MICHIGAN

DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION

FOR

**BASCULE SPAN STRUCTURAL STEEL**

BRG:JST 1 of 14 APPR:MJF:CAI:10-19-23

**a. Description.** The work consists of all permanent and temporary work necessary for furnishing, fabricating, transporting, erecting, surface preparation, and coating of all new structural steel that is on or attached to the movable span leaves or is integral to the operation of the bascule span as shown on the plans. Rack frames are included in this special provision. Perform all work in accordance with section 707 of the Standard Specifications for Construction and “20SP-707A - Structural Steel and Aluminum Construction”, except as noted herein.

This work includes all shop and field fasteners for connection of other items to the bascule span structural steel, except for the items furnished as a part of work described in the special provisions for: “Bridge Machinery-General”, “Operating Machinery”, “Tail Lock Machinery”, “Segmental Treads and Tracks”, and “Bridge Electrical Work” and their associated pay items, unless otherwise shown or noted on the plans or in the special provisions.

The work includes shop assembly, match-marking, disassembly and field erection of all elements of the bascule span, including the structural steel included herein as well as the segmental treads and tracks.

The work includes all survey, bracing, shoring, jacking, and temporary construction supports required to construct the bascule span of the new bridge, and all work associated with placing the movable leaves of the bascule span in proper operating condition.

Coordinate with the General Contractor and all other subcontractors whose work interfaces with the work described herein. This coordination must be completed to ensure that the finished work performs as designed.

**b. Materials.** Conform to the requirements of sections 707, 906, and 1005 of the Standard Specifications for Construction, unless noted otherwise on the plans or herein. Conform to section 716 for coating of structural steel.

1. Furnish steel conforming to *AASHTO M270M/M270,* *Grade 50* unless otherwise noted on the plans.

2. Order all plate from the mill that is to be bent during fabrication such that the bend line will be oriented perpendicular to the direction of rolling. See subsection 707.03.D.1 of the Standard Specifications for Construction for additional direction of rolling requirements.

3. Fracture Control Plan. See subsection 707.03.C of the Standard Specifications for Construction for fracture critical member requirements, except as modified herein.

Ensure all fracture critical members (FCM) noted on the plans are fabricated in accordance with the requirements of the fracture control plan.

Ensure Charpy V-Notch (CVN) test requirements are in accordance with *AASHTO M270M/M270* for temperature zone 2.

4. Bolts and Anchors. Furnish high strength bolts that meet subsection 906.07 of the Standard Specifications for Construction, unless another type of bolt is specifically called for.

5. Sidewalk Panels. Furnish steel plate of the size, shape, and thickness shown on the plans and in accordance with *ASTM A709/A709M* *Grades 50* or *50W* for the sidewalk on the bascule span. Do not provide additional joints or splices not shown on the plans without prior written approval of the Engineer. See the Special Provision for Methyl Methacrylate Polymer Concrete Overlay for sidewalk panel slip resistant surface requirements.

6. Submittals. Prepare and submit complete steel shop detail drawings and steel erection drawings per subsection 104.02 of the Standard Specifications for Construction.

Prepare and submit span balancing calculations along with counterweight shop drawings. See Special Provision for Counterweights and Balance for the balancing calculation format and associated requirements. Prepare span balance calculations based on actual weights of all proposed elements to be furnished for the construction of the movable bascule leaves.

7. Bolts and Nuts. Furnish bolts and nuts in accordance with subsection 906.07 of the Standard Specifications for Construction.

Assemble and ship from a single manufacturer all bolts and nuts. The manufacturer is responsible for all mill tests and other reports and must perform the rotational tests and certification.

Perform rotational capacity tests in accordance with FHWA requirements.

**c. Construction.**

1. Manufacturer’s Data. Submit producer or manufacturer's test reports and certifications in accordance with the standard specifications.

2. Shop Drawings. Submit shop drawings in accordance with subsection 707.03.A of the Standard Specifications for Construction and the *National Steel Bridge Alliance Shop Detail Drawing Presentation Guidelines G1.3-2002*.

