TECHNICAL SPECIAL PROVISION

FOR

T465 MOVABLE BRIDGES

FINANCIAL PROJECT ID: 437966-1-52-01

The official record of this Technical Special Provision has been electronically signed and sealed using a Digital Signature as required by Rule 61G 15-23.004, F.A.C.

This item has been digitally signed and sealed by Joshua C. Jackson, P.E. on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

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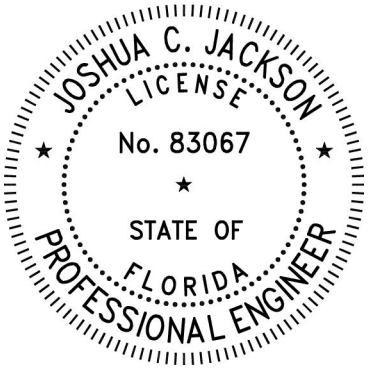

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SECTION T465 - MOVABLE BRIDGES

T465-1. GENERAL

T465-1.1. Description

This Technical Special Provision applies to Bridge Number 170158. Execute movable bridge work in accordance with the Contract Documents.

T465-1.2. Standards

Unless otherwise stated, the referenced standard or specification current as of January 2020, will apply. The following abbreviations will be used throughout the Contract Documents to designate standard specifications for material and workmanship:

American Association of State Highway and Transportation Officials	AASHTO
American Gear Manufacturers Association	AGMA
American Gas Association	AGA
American Institute of Steel Construction	AISC
American National Standards Institute	ANSI
American Refrigeration Institute	ARI
American Society of Mechanical Engineers	ASME
American Society for Testing and Materials	ASTM
American Society of Civil Engineers	ASCE
American Welding Society	AWS
Code of Federal Regulations	CFR
Florida Department of Transportation	FDOT
Institute of Electrical and Electronics Engineers	IEEE
International Organization for Standardization	ISO
National Association of Corrosion Engineers	NACE
Society of Automotive Engineers	SAE
Surface Preparation Standards	SSPC
Underwriters Laboratories	UL

T465-1.3. Supervisory Personnel Qualifications

Meet the requirements of the FDOT Specifications Section 105.

Bridge Operator(s) and Foreman:

A. Provide a qualified bridge operator for operation, testing, and adjusting of the bridge from the first chargeable workday through final acceptance.

B. Provide a foreman, who is qualified to operate the bridge, to supervise its operation, and to make any minor adjustments that may be required to the electrical or mechanical equipment.

T465-1.4. Field Measurements and Surveys

Conduct field surveys to verify existing dimensions shown on the plans, prior to development of submittals. Identify field verified dimensions on submittals. Conduct field measurements and surveys as required to supplement information provided in the plans and as necessary to provide a complete and satisfactory fitting and operational installation.

T465-1.5. Products

Provide materials and equipment meeting the requirements of this Technical Special Provision. Where products are called for, provide said products unless otherwise approved by the Engineer.

T465-1.6. Bridge Operator, Preventive Maintenance, and Routine Repair

Assume responsibility for the operation and all maintenance on the movable bridge as directed by the Engineer. For additional details see Technical Special Provision T465-5 Bridge Operator and Preventative Maintenance.

For Maintenance Requirements refer to the established Maintenance Procedures.

T465-1.7. Coordination

Coordinate installation and testing of the bridge drive and control systems.

Coordination of Shop Drawings: Provide Shop Drawings meeting the requirements of FDOT Specifications Section 5.

Coordinate with United States Coast Guard any necessary permitting including for bridge span closures as specified within the General Conditions and the FDOT Specifications.

T465-1.8. Quality Control

Perform all work under this Technical Special Provision in accordance with an approved Quality Control Plan meeting the requirements of FDOT Specifications Section 105.

T465-1.9. Equipment Start-Up

Verify that utilities, connections, and controls are complete, and equipment is in operable condition.

Observe start-up and adjustment. Record date and time of start-up, and results.

Observe equipment demonstrations to the Engineer. Record times and additional information required for operation and maintenance manuals.

Provide the services of a factory authorized start-up representative at the time of energizing and for the Functional Checkout as required in this Technical Special Provision.

T465-1.10. Inspection and Acceptance of Equipment

Prior to inspection, verify that equipment is tested, operational, clean, and ready for operation.

Assist Engineer with review. Prepare list of items to be completed and corrected.

T465-1.11. Submittals

T465-1.11.1. General

Shop Drawings:

1. Refer to FDOT Specifications Section 5.

2. Before preparation of shop drawings for new components that must mate with the existing structure, obtain all necessary field dimensions to provide proper fit of the new components. Where new components are to be attached to the existing structure where existing fasteners exist, take care that any fastener holes in the new components will mate with the bolts or holes in the existing material.

3. Mark standard drawings showing more than one model or size, to indicate the model or size proposed.

4. Submit shop drawings of cabinets containing electrical equipment and include outside dimensions, areas for conduit penetrations, one-line and three-line diagrams, wiring diagrams, schematic and interconnection diagrams, terminal block arrangements and numbers (if such terminal blocks are intended for connection in the field) and operating instructions.

5. Provide layout drawings and geographic diagrams for the complete electrical and mechanical span drive systems.

6. Submit shop drawings when installation and mounting details of switches, fixtures, and devices are different from or not specifically detailed on the Plans.

Samples: Refer to FDOT Specifications Section 6.

T465-1.11.2 Product Data

Submit products meeting the requirements of FDOT Specifications Section 5-1.4.4.

T465-1.11.3 As-Built Drawings

As a condition precedent to final acceptance under FDOT Specifications Section 5-11, submit for review and approval by the Engineer, complete as-built drawings meeting the requirements of FDOT Specifications Section 5-1.4.4. In addition, provide an electronic copy of all documents in a format acceptable to the Engineer.

Draft as-built drawings from the marked up working drawings. Provide the working drawings for checking purposes.

Ensure that as-built drawings are essentially the same as the working plans and shop drawings submitted for approval but showing all the changes made during construction.

T465-1.11.4. Operations and Maintenance Manuals

Operations and maintenance manuals will be comprised of a compilation of the manufacturers' catalog data, installation, and maintenance instructions.

At a minimum, the operations and maintenance manuals must consist of the equipment installed as required by this Contract placed within a duplicate copy of the original operations and maintenance manuals. All manuals which are produced under this Contract shall supersede the corresponding sections of the existing operations and maintenance manuals and shall also contain all applicable information contained within the originals.

Provide an electronic copy of all documents in a format acceptable to the Engineer.

As a condition precedent to final acceptance under FDOT Specifications Section 5-11, submit for review and approval by the Engineer, complete as-built drawings as well as operations and maintenance instructions meeting the requirements of FDOT Specifications Section 5-1.4.4. Initially submit outlines of the booklets. Submit full copies of the final booklets, as complete as possible, prior to Phase A of Functional Testing. Provide final, complete copies prior to Phase C of Functional Testing.

T465-1.11.4.1. First Booklet

Include in the first booklet, the following:

1. Table of Contents.

2. Operator's Instructions, covering all step-by-step sequence of operation of the bridge and its auxiliaries with respect to the work required by this Contract, and noting all precautions required for correct operation. Include complete instructions for the following:

a. Selection of the power supply (commercial or stand-by).

b. Normal operation of the bascule leaf span drive and span lock actuators on commercial power source.

c. Auxiliary operation of bascule leaf span drive and span lock actuators with either bascule leaf drive electric motors energized by the stand-by generator. Include in this description the method of transfer to stand-by operation and the necessary controls.

d. Emergency Operation of bascule leaf span drive and span lock actuators by use of the emergency procedures. Include in this description the method of transfer, the necessary controls, and a step-by-step sequence of operation under the conditions of a functioning Programmable Logic Controller (PLC) and a nonfunctioning PLC.

3. Detailed maintenance instructions for adjusting, calibrating and operating all the electrical and instrumentation equipment with respect to the work required by this Contract, including the manufacturer's recommended preventative maintenance lubrication schedule.

4. A set of descriptive leaflets, bulletins, and drawings covering all items of equipment and apparatus made a part of the bridge operation and control as required by this Contract.

5. The catalog number of each piece and, where applicable, a complete parts list of equipment required by this Contract to be used in case it becomes necessary to order replacement parts from the manufacturer. Furnish this information for all equipment including but not limited to span lock actuators, wear plates, shims, limit switches, lube pumps, seals, switches, circuit breakers, relays, controllers, disconnect switches, and cables.

