

Main Roads Technical Standard

MRTS82

Bridge Deck Expansion Joints

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Bridge Deck Expansion Joints

1 INTRODUCTION

This Standard applies to the supply and installation of bridge deck expansion joints.

This Technical 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 construction of bridge deck expansion joints shall use 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 Products

Clause	Category of Work
5.1	Bolted-in extruded aluminium expansion joints.
5.2.4	Epoxy Mortar
6.1	Cast in extruded aluminium expansion joints.
7.1.2	Wet to Dry Epoxy

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

Department of Transport and Main Roads
 Bridge Design
 GPO Box 1412
 Brisbane Qld 4001

Registered suppliers and products for the above items are listed in the relevant clauses in Annexure MRTS82.1.

2 DEFINITION OF TERMS

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

3 REFERENCES

Table 3 lists documents referenced in this Technical Standard

Table 3 – Referenced Documents

Reference	Title
AS 1214	Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series)
AS 1683.11	Methods of test for elastomers – Tension testing of vulcanized or thermoplastic rubber
AS 1683.13	Methods of test for elastomers - Compression set of vulcanized rubber under constant deflection
AS 1683.15.1	Methods of test for elastomers - International rubber hardness
AS 1683.23	Methods of test for elastomers - Rubber - Vulcanized - Determination of resistance to liquids
AS 1683.24	Methods of test for rubber – Determination of the resistance of vulcanized or thermoplastic rubbers to ozone cracking – Static strain test
AS 1683.26	Methods of test for elastomers - Rubber, vulcanized or thermoplastic - Accelerated ageing and heat resistance tests

Reference	Title
AS/NZS 4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
ISO 9001	Quality management systems – Requirements
ASTM D746	Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact

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, Witness 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	Witness Point	Milestone
5.3.2.2			Submission of epoxy mortar aggregate and mix proportions.
5.3.3		Installation of bolted-in aluminium expansion joint. Tightening of nuts.	
6.3.1		Placement of concrete around cast-in aluminium expansion joint.	
7.2.1	1. Fibre reinforced concrete expansion joint preparation.		
7.2.2		Placement of fibre reinforced concrete.	

4.2 Construction Procedures

The Contractor shall prepare documented procedures for all construction processes as stated in Clause 6 of MRTS50 *Specific Quality System Requirements*.

Procedures for those activities listed in Clause 4 of Annexure MRTS82.1 shall be submitted to the Administrator for approval in accordance with Clause 6 of MRTS50 *Specific Quality System Requirements*.

5 BOLTED-IN EXTRUDED ALUMINIUM EXPANSION JOINT

5.1 General

Bolted-in extruded aluminium expansion joints shall be used at expansion joints on a bridge deck which has an asphalt deck wearing surface.

Bolted-in extruded aluminium expansion joints shall be one of the registered products listed in Clause 1.1 of Annexure MRTS82.1.

