

**PORTSMOUTH-KITTERY  
16189B**

September 25, 2020

**SPECIAL PROVISION**

**AMENDMENT TO SECTION 619 – MAINTENANCE OF TRAFFIC**

Add or replace the following sections:

**Add** in Description:

**1.3** The item “Traffic Signals and Gates” shall consist of furnishing and installing barrier gates for use with the Exit 1 detour. The following shall pertain to this item:

**1.3.1** Requirements for furnishing all labor, materials, tools, and equipment, and performing all operations necessary to install, field test and place in satisfactory condition, the barrier gates indicated on the Contract Drawings and specified herein. The Contractor shall use this Specification in conjunction with the relevant portions of the other electrical and communications requirements included within the Contract Documents.

**1.3.2** The work under this item shall consist of furnishing, installing, testing, and operations of a resistance-type barrier gate on concrete footings and traffic signal pre-emption contacts, complete with all appurtenances, including anchor bolts, required for proper operation of the Exit 1 closure.

**1.3.3** The work shall include all control equipment for remote and local control of the barrier gate with all conduits, pull boxes, wiring, cables, grounding, bonding, and other equipment required to operate the barrier gate.

**1.3.4** It is the intent and purpose of these Specifications to cover and include all apparatus, appliances, material, and labor necessary to properly install, wire, connect, equip, test, adjust, and put in approved working order the respective portions of the work herein specified.

**Add** in Materials:

**2.3** All equipment shall conform to the requirements of the latest revision of the Standard Specifications for Movable Highway Bridges of the American Association of State Highway and Transportation Officials (AASHTO) and the Manual on Uniform Traffic Control Devices (MUTCD), except as may be otherwise provided herein.

**2.4** Materials and construction shall conform to the requirements of the current local Electrical Code, NEC and to any applicable local rules and ordinances. The Contractor shall obtain any required permits and approvals of all Departments or Agencies having jurisdiction.

**2.5** All equipment and materials shall be new. All equipment, materials, and workmanship shall be first-class in every particular and shall be manufactured and erected to the satisfaction of the Owners. If the Contractor has any objection to any feature of the equipment as designed and laid out, he must state his objection at once, in writing, to the Resident; otherwise, his objection will be ignored if offered as an excuse for malfunctioning of the equipment or for defective or broken apparatus.

**2.6** Each piece of electrical equipment and apparatus shall have a corrosion-resisting metal nameplate, on which is stamped the name of the manufacturer and the rating or capacity of the equipment or apparatus.

**2.7** All mounting hardware and all wire and cable terminals shall be vibration-proof.

**2.8** All metal parts of the installation, except structural steel, shall be of corrosion-resisting material such as aluminum, bronze, or stainless steel. Cast-iron, malleable iron, or steel with a hot-dip galvanized finish shall be used where specified herein or permitted by the Resident.

**2.9** Welding shall meet the requirements of the American Welding Society's (AWS) Structural Welding Code - Aluminum D1.2.

## **2.10 Shop Painting**

**2.10.1** Electrical equipment which has a galvanized finish and which normally are given a factory finish need not be shop painted. All other electrical equipment shall be given one shop coat.

## **2.11 Field Painting**

**2.11.1** Electrical equipment, which is normally given a factory painted finish suitable to the Owners, need not be field painted. All other electrical equipment shall be given two field coats of paint as specified under the requirements for painting structural steel. Before applying the two field coats, galvanized surfaces shall be cleaned free of all grease, oil, dirt, and foreign material and shall be etched with copper sulphate solution, after which the solution shall be applied.

**2.11.2** In lieu of etching and a coat of shop paint, the Contractor may use galvanizing primer as a first coat for galvanized surfaces. The final field coat on electrical equipment in the Control House shall be of a color and type of paint to match the house interior.

## **2.12 Barrier Gates**

**2.12.1** Each barrier gate shall be operated from the ITS control cabinet (local) as well as remotely from the NHDOT TMC, the MTA TMCC, and the MaineDOT TMC. The raise and

lower circuitry shall include a kill switch that allows the gate operation to be stopped instantaneously.