6. Copies of all warranties on equipment supplied to the project.

T465-1.11.4.2. Second Booklet

Include, in the second booklet, legible reduced size photocopies of the following drawings, corrected to show the work as constructed:

1. The complete spare parts list.
2. All wiring and schematic diagrams.
3. The control console and control panel layouts and wiring diagrams for all equipment.
4. The schedule of electrical and mechanical apparatus.

5. The complete speed-torque-current curves for main drive electric motors (i.e., factory test data).

6. All conduit and piping layout and installation drawings.

7. All approved electrical and mechanical shop drawings.

8. Purchasing

9. Lubrication Charts:

a. Provide lubrication charts.

b. Note: In addition to providing lubricating charts in the instruction books, mount full size wall charts as follows:

Mount copies of the first chart in each pier area near each piece of main drive machinery.

Mount a copy of the second chart in the Control House.

Provide mounted charts of at least 22 by 36 inch in size, mounted in a permanent frame behind transparent plastic. Furnish 2 full size permanent type reproducible of these charts to the Department for replacement purposes.

T465-1.11.5 Strain Gauge Testing Report

Submit copies of a full report documenting the results of the Dynamic Strain Gauge Testing as required in this Technical Special Provision.

T465-1.11.6 Schedule of Construction Phases and Functional Checkout

Submit a schedule for the phases of construction specifying the combined sequence of work for each discipline.

T465-2. BASCULE SPAN REALIGNMENT REQUIREMENTS

T465-2.1. Description

Develop and implement procedures necessary to obtain satisfactory alignment of the Bascule Leaf and span locks by removal and replacement of all live load shims, span lock shims, and associated hardware. Develop and implement procedures necessary to provide adequate clearance for all components to be installed by this Contract with respect to the Bascule Leaf and any other existing or proposed components. Develop and implement necessary temporary supports, tie-backs, falsework, shoring, jacking, etc., and procedures to safely align the Bascule Leaf, span locks, and all components to be installed by this Contract.

Review and approval of alignment procedures and temporary supports, tie-backs, falsework, shoring, or jacking systems is for compliance with the minimum requirements of the Contract Documents and is not a relief of responsibility for the satisfactory alignment of the Bascule Span. Review the plans for suggested procedures. Refer to Technical Special Provision T468 for additional information.

T465-2.1.1. Related Work

Coordinate work with span balancing requirements and structural replacement work as described herein and on the plans.

T465-2.1.2. Submittals for Field Assembly, Shop Drawings, and Alignment Records

A. For installation and alignment procedures of machinery components, have Supervisory Millwright review and initial all procedure submittals.

B. Submit as a minimum, the following items:

1. Submit adjustment procedures for live load shoe assemblies.

2. Instructions and procedures for assembly and alignment of end lock receiver assemblies including installation of shims and wear pads.

3. Detailed measurement and recording procedures including proposed measuring devices for physically establishing datum axes in the field.

4. Provide lists identifying all mechanical and electrical components and assemblies which when delivered to the field must be accompanied with critical dimensions that will affect interfacing with structural, mechanical, and electrical components; assemble measurements from Designated Fabricators.

5. Provide description of methods to be employed for establishing millwright information for verification of alignment, fit and tolerance requirements for field assembly and alignment of all machinery components.

6. Scope and schedule of periodic alignment checks.

7. Develop reporting forms for all measurements required by the Contract and as determined through the submittal process.

8. Provide anchor bolt tensioning or nut tightening as required.

T465-2.2. Materials

T465-2.2.1. Shims

Provide shim sets for each girder live load bearing location (6), span lock guide and receiver weldment mount locations (4), span lock guide and receiver location (6). Refer to Technical Special Provision T468 for additional requirements.

A. Shim Plates: Ensure that shims less than 1/2-inch thick are stainless steel. Refer to the plans for nominal dimensions. Refer to Technical Special Provision T468-2.1.6 for additional specifications.

B. Hardware: Remove and replace fasteners in kind reaming to next larger size. Embedded anchor bolts are to remain. Refer to Technical Special Provision T468 for additional specifications.

T465-2.2.2. Bumper Blocks

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T465-2.3. Construction Requirements

T465-2.3.1. Protection

Conduct construction and erection operations and provide protection as necessary to preclude dust and debris to settle upon or enter machinery or electrical components of the bridge.

When temporary supports are not in place preclude live loads from the leaf when the leaf is in the closed position prior to the conclusion of the installation operation of the live load shoe assemblies; failure to preclude live loads from the leaf could result in considerable damage to anchor bolts for the live load shoe assemblies; repair of anchor bolts and pedestals that are damaged by the failure to preclude such loading will be at no cost to the Department.

T465-2.3.2 Load Equalizing

When all six of the live load supports have been installed with the nominal shims indicated, lower each leaf until there is approximately 1/2-inch of space below each live load shoe. Use the following procedure to obtain equal loading on the three live load shoes for the leaf:

A. Release all brakes on the span drives to allow the span to settle down bringing at least one live load shoe into contact with its strike plate.

B. If two of three live load shoes contact their strike plates, raise the leaf and insert a temporary shim 1/2-inch thick, under the adjacent shoe (Sa). Lower the leaf by releasing the brakes. Measure the clearance (Co) under the opposite shoe (So). Raise the leaf and remove the 1/2-inch temporary shim from under the adjacent shoe and insert it under the opposite shoe. Lower the leaf by releasing the brakes. Measure the clearance (Ca) under the adjacent shoe. If the clearances Ca and Co measured under the two live load shoes with the temporary shim in place are equal, no additional shim adjustment is required at this time. If Ca is greater than Co, additional shims must be installed under Sa with a thickness of T= (Ca-Co)/2. If Co is greater than Ca, additional shims must be installed under So with a thickness of T= (Co-Ca)/2.

C. If one of the live load shoes does not contact its strike plate, measure the clearance (C1) under that shoe (S1). Raise the leaf and install a temporary shim of thickness (C1+1/2-inch) at S1. Lower the leaf and measure the resulting clearance C2 at the other shoe (S2). Install permanent shims at S1. The thickness (T) of the permanent shims will be T= [C1 + (1/2-inch-C2)/2)].

D. Repeat the above process for the third center live load shoe (Cc) placing a temporary shim underneath both the adjacent and opposite shoe and measuring the clearance (Ca=Cc=Co).

T465-2.3.3 Span Vertical Alignment

After the shimming described above to equalize the loads on the live load supports has been completed for the leaf, additional shim adjustments may be required to bring the tip of the leaf to the proper elevation and to align the roadway at the tip leaf. Use the following procedures to complete the shimming of the live load supports:

A. Lower the leaf to the fully closed position with all six live load shoes in firm contact with their strike plates.

B. Measure the elevation of the tip of the leaf at the center of the waterway with respect to the elevation of the roadway on the ends of the approach span adjacent to the bascule span.

C. Measure the differences in elevation between the roadway at the tip of the leaf at the center of the roadway and at the point on the roadway directly above each girder inboard of each curb.

D. Determine what adjustment in shim thickness is required at the live load supports to properly align the roadway at the tip of the leaf and to position them at the proper elevation with respect to the approach span roadway.

E. Install additional shims (or remove shims) above the live load shoes as required to position the roadway at the tip of the leaf at the proper elevation with respect to the roadway on the approach spans and to properly align the roadway on the leaf vertically with one another. Once load equalization has been performed, an equal thickness of shims must be added or removed from the three live load shoes on a given leaf.

F. After adjusting the thickness of the shims under each live load shoe, lower the leaf by releasing the brakes and check the tip of the bascule leaf to see if it is at the proper elevation and are properly aligned. Readjust shims under the strike plate if necessary.

T465-2.3.4 Alignment

The live load supports are properly aligned when the live load shoe is in full contact with the live load strike plate. Contact is full if a 0.002-inch feeler gage cannot be inserted between the shoe and the strike plate along the entire length of live load shoe.

T465-2.3.5 Bumper Blocks

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T465-3. COUNTERWEIGHT AND LEAF BALANCING

T465-3.1. Description

T465-3.1.1. Terminology

The terms “counterweight adjusting blocks”, “counterweight balancing blocks”, “counterweight blocks”, “adjusting blocks”, and “balance blocks” are used interchangeably.

The terms “balance state” and “balance condition” are used interchangeably.

The terms “steel ballast (counterweight)”, “counterweight steel ballast”, “steel ballast”, “counterweight transition slabs”, and “transition slabs” are used interchangeably.

The terms “tie down assembly”, “tie-down device”, “tie down”, and “hold down assembly” are used interchangeably.

T465-3.1.2. Requirements for Balance States

Properly balance the bridge for all angles of operation and consider the properly balanced condition for the bascule leaf as follows:

A. Ensure that each bascule leaf is unbalanced toward the channel (tip heavy) by a moment of 247 kip-ft plus or minus 25 kip-ft with the bridge in the lowered (closed) position.