Shop drawings must include complete details for fabrication, camber, erection, and shop assembly of members. Shop drawings must also include details, schedules, procedures, special erection equipment, net weights, centers of gravity, and diagrams showing sequence of erection.

Coordinate structural steel shop drawings with architectural, mechanical, and electrical shop drawings.

3. Shop Fabrication. Ensure plant certification requirements are in accordance with subsection 707.01.B. of the Standard Specifications for Construction.

A. General. Fabricate each built-up member full length without splices of any kind, except as noted on the plans.

Coordinate steel that is supporting or adjacent to machinery and electrical components with the machinery and electrical components for proper fits, clearances, tolerances, and sequences of erection. Ensure connections of machinery to structural steel are made in accordance with the requirements of the special provisions for: “Bridge Machinery – General”, “Operating Machinery”, and “Tail Lock Machinery”.

Meet subsection 707.03.D.1 of the Standard Specifications for Construction for direction of rolling, unless noted otherwise on the plans. For plates that are bent, position the bend line perpendicular to the direction of rolling.

For plates or members that are to be machined or milled, the thicknesses shown on the plans are for after milling. Allow for sufficient material to be machined when ordering stock. The pay weight will be based on the thickness shown on the plans.

For member connections and splices, whether at joints or between joints, the clearance between the in-to-in dimension of gusset or splice and the out-to-out dimension of the members must not exceed 1/16 inch. Furnish fills for members not meeting the maximum 1/16 inch clearance for fit and contact prior to bolting connection.

Abutting joints of compression members which have been faced for bearing must have a minimum of 75 percent of the main material in bearing when assembled. The maximum gap for portions not in contact is 0.010 inch.

Ensure that member fabrication tolerance conform to *AWS D1.5/D1.5M* except as noted in Table1:

**Table 1: Member Fabrication Tolerances**

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| --- |
| Deviation from Detailed Length: |
| Milled Ends and End Connection Angles Faced | ±1/32 inch |
| Bascule Girders, Floorbeams, Stringers | ±1/16 inch |
| All Other Members | ±1/8 inch |
| Deviation from Detailed Straightness, Sweep, or Camber: |
| All Members | ±1/16 inch |
| Deviation from Parallelism Between Corresponding Elements of the Same Part at Different Cross Sections Along the Length of the Member, or Twist: |
| All “I” sections | ±1/8 inch |

Provide camber for all members as shown on the plans.

Determine probable joint warpage due to welding of plates and incorporate such likely deviation in the theoretical joint alignments of the weld detail. This is critical for the bascule girders, rack supports, and machinery supports. The shop drawings must indicate incorporation of shrinkage adjustments.

Lay out and detail any temporary diaphragms or other devices used to maintain the straightness requirements, to keep plate warpage to a minimum, and to keep flange plates true to the web.

(1) Shims. Furnish shim packs wherever shims are called for on the plans, furnish material such that the total shim pack thickness can be adjusted in increments of 1/64 inch for machinery parts, 1/32 inch for machinery bases and structural parts that have machined surfaces, or 1/16 inch for structural steel connections for parts not having machined surfaces. If more stringent tolerances are shown on the plans, they supersede what is contained herein. Typically, the nominal shim pack thickness shown on the plans is equal to the theoretical gap between the mating surfaces. Furnish each shim pack with a total thickness equal to twice the nominal thickness. Individual shims for each shim pack must, as far as practical, have the following thicknesses: t, t/2, t/4, t/8, t/16, where “t” is the nominal thickness of the shim pack. Use the fewest possible shims in any joint. Blast clean and prime coat both surfaces of each shim piece for a Class B slip coefficient; this does not apply to 1/64 inch thick shims.

(2) Finishing. Finish any welded assembly that is to be finished after all welding is complete. Ensure anywhere the symbol (√) appears on the plans, machine finish the surface and faying surface. Hand grinding is not permitted.

B. Bascule Girders. The bascule girder assembly includes the web, the bottom flange, the top flange, all stiffeners, and incidental connection material.

The bascule girder web includes multiple plates of thicknesses, sizes, and shapes as shown on the plans. Prepare the plates and welded together in a controlled manner to preclude as much distortion as possible. Ensure all portions of the web are in a single plane to within a tolerance of ±3/16 inch. If the web weldment is not within this tolerance, it must be straightened before further fabrication.

