MICHIGAN

DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION

FOR

**SEGMENTAL TREADS AND TRACKS**

BRG:TNB 1 of 14 APPR:SCK:RAL:08-30-22

**a. Description.** This work consists of furnishing, fabricating and erecting the segmental treads that are attached to the segmental girders of the bascule leaf, and furnishing, fabricating and erecting the tracks on which the segmental treads roll and which are bolted to the track girders. Field machining of the existing segmental girder webs and track girders is included in this item. This work also includes adjusting shims at the live load bearings and passive center locks following completion of the track and tread replacement. Ensure the work is completed in accordance with section 707 and subsection 908.04 of the Standard Specifications for Construction, except as modified herein.

Supply keys, bolts, nuts, screws, washers, dowels, filler plates, spacer plates and shims required to assemble all components to the supports and provide proper alignment of all mechanical systems.

Supply all other materials, lubricants, labor, and equipment necessary to perform the work all in accordance with *AASHTO*, the special provisions, and the contract plans. Provide erection, installation, lubrication, testing, and alignment for all components.

Ensure all parts are new and are as shown or an approved equal. In cases where the Contractor proposes a substitution, the Contractor will be responsible to prove equality of the substitution with the original contract plans, including the submission of a sample for Engineer examination and/or a visit by the Engineer to the proposed manufacturing facility, all at the cost of the Contractor.

**b. Applicable Standards.** The publications listed below form a part of this special provision to the extent referenced. The text refers to the publications by basic designation only.

Ensure workmanship, materials, fabrication, and erection of the bridge components are in accordance with the requirements of *AASHTO Standard Specifications for Movable Highway Bridges (AASHTO)*, where not otherwise specified herein.

Other applicable standards:

1. *ASTM*.

2. *ANSI*.

3. *American Gear Manufacturer's Association (AGMA*).

4. *SAE*.

5. *AWS, Structural Welding Code, D1.5*, version specified in the contract.

6. *American Bearing Manufacturers Association (ABMA*).

7. *AISI*.

8. *AISC*.

9. *SSPC*.

**c. Submittals.**

1. General. Shop drawings must fully define all details and assemblies, indicate the methods and sequences employed in the assembly and installation of bridge machinery, and present the installation of necessary utilities, support, and service facilities. Ensure submittals are neat and legible, clearly show dimensions and pertinent ratings, and be marked to explicitly identify the intended use of each component.

Prepare shop drawings of fabrication details in accordance with subsection 707.03.A of the Standard Specifications for Construction.

Ensure certified drawings are approved prior to purchase of all standard or semi-standard machinery components including turned bolts and similar items.

2. Manufactured Items. Electronically submit shop drawings to the Engineer for review and approval in accordance with this special provision. Shop drawings must include complete details, classification of materials, schedules for fabrication and shop assembly, procedures and diagrams showing sequence and details for erection and approval.

A. Provide shop drawings for fabricated detail parts with a title to describe the parts detailed thereon. Identify each drawing by the complete project name and number. Complete and organize shop drawing submittals to allow the review and evaluation of logical groups of items, including the interfaces between adjacent or connected parts. Shop drawings must include the following information:

(1) Dimensions, call-outs and notes to completely define the form, fit, function, manufacturing process and allowable deviations for each item.

(2) Material specification for each item.

(3) Heat treatment or specific hardness requirements when mandated.

(4) The surface finish of machined surfaces and tolerances for each dimension for which a specific fit is required. Use a general tolerance block to define the tolerances of all other dimensions. Ensure the fits and finishes are the more rigorous of *AASHTO* or manufacturer specifications.

(5) Quantity required.

(6) Computed weight. Show component weights on the same shop drawing as the component detail.

B. Shop drawings for manufactured or purchased assemblies must include:

(1) Complete data on the design and construction of all detail components furnished as part of the machinery under this contract as presented in the contract.

(2) Show all proprietary items in outline on shop drawings.

(3) Provide complete assembly diagrams for proprietary components that show each part contained within the item and its corresponding manufacturer's part number. Ensure the diagrams are sufficient to enable complete disassembly and re-assembly of the subject component and enable the definition and procurement of proper spare/replacement parts.

