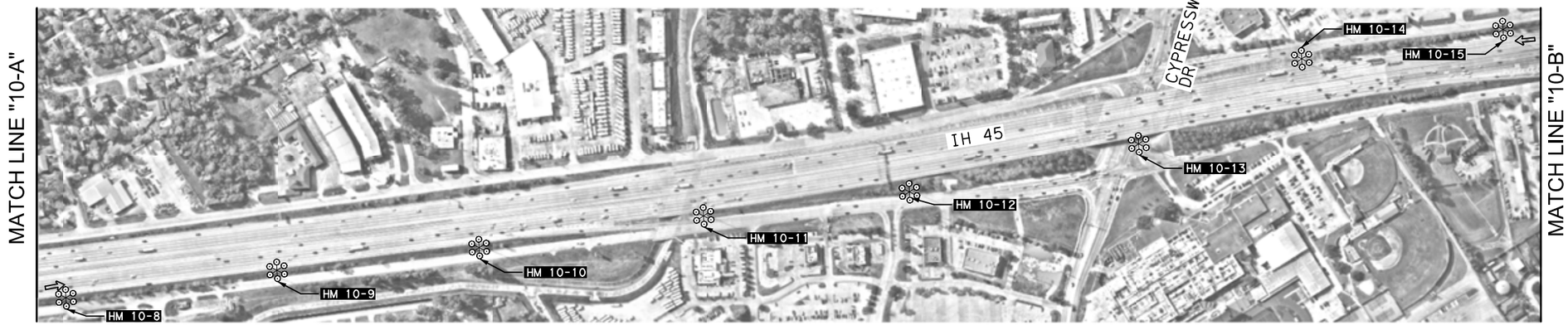
CSJ: 0110-05-134 SHEET 2 OF 5

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	78

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 11:08:06 PM
...\SHEET 78 LED 8 - LED 20.dgn





LEGEND:
- DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Z-PAT HIGH MAST UPGRADE

SCALE: 1" = 500'
250 0 250

NOTES:
1. ALL WORK MUST BE PERFORMED WITHIN TXDOT RIGHT OF WAY.
2. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE UTILITIES WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD; KNOWN OR UNKNOWN; PRIVATE OR PUBLIC (INCLUDING TXDOT OWNED).
3. CONTRACTOR TO VERIFY LUMINAIRE TYPE, PERFORMANCE, PHOTOMETRIC DATA, & ORIENTATION PRIOR TO REPLACEMENT.
4. THE COST OF REMOVING, SALVAGING, DISASSEMBLING, AND STOCKPILING EXISTING LUMINAIRES; FURNISHING AND INSTALLING NEW LUMINAIRES, CONNECTIONS, CONDUCTORS, AND CONDUIT ON THE RING; REWIRING CIRCUITS ON THE RING; REPLACING DAMAGED COMPONENTS; DISPOSAL OF UNSALVAGEABLE MATERIALS; CONDUCTING SYSTEM PERFORMANCE TESTING; AND MATERIALS, EQUIPMENT, LABOR, TOOLS, AND INCIDENTALS IS SUBSIDIARY TO ITEM 6000.
5. CONTRACTOR TO FOLLOW STATE AND LOCAL ENVIRONMENTAL REGULATIONS FOR FIXTURE DISPOSAL.
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					HIGH MAST QUANTITIES					
					ILLUMINATION MAINTENANCE 6000					
					RAISE LOWER RING	REPLACE HM LED LUM	HPS TO LED UPGRADE		AVIATION	Z-PATTERN
							REMOVE HM HPS FIXTURE	INSTALL HM LED FIXTURE	REPLACE FIX (LED)	MODIFY Z-PAT ASSM
					(6103)	(6160)	(6162)	(6161)	(6167)	(6000)
HM ID	LOCATION		LAMP DETAILS							
	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA	EA	EA
HM 10-1	30.024350	-95.428700	600	LED	1	6			3	
HM 10-2	30.026806	-95.428753	600	LED	1	6			3	
HM 10-3	30.029275	-95.428818	600	LED	1	6			3	
HM 10-4	30.031480	-95.428884	600	LED	1	6			3	
HM 10-5	30.033977	-95.428857	600	LED	1	6			3	
HM 10-6	30.036444	-95.428895	600	LED	1	6			3	
HM 10-7	30.038722	-95.429043	600	LED	1	6			3	
HM 10-8	30.040870	-95.429325	600	LED	1	6			3	
HM 10-9	30.043136	-95.429700	600	LED	1	6			3	
HM 10-10	30.045441	-95.430065	600	LED	1	6			3	
HM 10-11	30.047878	-95.430483	600	LED	1	6			3	
HM 10-12	30.050114	-95.430816	600	LED	1	6			3	
HM 10-13	30.052567	-95.431475	600	LED	1	6			3	
HM 10-14	30.054334	-95.432515	600	LED	1	6			3	
HM 10-15	30.056506	-95.432924	600	LED	1	6			3	
				TOTALS	15	90			45	

VICTOR A. TORRES
134333
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS
Victor Torres

PRINT DATE	REVISION DATE
3/21/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

HIGHMAST ILLUMINATION LAYOUT

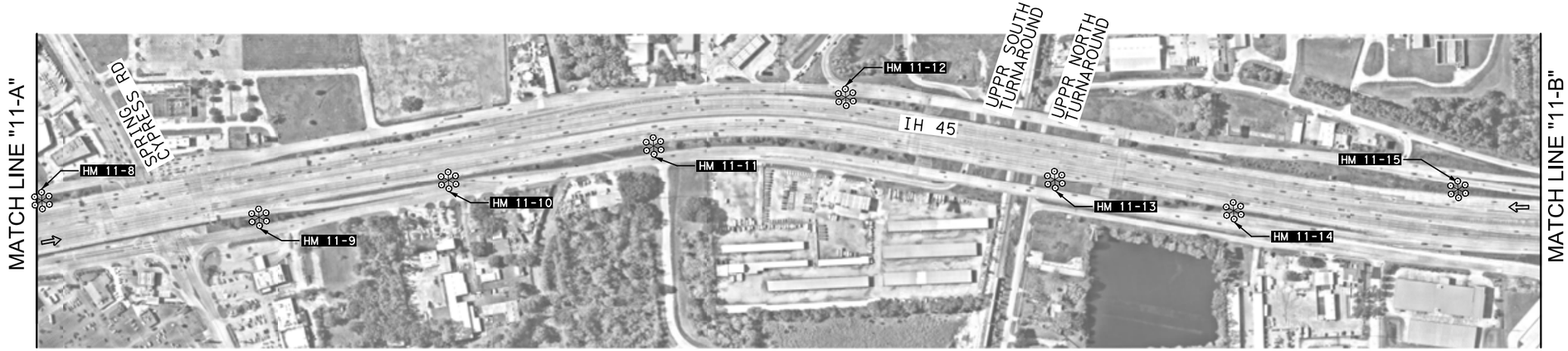
ML 9-B TO ML 10-B

CSJ: 0110-05-134 SHEET 3 OF 5

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	79

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

LEGEND:
- DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Z-PAT HIGH MAST UPGRADE



SCALE: 1" = 500'
250 0 250

NOTES:
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7. AERIAL AND SCALE FOR VISUAL REFERENCE ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION OR BIDDING. LUMINAIRE LOCATIONS ARE APPROXIMATE.

HM ID	LOCATION		LAMP DETAILS		HIGH MAST QUANTITIES: ILLUMINATION MAINTENANCE 6000					
					RAISE LOWER RING	REPLACE HM LED LUM	HPS TO LED UPGRADE		AVIATION	Z-PATTERN
							REMOVE HM HPS FIXTURE	INSTALL HM LED FIXTURE	REPLACE FIX (LED)	MODIFY Z-PAT ASSM
	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6103) EA	(6160) EA	(6162) EA	(6161) EA	(6167) EA	(6000) EA
HM 11-1	30.058758	-95.432717	600	LED	1	6			3	
HM 11-2	30.060842	-95.433715	600	LED	1	6			3	
HM 11-3	30.063005	-95.434138	600	LED	1	6			3	
HM 11-4	30.065176	-95.434527	600	LED	1	6			3	
HM 11-5	30.067354	-95.434930	600	LED	1	6			3	
HM 11-6	30.069516	-95.435353	600	LED	1	6			3	
HM 11-7	30.071789	-95.435083	600	LED	1	6			3	
HM 11-8	30.073578	-95.436175	600	LED	1	6			3	
HM 11-9	30.075850	-95.435909	600	LED	1	6			3	
HM 11-10	30.078012	-95.436331	600	LED	1	6			3	
HM 11-11	30.080252	-95.436691	600	LED	1	6			3	
HM 11-12	30.082347	-95.437216	600	LED	1	6			3	
HM 11-13	30.084542	-95.436130	600	LED	1	6			3	
HM 11-14	30.086437	-95.435688	600	LED	1	6			3	
HM 11-15	30.088981	-95.435860	600	LED	1	6			3	
				TOTALS	15	90			45	

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED PROFESSIONAL ENGINEER
Victor Torres

PRINT DATE	REVISION DATE
3/21/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

HIGHMAST ILLUMINATION LAYOUT

ML 10-B TO ML 11-B

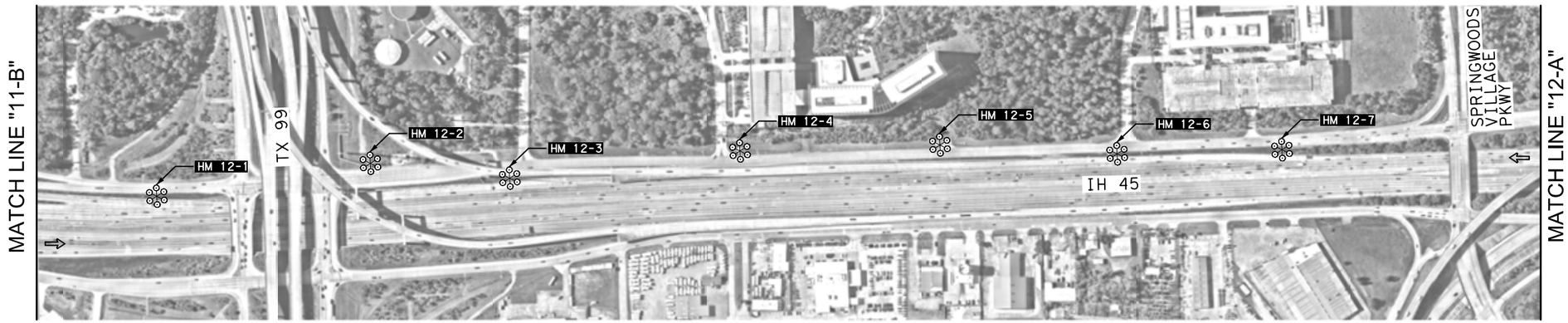
CSJ: 0110-05-134 SHEET 4 OF 5

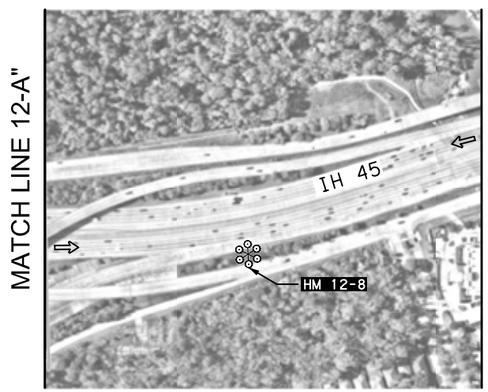
FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	80

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 11:03:58 PM
...\SHEET 80 LED 36 - LED 50.dgn

LEGEND:
- DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Z-PAT HIGH MAST UPGRADE





SCALE: 1" = 500'
250 0 250

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED PROFESSIONAL ENGINEER
Victor Torres

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HIGH MAST QUANTITIES

HM ID	LOCATION		LAMP DETAILS		ILLUMINATION MAINTENANCE 6000					
					RAISE LOWER RING	REPLACE HM LED LUM	HPS TO LED UPGRADE		AVIATION	Z-PATTERN
							REMOVE HM HPS FIXTURE	INSTALL HM LED FIXTURE	REPLACE FIX (LED)	MODIFY Z-PAT ASSM
	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6103) EA	(6160) EA	(6162) EA	(6161) EA	(6167) EA	(6000) EA
HM 12-1	30.091255	-95.435724	600	LED	1	6			3	
HM 12-2	30.093594	-95.436078	600	LED	1	6			3	
HM 12-3	30.095093	-95.435846	600	LED	1	6			3	
HM 12-4	30.097620	-95.436136	600	LED	1	6			3	
HM 12-5	30.099766	-95.436141	600	LED	1	6			3	
HM 12-6	30.101632	-95.435967	600	LED	1	6			3	
HM 12-7	30.103508	-95.435939	600	LED	1	6			3	
HM 12-8	30.108210	-95.435385	600	LED	1	6			3	
				TOTALS	8	48			24	

PRINT DATE	REVISION DATE
3/21/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

Texas Department of Transportation®

IH 45 ILLUMINATION

HIGHMAST ILLUMINATION LAYOUT

ML 11-B TO ML 12-B

CSJ: 0110-05-134 SHEET 5 OF 5

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	81

STATE	DIST.	COUNTY
TEXAS	HOU	MONTGOMERY,ETC

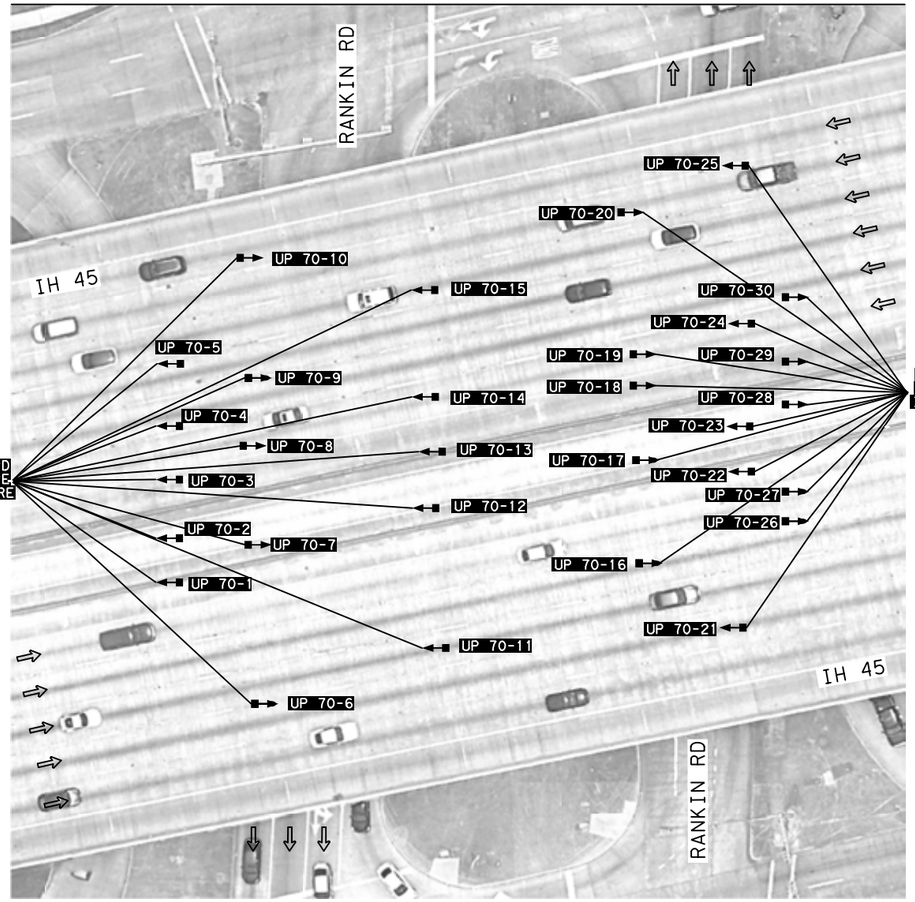
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

◄■ HPS UNDERPASS UPGRADE

●■ LED UNDERPASS UPGRADE



SCALE: 1" = 50'

25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER

Victor Torres

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
UP 70-1	UP 70-30	29.965615	-95.419042	250	LED	EA	EA	EA
					TOTALS	30	30	

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/21/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

Texas Department of Transportation®

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

RANKIN RD

CSJ: 0110-05-134 SHEET 1 OF 10

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	82

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

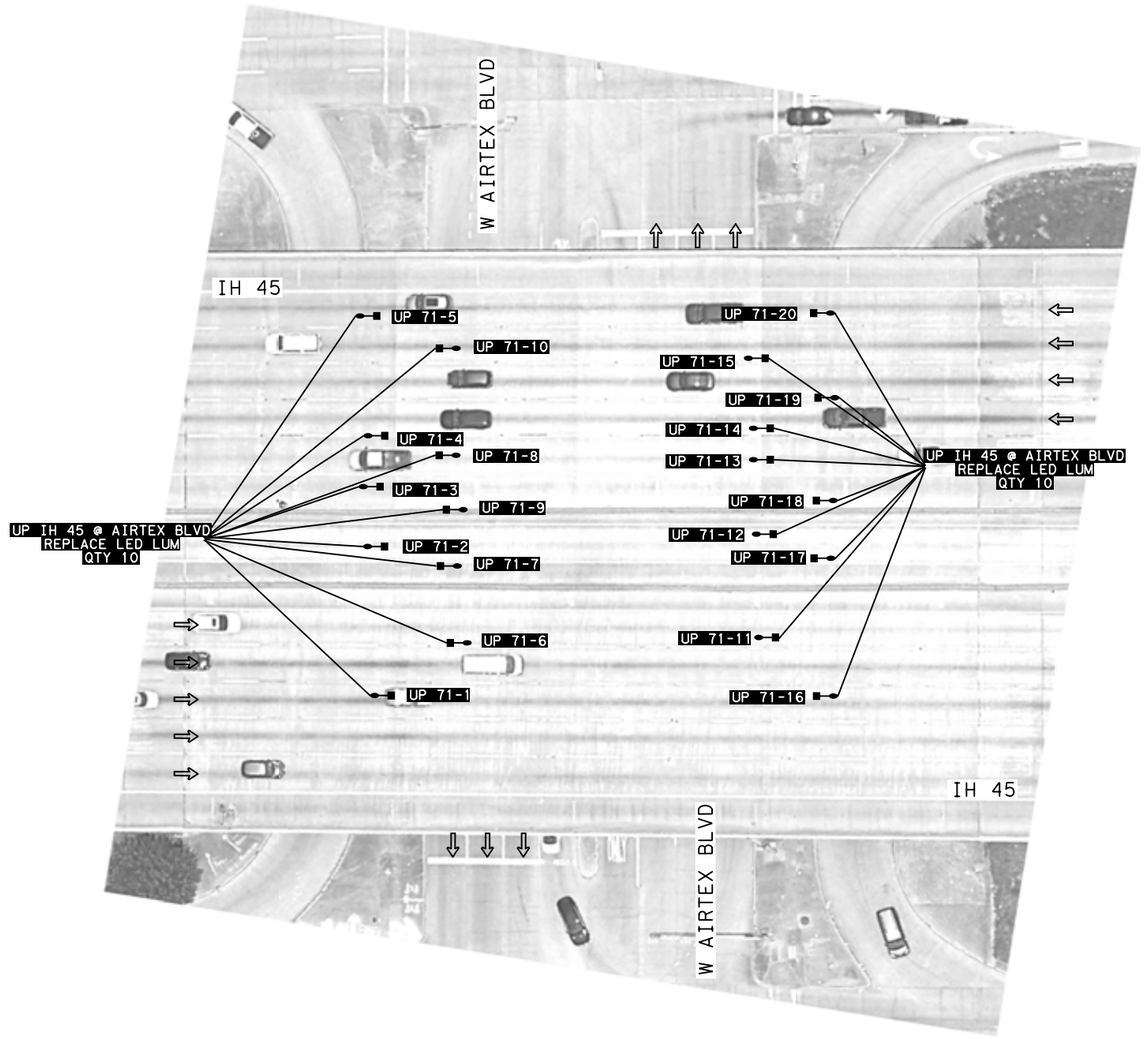
3/21/2024 11:13:49 PM ...\SHEET 82 UB A-1 Rankin Rd.dgn

LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



SCALE: 1" = 50'

25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER

Victor Torres

NOTES:

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
UP 71-1	UP 71-20	29.981996	-95.422647	250	LED	EA	EA	EA
					TOTALS			20
								20

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/21/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

W AIRTEX BLVD

CSJ: 0110-05-134 SHEET 2 OF 10

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	83

STATE	DIST.	COUNTY
TEXAS	HOU	MONTGOMERY,ETC

CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 11:14:46 PM

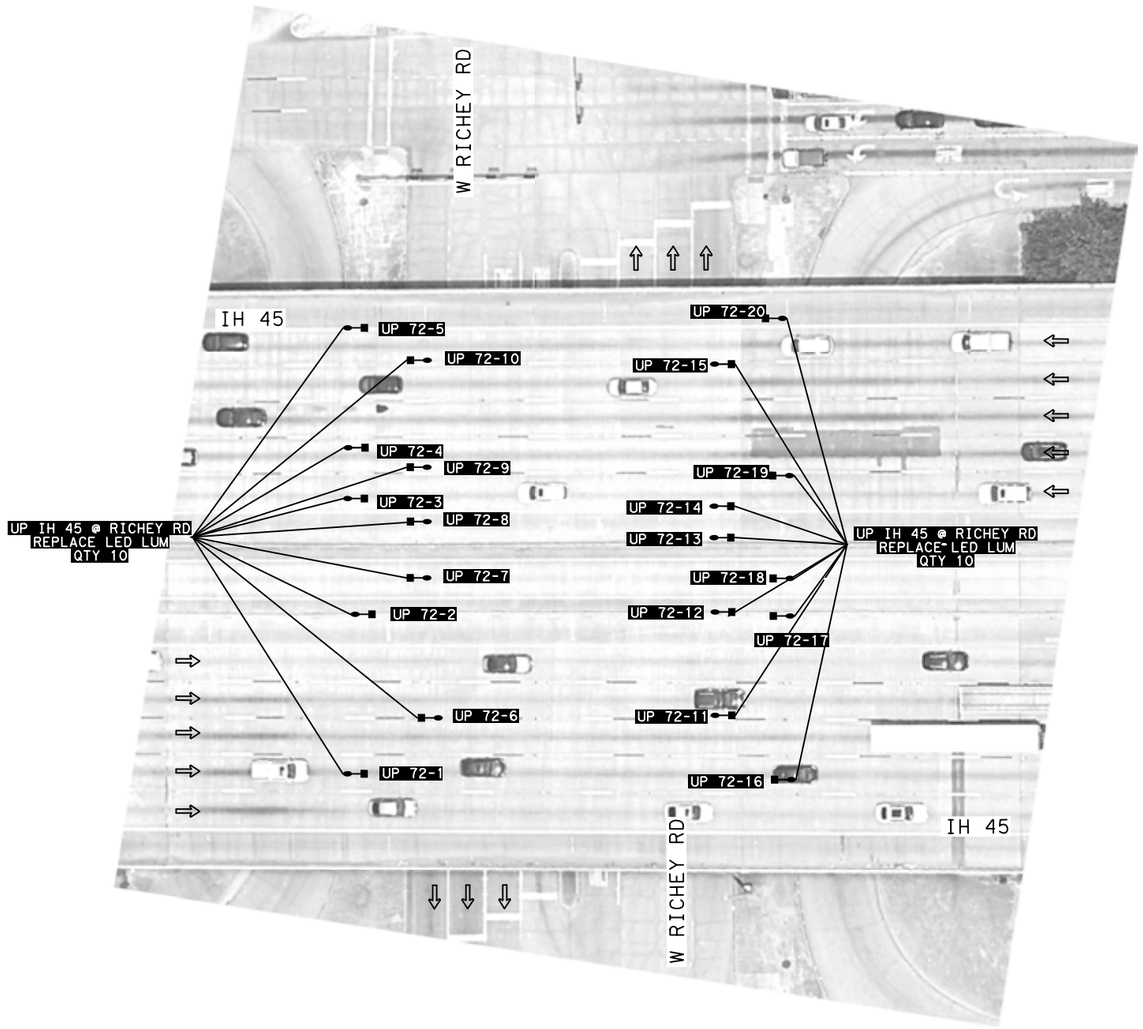
...\SHEET 83 UB A-2 Airtex Blvd.dgn

LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



SCALE: 1" = 50'

25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER

Victor Torres

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
						(6028)	(6030)	(6032)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA
UP 72-1	UP 72-20	29.997776	-95.425505	250	LED			20
					TOTALS			20

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TBPE Registration No. F-14592

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

W RICHEY RD

CSJ: 0110-05-134 SHEET 3 OF 10

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		84
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 11:15:57 PM

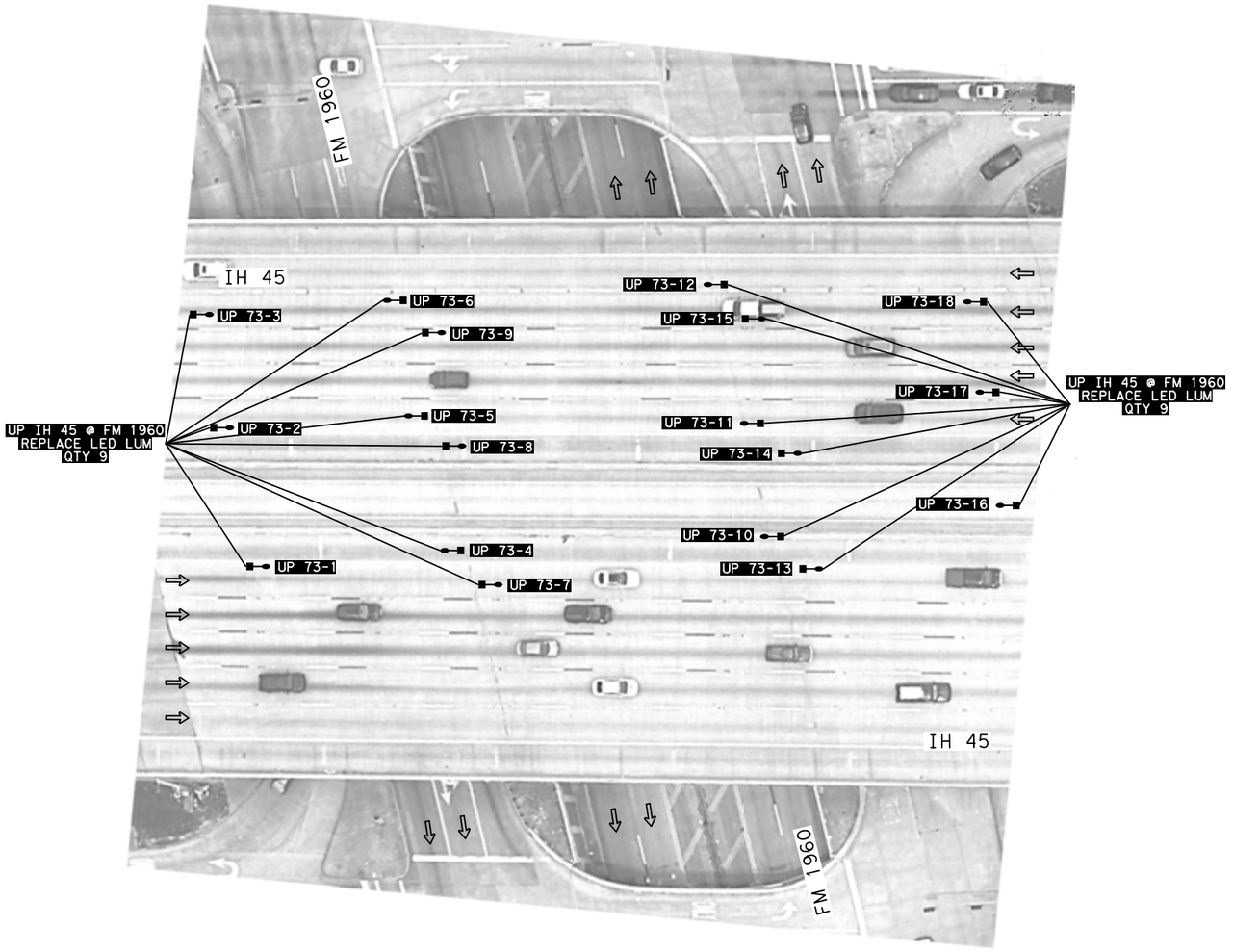
...\SHEET 84 UB A-3 W Richey Rd.dgn

LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



SCALE: 1" = 50'

25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER

Victor Torres

NOTES:

1. ALL WORK MUST BE PERFORMED WITHIN TXDOT RIGHT OF WAY.
2. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE UTILITIES WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD; KNOWN OR UNKNOWN; PRIVATE OR PUBLIC (INCLUDING TXDOT OWNED).
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7. AERIAL AND SCALE FOR VISUAL REFERENCE ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION OR BIDDING. LUMINAIRE LOCATIONS ARE APPROXIMATE.

UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
UP 73-1	UP 73-18	30.021390	-95.428847	250	LED	EA	EA	EA
					TOTALS			18
								18

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/21/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

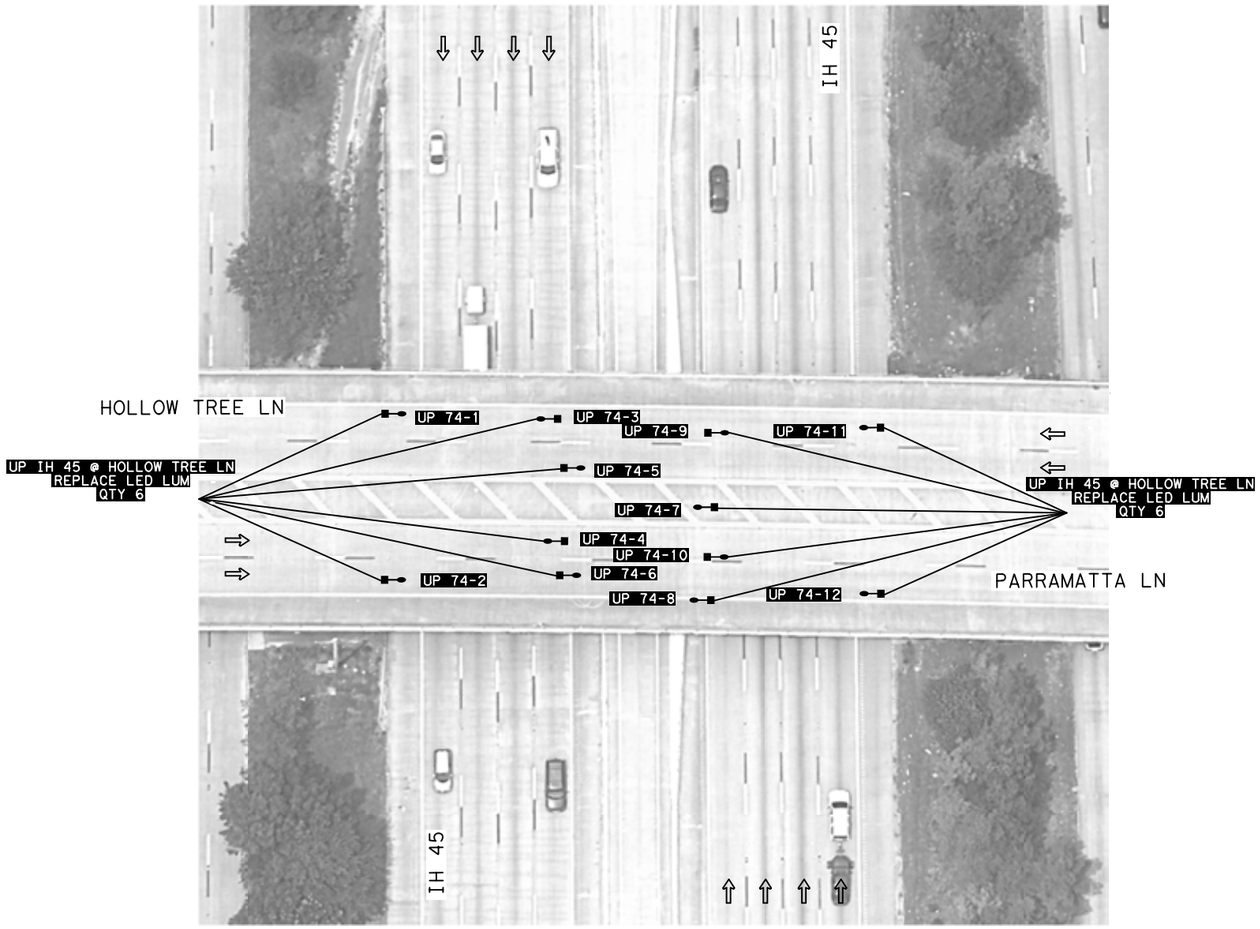
FM 1960

CSJ: 0110-05-134 SHEET 4 OF 10

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	85

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

LEGEND:
- ⇦ DIRECTION OF TRAFFIC FLOW
- ◄■ HPS UNDERPASS UPGRADE
- ●■ LED UNDERPASS UPGRADE



SCALE: 1" = 50'
25 0 25

VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER
STATE OF TEXAS
Victor Torres

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
						EA	EA	EA
UP 74-1	UP 74-12	30.028700	-95.429161	250	LED			12
					TOTALS			12

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/21/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

HOLLOW TREE LN/PARRAMATTA LN

CSJ: 0110-05-134 SHEET 5 OF 10

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		86
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

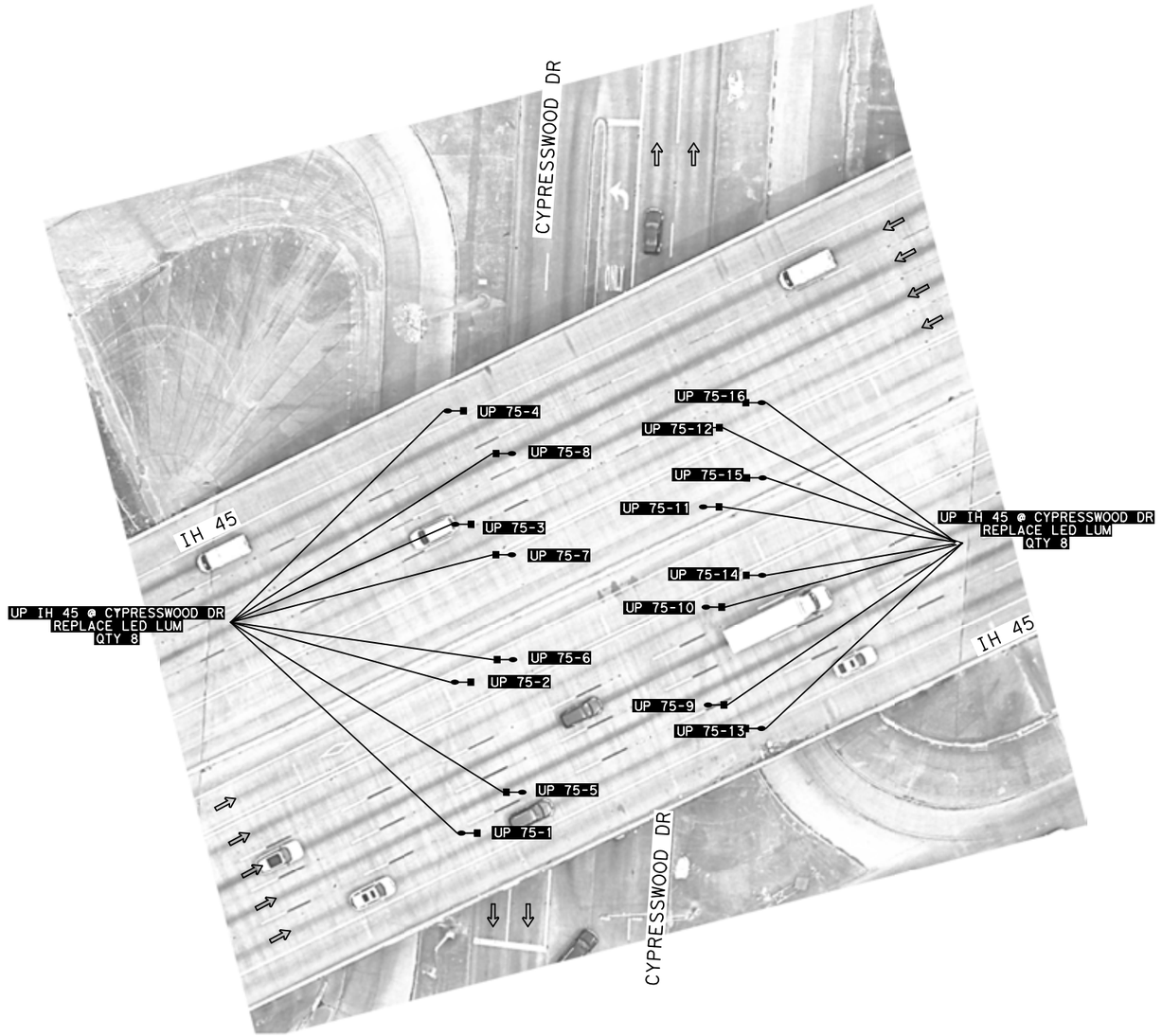
3/21/2024 11:21:46 PM
...\SHEET 86 UB A-5 Hollow Tree.dgn

LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



SCALE: 1" = 50'

25 0 25

VICTOR A. TORRES
134333
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS

Victor Torres

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
						EA	EA	EA
UP 75-1	UP 75-16	29.052562	-95.431828	250	LED			16
					TOTALS			16

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/21/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

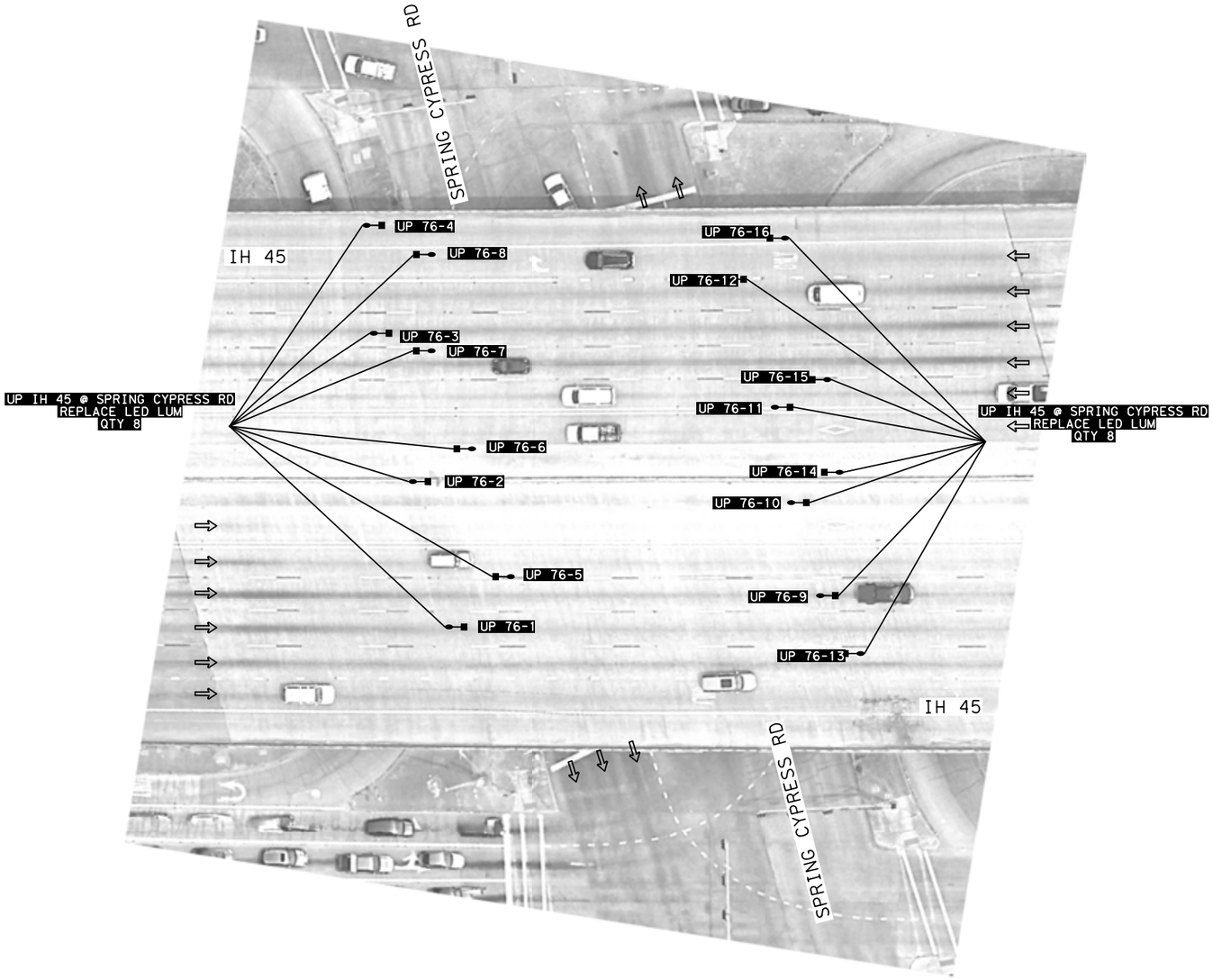
CYPRESSWOOD DR

CSJ: 0110-05-134 SHEET 6 OF 10

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	87

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

LEGEND:
⇦ DIRECTION OF TRAFFIC FLOW
HPS UNDERPASS UPGRADE
LED UNDERPASS UPGRADE



SCALE: 1" = 50'
25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED PROFESSIONAL ENGINEER
Victor Torres

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
UP 76-1	UP 76-16	30.074799	-95.436063	250	LED	EA	EA	EA
					TOTALS			16

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/21/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

SPRING CYPRESS RD

CSJ: 0110-05-134 SHEET 7 OF 10

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		88
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

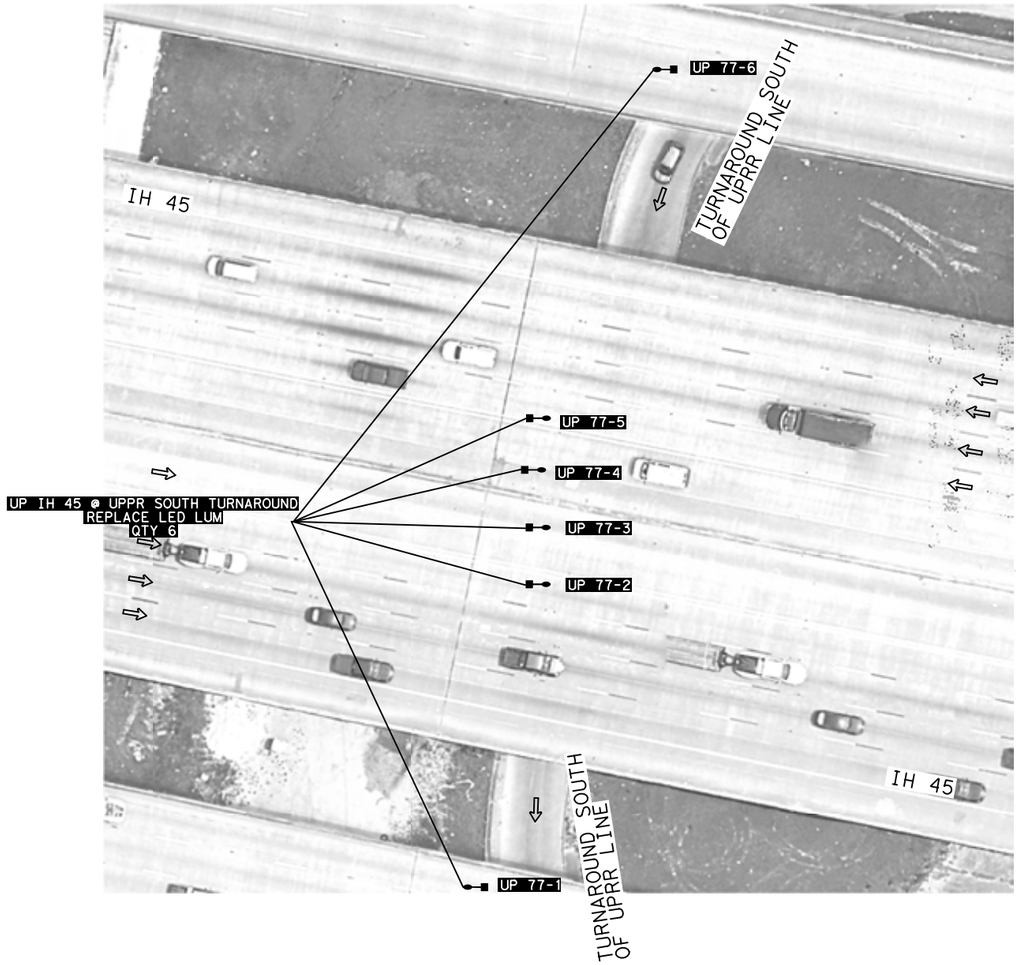
3/21/2024 11:20:09 PM
...\SHEET 88 UB A-7 Spring Cypress Rd.dgn

LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



SCALE: 1" = 50'

25 0 25

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						UNDERPASS QTY		
						ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA
UP 77-1	UP 77-6	30.083725	-95.436614	250	LED			6
					TOTALS			6

*REPRESENTS THE CENTER OF BRIDGE.

