## REVISION REGISTER

<table>
<thead>
<tr>
<th>Clause Number</th>
<th>Description of Revision</th>
<th>Authorised By</th>
<th>Issue Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole document</td>
<td>Reformatted</td>
<td>SCO</td>
<td>09/05/2017</td>
</tr>
<tr>
<td>Whole document</td>
<td>Complete review – no change</td>
<td>A/SDSE</td>
<td>11/06/2010</td>
</tr>
<tr>
<td>860.28.3 &amp; 860.29.8</td>
<td>Amended</td>
<td>SDSE</td>
<td>13/06/2007</td>
</tr>
<tr>
<td>Table 860.2</td>
<td>New Table, “Coefficient Of Friction For Unlubricated Sliding Surfaces” added</td>
<td>SDSE</td>
<td>13/06/2007</td>
</tr>
<tr>
<td>Whole document</td>
<td>Complete revision of Issue 2.1 to new format</td>
<td>MCP</td>
<td>01/08/2006</td>
</tr>
</tbody>
</table>
CONTENTS

Clause | Page No
--- | ---
GENERAL | 4
860.01 Scope | 4
860.02 References | 4
860.03 - 860.09 NOT USED | 4
860.10 Elastomeric Bearings | 4
860.11 Pot Bearings | 4
860.12 - 860.25 NOT USED | 5
DESIGN AND MANUFACTURE | 5
860.26 General | 5
860.27 Acceptance Tests for Elastomeric Bearings | 5
860.28 Design of Pot Bearings | 7
860.29 Acceptance Tests for Pot Bearings | 8
860.30 Rejection | 9
860.31 Transport and Delivery | 9
860.32 – 860.40 NOT USED | 9
INSTALLATION | 9
860.41 Location and Fixing of Elastomeric Bearings | 9
860.42 Location and Fixing of Pot Bearings | 10
860.43 Inspection of Pot Bearings | 10
860.44 Installation of Elastomeric Bearings | 10
860.45 Installation of Pot Bearings | 10
820.46 Tolerances for Installation | 11
860.47 – 860.80 NOT USED | 11
AS BUILT AND HANDOVER REQUIREMENTS | 11
860.81 – 860.90 NOT USED | 11
CONTRACT SPECIFIC REQUIREMENTS | 11
860.91 – 860.99 NOT USED | 11
ANNEXURE 860A | 12
Supply of Bearings by Principal | 12
SPECIFICATION 860
BRIDGE BEARINGS

GENERAL

860.01 SCOPE

1. The work under this specification consists of the design, manufacture, testing, delivery and installation of bridge bearings.

860.02 REFERENCES

1. Australian Standards, MAIN ROADS Western Australia Standards and MAIN ROADS Western Australia Test Methods are referred to in abbreviated form (e.g. AS 1234, MRS 67-08-43 or WA 123). For convenience, the full titles are given below:

   Australian Standards
   AS 5100.4  Bridge Design - Bearings and Deck Joints

   Australian/New Zealand Standards
   AS/NZS 3679.1  Structural Steel – Hot Rolled Bars and Sections
   AS/NZS 4680  Hot-dip Galvanised (Zinc) Coatings on Fabricated Ferrous Articles

860.03 - 860.09 NOT USED

860.10 ELASTOMERIC BEARINGS

1. Elastomeric Bearings to be supplied under this Contract shall comprise of laminated rubber elastomeric bearings and are designated on the Drawings by their AS Part Numbers as given in Tables A1 to A20 of AS 5100.4.

2. Bearings shall be of the sizes shown on the Drawings within the tolerances given in Appendix C of AS 5100.4.

860.11 POT BEARINGS

1. All materials used in the manufacture of the pot bearings shall conform to the relevant Australian Standards. The bearing units shall be simple to maintain or maintenance free and shall be suitably protected against corrosion and the ingress of dirt and other material. Non-metallic materials shall be chemically inert.

2. All exposed ferrous material components shall be hot-dip galvanised in accordance with the requirements of AS/NZS 4680 and shall have a minimum thickness of 85 microns.
3. The elastomer shall be natural rubber of IHRD 53 ± 5 complying with the requirements of AS 5100.4. Rubber pads shall have metallic sealing rings and in no case shall the clearance between sealing ring and cylinder exceed 400 micrometres with the ring hard up on any side of the pot.

