



STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
16 STATE HOUSE STATION
AUGUSTA, MAINE 04333-0016

Janet T. Mills
GOVERNOR

Bruce A. Van Note
COMMISSIONER

November 18, 2022
Subject: Bridge Rehabilitation
State WIN: 021751.01
Location: **Boothbay Harbor & Southport
Amendment No. 5**

Dear Sir/Ms.:

There will be a mandatory Pre-Bid meeting only for contractors prequalified for this project, the meeting will be Virtual and will be held at 10:00 am on Wednesday November 30, 2022. To register for this virtual meeting please email Jason.B.Stetson@maine.gov.

Please make the following changes to the bid documents

In the bid book:

On page 14, "NOTICE TO CONTRACTORS", CHANGE the bid opening date in the first paragraph which reads "November 30, 2022" per Amendment No. 4 to now read "December 7, 2022". Make this change in pen and ink.

Remove pages seventeen to twenty-five titled Proposal Schedule of items dated November 8, 2022, totaling 9 pages, and **Replace** with the attached Proposal Schedule of items dated November 18, 2022, totaling nine pages

Remove pages 154 and 155 titled SPECIAL PROVISION SECTION 643 TRAFFIC SIGNALS dated September 23, 2022, totaling two pages, and **Replace** with the attached SPECIAL PROVISION SECTION 643 TRAFFIC SIGNALS (Flashing Beacon) dated November 18, 2022, totaling two pages.

Remove pages 159 to 208 titled SPECIAL PROVISION SECTION 655 ELECTRICAL WORK (Bridge Control System) dated August 29,2022 totaling 49 pages and **Replace** with the attached SPECIAL PROVISION SECTION 655 ELECTRICAL WORK (Bridge Control System) dated November 18, 2022, totaling 50 pages.

In the plan sheet:

Remove Page two titled ESTIMATED QUANTITIES GENERAL NOTES totaling one-page dated August 19, 2022, and **Replace** with ESTIMATED QUANTITIES GENERAL NOTES totaling one-page dated August 19, 2022

Remove Page thirteen titled PIER 2 FENDER SYSTEM PLAN & ELEVATIONS dated August 19, 2022, and **Replace** with the attached PIER 2 FENDER SYSTEM PLAN & ELEVATIONS

Remove Page twenty-five titled END STOP DETAILS dated August 19, 2022, and **Replace** with the attached END STOP DETAILS

Remove page thirty-two titled TRUSS SWING SPAN JACK SUPPORT DETAILS dated August 19, 2022, and **Replace** with the attached TRUSS SWING SPAN JACK SUPPORT DETAILS

Remove page thirty-four titled STEEL GRID DECK AND JOINT DETAILS dated August 19, 2022 and **Replace** with the attached STEEL GRID DECK AND JOINT DETAILS

Remove page thirty-six titled BRIDGE GATE REMOVAL AND CROSS FRAME REPAIR DETAILS dated August 19, 2022, and **Replace** with the attached BRIDGE GATE REMOVAL AND CROSS FRAME REPAIR DETAILS

Remove page forty-five titled ADVANCE WARNING BEACON PLAN dated August 19, 2022, and **Replace** with the attached ADVANCE WARNING BEACON PLAN

Remove page forty-eight titled SOUTH CRASH BARRIER AND MAST ARM FOUNDATION DESIGN and **Replace** with the attached SOUTH CRASH BARRIER AND MAST ARM FOUNDATION

The following questions have been received:

Question:

Under Special Provision Section 655 – Electrical Work Bridge Control System 2.22 – Contractor shall design and install a CCTV System in accordance with MaineDOT Standard Specifications Section 654.211. We are requesting that the department provide the standard Specification as noted in section 2.22 if required.

Response: Please find revised Special Provision 655 – Electrical Work Bridge Control System included in this amendment.

Question: Coast Guard General Construction Requirements note 14 supplied in bid amendment 1 states that "Bridge protective fenders shall not be constructed or rebuilt with any metal surfaces on the rubbing face of the fender system. All bolts, spikes or other metal fastening device must be countersunk." Does this apply to then plan specified carriage bolts on the "rubbing face" of the fender system?

Response: Please see revised plan sheet number 13 of 48. All bolt heads shall be countersunk on the fender rubbing face.

Question: Some of the pay items listed on plan sheet 45 (Advance Warning Beacon Plan) seem to be missing from the proposal schedule of items list. Can you please review these items and tell us how to proceed?

Response: Please see revised sheet number 45 of 48. Item 626.46 has been removed and Item 626.421 has been added to the Estimated Quantities on sheet 2.

Question: 1-Please refer to Note 8 on drawing 31 and confirm that the painting of top flanges is intended for span 2 only.

Response: Note #8 on sheet number 31 of 48 refers to the painting of the top flanges of span 2 only.

Question: 2-Please refer to drawings 3 and 47/48 and special provision 643 (Barrier Gates). Please confirm that both sides of the crash barrier elements (i.e., arm mount & receiver) intended to be on drilled foundations. The drawings are not clear.

Response: All mast arms and crash barrier elements are to be installed on the foundations indicated on the respective sheets. Sheet 47 is indicating 1 mast arm foundation design, and 2 possible crash barrier foundation designs. The contractor shall choose 1 of the 2 crash barrier foundation possibilities on sheet 47 and both crash barrier elements (arm and receiver) shall be founded on that foundation. Sheet 48 indicates 2 possible mast arm foundation designs, dependent on how deep rock is encountered, and only one crash barrier design. See note 6 on both sheet 47 and 48.

Question: 3-Special Provision 643.19 calls for payment of the Flashing Beacon foundations under the 626 items, please confirm that the beacon foundations are paid under the 626.43 or 626.451 items.

Response: Please see revised Special Provision 643 Traffic Signals (Flashing Beacons). Item 624.421 24-inch Diameter Foundation has been added to the Estimated Quantities for the contract. The Advance Warning Beacon foundations shall be paid for under this item number.

Question: Please confirm all reinforcing steel on the project is to be plain

Response: Yes, all reinforcing steel on this project is plain.

Question: Please provide additional information regarding the existing Pier 2 Timber Pile to be removed. Specifically, the pile length and diameter. There are not any details included in the provided as built drawings.

Response: Existing pile diameter(s) shall be field verified. Sheet 9 of 19 (pg. 10 of pdf) of the 1938 original plans state that "Pile lengths shows are for estimate only" and that there are "52 treated wooden piles @ 90 lin. Ft. = 4680 lin. Ft".

Question: Please refer to special provision 643.01-Materials -9 which calls for a slab foundation “for the mounting of the barrier gate assembly...slab and wall shall be structurally integrated with the drilled shaft foundations..” What is the minimum slab size the DOT would require for the gate mount side?

Response: The minimum sized slab would be dictated by the selected and approved barrier gate and the manufacturer’s requirements for installation as well as the requirements of AASHTO, Special Provision 643 and other specifications noted.

Question: Please refer to drawing 2 general note 3, please clarify which elevation that “waterline” is referring to with regard to protective coating application: i.e., MLW, MHW MHHW?

Response: Protective coating shall be applied to concrete surfaces above the Mean High Water Level El. 4.0.

Question: Please refer to drawing 3 general note 11 which states the coating of all structural steel “excluding the fender system...”. The fender system drawings and pile special provisions appear silent on coating of the fender system steel or piles, please clarify what is required.

Response: The fender system piles are to be uncoated steel.

Question: 626.43 payment line item is for 30” diameter mast arm foundations, but Sheets 47 and 48 both state 36” diameter. Please clarify.

Response: This has been corrected in Bid Amendment #3.

Question: 626.451 payment line items is for 42” Diameter crash barrier foundations, but Sheets 47” and 48” reference 36, 42, and 60” diameter. Please clarify.

Response: Please reference other RFI responses regarding these foundations. Item numbers have been revised and further clarification provided.

Question: Is there a detail for the 15’ pedestal pole foundation SB-PI called out on drawing 44??

Response: Standard Detail 643(07) and Standard Specification 643 shall be worked together. Specifically reference Std. Spec. 643.023 Traffic Signal Structures.

Question: Please clarify: Note 6 on Sheet 47 (Abutment 1) states that alternative designs can be submitted for the crash barrier shafts to eliminate the rock socket. It appears as if one crash barrier shaft includes a smaller diameter (42”) and 5’ rock socket, and the other one is larger diameter (60”) without a rock socket. Would the larger diameter shaft terminate at top of rock (boring shows it at a depth of 27’), or 22’ as shown on the table?

Response: The tip of larger diameter shaft (60” diameter) shall terminate no shallower than 22’ below ground surface (bgs). The typical finish ground surface is assumed to be at El. 15, resulting in a minimum tip elevation of El. -7. Top of rock is at approximately El. -7 based on interpolating between BB-SBTG-201 and -202. Rock Sockets are required if rock is higher than El. -7.

Question: On Drawing 25 for the End Stop there is unidentified material shown between the 12X1" Strike Plate and another unidentified plate. Special Provision 860.16 indicates Stop Assembly to be provided "as depicted on Contract Plans", but the polyurethane bumper described in the SP is not actually identified on the plans. Please clarify/specify the location, size, shape, and construction of the polyurethane bumper/plate assembly required.

Response: Sheet 25 of 48 has been revised to clarify the location of Polyurethane Bumper called for in Special Provision 860.16. The Polyurethane Bumper that the design is based on is a high-performance industrial bumper that is 80 mm in diameter x 80 mm long on an integral 100 mm x 100 mm x 10 mm mounting plate.

Question: For the steel curb assemblies shown on Drawing 35, what is the connection detail to the open and filled grid deck on the swing span and to the CIP concrete deck on the approach spans? One detail of a sleeve and noted 1/2" galvanized anchor bolt was found on Sheet 31.

Response: The connection detail shall be 3/4" galvanized anchor bolts with a clip assembly detail to fit both grid deck and CIP concrete details. The anchor bolts shall be fitted through a 1" ID PVC or Stainless-Steel Sleeve. Clip details shall be submitted to the Department for review and approval.

Question: Does Structural Steel for the fender system, excluding pile, require galvanizing or some other type of coating?

Response: Fender system steel components are to be uncoated.

Question: For the steel curb assemblies shown on Drawing 35, is the curb required to be continuous with field welded splices between segments? If so, what is weld requirement at joints?

Response: The curb is required to be continuous between joints. Full pen welds are required between segments.

Question: Please refer to drawing 21, the section & elevation shows 1" ss rods at 2 per location horizontally per timber, the timber post connection detail shows 7/8" diameter at 1 per location horizontally, please clarify.

Response: The correct size shall be 1" diameter.

Question: Please refer to drawings 31 & 34, there is a conflict regarding the proposed stringer size; 31 shows w14x48 and 34 shows 14x42, please clarify.

Response: The correct proposed stringer size is W14x48 as shown on plan sheet 31 of 48. Plan sheet 34 of 48 has been revised.

Question: -Please refer to drawing 33 which shows top & bottom strut replacements and to drawing 36 which shows the plan with strut replacements at 20 locations with 2 locations shown as top and 2 as bottom and others just bold, please confirm that both top and bottom are intended at the other 16 locations.

Response: Please see revised sheet 36 of 48. The bridge recently received its regularly scheduled routine and fracture critical inspection, and a closer look was taken at the struts to be replaced. The quantity of strut replacement has increased.

Question: - Please refer to drawing 36 Note 2, this note states that the total number of struts replaced is not to exceed the number indicated on the plans. Please confirm that the total number of struts to be replaced is 36.

Response: Please see revised sheet 36 of 48. The bridge recently received its regularly scheduled routine and fracture critical inspection, and a closer look was taken at the struts to be replaced. The quantity of strut replacement has increased.

Question: Please refer to drawing sheet 1 which calls for fender system to be 2.5 CCA and to 528 which also calls for 2.5 CCA and UC5A for the fender however UC5A is only 1.5 CCA according to our timber supplier. Please confirm that 2.5 CCA is what is required.

Response: 1.5 CCA UC5A is acceptable as well as 2.5 CCA UC5B or UC5C, depending on regional availability.

Question: Please refer to special provision 528 and the requirement of UC4B treatment for fender walkway & sidewalk, which treatment material is required (0.6 CCA or 0.31 MCA)? This is usually designated by the specification as the CCA is for the UC5A.

Response: Either treatment is acceptable based on availability.

Question: Please refer to drawing M11 Elevation, the call out “End Stop (See note 8)” does not appear to be correct. Please clarify.

Response: Refer to drawing M11 Rev. 1 on which the End Jack callouts and Note 8 were revised. Sheet 32 of 48 has been updated to reflect these changes.

Question: The drawings on sheet 11 call for in-kind replacement of the pier fender, the pier 1 fender has an added platform not shown on the drawings on the upstream side, please confirm this is to be replaced. If so what are the dimensions and material sizes required?

Response: Per Note 3 on Sheets 11 and 20 of 48, the walkway and railing shall be replaced in-kind at pier 1 and 3 fenders. The Contractor shall field verify dimensions and may submit alternate walkway and railing designs for review and approval.

Question: Special Provision Section 860 Mechanical Work for Swing Bridge Rehabilitation, 862.3 Workforce Qualifications. Supervising Personnel states, “The installation and adjustment of all mechanical work shall be supervised and directed by foremen and supervising engineers who shall be on-site on a daily basis while work is on-going. Personnel proposed for this role shall have a minimum installation experience of two (2) movable bridge machinery projects.” This specification lists foreman and supervising engineers to be on-site. Can this requirement be satisfied by either a foreman OR supervising engineer, or are both positions required? Can this on-site personnel be separate than the Movable Bridge Project Coordinator?

Response: This requirement may be satisfied by either foreman or supervising engineer meeting the requirements of this special provision. This on-site person can be separate than the Movable Bridge Project Coordinator.

Question: For approach span grid deck, please provide connection requirements (welded, bolted, etc.) for the bearing bars at the longitudinal stage line joint, supplemental bars at the longitudinal stage line joint, and crossbars at transverse panel joints.

Response: Existing approach span grid deck details can be found in the 1972 shop drawings produced by the Reliance Steel Products Company.

Question: Timber supplier is requesting consideration on eliminating the requirement for Kiln-dry lumber after treatment for the new timber fender wood due to the difficulty in sourcing this material.

Response The kiln-dry lumber requirement shall be eliminated.

Question: Please refer to special provision 506 which in turn refers to standard spec 506. These appear to refer only to shop applied scenarios. Would power tool cleaning to SP15 be acceptable for the surface prep (i.e., beam tops and faying surfaces at existing steel connections) given the time of year and limited closure period?

Response: No, SSPC-SP 10 is the required surface preparation. The Contractor shall reference the manufacturer’s surface preparation requirements for the zinc rich paint.

Question: It is our understanding that, according to the special provision 105 (traffic control and management), the contractor may have lane closures with cone or barrel type channelizing devices outside of the winter closure windows, provided it does not hinder in any way the operation of the swing span. Please clarify.

Response: Correct. The Contractor is allowed roadway lane closures to perform work outside of the winter closure windows, provided that the normal operations of the bridge are not inhibited during this work.

Question: It is our understanding based on the coast guard permit that the contractor may occupy one of the two navigable channels outside of the winter channel closure windows, provided it does not hinder in any way the operation of the swing span. Please clarify.

Response: Outside of the winter channel closure windows, any work on the water shall adhere to the U.S Coast Guard Bridge Administration General Construction Requirements. Only one navigation channel can be blocked at a given time and barges need to be moved out of the navigation channel at the end of each workday unless provided written permission from the USCG. Any work planned shall be detailed and submitted to the USCG per Requirement #4. Any work outside of the winter channel closure windows shall not inhibit the normal operations of the bridge. Please note, summer maritime traffic at the bridge can be heavy and may make working on the water difficult to manage during these times.

Question: Previous questions have not been answered regarding temporary structural blocking, timber fender hardware requirements according to coast guard specifications, and timber fender schedules. Will these questions be addressed with ample time for consideration prior to 11/16?

Response: The bid opening date has been changed with this Amendment to 12/7/2022.

Question: The existing bridge has a load rating of 30 tons. What is the limiting component causing this rating?

Response: Span 3 interior girders control the rating. Span 1 interior girders rate at 38 Tons.

Question:

Special Provision 105 for the MBPC requires: "The MBPC shall assure that a responsible party will be on-site during all hours of construction".

Is this someone the MBPC assigns to supervise the work? Can it be the project superintendent? What does 'responsible party' mean?

Response: The intention of this specification is that the MBPC assure that appropriate personnel are on-site during construction activities to help relay any issues/concerns/questions to the MBPC for assistance with resolution. For example, this would mean making sure that the bridge control system vendor as specified in Special Provision 655 is on-site as required in the provision or that the supervision/workforce as specified in Special Provision 860 are on-site and performing work as required in the special provision. This may include the project superintendent during times when work is being performed that doesn't explicitly state any specialized experience in the Contract.

Question: Drawing 30 shows temporary concrete barrier used during Stages 2 and 3. The barrier is noted as "pinned", with no connection to the deck indicated. Pinned barrier is shown in standard details as barrier pinned to each other with rods, also with no connection to the deck required. Special Provision 507 paragraph b. on 116/366 provides requirement for patching anchor bolt holes in new deck. Please confirm that all temporary concrete barrier is not required to be bolted down to the deck or roadway.

Response: Temporary concrete barrier used in Stage 2 is required to be pinned to the deck. Temporary concrete barrier used in Stage 3 is NOT required to be pinned to the deck.

Question:

As a follow up question to your response in Amendment #3 on the 24" foundations associated with the advanced warning beacons; could you please provide clarity on the following questions:

- 1) The quantity on drawing 45 of 48 has been changed from 7 LF to 14 LF. Is this supposed to indicate a 24" foundation for both advanced warning beacons?
- 2) Drawing 46 of 48 "Northbound Approach" detail indicates, a new wooden pole is to support the Advanced Warning Beacon, is this still correct?
- 3) The response indicates to pay for the 14 LF of 24" foundations under the 626 items, but 626.421 was not included on the revised schedule of items. Please clarify.

Response: These questions have been resolved with this amendment and earlier RFI responses above.

Question: Please confirm that Abutment 1 and 2 reinforcing bars Mark A506 , A550, A506 and B550 are paid under the 503 reinforcing steel bid items.

Response: It is correct that Abutments 1 and 2 reinforcing bars Mark A506, A550, B506, and B550 are paid for under items 503.12 and 503.13.

Consider these changes and information prior to submitting your bid on **December 7, 2022**.

Sincerely,



George M. A. Macdougall P.E.

Contracts & Specifications Engineer

Maine Department of Transportation

Proposal Schedule of Items

Proposal ID: 021751.01

Project(s): 021751.01

SECTION: 1 INITIAL GROUP

Alt Set ID: Alt Mbr ID:

Contractor: _____

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price		Bid Amount	
			Dollars	Cents	Dollars	Cents
0010	202.01 REMOVING STRUCTURES AND OBSTRUCTIONS EXIST FENDER SYSTEM	LUMP SUM	LUMP	SUM	_____	_____
0020	202.01 REMOVING STRUCTURES AND OBSTRUCTIONS EXIST STL GRID DECK	LUMP SUM	LUMP	SUM	_____	_____
0030	202.08 REMOVING BUILDING NO.: 1, CONTROL HOUSE	LUMP SUM	LUMP	SUM	_____	_____
0040	202.12 REMOVING EXISTING STRUCTURAL CONCRETE	5.000 CY	_____	_____	_____	_____
0050	202.27 EXISTING MACHINERY REMOVAL AND DEMOLITION	LUMP SUM	LUMP	SUM	_____	_____
0060	202.56 REMOVE EXISTING ADVANCE WARNING BEACON	2.000 EA	_____	_____	_____	_____
0070	202.57 REMOVE EXISTING WARNING GATE BRIDGE MOUNTED	2.000 EA	_____	_____	_____	_____
0080	202.57 REMOVE EXISTING WARNING GATE FOUNDATION MOUNTED	2.000 EA	_____	_____	_____	_____
0090	203.20 COMMON EXCAVATION	270.000 CY	_____	_____	_____	_____
0100	203.35 CRUSHED STONE 3/4 INCH	5.000 CY	_____	_____	_____	_____

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SECTION: 1 INITIAL GROUP

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Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price		Bid Amount	
			Dollars	Cents	Dollars	Cents
0110	206.082 STRUCTURAL EARTH EXCAVATION - MAJOR STRUCTURES	20.000 CY	_____	 _____	_____	 _____
0120	304.10 AGGREGATE SUBBASE COURSE - GRAVEL	110.000 CY	_____	 _____	_____	 _____
0130	403.208 HOT MIX ASPHALT 12.5 MM HMA SURFACE	30.000 T	_____	 _____	_____	 _____
0140	403.213 HOT MIX ASPHALT 12.5 MM BASE	90.000 T	_____	 _____	_____	 _____
0150	409.15 BITUMINOUS TACK COAT - APPLIED	32.000 G	_____	 _____	_____	 _____
0160	501.239 DYNAMIC LOADING TESTS - PROVIDING FOR	4.000 EA	_____	 _____	_____	 _____
0170	501.48 STEEL H-BEAM PILES 74 LBS/FT, DELIVERED	4,750.000 LF	_____	 _____	_____	 _____
0180	501.481 STEEL H-BEAM PILES 74 LBS/FT, IN PLACE	4,750.000 LF	_____	 _____	_____	 _____
0190	501.90 PILE TIPS	50.000 EA	_____	 _____	_____	 _____
0200	501.91 PILE SPLICES	50.000 EA	_____	 _____	_____	 _____
0210	501.92 PILE DRIVING EQUIPMENT MOBILIZATION	LUMP SUM		 LUMP SUM	_____	 _____

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Proposal Schedule of Items

Proposal ID: 021751.01

Project(s): 021751.01

SECTION: 1 INITIAL GROUP

Alt Set ID: Alt Mbr ID:

Contractor: _____

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price		Bid Amount	
			Dollars	Cents	Dollars	Cents
0220	502.219 STRUCTURAL CONCRETE, ABUTMENTS AND RETAINING WALLS	LUMP SUM	LUMP	SUM	_____	_____
0230	502.26 STRUCTURAL CONCRETE ROADWAY AND SIDEWALK SLABS ON STEEL BRIDGES	LUMP SUM	LUMP	SUM	_____	_____
0240	502.291 SAW CUT GROOVING	LUMP SUM	LUMP	SUM	_____	_____
0250	502.49 STRUCTURAL CONCRETE CURBS AND SIDEWALKS	LUMP SUM	LUMP	SUM	_____	_____
0260	503.12 REINFORCING STEEL, FABRICATED AND DELIVERED	34,600.000 LB	_____	_____	_____	_____
0270	503.13 REINFORCING STEEL, PLACING	34,600.000 LB	_____	_____	_____	_____
0280	503.17 MECHANICAL WELDED SPLICE	685.000 EA	_____	_____	_____	_____
0290	504.70 STRUCTURAL STEEL FABRICATED AND DELIVERED	LUMP SUM	LUMP	SUM	_____	_____
0300	504.71 STRUCTURAL STEEL ERECTION	LUMP SUM	LUMP	SUM	_____	_____
0310	505.08 SHEAR CONNECTORS	LUMP SUM	LUMP	SUM	_____	_____
0320	506.1705 SURFACE PREP. OF EXISTING STRUCTURAL STEEL	LUMP SUM	LUMP	SUM	_____	_____

Maine Department of Transportation

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Project(s): 021751.01

SECTION: 1 INITIAL GROUP

Alt Set ID: Alt Mbr ID:

Contractor: _____

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price		Bid Amount	
			Dollars	Cents	Dollars	Cents
0330	506.1775 FIELD PAINTING NEW STL W/ ZINC RICH PAINT	LUMP SUM	LUMP	SUM	_____	_____
0340	507.0841 STEEL PIPE HAND RAILING	LUMP SUM	LUMP	SUM	_____	_____
0350	507.13 TEMPORARY BRIDGE RAILING	370.000 LF	_____	_____	_____	_____
0360	515.21 PROTECTIVE COATING FOR CONCRETE SURFACES	LUMP SUM	LUMP	SUM	_____	_____
0370	518.50 REPAIR OF UPWARD FACING SURFACES - TO REINFORCING STEEL < 8 IN.	50.000 SF	_____	_____	_____	_____
0380	518.60 REPAIR OF VERTICAL SURFACES < 8 IN.	250.000 SF	_____	_____	_____	_____
0390	518.70 REPAIR OF OVERHEAD SURFACES < 8 IN.	50.000 SF	_____	_____	_____	_____
0400	524.301 TEMPORARY STRUCTURAL SUPPORT BRIDGE	LUMP SUM	LUMP	SUM	_____	_____
0410	526.301 PORTABLE CONCRETE BARRIER TYPE I	LUMP SUM	LUMP	SUM	_____	_____
0420	526.305 PORTABLE CONCRETE BARRIER, BRACED TYPE 1	LUMP SUM	LUMP	SUM	_____	_____
0430	526.34 PERMANENT CONCRETE TRANSITION BARRIER	4.000 EA	_____	_____	_____	_____

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Proposal Schedule of Items

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Project(s): 021751.01

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Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price		Bid Amount	
			Dollars	Cents	Dollars	Cents
0440	528.01 STRUCTURAL TIMBER, FABRICATED AND DELIVERED	LUMP SUM	LUMP	SUM	_____	_____
0450	528.02 STRUCT TIMBER, ERECTION	LUMP SUM	LUMP	SUM	_____	_____
0460	530.02 PREFAB DECK PANEL	4,900.000 SF	_____	_____	_____	_____
0470	606.1722 BRIDGE TRANSITION - TYPE 2	6.000 EA	_____	_____	_____	_____
0480	606.25 TERMINAL CONNECTOR	2.000 EA	_____	_____	_____	_____
0490	606.55 GUARDRAIL TYPE 3 - SINGLE RAIL	210.000 LF	_____	_____	_____	_____
0500	609.11 VERTICAL CURB TYPE 1	40.000 LF	_____	_____	_____	_____
0510	610.08 PLAIN RIPRAP	115.000 CY	_____	_____	_____	_____
0520	626.11 PRECAST CONCRETE JUNCTION BOX	2.000 EA	_____	_____	_____	_____
0530	626.22 NON-METALLIC CONDUIT	450.000 LF	_____	_____	_____	_____
0540	626.221 NON-METALLIC CONDUIT CONCRETE ENCASED	125.000 LF	_____	_____	_____	_____
0550	626.251 NON-METALLIC UNDER PAVEMENT CONDUIT (SCHEDULE 80 OR GREATER RATING)	40.000 LF	_____	_____	_____	_____

Maine Department of Transportation

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Project(s): 021751.01

SECTION: 1 INITIAL GROUP

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			Dollars	Cents	Dollars	Cents
0560	626.421 24 INCH DIAMETER FOUNDATION	7.000 LF	_____	 _____	_____	 _____
0570	626.44 36 INCH DIAMETER FOUNDATION	28.000 LF	_____	 _____	_____	 _____
0580	626.451 42 INCH DIAMETER FOUNDATION	47.000 LF	_____	 _____	_____	 _____
0590	627.733 4" WHITE OR YELLOW PAINTED PAVEMENT MARKING LINE	650.000 LF	_____	 _____	_____	 _____
0600	627.75 WHITE OR YELLOW PAVEMENT & CURB MARKING	50.000 SF	_____	 _____	_____	 _____
0610	629.05 HAND LABOR, STRAIGHT TIME	20.000 HR	_____	 _____	_____	 _____
0620	631.10 AIR COMPRESSOR (INCLUDING OPERATOR)	12.000 HR	_____	 _____	_____	 _____
0630	631.11 AIR TOOL (INCLUDING OPERATOR)	12.000 HR	_____	 _____	_____	 _____
0640	631.12 ALL PURPOSE EXCAVATOR (INCLUDING OPERATOR)	12.000 HR	_____	 _____	_____	 _____
0650	631.172 TRUCK - LARGE (INCLUDING OPERATOR)	12.000 HR	_____	 _____	_____	 _____
0660	639.18 FIELD OFFICE TYPE A	1.000 EA	_____	 _____	_____	 _____

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			Dollars	Cents	Dollars	Cents
0670	643.01 TRAFFIC SIGNALS AND GATES MOVABLE BR HYBRID WARN AND RESIST GATE	LUMP SUM	LUMP	SUM	_____	_____
0680	643.60 FLASHING BEACON AT: EASTBOUND APPR	LUMP SUM	LUMP	SUM	_____	_____
0690	643.60 FLASHING BEACON AT: WESTBOUND APPR	LUMP SUM	LUMP	SUM	_____	_____
0700	643.72 TEMPORARY TRAFFIC SIGNAL	LUMP SUM	LUMP	SUM	_____	_____
0710	643.80 TRAFFIC SIGNALS AT SOUTHPORT BR RT 27 OVER TOWNSEND GUT	LUMP SUM	LUMP	SUM	_____	_____
0720	643.92 PEDESTAL POLE	1.000 EA	_____	_____	_____	_____
0730	643.94 DUAL PURPOSE POLE W/ 35' WARNING BEACON	2.000 EA	_____	_____	_____	_____
0740	643.97 WOOD POLES WITH GUYS AND SPAN WIRE	1.000 EA	_____	_____	_____	_____
0750	652.33 DRUM	20.000 EA	_____	_____	_____	_____
0760	652.34 CONE	20.000 EA	_____	_____	_____	_____
0770	652.35 CONSTRUCTION SIGNS	300.000 SF	_____	_____	_____	_____

Maine Department of Transportation

Proposal Schedule of Items

Proposal ID: 021751.01

Project(s): 021751.01

SECTION: 1 INITIAL GROUP

Alt Set ID: Alt Mbr ID:

Contractor: _____

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price		Bid Amount	
			Dollars	Cents	Dollars	Cents
0780	652.361 MAINTENANCE OF TRAFFIC CONTROL DEVICES	LUMP SUM	LUMP	SUM	_____	_____
0790	652.38 FLAGGER	560.000 HR	_____	_____	_____	_____
0800	655.3002 BRIDGE CONTROL SYSTEM	LUMP SUM	LUMP	SUM	_____	_____
0810	659.10 MOBILIZATION	LUMP SUM	LUMP	SUM	_____	_____
0820	660.21 ON-THE-JOB TRAINING (BID)	1,000.000 HR	_____	_____	_____	_____
0830	815.00 BUILDING CONTROL HOUSE	LUMP SUM	LUMP	SUM	_____	_____
0840	860.1851 LIVE LOAD ROLLERS	LUMP SUM	LUMP	SUM	_____	_____
0850	860.1863 END JACK ASSEMBLIES	LUMP SUM	LUMP	SUM	_____	_____
0860	860.1864 END SEAT ASSEMBLIES	LUMP SUM	LUMP	SUM	_____	_____
0870	860.1865 FULLY CLOSED STOPS	LUMP SUM	LUMP	SUM	_____	_____
0880	860.187 MISCELLANEOUS MECHANICAL REPAIRS	LUMP SUM	LUMP	SUM	_____	_____
0890	860.231 SPAN DRIVE MACHINERY	LUMP SUM	LUMP	SUM	_____	_____
0900	860.30 FUNCTIONAL TESTING	LUMP SUM	LUMP	SUM	_____	_____

Maine Department of Transportation

Proposal Schedule of Items

Proposal ID: 021751.01 Project(s): 021751.01

SECTION: 1 INITIAL GROUP

Alt Set ID: Alt Mbr ID:

Contractor: _____

Proposal Line Number	Item ID Description	Approximate Quantity and Units	Unit Price		Bid Amount	
			Dollars	Cents	Dollars	Cents
0910	880.02 BRIDGE BALANCING	LUMP SUM	LUMP	SUM	_____	_____
0920	880.031 BALANCE BLOCK STEEL	LUMP SUM	LUMP	SUM	_____	_____
0930	910.301 SPECIAL WORK STAFF GAUGES	LUMP SUM	LUMP	SUM	_____	_____
Section: 1			Total:		_____	_____
			Total Bid:		_____	_____

SPECIAL PROVISION
SECTION 643
TRAFFIC SIGNALS
(Flashing Beacon)

Standard Specification Section 643 shall apply with the following additions and modifications:

643.01 Description

The work shall consist of furnishing and installing all equipment necessary for erection and operation of advance flashing warning beacons where shown on the plans. Their installation shall be as described in this special provision.

