Technical Specification

Transport and Main Roads Specifications MRTS76 Supply and Erection of Steel Girders

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Queensland Government

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1 Introduction

This Technical Specification applies to the supply and erection of steel girders for bridge superstructures.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* and other Technical Specifications as appropriate.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

2 Definition of terms

The terms used in this Technical Specification shall be as defined in Clause 2 of MRTS01 *Introduction to Technical Specifications*.

3 Referenced documents

Table 3 lists documents referenced in this Technical Specification.

Table 3 – Referenced documents

Reference	Title
AS 3972	*General purpose and blended cements*
MRTS01	*Introduction to Technical Specifications*
MRTS50	*Specific Quality System Requirements*
MRTS70	*Concrete*
MRTS77	*Bridge Deck*
MRTS78	*Fabrication of Structural Steelwork*
MRTS81	*Bridge Bearings*
MRTS81A	*Stainless Steel Bridge Bearings*
Queensland Legislation	*Transport Operations (Road Use Management) Act 1995*

4 Quality system requirements

4.1 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specifications* and Clause 8.3 of MRTS50 Specific Quality System Requirements.

The Hold Points, Witness Points and Milestones applicable to this Technical Specification are summarised in Table 4.1.

Table 4.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
5.2.1	1. Approval of procedure for handling, transport and storage of girders		Submit handling, transport and storage procedure (not less than 14 days)
5.2.3.1	2. Transport of girders and other associated steelwork		
7.1	3. Approval of erection procedure	1. Erection of girders	Submit erection procedure (not less than 21 days)
7.2.2	4. Installation of elastomeric bearings		
7.2.3	5. Installation of pot-type bearings		

4.2 Construction procedures

The Contractor shall prepare documented procedures for all construction processes in accordance with the quality system requirements of the Contract.

Construction procedures for those activities listed in Table 4.2 shall be submitted to the Administrator in accordance with the quality system requirements of the Contract.

Table 4.2 – Construction requirements

Clause	Procedure
5.2.1	Handling, transport and storage of girders
7.1	Erection of girders

5 Steel girders

5.1 Manufacture of steel girders and associated steel components

Steel girders, cross bracing and girder restraints shall be of the lengths and dimensions shown on the project drawings.

Fabrication shall be in accordance with the requirements of MRTS78 *Fabrication of Structural Steelwork*.

5.1.1 Girder restraint fasteners

Girder restraint fastening bolts, nuts and washers shall be supplied and fabricated as shown on the project drawings and in accordance with MRTS78.

5.2 Handling, transport and storage

5.2.1 General

Girders shall at all times during handling, transport and storage, be kept in such a position that the girders are upright and vertical.

The method of handling, transport and storage shall be such as to avoid damage due to impact, bending, twisting and whipping. Girders shall be moved only while fully suspended. In no case shall they be moved by dragging across the terrain.

The Contractor shall submit a procedure for the handling, transport and storage of girders to the Administrator not less than 14 days prior to commencement of any such activities. **Milestone**

Handling, transport and/or storage of girders shall not proceed until the procedure has been approved by the Administrator. **Hold Point 1** The procedure shall cover handling and storage of girders during manufacturing and on site.

The Contractor shall be responsible for the stability of the girders at all times including during storage and transport.

5.2.2 Lifting

Steel girders shall be lifted upright and vertical with the top flange uppermost. Care shall be taken to ensure the protective coating is not damaged.

Cranes shall operate within their rated capacity. The Contractor shall provide the Administrator with the following details of the proposed crane for handling and/or erection of girders in the procedure for handling and transport of steel girders **[Refer Hold Point 1]**:

1. crane manufacturer's load chart, and
2. details of counterweight, jib length and rigging.

5.2.3 Transport

5.2.3.1 General

The Contractor shall assess the route from the location of fabrication to the Site and provide the Administrator with these details in the procedure for handling, transport and storage of steel girders **[Refer Hold Point 1]**. The Contractor shall also supply details of the anticipated arrival time of the girders and other associated steelwork on the Site and the planned rate of delivery.