4. Where sliding pot bearings are proposed, the PTFE pad shall consist of sheet manufactured from 100% virgin polytetrafluoroethylene (PTFE) resins. The PTFE pad shall contain lubricant retention cavities complying with the requirements of Clause 14.2 of AS 5100.4.

5. The Contractor shall lubricate the bearing surface of the PTFE pad with Dow Corning DC 44 or similar approved by the Superintendent.

6. Where constrained bearings are proposed, the sliding surfaces of the constraints shall be of approved materials exhibiting a coefficient of friction of not more than 8%.

860.12 - 860.25 NOT USED

DESIGN AND MANUFACTURE

860.26 GENERAL

1. Bearings shall comply with the requirements of AS 5100.4 except as varied by this Specification. Acceptance of bearings will depend on satisfactory completion of load tests as set out in Clause 860.27 for elastomeric bearings, and in Clause 860.29 for pot bearings.

860.27 ACCEPTANCE TESTS FOR ELASTOMERIC BEARINGS

860.27.01 GENERAL

1. The load testing of bearings is part of the acceptance requirements of this Specification. All tests shall be carried out in a testing laboratory certified by the National Association of Testing Authorities Australia for the type of bearing and class of test concerned.

2. Testing shall be carried out on completion of manufacture of all bearings. Acceptance of bearings will be dependent upon satisfactory completion of the tests detailed below:

   a. Compression test in accordance with Clause 860.27.02.
   
   b. Stability test in accordance with Clause 860.27.03.
   
   c. Proof loading in accordance with Clause 860.27.04.
   
   d. Determination of bearing stiffness in accordance with Clause 860.27.05.

3. A full description of the sequence and method of application of loads shall be recorded by the Contractor.
4. Test loads shall be applied slowly and at a uniform rate. When the specified loading has been attained it shall be maintained steady sufficiently long for a physical examination of the bearing or for two minutes whichever is the greater before unloading. If any damage occurs, then the load and time at which any damage begins to occur shall be recorded.

860.27.02 COMPRESSION TEST

1. All bearings shall be loaded individually to 1.5 times the rated load at zero rotation and zero shear given on the Drawings or in the relevant table of the AS 5100.4.

860.27.03 STABILITY TEST

1. 50% of bearings of the same capacity and type shall be loaded in pairs under the rated load at zero shear.

2. Lateral deflections of rectangular bearings shall be recorded in directions parallel to width and length dimensions. One bearing in the pair shall then be rotated through 180° in the horizontal plane. The pair shall then be reloaded with the maximum rated load and the lateral deflection parallel to each dimension again recorded at the same points on the non-rotated bearing. From these two results the lateral deflections for each bearing alone shall be calculated.

3. In case of bearings which are circular in plan one bearing shall be rotated with respect to the other for a series of equal loads until an orientation producing maximum lateral deflection is located. The bearings shall then be loaded under the maximum rated load and the maximum radial lateral deflection measured. The bearings shall be permanently marked and then reloaded with one bearing rotated through 180° with respect to the other. The lateral radial deflection shall then be measured at the same point on the non-rotated bearing and the lateral deflection for each bearing alone shall be calculated.

4. Any bearing in which the lateral deflection in any direction under the test load is greater than 5% of the vertical height of the bearing shall be rejected.

860.27.04 PROOF LOADING

1. The Contractor shall carry out the tests set out in Table 860.1 on one pair of bearings of each type and capacity. The bearings shall be loaded in stacked pairs in the test apparatus.

2. During the test described at (b) or (c) in Table 860.1, the net contact area shall be not less than 80% of the unloaded bearing area.
TABLE 860.1 PROOF LOADING TEST

| (a) | The rated load at zero rotation and maximum shear plus 1.5 x the maximum rated shear deflection. |
| (b) | 1.5 x rated load at zero rotation and maximum shear plus 1.0 x the maximum rated shear deflection. |
| (c) | 1.5 x the maximum rated shear deflection plus 0.5 x rated load at zero rotation and maximum shear. |

860.27.05 STIFFNESS

1. Bearings shall be tested to determine their compressive and shear stiffness.

2. All bearings shall be tested for compressive stiffness in accordance with Clause D3 of AS5100.4. Testing for compressive stiffness may be carried out in conjunction with the compression test. The mean compressive stiffness of all bearings tested shall be within 15% of the value given in AS 5100.4 and the compressive stiffness of any individual bearing shall be within 15% of the mean.