B. Required Interim Balance State: During construction and for conditions where the leaf is not secured with tie-down devices, ensure the bascule leaf remains tip heavy during all angles of operation and the unbalanced moment does not exceed 468 kip-ft and is no less than 50 kip-ft.

C. Center of gravity of the leaf forward of the centerline of rotation (trunnion) of the leaf with an alpha angle between a plus 20 degrees and a plus 50 degrees. The alpha angle is defined as the angle of elevation of the center of gravity of the leaf above (minus being below) the horizontal axis

through the centerline rotation of the leaf. Location of the center of gravity within this range will yield a closing imbalance moment for the full rotation of the leaf, with maximum imbalance being near the fully closed position and minimum imbalance at the fully open position of the leaf.

T465-3.1.3. General Scope of Work

The work specified in this Section is required for each leaf of the bascule span; items are not necessarily listed in the order of occurrence.

A. Develop and submit counterweight computations and finalized counterweight configuration.

B. Provide span tie-down devices for the specified conditions and for conditions determined as producing an unstable leaf.

C. Develop and submit Leaf Balancing Plan.

D. Furnish and place concrete or cast-iron counterweight adjusting blocks as required for achieving balancing.

E. Achieve and maintain acceptable interim balance states for the bascule leaf throughout the course of the work.

F. Achieve an acceptable final balance state for the bascule leaf upon completion of the work.

G. Furnish and install Span Balancing Test Gage Assemblies.

H. Field survey and document final dimensional configuration of counterweight concrete, steel ballast and adjusting blocks.

I. Assist the Department during the performance of Balance Verification Tests.

T465-3.1.4. Work Restriction and Requirements

A. Meet the requirements of FDOT Specifications Section 7 and 103.

B. Always maintain a Balanced Leaf Condition.

C. Ensure that a Balanced Leaf Condition is present prior to the removal of tiedown devices.

D. Ensure the main drive system is fully secured and operable at the initiation of the removal of tie-down devices.

E. The use of span locks as a tie-down device is not permitted.

F. If the span lock is configured such that it may only be thrown or driven manually, a span lock may be used to supplement a primary tie down device.

F. Refer to the plans for requirements and restrictions on Traffic Closures and Marine Closures.

T465-3.1.5. Tie Down Device Requirements

A. Tie-Down Devices: Provide tie-down devices on an individual leaf for an operation where the leaf will become unstable because of that operation.

B. Have tie-down devices in place prior to conducting the following operations:

1. Condition where the unbalanced moment exceeds the permissible limits designated under the provisions of this Technical Special Provision; and

2. All other operations which will result in an unstable leaf.

C. Structural Capacity:

1. Non-Movable Leaf Condition: For the condition where the leaf cannot be readily rotated into the down position, provide tie-down devices capable of sustaining the sum of the maximum imbalance moment and a 110-mph wind in accordance with the FDOT Structures Design Guidelines supplemented by ASCE 7-05.

2. Movable Leaf Condition: For the condition where the leaf can be readily rotated into the down position, provide tie-down devices capable of sustaining the sum of the maximum imbalance moment and a 20 psf wind load in accordance with the AASHTO Standard Specifications for Movable Highway Bridges.

D. Utilize tie-down devices in sets of three, one located at each main girder, unless otherwise permitted by the Engineer.

E. Connection of tie-down device elements to the main girder by welding will not be permitted; connection will be by bolting utilizing approved hole patterns.

F. Fabricate tie-down devices in accordance with the provisions of FDOT Specification 460.

T465-3.1.6. Coordination

Meet the requirements of FDOT Specifications Section 8-4.

Coordinate the work of this Section to ensure:

A. Proper installation and alignment of live load shoe assemblies.

B. Proper installation and alignment of span lock guides and receivers.

C. Proper alignment of the Bascule Leaf tip.

T465-3.1.7. Quality Assurance

Counterweight Computations: Provide signed and sealed counterweight computations and shop drawings.

T465-3.1.8. Submittals

As a minimum, submit the following for review and approval:

A. Shop drawings for concrete or cast-iron counterweight adjusting blocks; provide weight of block; product data for coal tar epoxy coating for cast-iron blocks.

B. Counterweight Computations:

1. Submit detailed counterweight computations and shop drawings for the final leaf configuration and final balance state.

2. Provide all counterweight shop drawings and counterweight computations signed and sealed by a Professional Engineer registered in the State of Florida.

3. Counterweight computations are to identify as a minimum, the center of gravity of the following component assemblies: Leaf structural steel, leaf machinery, unfilled grid flooring, concrete for the filled grid flooring, steel ballast (transition slabs) at each counterweight girder, counterweight concrete at each girder, and counterweight adjusting blocks.

4. The theoretical weight of the individual grid flooring panels is to be determined by the flooring manufacturer and noted in the bill of materials on the grid flooring shop drawings.

5. The shipping weight (actual weight) of the individual grid flooring panels is to be determined by the flooring manufacturer and utilized to finalize computations.

6. Use weights and dimensions from existing as-built drawings for computations of leaf structural steel, existing leaf machinery to remain, concrete for the filled grid flooring, steel ballast (transition slabs) at each counterweight girder, counterweight concrete at each girder, and existing counterweight adjusting blocks.

7. Shop drawings for placement of counterweight blocks: in addition to conventional drawings, provide isometric showing configuration of blocks to be utilized to achieve an acceptable final balance state.

8. After achieving an acceptable final balance state, submit revised drawings depicting the final configuration of the counterweight adjusting blocks.

9. At the completion of the Department's Balance Verification Testing, submit revised drawings documenting the final configuration of adjusting blocks in the counterweight pockets (main girders).

C. Span Balancing: Submit description of proposed equipment to be utilized, proposed balancing procedures, and proposed reporting forms.

D. Leaf Balancing Plan:

1. Prepare and submit a Leaf Balancing Plan for each leaf.

3. Specifically address each element of the Work associated with the leaf and the machinery of the leaf that will affect the balance of the leaf and the proposed measures that will be taken to ensure balanced leaf conditions throughout the duration of the Work.

5. Submit supporting shop drawings and counterweight computations.

6. Balance State Report:

a. Submit for final balance state after all work on the leaf is complete but prior to the Department conducting Balance Verification Tests.

b. As a minimum, the balance state reports must contain the following: Geometric parameters for equating pressure readings to torque and imbalance moment, pressure measurements with associated leaf positions, accompanying weather, wind, and temperature measurements, quantification of the location of the center of gravity of the leaf, summary and conclusions, and Signed and Sealed by a Professional Engineer registered in the State of Florida.

T465-3.1.9. Balance Calculations

A. Complete weight and center of gravity calculations from approved shop details of the Bascule Leaf and all parts attached thereto. Perform balance calculations for the Bascule Leaf (One complete set). Compute the balance calculations in two phases:

Phase 1 - Preliminary Balance Calculations using computed weights.

Phase 2 - Final Balance Calculations using measured weights for steel grid deck panels. Ensure the calculations are prepared, signed and sealed by a Professional Engineer registered in the State of Florida. To permit detailed checking, prepare these calculations as detailed below.

B. Compute weights based on the dimensions of the parts as shown in the existing as-built plans deducting for copes, cuts, clips and all open holes, except bolt holes.

C. Base the weight of heads, nuts, single washers, and threaded stick-through of all high tensile strength bolts, both shop and field, on the following unit weights:

Diameter of Bolt (in)	Weight per 100 Bolts (lb.)
1/2	17
5/8	31
3/4	52
7/8	78
1	114
1 1/8	154
1 1/4	205

D. Base the weight of fillet welds as follows:

Size of Fillet Weld (in)	Weight (lbs/ft)
1/4	0.11
5/16	0.17
3/8	0.24
7/16	0.65

E. No allowance is required for the weight of paint. Compute the weight of galvanizing as 7.5% of the steel weight of the components to be galvanized.

F. Compute weights of individual components to the nearest 0.1 lb. accuracy. Summarize weights of assemblies to the nearest 1.0 lb. accuracy. Summarize Bascule Leaf weight to the nearest 0.1-kip accuracy.

G. Locate the Center of Gravity (C.G.) of each component or assembly of components both horizontally and vertically.

1. Reference the C.G.’s longitudinally to the center of rotation:

a. Positive (+) distances are recorded for elements forward of the trunnion (i.e., toward the channel).

b. Negative (-) distances are recorded for elements behind the trunnion.

2. Reference the C.G.’s vertically to the center of trunnions:

a. Positive (+) distances are recorded for elements above the trunnion.

b. Negative (-) distances are recorded for elements below the trunnion.

