



## **CONSTRUCTION SPECIFICATION FOR INSTALLATION OF BEARINGS**

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<b>922.01</b>	<b>SCOPE</b>
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This specification covers the construction requirements for the installation of bearings.

#### **922.01.01 Specification Significance and Use**

This specification is written as a provincial-oriented specification. Provincial-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of the Ontario Ministry of Transportation.

Use of this specification or any other specification shall be according to the Contract Documents.

## **922.01.02 Appendices Significance and Use**

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

## **922.02 REFERENCES**

When the Contract Documents indicate that provincial-oriented specifications are to be used and there is a provincial-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.PROV, unless use of a municipal-oriented specification is specified in the Contract Documents. When there is not a corresponding provincial-oriented specification, the references below shall be considered to be to the OPSS listed, unless use of a municipal-oriented specification is specified in the Contract Documents.

This specification refers to the following standards, specifications, or publications:

### **Ontario Provincial Standard Specifications, Material**

OPSS 1202 Bearings - Elastomeric Plain and Steel Laminated

OPSS 1203 Bearings - Rotational and Sliding Surface

### **CSA Standards**

A3004-C2 Test Method for Determination of Compressive Strengths\*

\* Part of A3000 Cementitious Materials Compendium

## **922.03 DEFINITIONS**

For the purpose of this specification, the following definitions apply:

**Anchor** means a device employed to secure a bearing to the structure or to restrict movement of the structure or both.

**Bearing** means a structural device that transmits load while permitting translation or rotation or both.

**Certificate of Conformance** means a document issued by the Quality Verification Engineer confirming that the specified components of the Work are in general conformance with the requirements of the Contract Documents.

**Product Drawings** means drawings prepared by the manufacturer that have been approved by the Owner for use with the product.

**Quality Verification Engineer (QVE)** means an Engineer retained by the Contractor qualified to provide the services specified in the Contract Documents.

**Superstructure** means all parts of a bridge above the bearings.

**922.04 DESIGN AND SUBMISSION REQUIREMENTS**

**922.04.01 Submission Requirements**

**922.04.01.01 Layout and Installation Drawings**

**922.04.01.01.01 General**

At least 1 week prior to commencement of bearing installation, 1 hardcopy and 1 electronic PDF copy of bearing layout and installation Working Drawings shall be submitted to the Contract Administrator for information purposes only. An Engineer's seal and signature shall be affixed on the layout and installation Working Drawings verifying that the Working Drawings are consistent with the Contract Documents.

A copy of the Working Drawings shall be kept on site prior to and during the installation of the bearings.

**922.04.01.01.02 Elastomeric Bearings**

The layout and installation drawings for elastomeric bearings shall clearly indicate the following:

- a) Bearing layout and orientation.
- b) Dimensions and details of the bearings.
- c) Details of the top or bottom plate, or both, including anchorages or dowels or both.
- d) Installation details.
- e) Load resistance at serviceability and ultimate limit states, including maximum compressive permanent and total loads.
- f) Individual alphanumeric identification of each bearing.

**922.04.01.01.03 Rotational and Sliding Surface Bearings**

The layout and installation drawings for rotational and sliding surface bearings shall clearly indicate the following:

- a) Bearing layout and orientation.
- b) Top and bottom plate details, including anchorages.
- c) Installation details.
- d) Method of attachment of bearings to the top and bottom plates.
- e) Bearing identification letter and numbers.

## **922.04.01.02                      Jacking**

When jacking of the superstructure is specified in the Contract Documents, 1 hardcopy and 1 electronic PDF copy of the jacking Working Drawings shall be submitted to the Contract Administrator at least 1 week prior to commencement of jacking, for information purposes only. The submission shall include the method and location, type, and capacity of jacks to be used; the type and location of the gauges; and the calibration certificates for both the jacks and gauges. An Engineer shall affix his or her seal and signature on the jacking drawings verifying that the drawings are consistent with the Contract Documents and sound engineering practices.