3. 50% of bearings of each type, with a minimum of two bearings, shall be tested for shear stiffness in accordance with Clause D4 of AS 5100.4. The shear stiffness of any bearing shall be within 20% of the value given in AS 5100.4.

860.28 DESIGN OF POT BEARINGS

1. The bearings shall be free to rotate and to accommodate expansion and contraction of the structure in the directions and to the extents indicated on the Drawings. Throughout the range of movements indicated, the bearings shall be capable of carrying the vertical and lateral loads as set out on the Drawings.

2. Dimensional requirements of the bearings and arrangements for fixing are given on the Drawings. Variations from these may be acceptable, details must be submitted at time of tender.

3. Where bearing units are required to permit movements by sliding, the sliding requirement and frictional characteristics shall be in accordance with Clause 14 and Clause 11.2 of AS 5100.4 respectively.

4. The design of all bearings shall also take into account the combinations of loads and associated criteria specified for the acceptance testing.
860.29 ACCEPTANCE TESTS FOR POT BEARINGS

1. Upon completion of manufacture, and before final assembly of all the bearing units, the Contractor must notify the Superintendent in writing that the bearings are ready for inspection. The Superintendent shall inspect the internal components of each bearing unit prior to final assembly of the bearings.

2. To prevent the possibility of metal-to-metal contact under service conditions, all sliding bearings must be checked after final assembly and there must be a minimum clearance of 2.0mm between any opposed horizontal metal surfaces.

3. Pot bearing acceptance tests are required and shall be carried out in the presence of the Superintendent at a testing laboratory certified by the National Association of Testing Authorities Australia for the type of bearing and class of test concerned. Load testing shall be in accordance with Clause 13.2 of AS 5100.4 and as outlined below.

4. Testing shall be carried out on completion of manufacture of all bearing types. The Contractor shall give at least 4 weeks written notice of intention to test bearings to the Superintendent to enable adequate arrangements to be made for inspection.

5. A minimum of two bearing units from 10 identical bearings, or part thereof, of each type supplied shall be tested by the Contractor in the presence of the Superintendent.

6. Test loads shall be applied slowly and at a uniform rate. In tests where both vertical and horizontal loads are required, they may be applied simultaneously or independently. Where horizontal and vertical loads are applied independently, the horizontal load shall be applied after the vertical load. When the specified loading has been attained it shall be maintained steady sufficiently long for a physical examination of the bearing or for two minutes, whichever is the greater, before unloading.

7. Where the pot bearing is a sliding type, the coefficient of friction shall be determined by a separate test under the vertical load from Permanent Effects only. Before determining the coefficient of friction, the bearing sliding surfaces under load shall be moved forward and backward once to bed the surfaces. The horizontal load in the direction of sliding shall be monitored continuously throughout the test. The coefficient of friction shall be determined by the ratio of the horizontal load, measured when the surfaces of the bearing just begin to slide, to the applied vertical load, and shall be the average value from three separate tests. The tests shall be carried out with the PTFE in the unlubricated condition. The maximum measured coefficient of friction must not exceed the values specified in Table 860.2 for the relevant stresses on the PTFE. On completion of testing, the bearing surface shall be lubricated with Dow Corning DC 44 or similar approved by the Superintendent.
TABLE 860.2  COEFFICIENT OF FRICTION FOR UNLUBRICATED SLIDING SURFACES

<table>
<thead>
<tr>
<th>Bearing Pressure</th>
<th>5 MPa</th>
<th>10 MPa</th>
<th>15 MPa</th>
<th>20 MPa</th>
<th>30 MPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient of Friction</td>
<td>0.08</td>
<td>0.06</td>
<td>0.05</td>
<td>0.04</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Note: Friction values for intermediate bearing pressures shall be linearly interpolated.

