

Technical Specification

**Transport and Main Roads Specifications
MRTS61 Gantries and Support Structures for Road
Signs, Tolling Systems and ITS Devices**

November 2020

Copyright

© The State of Queensland (Department of Transport and Main Roads) 2020.

Licence



This work is licensed by the State of Queensland (Department of Transport and Main Roads) under a Creative Commons Attribution (CC BY) 4.0 International licence.

CC BY licence summary statement

In essence, you are free to copy, communicate and adapt this work, as long as you attribute the work to the State of Queensland (Department of Transport and Main Roads). To view a copy of this licence, visit: <https://creativecommons.org/licenses/by/4.0/>

Translating and interpreting assistance



The Queensland Government is committed to providing accessible services to Queenslanders from all cultural and linguistic backgrounds. If you have difficulty understanding this publication and need a translator, please call the Translating and Interpreting Service (TIS National) on 13 14 50 and ask them to telephone the Queensland Department of Transport and Main Roads on 13 74 68.

Disclaimer

While every care has been taken in preparing this publication, the State of Queensland accepts no responsibility for decisions or actions taken as a result of any data, information, statement or advice, expressed or implied, contained within. To the best of our knowledge, the content was correct at the time of publishing.

Feedback

Please send your feedback regarding this document to: tmr.techdocs@tmr.qld.gov.au

Contents

- 1 Introduction1**
- 2 Definition of terms1**
- 3 Referenced documents2**
- 4 Quality system requirements3**
 - 4.1 Hold Points, Witness Points and Milestones 3
- 5 Design requirements3**
 - 5.1 General 3
 - 5.2 Design review and approval 4
- 6 Foundation construction4**
- 7 Fabrication of steelwork and components4**
- 8 Handling, transport and storage4**
 - 8.1 General 4
 - 8.2 Lifting 5
 - 8.3 Transport to Site 5
 - 8.4 Storage 5
- 9 Erection of gantries and support structures5**
 - 9.1 General 5
 - 9.2 Erection of column supports 6
 - 9.3 Grouted base plates 6
 - 9.4 Splice joints 7
- 10 Level 2 inspection.....7**
- 11 Barrier protection construction.....7**
- 12 Fitting out7**
- Appendix A: Typical acceptable methods of aligning column support and grouting of base plates8**

1 Introduction

This Technical Specification applies to the design, supply and installation of gantries and support structures for static road signs, tolling systems and Intelligent Transport Systems (ITS) devices.

The requirements apply to the following types of gantries and support structures:

- above road gantry structures
- above road cantilever structures
- tolling structures on carriageway and side of the road, and
- sign supports on the side of the road for signs greater than 7.5 m wide or 8 m high or 40 m² sign face area.

Note that support structures for traffic signs and tolling systems on the side of the road up to 7.5 m wide or 8 m high, up to a maximum sign face area of 40 m² may be designed in accordance with the department's *Traffic and Road Use Management (TRUM) Manual*, Volume 3, Part 5: Design Guide for Roadside Signs.

This updated Technical Specification has incorporated the information provided in Technical Note 68 (TN68) *VMS Gantry Installation Procedure*.

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*. Further definitions shall be as defined in Table 2.

Table 2 – Definition of terms

Term	Definition
Business Days or days	Monday to Friday and excluding public holidays.
column supports	Vertical members that are fixed to the foundation via holding down bolts.
Fabricator	A Registered specialist sub-contractor engaged to supply steel and metalwork in accordance with the Drawings and Specifications.
fasteners	Bolts, nuts and/or washers. These may be as an assembly or as individual components.
gantries and support structures	Gantries spanning over the carriageway / road, mounting structures with multiple supports and cantilevered structures.
jacking bolts	Bolts that pass through tapped holes in the base plate and can temporarily support and align the column during erection and until the grout is poured.
Major Connection	Main structural connections such as in the columns and trusses but not including baseplate connections.
Drawings	The RPEQ certified drawings detailing the gantry design and project details.