VICTOR A. TORRES 134333 LICENSED PROFESSIONAL ENGINEER STATE OF TEXAS

Victor Torres

PRINT DATE	REVISION DATE
3/21/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

Texas Department of Transportation®

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

TURNAROUND SOUTH OF UPRR LINE

CSJ: 0110-05-134 SHEET 8 OF 10

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		89
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 11:23:09 PM

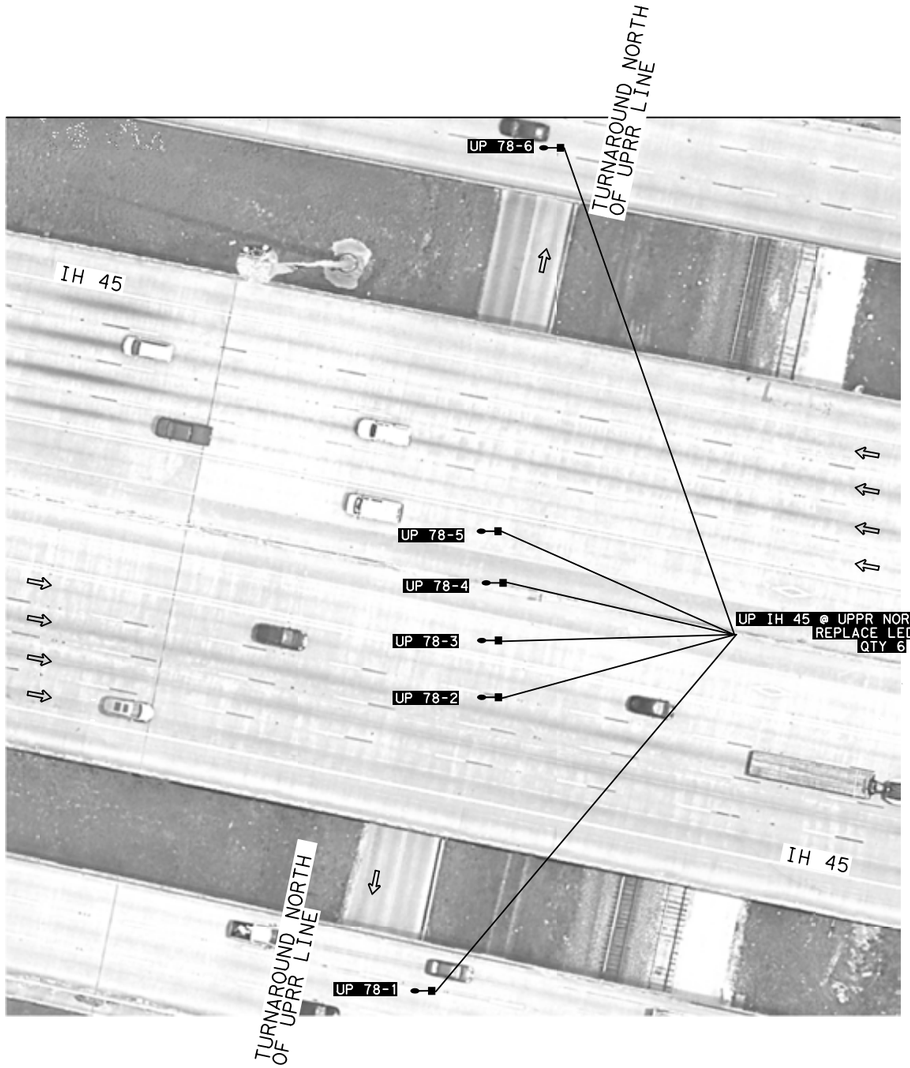
...\SHEET 89 UB A-8 UPPR South Turnaround.dgn

LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



SCALE: 1" = 50'

25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED PROFESSIONAL ENGINEER

Victor Torres

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
UP 78-1	UP 78-6	30.084442	-95.436453	250	LED	EA	EA	EA
					TOTALS			6

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/21/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

Texas Department of Transportation®

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

TURNAROUND NORTH OF UPRR LINE

CSJ: 0110-05-134 SHEET 9 OF 10

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		90
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 11:27:00 PM

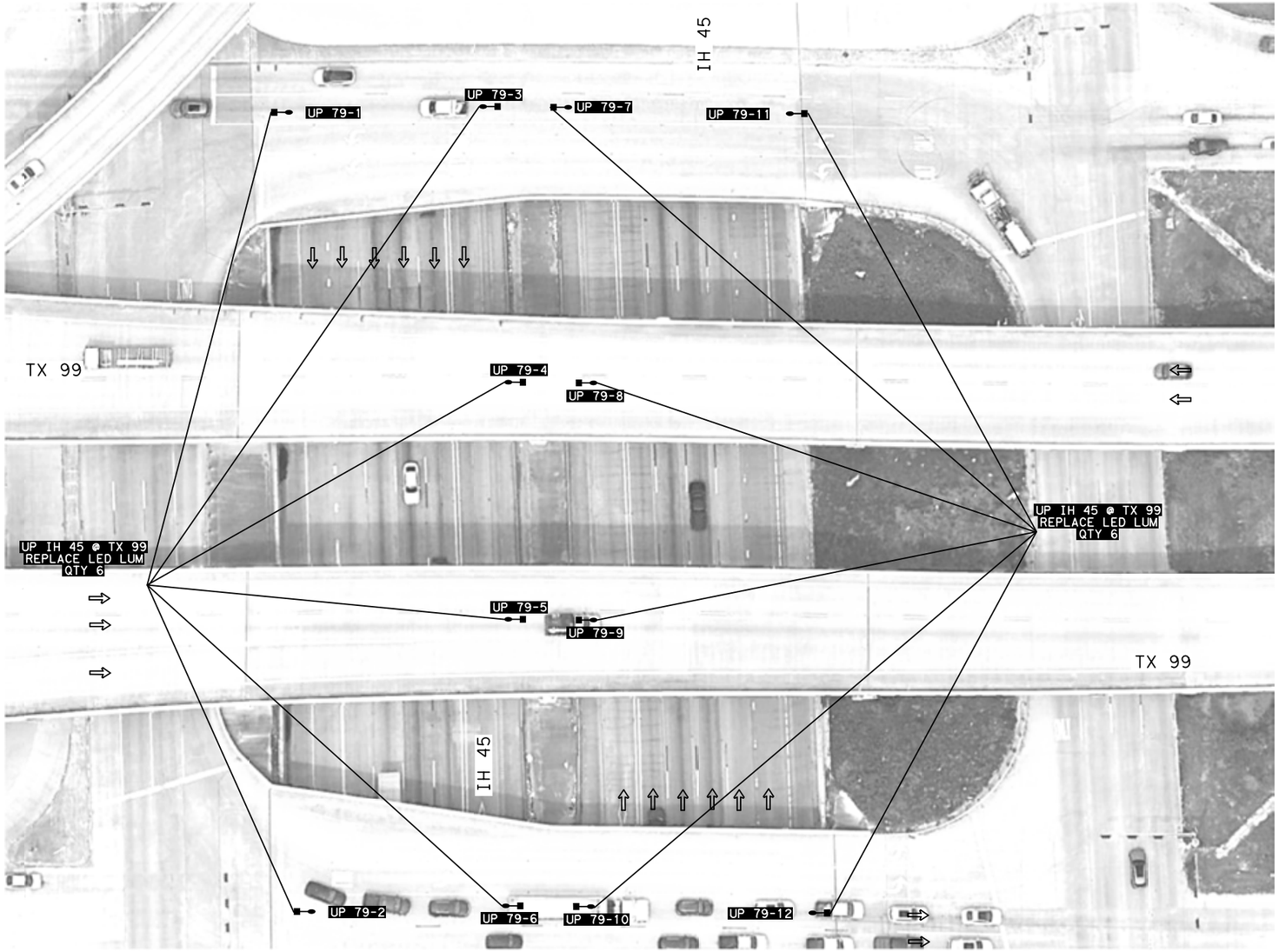
...\SHEET 90 UB A-9 UPPR NorthTurnaround.dgn

LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



SCALE: 1" = 50'

25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER

Victor Torres

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS) (6028)	INSTALL UP LUM (LED) (6030)	REPLACE UP LUM (LED) (6032)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA
UP 79-1	UP 79-12	30.092662	-95.435333	250	LED			12
					TOTALS			12

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/21/2024	

KBH Traffic Engineering, LLC
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Houston, TX 77079
Tel: 832-250-1861
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Texas Department of Transportation®

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

TX 99

CSJ: 0110-05-134 SHEET 10 OF 10

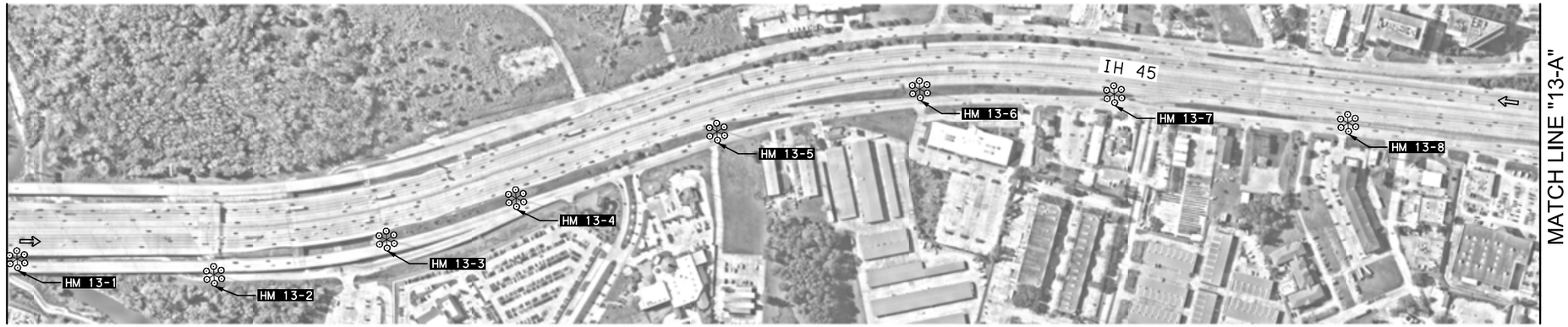
FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		91
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 11:28:22 PM

...\SHEET 91 UB A-10 TX 99.dgn

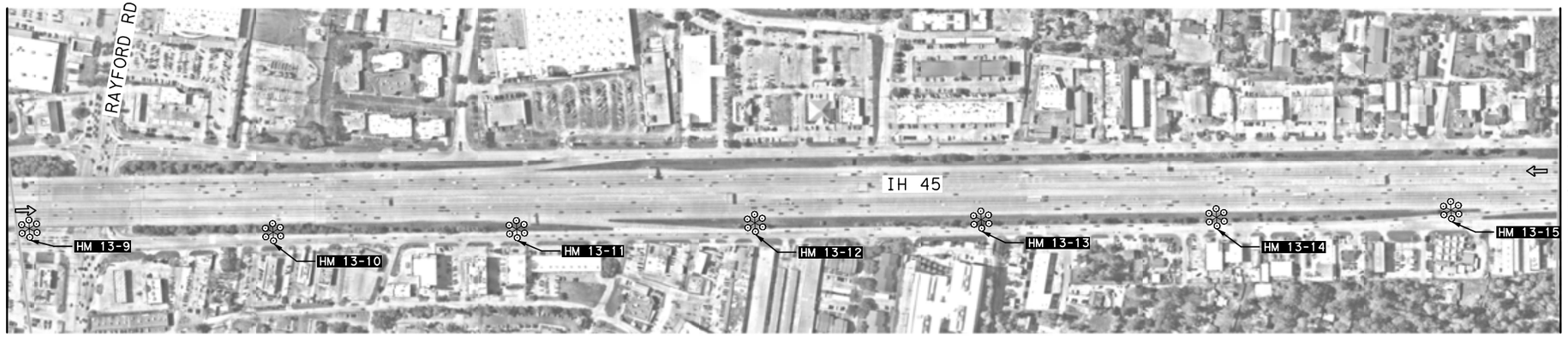
LEGEND:
- DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Z-PAT HIGH MAST UPGRADE

START OF CSJ 0110-04-208
MATCH LINE "12-B"



MATCH LINE "13-A"

MATCH LINE "13-A"



MATCH LINE "13-B"

SCALE: 1" = 500'
250 0 250

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HIGH MAST QUANTITIES
ILLUMINATION MAINTENANCE 6000

HM ID	LOCATION		LAMP DETAILS		RAISE LOWER RING	REPLACE HM LED LUM	HPS TO LED UPGRADE		AVIATION	Z-PATTERN
							REMOVE HM HPS FIXTURE	INSTALL HM LED FIXTURE	REPLACE FIX (LED)	MODIFY Z-PAT ASSM
	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6103) EA	(6160) EA	(6162) EA	(6161) EA	(6167) EA	(6000) EA
HM 13-1	30.110297	-95.436022	600	LED	1	6			3	
HM 13-2	30.112763	-95.436646	600	LED	1	6			3	
HM 13-3	30.114438	-95.437626	600	LED	1	6			3	
HM 13-4	30.115622	-95.438579	600	LED	1	6			3	
HM 13-5	30.117475	-95.440069	600	LED	1	6			3	
HM 13-6	30.119454	-95.441253	600	LED	1	6			3	
HM 13-7	30.121430	-95.441855	600	LED	1	6			3	
HM 13-8	30.123974	-95.442314	600	LED	1	6			3	
HM 13-9	30.126204	-95.442752	600	LED	1	6			3	
HM 13-10	30.128708	-95.443199	600	LED	1	6			3	
HM 13-11	30.131207	-95.443717	600	LED	1	6			3	
HM 13-12	30.133643	-95.444226	600	LED	1	6			3	
HM 13-13	30.136081	-95.444727	600	LED	1	6			3	
HM 13-14	30.138512	-95.445223	600	LED	1	6			3	
HM 13-15	30.140945	-95.445743	600	LED	1	6			3	
				TOTALS	15	90			45	

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED PROFESSIONAL ENGINEER
Victor Torres

PRINT DATE	REVISION DATE
3/21/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

HIGHMAST ILLUMINATION LAYOUT

ML 12-B TO ML 13-B

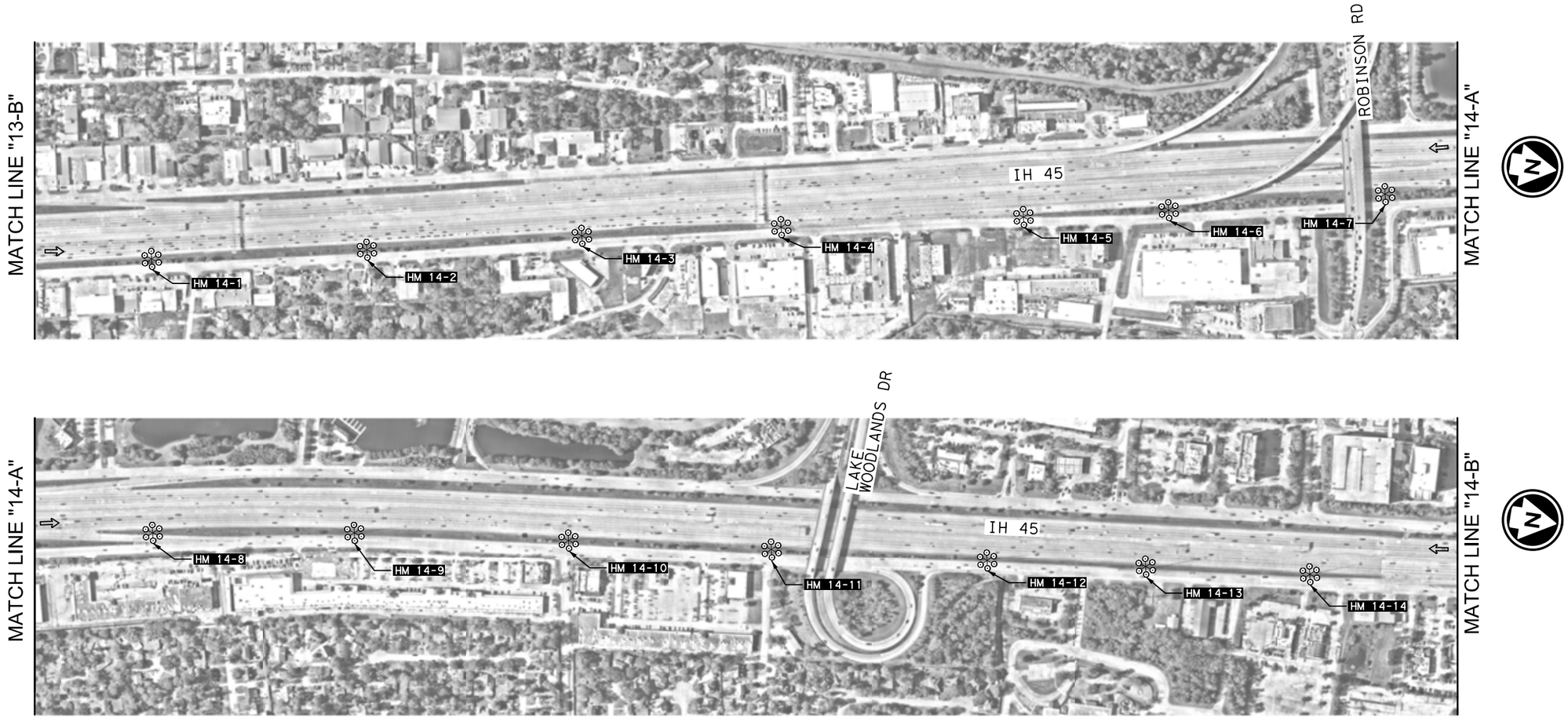
CSJ: 0110-04-208 SHEET 1 OF 5

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	92

STATE	DIST.	COUNTY
TEXAS	HOU	MONTGOMERY,ETC

CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 11:31:36 PM
...\SHEET 92 LED 1 - LED 14.dgn



LEGEND:
- DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Z-PAT HIGH MAST UPGRADE

SCALE: 1" = 500'
250 0 250

NOTES:
1. ALL WORK MUST BE PERFORMED WITHIN TXDOT RIGHT OF WAY.
2. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE UTILITIES WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD; KNOWN OR UNKNOWN; PRIVATE OR PUBLIC (INCLUDING TXDOT OWNED).
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6. ALL ELECTRICAL WORK SHALL MEET THE NATIONAL ELECTRIC CODE.
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					HIGH MAST QUANTITIES					
							ILLUMINATION MAINTENANCE 6000			
							HPS TO LED UPGRADE		AVIATION	Z-PATTERN
					RAISE LOWER RING	REPLACE HM LED LUM	REMOVE HM HPS FIXTURE	INSTALL HM LED FIXTURE	REPLACE FIX (LED)	MODIFY Z-PAT ASSM
HM ID	LOCATION		LAMP DETAILS		(6103)	(6160)	(6162)	(6161)	(6167)	(6000)
	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA	EA	EA
HM 14-1	30.143387	-95.446197	600	LED	1	6			3	
HM 14-2	30.145821	-95.446695	600	LED	1	6			3	
HM 14-3	30.148258	-95.447212	600	LED	1	6			3	
HM 14-4	30.150403	-95.447663	600	LED	1	6			3	
HM 14-5	30.153279	-95.448196	600	LED	1	6			3	
HM 14-6	30.154909	-95.448492	600	LED	1	6			3	
HM 14-7	30.157332	-95.449060	600	LED	1	6			3	
HM 14-8	30.159613	-95.449587	600	LED	1	6			3	
HM 14-9	30.161916	-95.449937	600	LED	1	6			3	
HM 14-10	30.164379	-95.450202	600	LED	1	6			3	
HM 14-11	30.166707	-95.450447	600	LED	1	6			3	
HM 14-12	30.169171	-95.450685	600	LED	1	6			3	
HM 14-13	30.171087	-95.450866	600	LED	1	6			3	
HM 14-14	30.172873	-95.451049	600	LED	1	6			3	
				TOTALS	14	84			42	

VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER
STATE OF TEXAS
Victor Torres

PRINT DATE	REVISION DATE
3/21/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

HIGHMAST ILLUMINATION LAYOUT

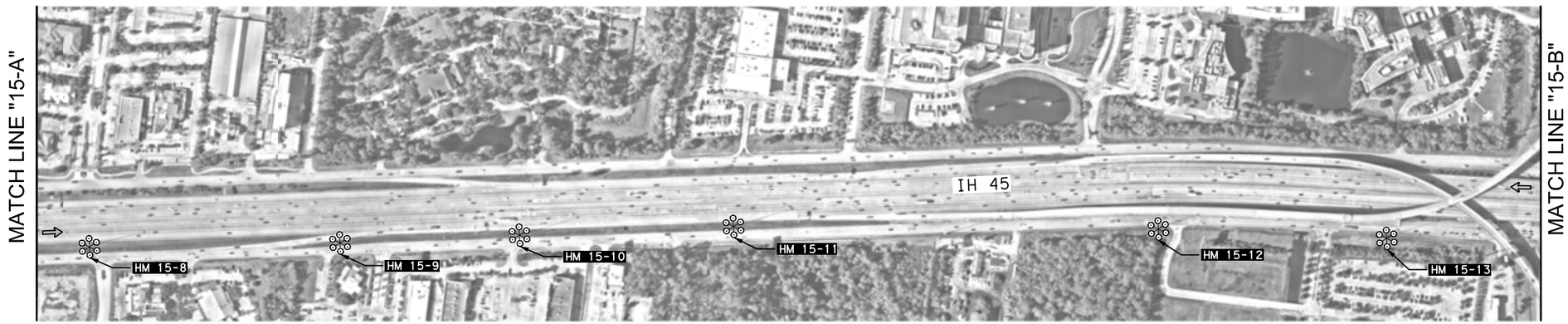
ML 13-B TO ML 14-B

CSJ: 0110-04-208 SHEET 2 OF 5

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	93

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

LEGEND:
- DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Z-PAT HIGH MAST UPGRADE



SCALE: 1" = 500'
250 0 250

NOTES:
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HIGH MAST QUANTITIES

ILLUMINATION MAINTENANCE 6000

HM ID	LOCATION		LAMP DETAILS		RAISE LOWER RING (6103)	REPLACE HM LED LUM (6160)	HPS TO LED UPGRADE: REMOVE HM HPS FIXTURE (6162)	HPS TO LED UPGRADE: INSTALL HM LED FIXTURE (6161)	AVIATION: REPLACE FIX (LED) (6167)	Z-PATTERN: MODIFY Z-PAT ASSM (6000)
	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA	EA	EA
HM 15-1	30.175901	-95.451289	600	LED	1	6			3	
HM 15-2	30.177936	-95.451538	600	LED	1	6			3	
HM 15-3	30.180066	-95.451727	600	LED	1	6			3	
HM 15-4	30.182124	-95.451881	600	LED	1	6			3	
HM 15-5	30.184535	-95.452103	600	LED	1	6			3	
HM 15-6	30.186925	-95.452356	600	LED	1	6			3	
HM 15-7	30.189321	-95.452745	600	LED	1	6			3	
HM 15-8	30.191645	-95.453190	600	LED	1	6			3	
HM 15-9	30.194272	-95.453639	600	LED	1	6			3	
HM 15-10	30.196259	-95.454049	600	LED	1	6			3	
HM 15-11	30.198558	-95.454522	600	LED	1	6			3	
HM 15-12	30.203107	-95.455237	600	LED	1	6			3	
HM 15-13	30.205551	-95.455482	600	LED	1	6			3	
				TOTALS	13	78			39	

PRINT DATE	REVISION DATE
3/21/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
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TBPE Registration No. F-14592

Texas Department of Transportation®

IH 45 ILLUMINATION

HIGHMAST ILLUMINATION LAYOUT

ML 14-B TO ML 15-B

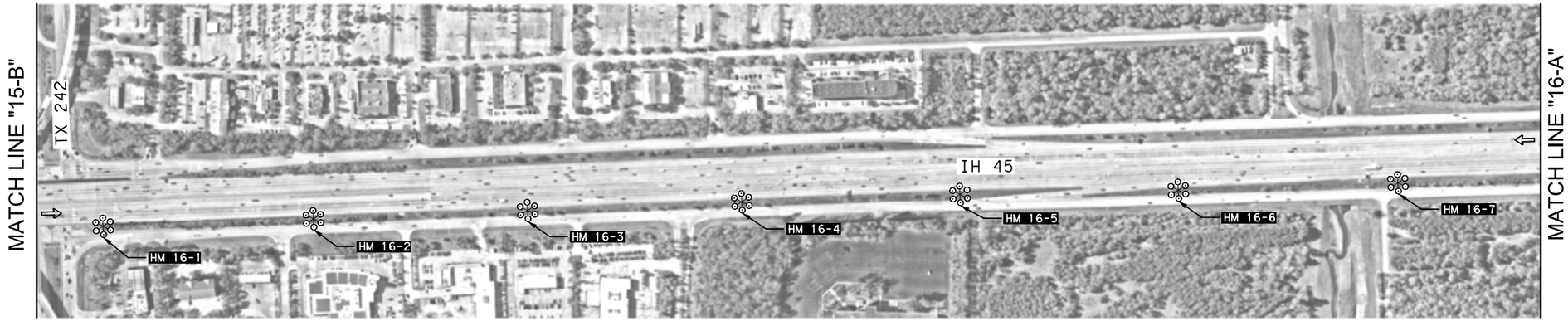
CSJ: 0110-04-208 SHEET 3 OF 5

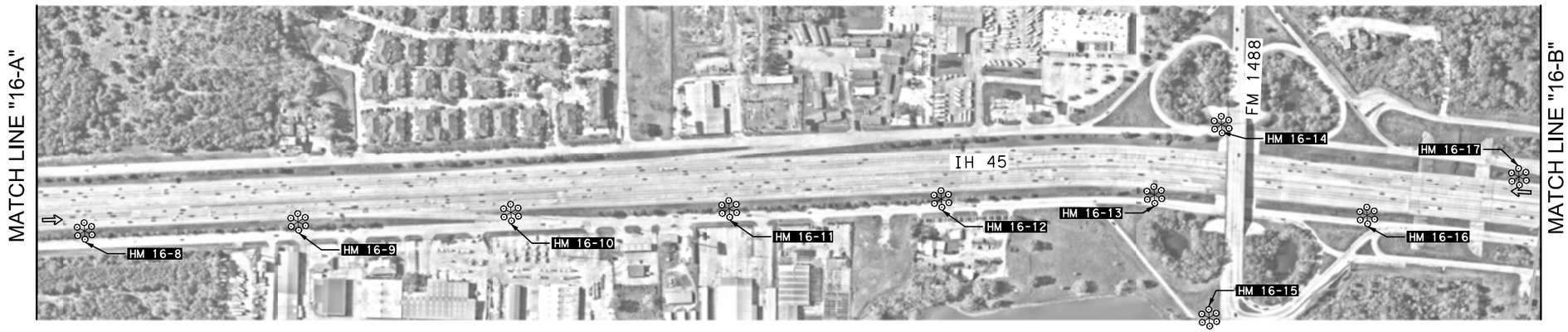
FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	94

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 11:34:38 PM
...\SHEET 94 LED 29 - LED 41.dgn

LEGEND:
- DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Z-PAT HIGH MAST UPGRADE





SCALE: 1" = 500'
250 0 250

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED PROFESSIONAL ENGINEER

Victor Torres

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7. AERIAL AND SCALE FOR VISUAL REFERENCE ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION OR BIDDING. LUMINAIRE LOCATIONS ARE APPROXIMATE.

HM ID	LOCATION		LAMP DETAILS		HIGH MAST QUANTITIES					
					ILLUMINATION MAINTENANCE 6000					
					RAISE LOWER RING	REPLACE HM LED LUM	HPS TO LED UPGRADE		AVIATION	Z-PATTERN
							REMOVE HM HPS FIXTURE	INSTALL HM LED FIXTURE	REPLACE FIX (LED)	MODIFY Z-PAT ASSM
	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6103) EA	(6160) EA	(6162) EA	(6161) EA	(6167) EA	(6000) EA
HM 16-1	30.207293	-95.455977	600	LED	1	6			3	
HM 16-2	30.210257	-95.456193	600	LED	1	6			3	
HM 16-3	30.212580	-95.456423	600	LED	1	6			3	
HM 16-4	30.214907	-95.456643	600	LED	1	6			3	
HM 16-5	30.217242	-95.456844	600	LED	1	6			3	
HM 16-6	30.219570	-95.457016	600	LED	1	6			3	
HM 16-7	30.221954	-95.457257	600	LED	1	6			3	
HM 16-8	30.224233	-95.457448	600	LED	1	6			3	
HM 16-9	30.226576	-95.457672	600	LED	1	6			3	
HM 16-10	30.228904	-95.457895	600	LED	1	6			3	
HM 16-11	30.231239	-95.458034	600	LED	1	6			3	
HM 16-12	30.233595	-95.458242	600	LED	1	6			3	
HM 16-13	30.235868	-95.458423	600	LED	1	6			3	
HM 16-14	30.236570	-95.459285	600	LED	1	6			3	
HM 16-15	30.236648	-95.456603	600	LED	1	6			3	
HM 16-16	30.238187	-95.458253	600	LED	1	6			3	
HM 16-17	30.239846	-95.458772	600	LED	1	6			3	
				TOTALS	17	102			51	

PRINT DATE	REVISION DATE
3/21/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

Texas Department of Transportation®

IH 45 ILLUMINATION

HIGHMAST ILLUMINATION LAYOUT

ML 15-B TO ML 16-B

CSJ: 0110-04-208 SHEET 4 OF 5

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	95

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

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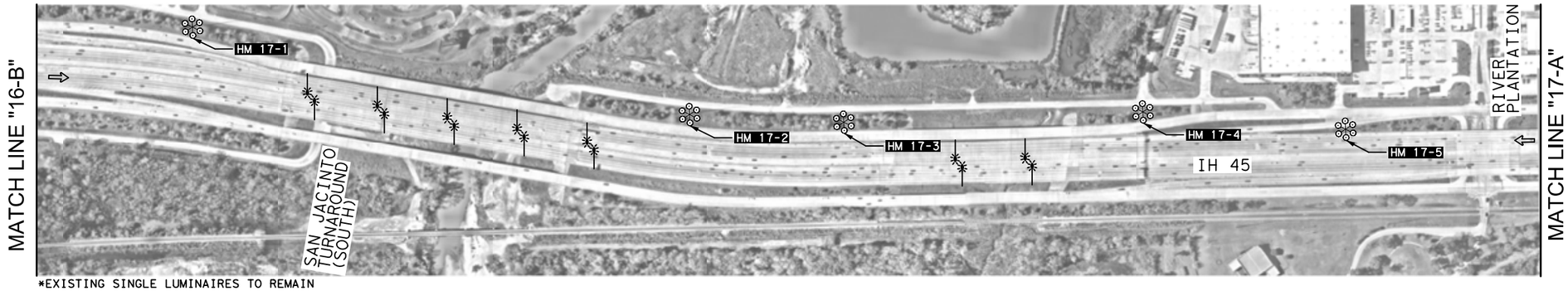
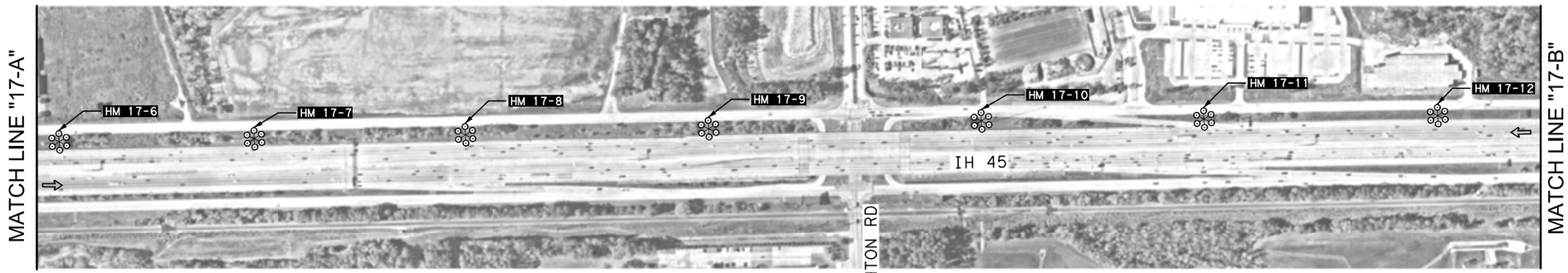
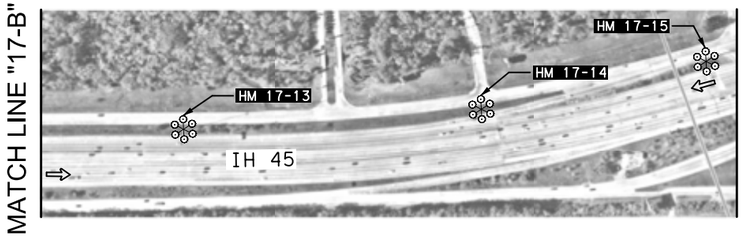


*EXISTING SINGLE LUMINAIRES TO REMAIN



*EXISTING SINGLE LUMINAIRES TO REMAIN



LEGEND:
- DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Z-PAT HIGH MAST UPGRADE
- EXISTING SINGLE LUMINAIRE

SCALE: 1" = 500'
250 0 250

NOTES:
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HIGH MAST QUANTITIES

ILLUMINATION MAINTENANCE 6000

HM ID	LOCATION		LAMP DETAILS		RAISE LOWER RING (6103)	REPLACE HM LED LUM (6160)	HPS TO LED UPGRADE: REMOVE HM HPS FIXTURE (6162)	HPS TO LED UPGRADE: INSTALL HM LED FIXTURE (6161)	AVIATION: REPLACE FIX (LED) (6167)	Z-PATTERN: MODIFY Z-PAT ASSM (6000)
	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA	EA	EA
HM 17-1	30.241885	-95.458872	600	LED	1	6			3	
HM 17-2	30.247261	-95.457633	600	LED	1	6			3	
HM 17-3	30.248915	-95.457516	600	LED	1	6			3	
HM 17-4	30.252179	-95.457492	600	LED	1	6			3	
HM 17-5	30.254368	-95.457201	600	LED	1	6			3	
HM 17-6	30.256580	-95.457233	600	LED	1	6			3	
HM 17-7	30.258639	-95.457213	600	LED	1	6			3	
HM 17-8	30.261159	-95.457211	600	LED	1	6			3	
HM 17-9	30.263817	-95.457188	600	LED	1	6			3	
HM 17-10	30.266782	-95.457169	600	LED	1	6			3	
HM 17-11	30.269197	-95.457155	600	LED	1	6			3	
HM 17-12	30.271747	-95.457137	600	LED	1	6			3	
HM 17-13	30.274289	-95.457077	600	LED	1	6			3	
HM 17-14	30.276950	-95.457186	600	LED	1	6			3	
HM 17-15	30.279079	-95.457678	600	LED	1	6			3	
				TOTALS	15	90			45	

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED PROFESSIONAL ENGINEER
Victor Torres

PRINT DATE	REVISION DATE
3/21/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

Texas Department of Transportation®

IH 45 ILLUMINATION

HIGHMAST ILLUMINATION LAYOUT

ML 16-B TO ML 17-C

CSJ: 0110-04-208 SHEET 5 OF 5

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		96
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/21/2024 11:36:29 PM
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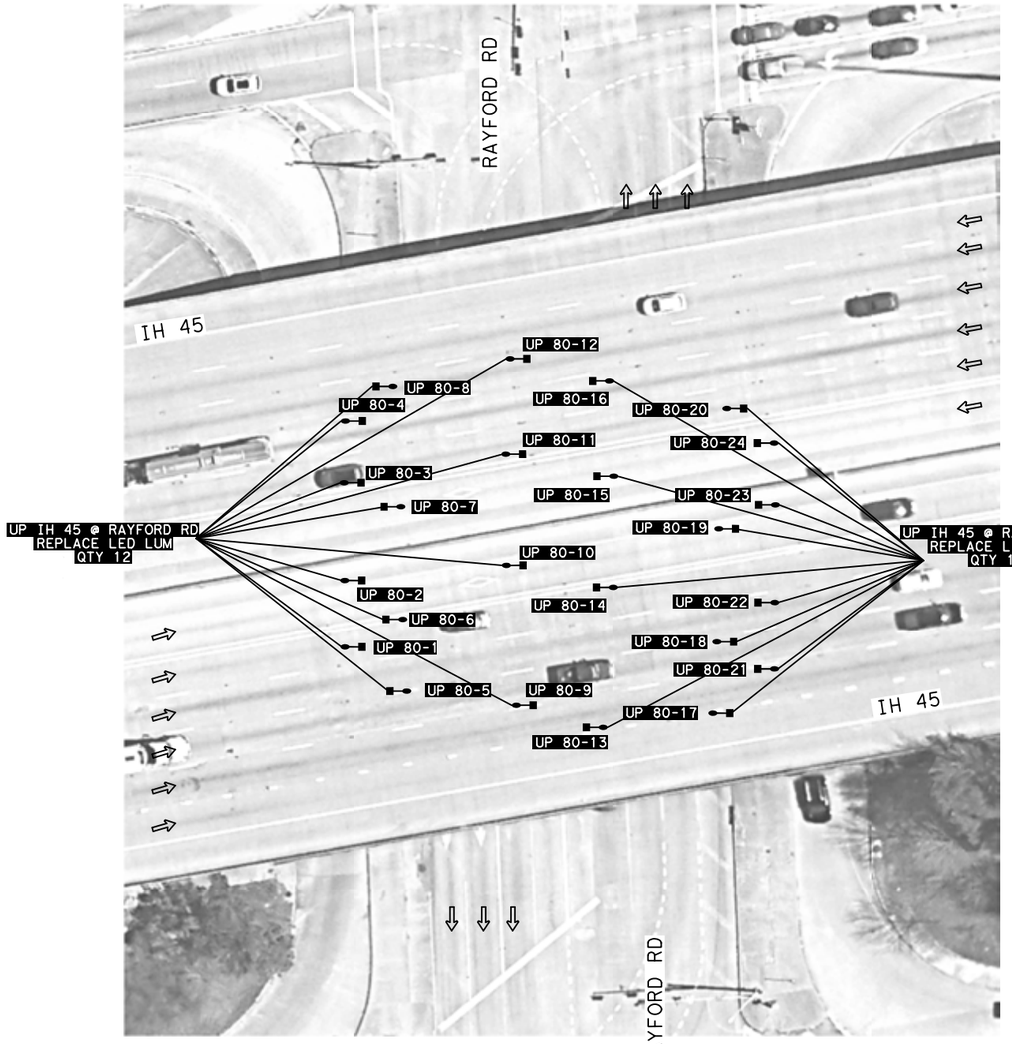
LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



SCALE: 1" = 50′

25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER

Victor Torres

NOTES:

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
UP 80-1	UP 80-24	30.126767	-95.443198	250	LED	EA	EA	EA
					TOTALS			24

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/22/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

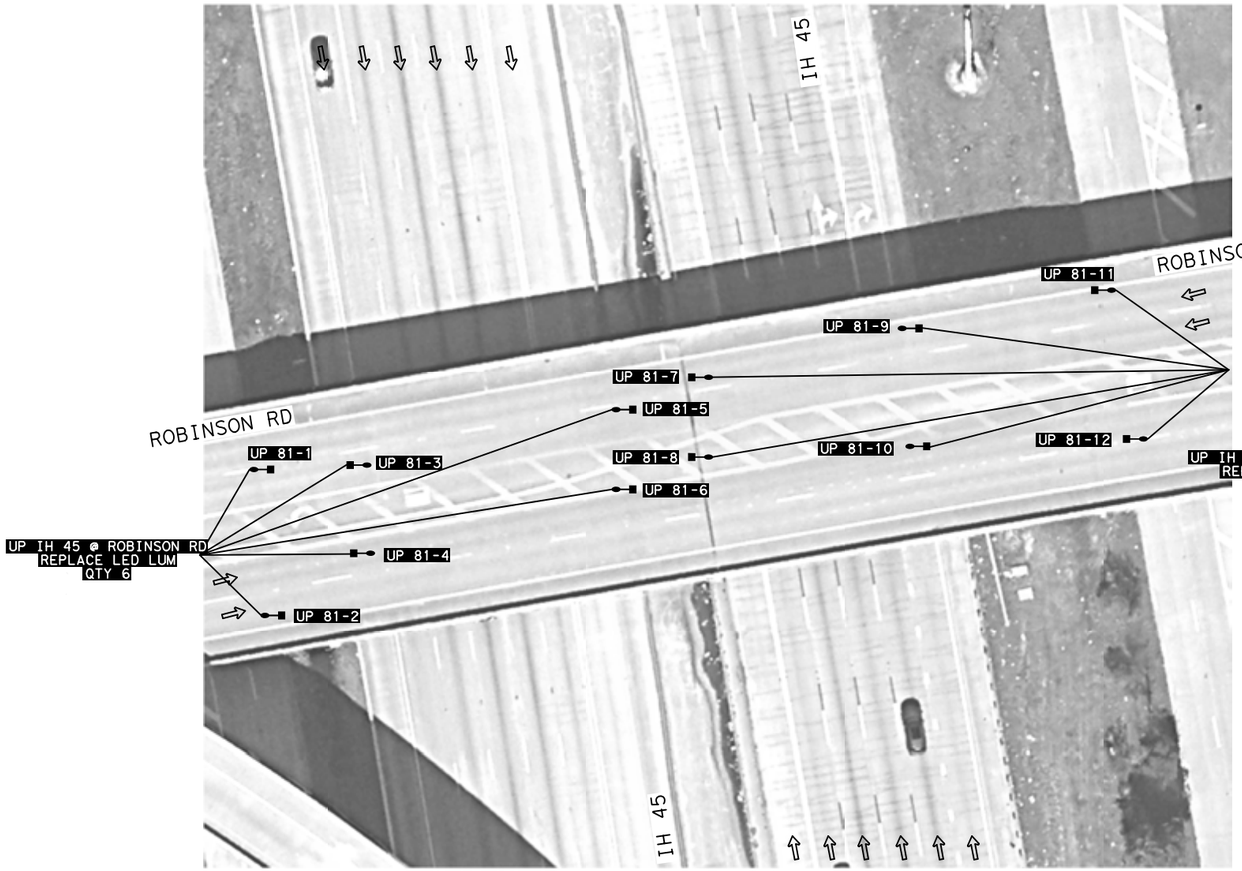
UNDERPASS ILLUMINATION LAYOUT

RAYFORD RD

CSJ: 0110-04-208 SHEET 1 OF 10

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		97
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

LEGEND:
⇦ DIRECTION OF TRAFFIC FLOW
HPS UNDERPASS UPGRADE
LED UNDERPASS UPGRADE



SCALE: 1" = 50'
25 0 25

STATE OF TEXAS
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LICENSED
PROFESSIONAL ENGINEER
Victor Torres

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7. AERIAL AND SCALE FOR VISUAL REFERENCE ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION OR BIDDING. LUMINAIRE LOCATIONS ARE APPROXIMATE.

UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	REMOVE UP LUM (HPS) (6028)	INSTALL UP LUM (LED) (6030)	REPLACE UP LUM (LED) (6032)
						EA	EA	EA
UP 81-1	UP 81-12	30.156960	-95.449397	250	LED			12
					TOTALS			12

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/22/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

Texas Department of Transportation®

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

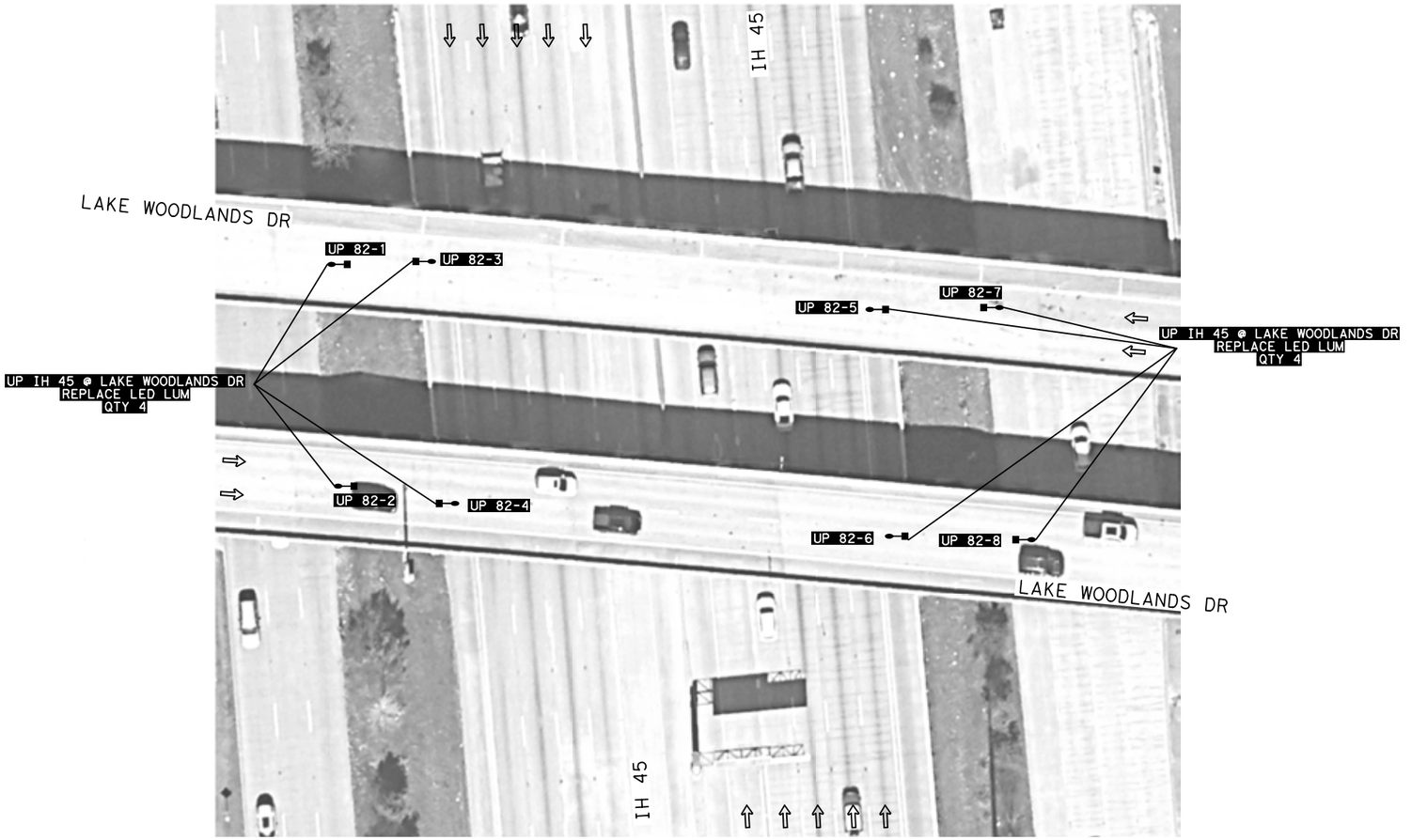
ROBINSON RD

CSJ: 0110-04-208 SHEET 2 OF 10

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		98
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/22/2024 8:35:44 AM
...\SHEET 98 UB B-12 Robinson Rd.dgn

LEGEND:
- ⇦ DIRECTION OF TRAFFIC FLOW
- HPS UNDERPASS UPGRADE
- LED UNDERPASS UPGRADE



SCALE: 1" = 50'
25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER
Victor Torres

NOTES:

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
						(6028)	(6030)	(6032)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA
UP 82-1	UP 82-8	30.167370	-95.450806	250	LED			8
					TOTALS			8

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/22/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

Texas Department of Transportation®

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

LAKE WOODLANDS DR

CSJ: 0110-04-208 SHEET 3 OF 10

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	99

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

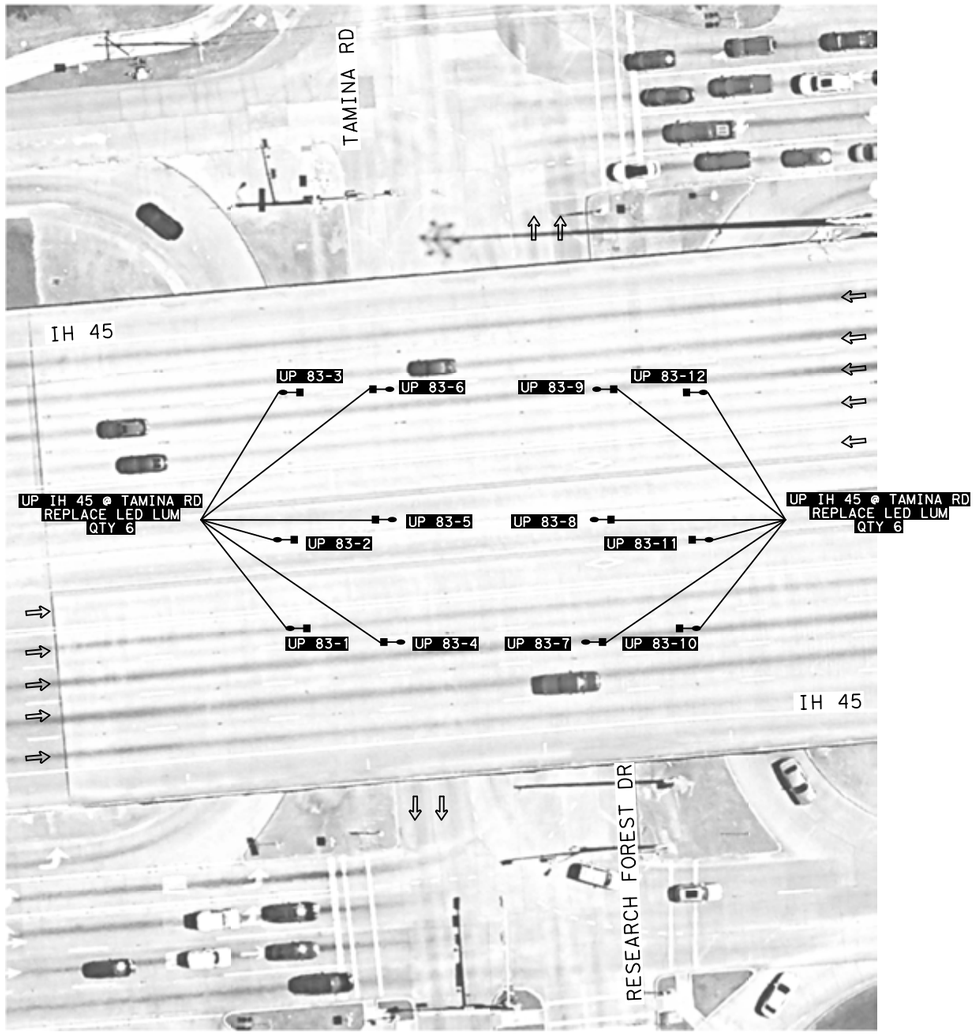
3/22/2024 8:37:17 AM
...\SHEET 99 UB B-13 Lake Woodlands Dr.dgn

LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



SCALE: 1" = 50'

25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER

Victor Torres

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						UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA
UP 83-1	UP 83-12	30.178314	-95.451835	250	LED			12
					TOTALS			12

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/22/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

TAMINA RD/RESEARCH FOREST DR

CSJ: 0110-04-208 SHEET 4 OF 10

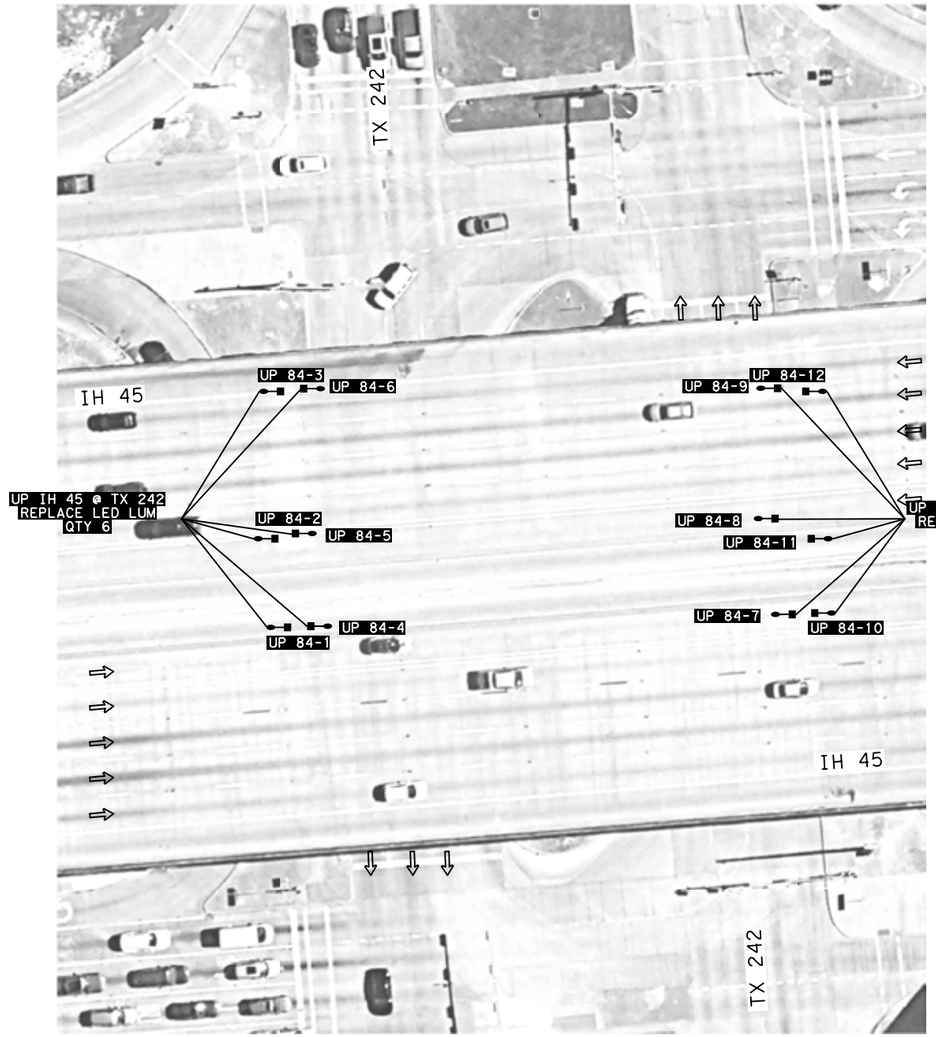
FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		100
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



SCALE: 1" = 50'

25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER

Victor Torres

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
UP 84-1	UP 84-12	30.207413	-95.456208	250	LED	EA	EA	EA
					TOTALS			12

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/22/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

TX 242

CSJ: 0110-04-208 SHEET 5 OF 10

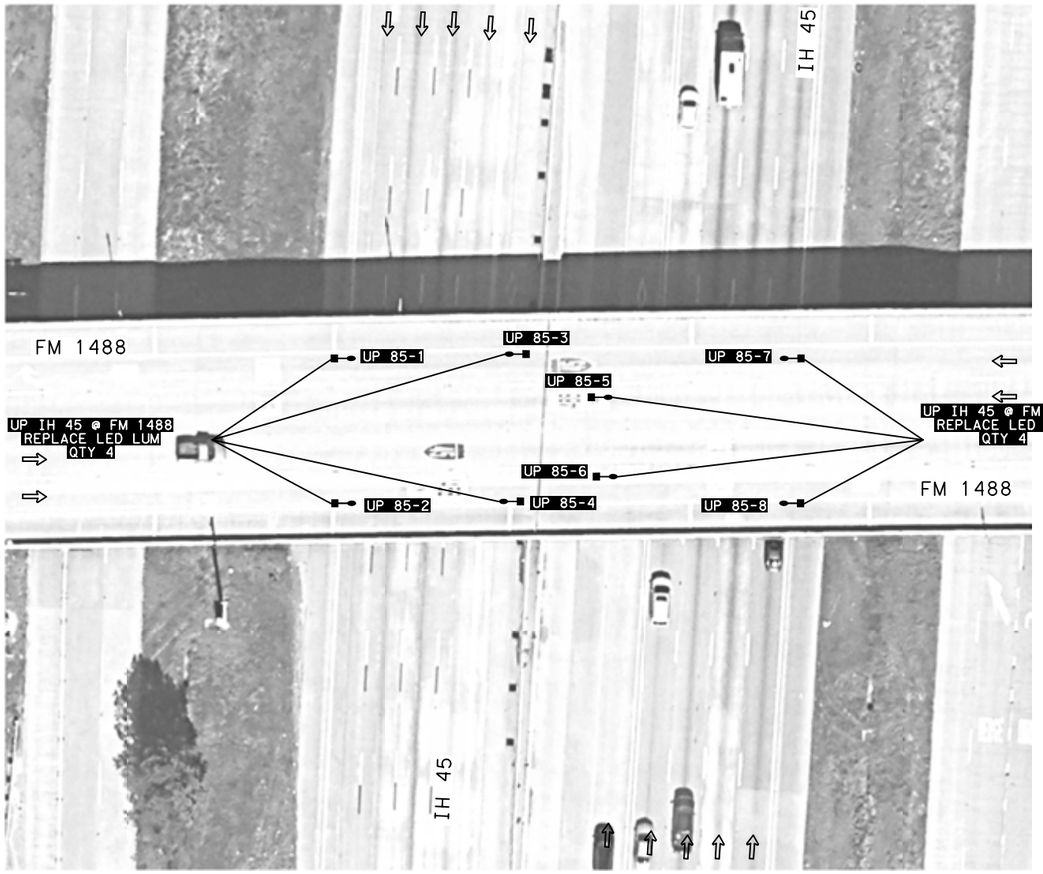
FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	101

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/22/2024 8:43:09 AM

...\SHEET 101 UB B-15 SH 242.dgn

LEGEND:
⇦ DIRECTION OF TRAFFIC FLOW
◄■ HPS UNDERPASS UPGRADE
●■ LED UNDERPASS UPGRADE



SCALE: 1" = 50'
25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER
Victor Torres

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						UNDERPASS QTY		
						ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA
UP 85-1	UP 85-8	30.236738	-95.458707	250	LED			8
					TOTALS			8

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/22/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

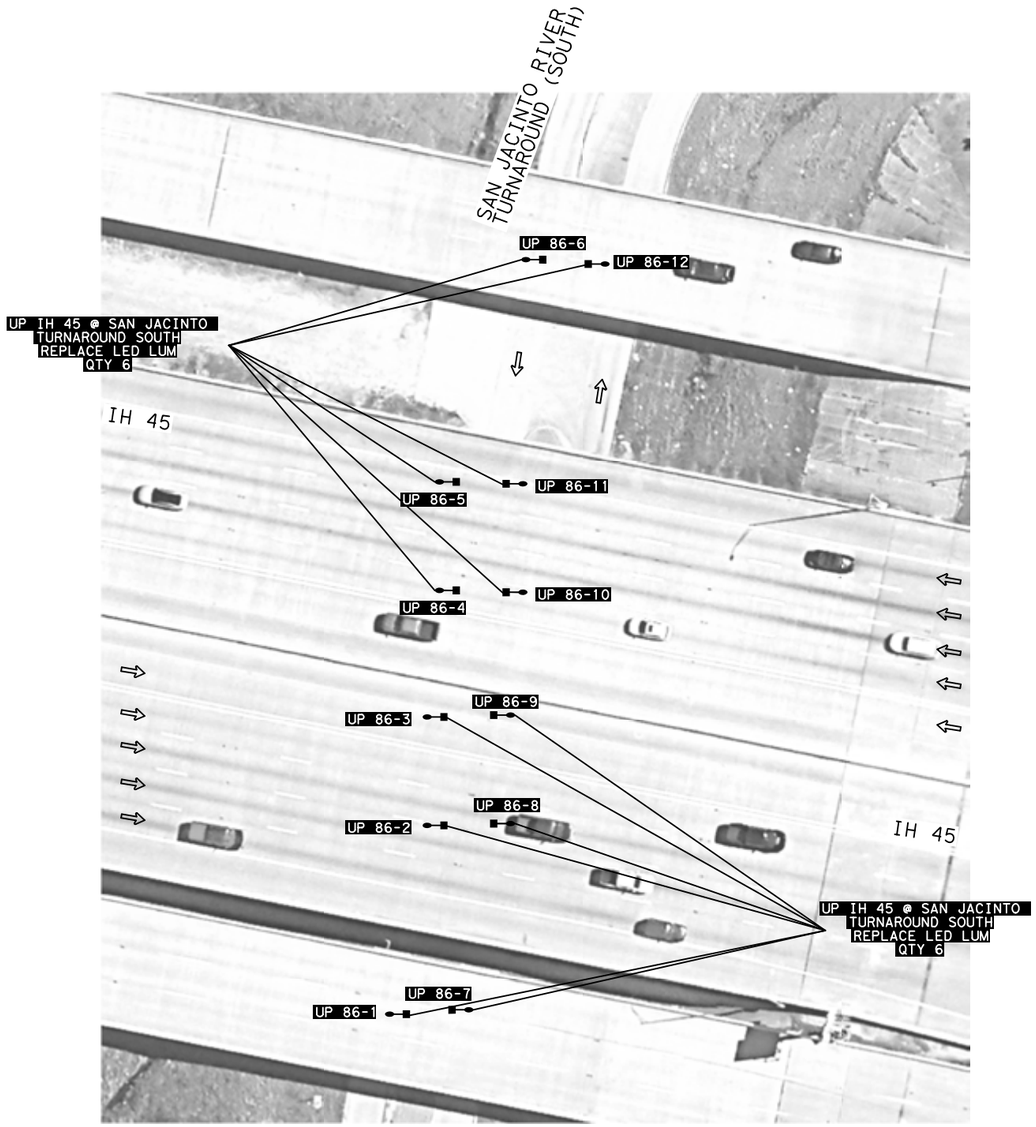
UNDERPASS ILLUMINATION LAYOUT

FM 1488

CSJ: 0110-04-208 SHEET 6 OF 10

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		102
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/22/2024 8:43:59 AM
...\SHEET 102 UB B-16 FM 1488.dgn



LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- HPS UNDERPASS UPGRADE
- LED UNDERPASS UPGRADE

SCALE: 1" = 50'

25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER

Victor Torres

NOTES:

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						UNDERPASS QTY		
						ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA
UP 86-1	UP 86-12	30.243285	-95.457863	250	LED			12
					TOTALS			12

*REPRESENTS THE CENTER OF BRIDGE.

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

PRINT DATE	REVISION DATE
3/22/2024	

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

SAN JACINTO RIVER TURNAROUND (SOUTH)

CSJ: 0110-04-208 SHEET 7 OF 10

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	103

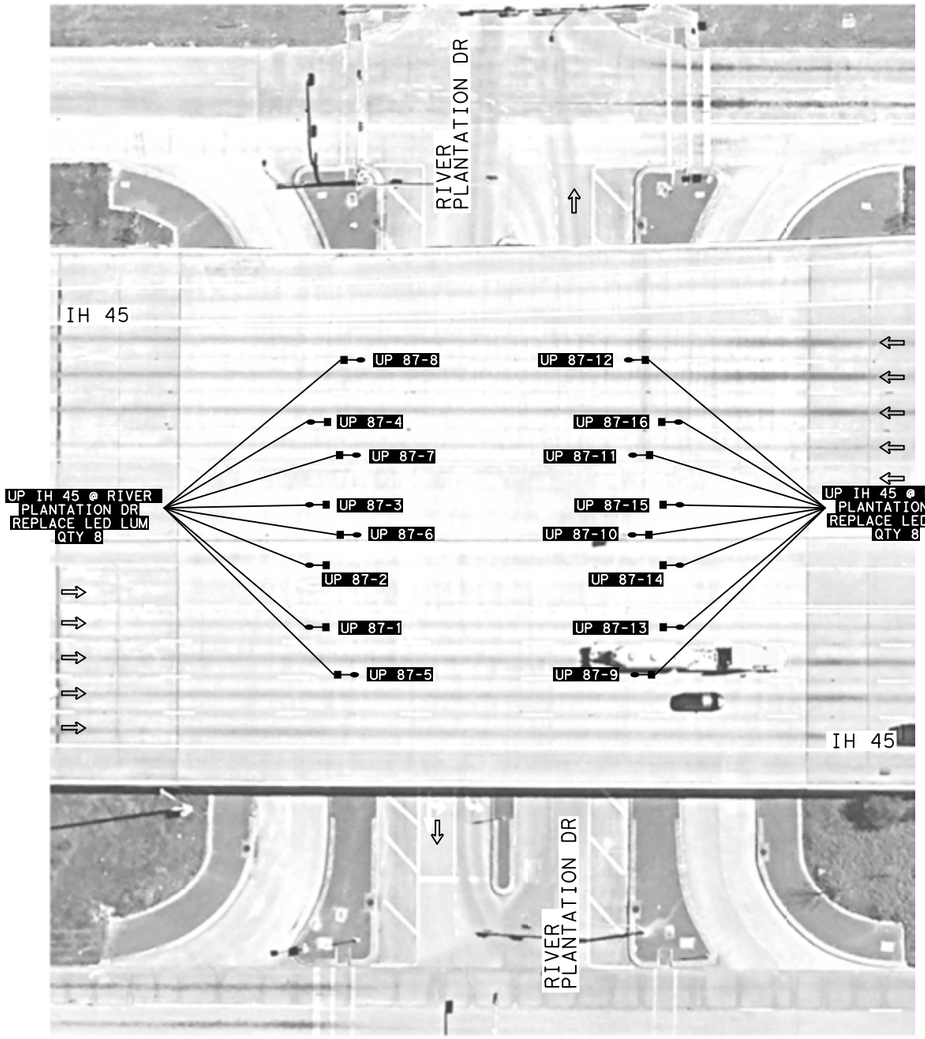
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



SCALE: 1" = 50'

25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED PROFESSIONAL ENGINEER

Victor Torres

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
						EA	EA	EA
UP 87-1	UP 87-16	30.255932	-95.456862	250	LED			16
					TOTALS			16

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/22/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

RIVER PLANTATION DR

CSJ: 0110-04-208 SHEET 8 OF 10

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	104

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/22/2024 8:39:34 AM

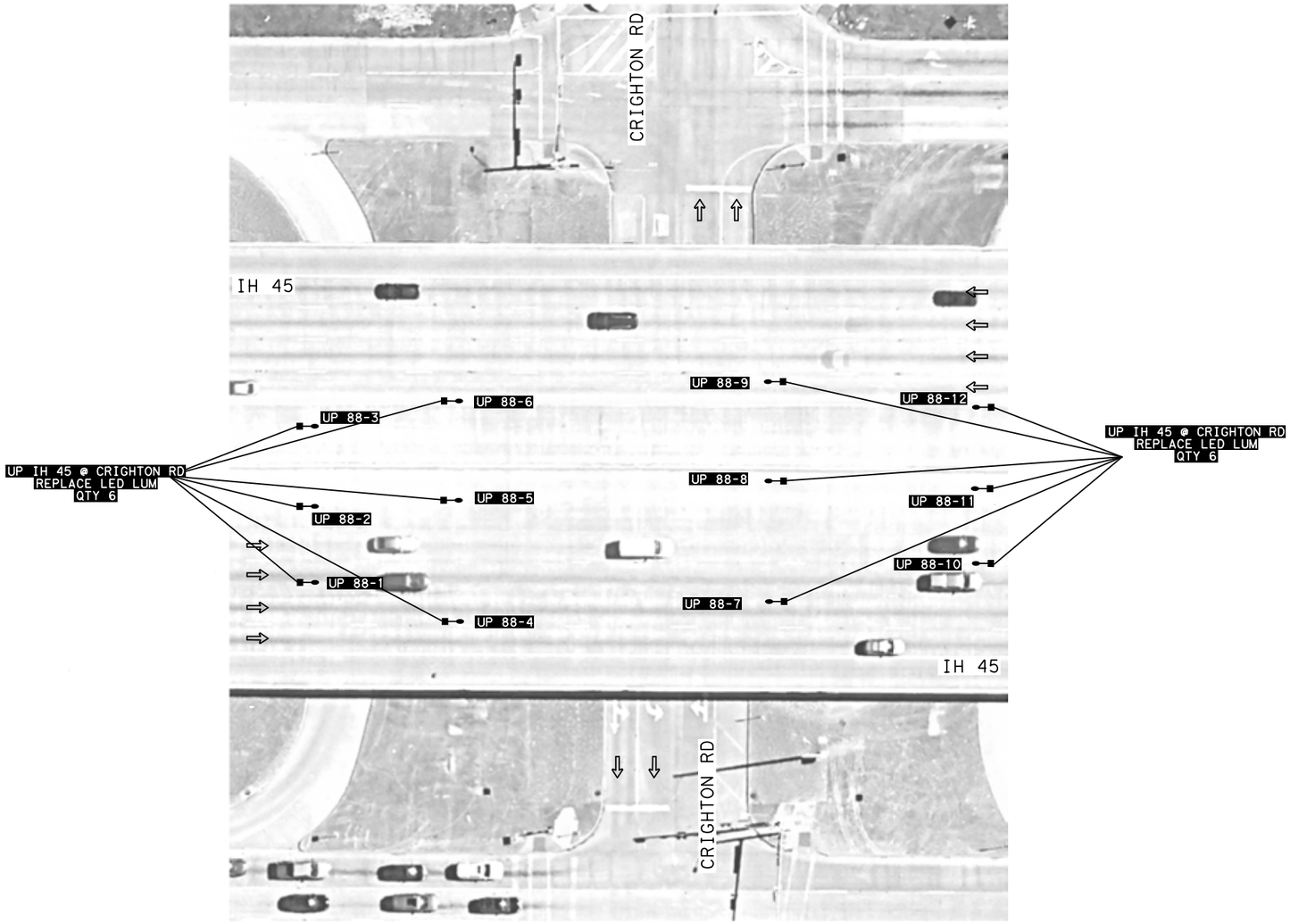
...\SHEET 104 UB B-18 River Plantation Dr.dgn

LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



SCALE: 1" = 50'

25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER

Victor Torres

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
UP 88-1	UP 88-12	30.265401	-95.456827	250	LED			12
					TOTALS			12

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/22/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

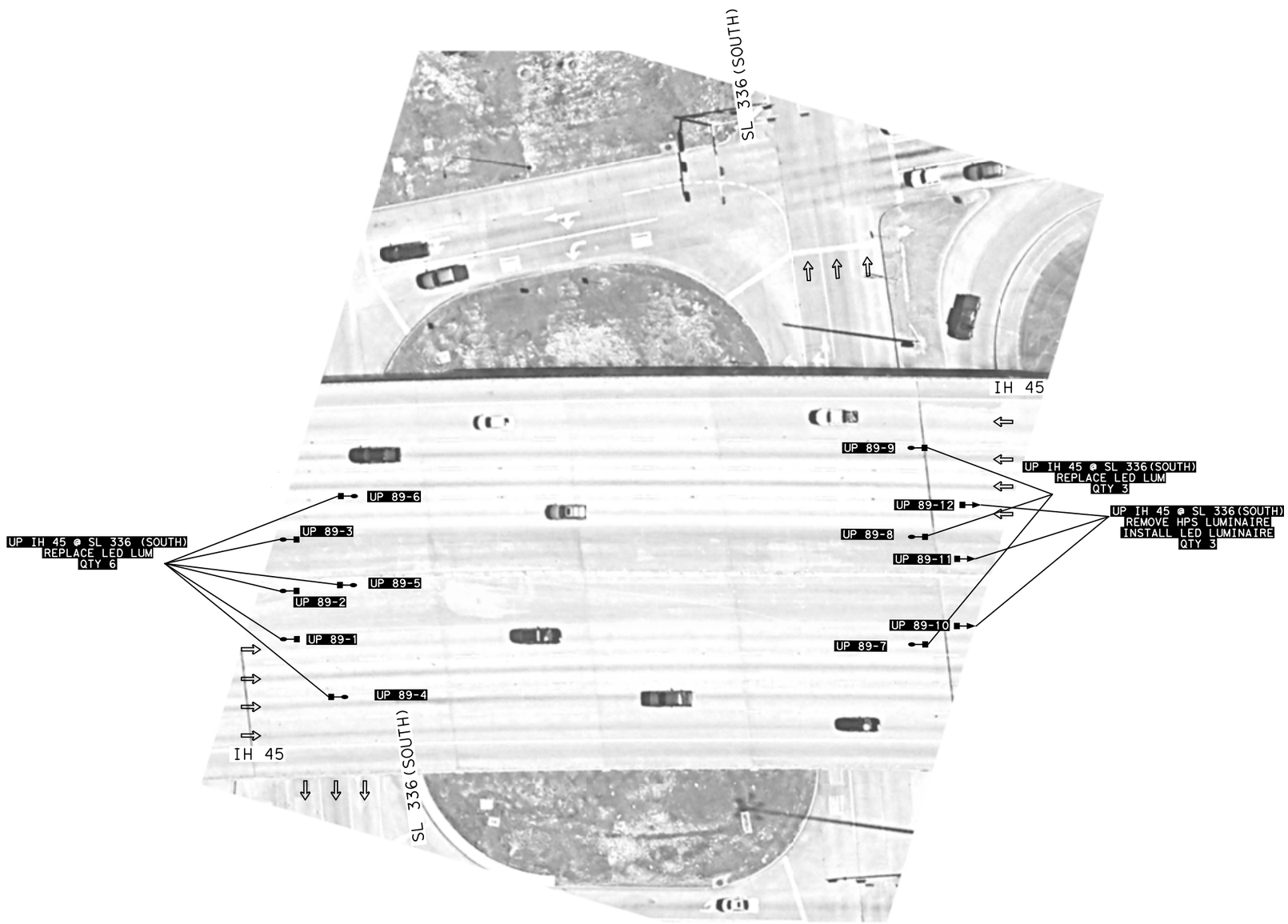
IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

CRIGHTON RD

CSJ: 0110-04-208 SHEET 9 OF 10

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		105
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45



LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- ◄■ HPS UNDERPASS UPGRADE
- ●■ LED UNDERPASS UPGRADE

SCALE: 1" = 50'

25 0 25

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028) EA	(6030) EA	(6032) EA
UP 89-1	UP 89-12	30.279791	-95.457516	250	LED	3	3	9
					TOTALS	3	3	9

*REPRESENTS THE CENTER OF BRIDGE.

VICTOR A. TORRES
134333
LICENSED PROFESSIONAL ENGINEER
STATE OF TEXAS
Victor Torres

PRINT DATE	REVISION DATE
3/22/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

SL 336 (SOUTH)

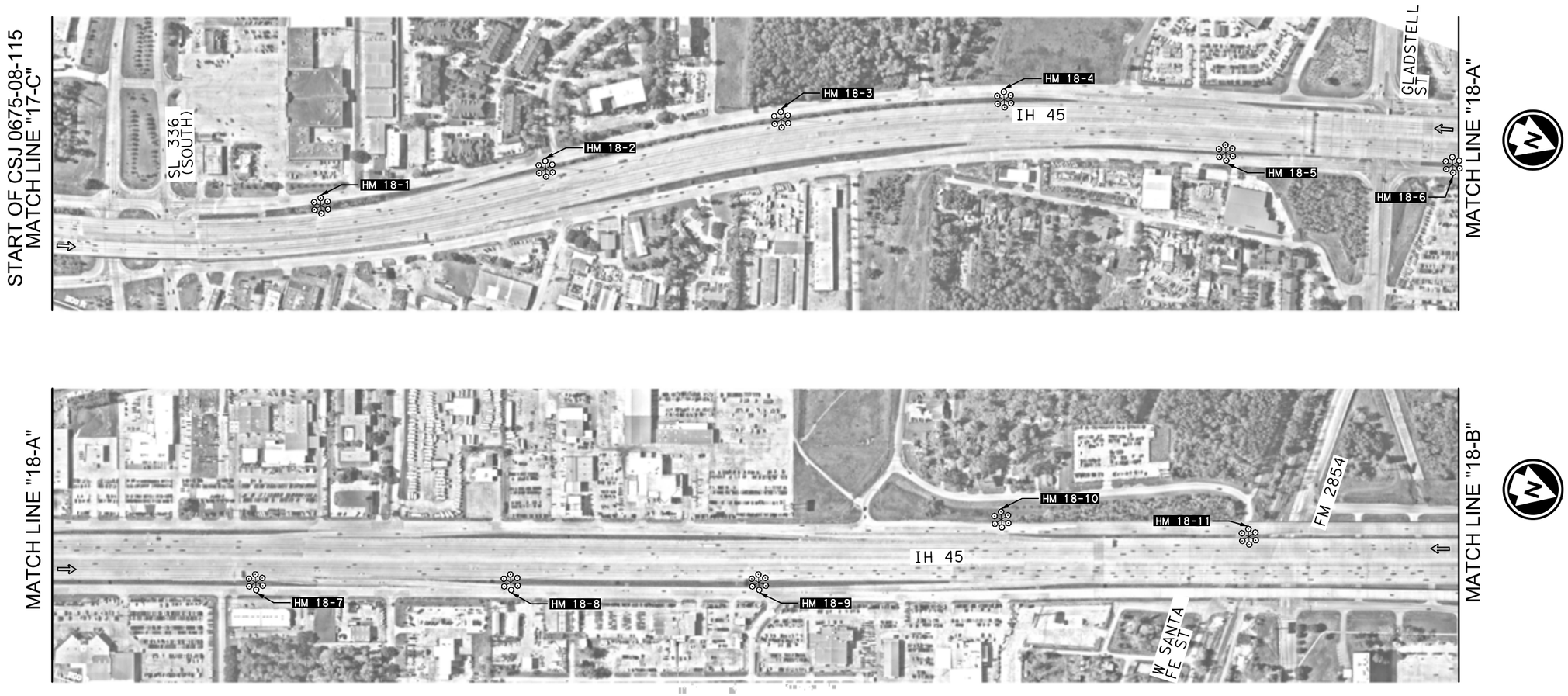
CSJ: 0110-04-208 SHEET 10 OF 10

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	106

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/22/2024 8:46:21 AM

...\SHEET 106 UB B-20 SL 336.dgn



LEGEND:

- DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Z-PAT HIGH MAST UPGRADE

SCALE: 1" = 500'
250 0 250

NOTES:

1. ALL WORK MUST BE PERFORMED WITHIN TXDOT RIGHT OF WAY.
2. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE UTILITIES WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD; KNOWN OR UNKNOWN; PRIVATE OR PUBLIC (INCLUDING TXDOT OWNED).
3. CONTRACTOR TO VERIFY LUMINAIRE TYPE, PERFORMANCE, PHOTOMETRIC DATA, & ORIENTATION PRIOR TO REPLACEMENT.
4. THE COST OF REMOVING, SALVAGING, DISASSEMBLING, AND STOCKPILING EXISTING LUMINAIRES; FURNISHING AND INSTALLING NEW LUMINAIRES, CONNECTIONS, CONDUCTORS, AND CONDUIT ON THE RING; REWIRING CIRCUITS ON THE RING; REPLACING DAMAGED COMPONENTS; DISPOSAL OF UNSALVAGEABLE MATERIALS; CONDUCTING SYSTEM PERFORMANCE TESTING; AND MATERIALS, EQUIPMENT, LABOR, TOOLS, AND INCIDENTALS IS SUBSIDIARY TO ITEM 6000.
5. CONTRACTOR TO FOLLOW STATE AND LOCAL ENVIRONMENTAL REGULATIONS FOR FIXTURE DISPOSAL.
6. ALL ELECTRICAL WORK SHALL MEET THE NATIONAL ELECTRIC CODE.
7. AERIAL AND SCALE FOR VISUAL REFERENCE ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION OR BIDDING. LUMINAIRE LOCATIONS ARE APPROXIMATE.

