

Superseded

Technical Specification

**Transport and Main Roads Specifications
MRTS84 Deck Wearing Surface**

July 2017

Superseded

Copyright



<http://creativecommons.org/licenses/by/3.0/au/>

© State of Queensland (Department of Transport and Main Roads) 2017

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

Contents

- 1 Introduction1**
- 2 Definition of terms1**
- 3 Referenced documents1**
- 4 Quality system requirements2**
 - 4.1 Hold Points, Witness Points and Milestones 2
 - 4.2 Construction procedures..... 2
- 5 Preparation of concrete surface.....3**
 - 5.1 General 3
 - 5.2 Joint sealing 3
 - 5.2.1 For Type A and Type B waterproof membranes3
 - 5.2.2 For Type C waterproof membranes3
 - 5.3 Concrete surface texture 3
- 6 Priming the concrete surface4**
- 7 Asphalt corrector course4**
- 8 Requirements where open graded asphalt surfacing is specified5**
- 9 Vehicle equipment and plant induced loads on bridge5**
- 10 Waterproof membrane5**
 - 10.1 General 5
 - 10.2 Design of Type A and B waterproofing membranes..... 6
 - 10.3 Type A waterproof membrane 6
 - 10.4 Type B waterproof membrane 7
 - 10.5 Application of binder and spreading of cover aggregate 7
 - 10.6 Protection of kerbs, parapets, scuppers, rails and other road / bridge furniture 7
- 11 Asphalt.....7**
 - 11.1 General 7
 - 11.2 Tack coat 7
 - 11.3 Asphalt 7
 - 11.4 Excessive hog..... 7
 - 11.5 Type C proprietary waterproof membrane..... 8
 - 11.5.1 General..... 8
 - 11.5.2 Installation Method Statement..... 8
- 12 Acceptance of Type C proprietary waterproof membrane9**
 - 12.1 General 9
- 13 Additional requirements 10**

1 Introduction

This Technical Specification applies to the construction of an asphalt deck wearing surface on bridges.

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.

The construction of asphalt deck wearing surfaces shall 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 products

Clause	Category of Work
5.2	Hot applied bitumen based crack sealant
6.4	Concrete Surface Primer
11.5	Type C Proprietary Waterproofing Membranes

Registered suppliers and products for the above items are listed in the relevant clauses in Annexure MRTS84.1.

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

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

This is also available at <https://www.tmr.qld.gov.au/business-industry/Business-with-us/Approved-products-and-suppliers/Bridges-and-other-structures-approved-products-and-suppliers>.

2 Definition of terms

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

3 Referenced documents

References used in this Technical Specification include, but are not limited to, documents listed in Table 3.

Table 3 – Referenced documents

Reference	Title
Technical report	Austrroads Technical Report AP-T68/06 <i>Update of the Austrroads Sprayed Seal Design Method</i>
BD 47/99	Design manual for roads and bridges: Volume 2, Section 3, Part 4: <i>Waterproofing and Surfacing of Concrete Bridge Decks</i> by UK Highway Agency. A copy of this document could be obtained from the following web address. http://www.dft.gov.uk/ha/standards/dmrb/vol2/section3.htm

Reference	Title
BA 47/99	Design manual for roads and bridges: Volume 2, Section 3, Part 5: <i>Waterproofing and Surfacing of Concrete Bridge Decks</i> by UK Highway Agency. A copy of this document could be obtained from the following web address. http://www.dft.gov.uk/ha/standards/dmr/vol2/section3.htm
Interim Advice Note 96/07	Guidance on Implementing results of research on bridge deck waterproofing by UK Highway Agency. A copy of this document could be obtained from the following web address. http://www.dft.gov.uk/ha/standards/ghost/ians/index.htm
MRTS11	<i>Sprayed Bituminous Surfacing (Excluding Emulsion)</i>
MRTS17	<i>Bitumen</i>
MRTS18	<i>Polymer Modified Binder</i>
MRTS22	<i>Supply of Cover Aggregate</i>
MRTS30	<i>Asphalt Pavements</i>
MRTS70	<i>Concrete</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 and Witness Points applicable to this Technical Specification are summarised in Table 4.1. There are no Milestones defined.

