

Main Roads Technical Standard

MRTS72

Manufacture of Precast Concrete Elements

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Manufacture of Precast Concrete Elements

1 INTRODUCTION

This Standard applies to the manufacture of precast reinforced concrete elements other than culverts, pipes and pretensioned prestressed concrete members.

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

This Technical Standard forms part of the Main Roads Specifications and Technical Standards Manual.

The requirements for the manufacture of precast concrete elements include the use of suppliers and products for the items listed in Table 1 that are registered by Transport and Main Roads.

Table 1 – Items Requiring Use of Registered Suppliers and Approved Products

Clause	Category of Work
5.4	Precast Concrete element manufacturer
9.3	Bar Chairs
10	Proprietary Cast-in-items

For information regarding registered suppliers and products for the above items refer to –

Queensland Department of Transport and Main Roads
Concrete Technology
GPO Box 1412
Brisbane Qld 4001

2 DEFINITION OF TERMS

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

3 REFERENCED DOCUMENTS

Table 3 lists documents referenced in this Technical Standard

Table 3 – Referenced Documents

Reference	Title
AS 5100	Bridge Design
AS/NZS ISO 9001	Quality Management System Requirements

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 Standards*.

The Hold Points and Milestones applicable to this Standard are summarised in Table 4.1.

Table 4.1 – Hold Points, Witness Points, and Milestones

Clause	Hold Point	Milestone	Witness Point
5.4	1. Approval of a new manufacturing procedure.	Submission of details of process of manufacture (28 days).	
5.6	2. Approval of drawings by the Administrator.	Submission of details of precast concrete elements and process of manufacture (14 days).	Submission of details of precast concrete elements and process of manufacture.

4.2 Conformance Requirements

The conformance requirements which apply to lots of work covered by this Standard are summarised in Table 4.2.

Table 4.2 – Conformance Requirements

Clause	Milestone
8.8	Tolerances
MRS70	Concrete

4.3 Testing Frequency

The minimum testing frequency for work covered by this Standard is each precast concrete element manufactured.

5 CONDITIONS FOR MANUFACTURE OF PRECAST CONCRETE ELEMENTS

5.1 Standard

All precast concrete elements shall be manufactured in accordance with the details shown in the Drawings and in accordance with this Standard.

5.2 Product Design

Alternative product designs which do not comply with Standard Drawings or the Drawings shall be approved by Transport and Main Roads Structures Division. The design shall also include certification of lifting points and the minimum concrete strength for lifting the product from the form.

5.3 Design Life

The design life of all precast concrete elements manufactured under this Standard shall be 100 years unless noted otherwise. The minimum exposure classification shall be B2 in accordance with AS 5100. Elements exposed to salt water shall have exposure classification C in accordance with AS 5100.

5.4 Manufacture by Registered Suppliers

Precast concrete elements shall be manufactured only by a Registered Supplier (refer Clause 1).

To be eligible for registration as a Registered Supplier, a manufacturer shall –

- a) operate a quality management system certified to a minimum of AS/NZS ISO 9001;
- b) establish procedures for manufacture of precast concrete elements; and
- c) have an inspection and test plan including Hold Points acceptable to the department for manufacturing precast concrete elements which demonstrates compliance with this Standard (the inspection and test plan shall address supply of materials).

Registration as a Registered Supplier of precast concrete elements shall be reviewed at intervals varying from 6 months to 3 years depending on registration level, or earlier if unsatisfactory performance is reported.

Where a new or innovative procedure is proposed to manufacture precast concrete elements, the manufacturer shall submit the procedure for manufacture to the department giving details of materials, equipment and processes not less than 28 days prior to establishment of the process. **Milestone**

Manufacture shall not occur until approval of the new procedure has been granted by Transport and Main Roads. **Hold Point 1**

5.5 Registration Status

Information regarding registered status can be obtained from Transport and Main Roads. Refer to Clause 1

5.6 Manufacture of Precast Concrete Elements

At least 14 days before manufacture is due to commence, the Contractor shall provide the following information **Milestone** –

- a) drawings showing the profile dimensions of the element, reinforcement details and grade of concrete;
- b) the calculated mass of element;
- c) the place of manufacture;
- d) outline of the method of manufacture and Quality Plan; and
- e) where the design is an alternative product design, a copy of the department's approval of the design shall also be submitted (Refer to Clause 5.2).