643.025 Flashing Beacon

1. Beacon Dimensions and Placement in Sign Assembly:

- a. Each flashing beacon shall consist of two, one-way, 1-section, 12-inch traffic signal head yellow indications, with an LED-array above and below the warning sign.
- b. The two signal heads shall be aligned vertically.
- c. The edge of the beacon signal housing should be located no closer than 12 inches outside of the nearest edge of the sign.

2. Beacon Flashing Requirements:

- a. When activated, the two yellow indications in each beacon shall flash in an alternating pattern.
- b. The flash rate shall match the 2009 MUTCD Section 4L.01 requirements for the flash rate of beacons with a rate of not less than 50 or more than 60 times per minute. The illuminated period of each flash shall be a minimum of ½ and a maximum of 2/3 of the total cycle.

3. Beacon Operations:

- a. The beacon, normally dark, shall initiate operations only upon bridge tender actuation, and shall cease operations at a predetermined time after the bridge closure. The predetermined time shall be determined by the Resident and the Bridge Tender.
- b. All beacons associated with a given approach, shall, when activated, simultaneously commence operation of their alternating flashing indications and shall cease operations simultaneously.
- c. Support pole or post will be outfitted with a NEMA aluminum pole mount cabinet.

4. Beacon Actuation:

- a. The beacon system shall be capable of simultaneous actuation via active detection system.

- b. The active detection system shall consist of actuation from the Bridge Tender Control Room.

5. Power Service:

- a. The Contractor shall establish power service for each beacon with the Utility Company. Service shall be 120 VAC, single phase, metered service.
- b. The Contractor shall be responsible for all service and connection charges until the beacons have achieved final approvals.

Each beacon shall be mounted on a 15-foot long 4-inch I.D. non-tapered Schedule 40 galvanized steel pole with pole cap, except as noted on the contract plans. Poles shall have a 0.75” minimum thickness galvanized ASTM A36 steel base plate circumferentially welded to the pole shaft. Anchor bolts for attachment of base plates to foundations shall be 0.75” x 17” (minimum) x 3” threaded. Four anchor bolts shall be provided for each support pole. Otherwise each beacon can be mounted on a wood pole.

Signs for flashing beacons assemblies shall be sheet aluminum and meet requirements of Section 645 for Type II regulatory, warning and route marker assembly signage. The signage assemblies shall include a W3-6 Draw Bridge sign.

643.18 Method of Measurement

Flashing beacons installed with signs and equipment shown on the plans and details at each location shall constitute a single installation. Each installation will be measured for payment by the lump sum complete in place.

643.19 Basis of Payment

Flashing Beacon will be paid for at the contract lump sum price, which payment will be full compensation for furnishing and installing all materials including, but not limited to the LED beacon arrays, flasher, timer, lockable controller cabinet, wiring and power service, pole risers, communication devices and all appurtenances and incidentals required for a complete and functioning installation. Foundations and conduit will be paid under applicable Section 626 pay items. Pedestal pole and wood pole will be paid under 643.92 and 643.97 respectively.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
643.60 Flashing Beacon at EB Approach (Southport)	Lump Sum
643.60 Flashing Beacon at WB Approach (Boothbay Harbor)	Lump Sum

SPECIAL PROVISION
SECTION 655
ELECTRICAL WORK
(Bridge Control System)

PART 1 – GENERAL

1.01 Description.

- A. This section includes general requirements for supply, delivery, storage, installation, testing and commissioning of a hard-wired relay Bridge Control System required under the scope of the contract.
- B. Provide a complete hard-wired relay Bridge Control System fully assembled and programmed (control logic, operator interface, interlocking, bypassing, , etc.) and ready for proper operation of the movable bridge. The control system shall be complete and shall include all equipment necessary to guarantee the proper control of the bridge operation from the operator control console.

1.02 Related Sections. The requirements contained in other sections of project specification shall also apply for installation and coordination of work.

1.03 Quality Assurance.

- A. The Control System that will be provided for the movable bridge control system shall comply with these special provisions and the latest revised applicable codes, specifications and standards here below listed:

1. National Electrical Manufacturer's Association (NEMA).

- a. AB-1: Molded Case Circuit Breakers.
- b. ICS-1: General Standards for Industrial Control and Systems.
- c. ICS-2: Standards for Industrial Control Devices, Controllers and Assemblies.
- d. ICS-4: Terminal Blocks for Industrial Use.
- e. ICS-6: Enclosures for Industrial Controls and Systems.

2. ANSI/IEEE Standards.

- a. ANSI/IEEE C37.90.1: Standard Surge Withstand Capability (SWC) Tests for Protection Relay Systems.
 - b. ANSI/IEEE C37.90.2: Trial Use Standard Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Trans-receivers.
3. AASHTO Standards.
- a. AASHTO LRFD Movable Highway Bridge Design Specifications.
4. FHWA-MUTCD Manual on Uniform Traffic Control Devices.
- B. The Contractor shall obtain any and all required permits and approvals of all Departments and Agencies having jurisdiction.
- C. Equipment and Material Provisions.
1. Ensure all equipment and materials are new. Provide first class equipment, materials, and workmanship. Manufacture and erect to the satisfaction of the Department. Warrant the in-service working of the electrical installations for 2 years following Acceptance. If the contractor has any objection to any feature of the electrical equipment as designed and laid out, he must state his objection prior to bidding and in writing to the Department, otherwise his objection will be ignored if offered as a reason for malfunctioning of the equipment or for defective or broken apparatus.
 2. Provide each piece of electrical equipment and apparatus with a corrosion-resistant metal nameplate on which is stamped the name of the manufacturer, catalog number, and the rating or capacity of the equipment or apparatus.
 3. Provide corrosion-resistant material for all metal parts of the installation (except structural steel), such as aluminum, bronze, or stainless steel. Use cast-iron, malleable iron, or steel with a hot-dip galvanized finish as specified. Where aluminum surfaces come into contact with metals other than stainless steel or zinc, paint the dissimilar metals with a prime coat of zinc-chromate primer followed by one coat of a suitable protective coating, excluding those containing lead pigmentation.
 4. Ensure all mounting hardware and all wire and cable terminals are vibration proof.

5. If any departures from the Plans or Special Provisions are deemed necessary, submit the details of such departures and the reasons for it to the Department. Do not start related work until approved by the Department.

1.04 Action and Informational Submittals.

A. Preconstruction Submittals.

1. Health and safety plan.
2. Work plan.
3. Quality Control (QC) plan.
4. Schedule of submittal items with dates.

B. Product Data.

1. Submit manufacturer's instructions, printed product literature and data sheets for all items described in these specifications and include product characteristics, performance criteria, physical size, finish and limitations.
2. Submit copies of Vendor, producer or manufacturer product data and system integration and/or engineered system shop drawings. These shall include design and installation shop drawings, catalog cuts, specifications, testing requirements, and installation and user instructions.

C. Product and System Data.

1. Submit manufacturer's instructions, printed product literature and product data which shall include as a minimum product characteristics, performance criteria, physical size, weights, arrangements of components, type of material used, type and characteristics of used electrical devices and the minimum space for the erection and maintenance.
2. The Contractor shall provide the following system data:
 - a. Schematic wiring diagrams.
 - b. Package control system architecture.
 - c. Material list.

- d. General arrangement drawings showing all equipment in its final position.
- e. Wiring Diagram: cross wiring diagrams from field terminal strip terminals to all external equipment (drawings and database format - Excel).
- f. System wire and cable schedule(s) including wire and cable number, number of wire, wire size, etc.
- g. Functional description all the equipment included in the package.
- h. Specifications of all equipment included in the package.
- i. Control logic diagrams (open and closed control loops, automatic sequences, functional groups, interlocks, bypasses, etc.) covering all the equipment included in the package.
- j. Troubleshooting guides, tables and block diagrams and manual operation.
- k. Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, cleaning procedures and maintenance information.
- l. Factory Acceptance Test (FAT) Procedures.
- m. Site Acceptance Test (SAT) procedures.
- n. Test Report.
- o. Certificates.
- p. Closeout Submittals Warranty.
- q. Sustainable Design Submittals.
 - 1. Construction Waste Management. Submit project Waste Management Plan highlighting recycling and salvage requirements.
 - 2. Recycled Content. Submit listing of recycled content products used, including details of required percentages

or recycled content materials and products, showing their costs and percentages of post-industrial content, and total cost of materials for project.

1.05 CLOSEOUT SUBMITTALS

- A. Provide data for each type and style of starter, relay and control device.
- B. Provide service and maintenance information including preventive maintenance, assembly, and disassembly procedures. Include electrical drawings from electrical general sections. Submit additional information necessary to provide complete operation, repair, and maintenance information, detailed to the smallest replaceable unit.
- C. Provide instructions on adjustments, troubleshooting, configuration, and modifying drive parameters.
- D. Provide copies of as-built submittals.
- E. Provide spare parts lists including renewal parts.

PART 2 – PRODUCTS

2.01 The following product specifications form a basis for the design of the Control System for the bridge.

- A. Material.
 - 1. Provide all apparatus, devices, circuits, appliances, material, or labor specifically mentioned or not, or included but that may be found necessary to complete the installation in a manner acceptable to the Department as if specifically included in these Special Provisions and without any extra cost to the Department.
- B. Conformance.
 - 1. Provide all electrical equipment and install according to the requirements of the latest revision of the AASHTO LRFD Movable Highway Bridge Design Specifications and as specified in these Special Provisions.
 - 2. Provide materials and construct according to the requirements of the current National Electrical Code and to all applicable local rules and ordinances. Obtain all required permits and approvals of all Departments or Agencies having jurisdiction.

C. Bridge Control System Vendor.

1. Provide a control system manufacturer/Vendor and retain that Vendor through Acceptance and warranty period. The control system Vendor is to have complete control system responsibility for the integration of all bridge operation and traffic control system components whether or not provided by that Vendor. Ensure the control system Vendor supervises the selection and installation of all bridge control equipment and associated components and CCTV systems.
2. Fabrication of the control equipment is to take place at a UL 508 (Underwriters Laboratory) certified facility.
3. Review and provide conformance and approval stamp for all electrical system working drawings of the electrical contractor, for component and interconnection compatibility, before submitting to the Department.
4. Conduct shop testing of the control system, in addition to field and final acceptance testing of the entire electrical bridge control system and traffic control system of the bridge, although not necessarily responsible for repairs of equipment not supplied nor installed by the Vendor. The Contractor is responsible overall.
5. Train the bridge operators and maintenance personnel and supervise all operations and testing.
6. Demonstrate competence in providing electrical control systems for at least 10 movable highway bridges of all types including swing spans. The Vendor is to demonstrate competence in at least 2 bridges with AC motor/digital vector drives. The Vendor is to identify the above required bridges, the owners, and a current contact familiar with the construction and operation of the bridge.
7. Supply field service staff with the capability of providing services for field coordination of construction and final adjustments, available to the electrical contractor and as directed by the Department, and capable of responding within 2 hours to an emergency at the bridge through the end of the warranty period.
8. Submit the name, qualifications, and current certified financial statement of the control system Vendor that the electrical contractor is proposing with the bid documents, which requires review and approval by the Department.

- D. Electrical Items Covered in Other Sections. Brakes, end seat actuators, end jack actuators, barrier gates, warning gongs, traffic signals and advance warning beacons are covered and paid for in other sections of these Special Provisions.
- E. Shop and Working Drawings. Submit for review within 120 days after the award of the Contract. The electrical work may not proceed without approved shop and working drawings. Any work performed before all required submissions being returned approved will be considered unauthorized and will be at the Contractor's risk of being rejected.
- F. Applicable Standards and Publications. The electrical installation shall be in accordance with all applicable codes, standards, laws, and ordinances in effect at the construction site and the latest version of same at the time of the construction. The following codes and standards are applicable and are not considered all inclusive:
1. National Electric Code (NEC).
 2. National Electrical Manufacturers Association (NEMA).
 3. National Board of Fire Underwriters.
 4. National Fire Protection Association (NFPA).
 5. National Electrical Safety Code (NESC).
 6. Board of Fire Underwriters.
 7. American National Standards Institute (ANSI).
 8. Environmental Protection Agency (EPA).
 9. Illuminating Engineering Society (IES).
 10. Insulated Cable Engineer's Association (ICEA).
 11. Joint Industrial Council (JIC).
 12. Occupational Safety and Health Act (OSHA).
 13. Underwriter's Laboratories, Inc. (UL).
 14. American wire gauge (AWG).
 15. National Electric Testing Association (NETA).

16. American Association of State Highway Transportation Officials
(AASHTO).

- G. Permits. Receive approval from the USCG for all construction channel closures and temporary navigation lighting and any other permits required.

2.02 Span Drive Motors and Motor Encoders. The Span Drive System consists of a pair of normal span drive motors with encoders and hand crank extension, and AC Flux Vector Drive as follows:

- A. The span drive motor construction has the following features: 7.5 horsepower; 900 rpm; NEMA Design B; 208VAC; vector duty; continuous duty rated; totally enclosed, non-ventilated; Class H insulation; extra-large conduit box; re-greaseable anti-friction bearings; 1.0 service factor; 1,000:1 speed range; 120 volt winding heaters; thermal switch (Klixon); suitable for 40° C ambient. Provide cast iron frame and size as required by the manufacturer. Coat with epoxy paint. The frame shown on the mechanical and electrical Plans is that of one manufacturer and is for illustration only. Modify the machinery platform, shaft dimensions with hand crank feature, conduit box location and all other equipment or machinery as necessary.
- B. Provide F1 and F2 assemblies for proper equipment orientation. Provide drive end shaft extension in accordance with the requirements of the mechanical plans to accommodate the mounting of the brake wheel, brake wheel coupling or half coupling. Provide opposite drive end shaft in accordance with the requirements of the mechanical plans, to accommodate the encoder, hand crank and hand crank manual operation interlock.
- C. Provide pancake type motor encoder mounted directly to the motor frame. Each span drive motor encoder shall be 1024 PPR minimum and shall have two sensors to allow the cable to be switched to the other connector in the event of one sensor failure. The span drive motor encoders shall be compatible with the Flux Vector Drives and shall be equal to Northstar RIM Tach or Department approved equal.
- D. Provide Span Drive motor and Flux Vector Drive from a single source to ensure complete compatibility. Provide drive motor from Baldor, Reliance, Marathon, or approved equal.

2.03 Span Drive Motor Brakes and Machinery Brakes. Provide the span drive motor brake and machinery brake as specified in the mechanical specifications and pay for under the respective mechanical pay item.

- 2.04 End Seats. Provide end seats actuators as specified in the mechanical Special Provisions and paid for under the respective mechanical pay item.
- 2.05 End Jacks. Provide end jack actuators as specified in the mechanical Special Provisions and paid for under the respective mechanical pay item.
- 2.06 Circuit Breakers. Protect all branch circuits from the power buses by molded-case circuit breakers mounted in the power panel. Provide all breakers with quick-make and quick-break contacts and with a trip-free and trip-indicating mechanism. Provide frame sizes a minimum of 100 amperes or as shown on the Plans. Equip the breakers with thermal-magnetic trips or adjustable, instantaneous, magnetic trip units, with trip rating as required. Provide molded-case circuit breakers meeting the requirements of NEMA Publication No. ABI-1975. Ensure interrupting capacity is as shown on the Plans but not less than 42,000 AIC. All circuit breakers, except lighting breakers, shall be trip tested with the trip testing results submitted to the Department for review and acceptance. Breaker coordination calculations shall be submitted to the Department for review and approval.
- 2.07 Power Panel. Provide a power panel as shown on the plans and as follows:
- A. Panelboard construction to meet the following requirements:
1. References. Provide a circuit breaker type panelboard with NEMA Type 1 enclosures to meet NEMA PB 1 and NEMA PB 1.1 General instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
 2. Manufacturers. Provide panelboards as manufactured by; Square D, GE or Cutler Hammer.
 3. Panelboard Bus. Copper current carrying components, ratings as indicated on Drawings. Furnish copper bus in each panelboard and insulated ground bus.
 4. Short circuit rating shall be as shown on Panel Schedule in the Plans.
 5. Molded Case Circuit Breakers. NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all pole, listed as SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers as indicated on the Drawings. Do not use tandem circuit breakers.
 6. Cabinet Front. Surface mount, as indicated on the Plans, with metal directory frame, and flush lock keyed; finished in manufacturer's standard gray color.

7. The breaker panel shall be configured for 42 circuits with a 150 amp main circuit breaker.
8. Circuit breaker arrangement, number of poles and trip ratings shall be as shown on the Plans. The Contractor shall ensure all circuit breaker ratings are appropriate and resize as necessary for selected equipment loads.

B. Install panelboard as follows:

1. Install panelboards in accordance with NEMA PB 1.1, surface mounted on the wall, height 6 ft to top from the finished floor, filler plates for unused spaces, typed circuit directory, engraved plastic nameplates.
2. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes to balance phase loads.
3. Ground and bond panelboard enclosures. Connect equipment ground bars of panels in accordance with NFPA 70.
4. Inspect and test panelboards in accordance with NETA ATS.

C. Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.

2.08 Starters and Magnetic Contactors.

- A. Ensure the continuous current rating of contactors and starters is adequate for the connected loads and no contactors/starters are smaller than NEMA size 1. Provide all contact poles with arc chutes and equip contactors rated 150 amperes and above with magnetic blowouts. Provide 3-element manual/automatic reset, overload relays for motor protection. Electrically and mechanically interlocked reversing contactors.
- B. Provide all contactors, relays, and other devices of the required current-carrying and interrupting capacity. Provide all apparatus of substantial construction according to the requirements of NEMA standards publications ICS 1 and 2, 2010 and 2008 respectively, for industrial control devices.

2.09 Overload Relays. Provide manual reset overload relays to protect motors and wiring against overheating due to excessive current. Provide for all brake, end seat actuators, end jack actuators and all gate motors. Heater elements are to be selected based on motor full-load running current and be provided, according to the motor nameplate value, after system is installed. Electronic overload relays may be used.

Auxiliary overload relay contacts shall be provided and used as necessary in accordance with the schematic diagrams of the Plans.

2.10 Disconnect Switches.

- A. Span Drive Motor Disconnect Switches. Install non-fused safety switches for use as disconnects within sight of each Span Drive Motor. Provide lockable, non-fusible, heavy-duty, safety switches, rated as shown on the Plans, and NEMA 4X 316 stainless steel enclosures. Provide each disconnect switch with a N.O./N.C. auxiliary contact for the control system and phenolic nameplate to identify corresponding motor.
- B. Brake Disconnect Switches. Install non-fused safety switches for use as disconnects within sight of the Motor Brake and the Machinery Brake. Provide lockable, non-fusible, heavy-duty, safety switches, rated as shown on the Plans, and NEMA 4X 316 stainless steel enclosures. Provide each disconnect switches with a N.O./N.C. auxiliary contact for the control system and phenolic nameplate to identify corresponding brake.
- C. End Jack and End Seat Disconnect Switches. Provide lockable non-fused, 3-phase, NEMA 4X manual motor starter switches for use as disconnect switches for each End Jack actuator and each End Seat actuator, rated as shown on the Plans, and located within sight of the associated actuator. Provide each manual motor starter switch with a N.O./N.C. auxiliary contact for the control system and phenolic nameplate to identify corresponding actuator.

2.11 Phase Monitor. Ensure this relay prevents energizing the bridge controls in the event of reversed phase sequence, phase loss, phase imbalance, over or under voltage. Tripping of this relay will disable the bridge control system which will disable the operation of all motors. The phase monitor shall have a selectable manual and automatic reset.

2.12 Power Monitor. The Motor Starter Cabinet door shall be provided with a data logging power and energy meter. The meter shall meet the requirements of ANSI C12.20 0.2 Accuracy Class and IEC 62053-22 0.2S Energy Measurements. It shall have 0.007 Hz Precision Frequency Measurements, programmable alarm limits, THD, and Harmonics Analysis, waveform recording of up to 512 samples per cycle, 170 events. It shall provide data logging with three historical logs of 64+ parameters each and keys to add functionality in the field. The power monitor shall be a Shark 200 or Department approved equal.

2.13 Motor Starter Cabinet and Drive Cabinet Terminal Blocks. Terminal blocks for conductors of Size No. 8 AWG and smaller shall be 1 piece blocks on phenolic material recognized under the UL Component Recognition program. Provide barriers at least 1/2 inch high by 1/8 inch thick and space 5.8 inch center-to-center.

Provide straps and screws of brass, nickel plated for use in highly corrosive atmospheres and rate for 50 amperes. Ensure the blocks provide a withstand voltage rating of 750 volts per IEEE switch gear standards. Ensure the terminal blocks provide strap screws suitable for use with ring tongue wire connectors. Provide corrosion resistant marking strips for conductor identification. Provide at least 10 percent spare terminals. Provide terminal blocks of Buchanan Type 2B112, General Electric Series CR 151B, Marathon series 1600, or Department approved equal.

- 2.14 Power Distribution Blocks. Provide power distribution blocks for all conductors larger than No. 8 AWG constructed from a single piece of hard-drawn copper, machined and electro-tinned. Mount all blocks on heavy duty phenolic material and provide with safety cover kits. Ensure number and size of primary and secondary wire openings are selected by the Contractor/Vendor and are approved equal to the 66000 series blocks as manufactured by Gould Shawmut or Series 145 by Marathon.
- 2.15 Bridge Control Cabinets. Provide lockable control panels enclosed in free-standing cabinets and install where shown on the Plans. Free standing cabinets shall be mounted on 1/2" stainless steel channel. Mount all circuit breakers, switches, contactors, starters, relays, regulating equipment, and other apparatus for control of the span and its auxiliaries on these enclosed panels.
 - A. Provide cabinet dimensions for review and approval by the Department using those shown in the contract plans for guidance.
 - B. Each device shall be front-connected, front-wired, and removable from the front. Arrange the equipment in all cabinets for ease of access and for safety and convenience of operation. Take special care to obtain a systematic and neat arrangement of the equipment. Suitably name each device and plainly mark by a laminated nameplate mounted near the device on the panel. Show an approved descriptive title for the apparatus together with the device designation appearing on the schematic wiring diagrams.
 - C. Provide a NEMA Type 12 enclosure constructed of 12 gauge minimum sheet-steel and reinforce with steel angles or channels so as to provide a rigid, free-standing structure. Provide the control cabinets with hinged doors. Ensure door panels are gasketed. Provide with 3-point, lockable vault-type latches. Provide corrosion resistant hardware. Provide each panel with suitable interior LED light fixtures operated from a door operated switch.
 - D. Each panel enclosure shall permit mounting in the available space along the walls of the room in which they are installed. If the final cabinet dimensions, as established by the manufacturer, should change, should necessitate rearrangement or modification of the equipment in order to fit in the available space, or both, make such rearrangements or modifications and at no extra

cost to the Department. The final arrangement of all equipment in the control house is subject to the approval of the Department.

- E. Paint the inside of the control panel enclosures and all metal reinforcing with 2 coats and the outside with 3 coats consisting of 1 coat of primer followed by 1 coat of white enamel on the inside surfaces and 2 coats of gray enamel on the outside. Ensure the exterior finish coat is ANSI 61 light gray enamel.
- F. Provide all contactors, relays, and other devices of the required current-carrying and interrupting capacity. Provide all apparatus of substantial construction according to the requirements of NEMA Standards Publications ICS 1 and 2, for industrial control devices.
- G. Ensure all internal wiring between devices, terminal blocks, or both are flame-retardant, cross linked polyethylene insulated, switchboard wire, Type SIS or equal. Provide stranded copper conductors of 14 AWG minimum.
- H. For each assembled control panel, connect all outgoing wire, No. 8 AWG or smaller to terminal blocks installed at the sides of the cabinet. Ensure the control panels also provide sufficient extra terminals to allow connections of all wires coming from limit switches and other devices that go on to the bridge control console and other locations as required even though these wires do not connect to apparatus on the control panels. Provide spare terminals at least 10 percent of those actually used. Identify each terminal per wire number shown on the Contractor's schematic wiring diagrams.
- I. Arrange all panel wiring systematically so that circuits can be readily traced. Install the wiring in a network of troughs consisting of horizontal and vertical sections securely bolted to the panels. Fabricate the troughs from heavy duty Noryl plastic shaped into a channel cross-section. After installation of the wiring, snap an insulated flanged cover over the open side of each trough section.
- J. Provide the floor areas in front of all power and control equipment rubber mats specifically designed for the application.

2.16 Control Console.

- A. Provide a bridge control console and install in the operator's room of the control house as shown on the Plans.
- B. Mount devices for controlling operation of the swing span and its auxiliaries on the control console. Ensure the console is of neat substantial construction. Fabricate from No. 10 gauge sheet-steel, properly formed and suitably reinforced to provide adequate strength. Fabricate the console top from No. 10 gauge, Type 316, stainless steel sheet with a non-glare, satin finish. Provide

removable doors in the front of the console, pivoted on 90 degree hinges and secured with flush type, 3-point vault type latches. Neatly fit up the console with close joints and ground off smoothly all rough edges or corners. Round off all projecting edges. Provide all metal hardware of substantial construction and having a satin-chrome plate finish. Provide all equipment mounting screws and bolts of 316 stainless steel.

- C. Paint the inside of the sheet-steel portions of the console and all metal reinforcing with 2 coats and paint the outside with 3 coats of paint consisting of 1 coat of primer followed by 2 coats of enamel on the outside surfaces and 1 coat of white enamel on the inside. Provide the finish coat of ANSI 61 Gray. Do not paint the stainless steel console top.
 - D. Take special care throughout the construction to ensure that the stainless steel console top and the equipment mounted thereon are completely protected from damage or defacement at all times.
 - E. Suitably light the console interior and control by a switch mounted near the front doors. Lighting shall illuminate all components and wiring without shadow and clear visibility of all tags, mold markings and wire numbers.
 - F. Ensure the wiring within the control console is insulated switchboard wire Type SIS or equal. Ensure wire is not smaller than 14 AWG. Arrange the wiring systematically so that all circuits can be readily traced. Terminate all conductors on easily accessible terminal blocks mounted inside the console at the rear. Provide spare terminals totaling at least 10 percent of those actually used. Identify wiring at equipment terminals by using marking strips on the terminals with type written numbers.
 - G. Mount indicating lights on the control console to show that the various steps in the sequence of operation have taken place so that the operator may proceed to subsequent steps at the proper time. Ensure the functions to be indicated and the color of the lenses are as shown on the Plans.
- 2.17 Position Transmitter. Provide an absolute encoder type span position transmitter within the Span Limit Switch enclosure, as called out on the plans, connected to the operating machinery through gearing. Ensure the Position Transmitter is geared single-turn, heavy-duty, and mounted in a NEMA 4X enclosure. The Position Transmitter shall produce an analog output 4-20mA output to be calibrated with the Span Position Indicator to show span position in degrees. Provide calculations to the Department for approval. The Position Transmitter resolution shall be 0.1 degree or better. Provide the Span Limit Switch and position transmitter from a single source to ensure complete compatibility. Provide a 12 VDC power supply for the position transmitter as shown on the plans. The Position Transmitter shall be a Turck RI360 Encoder or Department approved equal.