HIGH MAST QUANTITIES

ILLUMINATION MAINTENANCE 6000

HM ID	LOCATION		LAMP DETAILS		RAISE LOWER RING (6103)	REPLACE HM LED LUM (6160)	HPS TO LED UPGRADE: REMOVE HM HPS FIXTURE (6162)	HPS TO LED UPGRADE: INSTALL HM LED FIXTURE (6161)	AVIATION: REPLACE FIX (LED) (6167)	Z-PATTERN: MODIFY Z-PAT ASSM (6000)
	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA	EA	EA
HM 18-1	30.281672	-95.458757	600	LED	1	6			3	
HM 18-2	30.283995	-95.460244	600	LED	1	6			3	
HM 18-3	30.286394	-95.461883	600	LED	1	6			3	
HM 18-4	30.288768	-95.463090	600	LED	1	6			3	
HM 18-5	30.291402	-95.463415	600	LED	1	6			3	
HM 18-6	30.293935	-95.464259	600	LED	1	6			3	
HM 18-7	30.296600	-95.465160	600	LED	1	6			3	
HM 18-8	30.299407	-95.466094	600	LED	1	6			3	
HM 18-9	30.302193	-95.466986	600	LED	1	6			3	
HM 18-10	30.304719	-95.468682	600	LED	1	6			3	
HM 18-11	30.307520	-95.469411	600	LED	1	6			3	
				TOTALS	11	66			33	

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED PROFESSIONAL ENGINEER

Victor Torres

PRINT DATE	REVISION DATE
3/22/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

Texas Department of Transportation®

IH 45 ILLUMINATION

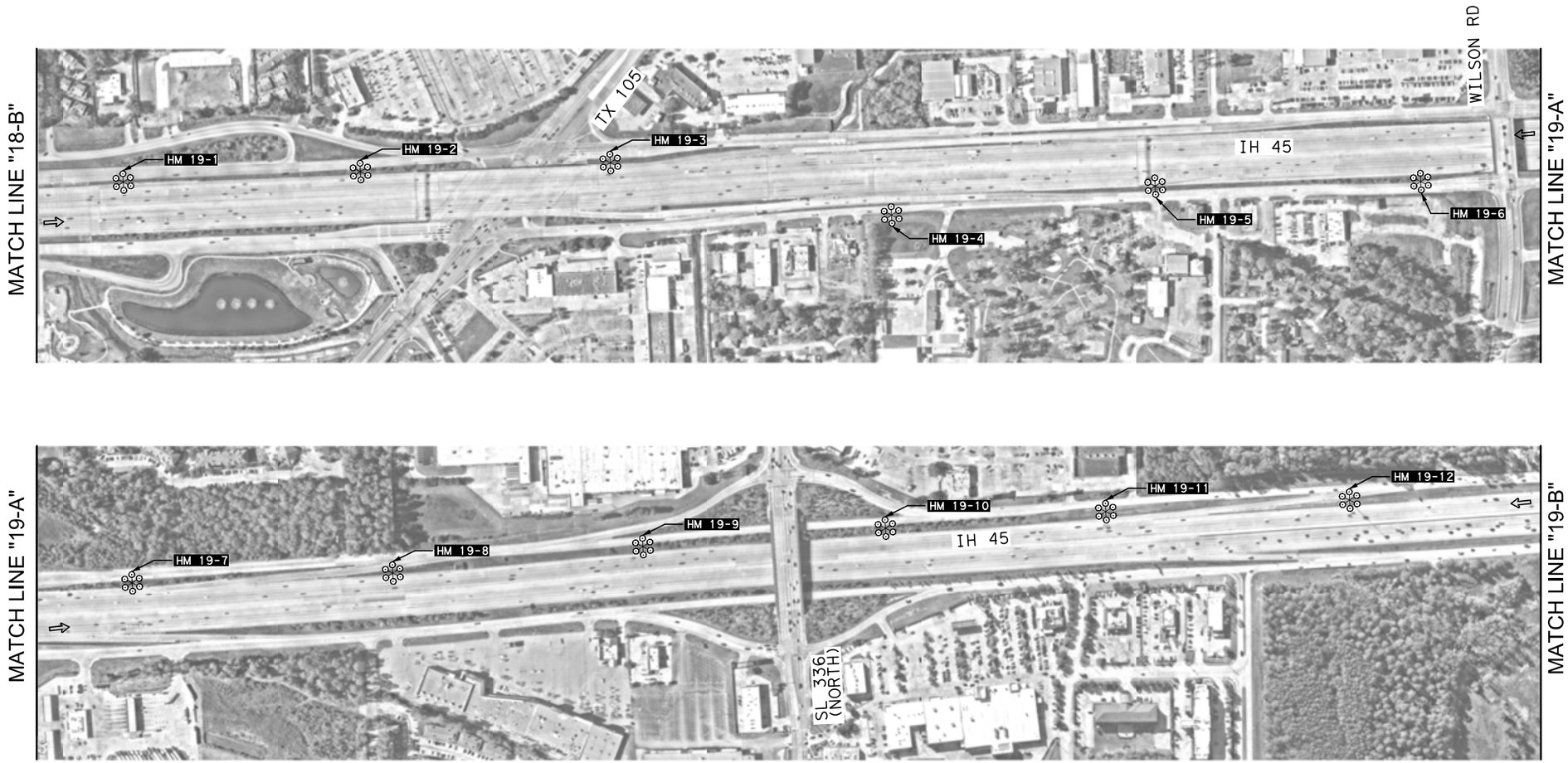
HIGHMAST ILLUMINATION LAYOUT

ML 17-C TO ML 18-B

CSJ: 0675-08-115 SHEET 1 OF 4

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	107

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45



LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Ⓩ Z-PAT HIGH MAST UPGRADE

SCALE: 1" = 500'

250 0 250

NOTES:

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2. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE UTILITIES WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD; KNOWN OR UNKNOWN; PRIVATE OR PUBLIC (INCLUDING TXDOT OWNED).
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7. AERIAL AND SCALE FOR VISUAL REFERENCE ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION OR BIDDING. LUMINAIRE LOCATIONS ARE APPROXIMATE.

					HIGH MAST QUANTITIES					
					ILLUMINATION MAINTENANCE 6000					
					RAISE LOWER RING	REPLACE HM LED LUM	HPS TO LED UPGRADE		AVIATION	Z-PATTERN
							REMOVE HM HPS FIXTURE	INSTALL HM LED FIXTURE	REPLACE FIX (LED)	MODIFY Z-PAT ASSM
HM ID	LOCATION		LAMP DETAILS		(6103)	(6160)	(6162)	(6161)	(6167)	(6000)
	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA	EA	EA
HM 19-1	30.310828	-95.470500	600	LED	1	6			3	
HM 19-2	30.313158	-95.471287	600	LED	1	6			3	
HM 19-3	30.315894	-95.472179	600	LED	1	6			3	
HM 19-4	30.319014	-95.472372	600	LED	1	6			3	
HM 19-5	30.321674	-95.473480	600	LED	1	6			3	
HM 19-6	30.324491	-95.474358	600	LED	1	6			3	
HM 19-7	30.326885	-95.475918	600	LED	1	6			3	
HM 19-8	30.329430	-95.476835	600	LED	1	6			3	
HM 19-9	30.331982	-95.477925	600	LED	1	6			3	
HM 19-10	30.334465	-95.478907	600	LED	1	6			3	
HM 19-11	30.336759	-95.479795	600	LED	1	6			3	
HM 19-12	30.339302	-95.480701	600	LED	1	6			3	
				TOTALS	12	72			36	

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER

Victor Torres

PRINT DATE	REVISION DATE
3/22/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

HIGHMAST ILLUMINATION LAYOUT

ML 18-B TO ML 19-B

CSJ: 0675-08-115 SHEET 2 OF 4

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	108

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/22/2024 8:50:23 AM

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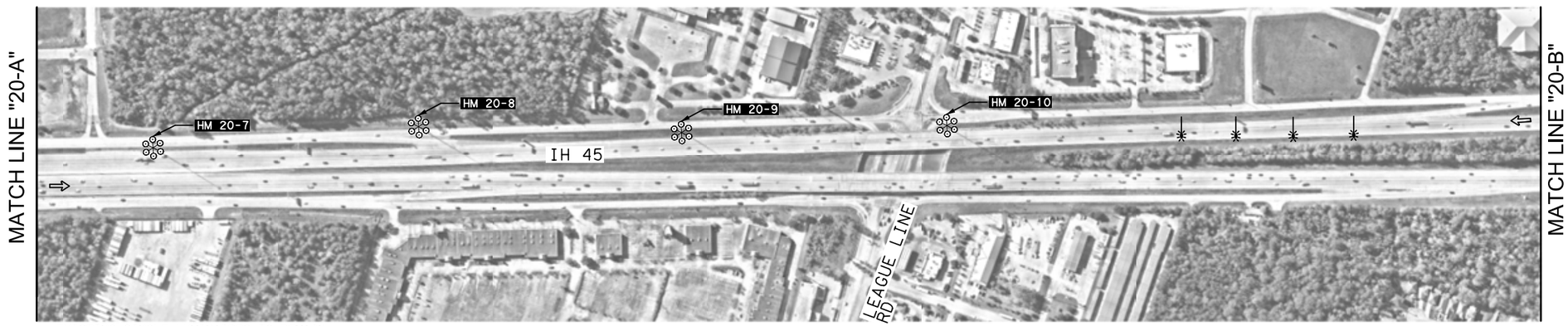

LEGEND:
- DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Z-PAT HIGH MAST UPGRADE
- EXISTING SINGLE LUMINAIRE

* EXISTING SINGLE LUMINAIRES TO REMAIN

SCALE: 1" = 500'
250 0 250

NOTES:
1. ALL WORK MUST BE PERFORMED WITHIN TXDOT RIGHT OF WAY.
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HIGH MAST QUANTITIES

ILLUMINATION MAINTENANCE 6000

HM ID	LOCATION		LAMP DETAILS		RAISE LOWER RING (6103)	REPLACE HM LED LUM (6160)	HPS TO LED UPGRADE: REMOVE HM HPS FIXTURE (6162)	HPS TO LED UPGRADE: INSTALL HM LED FIXTURE (6161)	AVIATION: REPLACE FIX (LED) (6167)	Z-PATTERN: MODIFY Z-PAT ASSM (6000)
	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA	EA	EA	EA
HM 20-1	30.341815	-95.481692	600	LED	1	6			3	
HM 20-2	30.344327	-95.482709	600	LED	1	6			3	
HM 20-3	30.346663	-95.483457	600	LED	1	6			3	
HM 20-4	30.349951	-95.484345	600	LED	1	6			3	
HM 20-5	30.352245	-95.484356	600	LED	1	6			3	
HM 20-6	30.356511	-95.484839	600	LED	1	6			3	
HM 20-7	30.358747	-95.484834	600	LED	1	6			3	
HM 20-8	30.361617	-95.485231	600	LED	1	6			3	
HM 20-9	30.364455	-95.485352	600	LED	1	6			3	
HM 20-10	30.367339	-95.485584	600	LED	1	6			3	
				TOTALS	10	60			30	

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER
Victor Torres

PRINT DATE	REVISION DATE
3/22/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

HIGHMAST ILLUMINATION LAYOUT

ML 19-B TO ML 20-B

CSJ: 0675-08-115 SHEET 3 OF 4

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		109
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

LEGEND:
- DIRECTION OF TRAFFIC FLOW
- HPS HIGH MAST UPGRADE
- LED HIGH MAST UPGRADE
- Z-PAT HIGH MAST UPGRADE
- EXISTING SINGLE LUMINAIRE

* EXISTING SINGLE LUMINAIRES TO REMAIN

SCALE: 1" = 500'
250 0 250

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER
Victor Torres

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PRINT DATE	REVISION DATE
3/22/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

Texas Department of Transportation®

IH 45 ILLUMINATION

HIGHMAST ILLUMINATION LAYOUT

ML 20-B TO END PROJECT

CSJ: 0675-08-115 SHEET 4 OF 4

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		110
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

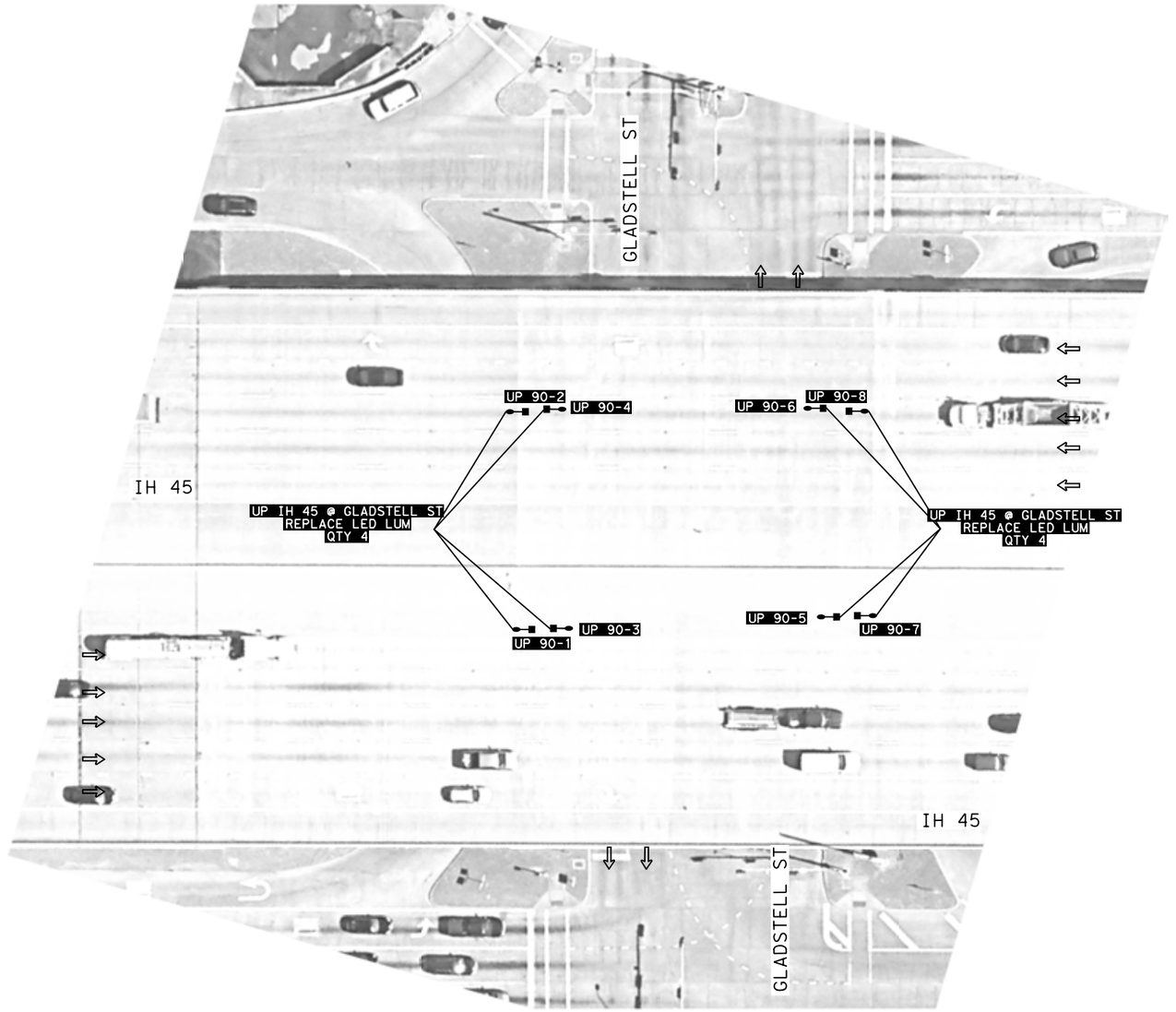
3/22/2024 8:52:22 AM
...\SHEET 110 SL 5 - SL 14.dgn

LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



SCALE: 1" = 50'

25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED PROFESSIONAL ENGINEER

Victor Torres

NOTES:

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						UNDERPASS QTY		
						ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA
UP 90-1	UP 90-8	30.293035	-95.464295	250	LED			8
					TOTALS			8

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/22/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

Texas Department of Transportation®

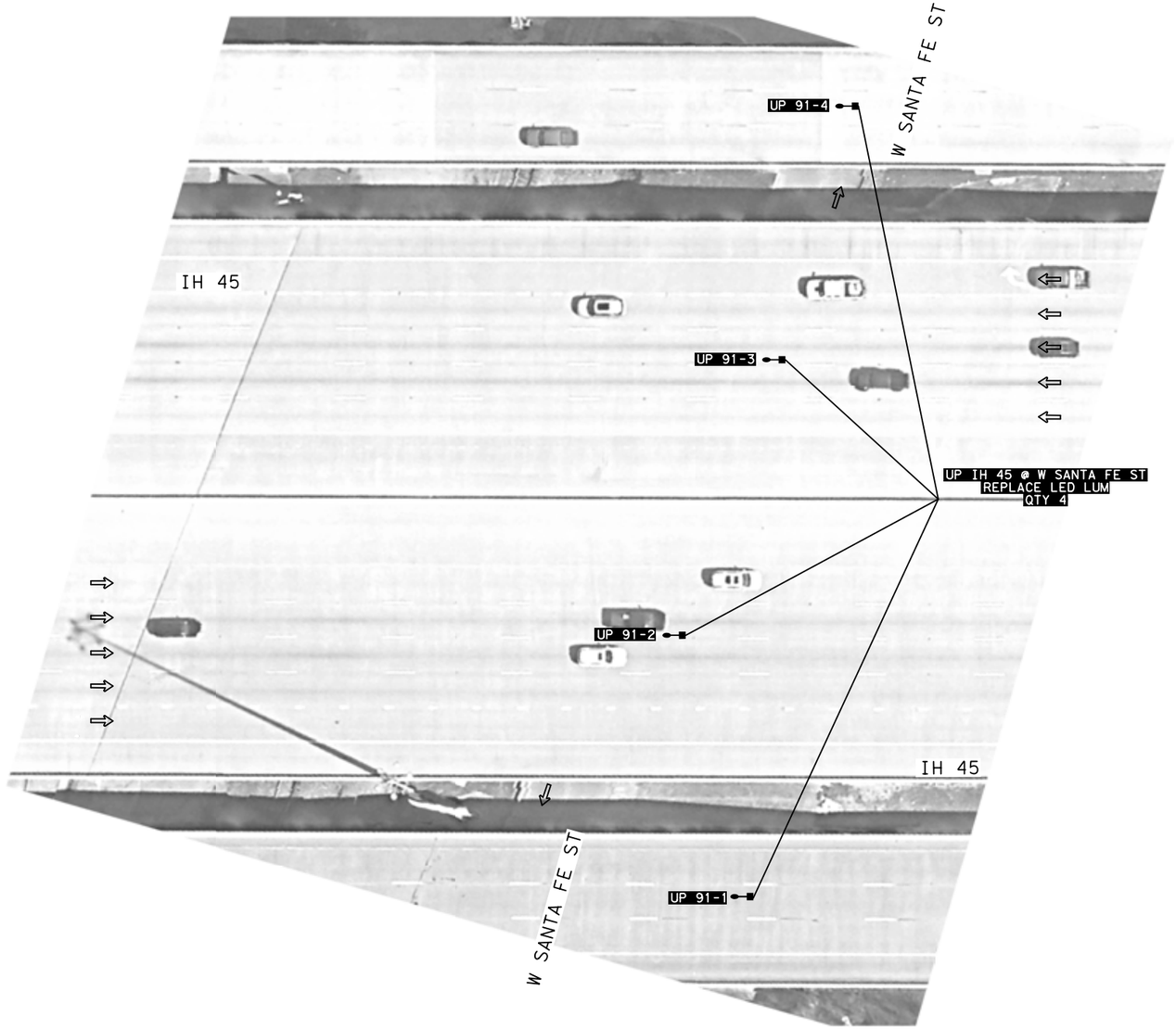
IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

GLADSTELL ST

CSJ: 0675-08-115 SHEET 1 OF 8

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		111
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45



LEGEND:

- ⇦ DIRECTION OF TRAFFIC FLOW
- ◄■ HPS UNDERPASS UPGRADE
- ●■ LED UNDERPASS UPGRADE

SCALE: 1" = 50'

25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED PROFESSIONAL ENGINEER

Victor Torres

NOTES:

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						UNDERPASS QTY		
						ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA
UP 91-1	UP 91-4	30.307363	-95.468998	250	LED			4
					TOTALS			4

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/22/2024	

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430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

W SANTE FE ST

CSJ: 0675-08-115 SHEET 2 OF 8

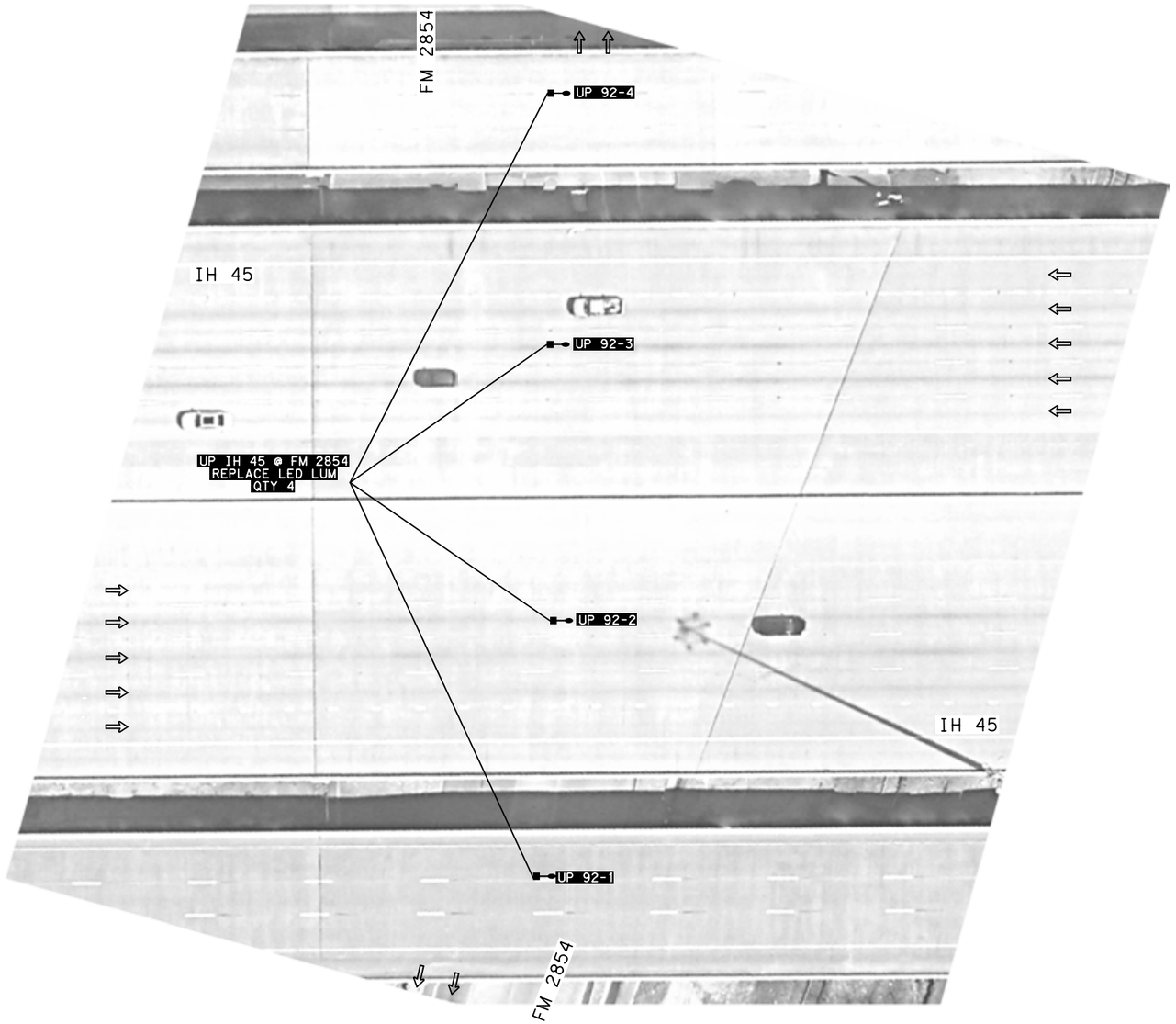
FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		112
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



SCALE: 1" = 50'

25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER

Victor Torres

NOTES:

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
UP 92-1	UP 92-4	30.308041	-95.469220	250	LED	EA	EA	EA
					TOTALS			4

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/22/2024	

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430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
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IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

FM 2854

CSJ: 0675-08-115 SHEET 3 OF 8

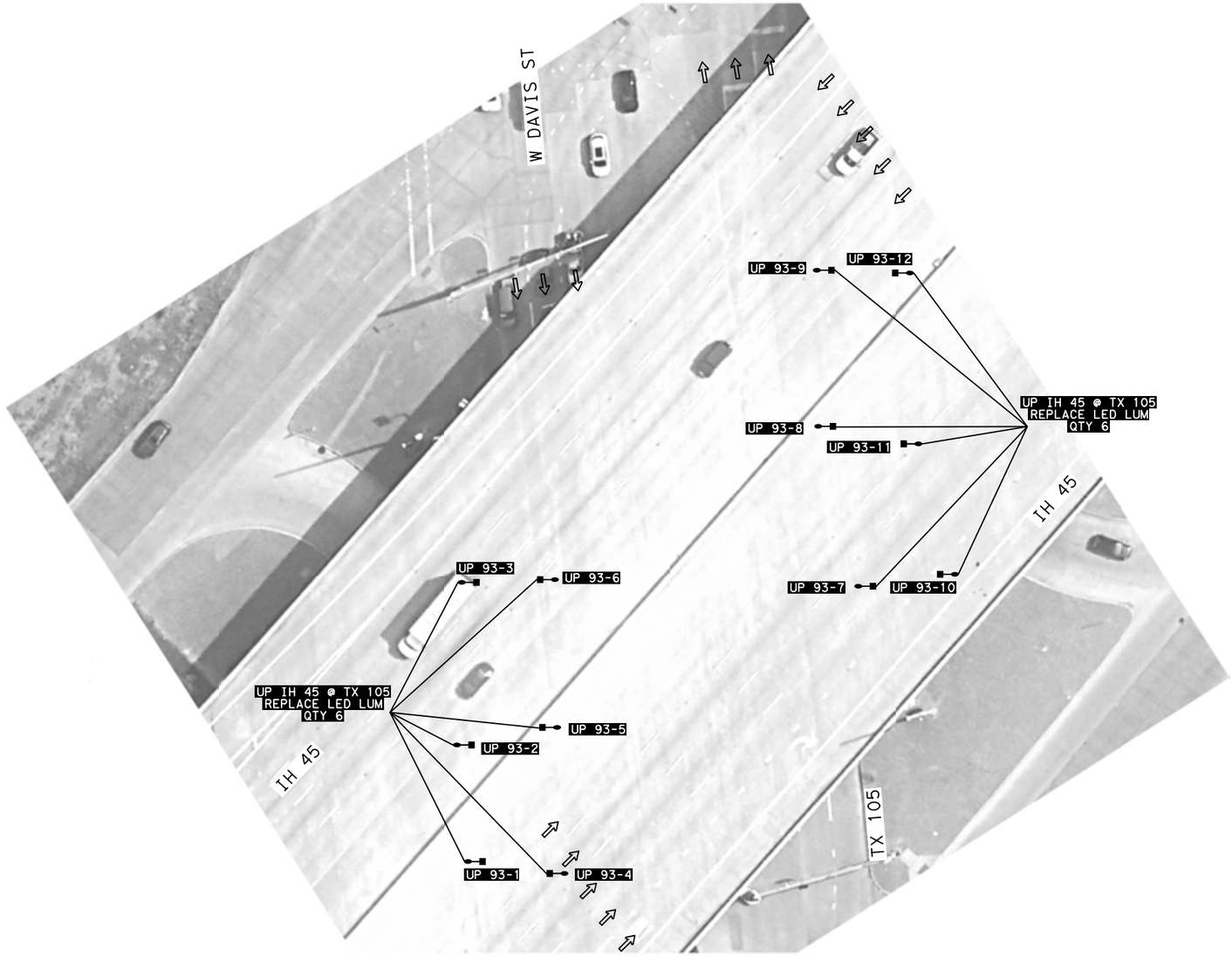
FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		113
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



SCALE: 1" = 50'

25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER

Victor Torres

NOTES:

1. ALL WORK MUST BE PERFORMED WITHIN TXDOT RIGHT OF WAY.
2. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY DAMAGE CAUSED BY CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE UTILITIES WHETHER UNDERGROUND, ABOVE GROUND, OR OVERHEAD; KNOWN OR UNKNOWN; PRIVATE OR PUBLIC (INCLUDING TXDOT OWNED).
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5. CONTRACTOR TO FOLLOW STATE AND LOCAL ENVIRONMENTAL REGULATIONS FOR FIXTURE DISPOSAL.
6. ALL ELECTRICAL WORK SHALL MEET THE NATIONAL ELECTRIC CODE.
7. AERIAL AND SCALE FOR VISUAL REFERENCE ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION OR BIDDING. LUMINAIRE LOCATIONS ARE APPROXIMATE.

UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
UP 93-1	UP 93-12	30.314995	-95.471579	250	LED	EA	EA	EA
					TOTALS			12

*REPRESENTS THE CENTER OF BRIDGE

PRINT DATE	REVISION DATE
3/22/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

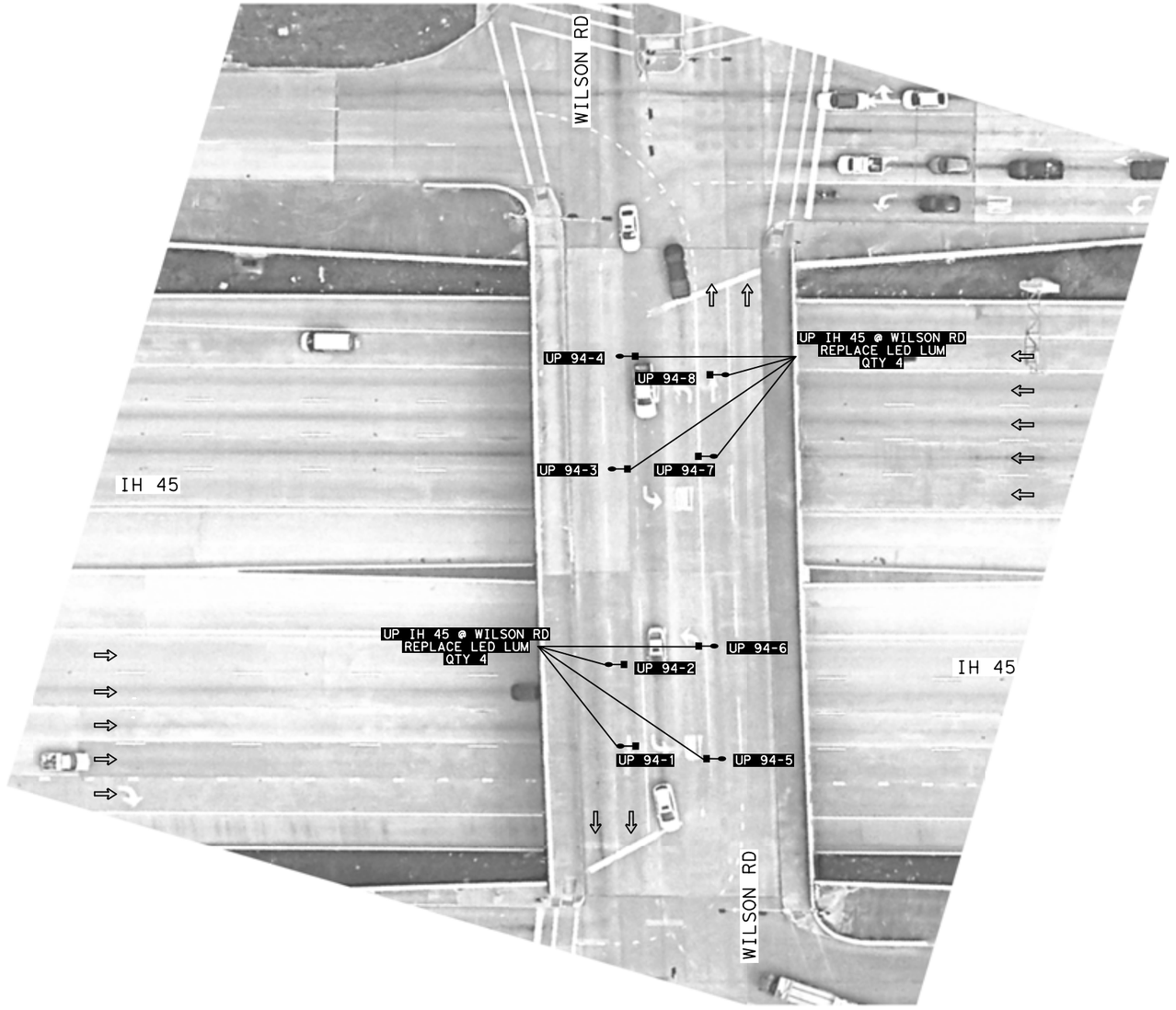
UNDERPASS ILLUMINATION LAYOUT

TX 105/W DAVIS ST

CSJ: 0675-08-115 SHEET 4 OF 8

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		114
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

LEGEND:
⇦ DIRECTION OF TRAFFIC FLOW
HPS UNDERPASS UPGRADE
LED UNDERPASS UPGRADE



SCALE: 1" = 50'
25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER
Victor Torres

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
UP 94-1	UP 94-8	30.325280	-95.475057	250	LED			8
					TOTALS			8

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/22/2024	

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Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

WILSON RD

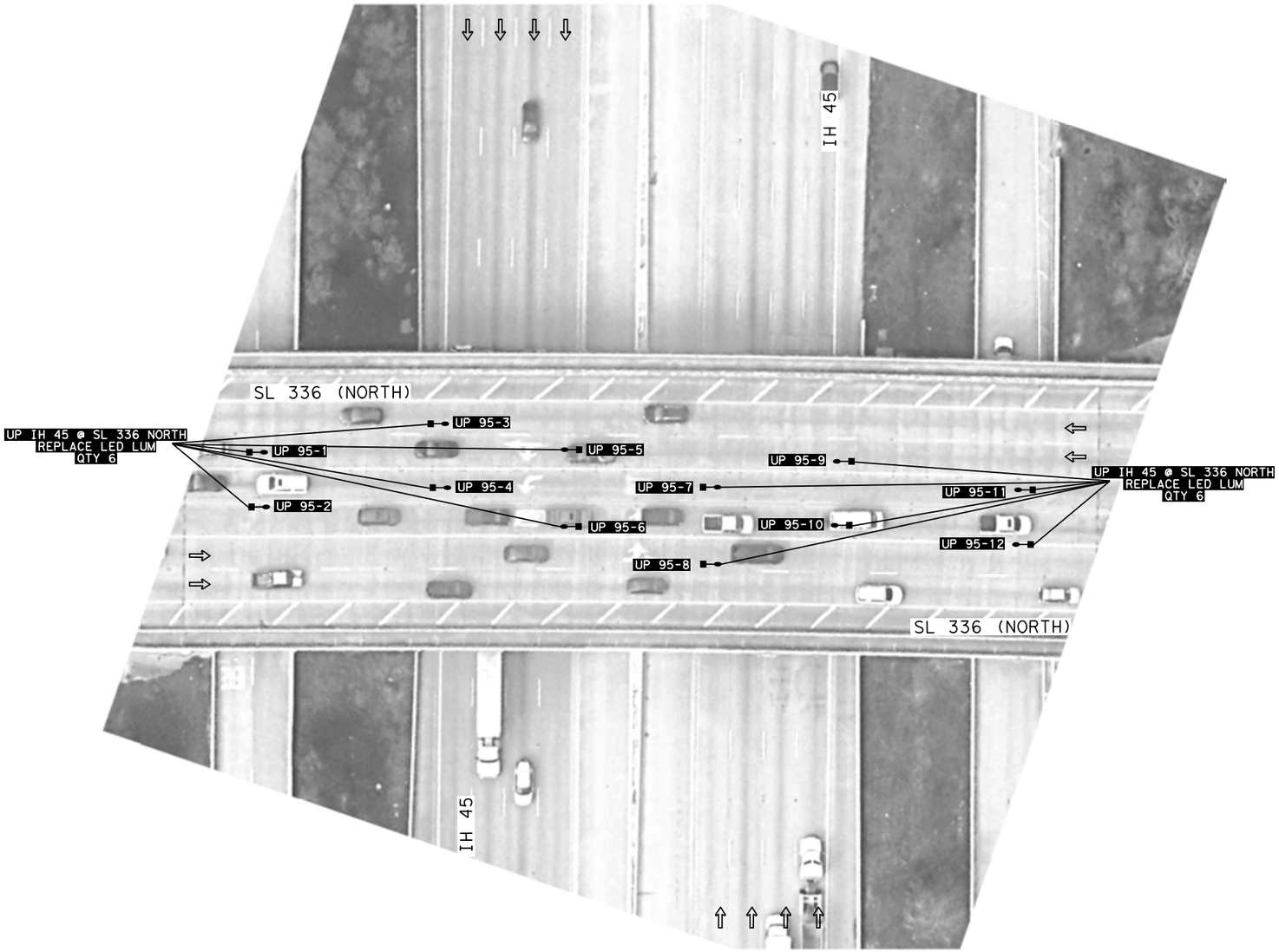
CSJ: 0675-08-115 SHEET 5 OF 8

FHWA TEXAS DIVISION	FEDERAL AID PROJECT	SHEET NO.
	SEE TITLE SHEET	115

STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/22/2024 8:59:19 AM
...\SHEET 115 UB C-5 Wilson Rd.dgn

LEGEND:
- ⇦ DIRECTION OF TRAFFIC FLOW
- ◄■ HPS UNDERPASS UPGRADE
- ●■ LED UNDERPASS UPGRADE



SCALE: 1" = 50'
25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER
Victor Torres

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	(6028)	(6030)	(6032)
UP 96-1	UP 96-12	30.333533	-95.478176	250	LED	EA	EA	EA
					TOTALS			12

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/22/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

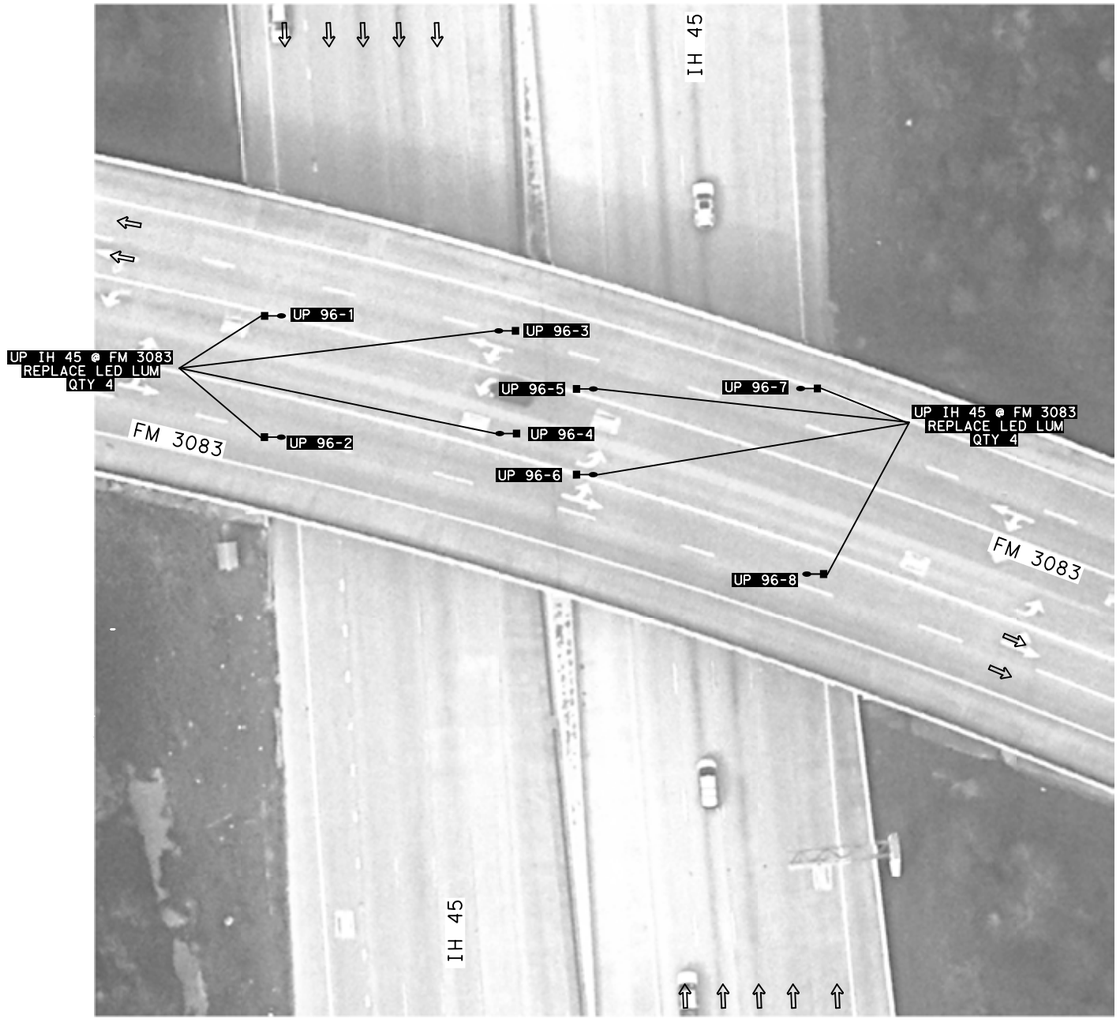
UNDERPASS ILLUMINATION LAYOUT

SL 336 (NORTH)

CSJ: 0675-08-115 SHEET 6 OF 8

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		116
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

LEGEND:
⇦ DIRECTION OF TRAFFIC FLOW
◄■ HPS UNDERPASS UPGRADE
●■ LED UNDERPASS UPGRADE



SCALE: 1" = 50'
25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER
Victor Torres

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UP ID		UP LUM LOC*		LAMP DETAILS		UNDERPASS QTY ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
						(6028)	(6030)	(6032)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA
UP 97-1	UP 97-8	30.351150	-95.483967	250	LED			8
					TOTALS			8

*REPRESENTS THE CETNER OF BRIDGE.