**2.12.2** Each barrier gate motor shall be controlled by a magnetic reversing contactor, electrically and mechanically interlocked, and shall be protected by a three-element, thermal overload relay, with automatic reset. This equipment shall be mounted in the motor control center.

**2.12.3** The barrier shall be designed for use as a penetration resistance barrier. The barrier shall be explicitly designed for traffic control that is typical on movable bridges, as required by AASHTO's LRFD for Movable Highway Bridge Design Specifications and shall be suitable for similar applications as well. A gate that allows vehicle penetration (such as a typical railroad gate or parking level arm) will not be accepted.

**2.13.4** The operating mechanism and main control components shall be contained in a weatherproof housing. The housing shall be constructed of .375" (9.5mm) carbon steel, hot dip galvanized after fabrication. Exterior surfaces shall be painted aluminum. All external fasteners ½" and under shall be stainless steel. Fasteners over ½" shall be stainless steel, hot dip galvanized or mechanically galvanized. Arm shaft openings shall incorporate O-ring seals.

**2.13.5** The connecting rod shall be of AISI 4150.

**2.13.6** The mechanism linkage shall be driven by a fully enclosed, heavy duty worm gear, double reduction speed reducer. The transmission shall have an occasional momentary peak load rating of not less than 30,000 inch-pounds. The output shaft shall be 2" in diameter. Gear ratio used shall produce an operation time of approximately 16 seconds.

**2.13.7** A heavy duty torque limiter shall be provided to limit torque transmitted to the operating mechanism in the event of excessive winds or a physical obstruction to the arm that could damage the mechanism during operation. The torque limiter shall be capable of being set anywhere within a range of 10,000 to 75,000 in-lbs torque. Each torque limiter shall be factory set for the load recommended by the manufacturer, based on installation requirements. Each torque limiter shall be adjusted and tested at the factory, under over-load condition, for a minimum of 5 minutes to verify the setting. The gate limit switch assembly shall be driven from the output side of the torque limiter so that slippage of the torque limiter will have no effect upon the limit settings.

**2.13.8** The motor shall be 480 VAC, three phase, 60 hz. The motor horsepower shall be as recommended by the barrier manufacturer to suit the installation, typically 1 hp. The motor shall be a C-face design and shall be mounted directly to the transmission. The motor shall be instantly reversing and overload protected. The motor shall be equipped with a solenoid-release, automatic brake. The brake shall have a manual release lever to permit manual operation of the barrier during setup or emergencies.

**2.13.9** The barrier limit switch assembly shall be a self-contained unit. The standard assembly shall provide 8 independent SPDT control switches. Switches shall be rated for 15 amps, 480 VAC. Switches shall be controlled by individually adjustable cams. The limit switch assembly design shall permit adjustment of all cams with the barrier in any position. The limit switch

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assembly shall have a removable cover to help prevent accidental contact with switch terminals. Shaft, cams, bushings and housing pieces shall be of non-ferrous corrosion resistant materials.

**2.13.10** The main arm shaft shall be of 2.5" (63mm) diameter AISI 4150 with a minimum tensile strength of 140,000 psi. The shaft shall be mounted in heavy duty sealed ball bearings with lubrication fittings.

**2.13.11** Front and rear access doors shall be mounted on strap hinges. Hinges shall be of the slip-off type and shall have stainless steel pins. A stop shall be mounted inside the door to secure the door from being raised off the hinges in the closed position. Door latches, two per door, shall use a vise action to compress a neoprene bulb-type gasket to seal the door openings.

**2.13.12** A pair of carbon steel rectangular tubes, hot dip galvanized after fabrication, painted aluminum, shall be rigidly affixed to the ends of the main arm shaft. The tubes shall be offset to locate the arm centerline at the height specified above the housing base. The tubes and a steel cross-member shall provide a sturdy mount for the arm and counterweights. The tubes shall have provision for easily adjusting the counterweight offset so the arm can be properly balanced in all positions.

**2.13.13** Hot dip galvanized steel counterweights shall be mounted at the rear of the side arm tubes to balance the arm. Counterweights shall be sectional and shall be balanced at the factory.

