Bridge Repair Manual

Appendix D to Road Structures Inspection Manual

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Government of South Australia
Department of Planning, Transport and Infrastructure

Road Structures Inspection Manual

Appendix D: Bridge Repair Manual
Department of Planning, Transport and Infrastructure, South Australia

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Every effort has been made to supply complete and accurate information. This document is subject to continual revision and may change. It is the user's responsibility to check DPTI's website to ensure that the current version is being used.

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STANDARD REPAIRS

This manual contains details of Standard Repairs prepared primarily for use in repairing defects in bridges and other structures, authorised by the Principal Engineer, Structures.

When recommending a repair method, inspection reports will refer to the relevant Standard Repair in the form SR No X where X is the repair number given herein. To provide further information links have been provided to a list of suppliers/manufacturers, together with their addresses, in order to assist in quickly obtaining the materials referred to in these repair methods.

To maintain the effectiveness of this system, users are requested to inform the Bridge Assets Group of any problems encountered in the use of the recommended repair methods or materials. Details of site conditions, preparation of surfaces etc., would be of importance in reassessing a repair method or material.

Notification of difficulties in obtaining a specified material, (e.g. if it is no longer available), or changes in suppliers and/or their contact details, is also requested. This information will be used to amend the details contained in this manual.

SR01 MAJOR REPAIRS TO SPALLING CONCRETE

SR01.1 Introduction

This repair method outlines the requirements for minor and major repairs to spalling concrete – combining and superseding what was previously contained in this standard repair and in Standard Repair 4. This repair involves removal of the deteriorated concrete to expose sound material, preparing the concrete substrate, priming the steel reinforcement and reinstating the excavated area.

SR01.2 Limitations

This is applicable for areas where the underlying steel reinforcement has corroded, inducing spalling of the overlying concrete area and increasing the potential for subsequent deterioration of the concrete and steel reinforcement.

SR01.3 Repair Method

The appropriate repair method shall be adopted from VicRoads Section 689 – Cementitious Patch Repair of Concrete. With each material the manufacturer's instructions should be followed.

SR01.4 Material Requirements

The following guidelines are to be read as the minimum requirement for material performance. All products must be compatible with one another and deemed appropriate for the application. All identification, sampling, testing, storage, preparation and application of products are to be as per the manufacturer's technical specification and in accordance with the applicable DPTI specifications. Technical data sheets, product test records and verification of code conformance is to be submitted to DPTI via the online web form at https://www.dpti.sa.gov.au/prequalified_products.

Alternatively, applying one of the proprietary curing compounds shown in the table below can achieve effective curing. Compounds must be applied in accordance with the manufacturer's instructions.

Reference	Material	Master Spec
i	Zinc rich primer	Part S36
ii	Concrete	Part CC20 Part CC25 Part CC26

Table 1: Material requirements SR01

In addition to that listed above, the selected products must also satisfy the performance criteria as outlined in the following tables.

i. *Zinc Rich Primer*

Test Procedure	Performance Metric	Requirement
AS 3894.3	Dry film thickness	75 µm – 125 µm

Table 2: Zinc rich primer test procedure

Zinc rich primer must:

- comply with APAS 2916/1 (Dual pack) or APAS 2916/2 (Single pack)

OR

- have a total zinc content of the non-volatile content not less than 85% by mass or greater than 94% by mass.

ii. *Concrete*

Refer to Section 689.06 of VicRoads Section 689.for material requirements for concrete.

Also refer to Section 689.08 (b) for requirements for concrete cover to steel reinforcement.

SR01.5 Revision Status

Revision Status: Standard Repair No. 1			
Revision Status	**Revision Date**	**Clause**	**Details**
1.0	Aug. 1999	All	First Issue
1.1	Sept. 2000	C.4	Remove SILIKAL R17 - product unavailable
2.0	Jan. 2001	All	First intranet release
2.1	Feb. 2004	C.3	Add repair material (5) TAMREZ R17
3.0	Mar 2018	All	Converted to Performance Based Specifications
3.1	Nov 2019	1.4 i	Added additional requirements
		1.4 ii	Removed copied text and added reference to VicRoads Section 689 document

Table 3: Revision status SR01

SR02 SEALING DECK JOINTS COVERED BY ASPHALTIC CONCRETE

SR02.1 Introduction

Some bridges have bituminous surfacing placed over gaps in the concrete deck slab. This arrangement does not provide reliable support for the roadway surfacing, particularly if the gap exceeds 15-20 mm, which can lead to breaking up of the road surface in the gap area over time. This repair method can be applied to fixed, expansion and longitudinal (construction) joints. Two versions of the repair are provided. The first uses asphalt to cover the joint. The second uses a rubberised crack sealant aggregate mix for use in locations remote from asphalt supplies.

SR02.2 Limitations

- Maximum gap width 30mm
- Minimum depth of Asphaltic Concrete 50mm
- Maximum depth of Asphaltic Concrete 100mm
- Maximum joint width of 500mm

Note: For fixed and expansion joints where the above limitations are not met, use *Standard Repair No.16*.

SR02.3 Repair Method

SR02.3.1 Asphalt Bridge Joint System

1) Profile out, or saw cut Asphaltic Concrete (A.C.) to produce a prepared repair width of 450mm.

2) Clean and dry joint and recess thoroughly. It is important for the integrity of the repair that all oil, grease, moss, loose material and moisture be removed from the joint and recess, as they will affect the bonding of the *ELASTOMERIC CRACK SEALANT*[i] to the surface.

3) Prime the joint and entire recess with a *POLYMER MODIFIED BINDER*[ii] that is compatible with the *ELASTOMERIC CRACK SEALANT*.

4) Install the backing rod at a depth approximately equal to the joint width (not required for joints less than 2 mm in width). Backing rod should be 30% wider than the joint and made of a compressible *BITUMEN IMPREGNATED POLYURETHANE FOAM*[iii]. Refer to SR02.1 diagram, below.

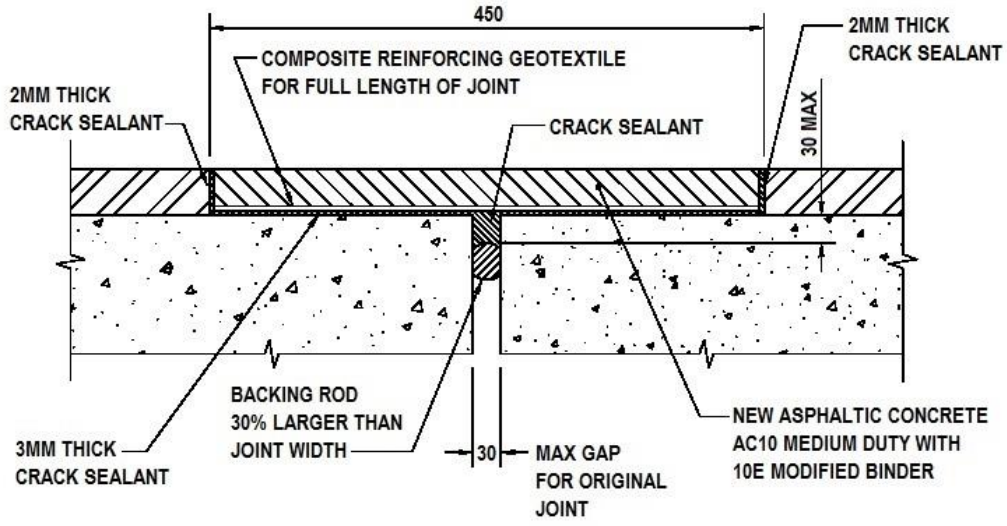

Figure 1: Asphalt bridge joint system SR02

5) Fill joint gap with selected *ELASTOMERIC CRACK SEALANT* in two layers: fill the joint up to 90% of the depth, allow to set for 10 minutes and then fill up to the top of the deck. Layering or stop ends may also be necessary due to filler fluidity.

6) Place 3 mm thick layer of the *ELASTOMERIC CRACK SEALANT* in bottom of recess and 2 mm thick layer on vertical walls.

7) Place a 400 mm wide strip of *COMPOSITE REINFORCING GEOTEXTILE*[iv] on the bottom of the recess for full length of joint. Add one more layer of *COMPOSITE REINFORCING GEOTEXTILE* for each 50mm increase in depth. Thus a second layer is required 50mm above the base geotextile layer when depth of A.C. reaches 100mm.

8) Backfill recess with suitable *AC10 MEDIUM DUTY*[v] using *10E MODIFIED BINDER*[vi]. If this cannot be obtained, the alternative choice can only be with the approval of the Superintendent, and shall be *AC10 MEDIUM DUTY* using a *35P MODIFIED BINDER*[vi].

   When two or more layers are used, allow the previously placed layer to cool to 100°C to prevent deformation when rolling the next layer of *AC10*. Compact to level with existing surface.