Record distances to components or assemblies to the nearest 0.010 foot of accuracy.

H. Use unit weights of rolled shapes per AISC. Use a unit weight of steel of 490 lb/ft^3.

I. Properly account (deduct) for items embedded in the Counterweight concrete (e.g., reinforcing steel, Counterweight bracing, etc.).

J. In computing the vertical distances to the C.G.'s of the components, account for the vertical geometry of the Bascule Leaf (i.e., the roadway vertical curve profile) and the effects of camber and dead load deflection. Compute dimensions based on the deflected shape with the bridge in the lowered (closed) position.

K. Summarize the computations in tabular form with components and subassemblies grouped together.

L. Report the weight and C.G. of each component in Department terminology as follows:

1. Weight, W in kips (to the nearest 0.01 kip).

2. Distances from center of trunnions to C.G., X (horizontal) and Y (vertical) in feet (to the nearest 0.010 foot).

3. The component contribution to unbalance torque in kip-ft shown as the products W*X and W*Y (to the nearest 0.1 kip-ft.).

4. Add the component weights and unbalanced torques to produce totals for each Bascule Leaf.

M. Report the weight and C.G. of the sum total of all components for each Bascule Leaf in Department terminology as follows:

1. Weight, W in kips (to the nearest 1.0 kip).

2. Distances from center of trunnions to C.G., X (horizontal), Y (vertical) and L (radial) in feet (to the nearest 0.010 foot).

3. Angle, α, between a horizontal line through the trunnion axis and a line from the trunnion axis through the C.G. of the Bascule Leaf in degrees (accuracy to 0.010 degrees). The angle is measured positive (+) upwards from a horizontal line extending forward (toward the channel) of the trunnion axis.

4. The net Bascule Leaf unbalance torque as the products, W*X, W*Y, and W*L, and the leaf unbalance torque, $T = W*L*\cos(\theta + \alpha)$, shown at ten degree increments of leaf angle, θ.

N. Perform a check of the size of the Counterweight and the Counterweight adjustment pockets as follows:

1. Report the sum total of components (or portion of components) forward of the trunnion in Department terminology (W, X, and $W*X_{forward}$).

2. Report the sum total of components (or portion of components) backward of the trunnion including the Counterweight with the adjustment pockets empty of balance blocks in Department terminology (W, X, and $W*X_{back\ empty}$).

3. Report the sum total of components (or portion of components) backward of the trunnion including the Counterweight with the adjustment pockets full of balance blocks in Department terminology (W, X, and $W*X_{back\ full}$).

4. $W*X_{back\ empty}$ is equal to or less than the product $0.950*(W*X_{forward} - M_{unbalance})$.

5. $W*X_{back\ full}$ is equal to or greater than the product $1.075*(W*X_{forward} - M_{unbalance})$.

6. For the above calculations, $M_{unbalance}$ equals 200 kip-ft.

The above calculations are to verify that the size of the adjustment pockets is adequate to provide the range of adjustment required.

T465-3.2. Materials

T465-3.2.1. Counterweight Blocks (Cast Iron)

Cast-iron Blocks:

A. Material: ASTM A48 or equivalent.

B. Unit Weight: Minimum 450 pcf.

C. Protective Coating: Coal Tar Epoxy: Abrasive blast and apply one coat of coal tar epoxy coating minimum 8 mils dry film thickness. Optional: Hot-dipped galvanized in accordance with ASTM A153.

T465-3.2.2. Strain Gauge Testing

A. Strain gauge rosettes with adhesive bond foil.

B. Amplifiers.

C. Cable links or wireless transmitters.

D. Data acquisition equipment.

T465-3.3. Construction Requirements

T465-3.3.1. Notifications

Notify the Engineer a minimum of 28 days prior to the date that is anticipated that the Department's Balance Verification Testing is going to be required.

Submit final Balance Report and confirm with the Department the date for Balance Verification Testing a minimum of 7 days prior to the date. Failure to submit the report or confirm the date may result in a delay of the Balance Verification Testing.

T465-3.3.2. Counterweight Adjusting Blocks

Fabricate counterweight adjusting blocks only after approval by the Engineer of the appropriate counterweight computations as specified elsewhere in this Technical Special Provision.

Place and arrange blocks throughout the course of the Work as required for achieving or maintaining acceptable balance states.

T465-3.3.3. Span Balancing - General

A. For the initial and final balance states, obtain, as a minimum, torque measurements as follows: At leaf angular positions of every 10 degrees from Fully Closed to Fully Open. For a minimum of three cycles of the leaf; the intent is to obtain three measurements at each angular position, the second and third measurement being made after the leaf is cycled back to the closed position.

B. For interim balance states (maintenance balancing), obtain, as minimum, torque measurements as follows: At leaf angular positions of one, 30 and 60 degrees. For a minimum of two cycles of the leaf, same intent as paragraph A above.

C. Given the numerous variables that may have an effect on the values of the torque measurements, schedule testing generally as follows in order that measurements taken on one day may be better correlated with measurements taken on another day:

1. In the morning at sunrise so as to minimize the differential in ambient temperature.

2. At a time with no wind; if wind exists, preferably the wind should not be in a direction along centerline of the bridge (perpendicular to the bridge deck surface).

3. If hydraulic drive: At a time where the main hydraulic system has remained idle for a period of time and the hydraulic oil is being maintained by the system at its lowest temperature.

D. For each torque measurement, obtain and record the following data: Ambient temperature, weather conditions, wind speed and direction at the roadway surface, and, if hydraulic drive, oil temperature in power unit reservoirs and surface temperature of blind end cylinder piping.

T465-3.3.4. Maintenance Balance During the Course of Construction

Maintain balance in accordance with the Leaf Balancing Plan.

Maintain the bascule leaf(s) in balance for those periods where the main drive system is operable.

Verify the condition of balance at time intervals appropriate with the work being performed in order to ensure a Balanced Condition at all times.

Verify the condition of balance prior to opening the structure to traffic in order to ensure a Balanced Condition for the safety of traffic.

T465-3.3.5. Final Balancing

Complete all work on the leaf, including application of protective coatings, with the exception of the installation of the live load shoe assemblies and the adjustment of the span lock assemblies, prior to initiation of the final balancing program.

Perform the final balancing of the leaf; achieve an acceptable final balance state.

Achieve an acceptable final balance state prior to the Department conducting Balance Verification Tests.

Submit Balance Report and arrangement of adjusting blocks; submit Balance Report a minimum of seven days prior to date that the project is ready for the Department to begin Balance Verification Testing.

T465-3.3.6. Dynamic Strain Gauge Testing

Dynamic Strain Gauge Testing includes, at minimum, the following items:

A. Description of experimental procedure including type and method of installation of strain gauge rosettes, method of transmission of low-level signals, data acquisition equipment and strip chart recorders.

B. Location plan of span drive equipment showing proposed location of strain gauges, amplifiers, cable or radio links, data acquisition equipment and all associated cabling.

C. Details of method of transmission of signals from shafting to data acquisition units.

D. Elementary wiring diagrams of interconnection of strain gauges, amplifiers, data acquisition equipment and strip chart recorders.

E. Description of electrical and mechanical factors including sample calculations for obtaining shaft torque from measured strains, span imbalance and curve fitting and basis for friction correction.

F. Mount adhesive bond foil strain gauge rosettes on the shafts of each rack pinion. Sufficiently clean the areas of the shafts where the gauges are to be mounted to remove all contaminants. Mount two rosettes on each main pinion shaft at 180 degrees from each other. Connect the two gauges such that any direct shear forces in the shafts are neglected and true torsional shear is measured.

G. Connect the gauge leads on each shaft to a four-arm amplifier securely mounted to the shaft. Transmit the signals from the shafts to the data acquisition equipment either through cable links wound on spring operated cable reels with sufficient capacity and torque or through wireless transmitters.

H. Connect the output loads from each channel of the amplifiers in each shaft to a strip chart recorder with at least 10-inch-wide chart paper. Provide the strip chart recorder with an event marker connected to sensors on the pinion shaft such that increments of pinion shaft revolutions are recorded. Interpret each increment as opening angle utilizing the gear ratios of the machinery. Provide a step-wise adjustable chart speed and include a setting of at least 10 inches per minute.

I. Record the strains in both main pinion shafts versus leaf angle simultaneously during opening and closing to a suitable scale. Ensure the readings for all main pinions are at the same strain scale and chart speed and recorded during the same span opening.

J. Numerically convert the strains induced in the rack pinion shafts to torque for at least 10 points at equal intervals along the strain plots for both opening and closing. Process this data to give a curve of torque for the full travel of the leaf versus opening angle, corrected for friction.