2.18 Meter. Meter for displaying span angle, motor current, and motor speed shall display values using a 3.5" 7-segment LED display with red digits 0.56" high and a user-programmable decimal point. The meters shall be suitable for use with 120VAC power. The meters shall accept 4-20 mA analog input. The meters shall be suitable for operation in temperatures from 0 to 55 deg C. Noise rejection shall be 50dB, 50/60Hz. Analog to digital conversion shall be by dual slope integration with at least 3 samples per second, nominal. Bezel dimensions shall be 3.78" x 1.89" x 0.51". The meter shall be Simpson F35 series or approved equal. It shall be calibrated to indicate span position of 0 to 65 degrees for the output range of the Position Transmitter.

2.19 Limit Switches.

- A. Fully Closed Limit Switch. Provide a single magnetic limit switch with magnetic targets as shown on the Plans. Coordinate the switch and target initial position such that it trips with the span is within 1" of contacting the hard stop and remains tripped as the Span Jacks raise and lower the span ends. Contractor to adjust switch and target positions in the field during testing. Provide a SEOOW cord with waterproof fittings connecting the switch to the terminal box as shown on the plans. The Fully Closed Limit Switch shall meet the following specifications: 316L stainless steel housing; fully potted and waterproof; end sensing; contain DPDT gold plated dry contacts rated at 10A/120VAC; operating temperature -50 deg C to 105 deg C; 1/4" ferrous metal sensing distance (3-7/8" sensing distance with magnetic target). shall be a TopWorx GO Switch Model 81 with Universal Mounting Bracket or Department approved equal. The targets shall be TopWorx GO Switch AMC5 magnetic targets or Department approved equal. All mounting brackets and hardware shall be fabricated from 316 stainless steel. Provide a deflector shield above the Fully Closed Limit Switch and Span Jacked Limit Switches to deflect water and debris from the switches.
- B. Span Jacked Limit Switches. Provide a total of two magnetic limit switches as shown on the plans. Set and adjust the switches and targets to trip with the span jacked to a suitable height allowing end seats to drive with sufficient clearance. The Span Jacked Limit Switches, magnetic targets, mounting brackets shall meet the same specifications and be of the same type listed above for the Fully Closed Limit Switch or Department approved equal.
- C. Gate Locked Limit Switches. Provide a total of two magnetic limit switches and magnetic targets to signal each barrier gate arm is locked in the receiver. Contractor to design limit switch configuration and adjustable mounts with the limit switch mounted on the gate arm tip and the target on the gate arm receiver. The contractor shall select an appropriate target to reliably trigger the limit switch. The Gate Locked Limit Switches shall meet the same

specifications and be of the same type listed above for the Fully Closed Limit Switch or Department approved equal.

- D. Overtravel Limit Switch. Provide one heavy duty limit switch with rod type lever arm and trip plate in accordance with the Plans. Contractor to design trip plate and provide in the shop plans. The switch shall be installed and adjusted to trip at 70 degrees span position. The rod length and trip plate shall be coordinated allow the switch to trigger at the overtravel position at full speed and come to a complete stop while keeping the Overtravel Limit Switch triggered (lever arm does not travel beyond the trip plate and reset). The switch shall meet the following specifications: enclosure water, oil, and dust tight; NEMA 4; DPDT with contacts of corrosion resistant silver alloy; spring return; current rating 20A at 125VAC; operating temperature range -40 degrees C to +90 degrees C. The Overtravel Limit Switch shall be a NAMCO Series SL limit switch or Department approved equal.
- E. Span Limit Switch. Provide a rotating cam limit switch in accordance with the Plans. The Span Limit Switch shall have 8 circuits with 8 DPDT switches individually, micro-adjustable and provisions for internal vernier adjustments. Ensure the limit switch allows for a + or - 1/4 degree contact operation repeatability. The DPDT switches shall be precision-type, snap action switches. Assemble each limit switch in a NEMA 4X enclosure. Provide a gear reducer coupled to the span drive speed reducer shaft extension with a 316 stainless steel zero-backlash flexible coupling. The gear reduction shall be of sufficient ratio to restrict the Span Limit Switch shaft rotation to less than 330 degrees with the span opened to 65 degrees travel. Cams and DPDT shall be adjusted in accordance with the settings shown in the Plans and adjusted in the field. The Position Transmitter shall be housed within the Span Limit Switch enclosure. The Span Limit Switch shall be suitable for vertical mounting. The Span Limit Switch shall be an AMETEK GEMCO 1980 Series rotating cam limit switch or Department approved equal.
- F. End Seat and End Jack Limit Switches. The bridge control system shall use the limit switches provided with the end seat actuators and end jack actuators as shown in the control schematic section of the Plans. In addition to the end seat actuator control switches, each end seat shoe shall be provided with two magnetic limit switches two sense driven and pulled positions as shown in the plans. These shall meet the same specifications and be of the same type listed above for the Fully Closed Limit Switch or Department approved equal.
- G. End Seat Manual Operation Safety Interlock Limit Switches. The bridge control system shall use the built-in manual operation safety interlock limit switches provided on the end seat actuators as shown in the control schematic section of the Plans. They shall prevent energization of the end seat actuators and protect personnel during manual operation and shall be failsafe.

- H. End Jack Manual Operation Safety Interlock Limit Switches. The Contractor shall design and provide a manual operation safety interlock limit switch for each end seat actuator to prevent energization of the end jacks and protect personnel while an actuator is manually operated. The switch shall be coordinated with a removable cover that must be removed to access the hand wheel and require the limit switch to trigger and remain triggered (normally closed contact open) while the cover is removed. The limit switch shall be fail-safe and not rely on a spring return to hold it in the actuated position. The removable cover is a Mechanical pay item.
 - I. Span Drive Motor Manual Operation Safety Interlock Limit Switches. The Contractor shall design and provide a manual operation safety interlock limit switch for each span drive motor to disable the span drive system and protect personnel while manually operating the span drive motors from the opposite drive end (ODE) shaft extension. The switch shall be coordinated with a removable cover, requiring removal of the cover to access the manual operation shaft and requiring the limit switch to trigger and remain triggered (normally closed contact open) while an operating lever or wheel is installed. The limit switch shall be fail-safe and not rely on a spring return to hold it in the actuated position. The removable cover is a Mechanical pay item.
 - J. Brake Limit Switches. The motor brake and the machinery brake shall be provided with set, released, and hand-released limit switches. These switches shall be provided as part of each brake assembly and are a mechanical pay item. The bridge control system shall interface with the brake limit switches as shown in the Plans.
- 2.20 Swing Span Drag Cable. Power and control conductors from the pivot pier to the movable span shall be carried with multi-conductor cables specifically designed for flexibility and dragging over a rough concrete surface. The cables shall be provided with extra flexible conductors with Class K stranding. The conductor makeup of the cable shall be as called out on the electrical plans. The cable shall be provided with two layers of .235" arctic grade, weather and sunlight resistant heavy duty neoprene jacket reinforced with Kevlar.
- 2.21 Heating, Ventilation, and Air Conditioning (HVAC). Contractor shall design and install split HVAC system for the operators house similar to that shown on the Plans. The HVAC system be sized to provide suitable cooling and heating during all seasons. The indoor unit shall be a flush ceiling mount type that fits without modification to the control house framing. The outdoor unit shall be installed along the back side of the control house with sufficient clearance according the manufacturer's installation instructions. Provide a NEMA 4X disconnect switch on back side of operator's house next to the outdoor unit. The HVAC system shall be powered from the Power Panel with an appropriately sized circuit breaker. HVAC system shall be provided with wireless remote control.

- 2.22 Closed Circuit Television (CCTV). The Contractor shall design and install a CCTV system in accordance with this special provision. It shall be arranged similar to that shown on the Plans. All materials must be new and must be manufactured and installed to the satisfaction of MaineDOT.
- A. A network video recorder (NVR) shall be provided that is capable of powering and operating a minimum of 6 IP cameras using Power over Ethernet (POE) CAT6 cables. The NVR internal memory shall allow a minimum of 48 hours of recording time for all cameras at 1080P resolution. The NVR shall be capable of displaying any number of cameras on the two separate monitors. NVR settings should be easily adjustable and provided with a suitable controller (mouse or other). The Contractor shall verify that the NVR is compatible the selected cameras and provide suitable operating power and data to the cameras without the use of separate POE injectors.
 - B. POE IP cameras shall be installed on the swing span and aimed toward the stop bars of each approach, up and down the swing span, and perpendicular to the swing span aimed toward approaching vessels. Cameras aimed toward the approach stop bars shall be varifocal with sufficient optical zoom to easily recognize vehicles at each approach stop bar (day and night). All cameras shall have electronic image stabilization. All cameras shall have 1080P minimum resolution and shall have low light capability (night vision). All cameras provided shall be weatherproof and capable of operating at -30 deg C to +50 deg C and include built-in heaters to prevent frost and icing. Contractor shall provide conduit to each camera to protect the CAT6 cables.
 - C. CAT6 cables shall be provided to each camera. CAT6 cables shall be installed in a continuous run between the NVR and each camera. No CAT6 cable splices are permitted. CAT6 cables shall be run in conduit
 - D. The CCTV system shall be provided with a suitable WiFi router for wireless local area network access from the Tender's shack using a computer, tablet, or smart phone.
 - E. Dual ceiling mounted monitors shall be provided which provide suitable image size for all cameras while minimizing the operator's view out the control house windows. Monitor resolution shall be 1080P minimum.
 - F. The entire CCTV system shall be powered from the control house GFCI receptacles. The Contractor shall provide suitable mount or shelf to contain the NVR and WiFi router.
 - G. Conduct operational tests of the complete installation under the supervision of the system vendor in the presence of MaineDOT (or designated

representative) to demonstrate to MaineDOT's satisfaction that all components and systems are installed, connected, and operate in accordance with the plans, special provisions, and approved shop drawings. Representatives of the manufacturers of CCTV equipment must be made available for adjustment or modification of their equipment, as needed, to the satisfaction of MaineDOT. Should the tests show any piece of equipment, in the judgement of MaineDOT, is defective or functions improperly, such adjustments and/or replacements must be made so as to make the installation satisfactory to MaineDOT.

2.23 Marine Navigation Lights.

- A. Pier 2 (pivot pier) navigation lights shall have a red, 180 degree viewing angle lens and lamp life not less than 50,000 hours. Fender lights shall meet 33CFR Subpart 66 standards. The fender lights shall be manufactured from light stabilized polycarbonate. New fender tip lights shall be approved equal to the SUN4-PL as manufactured by McDermott Light and Signal. New fender axis lights shall be approved equal to PLAT-LED with BGSOL-FLAT-PLATE with 30' (min) power cord as manufactured by McDermott Light and Signal. Each light and solar panel shall be provided with bird spikes.
- B. The existing red/green upper chord navigation lights, conduit and wiring shall be retained. Connections between existing wiring and the power panel shall be made using conductors sized to match the existing conductors. The existing red Pier 1 and Pier 3 navigation lights shall be retained. Conduit and wiring shall be replaced as shown in the plans. Connections to Pier 1 and Pier 3 navigation lights shall be made with three-conductor 12 AWG SEOW cord. One conductor shall ground the light housing.
- C. The contractor shall submit outline-dimensioned drawings of the new navigation lighting units, mounting details, and specification in the form of catalog cuts of proposed lights to be approved by the Department.

2.24 Span Drive Motor Drives.

- A. The Contractor shall furnish Flux Vector Drives (FVDs) with operating voltages and minimum current ratings as shown in these special provisions. FVD systems shall be built in accordance with UL508a standards.
- B. The FVD System shall be compatible with the squirrel-cage type, phasor-type construction, induction motor and shall be sized to ensure the motor full load amps (FLA) do not exceed the FVD continuous current rating. The flux vector drive shall meet the following criteria/specifications:
 - 1. Overload capacity of 200% for 28 seconds (from cold).

2. FVD shall be capable of operating with a supply voltage range of 200 VAC to 240 VAC $\pm 10\%$.
 3. The maximum continuous output current rating of the drive shall be no less than 30 Amps.
 4. The VFD shall be capable of providing 200% starting torque.
 5. The VFD shall utilize contactorless reversing controls.
 6. Speed regulation shall be 2% or better.
 7. FVD shall utilize sinusoidal PWM output modulation using insulated gate bi-polar transistors. Carrier frequency adjustable approximately 1 to 6 kHz.
 8. FVD shall utilize microprocessor-based control.
 9. Programmable parameters and at least the last four faults shall be stored in non-volatile memory.
 10. Operating modes fully programmable and selectable via external control inputs as required.
 11. FVD shall include built-in digital communications capability including Ethernet/IP or Modbus to enable set-up, configuration, and monitoring to be carried out with a PC or controller. Provide a copy of software (to be licensed to the Department along with all necessary cables, hardware, and manuals).
 12. FVD shall include a frame mounted keypad with backlit LCD display, useable for drive status monitoring and adjustment of all parameters. The keypad shall have a battery-operated real-time clock for accurate time stamping of events.
- C. Contractor shall provide a three-pole fuse block and fuses for each drive sized by the FVD manufacturer and installed in accordance with the Plans.
- D. Contractor shall provide three phase input line reactors and output load reactors for each drive which are UL recognized and sized by FVD manufacturer.
- E. Dynamic braking resistors sized by the drive manufacturer shall be provided. These shall provide braking torque of at least 150% rated motor full load torque on a 10% duty cycle (min). Resistors shall be mounted in a ventilated

stainless steel enclosure and provided with a normally closed thermal switch wired to the control system to initiate an FVD external trip in the event of a resistor overheat. The dynamic braking resistors shall be installed according to the Plans and the manufacturer's installation instructions.

- F. The FVDs shall load share in master/follower configuration with FVD 1 as the master and FVD 2 as the follower.
- G. FVD programmable inputs and outputs shall be in accordance with the Plans.
- H. FVDs shall be Unidrive M series drives as manufactured by Nidec or approved equal.

2.25 Barrier Gates. See Special Provision Section 527. The bridge control system shall interface with the barrier gates as shown in the Plans.

2.26 Warning Gong. See Special Provision Section 527. The bridge control system shall interface with the warning gongs as shown in the Plans.

2.27 Raceway/Wireways/Trough/Conduits.

- A. Install all wiring in conduit or raceways.
- B. Provide all conduits of standard weight, threaded, rigid steel conduit according to the requirements of ANSI Standard C80.1. Provide all conduits hot-dipped galvanized, inside and out, to meet the requirements of the above standard for protective coating. Make conduit couplings and fittings of malleable iron or steel, hot-dipped galvanized. See Miscellaneous Construction of MaineDOT Standard Specifications Section 626.
- C. Provide Electrical Metallic Tubing (EMT) hot-dipped and manufactured in accordance with U.L. 797 and to meet Federal Specifications WWC-563 (latest revision) and A.N.S.I. C80.3. Install in accordance with NEC Article 358.
- D. All conduits installed in outdoor locations are to be polyvinyl-chloride coated galvanized rigid metallic conduit (PVC-RMC). All coating shall be factory applied and purchased as PVC-RMC. Ensure conduit fittings, including couplings, unions, elbows, expansion and deflection fittings, and other items are also plastic coated. Provide conduits and fittings which are to be plastic coated with a factory applied PVC coating in the following manner. Coat the exterior of the galvanized rigid steel conduit or fitting with an epoxy acrylic, heat polymerizing adhesive. Bond a PVC plastic coating, 0.035 inch to 0.045 inch thick, to the outside metal surface the full length of the pipe, except for the threads. Ensure the plastic coating has an 85+ Shore A Durometer rating and conforms to NEMA RNI 1986 (Type A), ASTM D746, and Federal

Specifications LP406b, Method 2051, Amendment 1. Apply a 2-part red urethane, chemically cured coat to the interior of all conduit and fittings. Ensure this internal coating is a nominal 0.078 inch thickness and is sufficiently flexible so as to permit bending without cracking or flaking. Ensure the PVC coated, hot-dip galvanized steel conduit is UL labeled and listed.

- E. Coat all boxes and fittings, which serve as part of the raceway, with the same exterior PVC coating and red interior urethane coating. Ensure the plastic exterior coating and the red interior urethane coating are factory applied by the same manufacturer who produces the hot-dip galvanized conduit. Install PVC coated conduit according to the manufacturer's installation manual and using the tools recommended by the manufacturer. Repair all damaged PVC coating using the manufacturer's recommended products.
- F. Provide all installed conduit ends with insulated throat grounding hubs.
- G. All unions to connect sections of conduit that cannot be joined to each other or to boxes in the regular manner are to be made of malleable iron or steel, hot-dipped galvanized, PVC coated.
- H. Provide conduit (except for EMT) with a minimum of 1 inch diameter unless otherwise noted. Provide the interior surfaces having a smooth finish and free of burrs or projections which might cause injury to the cables. Ensure all conduits are free from blisters, cracks, or injurious defects. Ream conduits at each end after being threaded. Connect sections to each other with screw couplings made up so that the ends of both conduits will butt squarely against each other inside of the coupling. Install conduits so as to be continuous and watertight between boxes or equipment. Always protect conduits at all times from the entrance of water or other foreign matter by being well-plugged overnight or when the work is temporarily suspended.
- I. Make conduit bends and offsets by cold bending using Department approved methods and equipment. The use of a pipe tee or vise for bending conduit will not be permitted. Discard all conduit that have been crushed or in any way deformed.
- J. All bends are to be long sweep, free from kinks, and of such easy curvatures as to permit the drawing of conductors without injury. Make conduit runs with as few couplings as standard lengths will permit. Ensure the total angle of all bends between any 2 boxes or cabinets does not exceed 3 quarter bends, unless otherwise approved by the Department. The radius of curvature of pipe bends shall not be less than 8 times the inside diameter of the applied conduit. Long running threads will not be permitted. Install pull boxes wherever necessary to facilitate the installation of the wire.

- K. Exposed conduits are permissible within the control house but shall not interfere with placement of any equipment shown in the control house layout of the Plans, and shall not violate NEC working space requirements. Where conduits pass through the floors or walls of the house, provide with galvanized pipe sleeves for free passage of the conduits. After the conduits are installed, caulk the openings with an elastic compound and escutcheon plates provided on the interior walls, ceilings, and floors.
- L. Securely clamp and support the conduits at intervals not exceeding 6 feet in length, as required by NEC based on conduit diameter, or both.
- M. Securely clamp conduit runs exposed on the steel structure to the steel work. Ensure the clamps, in general, consist of clamps with back spacers attached to strut channel or structural steel supports bolted to the member. The minimum thickness of the structural supports shall be 3/8 inch. The use of J-bolts to fasten structural supports or to clamp conduits will not be permitted. Only PVC coated fasteners and supports provided by the conduit manufacturer shall be used in direct contact PVC-RMC.
- N. At any point where a conduit crosses an expansion joint longitudinally and/or laterally or where movement between adjacent sections of conduit can be expected, install conduit expansion/deflection fittings. Provide bronze expansion fittings with flexible bonding jumpers to maintain the electrical continuity across the joints. Ensure the fittings permit a total conduit movement of 4 inches and shall be AX/DX type by O.Z./Gedney, Spring City, or Crouse-Hinds, or approved equal.
- O. Make the flexible conduits for the connections between the rigid conduit system, all motors, and limit switches with sections of PVC coated, flexible, metallic, liquid tight conduit using a minimum length of 18 inches.
- P. Completely encase all conduit embedded in concrete, insofar as possible, with concrete at least 3 inches, measured in any direction, and hold securely in place during pouring and construction operations. Hold in place a group of conduits terminating together by template.
- Q. Assemble the conduit hand-tight and then using appropriate tools provided by or recommended by the conduit manufacturer, tighten 2 more turns. Touch up wrench marks or chuck marks with the manufacturer's provided touch-up compound. Perform all cuttings and threading as recommended by the conduit manufacturer. Mechanically join together all conduit enclosures and fittings to form a continuous electrical conductor to provide effective electrical continuity. Coat all exposed threads with conduit manufacturer's supplied coating material.

- R. Cap the ends of conduits under installation, spare conduits, empty conduits, and stubs during and after construction. Assure that no moisture or other matter is in or enters the conduits.
- S. Pitch all exterior conduits a minimum of 1 inch in 10 feet. Where conduits cannot be drained to pull boxes, install a drain "T" with drain fitting at the low point. Provide stainless steel drain fittings capable of passing 1.52 cubic inches of water per minute.
- T. Provide the ends of all conduits projecting into boxes and equipment enclosures with bronze insulated grounding bushings. Ensure the insulated portion is of molded phenolic compound, and each fitting has a screw type combination lug for bonding. Insulated bushings are to be O.Z./Gedney Type RBLG, Spring City Type GB, or approved equal. Bond together all bushings in all boxes or enclosures with No. 8 AWG bare copper wire.
- U. Carefully clean all conduits both before and after installation. Upon completion of the conduit and box installation, clear each conduit by snaking with a steel band and attach to it an approved tube cleaner equipped with a mandrel of a diameter at least 85 percent of the nominal inside diameter of the conduit and with a wire brush of the same diameter as the conduit. Then draw in the cables.
- V. Provide both ends of each conduit run, e.g. entry into enclosures, boxes, equipment fixtures, etc., with a brass tag having the same number stamped thereon according to the conduit diagrams. Securely fasten these tags to the conduit ends with No. 20 AWG brass wire.
- W. The wiring trough shall be NEMA 12, constructed of No. 12 gauge sheet steel with No. 10 gauge flanges suitably reinforced with structural steel angles, and welded continuously at all seams. Provide a gasketed removable cover on the front side to provide access to the interior. Secure covers by stainless steel screw clamps spaced no more than 8 inches apart. Support wireways and troughs every 5 feet. Provide details for hanging units as shown on the Plans.
- X. Paint the inside and outside of the wiring trough with 1 coat of primer followed by 1 coat of white enamel on the inside surfaces and 2 coats of gray enamel on the outside. Ensure the finish coat is ANSI 61 Light Gray. Support wireways from adjacent ceilings using stainless steel hanger rods and angles or as shown on the Plans.
- Y. Electrically connect all sections of each wireway and trough to form an electrical bond tied to the Bridge Grounding System.

2.28 Boxes.

- A. Provide terminal boxes of sufficient size to provide ample room for the terminal blocks, interior wiring, the installation of conduit terminations, and multiconductor cable fittings. Provide interior mounting buttons with tapped holes for mounting the terminal blocks.
- B. Stainless Steel Box. Ensure junction and terminal boxes and cabinets are NEMA 4X, 14-gauge, Type 316 stainless steel enclosures with hinged, 12-gauge stainless steel doors supported by a continuous stainless steel hinge with removable pin. Continuously weld seams and ground smooth. Provide each enclosure with stainless steel fast operating door clamp assemblies and oil-resistant gasket to ensure a watertight seal. Provide all boxes with breathers and drains. Ensure boxes and cabinets are Bulletin A51S and A4S with clamp assemblies A-L23SS as manufactured by Hoffman Engineering Company or a Department approved equal.
- C. Provide surface mounted interior and exterior boxes with external mounting lugs. Do not drill box for more conduits or cables than actually enter it. Provide exterior boxes with 1/2 inch combination drain and breather fittings.
- D. Provide terminal blocks in each terminal box for the connection of all conductors including spare conductors entering the box plus at least 10 percent spare terminals. Mount all terminal blocks and boards on suitable straps or structural steel brackets in such a manner as to permit routing the conductors behind the terminal blocks. Provide terminal blocks of 1 piece blocks suitable for use in highly corrosive atmospheres.
- E. Include power terminal blocks for wires No. 8 AWG and larger in each terminal box as required for such conductors. Provide each terminal consisting of a 1-piece power distribution block of molded phenolic compound. Provide a safety cover of insulating material for each block.
- F. Provide all exterior terminal and junction boxes with breathers, drains.

2.29 Submarine Cable Supports.

- A. The existing submarine cables shall be provided with a supporting and cabinet entry system specifically designed for armored cable of this type. The support shall be specifically designed to support armored submarine cable. It shall be fabricated from hot dipped galvanized malleable iron with multi-plate armor wrap. It shall be OZ Gedney type FS.
- B. The submarine cable cabinet entry fittings shall be hot dipped galvanized malleable or ductile iron designed to support and seal a single submarine cable. They shall be supplied with a locknut, a neoprene sealing ring specifically sized for the cable it is sealing, a lay-in-lug grounding lug, hot

dipped galvanized locking collar with pressure disc. It shall be OZ Gedney type GPE.

2.30 Hardware and Supports.

- A. Fabricate supports for conduits, cables, boxes, cabinets, disconnect switches, limit switches, and other separately mounted items of electrical equipment from structural steel a minimum of 3/8 inch thick. Include clip angles and other supporting members which are fabricated from structural steel plates and shapes and bolted to the structural members with the structural steel. Include all other supporting members under the electrical work.
- B. Provide structural steel brackets, boxes, and other equipment mounted on concrete surfaces with a full neoprene gasket at least 1/16 inch thick between the equipment and the surface of the concrete.
- C. Provide expansion anchors for fastening equipment or brackets to concrete surfaces of wedge type anchor bolts locked in place by an expansion wedge as the nut is tightened. Ensure all parts of the expansion anchors are of Type 316 stainless steel. Drill holes for the anchors to the size and depth recommended by the manufacturer using carbide tipped masonry drills.
- D. Provide stainless steel mounting bolts, nuts, washers, and other detail parts used for fastening boxes, disconnect switches, small limit switches, conduit clamps, cable supports, brackets, and other electrical equipment according to the requirements of ASTM Designation A276, Type 316. Provide hexagonal bolt heads and nuts with medium series lock washers. Do not use bolts smaller than 1/2 inch in diameter except as may be necessary to fit the mounting holes in small limit switches, boxes, and similar standard devices.
- E. Preformed metal framing channels, such as Kindorf, Unistrut, Superstrut, etc., used for mounting or supporting electrical equipment, conduits, or boxes shall be 316 stainless steel.

2.31 Wiring and Cables.

- A. Multiconductor cables shall be comprised of conductors listed below and containing a sunlight resistant and oil resistant jacket rated 90° C per UL Standard 1277 with minimum Flame-Spread Rating of 10-15 or higher, Class 1 in accordance with ASTM E84.
- B. Ensure all wires and their insulation and covering are of a nationally recognized brand with brand marks for identifying it. Individual conductors shall be provided with XHHW-2 insulation.

- C. Provide all wiring and cables according to the requirements of NEMA Publication No. WC 70. Before wire and cable orders are placed with any manufacturer, submit typical published test data for the type of insulation proposed showing that it meets the requirements of NEMA Publication No. WC7. Ensure all materials used to fabricate insulated wiring and cables are certified to be from stock not more than 1 year old.
- D. Provide all conductors consisting of stranded copper large enough to carry safely the maximum currents required without injurious heating or serious voltage drop. Ensure conductors for all motors and power circuits are not smaller than No. 12 AWG. Ensure all conductors are soft-annealed copper wire according to the requirements of NEMA Publication No. WC7. Ensure all conductors have Class B concentric stranding except for those in flexible cables.
- E. Provide a chemically cross-linked, polyethylene compound insulation according to the requirements of Part 3.7 of NEMA Publication No. WC7 with a thickness as required for 600 volts rated circuit voltage listed under Column B of Table 3-1.
- F. Provide bare, stranded, tin coated copper equipment ground conductors according to the requirements of NEMA Publication No. WC7, Part 2.
- G. Carry the circuits from the swing span to the pivot pier (Pier 2) with multiconductor bridge drag cables as shown on the Plans. The conductor sizes and number of wires shown on the Plans are the minimum permissible. Provide wiring and cables of sufficient size and number as may be required for the installation according to the wiring diagrams or approved working drawings.
- H. Do not install wiring in any conduit before all joints are made up tightly and the conduits rigidly secured in place.
- I. Draw the cables into conduits without injury to the wires or their insulation or covering. Leave sufficient slack in all cables to permit proper connections in boxes, cabinets, and enclosures.
- J. Permanently and clearly tag both ends of every single length of conductor according to the same numbers or designations appearing on the approved wiring diagrams.
- K. Neatly form conductors inside terminal boxes, the control console, and control panels into cables and lace with approved cable ties with the individual conductors leaving the cable at their respective terminal points. Loop these conductors to allow a minimum of 3 inches of free conductor when

disconnected. Hold the formed cables securely away from the terminals and from contact with the enclosure by means of approved insulating supports.