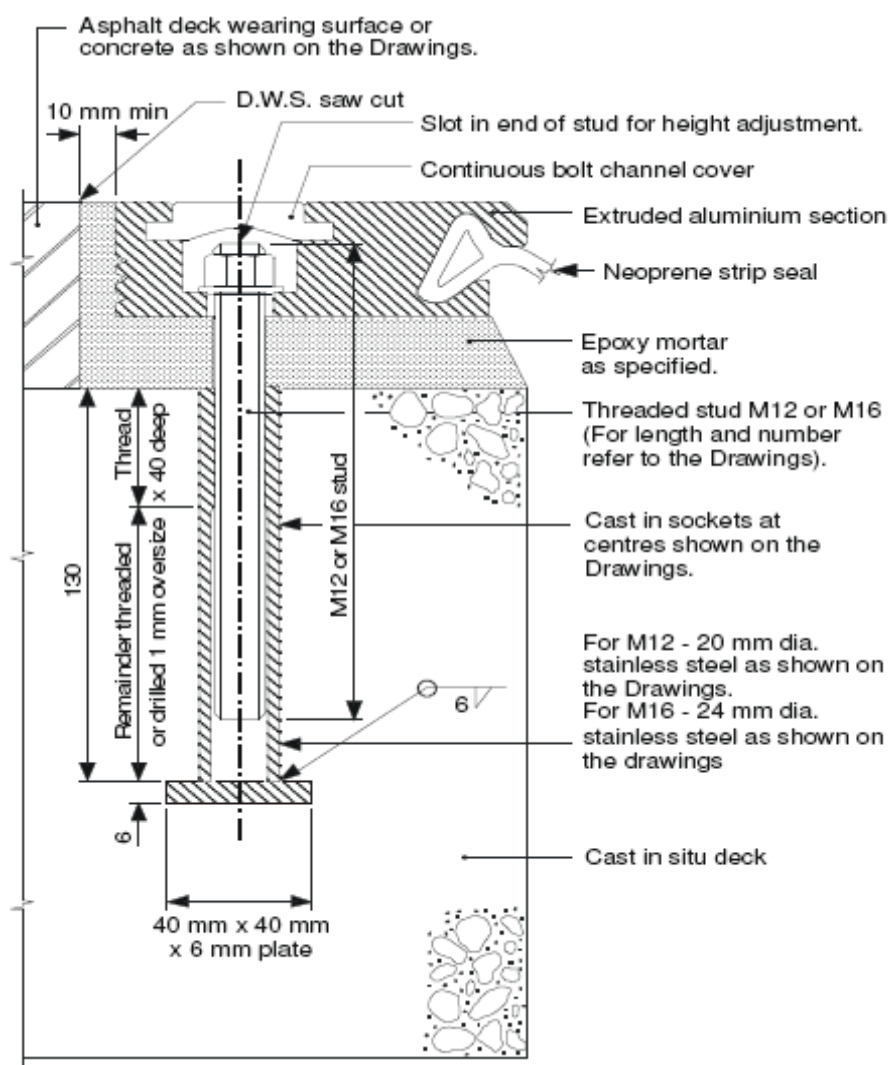
Alternative products may be submitted to the Administrator for approval.

5.2 Materials

5.2.1 Proprietary Joint

Bolted-in extruded aluminium and neoprene strip seal expansion joint shall comply with the details shown in the Drawings and those shown in Figure 5.2.1.

Figure 5.2.1 – Cross Section through Expansion Joint and Fixing



Any alternative design of expansion joint submitted to the Administrator for approval shall be made of similar material, shall have equivalent holding down arrangements and shall have an easily replaceable neoprene strip seal of equivalent durability.

The aluminium strip shall be supplied in modules with the minimum length as stated herein. Joints in the aluminium strip shall be provided only in the following locations –

- a) for a two lane bridge, a joint may be provided at the road centre line; and
- b) for bridges with more than two lanes, joints may be provided at the lane lines and the crown of the road. Joints shall not be used at the edge lines.

Aluminium strip modules shall be butted together without bonding. The upstand at the kerb shall be welded as detailed in the Drawings.

Kerb and parapet details shall be fabricated to the dimensions shown in the Drawings.

5.2.2 Neoprene Seal

The neoprene seal shall be supplied in one continuous length.

Preformed elastomeric joint seals of the strip seal type shall be made from vulcanised compound having polymerized chloroprene as the only base polymer.

The Contractor shall provide documentary evidence to the Administrator to verify that the elastomer used in the manufacture of the joint seals has been tested by a laboratory registered by NATA for the relevant tests and that it complies with the requirements specified in Table 5.2.2

The Administrator may waive the requirements for testing as above provided that –

- a) The elastomer for the manufacture of the strip seals is supplied by a company which has a quality assurance system to ISO 9001 that is third party certified for the manufacture and supply of elastomer;
- b) Test certificates supplied to validate that the elastomer meets the properties specified in Table 5.2.2 are not more than six months old;
- c) Day to day batch quality control on the manufacture of the elastomer is exercised by performing a test which accurately measures the cure characteristics of the elastomer and highlights variations resulting from incorrect ingredients or levels thereof; and
- d) The manufacturer establishes control points and limits on batches which have been Type Tested and uses these control points and limits for subsequent quality control purposes.

