TENDER DOCUMENTS

SUBSECTION 6.62
BRIDGE BEARINGS

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SUBSECTION 6.62 BRIDGE BEARINGS

6.62.1 GENERAL

6.62.1.1 This subsection sets out the requirements relating to the installation and replacement of bridge bearings.

6.62.1.2 Any specific requirements pertaining to the installation and replacement of bridge bearings under this Contract are set out on the drawings and in Section 4 *Special Technical Conditions*.

6.62.1.3 The requirements relating to reinforcing steel are described in subsection 6.31 *Reinforcing Steel for Concrete*.

6.62.1.4 The requirements relating to formwork are described in subsection 6.32 *Formwork*.

6.62.1.5 The requirements relating to cast-in-place concrete are described in subsection 6.33 *Cast-in-Place Concrete*.

6.62.1.6 The requirements relating to steel work are described in subsection 6.41 *Steel Work.*

6.62.1.7 The requirements relating to bridge jacking are described in subsection 6.61 *Bridge Jacking.*

6.62.2 MEASUREMENT UNITS

6.62.2.1 The measurement units and respective symbols thereof used in this subsection are described as follows:

Measurement Unit	Designation	Symbol
length	millimeter	mm
length	micrometer	µm
stress, pressure	megapascal	MPa
temperature	Celsius degree	°C

6.62.3 REFERENCE STANDARDS

6.62.3.1 The **Contractor** shall perform all work related to the installation and replacement of bridge bearings in accordance with the following standards and documents to which the provisions of this Contract are added:

6.62.3.1.1 (ASTM) ASTM International:

- ASTM A123/A123M *Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products*;

- ASTM A1011/A1011M *Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength*;
- ASTM B22/B22M *Standard Specification for Bronze Castings for Bridges and Turntables*.

6.62.3.1.2 CAN/CSA Group (Canadian Standards Association):

- CAN/CSA-A23.1/A23.2 *Concrete: Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete*;
- CAN/CSA-A23.3 *Design of Concrete Structures*;
- CAN/CSA-G40.20/G40.21 *General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel*;
- CAN/CSA S6 *Canadian Highway Bridge Design Code.*

6.62.3.1.3 (MTQ) Ministère des Transports du Québec:

- MTQ – *Cahier des charges et devis généraux* (CCDG).

6.62.4 MATERIALS

6.62.4.1 GENERAL

6.62.4.1.1 The **Contractor** is responsible for choosing the manufacturers of the products used and for the performance of those products once they are in place.

6.62.4.1.2 The Engineer may reject any materials that have not met the technical requirements in previous projects of the same type, in the opinion of the **Owner**.

6.62.4.1.3 The design and manufacturing of the bridge bearings shall comply with standard CAN/CSA S6. The installation of the bridge bearings shall comply with the manufacturer's recommendations.

6.62.4.1.4 The **Contractor** shall adapt the design of the bridge bearings it plans to use on the basis of the preliminary design details indicated on the drawings. The **Contractor** shall also demonstrate to the Engineer that the proposed bridge bearings are suitable both for the conditions of use and for the expected service loads. In addition, the **Contractor** shall assume, full responsibility for the types of bridge bearings it plans to use and for any costs that may result therefrom.

6.62.4.1.5 The bridge bearings shall be designed and dimensioned so as to meet the load, movement and space requirements indicated on the drawings and shall comply with standard CAN/CSA S6.

6.62.4.1.6 The design notes and shop drawings shall be signed and sealed by an engineer who is a member of the *Ordre des ingénieurs du Québec* (OIQ) and has at least ten (10) years of relevant experience in the design of bridge bearings of the type required by this Contract.

6.62.4.1.7 At least fourteen (14) days prior to the start of manufacturing, the **Contractor** shall submit to the Engineer, for review, the design notes, technical data sheet and shop drawings of the bridge bearings used.

6.62.4.1.7.1 The shop drawings shall include, without however being limited to, the following:

6.62.4.1.7.1.1 dimensions of bridge bearings;

6.62.4.1.7.1.2 maximum movements at serviceability limit states;

6.62.4.1.7.1.3 minimum and maximum loads at serviceability limit states and ultimate limits;

6.62.4.1.7.1.4 total rotation at the ultimate limit states for confined elastomeric bridge bearings;

6.62.4.1.7.1.5 details of the arrangement and spacing of the anchors;

6.62.4.1.7.1.6 bearing plates.