- L. Permanently mark each terminal of all terminal blocks to show the same number or designation as appears on the wire connected thereto.
- M. Splicing of wires will not be permitted except for wiring to service lighting fixtures and receptacles. Wherever it becomes necessary to join or branch conductors, use terminal blocks and clearly tag wires and terminal blocks.
- N. Secure multiconductor cables supported as shown on the Plans. Multiconductor cables not shown on the plans shall be supported on the steel work by bent plate cable clamps spaced not more than 5 feet on centers. Fabricate the cable clamps from galvanized steel or stainless steel plates bent to suit the cables outside diameters. In general, fasten the clamps to structural brackets bolted to the steel work.
- O. Where multiconductor cables enter cabinets or boxes, provide with watertight cable terminators. Ensure each cable terminator provides a watertight seal by compressing a tapered neoprene sealing ring around the outer jacket of the cable. Make cable terminator parts of bronze and be approved equal to the Series SF-327OB Watertight Cable Entrance Seals.
- P. Traffic signal wiring shall be in accordance with MaineDOT Standard Specifications Section 643.

2.32 Painting.

- A. Ensure the requirements for painting structural steel also applies to painting electrical equipment supports.
- B. Shop Painting. Electrical equipment such as conduits, boxes, supports, and other devices which have a galvanized finish and equipment such as motors, control desk, and control panel frames and enclosures which normally are given a factory finish need not be shop painted. Ensure all other electrical equipment is given one shop coat.
- C. Field Painting. Electrical equipment which is normally given a factory painted finish suitable to the Department need not be field painted. Ensure all other uncoated electrical equipment such as boxes, device enclosures, supporting clips and brackets, festoon cable connections, and other devices, is given 2 field coats of paint as specified under the requirements for painting structural steel. Before applying the 2 field coats, clean galvanized surfaces free of all grease, oil, dirt, and foreign material and etch with copper sulphate solution after which ensure the solution is applied. In lieu of etching and a coat of shop

paint, use galvanizing primer as a first coat for galvanized surfaces. Ensure the final field coat on electrical equipment is ANSI 61 Light Grey color.

2.33 Signal Horns. Contractor shall provide 2 resonator type signal horns with suitable mounts on the right side and left side of the control house as shown in the plans. The horns shall be powered with 120VAC from a dedicated circuit breaker on the power panel. The horns shall produce at least 105 dBA at 10', shall be UL certified, corrosion resistant, weatherproof, water and dust tight. The horns shall have operating temperatures of -37 deg C to 66 deg C. The signal horns shall be Federal Signal Model 55 or Department approved equal. The horn shall be controlled from a pushbutton on the Control Console as shown in the Plans.

2.34 Marine Radio – Communication with marine traffic will be by marine radio. The radio will be provided by the Department and is not in the Contractor's scope of supply.

2.35 Panel Factory Wiring.

A. Control Power wire.

1. Rating: 600V, 90°C, cross-linked polyethylene, Type SIS.
2. Conductors: Stranded copper, 14 AWG.

B. Analog signal cable.

1. Configuration: Twisted pair, shielded, and jacketed.
2. Insulation: 300V, 60°C, PVC, color-coded to permit identification of each conductor.
3. Conductors: Stranded copper, 18 AWG.
4. Shield: Metalized foil or tinned copper braid providing 100% coverage against noise together with 20 AWG stranded tinned drain wire.

C. Discrete signal wire.

1. Rating: 600V, 90°C, cross-linked polyethylene, Type SIS.
2. Conductors: Stranded copper, 18 AWG.

D. Encoder Cable.

1. To be provided by the encoder manufacturer.

2. Encoder cable shall be terminated at the encoder and at the FVD encoder terminals with no intermediate terminations.
 3. Encoder shields shall be terminated at the FVD only.
- E. Wires and cables shall be grouped and routed from terminal blocks to panel mounted instruments in separate raceway as follows:
1. Low-voltage/low current dc analog signals (30V/50mA or lower).
 2. High-voltage dc alarm signals (48V or greater).
 3. Low-voltage ac control signals (120V or lower).
 4. High-voltage ac power signals (greater than 120V).
- F. Terminal block requirements:
1. Type: High-density.
 2. Voltage: 600V.
 3. Wire range: 30 AWG to 12 AWG.
 4. Mounting: Rail-mounted with end anchors and barriers. All terminal strips shall be tagged with Multi-cable Tag Number, and each terminal shall be individually identified with a progressive number.
 5. Spare: Provide greater amount of 20% or 6 terminals per terminal strip.
 6. Install power distribution blocks to parallel feed to power control devices. Parallel wiring from instrument to instrument is not acceptable.
- G. Provide plug-in strip for ac supply power to devices requiring ac power via power cord.
- H. Circuit protection.
1. Install individual circuit breakers for protection of control panel power supply circuits as shown in the Plans.
 2. Group circuit breakers on separate terminal strip away from low voltage instrumentation circuitry.

3. Provide fuses for protection of individual instrumentation circuits. Instrumentation circuits for field-mounted instruments may be combined in logical groupings of no more than 10 devices/signals.
4. Provide 8 AWG internal copper grounding bus for ground connections.
5. Wire tags.
 - a. Type: Embossed, heat-shrink tubing. Fiber tape or any adhesive type tagging will not be accepted.
 - b. Color: White with black lettering.
 - c. Identify both ends of wires and/or cables with permanent wire marker.

2.36 Service Lighting.

- A. General. Assemble the service lighting fixtures listed in the material section of this specification for the bridge where required. Wire and install lighting fixtures, supports, brackets, and accessories as shown on the Plans.
 1. Methods of Wiring: Perform wiring as specified previously in this specification.
 2. Ground light fixtures according to the requirements of NEC Article 410.E.
- B. Recessed Fixtures. Support recessed fixtures from structural elements.
 1. Use mounting yokes provided with the fixtures. Use supports where required.
 2. Locate fixtures in center of panel where installed in modular tile ceilings, unless indicated otherwise. Refer to Reflected Ceiling Plan.
 3. Install suitable sealing gaskets where light leaks occur through gaps between the recessed fixture trim and adjacent surface.
- C. Exposed Fixtures. Install surface mounted and exposed fixtures as shown on the Plans.
 1. Hang suspended fixtures plumb, with continuous rows of fixtures in alignment.

2. Mount suspended fixtures in each room or area at the same height regardless of varying clear height conditions or as shown on the Plans.
 3. Install surface mounted fixtures drawn up tight against the substrate to eliminate gaps, except where NEC or local code restrictions require a separation between fixtures and substrate.
- D. Exterior Fixtures. Install exterior surface mounted and exposed fixtures as shown on the Plans. Ensure fixtures are factory equipped with waterproof gaskets and anodized aluminum frames or as shown on the Plans. Design to be completely waterproof, UL listed for wet locations.
1. Brackets: Match color to the light fixture. Provide outlet boxes, neoprene gaskets, and stainless steel hardware to render installation waterproof.
- E. Exit Sign/Emergency Lighting. Provide a UL 924 listed illuminated exit sign with emergency lights in the vicinity of the control house doorway. Exit sign shall be powered by 120VAC and have a battery backup providing exit sign and emergency light illumination for a minimum of 90 minutes. Exit sign shall have an AC indicator and test switch. Exit Sign/Emergency Light shall be powered from the power panel control house lighting circuit.
- 2.37 Surge Protective Device. The incoming power shall be protected with a surge protective device. It shall be a Type 2. It shall be mounted to or immediately next to the power panel. It shall be rated 120 to 600 VAC, 3 phase, 50 kA, in a NEMA 4X enclosure. It shall be Eaton Bussmann Catalog # BSPA050208Y85P or equal.
- 2.38 Nameplates. Provide nameplates for all devices and make of laminated phenolic plastic with white front and back and black core and not less than 0.094 inches thick. Etch lettering through the front layer to show black engraved letters on a white background. Provide lettering at least 1/4 inch high. Securely fasten nameplates to the equipment with stainless steel screws.
- 2.39 Equipment Signs. Provide all electrical devices, disconnect switches or cabinet equipment with a sign affixed to each unit. Provide the sign similar in construction to the aforementioned nameplates. Provide each sign of suitable size and letter characteristics. Ensure text indicates name and function of each item and also indicates if multiple power sources are present in the panel with instructions on where to turn them off. Securely attach signs using stainless steel screws. Submit to the Department all signs with size, location, and text.
- 2.40 Control Apparatus and Miscellaneous Equipment.

- A. Provide control apparatus according to the applicable requirements of NEMA, latest revision, Industrial Control and Systems, rated as shown on the Plans or as required, testing in accordance with NETA certification requirements for the control and miscellaneous apparatus.
- B. General Purpose Control and Power Switching Relays. General purpose control relays and relays for switching power circuits shall be UL listed NEMA type control relays. Relay contacts shall be field reversible cartridge type, number as required, plus at least one spare contact. Contacts shall be rated at least 10A at 300VAC. Relays shall include an LED indicator light, neon indicator light, or mechanical flag indicator for indicating when the relay is energized. General purpose control relays and power switching relays shall be Eaton-Cutler Hammer D26 Type M or Department approved equal.
- C. Time Delay Relays. Time delay relays shall be UL listed electronic time delay relays. Adjustment knobs shall be 1.5" diameter or larger, accurately time-calibrated, with high resolution markings. Time delays shall be as indicated on the Plans. Each timing relay shall be selected with a timing range such that the anticipated setting will be within 40%-60% of the full range. Relay identification information, screw terminals, and terminal markings shall be located on the front of the relay. Relays shall be of modular construction, with field replaceable coils and contacts. Coils shall be 120VAC, or as otherwise required. Contacts shall be rated at least 5A at 120VAC or higher as required by the application. Relays requiring sockets shall be provided with retainer clips. Time delay relays shall be Eaton-Cutler Hammer D26 Type M or Department approved equal.
- D. Selector Switches and Pushbuttons. Selector switches and pushbuttons shall be UL listed, size 30.5 millimeter, with operation as indicated on the Plans. Switches shall be of die cast metallic construction with corrosion resistant plating, rated NEMA 4X. Contact blocks shall be screw down stackable type. Contacts shall be rated 10A at 120VAC. Terminals shall be corrosion resistant screw type. Legend plates shall be as indicated on the Plans. The Emergency Stop pushbutton shall be a mushroom head push-pull maintained button. All other pushbuttons shall be momentary. Selector switches and pushbuttons shall be Square D 9001K series or Department approved equal.
- E. Pilot Lights. Pilot lights shall be UL listed and as indicated on the Plans. Pilot lights shall be 30.5 millimeter, NEMA 4X rated. Pilot lights shall be dual input remote test with LED lamps. Lenses shall be interchangeable rugged Lexan type. Legend plates shall be as indicated on the plans. Pilot lights shall be Square D 9001K series or Department approved equal.

2.41 Spare Parts. Provide the following spare parts:

- A. Span motor vector drive.

- B. 2 packages of 6 fuses of each kind and size installed.
- C. For rotary limit switches, provide a total of 8 contact assemblies. For limit switches without replaceable contacts, provide a complete switch.
- D. One set of contacts and contact fingers for each type of contactor and starter installed. Provide an additional set for every 5 of each type. Note: For units that do not incorporate replaceable contacts provide a complete unit with coil.
- E. 1 coil for every 5 or less of each size relay/contactor and motor starter installed.
- F. 1 complete relay, timer, contactor, and starter for each unit or fractional unit of 5 or less of each kind and size installed.
- G. 3 heaters for overload relays of each size installed.
- H. 1 complete navigation light of each type supplied.
- I. For the control console:
 - 1. 12 indicating lamps for each type and voltage.
 - 2. 1 package of 6 meter lamps of each kind installed.
 - 3. 2 lens caps of each color.
 - 4. 1 lens for each console unit.
 - 5. One complete unit for each type of indicating light and pushbutton used.
- J. 1 of each size and type of service lighting fixture installed.
- K. 1 position transmitter of each type used.
- L. 1 of each size and type of service lighting fixture installed, 1 of each type lens.
- M. 1 LED dimmer switch for the operator's house light.
- N. 1 span drive motor encoder.

PART 3 – EXECUTION

3.01 Submittals.

- A. Shop and Working Drawings. Submit for review within 120 days after the award of the Contract. The electrical work may not proceed without approved shop and working drawings. Any work performed before all required submissions being returned approved will be considered unauthorized and will be at the Contractor's risk of being rejected. Shop and working drawings shall consist of, but are not limited to, the following:
1. Certified dimension prints of all motors, limit switches, and other electrical apparatus external to the control console, control panel, panelboards, etc.
 2. A complete schematic wiring diagram including all power, control, lighting and convenience connections. Identify both electrical devices and each wire between devices by an individual unique designation of letters, numbers, or a combination of both. Use such designations wherever the devices or wires appear on other drawings. Include a complete set of fully edited catalog cuts for materials provided for review at the time of schematic submittal. Editing shall remove or strike through all material that is not relevant.
 3. At the time of schematic submittal, submit a complete set of fully edited catalog cuts for review of materials provided.
 4. Circuit breaker coordination charts, fault calculations, and frame and trip size calculations.
 5. Layout drawings and internal connection diagrams of the control console, control panels, lighting, heating, communication, and alarm equipment.
 6. A schedule of electrical apparatus which lists each electrical device by its designation as shown on the schematic wiring diagram and states for each device its rating, number of poles or contacts, function, catalog number, and location.
 7. A complete interconnection diagram(s) for all electrical apparatus and equipment, lighting, heating, communication, and alarm equipment. Provide diagram(s) that show the external connections of all devices and equipment. Computer-generated interconnection lists will not be acceptable in lieu of a true interconnection diagram.
 8. Layouts and calculations of the braking resistors for the span drive motors, together with load calculations and construction details.
 9. Outline drawings of all electrical components and cabinets.

10. A complete schematic conduit and cable diagram of all devices and equipment, including conduit wireway, drag cables, submarine cables and junction boxes, and showing all multiconductor cables for all lighting, heating. Show the size of each wireway and conduit, and identifications, the wire number of each conductor in the conduit including multiconductor cables on the diagrams.
11. A complete set of layout and installation drawings for the electrical work showing the location and installation, including support and mounting details, of all electrical and control apparatus and equipment, lighting, heating, communication, and alarm equipment, etc. including conduit physical layouts. Ensure these drawings are made to scale and show the exact location of all conduits, cables, wiring ducts, boxes, motors, brakes, limit switches, disconnect switches, and other electrical equipment as well as the method of supporting them on the structure.
12. Construction drawings of all multiconductor cables, including the sizes of conductors, type, and thickness of insulation, jackets, and other components, and giving the outer diameter of each finished cable.
13. Complete detail and procedures for the re-termination of the submarine cables.
14. Outline drawings and mounting details of all navigation aids including, but not limited span lights, fender lights and air horns.
15. Catalog cuts of lighting fixtures, switches, outlets, and electric heating equipment.
16. Arrangement of service and maintenance light wiring and fixtures, including service outlets, showing all conduits, boxes (including their support), and wiring.
17. Arrangement of conduits, wiring, and equipment for the electric heating and air conditioning units for the control house.
18. Detail drawings showing the construction and mounting details of all wiring troughs and raceways.
19. A complete list of all spare parts provided as part of the contract. The list shall be fully documented with manufacturer, model or item number, what installed items are replaced or renewed by each item and

any additional information which may be needed to fully identify the component.

20. Details and catalog cuts of the fire alarm system including detectors, annunciators, and alarms.
21. All other drawings which, in the opinion of the Department, are necessary to show the electrical work.
22. All layout and installation drawings for the electrical work before the submission of pertinent working drawings for the structure so that provision for mounting of conduits, cables, and other electrical equipment, where required, can be shown on the structural working drawings.
23. Certified dimension prints of the apparatus state in the certification the name of the job, the application of the apparatus, device designation, number required, right-hand or left-hand assembly, electrical rating, number of poles or contacts, material, finish, and all other pertinent data to show that the apparatus meets the specified requirements.
24. Upon completion of the work, correct all working drawings, including all working drawings submitted by the electrical system Vendor, to show the work as constructed. In addition, submit all as-built working drawings submitted by the electrical system Vendor, including all electrical schematics, ladder diagrams, system documentation, dimension drawings of equipment, and devices, in a computerized file form as well as PDF and Microstation files.
25. For inspection and test, if directed by the Department, samples of all apparatus or devices which are proposed to be used as part of the electrical installation.
26. Interconnection diagrams between equipment assemblies, and external interfaces, including power and control conductors. Include for enclosures and external devices.
27. Installation drawings with FVD and motors indicated. Indicate ventilation requirements, adequate clearances, and cable routes.
28. Schedule of equipment supplied. Schedule shall provide a cross reference between manufacturer data and identifiers indicated in shop drawings. For complete assemblies, such as FVD, provide the serial numbers of each assembly, and a sub-schedule of components within the assembly. Show circuits and device elements for each replaceable module.

29. Recommended spare parts listing for each assembly or component.
30. Installation instructions issued by the manufacturer of the equipment, including notes and recommendations, prior to shipment to the site. Provide operation instructions prior to acceptance testing.
31. Factory Test Plan and Test Reports. Submit within 7 working days of delivery to the project site.
32. Operation and Maintenance information and Data.
33. Complete technical product description including bill of materials, software, and a complete list of options provided with the drives.
34. Outline dimensions, conduit entry locations and weight.
35. Schematic and wiring diagrams.
36. Parameter programming.
37. Data indicating compatibility with motors being driven.
38. Manufacturer's Installation instructions.
39. Provide service and maintenance information including preventive maintenance, assembly, and disassembly procedures. Include electrical drawings from electrical general sections. Submit additional information necessary to provide complete operation, repair, and maintenance information, detailed to the smallest replaceable unit.
40. Copies of as-built submittals.
41. Routine preventative maintenance instructions, and equipment required.
42. Instructions on how to adjustment, trouble-shooting, configuration, modify program settings, and modify the control program.
- 43 FVD Specific Shop Drawings. The FVD shall be manufactured by a company with at least ten (10) years of experience in the production of this type of equipment. The manufacturing facility shall be ISO 9001 and ISO 14001 certified. All printed circuit boards shall be completely tested before being assembled into the complete FVD. The FVD shall

be subjected to a functional test and load test. The load test shall be at full rated load.

- A. Submit complete wiring diagrams, dimensional drawings transformer data and connection diagrams.
- B. Customer connection and power wiring diagrams.
- C. Compliance to IEEE 519 B harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD). The FVD manufacturer shall provide calculations; specific to this installation, showing total harmonic voltage distortion is less than 5%. Input line filters shall be sized and provided as required by the FVD manufacturer to ensure compliance with IEEE standard 519.

3.02 Examination.

- A. Verification of Conditions. Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
- B. Visually inspect substrate in presence of a Department representative.
- C. Inform Department of unacceptable conditions immediately upon discovery.
- D. Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Department representative.

3.03 Installation.

- A. Delivery and Storage. Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.
- B. The electrical work shall be installed as indicated on the Plans and in accordance with approved shop drawings and manufacturer's recommendations.
- C. All associated construction and installation work shall be installed using good installation judgement and in accordance with all prevailing national and local codes and ordinances.

3.04 Tests, Inspections, and Verifications (Bridge Control System).

A. Factory Inspection and Testing (General).

1. Ensure the control cabinets, control console, and other apparatus fabricated or assembled by the control system Vendor are subject to shop inspection to demonstrate compliance with all specified requirements. The inspection is intended as a means of facilitating the work and avoiding errors. It is expressly understood that the inspection will not relieve the Contractor of responsibility for imperfect material or workmanship. The assembled system may be subject to multiple witnessed tests as required by the Department.
2. Assemble all of the control cabinets, control console, motor drives, actual bridge motors with all required interfacing equipment, limit and cam switches and resolvers, simulated traffic control equipment, and temporarily interconnect for operational testing at the shop of the control system Vendor. Ensure the testing demonstrates proper operation of all bridge controls, drives, and auxiliary equipment according to specified requirements for system functioning. If necessary, provide portable generator to power the span drive motors.
3. Provide the testing plan including testing forms, acceptance criteria and equipment included in the testing to the Department for review and acceptance. The Department and/or Department's representative will witness all tests and special tests required.
4. Do not ship any equipment from the factory until it has been released for shipment by the Department. Provide notification a minimum of 21 day notice in advance of the date of the tests so that arrangements can be made for the Department to be present at the tests.
5. During the witnessed inspection also check for conformity all nameplate legends, conductor identifications, instrument scales, escutcheon plate engraving, and all other details of construction.

B. Manufacturer's Field Start-Up Service.

1. Provide all necessary field supervisory start-up time by the manufacturer's service engineering department to facilitate proper adjustment of all lighting, heating, communication, alarm equipment, and the bridge controls equipment so as to achieve satisfactory functioning of the drives.
2. Ensure the manufacturer's field service engineering personnel are experienced in the adjustment and functioning of all control equipment. Ensure the personnel are capable of locating and correcting

faults or defects and of obtaining from the manufacturer, without delay, new parts or replacements for apparatus that, in the opinion of the Department, does not perform satisfactorily.

- C. The Vendor shall be responsible for all the necessary tests of the electrical and control system, both Factory Acceptance Test (FAT) and the Site Acceptance Test (SAT). Testing shall include both hardware and software items included in its scope of supply.
- D. Testing shall include all system hardware and any other external device. Testing shall also include complete integrated testing of the interfaces including field devices, relay panel(s), machinery control equipment, and operator control console.
- E. Testing shall include functional tests of all logic blocks, including all associated interfaces with the operator console. All testing is to be carried out to show that the system operates correctly and in compliance with the provided logic drawings, ladder logics, block diagrams.
- F. In the event testing is interrupted for repairs or modification of the Bridge Control System, the Contractor / Department may require testing be restarted completely.
- G. Vendor shall provide all necessary test equipment and software including any special software or hardware required for a complete functional test of the system.
- H. Vendor shall clear and Contractor shall re-test and approve all punch list items before the Bridge Control System may be released for shipping. In presence of any pending punch list, the advanced shipping may be authorized by the Contractor only with the approval of the Department.
- I. The Vendor shall provide the necessary assistance to co-ordinate the field tests, to supervise the commissioning and start-up activities, to perform the training activities applicable for the package.
- J. Department and Contractor may attend all of the tests. Any limitation on time required for the tests is not accepted: any test is considered ended if and only if completed in every part as determined by the Department.

3.05 Factory Acceptance Tests (FAT).

- A. The electrical testing shall consist of factory testing of the major items of variable frequency drives, span drive motors, control panels, and simulated field devices as an integrated system. These tests shall be conducted by the equipment manufacturer and witnessed by the Department as specified herein.

The manufacturer shall submit test certificates and supporting data corroborating that the testing was performed and successfully completed in accordance with this specification. The testing shall be conducted at the manufacturer's plant or as elsewhere approved by the Department. The manufacturer shall submit his test procedures to the Department for approval prior to conducting the tests that would constitute acceptance of the manufactured equipment.

- B. The following separate items of equipment shall be factory tested in the presence of the Department:
 - 1. Span motor and variable frequency drive controller tested under load at either the motor manufacturer or the drive manufacturer's facility or some of the third-party independent testing companies' facility to be approved by the Department. The load testing shall conform to that described herein and include dynamometer testing.
- C. The factory testing of each system shall consist of completely wiring and cabling the systems as defined on the approved shop drawings in preparation for the tests.
- D. Performing complete functional tests shall be in accordance with Contractor provided, Department approved test procedure with test forms.
- E. The control system functional tests shall verify the bridge operating sequences for all modes of operation and prove the relay logic is in accordance with the specified sequence and the correct functionality of all control system permissive interlocks.
- F. The motor/drive combination shall be factory tested to verify and document that the combination meets all operating loads and duty cycle specified.
 - 1. The tests shall also include the determination of the variation in speed and motor currents with motor torques from zero to the maximum designed torque for the drive system. The speed-current-torque curve shall also be determined for overhauling torque and include the effects of the motor control equipment on imposed overhauling loads. None of these curves developed by the manufacturer's computer program simulation will be accepted in lieu of actual load tests. Note all tests shall be performed using the integrated motor and variable frequency drive controller combination and drive system shall be tested and coupled to dynamometers to simulate the load of the bridge and also to simulate out of balance conditions to prove the integrity of the proposed load sharing control. These tests shall,

in every respect, prove the ability of the combination to achieve the herein drive motor performance.

2. These tests shall be witnessed by the Department and the Department shall be given at least three (3) weeks advanced notice of the scheduled tests.
- G. The FAT will include all the equipment and developed software within Vendor scope of supply, as well as the integration with other subsystem supplied by different Vendors.
- H. Schedule and testing procedures shall be submitted to the Contractor/Department as early in the design as possible, but not less than 30 days prior to test. After schedule approval, at least 4 weeks prior to the start of testing, the Vendor shall provide the following documentation:
1. Detailed FAT procedure with test forms.
 2. Full documentation concerning hardware.
 3. Full documentation concerning drive parameter configuration complete with relevant comments.
 4. Records of all tests previously performed by the Vendor.
 6. Records of power-up of all Relay Control System components.
- I. This documentation, even if not issued as final review, shall be completed and detailed.
- J. Department may ask to postpone the starting date of FAT if any material omissions or relevant errors in the documentation are not corrected.
- K. Prior to the FAT all the necessary equipment shall be fully assembled, wired and connected in order to test all the functionality of the supply.
- L. The Vendor shall organize the testing activities and make available all the assistance and equipment necessary so that the testing activity proceeds as quickly as possible. Location, staff and equipment to perform the test are completely at Vendor's expense.
- M. During the test, all the mentioned documents shall be available.
- N. The control system shall be installed in its final configuration and mainly the following items shall be tested:
1. Hardware components and power supply.

2. Visual check in order to verify the equipment quantities and conformity to drawings and contractual characteristics, identification tags, safety coverings, cable run, interconnection between panels, etc.
 3. Project documentation check.
 4. Insulation resistance and dielectric test of components.
 5. Redundancy systems test.
 7. Test of loss of power and subsequent power up.
 8. Relay Control System diagnostic.
 9. Application software.
- O. As a general statement, 100% of hardware (spares included) and application software shall be tested. In order to facilitate the tests, the Vendor shall provide all the needed equipment to simulate digital/analogue inputs, to check the status of digital/analogue outputs and to simulate serial link communication.
- P. All the anomalies, defects or changes will be reported and corrected by the Vendor before the end of testing or, at least with the Department approval, before shipment. Contractor shall re-test and approve all punch list items before the Bridge Control System may be released for shipping. If during the test activity problems occur so that it will be difficult to continue, in the opinion of the Department's personnel, the testing will be interrupted until the Vendor remedies to these problems. In the event testing is interrupted for repairs or modification of the Bridge Control System, the Department or Contractor may require testing to be restarted from the beginning.
- Q. A check list shall be issued during the FAT at Vendor's workshop. Detailed check list shall be prepared by the Vendor and included in the FAT procedure. Other tests can be required according to the project needs and will be defined by the Department.
- R. Positive result in the test does not release the Vendor from his responsibilities to provide a system completely working and to perform all the modification, which could be necessary to assure system correct working in the field.
- S. After successful completion of the FAT, the FAT completion report shall be signed by the Vendor and Contractor/Department.

T. A final report shall be issued at the end of FAT, highlighting possible reservation as far the Contractor/Department are concerned; shipment authorization will be generally issued by the Contractor only after the complete solution for the pending reservation.

U. FVD Test (FAT and SAT).

1. A proposed test plan shall be submitted to the Department at least 28 calendar days prior to proposed testing for approval. The Department and/or Department's representative reserves the right to witness all tests and review any documentation. The contractor shall inform the Department and/or Department's representative at least 14 working days prior to the dates of testing.

2. Performance Verification Tests (FAT and SAT)

a. Performance Verification Test plan shall be provided by the Control System Vendor at least 60 days prior to the planned testing. It shall provide the step-by-step procedure required to establish formal verification of the performance of the FVD. Compliance with the specification requirements shall be verified by inspections, review of critical data, demonstrations, and tests. The Test Plan may be modified by the Department with the revised testing performed at no additional cost to the Department.

b. The Department and/or Department's representative(s) reserves the right to witness all tests, review data, and request other such additional inspections and repeat tests as necessary to ensure that the system and provided services conform to the stated requirements. The contractor shall inform the Department and/or Department's representative(s) at least 14 calendar days prior to the date the test is to be conducted.

V. Span Motor Tests (FAT and SAT).

1. Both span motors are to be subject to a complete test and include determination of efficiency and power factor at 50, 75, 100, 150, and 175 percent of full load in addition to breakdown load. In addition, determine complete speed-torque-current curves by test over the same torque range and in both motoring and braking modes.

2. In addition to the complete testing, test the motors to determine the power input in kw versus the output torque in pound foot for intervals from no-load to full-load torque (0, 25, 50, 75, and 100 percent).

