



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

Paul R. LePage
GOVERNOR

David Bernhardt
COMMISSIONER

December 4, 2018
Subject: Barbers Island Bridge
Rehabilitation
State WIN: 022607.00
Location: **Boothbay**
Amendment No. 3

Dear Sir/Ms.:

Please make the following changes to the Bid Documents:

In the Bid Book:

CHANGE on page 14, Notice to Contractors, the Bid Opening Date from “December 5, 2018”, to read “**December 12, 2018**”. Make this change in pen and ink.

REMOVE page 66, SPECIAL PROVISION - SECTION 107 – TIME - (Scheduling of Work) – (Disincentive Penalty), 1 page, dated October 5, 2018, and **REPLACE** with the attached, revised SPECIAL PROVISION - SECTION 107 – TIME - (Scheduling of Work) – (Disincentive Penalty), 1 page, dated December 3, 2018.

REMOVE page 67, SPECIAL PROVISION - SECTION 107 – Time - (Sunday Work), 1 page, dated October 5, 2018, and **REPLACE** with the attached, revised SPECIAL PROVISION - SECTION 107 – Time - (Sunday Work), 1 page, dated December 3, 2018.

REMOVE page 68, SPECIAL PROVISION - SECTION 107 – Time - (Scheduling of Work) – (Disincentive Penalty), 1 page, dated October 5, 2018. This page was a duplicate.

REMOVE pages 75-76, REMOVAL OF STRUCTURES AND OBSTRUCTIONS - (Building Removal), 2 pages, dated October 5, 2018, and **REPLACE** with the attached, revised SPECIAL PROVISION - SECTION 202 – REMOVAL OF STRUCTURES AND OBSTRUCTIONS - (Building Removal), 2 pages, dated December 3, 2018.

REMOVE pages 84 - 85, SPECIAL PROVISION - SECTION 203 – EXCAVATION AND EMBANKMENT – (Dredge Materials), 2 pages, dated October 5, 2018.

REMOVE page 101, SPECIAL PROVISION - SECTION 502 – STRUCTURAL CONCRETE (Bridge Drains), 1 page, dated October 5, 2018, and **REPLACE** with the attached, revised SPECIAL PROVISION - SECTION 502 – STRUCTURAL CONCRETE (Bridge Drains), 1 page, dated December 3, 2018.



PRINTED ON RECYCLED PAPER

REMOVE pages 248 - 254, SPECIAL PROVISION – SECTION 655 – ELECTRICAL WORK - (Field Instrumentation Devices), 7 pages, dated October 5, 2018, and **REPLACE** with the attached, revised SPECIAL PROVISION – SECTION 655 – ELECTRICAL WORK - (Field Instrumentation Devices), 8 pages, dated November 30, 2018.

REMOVE pages 267 - 281, SPECIAL PROVISION – SECTION 655 – ELECTRICAL WORK - (Low Voltage Motors), 15 pages, dated October 5, 2018, and **REPLACE** with the attached, revised SPECIAL PROVISION – SECTION 655 – ELECTRICAL WORK - (Low Voltage Motors), 15 pages, dated November 30, 2018.

In the Plan Set:

REMOVE SHEET NUMBER 22 OF 132, FOOTING & SEAL PLAN, and **REPLACE** with the attached SHEET NUMBER 22A OF 132, FOOTING & SEAL PLAN. One Pier Note was deleted, one Seal Cofferdam Note was revised, and one Seal Cofferdam Note was deleted.

The following questions have been received:

Question: On sheet 102 there is a note on the main drive motor identifying an “Absolute Encoder”. Is there a specification for this or any further information?

Response: See attached updated Special Provision - Section 655 - Electrical Work (Low Voltage Motors) Section 2.15.10 for encoder details.

Question: Can Hot Dip Galvanizing meeting the requirements of ASTM A123 be substituted for metalizing of the structural steel?

Response: No, Hot Dip Galvanizing may not be substituted for metallizing of the structural steel.

Question: Please provide the voltage that is running through the utility lines that are to be relocated.

Response: 7200.

Question: Please clarify who is responsible for the cost to relocate the utility lines.

Response: The utilities will do the relocation of their facilities and bear the costs. The Contractor is responsible for the layout of all poles, clearing, and access to the new poles as stated in Special Provision Section 104 - Utilities.

Question: Plan Sheet 102 calls out a rotary cam limit switch in the location of the motor output shaft coupling, please provide a detail showing where this is located and how it will be coordinated with the operating machinery.

Response: Rotary Cam callout on contract plans is clarified in the attached updated Special Provision – Section 655 - Electrical Work (Field Instrumentation Devices), Section 2.5.

Question: Please provide the location of the Stub Post Elevation detailed on Plan Sheet 38.

Response: The stub post can be found at panel points L1 and L15. See Plan Sheet 32.

Question: Section 504 of the standard specifications says all welding shall conform to AWS D1.5. Specification Section 860.7.17 (Mechanical Work for Swing Bridge) states the welds shall meet the requirements of ASW D1.1. Please clarify.

Response: Welding associated with the bid items referenced in Special Provision Section 860 – Mechanical Work for Swing Bridge Replacement are based on AWS D1.1 as identified in Section 860.7.17. However, Section 504.64 Non- Destructive Testing-Ancillary Bridge Products and Support Structures of the Standard Specifications shall apply. Payment for Non-Destructive Testing shall be incidental to the respective pay items for the bid items referenced in Special Provision Section 860 – Mechanical Work for Swing Bridge Replacement.

Question: End Lift components EL3, EL4, EL6, and EL9 (sheets 85-87) call for 1” diameter Hex Socket Flat Countersunk turned bolts. Machining the counter-bore will reduce the amount of material left to locate the plates on the body of the bolt. In addition, there may be additional stresses introduced to the bolts if the concentricity is off between the head and the body of the bolt or between the counter-bore and the thru-hole. Do the locational tolerances necessary for these elements require the use of turned bolts or could an acceptable connection be made with high strength flat countersunk screws be used in lieu of countersunk turned bolts?

Response: Design intent had assumed that turned holes and countersinks would be machined as part of same setup to ensure concentricity. Alternate sequencing of machining operations may produce acceptable results but tolerances will need to be monitored and controlled. Length of turned fit had been considered as part of design.

Question: Plan Sheet 22, Pier Note 7 states, “Bedrock which protrudes above a horizontal plane 12 inches below the proposed footing elevation shall be removed. Payment for bedrock removal will be made under item No. 206.11 Structural Rock Excavation – Piers.” Seal Cofferdam Note 5 states, “...the top of seal elevations require that the average bottom of seal elevation be below or equal to El. -23.0.” Where will the rock that is removed between 12 inches below the proposed footing elevation and the bottom of seal be paid?

Response: See attached revised plan sheet 22A. Any bedrock removal within the limits of the cofferdam shall be paid for under Pay Item 206.11 Structural Rock Excavation – Piers.

Question: The bid documents contain the General Decision Number ME180115, dated 4/06/2018, Construction Type: Highway. Is this the correct wage decision or should it be Heavy and Bridge?

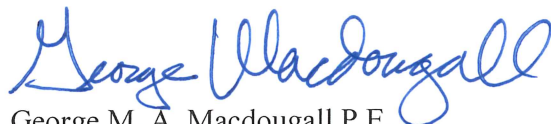
Response: Yes, Highway is the correct Construction Type.

Question: On plan sheet 99 Detail A shows the submarine cable installation. It shows the submarine cable with a 24" dia. precast concrete half-round cover over the submarine cable. The detail also shows the submarine cable below top of mudline. In the special provisions, page 310, 3.2.1.1 General Requirements, it states the submarine cables shall be laid on the bottom surface with protective concrete half round for the entire length. In special provisions, page 311, 3.2.2.1 Cable Protection, it states the submarine cables shall be anchored to the bottom of the navigable water channel. Please verify that the submarine cable shall be laid on the bottom of the water channel at current elevation with no trenching or excavation involved. Also, please verify that no additional anchoring is needed besides the precast half-round concrete sections.

