DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

Section 581—Pot Bearings

Retain Section 581 as written and add the following:

Disc Bearings

581.6 General Description

This work includes furnishing and installing disc bearings (fixed and expansion types). Use the quality, type, and size designated in this Specification, on the Plans, or ordered by the Engineer.

581.6.01 Definitions

General Provisions 101 through 150.

581.6.02 Related References

A. Standard Specifications

Section 501—Steel Structures

Section 506—Expanded Mortar

Section 535—Painting Structures

Section 851—Structural Steel

Section 852—Miscellaneous Steel Materials

Section 885—Elastomeric Bearing Pads

Section 886—Epoxy Resin Adhesives

Section 887—Bearing Plates with Polytetrafluroethylene Surfaces

B. Referenced Documents

ASTM A 709 Grade 36 (ASTM A 709M Grade 250)

A 709 Grade 50 (A 709M Grade 345)

581.6.03 Submittals

Provide the following reports to the Project Engineer and the Office of Materials and Research:

- Certified test reports
- Materials certificates
- Certificate of Compliance to conform with the requirements in this Specification
- Shop drawings
- Certification

A. Shop Drawings

Before fabricating the bearings, submit to the Engineer Shop Drawings according to Subsection 501.1.03.B, "Shop Drawings." Include the following on the drawings:

- Bearing plan and elevation
- Complete details and sections that show the materials incorporated into the bearing
- ASTM or other material designations
- Vertical and horizontal load capacity
- Rotation and translation capacity
- Compression stress on sliding surfaces and elastomeric surfaces at maximum and minimum design loads
- Complete design calculations
- Complete erection and installation procedure

B. Certification

Have the disc bearing manufacturer furnish the following to the Project Engineer and the Office of Materials and Research:

- Certified test reports
- Material certificates
- Certificate of compliance to conform with these Specifications for each bearing furnished

581.7 Materials

Ensure that materials meet the requirements of the following Specifications:

Material	Section
Painting	535
Structural Steel	851
Anchor Bolts, Nuts, and Washers	852.2.02
Elastomeric Bearing Pads	885
Epoxy Resin Adhesives	886
Bearing Plates with PTFE Surfaces	887

A. Metals

Use the stainless steel sliding surfaces indicated below:

- Stainless Clad Steel Plate: Minimum eight percent stainless steel conforming to the requirements of ASTM A 264 (both Shear Strength and Bond Strength tests in 8.13 and 8.14 of ASTM A 264 are required). Use stainless steel cladding that meets Type 304. Use backing steel (base metal) that meets ASTM Designation A 709 Grade 50W(A 709M, Grade 345 W).
- Stainless Steel Plate Welded To A Steel Backup Plate: Use at least 16 gage (1.6 mm) thickness of the stainless steel plate that meets ASTM 240 Type 304. Use steel backing plate that meets ASTM Designation A 709 Grade 50W (A 709M Grade 345W) unless otherwise indicated on the Plans. Use qualified welders to weld the stainless steel plate to the steel backing. Furnish welding procedures and welder qualification documents to the Department for review and approval prior to fabrication. Weld entirely around the perimeter of the stainless steel plate.
- Solid Stainless Steel Plate: Mill-finish the stainless steel sliding surfaces to a maximum surface roughness of 20 micro-inches (0.50μm), RMS, according to the requirements of ANSI Standard B 46.1. Remove and replace, at no additional cost to the Department, bearing plates whose stainless steel sliding surfaces have been scratched or damaged.

B. Structural Steel

Use structural steel for the masonry plates and the components of the bearings that meet the requirements of these ASTM Specifications:

- ASTM A 709, Grade 36 (ASTM A 709M, Grade 250)
- A 709, Grade 50 (A 709M, Grade 345)

Machine the steel plates confining the disc from solid steel plates.

C. Anchor Bolts

Use anchor bolts, including nuts and washers, that meet the requirements of Subsection 852.2.02.