Term	Definition
Registered Supplier	Pre-qualified supplier in accordance with departmental Registration Schemes. In this Technical Specification this refers to the <i>Registration Scheme: Suppliers and Products for Bridges and Other Structures</i> . Registration for certain suppliers is a pre-requisite for Administrator approval, not a substitute.
Registration Scheme	The process through which Fabricators are assessed as competent to carry out the fabrication.
RPEQ	Registered Professional Engineer of Queensland

3 Referenced documents

Table 3 lists documents referenced in this Technical Specification.

Table 3 – Referenced documents

Reference	Title
AS 1478.2	<i>Chemical admixtures for concrete, mortar and grout, Part 2: Methods of sampling and testing admixtures for concrete, mortar and grout</i>
AS1012.18	<i>Methods of testing concrete, Method 18: Determination of setting time of fresh concrete, mortar and grout by penetration resistance</i>
AS 5100	<i>Bridge Design</i>
ASTM C827	<i>Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures</i>
ASTM C1090	<i>Standard Test Method for Measuring Changes in Height of Cylindrical Specimens of Hydraulic-Cement Grout</i>
ASTM C1107	<i>Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)</i>
Design Criteria	<i>Design Criteria for Bridges and Other Structures</i>
DDPSM Vol 3 Chapter 21	<i>Drafting and Design Presentation Standards Manual (DDPSM) Volume 3: Structural Drafting Standards, Chapter 21: Major Sign Structures</i>
MRTS01	<i>Introduction to Technical Specifications</i>
MRTS50	<i>Specific Quality System Requirements</i>
MRTS63A	<i>Piles for Ancillary Structures</i>
MRTS70	<i>Concrete</i>
MRTS78	<i>Fabrication of Structural Steelwork</i>
MRTS78A	<i>Fabrication of Structural Stainless Steelwork</i>
MRTS79	<i>Fabrication of Aluminium Components</i>
MRTS278	<i>Supply of Structural Fasteners</i>
TN62	<i>Technical Note 62 - Assembly and Tensioning of High Strength Bolts and Nuts</i>
TN67	<i>Technical Note 67 - VMS Gantry Repair Procedure</i>
TN174	<i>Technical Note 174 – Purchasing Guidelines for Transport and Main Roads Major Sign Structures</i>

Reference	Title
TRUM Vol 3 Part 5	<i>Traffic and Road Use Management (TRUM) Manual, Volume 3: Signing and Pavement Marking, Part 5: Design Guide for Roadside Signs</i>
-	<i>Registration Scheme: Product Index for Bridges and Other Structures</i>
-	<i>Registration Scheme: Suppliers and Products for Bridges and Other Structures</i>
-	<i>Structures Inspection Manual</i>

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*. 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. Approval to proceed with fabrication of the steelwork and construction of the foundations		RPEQ certified design documentation accepted by Director (Structures Design Review and Standards).
8.1	2. Approval of procedure for the handling, transport and storage of fabricated steelwork and aluminium components		Submission of procedure for handling, transport and storage of fabricated steelwork and aluminium components (10 days)
9.1	3. Approval to proceed with the erection of gantries and support structures	1. Erection of gantries and support structures	Submission of procedure for erection of gantries and support structures (10 days)
9.3	4. Approval to proceed with the grouting beneath the base plates		
10	5. Acceptance of Level 2 inspection rating		

5 Design requirements

5.1 General

Design of gantries, support structures and their associated components, e.g. protection from vehicle impacts, maintenance platforms and access shall be in accordance with TN174, *Design Criteria for Bridges and Other Structures* and AS 5100.

The gantries and support structures shall allow for flexibility in mounting of signs, tolling systems and ITS devices on the structures and/or at any location along the length of the overhead part of the structures.

5.2 Design review and approval

Prior to the start of fabrication, the design documentation including RPEQ Drawings shall be submitted for review and acceptance to the Director (Structures Design Review and Standards). **Milestone** The design review process is detailed in the *Design Criteria for Bridges and Other Structures*.

The Contractor shall allow appropriate time in their programme to:

- a) produce the necessary design documentation in accordance with Transport and Main Roads standards
- b) submit the design documentation through the review process as detailed in the *Design Criteria for Bridges and Other Structures*, and
- c) be granted acceptance of the design from the Director (Structures Design Review and Standards).

