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JOB SPECIAL PROVISIONS (BRIDGE)

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Job No J7S3194  
Route 86  
Taney County

	<b>MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION</b> 105 W. CAPITOL AVE. JEFFERSON CITY, MO 65101 Phone (888) 275-6636
	<b>Burns &amp; McDonnell</b> 9400 Ward Parkway Kansas City, MO 64114 Certificate of Authority: 000165 Consultant Phone: (816) 333-9400
	If a seal is present on this sheet, JSP's has been electronically sealed and dated.
	JOB NO. J7S3194 Taney County, MO Date Prepared: 9/1/2021
	<b>Addendum:</b>
Only the following items of the Job Special Provisions (Bridge) are authenticated by this seal: A – O	

A. CONSTRUCTION REQUIREMENTS

**1.0 Description.** This provision contains general construction requirements for this project.

**2.0 Construction Requirements.** The plans and the asbestos and lead inspection report for the existing structure and the geotechnical report for the new structure(s) are included in the contract in the bridge electronic deliverables zip file for informational purposes only.

**2.1** In order to assure the least traffic interference, the work shall be scheduled so that a lane closure is for the absolute minimum amount of time required to complete the work. A lane shall not be closed until material is available for continuous construction and the contractor is prepared to diligently pursue the work until the closed lane is opened to traffic.

**2.2** Provisions shall be made to prevent any debris and material from falling into the waterway. If determined necessary by the engineer, any debris and material that falls below the bridge outside the previously specified limits shall be removed as approved by the engineer at the contractor's expense.

**2.3** Any damage sustained to the remaining structure as a result of the contractor's operations shall be repaired or the material replaced as approved by the engineer at the contractor's expense.

**2.4** Provisions shall be made to prevent damage to any existing utilities. Any damage sustained to the utilities as a result of the contractor's operations shall be the responsibility of the contractor. All costs of repair and disruption of service shall be as determined by the utility owners and as approved by the engineer.

**3.0 Environmental Contact.** Environmental Section may be contacted at the below address or phone number. The Missouri Department of Health may be contacted at (573) 751-6102.

MoDOT - Design Division - Environmental Section  
P.O. Box 270  
105 W. Capitol Ave., Jefferson City, MO 65102  
Telephone: (573) 526-4778

**3.1 Approved Smelter and Hazardous Waste Treatment, Storage and Disposal Facility.** The following is the approved smelter and hazardous waste treatment, storage, and disposal facility:

Doe Run Company - Resource Recycling Division - Buick Facility  
Highway KK  
Boss, MO 65440  
Telephone: (573) 626-4813

**4.0 Navigation Requirements.**

**4.1** All work shall be performed so that the free flow of navigation is not unreasonably interfered with, the navigable depths are not impaired and navigation lighting is visible at all times. Any floating equipment or vessels working in the channel shall display lights and signals as required by the current "Handbook of Missouri Boating Laws and Responsibilities" available on the Missouri Water Patrol web site. If scaffolding or nets are suspended below low steel in the navigation span, the engineer shall be advised so that the temporary reductions in clearance for

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lake traffic can be checked for reasonableness and appropriate notices can be published. Positive precautions shall be taken to prevent the accidental dropping of spark producing, flame producing, lighted or damaging objects onto barges or vessels passing beneath the bridge. All flame cutting, welding or other similar spark producing operations shall be ceased over the channel when vessels are passing beneath the bridge.

**4.2** The contractor shall be responsible for submitting a work plan to the engineer for review. When the engineer is in concurrence with the work plan, the engineer will forward the material to the appropriate agency or agencies for approval.

**4.3** The contractor shall be responsible for obtaining navigational permits from the Missouri State Water Patrol.

**5.0 Method of Measurement.** No measurement will be made.

**6.0 Basis of Payment.** Payment for the above described work will be considered completely covered by the contract unit price for other items included in the contract.

**B. RIGHT-OF-WAY AND ACCESS**

**1.0 Description.** The contractor shall become acquainted with the right-of-way limits, wetland limits and available work and storage space at the site. Any additional working areas and storage spaces required by the contractor shall be provided and paid for by the contractor. All bidders are required to visit the site in order to become acquainted with the proximity of buildings and other features along the lake, which shall be protected. By submission of a bid, the contractor acknowledges review of the site and acceptance of the existing site conditions.

**2.0 Method of Measurement.** No measurement will be made.

**3.0 Basis of Payment.** Payment for the above described work will be considered completely covered by the contract unit price of other items.

**C. BASIS OF LAKE LEVEL AT SITE**

**1.0 Description.** The contractor shall become acquainted with the nature of Table Rock Lake and shall consider all factors which may affect the character of the work and construction procedures.

**2.0 Construction Requirements.**

**2.1** Top of power pools indicating the preferred operating levels for Table Rock Lake is on the United States Army Corps of Engineers website, <https://www.swl-wc.usace.army.mil/pages/data/tabular/htm/tabrock.htm>, for reference by the contractor. A hydrograph of the lake surface level may be obtained by request to the United States Army Corps of Engineers (USACE).

U.S. Army Corps of Engineers Table Rock Project Office  
4600 State Highway 165  
Branson, Missouri 65616-8980  
Phone: (501) 340-1950

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Email: [ceswl-tr@usace.army.mil](mailto:ceswl-tr@usace.army.mil)

**2.2** Actual lake levels may be higher or lower than the power pool elevations noted on the website at any time during construction, and the water may exceed these elevations for any given period of time.

**3.0 Method of Measurement.** No measurement will be made.

**4.0 Basis of Payment.** Payment for the above described work will be considered completely covered by the contract unit price of other items.

D. WATER QUALITY PROTECTION

**1.0 Description.** Special measures shall be taken to prevent fuels, oils, greases, bitumens, chemicals, acids, waste washings, drilling slurry, herbicides, insecticides, lime, wet concrete, cement, silt or organic or other deleterious materials from entering surface or subsurface waters.

**2.0 Construction Requirements.**

**2.1** It is the responsibility of the contractor to investigate and comply with all applicable Federal, State, County, and Municipal laws concerning pollution of surface and subsurface waters, including pollutant discharge permit regulations. All work under this contract shall be performed in such a manner that conditions objectionable to the engineer or any enforcement agency shall not be created in surface or subsurface water through or adjacent to the project area.

**2.2** Water used in aggregate processing, concrete curing, foundation and concrete lift cleanup, and other waste waters shall not be allowed to reenter the lake directly if excessive or prolonged increase in the turbidity of the lake will result therefrom.

**2.3** The contractor shall establish and carry out a program for immediate removal of debris during construction in order to prevent the accumulation of unsightly, deleterious and potentially polluted materials in the water.

**2.4** The contractor shall not permit any fuel or oil storage containers, permanent or mobile, located near any waterway to be placed in such a manner to cause the spread of petroleum products in case of leakage. A contingency plan shall be formulated to be effective in event of accidental spill of petroleum products.

**3.0 Method of Measurement.** No measurement will be made.

**4.0 Basis of Payment.** Payment for work in connection with protecting the quality of surface and subsurface waters and with control of turbidity and erosion will be considered completely covered by the contract unit price for other items included in the contract.