Response: Correct, the submarine cable shall be laid on the bottom of the water channel at current elevation with no trenching or excavation involved. Correct, no additional anchoring is needed besides the precast half-round concrete sections.

Consider these changes and information prior to submitting your bid on **December 12, 2018**.

Sincerely,



George M. A. Macdougall P.E.
Contracts & Specifications Engineer

SPECIAL PROVISION
SECTION 107
TIME
(Scheduling of Work)
(Disincentive Penalty)

Movable Bridge Operations and Navigation Channel Restrictions:

The Contractor shall plan and prosecute work in such a manner as to limit the closure of the movable bridge operations, navigation channel vertical restrictions, and temporary detour usage starting no earlier than November 1, 2019 and ending no later than May 31, 2020.

The reconstructed bridge and approaches shall be substantially complete and open to two-way traffic on or before May 31, 2020. Substantially Complete is defined as having the following work complete and accepted, as a minimum:

- Fully operational mechanical and electrical bridge control systems, including all field testing and commissioning activities.
- Fully operational traffic safety and control systems, including the flashing beacons, warning and regulatory signs, traffic signals and gates.
- Bridge deck grooving; base pavement on the approaches; bridge rail; guardrail.
- All navigation channel aids including the navigation channel lights, fender system, and signs.

A disincentive/penalty of \$10,000.00 (ten thousand dollars) per calendar day shall be paid by the Contractor for every calendar day the navigation channel remains closed to boat traffic, a vertical clearance restriction on the channel remains, or the work is not considered substantially complete after May 31, 2020. The maximum disincentive paid by the Contractor will be capped at \$350,000.

SPECIAL PROVISION
SECTION 107
TIME
(Sunday Work)
(Holiday Work)

Subsection 107.3.3 of the Standard Specifications is amended as follows:

The Contractor will be allowed to work on Sundays during the movable bridge closure period. The Contractor shall provide the Resident with a minimum of 48 hours notice before commencing work on a Sunday.

The Contractor will not be allowed to work on Holidays except those noted in the Standard Specifications Section 107.3.1.

SPECIAL PROVISION
SECTION 202
REMOVAL OF STRUCTURES AND OBSTRUCTIONS
(Building Removal)

202.01 Description This item shall include the complete demolition and removal of the existing operator house.

202.02 General Removal of building shall include all attached structures including steps, slabs, walks, decks, piers, posts, driveways and other incidentals, as directed by the Resident.

All excavations shall be filled and compacted using vibratory equipment in one-foot layers to the surrounding existing grade levels. In this process, the contour and grades of the abutting land are to be followed. Erosion control including loaming, seeding, and mulch shall be done and will be considered to be incidental to the contract.

Under Section 202.02 of the Standard Specifications, ownership of buildings and all equipment, fixtures, and materials therein shall be interpreted as meaning all equipment, fixtures, and materials that are recognized as real property. Any items that are recognized as personal property are exempt and are reserved to the owner. If the bidder is in doubt as to whether any item not listed is real or personal property, they shall request a determination of the matter prior to date on which bids are to be received.

All debris and unusable materials shall be removed to an approved transfer station or approved landfill. Under no circumstances shall any material or debris be disposed of by burning on the premises nor shall the debris be burned at an off-premise site.

Rodent Control: With the "Notice to Proceed", or when a building becomes available to the Contractor, the Contractor will designate whether rodent control measures are required or not.

The Contractor shall not remove a building until the Contractor has certified it to be free of rodents. Should rodent control measures be required, the Contractor shall procure the extermination services as soon as possible. The Contractor will re-inspect the building within 7 days after the extermination services are performed. The cost of extermination services until the building is found to be rodent free will be paid for as a specialty item under Section 109.04(g) of the Standard Specifications.

Each building shall be removed promptly after notification that it is free of rodents. All subsequent inspection costs and extermination services necessary to assure that the building is rodent free at time of removal will be at the expense of the Contractor.

This building may or may not contain asbestos. Prior to any demolition of building(s) the Contractor will conduct an asbestos survey on the building(s) to determine if any asbestos exists. The survey will be conducted by a DEP certified Asbestos Inspector. No separate payment will be made for the survey and it shall be considered incidental. The survey results will be

communicated with the Resident. If no asbestos is discovered, the demolition process may proceed. If asbestos is found, the Contractor will employ a DEP certified Asbestos Abatement Contractor for its' removal and disposal. The Department will bear all expenses incurred in the abatement of any asbestos containing material as detailed in Standard Specification 109.7.5 – Force Account. Any questions can be directed to the Office of Legal Service (624-3020).

The Contractor shall remove all utility service connections prior to demolition of any building. The Contractor shall coordinate disconnection of overhead utilities with the appropriate utility companies.

The building has a portable toilet. The portable toilet shall be removed by the Department before the building is removed. The Contractor shall provide the Resident with 7 days of advanced notice before building removal.

All fill material used for foundation cavities, septic systems and other shall meet the Standard Specification requirements for Common Borrow, Section 703.18.

Contractor shall provide and maintain all temporary barricades, signs or other safety measures as necessary to complete the work. Contractor shall obtain any and all permits or licenses necessary for the performance of the work and conform to all Federal, State and local laws, regulations or ordinances applicable to the work.

Any oil/fuel tanks encountered will need to be properly disposed of. The fuel is a regulatory material and may be reused or disposed of in accordance to local, state, and federal regulations. The tanks shall also be disposed of in accordance to local, state, and federal regulations.

All plywood panels, hasps, padlocks, and other materials used to secure these buildings will remain the property of the Department of Transportation. These panels and padlocks will be transported to a location in the area to be determined by the Resident.

202.03 Method of Measurement The Work specified herein will be measured for payment by lump sum.

202.04 Basis of Payment All work for will be paid for at the contract Lump Sum price, which shall be full compensation for all materials, labor and equipment necessary for the work described above and as shown in the Plans, and/or as directed by the Resident. Backfilling with common borrow is incidental to the Remove Building pay item.

Payment will be made under:

<u>Pay Item</u>		<u>Pay Unit</u>
202.08	Remove Building: Operator's House	LS

SPECIAL PROVISION
SECTION 502
STRUCTURAL CONCRETE
(Bridge Drains)

The following is added to Standard Specifications Section 502:

502.01 Description The Contractor shall manufacture, furnish, and install the approach span bridge drains in accordance with the Contract Documents. The approach spans drains shall not be considered incidental to the Deck pay item, but instead shall be paid for separately. Installation includes the concrete removal and cutting of reinforcing steel and placement of new concrete and reinforcing steel as detailed on the Contract Drawings.

502.18 Method of Measurement The Work specified herein will be measured for payment per each, complete, in place, and accepted.

502.19 Basis of Payment The accepted Work specified herein will be paid for per each at the Contract unit price. The unit price shall include all components and associated hardware, and shall be full compensation for all labor, equipment, materials, professional services, and incidentals necessary for designing, manufacturing, furnishing, and installing the Bridge Drains on the existing approach spans.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
502.7 Bridge Drains	EA

SPECIAL PROVISION
SECTION 655
ELECTRICAL WORK
(Field Instrumentation Devices)

PART 1 – GENERAL

1.1 RELATED REQUIREMENTS

- .1 This section includes general requirements for supply, service, delivery, storage, installation, testing and commissioning of field instrumentation devices.
- .2 Provide supervision, labor, and assistance to manufacturer’s field representative and/or technical directors of installation for equipment installed as a part of this Contract. Follow specified procedures and instructions provided by these representatives. Representatives will not be present at all times. Department or Owner's Representative will determine when representatives are required.
- .3 The requirements of other related specification sections shall also apply for installation and coordination of work.