Table 5.2.2 – Elastomer Material Requirements

Property	Requirement	Test Method
Tensile Strength	13.8 MPa minimum	AS 1683.11 (Dumb-bell test pieces)
Elongation at Break	250% minimum	AS 1683.11 (Dumb-bell test pieces)
Hardness	IRHD 59 ± 5	AS 1683.15.1
Ageing		AS 1683.26 (Method A for 72 hours at 100°C)
Change in Tensile Strength	- 20% to 0	AS 1683.11 (Dumb-bell test pieces)
Change in Elongation at Break	- 20% to 0	AS 1683.11 (Dumb-bell test pieces)
Change in Hardness	IRHD 0 to + 10	AS 1683.15.1
Resistance to Ozone	No visible cracking	AS 1683.24 (Ozone concentration 100 ppm in air, 20% strain, 100 hours at 40°C)
Low Temperature Stiffening (Change in hardness)	IRHD 0 to + 15	AS 1683.15.1 (After 7 days at - 10°C)
Change in Volume in Oil	+ 70% maximum	AS 1683.23 (Using Oil 3 (IRM 903), after 72 hours at 100 °C)
Compression Set	40% maximum	AS 1683.13 (72 hrs at 100°C)
Low Temperature Brittleness	Not Brittle	ASTM D746 (B) (at - 30°C)

5.2.3 Studs

Studs shall be fabricated to the dimensions shown in the Drawings. They shall have a slot at one end for height adjustment using a screwdriver.

Studs shall be fabricated from Grade 304 stainless steel. Studs shall be supplied with one Grade 316 stainless steel nut and one Grade 304 stainless steel washer of 1.5 mm minimum thickness.

5.2.4 Epoxy Mortar

Epoxy mortar shall be either –

- a) an approved proprietary product capable of forming a dense mortar with fine aggregate and having superior adhesion to concrete; or
- b) a sand-epoxy mix.

Registered products are listed in Clauses 1.2 and 1.3 of Annexure MRTS82.1. Alternative products, including full technical details of the alternative formulation, may be submitted to the Administrator for approval.

Epoxy shall be supplied in kits which shall be used as a unit and not broken down into smaller portions.

No epoxy mortar shall be used once the pot life limit of the epoxy has expired. The pot life depends on aggregate temperature, epoxy temperature and surface temperature. The limit recommended by the manufacturer shall be observed. In hot weather, joints shall be installed during the cooler part of the day.

Aggregate used for epoxy mortar shall be well graded with 100% of material passing the 6.7 mm AS sieve and not less than 85% of material passing the 4.75 mm AS sieve. Aggregate shall be clean, free from impurities and completely dry. Bagged dry sand supplied by the epoxy manufacturer or filter medium sand supplied in bags may be acceptable.

5.3 Construction

5.3.1 Joint Preparation

Transverse saw cuts at the outer edges of the expansion joint recess shall be inserted in the deck wearing surface, from kerb to kerb. The depth of the saw cuts shall be slightly less than the depth of deck wearing surface. The deck wearing surface between the saw cuts and the underlying bond barrier shall be removed. The exposed concrete surface in the joint shall be sand blasted or well scabbled to produce a clean concrete surface.

Plugs shall be removed from the cast-in sockets and the studs inserted and adjusted to level.

For deck unit bridges, the recesses in the deck units above the anchor bolt nuts shall be filled with a compressible filler or shall be covered with a stainless steel or hot-dipped galvanised mild steel plate as shown in the Drawings.

5.3.2 Mixing Epoxy Mortar

5.3.2.1 Proprietary Epoxy Mortar

Proprietary epoxy mortar shall be mixed in accordance with the manufacturers instructions.

5.3.2.2 Sand-Epoxy Mix

All epoxy formulations shall be mixed by mechanical means. Depending on the quantity of material to be mixed at any one time, a paint stirrer type mixer attached to a power drill, rotating at 800 rpm may be suitable. The mixing operation shall continue for a minimum of 3 minutes.