When the Contractor proposes a change to the jacking specified in the Contract Documents, a Change Proposal shall be submitted to the Contract Administrator at least 3 weeks prior to commencement of jacking, for approval. The submission shall include the method and location, type, and capacity of jacks to be used; the type and location of the gauges; and the calibration certificates for both the jacks and gauges and, where necessary, the details of support for the jacks. Proposals shall bear the seals and signatures of the design and checking Engineers.

When jacking is not specified in the Contract Documents, 1 hardcopy and 1 electronic PDF copy of the jacking proposal drawings and calculations shall be submitted to the Contract Administrator at least 3 weeks prior to the commencement of jacking, for approval. The submission shall include the method and location, type, and capacity of jacks to be used; the type and location of the gauges; and the calibration certificates for both the jacks and gauges and, where necessary, the details of support for the jacks. Proposals shall bear the seals and signatures of the design and checking Engineers.

A copy of each jacking proposal drawing will be returned to the Contractor as one of the following:

- a) Stamped with the wording that allows for permission to construct. In this case, work can commence on receipt of the drawing by the Contractor.
- b) Stamped with the wording that allows for permission to construct as noted. In this case, work can start on receipt of the drawings by the Contractor. The drawings shall be updated as noted and shall be sealed and signed by an Engineer stating the drawings have been revised according to the noted comments.
- c) Showing only required changes. In this case, the drawings shall be updated as required and the submission process repeated.

When another authority is involved with the Contract, all submissions shall be made at least 5 weeks prior to the commencement of work.

A copy of the jacking drawings or the approved jacking proposal drawings shall be kept on site prior to and during the jacking operation.

## **922.05                                      MATERIALS**

### **922.05.01                                  Bearings**

Bearings shall be according to OPSS 1202 or OPSS 1203 and as specified in the Contract Documents.

**922.05.02                      Grout**

Grout for installation of rotational and sliding surface bearings or anchors shall be cement based, non-shrink, non-staining, and approved by the Owner. Grout shall have a minimum 7-Day compressive strength of 35 MPa.

**922.07                              CONSTRUCTION**

**922.07.01                      General**

The bearings shall be protected from damage, distortion, excessive heat, and deleterious matter during the handling, transportation, storage, and installation.

The bearings shall not be disassembled by the Contractor without the permission of the bearing supplier. The bearing supplier's representative shall be present during disassembly and reassembly.

Upon completion of the structure, the top and bottom surfaces of the bearings shall be in full contact with the structure.

Grouting operations shall be according to the manufacturer's recommendations, except that the temperature of the air, concrete, and bearings shall not be less than 10 °C at the time of grouting and shall be maintained at not less than 10 °C for a minimum of 96 hours after grout is placed.

Where pintles are specified in the Contract Documents, they shall engage the steel plate of the bearings through the entire thickness of that plate.

When elastomeric bearings are replaced on an existing structure, the top and bottom of the bearings shall be in full contact with the structure. Work required to achieve full contact shall be as specified in the Contract Documents. If the work as specified in the Contract Documents does not achieve full contact of the bearings, the Contract Administrator shall be notified and the work shall proceed only when directed.

**922.07.02                      Bearing Seats**

The bearing seats shall be finished level and to an elevation established from the Contract Documents.

For elastomeric bearings, the finish of the concrete surface shall be smooth and not vary more than 1 mm along a straightedge placed in any direction across an area that extends at least 25 mm beyond the outside limits of the bearing. For other types of bearings, deviation along the straightedge shall not vary more than 3 mm.

Any concrete surface area prepared by grinding shall not allow water to pond in the area. For elastomeric bearings, the bearing seat areas prepared by grinding shall be intentionally roughened such that the surface has an equivalent to trowel finish. All surface areas shall be inspected and deemed acceptable by the Contract Administrator prior to installation of bearings.