1.2 REFERENCES

- .1 Occupational Safety and Health Administration – OSHA
- .2 National Fire Protection Association – NFPA
 - .1 ANSI/NFPA 70 - National Electrical Code
 - .2 ANSI/NFPA 70B - Recommended Practice for Electrical Equipment Maintenance
 - .3 ANSI/NFPA 70E - Standard for Electrical Safety in the Workplace
 - .4 ANSI/NFPA 101 - Life Safety Code
- .3 Instrumentation Systems and Automation Society (ISA)
 - .1 ISA 5.1 - Instrumentation Symbols and Identification
 - .2 ISA/ANSI-S 84.01 - Application of Safety Instrument Systems for the Process Industry
 - .3 ISA S 71.01 - Environmental Conditions for Process Measurement and Control Systems: Temperature and Humidity
- .4 National Electrical Manufacturers Association (NEMA)

- .1 NEMA 250 - Enclosures for electrical Equipment (1000 Volts maximum)
- .5 Institute of Electrical and Electronic Engineers (IEEE)
 - .1 IEEE STD.472 - Surge Withstand Capabilities
 - .2 IEEE C37.90.1 - Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems
 - .3 IEEE 730 - Standard for Software Quality Assurance Plans
 - .4 IEEE 828 - Standard for Software Configuration of Management Plans
 - .5 IEEE 1042 - Guide to Software Configuration management IEEE Computer Society Document
- .6 MUTCD - Manual of Uniform Traffic Control Devices.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 The Contractor shall submit copies of vendor, producer or manufacturer data for instrumentation devices and apparatus. These shall include design and installation shop drawings, catalog cuts, specifications, data sheets, physical dimensioned drawings, testing and calibration requirements, and installation instructions for the following items, but not excluding other items or materials not specifically mentioned herein.
- .2 Product Data:
 - .1 Mechanical Limit Switch
 - .2 Geared Limit Cam Switch
 - .3 Rotary Cam Limit Switch
 - .4 Inductive Proximity Sensor

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store limit switches off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect limit switches from damages.

- .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: Plan related to the Work of this Section. Remove and/or reuse and return of pallets, crates, padding, packaging materials as required.

1.5 MEASUREMENT AND PAYMENT

- .6 The Contract Lump Sum Amount shall include all costs for Field Instrumentation Device for Electrical including all costs associated with the electrical system installation, testing, commissioning, and documentation requirements.
- .7 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.

PART 2 – PRODUCT

2.1 GENERAL DESCRIPTION

- .1 The contractor shall furnish all limit switches defined herein.
- .2 The limit switches shall consist of lever arm and plunger type limit switches as herein specified and described on the Contract Drawings.
- .3 All limit switches shall be manufactured in accordance with the requirements of NEMA A600 and be U.L. listed.

2.2 MECHANICAL LIMIT SWITCHES

- .1 Function: Monitor position of machinery parts; protecting equipment and personnel from dangerous contacts and/or conditions.
- .2 Construction:
 - .1 Metallic, industrial heavy duty design
 - .2 Suitable for application in harsh industrial or corrosive environments
 - .3 Electrically isolated bodies for industrial/corrosive environments
 - .4 Zinc casings sealed w/ epoxy resin
 - .5 Shock and vibration resistant
 - .6 Stainless steel operating rod or lever arm

- .7 Stainless steel cable gland
- .8 Limit switch operating heads are as indicated in the Limit Switch Application Table
- .3 Operating Temperature: -40 °C to 85 °C
- .4 Enclosure Rating / Degree of Protection: NEMA 4X / IP67.
- .5 Minimum Actuation Speed:
 - .1 Slow action contacts: 0.060 m/s
 - .2 Snap action contacts: 0.001 m/s
- .6 Ratings:
 - .1 Rated operational voltage: 130 V
 - .2 Rated Thermal Current: 10A min
 - .3 Rated Insulation Voltage: 300V minimum
- .7 Certifications / Approvals: UL
- .8 Features and auxiliaries:
 - .1 The switches shall be provided with 2 NO and 2 NC contacts
 - .2 The Contractor shall furnish formed galvanized steel supporting brackets and associated stainless steel hardware.
 - .3 Manufacturer pre-wired connection
 - .4 The joint of the mechanism between the spring buffer and the plunger rod shall be covered with a watertight, neoprene bellows-type boot.
- .9 The Contractor shall submit outline drawings, dimensioned layout, switch contact configuration diagram and specification data sheet of the limit switches to the Engineer for approval prior to procurement.

2.3 MAGNETIC LIMIT SWITCHES (GO™ SWITCH)

- .1 Function: Monitor position of machinery parts; protecting equipment and personnel from dangerous contacts and/or conditions.
- .2 Construction:
 - .1 Proximity triggering with ferrous metal and magnetic targets - no exposed moving parts
 - .2 Metallic, industrial heavy duty design
 - .3 Suitable for application in harsh industrial or corrosive environments
 - .4 Electrically isolated bodies for industrial/corrosive environments

- .5 Shock and vibration resistant
- .6 Stainless steel sensing face and housing
- .7 Stainless steel cable gland
- .8 3/8" (10mm) sensing distance (ferrous metal)
- .9 Provide target magnet to extended sensing as required (with resin cover or stainless cover)
- .10 AC/DC, NO/NC Wiring Flexibility
- .3 Operating Temperature -58°F to 221°F (-50°C to 105°C)
- .4 Enclosure Rating / Degree of Protection: NEMA 4X / IP67.
- .5 Contact Ratings: Dry Contact, Single Pole Double Throw (SPDT); 5A/240VAC, 10A/120VAC, 3A/24VDC
- .6 Certifications / Approvals: UL
- .7 The Contractor shall submit outline drawings, dimensioned layout, switch contact configuration diagram and specification data sheet of the limit switches to the Engineer for approval prior to procurement.

2.4 SHAFT SPEED MONITOR SWITCH

- .1 Function: Monitor machinery shaft speed protecting equipment and personnel from dangerous overspeed conditions. While the monitored shaft is rotating, the pulser disc or wrap mounted on the shaft generates an alternating magnetic field whose frequency is proportional to the speed of the monitored shaft. This alternating magnetic field is detected by the sensor and is transmitted to the speed switch in the form of a digital pulsed signal. The digital signal is then converted to a proportional voltage that is continually compared to a reference voltage corresponding to each relay set point. The relay energizes or de-energizes whenever the control signal voltage crosses the set-point reference voltage.
- .2 Construction: (Basis of design manufacturer: Electro-Sensors DSP or equivalent)
 - .1 Sensor: Cast aluminum, C.S.A. and FM, Approved UL, Rated Class I Group C, D; Class II Group E, F, G; Class III
 - .2 Signal Cable: 3-conductor shielded, length as required
 - .3 Sensor Distance: 1/16" to 3/8"
 - .4 Pulser Wraps: Provide, stainless steel, split collar, custom machined to the diameter of the monitored shaft.
- .3 Speed Calibration: Select speed range suitable with machinery shaft speed.
- .4 Operating Temperature: -40 °C to 60 °C (Sensor and Pulser Wrap)
- .5 Input Power: 115V, 50-60 Hz.

- .6 Input Signal: Open collector/logic
- .7 Output Signal: 0-10 Vdc
- .8 Certifications / Approvals: UL
- .9 Provide the following Options and Features:
 - .1 Relay Outputs: 2 Form C (SPDT), 5-amp, 115V, with LED indication when energized.
 - .2 Speed Set Points: Two independent Over/Under speed set points.
 - .3 Set-Point Relay Delay: the set-point relay energized for a period of 0.1 to 15 seconds after a fault condition has been detected. The delay will automatically reset itself when the fault condition is cleared or the relay will de-energize if the fault condition persists beyond the delay time.
 - .4 Relay Latch Function: The relay latch function provides the user with the ability to latch the relay in the de-energized mode once it has been tripped.
 - .5 Digital Meter: The meter provides a convenient method of accurately calibrating the DSP as well as providing an indication of actual running speed after set up.
 - .6 The Contractor shall furnish formed galvanized steel supporting brackets and associated stainless steel hardware.
- .10 The Contractor shall submit outline drawings, dimensioned layout, switch contact configuration diagram and specification data sheet of the limit switches to the Engineer for approval prior to procurement.