If any part is modified in any manner from the way it is described or delivered by its original manufacturer, electronically deliver a drawing which details each modification, and assign the part a unique part number to assure procurement of proper spare/replacement parts.

C. Component assembly drawings must include:

(1) Certified external dimensions and clearances affecting interfaces or installations;

(2) Gross weight;

(3) Details of all turned bolts used to mount the machinery to its supports.

D. Electronically submit detailed procedures for installation, alignment, testing, and indexing of components. Obtain approval from the Engineer prior to construction and delivery of any machinery to the site.

Include complete shop bills of materials for all machinery parts. If the bills are not on the shop drawings, furnish prints of the bills for approval in the same manner as specified for the drawings. State the computed weight of each piece of machinery on the shop drawing upon which it is detailed.

Electronically furnish complete assembly and erection drawings. Ensure these drawings provide identification of, and essential locating dimensions for each part or assembly with respect to the bridge or foundation.

Resubmit shop drawings, which are unapproved or require correction, until the Engineer approves them. This approval-procedure cannot be used as a cause for delay. Bear all costs or damages which may result from the ordering or fabrication of any materials prior to the approval of the shop drawings. As a means of expediting delivery prior to approval of the shop drawings, the Contractor may request in writing from the Engineer, approval to order raw materials of the correct type for later fabrication from accepted shop drawings. Ensure such approval by the Engineer is in writing.

**d. Quality Assurance.** The Engineer will, at their discretion and as they deem necessary, inspect and verify the procedures and operations performed during the installation of the bridge operating machinery.

The Engineer may inspect, test materials and fabrication procedures in the mill, shop, and field. Such inspections and tests do not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

All details shown on the plans are typical and apply to similar conditions unless otherwise indicated. Verify all dimensions and details at the site before proceeding with any work and to avoid causing subsequent delay in work.

The Engineer is responsible for reviewing all Quality Control records and test reports submitted by the Contractor’s QC Manager. As used herein, certified test reports refer to reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. As used herein, factory tests refer to tests performed on the actual materials or equipment proposed for use. Ensure testing is consistent with the MDOT Materials Source Guide where applicable.

The Engineer has the authority to reject materials and workmanship that do not conform to the requirements of the contract. The Engineer may conduct inspection of material and workmanship before, during, and after fabrication, as he/she deems necessary. Rejection may include materials and workmanship, which are being fabricated and are found to contain defects or to have been subjected to damaging fabrication procedures, while still in process. The Engineer has the right to perform, at the expense of MDOT, non-destructive tests of material and workmanship. At the discretion of MDOT, the Engineer may exercise QA functions on site, and at the mill and shop. The Contractor must provide access to facilities and furnish means and assistance for testing materials and workmanship without cost to MDOT.

MDOT’s Quality Assurance (QA) program, including a review of tests, reports, and mill, shop, or field inspections, will not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with specified requirements.

The Engineer must have access at all times to any portion of shops and field where the Contractor is working under this special provision.

**e. Contractor Experience.** Provide personnel including certified millwrights and supervising engineers familiar and experienced in the installation and operation of mechanically operated movable bridge machinery, especially for bascule bridges. Substitutions of experienced personnel are prohibited without written consent of the Engineer. Submit a tabulation of experience in the installation and operation of movable bridge components, specifically for bascule bridges, to the Engineer.

The on-site supervisory personnel of the mechanical work must have conducted a minimum of two successful mechanical component rehabilitations on a movable bridge in the past 10 years.

**f. Materials.**

1. General. Ensure all components and materials are new.

Submit independent laboratory test results for Brinell hardness tests, and include on inspection reports, for castings and forgings, for which hardness values are required on the plans, in the materials specifications or specified herein.

See subsection 707.03.B of the Standard Specifications for Construction for MDOT shop inspection requirements. Ensure inspection and testing are in accordance with the following requirements:

A. Inspection at the plant or shop does not relieve the Contractor from responsibility for furnishing satisfactory materials and workmanship. Acceptance of a material or item will not prevent subsequent rejection if material is defective. Remedy defects due to erection, materials, or design for products used by the Contractor for a period of 1 year after final tests and acceptance, at the Contractor’s own expense. If necessary, others may correct such defects at the Contractor’s expense, when written notification is given of the presence of defects or malfunction, and no satisfactory corrective action is provided after 14 days.