E. REMOVAL OF EXISTING BRIDGE – BRIDGE NO. (A0590)

**1.0 Description.** This work shall consist of the removal of the existing Route 86 bridge over the Long Creek Arm of Table Rock Lake as detailed in the plans, described herein and as directed by the engineer. This work shall be in accordance with [Sec 216](#) for removal of bridges. The scope of this item shall also include the removal and disposal of miscellaneous appurtenant items.

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The length of structure to be removed is approximately 1,572 feet, and is comprised of a single 180 ft through truss span, a three span through truss 360 ft – 480 ft – 360 ft and three 60 ft simple rolled beam spans. Plans of the existing bridge have been included for information.

**2.0 Construction Requirements.**

**2.1 Demolition.** Removal of Bridge No. A0590 shall not begin until new Bridge A8907 is complete and is open to traffic. The contractor shall prepare and submit a detailed plan for the removal of the existing bridge for review and acceptance by the engineer. The contractor's removal plan shall specify adequate resources available as back up to meet unforeseen contingencies that could jeopardize the completion of the project. In addition, the plan shall include possible alternative methods for span removal should water levels change drastically or equipment fail while in service. The engineer's acceptance of the plan will not relieve the contractor of the responsibility for obtaining satisfactory results. The contractor's proposed plan may also be reviewed by other federal, state and local agencies. The contractor is advised that the review and approval process may be lengthy and shall be initiated well in advance of the scheduled date for commencement of removal operations.

**2.1.1** The contractor shall conduct all removal operations without disruption of traffic on the newly constructed bridge, except as may be specifically authorized by the engineer. Any damage sustained to the new bridge or other existing facilities to be used in place resulting from the contractor's removal operation shall be repaired or replaced to the satisfaction of the engineer at the contractor's expense. Any use of explosives shall be in conformance with [Sec 109](#), and all required permits must be obtained. The contractor shall take all necessary precautions to protect people and property from any falling or blast debris from the removal operation.

**2.2 Utilities.** Prior to commencing removal activities, the contractor shall verify the location of existing utilities and adjacent facilities. The removal work shall be performed in such a manner so as not to cause any settlement or damage to the existing utilities and/or adjacent facilities. Any damage to existing utilities and/or adjacent facilities shall be repaired at the contractor's expense in a manner satisfactory to the engineer.

**2.2.1** Presently there are power lines west of the existing bridge. Prior to the start of removal work by the contractor, the contractor shall ensure the power lines will not present a hazard to the contractor's operations, nor shall the contractor's operation present a hazard to the power lines.

**2.2.2** No utilities are known to be on the existing bridge.

**2.3 Material Disposal.** All material disposals shall be in accordance with [Sec 202](#). Any permit or license require for deposal of material shall be in accordance with [Sec 107](#).

**3.0 Method of Measurement.** No measurement will be made.

**4.0 Basis of Payment.** Payment for the above described work will be considered completely covered by the contract lump sum price for "Removal of Bridges (A0590)".

F. DEMOLITION PROCEDURES AND SAFETY CONSIDERATIONS

**1.0 Description.** This work shall consist of the most feasible and effective method for removal of the existing bridge structure.

**2.0 Removal Requirements.**

**2.1** The steel, concrete and associated materials on the bridge decking may be lowered onto barges in pieces and demolished further at a non-wetland site. The superstructure shall be demolished in stages and removed from the lake.

**2.2 Definition of Demolition Terms.**

(a) Demolition materials shall describe all non-concrete excavated materials, including but not limited to, any liquids, wood, steel, earth excavations, cleared vegetation and refuse. Demolition materials shall become the property of the contractor and shall be removed from the project site. Demolition materials shall not be buried or burned on the site.

(b) Disposal debris refers to mass concrete rubble that is to be removed from the lake. The term "concrete" as used herein shall be interpreted to mean both reinforced and unreinforced mass concrete.

(c) Flyrock is rubble projectiles thrown by the blast to variable distances from a blast site.

(d) Mucking is defined as the removal of blast demolition materials, disposal of debris or muck from the blast location to the final disposal site.

**2.2.1** Concrete rubble and flyrock resulting from the demolition of existing Piers 2, 3, and 4 may remain in the lake provided all exposed non-concrete projections are removed. No other concrete rubble shall be left in the lake. With the exception of rubble from existing Piers 2, 3, and 4, all rubble shall become the property of the contractor and shall be removed and placed in a non-wetland site.

**2.2.2** Exposed, non-concrete projections (e.g., exposed rebar, steel sheet piling, timber piling, etc.) shall be regarded as demolition materials, as defined above, and shall be severed and removed by any safe, practicable means and disposed of properly in a non-wetland site.

**2.3 General Requirements.** The project shall require the demolition of reinforced concrete, structural steel and the severance of metal from both above and below the water level. Precautions to avoid damage and control flyrock, air blast overpressure, particle velocity and to mitigate blast impacts on lake fauna shall be taken.

**2.3.1** Methods used for steel severance fall into five categories as shown below. The burning bar method shall be prohibited from being used in underwater operations.

- (a) Standard shearing or sawing.
- (b) Standard oxyacetylene torches.
- (c) Ultrathermic cutting rods.
- (d) Prime cut rods.
- (e) Burning bars.
- (f) Linear shape charges.

**2.3.2** The contractor shall use any safe means to remove the existing bridge, provided that nearby structures remain secure and provided that lake vessel and motor vehicle traffic is not delayed without approval of the appropriate federal, state and local agencies. Should the contractor elect to use blast demolition, the contractor shall adhere to the following restrictions:

- (a) Non concrete projections (e.g. rebar, steel sheet piling, timber piling, etc.) protruding from the removal limits at existing Piers 2, 3, and 4 are not permitted and shall be removed from the lake. Concrete and the reinforcing steel that is embedded in the concrete may be left on the bottom of the lake. All superstructure steel must be removed from the lake.
- (b) Controlled blasting methods for metal severance shall be in accordance with all requirements for blasting.
- (c) The contractor shall use the minimum charge necessary during each shot.

**2.3.3** All reinforcement and embedded metals may not be detailed on the reference drawings. Reinforcement supports, form ties and other embedded items not shown on the reference drawings may exist in the concrete. The contractor shall be responsible for making allowances for the embedded items.

**2.4 Operational Blasting Plan.** The operation blasting plan shall include the requirements that a pre-demolition meeting be held at least two weeks prior to the plan execution. The meeting shall be coordinated with the engineer, who will invite other applicable agencies. The operational blasting plan shall be a document, subject to amendment by the contractor, which shall specify the blast demolition parameters established to date and the means and reasons for modification. The contractor shall submit, at least 21 days prior to commencing blasting, four copies of the original operational blasting plan to the engineer. The operational blasting plan shall include as a minimum requirement the following items:

- (a) List of permits and clearances required, when applied for and date of approval or anticipated approval by federal, state and local agencies.
- (b) Precautions to avoid damage and control flyrock, air blast overpressure, particle velocity and to mitigate blast impacts on lake fauna (e.g., repelling charges).
- (c) Plan and explanation showing location of warning signs, signals and buoys to be used. Methods for radio and visible communications to be used for control of lake vessel and motor vehicle traffic before blast initiation, during closure for detonation and following the blasting operations.