2.5 GEARED LIMIT CAM SWITCH

- .1 Items identified as geared limit cam switch or rotary cam limit switch in this specification or on the Contract Plans shall be provided as individual stand alone lever arm limit switches which meet the requirements of mechanical limit switches per section 2.2 and provide the following functionality:
 - .1 Span Full Open (1 switch required)
 - .2 Span Nearly Open (1 switch required)
 - .3 Span Nearly Closed (2 switches required)
 - .4 Span Full Closed (1 switch required)
- .2 The limit switches shall be mounted on supports anchored to the piers and shall contact strike plates mounted to the moving span. All supports and strike plates shall be stainless steel and shall utilize stainless steel fasteners. Supports shall be of durable construction and shall not exhibit any permanent deformation under an imposed load of 300 lbs. in any direction.

- .3 The Span Full Closed limit switch shall be mounted on the west approach pier adjacent to the full closed bumper block. All other position indication limit switches shall be mounted on the center pier on the side of the center bearing opposite the span drive machinery.
- .4 Exact location of position indication limit switches shall be determined in field to provide the indicated functionality. Supports shall be located so as to avoid interference with any other part of the moving or stationary structure during operation.
- .5 The Contractor shall submit outline drawings, dimensioned layout, switch contact configuration diagram and specification data sheet of the limit switches to the Engineer for approval prior to procurement.

2.6 MOUNTING PLATES, BRACKETS, AND HARDWARE

- .1 The Contractor shall design, and/or fabricate mounting plates and/or brackets required for mounting of field instrumentation devices including limit switches, speed and/or position sensors. The field instrument mounting plates, brackets, and hardware shall be stainless steel.

PART 3 – EXECUTION

3.1 INSTALLATION

- .1 Install the limit switches in accordance with manufacturer's recommendations and the approved shop and working drawings.
- .2 The Contractor shall be responsible for determining suitable locations for the field installation of limit switches required for proper operation of the control system. The Contractor shall provide stainless steel mounting brackets and associated hardware as required to securely mount the limit switches in its proper position to ensure correct operational functionality and repeatability of control system performance which rely on the input signal from the limit switches.
- .3 The Contractor shall be responsible for instrumentation leads from the limit switches to field termination boxes, and for circuit wirings and conduit raceways required to complete the circuits.
- .4 The Contractor shall be responsible for testing and commissioning, making necessary field adjustments, and/or relocating limit switches and other field instruments as necessary to achieve proper operation.,

METHOD OF MEASUREMENT AND PAYMENT

- .1 The Contract Lump Sum (LS) Amount. All costs for the requirements of this Special Provision are incidental to the bridge control system and are to be included in the Lump Sum (LS) Amount of Bid Item 655.3002 BRIDGE CONTROL SYSTEM.

--END OF SECTION--

SPECIAL PROVISION
SECTION 655
ELECTRICAL WORK
(Low-Voltage Motors)

PART 1 – GENERAL

1. ELECTRICAL WORK DESCRIPTION

1.1 GENERAL REQUIREMENTS

- .1 This section includes general requirements for supply, delivery, storage, installation, testing and commissioning of low voltage, 3-phase, fractional and integral horsepower squirrel cage induction electric motors 1/2 to 400 hp.
- .2 Provide motors either separately or as an integral part of mechanical system. Motor horsepower and torque characteristics shall be coordinated with driven piece of equipment by manufacturer. Provide Low-Voltage Motors of a sufficient size and characteristic for the application and duty of the driven equipment with appropriate design margin meeting the specific application requirements.
- .3 The span drive motors shall be AC gearmotors with integral disc brakes. The motors shall be assembled with the gearboxes as indicated on the Mechanical Plans and Specifications.
- .4 The requirements of other related specification sections shall also apply for installation and coordination of work.

1.2 RELATED SECTIONS

- .1 The requirements contained in other sections of project specification shall also apply for installation and coordination of work.

1.3 REFERENCES

- .1 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA MG 1 (2014) Motors and Generators
- .2 Institute of Electrical and Electronics Engineers(IEEE)

- .1 IEEE 112 (2004) Standard Test Procedure for Polyphase Induction Motors and Generators
- .2 IEEE 841 (2009) IEEE Standard for Petroleum and Chemical Industry--Premium-Efficiency, Severe-Duty, Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors--Up to and Including 370 kW (500 hp)
- .3 AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)
 - .1 ABMA 11 (2014) Load Ratings and Fatigue Life for Roller Bearings
 - .2 ABMA 9 (2015) Load Ratings and Fatigue Life for Ball Bearings
- .4 International Electrical Testing Association (NETA)
 - .1 NETA ATS Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
 - NETA MTS Standard for Maintenance Testing Specifications for Electrical Power Equipment and Systems

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 The Contractor shall submit copies of vendor, producer or manufacturer product data. These shall include design and installation shop drawings, catalog cuts, specifications, testing requirements, and installation instructions.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for motor control centres and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Data sheets and publications on all major components including, but not limited to the following:
 - .1 Product description, motor physical dimension and terminal connection drawings
 - .2 Motor performance curves
- .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, cleaning procedures and maintenance information.
- .4 Test Report
- .5 Factory Test Procedures
- .6 Certificates
- .7 Closeout Submittals Warranty
- .8 Sustainable Design Submittals:

- .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
- .2 Recycled Content:
 - .1 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.

1.5 CLOSEOUT SUBMITTALS

- .1 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.
- .2 Provide instructions on how to adjustment, trouble-shooting, configuration, modify program settings, and modify the control program.
- .3 Include copies of as-built submittals.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoor, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect motor control centres from damages.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: Plan related to the Work of this Section. Remove and/or reuse and return of pallets, crates, padding, packaging materials as required.

PART 2 – PRODUCTS

2.1 DESCRIPTION

- .1 Motors shall be in accordance with applicable requirements of, NEMA MG-1, NFPA 70, IEEE 112, and UL 1004.
- .2 The motor's torque characteristics in relation to the speed and starting current, shall conform to the motor design classification.
- .3 Outdoor motors and motors on bridge structures shall be severe duty, totally enclosed and rated for application in high humidity, wet, and salty environments.
- .4 General duty motors installed in an environmentally controlled indoor, non-corrosive environment shall conform to NEMA MG-1.
- .5 Special purpose motor(s) shall conform to the specific technical and manufacturer's requirements for the application and shall have precedence over the technical requirements for the general duty motors.

2.2 GENERAL PERFORMANCE AND REQUIREMENTS

- .1 The motors shall be designed to adequately braced for direct-on-line starting, with full rated voltage applied at their terminals. The starting performance of the motors shall comply with NEMA MG-1 requirements.
- .2 Electric motor of sizes 1 – 500 horsepower shall meet “NEMA Premium efficiency class IE3 standards.
- .3 Maximum voltage dip at motor terminal during initial starting condition, for motor started directly across line shall not exceed 20% of the system nominal voltage
- .4 Motor locked rotor current shall be limited to 650% when started at full voltage.
- .5 The motors shall withstand the dynamic torque stressing due to the switching phenomena (direct-on-line starting, short-circuit followed by transfer to another source and re-acceleration).
- .6 Torque and Acceleration: The torque characteristics of all induction motors shall be as required to accelerate the inertia loads of the motor and driven equipment to full speed without damage to the motor or the equipment at any voltage from 90% to 110% of motor nameplate voltage.
- .7 When electrically driven equipment differs from that indicated, make adjustments to the motor size, wiring and conduit systems, disconnect devices, and circuit

protection to accommodate the equipment actually installed, at no additional cost to the Government.