6.62.4.2 BRIDGE BEARINGS

6.62.4.2.1 Laminated elastomeric bridge bearings

6.62.4.2.1.1 The laminated bridge bearings shall be die-cast in a single block and heated in smooth-finish blocks.

6.62.4.2.1.2 The laminated bridge bearings shall be made of natural rubber having a hardness of 55 ± 5 and shall contain steel frets.

6.62.4.2.1.3 The natural rubber shall withstand the weather conditions prevailing at the work site on the bridge. It shall be virgin natural polyisoprene or virgin polychloroprene.

6.62.4.2.1.4 The elastomer and steel laminae shall meet, without however being limited to, the following requirements:

6.62.4.2.1.4.1 the elastomer and steel laminae shall be of uniform thickness;

6.62.4.2.1.4.2 the steel laminae shall be made of 3 mm thick rolled mild sheet steel, having a minimum yield strength of 260 MPa, compliant with standard CAN/CSA G40.21, or grade 36, Type 1, compliant with standard ASTM A1011/A1011M;

6.62.4.2.1.4.3 the inner steel laminae shall have no sharp edges;

6.62.4.2.1.4.4 the steel laminae shall be fully bonded to the elastomer on all surfaces during casting;

6.62.4.2.1.4.5 the lateral surface elastomer cover shall be at least 6 mm thick. The outer layer cover thickness, at the top and bottom, shall not exceed 70% of the thickness of a single elastomer inner layer;

6.62.4.2.1.4.6 the spacing of the steel laminae shall be less than the smallest dimension of the elastomer, divided by sixteen (16);

6.62.4.2.1.4.7 the average compressive strain of each elastomer layer shall be less than 7% of their respective thickness.

6.62.4.2.1.5 The following are some bridge bearings that meet the requirements described above:

- *EL Series* bridge bearing, manufactured by Goodco Z-Tech;
- *LE Series* elastomeric bridge bearing, manufactured by LCL-Bridge Products Technology Inc.

6.62.4.2.2 Bridge bearings with replaceable confined elastomeric

6.62.4.2.2.1 The elastomeric material shall be a natural rubber-based compound resistant to the weather conditions prevailing at the work site.

6.62.4.2.2.2 The bridge bearings shall be fitted with a 3 mm thick neoprene protective skirt fixed to the upper plate to minimize the seepage of contaminants.

6.62.4.2.2.3 The steel shall be 300W or 350W grade and compliant with standard CAN/CSA G40.21.

6.62.4.2.2.4 Exposed steel shall be hot dip galvanized in accordance with standard ASTM A123/A123M.

6.62.4.2.2.5 The bridge bearings shall be equipped with lateral adjustment screws or with an equivalent device that allows for the precise adjustment of the bearing alignment to ensure a rectilinear sliding between the lateral retaining bars. The bridge bearings shall be designed so as to make it possible for the bearing plates to be firmly secured in place after final adjustment of the alignment.

6.62.4.2.2.6 The bridge bearings shall be equipped with a longitudinal adjustment device that allows for the precise adjustment of the bridge bearing's longitudinal position according to the temperature at the time of installation and to ensure optimum positioning. The bridge bearings shall be designed so as to make it possible for the bearing plates to be firmly secured in place after the final longitudinal adjustment.

6.62.4.2.2.7 Where indicated on the drawings, the bridge bearings shall be fitted with reinforced plates that allow the insertion of four (4) lifting jacks at the corners between the plates in order to lift the structure under the permanent load conditions and replace the replaceable parts of the bridge bearing, without having to install lifting systems in future maintenance works.

6.62.4.2.2.8 The following are some bridge bearings that meet the requirements described above:

- *PMG* bridge bearing manufactured by Goodco Z-Tech;
- *L-PG Series*, manufactured by LCL-Bridge Products Technology Inc.