K. Submit 10 copies of a full report documenting the results of the strain gauge tests. The reports shall contain as a minimum the following:

1. Description of experimental procedure and equipment used.
2. Span drive diagram showing location at which strain gauges and event markers were attached and all applicable gear ratios.
3. Copies of original strip charts for both leaf opening and leaf closing for all rack pinion shafts.
4. Description of relationships and sample calculations for obtaining rack pinion shaft torque from strains, span imbalance moment from pinion shaft torque and curve fitting, and basis for friction correction.
5. Fitted curves of torque versus opening angle during opening and closing for each rack pinion shaft.
6. Curve of shaft torque versus opening angle corrected for friction.
7. Define the approximate range of probable error.

The reports will be bound in between heavy plastic covers. Include in the report an introductory section incorporating the name of the bridge, the shafts tested, the date of the test, weather conditions during testing, and any other information requested by the Engineer. The reports will also meet the requirements of FDOT Specifications Section 5-1.4.4.2.

T465-3.3.7. Balance Verification Tests and Final Balancing

Provide safe access to the bridge for the Department to conduct Balance Verification Tests.

Place additional adjusting blocks, remove existing blocks, or change arrangement of adjusting blocks as required by the Engineer.

Record changes for submittal of final adjusting block configuration.

T465-3.3.8. Acceptance and Final Documentation

Testing by the Department that verifies that a leaf is in an acceptable final balance state is the basis that the leaf is acceptable with respect to balancing.

Obtain test results from the Engineer and combine with revised drawings showing final adjusting block configurations; submit as final documentation of the final balance state.

T465-4. MOVABLE BRIDGE FUNCTIONAL CHECKOUT

T465-4.1. General Requirements

Thoroughly checkout and test the movable bridge operation as defined herein, to determine compliance with the requirements for construction, safety, maintenance, and operation of the facility as required in the contract documents. Include in the tests verification of all functions related to leaf operation, maintenance, and safety whether specifically defined herein or required of the contract.

Collect and assemble full documentation of the test requirements and provide in booklet form meeting the requirements of FDOT Specifications Section 5-1.4.4.2.

Detail and submit in shop drawing format, for approval, test procedures for specific tests to be performed and the acceptance criteria for each test. Each procedure will be reviewed before and after testing by the Engineer.

Ensure this testing demonstrates the functionality of the bridge components as well as the complete operation of the constructed facility. Shop test individual systems prior to this procedure as required herein or under individual item specification.

Verify all mechanical, electrical, and structural systems integration requirements.

T465-4.2. Material Requirements

Functional Acceptance Test Books: Integrate and assemble information required for Functional Test books meeting the requirements of FDOT Specifications Section 5-1.4.4.2.

T465-4.3. Construction Requirements

T465-4.3.1. General

A. The Functional Acceptance Tests consists of three parts.

1. Preliminary Checkout.
2. Functional Test
   (Phase A) – East Span (Not used)
   (Phase B) – West Span (Not used)
   (Phase C) – Complete Bridge.
3. 60 Day Operational Testing Period (included in contract schedule).

B. Engineer Notification: Provide adequate notice (20 working days minimum) prior to all tests so that the Engineer can witness and accept the method and result of the testing. Perform all testing after all required submittals are reviewed and approved by the Engineer.

C. Manufacturer Representatives: Arrange to have at the site, for each test, appropriate representatives of the bridge drive and electrical control equipment. These representatives must be prepared to adjust the equipment, of locating faults or defects and correcting them, and of obtaining from the manufacturers, without delay, new parts or replacements of apparatus which, in the opinion of the Engineer, do not perform satisfactorily.

D. Field Tests: Arrange for and provide all necessary field tests, as indicated herein and as directed by the Engineer, to demonstrate that the entire modified or reworked area is in proper working order and is in accordance with the approved Plans and Specifications.

E. Phasing of Tests:

1. Implement the construction of the bridge in phases as required by the Maintenance of Traffic Plan, refer to the Plans. In general, the phases will consist of installing replacement systems as required by this Contract for each leaf individually and in sequential order at the discretion of the Contractor followed by the completion of the integrated system (Phase C). Submit a proposed schedule for review prior to the start of construction; refer to applicable sections of this Technical Special Provision. Conduct independent, functional acceptance testing for each phase.

2. Once construction work begins, do not open the structure to traffic until the detailed requirements for preliminary and functional testing as described below, and approved by the Engineer, are completed to the satisfaction of the Engineer. Functions which have been completed to the extent required of the testing may be accepted in part, provided the deficiencies have been documented, an approved plan of corrective action has been submitted, and an approved method of providing a safe substitute function has been implemented (example, gate functions may be provided by temporary flagmen).

3. Acceptance of a structure for operation and receipt of all required records and documentation will constitute completion of preliminary phases of the Movable Bridge Functional Checkout. Completion of Phase C will be accepted only when the entire integrated system has been tested and accepted, all temporary functions have been removed, all required records and documentation have been provided, and the 60 Day Operational Testing Period has been successfully completed.

T465-4.3.2. Tests

The Functional Acceptance Tests: Present specific, step by step procedures to demonstrate and provide data for evaluation of each function of the movable bridge. Include for each test quantitative measurements including torque, amperage, watts, pressure, temperature, speed, RPM, and other parameters required by the Engineer to evaluate functionality. Include method of measurement, and their method of recording. Refer to the testing requirements in applicable sections of Technical Special Provisions T468 and T508.

Acceptance Criteria: Present Functional Acceptance criteria that is concise and void of ambiguities. State specific performance of each component or function with regards to the requirements of the design and each unique condition of performance. Include all normal and emergency operating conditions as defined in the Contract documents and design specifications and all maintenance modes of operation.

T465-4.3.3. Preliminary Checkout

A. Prior to scheduling the Functional Acceptance Test and presenting Acceptance Criteria, perform preliminary checks and make adjustments on the new work, such that the system is in general working order. Ensure that all control wiring has been completed and properly labeled. Coordinate this work with the maintenance of traffic plan such that any failure of the system being tested would not interfere with the scheduled use of the bridge. Preliminary Functional Tests are to be completed, at a minimum, at the end of each night closure before opening the bridge for vehicular and marine traffic.

B. Perform drive system tests during periods in which the span (or leaf) being tested is normally closed (i.e., closed to marine traffic). Provide backup means of lowering the leaf(s) if vehicular traffic is scheduled to use the bridge.

C. Run the bridge continuously in normal mode (not manual mode) for at least five days before performing the Functional Checkout.

D. Record the following during the preliminary checkout (record using time as the base measurement):

1. Chart recorded wattmeter, current, voltage readings for each main span drive and span lock electric motor during their full cycle of operation.

T465-4.3.4. Functional Tests

Upon approval of the Engineer to proceed, conduct the Functional Acceptance Tests. The tests include the following Functional Tests and Acceptance Criteria:

T465-4.3.4.1. Control Functions (testing both manual and automatic operations)

A. Bridge Sequence: Demonstrate the correct operation of the bridge as described in this Technical Special Provision and on the plans.

B. Demonstrate EMERGENCY STOP of the leaf at or during each phase of opening and closing the bridge (phases include ramping up or down, full speed, and creep speed).

C. Interlocks:

1. Simulate the operation of each limit switch to demonstrate correct operation and interlocking of systems.

2. Demonstrate BYPASS operation for each failure for each required bypass (as listed in Technical Special Provision T508).

3. Simulate each failure for which there is an alarm message to demonstrate correct message displays.

4. Provide comprehensive testing of interlocks to demonstrate that unsafe or out of sequence operations are prevented.

D. Position Indicator: Observe readings with each leaf closed and fully open to assure correct readings.

E. Navigation Lights:

1. Demonstrate that all lamps are working.

2. Demonstrate proper change of channel lights from red to green.

F. Traffic Gates, Pedestrian Gates, and Traffic Barriers:

1. Demonstrate proper operation of each gate arm.

2. Demonstrate opening or closing times. Time should not exceed 15 seconds in either direction.

3. Demonstrate door switch safety interlocks and manual operations using hand crank.

G. Span Locks (also refer to the requirements of Technical Special Provision T468):

1. Operate each span lock through one complete cycle and record, with chart recorder, electric motor power (watts) throughout the operation, record lock bar-to-guide and lock bar-to-receiver, clearances.

2. Operate each lock with hand crank or manual pump for one complete cycle.

3. Record time of operation, stroke, and maximum operating and relief pressures for each lock bar and power unit.

4. Verify lock bar to guides and receiver clearances and parallelism.

5. Verify that there is no movement of the leaf caused by the operation of the span locks, when the locks are pulled and driven with the bridge fully seated.