The epoxy mortar shall then be prepared by slowly adding the aggregate to the mixed resin binder and mixing thoroughly. The proportions of the mix shall be either –

- a) where fine aggregate is used (i.e. not less than 80% of material passing the 2.36 mm AS sieve), one part resin binder to not more than two parts of aggregate measured by volume; or
- b) where coarse aggregate is used (i.e. less than 80% of materials passing the 2.36 mm AS sieve), one part resin binder to not more than four parts of aggregate measured by volume.

The mix may be adjusted by reducing the proportion of aggregate, if necessary, to suit local requirements.

The Contractor shall submit a sample of the proposed aggregate and mix proportions to the Administrator at least 14 days before the mix is to be used. **Milestone**

Where no experience with epoxy mortar using the aggregate is available, the Administrator may require that a trial mix or mixes be made and submitted for approval.

After a mix is approved it shall not be varied without the approval of the Administrator.

5.3.3 Installing Aluminium Strip

Installation of aluminium strip shall be a **Witness Point**.

Aluminium strip shall be match drilled to the stud locations with 14 mm diameter holes for M12 studs or 18 mm diameter holes for M16 studs.

The aluminium strip shall be bedded on epoxy mortar, mixed in accordance with Clause 5.3.2, with the joint adjusted to the level and profile of the deck wearing surface. Before placing epoxy mortar, the concrete surface shall be primed with neat epoxy similar to that used in the epoxy mortar.

Sufficient epoxy mortar shall be used to enable the aluminium strip to be set flush with the deck wearing surface and fully bedded on the mortar. Excess mortar shall be cleaned up immediately.

After the epoxy has cured, the nuts on the studs shall be tightened to a torque of 14 Nm for M12 nuts or 25 Nm for M16 nuts. **Witness Point**

5.3.4 Installing Neoprene Strip Seal

The neoprene strip seal shall be installed between adjoining aluminium sections. The neoprene seal shall be installed in a continuous piece using appropriate lubricant and tools as recommended by the manufacturer.

5.3.5 Installing Bolt Channel Cover

The bolt channel cover shall be installed as a continuous strip as recommended by the manufacturer. If no cover is provided with the aluminium strip, the bolt channel shall be filled with Class 320 bitumen in accordance with the requirements of MRTS17 *Bitumen* or a proprietary flexible polyurethane filler.

5.3.6 Finishing

The gap between the aluminium strip and the deck wearing surface shall be filled with epoxy mortar, finished flush with the top of the joint and the deck wearing surface.

6 CAST-IN EXTRUDED ALUMINIUM EXPANSION JOINT

6.1 General

Cast-in extruded aluminium expansion joints shall be used at expansion joints on a cast in situ reinforced concrete bridge deck as shown in the Drawings. Where the Drawing shows the joint to be cast in a recess, the recess shall be formed.

Cast-in extruded aluminium expansion joints shall be one of the registered products listed in Clause 2 of Annexure MRTS82.1.