SR02.3.2 Rubberised Crack Sealant Bridge Joint System

1-5) As for Ashpalt Bridge Joint System

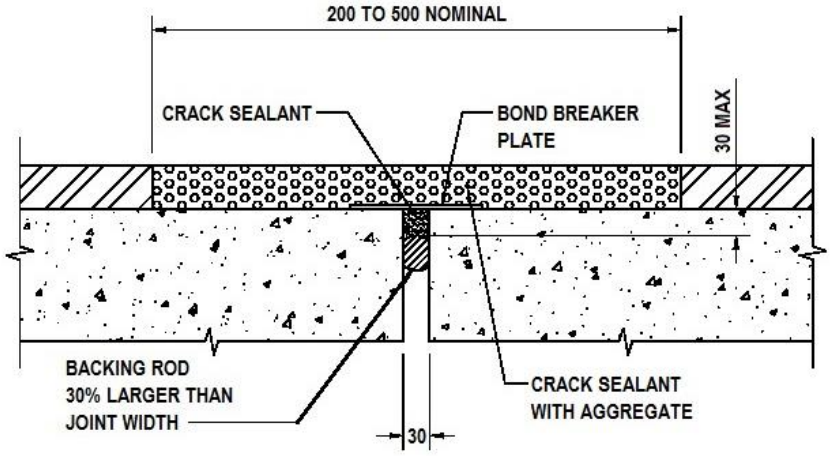

Figure 2: Crack sealant bridge joint system SR02

6) Place 150 x 5mm, galvanised, 250 grade plate over the filled gap and fix it to one side of the joint.

7) Apply a liberal coating of selected *ELASTOMERIC CRACK SEALANT* to the bottom of the joint (about 5mm thick) then immediately apply the first layer of *GRADED SPRAY SEALING AGGREGATE*[vii]. The nominal *AGGREGATE* size should be 14mm and where the depth of the joint is greater than 70mm a blend of *AGGREGATE* sizes should be provided.

   Hand tamp the *AGGREGATE* in to place. Continue filling the joint in layers using this process. The ratio of *AGGREGATE* to *ELASTOMERIC CRACK SEALANT* should be approximately 70:30. When each layer of *ELASTOMERIC CRACK SEALANT* is poured ensure 2-5mm of *AGGREGATE* protrudes above the surface of the *ELASTOMERIC CRACK SEALANT* layer as is necessary to provide the required interlocking mechanism with the subsequent layer of *AGGREGATE*.

   The final surface layer should be similar in appearance to a spray sealed surface. A smaller sized *AGGREGATE* may be used in the final layer/s as required in order to give the finished surface of the joint a texture better suited for the wearing course adjacent the joint. Slightly overfill the joint, as the *ELASTOMERIC CRACK SEALANT* will shrink due to contraction on cooling to ambient temperature.

8) Allow the *ELASTOMERIC CRACK SEALANT* to cool to ambient temperature prior to trafficking.

9) If the final surface level of the joint is lower than desired after cooling, subsequent layers of *ELASTOMERIC CRACK SEALANT* and finish surface *AGGREGATE* can be installed in the same manner. If this done, ensure all loose *AGGREGATE* is removed and the surface is clean and dry prior to adding another layer.

SR02.4 Material Requirements

The following guidelines are to be read as the minimum requirement for material performance. All products must be compatible with one another and deemed appropriate for the application. All identification, sampling, testing, storage, preparation and application of products are to be as per the manufacturer's technical specification and in accordance with the applicable DPTI specifications. Technical data sheets, product test records and verification of code conformance is to be submitted to DPTI via the online web form at https://www.dpti.sa.gov.au/prequalified_products.

Reference	Material	Master Spec
i	Elastomeric crack sealant	Part R37 Part R38
ii	Polymer modified binder	Part R25 Part R26
iii	Bitumen impregnated polyurethane foam	n/a
iv	Composite reinforcing geotextile	Part R85
v	Medium duty coarse asphalt mix (AC10)	Part R27
vi	10E modified binder 35P modified binder	Part R25 Part R26
vii	Graded spray sealing aggregate	Part R26

Table 4: Material requirements SR02

In addition to that listed above, the selected products must also satisfy the performance criteria as outlined in the following tables.

i. *Elastomeric Crack Sealant*

n/a

ii. *Polymer Modified Binder*

Test Procedure	Performance Metric	Requirement
AS 2341.23	Mass residual from evaporation	20% min.
AS 2341.32	Acidity	4.0 – 7.0 pH

Table 5: Polymer modified binder test procedure

iii. *Bitumen Impregnated Polyurethane Foam*

- Proven for durability to resist weathering and disintegration

Test Procedure	Performance Metric	Requirement
AS 2282.3	Density	95 kg/m3 approx.
RMS T1150	Compression, pressure to produce 50% of original thickness	80 kPa min.
RMS T1151	Extrusion, at the free edge	6 mm max.
RMS T1150	Recovery, thickness after 50% compression	70% min.
AS 2282.6	Tensile strength	250 kPa min.
AS 2282.7	Tear resistance	900 N/m min.

Table 6: Bitumen impregnated polyurethane foam test procedure

iv. *Composite Reinforcing Geotextile*

- Inert to all chemicals naturally found in soils and shall have no solvents at ambient temperature.
- Shall consist of a reinforcing grid thermally bonded to a paving fabric at the grid nodes.
- Shall not be susceptible to hydrolysis, shall be resistant to aqueous solutions of salts, acids and alkalis and shall be non-biodegradable.
- Minimum of 2% finely divided carbon black, well dispersed in the polymer matrix to inhibit attack by ultra-violet light and provide a minimum UV resistant design life as appropriate for the site and structure.

v. *Medium Duty Coarse Asphalt Mix (AC10)*

n/a

vi. *10E Modified Binder or 35P Modified Binder*

n/a

vii. *Graded Spray Sealing Aggregate*

n/a

SR02.5 Revision Status

Revision Status: Standard Repair No. 2			
Revision Status	**Revision Date**	**Clause**	**Details**
1	Aug 1999	All	First Issue
2	Jan 2001	All	First intranet release
3	Aug 2006	All	SAMIFILLA Bridge Joint System Add
4	Mar 2018	All	Converted to Performance Based Specifications

Table 7: Revision status SR02

SR03 SEALING CONSTRUCTION JOINTS IN CONCRETE DECKS

SR03.1 Introduction

Where a construction joint is provided in a concrete bridge deck, deterioration of the joint and subsequent cracking of the surfacing asphalt can often occur. This repair method outlines how this can be repaired by excavating a small repair area, applying an elastomeric crack sealant to protect the joint and backfilling the concrete recess to reinstate the road surface.

SR03.2 Limitations

Minimum depth of Asphaltic Concrete must be 50mm for this repair.

SR03.3 Repair Method

1) Profile out or saw cut Asphaltic Concrete (A.C.) to produce a prepared repair width of 300mm.

2) Clean and dry joint and recess thoroughly. It is important for the integrity of the repair that all oil, grease, moss, loose material and moisture be removed from the joint and recess, as they will affect the bonding of the *ELASTOMERIC CRACK SEALANT*[i] to the surface.

3) Form a 10 mm Vee symmetrically over the joint for full length using a comb hammer or angle grinder with masonry disc.

4) Prime the crack and entire recess with a *POLYMER MODIFIED BINDER*[ii], compatible with the selected *ELASTOMERIC CRACK SEALANT* product.

5) Fill the crack to the surface with selected *ELASTOMERIC CRACK SEALANT* with elastomeric polymers and allow sufficient time to set as per manufacturer's instructions.

6) Place 3 mm thick layer of *ELASTOMERIC CRACK SEALANT* in bottom of recess and 2 mm thick layer on vertical walls.

7) Place a 250 mm wide strip of compatible *COMPOSITE REINFORCING GEOTEXTILE*[iii] in the bottom of the recess for the full length of the joint. Add one more layer of *COMPOSITE REINFORCING GEOTEXTILE* for each 50mm increase in depth. Thus a second layer is required 50mm above the base geotextile layer when depth of A.C. reaches 100mm.

8) Backfill recess with *AC10 MEDIUM DUTY*[iv] using *10E MODIFIED BINDER*[v]. If this cannot be obtained, the alternative choice can only be with the approval of the Superintendent, and shall be *AC10 MEDIUM DUTY* using *35P MODIFIED BINDER*[vi].

   When two or more layers are used, allow the previously placed layer to cool to 100°C to prevent deformation when rolling the next layer of *AC10*. Compact to level with existing surface.

Note: SAMIFILLA 'HM' is required to be heated in a kettle and poured in place when hot. Refer to the manufacturer's instructions below.