D. Polyether Urethane Elastomeric Disc

Ensure that the disc material is 100 percent polyether urethane meeting the following Specifications:

Property	Test Method	Range of Values
Hardness, Durometer D	ASTM D 2240	62 + or -2
Tensile Stress psi at 100% elongation at 200% elongation	ASTM D 412 Pulled at 20 in/min. (pulled at 8.5 mm/s)	2,030 minimum 3,771 minimum (14 minimum) (26 minimum)
Tensile Strength	ASTM D 412	5,000 minimum (34.5 minimum)
Ultimate Elongation, %	ASTM D 412	220 minimum
Compression Set, 22 hours at 159 degrees F., % (71° C, %)	ASTM D 395	40% maximum
Compression Strain, % at 5,000 psi stress* (35 MPa)		Strain % 8.0 min 15.0 max

* Compression stress is based on the net plan area of the rotational element and the compressive strain is the percentage of the original thickness. Gross bearing dimensions shall have a tolerance of -0 inch to + 1/8 inch (-0 mm to +3 mm).

E. Shear Restriction Mechanism

Design a shear restriction mechanism to take horizontal forces at all possible vertical loads that consists of a pin connected to the bottom plate and a ring connected to the upper bearing plate.

F. Expanded Mortar

Set anchor bolts in preformed or drilled holes using expanding mortar that meets the requirements of Section 506.

G. Paint

Paint exposed steel of each bearing assembly other than stainless steel according to System VI of Section 535. Take care to keep Polytetrafluroethylene (PTFE) or sliding surfaces free of paint.

H. Design and Applicable Codes

Design, fabricate, and erect disc bearings according to these Specifications and the applicable requirements of the following Standard Codes and Specifications.

- Section 501, including supplements

- Current AASHTO Standard Specifications for Highway Bridges

Additional design parameters with which the disc bearing manufacturer must comply:

1. Bearing on Concrete: Maximum bearing pressure is as indicated in AASHTO.
2. Polyether Urethane Disc: Design compressive strength is 5000 psi (35 MPa).
3. Virgin PTFE: Design compressive strength is 3,500 psi (25 MPa).
4. Sliding Surfaces: Accommodate translation by sliding of a hard mating surface of stainless steel across a PTFE surface.
    a. Stainless Steel Sliding Surface: Accurate, flat surface with Brinnell hardness of 125 minimum.
        1) Stainless steel sliding surface to completely cover PTFE surface in all operating positions of the bearing.
        2) Position the stainless steel sliding surface so that the sliding movement causes the dirt and dust accumulation to fall from the surface of the stainless steel.
    b. PTFE Sliding Surface: Do not use holes or slots in the PTFE sliding surface.
    c. Static Coefficient of Friction: Under a load of 3,500 psi (25 MPa), do not exceed 4 percent for unfilled PTFE nor 8 percent of filled PTFE surfaces.
    d. Rotation: 0.03 radians maximum.

I. Substituted Bearings

Disc bearings may be substituted for the bearings shown on the Plans provided the bearings to be substituted are approved by the State Bridge Engineer and comply with the following:.

1. Equal or better load carrying and moment capacity.
2. All control dimensions are maintained and bearings fit within the limits of detailed masonry plate.
3. Use filled or unfilled (recessed) PTFE.
4. Use Polyether Urethane disc material as a medium within the shear restricted disc bearing.
5. The Polyether Urethane disc shall be lined with PTFE on the bottom side of expansion guided bearings.
6. Do not use aluminum or aluminum alloy.
7. Equal or better than the pot bearings shown on the Plans in all structural respects and meets all design requirements.

581.7.01 Delivery, Storage, and Handling

A. Assembling and Marking

Have each disc bearing assembled at the plant, marked for identification, and delivered to the construction site as a complete unit.

Mark each bearing with permanent match-marks to indicate the normal position of the bearing.