Manufacture of precast concrete products shall not commence until approval of drawings has been granted by the Administrator. **Hold Point 2**

The manufacturer shall advise the Administrator when the first cast of each member type is to occur. **Witness Point**

6 MATERIAL

Concrete shall comply with the requirements of MRTS70 *Concrete* except as amended by this Standard.

Steel reinforcing shall comply with the requirements of MRTS71 *Reinforcing Steel* except as amended by this Standard.

Cast in items shall comply with Clause 10 of this Standard.

7 MARKING, HANDLING, STORING AND TRANSPORTING

7.1 Marking

On each precast concrete element, the following information shall be clearly and permanently marked on a surface which shall not be on permanent display when erected –

- a) the date of manufacture;
- b) the identification number;
- c) the manufacturer's name or registered mark; and
- d) the maximum mass of the element.

7.2 Provision for Lifting

Each precast concrete element shall be provided with approved lifting points. Approved lifting points shall be –

- a) As detailed on the drawing. The designer shall be responsible for certification of the lifting attachments. A rigging diagram shall be shown on the drawing;
- b) The minimum factor of safety for the design of the lifting points shall be 5.0;

- c) In all cases the following minimum number of lifting attachments shall be provided –
- For panel designed for edge lifting a minimum of two lifting attachments in the edge of the panel shall be provided; and
 - For panels and other products designed to be lifted flat a minimum of four (4) lifting attachments shall be provided,
- d) In no case shall the rated working load limit (stamped on the head of the anchor for proprietary lifting attachments) of any single lifting attachment installed in the product be less than the calculated mass of the product.

7.3 Handling

Precast concrete elements shall be handled in a manner which shall avoid damage to the element and shall be lifted using the lifting points provided.

7.4 Transporting

Precast concrete elements shall not be transported from the place of manufacture until the greater of 7 days has elapsed since casting or the time when concrete has attained 70% of the specified 28 day characteristic strength.

Adequate packers or supports shall be provided to support and firmly hold precast concrete elements during transport. The packers or supports shall not damage or stain the product in any way.

7.5 Storing

Precast concrete elements shall be stored clear of the ground on adequate supports placed on a plane surface in a manner that shall avoid damage, twisting or warping. When wet or dry, the ground shall not be liable to subsidence under the weight of the elements.

Slabs and panels may be stacked up to 6 layers high provided that supports are provided to separate each layer. Supports for upper layers shall be placed directly above the supports of the layer below.

Material used for supports shall not damage or stain the product in any way.

8 MODIFICATIONS TO MRS70

8.1 General

Notwithstanding any requirements to the contrary in *MRS70 Concrete*, Clauses 8.2 to 8.9 shall apply to the manufacture of precast concrete elements.

8.2 Placing Concrete

Placing of concrete shall be a mandatory hold point in the manufacturer's Quality Management System and can also be enforced as a witness or hold point by the Administrator if required.

8.3 Concrete Class

Precast concrete elements shall be manufactured from concrete with characteristic 28 day strength not less than –

- a) normal service conditions (exposure classification B2) 40 MPa; or
- b) saltwater conditions (exposure classification C) 50 MPa.

The maximum aggregate size shall be 20 mm unless shown otherwise in the Drawings.

8.4 Formwork

Formwork shall be constructed from metal, timber forms are not acceptable. Where a hole or void in the concrete is shown on the drawing the formwork or void former shall be removed after casting. Permanent hole formers are not accepted unless shown on the drawing.

8.5 Fillets

Internal corners and external edges of all precast concrete elements shall be finished with curved or straight fillets appropriate to the application.