6.62.4.2.3 Self-lubricating bronze spherical mobile bridge bearings

6.62.4.2.3.1 The steel shall comply with standard CAN/CSA-G40.21 and be 300W or 350W grade.

6.62.4.2.3.2 The exposed steel of bridge bearings shall be metallized in accordance with the CCDG.

6.62.4.2.3.3 The exposed steel of the transition plate, adjustment plates and pedestals shall be galvanized in accordance with standard ASTM A123/A123M or metallized.

6.62.4.2.3.4 The bronze spherical plate shall comply with standard ASTM B22/B22M and be C86300 grade.

6.62.4.2.3.5 The self-lubricating bronze plate shall be fitted with bored or drilled recesses, which shall be filled with a lubricant. The lubricating surface shall represent 25% of the total surface and the lubricant shall have the following characteristics:

6.62.4.2.3.5.1 the solid lubricant shall consist of a combination of solids having non-degrading properties and lubricity and shall be able to withstand airborne exposure, de-icing materials and water over the long term;

6.62.4.2.3.5.2 the lubricant shall remain effective at -40°C;

6.62.4.2.3.5.3 the lubricant shall be compatible with all bridge bearing components to avoid any electrolytic or chemical reactions there between;

6.62.4.2.3.5.4 no tar, grease, petroleum solvent or other non-lubricant binder shall be used;

6.62.4.2.3.5.5 the static coefficient of friction shall not be greater than 0.1.

6.62.4.2.3.6 All plates used in the manufacturing of the bridge bearings, including the beveled plates, adjustment plates, transition plates and pedestals shall have a minimum thickness of 25 mm.

6.62.4.2.3.7 The sliding surfaces of the bronze plate and steel plates on which the movement occurs shall be machined so as to obtain a maximum roughness of 3.2 µm.

6.62.4.2.3.8 The manufacturing tolerance required for the realization of the radius of curvature on the bronze plate shall comply with a size that has not been reduced by more than 0.25 mm on the radius of curvature in accordance with the drawings. In no case shall the size of the radius of curvature of the bronze plaque exceed the size of radius of curvature indicated on the drawings by more than 0.25 mm.

6.62.4.2.3.9 The manufacturing tolerance required for the realization of the radius of curvature on the upper concave plate shall comply with a size that has not been reduced by more than 0.25 mm on the radius of curvature in accordance with the drawings. In no case shall the size of the radius of curvature of the bronze plate exceed the size of radius of curvature indicated on the drawings by more than 0.25 mm.

6.62.4.2.3.10 All surfaces of the steel plates that come into contact with one another shall be machined so as to obtain a maximum roughness of 6.4 µm.

6.62.4.2.3.11 The bridge bearings shall be fitted with a 3 mm thick removable neoprene protective skirt fixed to the upper plate to minimize the seepage of contaminants.

6.62.4.2.3.12 A beveled plate shall be used, when necessary, to give the bridge bearing a leveled loading surface.

6.62.4.2.3.13 The **Contractor** shall provide all the filler plates required to adjust the bridge bearings according to the installation tolerances.

6.62.4.2.3.14 The bridge bearings shall have an integrated reference system for reading the displacements and rotation relative to a fixed point.

6.62.4.2.3.15 The design of the self-lubricating bronze spherical mobile bridge bearings shall meet, without however being limited to, the following requirements:

6.62.4.2.3.15.1 the **Contractor** shall design the bridge bearings while considering, without however being limited to, the available vertical, longitudinal and transverse clearance, the slope of the seat, the slope of the span and the configuration required for jacking;

6.62.4.2.3.15.2 the dimension indicated on the drawings for the bridge bearing thickness is given for information purposes only. If the bridge bearings have a different thickness, the elevation of the seat block shall be corrected accordingly;

6.62.4.2.3.15.3 the shop drawings of the bridge bearings shall be complete and include the beveled plates, adjustment plates, transition plates required to make the connection with the existing bridge steel and all other parts that are planned to be replaced on the bridge. The height of each part and the total height of all parts shall be indicated on the shop drawings;

6.62.4.2.3.15.4 where applicable, the **Contractor** shall, carry out the design of the pedestals according, without however being limited to, the dimensions and configuration of the bridge bearings, the lifting methods and the site conditions. It shall provide the Engineer with a design note and shop drawings of the pedestals, which shall be signed and sealed by an engineer, member of the OIQ at least fourteen (14) days prior to the beginning of manufacturing.