**922.07.03                      Alignment**

The longitudinal and transverse centrelines of the bearings shall be installed within  $\pm 3$  mm of the position specified in the Contract Documents. The centreline of the bearing along the direction of movement shall be parallel to the direction of movement of the bridge at that bearing location.

**922.07.04                      Installation of Anchors**

The diameter, length, and material of the anchor and the diameter and depth of the anchor hole shall be as specified in the Contract Documents.

For pier caps, coring for installation of bearing anchors is not permitted.

Where coring of the bearing seats to receive anchors is specified in the Contract Documents, care shall be taken to ensure that the coring is done without damaging or cutting the steel reinforcement. Where permitted, coring shall not commence earlier than 3 weeks prior to bearing installation. In lieu of coring, the holes may be formed.

The holes shall be protected against entry of moisture and shall be completely filled with grout, when the anchors are installed.

**922.07.05                      Grouting**

Where the anchors for rotational and sliding surface bearings require core drilling or preformed holes, the bearings shall be bedded over their entire area on grout that does not contain any voids. The use of permanent shims to achieve the theoretical elevation at the top of the bearing shall not be allowed.

The thickness of the grout bedding for rotational and sliding surface bearings shall be 12 mm ± 3 mm. The substrate shall be roughened by bushhammering, cleaned, and prewetted prior to grouting. Transfer of superstructure load to the bearings shall not be allowed until the grout has reached a minimum strength of 30 MPa.

The grout material shall be mixed, handled, and cured according to the manufacturer’s instructions.

Grout is not permitted in contact with elastomeric bearings.

**922.07.06                      Tolerances**

Bearings shall be set level to within a 500H:1V slope in any direction. The top of the bearing shall be set at the theoretical elevation specified in the Contract Documents, within the following tolerances:

Concrete deck and precast I-type girders	± 5 mm
Steel plate girders	0 to + 3.0 mm
Steel and precast concrete box girders	0 to + 2.0 mm

**922.07.07                      Temporary Attachments**

Temporary clamping devices shall be used to maintain correct orientation and setting and to prevent movement or separation of the bearing components during the handling, transportation, and installation. The clamping devices shall not be used for lifting or suspending the bearings. Clamping devices shall be removed after each bearing is in its final position, with all permanent connections made, and after all grout and concrete in contact with the bearing have been placed.

**922.07.08                      Permission to Proceed**

Upon completion of the installation of the bearings on the substructure and prior to any loading on the bearings, the Quality Verification Engineer shall conduct an interim inspection to verify that the installation has been carried out in general conformance with Contract Documents and issue the Contractor written permission to proceed.

## **922.07.09                      Jacking**

Jacking operations shall be carried out under the direct supervision of an Engineer.

The lifting or lowering of the structure shall be carried out in one uniform and synchronized jacking operation. At no time during jacking operations shall the difference between any of the jacking points be more than 3 mm at the same abutment or pier cap.

When jacking is required in order to adjust the bearings, the structure shall be jacked the minimum amount required to allow the bearings to be adjusted.

## **922.07.10                      Positive Attachment of Elastomeric Bearing Strips**

Where positive attachment is specified for elastomeric bearing strips on ballast walls, wing walls, elastomer shall be attached with stainless steel concrete nails spaced at 400 mm or epoxy adhesive.

## **922.07.11                      Sampling for Quality Assurance Testing**

### **922.07.11.01                  Sampling of Bearings**

After the bearings have been fabricated, the Contract Administrator shall be notified in writing of the identification and availability of the bearings.

Where strip bearings have been specified for precast boxes placed side-by-side, each bearing strip shall be supplied at least 600 mm longer than required. A sample, 600 mm in length, shall be cut in the field from one end of each strip bearing and supplied for testing.

Elastomeric bearings beyond the number of bearings specified for installation shall be supplied as specified in the Contract Documents.