Table 4.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
6	1. Application of concrete surface primer		
7	2. Total asphalt thickness	1. Laying of asphalt	
9	3. Acceptance of Equipment Operational Plan		
11.3		2. Laying of asphalt	
11.4	4. Adjustment of surface levels of deck wearing surface		
11.5.2	5. Installation Method Statement		

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 Clause 1 of Annexure MRTS84.1 shall be submitted to the Administrator for approval in accordance with the quality system requirements of the Contract.

5 Preparation of concrete surface

5.1 General

The concrete surface shall be thoroughly broomed to remove all loose material. Any deposits of cement mortar, grout or concrete adhering to the surface shall be removed. Any patches of oil or other material which might be detrimental to the adhesion of the primer or waterproofing membrane to concrete shall be removed (e.g. by using a suitable solvent and then allowing an appropriate period before priming).

The gap in the concrete surface at any expansion joints shall be temporarily sealed. The concrete surface directly under a future expansion joint and surrounding bedding material shall be covered to prevent bituminous products adhering to the concrete.

5.2 Joint sealing

5.2.1 For Type A and Type B waterproof membranes

For deck unit bridges, all fixed transverse joints at abutments and piers shall be sealed with a hot applied bitumen based crack sealant.

For bridges without an insitu deck all mortar joints between prestressed concrete deck units in the deck surface shall be sealed with a registered hot applied bitumen based crack sealant (refer Clause 1).

The sealant shall be bitumen-based. It shall have superior adhesion to concrete surfaces and have good extension characteristics to operate effectively at pavement and deck temperatures between -15°C and 75°C without damage. It shall form a soft rubber like characteristic at these temperatures and have an extension characteristic of at least 300% at 25°C. The sealant shall have a melting point of at least 170°C.

Registered products are listed in Clause 2.1 of Annexure MRTS84.1. Alternative products may be submitted to the Administrator for approval, but shall not be used unless approved in writing by the Administrator.

Dimensions of the finished sealant shall be in accordance with the manufacturer's recommendations. Hot applied bitumen based crack sealant shall be mixed, heated and applied strictly in accordance with the manufacturer's recommendations.

5.2.2 For Type C waterproof membranes

For Type C waterproof membranes, joints shall be sealed as stated in the method statement required under Clause 11.5.

5.3 Concrete surface texture

The surface texture of the concrete shall be checked in the following stages:

- a) after the concrete surface is prepared in accordance with Clause 5.1, and
- b) prior to priming.

This check shall be conducted in accordance with MRTS70 *Concrete*. Testing shall not be undertaken on, or partially on, gaps, joints or the like in the concrete surface. Where the surface texture of the concrete does not comply with Clause 20.2.1 of MRTS70 *Concrete*, the surface shall be roughened by a means approved in writing by the Administrator such that it does comply with Clause 20.2.1 of MRTS70 *Concrete*.

6 Priming the concrete surface

Priming shall not occur until the concrete to be primed complies with Clause 5 in all respects (i.e., until surface texture complies and the surface is prepared).

After preparation of the concrete surface, and prior to placement of the corrector course (where used) or waterproof membrane, the concrete surface shall be primed.

The primer shall be a registered product that is suitable for use as a bituminous primer for concrete surfaces (refer to Clause 1). However, not all registered products are suitable for use in all situations as the requirements of the products material safety data sheet (MSDS) and the manufacturer's recommendations must be considered as part of the selection and application process. The primer shall consist of bitumen and one or more compatible substances in a mixture which performs as a rapid curing prime.

Registered products are listed in Clause 2.2 of Annexure MRTS84.1. Alternative products may be submitted, in writing, to the Administrator for approval, but shall not be used unless approved in writing by the Administrator.