3. Prepare a complete set of speed-torque-current curves for each span motor and submit to the Department. Ensure the curves cover the interval from 200 percent braking torque to breakdown driving torque, referred to full-load motor torque.
4. Include an insulation resistance test for both span motors. Include insulation resistance values, test voltage, temperature and humidity on the test report. Test between each lead and ground.
5. Report tests on the standard forms for induction motors of the National Electric Manufacturers Association and IEEE. In addition to any other format as necessary to provide complete information. Certify all test reports and curve sheets and submit 7 copies of each. Do not ship motors from the plant of the manufacturer until the test reports have been approved by the Department.
6. Both motors to be given a full load heat run with the complete IEEE test with speed/torque/current curves submitted with all test results for approval. Submit motor outline drawing, specification, and test results before shipping. Ensure testing is witnessed by the Department or a representative of the Department.

3.06 Site Acceptance Test (SAT) and Commissioning Assistance. Prior to the full Bridge Control System Site Acceptance test, all control house mounted bridge control equipment shall be completely inter-wired, powered and pre-tested to the maximum extent possible before the house is hoisted prior to being set in place. The testing procedure shall be sent to the Department for review at least 30 days prior to starting the work.

- A. The Site Acceptance Test is intended to verify that the system, as accepted at FAT completion, will still perform on site as per specification after the shipment. This test will be performed after erection and wiring.
- B. It shall fully cover all the functionalities of the Bridge Control System, Traffic Control System and all the auxiliary systems.
- C. The other checks shall be repeated as "Sample", with an extent suitable to demonstrate that the system has been properly restarted and the configuration correctly reloaded as required and accepted by the Department.
- D. Vendor's technicians shall be on site during field test to perform the test and solve any problem that could arise.
- E. Before performing the test, Vendor is asked to issue and submit for Contractor/Department approval, a Site Acceptance Test Procedure complete

with check-lists identifying each test to be performed. It shall be submitted at least 30 days prior.

- F. The Vendor's minimum responsibilities for tests, startup, and commissioning activities are as follows:
1. Check of installed equipment (quantity, quality).
 2. Check of insulation of cables and equipment.
 3. Check of cables for continuity and conformity to drawings.
 4. Switch on operating voltage to equipment after checking protection settings.
 5. Calibration of all adjustable monitoring equipment.
 6. Calibration and proper operation checkout of all field equipment: controls, local commands indicators and actuators.
 7. No load tests (with the machines energized).
 8. Check of direction of rotation of the machines.
 9. Check of machine power consumption and protection settings.
 10. Calibration and check the proper operation of the electrical controls, which are possible only when the equipment is running.
 11. Complete operation of every system, sequence, interlock, bypass and manual operation of individual systems and the complete system.
- G. Vendor shall have at their disposal all the necessary equipment for testing and put the system into service.
- H. The commissioning and system tests include the download of the final hardware/parameter configuration.
- I. Any drive parameter change required by Contractor on site and implemented by Vendor personnel shall be considered part of the Site Acceptance Test scope of work.
- J. Delivery and Storage. Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

3.07 Maintenance and Warranty.

A. Maintenance.

1. Support during the warranty period - The Contractor shall provide on-site, on-call maintenance services by Contractor personnel on the following basis:
 - a. The service shall be on a per-call basis with 8-hour response. Contractor shall support the maintenance of all hardware and software of the system. Various personnel of different expertise shall be sent on-site depending on the nature of the maintenance service required.
 - b. Costs shall include travel, local transportation, living expenses, and labor rates of the service personnel while responding to the service request.
 - c. The provisions of this Section are not in lieu of, nor relieve the Contractor of, warranty responsibilities covered in this specification. Should the result of the service request be the uncovering of a system defect covered under the warranty provisions, all costs for the call, including the labor necessary to identify the defect, shall be borne by the Contractor.

B. Warranty. The complete system shall be warranted by the manufacturer for a period of two years from bridge final acceptance, or the contracted period of any extended warrantee agreed upon by the contractor and the Department, after successful completion and the Department's acceptance of the acceptance test results. Any component failing to perform its function as specified and documented shall be repaired or replaced by the contractor at no additional cost to the Department.

C. Performance warranty.

1. If a failure of performance achievement occurs, the Vendor shall provide all the necessary action to satisfy with this specification requirements including addition or replacement of system components, system reconfiguration, etc.
2. Provide extended warranty for controller equipment, software and firmware supplied. Warranty shall provide replacement parts and software and firmware maintenance for installed system to Department for period extending through start-up and acceptance period of the project and for period of 2 additional years.

3.08 Training. Vendor shall provide training course to instruct the operator and maintenance personnel on the main operation and maintenance. The Vendor shall submit the courses contents to the Contractor and the Department for approval prior to the training courses being held. The training shall include all aspects of the equipment and control of the bridge systems including technical knowledge of all systems and troubleshooting of all systems.

A. Maintenance Personnel Training.

1. Coordinate training requirements with the Department for up to 8 maintenance personnel.
2. Provide the services of competent instructors who will give full instruction to designated personnel in operation, maintenance, calibration, configuration, and programming of the complete control system. Orient the training specifically to the system installed.
3. Instructors shall be thoroughly familiar with the subject matter they are to teach.
4. The number of training days of instruction furnished shall be 4 but not necessarily contingent. A training day is defined as eight hours of instruction, including two 15-minute breaks and excluding lunch time; Monday through Friday.
5. Provide a training manual for each student at each training phase which describes in detail the material included in each training program. Provide one additional copy for archiving.
6. Provide equipment and materials required for training. Unused copies of training manuals shall be turned over to the Department at the end of last training session.
7. Contractor shall provide video recordings, if available, of all training provided to the Department for subsequent use in training new personnel. All training aids, texts, and expendable support material for a self-sufficient presentation shall be provided.

B. Operating Personnel Training Program.

1. Provide one 4-hour training session at the site at a time and place mutually agreeable between the Contractor and the Department.

2. Provide session to train 4 operation personnel in the functional operations of the system and the procedures that personnel will follow in system operation. This training shall include:
 - a. System overview.
 - b. General theory of operation.
 - c. System operation.
 - d. Faults.
 - e. Failure recovery procedures.
 - f. Troubleshooting.

3.09 Cleaning.

- A. Progress Cleaning. Leave work area clean at end of each day.
- B. Final Cleaning. Upon completion remove surplus materials, rubbish, tools and equipment.
- C. Waste Management: Separate waste materials for reuse and recycling. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

Part 4 - MEASUREMENT AND PAYMENT

4.01 Method of Measurement and Payment.

- A. The Contract Lump Sum (LS) Amount shall include all costs associated with the control system demolition, procurement, installation, testing, commissioning, training, warranties, and documenting as required per the control system design requirements and as specified herein.
- B. Payment will be under the Contract Lump Sum Amount and such payment shall be full compensation of all labor, equipment and materials necessary to complete the work.

4.02 Items of Payment. Items of payment are broken as follows:

<u>Bid Item Description of Item</u>	<u>Unit</u>
655.3002 BRIDGE CONTROL SYSTEM	LS
END OF SECTION	

Date: 9/22/2022

Username:

Division: HIGHWAY

Filename: ... \BRIDGE\MSTA\002_Notes_01.dgn

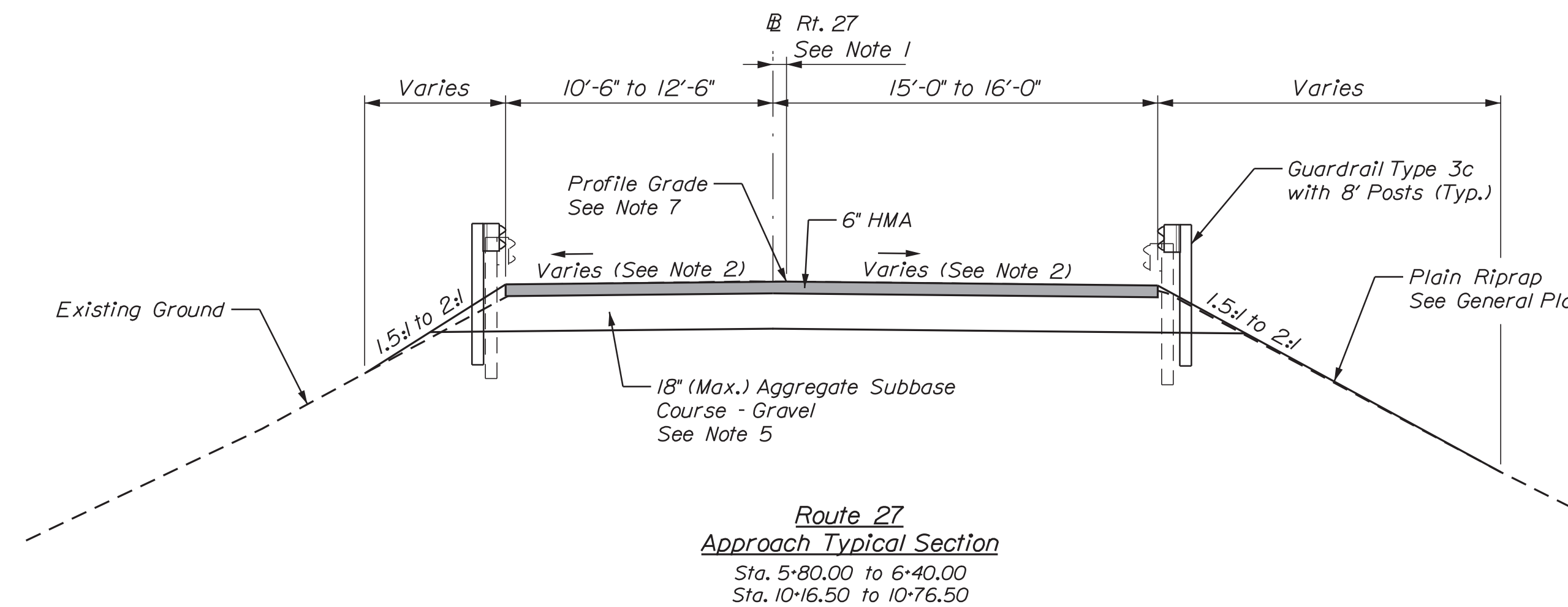
ESTIMATED QUANTITIES			
ITEM NO.	DESCRIPTION	QUANTITY	UNIT
202.01	Removing Structures and Obstructions, Existing Fender System	1	LS
202.01	Removing Structures and Obstructions, Existing Steel Grid Deck	1	LS
202.08	Removing Building No. 1 - Control House	1	LS
202.12	Removing Existing Structural Concrete	5	CY
202.27	Existing Machinery Removal and Demolition	1	LS
202.56	Remove Existing Advance Warning Beacon	2	EA
202.57	Removing Existing Warning Gate, Bridge Mounted	2	EA
202.57	Removing Existing Warning Gate, Foundation Mounted	2	EA
203.20	Common Excavation	270	CY
203.35	Crushed Stone 3/4-inch	5	CY
206.082	Structural Earth Excavation - Major Structures, Plan Quantity	20	CY
304.10	Aggregate Subbase Course - Gravel	110	CY
403.208	Hot Mix Asphalt, 12.5 mm Nominal Maximum Size	30	TON
403.213	Hot Mix Asphalt, 12.5 mm Nominal Maximum Size (Base and Intermediate Base Course)	90	TON
409.15	Bituminous Tack Coat, Applied	32	Gal
501.239	Dynamic Loading Tests - Providing For	4	EA
501.48	Steel H-beam Piles 74 lb/ft, Delivered	4750	LF
501.481	Steel H-beam Piles 74 lb/ft, In Place	4750	LF
501.90	Pile Tips	50	EA
501.91	Pile Splices	50	EA
501.92	Pile Driving Equipment Mobilization	1	LS
502.219	Structural Concrete, Abutments and Retaining Walls	5 CY	1 LS
502.26	Structural Concrete Roadway and Sidewalk Slab on Steel Bridges	130 CY	1 LS
502.291	Saw Cut Grooving	5,100 SF	1 LS
502.49	Structural Concrete Curbs and Sidewalks	3 CY	1 LS
503.12	Reinforcing Steel, Fabricated and Delivered	34600	LB
503.13	Reinforcing Steel, Placing	34600	LB
503.17	Mechanical/Welded Splice	685	EA
504.70	Structural Steel Fabricated and Delivered	90,000 LB	1 LS
504.71	Structural Steel Erection	90,000 LB	1 LS
505.08	Shear Connectors	3,700 EA	1 LS
506.1705	Surface Preparation of Existing Structural Steel	1,500 SF	1 LS
506.1775	Field Painting, New and Existing Steel with Zinc Rich Paint	1	LS
507.0841	Steel Pipe Hand Railing	300 LF	1 LS
507.13	Temporary Bridge Rail	370	LF
515.21	Protective Coating for Concrete Surfaces	1,150 SY	1 LS
518.50	Repair of Upward Facing Surfaces - to Reinforcing Steel < 8 inches	50	SF
518.60	Repair of Vertical Surfaces < 8 inches	250	SF
518.70	Repair of Overhead Surfaces < 8 inches	50	SF
526.301	Temporary Concrete Barrier, Type I	610 LF	1 LS
526.305	Temporary Concrete Barrier, Braced Type I	370 LF	1 LS
526.34	Permanent Concrete Transition Barrier	4	EA
528.01	Structural Timber, Fabrication and Delivery	89,100 BF	1 LS
528.02	Structural Timber, Erection	89,100 BF	1 LS
530.02	Prefabricated Deck Panels	4900	SF
606.1722	Bridge Transition - Type II	6	EA
606.25	Terminal Connector	2	EA
606.55	Guardrail Type 3 - Single Rail	210	LF
609.11	Vertical Curb Type I	40	LF
610.08	Plain Riprap	115	CY
626.11	Precast Concrete Junction Box	2	EA
626.22	Non-Metallic Conduit	450	LF
626.221	Non-Metallic Conduit Concrete Encased	125	LF
626.251	Non-Metallic Under Pavement Conduit (Sch. 80 or Greater)	40	LF
626.43	30-inch Diameter Foundation 626.44 36-inch Diameter Foundation	28	LF
626.451	42-inch Diameter Foundation	47	LF
627.733	4" White or Yellow Painted Pavement Marking Line	650	LF
627.75	White or Yellow Pavement & Curb Marking	50	SF
629.05	Hand Labor, Straight Time	20	HR
631.10	Air Compressor (Including Operator)	12	HR
631.11	Air Tool (Including Operator)	12	HR
631.12	All-Purpose Excavator (Including Operator)	12	HR
631.172	Truck-Large (Including Operator)	12	HR
639.18	Field Office Type A	1	EA
643.01	Traffic Signals and Gates, Movable Bridge Hybrid Warning and Resistance Gate	1	LS
643.60	Flashing Beacon at Eastbound Approach	1	LS
643.60	Flashing Beacon at Westbound Approach	1	LS
643.72	Temporary Traffic Signal	1	LS
643.80	Traffic Signals at Southport Bridge Route 27 over Townsend Gut	1	LS
643.92	Pedestal Pole	1	EA
643.94	Dual Purpose Pole with 35' Warning Beacon	2	EA
643.97	Wood Poles with Guys and Span Wire	1	EA
652.33	Drum	20	EA
652.34	Cone	20	EA
652.35	Construction Signs	300	SF
652.361	Maintenance of Traffic Control Devices	200 CD	1 LS
652.38	Flaggers	560	HR
655.3002	Bridge Control System	1	LS
659.10	Mobilization	1	LS
660.21	On-The-Job Training	1000	HR
815.00	Building: Control House	1	LS
860.1851	Live Load Rollers	1	LS
860.1863	End Jack Assemblies	1	LS
860.1864	End Seat Assemblies	1	LS
860.1865	Fully Closed Stops	1	LS
860.187	Miscellaneous Mechanical Repairs	1	LS

ESTIMATED QUANTITIES			
ITEM NO.	DESCRIPTION	QUANTITY	UNIT
860.231	Span Drive Machinery	1	LS
860.30	Functional Testing	1	LS
880.02	Bridge Balancing	1	LS
880.031	Balance Block - Steel	1	LS
910.301	Special Work - Staff Gauges	1	LS
524.301	Temporary Structural Support - Bridge	1	LS
626.421	24-inch Diameter Foundation	7	LF

GENERAL BRIDGE CONSTRUCTION NOTES

- For easements, construction limits and right of way lines, refer to the Right of Way Plans.
- All utility facilities shall be adjusted by the respective utilities unless otherwise noted.
- Protective Coating for Concrete Surfaces shall be applied to the following areas:
All exposed surfaces of existing and proposed concrete above the waterline.
- Project information referred to below may be accessed at the following MaineDOT web address: <https://www.maine.gov/mdot/contractors/>
- Bidders and Contractors may access the existing bridge plans at the MaineDOT web address. The plans are reproductions of the original drawings as prepared for the construction of the bridge. It is very unlikely that the plans will show any construction field changes or any alterations which may have been made to the bridge during its life span.
- Bidders and Contractors may access a copy of the project geotechnical report at the MaineDOT web address.
- Geotechnical information furnished or referred to in this plan set is for the use of the Bidders and the Contractor. No assurance is given that the information or interpretations will be representative of actual subsurface conditions at the construction site. MaineDOT will not be responsible for the Bidders' or Contractor's interpretations of, or conclusions drawn from, the geotechnical information. The boring logs contained in the plan set present factual and interpretive subsurface information collected at discrete locations. Data provided may not be representative of the subsurface conditions between the boring locations.
- Quantities included for pay items measured and paid for by Lump Sum are estimated quantities and are provided by MaineDOT for informational purposes only. Lump Sum pay items will be paid for at the Contract Bid amount, with no addition or reduction in payment to the Contractor if the actual final quantities are different from the MaineDOT provided estimated quantities, except as follows:
 - If a Lump Sum pay item is eliminated, the requirements of Standard Specifications Section 109.2, Elimination of Items, will take precedence.
 - If other Contract Documents specifically allow a change in payment for a Lump Sum pay item, those requirements will be followed.
 - If a design change results in changes to estimated quantities for Lump Sum pay items, price adjustments will be made in accordance with Standard Specifications Section 109.7, Equitable Adjustments to Compensation.

- All existing bridge materials and fender system timbers to be removed shall be removed by, and become the property of, the Contractor. The steel portions of the existing bridge may be coated with a lead-based paint system. The existing fender system timbers are creosote treated. The Contractor is responsible for the containment, proper management, and disposal of all lead contaminated hazardous waste and creosote contaminated hazardous waste generated by the process of demolishing the bridge components and existing fender systems. The Contractor is responsible for implementing appropriate OSHA mandated personal protection standards related to this process. Once the existing bridge and fender system materials are removed, the Contractor is solely responsible for the care, custody, and control of the components of the existing bridge and fender system materials and any hazardous waste generated as a result of storage, recycling, or disposal of the bridge and fender system components. The Contractor shall recycle or reuse the steel in accordance with Maine Department of Environmental Protection's "Maine Hazardous Waste Management Regulations," Chapter 850. A copy of this regulation is available at the MaineDOT's offices on Child Street in Augusta. Payment for all labor, materials, equipment, and other costs required to remove and dispose of the existing bridge materials and fender system will be considered incidental to the respective bridge and fender system removal pay items. The existing bridge and fender system materials shall be removed by and become the property of the Contractor.
- The Contractor shall submit Fender Demolition Plans and Existing Grid Deck Demolition Plans to the Resident at least 10 business days prior to the start of demolition work. The plans shall outline the methods, equipment, and sequencing to be used to remove and dispose of all materials. No work related to the removal of the bridge materials shall be undertaken by the Contractor until MaineDOT has reviewed the plans for appropriateness and completeness. Payment for all work necessary for developing, submitting, and finalizing the Demolition Plans will be considered incidental to the respective removal pay items.
- All new structural steel, excluding the fender system, shall be field painted with a minimum 10mil DFT of a Zinc Rich Paint and compatible topcoat sealer. Unless noted otherwise, the finish topcoat color of all steel shall be green and match the following Federal Standard 595C, light green, color number: 14272. This work shall conform to section 506 of the MaineDOT Standard Specification and shall be paid for under Item 506.1775, Field Paint New and Existing Steel with Zinc Rich Paint. The Contractor shall provide a sample of the coating for field verification of existing bridge color match.
- The Contractor shall plan and conduct work so that upon completion of the project there is no drop-off from the edge of the shoulder pavement.
- Do not excavate for Aggregate Subbase Course where existing material is suitable as determined by the Resident.
- In areas where the Resident directs the Contractor not to excavate to the subgrade line shown on the plans, payment for removing existing pavement, grubbing, shaping, ditching, and compacting the existing subbase and layers of new subbase 6 inches or less thick will be made under appropriate equipment rental items.



NOTES:

- The proposed geometric layout shifts 1'-9" to the right from start of transition near Sta. 5+80.00 to start of bridge deck near Sta. 6+40.00. This proposed geometric layout shifts 1'-9" back to the left from end of bridge deck near Sta. 10+16.50 to end of approach near Sta. 10+76.50.
- Cross slope shall transition from existing cross slopes at approach ends to -1.0% at bridge deck.
- The pavement and subbase depths as shown on the plans are intended to be nominal.
- See Sheet 35 for sidewalk details.
- See Deck Over Backwall Detail on Sheet 23 for aggregate subbase transition.
- Stationing is approximate.
- The proposed profile shall match existing elevations at the start of each approach, and match proposed elevations of the top of bridge deck at the end of each approach. The Contractor shall lay out the profile and it will be accepted by the Resident.

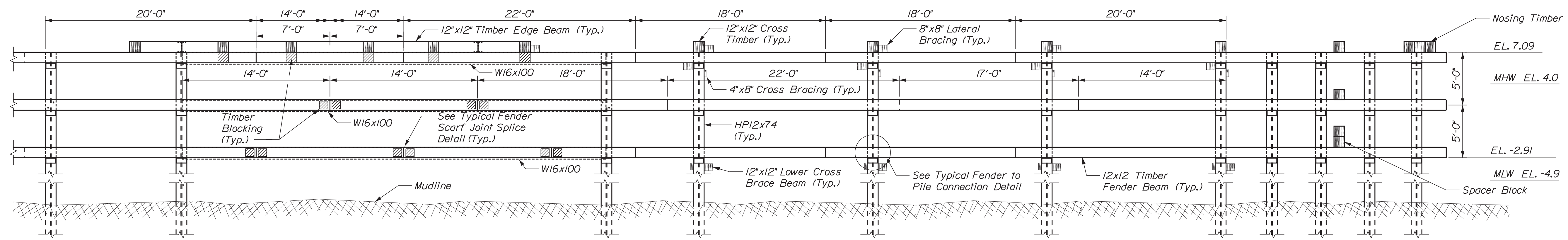
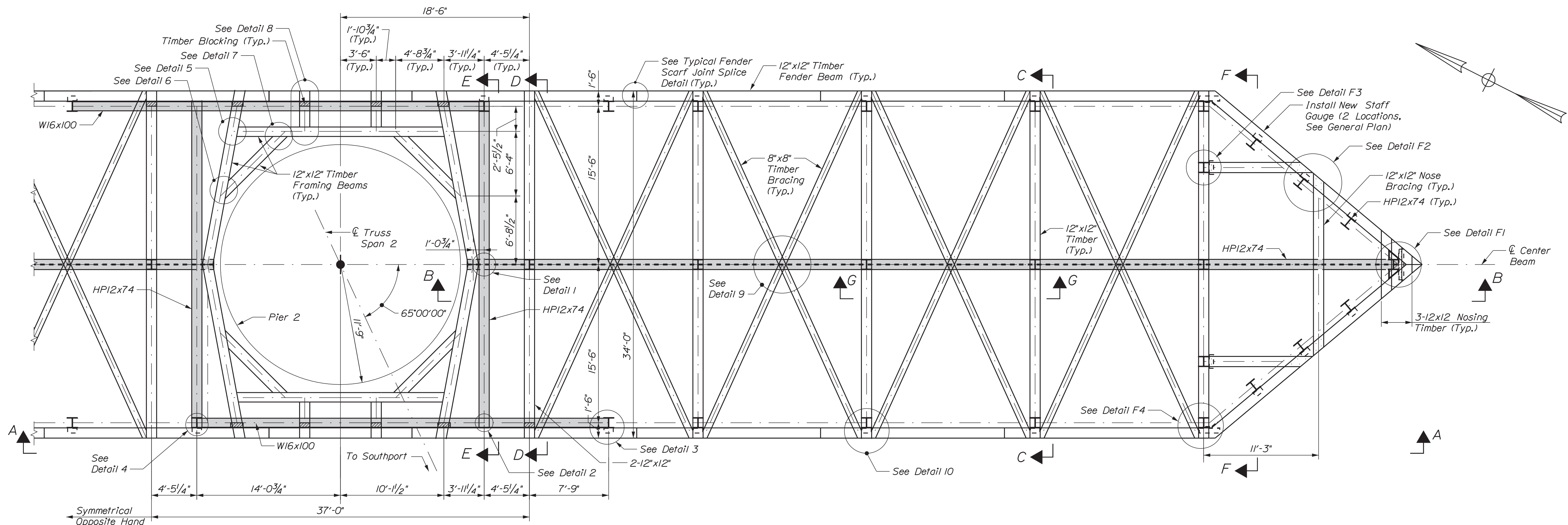
STATE OF MAINE DEPARTMENT OF TRANSPORTATION		2309401		BRIDGE NO. 2789	
SOUTHPORT BRIDGE ROUTE 27 OVER TOWNSEND GUT		LINCOLN COUNTY		ESTIMATED QUANTITIES & GENERAL NOTES	
SOUTHPORT & BOOTHBAY HARBOR ME		REVISIONS 1 REVISIONS 2 REVISIONS 3 REVISIONS 4		FIELD CHANGES	
PROJ. MANAGER: J. STETSON, PE		DATE: 8/19/22		DATE: August 19, 2022	
DESIGN: DAVID BCP		BY: Robert S. Blunt		SIGNATURE: [Signature]	
CHECKED: REVIEWED: CTA		DATE: 8/19/22		P.E. NUMBER: 11158	
DESIGN: DET-FAILED: 02		DATE: 8/19/22		DATE: August 19, 2022	
REVISIONS 1		DATE: 8/19/22		DATE: August 19, 2022	
REVISIONS 2		DATE: 8/19/22		DATE: August 19, 2022	
REVISIONS 3		DATE: 8/19/22		DATE: August 19, 2022	
REVISIONS 4		DATE: 8/19/22		DATE: August 19, 2022	
FIELD CHANGES		DATE: 8/19/22		DATE: August 19, 2022	
SHEET NUMBER		2		OF 48	

Date: 8/19/2022

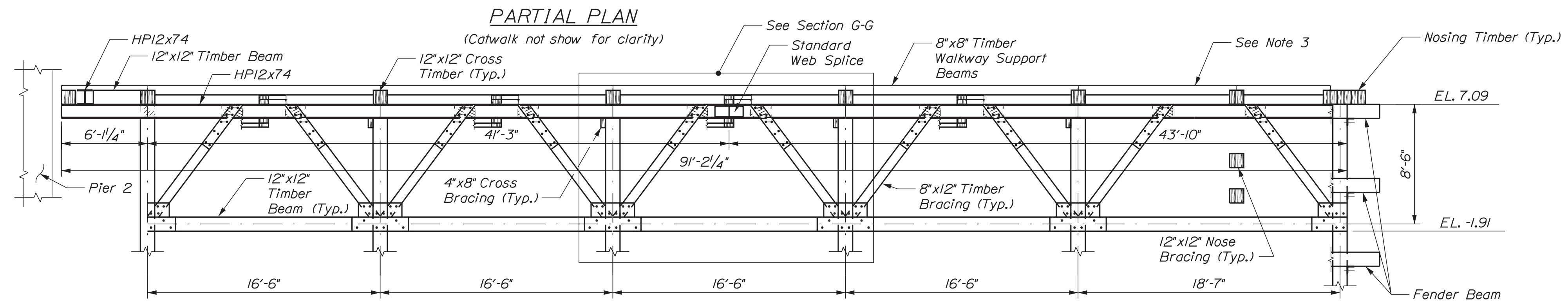
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Division: BRIDGE

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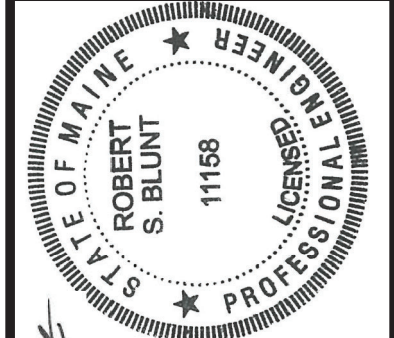
VIEW A-A
(Catwalk not shown for clarity, See Pier 2 Catwalk Details)



VIEW B-B
(Catwalk not shown for clarity)

- NOTES:**
1. South end of fender system shown, north end of fender system similar by opposite hand.
 2. See Pier 2 Fender System Details sheets for Sections C-C, D-D, E-E, F-F, G-G; Details 1 through 10; Details F1 through F4; and Typical Fender Scarf Joint Splice.
 3. For catwalk details see Pier 2 Fender System Catwalk Details sheet.
 4. Steel fabrication shop drawings for all structural steel shall be submitted to the Department for review and approval prior to fabrication.
 5. All timber fender connectors shall be 1" dia. and hot-dip galvanized in accordance with ASTM A153.
 6. ~~The Contractor shall use carriage bolt heads for all connectors at the outside face of fender beams. The Contractor may opt to use countersunk heads in lieu of carriage bolt heads as approved by the Resident.~~
 6. The Contractor shall countersink connector bolt heads at the outside face of fender beams.