Transport of girders, cross bracing and girder restraints shall not proceed until all inspections required by the Administrator have been satisfactorily completed. **Hold Point 2** Inspections include but are not limited to checking for damage, buckling and required inspections associated with other relevant Transport and Main Roads Specifications and project documentation.

5.2.3.2 Certification of vehicles

Prime movers shall display a current Certificate of Inspection issued by the Department of Transport and Main Roads or be currently registered in the National Heavy Vehicle Accreditation Scheme maintained by the National Heavy Vehicle Regulator.

5.2.3.3 Mass of loads

All road transport shall comply with the vehicle limits prescribed by the *Transport Operations (Road Use Management) Act 1995* and Regulations.

5.2.3.4 Escorts and pilots

All road transport shall comply with the relevant clauses of the traffic regulations pertaining to provision of pilot vehicles and/or police escorts.

5.2.3.5 Support of girders during transport

Steel girders, cross bracing and girder restraints shall be supported on timber bearers in such a manner that the items shall not suffer any distortion and shall be kept clean and free from damage to the protective coating.

Girders shall be stored on timber support bearers. The contact surface between girders and bearers shall have a minimum plan area of 0.1 m².

Girders shall be braced against damage, buckling and overturning etc.

5.2.3.6 Support of girders during storage

Girders shall be stored on timber support bearers in such a manner that the girders shall not suffer any distortion and shall be kept clean and free from damage to the protective treatment coatings. The contact surface between girders and bearers shall have a minimum plan area of 0.1 m². The bearers shall be sufficiently high to store the girders clear of the ground even if subsidence occurs. The ground beneath the girders shall be levelled so as to maintain the same clearance as at the supports. Girders shall be independently braced laterally to prevent overturning.

Cross bracing and girder restraints shall be stored clear of the ground.

Supports and bracing shall be carefully placed so as not to damage the protective coating.

6 Materials

6.1 Registered suppliers and proprietary products

Work Operations that require the use of registered suppliers and proprietary products are listed in Table 6.1.

Table 6.1 – Items requiring use of registered suppliers and proprietary products

Clause	Category of Work
7.3.2	Application of proprietary cement mortar for seating of girders on mortar seats
7.3.3 and 7.3.5.2	Application of epoxy paste for seating of girders on bearings and girder restraint angles on substructure

Clauses 1 and 2 of Annexure MRTS76.1 lists the registered proprietary products to be used for the project.

Registered suppliers and proprietary products are listed in Transport and Mains *Roads Product Index for Bridges and Other Structures*. Access this document via:

https://www.tmr.qld.gov.au/business-industry/Business-with-us/Approved-products-and-suppliers/Bridges-and-other-structures-approved-products-and-suppliers

6.2 Cement mortar

6.2.1 Cement

Cement shall be Type GP or Type HE complying with the requirements of AS 3972.

6.2.2 Sand

Sand shall consist of sharp, coarse, clean siliceous sand, free from dust, clay, organic matter or other deleterious substances. Grading and fineness shall be such that the mortar produced shall be impervious to moisture.

6.2.3 Water

Water shall be free from matters that are damaging to concrete, mortar and steel.

6.2.4 Mortar proportions

Mortar shall consist of a mixture of one part of cement to three parts of sand uniformly mixed (1:3) so that no segregation occurs.

The water / cement ratio shall be the minimum required to allow placement as specified for the particular application.

6.3 Proprietary cement mortar

Proprietary cement mortar shall be a registered product.

Cement mortar shall be capable for use as bearing mortar pads / seats for pot bearings or girders.

Cement mortar shall have the following properties at a flowable consistency:

1. A minimum compressive strength of 50 MPa, and
2. Low shrinkage:
    a. Less than 500 microstrain at 21 days, and
    b. Less than 600 microstrain at 28 days.

Clause 1 of Annexure MRTS76.1 lists the registered products to be used for the project.