B. Transportation, Storage, and Handling During Construction

Follow these guidelines to transport, store, and handle disc bearings during construction:

1. Protect each disc bearing from dust and moisture.
2. Store the PTFE surface in the shade to avoid the damaging effects of ultraviolet rays.
3. Protect the disc bearings from damage during construction and prevent contamination of the various components of the disc bearings.

Ensure that the Fabricator also follows the above requirements.

During transportation and storage, cover the bearings with moisture-proof and dust-proof covers.

581.8 Construction Requirements

581.8.01 Personnel

A. Skilled Representative

Have the bearing manufacturer provide a skilled representative who is certified by the manufacturer to be experienced in similar installations.

The representative shall:

- Give aid and instruction during the disc bearing installation.
- Be present during the initial bearing installation.
- Be present during welding of the lower steel plates to the masonry plates, if not performed in the manufacturer's shop.
- Remain on the job until the bearing installation proceeds without trouble and until the workmen are experienced with the work for each installation as determined by the Engineer.

Arrange to have the manufacturer's skilled representative present whenever requested by the Engineer.

581.8.02 Equipment

General Provisions 101 through 150.

581.8.03 Preparation

General Provisions 101 through 150.

581.8.04 Fabrication

A. Polytetrafluroethylene (PTFE)

Ensure that the PTFE, including its connection to its backup material, conforms with the requirements of Section 887, except as modified in this Specification.

Have the PTFE sliding surface bonded under factory controlled conditions to a rigid backup material that can resist bending stresses of the sliding surfaces.

As an alternate, PTFE material of twice the thickness specified above may be recessed for half its thickness in the backup material. Ensure that it is at least 1/8 in (3 mm) thick and that the PTFE sliding surface is bonded under factory controlled conditions.

1. When shown on the Plans, weld the lower steel plate to the masonry plate before installing the disc.

   If welding procedures established and approved by the Engineer restrict the temperature of the bond area to no greater than 300 °F (150 °C), welding to steel plates with a bonded PTFE surface is permitted.

   Use temperature-indicating wax pencils or other suitable means to determine the temperature.
2. After fabricating the backup material, plane it before bonding the stainless steel or PTFE to a true plane surface.
3. Have the PTFE sheets bonded at the bearing manufacturer's factory under controlled conditions in accordance with the written instructions of the manufacturer of the approved adhesive system.
4. When epoxy bonding PTFE sheets, ensure that the side of the PTFE sheet to be bonded to the metal is factory treated by the sodium napthalene or sodium ammonia process.
5. After the bonding operation, ensure that the PTFE surface is smooth, flat, and bubble free. Polish the filled PTFE surfaces.
6. Positively locate the elements of the bearing in the bearing manufacturing and assembling.
7. If using bearings other than those detailed on the Plans, obtain approval before constructing the substructure upon which the bearings will be installed.
8. Have each bearing assembled at the manufacturer's plant, marked for identification, and delivered to the construction site as a complete unit.

   Ensure that the bearings have permanent match-marks to indicate the normal position of the bearing.

581.8.05 Construction

A. Erection

Place bearings at their proper locations before erecting the superstructure supported by the bearings.

1. Install Pier Tops

   Install pier tops horizontal at the correct elevation with a plus or minus tolerance of zero. Do not install the masonry plates until the Engineer accepts the pier tops.

2. Install the Anchor Bolts

   Cast anchor bolts in the concrete or set them in preformed holes, unless otherwise shown on the Plans. If setting them in preformed holes, fill the preformed holes in the concrete substructure with epoxy grout.

   a. Insert the anchor bolts to the prescribed depth.

   b. Place additional grout as required in the annular space around the anchor bolts until the grout is well packed and flush with the top surface of the concrete.

   c. Wipe clean the exposed surfaces of the anchor bolts and substructure. Do not allow a load on grout that has not been in place at least 7 days.

3. Install Masonry Plates

   Set the masonry plates to the proper elevation on the previously finished concrete pads.