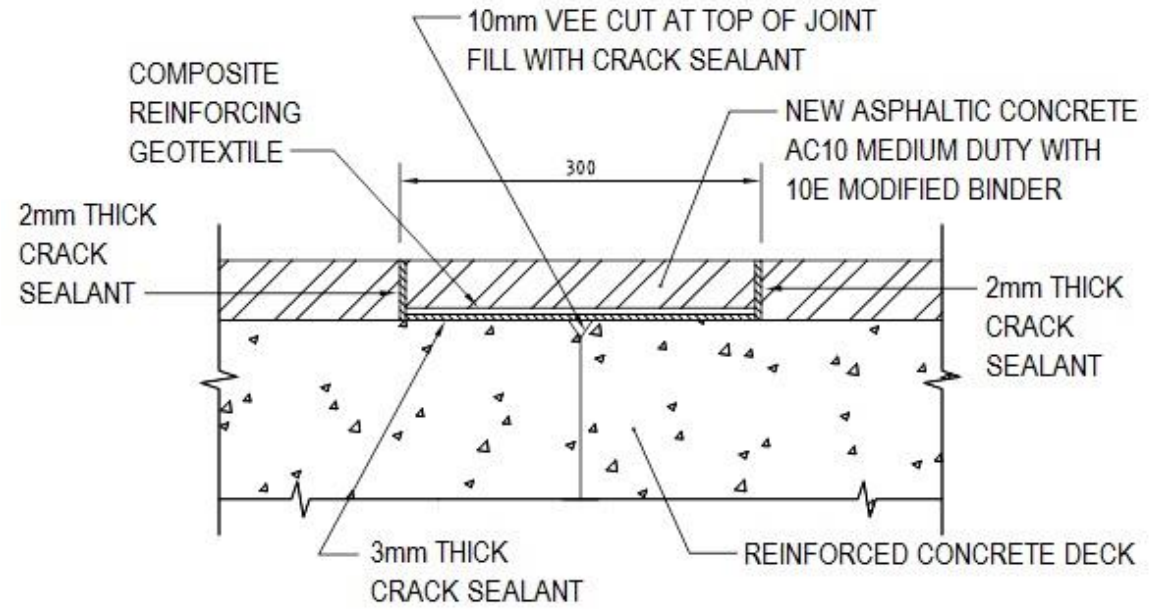

Figure 3: Standard repair no. 3

SR03.4 Material Requirements

The following guidelines are to be read as the minimum requirement for material performance. All products must be compatible with one another and deemed appropriate for the application. All identification, sampling, testing, storage, preparation and application of products are to be as per the manufacturer's technical specification and in accordance with the applicable DPTI specifications. Technical data sheets, product test records and verification of code conformance is to be submitted to DPTI via the online web form at https://www.dpti.sa.gov.au/prequalified_products.

Reference	Material	Master Spec
i	Elastomeric crack sealant	Part R37 Part R38
ii	Polymer modified binder	Part R25 Part R26
iii	Composite reinforcing geotextile	Part R85
iv	Medium duty coarse asphalt mix (AC10)	Part R27
v	10E modified binder 35P modified binder	Part R25 Part R26

Figure 4: Material requirements SR03

In addition to that listed above, the selected products must also satisfy the performance criteria as outlined in the following tables.

i. *Elastomeric Crack Sealant*

n/a

ii. *Polymer Modified Binder*

Test Procedure	Performance Metric	Requirement
AS 2341.23	Mass residual from evaporation	20% min.
AS 2341.32	Acidity	4.0 – 7.0 pH

Table 8: Polymer modified binder test procedure

iii. *Bitumen Impregnated Polyurethane Foam*

- Proven for durability to resist weathering and disintegration

Test Procedure	Performance Metric	Requirement
AS 2282.3	Density	95 kg/m3 approx.
RMS T1150	Compression, pressure to produce 50% of original thickness	80 kPa min.
RMS T1151	Extrusion, at the free edge	6 mm max.
RMS T1150	Recovery, thickness after 50% compression	70% min.
AS 2282.6	Tensile strength	250 kPa min.
AS 2282.7	Tear resistance	900 N/m min.

Table 9: Bitumen impregnated polyurethane foam test procedure

iv. *Composite Reinforcing Geotextile*

- Inert to all chemicals naturally found in soils and shall have no solvents at ambient temperature.
- Shall consist of a reinforcing grid thermally bonded to a paving fabric at the grid nodes.
- Shall not be susceptible to hydrolysis, shall be resistant to aqueous solutions of salts, acids and alkalis and shall be non-biodegradable.
- Minimum of 2% finely divided carbon black, well dispersed in the polymer matrix to inhibit attack by ultra-violet light and provide a minimum UV resistant design life as appropriate for the site and structure.

v. *Medium Duty Coarse Asphalt Mix (AC10)*

n/a

vi. *10E Modified Binder or 35P Modified Binder*

n/a

SR03.5 Revision Status

Revision Status: Standard Repair No. 3			
Revision Status	**Revision Date**	**Clause**	**Details**
1	Aug 1999	All	First Issue
1.1	Jan 2000	Title	Title changed
2	Jan 2001	All	First intranet release
3	Feb 2018	All	Converted to Performance Based Specifications

Table 10: Revision status SR03

SR04 DELETED

SR05 EPOXY PRESSURE INJECTION OF CRACKS

SR05.1 Introduction

This section outlines the method and quality of materials to be used in the repair of concrete cracks. Concrete cracks can be described as either active or inactive – the former where movement in the crack is live and subject to further movement, or the latter where movement in the crack is dormant and will not open, close or extend further. This repair method involves sealing off the cracks such that the contained reservoir can be pressure injected with epoxy resin, filling all voids and reinstating the bond between separated concrete. This is not intended for load transfer. The products selected should be compatible with one another and considerate of the cause of damage such that future degradation is avoided.

SR05.2 Limitations

- Maximum crack width 12mm
- Maximum crack depth 25mm
- Minimum crack depth 12mm – crack depths less than this may be more appropriate for sealant alone without the need for pressure injected resin

SR05.3 Repair Method

Refer to VicRoads Section 687 – Repair of Concrete Cracks for repair method details.

Note that Sections 687.10, 687.11, 687.12 and 687.13 of the VicRoads document do not apply for this type of repair.

SR05.4 Material Requirements

The following guidelines are to be read as the minimum requirement for material performance. All products must be compatible with one another and deemed appropriate for the application. All identification, sampling, testing, storage, preparation and application of products are to be as per the manufacturer's technical specification and in accordance with the applicable DPTI specifications. Technical data sheets, product test records and verification of code conformance is to be submitted to DPTI via the online web form at https://www.dpti.sa.gov.au/prequalified_products.

Reference	Material	Master Spec
i	Epoxy resin	Part CC25
ii	Elastomeric crack sealant	Part R37 Part R38

Table 11: Material requirements SR05

In addition to that listed above, the selected products must also satisfy the performance criteria as outlined in the following tables.

i. *Epoxy Resin*

Test Procedure	Performance Metric	Requirement
ASTM D2556	Viscosity, at 20°	300 mPa.s max.
BS 6319	Compressive strength	60 MPa min.
BS 6319	Tensile strength	25 MPa min.
BS 6319	Flexural strength	50 MPa min.
ASTM C882	Bond strength (or failure in concrete, whichever occurs first)	2.5 MPa min.

Table 12: Epoxy resin test procedure

ii. *Elastomeric Crack Sealant*

n/a

SR05.5 Revision Status

Revision Status: Standard Repair No. 5			
Revision Status	**Revision Date**	**Clause**	**Details**
1	Aug 1999	All	First Issue
1	Aug 1999	All	RAMSET, HILTI, BAUER EPOXIES, EPIREZ, BICS, RESIMAX
2	Jan 2001	All	First intranet release
3	Mar 2018	All	Converted to Performance Based Specifications
4	May 2020	5.3	Added clarification regarding extent of VicRoads document applying to this repair

Table 13: Revision status SR05

SR06 SEALING LEAKS IN CRACKED CONCRETE WITH WATERPROOF SLURRY

SR06.1 Introduction

This repair method utilises a *WATERPROOFING CEMENT*[i] slurry system and is to be used on areas where water percolates through fine cracks in concrete surfaces.

The water flow is usually fairly moderate, but the affected area often has significant efflorescence carried away from the crack due to water flow. Any reinforcing bars located at the crack site are in danger of eventual corrosion.

The *WATERPROOFING CEMENT* concentrate is mixed with water to create cementitious slurry that is applied over the cracked area. Further water leakage activates chemicals in the material which induces non-soluble crystals to grow into the cracks, pores and capillary tracts of the concrete, preventing any future flow of water. The selected product system may also employ a curing agent.

SR06.2 Limitations

Maximum crack width 1mm

SR06.3 Repair Method

SR06.3.1 Surface Preparation

The surface shall be cleaned so that scale, efflorescence and all other foreign matter is absent. The width of the prepared concrete surface is to be 100mm either side of the crack. The concrete surface is to be prepared using either water blasting or grinding, whichever is deemed most appropriate. These methods, respectively, require the use of:

1) A high pressure water blaster 17200 kPa (2500 psi) minimum, with turbo head attachment. Where water blasting is used, the concrete will be suitably wetted.
2) A diamond impregnated grinding cup. Where grinding is used, then the surface must be saturated with water so that absorption of water into the pores of the concrete occurs.