2.3 MOTOR RATING

- .1 Motor ratings as indicated on the design drawing and as specified.
- .2 Provide general purpose totally enclosed ac motors with a service factor of 1.15.

2.4 VARIABLE SPEED MACHINES

- .1 Motors driven by adjustable speed drive shall have duty ratings be suitable for operation on an adjustable speed drive over the operational speed range duty cycle without exceeding the maximum temperature rise.
- .2 Provided motors with external cooling fans to force cool the machine if it is not possible to maintain motor's temperature rise below its rating limit with an integral fan performance.

2.5 ENCLOSURE SYSTEM

- .1 The motor housings shall be rated IP65, and provided with stainless steel hardware and nameplate. The motor shall be rated for high humidity environments and the winding insulation shall be extra heavy duty. The motor frames shall be provided with condensation drains.
- .2 Totally Enclosed Fan Cooled (TEFC): General industrial applications relatively clean, dry locations (pumps, fan, compressors). Prevents the free exchange of air between the inside and outside of the frame, but does not make the frame completely air tight. A fan is attached to the shaft and pushes air over the frame during its operation to help in the cooling process.
- .3 Totally Enclosed Wash down (TEWD): Application in moist corrosive environments. Designed to withstand high pressure wash-downs or other high humidity or wet environments. Available on TEAO, TEFC and TENV enclosures totally enclosed, hostile and severe environment motors.
- .4 Provision for Vibration Monitoring
 - .1 Provide a smooth surface on motor housing in the vertical, horizontal, and axial directions at each bearing housing for attaching a magnet mounted accelerometer in order to monitor the motor vibration. Ensure the smooth surface is on the bearing housing, with the axial surface as close to the motor centerline as possible.

- .2 Provide a motor housing with a surface finish of 63 micro-inch minimum, corrosion resistant, with a minimum diameter finished surface of 50 millimeters. As an option sand disks with a minimum thickness of 9 millimeters can be used to meet the smooth surface requirement. Ensure surface is level within 1 degree or 0.0254 millimeters. Identify the smooth surface using a printed label or embossed plate stating "Vibration data collection point - Do Not Paint".

2.6 MOTOR FRAME

- .1 Motor's frame construction shall be heavy-duty, cast-iron construction, epoxy primer inside and out, and gaskets on all joints. Motor frame, fan covers, end brackets, drip shields, and bearing housing shall be cast iron with corrosion-resistant treatment. Motor supporting feet shall be an integral part of frame for very rigid mounting and to minimize vibration.
- .2 Provide motors with stainless steel replaceable automatic drainage fittings. Locate drain holes at low point of motor in final mounted position.
- .3 Drill and tap for ground lug connection. Locate bolt holes on motor frame, external to, and on same side as terminal box.

2.7 STATOR AND STATOR ASSEMBLY

- .1 The motors of 250hp and larger shall have form wound coils and a sealed Vacuum Pressure Impregnation (VPI) insulation system with epoxy resins.
- .2 The motors smaller than 250hp may have form wound or random wound coil. The motors with form wound coil shall have a sealed VPI insulation system with epoxy resins that withstand an immersion type test as required by applicable reference standards. The motors with random wound coil shall have a moisture resistant VPI insulating system or another type of insulation designed to prevent growth of fungus and ingress of moisture.
- .3 Windings shall be copper.
- .4 Windings shall be random-wound coils; winding insulation shall be of Class F at least, but the temperature rise shall correspond to Class B conditions.
- .5 The six (6) terminals of the three (3) phases of the stator windings shall be brought out in the main motor terminal box for testing purposes.

2.8 ROTOR AND SHAFT ASSEMBLIES

- .1 Motor shaft shall be machined, carbon steel capable of transmitting torque produced by motor.
- .2 The rotor squirrel-cage shall be made copper, copper-alloy bars or shall be fabricated aluminum, or integrally die-cast aluminum.
- .3 Rotor shall be epoxy-coated.
- .4 Dynamically balance motors by one of following means:
- .5 Drilling out parent metal in such a manner that structural strength of rotor is not weakened.
- .6 Use balance washers securely pinned in place.
- .7 Chiseling, sawing, or use of solder or similar deposit materials to achieve balance is not acceptable.

2.9 BEARING

- .1 Construct and provide bearing and bearing housing seals to prevent dirt or moisture from entering motor. The bearings shall be protected by a dust-proof and water-proof enclosure according to IP55 degree of protection or higher.
- .2 The bearings with oil lubrication shall be fitted with a sight gauge marked with the proper oil level and shall have fill and drain openings. When oil rings are used, means shall be provided for observing oil ring rotation while the motor is operating. The bearings with grease lubrication shall have grease valves for lubrication while the motor is running.
- .3 Where insulated bearings are required as a protection against the occurrence of shaft currents, one or both bearings shall be insulated, in consideration of the motor driven equipment assembly. At motors with one shaft extension, at least the bearing opposed to the driven equipment has to be insulated. At motors with two shaft extensions, both bearings have to be insulated, as well as one of the shaft couplings. Generally, piping and conduit to insulated bearings shall also be insulated.
- .4 Anti-friction type bearings shall be grease lubricated and have minimum rated life L10 with a median life no less than 50% of L10 life, as defined by AFBMA. Reliability of each bearing shall be greater than 90%.
- .5 Provide interior bearing caps or other suitable means to prevent lubricant from entering motor.
- .6 Design bearings so damage does not occur by axial rotor movement during motor startup and shutdown.

- .7 Motors provided with roller bearings or angular contact ball bearings shall be fitted with a transport lock to prevent damage to the bearings, due to vibration, during transport.
- .8 Shaft and bearings for belt-connected motor shall withstand normal belt pull of equipment furnished and momentary and continuous overloads due to acceleration caused by incorrect belt tension.
- .9 Bearings for motors shall be designed to carry 200% of maximum thrust develops during starting and stopping, and while operating at any capacity on rated performance curve.
- .10 Motors shall have metallic bearing isolators on each bearing.
- .11 Furnish vertical motors coupled to vertical pumps with non-reversing ratchets and bolted couplings with case drip shields.

2.10 LUBRICATION SYSTEM

- .1 System shall be capable of operating at least 8,000 hours without requiring addition of grease or complete change of grease.
- .2 Provide system with readily accessible grease inlet and outlet plugs in bearing housings to enable regreasing while motor is in service.

2.11 ANTI-CONDENSATION SPACE HEATERS

- .1 Provide low surface-temperature, anti-condensation space heaters for motors installed indoors and outdoors for motor size indicated. The heater shall be mounted on inside of motor frame or winding end turns. Anti-condensation space heaters shall be provided in all the motors of the following types:
 - .2 Indoor motors rated 200kW or 250HP and larger.
 - .3 Outdoor motors rated 30kW or 40HP and larger
- .4 The space heaters shall have sufficient capacity to keep the motor windings and internal parts dry when the motor is not running.
- .5 Space heaters shall be rated and designed to operate at the supply source voltage indicated on the design drawings and/or Data Sheet. Space heaters shall be suitable for installation environment.
- .6 The space heaters and their connections shall be protected against accidental contact with the personnel, but shall be accessible for service and replaceable in the field.
- .7 Flame retardant insulated wires shall be used for the space heater connections.

Sheath temperature at 110% of rated voltage, when operating at ambient temperature, shall not exceed 200°C or cause motor insulation temperature to exceed 130 °C, whichever is more restrictive.