Ensure the curved bottom flange plate, which supports the segmental treads, is rolled to the radius shown on the plans. When plates are ordered from the mill, order widths and lengths of plates such that the bending is performed perpendicular to the direction that the plate was rolled. Prior to bending, heat the area of the plate that is to be bent to no less than 1,100 °F and no more than 1,200 °F. Furnish the Engineer with 7 calendar day notification prior to bending plates so they have the opportunity to be present.

Weld all flange and stiffener plates to the web before the bottom flange is machined. Ensure the bottom flange is so accurately welded to the web plates that not less than the designated thickness of metal remains after finishing. Flange plates are to be square with the web. Order the bottom flange plates with extra thickness to allow for finishing and tolerances. The pay weight is to be based on the full thickness shown on the plans.

Weld the stiffener plates to the web and flange plates before the flange plates are machine finished. Finish the flange plates to provide true and uniform bearing for the segmental treads.

Fabricate as a minimum, the heel portion of the bascule girder into a subassembly prior to boring the hole in the girder web for the pinion shaft bearing, prior to machining the curved surface of the bottom flange of the bascule girder to which the tread attaches, and prior to machining the curved rolling surface of the tread. Include in the heel subassembly the web plate, the curved bottom flange plate and all radial stiffeners attached to the web.

Ensure the cylindrical surface of the bascule girder flange is absolutely concentric with the center of the hole in the web that supports the main pinion bearing, designated Point 0 on the plans. Formulate a procedure to achieve this and submit it to the Engineer for review. After all welding of this subassembly is complete, precisely locate the center of roll and bore the hole for the bearing. Locate Point 0 accurately and precisely on the web as shown on the plans and then marked with a center punch. This center punch mark must serve as the center of radius for machining of the segmental flange plate and segmental treads and boring the pinion shaft hole. Shop assemble the segmental treads to the heel subassembly as described herein before finishing the tread surfaces. Machine the curved rolling surface of the treads after permanently attaching to the bascule girder bottom flange.

C. Installation of Segmental Treads. Install segmental treads to within ±0.015 inch radially along the entire curve, as measured from the main pinion bearing bore. Develop and submit a procedure for approval outlining the methods and tolerances for measuring to this accurately over the full circumference.

The segmental treads must bear fully over the entire mating surface of the bascule girder flange.

Prepare a detailed written procedure for accurately aligning and bolting the segmental treads to the bascule girders and submit to the Engineer for review and approval.

After final machining of the portion of bottom flanges of the bascule girders to which treads are attached, blast clean the faying surface of the girder flanges and treads. Perform blast cleaning of this surface in accordance with *SSPC-SP10/NACE No. 2*, *Near White Blast Cleaning*.

Provide a minimum blast profile to this surface of 3.0 mils. Employ blasting equipment and necessary blasting materials that will ensure achieving this minimum blast profile. In the presence of a representative of the Engineer or a designated representative, measure and document this surface profile in accordance with *NACE standard RPO287 “Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape”* and provide documentation thereof. Furnish the Engineer a minimum of 7 days written notice prior to measuring the blasted surface profile.

Immediately after completion of surface preparations and verification of achieving the 3.0 mil roughness attach treads to bascule girder flanges. Take all precautions necessary to assure that no corrosion develops on final blast cleaned faying surfaces before mounting and final bolting of treads to girder flanges.

Install and fully tension the turned bolts. See plan notes regarding specific requirements for installation and final tensioning of bolts between treads and bottom flanges of bascule girders.

Perform final finishing of the outside radius of the treads after they are final bolted to the bascule girders. Final finishing must bring the tread surfaces to the radius, and within the tolerance, shown on the plans and specified herein.

The circumferential surface must not deviate from theoretical by more than ±1/32 inch at any point along its surface. Confirm this by accurately measuring the radius at the fully open and fully closed points and at each midpoint between adjacent lugs along both sides of the treads. Record these measurements and submit to the Engineer for review. Use a straightedge to check for cross-width flatness. A 0.020 inch feeler gage must not pass between the straightedge and the tread at any point.