The surface must be thoroughly wetted and then cleared of free water before proceeding with the application of waterproofing slurry.

SR06.3.2 Slurry Application

Mix the *WATERPROOFING CEMENT* slurry in accordance with manufacturer's instructions. Take note that there are slight differences in the mixing proportions of concentrate powder and water depending whether brush or spray application is to be used. Never add more water than is advised, but rather restir if the slurry goes hard in the mixing bucket. Adhere to manufacturer’s specification and guidelines with regards to pot life and working life.

Apply the *WATERPROOFING CEMENT* slurry coat over the prepared surface area (200mm wide) to achieve a coating thickness of 1.5mm. This can be accomplished using a semi-stiff short bristle brush or broom.

Alternatively, it can be applied using spray equipment for extensive areas. In this case, the spray nozzle must be held close enough such that the material is forced into the crack and surface pores.

Cure the *WATERPROOFING CEMENT* slurry treated area as per the manufacturer's instructions. Where a curing agent is required, this shall be applied as a fine mist spray after the concrete slurry repair has reached initial set. Initial set time depends on the selected products and weather conditions.

SR06.4 Material Requirements

The following guidelines are to be read as the minimum requirement for material performance. All products must be compatible with one another and deemed appropriate for the application. All identification, sampling, testing, storage, preparation and application of products are to be as per the manufacturer's technical specification and in accordance with the applicable DPTI specifications. Technical data sheets, product test records and verification of code conformance is to be submitted to DPTI via the online web form at https://www.dpti.sa.gov.au/prequalified_products.

Reference	Material	Master Spec
i	Waterproofing cement	n/a

Table 14: Material requirements SR06

In addition to that listed above, the selected products must also satisfy the performance criteria as outlined in the following tables.

i. Waterproofing Cement

- Repair agent shall be cement based with crystalline water proofing additives.
- Product Grade / waterproofing agent concentration shall be selected to create impervious patch and stop water percolation through the treated concrete.
- Waterproofing slurry must not be applied during temperatures less than 4°C.
- This product must be kept dry in storage, and also not allowed to freeze.

Test Procedure	Performance Metric	Requirement
AS1012	Compressive strength @ 28 days – of the structure 15 MPa to 30 MPa 30 MPa to 50 MPa ≥ 50 MPa	 – of the repair 23 MPa min. 35 MPa min. 60 MPa min.
AS1012	Flexural strength @ 28 days – of the structure 15 MPa to 30 MPa 30 MPa to 50 MPa ≥ 50 MPa	 – of the repair 4 MPa min. 6 MPa min. 10 MPa min.
AS1012	Tensile strength @ 28 days – of the structure 15 MPa to 30 MPa 30 MPa to 50 MPa ≥ 50 MPa	 – of the repair 1.8 MPa 2.8 MPa 3.8 MPa
BS EN 1542	Bond strength by pull-off	0.75 MPa min.

Table 15: Waterproofing cement test procedure

SR06.5 Revision Status

Revision Status: Standard Repair No. 6			
Revision Status	**Revision Date**	**Clause**	**Details**
1	Aug 1999	All	First Issue
1	Aug 1999	All	First Issue: XYPEX
1	Aug 1999	All	First Issue: VANDEX BB75
2	Jan 2001	All	First intranet release
3	Mar 2018	All	Converted to Performance Based Specifications

Table 16: Revision status SR06

SR07 SEALING DECK JOINTS NOT COVERED BY ASPHALTIC CONCRETE

SR07.1 Introduction

Joints are provided in the concrete deck of bridges to improve constructability of concrete pours and to prevent cracking. These joints need to be sealed to prevent the ingress of debris and water which can damage reinforcement and the structure below.

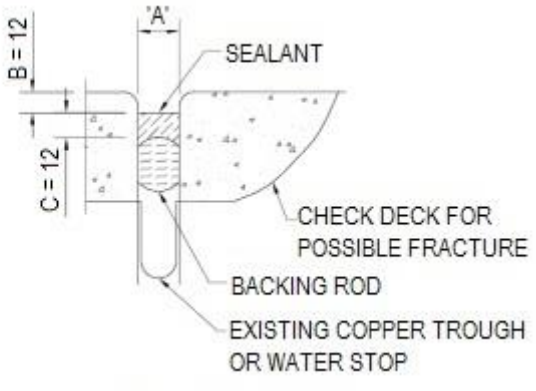

Figure 5: Sealing of deck joints SR07

SR07.2 Limitations

This repair method is limited for use where the deck and nosing are found to be in sound condition. If there is a copper trough or other water-stop, the deck edge may be fractured and therefore unsuitable for this repair. In this case a new nosing is required - see *Standard Repair No. 16*.

SR07.3 Repair Method

SR07.3.1 Preparation

1) The surface shall be cleaned so that scale, efflorescence and all other foreign matter is absent. The concrete surface is to be prepared using either:-

   (a) *Sliding plate joint*: Remove the plate and check that the base plates are sound.

   (b) *Joints with nosings at road surface level*: Expose the old sealant.

2) Scrape out old sealant from the joint and sweep out all loose material.

3) Check the edge of the concrete deck for soundness. See *Section 2 - Limitations*.

4) Measure the joint width between adjacent faces of the concrete deck.

5) Prime with a compatible product in accordance with the manufacturer's instructions.

6) The *JOINT SEALANT* is to be selected and installed based on the repair area and in accordance with the manufacturer's instructions:

   (a) Sealant for road – two-part *SILICONE JOINT SEALANT*[i] to be installed in accordance with manufacturer's instructions.

(b) Sealant for kerbs – one-part *POLYURETHANE JOINT SEALANT*[ii] to be installed in accordance with the manufacturer's instructions.

The selected joint sealant is to be super-low modulus to ensure adequate flexibility, fast curing to minimise traffic disruption and gun-grade for easy application.

7) The sealant shall be allowed to cure in accordance with the manufacturer's instructions.

SR07.3.2 Installation

1) Clean the sides of joint thoroughly by sandblasting. It is essential to remove all moisture, powder, dirt, dust, grease, oil and other foreign matter.

2) Push correct size closed cell *POLYETHYLENE BACKING ROD*[iii] indicated in the attached table corresponding to the joint opening into the joints between nosings to the depth indicated.

3) The cleaned vertical faces of the concrete above the backing rod to be primed to ensure a good bond with the *JOINT SEALANT* at the interface.

4) When the primer has dried or set according to the Manufacturer's recommendations, the *JOINT SEALANT* can be placed to the depth shown. The ambient and substrate temperatures will govern this time - faster for warmer conditions.

5) Re-install sliding plate as appropriate.

Table of Dimensions					
Joint Width (mm) – Dimension 'A'	25	38	50	65	75
Depth to Sealant (mm) – Dimension 'B'	12	12	12	12	12
Sealant Depth (mm) – Dimension 'C'	12	12	12	12	12
Backer Rod Outside Diameter (mm)	32	50	60	75	90
Total Depth Required (mm) Minimum	38	75	85	100	115

Table 17: Table of Dimensions SR07

SR07.4 Material Requirements

The following guidelines are to be read as the minimum requirement for material performance. All products must be compatible with one another and deemed appropriate for the application. All identification, sampling, testing, storage, preparation and application of products are to be as per the manufacturer's technical specification and in accordance with the applicable DPTI specifications. Technical data sheets, product test records and verification of code conformance is to be submitted to DPTI via the online web form at https://www.dpti.sa.gov.au/prequalified_products.

Reference	Material	Master Spec
i	Waterproofing cement	n/a
ii	Polyurethane joint sealant	n/a
iii	Polyethylene backing rod	n/a

Table 18: Material requirements SR07

In addition to that listed above, the selected products must also satisfy the performance criteria as outlined in the following tables.

i. Silicone Joint Sealant

- Two-part rubber sealant
- Rapid cure
- Self-levelling and therefore appropriate for horizontal (road) applications

Test Procedure	Performance Metric	Requirement
ISO 8339	E-Modulus @ 100%	0.1 MPa max.
ISO 7390	Sag flow	Self-levelling
ISO 1183	Specific gravity, Method A	1.1 – 1.55
ISO 868	Shore A hardness	10 – 25
ASTM-C603	Extrusion rate	90 – 250 g/min
ASTM-C679	Tack-free time	30 – 70 mins
ASTM-C794	Adhesion to concrete, average peel strength	35N min.