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
2309401
BRIDGE NO. 2789
WIN
21751.01



Signature: Robert S. Blunt
P.E. NUMBER: 11158
DATE: August 19, 2022

PROJ. MANAGER	DATE	BY	REVISION
J. Stetson, PE	8/19/22	DPD	1
DESIGN-DETAILED		RESUBMIT	
CHECKED-REVIEWED			
DESIGN-DETAILED			
DESIGN-DETAILED			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

SOUTHPORT BRIDGE ROUTE 27
OVER TOWNSEND GUT
SOUTHPORT & BOOTHBAY HARBOR ME
LINCOLN COUNTY
**PIER 2 FENDER SYSTEM
PLAN & ELEVATIONS**

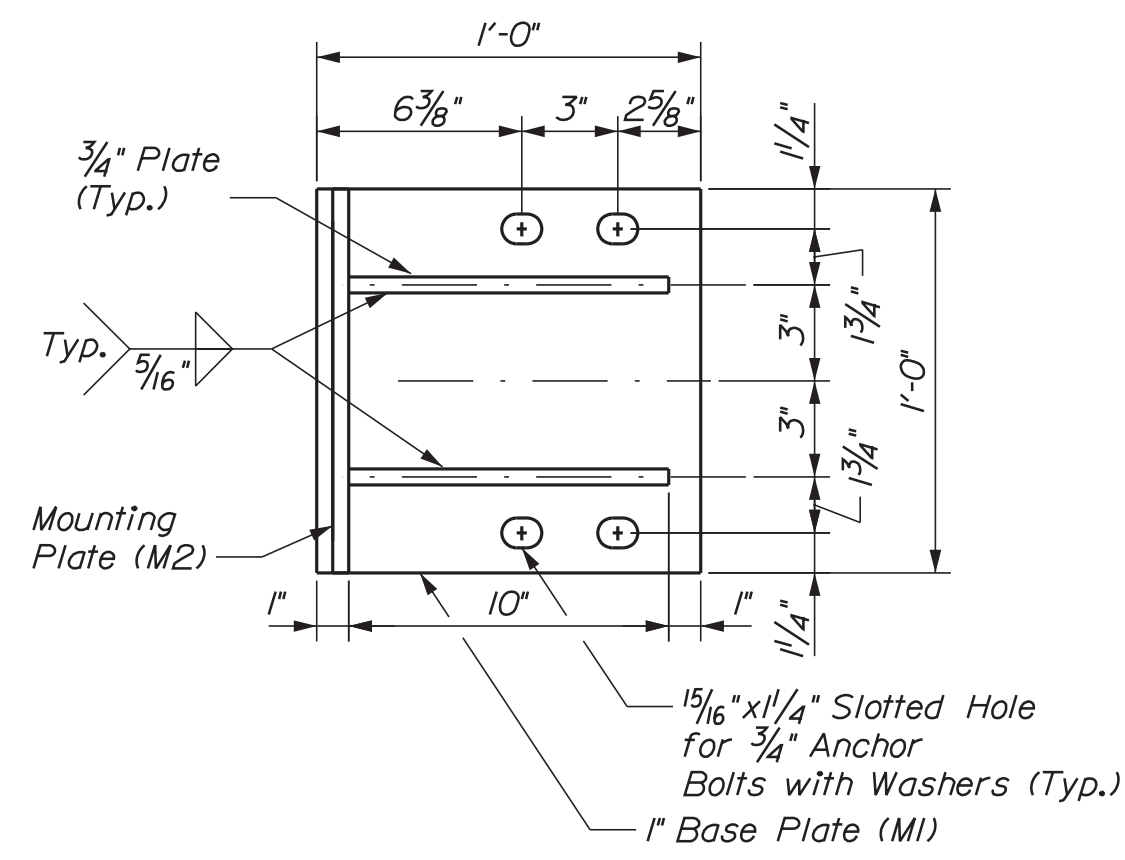
SHEET NUMBER
13
OF 48

Date: 8/19/2022

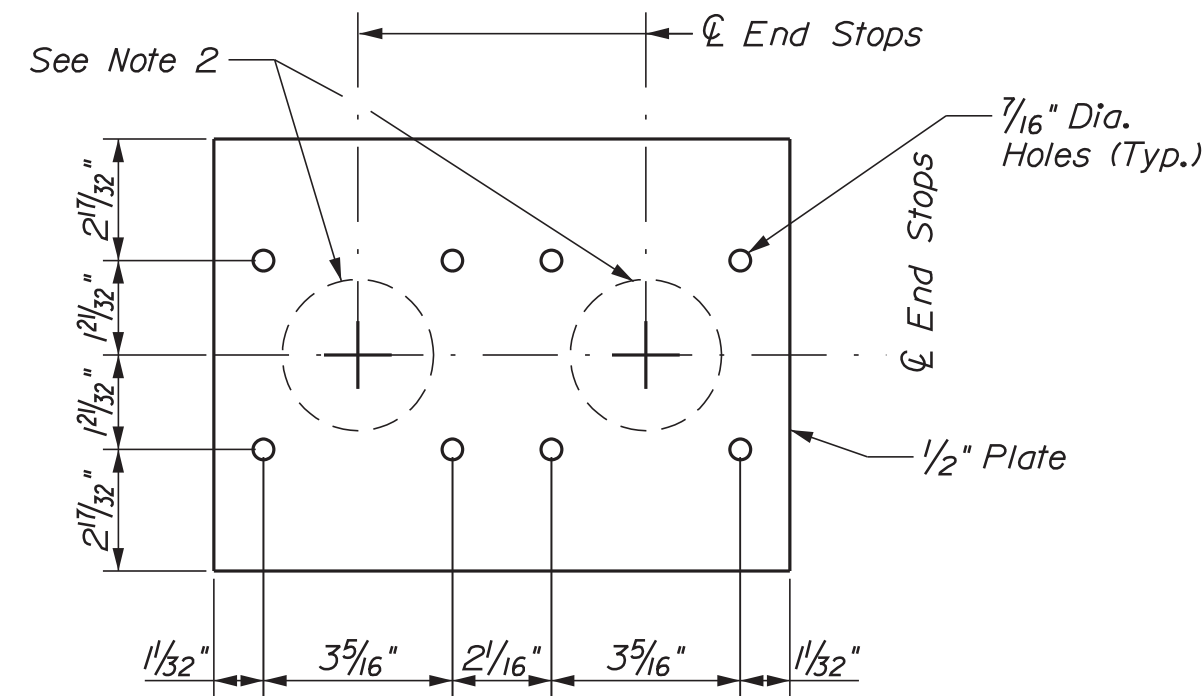
Username: BRIDGE

Division: BRIDGE

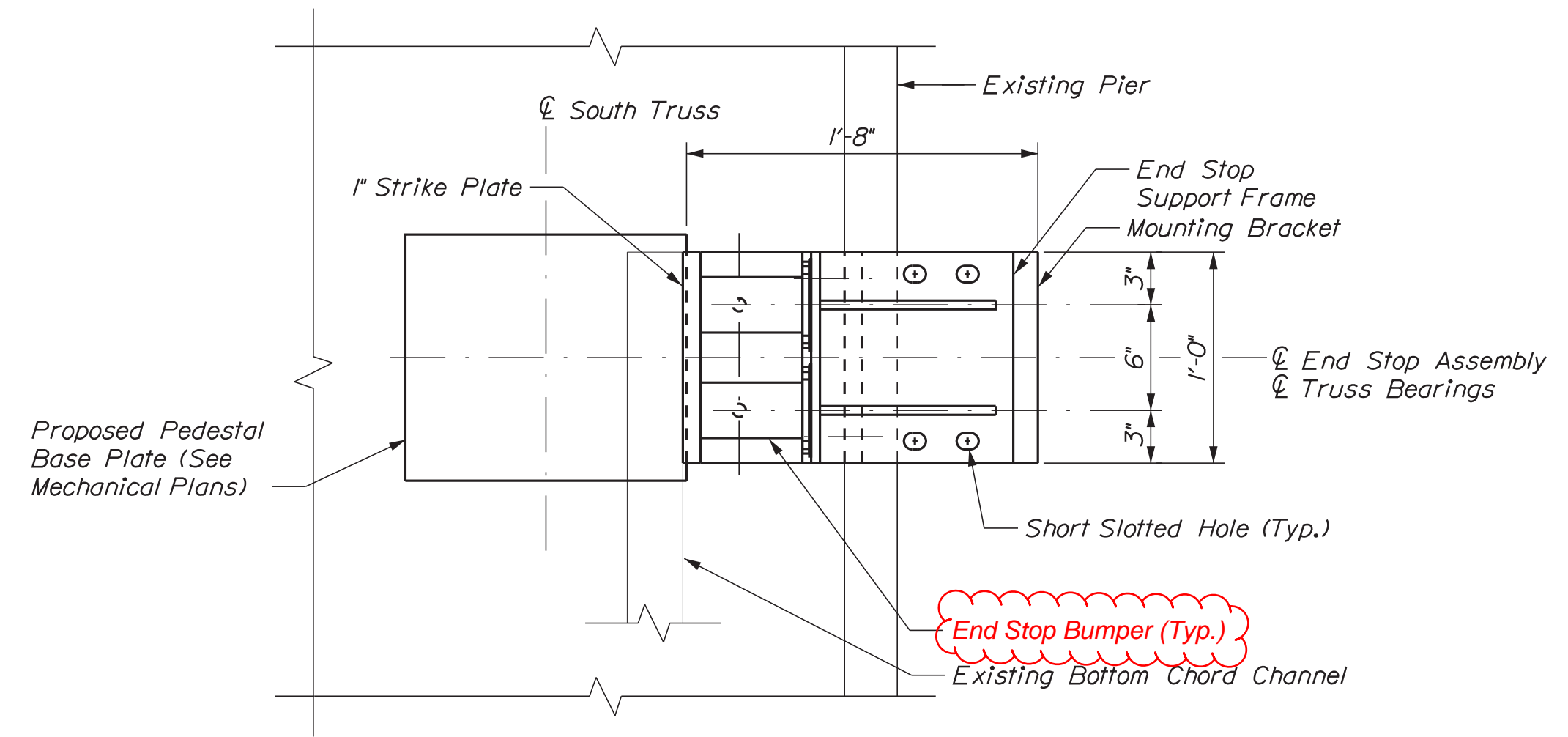
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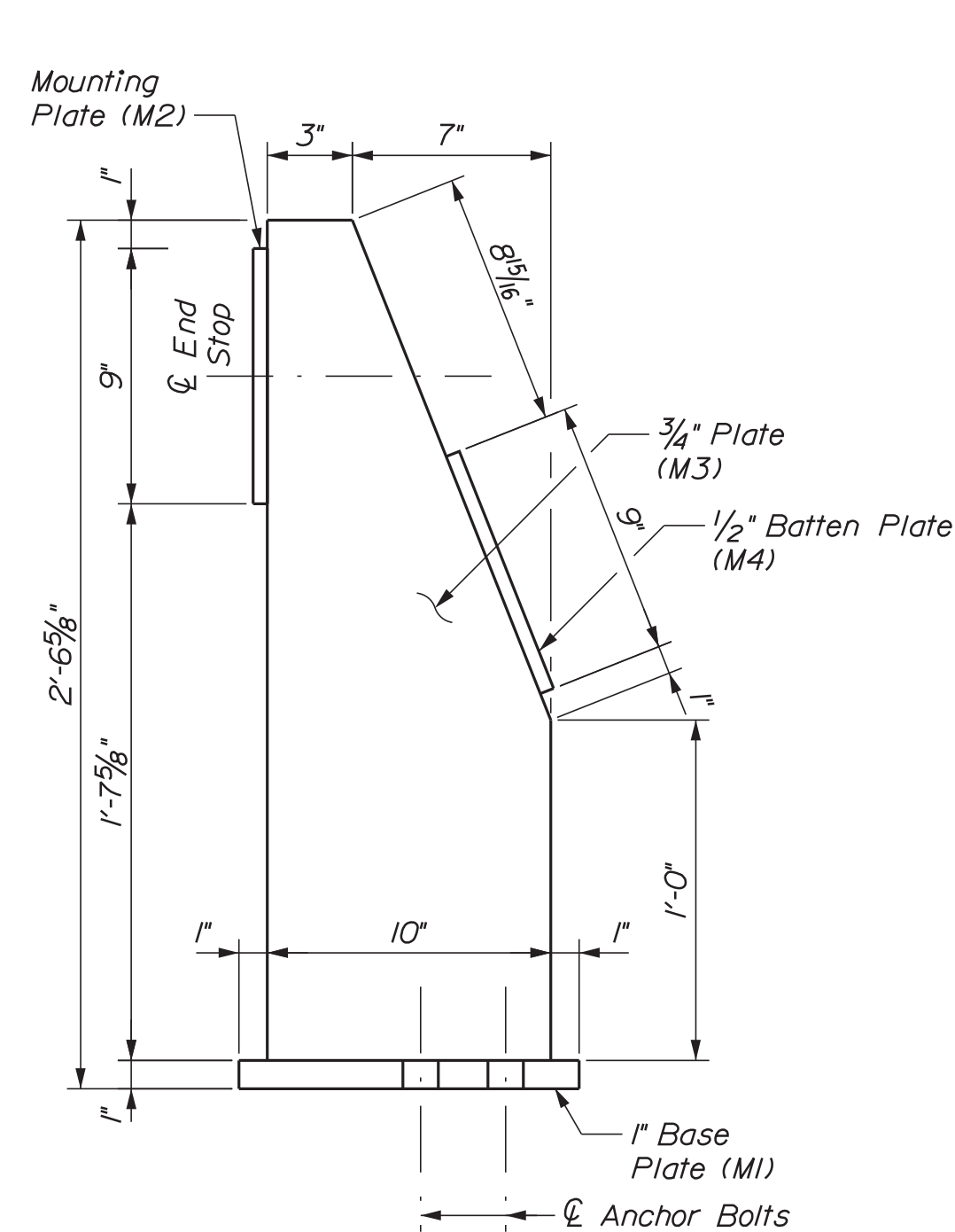
PLAN



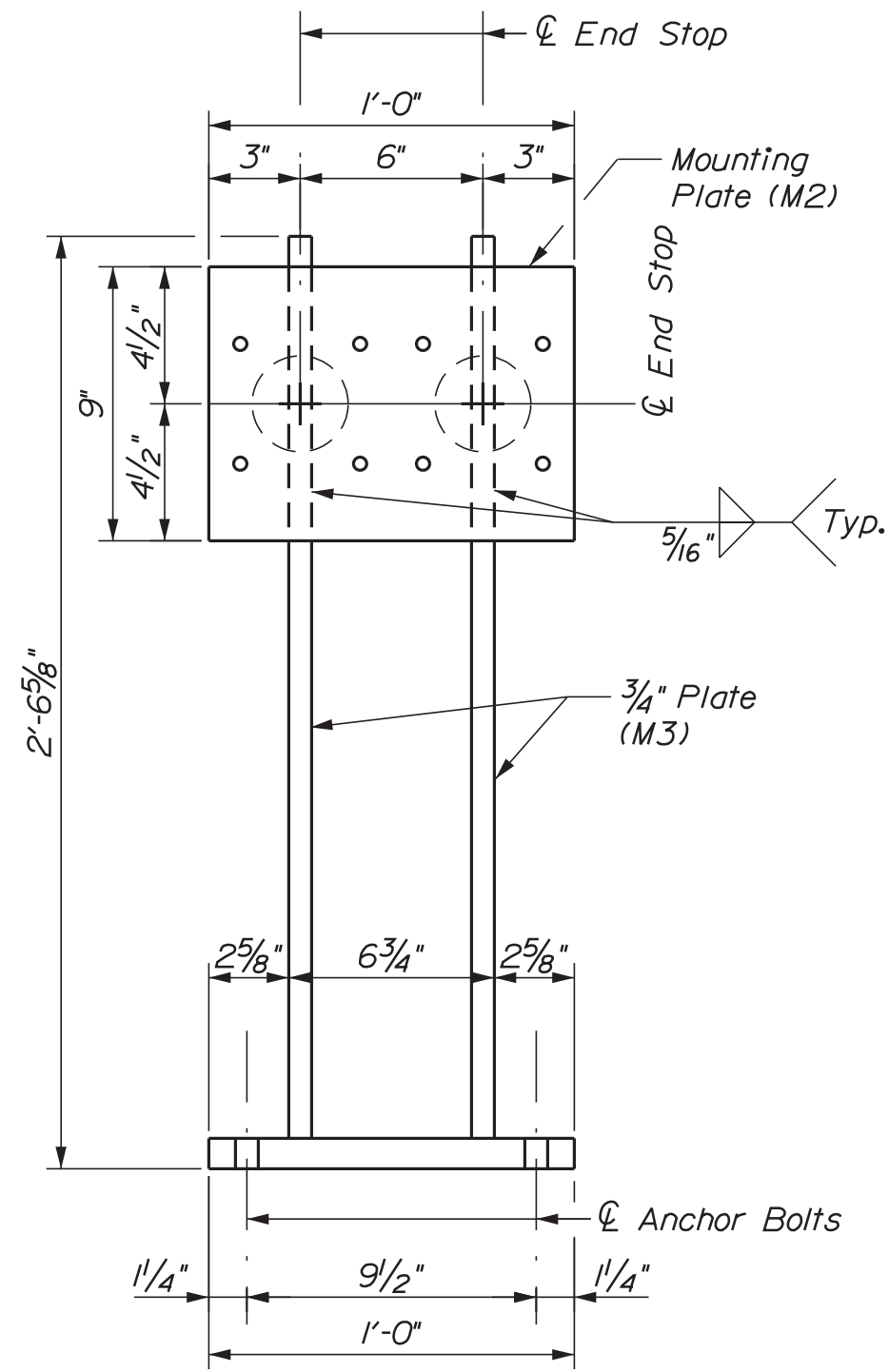
MOUNTING PLATE (M2)



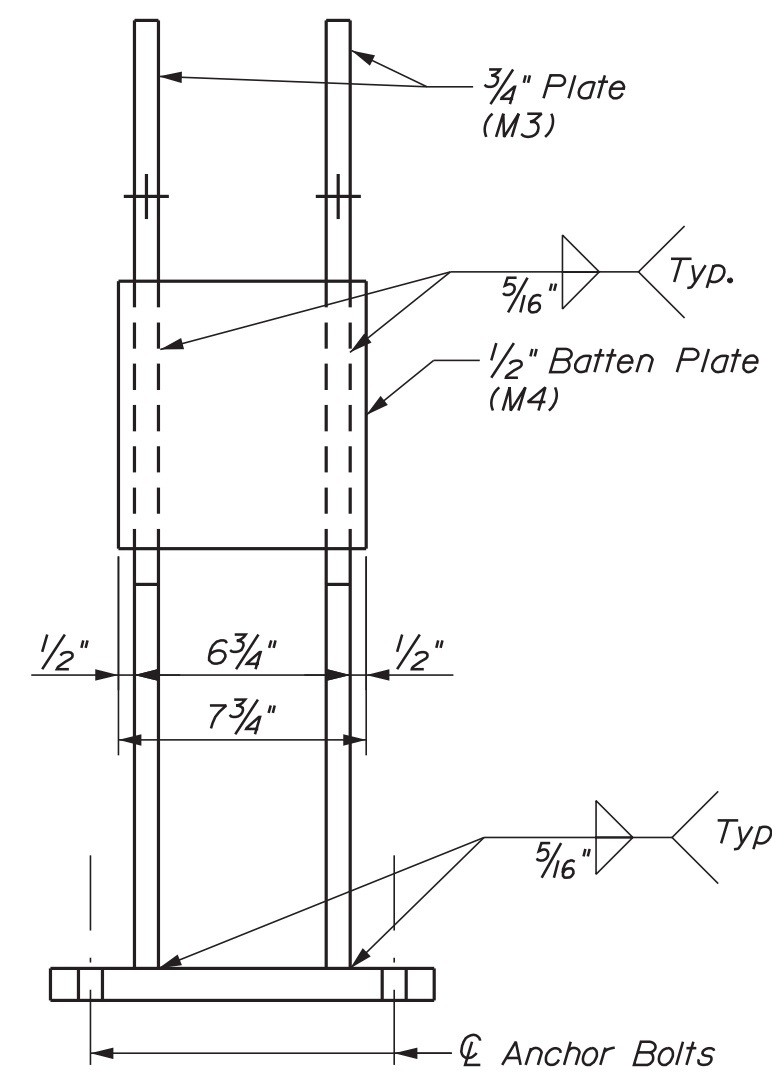
END STOP PLAN



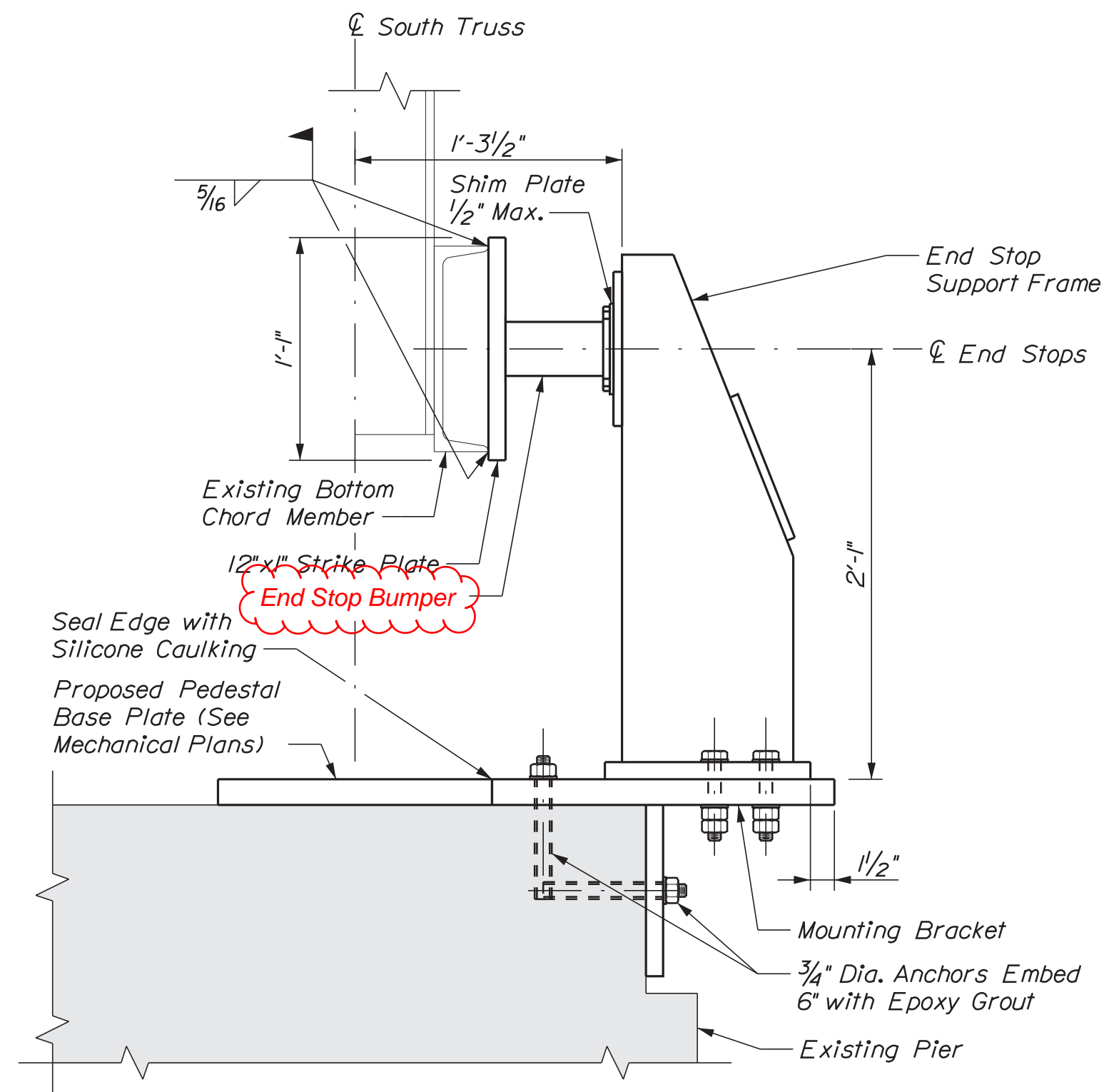
ELEVATION



LEFT END VIEW
1/2\"/>

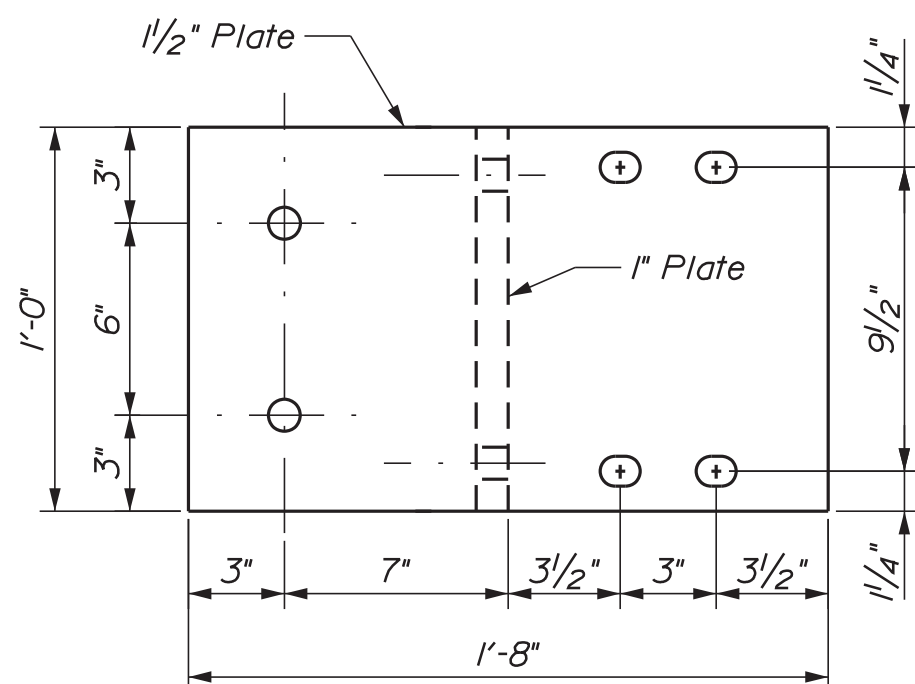


RIGHT END VIEW
Mounting Plate (M2) Not shown for clarity

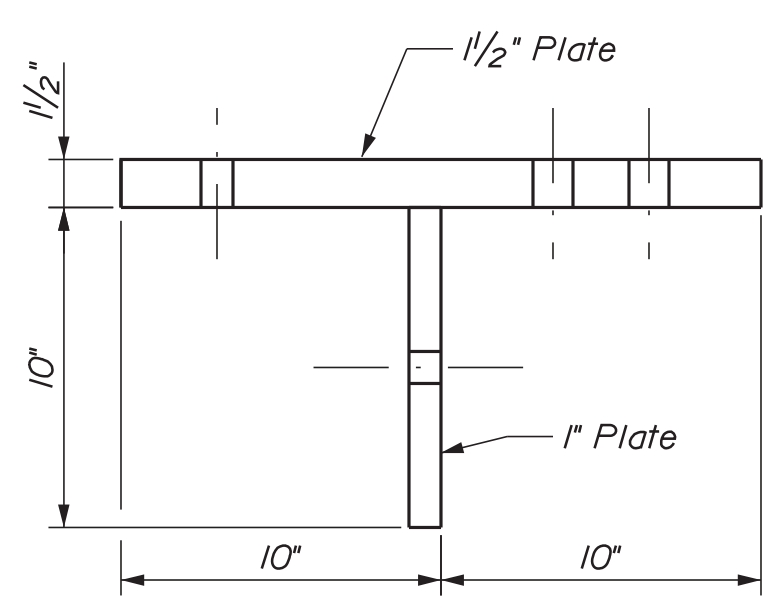


END STOP ELEVATION

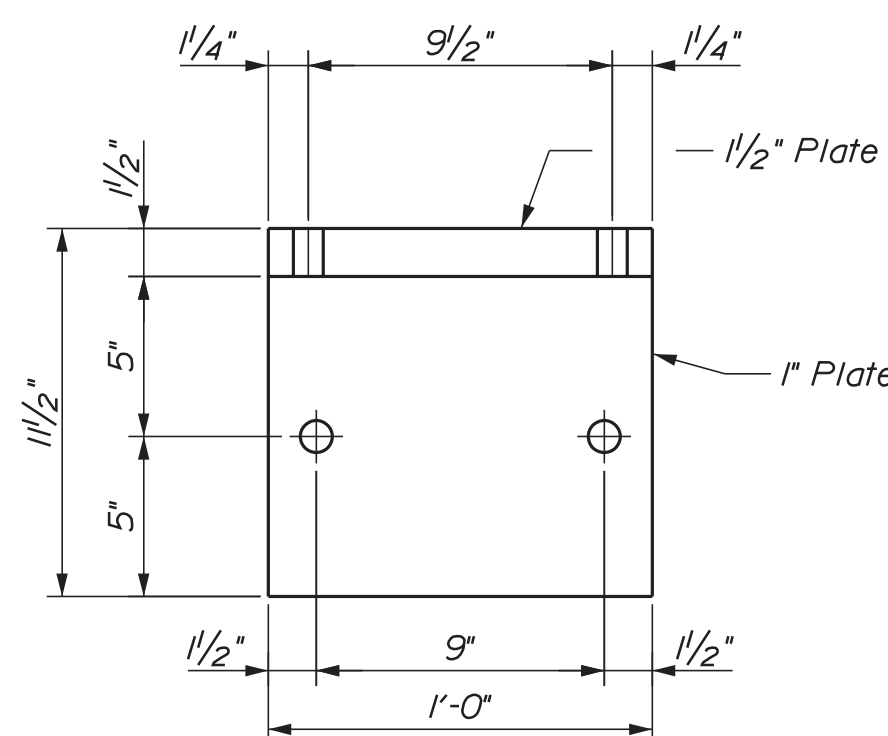
END STOP SUPPORT FRAME DETAILS



PLAN



ELEVATION



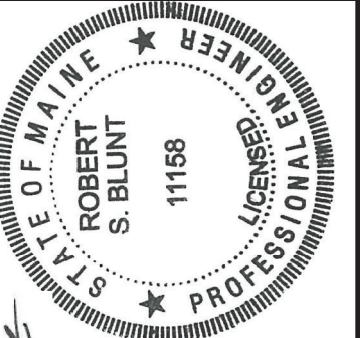
SECTION

MOUNTING BRACKET DETAILS

NOTES:

- All dimensions shall be field verified by the Contractor prior to fabrication.
- Shop drawings for end stop mounting assembly shall be submitted to the Department for review and approval prior to fabrication. The Contractor shall verify mounting plate and end stop support dimensions are consistent with selected end stops by the Contractor in accordance with Specification 860.
- Procurement, assembly, and installation of end stop shall be paid for under Item 860.1862, Fully Closed Stops.
- Pier Cap shall be cleaned and prepped for receiving Mounting Bracket as directed by the Resident prior to installation.