The primer shall be applied to the surface of the concrete deck using a sprayer with a current Queensland Sprayer Certificate issued by the Queensland Department of Transport and Main Roads. Further, it shall be applied in a safe manner having regard to the MSDS for the product, a copy of which shall be provided to the Administrator prior to application of the primer. **Hold Point 1**

The rate of application of the primer shall be as stated in Clause 2.3 of Annexure MRTS84.1 or where not stated, as recommended by the manufacturer. Where the rate of application is not stated in Clause 2.3 of Annexure MRTS84.1 and the manufacturer does not recommend a rate of application, the rate of application shall be 0.5 L/m². Prior to application of the binder for the waterproofing membrane, the primer shall be cured in accordance with the recommendations of the manufacturer.

7 Asphalt corrector course

A dense graded asphalt corrector course shall be placed to correct the profile caused by the hog of prestressed concrete deck units and / or height differences between concrete deck units.

The corrector course shall be DG10 dense graded asphalt that complies with, and is constructed in accordance with, MRTS30 *Asphalt Pavements*. In particular, the thickness of the corrector course shall comply with the minimum and maximum target layer thicknesses nominated in MRTS30 *Asphalt Pavements* at all points. The final surface heights of the asphalt corrector course shall achieve a level tolerance of ± 10 mm. More than one layer of correction may be required in some circumstances to achieve the required surface profile.

The Contractor shall submit the Equipment Operational Plan and the Administrator will confirm the suitability of the Equipment Operational Plan in accordance with the requirements of Clause 9 prior to the commencement of the asphalt corrector course. The laying of asphalt shall be a witness point

Witness Point 1

Where the total thickness of asphalt required is greater than that shown in the Contract, the Contractor shall advise the Administrator prior to the commencement of construction of the asphalt. **Hold Point 2**

The asphalt corrector course shall only be applied to a primed concrete deck.

8 Requirements where open graded asphalt surfacing is specified

Wherever an open graded asphalt surfacing is specified on a bridge deck, the deck wearing surface as a whole must comprise an open graded surfacing placed on a 50 mm thick DG14 layer, placed over a dense graded asphalt corrector course (where required). The waterproofing membrane shall be placed between the open graded asphalt surfacing and the 50 mm DG14 layer.

9 Vehicle equipment and plant induced loads on bridge

For each bridge, the Contractor shall prepare and submit an Equipment Operational Plan that provides details about all the proposed vehicles, plant and equipment that will load / traffic the bridge. The Equipment Operational Plan shall include:

- a) a list of all vehicles, plant and equipment that will load / traffic the bridge
- b) gross maximum (loaded) mass of all individual vehicles, plant and equipment in tonnes, including any incidental mass, fuel and any attachments on vehicles, plant and equipment
- c) vibrating frequency (Hz) and nominal amplitude (mm) of vibrating rollers. Preference shall be given to oscillating drum rollers
- d) rotational speed (rpm) of the milling drum, milling depth range and number of teeth on the drum of cold milling machines
- e) each combination of vehicles, plant and equipment that may occur during the works for the purpose of evaluating the load distribution on the bridge during bridge work, and
- f) any additional details requested by the Administrator.

In addition, the Contractor shall submit the proposed program of works, including the proposed times for placing the prime, waterproofing membrane, asphalt and all other bituminous products.

The Contractor shall submit the Equipment Operational Plan to the Administrator at least 20 days prior to the commencement of any bridge work. The Administrator will confirm the suitability of the Equipment Operational Plan. No work related to the deck wearing surface shall commence until the Administrator has approved the Equipment Operational Plan and written advice of this is received by the Contractor **Hold Point 3**

10 Waterproof membrane

10.1 General

Prior to construction of the deck wearing surface, a waterproofing membrane shall be applied as follows:

- a) on the surface of the primed concrete deck where the final surface is dense graded asphalt and an asphalt corrector course is not required
- b) on top of the asphalt corrector course where the final surface is dense graded asphalt and an asphalt corrector course is required and Type A or Type B waterproofing membrane is used

- c) on the surface of the primed concrete deck where the final surface is dense graded asphalt and an asphalt corrector course is required and Type C waterproofing membrane is used
- d) between the open graded asphalt and the 50 mm DG14 layer detailed in Clause 8 where the final surface is open graded asphalt and Type A or Type B waterproofing membrane is used, or
- e) Type C waterproofing membrane on the surface of the primed concrete deck plus a Type A or Type B waterproofing membrane between the open graded asphalt and the 50 mm DG14 layer detailed in Clause 8 where the final surface is open graded asphalt.