B. Unless otherwise provided, furnish without charge, test specimens required herein, and all labor, testing machines, tools, and equipment necessary to prepare the specimens and to make the physical tests and analyses. Electronically furnish copies of test reports and chemical analyses to the Engineer.

C. Proposed substitutions to the specific manufacturers and/or models shown on the plans must meet the requirements, be appropriate for the intended application, and the Engineer must approve them as equivalent to the specified item(s).

2. Standard Products. Ensure materials and equipment are standard, current production, cataloged products of established manufacturers, and have at least 2 years of commercial or industrial use prior to bid opening. Where two or more units of the same class of equipment are required, ensure these units are products of a single manufacturer; however, the component parts of the system need not be the products of the same manufacturer.

A. High Strength Bolts, Nuts and Washers. Ensure heavy hexagonal head bolts, heavy hexagonal nuts, and hardened washers are in accordance with section 713 of the Standard Specifications for Construction.

B. High Strength Turned Bolts. Ensure turned bolts are in accordance with *ASTM F3125/F3125M, Grade A 325 Type 1*, except deviations specifically called in the contract. Ensure turned bolts 1½ inches and larger conform to *ASTM A449, Type 1*, unless otherwise specified on the plans.

C. Shims. Ensure that all machinery shims required for leveling and alignment of equipment, including tapered shims, are stainless steel, *ASTM A240/A240M, Type 316*.

D. Keys. Unless otherwise specified herein or on the plans, make keys for all components from cold-finished carbon steel squares or flats that meet the requirements of *ASTM A668/A668M, Class M*, with a minimum tensile strength of 145,000 psi, and minimum yield strength of 120,000 psi, or approved equal or greater strength alternative.

3. Segmental Tracks and Treads. Ensure the material for the segmental treads and tracks is either steel castings or steel forgings as stipulated below.

A. Steel Castings. Castings must meet the requirements of *ASTM A148/A148M, Grade 130-115*. *Supplementary requirements S1, Magnetic Particle Examination*, apply.

The material must meet the Charpy V- Notch Impact Requirements specified in current *ASTM A148/A148M*, except that the minimum requirements will be 15 foot-pounds of energy absorbed at -50 °F.

Cast at least one test coupon integrally with each casting. Ensure all coupons are of sufficient size to allow for all necessary testing. If the coupons are insufficient in size, shape, or quality, the casting will be rejected. Do not flame-cut within 1/2 inch of the finished test specimens.

B. Steel Forgings. If the Contractor prefers to use steel forgings in lieu of steel castings, a written procedure documenting how the forgings are to be made to meet the requirements contained herein must first be submitted to the Engineer for review and approval.

Forgings must meet the requirements of *ASTM A668/A668M*, *Class M* (normalized, quenched, and tempered), except that for material thickness exceeding 20 inches, ensure the minimum tensile strength is not less than 130 ksi and the minimum yield strength not less than 110 ksi.

The material must meet the Charpy V-Notch Impact Requirements specified in current *ASTM A148/A148M*, except that the minimum requirements will be 15 foot-pounds of energy absorbed at -50 °F.

4. Details and Workmanship. Finish, assemble, and adjust the machinery in an approved manner using best machine-shop practice. Place the limits of accuracy and the allowances for all metal fits, on the working drawings. Ensure fits and finishes of machinery parts are as called for on the plans or as specified in *AASHTO, Paragraph 6.7.8*.

Ensure the symbols are in accordance with *ANSI B46.1*, where surface finishes are indicated on the plans or specified herein. Specify values of roughness height in micro-inches as an arithmetical average deviation from the mean line. Roughness specified is the maximum value, and any smoother finish will be satisfactory. Determine compliance with specified surface roughness by trained sense of feel and by visual inspection of the work compared to "Standard Roughness Comparisons" in accordance with the provisions of *ANSI B46.1*. Ensure unspecified values of roughness width and waviness are consistent with the general type of finish specified by the roughness height. Reject flaws such as scratches, ridges, holes, peaks, cracks, or checks which will make the part unsuitable as determined by the Engineer.