6.62.4.2.3.16 The following are some bridge bearings that meet the requirements described above:

- *CN* bridge bearing manufactured by Goodco Z-Tech;
- model *LS* Series manufactured by LCL-Bridge Products Technology Inc.

6.62.5 INSPECTION AND STORAGE

6.62.5.1 The bridge bearings shall be clearly identified by the manufacturer. The **Contractor** shall, upon receipt of the bridge bearings, provide the Engineer with the delivery slips.

6.62.5.2 The bridge bearings shall be protected against shock and contaminants during all stages of handling, storage and installation.

6.62.5.3 Damaged bridge bearings or bridge bearings deemed as such by the Engineer will be rejected.

6.62.6 EXECUTION OF WORK

6.62.6.1 REMOVAL OF EXISTING BRIDGE BEARINGS

6.62.6.1.1 The **Contractor** shall remove the existing bridge bearings in compliance with the requirements relating to the specific details of any temporary supports indicated on the drawings and as required by subsection 6.61 *Bridge Jacking.*

6.62.6.1.2 The existing bridge bearings shall not be removed until the loads have been completely transferred to the temporary support system and the existing bearing is no longer carrying a load.

6.62.6.1.3 The existing bridge bearings shall not be removed until the **Contractor**'s design engineer has given authorization to proceed.

6.62.6.1.4 Unless otherwise indicated on the drawings, the existing bridge bearings removed become the property of the **Contractor**, who shall dispose thereof, at no cost to the **Owner**, in an appropriate site.

6.62.6.2 PLACEMENT OF NEW BRIDGE BEARINGS

6.62.6.2.1 Bridge bearings shall be placed in accordance with the drawings and specifications and as recommended by the manufacturer.

6.62.6.2.2 At the time of placement, the bearing surfaces and bridge bearings themselves shall be clean and free of any non-adhering material and lubricant.

6.62.6.2.3 The **Contractor** shall ensure that the type of electrode used to weld the bridge bearing upper plates to the girders is compatible with the type of steel that the plates and girders are made of.

6.62.6.2.4 Once the site welding completed, the welds and uncovered surrounding steel surfaces shall be protected by means of two (2) layers of cold galvanizing product in accordance with Article 15.14.2.2.4 *Réparation après la galvanisation* of the CCDG.

6.62.6.2.5 The bridge bearing alignment shall be such that the bearing axis is perfectly parallel to the direction of movement.

6.62.6.2.6 The bearing position shall be such that the two (2) bearing axes are placed at ±3 mm of their theoretical positions under the structural components to be supported.

6.62.6.2.7 Unless otherwise indicated on the drawings, the **Contractor** shall establish its schedule so that the installation takes place at a time when the ambient temperature forecasted by Environment and Climate Change Canada ranges between +20°C and -10°C.

6.62.6.2.8 The positioning and final alignment of the new bridge bearings shall be checked by the bridge bearing manufacturer's engineer, member of the OIQ. The **Contractor** shall provide the Engineer with a certificate of conformity of the installation of the bridge bearing, signed and sealed by the manufacturer's engineer.

6.62.6.2.9 The **Contractor** shall compare the loads measured at the time the lifting operations were carried out with those calculated for the design of the bridge bearings. The **Contractor** shall provide the Engineer with a certificate of conformity, signed and sealed by the manufacturer's engineer, member of the OIQ, certifying to the performance and sustainability of the new bridge bearings in relation to the loads recorded during the lifting operations.

6.62.6.2.10 The loading of the bridge bearings shall be carried out after the concrete of the repairs and rebuilt bridge seats has reached at least 75% of the specified strength at twenty-eight (28) days. The loading of the bridge bearings shall have received prior authorization from the Engineer.

6.62.6.2.11 Unless otherwise indicated on the drawings, the bridge bearing anchor rod nuts shall be tightened with a spud wrench of an approximate length of 400 mm. After tightening, the anchor rod threaded end shall protrude the nut by at least 3 mm.

6.62.6.2.12 In the case of mobile bridge bearings retained by means of anchor rods, these rods shall be centered in the upper plate slotted holes.

END OF SUBSECTION