The waterproofing membrane shall consist of one of the following types:

- a) Type A – A seal with bitumen binder in accordance with the requirements of Clause 10.3
- b) Type B – A seal with an S4.5S polymer modified binder in accordance with Clause 10.4, or
- c) Type C – Proprietary waterproofing membrane in accordance with Clause 11.5 and Clause 12.

Unless stated otherwise in Clause 2.4 of Annexure MRTS84.1, a Type B waterproof membrane shall be used.

The cover aggregate used for the waterproofing membrane shall be pre-coated aggregate conforming to the requirements of MRTS22 *Supply of Cover Aggregate* for aggregate quality Category B of nominal size as stated in Clause 2.4 of Annexure MRTS84.1 or, where not so stated, not less than 10 mm nominal size.

10.2 Design of Type A and B waterproofing membranes

The Contractor shall be responsible for the design of the binder application and aggregate spread rates to be used. The design binder application rate and aggregate spread rate shall be determined in accordance with the requirements of Austroads Technical Report AP-T68/06 Update of the Austroads Sprayed Seal Design Method and achieve an application rate not less than 1.5 L/m² and not more than of 1.8 L/m² for high shear applications (refer Clause 10.4). In so doing, the Contractor shall:

- a) give due consideration to any additional requirements stated as per Clause 13
- b) consider the traffic to which the waterproofing seal will be subjected, and
- c) consider any embedment into any asphalt.

The requirements of Clauses 6.1.2 and 6.3 of MRTS11 *Sprayed Bituminous Surfacing (Excluding Emulsion)* shall also apply. The definitions and roles of the Seal Designer and a Seal Designer's Delegate shall be as defined in Clause 2 of MRTS11 *Sprayed Bituminous Surfacing (Excluding Emulsion)* and apply to the waterproofing membrane.

10.3 Type A waterproof membrane

Type A waterproof membranes shall consist of joint sealing followed by a single application of binder and cover aggregate and shall only be used where it is not practical to use a Type B waterproofing membrane where supply of a polymer modified binder is difficult, such as in remote areas.

The binder shall be Class 170 bitumen that complies with the requirements of MRTS17 *Bitumen*. The binder and cover aggregate shall be applied in accordance with the requirements of Clause 10.6.

10.4 Type B waterproof membrane

Type B waterproof membrane shall consist of a single application of binder and cover aggregate. Type B Waterproofing membrane is suitable where the deck wearing surface is located in a high shear environment (e.g. where there are high horizontal shear forces induced by braking and / or cornering traffic, where there is a steep gradient or on the approaches to a signalised intersection).

The binder shall be a polymer modified bituminous binder conforming to PMB Class S4.5S in accordance with the requirements of MRTS18 *Polymer Modified Binder*. The binder and cover aggregate shall be applied in accordance with the requirements of Clause 10.6.

Type B waterproofing membrane shall not be trafficked unless otherwise approved by the Administrator.

10.5 Application of binder and spreading of cover aggregate

The binder and cover aggregate used for the waterproofing membrane shall be applied in accordance with the requirements of MRTS11 *Sprayed Bituminous Surfacing (Excluding Emulsion)*.

10.6 Protection of kerbs, parapets, scuppers, rails and other road / bridge furniture

Kerbs, parapets, scuppers, rails and other road / bridge furniture shall be protected during the spraying of primer and binder to prevent adherence of any overspray.

11 Asphalt

11.1 General

All works shall be supplied and constructed in accordance with the relevant Technical Specifications and the Drawings.

11.2 Tack coat

A tack coat shall be applied in accordance with the requirements of MRTS30.