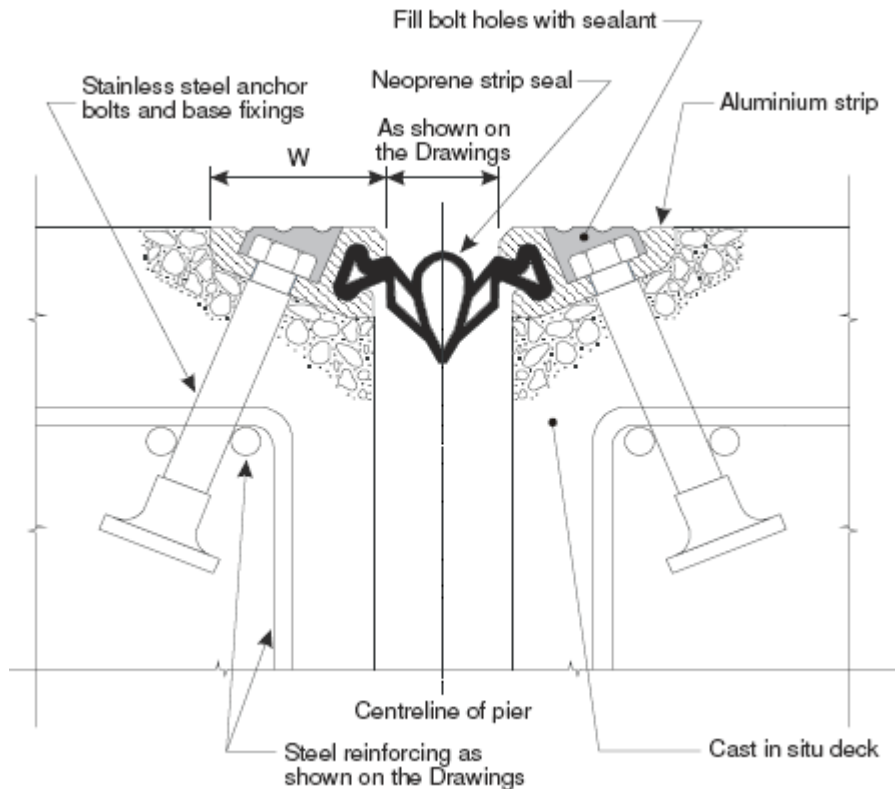
Alternative products may be submitted to the Administrator for approval.

6.2 Materials

6.2.1 Proprietary Joint

Cast-in extruded aluminium and neoprene strip seal expansion joints shall comply with the details shown in the Drawings and those shown in Figure 6.2.1.

Figure 6.2.1 – Cross Section Through Cast-in Aluminium Expansion Joint



Any alternative design of expansion joint submitted to the Administrator for approval shall be made of similar material, shall have equivalent holding down arrangements and shall have an easily replaceable neoprene strip seal of equivalent durability.

The aluminium strip shall be supplied in modules with the minimum length as stated herein. Joints in the aluminium strip shall be provided only in the following locations –

- a) for a two lane bridge, a joint may be provided at the road centre line; and
- b) for bridges with more than two lanes, joints may be provided at the lane lines and the crown of the road. Joints shall not be provided at the edge lines.

Aluminium strip modules shall be butted together without bonding. The upstand at the kerb shall be welded as detailed in the Drawings.

The neoprene seal shall be supplied in one continuous length.

Kerb and parapet details shall be fabricated to the dimensions shown in the Drawings.

6.2.2 Anchor Bolts

Anchor bolts shall be of the diameter and length and shall be at the spacing recommended by the manufacturer of the expansion joint. Anchor bolts shall have hexagonal heads. Base fixings shall be of sufficient size as to provide substantial pull-out resistance for anchors. Anchor bolts and base fixings shall be fabricated from stainless steel.

6.2.3 Neoprene Strip Seal

A flush neoprene strip seal shall be provided. Draped seals are not acceptable.

The seal shall be continuous across the width of the bridge. The properties of the seal shall conform to Table 5.2.2.

6.3 Construction

6.3.1 Installing Aluminium Strip

The aluminium strip shall be securely supported on the deck formwork so that it is not displaced during placement of concrete.

Anchor bolts shall be firmly tightened onto the PVC sleeves, where provided.

Steel reinforcement shall be tied to the anchor bolts near the base fixings in accordance with the details shown in the Drawings.

Extreme care shall be taken during placement of concrete to ensure that proper compaction is achieved around the anchor bolts and under the aluminium strip without displacement of the strip. **Witness Point**

6.3.2 Installing Neoprene Strip Seal

The neoprene strip seal shall be installed between adjoining aluminium sections. The neoprene seal shall be installed in a continuous piece using appropriate lubricant and tools as recommended by the manufacturer.

6.3.3 Filling of Anchor Bolt Recesses

The anchor bolt recesses in the top of the aluminium strip shall be filled with a proprietary flexible polyurethane filler.

7 FIBRE REINFORCED CONCRETE DECK EXPANSION JOINT

7.1 Materials

7.1.1 Fibre Reinforced Concrete

Fibre reinforced concrete shall contain a minimum of 75 kg/m³ of enlarged end steel fibres, 18 mm x 0.6 mm x 0.3 mm, or an approved equivalent product.