Ensure unspecified surface finishes are in accordance with *AASHTO, Paragraph 6.7.8*. Machine mating surfaces to provide an even and true bearing. Highly polish and finish true to the given dimensions surfaces with rotating or sliding contact. Indicate surfaces to be machine-finished on shop drawings by symbols, which are in accordance with *ANSI B46.1*.

So far as practicable, lay out all work to secure proper matching of adjoining unfinished surfaces. Remedy large discrepancies between adjoining unfinished surfaces to realize proper alignment. Chip or grind unfinished surfaces free of all projections and rough spots. Ensure unfinished surfaces are true to the lines and dimensions shown on the shop drawings. Fill depressions or holes not affecting the strength or function of the parts in a manner approved by the Engineer.

5. Mechanical Component Requirements.

A. Keys, Keyways, and Set Screws. Ensure keys and keyways are in accordance with the dimensions and tolerances for square and flat keys of the *ANSI Standard B17.1*, unless otherwise specified. Machine keys for an FN2 side fit and an LC4 fit on top and bottom with keyways in shafts and hubs and a 63 micro-inch finish or better unless otherwise specified. Cut keyway corners and key chamfers with the fillet radius and chamfer as suggested by *ANSI B17.1*. Effectively hold all keys in place. Provide custom keys as necessary to meet the required key fits and finishes.

B. Shims. Neatly trim all machinery shims required for leveling and alignment of equipment to the full bearing dimensions of the assembled parts, drill for all bolts that pass through the shims, and construct the shims of stainless steel. Do not use slotted shims unless the plans note otherwise. Ensure in general, total shim thickness available is no less than equal to twice the nominal thickness shown on the plans, and furnish sufficient varying thicknesses to secure 0.010-inch variations of the shim allowance including one shim equal to the full allowance. Provide shims with less than 0.010-inch variations if required to achieve proper machinery installation alignment tolerances. Mark each shim with the thickness with an indelible marker. Show shims in detail on the shop drawings. Individually pack shim packs to prevent damage from handling during shipment to the project site. Clearly mark packaging with the plan sheet number and item number of the part for which the shim pack was fabricated. Place shims to provide full contact between machinery and machinery supports.

C. Turned Bolts. Finish the bodies of turned bolts to 63 micro-inches or better, as defined by *AASHTO, Paragraph 6.7.8*. Ensure threads for the turned bolts and nuts are in accordance with the Unified Thread Standards, coarse thread series with a Class 2A tolerance for bolts and Class 2B tolerance for nuts, in accordance with *ANSI B1.1*, unless otherwise specified. Manufacturers designate turned bolts by their nominal thread size. Ensure the turned bolt body is 1/16 inch larger in diameter than the nominal size specified and has an LC6 fit with reamed holes. Ensure bolt head and nut bearing surfaces are flat and square with the axis of the bolt holes. Spot face bolt head and nut bearing surfaces to 125 microinches. Unless otherwise noted, the Contractor may sub-drill (in the shop) bolt holes in machinery parts required for connecting to supporting steelwork smaller than the turned bolt diameter and must ream them together with supporting structural steel either during assembly or at erection, after the parts are correctly assembled and aligned. Provide positive type locking. Double heavy hex nuts are preferred. Where not using double heavy hex nuts (*ASTM A563/A563M, Grade DH*), use heavy hex and jam nuts (*ASTM A563/A563M, Grade DH*). Install turned bolts with a hardened flat circular plain washer meeting *ASTM F436/F436M-1* at the head and nut ends.

D. Patterns for Castings. Patterns for castings, specifically cast for this project, must be constructed and finished to give a neat appearance to the castings. Unfinished edges and inside corners must have rounded edges and fillets. Draft in patterns must assure an average thickness equal to that shown on the plans. Ensure ample thickness of material is provided so that, after finishing the castings, the thickness of metal at every point is not less than shown on the plans, except as required for draft. Ensure the allowance for draft is as small as is practicable. Each pattern must have a distinctive mark that shows on the castings. Ensure these marks on the track castings are located on the west end of the west castings and the east end of the east castings and are within 2 inches of the top surface. Marking must ensure traceability to heat number and test report data.