8.6 Removal of Formwork

Formwork shall not be removed from the concrete or the product lifted until the concrete has attained a strength equal to 60% of the specified 28 day characteristic strength. Curing shall continue as soon as practical but no later than 1 hour after removal of form work. **Nonconformance**

Permission for early stripping or lifting of the product may be granted by the Administrator to a minimum of 40% of the specified 28 day strength, subject to the following conditions –

- a) Product design approval;
- b) Certification of product lifting points; and
- c) Satisfactory performance.

Under no circumstances shall the formwork be stripped, or the product lifted before the concrete has attained a strength of 40% of the specified 28 day concrete strength. Where a minimum lifting strength is shown on the drawings which is higher than these requirements the drawing requirements shall apply.

8.7 Curing

Curing shall continue until the lesser of 7 days or the time when the concrete has attained 70% of the specified 28 day characteristic strength. Where concrete is steam cured for a lesser time than the above curing requirements, the concrete shall be kept covered and saturated until the concrete cools to not more than 20°C above ambient temperature and alternative curing is commenced to achieve the above requirements.

8.8 Finish

8.8.1 Surface Condition

The concrete shall be dense and hard and substantially free from chipped edges, fins, protrusions and surface roughness.

Elements shall not be coated with cement wash or any other preparation not specified or otherwise approved by the Administrator.

8.8.2 Defects, Dents and Bulges

Elements shall be free from fractures and cracks wider than 0.1 mm. Dents not exceeding 3 mm in depth and bulges not exceeding 3 mm in height shall be permitted provided they do not extend over the surface for a distance of more than 180 mm.

8.8.3 Air Holes

Air holes exceeding 12 mm in lateral dimension and having a depth greater than 3 mm shall be filled in accordance with Clause 25 of MRS70 *Concrete*.

8.9 Tolerances

Completed precast concrete elements shall comply with the tolerances set out in Table 8.9.

Table 8.9 – Tolerances for Precast Concrete Elements

Precast Concrete Element	Tolerance (mm)				
	Thickness of Any Section	Length or Width	Internal Dimensions	Straightness †	Squareness
Slabs and panels including RSS wall panels	± 3	± 3	-	3	± 3 in 500 mm
Pits, gullies and manholes	+ 5, - 3	± 5	± 5	-	± 5 in 500 mm
Kerbs, channels and blocks	+ 5, - 3	± 5	-	5	± 3 in 500 mm
Retaining walls	± 5	± 10	-	3	± 5 in 500 mm
Traffic barriers	± 5	± 10	-	5	± 5 in 500 mm

† Deviation from a 1 metre long straight-edge.

9 MODIFICATIONS TO MRS71

9.1 General

Notwithstanding any requirements to the contrary in MRS71 *Reinforcing Steel*, Clauses 9.2 to 9.3 shall apply to the manufacture of precast concrete elements.

9.2 Cover

The tolerance for cover to steel reinforcing in elements in saltwater conditions (exposure classification C) shall be + 10 mm, - 0 mm where a positive value indicates the amount of clearance cover to reinforcement may increase and a negative value indicates the amount that cover may decrease.

The tolerance for cover to steel reinforcing in all other elements shall be ± 5 mm.

9.3 Bar Chairs

Plastic bar chairs shall be used to maintain cover to the reinforcement. Where precast elements are to be placed in a saltwater environment either stainless steel spacers or plastic bar chairs shall be used. Plastic bar chairs shall be an approved product (refer Clause 1).

10 CAST IN ITEMS

Cast in items including but not limited to ferrules, formwork anchors, lifting devices, anchor points, lintels, and drainage grate surrounds shall be either –

- a) Fabricated by an approved fabricator in accordance with MRS78; or
- b) Proprietary items as specified in the Drawings or approved equivalent. Proprietary cast in items shall be an approved product (Refer to Clause 1)

11 ACCEPTANCE

Precast concrete elements shall remain available for inspection for a minimum of 7 days.

The acceptability of precast concrete elements shall be determined by inspection on the basis of visual inspection, geometric measurement, measurement of clear cover to reinforcement, reinforcement spacing and location, and specified 28 day concrete strength.

Precast concrete elements may be rejected should they fail to meet any of the requirements of this Standard.