H. Bumper Blocks: Demonstrate bumper block contact points relative to leaf position and contact face parallelism. Record clearances between bumper blocks with leaf at fully open position.

I. Bridge Machinery (also refer to the testing requirements of Technical Special Provision T468):

1. Demonstrate operation of all lubrication systems.

2. Demonstrate live load shoe contacts and alignment of the bascule leaf rear and center span joints.

3. Operate the leaf through 6 continuous cycles at full speed, 3 cycles for each electric motor. During this inspect the machinery for proper function. Correct any abnormal conditions to the satisfaction of the Engineer, and retest in entirety.

J. Span Brakes Control:

1. During the span raise and lower operations, verify and record the normal automatic set and release operation of the brakes.

2. Demonstrate brake hand release, each brake, one at a time, and monitor the hand release indication through the PLC.

3. With the Span in non-permissive operation mode (span locks driven, drives not energized), manually activate the brake set and release switches and monitor their set/released indication at the control desk.

4. Drift Test – Perform the following test:

a. Using manual control at the electronic drive, set to creep speed, manually release the brakes and raise the bascule leaf approximately two to three inches off of the bearing plates. Stop the bridge by setting the brakes and removing the raise signal at the drive.

b. Remove power from the motors and verify that the brakes hold the load.

c. Manually release the machinery brakes and verify that the motor brakes hold the load.

d. Slowly release the motor brakes and drift the leaf down to rest on the live load shoes.

e. Repeat the above steps to test the holding capacity of the machinery brakes.

K. Emergency Power: Monitor and verify correct operation of PLC system while operating under emergency power. Perform automatic transfer by simulating loss of normal power and return to normal.

L. Automatic Transfer Switch:

1. Perform automatic transfer by simulating loss of normal power and return to normal power.

2. Monitor and verify correct operation and timing of: normal voltage sensing relays, engine start sequence, time delay upon transfer, alternate voltage sensing relays, automatic transfer operation, interlocks and limit switch function, timing delay and retransfer upon normal power restoration, and engine shut-down feature.

M. Programmable Controller Program:

1. Demonstrate the completed program's capability prior to installation or connection of the system to the bridge. Coordinate the arrangements and scheduling for the demonstration with the Engineer and the Engineer-of-Record.

2. Prepare a detailed field test procedure and provide to the Engineer-of-Record for approval. Provide for testing as listed below:

a. Exercise all remote limit switches to simulate faults (including locks, gates, traffic lights etc.). Ensure proper readouts appear on the alphanumeric display.

b. When the local testing of all individual remote components is completed, check all individual manual override selections for proper operation at the console. When all override selections have checked out satisfactorily, put the system in automatic (PLC) mode and exercise for a full raise and lower cycle. It should operate as diagramed on the plan sheet for the sequence of events.

c. Exercise a PLC sequence of operation interweaving the by-pass functions with the automatic functions for all remote equipment.

d. Remove the power from the input utility lines, at which time, the Automatic Transfer Switch should activate the engine-generator to supply power. Raise and lower the bridge again. Upon completion of test, reapply utility power to the ATS; load should switch over to utility for normal operation.

e. Include, in the testing, verification that all safety features are included in the program and that the program will not accept commands that are contrary to the basic sequence diagram. Include the failure mode testing in the written field test procedure submitted for approval by the Engineer.

N. Condition Monitoring System

1. Demonstrate all system screens and that status indications are correct.

2. Demonstrate that all sensors and transmitters are functioning and that the software is recording events as required.

3. Start a bridge operation sequence and observe displacement sensors as traffic passes over the bridge.

4. Operate the bridge and observe power performance, vibration and frequency acceleration.

O. Submarine Cable Assembly (HDPE Conduits):

1. Perform the following tests, using a 1,000-volt megger, on each conductor of the installed submarine cable assembly:

a. Insulation Resistance (IR): Measure and record the IR of each conductor to the rest of the conductors in the conduit. Measure and record the IR of each conductor to ground.

b. Calculate and record the Polarization Index (PI) for each conductor as discussed in IEEE 62-1995 Revision using the 60 second- and 10-minute readings.

2. IR readings of less than 100 MΩ are unacceptable. PI readings of less than 1.0 are unacceptable.

3. If more than 10% of conductors in any conduit fail the PI or the IR measurements then all the conductors are deemed to be defective and have to be replaced.

4. If, at any time during construction, or after the initial testing described above, any of the conduits in the submarine cable assembly is damaged, then perform the IR and PI tests again on the conductors in that conduit except that the IEEE 62-1995 Revision 30 second and 60 second readings can be used to determine the PI.

P. Flexible SOOW Cables (Droop Cables)

1. Perform the following tests, using a 1,000-volt megger, on each cable of the installed droop cable assembly:

a. Insulation Resistance (IR): Measure and record the IR of each conductor to the rest of the conductors. Measure and record the IR of each conductor to ground.

2. IR readings of less than 100 MΩ are unacceptable.

3. If more than 10% of conductors of any cable fail the IR measurements then the cable is deemed to be defective and has to be replaced.

4. If, at any time during construction, or after the initial testing described above, the droop cable assembly is damaged, then perform the IR tests again.

T465-4.3.5. Bridge Operational Testing Period

Upon successful completion of the Functional Checkout and the repair of all items that were identified during the functional tests, open the bridge for vehicular and marine traffic permanently with respect to this Contract, and start a 60 day a bridge operational testing period. <u>The 60-day bridge operational testing period is included as part of the contract schedule.</u>

Provide all materials and labor to operate and maintain the bridge for the operational testing period.

During this period, open the bridge a minimum of 4 times per day.

During this period, under observation by the Engineer, test all aspects of the movable bridge and its operation.

Repair or replace any mechanical or electrical component of the bridge that becomes inoperative or defective during the 60-day period, at no additional compensation.

If correction of inoperative or defective equipment requires installation of components from a different manufacturer, or reconfiguration of components, the changes will be subject to approval by the Engineer. Additional functional testing of the corrected systems may be required, and the 60-day Operational Testing Period may be increased or restarted at the sole discretion of the Engineer. Perform the tests at no additional compensation.

T465-5. BRIDGE OPERATOR AND PREVENTATIVE MAINTENANCE

T465-5.1. Description

Provide bridge tending services for the bridge(s) that are part of this contract through final acceptance. Provide adequate, responsible personnel trained as bridge tenders to operate the bridge(s).

Bridge administration, maintenance, repairs, and operation will be the responsibility of the Contractor throughout the life of the Contract. During this period, make immediate repairs of any damage caused by the Contractor's use or operations at the Contractor's expense.

Adhere, at all times, to the Bridge Operations and Maintenance Manual and to the U.S. Coast Guard Code of Federal Regulations (CFR) 33.

T465-5.2. Contractor's Responsibilities

Furnish all labor, materials, equipment, training, uniforms, tools, transportation and supplies required to perform the services outlined. Additionally, furnish all supplies required for routine housekeeping including light bulbs, toilet paper, towels, cleaning solutions, etc. as required.

T465-5.2.1. Conformance with Contract Documents

Specific tasks to which the Contractor must conform include but are not limited to the following:

a. Operate the bridge according to the Bridge Operations and Maintenance Manual.

b. Provide the Engineer with complete bridge tenders competency qualification form.

c. Provide proper supervisory personnel.

d. Inform the Department of mechanical, electrical, plumbing, air conditioning, and facility maintenance malfunctions and conduct the appropriate repair procedures for which the Contractor is responsible.

e. Inform the Department each day of malfunctioning navigation lights.

f. Inform the Department of events that may have jeopardized bridge structural integrity.

g. Respond within 15 minutes to any telephone call made to the Contractor by the Department.

h. Supervisors or other repair personnel must respond in person within one hour when requested.

i. Advise the Engineer when supervisory personnel serve as a bridge tender.

j. Inform the Department of any complaints from citizens or public agencies.

k. Notify the U.S. Coast Guard and the Engineer within 30 minutes of any event which causes lane closure or restriction of waterborne traffic.

l. Update and provide to the Engineer all completed forms as required by the Department and the U.S. Coast Guard monthly or when requested.

m. Respond to any emergency repair of a malfunctioning bridge within the allotted time as specified by these specifications and the Engineer.

n. Conduct preventative maintenance as required.