**2.5 Flyrock Control.** Flyrock shall be prevented or limited as necessary to avoid injury or damage at the site and in adjoining areas. The contractor shall use whatever means the contractor deems necessary to prevent injury or damage due to flyrock. Before the firing of any blast in areas where flying rubble may result in personal injury or in damage to property or the work site, the concrete structure to be shot shall be covered with approved blasting mats, soil or other equally serviceable material to prevent flyrock.

**2.6 Mucking.** Concrete rubble, except as noted above, shall be regarded as disposal debris when displaced from original position in the structure. The department does not specify any limits on the muck size (i.e., the size of rubble blocks). Exposed, non-concrete projections, both above and below the water, shall be severed and removed by any safe, practicable means and disposed



off-site. All cutting of non-concrete materials and all work with diving or hand-held tools, which may be necessary for muck removal, shall be considered as incidental items to mucking.

## **2.7 Blasting Safety.**

**2.7.1** The contractor shall coordinate and work with the applicable federal, state and local agencies, as approving authorities, prior to delaying lake vessel and motor vehicle traffic. The contractor shall keep the traffic and all pedestrians at safe distances from vibration, air blast and blast noise after the appropriate agencies have given approval.

**2.7.2** Flaggers shall be used to warn lake traffic before blasting. Not less than one hour prior to and during the detonation of explosives, flaggers shall be stationed in radio equipped boats positioned one-half mile upstream and downstream of the bridge to positively warn approaching river traffic of the impending action and obstructions in the lake. The contractor shall provide such warning devices as may be necessary to keep boats out of the immediate danger area.

**2.7.3** If, in the opinion of the person in charge of the explosive detonation, the use of radio, telephone or other electronic equipment in the area should be prohibited, at any time, the engineer shall be advised well in advance so that timely notices can be published.

## **2.8 Removal of Demolition Materials and Refuse.**

**2.8.1** All demolition materials and refuse, except as specified above, resulting from demolition operations for this contract shall be removed from the site before completion of the work under these specifications.

**2.8.2** All construction and demolition operations in or over the lake shall be in accordance with to the requirements and directions of the engineer and other authority having jurisdiction. All work shall be conducted so that free navigation of the waterway shall not be unreasonably interfered with, and that the existing navigable depths shall not be impaired.

**3.0 Method of Measurement.** No measurement will be made.

**4.0 Basis of Payment.** Payment for the above described work will be considered completely covered by the contract lump sum price for "Removal of Bridges (A0590)".

## **G. ACCESS TO THE CONSTRUCTION**

**1.0 Description.** The contractor shall provide facilities for inspection at each superstructure and substructure unit with convenient and safe access from ground or water level.

## **2.0 Construction Requirements.**

**2.1** These facilities may be approved mechanical conveyances or suitable ladders, securely fastened to the substructure where necessary. All ladders shall be kept in good condition for the duration of this contract and, where fastened to the face of pier/bents, shall be removed from the site when the contractor's work is finished.

**2.2** In case of mechanical conveyances (lifts, elevators, etc.) these shall meet all state, local, and federal codes, unless the contractor is otherwise advised by the engineer. Mechanical

conveyances shall become the property of the contractor on completion of the construction and shall be removed by the contractor.

**3.0 Method of Measurement.** No measurement will be made.

**4.0 Basis of Payment.** Payment for furnishing, constructing, and maintaining construction ladders or other conveyances and any operational expenses involved therewith will be considered completely covered by the contract unit price for other items included in the contract.

#### H. WATER TRANSPORTATION FOR ENGINEER

**1.0 Description.** Upon award of the contract, the contractor shall furnish to the engineer a motorboat and all safety equipment required by the Missouri State Water Patrol at the site, along with adequate docking facilities. The boat shall be for the exclusive use of, and operated by, the engineer or his/her representatives.

#### **2.0 Construction Requirements.**

**2.1** The boat shall not be less than 18 feet in length with at least a 72 inch beam, equipped with two outboard motors, one motor of at least 70 horsepower and the second motor of at least 9.9 horsepower. The boat shall be capable of accommodating at least six adult passengers, including the operator. The engineer shall at all times retain the right to travel on or be present on any of the contractor's floating plant or equipment.

**2.2** The boat and motor shall be in good condition and meet the approval of the engineer. The boat and safety equipment shall at all times meet all applicable boating regulations of the US Coast Guard.

**2.3** The boat shall be equipped with two fuel tanks, complete remote control, a spotlight and an adequate whistle or horn. The motor shall be equipped with electric and hand starters, an alternator or generator and slip clutch propeller protection. The requirements are in addition to all US Coast Guard or State requirements.

**2.4** The contractor shall provide service, gas, oil and shall maintain the boat for the duration of this contract unless otherwise directed by the engineer. The contractor shall monitor the operation of the boat and provide assistance as needed.

**2.5** The contractor shall provide one safe and serviceable docking facility for one boat unless otherwise directed by the engineer. The docking facilities shall be located within the right-of-way. The docking facilities shall be maintained in serviceable condition for the duration of the contract. At the termination of the contract, the dock shall be immediately removed and remain the property of the contractor.

**2.6** The contractor shall provide adequate liability insurance (with minimum coverage of \$500,000) and shall save the Commission harmless from any and all damage to or caused by the boat while being operated by the engineer.

**2.7** The contractor will be permitted to request and make changes from any of the above requirements, provided the changes are first approved in writing by the engineer.

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**2.8** Upon completion of the work in this contract, and when released by the engineer, the boat and all related items shall become the property of the contractor.

**3.0 Method of Measurement.** No measurement will be made.

**4.0 Basis of Payment.** Payment for water transportation shall be full compensation for furnishing and maintaining the boat complete with docking facilities and all other incidentals necessary to complete the item and will be considered completely covered by the contract lump sum price for "Water Transportation for Engineer".

I. COLD WEATHER CONCRETING IN MASSIVE BENTS AND PIERS

**1.0 Description.** This work shall consist of constructing massive concrete bents and piers in cold weather.

**2.0 Construction Requirements.**

**2.1** When curing any mass concrete pour (a pour in which the concrete being cast has dimensions greater than or equal to six (6) feet in three directions, diameters greater than or equal to six (6) feet or as determined in [JSP Mass Concrete J1.2](#)), cold weather concreting in [Sec 703](#) shall be modified by the below requirements. Provisions shall be made in these sections to insert a thermal probe by installation of a galvanized steel conduit or other methods as approved by the engineer.

(a) When curing is complete on any mass concrete pour, the temperature of the surrounding air shall be reduced gradually at a rate not exceeding 25°F (14°C) in 24 hours, until 14 days after placement.

(b) If insulated forms are used for curing, the insulated forms shall not be removed until the temperature differential between the center of the concrete mass and surrounding air does not exceed 20°F (11°C). The insulated forms will not be required to be left in place beyond 14 days after placement.