11.3 Asphalt

Asphalt as specified in the contract shall be placed over the waterproof membrane. The laying of asphalt shall be a witness point. **Witness Point**

The standard of asphalt shall be consistent with the adjoining pavements. For example:

- a) DG14HS where the adjoining pavements are HILL pavements (as defined in the *Pavement Design Manual*) and / or the adjoining pavements contain asphalt complying with MRTS30 *Asphalt Pavements*
- b) DG14(320) where the adjoining pavements have a sprayed seal surface or DG14(320) surface, or
- c) DG14 (A5S) for most other situations.

Asphalt shall comply, and shall be constructed in accordance, with MRTS30 *Asphalt Pavements*, as relevant for the mix being used.

11.4 Excessive hog

In cases of excessive hog, adjustment of the deck wearing surface levels in order to preserve the minimum thickness of the dense graded asphalt surfacing layer over prestressed units may be

necessary. Adjustment of the deck surface levels shall not be carried out unless prior approval has been given by the Administrator. **Hold Point 4**

11.5 Type C proprietary waterproof membrane

11.5.1 General

Refer Clause 12 for acceptance criteria of Type C proprietary waterproofing membrane.

Type C proprietary waterproofing membranes shall be used for special circumstances listed below where waterproofing Types A or B is found not adequate to ensure the long term durability of the structure. Proprietary waterproofing membrane shall be a high performance waterproofing membrane.

The examples of special circumstances where proprietary high performance waterproofing membrane system shall be required are listed below:

- transversely stressed deck unit bridges
- rehabilitation of transversely stress deck unit bridges
- where bridge decks are suffering from high Alkali reactivity
- rehabilitation of decks where the deck reinforcing steel has been damaged or exposed, and
- bridge decks in salt spray susceptible areas.

Type C proprietary waterproofing membrane shall be a registered product. Registered Type C waterproof membrane systems are listed in Clause 2.6 of Annexure MRTS84.1.

11.5.2 Installation Method Statement

At least 28 days prior to the commencement of the installation of the approved Type C waterproofing membrane, the Contractor shall submit a Method Statement for its installation of to the Administrator. Installation shall not be commenced until written acceptance is received from the Administrator

Hold Point 5 The Installation Method Statement shall be prepared in consultation with the membrane supplier. In addition to the method of application of the waterproofing membrane and quality control measures in all stages of application of the membrane on the bridge deck, the Installation Method Statement shall clearly address special requirements. Several of these are listed below:

- Method of surface preparation to ensure appropriate surface preparation is achieved. The method of surface preparation shall be similar to the method used in site trials as specified in Clause 12. The required concrete surface texture shall be in accordance with the supplier's specification.
- Method of ensuring the surface moisture content of the concrete is acceptable to the membrane supplier.
- Where required, the Method Statement to correct the profile caused by the hog of prestressed concrete bridge girders and / or height differences between bridge girders.
- Where applicable, method statement shall demonstrate the treatment at the longitudinal joints of transversely stressed deck unit bridge decks.
- If the membrane is proposed to be applied on early aged concrete (i.e seven to 28 days), the Method Statement shall include the additional requirements to improve the performance of the membrane in accordance with IAN 96/07.

- The Method Statement shall include the methodology to repair any defects and to reinstate any damage to the waterproofing membrane during construction of the membrane. This method shall be in accordance with supplier's specifications.
- The Method Statement for details of sealing of the fixed joints shall be included. Fixed joints shall be sealed using polyethylene backing rod or similar in accordance with the membrane manufactures' specifications. Hot applied bitumen based crack sealant shall not be used for spray applied applications without confirmation of the suitability from the membrane supplier.
- Method of temporary protection of waterproofing prior to completion of subsequent tack coat and surfacing, and
- Type of tack coat and rate of application to be used between membrane and the overlay as per the membrane supplier's specifications.