6.4 Epoxy paste

Epoxy paste shall be a registered proprietary product.

Epoxy paste shall consist of a proprietary two-part epoxy product capable of gap filling between the girder restraint angles and the headstock, and between the bearing and the girder soffit.

Epoxy paste shall have a minimum compressive strength of 50 MPa.

Clause 2 of Annexure MRTS76.1 lists the registered products to be used for the project.

6.5 Bearings

Elastomeric bearings shall comply with the requirements of MRTS81 *Bridge Bearings*.

Pot-type bearings shall comply with the requirements of MRTS81 *Bridge Bearings* or MRTS81A *Stainless Steel Bridge Bearings*.

7 Erection of steel girders

7.1 General

The Contractor shall submit its procedure for the erection of girders not less than 21 days prior to commencement of erection. **Milestone**

The Contractor may be required to submit to the Administrator, a certificate, signed by a Registered Professional Engineer of Queensland, certifying that the Contractor's proposed construction methods do not compromise the structural integrity or the long-term durability of the completed structure. The Administrator may request such a certificate up to seven days after receiving the Contractor's erection procedure. The certificate shall be considered to be part of the Contractor's erection procedure.

Erection of girders shall not proceed until the erection procedure has been approved by the Administrator. **Hold Point 3**

Erection of girders shall be a Witness Point. **Witness Point 1**

The Administrator shall have the right at all times to stop any handling deemed damaging to the girders.

Loading of headstocks and bearing pedestals due to erection of girders shall be in accordance with the requirements of MRTS70 *Concrete*.

Before releasing the load from the lifting gear, the girders shall be supported such that they cannot be overturned or slide. Methods to prevent overturning or sliding shall include, but not limited to, installation of independent bracings or use of girder restraints. Consideration shall also be given to overturning moments from formwork and other items attached to the girders.

7.2 Installation of bearings

7.2.1 Preparation of bearing seats

Bearing seats shall be thoroughly cleaned prior to installation of bearings. If a curing compound has been applied to the bearing seat, it shall be removed by grinding or sandblasting then cleaned of dust and laitance with clean water.

7.2.2 Installation of elastomeric bearings

Prior to installation, elastomeric bearings shall be inspected, and notwithstanding any previous approval, the bearings shall not be installed until inspected and approved by the Administrator. **Hold Point 4**

Elastomeric bearings shall be placed within ± 3 mm of the correct plan position on the bearing seat.

7.2.3 Installation of pot-type bearings

Prior to installation, pot-type bearings, including sliding surfaces, where applicable, shall be inspected and, notwithstanding any previous approval, the bearings shall not be installed until inspected and approved by the Administrator. **Hold Point 5**

Unless shown otherwise on the project drawings, sliding bearings shall be set central to the range of movement.

Sockets for holding down bolts shall be installed in the bearing pedestals as shown in the project drawings to a tolerance of ± 2 mm of the dimensions relative to the bearing pedestal.

Pot-type bearings shall be seated on proprietary cement mortar on the pedestal as shown on the Drawings. Proprietary cement mortar shall be a registered product in accordance with Clause 6.3 and shall be applied in accordance with the manufacturer's recommendations.

Where the bearings are seated on proprietary cement mortar, wedges shall be used to temporarily support the bearings at the correct level. Wedges shall be removed when the mortar has cured and the remaining voids shall be filled with proprietary cement mortar.

Surplus cement mortar squeezed out during placement of bearings shall be removed immediately before it has set.

7.3 Installation of steel girders

7.3.1 General

Unless shown otherwise in the project drawings, steel girders shall not be seated at any position other than at the bearing points.

7.3.2 Seating girders on mortar seats

Where the drawings show that the girders are to be seated on cement mortar, a suitable bonding agent shall be added to the mortar which shall have the consistency of mortar used in bricklaying. The quantity of mortar placed shall be sufficient to provide, after erection, the widths and thicknesses shown in the project drawings and to provide an even seating for the girder.