PRINT DATE	REVISION DATE
3/22/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

FM 3083

CSJ: 0675-08-115 SHEET 7 OF 8

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		117
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

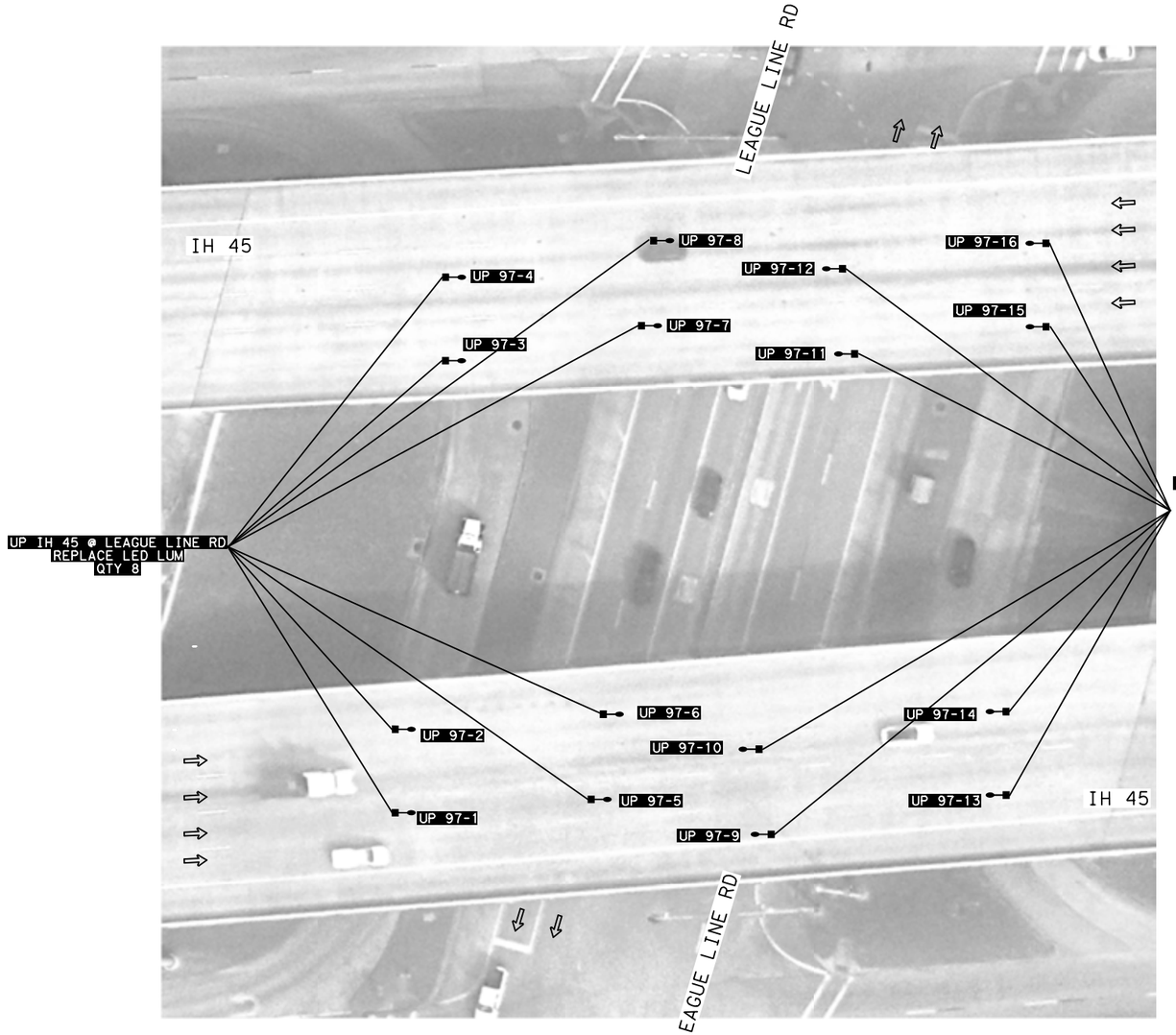
3/22/2024 9:00:40 AM
...\SHEET 117 UB C-7 FM 3083.dgn

LEGEND:

⇦ DIRECTION OF TRAFFIC FLOW

HPS UNDERPASS UPGRADE

LED UNDERPASS UPGRADE



SCALE: 1" = 50'

25 0 25

STATE OF TEXAS
VICTOR A. TORRES
134333
LICENSED
PROFESSIONAL ENGINEER

Victor Torres

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						UNDERPASS QTY		
						ILLUM MAINT 6000		
						REMOVE UP LUM (HPS)	INSTALL UP LUM (LED)	REPLACE UP LUM (LED)
UP ID		UP LUM LOC*		LAMP DETAILS		(6028)	(6030)	(6032)
FROM	TO	LATITUDE	LONGITUDE	EQ WATT	TYPE	EA	EA	EA
UP 97-1	UP 97-16	30.366837	-95.485115	250	LED			16
					TOTALS			16

*REPRESENTS THE CENTER OF BRIDGE.

PRINT DATE	REVISION DATE
3/22/2024	

KBH Traffic Engineering, LLC
430 State Hwy 6 S, Suite 120,
Houston, TX 77079
Tel: 832-250-1861
TBPE Registration No. F-14592

IH 45 ILLUMINATION

UNDERPASS ILLUMINATION LAYOUT

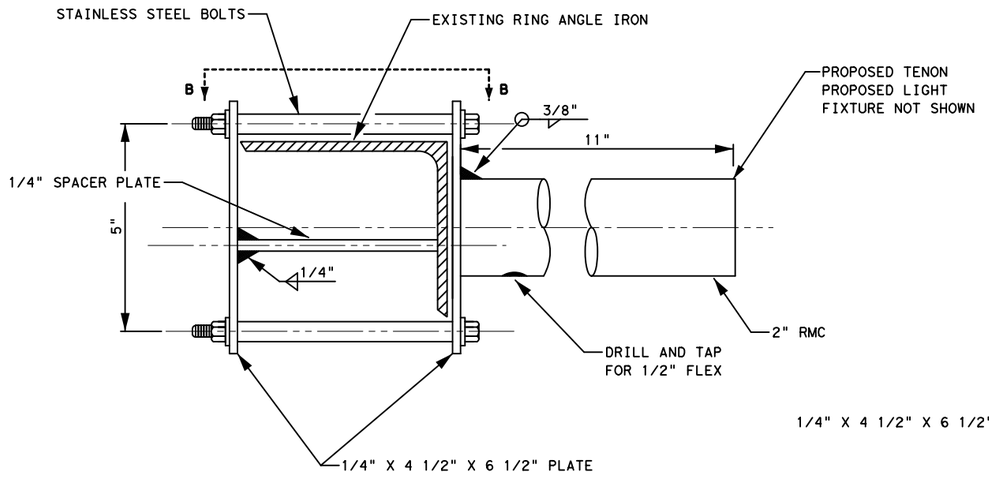
LEAGUE LINE RD

CSJ: 0675-08-115 SHEET 8 OF 8

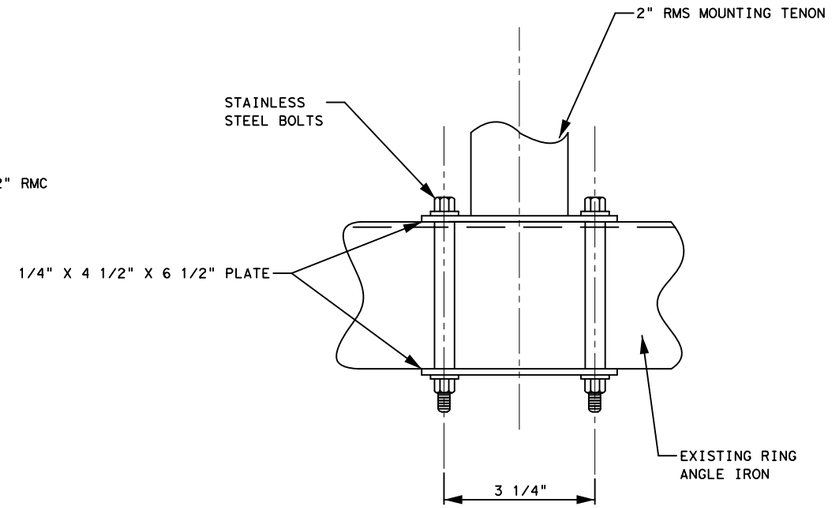
FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		118
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

3/22/2024 9:01:24 AM

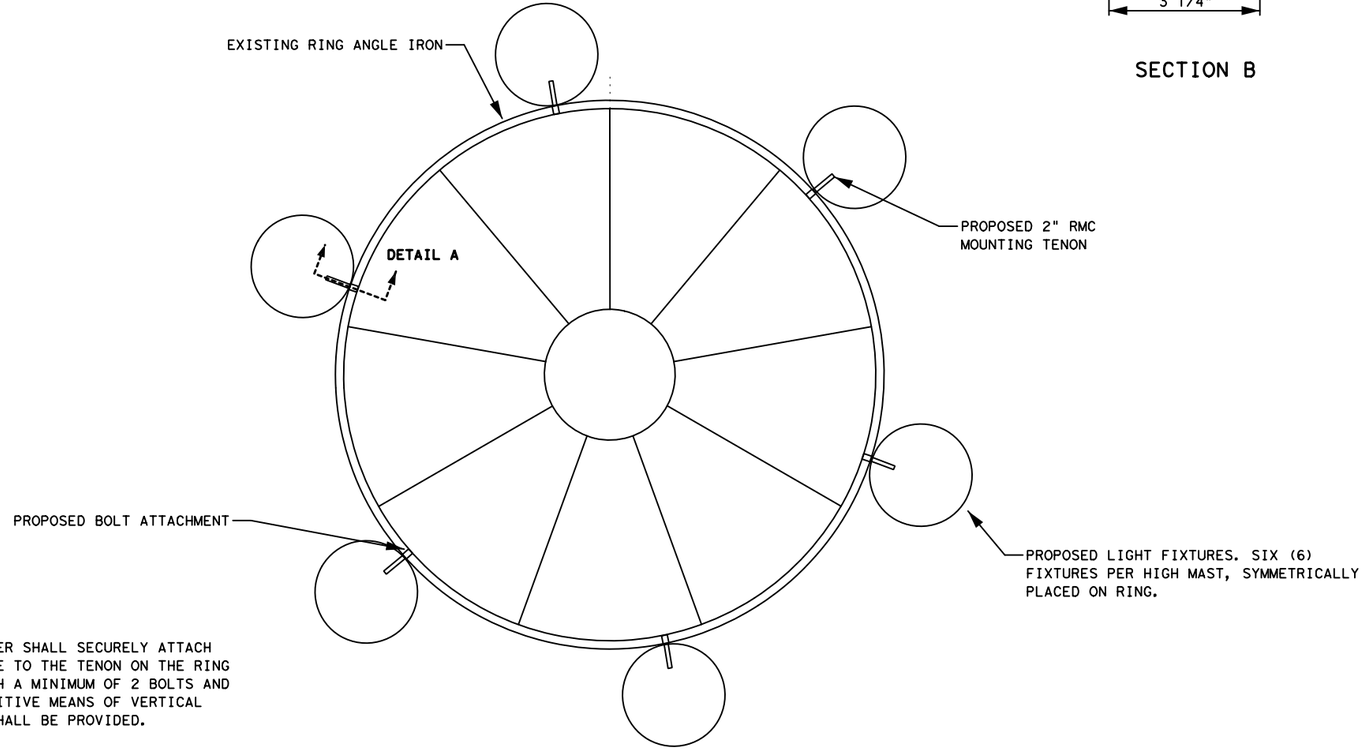
...\SHEET 118 UB C-8 League Line Rd.dgn



BOLT ON ATTACHMENT AND MOUNTING TENON
(DETAIL A)



SECTION B



THE SLIPFITTER SHALL SECURELY ATTACH THE LUMINAIRE TO THE TENON ON THE RING ASSEMBLY WITH A MINIMUM OF 2 BOLTS AND CLAMP. A POSITIVE MEANS OF VERTICAL ADJUSTMENT SHALL BE PROVIDED.

PLAN VIEW HIGH MAST RING

DETAIL SHEET FOR CONVERT Z-PATTERN HIGHMAST

NOTES:

1. LOWER RING. REMOVE ALL ITEMS FROM THE HIGH MAST RINGS SUCH THAT ONLY THE RING, BUMPERS, COUNTERWEIGHTS, OBSTRUCTION LIGHTS, WIRE ROPE AND POWER CABLE REMAIN. REPLACE ITEMS AS PRESCRIBED IN HMID-03. THE SPECIAL PROVISION "CONVERT Z-PATTERN HIGH MAST ILLUMINATION ASSEMBLY TO LED" PROVIDES FOR A COMPLETE CONVERSION FROM Z-PATTERN LIGHTING TO LED LIGHTING.
2. FURNISH AND INSTALL SIX (6) TXDOT STANDARD TYPE A(DMS-1120) HIGH MAST LUMINAIRE FIXTURES ORIENTED IN THE SAME DIRECTION TOWARDS THE FREEWAY OR AS DIRECTED.
3. REPLACE OR INSTALL NEW LIGHTNING PROTECTION ON THE OUTSIDE OF THE HIGH MAST FOUNDATION INSTALLED
4. INSTALL NEW DC DISCONNECT WITH A NON-FUSED 30A BREAKER AND NEW MALE/FEMALE CONNECTORS.
5. PROVIDE TWO (2) NEW MAINTENANCE WHIPS FOR THE HIGH MASTS ON THIS PROJECT.
6. INSTALL NEW LANYARD CHAIN.
7. VERIFY ALL COTTER PINS AND BOLTS ARE STAINLESS STEEL. REPLACE IF NECESSARY AND AS DIRECTED BY THE ENGINEER.
8. CHECK ALL BUMPERS. REPLACE IF NECESSARY AND AS DIRECTED BY THE ENGINEER.
9. REPLACE ALL MUSTANG CABLE WITH POWER FLEX 90 W.
10. ESTABLISH LIGHTING KNOTS.
11. VERIFY ASSEMBLY IS PROPERLY GROUNDED, REPAIRE OR REPLACE GROUNDING SYSTEM/COMPONENTS AS NEEDED INCLDUING INSTALLIUNG GROUND RODS AT NO ADDITIONAL COST.
12. CONCRETE FOUNDATION TO BE TAPPED AND DRILLED FOR COPPER BRAID.
13. REPLACE OBSTRUCTION LIGHTS WITH NEW LED EQUIVALENT INCLUDING NEW TRANSFORMERS: 3R,RAINPROOF, 500 KVA, SINGLE PHASE, 480/120 TRANSFORMERS OR AS DIRECTED.
15. CHECK TORQUE ON ALL BOLTS ON RING. REPLACE MISSING BOLTS AND TIGHTEN IF NECESSARY.
16. REPLACE TAPE AT WIRE ROPE LOOPS WITH STEEL BANDS.
17. TEST HIGH MAST WINCH AND VERIFY THERE ARE NO DEFECTS TO THE AIRCRAFT CABLES USED TO RAISE/LOWER RING. REPORT THE NEED FOR REPAIR OR REPLACEMENT TO THE ENGINEER FOR APPROVAL AND PAYMENT UNDER TROUBLESHOOTING ITEMS.
17. BALANCE THE RING AND PUT ASSEMBLY INTO SERVICE FOR TESTING.

STATE OF TEXAS
CHARLES R. STEVENS, JR.
101286
PROFESSIONAL LICENSED ENGINEER

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

PRINT DATE	REVISION DATE
3/21/2024	

STEVENS TECHNICAL
TEXAS REGISTERED ENGINEERING FIRM F-13097
8131 JACKRABITT RD
Houston, TX. 77095
PHONE: (713) 828-4742

Texas Department of Transportation®

IH 45 ILLUMINATION

CONVERT Z-PATTERN HIGH MAST DETAIL

CSJ: 0500-03-652 SHEET 1 OF 1

FHWA TEXAS DIVISION	FEDERAL AID PROJECT		SHEET NO.
	SEE TITLE SHEET		119
STATE	DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY,ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

8:16:13 PM 3/21/2024 ...\119 HIGH MAST RETROFIT.dgn

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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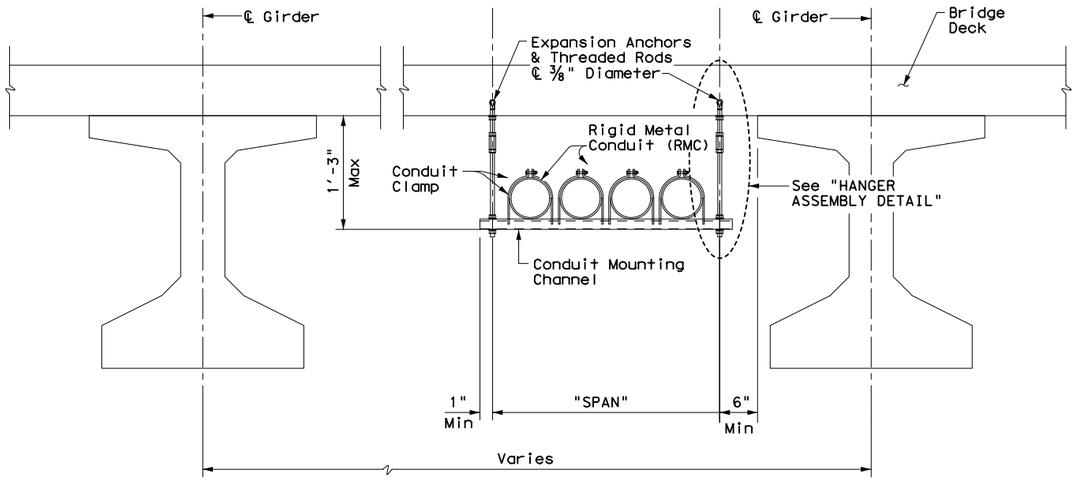
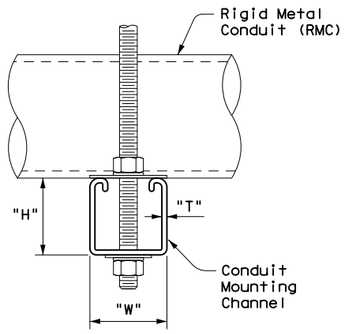
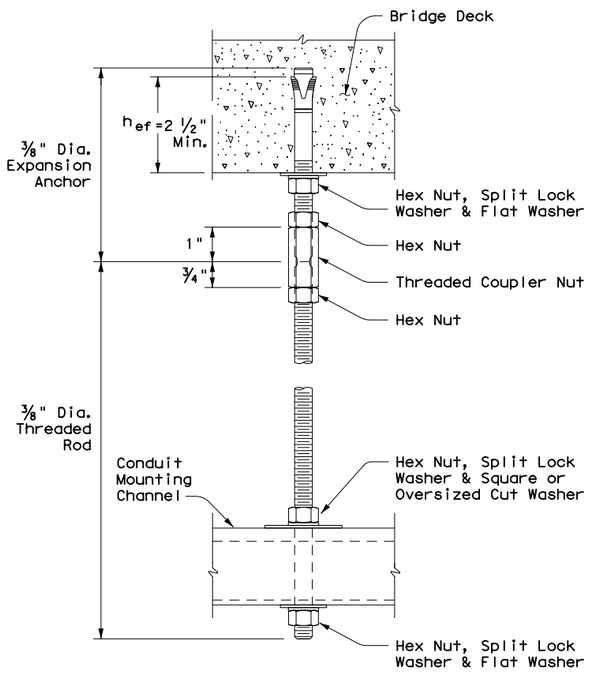


CONDUIT HANGING DETAIL

CONDUIT MOUNTING CHANNEL		
"SPAN"	"W" x "H"	"T"
less than 2'	1 5/8" x 1 3/8"	12 Ga.
2'-0" to 2'-6"	1 5/8" x 1 5/8"	12 Ga.
>2'-6" to 3'-0"	1 5/8" x 2 7/16"	12 Ga.

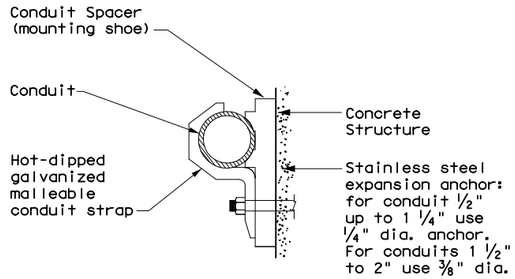
Channels with round or short slotted hole patterns are allowed, if the load carrying capacity is not reduced by more than 15%.

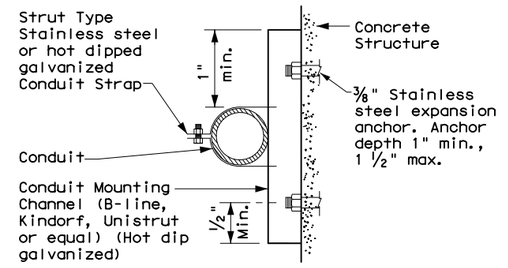




HANGER ASSEMBLY DETAIL

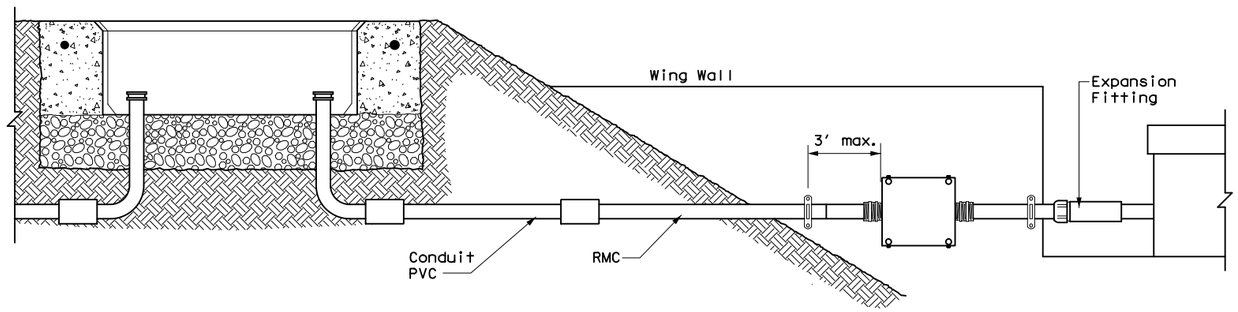
ELECTRIC CONDUIT TO BRIDGE DECK ATTACHMENT





CONDUIT MOUNTING OPTIONS

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



TYPICAL CONDUIT ENTRY TO BRIDGE STRUCTURE DETAIL

EXPANSION ANCHOR NOTES FOR BRIDGE DECK ATTACHMENT

1. Use torque controlled mechanical expansion anchors that are approved for use in cracked concrete by the International Code Council, Evaluation Service (ICC-ES). The chosen anchor product shall have a designated ICC-ES Evaluation Report number, and its approval status shall be maintained on the ICC-ES website under Division 031600 for Concrete Anchors.

2. Unless otherwise approved by the Engineer: do not use adhesive anchors; do not use expansion anchors that are not included in the ICC-ES approval list; and do not use expansion anchors that are only approved for use in uncracked concrete.

3. Use anchors manufactured with stainless steel expansion wedges. Anchors manufactured with carbon steel expansion wedges are not allowed. Anchor bodies can be either zinc-plated carbon steel or stainless steel. For application in marine environment, both the anchor body and expansion wedge shall be stainless steel.

4. Install anchors as shown on the plans and in accordance with the anchor manufacturer's published installation instructions. Arrange a field demonstration test to evaluate the procedures and tools. The test shall be witnessed and approved by the Engineer prior to furnishing anchors on the structure.

5. Prior to hole drilling, use rebar locator to ensure clearing of existing deck strands or reinforcement. Install anchors to ensure a minimum effective embedment depth, (h_{ef}), as shown. Increase (h_{ef})as needed to ensure sufficient thread length for proper torqueing and tightening of anchors.

6. Use anchors of minimum 1600 Lbs tensile capacity (minimum of steel, concrete breakout, and concrete pullout strengths as determined by ACI 318 Appendix D) at the required minimum embedment depth (h_{ef}). No lateral loads shall be introduced after conduit installation.

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS
CONDUIT SUPPORTS

ED(2)-14

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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.

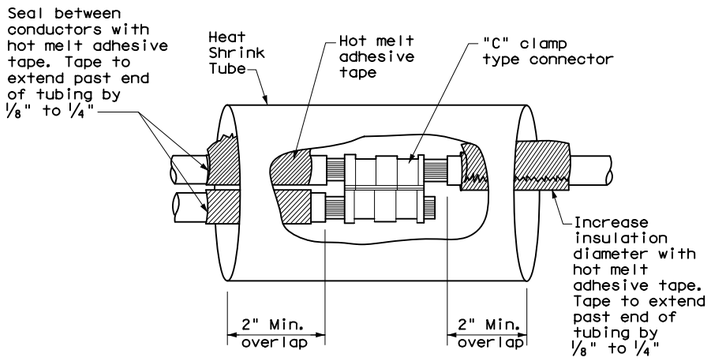
GROUND RODS & GROUNDING ELECTRODES

A. MATERIAL INFORMATION

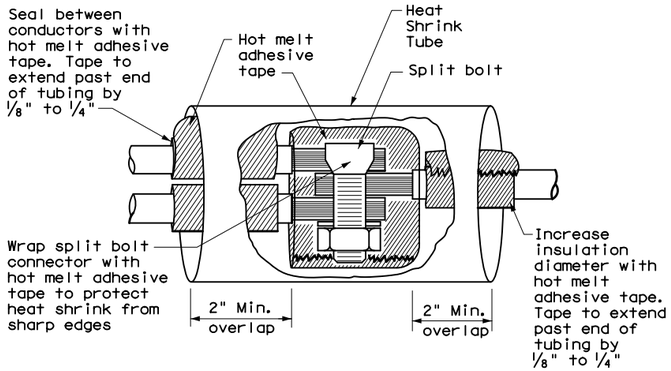
1. Provide and install a grounding electrode at electrical services. Provide ground rods according to DMS 11040 and the plans. Larger diameter or longer length rods may be called for in some specific locations, see the individual plans sheets. Concrete encased grounding electrodes may be called for in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

B. CONSTRUCTION METHODS

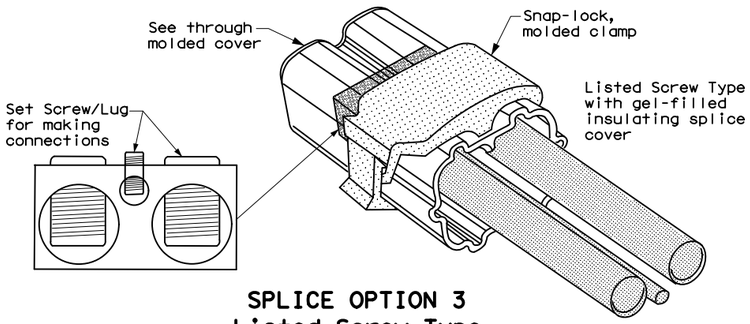
1. Furnish auxiliary ground rods for lightning protection and install in soil, concrete, or both, as called for in the plans. For ground rods installed in concrete, ensure the connection of the conductor to the ground rod is readily accessible for inspection or repairs. For ground rods installed in soil, 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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ELECTRICAL DETAILS CONDUCTORS

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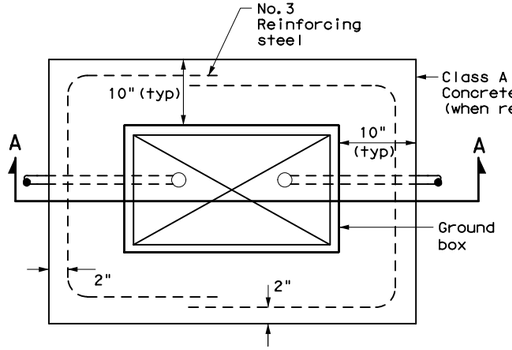
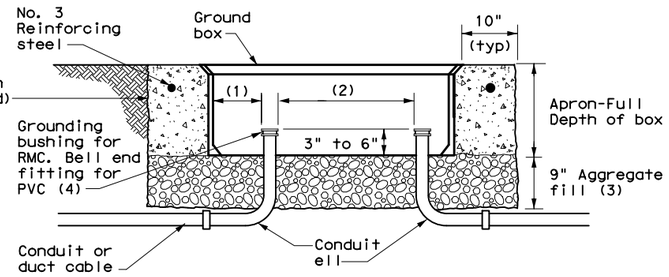


PLAN VIEW



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.

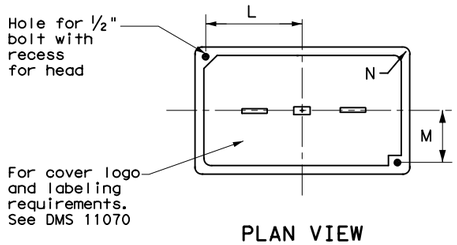
(2) Maintain sufficient space between conduits to allow for proper installation of bushing.

(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



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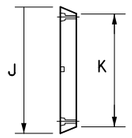
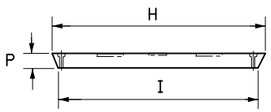


END



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	

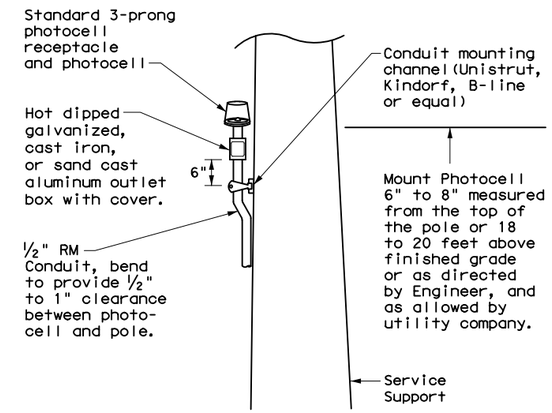
* Example only, not for construction. All new electrical services must have electrical service data chart specific to that service as shown in the plans.

** 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

ED(5)-14

FILE: ed5-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT October 2014	CONT	SECT	JOB	HIGHWAY
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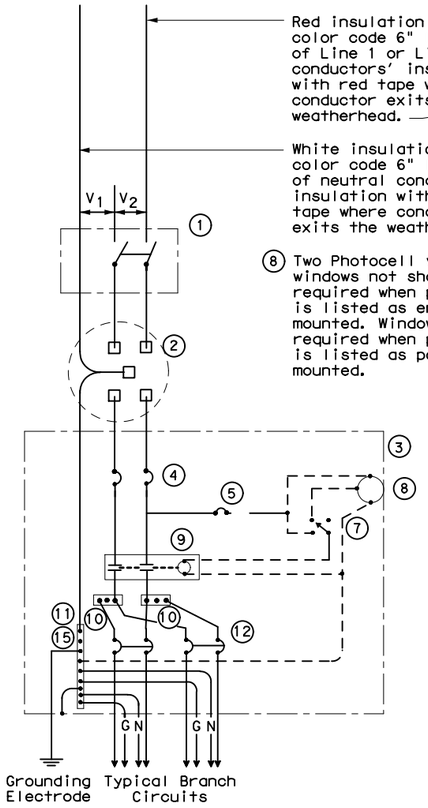
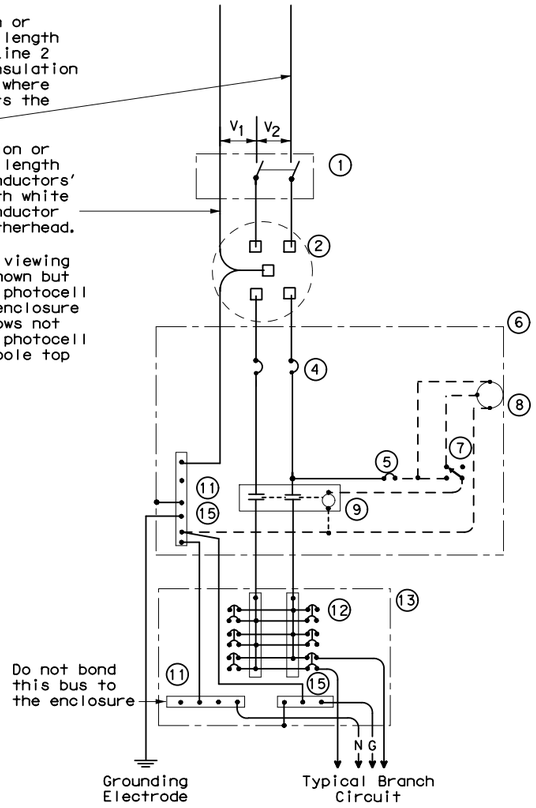
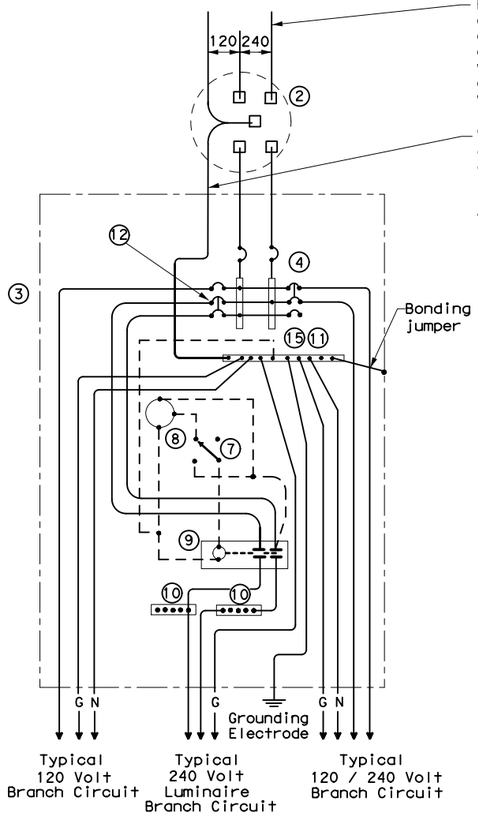


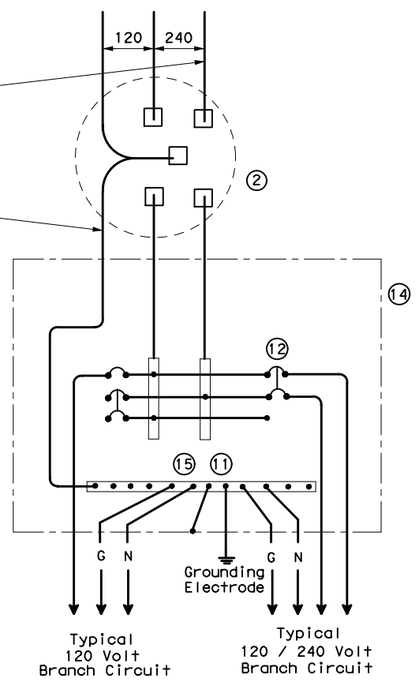
SCHEMATIC TYPE A
THREE WIRE



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 ⅝ 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.

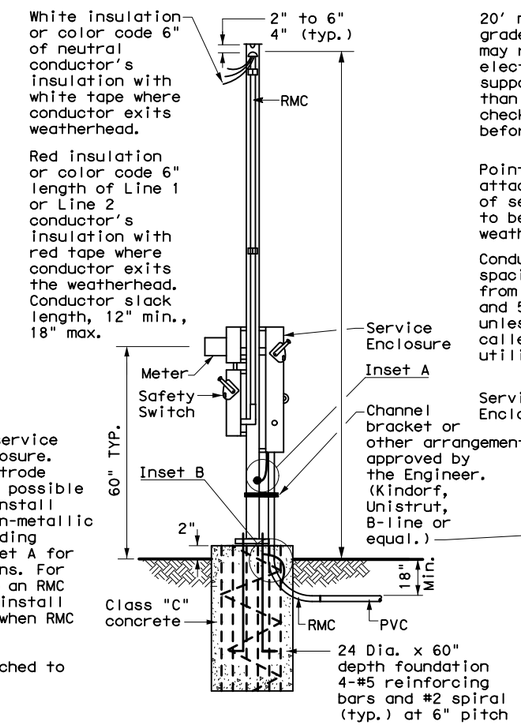
7. Drill and tap steel poles and frames for ½ in. X 13 UNC tank ground fitting. For steel pole service supports, provide and install tank ground fitting 4 in. to 6 in. below electrical service enclosure. Provide properly sized hole through the bottom of the enclosure for the service grounding electrode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

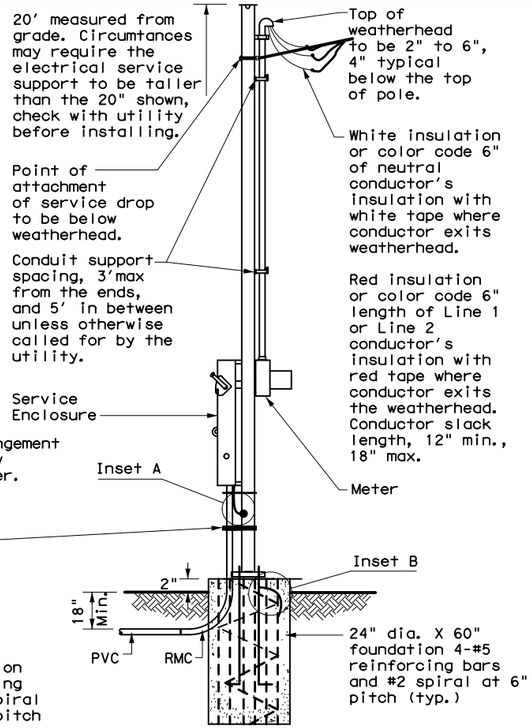
9. Provide ¼" - 20 machine screws for bonding. Do not use sheet metal screws. Remove all non-conductive material at contact points. Terminate bonding jumpers with listed devices. Install minimum size 6 AWG stranded copper bonding jumpers. Make up all threaded bonding connections wrench tight.

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.

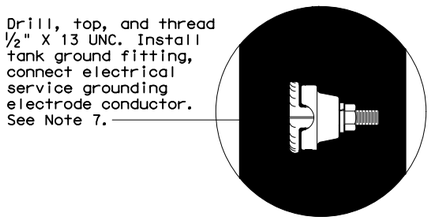


WITH SAFETY SWITCH



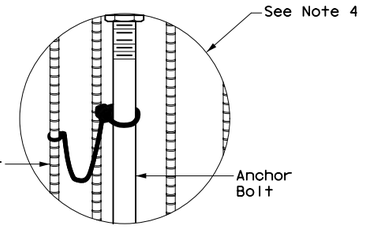
WITHOUT SAFETY SWITCH

SERVICE SUPPORT TYPE SP (O) - OVERHEAD SERVICE

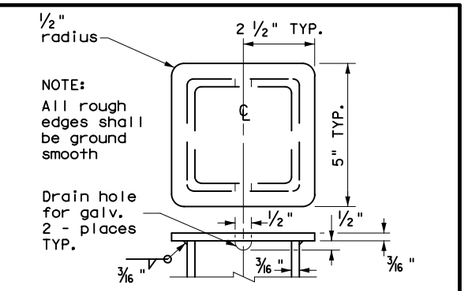


FRONT VIEW

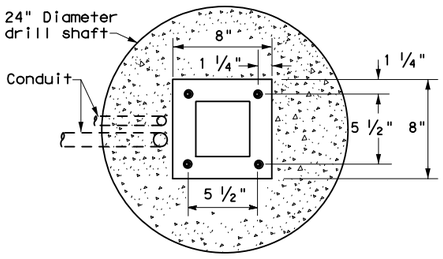
INSET A



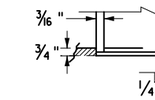
INSET B



POLE TOP PLATE

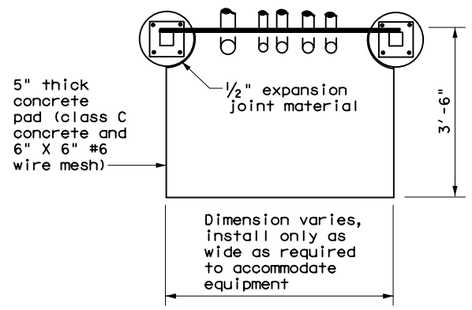


BASE PLATE DETAIL



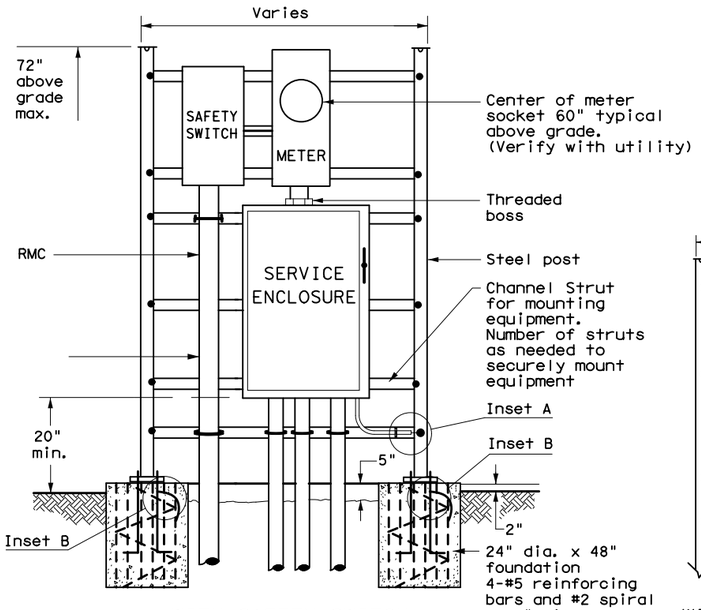
BOTTOM OF POLE

SERVICE SUPPORT TYPE SF & SP



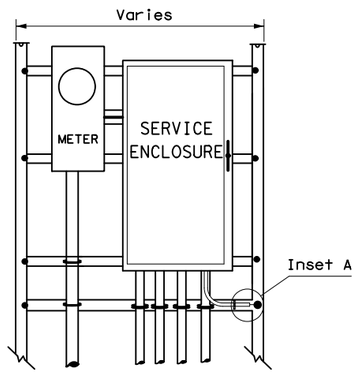
TOP VIEW

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



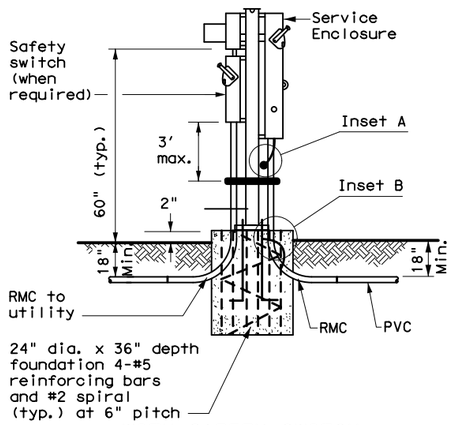
WITH SAFETY SWITCH

FRONT VIEW

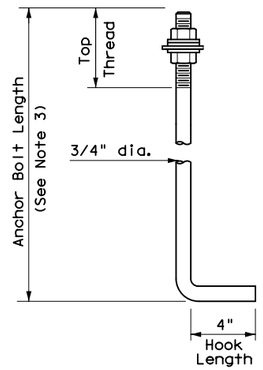


WITHOUT SAFETY SWITCH

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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	HOU	MONTGOMERY, ETC		126

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PEDESTAL SERVICE NOTES

1. Manufacture pedestal electrical services in accordance with Departmental Material Specifications (DMS)11080 "Electrical Services", 11085 "Electrical Services-Pedestal (PS)" and Item 628 "Electrical Services. "Provide pedestal electrical services as listed on the Material Producers list (MPL) on the Department's web site under "Roadway Illumination and Electrical Supplies," Item 628. Ensure all mounting hardware and installation details of services meet utility company specifications. Contact the local utility company for approval of pedestal details prior to installing the electrical pedestal service. Submit any changes required by the utility company prior to manufacturing the pedestal enclosure.

2. When a meter socket is required, provide a socket with a minimum 100 amp rating that complies with local utility requirements.

3. Provide Class A or C concrete for pedestal service foundations in accordance with Item 420, "Concrete Substructures," except that concrete will not be paid for directly but is considered subsidiary to Item 628.