12 Acceptance of Type C proprietary waterproof membrane

12.1 General

Type C waterproofing membrane shall be a proprietary, high performance product installed to properly prepared concrete decks by operatives trained by the supplier with all defects repaired to the satisfaction of the supplier meeting the requirements below.

Type C proprietary waterproofing membrane shall have the following minimum performance qualities as appropriate:

- a) sufficiently robust to transient vehicular loading
- b) provide adequate resistance for ingress of water, effects of chloride ions and chemicals on the bridge deck
- c) resistant to mechanical impact
- d) excellent crack bridging properties
- e) UV resistance
- f) membrane curing time
- g) high tensile strength while sufficiently flexible and tough
- h) resistance to heat and aggregate indentation at 125°C, and
- i) uniform adhesion at all interfaces between concrete, primer, waterproofing membrane, tack coat, any additional protective layer and surfacing in order to ensure long term durability of the concrete deck, waterproofing system and the surfacing.

Type C proprietary waterproofing membrane can be a liquid applied system or sheet system. Such waterproofing systems shall be applied in accordance with the manufacturer's specifications. The thickness of spray applied waterproofing membranes shall be a minimum of 2 mm overall, including peaks and rises in the concrete deck, but shall not be greater than 3 mm.

The requirement for Type C proprietary waterproofing membrane shall be identified during the concept design stage to enable sufficient time for product evaluation. If a requirement for Type C high performance waterproofing membrane is identified at the concept design stage, the proposal to use a Type C proprietary waterproof system shall be informed in writing to the Director (Bridge and Marine Engineering) for review and acceptance.

Type C proprietary waterproofing membrane systems shall demonstrate the required performance by laboratory testing, site trials and past performance of the application on bridge decks. The proprietary products shall be submitted to the Transport and Main Roads Director (Bridge and Marine Engineering) for evaluation. Such evaluation shall be undertaken outside a contractual situation.

Proprietary waterproofing membranes shall be tested for the performance in a laboratory with appropriate NATA registration or in an overseas laboratory in NATA's Mutual Recognition Arrangement (MRA) Network. Requirements, tests and checks for proprietary high performance waterproofing systems shall be in accordance with Appendix B of BD 47/99: *Waterproofing and surfacing of concrete bridge decks* issued by The Highways Agency, England. In addition, this assessment shall be extended to the following:

- a) The minimum adhesion and bond strength requirements in BD 47/99 are applicable only for surface thickness of 120 mm or more. Therefore, adhesion to concrete substrate shall be assessed in accordance with Interim Advice Note 96/07 (IAN 96/07) *Guidance on implementing results of research on bridge deck waterproofing decks* issued by The Highways Agency, England for asphalt thickness less than 120 mm (60–90 mm), and
- b) Waterproofing systems shall be assessed for a bridge deck service surface temperature in the range of 5°C to 60°C.

In lieu of the NATA test requirements, valid assessment and certification of waterproofing systems by the British Board of Agreement (BBA), Highway Authorities Product Approval Scheme (HAPAS) is acceptable. This assessment shall be extended for the additional requirements as stated above.

Following the successful results of the laboratory test programme to Appendix B of BD 47/99 or the BBA certificate, the supplier of Type C proprietary waterproofing system shall then be required to undertake a site trial prior to construction of the membrane in accordance with Appendix C of BD 47/99 at a site in Australia where temperatures are similar to Queensland. Preparation of the bridge deck for the site trial and application of the waterproofing membrane for the site trial shall be witnessed by a representative of the Transport and Main Roads Structures branch to cover the installation procedure defined in the supplier's Method Statement for application of the waterproofing membrane for site trials. The method statement shall also include the method of surface preparation to ensure the appropriate surface preparation is achieved as per the supplier's specification.

Transport and Main Roads acceptance of the Type C proprietary waterproofing membrane requires both submission of the successful test results and the acceptable performance at the site trials. The method statement used for the site trial shall be submitted to Transport and Main Roads.

13 Additional requirements

The requirements of MRTS84 *Deck Wearing Surface* are varied by the supplementary requirements given in Clause 3 of Annexure MRTS84.1.

Superseded