Construction of the foundations and/or steelwork shall not commence until Approval has been given by the Administrator. **Hold Point 1**

The purpose of this Hold Point is for the Administrator to confirm that a certified and accepted design has been prepared and is ready for construction to proceed.

6 Foundation construction

Foundations (including pile caps) shall be constructed in accordance with the project documentation and Transport and Main Roads Technical Specifications.

7 Fabrication of steelwork and components

All structural steelwork shall be supplied to MRTS78 *Fabrication of Structural Steelwork*. All bolts, nuts and washers shall be supplied to MRTS278 *Supply of Structural Fasteners*.

All stainless steel components including bolts, nuts and washers shall be supplied to MRTS78A *Fabrication of Structural Stainless Steelwork*.

All aluminium components including bolts, nuts and washers shall be supplied to MRTS79 *Fabrication of Aluminium Components*.

All fabrication shall be inspected in accordance with MRTS78 *Fabrication of Structural Steelwork*, MRTS78A *Fabrication of Structural Stainless Steelwork* and/or MRTS79 *Fabrication of Aluminium Components* as applicable.

8 Handling, transport and storage

8.1 General

The method of handling, transport and storage shall be such as to avoid damage due to bending, twisting and warping of any parts of the fabricated components, or any damage to protective or decorative coatings. The designated lifting locations shall be shown on the design Drawings.

Fabricated components shall be moved only while fully suspended. In no case shall they be moved by dragging across the terrain.

The Contractor shall submit the procedure for the handling, transport and storage of fabricated steelwork and aluminium components to the Administrator at least 10 days prior to commencement of such activities. **Milestone**

Handling, transport and/or storage of the fabricated components shall not proceed until the procedure has been accepted by the Administrator. **Hold Point 2**

8.2 Lifting

All fabricated components, protective or decorative coatings shall not be damaged during lifting. Special lifting devices and equipment shall be provided by the Contractor for this purpose where necessary.

Cranes shall work within their rated capacity. Cranes shall be supported on prepared platforms certified by an experienced RPEQ Geotechnical Engineer. If requested by the Administrator, the Contractor shall submit the load chart(s) of the proposed crane(s) and details of counterweight, jib length and rigging for review and acceptance.

8.3 Transport to Site

Chains shall not be used to tie down fabricated components, nylon strapping or similar shall be used.

Loose parts shall be crated, tied or bolted in place to avoid loss or damage during transport. Temporary bolts and/or other material required to secure loose parts during transport shall be provided by the Contractor.

8.4 Storage

Fabricated components shall be stored in such a manner as to prevent damage to components and protective or decorative coatings. Components shall be stored above ground on timber support bearers and shall be kept free of dirt, grease and other foreign matters.

The bearers shall be sufficiently high to store the fabricated components clear of the ground even if subsidence occurs. The ground beneath the fabricated components shall be levelled so as to maintain the same clearance as at the supports.

Fabricated components stored in the open shall be self-draining and shall be kept free of soil, ashes, vegetable matter and other corrosion-inducing substances.

9 Erection of gantries and support structures

9.1 General

Gantries and support structures shall not be placed on the foundation until such time as the concrete in the foundation including the pile caps has reached 100% percent of the characteristic 28 day strength and 14 days age.

The Contractor shall submit the procedure for erection of gantries and support structures including grouting beneath base plates to the Administrator for review at least 10 days prior to erection.

Milestone Erection shall not commence prior to acceptance of procedure has been given by the Administrator. **Hold Point 3**

Gantries and support structures shall be erected in accordance with the project documentation.

Witness Point 1

9.2 Erection of column supports

The area directly beneath the column base plate, shall be treated as a construction joint in accordance MRTS70 *Concrete*, prior to the erection of the column supports.

The method of erecting and levelling / aligning column supports shall be documented on the RPEQ Certified Design Drawings. The use of levelling nuts to support gantries and structures during erection is prohibited.

Transport and Main Roads and other asset owners have had fatigue induced failures due to the use of levelling nuts. During erection, the holding down bolts are placed into compression as the base plate bears onto the levelling nuts. This compression is locked into the holding down bolts as the force is inadequately transferred into the grout. During service, the force in the bolt can fluctuate between compression and tension. This stress reversal reduces the fatigue life of the holding down bolts and hence the use of levelling nuts is prohibited.