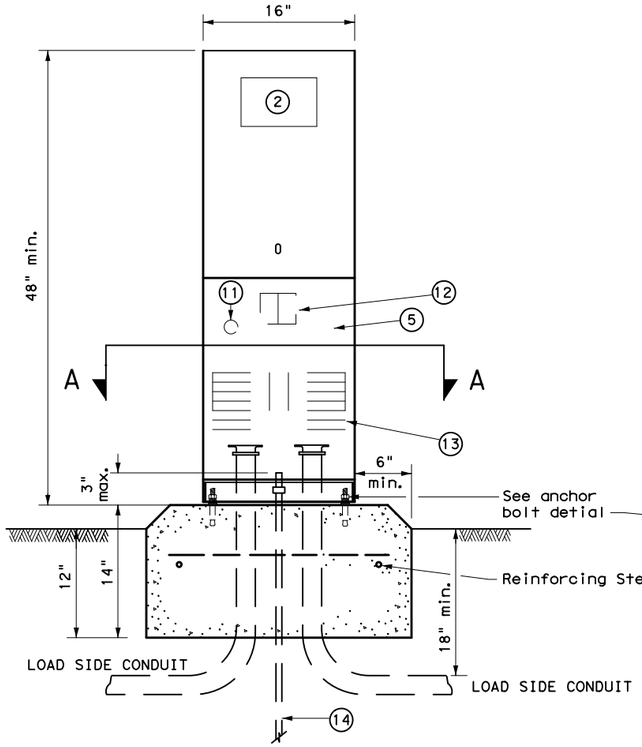
4. Provide #4 reinforcing steel for foundations in accordance with Item 440, "Reinforcement for Concrete."

5. Install ½ in. X 2 ⅛ in. minimum length concrete single expansion type anchors for mounting pedestal enclosure to foundation. Anchor location to match mounting holes in each corner of enclosure. Secure each of the four corners of the pedestal enclosure to the anchors in the foundation with a ½ in. galvanized or stainless steel machine thread bolt, a properly sized locknut and a flat washer.

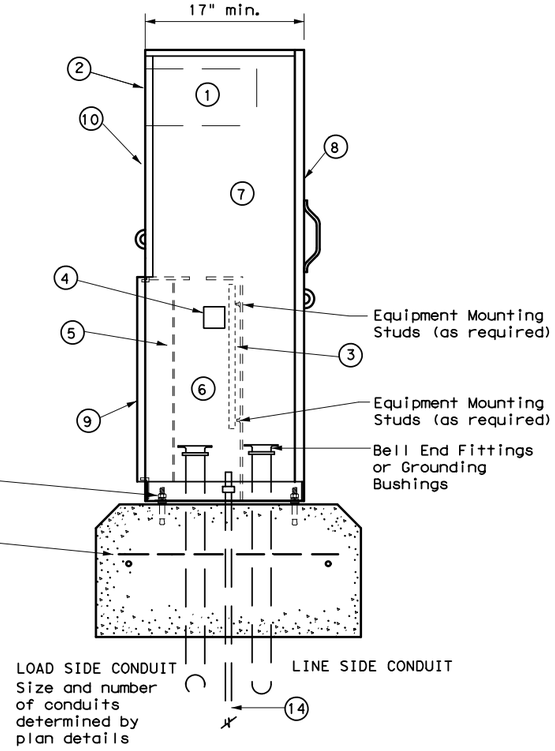
6. Finish top of concrete foundation in a neat and workmanlike manner. If leveling washers are used, ensure no more than ⅛ in. gap at any corner. Do not exceed a maximum dip or rise in the foundation of ⅛ in. per foot. When properly installed, ensure the top of the service enclosure is level front to back and side to side within ¼ in. Repair rocking or movement of the service enclosure at no additional cost to the department.

7. Do not use liquidtight flexible metal conduit (LFMC) on pedestal type services.

8. Ensure all elbows in the foundation are sized as per utility provider's conduit requirements for underground conduit and feeders. PVC extensions may be installed provided the ends of the rigid metal conduits are more than 2 in. below the top of the concrete foundation. Where extension conduits are metal, grounding bushings must be installed with a bonding jumper properly terminated.

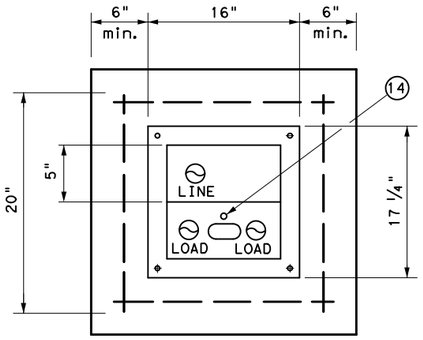


FRONT VIEW

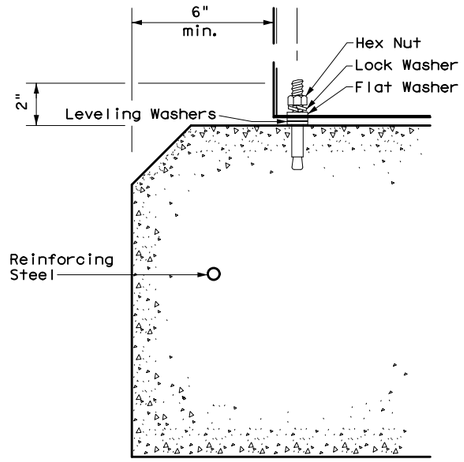


SIDE VIEW

TYPE C shown, TYPE A similar except that TYPE A shall have individual circuit breakers (CB) mounted on an equipment mounting panel. CB Handles shall protrude through hinged deadfront trim.



SECTION A-A



ANCHOR BOLT DETAIL

LEGEND	
1	Meter Socket, (when required)
2	Meter Socket Window, (when required)
3	Equipment Mounting Panel
4	Photo Electric Control Window, (When required)
5	Hinged Deadfront Trim
6	Load Side Conduit Trim
7	Line Side Conduit Area
8	Utility Access Door, with handle
9	Pedestal Door
10	Hinged Meter Access
11	Control Station (H-O-A Switch)
12	Main Disconnect
13	Branch Circuit Breakers
14	Copper Clad Ground Rod - 5/8" X 10'

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS
ELECTRICAL SERVICE SUPPORT
PEDESTAL SERVICE TYPE PS
ED(9)-14

FILE: ed9-14.dgn		DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT		
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TIMBER POLE (TP) SERVICE SUPPORT NOTES

1. Ensure electrical service support is a class 5 treated timber pole as per Item 627 "Treated Timber Poles." Embed timber pole to depth required in Item 627.
2. Conduit and electrical conductors attached to the electrical service pole and underground within 12 in. of service pole are not paid for directly but are subsidiary to the electrial service.
3. Install pole-top mounted photocell (T) on north side of pole, or in service enclosure (E) as required. See Electrical Service Data chart in plan set.
4. Gain pole as required to provide flat surface for each channel. Gain timber pole to 5/8 in. max. depth and 1 7/8 in. max. height. Gain pole in a neat and workmanlike manner.
5. Mount meter and service equipment on stainless steel or galvanized channel (Unistrut, Kindorf, or equal). Provide channel sized 1 in. to 3 3/4 in. maximum depth, and 1 1/2 in. to 1 5/8 in. maximum width. File smooth the cut ends of galvanized channel and paint with zinc rich paint before installing on pole. Secure each channel section to timber pole with two galvanized or SS lag bolts, 1/4 in. minimum diameter by 1 1/2 in. minimum length. Use a galvanized or SS flat washer on each lag bolt. Do not stack channel.
6. When excess length must be trimmed from poles, trim from the top end only.

(1) Class 5 pole, height as required

(2) Service drop from utility company (attached below weatherhead)

(3) Service conduit (RMC) and service entrance conductors - One Red, One Black, One White (See Electrical Service Data)

(4) Safety switch (when required)

(5) Meter (when required)

(6) Service enclosure

(7) 6 AWG bare grounding electrode conductor in 1/2 in. PVC to ground rod - extend 1/2 in. PVC 6 in. underground.

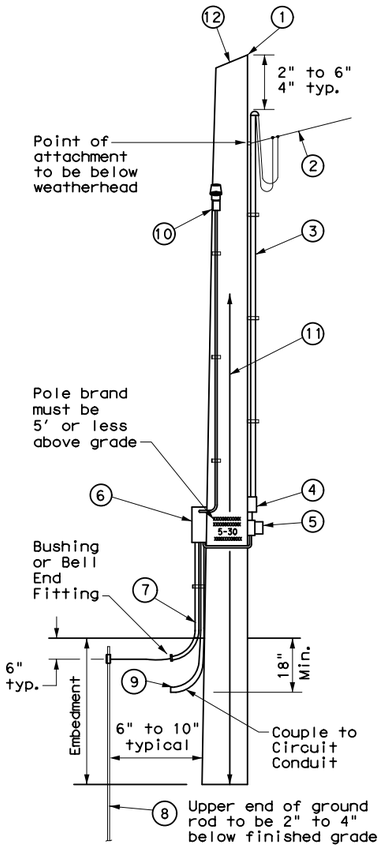
(8) 5/8 in. x 8 ft. Copper clad ground rod - drive ground rod to a depth of 2 in. to 4 in. below grade.

(9) RMC same size as branch circuit conduit.

(10) See pole-top mounted photocell detail on ED(5).

(11) When required by the serving utility provide bare 6 AWG copper conductor. Run wire from pole top to butt wrap or copper butt plate. Protect conductor with non-conductive material to a height of 8 ft. above finished grade.

(12) When required by utility, cut top of pole at an angle to enhance rain run off.

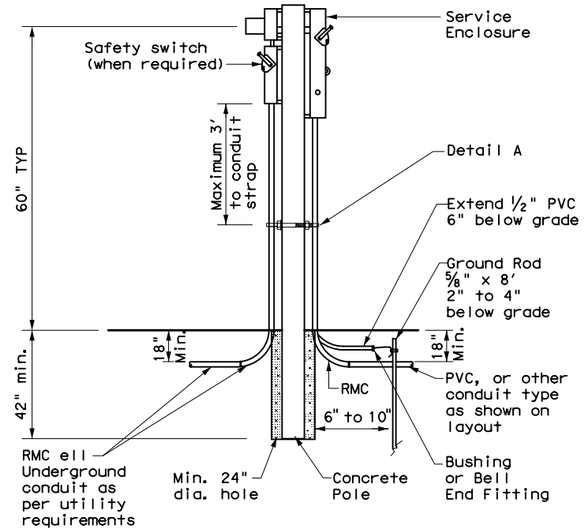


SERVICE SUPPORT TYPE TP (O)

GRANITE CONCRETE (GC) & OTHER CONCRETE (OC) NOTES

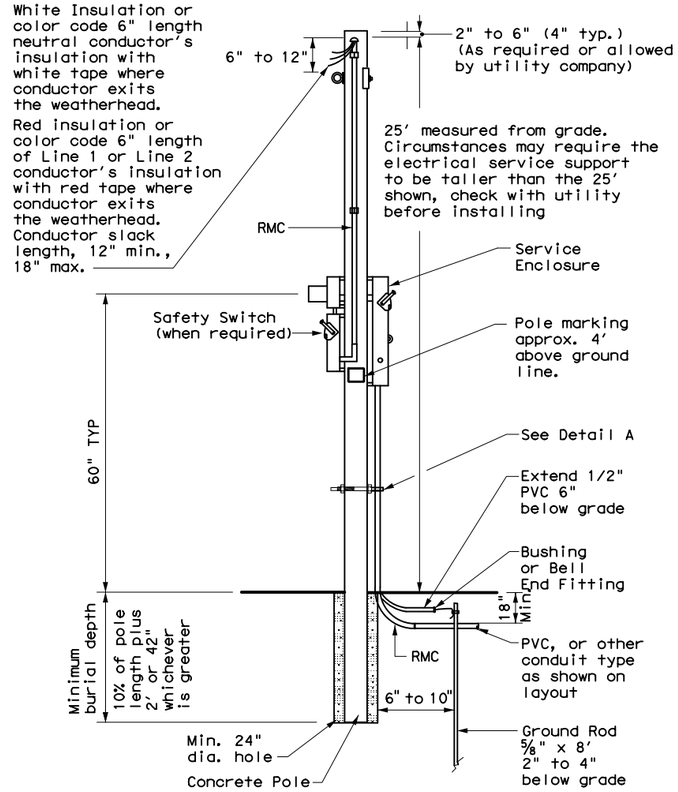
Ensure electrical service support structures bid as type Granite Concrete (GC) or Other Concrete (OC) meet the following requirements.

1. Provide GC and OC poles that meet the requirements of DMS 11080 "Electrical Services."
2. Provide prestressed concrete poles suitable for direct embedment into the ground without special foundations.
3. Verify poles are marked as required on DMS 11080. Location of marking should be approximately 4' above final grade. Use the two-point pickup locations when handling pole in horizontal position, and one-point pickup location for use in raising the pole to a vertical position. These marks are small but conspicuous.
4. Embed poles 42 in. or 10% of the length plus 2 ft., whichever is greater.
5. Ensure all installation details of services are in accordance with utility company specifications.
6. Install a one point rack or eye bolt bracket 6 inches to 12 inches below the weatherhead as an overhead service drop anchoring point for the electric utility.
7. Furnish and install galvanized or stainless steel channel strut 1 1/2 in. or 1 5/8 in. wide by 1 in. up to 3 3/4 in. deep (Unistrut, Kindorf, B-line or equal). Attach channel strut with stainless steel concrete anchors (max. 1" depth), square U-bolts or back to back channel strut with long bolts, or other secure mounting as approved by the Engineer. Ensure bolts are galvanized in accordance with ASTM A153. Do not stack channel struts.
8. Backfill the holes thoroughly by tamping in 6 in. lifts. After tamping to grade, place additional backfill material in a 6 inch high cone around the pole to allow for settling. Use material equal in composition and density to the surrounding area. Backfilling will not be paid for directly but is subsidiary to various bid items.



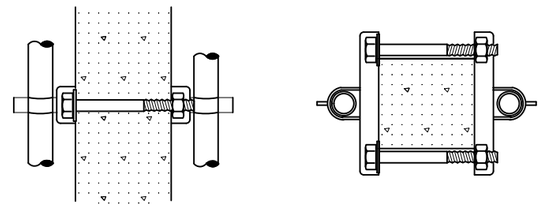
CONCRETE SERVICE SUPPORT

Underground (U)



CONCRETE SERVICE SUPPORT

Overhead (O)



DETAIL A

See Note 7. Before installing channel that has been cut, file sharp edges and paint with zinc-rich paint. Ensure there is no paint splatter on the pole.

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS SERVICE SUPPORT TYPES GC, OC, & TP

ED(10)-14

FILE: ed10-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
©TxDOT October 2014	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	04	208, ETC	IH 45
	DIST	COUNTY		SHEET NO.
	HOU	MONTGOMERY, ETC		128

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DUCT CABLE & HDPE CONDUIT NOTES

1. Provide duct cable in accordance with Departmental Material Specification (DMS) 11060 "Duct Cable" and Item 622 "Duct Cable." Provide duct cable as listed on the Material Producer List (MPL) on the Department web site under "Roadway Illumination and Electrical Supplies" Item 622.

2. Provide High-Density Polyethylene (HDPE) conduit in accordance with DMS 11060 and Item 618, "Conduit." Provide HDPE as listed on the MPL on the Department web site under "Roadway Illumination and Electrical Supplies," Item 618.

3. Supply duct cable with a minimum 2 in. diameter, unless otherwise shown in the plans. Provide duct cable and HDPE conduit as shown by descriptive code or on the plans. Bend duct cable and HDPE conduit as recommended by the manufacturer, with a minimum bending radius of 26 in. for 2 in. duct. Follow manufacturers' recommendations when handling duct cable and HDPE conduit reels and during installation of duct cable and HDPE conduit.

4. Do not splice conductors within duct cable or HDPE conduit. Couple duct cable and HDPE entering a ground box or foundation to a PVC elbow. When galvanized steel RMC elbows are called for in the plans and any portion of the RMC elbow is buried less than 18" from possible contact, ground the RMC elbow.

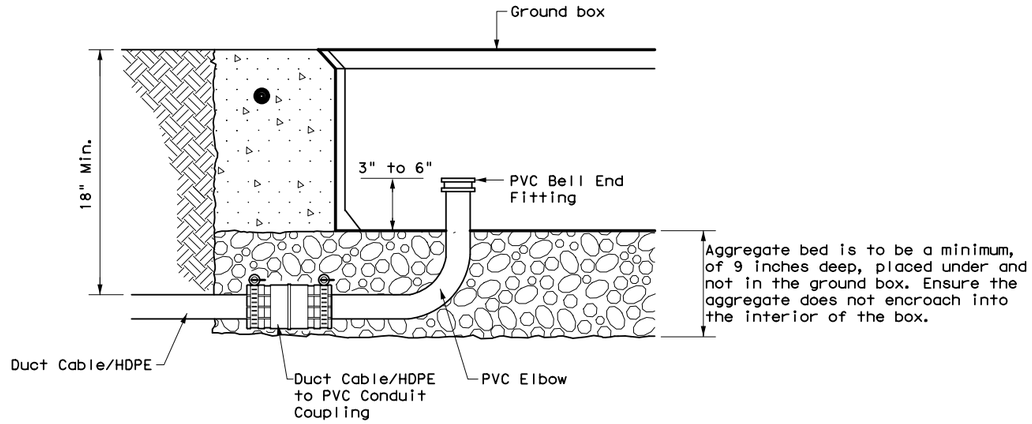
5. Furnish and install duct cable with factory installed conductors, sized as shown in the plans and as required by the National Electrical Code (NEC). The NEC contains specific requirements for duct cable in Article, "Nonmetallic Underground Conduit with Conductors: Type NUCC."

6. When conduit casing is called for in the plans, extend duct cable or HDPE conduit through the conduit casing in one continuous length without connection to the casing.

7. Seal the ends of duct cable or HDPE conduit with duct seal, expandable foam, or other approved method after completing the pull tests required by Item 622.

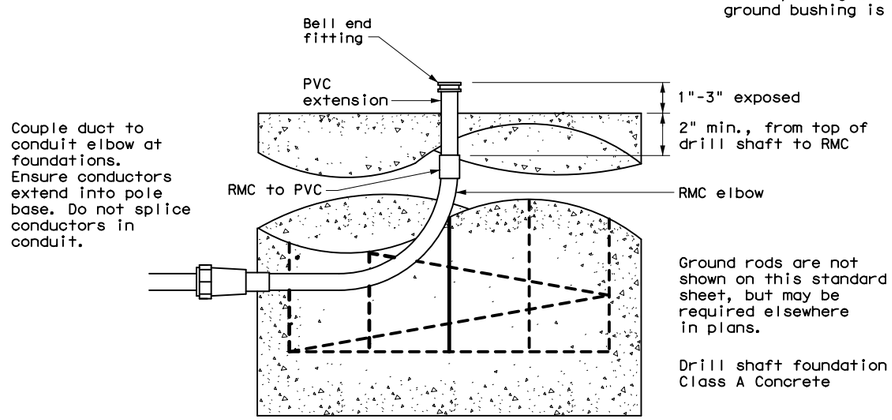
8. Provide minimum cover of 24 in. under roadways, 18 in. in other locations, or as shown on the plans.

9. Furnish and install listed fittings to couple duct cable or HDPE conduit to other types of conduit. Duct cable and HDPE conduit may be field-threaded and spliced with PVC or RMC threaded couplings; connected with listed tie-wrap fittings; connected using listed coupling made of HDPE with stainless steel external banding clamps and locking rings; connected with approved electrofusion conduit couplings; or connected using an approved chemical fusion method using an epoxy or adhesive specifically designed for HDPE couplings and connectors all installed in accordance with their manufacturer's instructions. Do not use PVC glue on HDPE. Do not use water pipe fittings, or connect conduit with heat shrink tubing.

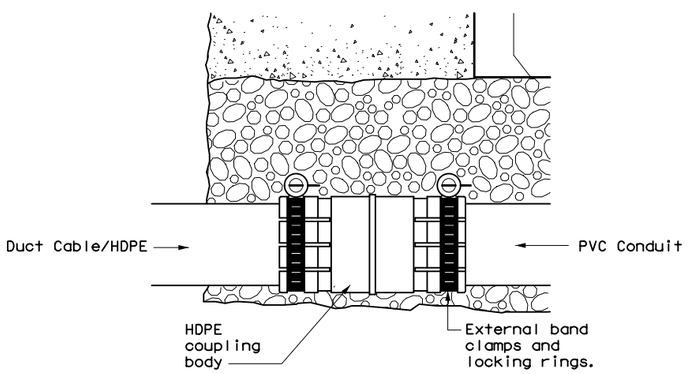


DUCT CABLE/HDPE AT GROUND BOX

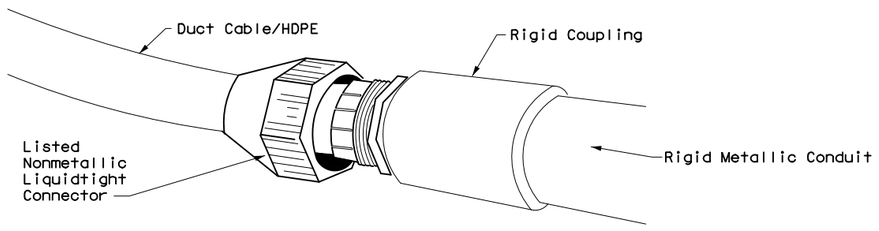
When the upper end of an RMC Ell does not enter the ground box, it may be extended with a SCH-40 PVC conduit nipple and bell end, provided there is a minimum of 18" of cover over all parts of the elbow. If not, a rigid extension and ground bushing is required.



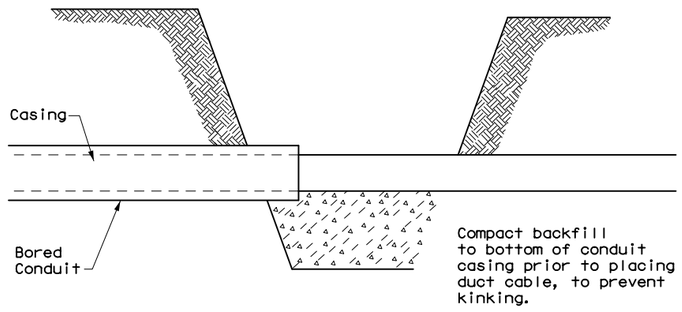
DUCT CABLE / HDPE AT FOUNDATION



DUCT CABLE/HDPE TO PVC



DUCT CABLE/HDPE TO RMC



BORE PIT DETAIL

Texas Department of Transportation

Traffic Operations Division Standard

ELECTRICAL DETAILS
DUCT CABLE/ HDPE CONDUIT

ED(11)-14

FILE: ed11-14.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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	DIST	COUNTY		SHEET NO.
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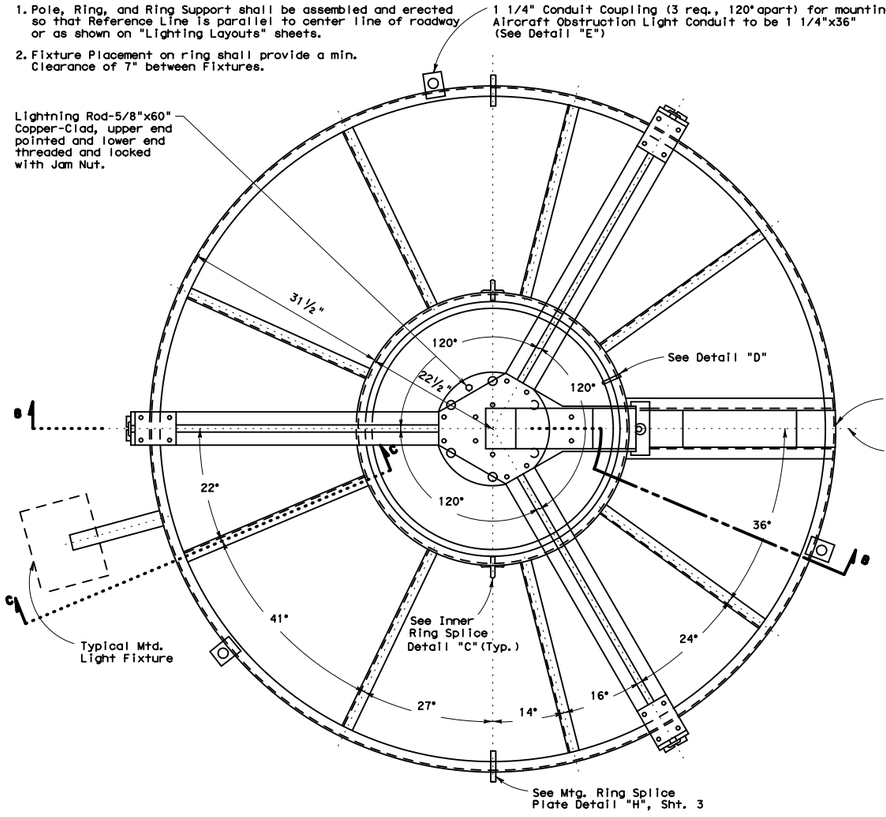
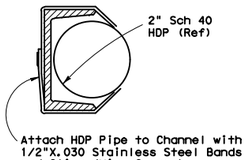
NOTES:

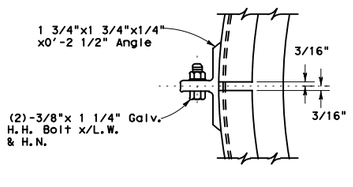
1. Pole, Ring, and Ring Support shall be assembled and erected so that Reference Line is parallel to center line of roadway or as shown on "Lighting Layouts" sheets.
2. Fixture Placement on ring shall provide a min. Clearance of 7" between Fixtures.



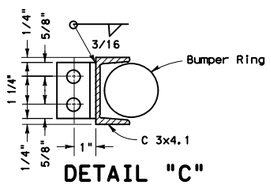
LIGHT MOUNTING RING & SUPPORT ASSEMBLY



DETAIL "D"
BUMPER RING ATTACHMENT

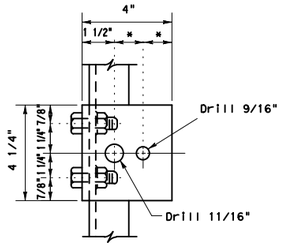


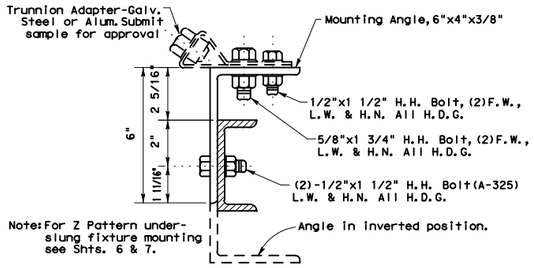
PLAN



DETAIL "C"
INNER RING SPLICE

* As required by Trunnion Adapter supplied.



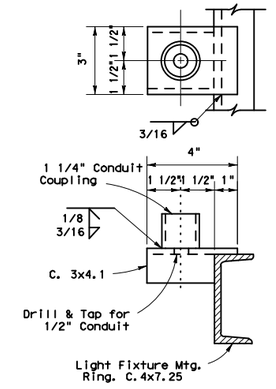


Note: For Z Pattern under-slung fixture mounting see Shts. 6 & 7.

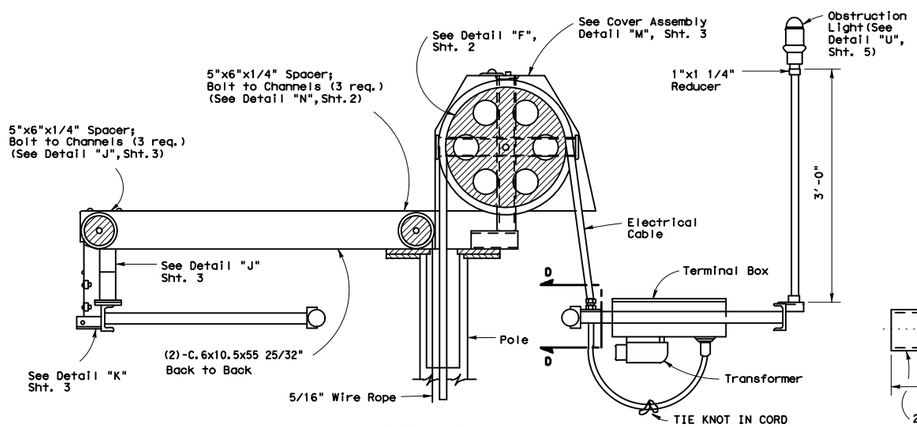
Note: Aiming capabilities may be by method shown or by Steel Mounting-Aiming Device as approved by the Engineer. Mark position of fixture with center punch or drill after fixture has been aligned to the right position on the roadway, as directed by the Engineer.

SECTION C-C
(FOR TRUNNION MOUNT)

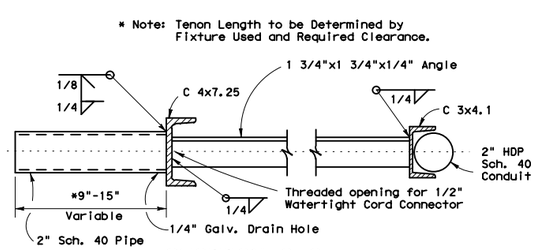
NOTE: Provide S.S. or galv. cable safety lanyard for Light Fixture when Trunnion Mount is used.



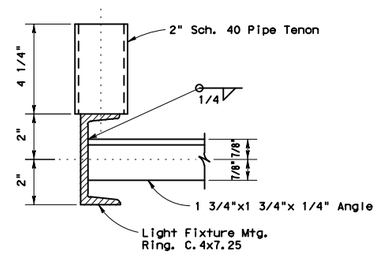
DETAIL "E"
(CONDUIT ATTACHMENT FOR OBSTRUCTION LIGHTS. TYPICAL (3) PLACES)



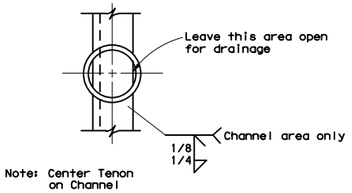
SECTION B-B



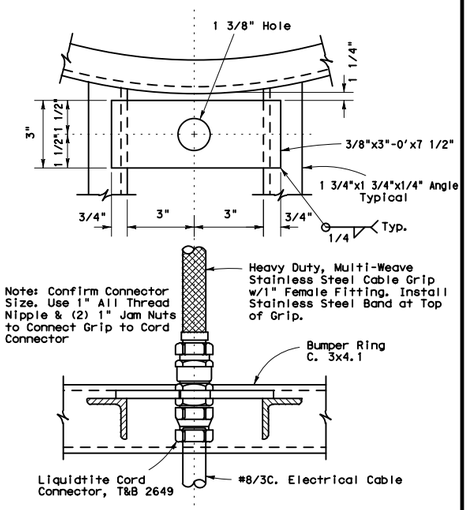
SECTION C-C
(FOR AREALIGHTS)



SECTION C-C
(FOR FLOODLIGHTS)



Note: Center Tenon on Channel



SECTION D-D

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

Texas Department of Transportation
Traffic Operations Division

HIGH MAST ILLUMINATION DETAILS

HMID(1)-03

REVISIONS		DN: TXDOT	CK: TXDOT	DW: TXDOT	CK: TXDOT
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4-87	4-96	0110	04	208, ETC	IH 45
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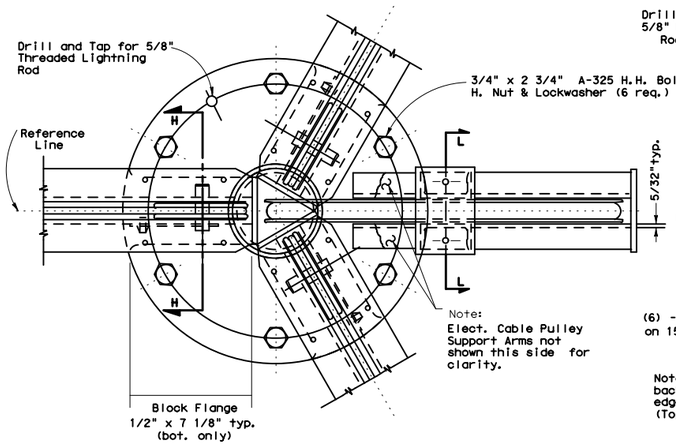
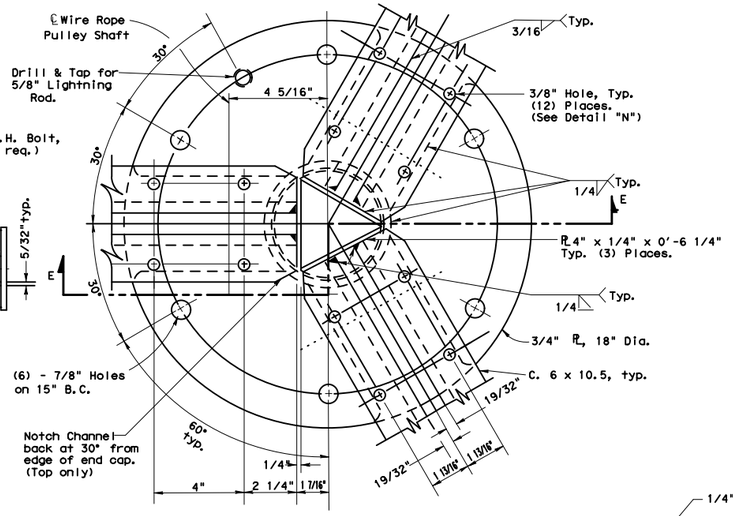
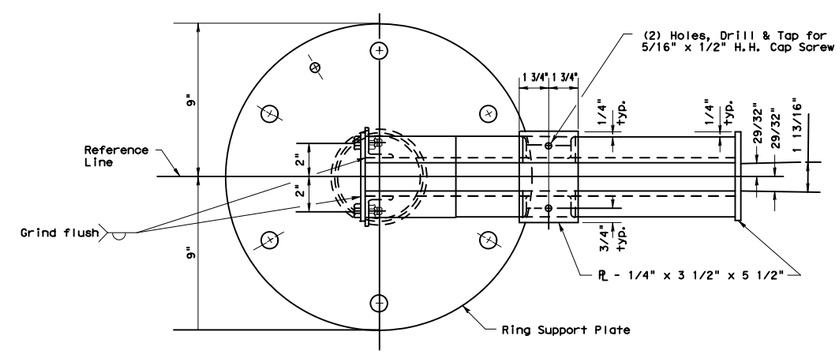


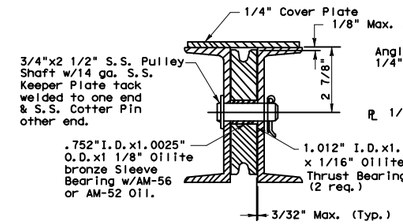
PLAN VIEW



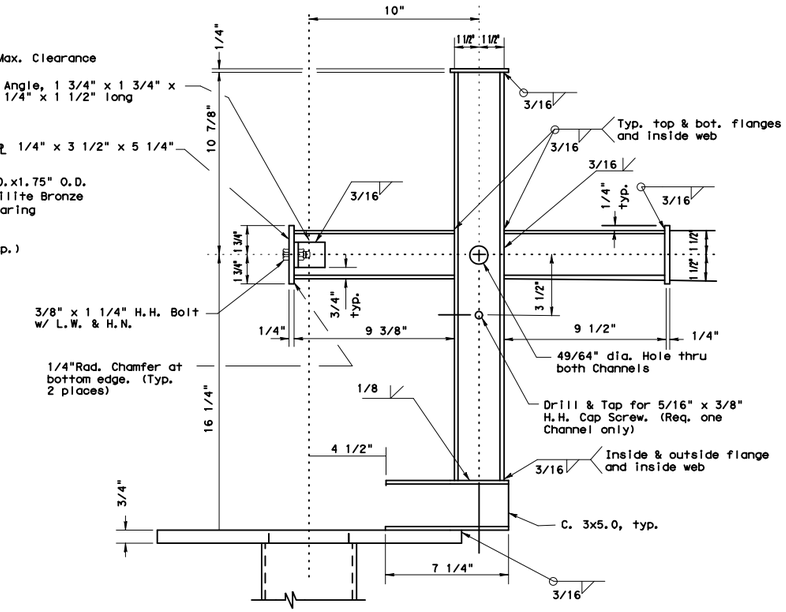
DETAIL "G"
TOP PLATE CONNECTION
(LESS ELECT. CABLE PULLEY SUPPORT)
(SEE DETAIL "L")



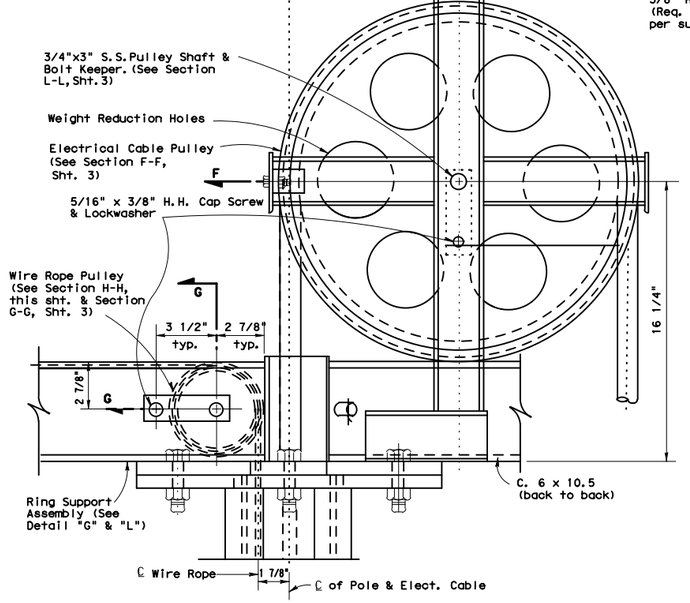
PLAN VIEW



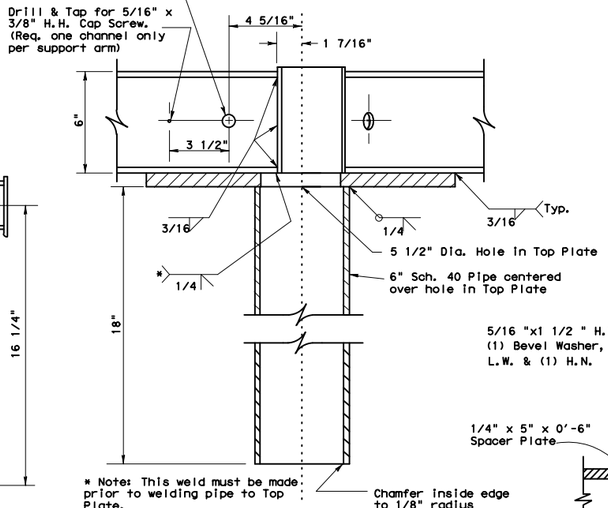
SECTION "H-H"
PULLEY MOUNTING FOR RING SUPPORT ARMS



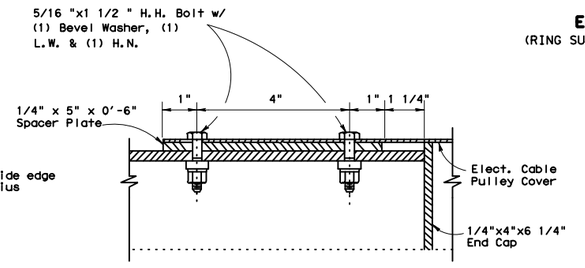
DETAIL "L"
ELECT. CABLE PULLEY SUPPORT
(RING SUPPORT ARMS NOT SHOWN FOR CLARITY)



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



SECTION "E - E"



DETAIL "N"

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HIGH MAST ILLUMINATION DETAILS

HMID(2)-03

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	HOU	MONTGOMERY, ETC		131

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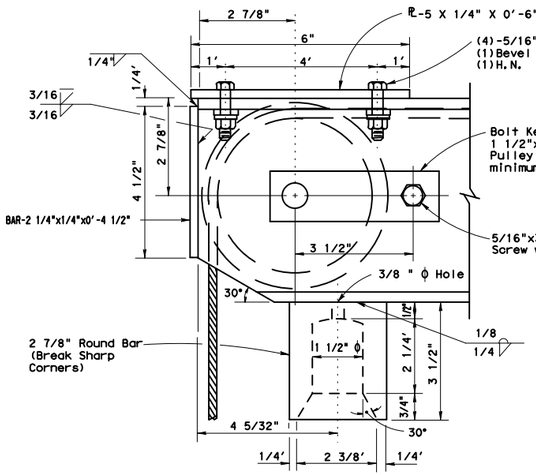
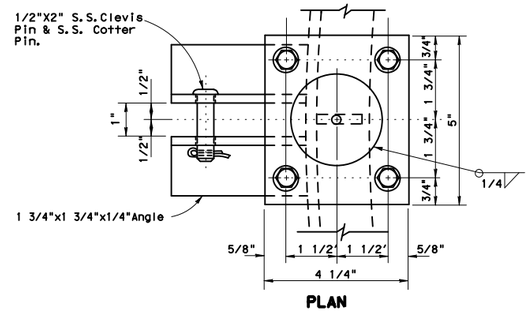


DETAIL "J"



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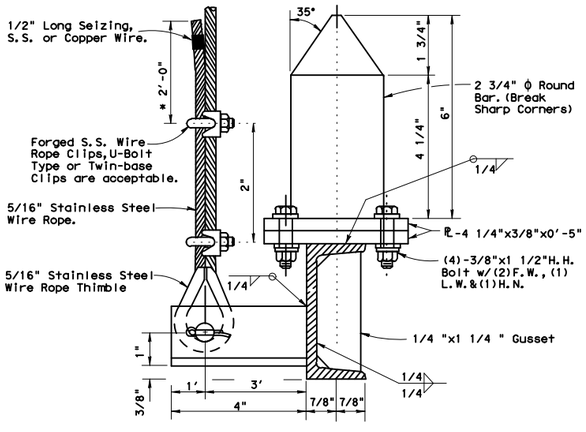
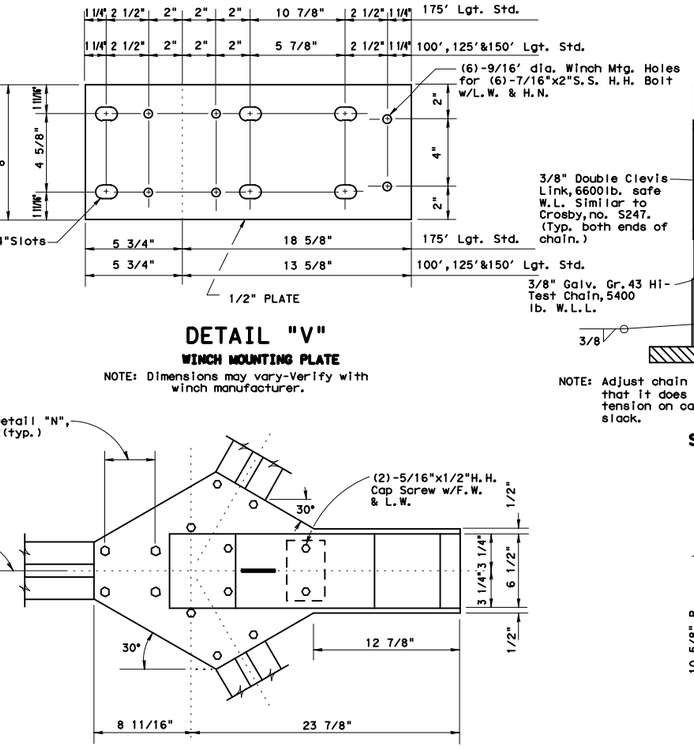


DETAIL "K'

MOUNTING RING CONNECTION & STABILIZER

* EXTRA 2'-0" of wire cable to be attached to ring with SS Bands as directed by Engineer.