T465-5.2.2. Documentation

Submit all appropriate forms for documenting preventative maintenance procedures to the Department each month

T465-5.3. Requirements

T465-5.3.1. Bridge Tender

Employ bridge tenders that are at least 18 years of age with corrected vision of 20/40 or better and the ability to distinguish red, amber and green colors. Bridge tenders must have normal hearing and be able to climb bridge stairs and ladders. Subject bridge tenders to drug screening within 30 days of employment. Employees failing such screenings will be dismissed from work associated with this contract. Bridge tenders must be able to:

1. Read and comprehend Department and U.S. Coast Guard manuals, rules, regulations and procedures.

2. Update and maintain logs and records in legible English according to the dictates of this Contract.

3. Effectively communicate in English on a V.H.F. marine radio.

4. Follow instructions and respond appropriately and professionally in various situations.

Bridge tending candidates will meet the training and testing requirements described in the Department's Bridge Operations and Maintenance Manual, Section III (C-2).

T465-5.3.2. Bridge Tender Supervisor

Provide a responsible Bridge Tender Supervisor. Provide the Bridge Tender Supervisor with a cellular telephone so that he or she will be available 24 hours a day, seven days a week, for immediate contact by the Department or by members of the bridge tending staff. This individual shall respond via telephone to efforts to contact him or her by the Engineer within 15 minutes. Bridge tender supervisors will be required, when necessary, to respond to a bridge site within one hour after notification. The bridge tender supervisor will spend much of his or her time in the field, ensuring that all bridge operations are safe and in accordance with the rules and regulations spelled out in CFR 33 and in the Bridge Operations and Maintenance Manual.

Provide Bridge Tender Supervisors with a picture identification card that will list the bridge he or she supervises. If an emergency situation arises where the supervisor must serve as a bridge tender, he or she must notify the Engineer or his designated representative immediately. Failure to notify the Engineer that the supervisor is serving as a bridge tender will result in a non-conformance assessment as detailed in the non-conformance section of this Contract. A Bridge Tender Supervisor, however, is not authorized to serve as a temporary bridge tender unless he or she has met all the requirements for bridge tender qualification and refresher training.

Bridge tender supervisors must have a minimum of one-year experience as a bridge tender and one-year experience in a supervisory capacity.

Bridge tender supervisors must successfully complete the bridge tender training program in order to meet the qualifications of a trained bridge tender, as spelled out in the Bridge Operations and Maintenance Manual. After employment, they must be trained and tested on all bridge sites in their area of supervision

T465-5.3.3. Mechanic

Provide one mechanic to perform preventative maintenance work and mechanical repairs on the bridges in this contract. At least one mechanic will be on call after normal office hours and on weekends and holidays at all times for emergency repairs.

This mechanic will have at least two years hands-on maintenance or millwright experience, working with mechanical, electrical or hydraulic equipment. Vocational/technical training in mechanical, electrical or hydraulic repair can substitute at the rate of 720 classroom hours for a maximum of one year of the required experience.

T465-5.3.4. Electrician

Provide one electrician to perform preventative maintenance and emergency repairs on the bridges covered by this contract. At least one electrician will be on call after normal office hours and on weekends and holidays at all times for emergency repairs. Provide an electrician that will be capable to respond, via telephone, within 15 minutes if required.

Should their services be needed, electricians are required to respond to the bridge site within one hour following notification, prepared with the necessary equipment, materials and supplies to repair the bridge in a timely and efficient manner.

See FDOT Specification 105-8.10.5.1 for additional information.

T465-5.3.5. Forms

The Department will supply originals of the forms to be used in this contract at the Pre-Construction Meeting. Supply copies of all of these forms needed during the length of the contract. Submit all necessary forms monthly or as directed by the Department:

1. Bridge Tender's Report on Unnecessary Bridge Opening and/or Unauthorized Approach of Vessel: The bridge tender uses this form to document vessels requesting openings to

accommodate outriggers or antennas, or to report vessels that are approaching the bridge in an unsafe manner (Under no circumstances are bridge tenders to engage in verbal altercations with boat captains).

2. Vehicle Traffic Accident on Bridge: This form serves to record all vehicular accidents on the bridge. Please note on the report the responding agency's case number.

3. Bridge Tender Supervisor Inspection Form: Used to monitor overall bridge conditions to ensure high standards are maintained.

4. Monthly Equipment Checklist: On a monthly basis, the bridge tender supervisor will inspect the bridge house to determine that all required equipment and supplies are in stock or are in working order and good condition.

5. Bridge Maintenance Log: Documents the date, time and assignment for any repair or maintenance crew serving the bridge. This will record for future reference when various repairs and maintenance work are performed.

6. Telephone Log: Documents all incoming and outgoing phone calls.

7. Bi-Annual Emergency Generator Checklist: Allows maintenance personnel to document maintenance procedures to the bridges' auxiliary emergency generators.

8. Bridge Tender's Comment Log: Allows bridge tenders on each shift to note problems, incidents or malfunctions.

9. Drawbridge Malfunction Report: This form is filled out jointly by the bridge tender and the repairman responding to the scene to make emergency bridge repairs. The bridge tender fills out the top half of the form, which asks for information regarding the problem the bridge tender is having and date and time the malfunction occurred. The bottom half of the form is filled out by the responding electrician or repairman, who notes the repairs that were made. It is important for the bridge tender to keep track of the amount of time the bridge was down to either marine or vehicular traffic. Managers within the Department use these reports to track the amount of down time for each bridge in a given period of time. It is imperative that this form be completely and accurately filled out each time the operation of the bridge is interrupted due to electrical or mechanical failure.

10. Report of Bridge Accident Caused by Water-Borne Traffic: This three-page report documents any mishaps or accidents involving the bridge structure and marine vessels.

11. Bridge Information: Each bridge needs to maintain its own list of emergency phone numbers for police, fire, and rescue agencies. As a matter of consideration, it is also recommended that other public service agencies, such as mass transit, be kept informed when the bridge is closed to vehicular traffic due to electrical/mechanical malfunctions.

12. Bridge Tender Shift-Change Checklist: When one bridge tender relieves another, this form is used to document the exchange of information regarding bridge problems, malfunctions, or deficiencies.

13. Bridge Tender Safety Equipment Checklist: Used by the bridge tender supervisor to maintain the appropriate safety equipment on bridge and ensure that they are in good working order.

14. Report of Drawbridge Openings: The primary bridge documentation report, this form is used to log the date, time, direction, weather conditions and name of every vessel accommodated by the bridge.

15. Electrical & Mechanical Components: A checklist for electricians and mechanics performing routine preventative maintenance procedures.

16. Supervisors Report: Allows managers to schedule the various mandated inspections.

T465-5.4. Materials

T465-5.4.1. General

A. Furnish all miscellaneous equipment, tools, and supplies required for the maintenance and repair of the bridge, as described in the Bridge Operations and Maintenance Manual for the duration of the Contract.

B. Routine housekeeping supplies including but not limited to toilet paper, brooms, mops, buckets, towels, cleaning solutions, all light bulbs, and batteries (including generator batteries and battery charger) as required.

T465-5.4.2. Parts

Provide new parts. Rebuilt and/or repaired parts can never be used, unless approved in advance by the Engineer. Provide all parts of a brand or quality equal to or better than the ones being replaced and 100 percent compatible with the existing equipment.

T465-5.4.3. Tools

Furnish all miscellaneous equipment, tools, and supplies required for the maintenance and repair of the bridge, as described in the Bridge Operations and Maintenance Manual.

T465-5.4.4. Utilities

Pay for all telephone, electric, water, and sanitary sewer utility charges on existing facilities during the length of the contract. Provide and maintain the telephones on the bridges.

T465-5.4.5. Marine Radios

Maintain all marine radios and antennas.

T465-5.4.6. Plumbing

Assume responsibility for making all repairs to maintain water and sewer service to the bridge house. Those repairs will include, but not be limited to, fixing stopped-up toilets, leaking faucets, broken water and sewer lines and any other repairs that would otherwise be the responsibility of the Department. Provide a portable toilet on the bridge in the event water or sewer service is going to be interrupted for more than 24 hours.

T465-5.4.7. Incidental Materials and Supplies

Assume responsibility for purchasing all fuel, fuel filter, oil filters, air filters, spark plugs, points, bolts, nuts and hoses required to operate and maintain the emergency power generators. Assume responsibility for maintaining the specified fuel for each generator such that the fuel level does not fall below one half of a tank to ensure the bridge's power needs during any emergency. Damage caused by supplying the wrong kind of fuel will be the Contractor’s liability. Top off all fuel tanks at the completion of the contract. Assume responsibility for maintaining the lighting and wiring systems on each bridge and supply and replace all light bulbs and lenses as needed.