**3.0 Method of Measurement.** No measurement will be made.

**4.0 Basis of Payment.** Payment for the above described work, including all material, equipment, labor and any other incidental work necessary to complete this item, will be considered completely covered by the contract unit price for the concrete.

J. MASS CONCRETE

**1.0 Description.**

**1.1 Definition.** Mass concrete is defined as any large volume of cast-in-place concrete with dimensions large enough to require that measures be taken to cope with the generation of heat and attendant volume changes to minimize cracking.

**1.2 Determination of Mass Concrete.** When the minimum dimension of the concrete exceeds four feet and has a volume of concrete to surface area ratio when measured in feet, greater than 1.0, then provisions for the placement of mass concrete shall apply. The surface area for this

ratio shall include the summation of all the surface areas of the concrete component being considered, including the full underside (bottom) surface of footings and caps, the interior, exterior and construction joint surfaces of box sections, etc.

**2.0 Construction Requirements.** Measures must be taken to cope with the generation of heat and attendant volume change to minimize cracking of mass concrete. When placing mass concrete, the contractor shall ensure that the temperature differential between any point in the interior of the concrete element greater than 12 inches from the surface and the surface of the concrete element does not exceed 40°F immediately following placing of any lift during the heat dissipation period for a minimum of 24 hours after placement. The contractor shall maintain records of the temperature differential and shall immediately apply corrective measures when the temperature differential nears 35°F so as to limit it to the 40°F maximum. This may be accomplished through a combination of the following:

- (a) Use of Type II or Type IV cement.
- (b) Selection of concrete ingredients to minimize the heat generated by hydration of the cement.
- (c) Cooling component materials to reduce the temperature of the concrete while in its plastic state.
- (d) Insulating the forms and the surface of the concrete to prevent heat loss.
- (e) Controlling the rate of placing the concrete.
- (f) Placement of concrete at times of day when the ambient temperature is lowest or highest.
- (g) Providing supplemental heat at the surface of the concrete to prevent heat loss.
- (h) Other acceptable methods which may be developed by the contractor.

The temperature difference within the mass concrete element must not exceed 40°F from the time the concrete is placed until the interior of the mass concrete element cools from its maximum to within 40°F of the daily low air temperature or for a period of 14 days, whichever occurs first. If this requirement is exceeded and cracking occurs, the mass concrete element may be subject to removal, at the discretion of the engineer.

Prior to placing any concrete covered by this special provision, the contractor shall submit to the engineer a detailed plan covering how these temperature differentials will be determined and how the restrictions are to be achieved.

No concrete covered by this special provision shall be placed until the contractor's temperature differential plan is reviewed and approved by the engineer.

The contractor shall install within the concrete placed in each mass concrete pour and in the surrounding environment of the concrete, temperature sensing devices of a type approved by and at locations as designated by the engineer. These devices shall be accurate to within plus or minus 2°F within the temperature range of 32°F to 212°F. The temperature shall be recorded automatically by an approved strip-chart recorder furnished by the contractor or other acceptable means approved by the engineer. The sensing system shall contain as a minimum two

independent sets of sensing devices in order to assure readings if one of the systems fail. The engineer may approve manual observation and recording of temperatures at 6-hour intervals where conditions warrant.

**3.0 Method of Measurement.** No measurement will be made.

**4.0 Basis of Payment.** No separate payment will be made for compliance with this special provision. The cost of furnishing all equipment, materials, and labor and performing all work required for placement and curing of mass concrete, as prescribed above and as shown on the plans, will not be paid for separately and all costs therefore shall be included in the contract price bid for other items of work.

#### K. HIGH LOAD MULTI-ROTATIONAL BEARING ASSEMBLY

**1.0 Description.** This item shall include designing, furnishing and installing complete-in-place factory produced bearings in accordance with details shown on the plans and this special provision. The term HLMR (High Load Multi-Rotational) bearing shall be considered interchangeable with Pot Bearing or Disc Bearing.

**2.0 Materials.** Material requirements, tolerances, finishes and other details for these bearings are prescribed on the plans and in this special provision.

##### **2.1 Material Substitution.**

**2.1.1** Standard manufactured HLMR bearings may be substituted for plan bearings provided the bearings meet all contract requirements for materials, movement and loads. In addition the bearing shall be capable of resisting a lateral load as shown on the plans. Masonry plates shall be designed for a maximum load of 1000 psi (6.9 MPa).

**2.1.2** A center bar guide system may be used in lieu of an exterior guide bar system to meet plan requirements, provided the guide and keyway have mating surfaces of stainless steel and Teflon. For either system, provisions shall be made to accommodate the total transverse movements as shown on the plans before the guides are engaged. The fixed bearing shall also provide for the total transverse movements as shown on the plans. For both expansion and fixed bearings, the transverse movement indicated on the plans is due to thermal effects and no additional movement beyond what is specified on the plans shall be allowed. Provisions shall be made for the transverse guidance mechanism to allow equal movements, one-half of total movement, due to thermal expansion and contraction at 60°F (16°C). The guidance mechanism shall be adjusted appropriately for temperatures different than 60°F (16°C).

**2.1.3** Any modifications required to meet the height of bearings shown on bridge plans will be the responsibility of the contractor. Cost of any modification required shall be borne by the contractor.

**2.2 Polytetrafluoroethylene (PTFE) Requirements.** PTFE sliding surfaces for expansion bearings are designed to translate or rotate by sliding of a self-lubricating PTFE surface across a smooth hard mating surface of stainless steel. The unfilled or filled PTFE sliding surfaces shall have 3/64-inch (1.0 mm) minimum thickness and 3/32-inch (2.0 mm) maximum thickness.

<b>Maximum Coefficient of Friction (PTFE to stainless steel as furnished)</b>	
At 75% of Capacity	0.03
At 25% of Capacity	0.05

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**2.2.1** The PTFE sliding surface shall be bonded under factory controlled conditions to a rigid back-up material capable of resisting any bending stresses to which the sliding surfaces may be subjected. Alternatively, PTFE material of twice the thickness specified above may be recessed for half its thickness in the back-up material.

**2.2.2** The mating stainless steel surface to the PTFE shall be an accurate flat surface as required by the design and shall have a minimum Brinell hardness of 125 and a surface finish of less than 20 micro inches (0.508  $\mu\text{m}$ ) rms. The mating surfaces shall completely cover PTFE surface in all operating positions of the bearing. Stainless steel used as a mating surface shall be seal welded around its entire perimeter.

**2.3 PTFE Resin.** The virgin PTFE resin, filled or unfilled PTFE sheets, back-up materials and all other parts of the fixed or expansion bearings shall have the friction, mechanical and physical properties prescribed in this specification, or as shown on the bridge plans. PTFE resin shall be virgin material in accordance with ASTM D4895. Specific gravity shall be 2.13 to 2.19. Melting point shall be  $\pm 623^{\circ}\text{F}$  ( $\pm 327^{\circ}\text{C}$ ).

**2.4 Filler Material.** Filler material when used, shall be milled glass fibers, carbon or other approved inert filler materials.