All bearings shall be available for sampling either at the project site or at a location acceptable to the Contract Administrator. Sample bearings for testing purposes will be selected at random by the Contract Administrator from all the bearings of each size and thickness fabricated for the Contract. The Contract Administrator shall advise the Contractor in writing which bearings have been selected for testing.

Elastomeric bearings for testing, and a copy of the bearing layout and installation drawings and Working Drawings according to OPSS 1202, shall be delivered by the Contractor to:

Head, Concrete Section  
145 Sir William Hearst Avenue, Room 15  
Downsview, Ontario, M3M 0B6

Bearings weighing more than 30 kg shall be delivered on a wooden pallet which can be lifted by a forklift.

### **922.07.11.02                  Sampling of Approach Slab Bearings and Ballast Wall Bearings**

Elastomers delivered to the site shall exceed the required length to allow for a 1m labelled test sample to be taken from the approach slab or ballast wall elastomers on each structure.

Elastomers shall be delivered by the Contractor, along with a transmittal form to:

Head, Concrete Section  
145 Sir William Hearst Avenue, Room 15  
Downsview, Ontario, M3M 0B6

**922.07.11.03                    Grout Sampling**

One set of three compressive strength cubes shall be cast for each day of production of grout. Casting of cubes shall be according to CSA A3004-C2. For early strength testing, additional cubes shall be cast. Cubes for compressive strength testing shall be delivered by the Contractor, with a transmittal form, to the Regional Quality Assurance Laboratory.

**922.07.12                        Certificate of Conformance**

After loading of the deck and any specified jacking, but prior to opening to traffic, a Certificate of Conformance shall be submitted to the Contract Administrator confirming fabrication and installation are in general conformance with the Contract Documents.

**920.07.13                        Management of Excess Materials**

Management of excess material shall be according to the Contract Documents.

**922.08                            QUALITY ASSURANCE**

**922.08.01                        Acceptance of Bearings**

Acceptance of bearings shall be on a lot basis. The number, type, and size of elastomeric bearing samples to be selected for destructive testing shall be as specified in the Contract Documents.

The acceptance of bearings shall be according to the requirements of this specification. If the bearing tested does not meet the requirements of this specification, all bearings from the lot are unacceptable and shall not be included in the Work. Unacceptable bearings that have been included in the Work shall be removed and replaced at the Contractor's expense. Repairs to elastomeric bearings are not permitted.

Bearings supplied as replacements for rejected bearings shall be sampled, tested, and accepted on the same basis as the original bearings.

The Contractor shall allow 60 Days from the time of submission of elastomeric bearings and drawings, according to this specification, for the Owner's testing program.

**922.08.02                        Acceptance of Approach Slab Bearings and Ballast Wall Bearings**

Acceptance of bearings shall be on a lot basis. For testing of approach slab bearing and ballast wall bearing elastomers, a lot shall be all the bearings on a structure.

The acceptance of bearings shall be according to the requirements of OPSS 1202. For each lot, one 1 m sample of elastomer shall be tested according to OPSS 1202. If the bearing tested does not meet the requirements of this specification, all bearings from the lot shall be considered unacceptable but with the agreement of the Owner may be permitted to remain in the Work with a payment adjustment. The payment adjustment shall be calculated based on individual lots and applied according to the Basis of Payment section of this specification.

**922.08.03                        Acceptance of Grout Compressive Strength**

One set of three cubes shall be tested for 7-Day compressive strength according to CSA A3004-C2. Grout shall be acceptable if the average 7-Day compressive strength of the set of three cubes is greater than or equal to 35 MPa. Unacceptable grout shall be removed and replaced at the Contractor's expense.



**922.09 MEASUREMENT FOR PAYMENT**

**922.09.01 Bearings**

For measurement purposes, a count shall be made of the number of the bearings installed and of the bearings supplied for destructive testing.

Alternatively, bearings may be a lump sum item.

**922.10 BASIS OF PAYMENT**

**922.10.01 Bearings - Item**

Payment at the Contract price for the above tender item shall be full compensation for all labour, Equipment, and Material to do the Work.