Table 19: Silicone joint sealant test procedure

ii. Polyurethane Joint Sealant

- One-part polyurethane sealant
- Gun-grade
- Rapid cure
- Non-sag (0mm sag flow) appropriate for vertical (kerb) applications

Test Procedure	Performance Metric	Requirement
ISO 8339	E-Modulus @ 100%	1 MPa max.
ISO 7390	Sag flow	0 mm, non-sag
ISO 868	Shore A hardness	20 – 40

Table 20: Polyurethane joint sealant test procedure

iii. Polyethylene Backing Rod

- Proven for durability to resist weathering and disintegration

Test Procedure	Performance Metric	Requirement
AS 2282.3	Density	35 kg/m3 approx.
RMS T1150	Compression, pressure to produce 50% of original thickness	100 kPa min.
AS 2282.6	Tensile strength	250 kPa min.

Table 21: Polyurethane backing rod test procedure

SR07.5 Revision Status

Revision Status: Standard Repair No. 7			
Revision Status	**Revision Date**	**Clause**	**Details**
1	Aug 1999	All	First Issue
1.1	Jan 2000	A.6; B.4	Add extra primer details
2	Jan 2001	All	First intranet release
3	Nov 2006	All	DOW CORNING 902 RCS Sealant Added
4	Mar 2018	All	Converted to Performance Based Specifications

Table 22: Revision status SR07

SR08 ABUTMENT DECK JOINT REPAIR

SR08.1 Introduction

Some bridge arrangements include a concrete deck cast atop the abutment wall and backfilled with soil, as shown in the detail below. Water and soil fines can percolate through the joint between these elements causing deterioration or staining on the visible face. This can be avoided by sealing the joint between the deck and abutment, as outlined in this repair method.

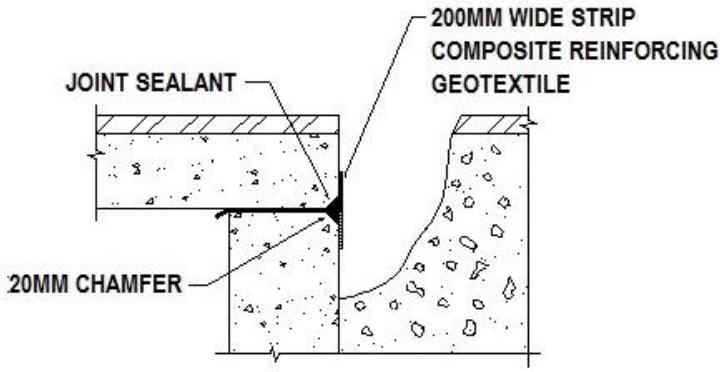

Figure 6: Abutment deck joint repair SR08

SR08.2 Limitations

This repair method is limited to bridge arrangements where the deck is sitting atop the abutment back wall and where the soil backfill can be removed for access without causing damage to the structure.

If the concrete structure presents deterioration or spalling, these should be repaired by the methods outlined in the other applicable Standard Repair Manuals.

SR08.3 Repair Method

1) Excavate approximately 200 mm behind the abutment backwall to expose the joint chamfer formed by the deck resting on the abutment backwall, for the length of the abutment.

2) Vee out chamfers to approximately 40 mm (20 mm each chamfer) for the complete abutment length.

3) Apply a *POLYURETHANE JOINT SEALANT*[i] as per manufacturer's instructions.

4) Install a *COMPOSITE REINFORCING GEOTEXTILE*[ii] strip over sealant and compact fill.

5) Reinstate road surface.

SR08.4 Material Requirements

The following guidelines are to be read as the minimum requirement for material performance. All products must be compatible with one another and deemed appropriate for the application. All identification, sampling, testing, storage, preparation and application of products are to be as per the manufacturer's technical specification and in accordance with the applicable DPTI specifications. Technical data sheets, product test records and verification of code conformance is to be submitted to DPTI via the online web form at https://www.dpti.sa.gov.au/prequalified_products.

Reference	Material	Master Spec
i	Polyurethane joint sealant	n/a
ii	Composite reinforcing geotextile	Part R85

Table 23: Material requirements SR08

In addition to that listed above, the selected products must also satisfy the performance criteria as outlined in the following tables.

i. Polyurethane Joint Sealant

- One-part polyurethane sealant
- Gun-grade
- Rapid cure
- Non-sag (0mm sag flow) appropriate for vertical (kerb) applications

Test Procedure	Performance Metric	Requirement
ISO 8339	E-Modulus @ 100%	1 MPa max.
ISO 7390	Sag flow	0 mm, non-sag
ISO 868	Shore A hardness	20 – 40

Table 24: Polyurethane joint sealant test procedure

ii. Composite Reinforcing Geotextile

- Inert to all chemicals naturally found in soils and shall have no solvents at ambient temperature.
- Shall consist of a reinforcing grid thermally bonded to a paving fabric at the grid nodes.
- Shall not be susceptible to hydrolysis, shall be resistant to aqueous solutions of salts, acids and alkalis and shall be non-biodegradable.
- Minimum of 2% finely divided carbon black, well dispersed in the polymer matrix to inhibit attack by ultra-violet light and provide a minimum UV resistant design life as appropriate for the site and structure.

SR08.5 Revision Status

Revision Status: Standard Repair No. 8			
Revision Status	**Revision Date**	**Clause**	**Details**
1	Aug 1999	All	First Issue
2	Jan 2001	All	First intranet release
3	Mar 2018	All	Converted to Performance Based Specifications

Table 25: Revision status SR08

SR09 RE-GROUTING OF BEARING PLATES

SR09.1 Introduction

Mortar pads which are breaking up, may be repaired using the following procedure. Refer to the detail below.

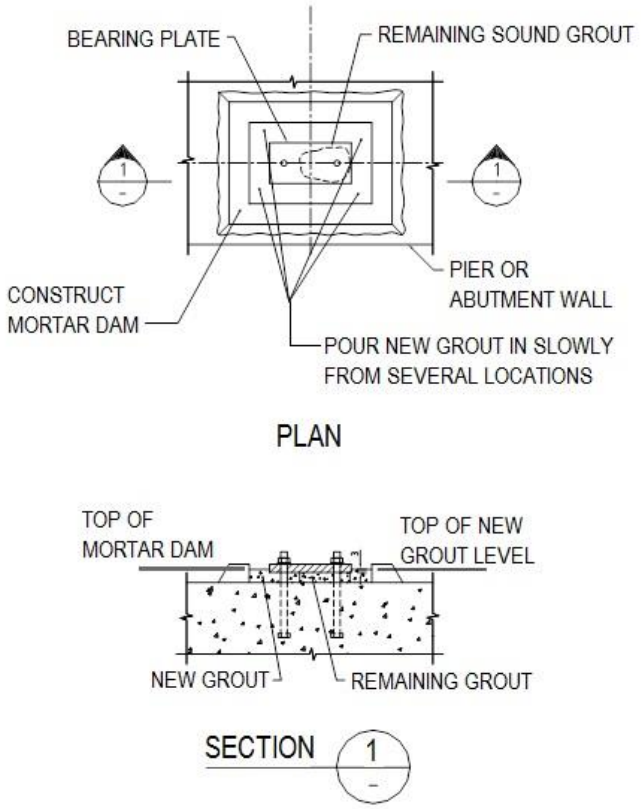

Figure 7: Regrouting under bearing plates SR09

SR09.2 Limitations

This repair method is limited to the repair of arrangements similar in nature to the details shown above.

SR09.3 Repair Method

1) Support girder to prevent it dropping if a large portion of the existing grout is to be removed.

2) Remove all loose and friable grout, blow clean with water blast, and allow to dry. Care shall be taken to prevent dust contamination of the surfaces of sliding bearings.

3) Construct a dam around the bearing to approximately the height of the top of the bearing plate so that the *GROUT* can flow under a head. Stiff cement mortar may be used to form the dam. The *GROUT* is to be selected from whichever of the following options is most appropriate:

   a) *POLYMER MODIFIED CEMENTITIOUS GROUT*[i]

   b) *EPOXY GROUT*[ii]

4) Pour grout in slowly from several locations to prevent air entrapment. Stop when *GROUT* level reaches 3 mm above underside of bearing plate.

5) Once *GROUT* has reached minimum strength remove girder props and remove dam. This minimum strength is to be the greater of: 20 MPa, the strength of the concrete pier or abutment wall, or as specified by the superintendent.

SR09.4 Material Requirements

The following guidelines are to be read as the minimum requirement for material performance. All products must be compatible with one another and deemed appropriate for the application. All identification, sampling, testing, storage, preparation and application of products are to be as per the manufacturer's technical specification and in accordance with the applicable DPTI specifications. Technical data sheets, product test records and verification of code conformance is to be submitted to DPTI via the online web form at https://www.dpti.sa.gov.au/prequalified_products.

Reference	Material	Master Spec
i	Polymer modified cementitious grout	n/a
ii	Epoxy grout	n/a

Table 26: Material requirements SR09

In addition to that listed above, the selected products must also satisfy the performance criteria as outlined in the following tables.

i. *Polymer Modified Cementitious Grout*

- Satisfying AS 1379
- Non-shrink, cement-based grout

Test Procedure	Performance Metric	Requirement
ASTM C942	Compressive strength	Greater of: 20MPa; substrate grade; as instructed by superintendent.
ASTM C882	Bond strength	2.5 MPa min.