**2.13.14** The barrier arm design shall be double rail aluminum tube. Arm length shall be measured from the centerline of the housing. Stainless steel truss cables and a roadway type bumper rod shall be furnished with longer arms at the discretion of the manufacturer. Front and rear arm surfaces shall be covered with alternating red and white high intensity reflective sheeting. Stripes shall be 16" (406mm) wide and shall slope at 45 degrees down toward the arm tip. Remaining exposed surfaces shall be painted white.

**2.13.15** The barrier shall utilize 6x25 construction, 300-series stainless steel, annealed energy absorption cables to assist in diffusing the kinetic energy of an impacting vehicle. Cables shall be annealed in a coil not less than 42" diameter. The barrier shall typically be capable of absorbing the energy of a 5,000 pound vehicle traveling up to 50 mph. Actual capacity shall necessarily depend on individual barrier configuration. Double rail aluminum tube arms shall have two or three .50" (12mm) cables, one inside each tube, and one along the center of the arm if three cables are used.

**2.13.16** The energy absorption cables shall be anchored at both ends of the span in the closed to traffic position. At the housing, heavy duty side arm locks shall be mechanically linked to the operating mechanism to automatically engage and lock the side arm tubes into a rigid configuration when the arm is lowered, to assist in transferring the load into the housing in the event of an impact. This will minimize the chance of damage to the internal operating mechanism.

**2.13.17** The energy absorption cables shall be anchored at the tip end of the arm in the closed to traffic position. A passive end latch mounted on the arm tip shall engage a rigidly

mounted and anchored socket on a post. End latches shall not require powered actuation for proper engagement.

**2.13.18** The barrier shall be fixed to a suitable foundation, as specified elsewhere, using anchor bolts as designed by the Contractor or as recommended by the manufacturer.

**2.13.19** Both a handcrank and a drill crank shall be provided with each barrier to facilitate manual operation.

**2.13.20** A manual disconnect switch shall be provided, pre-wired at the factory to break the main motor leads, to protect personnel during service. A handcrank safety switch shall be provided to prevent automatic actuation of the barrier during manual operation. Additionally, safety switches shall be installed and set at the factory to break the control circuit when either access door is opened. Door safety switches shall have a pull-to-override feature for test operation and shall automatically reset when doors are closed. Control components and terminal blocks shall be mounted inside an electrical enclosure, which shall be mounted inside the operator housing, with roadway side access, except where customer requirements prevent this arrangement. Stud and nut terminal blocks shall be fully labeled and clearly coded to control system vendor wiring diagrams. All control wiring shall be clearly coded to control system vendor wiring diagrams and shall terminate at the terminal block. Connections to stud-type terminals shall have lugs. Conductors shall be #14 AWG stranded, minimum.

**2.13.21** The arm end latch shall be equipped with an extended range proximity switch to indicate correct engagement of the end lock. The mechanism shall be mounted on the arm end lock and send a confirmation signal only when the end lock is properly engaged. The mechanism shall be fully adjustable and preset at the factory.

**2.13.22** The barrier gates shall be model VR6 as manufactured by B&B Roadway or approved equivalent by FedTransit Safety Systems or Automatic Power.

## **2.14 Barrier Gate Housing**

**2.14.1** All internal wiring for each traffic gate shall be brought to numbered terminal blocks inside the housing for the connection of external circuits.

**2.14.2** Each traffic gate housing shall be bolted to its concrete or steel base as indicated on the Plans.

**2.14.3** Doors shall be provided on the roadway and sidewalk side of the housing, large enough for convenient removal of the largest component of the operating mechanism. Each door shall be equipped with neoprene gaskets, 2 safety interlock switches, silicon bronze hinges with stainless steel pins, stainless steel catches and bolts, and hockey puck type padlocks with common keys to the barrier gate locks.

**2.14.4** Each traffic gate housing shall be equipped with a thermostatically controlled heater; switched service light; and duplex, 15-ampere, 120-volt, Specification Grade GFI receptacle. A 15-ampere circuit breaker shall protect the above units and be mounted in the traffic gate housing.