At the beginning of the contract, meet with the Engineer to take an inventory of all state-owned equipment on each bridge covered by this Contract. This inventory will be listed on the Monthly Equipment Checklist form. The Contractor is to then sign this form indicating that he/she has received it and will be responsible for this equipment.

At the first of each month for the duration of this contract, conduct a survey of this equipment, and submit a signed form to the Engineer. Replace any missing or damaged equipment at no cost to the Department. If such discrepancies are not resolved within five days, and the Department has to correct them, the Contractor shall be billed for the entire cost incurred by the Department.

T465-5.5. Construction Requirements

T465-5.5.1. General Requirements

General requirements include but are not limited to the following:

A. Bridge tenders shall make the safety of the following a priority:

1. Personal
2. Public
3. Construction and Contractor
4. Bridge structure

B. Do not schedule bridge tenders more than 16 hours of work in a 24-hour period or more than 56 hours in a seven-day work week.

C. Keep the bridge house clean and orderly at all times. Remove all trash or other types of debris found inside the traffic gate areas.

D. Bridge tenders are to provide prompt and courteous service to the boating and motoring public at all times.

E. Maintain a roster of qualified employees throughout the duration of the Contract.

F. Respond in writing to the Engineer to answer any complaints filed by the public, the U.S. Coast Guard, or the Department concerning the conduct of employees or the operation of the bridge. Should complaints be made directly to the Contractor, make the Department aware of such complaints by providing the Engineer with copies of any and all paperwork associated with these complaints along with details of how the matter was resolved.

T465-5.5.2. Bridge Tender Inspection

Weekly inspections of all shifts shall be conducted by the Bridge Tender Supervisors using the Bridge Tender Supervisor Inspection Form.

T465-5.5.3. Preventative Maintenance Inspection

Immediately and appropriately address any preventative maintenance deficiencies discovered as a result of these inspections under this item.

Any deficiencies discovered as a result of these inspections which fall outside the scope of preventative maintenance and require Departmental involvement are to be communicated immediately to the Department so that the Department can take corrective action or authorize the Contractor to take corrective action. When the Department decides to utilize the Contractor's services to rectify any non-preventative maintenance deficiencies, work required to correct such deficiencies shall be considered unforeseen work as defined in FDOT Specification Section 4-4. Give the Department no less than 48 hours advance notice of all preventative maintenance inspections. Perform all work to the satisfaction of the Engineer. The Engineer may elect to inspect any and all work performed at any time.

The results of all inspections are to be recorded and reported to the Department using appropriate forms. All monthly, quarterly, semi-annual and annual inspections as required by the Bridge Operations and Maintenance Manual will be scheduled in advance of the actual inspections. Submit a monthly schedule of all inspections to the Department in advance. The Engineer may elect to be present during the scheduled inspection.

If any problem precludes a scheduled inspection, notify the Engineer as soon as possible. Reports from these inspections are to be submitted to the Engineer's office at the first of each month.

T465-5.5.4. Preventative Maintenance during Construction

Assume the responsibility for all maintenance on the movable bridges from the first chargeable workday through final acceptance, including all aspects of bridge administration, maintenance, repairs and operation. Maintenance Requirements are described below. Provide preventative maintenance services for all bridges included in this Contract. During this period, make immediate repairs of any damage occasioned by use or operation at Contractor expense. In the event that the construction activities or operations result in damage to a bridge requiring repairs, such repairs have a priority right to any equipment, material or labor at the Contractor's disposal. Provide proper maintenance of all components of the mechanical and electrical systems involved in the operation of the bridge covered by this contract.

Assume responsibility for performing all preventative maintenance inspections and services to all mechanical, electrical, hydraulic, and other related systems. Perform all preventative maintenance in accordance with all applicable specifications established for proper maintenance of these bridges. These specifications include the Department's Bridge Operations and Maintenance Manual, as well as any and all manufacturer's manuals for each system's constituent components.

As a minimum, perform at least one inspection per month on each and every component of the bridge system for all bridge systems for all bridges covered under this contract. These monthly inspections will be documented on the electrical and mechanical inspection forms provided by the Department. Any item graded poor or fair shall require timely corrective action. Where Department or manufacturer's specifications require inspections and/or preventative maintenance service intervals more frequent than once a month, schedule and report the completion of these services to the Department.

All work shall be performed to the satisfaction of the Engineer. The Engineer may elect to inspect all work done by the Contractor at any time.

T465-5.5.4.1. Gear Box Oil/Hydraulic Fluid Provision

If the contract is at least one year in length, preventative maintenance shall include the

annual changing of the oil or the hydraulic fluid in all gear boxes and fluid reservoirs. This provision is in addition to any direction in the plans to change the oil in a reservoir as part of the contracted work. The Department will provide the oil or fluid for this yearly procedure. Recycle or dispose of the used oil and fluid in accordance with all federal, state, and local laws and regulations.

T465-5.5.5. Plumbing

Assume responsibility for making all repairs to maintain water and sewer service to the bridge house. Those repairs will include, but not be limited to, fixing stopped-up toilets, leaking faucets, broken water and sewer lines and any other repairs that would otherwise be the responsibility of the Department. Provide a portable toilet on the bridge in the event water or sewer service is going to be interrupted for more than 24 hours.

T465-5.5.6. Air-Conditioning and Heating

Assume responsibility for maintaining the air conditioning and heating units on the bridge, including the monthly cleaning of all air conditioning filters. Notify the Department of an air conditioning breakdown. Provide parts and repair services.

T465-5.5.7. Utilities

Pay for all telephone, electric, water, and sanitary sewer utility charges on existing facilities during the length of the Contract. Provide and maintain the telephones on the bridges.

T465-5.5.8. Bypass Utilization

The bridge tender will NOT, under any circumstances, utilize the bypass switches without proper authorization. Contract personnel are to gain such authorization on each and every occasion from the Bridge Tender Supervisor and the Engineer. Bridge tenders may gain such authorization over the telephone, but an electrician will be expected to follow-up such authorization with an on-site service call to the bridge within one (1) hour of the time that authorization is provided.

T465-5.5.9. Equipment Failures

In the event the bridge becomes inoperable due to an equipment failure, whether the specific item which failed is under contract or not, respond within 30 minutes by notifying the Department via the Engineer or the District Maintenance Engineer, if possible, and initiate corrective action to remedy the situation using the same design configuration.

Document any equipment failure by completing a Preliminary Cause of Failure Report, which must include a description of the event. Submit this report to the Engineer within ten days.

If repair is not possible within a reasonable time, document temporary resolutions for review and approval by the Engineer.

T465-6. METHOD OF MEASUREMENT

A. Movable Bridge General, no separate measurement will be made for the following:

1. Field surveys and verification of dimensions.
2. Coordination requirements.
3. Furnishing operating instruction books or any other submittal requirements.
4. Providing bridge operations and maintenance training.
5. The preparation, review, and transmittal of required submittals and shop drawings.

B. Bascule Leaf Realignment/Adjust Modify Live Load Shoes:

1. The work of furnishing, installing, and adjusting live load shoe shims as described in this Technical Special Provision and on the plan will be paid by a Contract lump sum price.

2. No separate measurement will be made for the removal and proper disposal of the existing shims and associated hardware at the live load bearings.

3. For span lock shim and hardware method of measurement and payment see Technical Special Provision T468.

C. Counterweight and Leaf Balancing:

1. The work of furnishing equipment, labor, and materials required to test, rebalance, and adjust the leaf balances as described in this Technical Special Provision shall be paid for at the Contract price for each of the (1) counterweight locations.

D. Preventative Maintenance: The work of maintaining the bridge for the duration of the Contract shall remain the responsibility of the Contractor and will be measured and paid for by the Plan quantity day.

E. Movable Bridge Operator: The quantity to be paid will be at the Contract unit price per day for the actual days the Movable Bridge Operator is operating the bridge.

F. Movable Bridge Functional Checkout: The quantity to be paid for Movable Bridge Functional Checkout will be at the Contract lump sum price once completed and accepted.

T465-7. BASIS OF PAYMENT

Price and payment will be full compensation for all work specified in this Technical Special Provision, including furnishing and installing all equipment and materials.

Payment will be made under:

Pay Item	Description	Unit
0465-2-508	Movable Bridge Machinery and Castings – Rehabilitation, Adjust & Modify, Live Load Shoes …….....	LS
0465-3-17	Movable Bridge Counterweight, F&I Balance Blocks …….	EA
0465-3-50	Movable Bridge Counterweight, Adjust ……..	EA
0465-20	Movable Bridge Preventative Maintenance & Routine Repair ……	DA
0465-21	Movable Bridge Operator …….….....	DA
0465-71-3	Movable Bridge Functional Checkout, Phase C ……...	LS