2.12 MOTOR TERMINAL BOXES

- .1 Equip each motor with corrosion resistance, cast iron terminal boxes, unless indicated otherwise.
- .2 Provide motor with oversized terminal box to accommodate oversize motor power supply cables and to allow ample room for bending radius and stiffness of motor supply cables, and for terminating grounding conductor. For the motors larger than 100 kW, two (2) cable entrances shall be provided.
- .3 Motor leads shall have brass or stainless-steel ferrules embossed with appropriate lead number, or leads imprint with lead number.
- .4 Fit motor terminal box with neoprene gaskets.
- .5 Main terminal boxes shall be capable of rotation in 90° increments to permit connection on any one of four sides. The direction of the cable entrance in the terminal boxes, especially for the main terminal box, shall be adjustable in the field and changeable at a later date.
- .6 Provide motor lead seal and separator gasket between motor frame and terminal box.
- .7 Provide main terminal boxes with threaded conduit entrances or hubs for cable glands. Coordinate size with Engineer.
- .8 Terminate main lead electrical connections with tinned lugs suitable for cooper and aluminum conductor cables.
- .9 The terminal leads of the motor windings, of the heaters and of the monitoring devices shall be connected to terminals in separate terminal boxes (one for each of the lead groups indicated above).
- .10 Each terminal box shall have a corresponding mark or an indication of the purpose.
- .11 The holes in the terminal boxes for cable entrance shall be hermetically sealed for shipment.

Motor main or accessory leads that pass outside the motor enclosure shall be protected against mechanical damage.

2.13 MONITORING PROVISIONS

- .1 Provide the following monitoring provisions for motor rated 200kW or 250HP and larger:
- .2 The Stator winding.
 - .1 Minimum six (two for each phase) Resistance Temperature Detectors (RTD), uniformly distributed. The RTD's shall be embedded in the stator slots as follows:
 - .2 If there are two or more coil-slides per slot, the RTD's shall be located between the insulated coil-sides within the slot.
 - .3 If there is one coil-slide per slot, the RTD's shall be located between the wedge and the outside of the winding insulation.
 - .4 Minimum three (one for each phase) thermistors.
- .3 Bearings.
 - .1 One RTD for each bearing. Instead of RTD's, thermocouples may be provided.
 - .2 The temperature monitoring devices of the bearings shall be installed as close as possible to the heat generating surfaces and shall be located preferably in the bottom half of the bearing housing.
 - .3 The three-lead RTD's shall be of platinum Pt 100 (100 Ohm at 0°C).
 - .4 The thermocouples (if used) shall be chromel-constantan (E) type.
 - .5 The preferable solution is to provide adequate two-wire transducers (for RTD's, thermocouples, etc.) with output 4-20 mA.
 - .6 The transducers shall be mounted into appropriate motor terminal boxes. Electrical connections of the transducers shall be made on terminal blocks conveniently located for external wiring.
 - .7 For motors with great vibration, the transducers may be installed in a box mounted outside of the motor.
- .4 Provisions shall be made for installation of vibration detector/s (e.g. proximity probe/s) in agreement with the drive equipment manufacturer.

2.14 IDENTIFICATION AND TAGGING

- .1 Securely attach embossed or stamped, stainless steel nameplates with stainless steel screws or pins.
- .2 Nameplate shall contain standard information in accordance with applicable reference standards.

- .3 If identification number cannot be included on motor nameplate, provide separate stainless steel equipment identification nameplate in accordance with equipment identification as indicated.
- .4 Motor power and space heater circuits may be derived from different sources. Covers of motor terminal boxes containing space heater leads shall be provided with nameplate reading: "ISOLATE MOTOR AND HEATER CIRCUITS BEFORE REMOVING COVER".

2.15 SPECIAL PURPOSE MOTORS

- .1 Span Drive Motor
 - .1 Ratings: 7.5 hp
 - .2 NEMA Motor Characteristic: Design D
 - .3 RPM: 900
 - .4 Duty Cycle: 30-Minute Duty Cycle
 - .5 Rated Voltage: 230V, Three-phase.
 - .6 Type of Motor Enclosure: TEFC
 - .7 Insulation Class:F
 - .8 Refer to Mechanical Specification for braking torque requirement.
 - .9 Motor Brake Features and Functions: The brake will engage whenever the motor is disconnected from the line, the current of the brake coil is also interrupted, which makes the coil stop actuating. The braking system shall allow for normal braking or fast braking. The bridge rectifier connection shall be configured for normal braking. The alternating current (AC), 120V power supply for the bridge rectifier shall be obtained from an independent source. Provide brake with manual release lever to allow the motor shaft to be released in emergency cases or power outages.
 - .10 Each motor shall be fitted with a pancake-type, through shaft, bearingless, pulse-generating encoder with dual outputs compatible with the control system. The pulse generator shall provide an A,B,Z pulse code, 1024 pulses per revolution, with bi-directional quadrature, 90-degree gap between A and B phases. Encoder cable shall be 4 #16 AWG, individually twisted, shielded pairs. Shields shall be grounded at the motor only.
- .2 Machinery Brake Motor
 - .1 Motor size and performance characteristics shall be per manufacturer standards and mechanical performance requirements.
 - .2 NEMA Motor Characteristic: Design D
 - .3 RPM: 1800
 - .4 Duty Cycle: Intermittent

- .5 Rated Voltage: 230V, Three-phase.
 - .1 Type of Motor Enclosure: TEFC
 - .2 Insulation Class: F
 - .3 Accessories: position indication dry contact outputs for brake set, brake release, and manual release. Limit switches shall be in NEMA 4X stainless steel enclosure.
- .3 End Jack Motor
- .1 Motor size and performance characteristics shall be per manufacturer standards and mechanical performance requirements.
 - .2 NEMA Motor Characteristic: Design C
 - .3 RPM: 1800
 - .4 Duty Cycle: Intermittent
 - .5 Rated Voltage: 230V, Three-phase.
 - .6 Type of Motor Enclosure: TEFC
 - .7 Insulation Class: F
 - .8 Accessories: position indication dry contact outputs for brake set, brake release, and manual release. Limit switches shall be in NEMA 4X stainless steel enclosure.
- .4 End Seat Motor
- .1 Motor size and performance characteristics shall be per manufacturer standards and mechanical performance requirements.
 - .2 NEMA Motor Characteristic: Design C
 - .3 RPM: 1800
 - .4 Duty Cycle: Intermittent
 - .5 Rated Voltage: 230V, Three-phase.
 - .6 Type of Motor Enclosure: TEFC
 - .7 Insulation Class: F
 - .8 Accessories: position indication dry contact outputs for brake set, brake release, and manual release. Limit switches shall be in NEMA 4X stainless steel enclosure.
- .5 Traffic Barrier Gate Operator Motor
- Refer to Specification Section 265622 Resistance Barrier Gates.

PART 3 – EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for motor control centres installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative and Consultant.
 - .2 Inform Departmental Representative and Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Departmental Representative.

3.2 INSTALLATION

- .1 Install, align, and connect motors in accordance with the equipment manufacturer's instructions.
- .2 Mount motors with bolts. Ensure motor feet are coplanar within 0.0254 millimeters, and base mounting points are accessible and adjustable to enable machine alignment. Install alignment jack bolts for motors over 15 hp to enable alignment.
- .3 Alignment
 - .1 Before attempting alignment, demonstrate that the load does not have any load/force imposed by the piping system. Minimum alignment values (below) are for motor and load at normal running temperatures. Ensure values are compensated for thermal growth. Correct limited movement of the motor or load (commonly known as bolt-bound) to ensure alignment capability. Do not undercut hold down bolts in order to perform adjustment.
 - .2 Provide commercially die-cut shims, without seams or folds, made of corrosion resistant stainless steel. Use no more than four shims at any single point.