E. Quality of Castings/Forgings. Notify the Engineer at least 2 weeks prior to casting/forging, so the Engineer may observe the casting/forging process.

Remove all fins or other irregularities from castings so they have clean, smooth surfaces suitable for this class of work. Castings/forgings that are to be attached to structural steel or other castings must have their contact surfaces finished. Ensure unfinished edges of bases, ribs, and similar parts are neatly cast/forged with rounded corners. Inside corners must have a radius of 1 inch minimum unless noted otherwise on the plans. Finish bosses to correct plane.

Conduct the physical tests after the castings/forgings have been heat treated. Send test reports to the Engineer within 10 days after the tests are completed. No final machining is to be performed until the Engineer has reviewed and accepted the test results.

Where castings/forgings are finished, ensure the thickness of the metal remaining after finishing is not less than the thickness shown on the plans.

Cracks, pitting, lamination, underruns, or warping may be cause for rejection at the discretion of the Engineer. Ensure any casting/forging that is rejected is recast/reforged. Any casting/forging may be rejected either before or after finishing. Limited welding repairs may be permitted with prior approval by the Engineer.

Ultrasonically test the segmental treads and tracks. Ensure the tread surfaces, lug surfaces, and pocket surfaces are rough machined and, if necessary, rough profiled prior to ultrasonic testing. Perform ultrasonic testing in accordance with *ASTM A609/A609M, Method A, meeting Quality Level 1*. Segmental treads and tracks that do not pass this test may be rejected. Submit test results, whether positive or negative, to the Engineer. Test records meeting Quality Level 2 may be considered for weld repair, provided the manufacturer submits a procedure to the Engineer for review and approval.

F. Fabrication of Castings/Forgings. Plane each segmental tread and track true to the dimensions shown on the plans. No surface must deviate from theoretical by more than 0.005 inch per foot, nor more than 0.030 inch between extremes. Scribe a centerline on the mating surfaces of each segmental tread and track. Place a center-punch mark at the first and last positions of roll and scribe a line at right angles to the centerline completely across the width of the face and for 1 inch on the vertical side faces as an aid in accurate erection of the bascule girders and track in the field. The depth of these scribe lines must not exceed 0.020 inch.

Segmental treads and tracks are to be match-marked after initial shop alignment. An alternate method of track layout may be proposed and submitted to the Engineer for review and approval.

Locate identifying marks and match marks in such a manner as to be clearly visible after construction is complete, e.g. they must not be encased in concrete.

**g. Shop Inspection, Assembly, and Testing.** Perform all shop testing and shop alignment verification in the presence of MDOT officials or their representative(s). Give the Engineer at least 2 weeks notification prior to all testing.

Do not ship equipment to the field without being successfully tested and calibrated.

The shop may fabricate a single solid full bearing shim to precise dimensions for any machinery assembled in the shop. Ensure such shims are uniquely identified and detailed on the shop drawings.

1. Track and Tread Shop Testing. Test track and tread segments in the shop prior to delivery. Mount the track and tread plates onto mockup supports to allow the assembled curved tread to be rolled on the flat track. The alignment of the assembled parts must meet the field installation tolerances. Measure the radial runout of the assembled tread segments and demonstrate that the runout does not exceed 0.010 inches total indicator reading. Roll the assembled tread on the flat track through at least 3 cycles (rolling from seated to raised, and back to seated is considered one cycle) to verify smooth rolling. Measure the clearance between the pintles and pockets in two locations on each side of the segment to verify adequate clearance is present. Coat the rolling surface of the track or tread with a thin layer of gear bluing and observe contact after rolling. Ensure contact across the splits is smooth and consistent. Sharp sounds of sudden movements that indicate steps or changes in contact will deem the alignment or fabrication of the components unacceptable.

**h. Construction.**

1. Delivery, Storage and Handling. Deliver all components and materials to the site in accordance with the approved schedule of work. Provide any special provisions used for material handling. Do not ship any equipment to the field without successfully testing and calibrating.

Clean all machinery of dirt, chips, grit, and all other injurious material prior to shipping.