Immediately following the placement of the cement mortar seating and before the mortar sets, the girder shall be seated on the headstocks at the position shown in the project drawings. Any excess mortar shall be struck off.

Cement mortar shall be in accordance with Clauses 6.2 or 6.3. Where registered proprietary product is used, it shall be applied in accordance with the manufacturer's recommendations.

7.3.3 Seating girders on elastomeric bearings

Where the project drawings show that the steel girders are to be seated on elastomeric bearings, the top surface of the bearings shall be coated with epoxy paste.

Epoxy paste material shall be a registered product in accordance with Clause 6.4.

The steel girder shall be lowered and supported on temporary packers on top of the headstock to ensure that the soffit of the girder will clear the top of the bearing by 1 mm at the closest point. Once the above clearance has been established, the girder shall be removed and the top surface of the bearing shall be coated with an epoxy paste.

The girder shall then be lowered into position, supported on temporary packers and maintaining a minimum epoxy paste thickness of 1 mm. The periphery of the bearing shall be checked to ensure that the entire interface between the steel girder and bearing is filled with epoxy paste. Surplus epoxy paste squeezed out shall be removed immediately before it has set.

If the epoxy paste sets before completion of this operation, the girder shall be lifted and all contact surface cleaned before repeating the process.

After the epoxy paste has fully cured over a period of not less than 48 hours and has achieved a minimum compressive strength of 40 MPa, the temporary packers shall be removed without dislodging the girders.

7.3.4 Seating girders on pot-type bearings

The steel girder shall be placed squarely on the bearings and the attaching bolts inserted. Bolts shall not be tightened until both ends of the steel girder have been placed in their correct positions on their respective bearings.

Transport brackets and their screws / bolts shall be removed from the pot bearings after installation of girders is completed.

7.3.5 Girder restraint angles

Where girder restraint angles are specified in the project drawings, the installation shall meet the requirement of this clause.

7.3.5.1 Initial positioning / temporary installation

During placing of girders care shall be taken to ensure that the holes in the girders align with the corresponding holes in the girder restraint angles.

The fixed end of the girders shall be lowered slightly ahead of the expansion end to ensure that the holes in the girders align with the corresponding holes in the girder restraint angles.

Nuts and washers shall be installed onto the girder restraint holding-down bolts. Bolts, nuts and washers shall be installed to the girder restraint angles (if specified). All nuts shall be securely tightened before removing the load from the lifting gear.

7.3.5.2 Final positioning / permanent installation

At least seven days after casting the bridge deck slab, the girder restraint angles shall be permanently fixed. The restraint angles at one end only shall be able to be adjusted at any time for final positioning.

The girder restraint angles shall be completely bedded on epoxy paste.

Epoxy paste material shall be a registered product in accordance with Clause 6.4.

At the expansion joint end of the girder, the girder restraint angles shall be installed in such a manner that the girder restraint bolt is located mid-way along the length of the slotted hole in the girder restraint angles.

The girder restraint angles shall be supported in the correct positions until the epoxy paste has fully cured over a period of not less than 48 hours. After the epoxy paste has fully cured, all nuts shall be securely tightened.

If the bridge is located on a vertical grade, care shall be taken to ensure that no shear deflection is induced in the bearings and the deck and girders do not move downhill during the above operations.

7.3.6 Temporary bracing

Girders shall be adequately braced prior to removing the load from the lifting gear after erection of the girder.

8 Erection of steel cross bracing

Steel cross bracing shall be erected in accordance with the details shown on the project drawings.

9 Loading of girders

Construction plants or vehicles of any type shall not be placed on the erected girders prior to the completion of the bridge concrete deck.

Load limitations on the newly cast bridge decks shall be in accordance with the requirements of MRTS77 *Bridge Deck*.

10 Supplementary requirements

The requirements of this Technical Specification are varied by the supplementary requirements given in Clause 3 of Annexure MRTS76.1.