.3 Align motor and load to the following minimum specifications:

Speed(RPM)	Close-Coupled Offset (mils)	Close-Coupled Angle(mils/in.)	Spool Piece Angle (mils/in.@ coupling pt.)
600	6.0	2.0	3.0
900	5.0	1.5	2.0
1200	4.0	1.0	1.5
1800	3.0	0.5	1.0
3600	1.5	0.4	0.5
7200	1.0	0.3	0.4

- .4 Perform motor and load alignment under the direction of the manufacturer's representative.
- .5 Recheck alignment of motors and adjust as required after the motor has been in operation for not less than 48 hours.
- .6 Provide written final alignment settings as part of the final test data.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Ensure moving and working parts are lubricated where required.
- .3 Perform inspections and test procedures on all motors in accordance with NETA ATS and NETA MTS 7.15.1 for rotating machinery, AC motors.
- .4 Utilize Vibration Analyzer to measure vibration levels.
- .5 Use an accelerometer, either stud-mounted or mounted using a rare earth, low mass magnet and sound disk (or finished surface) with the FFT analyzer to collect data. Ensure the mass of the accelerometer and its mounting have minimal influence on the frequency response of the system over the selected measurement range.
- .6 Vibration Data (main drive motor only)
 - .1 Collect vibration data in the axial, vertical, and horizontal direction for each motor bearing.
 - .2 Obtain two narrowband spectra for each data collection point in the following manner:

- .3 For all machines regardless of operating speed, obtain a 5 to 500 Hz spectrum with a minimum of 400 lines of resolution.
- .4 Acquire an additional spectrum of 5 to 2500 or 5 to 5000 Hz for machines operating at or below 1800 RPM or greater than 1800 RPM, respectively.
- .7 Ensure vibration limits conform to the following:

Frequency Range(CPM)	Vibration limit(inch/sec)
0.3 x RPM to 0.8 x RPM	0.04
0.8 x RPM to 1.2 x RPM	0.75
1.2 x RPM to 3.5 x RPM	0.04
3.5 x RPM to 120,000cpm	0.03

- .8 Provide final test reports to the Department and/or Department's Engineer.

METHOD OF MEASUREMENT AND PAYMENT

- .1 The Contract Lump Sum (LS) Amount. All costs for the requirements of this Special Provision are incidental to the Electrical Service and Distribution System and are to be included in the Lump Sum (LS) Amount of Bid item 655.202 ELECTRICAL SERVICE AND DISTRIBUTION SYSTEM

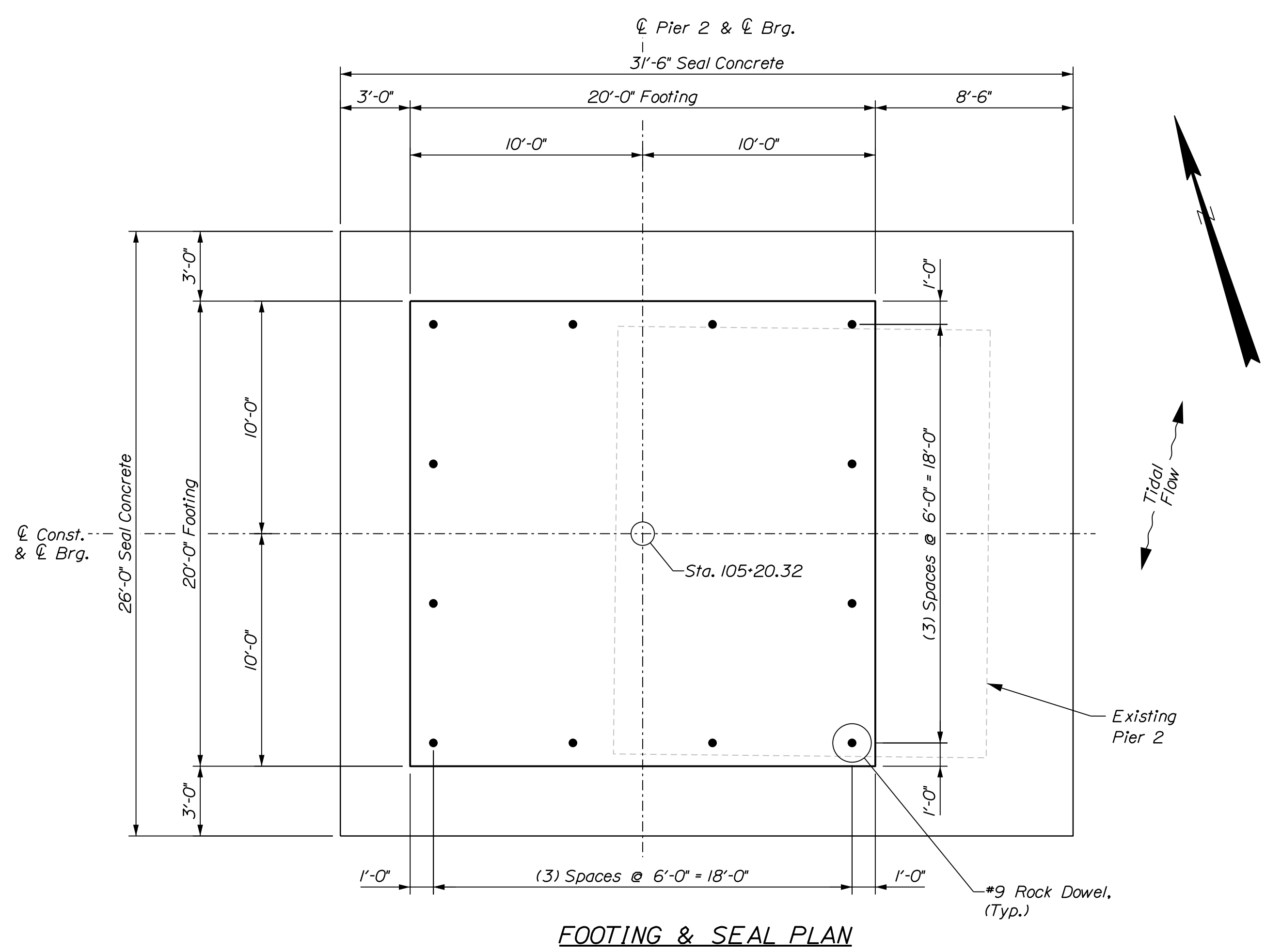
--END OF SECTION--

Date: 12/13/2018

Username:

Division:

Filename: ... \CADD\024_Pier2_FootingSeal.dgn



FOOTING & SEAL PLAN

ROCK DOWEL NOTES:

1. Rock dowels shall project into the footing a minimum of 2'-0" and shall be grouted into bedrock a minimum of 3'-0".
2. Rock dowels shall be stainless steel #9 deformed bars conforming to ASTM A955, with a minimum yield strength of 75 ksi.
3. Dowels shall be installed in a minimum of 3-inch diameter drilled hole and grouted.
4. Grout shall have a minimum 28-day compressive strength of 5000 psi and a maximum water cement ratio of 0.45.
5. Rock dowels shall be paid for as a Lump Sum, Item No. 504.906 - Rock Dowels. Payment for Rock Dowels shall include compensation for providing all materials, equipment, personnel, labor, tools, mobilization/demobilization costs and incidental items necessary to complete the dowel installation.

PIER 2 DESIGN CRITERIA:

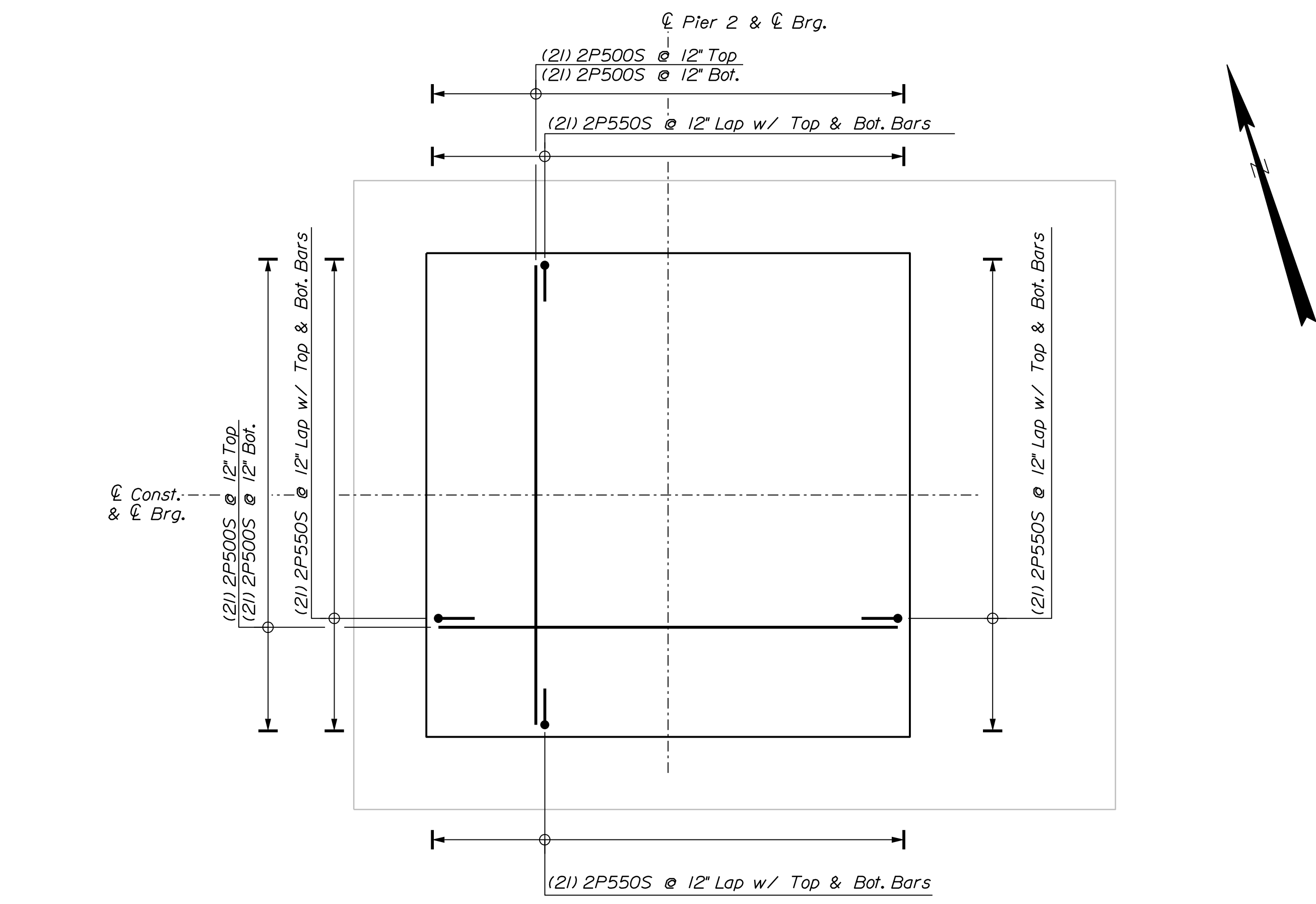
1. Critical AASHTO Load Combination: Maine Modified Strength I with Ice Extreme Event II with Ice
2. Buoyancy: Q1.1 - Water level at EL. 4.23
Q50 - Water level at EL. 9.5
3. Stream flow: Q1.1 - Velocity of 5 fps
Q50 - Velocity of 5 fps, applied 20 degrees to longitudinal centerline of pier. Debris loading accounted for by increasing exposed surface area of pier by 25%.
4. Wind: II5 mph
5. Ice: Q1.1 - Thickness 0'-6", pressure 30.7 ksf (1'-0" thickness at Extreme Event II)
Q50 - Thickness of 0'-6", pressure 15.3 ksf (1'-0" thickness at Extreme Event II)
30% of nose force applied transverse to pier.
6. Scour: Q100 - Water level at El. 9.9
Scour depth assumed at El. -21.5
7. Vessel Collision: Deadweight Tonnage - 25 Tonnes
Velocity of 8.78 Tps
Water Level at El. 4.23

PIER NOTES:

1. The maximum factored applied footing pressure is 19 ksf. (Extreme Event II with Ice)
2. The maximum factored applied seal pressure is 17.8 ksf. (Strength I with Ice)
3. Reinforcing steel shall have a minimum concrete cover of 3 inches in the footing and 2 inches in the cap and column unless otherwise noted.
4. The bedrock will vary in nature, slope, and degree of fracturing. Bedrock elevations shown are estimated based on the boring information. Actual rock elevations may vary. After the foundation excavations are completed and all unsound bedrock removed, the Contractor shall survey the foundation bedrock and provide the exact bedrock elevations to the Resident for review and approval by the Engineer.
5. If the bedrock elevations vary from the elevations assumed in the development of the plan set, the pier may need to be modified. The Contractor shall grant the Department seven (7) Calendar Days to modify the plans from the date the Resident accepts the bedrock survey.
6. Pier seal concrete shall be placed on bedrock cleaned of all loose, weathered or fractured rock and loose soil. Cofferdam excavation inspection shall be the responsibility of the Contractor and shall be conducted in accordance with Special Provision 511 Cofferdams
7. Refer to Special Provisions for mass concrete pour requirements for Cast-in-Place Pier Column Alternate.
8. The Contractor may adjust reinforcing steel in the cap, corbels, and center bearing pedestal as required to allow for the precise installation of the anchor bolts. All adjustments made shall be approved and verified by the Resident.

SEAL COFFERDAM NOTES:

1. When sheet piling is used for seal cofferdams, appropriate rolled corners shall be used, and the inside face of the sheet piling shall be at or outside of the seal concrete dimensions shown.
2. The seal concrete placement dimensions shown represent the minimum seal size necessary to meet design requirements and are not based on the use of any particular sheet pile section.
3. The horizontal pay limit for seal concrete will be to the dimensions shown on the plans. No additional payment will be made for concrete placed outside these limits.
4. In no case shall the sheet piling protrude into the navigation channel.
5. The maximum water elevation is expected to be 4.62. The Contractor shall design the cofferdam accordingly. In order to achieve the appropriate seal depth, solid bedrock may need to be removed. Any removal of solid bedrock required to meet the appropriate bottom of seal requirements based on the Contractor's design will be paid for under Pay Item 206.11, Structural Rock Excavation - Piers.
6. Each seal shall be cored full depth in at least three (3) locations to ensure that the seal was satisfactorily placed. The final core run shall sample the concrete/bedrock interface and extend at least one foot into the bedrock. Holes drilled for dowels may be acceptable to confirm seal placement provided these are cored as described herein. These locations will be approved by the Resident. Seal concrete core samples will be a minimum of 3 inches O.D., be adequately stored in boxes and each core run labeled. In the event that voids or any other defects are found, the Contractor shall correct the defects in a manner approved by the resident. For each core that reveals a void or defect, two additional cores shall be taken after repairs are made. One of the two additional cores shall be taken in approximately the same location as the original core. The other core will be located by the Resident. All core holes shall be refilled using a non-shrink grout. The cost of all coring and repairs will be considered incidental to "Structural Concrete Piers (Placed Under Water)".



FOOTING REINFORCEMENT PLAN

For reinforcing into column see Pier 2 Reinforcement sheet or Precast Column Alternate sheets.

STATE OF MAINE DEPARTMENT OF TRANSPORTATION STP-2260(700)		BRIDGE NO. 2039 WIN 22607.00 BRIDGE PLANS	
PROJ. MANAGER	L. TIMBERLAKE	DATE	12/3/2018
DESIGN-DETAILED	T. AQUILAR	BY	D. DEPAOLO
CHECKED-REVIEWED	T. MCALLIFFE	DATE	10-19-18
DESIGN-DETAILED	B. COLLEBURN	SIGNATURE	THOMAS KENDRICK
REVISIONS 1	NOTE CHANGES	NO. NUMBER	10075
REVISIONS 2		P.E. NUMBER	12-3-18
REVISIONS 3		DATE	12/3/2018
REVISIONS 4			
FIELD CHANGES			
BARTERS ISLAND BRIDGE BACK RIVER BOOTHBAY LINCOLN COUNTY		PIER 2 FOOTING & SEAL PLAN	
SHEET NUMBER		22A	
McFarland and Johnson		OF 132	