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
2309401
WIN
21751.01
BRIDGE NO. 2789



PROJ. MANAGER	J. STETSON, PE	DATE	8/19/22
DESIGN-DETAILED		BY	RSBLUNT
CHECKED-REVIEWED	CTA	DATE	8/19/22
DESIGN2-DETAILED2		SIGNATURE	1158
DESIGN3-DETAILED3		P.E. NUMBER	11158
REVISIONS 1		DATE	August 19, 2022
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

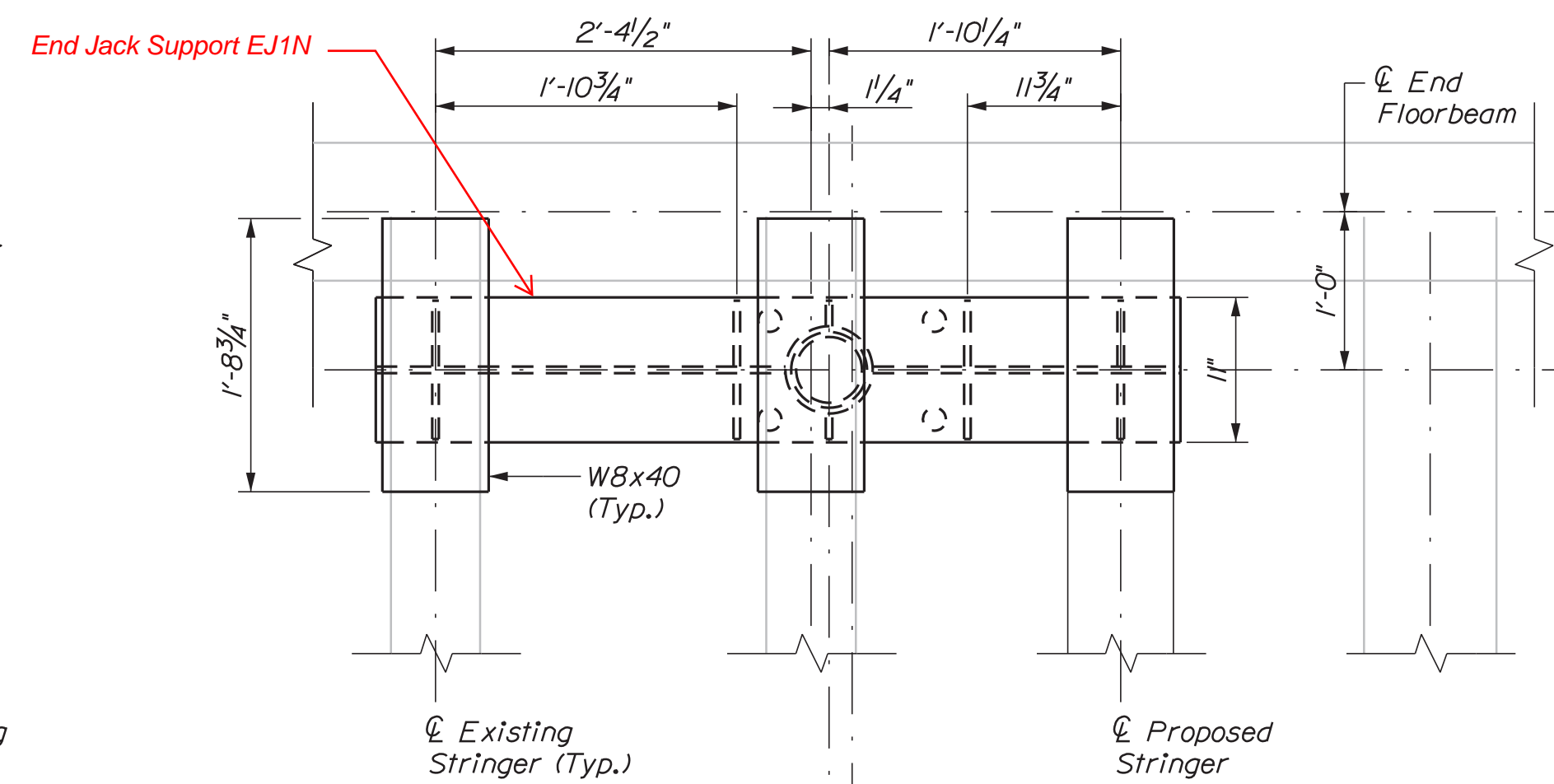
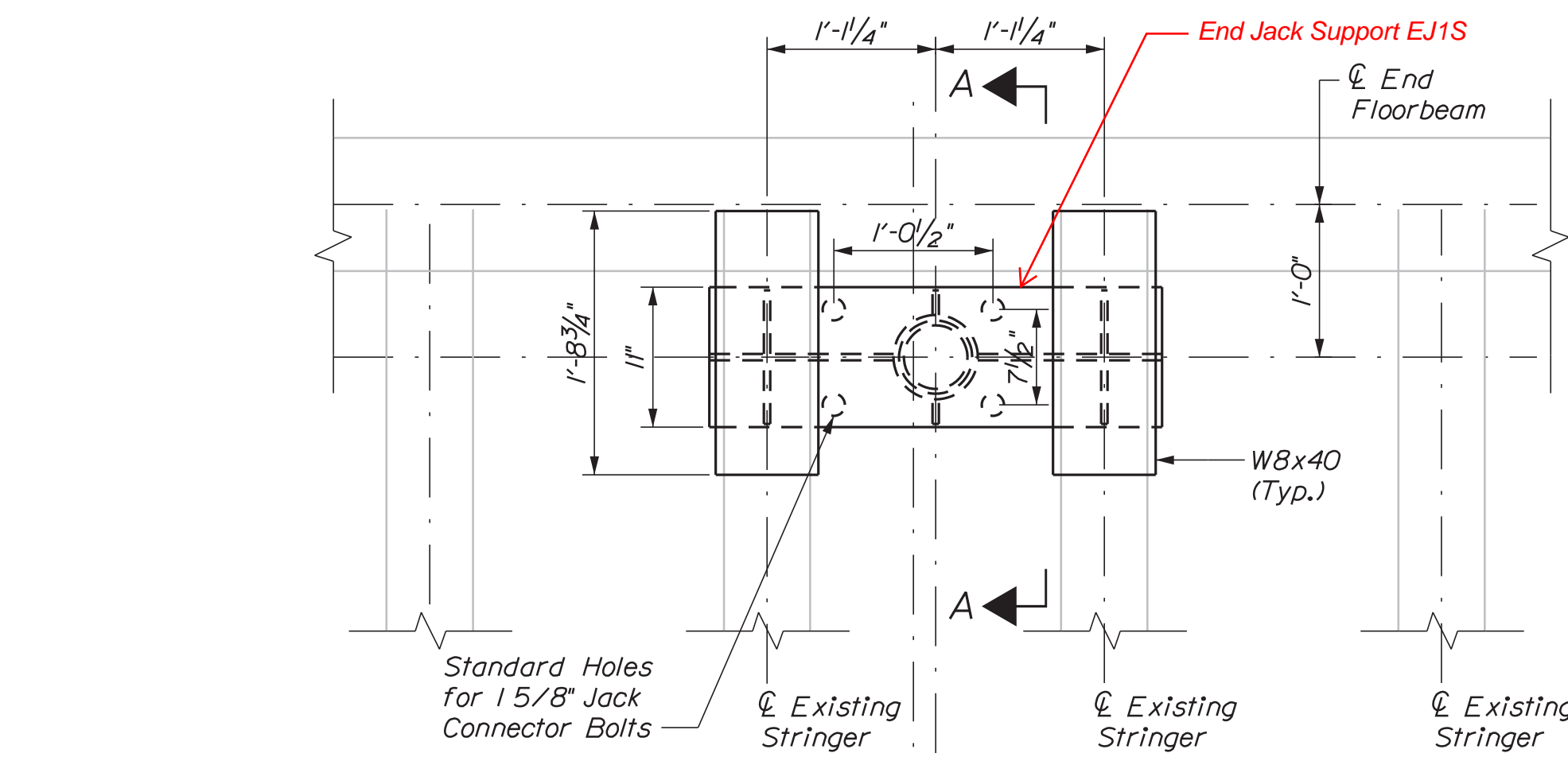
SOUTHPORT BRIDGE ROUTE 27
OVER TOWNSEND GUT
SOUTHPORT & BOOTHBAY HARBOR ME LINCOLN COUNTY

SHEET NUMBER

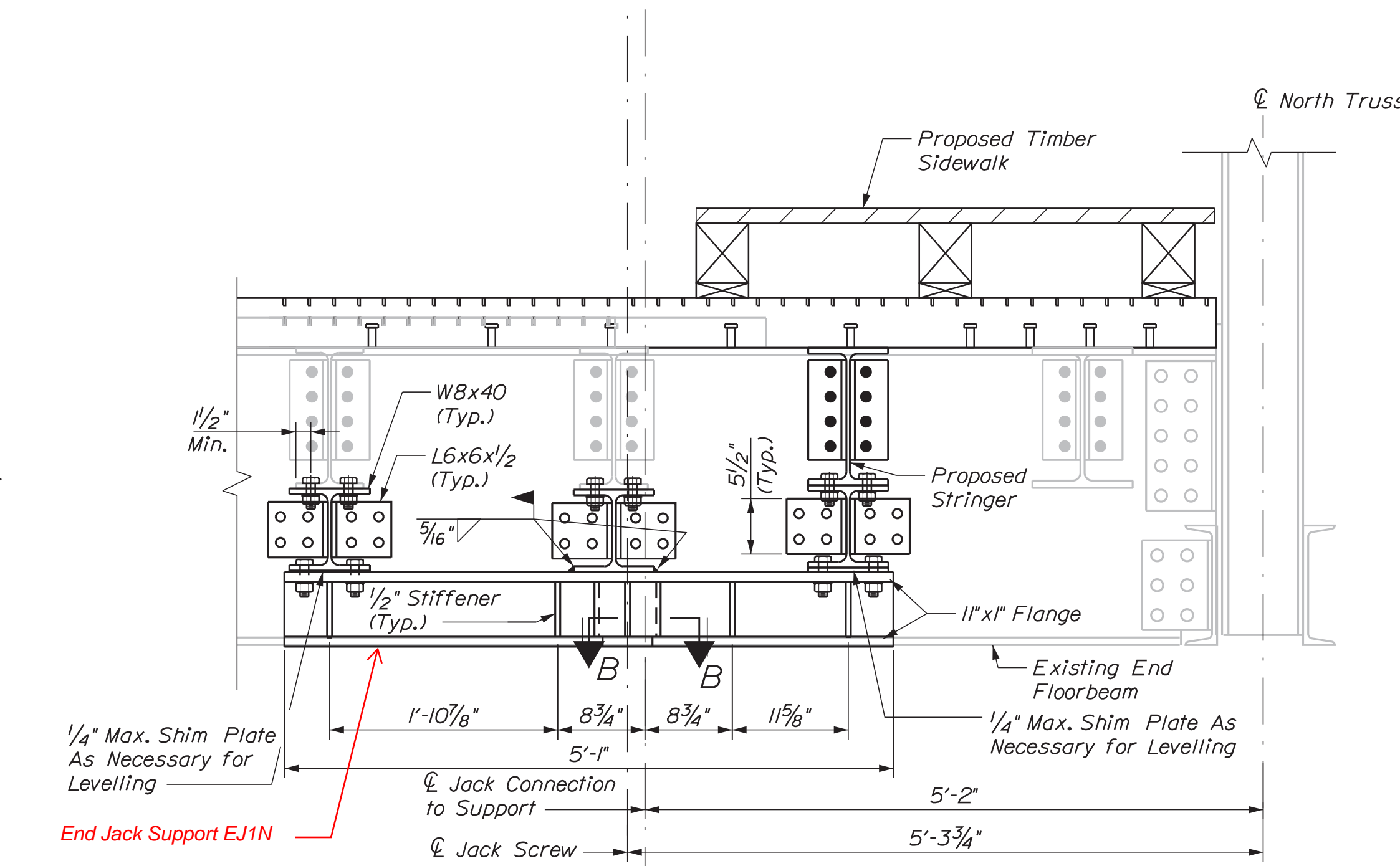
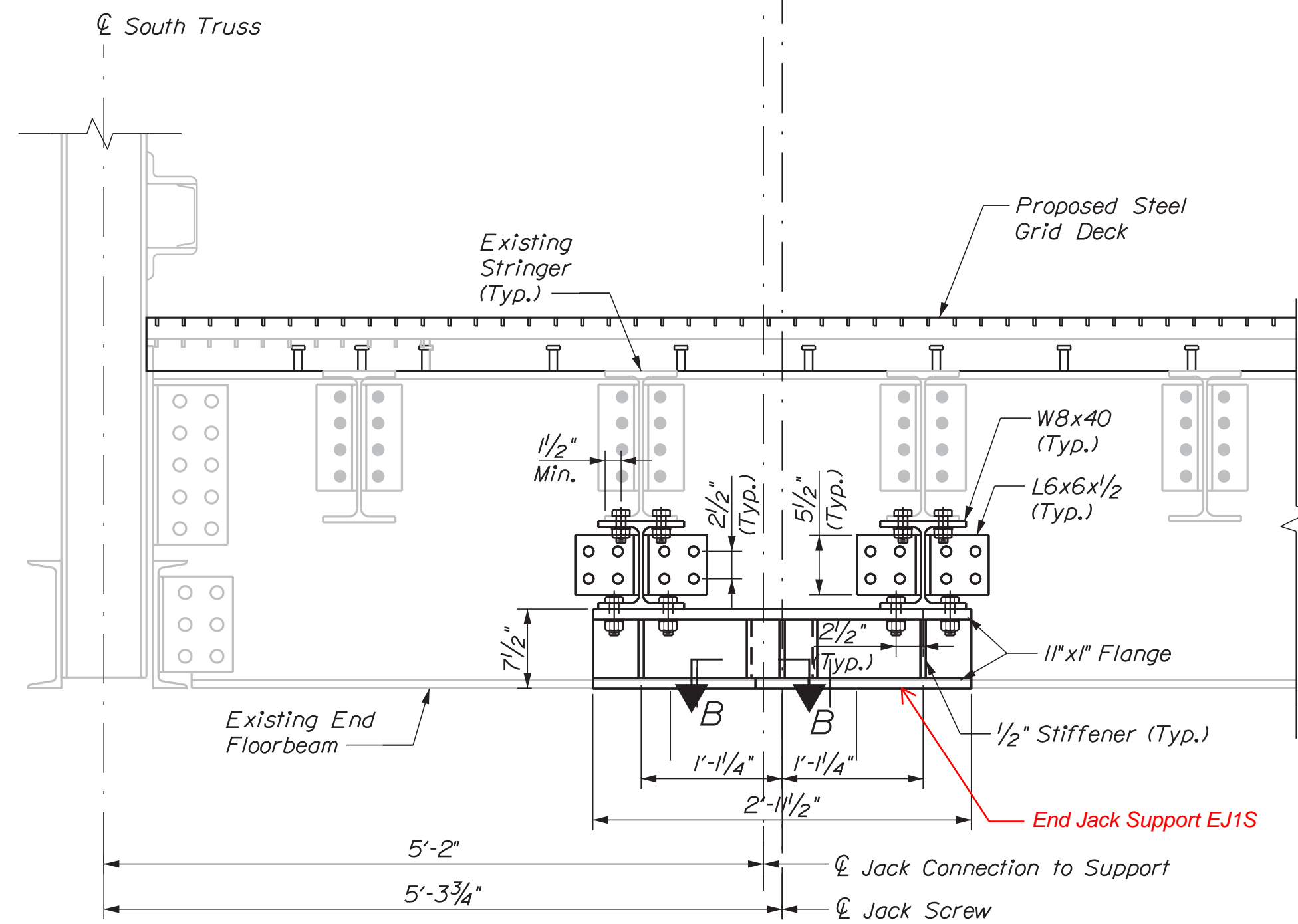
25

OF 48

END STOP DETAILS



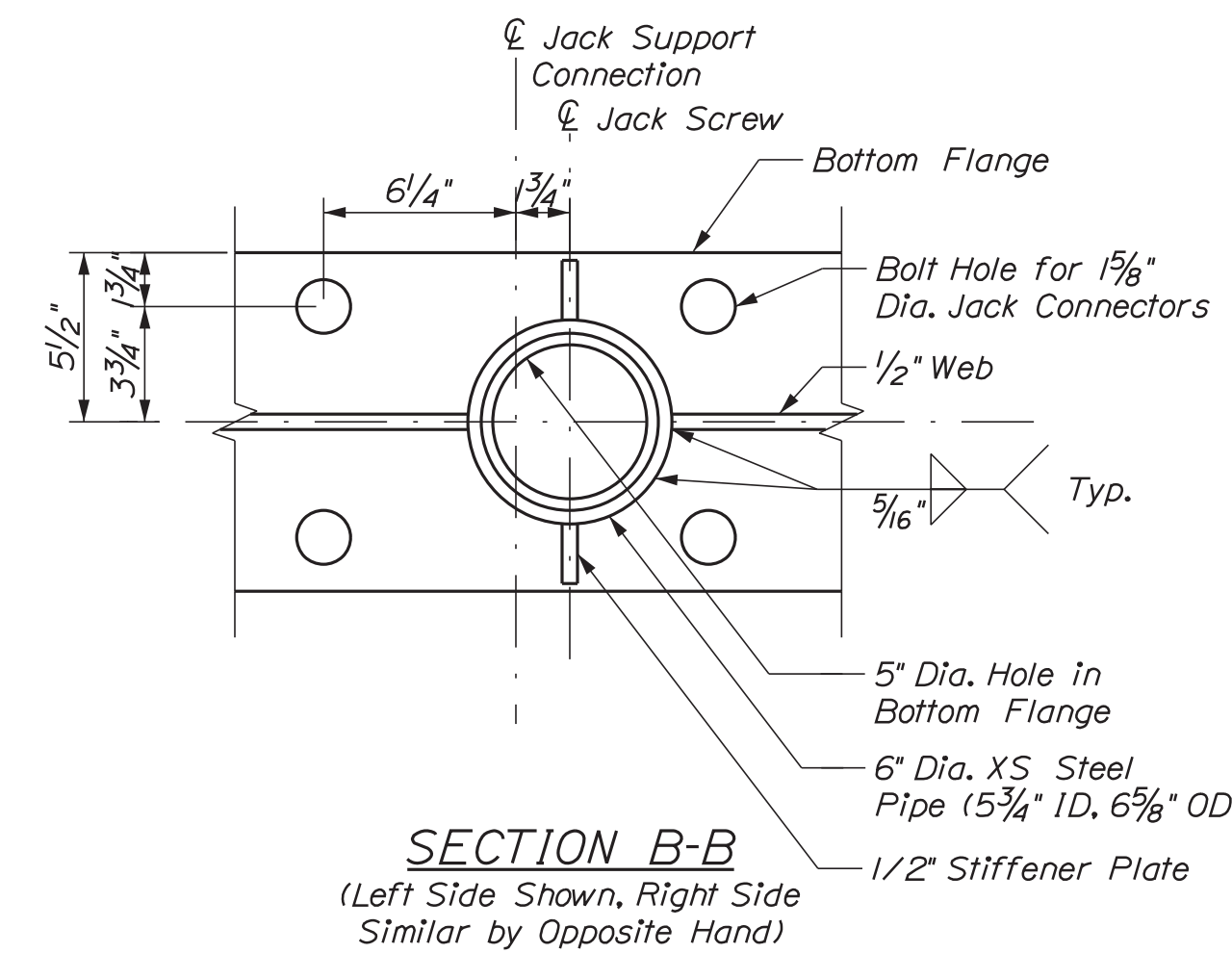
JACKING PLAN



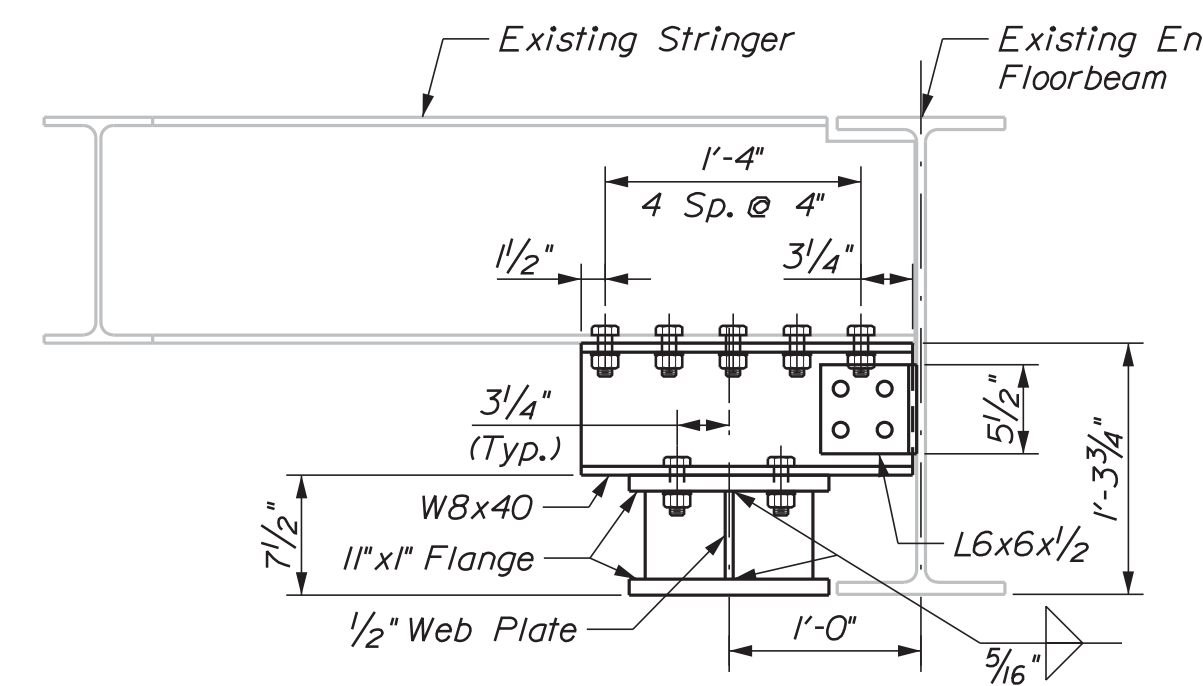
JACKING ELEVATION

(View Looking Towards Southport)
(Boothbay End Similar by Opposite Hand)

Jack Details and Top of Pier Not Shown. See Mechanical Drawings.



SECTION B-B
(Left Side Shown, Right Side Similar by Opposite Hand)

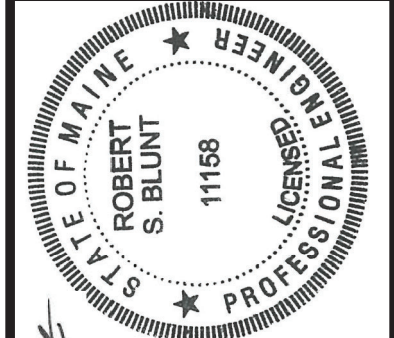


SECTION A-A

Jack and Shims Not Shown. See Mechanical Drawings.

NOTES

1. See Mechanical Drawings for jack details. The Contractor shall verify jack dimensions, configuration, and connector layout prior to fabrication of truss end jack support details.
2. The Contractor shall submit shop drawings to the Department at least 14 days prior to fabrication.
3. Procurement, fabrication, and installation of all jack support components shall be paid for under item 860.186, End Jack Assemblies.
4. All jack support connectors shall be 7/8" diam. F3125, Grade 325 High Strength Bolts.