The column supports shall be supported by temporary works in such a way that the following is achieved:

- i. adjustable to align and level the column support
- ii. allow adequate access for grouting operations beneath the base plate, and
- iii. on completion of the grouting, the compression load is uniformly distributed over the grouted area.

Two such suitable methods include:

- a) the use of adjustable steel wedges, and
- b) the use of temporary jacking bolts.

An example of the above methods is provided in Appendix A.

9.3 Grouted base plates

Grouting beneath the base plate(s) **Hold Point 4** shall not proceed until:

- a) the alignment and levels have been accepted by the Administrator; and
- b) where rainwater may collect inside a column (as in the case of hollow sections) a suitable bleed / drainage point has been detailed to allow the column to drain (refer to commentary below).

Transport and Main Roads and other asset owners have had incidences with rainwater entering the steelwork through gaps in the steelwork connections and/or the drainage / vent holes provided for galvanising. Columns are particularly vulnerable. To mitigate this issue, MRTS61 now specifies a bleed / drainage point in the grouted base plates. Technical Note 67 *VMS Gantry Repair Procedure* proposes the use of timber wicks to draw out excess moisture as a suitable bleed / drainage point. Other solutions may be proposed by the designer and should be included in the design documentation.

The formwork used for grouting shall be positioned as such to achieve the shape as shown on the Drawings. The grout shall be a Transport and Main Roads approved flowable, precision cementitious grout. The product approval shall be sought through the *Product Index for Bridges and other Structures*.

The grout shall have the following minimum characteristics or as detailed on the drawings:

Table 9.3 – Minimum grout characteristics

Characteristic	Standard	Minimum Value
Compressive Strength	AS 1478.2	50 MPa @ 28 Days
Initial Setting Time	AS 1012.18	3 hours > initial setting time < 6 hours
Plastic Volume Change	ASTM C827	Refer to ASTM C1107
Hardened Volume Change	ASTM C1090	Refer to ASTM C1107

Unless nominated by the designer the grout shall have reached a minimum compressive strength of 40 MPa, before the temporary supports (for example, jack bolts) shall be removed. Any remaining voids shall be grouted and finished flush with the top of the baseplate.

9.4 Splice joints

Assembly and tensioning of bolts and nuts for splice joints shall conform to TN62 *Assembly and tensioning of high strength bolts and nuts*. The Contractor, at their expense, shall undertake a trial assembly any Major Connection of the steelwork in the workshop to confirm / rectify fit-up of joints after galvanising, in accordance with MRTS78 *Fabrication of Structural Steelwork*.

Gaps in the steelwork connections affects the condition rating of the structure. Refer to the Transport and Main Roads' *Structures Inspection Manual* and the suggested condition rating for observed gaps in splice plates. Also refer to Clause 10 of this Technical Specification.

10 Level 2 inspection

Gantries and support structures shall be recorded in the inventory in the Transport and Main Roads' *Bridge Information System* (BIS) and shall be subject to the Level 2 inspection regime at the completion of erection. The Contractor shall arrange and bear the costs of a Level 2 inspection and, if applicable subsequent repairs and inspections, until the structure has achieved an acceptable overall Condition State Rating of 1. **Hold Point 5**

11 Barrier protection construction

Permanent barrier protection shall be constructed in accordance with the project documentation.

Traffic control or temporary barrier protection shall remain in place until both construction of the permanent barrier protection, gantries and support structures are completed.

12 Fitting out

Signs, ITS devices, electrical components and conduits shall be supplied and installed in accordance with the project documentation.

Appendix A: Typical acceptable methods of aligning column support and grouting of base plates

Method 1: The use of steel wedges

An acceptable procedure using steel wedges is as follows:

- a) Fabricate / procure four adjustable steel wedges (refer to Figure A1 below).