Table 27: Polymer modified cementitious grout test procedure

ii. Epoxy Grout

- Satisfying AS 1379

Test Procedure	Performance Metric	Requirement
BS 6319	Compressive strength	Greater of: 20MPa; substrate grade; as instructed by superintendent.
ASTM C882	Bond strength	2.5 MPa min.

Table 28: Epoxy grout test procedure

SR09.5 Revision Status

Revision Status: Standard Repair No. 9			
Revision Status	**Revision Date**	**Clause**	**Details**
1	Aug 1999	All	First Issue
2	Jan 2001	All	First intranet release
3	Mar 2018	All	Converted to Performance Based Specifications

Table 29: Revision status SR09

SR10 DELETED

SR11 REPAIRS TO MASONRY WALLS LAID IN LIME MORTAR

SR11.1 Introduction

This repair procedure is concerned with the repair of masonry walls that have been deteriorated due to the fretting process. This advice has been developed after discussions with David Young of the Department of Mines and Energy. David has had considerable experience in the preservation and restoration of stonework and presented a paper on this subject at the South Australian Division of the I E Aust Geomechanics Group on 20 February 1984.

In developing the repair procedure, it is important to understand the mechanism by which fretting occurs. This is necessary to ensure that an inappropriate repair procedure is not specified, resulting in an increased rate of deterioration and even more expensive repairs at a later date.

Fretting is caused by a cycle of wetting and drying. Water passing through the fill behind and below the wall dissolves any salts present in the soil. As mortar and stone are both pervious, this water is drawn up into the wall by capillary action, again dissolving any salts present in the wall. The water is drawn towards any face of the wall in contact with air, where it evaporates leaving behind any salts which were dissolved. These salts form crystals just below the surface of the wall and the pressure developed during crystallisation is usually sufficient to spall the surface layer. If this process continues unchecked for a length of time, considerable loss of material may occur. Since lime mortar is much more pervious than the hard sandstone with which many walls are built, most of the moisture will percolate through the mortar and thus most of the fretting will occur there. Furthermore, in most sandstones an aging process caused by the action of rain and air and known as case-hardening occurs, which toughens the outer skin. In preservation of masonry, it is important to keep this case-hardened skin undamaged as it provides protection against deterioration.

To stop the fretting process, it is necessary to halt the flow of salt laden water through the wall. This can only be done by waterproofing all parts of the wall in contact with soil, requiring the whole of the back fill and the foundation to be removed. As this is not practical, another solution must be found. Often a coating of silicone is applied to the exposed surfaces of masonry. This prevents ingress of water from the front such as rain, but does not stop water entering from the back face in contact with soil. Thus the wetting and drying process is unchecked and the fretting continues unabated. Another solution suggested by the greater susceptibility of the soft lime mortar to fretting is to replace it with a harder mortar such as a cement mortar. This material has hydraulic properties, i.e. it is not affected by water unlike lime mortar which disintegrates or "slakes". Thus it might appear that cement mortar is the ideal material with which to repoint as it will withstand mechanical and water damage. However, cement mortar is less pervious than lime mortar so therefore more of the salt laden water permeating through the wall will now flow through the stone. Thus whilst fretting of the mortar will have been reduced, the rate of fretting of the stone will increase and probably the case-hardened layer will be removed. The next repair could well involve replacement of the stone, a much more difficult task than replacing the mortar.

The recommended repair method consequently seeks to avoid these pitfalls. This involves removing as much of the salt affected lime mortar as is possible and replacing this with a new, weak lime mortar mix. This method is not a permanent repair. The lime mortar will fret as before and probably at an increased rate as it is weaker than the original mix, but the stones will be protected as much as possible. Future repointings will be required at increased intervals which can only be determined from experience, perhaps even 30 or 20 years. In this method, the lime mortar acts as a sacrificial protection (in much the same way as zinc does in galvanising) to protect the difficult-to-replace stone.

SR11.2 Limitations

This repair method is limited to the repair of masonry walls where the original lime mortar has deteriorated but the stone and overall structural integrity remain.

SR11.2.1 Heritage Structures

This repair method does not apply to the repair of masonry walls for SA Heritage structures that is, structures included on the SA Heritage Register. Repairs to masonry walls to these heritage structures should follow the requirements outlined in the Department for Environment and Water (DEW) "TS03 Guideline Repointing of masonry". Note this document is currently in draft so prior to any repair commencing the Heritage SA Conservation Team at DEW should be contacted to discuss an appropriate stone repair/ repointing approach. They will need to be contacted in any case, as repointing of a State Heritage listed bridge would be defined as development under the Development Act 1993/ Planning, Development and Infrastructure Act 2016.

SR11.3 Repair Method

SR11.3.1 Repointing

This is best done in the winter as lime mortar relies on absorbing carbon dioxide from the air to set off. This process takes time and if the temperature is too warm, the mortar will not set off before it has dried out. If working in hot weather, the mortar should be lightly sprayed with water at two to four hourly intervals for one day after placement.

1) Rake out all loose and fretting mortar from joints. With a square edged tool, rake out another 20 mm of mortar (to ensure that all crystallised salt is removed). The minimum depth of the recess shall not be less than 20 mm, as the new mortar will not satisfactorily bond in a thinner layer than this.

2) Thoroughly wet stone and remaining mortar to ensure that new mortar will bond and that its water will not be sucked out by the dry stone. There must not be any excess water, indicated by pooling, as this will make the new mortar sloppy. The wetting may be satisfactorily done using a small hand spray. Water must be free from dissolved salts – in general, if it is suitable for drinking (potable) it will be suitable for the mortar.

3) Pack joints with a suitable stiff *LIME MORTAR*[i] mix and allow to cure as per manufacturer's instructions. It is important to ensure that no voids are left, therefore it is recommended that a suitable tool be used to ram the *LIME MORTAR* into the joint. The surface should be tooled off in the same manner as that used originally.

If the appearance is important, then:

4) Several hours after pointing, spray a suitably coloured dust on the mortar only and not on the stone. This can be done using a low pressure air spray and introducing the dust through a venturi. The dust is selected based on its colour matching to the existing mortar and must be compatible with the mortar. The dust product must be free from salts.

SR11.3.2 Recoping

Where a mortar coping (as distinct from a stone coping or capping course) has been used to weather-proof the top of a wall, it may be repaired as follows:

1) Remove exiting defective mortar coping gently scraping off all loose and friable mortar to expose stone.

2) Wet surface of stone as for repointing, to ensure bond.

3) Apply a 10 mm layer of *LIME MORTAR*[i] to the top of the stone and allow to cure as per manufacturer's instructions. This must be slapped on to ensure bond, and the top surface left rough.

4) The following day apply a 10mm layer of *CEMENT MORTAR*[ii]. Finish off the top surface with a steel float.

If the appearance is important, then:

5) After the manufacturer's recommended time has elapsed, spray a suitably coloured dust on the mortar as for the lime mortar for repointing.

SR11.3.3 Underground Repointing

The first course of pointing underground should be excavated and checked for fretting of the mortar. This is not expected to be a problem as the mortar should not have been subjected to the same wetting and drying processes as joints above the ground. The natural surface must be reinstated.

SR11.3.4 Other Work Associated with Repointing

Sometimes water running over the wall may contribute to the deterioration of the mortar. In these cases, it is recommended that a cut off drain be installed no more than three metres from the wall to intersect and divert the ground water.

SR11.4 Material Requirements

The following guidelines are to be read as the minimum requirement for material performance. All products must be compatible with one another and deemed appropriate for the application. All identification, sampling, testing, storage, preparation and application of products are to be as per the manufacturer's technical specification and in accordance with the applicable DPTI specifications. Technical data sheets, product test records and verification of code conformance is to be submitted to DPTI via the online web form at https://www.dpti.sa.gov.au/prequalified_products.

Reference	Material	Master Spec
i	Lime mortar	n/a
ii	Cement mortar	n/a

Table 30: Material requirements SR11

In addition to that listed above, the selected products must also satisfy the performance criteria as outlined in the following tables.

i. *Lime Mortar*

- 1 part sand to 5 parts lime.

ii. *Cement Mortar*

- 1 part cement, 2 parts lime and 9 parts sand.
- Mix in same manner as for lime mortar but use within one hour of mixing.
- Cement is to be Type A Portland cement blended with up to 20% of flyash which imparts a pozzolanic effect and improves workability.

Lime

- Hydrated lime complying with AS 1672.1

Sand

- Sand aggregate complying with AS 2758.1
- Washed concrete sand. The sand must be free from salts. Bricklayers sand is not suitable as it has a certain amount of clay to impart plasticity or workability to cement mortar. Subsequently, the clay shrinks. A mortar containing lime has sufficient workability without the addition of clay. The presence of clay in the sand can be tested by shaking a sample in a jar of water; the clay will stay in suspension and cloud the water.