**2.5 Adhesive Material.** Adhesive material shall be an epoxy resin in accordance with Federal Specification MMA-A-134.

**2.6 Unfilled PTFE Sheet.** Finished unfilled PTFE sheet shall be made from virgin PTFE resin and in accordance with the following requirements.

Properties	Value	Test Method
Tensile Strength, psi (MPa) min.	2800 (19.3)	ASTM D4895
Elongation, percent, min.	200	ASTM D4895

**2.7 Filled PTFE Sheet.** Filled PTFE sheet shall be made from virgin PTFE resin uniformly blended with inert filler material. Finished filled PTFE sheets containing glass fiber or carbon shall be in accordance with the following requirements.

Mechanical Requirements			
Properties	15% Glass Fibers	25% Carbon	Test Method
Tensile Strength, psi (MPa) min.	2000 (13.8)	1300 (9.0)	ASTM D4895
Elongation, percent, min.	150	75	ASTM D4895

Physical Requirements			
Properties	15% Glass Fibers	25% Carbon	Test Method
Specific Gravity, min.	2.20	2.10	ASTM D792
Melting Point, $^{\circ}\text{F}$ ( $^{\circ}\text{C}$ )	81 $\pm 18$ (27 $\pm 10$ )	621 $\pm 18$ (327 $\pm 10$ )	ASTM D4895

**2.8 Surface Treatment.** Where PTFE sheets are to be epoxy bonded, one side of the PTFE sheet shall be factory treated by an approved manufacturer by the sodium ammonia or sodium naphthalene process.

**2.9 Stainless Steel Mating Surface.** Stainless steel mating surfaces, when used, shall be 16-gage minimum thickness and in accordance with ASTM A240 Type 304 with a surface finish of

less than 20 micro inches (0.500  $\mu\text{m}$ ) rms. Stainless steel mating surfaces shall be polished or rolled as necessary to meet the friction requirements of this specification.

**2.10 Structural Carbon Steel.** Masonry plates, sole plates, guide bars, and other bridge bearing components shall be constructed of structural steel in accordance with ASTM A709 Grade 36 (250) and shop coated a prime coat of the coating system as specified on the bridge plans to provide a minimum dry film thickness of 5 mils (125  $\mu\text{m}$ ) in accordance with [Sec 1081](#).

**2.11 Elastomeric Components.** The neoprene elastomer shall be 50 Durometer in accordance with [Sec 1038](#) and dimensions as shown on the bridge plans.

**2.12 Guiding Arrangements.** Guiding arrangements shall have Teflon to stainless steel sliding surfaces.

**2.13 Fabrication.**

**2.13.1** Shop drawings shall be prepared in accordance with [Sec 1080](#).

**2.13.2** Fabrication of all parts of the bearing shall be in strict accordance with the approved shop drawings. The clearance between guide bar and bearing of all guided bearings shall be maintained in strict compliance with the bridge plans.

**2.13.3** During the welding procedure of the stainless steel plates to the top plate and guide bars the surface of the stainless steel plates shall be protected from weld splatter.

**2.13.4** The bonding of the PTFE sheets shall be performed at the factory of the bearing manufacturer of the expansion bearing under controlled conditions and in accordance with the written instructions of the manufacturer of the approved adhesive system. After completion of the bonding operation, the PTFE surface shall be smooth and free from bubbles. Filled PTFE surfaces shall then be polished.

**2.14 Testing and Acceptance.** Each manufactured lot of bearing assemblies shall be accompanied by a manufacturer's certificate stating that the steel, neoprene elastomer and PTFE material are in accordance with this specification and shall show the actual test results for the materials used in the manufacturing of the bearings. Acceptance of bearing assemblies will be based on satisfactory manufacturer's certification, acceptable test results and inspection at the time of installation.

**2.14.1** The manufacturer shall furnish facilities for the test and inspection of the completed bearings, representative samples at the plant or at an independent test facility.

**2.14.2** A random sample from the production lot of bearings shall be tested. As soon as all bearings have been manufactured for a given project, notification shall be given to the engineer.

**2.14.3** The test method and equipment shall be approved by the engineer and include the following requirements.

(a) The test shall be arranged so that the coefficient of friction of the first movement of the manufactured bearing can be determined.

(b) The bearing surface shall be cleaned prior to testing, upon instructions of the bearing manufacturer.

(c) The test shall be conducted at maximum working stress for the PTFE working surface with the test load applied continuously for 12 hours prior to measuring friction.

(d) The first movement static and dynamic coefficient of friction of the test bearing shall be determined at a sliding speed or less than one inch (25 mm) per minute and shall not exceed the coefficient of friction for design.

(e) The bearing specimen shall then be subjected to 100 movements of at least one inch (25 mm) of relative movement and if the test facility permits, the full design movement at a speed of less than one foot (305 mm) per minute. Following this test, the static and kinetic coefficient of friction shall be determined again and shall not exceed the values measured in requirement (d). The bearing or specimen shall show no sign of bond failure or other defects.

(f) A proof load test shall be performed on a sample selected at random from the production lot, by applying load equal to 150 percent of the design capacity of the bearing for a period of one hour. The test bearing shall show no sign of failure or other defects while under load or subsequently upon disassembly and inspection.

**2.14.4** Bearings represented by the test specimen passing the above requirements will be approved for use in the structure subject to on-site inspection for visible defects.

**2.15 Packaging.** The bearings shall be packaged and crated in such a manner that they will be protected from dust and moisture, and not become damaged while being handled, transported or stored. The contractor shall replace any bearing damaged during handling, transporting or storing at no expense to the Commission.

**3.0 Construction Requirements.** The bridge bearings are not designed to accept bending stresses and shall be fully supported over the entire area of the bottom and upper surfaces at all times when under load. Where a steel masonry plate is to be used and laid directly on the bent cap, the area under the plate shall be finished to within 1/8" above plane elevations and shall be dressed to a uniform, level bearing with a Carborundum brick or power grinder after the concrete has set sufficiently to fix the larger particles of sand.

**3.1** The masonry plate shall be set to line and grade. The contractor shall locate the bearings at the proper elevation and orient them in the proper direction. The engineer will approve the location and orientation of the bearing. The upper part of the bearing shall be located relative to the base of the bearing according to the engineer's recommendations for the temperature at the time of erection.

**3.2** If for any reason the bearings are disassembled, extreme care shall be used to insure that the rubber pads and piston rings are properly seated in the recess with the piston ring gaps 180 degrees apart.

**3.3** It is necessary to exercise care in aligning both the base and upper part of the guided expansion bearing parallel to the axis of the structure, otherwise a wedging action will occur and unsought horizontal forces will result.

**3.4** The contractor shall align all bearings on any one bent exactly to the direction as shown on the plans.



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**3.5** The contractor shall avoid scratching, gouging or otherwise marking the PTFE or mating stainless steel surfaces of the bearings during handling or erection. The contractor shall use whatever means are necessary to protect the bearings from dirt, grout or other foreign materials during the construction of other elements of the structure.