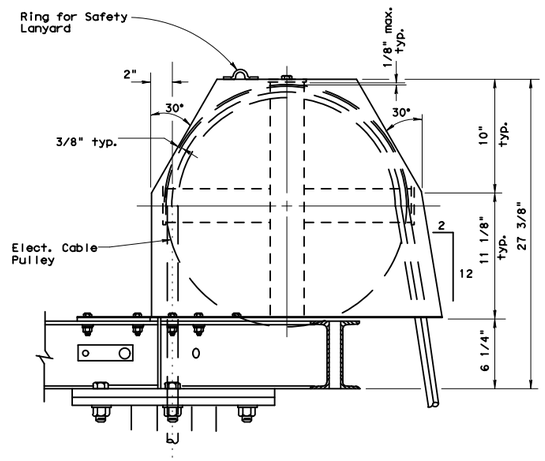
DETAIL "V"

WINCH MOUNTING PLATE

NOTE: Dimensions may vary-Verify with winch manufacturer.

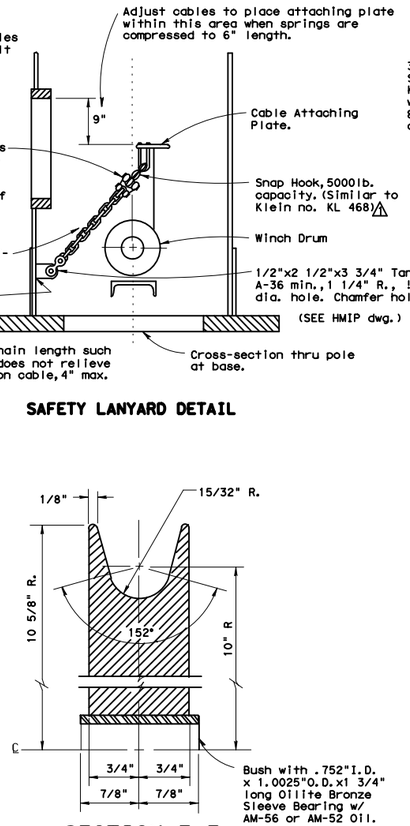
PLAN

NOTE: Cover to be 14 ga. galv. sht. metal or 0.10" anodized aluminum sheet.



DETAIL "M"

COVER CAP ASSEMBLY

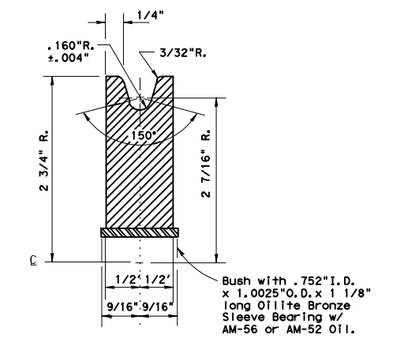


SAFETY LANYARD DETAIL

SECTION F-F

ELECTRICAL CABLE PULLEY

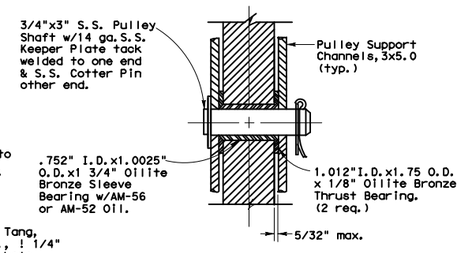
(Pulley material to be aluminum alloy, Type 356-T6 or equal)



SECTION G-G

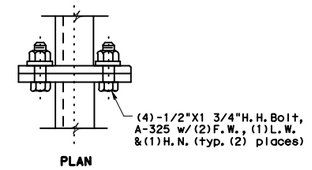
WIRE ROPE PULLEY

(Pulley material to be plated steel or Stainless Steel)

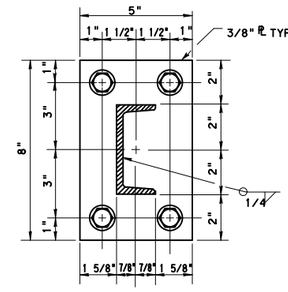


SECTION L-L

ELECTRICAL CABLE PULLEY MOUNTING



PLAN



DETAIL "H"

MOUNTING RING SPLICE PLATE

Texas Department of Transportation
Traffic Operations Division

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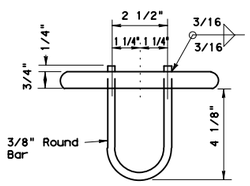
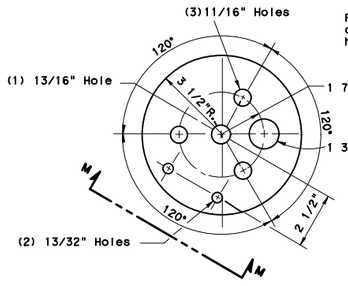
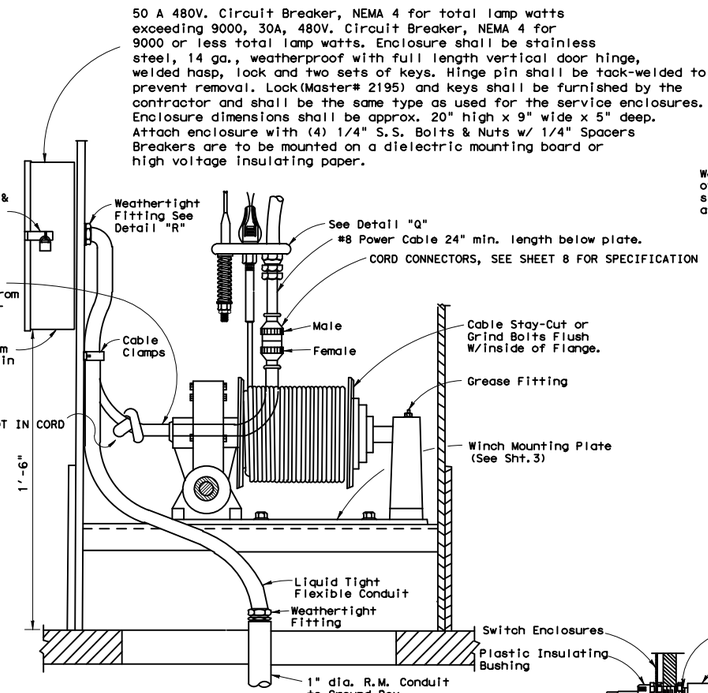


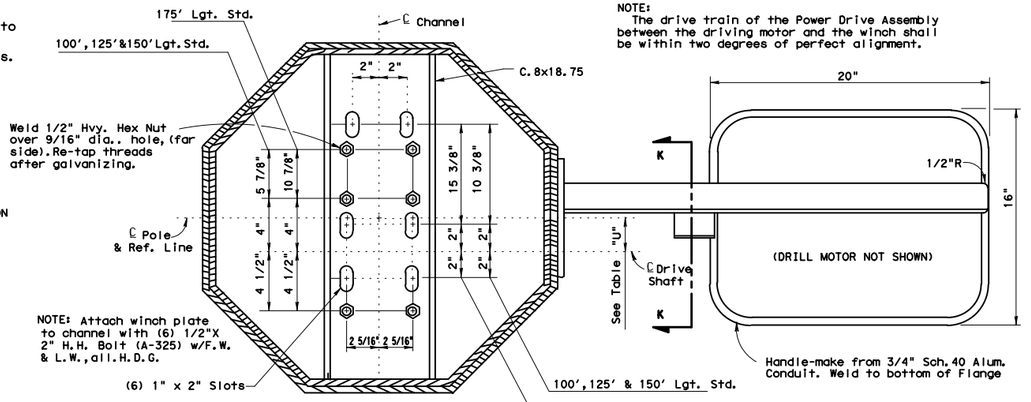
VIEW "M-M"



PLAN VIEW



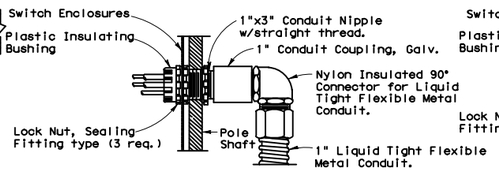
SECTION J-J
(WINCH ASSEMBLY)



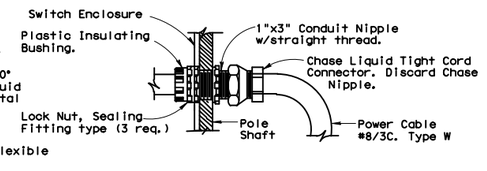
DETAIL "P"
(WINCH MOUNTING CHANNEL)
Dimensions may vary-Verify with winch manufacturer.

TABLE OF "U" DIMENSIONS

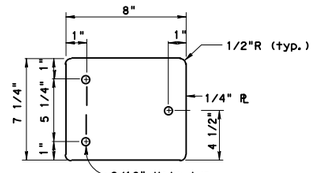
Pole Ht. Ft.	8 Sided 80 MPH	8 Sided 100 MPH	12 Sided 80 MPH	12 Sided 100 MPH
100	3 1/2"	3 1/2"	2 1/2"	2 1/2"
125	3 1/2"	3 1/2"	2 1/2"	2 1/2"
150	3 1/2"	3 1/2"	2 1/2"	2 1/2"
175	4 1/2"	4 1/2"	3 1/2"	3 1/2"



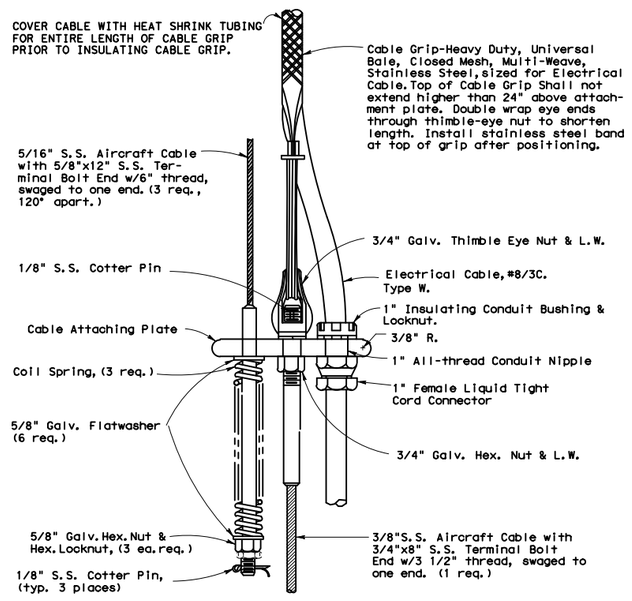
(POWER FEED FROM GROUND BOX)



(POWER OUT TO LIGHT RING)

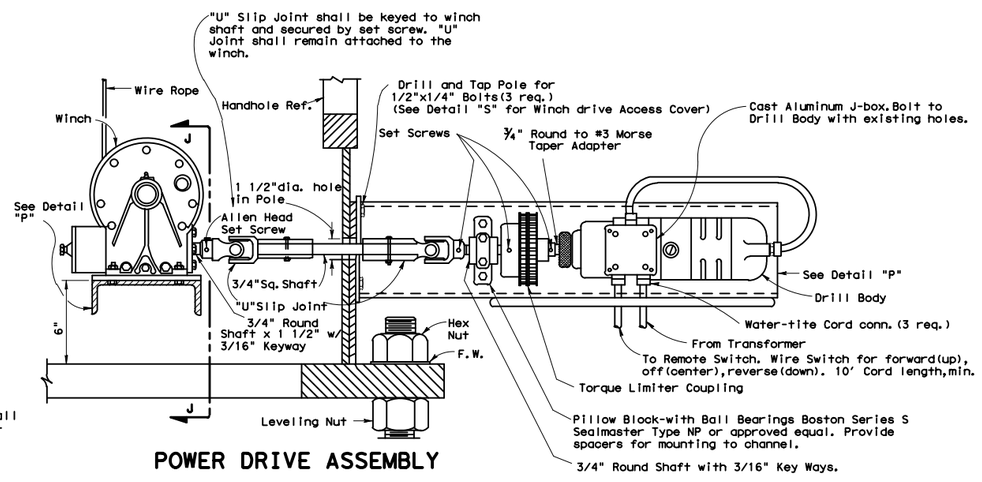


DETAIL "S"
(WINCH DRIVE ACCESS COVER)

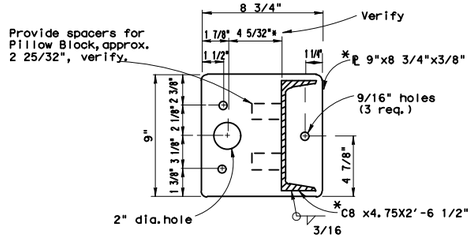


DETAIL "Q"
(CABLE ATTACHING PLATE)

NOTE: 3/8"Cable for this Project shall be 19x7 Rotation Resistant per Sheet 9.



POWER DRIVE ASSEMBLY



SECTION K-K
(DRILL MOTOR MOUNTING PLATE)
* Make from 6061-T6 Aluminum

Texas Department of Transportation
Traffic Operations Division

HIGH MAST ILLUMINATION DETAILS

HMID(4)-03

REVISIONS
4-86, 5-86, 12-87, 4-96, 12-3-86, 4-89, 12-8-86, 10-93

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

CONT	SECT	JOB	HIGHWAY
0110	04	208, ETC	IH 45

DIST	COUNTY	SHEET NO.
HOU	MONTGOMERY, ETC	133

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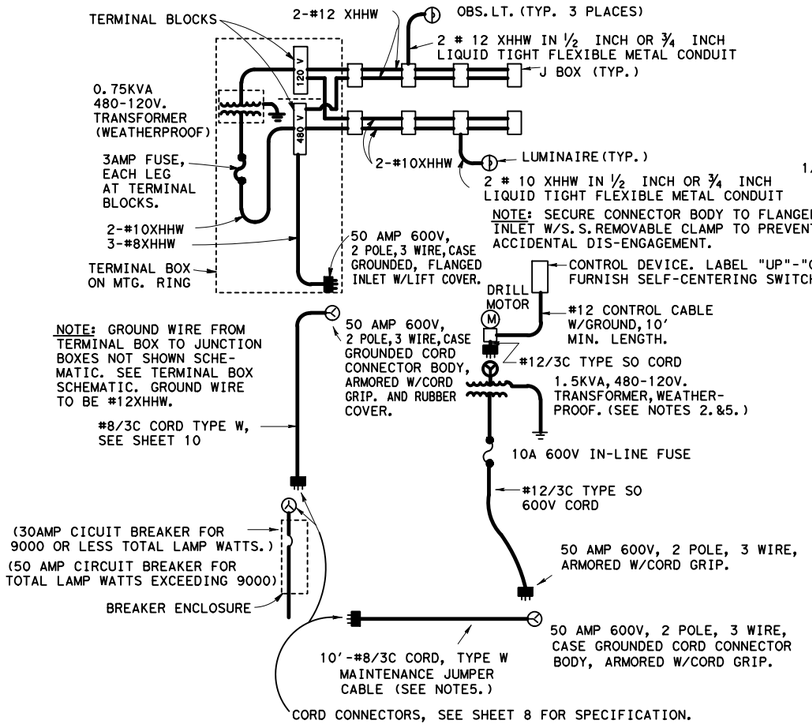
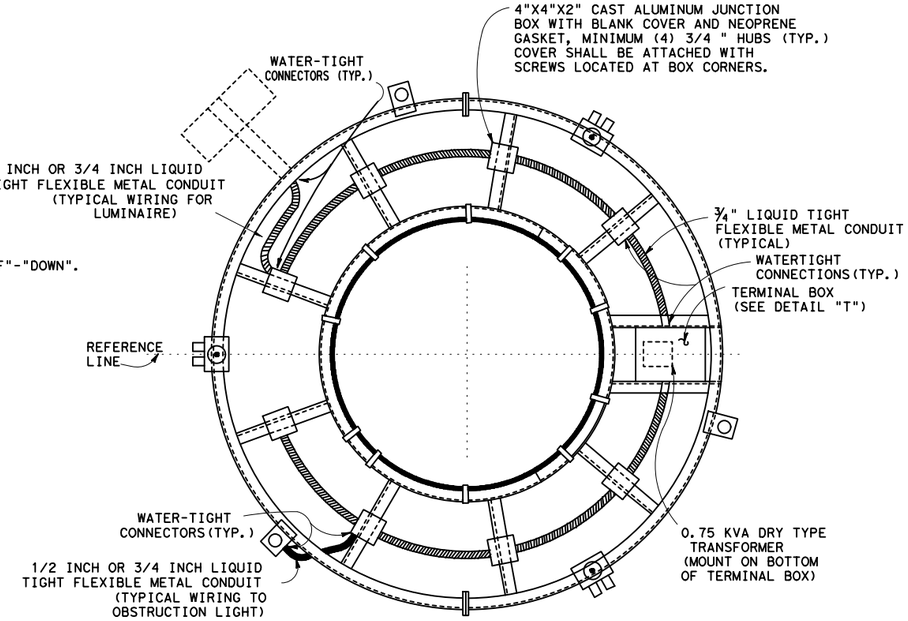
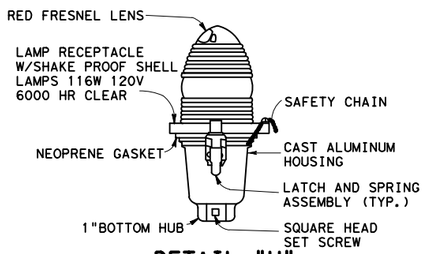


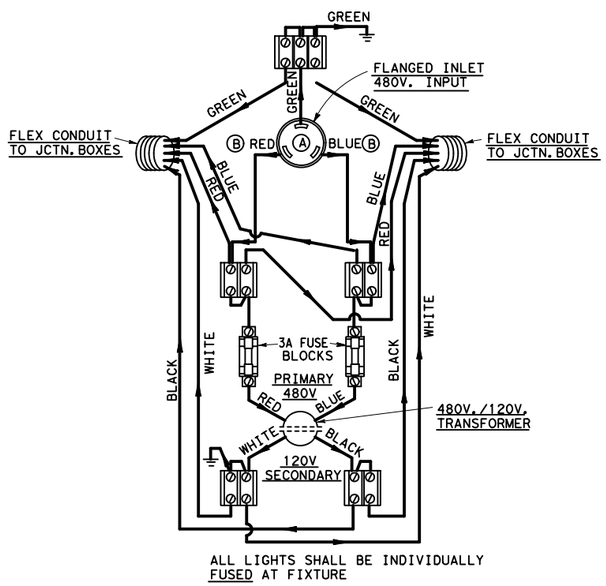
ONE-LINE SCHEMATIC



LIGHT MOUNTING RING

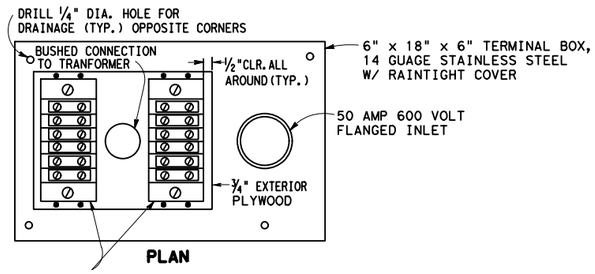


DETAIL "U"
(OBSTRUCTION LIGHT)



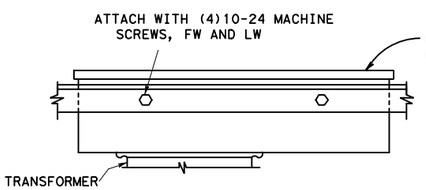
TERMINAL BOX SCHEMATIC

NOTES:
1. OBSTRUCTION LIGHTS COLOR CODE: FROM SECONDARY SIDE OF TRANSFORMER THROUGH-OUT-CIRCUIT TO SOCKET, WHITE-NEUTRAL, BLACK-LOAD.
2. POWER SUPPLY CORD TO FLANGED INLET: GREEN-GROUND, WHITE LINE, BLACK LINE. FROM FLANGED INLET Ⓐ TO TERMINAL BLOCKS: GREEN-GROUND, RED LINE, BLUE-LINE. FROM THERE ON ALL 480V. CIRCUIT WIRES TO BE RED AND BLUE TO JUNCTION BOXES.
3. WIRE SIZE FROM POWER SUPPLY TO TERMINAL BLOCKS SHALL BE #8 AWG-SEE Ⓑ.
4. WIRE SIZE FROM TERMINAL BLOCKS TO JUNCTION BOXES SHALL BE #12 AWG.
5. MOUNT TERMINAL BLOCKS ON ¾" EXTERIOR GRADE PLYWOOD.
6. FOR 2-WIRE, 480V. SERVICE, OMIT FUSE IN GROUNDED CONDUCTOR IN LEADS TO TRANSFORMER.



PLAN

600 VOLT TERMINAL BLOCKS



DETAIL "T"
(TERMINAL BOX)

NOTES:

1. PLUGS, CONNECTOR BODIES AND FLANGED INLETS AT CORD TO RING CONNECTION SHALL BE "TWIST LOCK" TYPE, 3-PRONG, RATED 50 AMPS AT 600V, AND 20 AMPS FOR 120 V. 50 AMP CONNECTORS SHALL BE 3 WIRE CASE GROUNDED, ARMORED, WITH CORD GRIP, 20 AMP CONNECTOR SHALL BE 3 WIRE GROUNDING WITH CORD GRIP, NEMA TYPE L5-20.
2. PROVIDE HANDLE ON 1.5KVA TRANSFORMER FOR PORTABILITY. (SEE ONE-LINE SCHEMATIC)
3. CIRCUIT BREAKERS SHALL BE ITE #E43B030 OR #E43B050, SQUARE "D" #FAL24030 S/N OR #FAL24050 S/N, OR EQUAL.
4. CONDUIT ENTRIES INTO TERMINAL BOX SHALL BE INTO THE SIDE OF THE BOX.
5. A MINIMUM OF ONE (1) MAINTENANCE JUMPER CABLE SHALL BE SUPPLIED FOR EACH PROJECT. SUPPLY ONE (1) PORTABLE TRANS-FORMER FOR EACH POWER DRIVE UNIT REQUIRED FOR PROJECT.

Texas Department of Transportation
Traffic Operations Division

HIGH MAST ILLUMINATION DETAILS

HMID(5)-03

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

REVISIONS
6-87
11-87
10-88
10-93
4-96

CONT	SECT	JOB	HIGHWAY
0110	04	208, ETC	IH 45
DIST	COUNTY		SHEET NO.
HOU	MONTGOMERY, ETC		134

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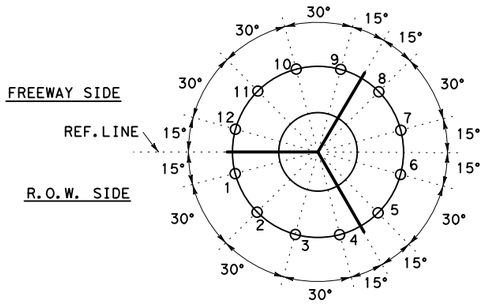
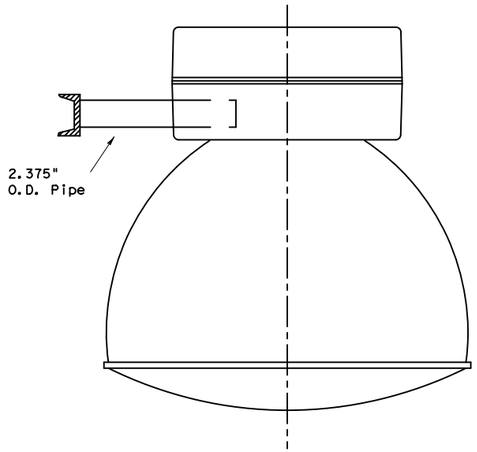


12-LIGHT SETTING

LUMINAIRE LOCATIONS

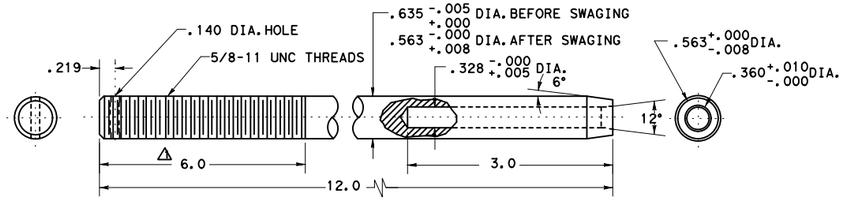
NOTE: AIRCRAFT OBSTRUCTION LIGHT LOCATIONS NOT SHOWN. THREE ARE REQUIRED LOCATED APPROX. 120° APART. LOCATIONS WILL VARY DEPENDENT ON THE LIGHT SETTING USED.



AREALIGHT MOUNTING ASSEMBLY
(SYMMETRIC AND ASYMMETRIC)

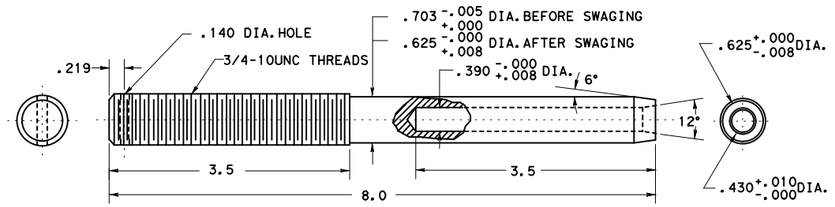
NOTES: IF ASYMMETRIC FIXTURES ARE USED, THE REFRACTORS SHALL BE ORIENTED TO PROPERLY ILLUMINATE THE ADJACENT ROADWAYS. ORIENTION SHALL BE AS SHOWN IN PLANS.

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



TERMINAL FOR 5/16 "WIRE ROPE
MATERIAL: STAINLESS STEEL, TYPE 303SE OR 304
WITH 115,000 P.S.I. MAX. ULTIMATE TENSILE STRENGH.

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



TERMINAL FOR 3/8 "WIRE ROPE
MATERIAL: STAINLESS STEEL, TYPE 303SE OR 304
WITH 115,000 P.S.I. MAX. ULTIMATE TENSILE STRENGH.

GENERAL NOTES:

1. AFTER FINAL AIMING HAS BEEN COMPLETED AND APPROVED BY THE ENGINEER, FIXTURES MUST BE LOCKED IN POSITION. CONTRACTOR MUST SUBMIT PROPOSED LOCKING SCHEME WITH THE FIXTURE SUBMITTAL. (FLOODLIGHTS ONLY).

3/03 Revision

⚠1 Removed obsolete diagrams and updated drawings.

Texas Department of Transportation
Traffic Operations Division

HIGH MAST ILLUMINATION DETAILS

HMID(6)-03

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

REVISIONS: 10-93, 10-95, 4-96, 3-03

CONT	SECT	JOB	HIGHWAY
0110	04	208, ETC	IH 45

DIST	COUNTY	SHEET NO.
HOU	MONTGOMERY, ETC	135

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1. AREA LIGHTING (Bid under Item 614, "High Mast Illumination Assemblies")

A. Area lighting shall be symmetric or asymmetric, as shown on the descriptive code. The number and wattage of the fixtures on each pole shall be as shown on the lighting layouts. The lighting pattern for symmetric fixtures shall be IES Type V; for asymmetric fixtures, it shall be IES Type II, III, or IV.

B. All luminaires shall be pre-qualified before installation. A sample of each type of luminaire to be considered for pre-qualification shall be submitted to TXDOT's Traffic Operations Division - Traffic Engineering Section (TRF-TE).

Traffic Operations Division - TE
Texas Department of Transportation
125 East 11th Street
Austin, TX 78701-2483

Sample luminaires are non-returnable. A list of pre-qualified luminaires may be obtained by contacting TRF-TE. In addition, luminaires will be sampled and tested in accordance with Item 614. Luminaires that inconsistently pass testing or that are inconsistent with published photometric information will be removed from the pre-qualified list at the discretion of the Engineer. Once a fixture has been approved, no changes shall be made in any material or manufacturing methods without prior approval of the Department. Unapproved changes will result in rejection of all fixtures.

C. Symmetric and Asymmetric fixtures shall meet the following requirements unless otherwise approved by the Engineer:

1. Luminaire Construction

a) The luminaire housing shall be formed, cast or drawn from low copper aluminum and shall be free of cracks and excessive porosity. Formed aluminum shall have a minimum thickness of 0.090, and shall have all seams welded. The minimum thickness of cast parts shall be as approved by the Engineer. Nuts, screws, and washers shall be made of Type 316 stainless steel. The housing shall be marked with minimum 2" letters to indicate the photometric type as being either A, B, C, or S as specified. Marking shall be permanent and shall be by stencil or stick on labels similar to "wattage" label on cobra heads. Wattage label will not be required on high mast fixtures. The fixture housing shall be constructed separate from the fixture reflector.

b) Fixtures shall be natural aluminum in color or shall be painted gray.

c) The slipfitter shall securely attach the luminaire to the tenon on the ring assembly with a minimum of 2 bolts and clamp. A positive means of vertical adjustment shall be provided.

d) For optical assemblies with lenses, reflectors shall be polished aluminum with Alzak or equal coating and shall not be painted. The optic assembly shall be sealed. The lens shall be tempered glass or prismatic glass, either flat or sag. The optic assembly shall be provided with a resilient seamless or sonically welded silicone rubber gasket, and constructed so that a positive seal against weather and other contaminants will be maintained. The latches shall be stainless steel, spring loaded, and hand operated (2 latches minimum, 3 attachment points),and shall provide a positive means of maintaining closure of the luminaire.

e) For optical assemblies without lenses, optical assembly shall consist of an open ventilated borosilicate glass reflector. The reflecting prisms shall be protected from dirt depreciation by a spun on hermetically sealed aluminum cover. There shall be no glass lens/refractor on this optical assembly.

f) Asymmetric fixtures shall have field rotatable optics with accurate degree of rotation markings. Reflector shall have "house side" and "street side" markings.

g) The socket shell shall be nickel plated and shall be rigidly attached to a high grade porcelain mogul base, which shall extend and enclose the metal shell. A locking means shall be incorporated in the shell of the socket to positively resist the removal of the lamp. This locking means shall be a spring loaded center tip. Lamp socket shall be non-adjustable and shall be riveted, welded, or otherwise permanently installed. Lamps shall be held securely in the proper position with a lamp support.

h) The terminal block shall use nickel plated brass connectors.

i) Fixture weight including ballast shall not exceed 80 pounds, and effective projected area (EPA) shall not exceed 2.62 square feet.

j) The Contractor may be responsible for fixture testing costs. See TXDOT's "Manual of Testing Procedures," Chapter 11 - "Traffic Systems and Illumination," TEX-1110-T - "Sampling Lighting Assemblies," at http://manuals.dot.state.tx.us/dynaweb/.

2. Photometrics

a) The Contractor shall submit a computer generated light level array of the area to be lighted by high mast poles. All computer generated arrays shall have 400 watt fixtures derated to 40,000 lumens per lamp.

b) The Type "A" 400 watt asymmetric fixture shall be IES cutoff. The Department will use the measured photometric data of sampled fixtures to run the following tests on a computer simulation:

(1) When mounted in the level position, 50 ft. above the midpoint and 20 ft outside of either long side of a rectangular area measuring 340 ft. by 50 ft., the fixture shall pass the following tests:

(a) The fixture shall provide a measured minimum intensity of 0.15 horizontal foot-candles at any point on the surface of this area.

(b) The fixture shall provide a measured maximum to minimum light ratio, based on horizontal foot-candles, of less than 25.

(c) The fixture shall provide an average measured intensity of 0.6 horizontal foot-candles on the surface area.

(2) When mounted in the level position, 50 ft. above the midpoint and 20 ft outside of either long side of a rectangular area measuring 260 ft. by 30 ft., the fixture shall provide a measured minimum intensity of 0.30 horizontal foot-candles at any point on the surface of this area.

c) The Type "B" 400 watt asymmetric fixture shall be IES cutoff. The Department will use the measured photometric data of sampled fixtures to run the following tests on a computer simulation:

(1) When mounted in the level position, 50 ft. above the midpoint and 20 ft outside of either long side of a rectangular area measuring 260 ft. by 65 ft., the fixture shall pass the following tests:

(a) The fixture shall provide a measured minimum intensity of 0.15 horizontal foot-candles at any point on the surface of this area.

(b) The fixture shall provide a measured maximum to minimum light ratio, based on horizontal foot-candles, of less than 25.

(c) The fixture shall provide an average measured intensity of 0.6 horizontal foot-candles on the surface area.

(2) When mounted in the level position, 50 ft. above the midpoint and 20 ft outside of either long side of a rectangular area measuring 200 ft. by 40 ft., the fixture shall provide a measured minimum intensity of 0.30 horizontal foot-candles at any point on the surface of this area.

d) The Type "C" 400 watt asymmetric fixture shall be IES cutoff. The Department will use the measured photometric data of sampled fixtures to run the following tests on a computer simulation:

(1) When mounted in the level position, 50 ft. above the midpoint and 20 ft. outside of either long side of a rectangular area measuring 220 ft. by 80 ft., the fixture shall pass the following tests:

(a) The fixture shall provide a measured minimum intensity of 0.15 horizontal foot-candles at any point on the surface of this area.

(b) The fixture shall provide a measured maximum to minimum light ratio, based on horizontal foot-candles, of less than 25.

(c) The fixture shall provide an average measured intensity of 0.6 horizontal foot-candles on the surface area.

(2) When mounted in the level position, 50 ft. above the midpoint and 20 ft. outside of either long side of a rectangular area measuring 160 ft. by 50 ft., the fixture shall provide a measured minimum intensity of 0.30 horizontal foot-candles at any point on the surface of this area.

e) The Type "S" 400 watt Symmetric fixture shall be IES cutoff. The Department will use the measured photometric data of sampled fixtures to run the following tests on a computer simulation:

(1) When mounted in the level position at 50 foot mounting height, the fixture shall provide the minimum light levels as shown below:

(a) 0.15 horizontal foot-candles within a 130 foot radius.

(b) 0.30 horizontal foot-candles within a 100 foot radius.

(c) 0.50 horizontal foot-candles within a 60 foot radius.

3. Ballasts

a) All ballasts shall be isolated-winding lag-type magnetic regulators designed to operate 400 watt high pressure sodium lamps rated 480 volts. Ballasts shall be capable of starting lamps at an ambient temperature of -20 degrees F. Ballast wiring shall include a grounding terminal bonded to metal housing. Ballasts shall be fused with a 5 amp time-delay fuse in an insulated fuse holder. Fuse holders shall be internal to the housing. Ballast wiring to the terminal board shall be through a quick-disconnect plug. Windings shall be made from copper wire.

b) When the circuit voltage indicated on the plans is applied, the ballast input wattage during fluctuations of the test voltage of +10% and -10% shall not exceed 552 watts for a 400 watt HPS lamp.

3/03 Revision

⚠1 Revised Area Lighting Requirements

Texas Department of Transportation
Traffic Operations Division

HIGH MAST ILLUMINATION DETAILS

HMID(7)-03

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

REVISIONS
9-91
10-93
4-96
3-03

CONT	SECT	JOB	HIGHWAY
0110	04	208, ETC	IH 45

DIST	COUNTY	SHEET NO.
HOU	MONTGOMERY, ETC	136

76G

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c) During fluctuation of the line voltage of +10% or -10%, the lamp wattage fluctuation shall not exceed a total of 20%. Ballast shall maintain lamp wattage between 280 and 475 watts for a 400 watt HPS lamp.

d) The power factor of any ballast when tested at the circuit voltage indicated in the plans shall not be less than 90% at any point in life. Ballast factor shall be between .95 and 1.0.

e) The electronic starting aid shall provide a starting pulse with an amplitude of 2500 volts minimum, 4000 volts maximum. The pulse width shall be a minimum of 0.8 microseconds at 2250 volts. The pulse shall occur when the open-circuit voltage is equal to or greater than 90 percent of peak open-circuit voltage. Pulse repetition rate shall be a minimum of one per cycle and pulse current shall be a minimum of 0.18 amperes. Electronic starting aids shall be replaceable without the use of tools. The starting aid shall discontinue to pulse when the lamp starts. Starter shall sense an inoperative or missing HPS lamp and automatically shut down luminaire to protect ballast after 10 minutes.

f) Ballasts shall permanently and clearly indicate the following: lamp type, catalog number, voltage rating, connection diagram, and manufacturer. Capacitors in all luminaires shall be non-PCB type.

4. Lamps

a) All lamps shall be new and of recent manufacture.

b) Lamps shall be high pressure sodium and shall meet ANSI C78 requirements. Lamps shall be the type that extinguish at the end of usable lamp life and remain extinguished without cycling. 400 watt lamps shall contain less than 4.0 mg of mercury. Lamps shall be lead free and shall pass the Federal Toxic Characteristic Leachate Procedure (TCLP). Lamp shall be Osram-Sylvania LU400/Eco Plus. No alternatives will be approved.

c) 400 watt high pressure sodium lamps shall have average initial lumens of 50000 and average rated life of 24000 hours.

⚠1 2. 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.

B. Where stainless steel bands are called for on the HMID 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, the entire high mast assembly shall be controlled by an FAA approved photocell mounted inside the service enclosure. Ring mounted luminaires shall be controlled by up to 4 additional ring mounted photocells, with each photocell controlling up to 3 fixtures. 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 follow-through. Relay or switch shall be time delay type with normally closed contacts. Photocell shall be rated a minimum of 1800 VA.

b) Service enclosure mounted 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 240 volts. A permanent placard shall be installed on the inside of the service enclosure door to indicate that an FAA approved photocell is required.

c) High mast assembly ring mounted photocells (one foot-candle photocells) shall turn on at light levels below 1.0 (plus or minus 0.5) foot-candle, and shall turn off at 2 foot-candles higher than this level. These photocells shall be rated for operation at 480 volts. Photocells shall be mounted upright on the terminal box or on various junction boxes around the ring as approved by the Engineer. Conduit entries shall not be made into the top of the terminal box or junction boxes. The Contractor shall submit mounting details to the Engineer for approval.

2. When obstruction lights are not required, eliminate the 3 obstruction light fixtures, 3 mounting posts, 480/120 volt transformer, 120 volt wiring, and 3 mounting post support connections shown on detail "E", sheet 1.

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 and the male connector on the maintenance jumper 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 HBL 330P7W.

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 50 amp twist lock receptacle to the opposite end of the maintenance jumper to match the flange mounted plug on the ring and the portable transformer.

5. The Contractor shall make a brochure submittal on the cord connectors.

E. When shown on the plans, spill light shall be restricted to less than 0.15 horizontal footcandles.

F. The Contractor shall provide shop drawings for high mast illumination assemblies in accordance with this Item and Item 441. An Engineer licensed in the State of Texas shall seal the shop drawings.

3. TESTING

A. Fixtures, lamps and ballasts will be sampled and tested in accordance with the Department "Manual of Testing Procedures" except as noted in these specifications.

B. Ballasts and fixtures will be tested using a reference lamp.

C. The Department will bear the cost of all testing of equipment that complies with the specification requirements. However, the source of supply of fixtures and ballasts must be approved as required in Article 6.1 of the Standard Specifications. Such approval will be contingent on the supplier agreeing to bear the cost of testing any equipment that fails to comply with the specification requirements listed in this specification.

D. All other equipment will be tested in accordance with Item 614 of the Standard Specifications and Materials and Test Division Test Standards.

E. After High Mast Assembly 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 or fixture inspection. If any malfunction occurs, the problem shall be corrected at the Contractor's expense and the lowering test will be repeated.

4. 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.

5. 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 replace by the contractor at the contractor's expense.

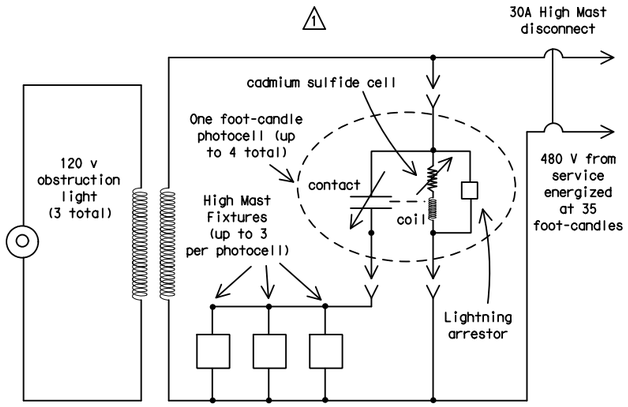
⚠2 6. WIRE ROPE AND TERMINALS

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-410D, 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 7. 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.

⚠1



One foot-candle photocell keeps High Mast fixtures
off when FAA photocell energizes
circuit at 35 foot-candles. Fixtures
come on when sun goes down at 1 foot-candle.

One Foot-candle Photocell Schematic

Use on ring when obstruction lights are installed
and FAA photocell is installed in electrical service.

3/03 Revision

⚠1 Revised General requirements; add diagram

⚠2 Revised Wire Rope and Terminals

Texas Department of Transportation
Traffic Operations Division

HIGH MAST ILLUMINATION DETAILS

HMID(8)-03

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REVISIONS	CONT	SECT	JOB	HIGHWAY
4-89	0110	04	208, ETC	IH 45
10-93	DIST	COUNTY		SHEET NO.
4-96	HOU	MONTGOMERY, ETC		137
3-03				

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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.