When Bearings is a lump sum item, payment at the Contract price for the tender item Bearings shall include full compensation for the bearings supplied for destructive testing.

For structural rehabilitation, when repairs to the existing bearing seat or soffit above the bearing areas is required prior to the installation of the new elastomeric bearing to ensure full contact is achieved, and if the work is not specified in the Contract Documents, payment for such work shall be administered as a Change in the Work.

**922.10.02 Payment Adjustment for Bearings**

**922.10.02.01 Elastomeric Bearings with Steel Laminates**

When the elastomer cover to each of the embedded steel plates in the test sample is within the tolerances of the specifications, a payment adjustment factor of 1.00 shall be applied to the Contract price for the bearings location represented by the sample. Bearings that do not meet tolerances are rejectable and shall be removed and replaced at the Contractor's expense.

When the elastomer cover to any or all of the embedded steel plates in the test sample is within the payment adjustment range shown in Table 1 and/or Table 2, and the Contractor requests that the Owner accept the bearings in the lot represented by the sample as is, the cover payment adjustment factor equal to 0.5, shall apply to the lot. In the case where both Table 1 and Table 2 indicate a cover payment adjustment factor of 0.5, the payment adjustment factor of 0.5 applies.

When multiple test samples are represented by the tender item, the payment adjustment shall apply to the total plan area of laminated elastomeric bearings represented by the sample, divided by the total plan area of all laminated elastomeric bearings represented by the tender item.

When the average elastomer cover to the embedded steel plates in the test sample exceeds the tolerance specified in the Contract Documents and exceeds 70% of the average effective elastomer thickness of internal layers, or when the average thickness of individual layers of elastomer exceeds the tolerance specified in the Contract Documents, the Contractor may request that the Owner accept the bearings if they meet the design requirements. The bearing supplier shall update the bearing design on the shop drawings for the as-built configuration and shall evaluate the bearing for the design loads based on the as-built geometry.

**922.10.02.02****Approach Slab and Ballast Wall Bearings**

The payment adjustment for each unacceptable lot of approach slab and ballast wall bearings shall be minus \$2,000.

**TABLE 1**  
**Payment Adjustment Factors for Elastomer Cover to Embedded Steel Plates – Low Cover at Top and Bottom and Low Cover at Sides**

		Minimum Top and Bottom Cover, mm		
		< 3.0	3.0 to 3.9	≥ 4.0
Minimum Side Cover, mm	< 4.0	Rejectable	Rejectable	Rejectable
	4.0 to 4.9	Rejectable	Rejectable, Contractor may request to have bearings within this range accepted with a payment adjustment factor of 0.5	Rejectable, Contractor may request to have bearings within this range accepted with a payment adjustment factor of 0.5
	≥ 5.0	Rejectable	Rejectable, Contractor may request to have bearings within this range accepted with a payment adjustment factor of 0.5	Acceptable

**TABLE 2**  
**Payment Adjustment Factors for Elastomer Cover to Embedded Steel Plates – Low Cover at Top and Bottom and High Cover at Sides**

		Minimum Top and Bottom Cover, mm		
		< 3.0	3.0 to 3.9	≥ 4.0
Maximum Side Cover, mm	≤ 12.0	Rejectable	Rejectable, Contractor may request to have bearings within this range accepted with a payment adjustment factor of 0.5	Acceptable
	12.1 to 15.0	Rejectable	Rejectable, Contractor may request to have bearings within this range accepted with a payment adjustment factor of 0.5	Rejectable, Contractor may request to have bearings within this range accepted with a payment adjustment factor of 0.5
	> 15.0	Rejectable	Rejectable	Rejectable

**Appendix 922-A, November 2016  
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS**

**Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.**

**Designer Action/Considerations**

No information provided here.

**Related Ontario Provincial Standard Drawings**

No information provided here.