8. Should any bearing exhibit any signs of damage or permanent distortion either during or after test loading or should the horizontal coefficient of static friction exceed the value specified in Clause 860.28, this shall constitute a failure under test and shall be cause for rejection of all bearings of the type represented. Bearings exhibiting any signs of damage or permanent distortion before testing shall be rejected.

9. The satisfactory test performance of any bearing does not preclude it from being rejected if it shows signs of damage or permanent distortion after delivery.

10. All costs incurred in testing shall be borne by the Contractor and considered as incidental to the supply of bearings.

860.30  REJECTION

1. Where a bearing is rejected on the basis of unacceptable test performance, the Contractor may elect to test all bearings of the type represented and only bearings successfully passing the tests may be accepted. In addition all replacement bearings shall be acceptance tested. The cost of all additional testing shall be at no cost to the Principal.

860.31  TRANSPORT AND DELIVERY

1. The Contractor shall take all necessary precautions to prevent damage to the bearings during handling, storage and delivery to site.

2. All elastomeric bearings shall be clearly labelled with the project name, AS Part Number and test number referred to in the test certificate, together with any other relevant information.

3. All pot bearings shall be marked and identified in accordance with Clause 13.3 of AS 5100.4.

4. If bearings are to be lifted by crane they shall be lifted on a properly designed platform. Wire rope slings shall not contact the bearings during handling.

860.32 – 860.40  NOT USED

INSTALLATION

860.41  LOCATION AND FIXING OF ELASTOMERIC BEARINGS

1. All bearings shall be placed on mortar pads and shall be located in position on the abutments and piers by steel dowels which shall protrude through the lower outer steel plate unless otherwise shown on the Drawings.
860.42 LOCATION AND FIXING OF POT BEARINGS

1. Fixing arrangements including oversize holes are indicated on the Drawings to accommodate construction tolerances. The bearings shall be proportioned to accommodate the oversize holes together with appropriate bolts and washers unless alternative arrangements are approved.

2. The bearing units shall be constructed so as to be capable of being temporarily secured in their correct relative positions during installation and pouring of the deck concrete. The fixing arrangement of the pot bearings shall be designed to permit future removal of the bearings without raising the bridge deck in excess of 5mm and shall accommodate the raising of the bearing level up to 20mm resulting from settlement of the structure.

3. The Contractor shall supply all necessary fixings with the pot bearings. All fixings shall be hot-dip galvanised.

4. The Contractor shall supply and install 10mm thick galvanised steel shims between the top of each pot bearing and the deck soffit as nominated on the Drawings. Shims shall be manufactured from steel Grade 300 to AS/NZS 3679.1 and galvanised. Shims shall be slotted and plan size shall be determined to suit the Contractor’s chosen pot bearing dimensions. The bearing top fixing bolts shall be removable to allow shims to be removed as settlement occurs.

860.43 INSPECTION OF POT BEARINGS

1. The internal components of each pot bearing shall be inspected prior to final assembly of the bearing units.

2. To prevent the possibility of metal to metal contact under service conditions, all sliding bearings shall be checked after final assembly and there shall be a minimum clearance of 2.0mm between any opposed horizontal metal surfaces.

860.44 INSTALLATION OF ELASTOMERIC BEARINGS

1. All elastomeric bridge bearings shall be installed to the requirements of this Specification and the details shown on the Drawings.

2. Grout pads shall be well compacted and shall be constructed with formed sides as detailed on the Drawings. Bearings may be used to set the levels of the pad but shall be removed for inspection of the finished pad.

3. The pads shall consist of an approved non shrink cementitious grout with a minimum of 28 days compressive strength of 30MPa when tested using a 70mm cube, or as specified on the Drawings. A minimum of two cubes shall be taken from each batch of mortar mixed.

860.45 INSTALLATION OF POT BEARINGS

1. The Contractor shall be responsible for the installation of the bearings in accordance with the manufacturer’s published recommendations and to the lines and levels shown on the Drawings.
2. Grout packing shall be with an approved non shrink cementitious grout mixed and placed in accordance with the manufacturer's published recommendations.

3. The grout shall have a minimum 28 day compressive strength of 40MPa when tested using a 70mm cube, or as specified on the Drawings. A minimum of two cubes shall be taken from each batch of mortar mixed.