7. 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 1/4" diameter oil-tempered MB Steel treated for overstress. Springs shall not develop permanent set from 3-inch compression.

8. 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.

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

A. Drive Motor

1. Drive motor shall be 1-1/4" 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.

⚠1

10. 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 3. 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 Light Ring and Luminaires

1. Prior to mounting luminaires to the light ring, Contractor shall ensure the ring is level. Luminaires shall be mounted level on the light ring. Luminaires shall be oriented as shown on plans.

3/03 Revision

⚠1 Revised Construction Methods.

Texas Department of Transportation
Traffic Operations Division

HIGH MAST ILLUMINATION DETAILS

HMID(9)-03

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

REVISIONS: 10-93, 10-95, 4-96, 3-03

CONT	SECT	JOB	HIGHWAY
0110	04	208, ETC	IH 45

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HOU	MONTGOMERY, ETC	138

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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

7/8" Dia Holes equally spaced on 15" Dia Bolt Circle

85 Percent Minimum Penetration

3/4"

3/8

HM-6

7 1/4" Dia

Match Mark

Reference Line

VIEW C

8"

1/4" Plate

1"

5 1/4"

3 1/2"

7 1/4"

1"

1" 6" 1"

Provide 3~ 1/2" Dia x1 1/4" 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 3/8" Dia holes 24" above Base Plate

2 3/4" 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 1/2" 4" 5 7/8" 100′,125′ & 150′ Poles

10 7/8" 175′ Pole

6 ~ 1/2" Heavy Hex Nuts welded under 9/16" Dia holes. Tap nuts after galvanizing.

2 5/16"

2 5/16"

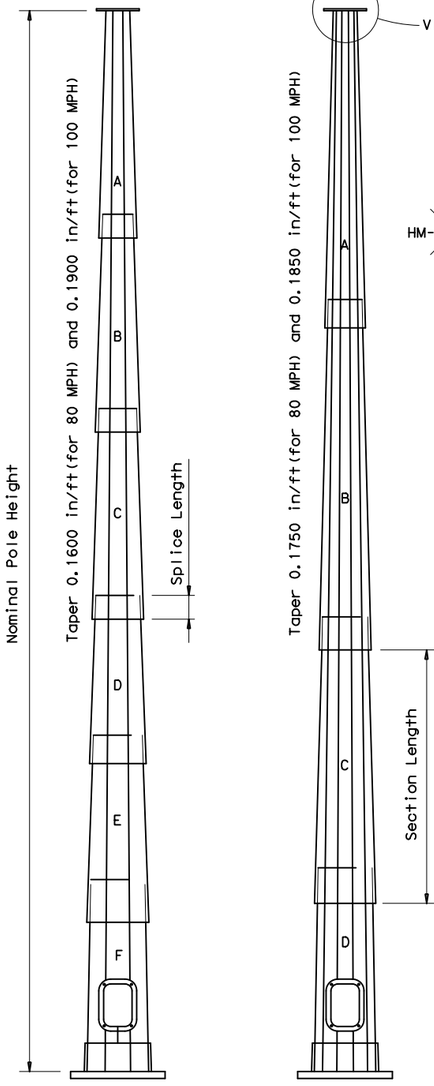
2"2"

℄ Channel

6 ~ 1"x2" Slots 2"2" 10 3/8" 100′,125′ & 150′ Poles

15 3/8" 175′ Pole

WINCH MOUNTING CHANNEL



8 SIDED

12 SIDED

POLE ELEVATIONS

(Showing 175 Ft Poles)

VIEW C

T

1/2"

Handhole Frame

HM-3

1/4

3/4x 3/8

1/4

HM-7

Winch Drive Access Cover

Tang

Channel

8"

6"

VIEW F

VIEW D

HM-8

3/8

1/2"x2 1/2"x3 3/4" Tang, A36 Min, 1 1/4" R, 1 1/4" Dia chamfered hole. Place Tang on flat adjacent to handhole.

SECTION B-B

1′-0"

Access Cover to be 1/4" Plate

B

Drill and tap for 1/2"x1" cap screw (4 req'd)

A

A

Ground Sleeve

1/4"

Typ

S

R=3 1/2"

1′-6"

Drill and Tap for 3 1/2" bolts.

1 1/2" Dia Hole

5 1/4"

5 5/16"

3"3"

8 7/8"

8 7/8"

1′-0"

1′-7"

See HMIF for Anchor Bolt Detail

3/8" U

6"

VIEW G

B

ELEV OF POLE BASE

U

Reference Line

6 ~ 5/8"x1 1/4" Slots 4 1/2" 4" 5 7/8" 100′,125′ & 150′ Poles

10 7/8" 175′ Pole

2 1/2"

1 1/4"

2"2"2"

2 1/2"

1 1/4"

1 11/16"

8"

4 5/8"

1 11/16"

2"

4"

2"

1/2" Plate

6 ~ 9/16" Dia holes 2"2" 10 3/8" 100′,125′ & 150′ Poles

15 3/8" 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

3/8"

1/4

HM-1

t

t x 3/8

t

STANDARD WELD

1/4

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.)

3/8"

1/4

HM-2

t

t x 3/8

t

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

7/8"

VIEW F

℄ Winch Drive

1 3/8" 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:
©TxDOT August 1995	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	04	208, ETC	IH 45
5-98	DIST	COUNTY		SHEET NO.
8-16	HOU	MONTGOMERY, ETC		139

77A

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TABLE OF VARIABLE POLE DIMENSIONS

	Ht (ft)	Section	8 SIDED POLE Diameter (Inches) Bottom	Top	Thickness (inches)	Length (feet)	Splice (inches)	12 SIDED POLE Diameter (Inches) Bottom	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

FILE: hmip-16.dgn	DN:	CK:	DW:	CK:	
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REVISIONS 5-98 8-16	0110	04	208, ETC	IH 45	
	DIST	COUNTY		SHEET NO.	
	HOU	MONTGOMERY, ETC		140	

77B

ROADWAY ILLUMINATION ASSEMBLY NOTES

1. Details apply to roadway lighting installations bid or referenced under Item 610, "Roadway Illumination Assemblies." Provide, furnish, and install all other materials not shown on the plans which may be necessary for complete and proper construction. Where manufacturers provide warranties or guarantees as a customary trade practice, furnish to the State such warranties or guarantees.

2. The locations of poles and fixtures may be shifted by the Engineer to accommodate local conditions. Install or remove poles and luminaires located near overhead electrical lines using established industry and utility safety practices and in accordance with laws governing such work. Consult with the appropriate utility company prior to beginning such work.

3. 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, Intertek Testing Services NA Inc., or FM Approvals LLC can be considered equivalent to UL. Faulty fabrication or poor workmanship in any material, equipment, or installation is justification for rejection.

4. Provide Roadway Illumination Light Fixtures as per TxDOT Departmental Material Specification (DMS) 11010, Item 610, and as shown on the Material Producers List (MPL) for Roadway Illumination and Electrical Supplies.

5. Fabricate steel roadway illumination poles in accordance with Roadway Illumination Poles (RIP) standards and Item 610. Poles fabricated according to RIP standards do not require shop drawing submittals.

   a. Alternate designs to RIP standards or the use of aluminum to fabricate poles will require the submission of shop drawings electronically. For instructions on submitting shop drawings electronically see "Guide to Electronic Shop Drawing Submittal" on the TxDOT web site.

   b. Limitations on use of the RIP standard: The RIP standard details were developed for installations in locations where the 3-second gust basic maximum wind speed is 110 mph, and where the elevation of the base of the pole is less than (i.e. not more than) 25′ above the elevation of the surrounding terrain, in accordance with the "AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals," 6th Edition (2013) of the AASHTO Design Specifications. For poles to be installed in regions where the maximum basic wind speed exceeds 110 mph or to be mounted more than 25′ above the surrounding terrain, provide poles meeting the following requirements:

      i. Submittals. Following the electronic shop drawing submittal process (see Guide to Electronic Shop Drawing Submittal on the TxDOT web site), submit to the Engineer for approval fabrication drawings and calculations for the poles, sealed by a Texas licensed professional engineer (P.E.).

      ii. Luminaire Structural Support Requirements. Provide light poles, arms, and anchor bolt assemblies with a 25 year design life to safely resist dead loads, ice loads and the required basic wind speeds at the location of installation in accordance with the 6th edition (2013) of the AASHTO Design Specifications. For transformer base poles, include transformer base and connecting hardware in calculations and shop drawing submittals. Structurally test all transformer bases to resist the theoretical plastic moment capacity of the pole. Submit certification of the plastic moment load test and FHWA breakaway requirement test of the model of base being furnished with the shop drawings. Show breakaway base model number, manufacturer's name, and logo on shop drawings. Include on manufacturer's shop drawings the ASTM designations for all materials to be used.

6. For both transformer and shoe-base type illumination poles, provide and install double-pole breakaway fuse holders as specified by DMS-11040. Breakaway fuse holders are listed on the MPL for Roadway Illumination and Electrical Supplies under Items 610 & 620. Provide 10 amp time delay fuses for breakaway connectors in light poles, or inside the light fixture for underpass luminaires. In each pole, connect luminaires to the breakaway connector with continuous stranded 12 AWG copper conductors as listed on the MPL. Bond all equipment grounding conductors together and to the ground lug in the transformer base or hand hole.

7. Tighten anchor bolts for shoe base, concrete traffic barrier base, and bridge mount roadway illumination poles, in accordance with Item 449.

8. Install T-Base with following procedure:

   a. Anchor Bolt Tightening.

      i. Coat the threads of the anchor bolts with electrically conductive lubricant.

      ii. Place the T-base over the anchor bolts. Foundation must be level and flat. The maximum permissible gap under any one corner of the t-base is 1/8" before nuts are tightened.

      iii. Coat the bearing surfaces of the nuts and washers with electrically conductive lubricant. Install (1) 1/2" hold down washer, (1) lock washer, and (1) nut on each anchor bolt. Turn the nuts onto the bolts so that each is hand-tight against the washer.

      iv. Using a torque wrench, tighten each nut to 150 ft-lb. Uniform contact is required between the foundation and the T-base in the corner regions of the T-base, and all corner gaps must be closed after applying torque. If a gap still exists after torquing to 150 ft-lbs, continue torquing each bolt incrementally until gap is closed or maximum allowable torque of 250 ft. pound is reached, whichever comes first. If 250 ft-lbs is not enough to close the gap the foundation must be leveled. Gaps along the straight sides of the T-bases and the foundation are permissible. Ensure that no high point of contact occurs between the straight sides of the T-base and the foundation.

      v. Check top of T-base for level. If not level then foundation must be leveled.

   b. Top Bolt Procedure

      i. Erect pole over T-base with crane. Coat bolts, nuts, washers, and lock washers with electrically conductive lubricant.

      ii. Install bolts and 1/2" connecting washers from the inside of the T-base, thread up through the pole base. Install flat washers, lock washers and nuts snug tight according to Item 447, "Structural Bolting."

      iii. Tighten each nut to 150 ft-lb. using a torque wrench.

   c. Level and Plumb

      i. Ensure pole is plumb and mast arm is perpendicular to the roadway according to plans to within 5 degrees.

9. Construct luminaire pole foundations in accordance with Item 416, "Drilled Shaft Foundations," and TxDOT standard sheet RID(2).

10. Provide and install underpass luminaires in accordance with Item 610, DMS-11010, and TxDOT standard sheet RID(3). Typical luminaire size for underpass luminaires is 150W HPS or 150W EQ LED.

11. Mount luminaires on arms level as shown by the luminaire level indicator.

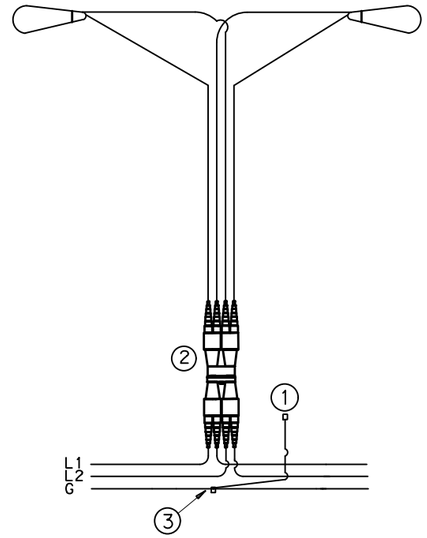
12. Orient luminaires perpendicular to the roadway intended to be lit unless otherwise shown on the plans.

Wiring Diagram Notes:

(1) Use 1/2 in.-13 UNC threaded, copper or tin-plated copper, pole bonding connector, sized appropriately for conductors, bonded to T-base, or use ground lug in handhole as available.

(2) Use pre-qualified two-pole breakaway connectors for all luminaire pole installations. For luminaires fed by a circuit with a neutral conductor, use double pole breakaway connectors with the neutral side unfused and marked white.

(3) Split Bolt or other connector.



L1,L2 = Hot Conductors
G = Grounding Conductor

TYPICAL WIRING DIAGRAM

LUMINAIRES SERVED AT 480V ON 240/480 VOLT SERVICE OR LUMINAIRES SERVED AT 240V FOR 120/240 VOLT SERVICE.

Decorative LED Lighting Notes:

1. LED Drivers in Remote Outdoor enclosures (for drivers that do not include an enclosure as part of a factory assembly):

   a. Provide NEMA 3R outdoor enclosure or as approved.

   b. Install enclosure at least 12" above ground or other horizontal surface. Mount vertically or on ceiling, and avoid direct sun where possible.

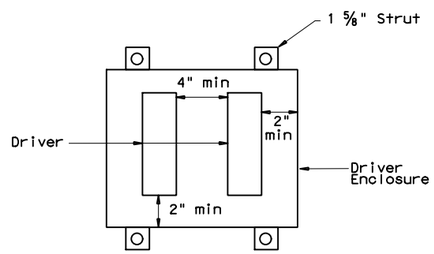
   c. Install drivers with at least 2 inches of space from enclosure walls.

   d. For multiple drivers in an enclosure, provide at least 4 inches side to side and 1 inch end to end from other drivers or electronic equipment

   e. For drivers mounted on back wall of enclosure, mount enclosure on 1 5/8" strut or other standoff to dissipate heat, or mount driver to side of the enclosure or to the metal cover.

   f. Provide remote drivers with a maximum of 100 watts

   g. Provide drivers with documentation of 100,000 hr lifetime at Tcase of 65C or higher.



Driver Spacing In Remote Enclosure

Texas Department of Transportation — Traffic Safety Division Standard

ROADWAY ILLUMINATION DETAILS

RID(1)-20

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© TxDOT January 2007	CONT	SECT	JOB	HIGHWAY
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7-17	DIST	COUNTY		SHEET NO.
12-20	HOU	MONTGOMERY, ETC		141

72A

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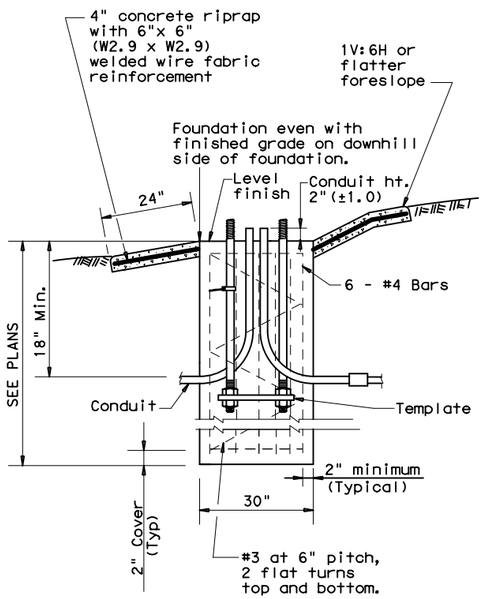
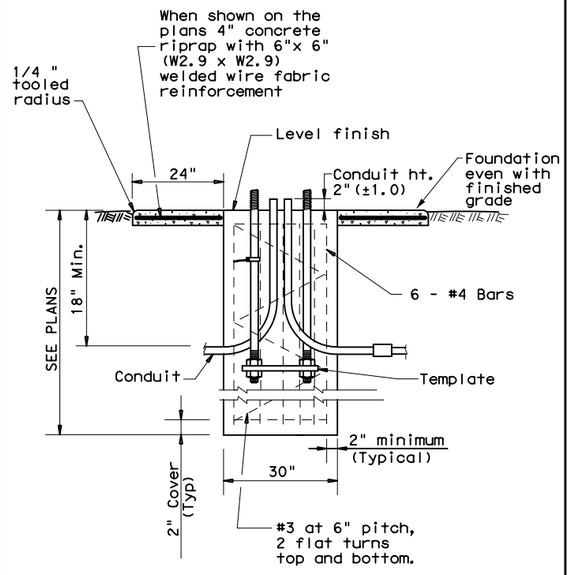


SECTION A-A
SHOWING SLOPED GRADE



SECTION A-A
SHOWING CONSTANT GRADE

TABLE 1
ANCHOR BOLTS

POLE MOUNTING HEIGHT	BOLT CIRCLE		ANCHOR BOLT SIZE
	Shoe Base	T-Base	
<40 ft.	13 in.	14 in.	1in. x 30in.
40-50 ft.	15 in.	17 ¼in.	1 ¼in. x 30in.

TABLE 2
RECOMMENDED FOUNDATION LENGTHS
(See note 1)

MOUNTING HEIGHT	TEXAS CONE PENETROMETER N Blows/ft		
	10	15	40
≤20 ft.	6′	6′	6′
>20 ft. to 30 ft.	8′	6′	6′
>30 ft. to 40 ft.	8′	8′	6′
>40 ft. to 50 ft.	10′	8′	6′

TABLE 3
PAY QUANTITY OF RIPRAP PER FOUNDATION (Install only when shown on the plans)

Foundation Diameter	RIPRAP DIAMETER	RIPRAP (CONC) (CL B)
30 in.	78 in.	0.35 CY

GENERAL NOTES:

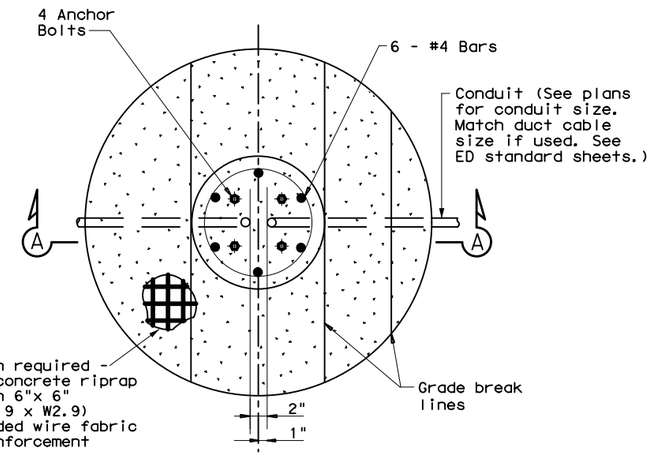
1. "Recommended Foundation Lengths" table is for information purposes only. Foundation lengths shall be as shown on the plans, or as directed by the Engineer. Foundations will be paid for under Item 416, "Drilled Shaft Foundations," unless otherwise shown on the plans.
2. Erect roadway illumination assembly poles plumb and true. Form and level the top 6" of the foundation so the pole will be plumb. Use leveling nuts to plumb shoe base poles. Do not use shims or leveling nuts under transformer bases. Do not grout between baseplate and the foundation.
3. Ensure Class 2A and 2B fit for anchor bolts and nuts. Tap and chase nuts after galvanizing. Anchor bolt body with rolled threads need not be full size.
4. Use appropriate class of concrete as specified in Items 416 and 432. Concrete for riprap may be upgraded to Class C at no extra cost to the Department.
5. Place riprap around the foundation when called for elsewhere in the plans. Riprap will be paid for under Item 432.
6. Locate breakaway roadway illumination assemblies as shown in the placement table, unless otherwise dimensioned on the plans. Protect non-breakaway illumination assemblies from vehicular impact (i.e. 2.5 ft. behind guard rail or mounted on traffic barrier), or located outside the clear zone, except that 2.5 ft. from curb face is minimum desired for light poles on city streets, 45 mph or less. See Roadway Design Manual for further information.
7. Use 4 hold down and 4 connecting washers on transformer base poles as recommended by the manufacturer and supplied with base.
8. Install a minimum of 2 conduits in each foundation. See lighting layout sheets for locations of foundations with more than 2 conduits. Cap unused conduits in foundations on both ends.
9. Conduit location in foundations is critical for breakaway devices. Place conduits 2 in. apart on centerline as shown.
10. Bond anchor bolt to rebar cage with #6 bare stranded copper conductor. Use listed mechanical connectors rated for embedment in concrete. The bonded steel in the foundation creates a concrete encased grounding electrode which replaces the ground rod.
11. Grade earthwork around T-base foundations even with the finished grade as shown in Section A-A to ensure proper function of the breakaway device. Use riprap on T-base foundations that are located on sloped grades, and as shown on the plans for level grades.

TABLE 4
BREAKAWAY POLE PLACEMENT (See note 6)

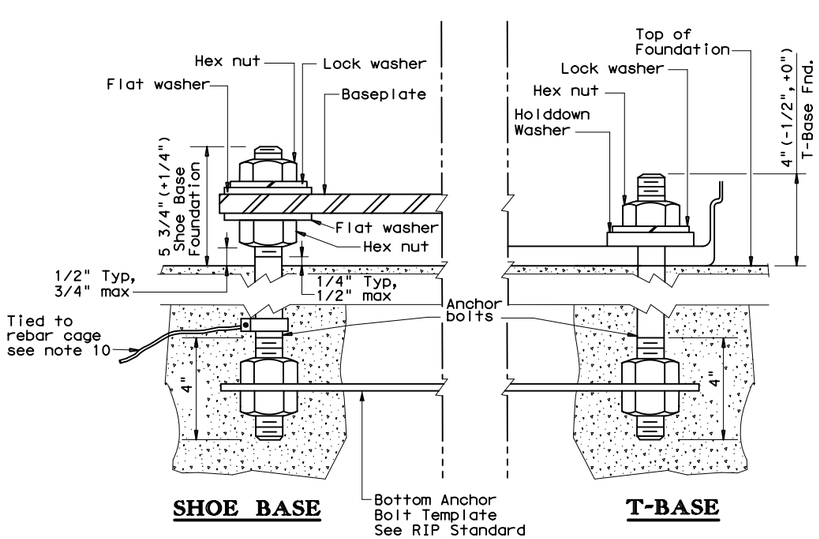
ROADWAY FUNCTIONAL CLASSIFICATION	** POLE OFFSET (DISTANCE TO FACE OF TRANSFORMER BASE)
Freeway Mainlanes (roadway with full control of access)	15 ft. (minimum and typical) from lane edge
All curbed, 45 mph or less design speed	2.5 ft. minimum (15 ft. desirable) from curb face
All others	10 ft. minimum*(15 ft. desirable) from lane edge

* or as close to ROW line as is practical

** provide 2/5 of the luminaire mounting height behind the pole for "falling area" to prevent encroachment on the other travel lanes. See design guidelines.



FOUNDATION DETAIL



ANCHOR BOLT DETAIL

Texas Department of Transportation

Traffic Safety Division Standard

ROADWAY ILLUMINATION DETAILS
(RDWY ILLUM FOUNDATIONS)

RID(2)-20

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©TxDOT January 2007	CONT	SECT	JOB	HIGHWAY
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7-17	HOU	MONTGOMERY, ETC		142
12-20				

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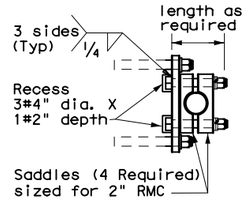
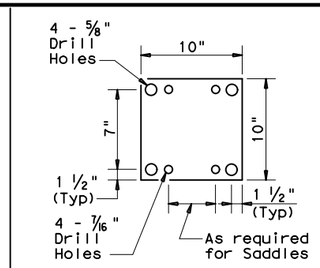
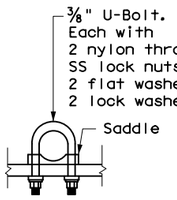


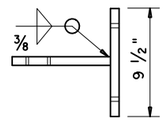
SECTION A-A



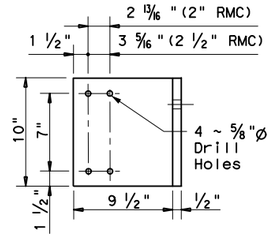
MOUNTING PLATE
(ASTM A-36 or better)



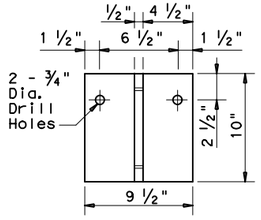
CLAMP DETAIL
(2 Req'd)



PLAN VIEW

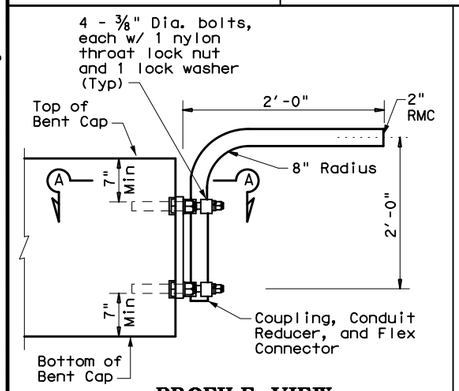


FRONT

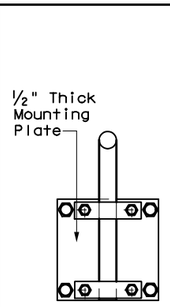


SIDE

BRACKET DETAIL
Make from 1/2" plate (ASTM A-36 or better)

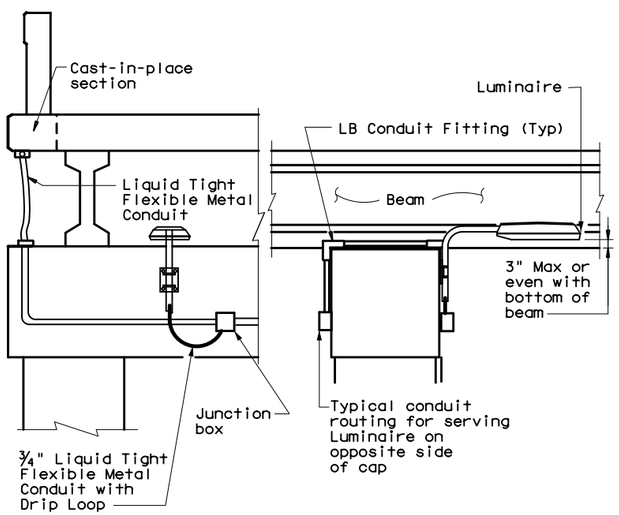


PROFILE VIEW
Or as Required
(See Note A.3)



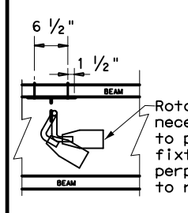
END VIEW

UNDERPASS LIGHTING ARM



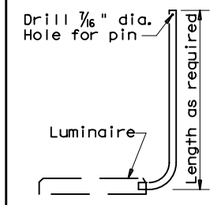
IN RD IL AM (U/P)(TY 1)
If bridge has pre-cast panels under deck, run circuit under deck edge.

UNDERPASS LIGHTING TYPE 1

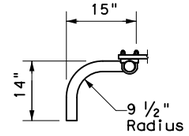


PLAN VIEW

FIXTURE ORIENTATION

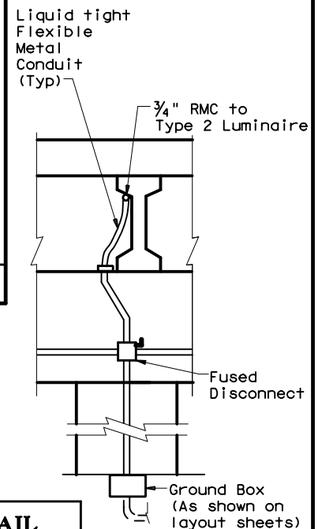


SIDE



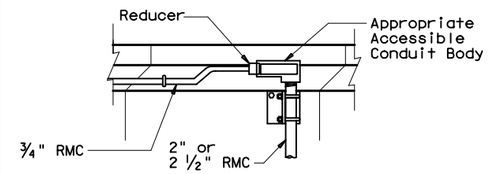
PLAN VIEW

ARM DETAIL

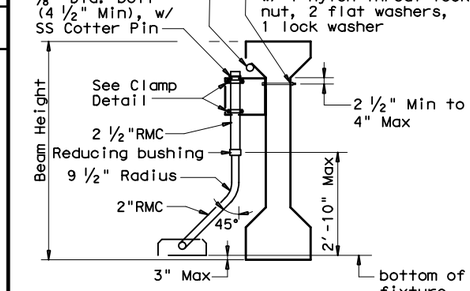


3 - No. 12 XHHW in 3/4" RMC for Branch Circuit runs from fused disconnect to underpass Luminaires

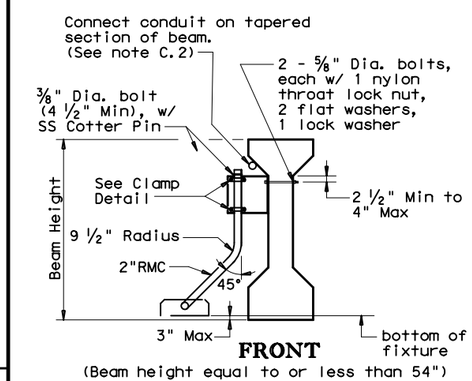
CONDUIT DETAIL



CONDUIT CONNECTION PROFILE



FRONT
(Beam height greater than 54")



FRONT
(Beam height equal to or less than 54")

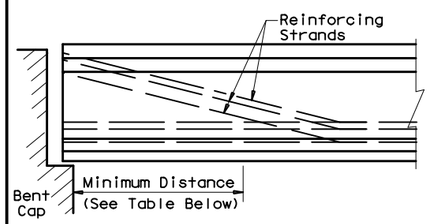


TABLE 5

LOCATION OF UNDERPASS LIGHT MOUNTING BRACKET TABLE

SPAN LENGTH	MINIMUM DISTANCE
≤ 50'	10'-0"
50'- 70'	15'-0"
70'- 90'	20'-0"
> 90'	25'-0"

IN RD IL AM (U/P)(TY 2)

LOCATION OF UNDERPASS LIGHT MOUNTING BRACKET

UNDERPASS LIGHTING TYPE 2

GENERAL NOTES:

A. ALL 150 watt HPS and 150 watt equivalent LED Luminaires

1. Luminaire locations, conduit and conductor sizes and routing are typical and diagrammatic only. See project layout sheets for specific details.
2. Conduit will be paid for under Item 618, "Conduit" and conductors will be paid for under Item 620, "Electrical Conductors," unless otherwise shown on the plans.
3. Adjust conduit in saddles to place fixture height and orientation as required. See fixture orientation detail and plans. Where practicable, place luminaires so the bottom of luminaire is above the bottom of the beam, maximum of 3 in. (See detail UNDERPASS LIGHTING ARM TYPE 2)
4. Except as noted, galvanize all structural steel and exposed bolts, nuts, and washers in accordance with Item 445 "Galvanizing".
5. Fabrication of brackets and support arms will not be paid for directly but is subsidiary to Item 610, "Roadway Illumination Assemblies."
6. Install a heavy duty NEMA 3R fused disconnect or breaker enclosure rated at 30 amps and 480 volts to switch underpass luminaires as shown on plans, with at least one per bridge circuit. Install 20 amp time-delay fuses or inverse-time circuit breakers. Mount disconnect or breaker enclosure 10 ft. (min) above grade on columns or bent caps as approved by the Department. Modify disconnect to allow padlocking in the "ON" and "OFF" positions. Padlocks and disconnect switches or circuit breakers for underpass fixtures will not be paid for directly but are subsidiary to the various bid items of the contract.
7. Conduit on columns, caps, and slab is shown surface mounted. For new columns and caps, embed PVC conduit in concrete. Bond and ground metal junction boxes and conduit.

B. TYPE 1

1. Provide 2 in. rigid metal conduit (2.375" O.D., 0.146" wall) for Type 1 arm shaft.
2. Use 3/8 in. stainless steel bolt or stud non-epoxy type expansion anchors for concrete for Type 1 mounting. Except as noted, provide an allowable 2650 lbs minimum pull-out force (after consideration of adjustment factors for edge distance and bolt spacing) for each anchor. Install each anchor to the embedment depth recommended by the manufacturer.
3. Attach conduit to plate with 4 saddles, four - 3/8 in. diameter bolts, nylon throat lock nuts, and lock washers.

C. TYPE 2

1. Provide 2 in. rigid metal conduit (2.375" O.D., 0.146" wall) or provide a combination of 2 1/2 in. (2.875" O.D., 0.193" wall) and 2 in. (2.375" O.D., 0.146" wall) rigid metal conduits with a reducing bushing as beam height stipulated for Type 2 arm shaft. Field cutting and threading will be permitted. Paint cut and threaded areas with zinc rich paint after conduit is connected to adjacent fitting.
2. Connecting conduit may be strapped to tapered section only of precast beams as shown. Anchor as approved by the Engineer. Maximum anchor depth is 1 in.
3. Indiscriminate drilling into precast concrete beams may result in reduced beam strength. Use drilling location and method as directed by the Engineer. See Location of Underpass Lighting Mounting Bracket detail. The locations shown in the table are such that reinforcing strands will not be damaged.

Texas Department of Transportation

Traffic Safety Division Standard

ROADWAY ILLUMINATION DETAILS
(UNDERPASS LIGHT FIXTURES)

RID(3)-20

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2-14		DIST	COUNTY		SHEET NO.
7-17		HOU	MONTGOMERY, ETC		143
12-20					

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I. STORMWATER POLLUTION PREVENTION

Texas Pollutant Discharge Elimination System (TPDES) TXR 150000: Stormwater Discharge Permit or Construction General Permit is required for projects with 1 or more acres disturbed soil. Projects with any disturbed soil must protect for erosion and sedimentation in accordance with Item 506. Refer to the TxDOT SWP3 Summary Sheets, SWP3 Binder Template, and Form 2118.

No Additional Comments

II. WORK IN OR NEAR STREAMS, WATERBODIES AND WETLANDS

United States Army Corps of Engineers (USACE) Permit is required for filling, dredging, excavating or other work in water bodies, rivers, creeks, streams, wetlands or wet areas. The Contractor must adhere to all of the terms and general conditions associated with the following permit(s). If additional work not represented in the plans is required, contact the Engineer immediately.

☒ No United States Army Corps (USACE) Permit Required

☐ Work is authorized by the United States Army Corps of Engineers (USACE) under a Nationwide Permit (NWP) without a Pre-Construction Notification (PCN). Project specific permit was not issued by USACE, therefore is not in the plan set. The USACE general conditions are in the “General Notes."

☐ Work is authorized by the United States Army Corps of Engineers (USACE) under a Nationwide Permit (NWP) with a Pre-Construction Notification (PCN). The project specific permit issued by the United States Army Corps of Engineers (USACE) is included in the plan set. The USACE general conditions are in the “General Notes."

☐ Work is authorized by the United States Army Corps of Engineers (USACE) under a Individual Permit (IP). The project specific permit issued by the United States Army Corps of Engineers (USACE) is included in the plan set.

☐ Work would be authorized by the United States Army Corps of Engineers (USACE) permit. The project specific permit issued by the USACE will be provided to the contractor.

United States Coast Guard (USCG) Permit is required for projects that involve the construction or modification (including changes to lighting) of a bridge or causeway across a water body determined to be navigable by the United States Coast Guard (USCG) under Section 9 of the Rivers and Harbors Act. If additional work not represented in the plans is required, contact the Engineer immediately.

☒ No United States Coast Guard (USCG) Coordination Required

☐ United States Coast Guard (USCG) Permit

☐ United States Coast Guard (USCG) Exemption

No Additional Comments

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 area and contact the Engineer immediately.

No Additional Comments

IV. VEGETATION RESOURCES

Preserve native vegetation to the extent practical. Refer to TxDOT Standard Specifications in order to comply with requirements for invasive species, beneficial landscaping and tree/brush removal.

No Additional Comments

V. FEDERAL LISTED, PROPOSED THREATENED, ENDANGERED SPECIES, CRITICAL HABITAT, STATE LISTED SPECIES, CANDIDATE SPECIES AND MIGRATORY BIRDS

If any of the listed species below are observed, cease work in the area, do not disturb species or habitat and contact the Engineer immediately.

The work may not remove active nests (from bridges, structures, or vegetation adjacent to the roadway, etc.) during nesting season (February 15 to October 1). If removal of structures or vegetation is necessary during the nesting season, the Contractor shall conduct a bird survey no more than 3 days in advance of the clearing/demolish start date. All bird surveys shall be conducted by a Field Biologist and adhere to the guidance document “Avoiding Migratory Birds and Handling Potential Violations” found in the TxDOT Environmental Compliance Toolkits at the time of the survey. (See below for Field Biologist and Ornithologist qualifications)

No Additional Comments

Field Biologist, Ornithologist – a field biologist is defined as an individual qualified to perform field investigations, presence/absence surveys and habitat surveys for protected avian species or species of concern. A mandatory bachelor’s degree in biology or a related science is required. At a minimum, the Field Biologist, Ornithologist, shall have completed and reported a minimum of three presence/absence and habitat surveys for protected avian species in the past five years. A minimum of three projects must have been conducted in Texas. Surveys shall have been performed for documentation of species in accordance with a protocol approved by USFWS or TPWD, or following generally accepted methodologies.

VI. HAZARDOUS MATERIALS OR CONTAMINATION ISSUES

Refer to TxDOT Standard Specifications in the event potentially contaminated materials are observed, such as dead or distressed vegetation, trash disposal areas, drums, canisters, barrels, leaching or seepage of substances, unusual smells or odors, or stained soil, cease work in the area and contact the Engineer immediately.

No Additional Comments

VII. OTHER ENVIRONMENTAL ISSUES

Comments:

STATE OF TEXAS
CHARLES R. STEVENS, JR
101286
LICENSED PROFESSIONAL ENGINEER

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

Version 2.2

Texas Department of Transportation

TxDOT Houston District

ENVIRONMENTAL PERMITS, ISSUES AND COMMITMENTS

EPIC

FILE: EPIC Sheet.dgn	DN:	CK:	DW:	CK:
© TxDOT: March 2017	CONT	SECT	JOB	HIGHWAY
REVISIONS	0110	04	208	IH 45
UPDATED section V. text and added definition (10/17) ADDED USCG and USACE notes in Section VII (04/18)	DIST	COUNTY		SHEET NO.
	12	MONTGOMERY, ETC		144

DATE: Mar 21, 2024
FILE:

STORMWATER POLLUTION PRVENTION PLAN (SWP3):

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

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

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

1.0 SITE/PROJECT DESCRIPTION

1.1 PROJECT CONTROL SECTION JOB (CSJ):
0110-04-208, ETC

1.2 PROJECT LIMITS:
IH 10 TO N OF LEAGUE LINE RD (TOTAL PROJECT, ALL CSJ)

1.3 PROJECT COORDINATES:

BEGIN: 29.777022, -95.369341

END: 30.373565, -95.485681

1.4 TOTAL PROJECT AREA (Acres): 0

1.5 TOTAL AREA TO BE DISTURBED (Acres): 0

1.6 NATURE OF CONSTRUCTION ACTIVITY:
REPLACING HIGH MAST AND UNDERPASS LIGHTING FIXTURES AND ILLUMINATION TROUBLESHOOTING

1.7 MAJOR SOIL TYPES: N/A

Soil Type	Description

1.8 PROJECT SPECIFIC LOCATIONS (PSLs): N/A

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

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

Type	Sheet #s

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

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

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

1.10 POTENTIAL POLLUTANTS AND SOURCES:

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

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

Tributaries	Classified Waterbody
Unnamed Tributary of Greens Bayou, Halls Bayou	*Greens Bayou Above Tidal (1016); Impaired for bacteria
Little White Oak Bayou	*Buffalo Bayou Tidal (1013); Impaired for bacteria
I-Plan/TMDLs: Houston-Galveston Region BIG	

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

1.12 ROLES AND RESPONSIBILITIES: TxDOT

X Development of plans and specifications
X Perform SWP3 inspections
X Maintain SWP3 records and update to reflect daily operations
☐ Other: _____
_____
☐ Other: _____
_____

1.13 ROLES AND RESPONSIBILITIES: CONTRACTOR

X Day To Day Operational Control
X Maintain schedule of major construction activities
X Install, maintain and modify BMPs
☐ Other: _____
_____
☐ Other: _____
_____
☐ Other: _____
_____

STATE OF TEXAS
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PROFESSIONAL LICENSED ENGINEER

CHARLES R. STEVENS, JR., P.E. — 3/21/2024 DATE

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

July 2023 Sheet 1 of 2

Texas Department of Transportation

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6	SEE TITLE SHEET		145
STATE	STATE DIST.	COUNTY	
TEXAS	HOU	MONTGOMERY, ETC	
CONT.	SECT.	JOB	HIGHWAY NO.
0110	04	208, ETC	IH 45

STORMWATER POLLUTION PRVENTION PLAN (SWP3):

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

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

2.1 EROSION CONTROL AND SOIL STABILIZATION BMPs: N/A

T / P

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

2.2 SEDIMENT CONTROL BMPs: N/A

T / P

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

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

2.3 PERMANENT CONTROLS: N/A

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

BMPs To Be Left In Place Post Construction:

Type	Stationing	
	From	To

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

2.4 OFFSITE VEHICLE TRACKING CONTROLS:

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

2.5 POLLUTION PREVENTION MEASURES:

- ☐ Chemical Management
- ☐ Concrete and Materials Waste Management
- X Debris and Trash Management
- ☐ Dust Control
- ☐ Sanitary Facilities
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____
- ☐ Other: _____

2.6 VEGETATED BUFFER ZONES: N/A

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

Type	Stationing	
	From	To

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

2.7 ALLOWABLE NON-STORMWATER DISCHARGES:

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

2.8 DEWATERING:

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

2.9 INSPECTIONS:

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

2.10 MAINTENANCE:

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

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

July 2023 Sheet 2 of 2

Texas Department of Transportation

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6	SEE TITLE SHEET		146
STATE	STATE DIST.	COUNTY	
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CONT.	SECT.	JOB	HIGHWAY NO.
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