Cement

- Blended cement complying with AS 3972

SR11.5 Revision Status

Revision Status: Standard Repair No. 11			
Revision Status	**Revision Date**	**Clause**	**Details**
1	Aug 1999	All	First Issue
2	Jan 2001	All	First intranet release
3	Mar 2018	All	Converted to Performance Based Specifications
4	Jan 2020	11.2.1	Added Heritage Structure limitation

Table 31: Revision status SR11

SR12 DELETED

SR13 DOUBLE GIRDER CORROSION PROTECTION

This SR is adequate for now. However, future site investigations are recommended to see if any improvements can be made or it there are alternatives that would give a better result.

SR13.1 Introduction

Where construction of a bridge was originally made in two stages, a longitudinal joint is formed in the deck slab at the centreline, usually located between two closely spaced steel girders. This is done to enable single lane traffic operation during construction. These longitudinal joints often leak and require repair to be completed as given in *Standard Repair No. 3* (refer also to the diagram shown below). Paired girders associated with the longitudinal deck joint, form a cavity due to their close proximity, and joint leakage usually causes the girder steel to corrode on the faces forming this cavity.

Treatment of this girder corrosion is often an additional and complementary action when carrying out sealing repairs to longitudinal joints in deck slabs.

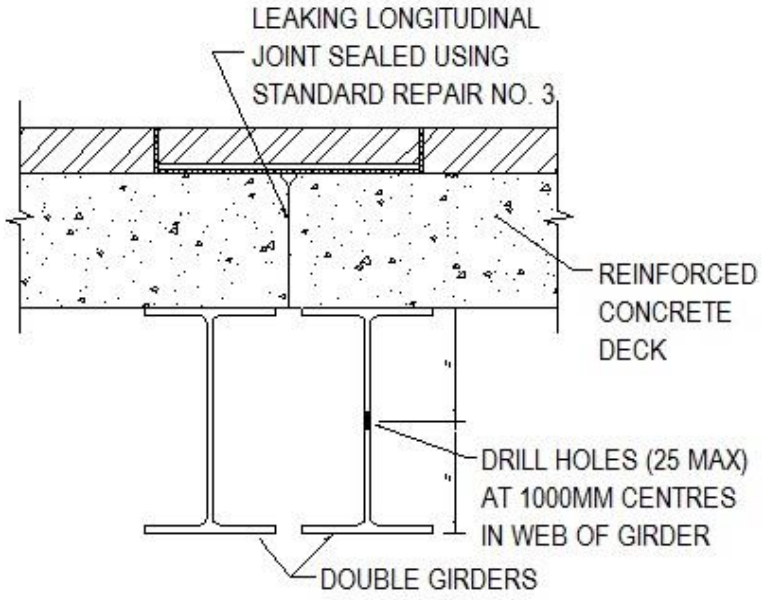

Figure 8: Double girder corrosion protection SR13

SR13.2 Limitations

This repair method is limited to the repair of arrangements similar in nature to the details shown above.

SR13.3 Repair Method

Refer to the above figure when performing this repair procedure.

1) Use a long scraper to dislodge the corrosion products as much as possible. The toes of the bottom flanges are usually 10 to 30 mm apart, and a reasonable amount of rust removal is possible.

2) Mark the mid-depth position of the girder web at 1 metre centres along the length of girder where corrosion is occurring.

3) Drill holes at these positions 25mm diameter maximum.

4) Using suitable spray equipment, apply *CORROSION INHIBITOR*[i] through the drilled holes. The nozzle should be angled around in all directions during application to ensure that the inhibitor reaches all areas inside the cavity.

5) On completion, clean the bare areas of the drilled web metal.

6) Apply one coat of *ZINC RICH PAINT*[ii] to the bare drilled web metal.

SR13.4 Material Requirements

The following guidelines are to be read as the minimum requirement for material performance. All products must be compatible with one another and deemed appropriate for the application. All identification, sampling, testing, storage, preparation and application of products are to be as per the manufacturer's technical specification and in accordance with the applicable DPTI specifications. Technical data sheets, product test records and verification of code conformance is to be submitted to DPTI via the online web form at https://www.dpti.sa.gov.au/prequalified_products.

Reference	Material	Master Spec
i	Corrosion inhibitor	Part S36
ii	Zinc rich paint	Part S36

Table 32: Material requirements SR13

In addition to that listed above, the selected products must also satisfy the performance criteria as outlined in the following tables.

i. *Corrosion Inhibitor*

Test Procedure	Performance Metric	Requirement
AS 3894.3	Dry film thickness	25 µm min.

Table 33: Corrosion inhibitor test procedure

ii. Zinc Rich Paint

Test Procedure	Performance Metric	Requirement
AS 3750.9	Dry film thickness	125 µm

Table 34: Zinc rich paint test procedure

Zinc rich paint must:

- comply with APAS 2916/1 (Dual pack) or APAS 2916/2 (Single pack)

OR

- have a total zinc content of the non-volatile content not less than 85% by mass or greater than 94% by mass.

SR13.5 Revision Status

Revision Status: Standard Repair No. 13			
Revision Status	**Revision Date**	**Clause**	**Details**
1	Aug 1999	All	First issue
2	Jan 2001	All	First intranet release
3	Mar 2018	All	Converted to Performance Based Specifications
3.1	Nov 2019	13.4 i	Changed minimum thickness from 75 µm to 25 µm
		13.4 ii	Added additional requirements

Table 35: Revision status SR13

SR14 REPAIR OF CORRODED GIRDER WEBS

SR14.1 Introduction

This repair procedure is used to replace lost web material caused by corrosion. Existing web plates are strengthened by welding new plates onto the existing web faces.

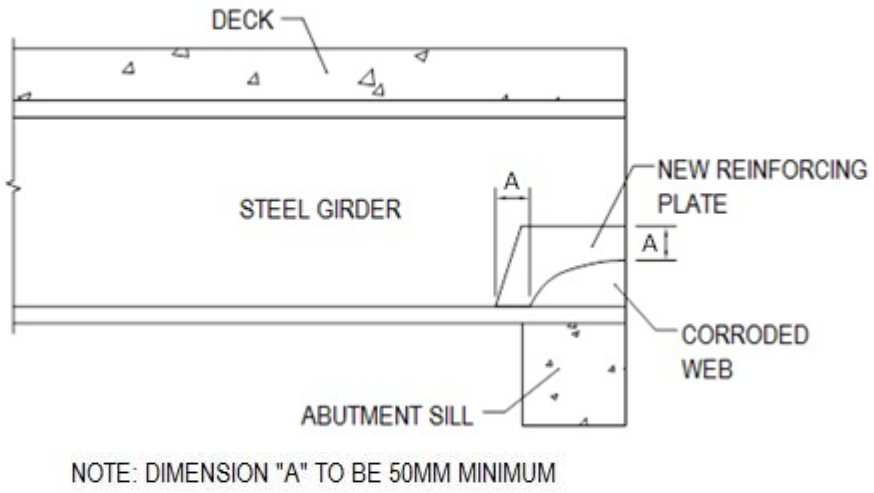

Figure 9: Standard repair no. 14

SR14.2 Limitations

This repair method is limited to the repair of steel girders and defects similar in nature to the details shown above.

If the extent of the corroded area is large enough to compromise load transfer to the supports, contractor shall provide adequate temporary support during execution.

SR14.3 Repair Method

SR14.3.1 Reinforcing Plate Installation

Refer to the above figure when performing this repair procedure.

1) A 6 mm thick *STEEL PLATE*[i] is to be installed on *each side* of the corroded web.

2) Attachment is to be made using 5 mm fillet welds.

3) A grease nipple is to be provided on one of the plates such that the corroded area can be filled with grease. A hole may need to be drilled in the girder to allow grease to cover both faces.

4) The boundaries of the new reinforcing plate should be located at the end face of the web, on the bottom flange (bottom edge ground to accommodate the bottom flange taper and fillet), and 50 mm outside the corrosion edge on the web where full section remains (see diagram).

5) Corrosion protection for the web and repair is to be in accordance with the recommendations which follow this repair advice.

SR14.3.2 Touch up Painting of Steel Structures & Components

The following procedures pertain to the spot cleaning and touch-up painting of steel structures and components.

Before any paint on the structure is disturbed by the works the paint shall be sampled, as per DPTI Test Procedure TP910 “Paint Sampling and Analysis – Structures and Buildings” and tested for hazardous metallic pigments to AS4361.1 “Guide to hazardous paint management. Part 1: Lead and other hazardous metallic pigments in industrial applications” and if found positive, managed as per the Standard.

1) Surface Preparation

a) Preliminary Cleaning

Large deposits of bird droppings and other deleterious material shall be removed manually for disposal as per statutory regulations.