The maximum aggregate size shall be 10 mm and shall not exceed 35% by volume of the mix. The 28 day characteristic compressive strength shall be 40 MPa and the water cement ratio shall not exceed 0.50. An approved water reducing agent shall be used.

7.1.2 Wet-to-Dry Epoxy

Wet-to-dry epoxy shall be an epoxy formulation suitable for adhering new concrete to old.

Wet-to-dry epoxy shall be a registered product as listed in Clause 3 of Annexure MRTS82.1. Alternative products, including full technical details of the alternative formulation, may be submitted to the Administrator for approval.

7.1.3 Steel Reinforcing

Steel reinforcing bars as detailed in the Drawings shall comply with the requirements of MRTS71 *Reinforcing Steel*.

7.1.4 Anchor Rods

Anchor rods shall be round steel reinforcing bar, threaded at one end, of diameter shown in the Drawings and hot-dip galvanised in accordance with the requirements of AS 1214 and/or AS/NZS 4680, as applicable.

7.1.5 Compressible Filler

Compressible filler shall be a bitumen impregnated fibrous board of appropriate thickness.

7.1.6 Joint Compression Seal

The elastomeric neoprene compression seal for installation in the joint shall be of the type and size shown in the Drawings. The correct type of primer and lubricant adhesive for the seal, as recommended by the manufacturer, shall be provided.

7.2 Construction

7.2.1 Joint Preparation

Where a deck wearing surface has been installed, transverse saw cuts at the outer edges of the expansion joint shall be inserted in the deck wearing surface, from kerb to kerb. The depth of the saw cuts shall be slightly less than the depth of deck wearing surface. The deck wearing surface between the saw cuts and the underlying bond barrier shall be removed. The exposed concrete surface in the joint shall be sand blasted or well scabbled to produce a clean concrete surface.

The anchor rods shall be screwed into the cast-in sockets and bent to maintain a minimum 25 mm cover, cutting off any excess length as required.

The longitudinal joint reinforcement shall be installed as shown in the Drawings.

For deck unit bridges, the recesses in the deck units above the anchor bolt nuts shall be filled with a compressible filler or shall be covered with a stainless steel plate as shown in the Drawings.

Formwork, to produce the joint gap specified in the Drawings, shall be inserted in the joint. The formwork shall be suspended from elevated transverse battens attached to the deck wearing surface on either side of the joint. The surface of formwork shall be treated with a bond release compound.

Preparation of the joint shall be a Hold Point. **Hold Point 1**

7.2.2 Placement of Fibre Reinforced Concrete

Fibre reinforced concrete shall be mixed by placing all fibres in the mixer bowl with 80% of the mixing water and the water reducing agent.

The aggregates and cement shall be added to the mixer, followed by the remaining water, to achieve a target slump of 80 mm.

The slump and compressive strength of fibre reinforced concrete shall be tested in accordance with the provisions of MRTS70 *Concrete*.

Not more than 20 minutes prior to placing the concrete, the deck concrete in the joint shall be coated with wet-to-dry epoxy, mixed and applied strictly in accordance with the manufacturer's recommendations.

Fibre reinforced concrete shall be carefully placed in the prepared formwork and shall be compacted using an immersion vibrator. **Witness Point** The surface of the fibre reinforced concrete shall be levelled by screeding directly from the deck wearing surface each side of the joint. The surface shall be finished with a steel float.

7.2.3 Seal Installation

After the concrete has set and the formwork has been removed, the neoprene seal shall be installed in the expansion joint gap in accordance with the manufacturer's recommendations, using the appropriate primers and lubricant. The seal shall not be stretched excessively during installation and the top of the seal shall be set at a depth below the top of the deck wearing surface as shown in the Drawings.

8 SUPPLEMENTARY REQUIREMENTS

The requirements of MRTS82 *Bridge Deck Expansion Joints* are varied by the Supplementary requirements given in Clause 5 of Annexure MRTS82.1.