Machine a longitudinal centerline groove along the full circumference of the treads and along the full length of the tracks. Machine transverse grooves, 90 degrees to the longitudinal grooves, at the fully closed and fully open positions on both the treads and tracks. Ensure these grooves are V-shape and between 1/16 and 3/32 inch deep. The included angle of the V must be 60 degrees. Machine additional grooves into the vertical faces of the treads and tracks at the ends of all grooves described above. Ensure the vertical-face grooves are approximately 3 inches long.

Align and test the proper mating of the segmental treads and tracks using the “Numerical Roll Through Procedure” described in subsection c.7.C of this special provision.

D. Rack Girders. After the rack girders are completely welded, ensure the bottom flanges of the girders supporting the racks are machined throughout the length shown on the plans to provide a true plane for attaching the racks. Straighten the girders, if necessary, so that planing of the bottom flange does not exceed 1/8 inch.

E. Machinery Supports. Furnish supports for the machinery components and install as shown on the plans and as described herein. Make scribe lines on the supports in the shop to assure accurate location in the field. The cost of making modifications to the supports to make them compatible with the machinery selected by the Contractor is to be included in this work. To facilitate the proper erection and alignment of the operating machinery, ensure the bearing surfaces of the machinery supports are square and true. Finish the bearing surfaces after all welding is completed. Take precautions to ensure that the bearing surfaces are square and true after finishing. The Contractor may elect to stress relieve the weldments prior to finishing. If the Contractor elects to stress relieve the weldments, no additional payments are to be made.

4. Galvanizing.

A. General. Hot-dip galvanize the following items, including all appurtenant parts in accordance with *ASTM A123/A123M* and *ASTM* *A153*/A153M for threaded hardware, unless noted otherwise.

• Center break weldments and rear break weldments.

• Fascia sidewalk stringer.

• Complete sidewalk panels including sidewalk plate, supporting angles, stiffener plates, fascia angle, curb plate and connection angles.

• Front sidewalk breaks.

• Rear sidewalk and curb breaks.

• Longitudinal breaks.

• Angles embedded in the roadway slab on the bascule leaf.

• Access ladders and all associated safety related components and attachment hardware.

• All bolts, unless noted otherwise on the plans.

• All anchor bolts, from the exposed end to a point 3 inches below the surface of the concrete, unless noted otherwise on the plans.

• Steel stairways located in bascule piers.

• Machinery supports where noted on the plans.

• Any other items designated on the plans to be galvanized.

B. Repair of Damaged Galvanized Coating. Repair any galvanized areas that are damaged by abrasion and other causes in accordance with section 716 of the Standard Specifications for Construction.

5. Painting. Clean and paint all structural steel per project plans and in accordance with section 716 of the Standard Specifications for Construction, unless otherwise noted.

6. Welding. Perform welding in accordance with subsections 707.03.D.10, 707.03.D.11, and 707.03.D.12 of the Standard Specifications for Construction.

7. Shop Assembly. Assembly is required in accordance with subsection 707.03.D.14.d. of the Standard Specifications for Construction.

A. Bascule Leaf. Completely assemble each bascule leaf in the shop. Shop assembly includes all structural steel fabricated in accordance with this special provision. After the new bascule span steel has been fabricated, assemble each bascule leaf as follows:

(1) Assemble each bascule leaf, including bascule girders/segmental girders with treads permanently bolted, counterweight framing, machinery room framing, floor beams, stringers, and, bracing. Ensure truss assemblies are complete with all chords, verticals, and diagonals. Maintain a center-to-center distance between the bascule girders of the assembled bascule leaf as measured between longitudinal scribe lines on the attached treads within 1/32 inch of the dimension shown on the plans for all locations along the length of roll. For each bascule girder, assure that the centerline of bore for the pinion shaft bearing is located within 0.010 inch of the theoretical center of roll shown on the plans. Assure that the radius of roll after final machining of the rolling surface of the tread is within 1/16 inch of the theoretical radius shown on the plans. Furnish the Engineer a minimum of 14 days written notice to witness the verification of these dimensions.