Signature: Robert S. Blunt
P.E. Number: 11158
Date: August 19, 2022

PROJ. MANAGER	J. STETSON, PE	DATE	8/19/22
DESIGN-DETAILED	BCP	DDP, B WASE	8/19/22
CHECKED-REVIEWED	CTA	REBLUNT	
DESIGN-DETAILED2			
DESIGN-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

SOUTHPORT BRIDGE ROUTE 27
OVER TOWNSEND GUT
SOUTHPORT & BOOTHBAY HARBOR ME
LINCOLN COUNTY
TRUSS SWING SPAN
JACK SUPPORT DETAILS

SHEET NUMBER

32

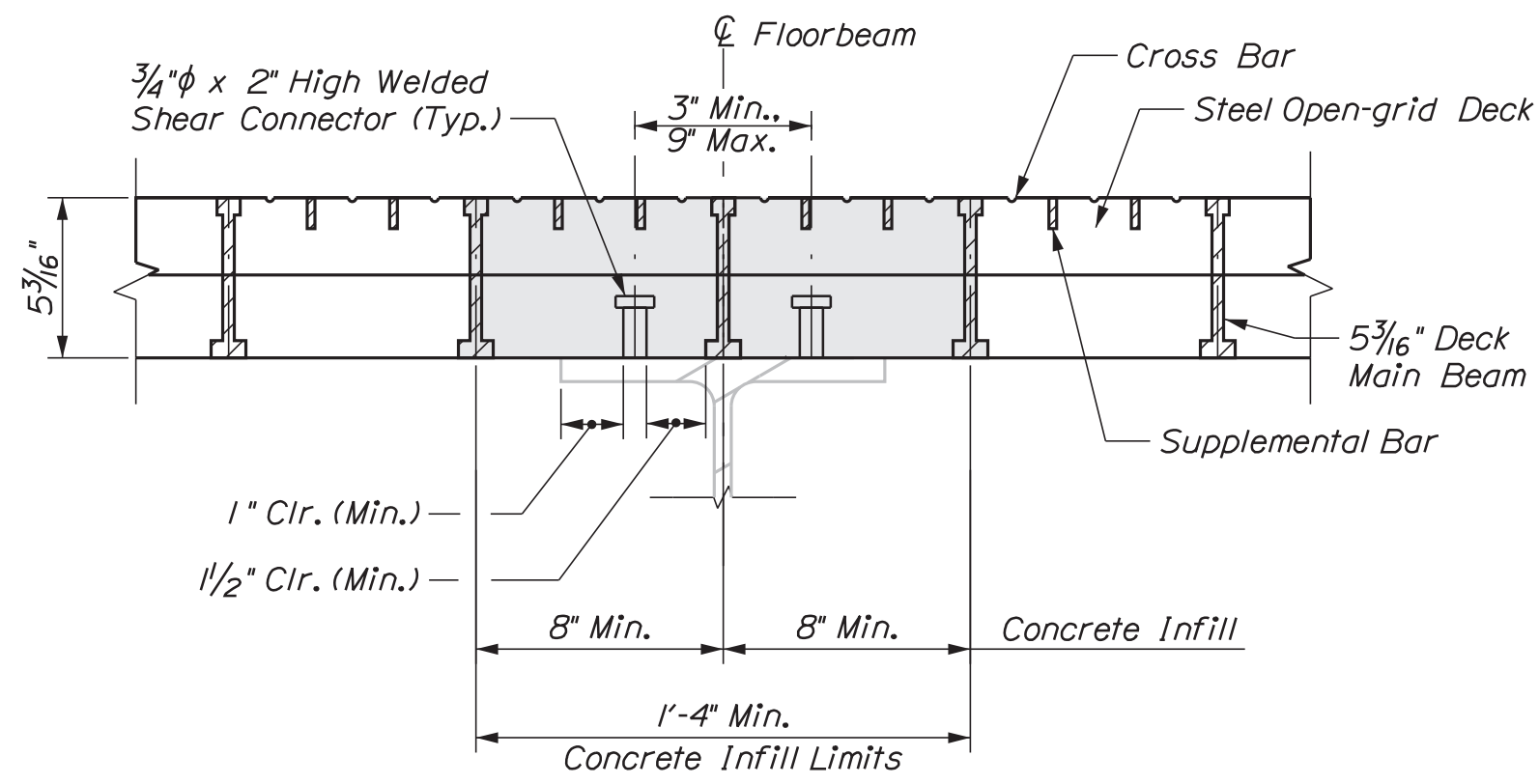
OF 48

Date: 8/19/2022

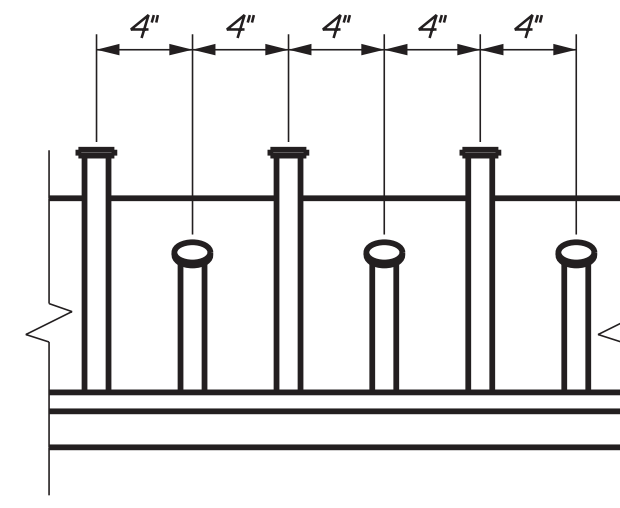
Username: BRIDGE

Division: BRIDGE

Filename: ... \MSTA\034_Deck_Grid_01.dgn



SECTION A-A



JOINT PLATE DETAIL 1
ANCHOR STUD LAYOUT

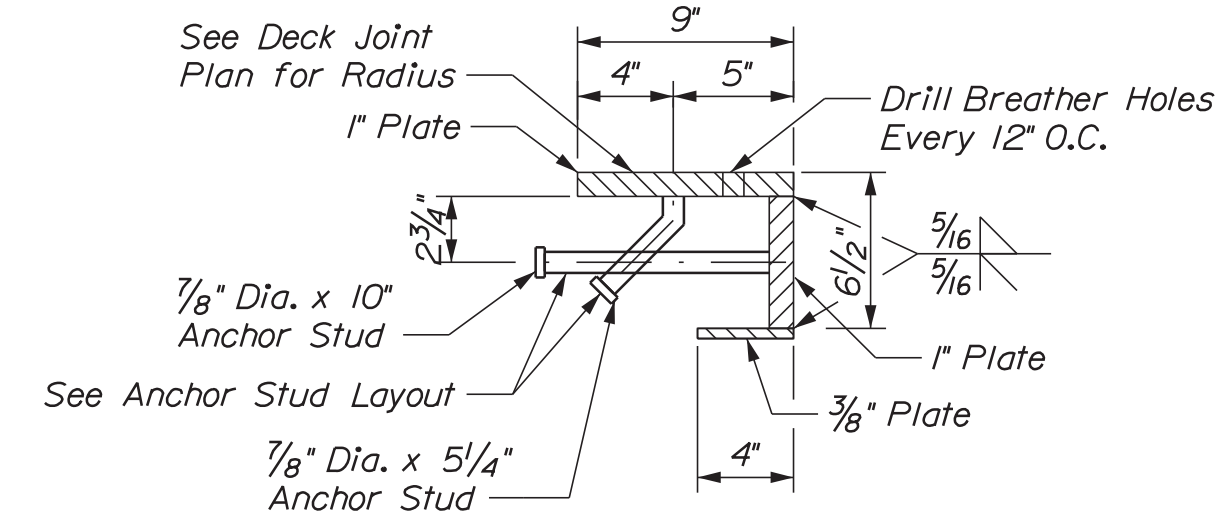


PLATE JOINT DETAIL 1

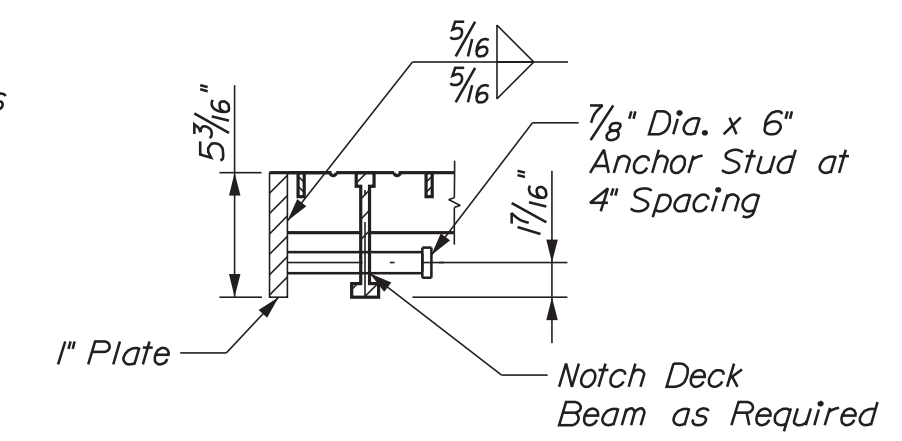
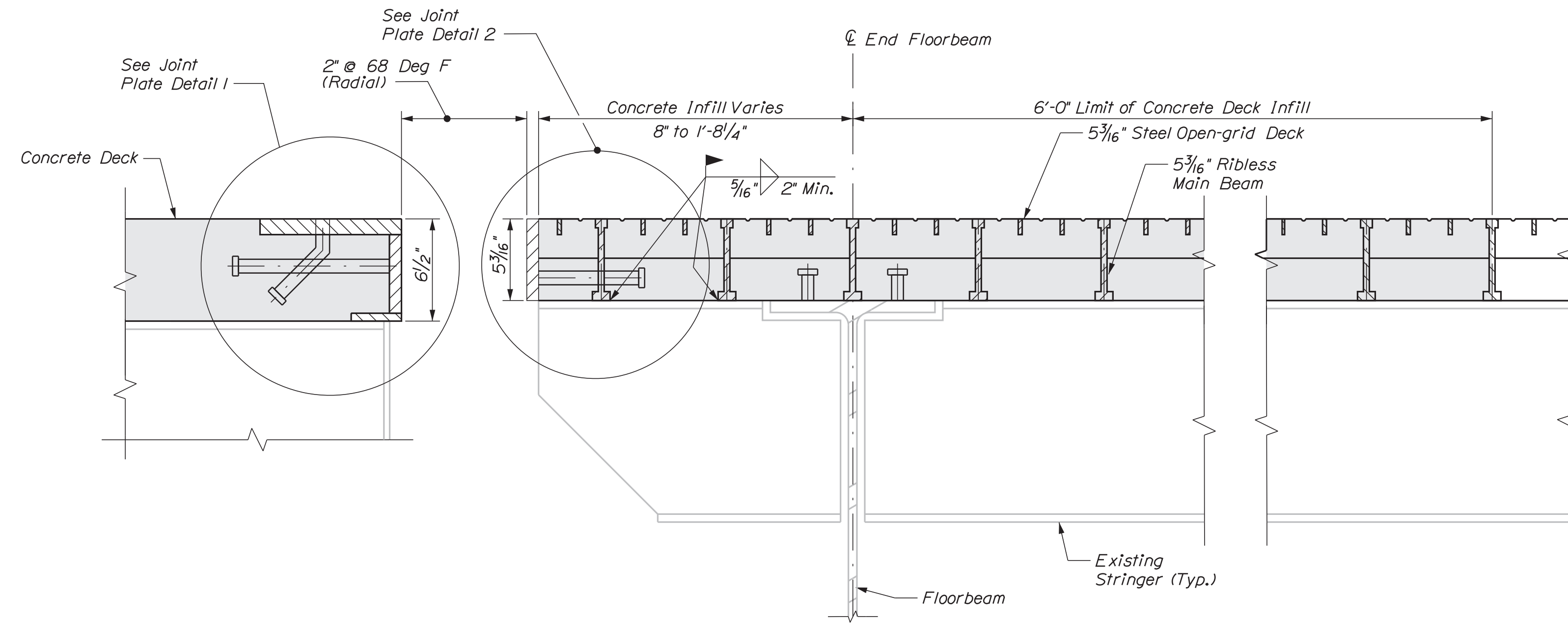
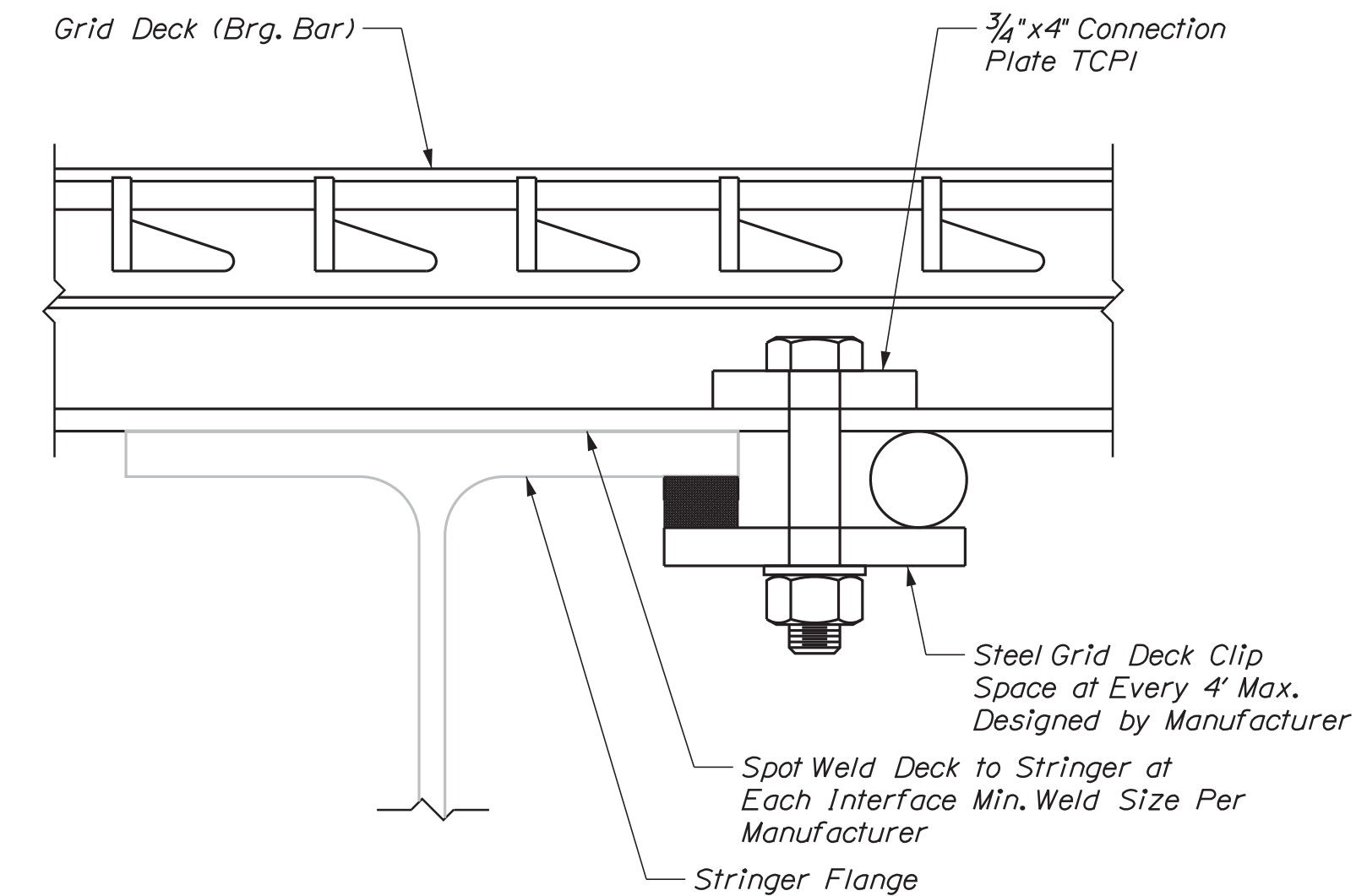


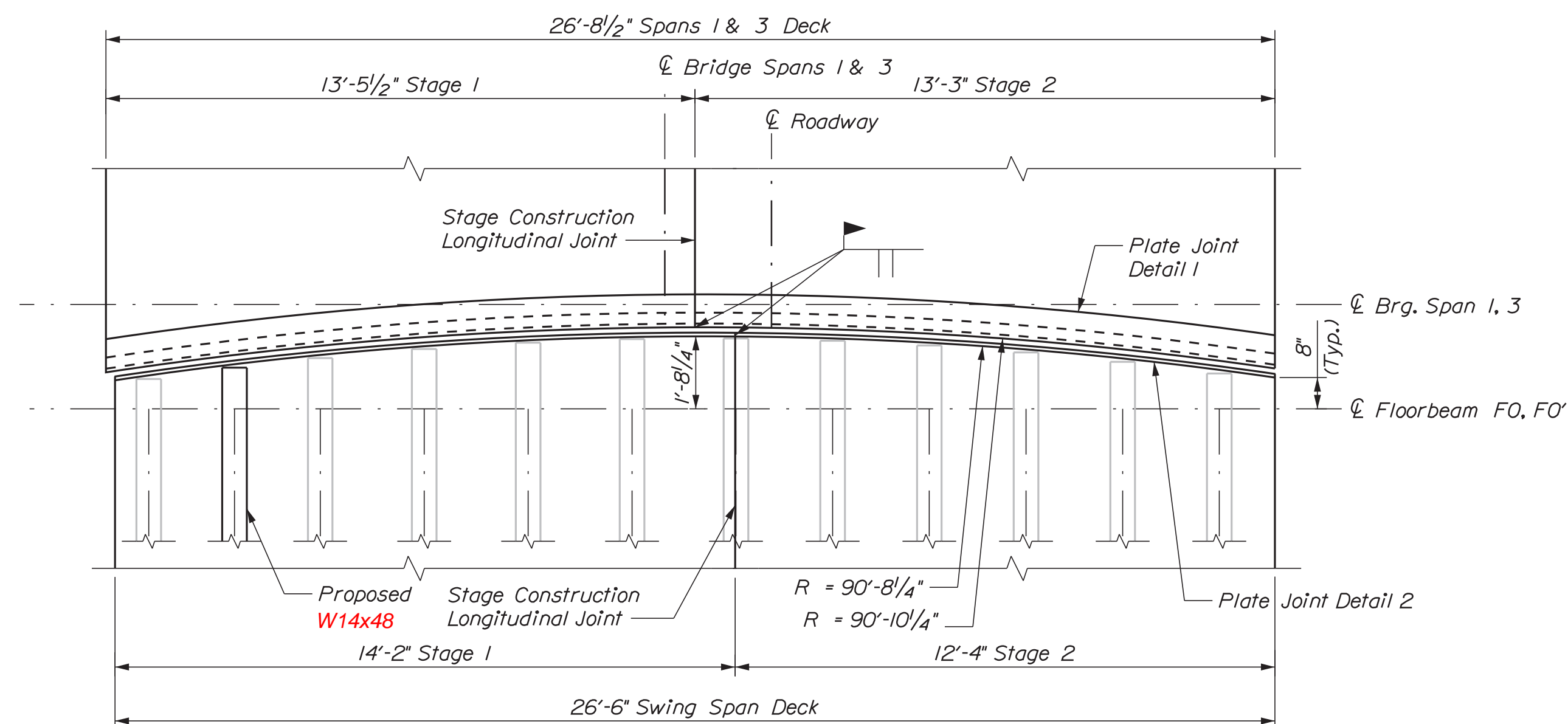
PLATE JOINT DETAIL 2



SECTION B-B



TYPICAL CLIP ASSEMBLY DETAIL

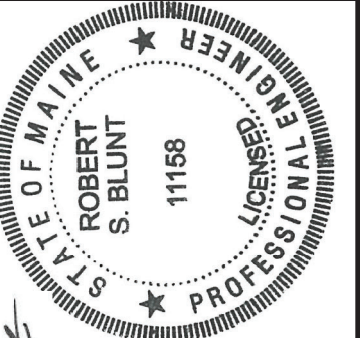


DECK JOINT PLAN
(Pier 1 shown, Pier 3 Similar)

NOTES

- All new structural steel shall be shop painted with connections masked. Any existing steel within 6" of new steel shall be painted.
- Concrete material for infilling concrete deck shall meet the requirements of Special Provision 502.
- Concrete infill shall not project above the top of the steel grid deck.
- Ceramic ferrules for existing shear connectors shall be completely removed prior to installing new grid deck.
- Contractor shall field verify joint radius.
- See Truss Swing Span Plan and Typical Section sheet for locations of Sections A-A and B-B.
- Procurement, fabrication, and installation of steel plate joints shall be incidental to related deck items.
- Steel grid deck clip assembly detail shall be designed by the steel grid deck supplier. Shop drawings shall be submitted to the Resident prior to steel grid deck fabrication and installation. The connection of the new steel grid deck to truss floorbeams and stringers shall include both weldments and clips as indicated in the typical clip assembly detail. Design, procurement, and installation of clips shall be incidental to Item 530.02, Prefabricated Deck Panels.

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
2309401
WIN
21751.01
BRIDGE NO. 2789
BRIDGE PLANS



PROJ. MANAGER	J. STETSON, PE	DATE	8/19/22
DESIGN-DETAILED	BCP	BY	RSBLUNT
CHECKED-REVIEWED	CTA	DATE	8/19/22
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS	1	SIGNATURE	1158
REVISIONS	2	P. E. NUMBER	August 19, 2022
REVISIONS	3	DATE	
REVISIONS	4		
FIELD CHANGES			

SOUTHPORT BRIDGE ROUTE 27
OVER TOWNSEND GUT
SOUTHPORT & BOOTHBAY HARBOR ME
LINCOLN COUNTY
STEEL GRID DECK AND
JOINT DETAILS

SHEET NUMBER
34
OF 48

Date: 8/19/2022

Username:

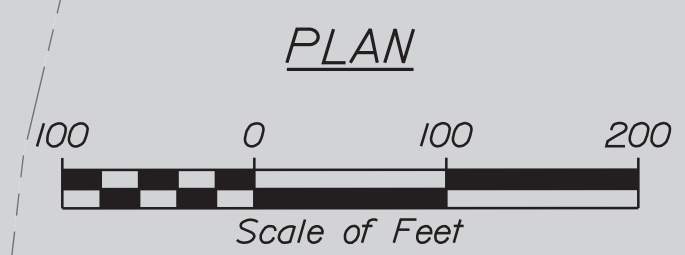
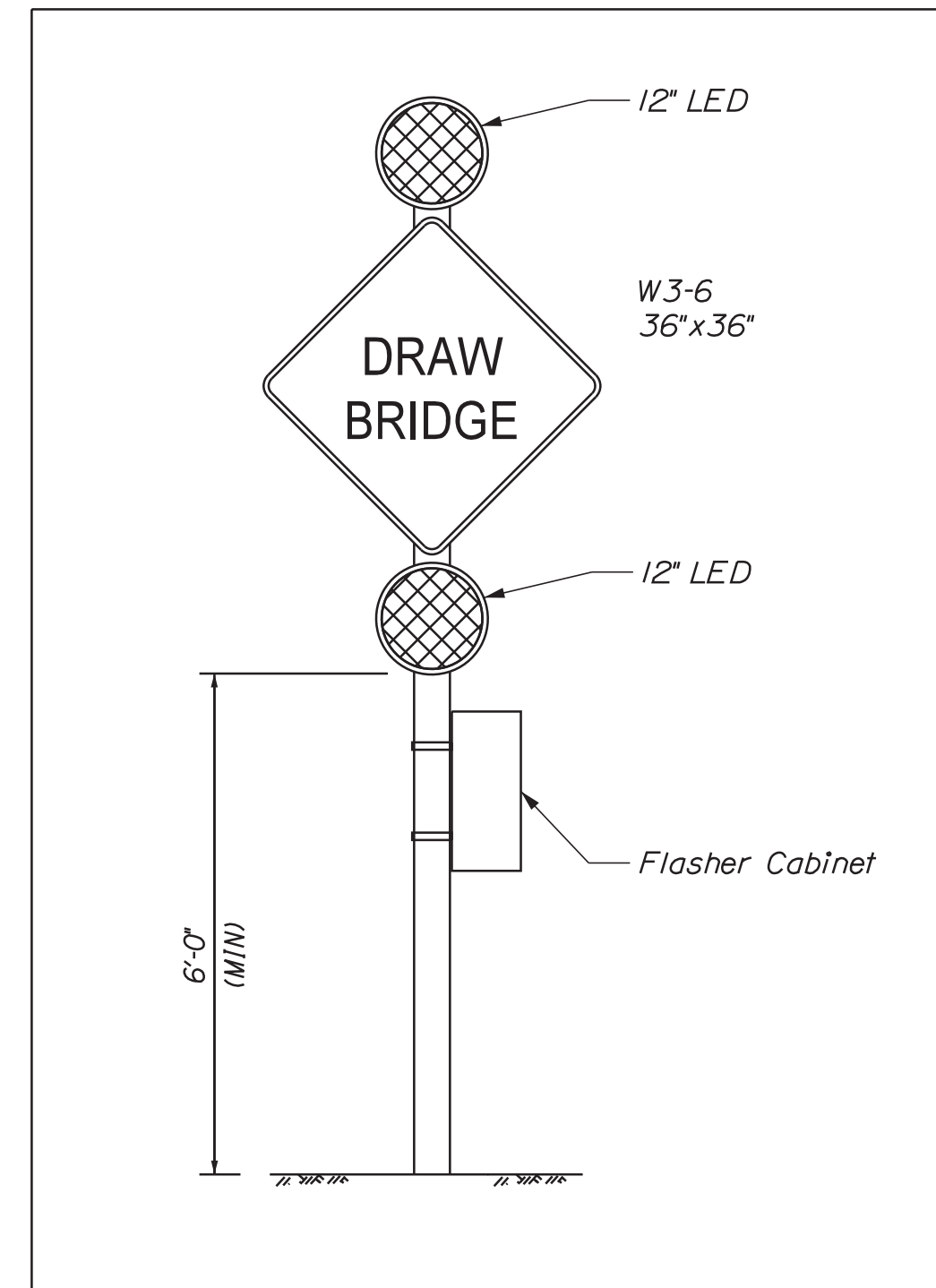
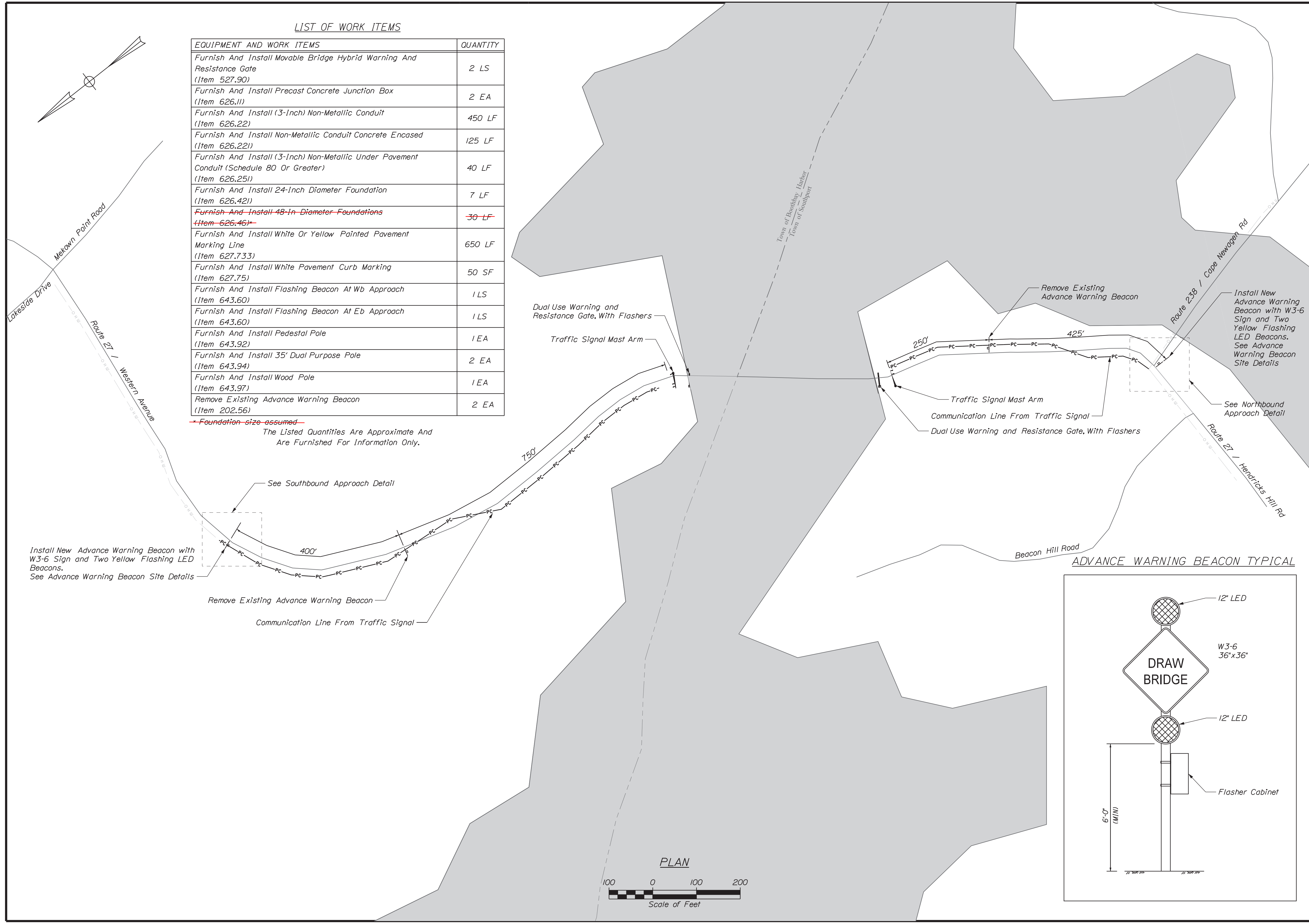
Division: BRIDGE

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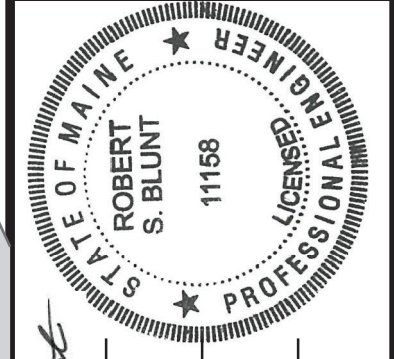
LIST OF WORK ITEMS

EQUIPMENT AND WORK ITEMS	QUANTITY
Furnish And Install Movable Bridge Hybrid Warning And Resistance Gate (Item 527.90)	2 LS
Furnish And Install Precast Concrete Junction Box (Item 626.11)	2 EA
Furnish And Install (3-Inch) Non-Metallic Conduit (Item 626.22)	450 LF
Furnish And Install Non-Metallic Conduit Concrete Encased (Item 626.221)	125 LF
Furnish And Install (3-Inch) Non-Metallic Under Pavement Conduit (Schedule 80 Or Greater) (Item 626.251)	40 LF
Furnish And Install 24-Inch Diameter Foundation (Item 626.421)	7 LF
Furnish And Install 48-In Diameter Foundations (Item 626.46)	30 LF
Furnish And Install White Or Yellow Painted Pavement Marking Line (Item 627.733)	650 LF
Furnish And Install White Pavement Curb Marking (Item 627.75)	50 SF
Furnish And Install Flashing Beacon At Wb Approach (Item 643.60)	1 LS
Furnish And Install Flashing Beacon At Eb Approach (Item 643.60)	1 LS
Furnish And Install Pedestal Pole (Item 643.92)	1 EA
Furnish And Install 35' Dual Purpose Pole (Item 643.94)	2 EA
Furnish And Install Wood Pole (Item 643.97)	1 EA
Remove Existing Advance Warning Beacon (Item 202.56)	2 EA

~~Foundation size assumed~~
The Listed Quantities Are Approximate And Are Furnished For Information Only.



STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
2309401
WIN
21751.01
BRIDGE NO. 2789
BRIDGE PLANS



PROJ. MANAGER	J. STETSON, PE	DATE	8/19/22
DESIGN-DETAILED	MDS	BY	RSBLUNT
CHECKED-REVIEWED	CTA	DATE	8/19/22
DESIGN2-DETAILED2		SIGNATURE	11158
DESIGN3-DETAILED3		P.E. NUMBER	August 19, 2022
REVISIONS 1		DATE	
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

SOUTHPORT BRIDGE ROUTE 27
OVER TOWNSEND GUT
SOUTHPORT & BOOTHBAY HARBOR ME
LINCOLN COUNTY
ADVANCE WARNING
BEACON PLAN

SHEET NUMBER
45
OF 48