**2.14.5** Each traffic gate housing shall be furnished with removable doors.

## **2.15 Barrier Gate Arm Lights**

**2.15.1** The number of beacons on the traffic gate arms shall be as shown on the wiring diagrams. Each beacon shall be a weatherproof, two-way, cast-aluminum unit with red Fresnel lenses, front and back. The lights shall be interconnected and grounded with four-conductor portable cord using watertight connectors at the fixtures. A 120 volt, 8-watt, red LED lamp shall be installed in each fixture. The beacons shall be connected so that adjacent units will flash alternately. Fuses for the beacons shall be installed in molded rubber connection kits.

**2.15.2** The flasher shall be a 120 VAC solid state flasher having two alternately flashing circuits and one steady burn circuit. The flasher shall be designed for heavy duty applications. The flasher assembly shall include mounting hardware as required, solid-state flasher circuitry, a terminal block, silicon heat sink compound, and a transformer when required. The flasher assembly shall be fully wired at the factory. The flasher base plate compound shall be anodized for corrosion protection. All components shall be of industrial quality. The terminal block shall be clearly marked for field connections. The flash rate for the two alternately flashing circuits shall be .50 seconds on, .50 seconds off. An additional steady burn circuit shall be provided for the lamp farthest from the gate stand. The flasher shall be B & B Roadway Model FL, or equal approved by the Resident.

**2.16 Emergency Pre-emption** – The gate shall include an emergency pre-emption receiver suitable for operation with the Town of Kittery and City of Portsmouth emergency vehicles. Pre-emption receiver shall allow authorized vehicles to raise or lower the barrier gate arm.

**Add** in Construction Requirements:

## **3.4 Submittals**

**3.4.1** The Contractor shall furnish seven copies of complete maintenance and servicing data for the Barrier gates.

**3.4.2** The Contractor shall prepare and submit for review, within 90 days after the award of the Contract, the following working drawings executed in accordance with the provisions of the Contract:

- Assembly drawings of the gate stands locating and identifying all apparatus and equipment inside. Arrangement and complete construction details of the gate operating machinery.
- Detail drawings showing the construction of gate arms, including provisions for guying and bracing.
- Wiring diagrams of all gate electrical equipment, including development diagrams for the gate limit switches. All wires shall be suitably numbered in accordance with the wire numbers on the control system vendors approved shop drawings.

- Certified dimension prints of apparatus shall 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 any other pertinent data to show that the apparatus meets the specified requirements.

### **3.5 Barrier Gate Operations**

**3.5.1** The barrier arm shall pivot in the vertical plane via a mechanical 4-bar linkage. The linkage shall utilize cranks keyed to the main arm shaft and transmission shaft and an adjustable connecting rod between a pair of self-aligning spherical rod ends.

**3.5.2** An auxiliary crank shall be used, paired with the transmission crank, to reduce the load on the transmission and to better balance and stabilize the load on the housing and mounting structure. The auxiliary crank shall be mounted in a permanently lubricated bronze bearing. The velocity of the arm shall follow a sinusoidal pattern to provide smooth operation. The arm shall begin and end its full motion path with zero velocity and accelerate smoothly to maximum velocity at mid-travel.

### **3.6 Spare Parts**

**3.6.1** Spare parts shall be supplied in accordance with AASHTO Article 2.10.58 requirements and the Contract Plans. The spare parts shall be furnished and packed in suitable cartons for storage in the communications equipment shelter. The spare parts supplied shall include, but not be limited to the following:

- One (1) barrier gate motor, complete with motor pinion.
- One (1) barrier gate rotary cam limit switch with operating mechanism.
- Two (2) access door limit switches.
- Four (4) arm beacon fixtures complete with bulbs.
- Six (6) lamps for arm bulbs.
- One (1) barrier gate arm
- One (1) flasher unit.

**3.7** Warranty Requirements - The Contractor shall warranty the in-service working of the gate and gate control equipment for one year following the date of project acceptance. A warranty shall cover the barrier and related equipment against defective material and components for 2 years from date of Final System Acceptance. Manufacturer shall furnish replacement parts for a minimum of 5 years. Replacement parts for most components shall normally be available within two working days.