(2) During shop assembly, do not final drill holes for lateral bracing between floor beams 5 and 7. For all other locations, locate and drill bolt holes in the stringer flanges, as shown on the plans, for lateral bracing attachment.

(3) Temporarily support the bascule girders to replicate their theoretical position in the field.

(4) Assemble the steel for each leaf after temporary supports are set true, level, and collinear with each other.

(5) Perform the shop assembly such that the result is bascule girders that are straight and parallel to each other; floor beams and are perpendicular to the girders; stringers are parallel to the girders; webs of bascule/segmental girders and floor beams are vertical; and webs of stringers are perpendicular to the deck.

(6) Bolted parts must fit solidly together when assembled and must not be separated by gaskets or other compressible material. Clean joint contact surfaces of primary stress-carrying members. Ensure other joint contact surfaces and the areas adjacent to the bolt holes are free from all scale (except tight mill scale), burrs, dirt, paint, and other foreign material that could prevent solid seating of the parts.

(7) Drill or Ream holes for field connections in the shop with the connecting parts assembled, or else drilled or reamed to a steel template.

(8) Ensure members are free from twists, bends, or other deformations. Take measurements while the pieces are in assembly and before any reaming or drilling is performed to ensure that the assembly conforms to the dimensions shown on the approved shop drawings, within the dimensional tolerances.

(9) Ensure pieces to be connected by bolts are not subject to any welding, unless such welding is shown on the plans or approved by the Engineer.

(10) Completely shop survey each fully assembled bascule leaf. Submit survey to the Engineer. Provide a datum with the survey. Ensure all floor beams are parallel and the proper distance apart. Ensure the bascule girders are in-line and parallel. Measure the diagonal leaf dimensions to verify squareness. Final erection tolerances are shown under “Field Assembly,” in subsection c.8 of this special provision.

(11) Match mark all steel for reassembly in the field.

B. Rack Frames. Shop assemble each rack frame, including the rack girder, columns, diagonal, and bottom strut.

Sub-drill and ream all holes for field bolts in the rack frame to the sizes shown on the plans. Prior to reaming, ensure undersized bolts are used to hold the assembled pieces in their exact positions. It is imperative that the accuracy of these assemblies is exact to ensure proper alignment in the field. Maintain all work points and work lines to within 1/32 inch of their theoretical locations during this assembly.

Scribe the centerlines of the rack support columns, both directions, on the top and sides of the rack girder support plates. Scribe matching lines on the bottom flanges of the girders.

Ensure all shop assembly methods are compatible with the erection methods, unless otherwise permitted in writing by the Engineer.

C. Numerical Roll Through Procedure. Perform a numerical roll through test for each of the fully assembled heel portions of the bascule girders with treads permanently attached to assure acceptable mating of tracks with corresponding treads. Perform the procedure only in the presence of the Engineer or designated representative. Furnish the Engineer a minimum of 14 days advanced notice of when this procedure will be performed for each of the four bascule girders to enable him to witness it.

Perform the roll-through procedure as follows:

(1) The longitudinal centerlines scribed on the final-machined treads when attached to the bascule girders must precisely correspond to the longitudinal centerlines scribed on the final-machined tracks when permanently erected in the field.

(2) The transverse lines at the first and last positions of roll scribed on the final-machined treads when attached to the bascule girders must precisely correspond to the transverse line scribed on the final-machined tracks when permanently set in the field.

(3) All track pockets must precisely mate with corresponding tread lugs without interference and without the space between any lugs and mating receiving pockets exceeding the maximum shown on the plans.

Prepare and submit complete details of the proposed numerical roll-through procedure for review and approval by the Engineer. Following is an outline of a recommended form for the procedure:

Step 1. After final machining of the tread when permanently attached to the bascule girder, place a permanent longitudinal scribe line on the tread. Assure this scribe line corresponds to the precise centerline of the bascule girder web. Furnish details on how this will be achieved.

Step 2. For the first position of roll, project the center of bore in the bascule girder web for the pinion shaft bearing down to the attached tread. Place a permanent transverse scribe line for this position onto the rolling face of the tread. Extend this line onto the vertical surfaces of the edge of the plate for future use during field erection.