**4.0 Method of Measurement.** Measurement will be made per each. The HLMR bearing, complete in place, shall include the steel sole plate, masonry plate, neoprene masonry pad, anchor bolts, heavy hexagon nuts and washers, coupling nuts, coating and any incidental material needed to complete the work.

**5.0 Basis of Payment.** Payment for the above described work, including all material, equipment, labor, and any other incidental work necessary to complete this item, will be considered completely covered by the contract unit price for "High Load Multi-Rotational Bearing Assembly".

L. MODULAR EXPANSION JOINT SYSTEM

**1.0 Description.** This work shall consist of furnishing materials, services, labor, tools, equipment, and incidentals necessary to design, fabricate, inspect, test and install the expansion joint system including the barrier and curb sliding plates, skid resistant plate, and concrete and reinforcing steel in the blockouts as specified.

**1.1 General.** The modular expansion joint system shall consist of multiple strip seal joints that shall allow movements as shown on the plans. The configuration of the expansion joint system shall consist of neoprene strip seals mechanically held in place by steel edge and separation beams. Each separation beam shall be supported by independent multiple support bars welded to the separation beams, or by a single support bar system welded or bolted to the separation beams. The multiple support bars shall be suspended over the joint opening by sliding elastomeric bearings. Scissor type modular expansion joint systems will not be permitted. An equidistant control system shall be incorporated that develops its maximum compressive force when the joint is at its maximum opening. The final completed expansion joint system shall be continuous across the full width of the roadway and continue into the traffic barriers as shown on the plans.

**1.2 Qualified Manufacturers.** The qualified manufacturer shall have a minimum of 5 years experience in designing and fabricating modular expansion joint systems and be certified under the AISC certification program for either "Simple Bridge" or "Bridge and Highway Metal Component Manufacturers". The following manufacturers are known suppliers of modular expansion joint systems:

D.S. Brown  
300 East Cherry Street  
North Baltimore, OH 45872  
Telephone (419) 257-3561  
[www.dsbrown.com](http://www.dsbrown.com)

D.S. TechStar, Inc.  
1219 West Main Cross Street  
Findlay, OH 45840  
Telephone: (419) 424 0888  
[www.techstar-inc.com](http://www.techstar-inc.com)

Watson-Bowman & Acme Corp  
95 Pineview Drive  
Amherst, NY 14120  
Phone (716) 691-7566  
[www.wbacorp.com](http://www.wbacorp.com)

Mageba USA  
575 Lexington Avenue, 4<sup>th</sup> Floor  
New York, NY 10022  
Phone (212) 644-3339  
[www.magebausa.com](http://www.magebausa.com)

## **2.0 Design Requirements.**

**2.1 Truck and Impact Loading.** The modular expansion joint system shall be designed in accordance with the latest edition of AASHTO LRFD Bridge Design Specifications except that the LRFD truck loading shall be HS-20 Modified (HS-25) and impact being 100 percent. The modular expansion joint system shall be designed for the maximum number of lanes between the barrier curbs, and the lane width shall be considered as 10 feet. The modular expansion joint system shall be designed such that the joint system is designed to support a wheel load being 12 inches from the roadway face of the curb. The modular expansion joint system shall be designed for the staged traffic loading as shown on the plans.

**2.2 Field Splices.** The design and fabrication of the modular expansion joint system shall be one continuous unit without field splices except as required by stage construction requirements as shown on the plans. If the site and/or stage construction requirements require the need for field splices, the splices shall be located in areas outside the main traffic lanes or as shown on the plans and consist of a welded separation beam splice in which the weld is a full penetration weld, or another connection that is capable of developing the capacity of the spliced members. The contractor shall complete the field splices in accordance with the details and procedures included in the shop drawings.

**2.3 Movement.** The modular expansion joint system shall be designed to provide the minimum total movement as noted on the plans and to accommodate all expected longitudinal movements (i.e. thermal, creep, shrinkage, elastic shortening, etc.) as well as vertical and horizontal rotations. This design shall incorporate strip seal glands with a maximum movement range of 3.15 inches per seal.

**2.4 Fatigue.** The modular expansion joint system shall be tested and designed following the guidelines provided in the National Cooperative Highway Research Program (NCHRP), Report 402 "Fatigue Design of Modular Bridge Expansion Joints" as well as the provisions included in Chapter 14, "Joints and Bearings", of the latest edition of AASHTO LRFD Bridge Design Specifications.

**2.5 Water Tightness.** After the modular expansion joint system has been completely installed, the joint shall be flooded for a minimum of one hour to a minimum depth of 3 inches. Testing shall be performed in stages with traffic flow maintained in accordance with the traffic control plans. If the engineer observes leakage, the expansion joint system shall be repaired at the contractor's expense. The repair procedure shall be as recommended by the manufacturer and approved by the engineer.

**2.6 Corrosion Protection.** All steel surfaces, except as noted, shall be hot dip galvanized in accordance with AASHTO M111 (ASTM A123).

**2.7 Anchorage of Expansion System.** The modular expansion joint system anchorage shall be designed by the manufacturer and included in the design computations and shown in the shop drawings.

**3.0 Material.** All material shall be in accordance with Division 1000, Material Details, and specifically as follows.

**3.1 Structural Steel.** Structural steel shall be in accordance with AASHTO M270, Grade 50 (ASTM A709, Grade 50). All shop-welded connections that splice the horizontal separation

beams and edge beams shall be full penetration welds. All separation beams to support bar connections shall be full penetration welds or bolted connections in accordance with NCHRP Report 402 requirements. Aluminum components will not be permitted. All fabrication of structural steel shall be in accordance with [Sec 712](#) and [1080](#).

**3.2 Stainless Steel.** The stainless steel shall be in accordance with [Sec 1038.4.2](#).

**3.3 Sliding Bearings.** The sliding bearings shall be fabricated as steel reinforced elastomeric pads with polytetrafluorethylene (PTFE) in accordance with [Sec 1038](#) or other proprietary material (with the engineer's approval) as required by the manufacturer. The bearings shall be designed so that they are removable and replaceable.

**3.4 Strip Seals and Lubricant Adhesive.** Strip seals and lubricant adhesive shall be in accordance with [Sec 717](#) and [1073](#). The strip seals shall not protrude above the top of the joint.

### **3.5 Submittals.**

**3.5.1 Design Computations and Shop Drawings.** The contractor shall submit, for the engineer's review, the design computations and shop drawings. All shall be signed, sealed and stamped by a registered professional engineer in the State of Missouri in accordance with Authentication of Certain Documents in [Sec 107](#). The design computations shall include fatigue design and a strength design for all structural elements and connections. Shop drawings shall be prepared for the modular expansion joint system in accordance with [Sec 1080](#). The shop drawings shall also include the following:

- (a) Plans, elevation, and section of the joint system for each movement rating and roadway width showing dimensions and tolerances.
- (b) All ASTM, AASHTO or other material designations.
- (c) Method of installation, including but not limited to sequence, setting relative to temperature, anchorage during setting and installation at curbs.
- (d) Corrosion protection system.
- (e) Details of temporary support for shipping and handling.
- (f) Details of blockout reinforcement and anchorage.
- (g) Fatigue testing report.
- (h) Details of adjustments to record drawings based on the selected modular joint system.