4. Install the Bearings

   a. Place the bearing at the predetermined locations when erecting the superstructure.

   b. Remove the temporary restraints as directed by the bearing manufacturer.

   c. Adjust the bearings as follows:

      - Adjust the expansion bearings from the normal position at 60 °F (15 °C) to allow for the ambient temperature during erection or casting.
      - Adjust the disc bearings to allow them to move when dead loads are applied. Ensure that the bearing is properly positioned and parallel (free from rotation) after applying the dead load.
      - Adjust the bearings horizontally on the masonry plate to properly fit the superstructure members being erected.

   d. After adjustments and approval by the Engineer, weld the bearings to the masonry plate.

581.8.06 Quality Acceptance

Instruct the manufacturer to furnish facilities to test and inspect the completed bearings in the plant or at an independent test facility. An approved testing laboratory or the manufacturer supervised by an approved independent expert shall perform the testing.

Follow these testing guidelines:

- Instruct the manufacturer to allow the Engineer and Inspectors access to the plant and test facilities.
- Furnish certified test reports, materials certificates, and a certificate of compliance to conform with the requirements in the Specifications.
- Perform testing according to Section 887 and this Specification. The Department reserves the right to sample and test the material and disc bearing assemblies as shown in Section 106.
- Test complete bearing assemblies or a specially manufactured disc bearing prototype that has a capacity of 400 kips (181 000 kg).

Successfully tested full-size bearings that meet the requirements of this subsection and have no damaged components, finishes, or surfaces may be used in construction. Provide prototype disc bearings, if used, at no additional expense to the Department.

Specific Items tested are as follows:

A. Coefficient of Friction

Perform tests to determine the static coefficient of friction of the first movement under a load of 3,500 psi (25 MPa) on a disc area applied continuously for 12 hours before testing. Determine under a load of 2,000 psi (14 MPa) on a disc area the following:

1. The static coefficient of friction value shall not exceed 10 percent for filled PTFE surfaces and 6 percent for unfilled PTFE surfaces.
2. The first movement static and dynamic coefficient of friction at a sliding speed of less than 1 in per min (0.4 mm per sec). Values shall not exceed 10 percent for filled PTFE surfaces and 6 percent for unfilled PTFE surfaces.
3. The static and dynamic coefficient of friction is determined after the bearing is subjected to 100 design movements at a speed of less than 1 ft per min (5 mm per sec). Values shall not exceed those indicated in step 2 above. Signs of bond failure or other defects are cause for disc bearing rejection.

B. Proof Loading

Perform, under maximum design loads, proof loading and compression deflection tests on a full-size disc bearing.

C. Rotation

The Polyether Urethane element shall be capable of retaining initial contact with the steel bearing plates through the rotational range under a compressive load equal in magnitude to the design load.

D. Cold Flow

Subject an approved sample of filled PTFE or unfilled PTFE to a static pressure of 3,500 psi (25 MPa) for at least 24 hours. Ensure that the PTFE material is bonded or mechanically connected to its backup material in the same way as the disc bearing.

Apparent cold flow of the PTFE material is cause for disc bearing rejection.

581.8.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

581.9 Measurement

Disc bearing assemblies are measured by Lump Sum for each bridge. Determine the actual quantities required before submitting the bid.

581.9.01 Limits

General Provisions 101 through 150.

581.10 Payment

The work in this Specification will be paid for on a Lump Sum basis.

Payment is full compensation for:

- Furnishing materials and equipment including structural steel components of the bearings, masonry plates, top plates, sole plates, PTFE, Polyether Urethane Disc, anchor bolts, and welding
- Designing the disc bearing
- Performing tests
- Furnishing prototype bearings and test samples
- Performing Work as described and specified in this Specification or the Plans
- Providing incidentals to complete the work

Payment will be made under:

Item No. 581	Pot bearings, bridge No.___	Per lump sum

581.10.01 Adjustments

General Provisions 101 through 150.