Prior to shipment from the manufacturer’s and/or fabricator’s plant or plants, prepare the various elements for shipment. Securely mount all large, bulky and/or heavy items on skids or pallets of ample size and strength to facilitate loading and unloading. Securely attach a packing list enclosed in a moisture proof envelope and indicating the contents of each such box to the outside of the container. Ensure all packaging is suitable and components are mounted to the skid/pallet in a manner which will prevent damage to the equipment during loading, shipment, unloading, storage and any associated and/or subsequent handling. Provide weatherproof covers during shipment to protect items shipped in open railway cars, trucks, or barges. Furnish any eyebolts, special slings, strongbacks, skidding attachments or other devices used in loading the equipment at the manufacturer’s and/or fabricator’s plant or plants for unloading and handling at the destination.

Coat finished and unpainted metal surfaces that would be damaged by corrosion with a 0.030 inch minimum film thickness, as soon as practicable after finishing, of No-Ox-Id A-Special, Cosmoline Rust-Veto 342, or approved equal. Remove this coating from all surfaces prior to lubrication for operation and from all surfaces prior to painting after erection. If the anti-rust coating on any part becomes compromised prior to part installation, restore the coating immediately.

Take every precaution to ensure that the bearing surfaces are not damaged and that all parts arrive at their destination in satisfactory condition.

Ensure all shipping units have lifting eye bolts or lifting holes properly sized for safe working loads. Locate lifting eye bolts or lifting holes to provide a balanced lift.

Material storage on site must afford easy access for inspection and identification, protection from the ground and prevent distortion, condensation, or damage.

Ensure all removed materials are disposed of in accordance with all pertinent existing legal and environmental requirements and guidelines for material disposal in effect at the time of letting. MDOT will specifically identify which items are to be retained. Deliver and store retained items as directed by MDOT, and all others become the property of the Contractor and properly discarded as required.

2. Erection. Do not commence erection work until the required items have been completed and approved for installation, and until preparations have been satisfactorily completed, where required.

Provide personnel and supervising engineers familiar and experienced in the installation of movable bridge machinery, especially for bascule bridges. Provide all the precision equipment that may be required for the proper and accurate installation of the machinery.

Prior to erection, remove the coating from all finished surfaces, coated with a rust-inhibiting coating, with an approved solvent. Prevent soil and waterway contamination by appropriate containment. Collect and dispose of waste solvents, coating, and expendables in accordance with section 107 of the Standard Specifications for Construction. Cover machinery parts with a sound tarpaulin or other durable waterproof covering during erection and work interruptions. Avoid potential for condensation to accumulate on finished surfaces and inspect/recoat as necessary to prevent corrosion.

Mechanics and millwrights, skilled in the type of work involved, must erect and adjust the machinery. Ensure representatives of the machinery manufacturers are present during final assembly. Provide them with all necessary precision measuring and leveling instruments as may be required. Erect the machinery with exactness and truly align it in its proper position, so that when entirely assembled, it will operate without binding or undue looseness of the components. Ensure all parts requiring alignment are precisely adjusted and aligned to provide acceptable installation tolerances as specified in the contract.

Erect all parts of the machinery in accordance with erection marks and match-marks. When the final position of the machinery will change upon application of the full dead load, make the final adjustments after the dead load is fully applied. Before final drilling or reaming, adjust all parts to exact alignment by means of shims furnished for each part. After final alignment and bolting, all components must operate without binding or undue looseness of the components.

Drill bolt holes in structural steel for connecting machinery after final alignment of the machinery. The Contractor may use erection holes, sub-drilled 1/4 of an inch undersize for temporary bolts, for erection and alignment of the machinery. After aligning the machinery in its final position, sub-drill and ream full-size holes for the permanent turned bolts; install full-size bolts; and remove the temporary bolts.