**3.5.2 Maintenance Manual.** The manufacturer shall submit to the engineer a written maintenance manual and part replacement plan at the time of the shop drawing submission. Included in the submission shall be list of parts to be inspected, acceptable wear tolerances and the method of part replacement. The manufacturer shall conduct a pre-installation meeting to train MoDOT's construction inspectors and maintenance personnel on the installation and maintenance of the modular expansion joint system.

**3.5.3 Certificates of Compliance.** The manufacturer shall provide certification of the manufacturer's experience, including a list of projects, and certificate of compliance with the AISC

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certification program, in accordance with Section 1.2 of this job special provision, to be submitted to the engineer.

**4.0 Construction Requirements.** The expansion joint system shall be stored at the job site in accordance with the manufacturer's written recommendations. Damage to the joint system during shipping or handling will be cause for rejection of the joint system. Any damage to the corrosion protection system shall be repaired to the satisfaction of the engineer at the contractor's expense. The support boxes shall rest on cast-in-place concrete or grout pads installed into a preformed blockout. The contractor shall coordinate the size and reinforcing of the blockout with the selected modular joint manufacturer. This includes reinforcement in the blockout, the adjacent and supporting concrete slab and other concrete and structural steel supporting elements. Modifications to the record drawings to accommodate the selected modular system shall be the contractor's responsibility. The contractor shall provide details of any adjustments to the record drawings with the shop drawing submittal. Concrete shall be forced under and around support boxes, anchorage systems and supporting hardware. Proper consolidation shall be achieved by localized internal vibration. Installation of the modular expansion joint system shall be as recommended by the manufacturer. The contractor shall obtain the services of a qualified technical representative, approved by the manufacturer of the expansion joint system and acceptable to the engineer, to assist during the installation. The installation shall not occur without the qualified technical representative being present. The qualified technical representative shall have 3 years of experience working on installation of modular expansion joint systems on bridges. This experience shall also include modular joints that had field splices for staged construction.

**5.0 Method of Measurement.** Final measurement will not be made except for authorized changes during construction or where appreciable errors are found in the contract quantity. Where required, the modular expansion joint system will be measured to the nearest linear foot, based on measurement from the roadway face of curb to roadway face of curb along the centerline of the joint. Portions of the joint that extend past the roadway face of curbs will not be measured for payment. The revision or correction will be computed and added to or deducted from the contract quantity.

**6.0 Basis of Payment.** Modular expansion joint system, including all material, coating, equipment, labor, fabrication, installation, technical assistance and any other incidental work necessary to complete this work, will be paid for at the contract unit price for "Modular Expansion Joint System (Bent 4)" and "Modular Expansion Joint System (Bent 8)".

M. DRAINAGE SYSTEM

**1.0 Description.**

**1.1** This work shall consist of furnishing, fabricating and installing the drainage items necessary to complete the entire drainage system as shown on the contract plans.

**1.2** Detailed shop drawings of the drainage system shall be prepared and submitted to the engineer. Shop drawings shall be in accordance with [Sec 1080](#). Catalog data may be furnished for components that are standard manufactured items in lieu of detailed drawings, provided that governing dimensions are given.

**2.0 Materials.**

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**2.1** Reinforced fiberglass pipe, collection basins and fittings shall be a Reinforced Thermosetting Resin Pipe (RTRP) system in accordance with the requirements of ASTM D2996. The RTRP system shall have a minimum short time rupture strength hoop tensile stress of 30,000 psi. The RTRP system shall be pigmented resin throughout the wall. The color of the RTRP system shall be concrete gray or as specified on the bridge plans. The RTRP system shall not be coated with paint, gel-coat or any other exterior coating.

**2.2** The contractor shall furnish a manufacturer's certification to the engineer for each lot furnished, certifying that the materials supplied are in accordance with all requirements specified. The certification shall include results of all required tests. Acceptance of the material will be based on the manufacturer's certification and upon results of such tests as may be performed by the engineer. The certification shall show the quantity and lot number that is represented.

**3.0 Construction Requirements.**

**3.1** All connections shown on the plans to facilitate future removal for maintenance cleanout or flushing shall be made with a threaded gasket coupler system, bolted gasket flange system or a female to male threaded PVC plug. Adhesive bonded joints will be permitted for runs of pipe between such connections.

**3.2** Runs of pipe shall be supported at a spacing of not greater than the lesser of those as recommended by the manufacturer of the pipe or as shown on the bridge plans. Supports that have point contact or narrow supporting areas shall be avoided. Standard sling, clamp, clevis hangers and shoe supports designed for use with steel pipe may be used. Minimum hanger thickness shall be 3/16 inch with the minimum strap width for the pipe sizes shown in the table below. Straps shall have 120 degree minimum contact with the pipe. Pipe supported on a surface with less than 120 degrees of contact shall have a split fiberglass pipe protective sleeve bonded in place with adhesive. All new steel, hangers and miscellaneous hardware for drainage system shall be ASTM A709 Grade 36 steel except as noted on the bridge plans. All new steel, hangers and miscellaneous hardware for drainage system shall be galvanized in accordance with ASTM A153 except as noted on the bridge plans.

Pipe Size inches (mm)	Minimum Strap Width inches (mm)
3 (76.2)	1.25 (32)
4 (101.6)	1.25 (32)
6 (152.4)	1.50 (38)
8 (203.2)	1.75 (45)
10 (254.0)	1.75 (45)
12 (304.8)	2.00 (51)
14 (355.6)	2.00 (51)

**3.3** The RTRP system shall be handled and installed in accordance with guidelines and procedures as recommended by the manufacturer.

**3.4** When the drainage system continues between superstructure units and/or between the superstructure and substructure units, the drainage system shall have allowance for the expected differential expansion and contraction movements as recommended by the manufacturer.

**4.0 Method of Measurement.** No measurement will be made.

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**5.0 Basis of Payment.** Payment for the above described work, including all material, equipment, labor and any other incidental work necessary to complete this item will be considered completely covered by the contract lump sum price for “Drainage System (On Structure)”.

N. SLAB DRAIN WITH GRATE

**1.0 Description.** This item of work consists of furnishing, fabricating and installing the drainage items necessary to complete the drainage system as shown on the bridge plans.

**2.0 Materials.**

**2.1** All structural steel or casting materials and hardware shall be galvanized in accordance with ASTM A123, ASTM A153 and [Sec 1081](#).

**2.2** Detailed shop drawings of the drainage system shall be prepared and submitted to the engineer. Shop drawings shall be accordance with [Sec 1080](#). Catalog data may be furnished for components that are standard manufactured items in lieu of detailed drawings, providing governing dimensions are given.

**2.3** All material for the deck inlets and grates may be castings in lieu of ASTM A709 Grade 36 (250) structural steel as shown on the plans. Castings shall be cast gray iron in accordance with Sec 614. A standard manufactured grate of similar size and meeting the above material requirements may be submitted to the engineer for approval.