Step 3. For each machined lug of the treads, precisely measure and record the distance from the inside edge of the lug to the scribed longitudinal centerline. Precisely measure and record the distance from the transversely scribed line for the first position to the front and back edges of each lug.

Step 4. For the mating tracks, make a temporary transverse reference line near the first position of roll. Also make a temporary longitudinal reference line near the centerline of the plate.

Step 5. For each pocket of the track, precisely measure and record the distance from the inside edge of the pocket to the temporary longitudinal reference line. Similarly, precisely measure and record the distance from the front and back edges of each pocket to the temporary transverse reference line at the rolling surface.

Step 6. Correlate the measurements from Step 3 for the inside edges of each tread lug with the measurements from Step 5 for the inside edge of each track pocket to determine the optimum location to place a permanent longitudinal scribe line for the track. The optimum location will minimize the potential for interference between the inside edges of tread lugs and the inside edge of track pockets. Perform any supplemental machining of inside faces of track pockets required to assure minimum clearance shown on the plans is provided between inside edges of all tread lugs and inside edges of corresponding track pockets. Place permanent longitudinal scribe line on track. Extend scribe line onto vertical faces at front and back of tread.

Step 7. Correlate the measurements from Step 3 for the front and back edges of each tread lug with the measurements from Step 5 for the front and back edges of each track pocket to determine the optimum location to place a permanent transverse scribe line representing the first position of roll for the track. The optimum location will minimize the potential for interference between the front and back edges of the tread lugs and the front and back edges of track pockets. Provide any supplemental machining of front and back faces of track pockets required to assure minimum clearance shown on the plans is provided between front and back edges of all tread lugs with front and back edges of all track pockets. Place permanent transverse scribe lines for first and last position of roll on track. Extend scribe line onto vertical edge of tread.

8. Field Assembly.

A. General. Perform field assembly of steel in accordance with the standard specifications, unless noted otherwise on the plans.

No field welding is permitted, unless it is shown on the plans.

Erect portions of bascule leaves that interfere with navigation with the span in the open position. When necessary, lower the leaves for adjustment of the lateral and vertical alignment of the bascule girders, the lateral and vertical alignment of the breaks in the floor and the placing of concrete in the roadway deck.

During periods when a bascule leaf is unbalanced, provide positive, sturdy supports, shoring, and/or falsework to support the unbalanced loads in accordance with “20SP-707D Complex Steel Erection, Shoring and Falsework”, except as noted herein.

Submit proposed construction methods and sequences required to move leaf while in an unbalanced condition for approval of the Engineer. Submit full procedures that will be used to assure full control of the leaf is maintained.

The design of the structure assumes that the structural steel is completely erected before it is allowed to deflect under its dead load. Deflections incurred during various stages of erection are not considered. Therefore, the actual erection methods and sequence employed by the Contractor may have a substantial effect on the final steel profile. Take all necessary compensatory action to ensure that the final alignment and profile of the erected steel, including the grid deck, conforms to the plans. Ensure any corrective work necessary to reposition previously erected steel to achieve acceptable alignment and profile is approved by the Engineer and is performed at no additional cost to the contract.

Submit in detail the proposed procedure and sequence for the installation/final alignment of the jaw wear plates, center brake, rear brakes, longitudinal brakes, live load bearings, and span locks to the Engineer prior to the start of work.

The first time a bascule leaf is slowly moved, make a check of all points of minimal clearance or possible interference between the fixed and movable parts of the structure, or as otherwise specified on the plans.

Ensure that the floor beams and stringers on the bascule span are erected the correct distance below the floor lines as shown on the plans, and that the floor grid units, which are supported on them, are at the proper elevation at all points.

At the completion of construction, ensure each rack is parallel to its respective track, and ensure each rack segment is adjusted so that its mating pinion engages it along its full length within the specified tolerances. Place the span in operating condition, to the satisfaction of the Engineer, on its final completion. Operate the span sufficiently for the Engineer to inspect its operation to his satisfaction. Repair or replace faulty and/or defective work at no additional cost to the contract and to the approval of the Engineer.

Employ a land surveyor licensed in the State of Michigan to perform all survey work necessary to erect the bascule span in accordance with the contract.