Tighten the turned bolts following the *Research Council on Structural Connection* *2020 Specification for Structural Joints Using High-Strength Bolts* using the calibrated wrench installation method in its entirety except the minimum bolt pretension for pre-installation verification must be equivalent to 70 percent of the proof load value for the turned bolt’s thread size published in *ASTM F3125/F3125M, Grade A325*. The Engineer may consider alternate installation methods. Submit detailed pre-installation verification and installation procedures to the Engineer for approval at least 7 calendar days prior to starting the work. Do not begin tightening bolts until the Engineer has approved the procedure. Use thread lubricant with an established friction coefficient during installation of turned bolts. Include friction coefficient data for thread lubricant with installation procedures to confirm torque magnitudes. For standard high strength fasteners in standard size holes, tighten in accordance with the turn of the nut method as specified in subsection 707.03.E.6 of the Standard Specifications for Construction.

Throughout the installation, adjust or tighten bolts and nuts only with wrenches that fit; do not tighten with chisels and hammers.

Assemble, erect, align, and adjust the machinery and all machine-like elements or parts at the bridge site under the direct and continuous supervision of the Engineer, to whom the Contractor must afford every opportunity and facility for access to inspect and view the work.

A. Erection of Track and Tread Segments. Install the track and tread segments in accordance with the procedure shown on the plans. Adjust new segment alignment with shims and segment positioning to achieve the alignment requirements shown on the plans.

With all track and tread segments installed in a quadrant, perform roll tests to observe contact. Clean the contact surfaces of lubrication and debris and apply a thin layer of gear bluing. Roll the bascule leaf through one cycle and observe contact on the rolling surfaces and pintles. Ensure contact on the rolling surfaces is 70 percent of contact surface width. Correct hard contact on one edge or the pintles that indicates misalignment by shimming or adjusting the track/tread segment positioning. Once final alignment is accepted, install turned bolts in track and tread segments to retain alignment.

B. Center Lock and Live Load Bearing Adjustments. After the new track and tread installation is complete and alignment is finalized, adjust the live load bearings and center locks using new shims as detailed on the plans. Coordinate the live load bearing adjustments with the center lock adjustments. Adjustments are considered complete when the center locks have the required clearance between the tongue and jaw, the roadway alignment is acceptable, and all four live load bearings have firm contact with the leaves in the seated position.

Adjust the center lock jaw plates as shown on the plans. Reuse the existing plates. Provide new shims, as shown on the plans, to adjust the clearance. Provide new fasteners. Match holes for fasteners in the new components with holes in the existing steel.

Reuse existing live load bearing plates. Provide new shims, matching the dimensions of the existing live load plates, to adjust the clearance. Provide new fasteners. Match holes for fasteners in the new components with holes in the existing plates.

3. Painting. Cleaning and painting of new machinery metalwork surfaces must conform to the requirements for cleaning and painting as required by section 715 of the Standard Specifications for Construction and as modified herein. Indicate cleaning and painting of machinery metalwork surfaces on the shop drawings. Use products from the MDOT qualified products list (915) and submit the paint system to the Engineer for approval.

Ensure the top surfaces of the segmental treads, which mate with the bascule girder flanges, and the bottom surfaces of the tracks, which mate with the track girders, are blast cleaned and prime painted with a 1 mil coat of zinc rich primer after machining. Warning: Do not exceed 1.2 mil.

Ensure the tread surface and other contact surfaces of the segmental treads and tracks are painted with a clear lacquer after finishing.

Cover or protect all items not to be painted from cleaning and painting work and keep clean of overspray. Submit the coverage and protection measures to the Engineer for approval.

All metalwork to be painted must receive the three-coat specified paint system except for the finished, bearing, and lubricated surfaces.

For shop painted components blast clean all metalwork to be painted in accordance with section 715.03.C of the Standard Specifications for Construction for near-white blast. Do not blast clean on-site.

Before application of paint in the shop, clean surfaces which require painting of all chips, burrs, dirt, rust, mill scale, sand, grease, and other extraneous materials by employing methods such as chipping, grinding, wire brushing, solvents, followed by the required abrasive blast cleaning and residual dust removal by compressed air. Mask or shield finished machined surfaces not to be painted from abrasive blasting operations. After cleaning, paint surfaces requiring paint with the three-coat paint system. Coat bearing or sliding surfaces that are not to be painted with temporary protective materials as approved by the Engineer.

Apply paint systems by conventional air spray, airless spray equipment or brush in accordance with this special provision.