**2.4** Drainage pipes and elbows shall be ASTM A500 or A501 with a minimum wall thickness of 0.322 inches (8 mm). All bolts shall be ASTM A307 and pipe supports ASTM A709 Grade 36 (250). Joints and openings shall be accurately cut and carefully welded to result in watertight and neat appearing joints. All welding shall in accordance with AWS D1.5-95 and [Sec 1080](#).

**3.0 Construction Requirements.** The slab drain with grate shall be handled and installed in accordance with guidelines and procedures as recommended by the manufacturer and as shown on the plans.

**4.0 Method of Measurement.** Measurement for slab drain with grate will be made per each.

**5.0 Basis of Payment.** Payment for the above described work, including all material, equipment, labor and any other incidental work necessary to complete this work, will be considered completely covered by the contract unit price for “Slab Drain with Grate”.

O. NAVIGATION LIGHTING

**1.0 Description.** This work shall consist of furnishing and installing solar powered navigation lighting fixtures at Bents 6 & 7 and at mid-channel of Span (6-7). Conduit shall be installed in the event AC powered light fixtures are installed in the future as shown in the contract plans.

**2.0 Material.** All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Conduit System on Structure	<a href="#">707</a>

Item	Section
Highway Lighting	901

All electrical equipment including all connecting electrical infrastructure such as raceways, wiring, conduit fittings and bodies, junction/pull boxes and terminations proposed for use shall be UL Listed. Navigation lanterns and solar power supplies shall be UL Listed and/or be certified by an independent testing laboratory citing compliance of the lantern photometry to standards established by the United States Coast Guard.

**2.1 Working Drawings.** Before any work is started on the navigational light system, working drawings shall be submitted for review by the engineer. Layout on the plans showing the arrangements and locations of all equipment are to be considered as illustrative. The contractor may suggest modifications as necessary for proper construction and operation with approval of the engineer. The location of the wiring cables, conduits and navigation lighting fixtures shown on the plans is diagrammatic only and may be subject to slight shifting as required to meet field conditions as approved by the engineer. Any discrepancies between field conditions, plans and specifications or installation conflicts shall promptly be brought to the attention of the engineer.

## **2.2 Navigation Lights.**

**2.2.1** All navigation lights shall be of sufficient candlepower as to be visible against the background lighting at a minimum distance of 2000 yards (1.8 km), 90% of the nights of the year. The lamp and lens shall be optically aligned and of such design to provide this visibility. The navigation light system shall be operated automatically from sunset to sunrise and at other times when visibility is less than one nautical mile (1.8km).

**2.2.2** The navigation lights shall be in accordance with [Sec 901](#) and the Contract drawings. Navigation light fixtures are herein defined as assemblies consisting of LED type lantern with integral solar power supply and pendant type swing arm assembly designed and manufactured by a single manufacturer.

**2.2.3** Lanterns shall be part of the manufacturer's standard product line and in production for a minimum of five years with an installed base. Lantern housings shall be copper-free cast aluminum (NPC 356) with clear anodized finish. Fittings shall be 316 stainless steel. Mounting base shall be fitted with a grommeted hole for wires to pass into the lantern directly from the pendant swing arm.

**2.2.4** The lantern optical section shall consist of a Fresnel lens, made of glass or acrylic in the color indicated specifically engineered for use with the particular LED light source. The lens and focal point shall be designed for not less than an eight degree vertical beam divergence. Lenses shall be of the color indicated. Clear lenses with LEDs of the indicated color are not acceptable. On pendant swing arm type mounts the lantern lens shall be provided with a 0.125" drain hole at the end of the lens.

**2.2.5** The swing arm assembly shall be designed such that all wiring or future wiring into the swivel joint bearing sleeve, down through the pendant arm and into the lantern shall be completely concealed.

The swing arm shall be counterweighted to limit pulling force as indicated on the Contract plans but in no case shall it exceed 35 pounds force. The complete assembly shall be designed such that when installed the movement of the arm through the full arc of travel shall be free and clear of interference with any part of the assembly, the signal light for example, and such that the pulling



motion will be smooth and continuous. However, the arm shall include a locking mechanism to prevent it from swinging when not being serviced. The manufacturer of the assembly shall provide all necessary retaining clips and anchors suitable for anchoring in preformed concrete and indicate on the working drawings the method for installing them.

**2.2.6 Operation.** The navigation lights shall meet the following:

- (a) Minimum autonomy of 150 hours.
- (b) Minimum equivalent peak sun hours to maintain minimum autonomy of 3 hours.
- (c) Minimum maintenance free lifespan of 5 years.

**2.3 Retro-Reflective Panels.** High intensity red retro-reflective panels 2 x 2 foot (0.6 x 0.6 m) shall be placed on the bents in accordance with Title 33, CFR, Part 118 at the locations shown on the Contract plans to effectively reflect the search light of an approaching vessel. Aluminum panels shall be isolated from steel or concrete with an isolating material.

**2.4 Junction Boxes.** All junction boxes shall conform to [Sec 1062](#) and be UL Listed; specifically:

**2.4.1** All concrete-embedded barrier-mounted junction boxes shall be rated NEMA 4X, SS 316, with outer flange to seat box in opening and gasketed cover with stainless steel, Allen-head type retaining bolts, flush with the cover.

**2.4.2** Surface-mount junction boxes shall be NEMA 4X, SS 316, with bolted and gasketed covers and factory-fitted mounting lugs. All boxes shall be drilled and tapped for bottom-entry only.

### **3.0 Construction Requirements.**

**3.1 Navigation Lights.** Each channel on both sides of the bridge shall be marked with 180° red margin-of-channel lanterns and 360° green center-of-channel lanterns, all pendant-mount, swing arm type, supported on swivel mounts attached to the barrier wall at the locations and by the means indicated on the Contract plans. Margin-of-channel lights shall be aligned to show 90° on either side of a line parallel to the axis of the channel so as to be visible from an approaching vessel. Center-of-channel lights shall be aligned in line with the axis of the channel so as to be visible from an approaching vessel.

**3.1.1** The rotating mechanism shall have a hinged pad-lockable security cover.

**3.2 Junction Boxes.** Submit junction boxes for review and acceptance by the engineer. Install outdoor surface-mount boxes with conduits connected bottom-entry only.

**3.2.1** Embed barrier-mounted junction boxes such that the cover is flush with the concrete barrier.

**3.2.2** Install surface-mount junction boxes to concrete with stainless steel bolts and anchors; submit shop drawing and cut sheets showing all details for review and approval by the engineer.

**3.2.3** Label conduit runs in all junction boxes.

**3.2.4** All cable entrances shall be watertight. The entire assembly shall be constructed to prevent insect entry.



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**3.3 Navigation Lighting Testing.** Testing of the navigation lighting system shall be in accordance with [Sec 901](#).

**4.0 Method of Measurement.** No measurement will be made.

**5.0 Basis of Payment.** Payment for the above described work, including all material, equipment, labor and any other incidental work necessary to complete this item, will be considered completely covered by the lump sum price for "Navigation Lighting System".

**5.1** Payment for conduit for future wiring as indicated in the plans will be considered completely covered by the unit price for other items in the contract.