Submit to the Engineer, in the form of shop drawings, all survey information pertaining to the racks and rack supports prior to the start of span erection.

Upon completion of span erection, survey the leaf to verify squareness. Ensure the bascule girders are in-line and parallel. Take measurements across the channel and back-check them by measuring the diagonal span dimensions. Submit measurements taken to verify squareness to the Engineer.

B. Rack Frames. Set the anchor bolts for the rack frames to the positions shown on the plans so that their tops are within 1/16 inch in any direction of the specified locations. Secure the anchor bolts so they will not move during subsequent placement of concrete. Perform a detailed survey of each anchor bolt, provide documentation of the survey results to the Department for review and acceptance. Place concrete around the anchor bolts only after acceptance of the survey documentation by the Department. Perform a second survey of the anchor bolts after the concrete that encases them is set. Again, provide documentation of the survey to the Department for review and acceptance.

Set each rack column so that its base and its top are within 1/16 inch of their specified locations. Erect the bottom horizontal struts, the diagonal struts, and the rack girders. Ensure that the front column cap plate and the rear column girder seat plate are level and within 1/32 inch of their specified locations. Secure rack frames so that subsequent concrete placement will not move the frames. Prior to placing the encasing concrete, perform a detailed survey to ascertain the exact locations of each column top and each girder seat plate. Furnish documentation of the survey to the Department for review and approval. Place concrete around the rack frames only after approval of the survey documentation by the Department. Perform a second survey of the rack frames after the concrete that encases them is set. Again, furnish documentation of the survey to the Department for review and approval.

After the concrete encasing the rack frames has set, make further adjustments to the rack girders so that the racks are within 1/32 inch of their specified location at both ends of each rack segment.

Do not pour concrete on the tops of the rack girders or uplift brackets until after the main pinions have been installed and final alignment adjustments have been made to the racks.

C. Tracks. Carefully and accurately set the tracks, which support the movable bascule leaves in all positions, using the leveling bolts provided on the grillages. Set the tops of the tracks at the exact elevation called for on the plans and align them so they are perfectly level and all in the same horizontal plane. Centerlines of the track plates must be the exact distance apart and parallel to the longitudinal center line of the bridge.

It is imperative that the tracks are set to nearly perfect alignment prior to further construction; otherwise, the proper operation of the bascule span cannot be assured.

Furnish competent personnel and all survey and other measuring equipment to assure accurate positioning of tracks. Prior to grouting and placing the encasing concrete, perform a detailed survey to ascertain the exact locations of the front and rear of each track. Furnish documentation of the survey to the Department for review and approval. Grout under the tracks and place concrete around the tracks only after approval of the survey documentation by the Department. Perform a second survey of the tracks after the concrete that encases them is set. Again, furnish documentation of the survey to the Department for review and approval.

Refer to the plans for specified tolerances. Furnish all tools, equipment, and means necessary to assure tracks do not shift after being positioned until encasing concrete around the track is poured and cured.

D. Alignment of Bascule Span Steel. The central planes of rotation of the rolling segments must coincide with the vertical planes through the center lines of their respective tracks for all positions of the movable leaf. Take special care to maintain each rolling segment in the same vertical plane during the erection of the bridge and the placing of the counterweight. Perform the following steps in order:

Step 1. For each bascule leaf, the center of curvature (center of roll) of the bascule/segmental girders must be carefully maintained in the same axis and exactly opposite to each other at all times, so there is no warp in the structure when completed or when it is operated.

Step 2. Align the bascule girders laterally at the center of span so that the jaw portions of the centerlocks are precisely centered horizontally with respect to the mating diaphragm portions.

Step 3. Ensure that the longitudinal centerlines of the 2 bascule girders are in the same plane. Do this by measuring from corresponding surfaces at floorbeam line 1 and floorbeam line 7 to a single reference plane. The maximum tolerance for this must be ±1/32 inch at floorbeam line 1 and 1/8 inch at floorbeam line 7.

Step 4. Install all floorbeams, trusses, and stringers.

Step 5. Drill holes for lateral bracing between floor beams 5 and 7. Install bolts and fully tighten.