820.46 TOLERANCES FOR INSTALLATION

1. Bearings shall be installed to the following tolerances:
   a. Misplacement of centre lines ± 3mm
   b. Variation from specified level at centre ± 3mm
   c. Inclination from horizontal 1 in 300

860.47 – 860.80 NOT USED

AS BUILT AND HANDOVER REQUIREMENTS

860.81 – 860.90 NOT USED

CONTRACT SPECIFIC REQUIREMENTS

860.91 – 860.99 NOT USED
ANNEXURE 860A

SUPPLY OF BEARINGS BY PRINCIPAL

<table>
<thead>
<tr>
<th>Description</th>
<th>Number</th>
<th>Location</th>
<th>Time of Availability (Weeks after Commencement of Contract)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(NOTE: This Annexure is used in conjunction with Clause 860.91 and should be varied as required to suit. Delete this note, and the Annexure, where not applicable)
GUIDANCE NOTES

FOR REFERENCE ONLY – DELETE GUIDANCE NOTES FROM FINAL DOCUMENT

1. All edits to downloaded Specifications shall be made using Track Changes, to clearly show added/deleted text.

2. If all information relating to a clause is deleted, the clause number should be retained and the words “NOT USED” should be inserted.

3. The proposed documents with tracked changes shall be submitted to the Project Manager for review, prior to printing the final batch of documents. When this final printing is carried out, the tracked changes option is to be turned off.

4. Before printing accept all changes in the document, turn off Track Changes and refresh the Table of Contents.

5. The Custodian of this specification is the Structures Design and Standards Engineer.

---

1. CLAUSE 860.91 BEARINGS SUPPLIED BY THE PRINCIPAL:

If the Principal will pre-supply bearings, include Clause 860.91 and complete Annexure 860A.

1.1 Annexure 860A is provided for listing Principal supplied items such as pre-tested bearings, in which case the clauses relating to materials, manufacture and testing should be deleted (Clauses 860.26 to 860.40). The description to be entered in Annexure 860A should include identification with items shown on the Drawings as well as the size and weight, and the location for pick-up of bearings.

2. BEARING TYPE:

If elastomeric bearings only are specified, mark all clauses for pot bearings as “Not Used” and delete the other sub-clauses as appropriate. If pot bearings only are specified, mark all clauses for elastomeric bearings as “Not Used” and delete the other sub-clauses as appropriate.

3. CLAUSE 860.41 LOCATION AND FIXING OF ELASTOMERIC BEARINGS:

If Drawings show elastomeric bearings placed on epoxy pads, remove all reference to mortar in this clause and to grout and mortar in 860.44.
CONTRACT SPECIFIC REQUIREMENTS

860.91 BEARINGS SUPPLIED BY THE PRINCIPAL

1. The Principal will make available free of charge to the Contractor permanent bearings as listed in Annexure 860A to be used in the Works.

2. The Contractor shall be responsible for collecting and transporting and installing the bearings as shown on the Drawings.

3. The items will be available at the commencement of the Contract.

4. The Contractor shall supply all dowels, mortar and other materials required for satisfactory installation of the bearings.
# AMENDMENT CHECKLIST

Specification No.  **860**  
Title: **BRIDGE BEARINGS**  
Revision No: __________

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>SIGN OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Project Manager has reviewed Specification and identified Additions and Amendments.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Any unlisted materials/products proposed and approved by the Project Manager? If “Yes” provide details at 16.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Clause deletes shows as “NOT USED”.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Appropriate <strong>INSPECTION AND TESTING</strong> parameters included in Spec 201 (Text Methods, Minimum Testing Frequencies verified).</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td><strong>HANOVER</strong> and <strong>AS BUILT</strong> requirements addressed.</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Main Roads QS has approved changes to <strong>SMM</strong>.</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Project Manager certifies completed Specification reflects intent of the design.</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Completed Specification – independent verification arranged by Project Manager.</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Project Manager’s review completed.</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td><strong>SPECIFICATION GUIDANCE NOTES</strong> deleted.</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td><strong>TABLE OF CONTENTS</strong> updated.</td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Supporting information prepared and submitted to Project Manager.</td>
<td></td>
</tr>
</tbody>
</table>

Further action necessary:

Signed: __________________________ (Project Manager)  
Date: __________