Ensure the painted surfaces are free from dry spray, overspray, runs, sags, drips, excessive paint build-up, ridges, waves, laps, streaks, brush marks and variations in color, texture and finish (glossy or dull). Ensure the coverage is complete and each coat produces an even film of uniform thickness, completely coating corners and crevices, and bonds to the underlying surface. When spot repairs are necessary, feather the edges of the surrounding coating, leaving surfaces prior to painting, tapered and free of loose or damaged coating. Exercise care to avoid over-spraying or spattering paint on surfaces not to be coated. Repair overspray and damage to surfaces not to be coated at the Contractor's expense.

After installing the machinery items in final position on the bridge, clean all surfaces which require paint, including bolts, of grease, oil, and loose materials by the use of solvents and compressed air, and repair all unprimed or damaged shop-coated surfaces with the touch-up primer followed by a full intermediate coat. Take special care to avoid painting of machinery bearing and sliding surfaces and mask and protect from paint these surfaces and all nameplates, legend plates, and escutcheons mounted on machinery.

After completion of the operating tests and acceptance of the machinery, clean all oil, grease, dirt, and other foreign matter from the exposed machinery surfaces which require the third coat of paint, including bolts, and those shop painted surfaces that were damaged and repaired with field-applied primer and intermediate coat. Then give the exposed surfaces a third field coat, the topcoat, which will match the structure color as shown on the shop drawings.

4. Field Inspection and Testing. Perform all field testing and alignment verification in the presence of the Engineer. Provide the Engineer at least 2 weeks notification prior to all testing. Provide electrical and mechanical technicians as well as all the tools and labor necessary to make necessary adjustments.

5. Contractor Bascule Span Operation. This work consists of temporary operation of the bridge during construction activities. Assume responsibility for operating the bridge from the time that the normal operating procedure is affected by construction activities until the rehabilitations are complete and the bridge is fully operable in its final form and as approved by the Engineer. Provide the Engineer with proposed dates for commencement and conclusion of temporary Contractor operation of the bridge.

Factors that are considered as affecting the normal operating procedure include: work on the bridge machinery, work on the bridge electrical control system, work on the operator’s house, work that affects the barrier gates, any work that affects span balance, Contractor staff, materials and/or equipment on the bascule spans or interfering with the bridge operator’s view of roadway or waterway traffic.

Maintain and provide any required adjustments and/or corrections to the mechanical and electrical equipment of the bridge during construction and through the period of temporary Contractor operation.

Provide a minimum of two persons to supervise the operation of the bridge for a period of 7 calendar days (24 hours a day) after the bridge is fully operational on the new mechanical components; and for an additional 7-day period (24 hours a day), provide one person. Ensure these people can operate the bridge, supervise its operation, and make any adjustments or corrections required in the mechanical equipment of the bridge. They must instruct and qualify the MDOT employees in the operation of the bridge. Any adjustments or corrections required during the two 7-day periods must be at no additional cost to the contract.

**i. Measurement and Payment.** The completed work, as described, will be measured as a lump sum and paid for at the contract price using the following pay items:

**Pay Item Pay Unit**

Segmental Treads and Tracks, Furn and Fab (B01 of 15012) Lump Sum

Segmental Tread and Tracks, Erect (B01 of 15012) Lump Sum

Center Lock and Live Load Bearing Adjustments (B01 of 15012) Lump Sum

1. **Segmental Treads and Tracks, Furn and Fab (B01 of 15012)** includes furnishing and fabricating the segmental treads and the tracks, as shown on the plans.

2. **Segmental Treads and Tracks, Erect (B01 of 15012)** includes assembling the bascule girders the segmental treads, and erecting the tracks on the track girders, as shown on the plans. This includes field machining of the existing bascule girder webs and track girders.

3. **Center Lock and Live Load Bearing Adjustments (B01 of 15012)** includes replacing the center lock jaw plates, installing and adjusting shims at the center locks, and installing and adjusting shims at the live load bearings, as shown on the plans.

Do not measure non-metallic materials for payment but include the cost in the prices stipulated for the machinery.

Payment includes furnishing or payment for temporary power or for opening or closing the span, and other incidentals necessary for the complete installation and testing are included in the price bid for the work.