Step 6. Bolt the steel grid deck in place. Drill holes for grid deck between floor beams 5 and 7.

Step 7. Pour concrete counterweight in a fully shored condition to prevent deflection of the bascule steel.

Step 8. Adjust the shims at the center lock jaw plates such that when lowering the leaves, both diaphragm castings strike their respective jaw plate at precisely the same position of the bascule leaf.

Step 9. Adjust the shims at the uplift supports at the girder tails so that when both leaves are in the fully closed position the strike plates at all four uplift supports make full and firm contract on the uplift bearing plates.

Step 10. Adjust the shims at the rear locks so that when the rear lock is driven, the "clearance" between each rear lock strut and associated bascule girder strike plate is as specified on the plans.

Step 11. After the above adjustments have been made, align the mating sections of roadway center and rear break plates so their teeth align properly.

Step 12. Adjust the longitudinal breaks. Ensure when the bascule leaves are fully closed there are no gaps anywhere along the longitudinal breaks and both sides of the breaks are flush at the deck surface, except that the movable side of a joint may be as much as 1/16 inch lower than the fixed side.

Step 13 - Pour deck concrete only after all the above steps are completed.

E. Final Alignment of Racks. Adjust the positions of the rack girders and/or the rack segments, both vertically and horizontally, so that the engagement of each pinion to its corresponding rack is within the specified tolerances throughout the entire length of the racks. Add or remove rack shims or girder shims as necessary. Field assemble the racks to the rack support girders with turned bolts as match-marked by the fabricator of the racks. Drill the bolt holes in the rack girders from the solid while assembled in the field. When assembled, ensure the pitch lines and centerlines are straight. After final adjustment, ensure all bolts connecting the rack support girders to the columns are fully tightened in accordance with subsection 707.03.E.6 of the Standard Specifications for Construction. Do not pour concrete deck above rack frame until this final adjustment has been performed.

F. Floor Beams on Bascule Span. Assure the floor beams and stringers on the bascule span are fabricated and erected to be at the correct distance below the top of floor as shown on the plans. Assure the positions of these members will enable the roadway steel grid, which will be supported on them, to be at the proper elevation at all points.

G. Center and Rear Brakes in Roadway. Ensure that the center and rear roadway brake plates are adjusted to be parallel and at the same elevation as the surface of the concrete deck. Ensure the mating elements of the finger plate teeth of the roadway center and rear brake are in proper alignment with respect to one another, as shown on the plans.

Do not connect the sections of the roadway floor grid between floor beams 5 and 7 to the stringers until the center break sections have been set to proper alignment and the center locks are precisely aligned both vertically and horizontally.

Do not connect the roadway floor grid sections to the stringers until after the grid sections have been set to their proper alignment.

Coordinate the work at the roadway rear break so that proper alignment, clearance and meshing of teeth are maintained during construction of the adjacent concrete deck.

H. Metal Work Set in Concrete. Place and maintain all metal work to be set or embedded in concrete with care to ensure exact alignment and elevation. Where grout is shown on the plans, adjust and support the metal parts by means of leveling bolts. Furnish an approved self-leveling, high strength non shrink and non-staining grout. The furnishing and placing of grout will be considered incidental to the work of this bid item and others and no separate payment will be made for it.

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

**Pay Item Pay Unit**

Bascule Span Structural Steel, Furn and Fab Pound

Bascule Span Structural Steel, Erect Pound

Misc Structural Steel, Furn and Fab Pound

Misc Structural Steel, Erect Pound

1. **Bascule Span Structural Steel, Furn and Fab** and **Bascule Span Structural Steel, Erect** include all structural steel affixed to the bascule leaves, those portions of the longitudinal breaks and rear breaks that are fixed to the bascule piers, the grillages that support the bascule tracks, the rack frames, and other items clearly designated on the plans.

2. **Misc Structural Steel, Furn and Fab** and **Misc Structural Steel, Erect** include all structural steel for the service platforms and stairways within the bascule piers, steel walkways and stairways providing access to the fender system and dolphins, and other items clearly designated on the plans.

Payment does not include the cost of balancing the bascule span. Span balance will be paid for under a separate item.