Figure A1 – Example of adjustable steel wedges



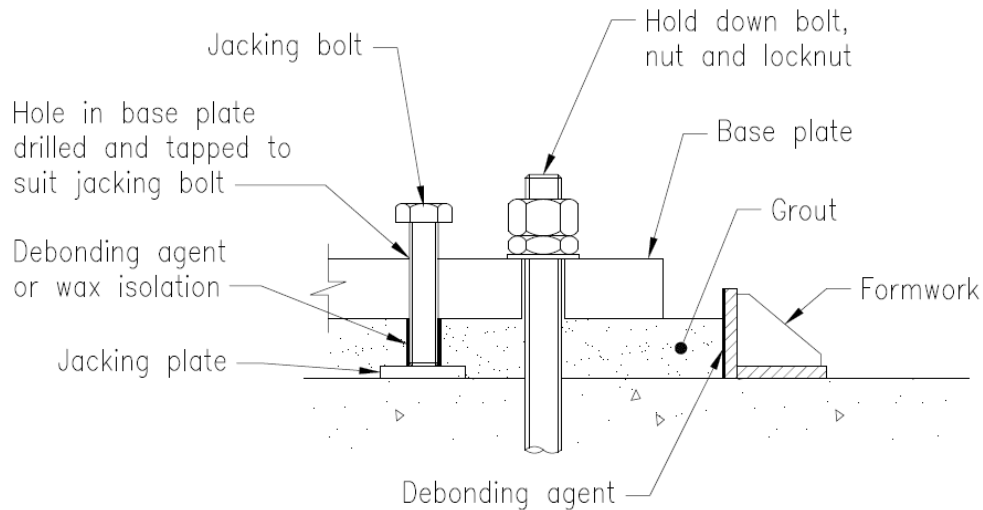
- b) Coat the steel wedges with a suitable debonding agent to allow their removal. Stand the column support over the holding down bolts and lower until it has landed onto the steel wedges. Adjust to achieve alignment and levels as shown on the Drawings. Install washers and nuts of the holding down bolts to finger tight. Grouting of bases shall not proceed until the alignment and levels have been accepted by the Administrator **[Refer to Hold Point 4]**.
- c) Erect grout formwork ensuring it is sufficiently rigid and sealed to prevent grout loss. Faces of formwork in contact with grout shall be coated with a suitable debonding agent applied to allow their release after the grout has cured. The grout shall be as specified in Table 9.3 or as shown in the Drawings. Grout to be mixed in accordance with the manufacturer's specifications.
- d) Grout shall be poured with sufficient head to fill the gap beneath the base plate and concrete foundation. Base plates are generally provided with vent and drainage holes to facilitate galvanising. The volume of grout used should be monitored to ensure grout entering these vent holes is kept to a minimum.
- e) Once the grout has attained sufficient strength, refer to Clause 9.3, to support the temporary design loads from the weight of the structure and wind loading, the steel wedges may be removed.
- f) Clean the voids formed by the steel wedges and fill with grout.
- g) Once the grout is fully cured (including repaired areas) complete installation of the holding down bolts to snug tight or as detailed on the Drawings.

Method 2: The use of jacking bolts

An acceptable procedure using jacking bolts is as follows:

- a) Drawings shall detail and certify the design of the jacking bolts, the use of the jacking bolts and their associated components. For example, the tapped holes in the base plate to support the design loads (refer Figure A2 below).

Figure A2 – Typical jacking bolt arrangement



TYPICAL JACKING BOLT ARRANGEMENT

- b) Erect grout formwork ensuring it is sufficiently rigid and sealed to prevent grout loss. Faces of formwork in contact with grout shall be coated with a suitable agent applied to allow their release after the grout is cured. Grouting of bases shall not proceed until the alignment and levels have been accepted by the Administrator **[Refer to Hold Point 4]**. The grout shall be as specified in Table 9.3 or as shown in the Drawings. Grout to be mixed in accordance with the manufacturer's specifications.
- c) Grout shall be poured with sufficient head to fill the gap beneath the base plate and concrete foundation. Base plates are generally provided with vent and drainage holes to facilitate galvanising. The volume of grout used should be monitored to ensure grout entering these vent holes is kept to a minimum.
- d) Once the grout has attained sufficient strength to support the temporary design loads from the weight of the structure and wind loading, the jacking bolts may be removed.
- e) Clean the voids formed by the jacking bolts and fill with grout.
- f) Once the grout has cured, complete installation of the holding down bolts to snug tight or as detailed on the Drawings.