Wash with a water / detergent mixture preferably via a high pressure washer. Deposits of oil and grease shall be removed by solvent cleaning in accordance with AS 1627.1.

Where possible, weld spatter, surface irregularities and sharp edges must be removed by mechanical means. All edges of the steel girders must be checked for sharp edges and where found must be ground to a minimum 2 mm radius.

b) Final Cleaning

Where possible all surfaces must be machine (Bristle Blaster preferable) or hand tool cleaned back to the metal, removing all rust, mill scale, weld slag, paint, or any extraneous material.

All cleaned surfaces must be primed within 4 hours of completion of cleaning, or before discolouration occurs, whichever occurs first.

2) Application of Paint

a) Safety Precautions

All recommendations provided on the paint manufacturer's safety data sheets shall be followed and work and work-site procedures shall be carried out in strict accordance with the Work Health and Safety Act 2012 (SA).

b) Coating System

Apply three (3) coats of a one pack *ZINC RICH PAINT*[ii] or if data available the paint system the bridge was last painted with as per manufacturer's instructions. Spray-on products are available and suitable for exposed areas of beams however these are (usually) not suitable for the ends of beams in embankments.

SR14.4 Material Requirements

The following guidelines are to be read as the minimum requirement for material performance. All products must be compatible with one another and deemed appropriate for the application. All identification, sampling, testing, storage, preparation and application of products are to be as per the manufacturer's technical specification and in accordance with the applicable DPTI specifications. Technical data sheets, product test records and verification of code conformance is to be submitted to DPTI via the online web form at https://www.dpti.sa.gov.au/prequalified_products.

Reference	Material	Master Spec
i	Steel plate	Part S30
ii	Zinc rich paint	Part S35

Table 36: Material requirements SR14

In addition to that listed above, the selected products must also satisfy the performance criteria as outlined in the following tables.

i. Steel Plate

- The grade of the steel plate is to be equal to or greater than that of the web, satisfying Part S30 and AS 3678.

ii. Zinc Rich Paint

Test Procedure	Performance Metric	Requirement
AS 3750.9	Dry film thickness	125 µm

Table 37: Zinc rich paint test procedure

Zinc rich paint must:

- comply with APAS 2916/1 (Dual pack) or APAS 2916/2 (Single pack)

OR

- have a total zinc content of the non-volatile content not less than 85% by mass or greater than 94% by mass.

SR14.5 Revision Status

Revision Status: Standard Repair No. 14			
Revision Status	**Revision Date**	**Clause**	**Details**
1	Jan 2004	All	First issue and intranet release
2	Mar 2018	All	Converted to Performance Based Specifications
2.1	Nov 2019	13.2	Removed original para “Lead Risk” and replaced with references to TP910 and AS4361.1
		14.4 ii	Changed thickness from 80 µm min 125 µm Added additional requirements

Table 38: Revision status SR14

SR15 REPAIR TO ABUTMENT BACKWALLS

SR15.1 Introduction

The following repair procedure is used for bridge structures where the material forming the approach is spilling through the recess in the abutment that accommodates the girders.

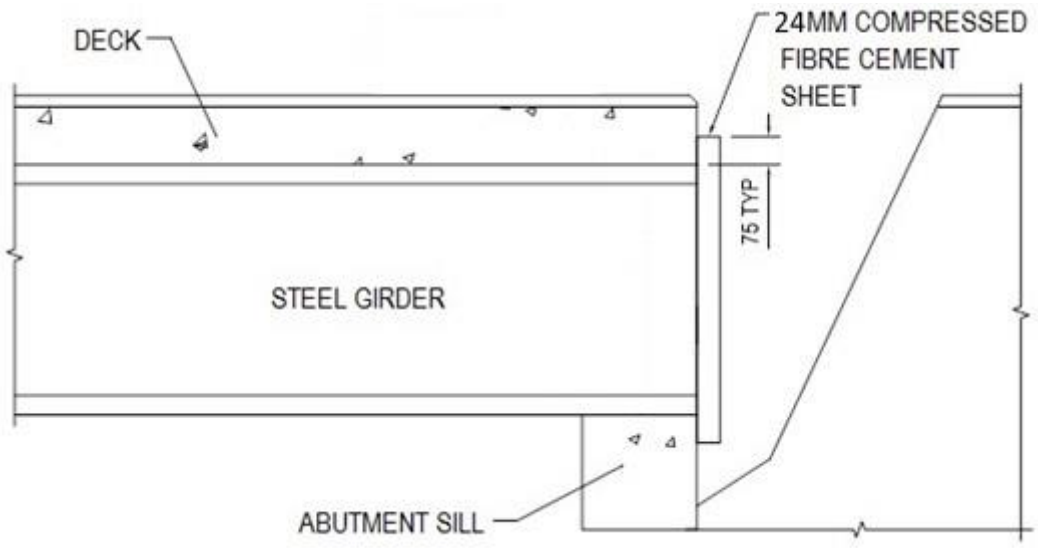

Figure 10: Standard repair no. 15

SR15.2 Limitations

This repair method is limited to the repair of arrangements similar in nature to the details shown above and where excavation of the approach will not cause any damage or loss of structural integrity. Adequate planning should consider any effects induced on the abutment sill or compressed fibre cement sheet during backfilling operations.

SR15.3 Repair Method

Refer to the above figure when performing this repair procedure.

1) Excavate behind both abutments to expose ends of girders and at least 150mm below sill level.

2) Clean back faces of abutment and deck & backwall, and remove and clean material from the abutment sill.

3) Prepare suitable *COMPRESSED FIBRE CEMENT SHEET*[i] for the size and shape of the repair/s. The sheet is to be 24 mm thick and dimensioned to allow at least a 75 mm overlap on all sides of the opening in the abutment.

4) Apply a compatible heavy duty, one-component *POLYURETHANE JOINT SEALANT*[ii] around all edges of the *COMPRESSED FIBRE CEMENT SHEET*.

5) Install the *COMPRESSED FIBRE CEMENT SHEET* over the end of the girder, symmetrically over the opening in the abutment.

6) Replace backfill behind abutment in layers, suitably compacting each layer as it is placed.

7) Re-instate road surface.

SR15.4 Material Requirements

The following guidelines are to be read as the minimum requirement for material performance. All products must be compatible with one another and deemed appropriate for the application. All identification, sampling, testing, storage, preparation and application of products are to be as per the manufacturer's technical specification and in accordance with the applicable DPTI specifications. Technical data sheets, product test records and verification of code conformance is to be submitted to DPTI via the online web form at https://www.dpti.sa.gov.au/prequalified_products.

Reference	Material	Master Spec
i	Compressed fibre cement sheet Type A Flat Sheet – Category 5 in accordance with AS 2908.2	n/a
ii	Polyurethane joint sealant	n/a

Table 39: Material requirements SR15

In addition to that listed above, the selected products must also satisfy the performance criteria as outlined in the following tables.

i. *Compressed Fibre Cement Sheet*
Type A Flat Sheet – Category 5 (in accordance with AS 2908.2)

Test Procedure	Performance Metric	Requirement
AS 2908.2	Average bending strength	18 MPa
AS 2908.2	Water tightness	Pass

Table 40: Compressed fibre cement sheet test procedure

ii. *Polyurethane Joint Sealant*

- One-part polyurethane sealant
- Gun-grade
- Rapid cure
- Non-sag (0mm sag flow) appropriate for vertical (kerb) applications

Test Procedure	Performance Metric	Requirement
ISO 8339	E-Modulus @ 100%	1 MPa max.
ISO 7390	Sag flow	0 mm, non-sag
ISO 868	Shore A hardness	20 – 40

Table 41: Polyurethane joint sealant test procedure

SR15.5 Revision Status

Revision Status: Standard Repair No. 15			
Revision Status	**Revision Date**	**Clause**	**Details**
1	Jan 2004	All	First issue and intranet release
2	Mar 2018	All	Converted to Performance Based Specifications
2.1	Nov 2019	15.4 ii	Match requirements to SR07 and SR08
2.2	May 2020	15.4	Added requirement for Type A Flat Sheet – Category 5 compressed fibre cement sheeting

Table 42: Revision Status SR15

SR16 DECK JOINT NOSING REPAIR

SR16.1 Introduction

The following repair method is suggested for areas where there is damage to the deck nosing at an expansion joint. This may be required in the replacement of failed old propriety joints such as Fel-Span, Transflex and P.S.C FT joints.

This repair requires a suitable heavy-duty, rapid-cure, *POLYMER MORTAR*[i] system. The individual components of the system (i.e. primer, liquid polymer and blended aggregate) shall be compatible and all form one proprietary system.

Reference to this repair is made in *Standard Repair No. 2*.

This repair is also recommended for reconstruction of failed deck joints by providing structural joint nosings at road level and then sealing using the method provided in *Standard Repair No.7*.

The repair procedure shown here-in should be read in conjunction with the diagram as seen below.

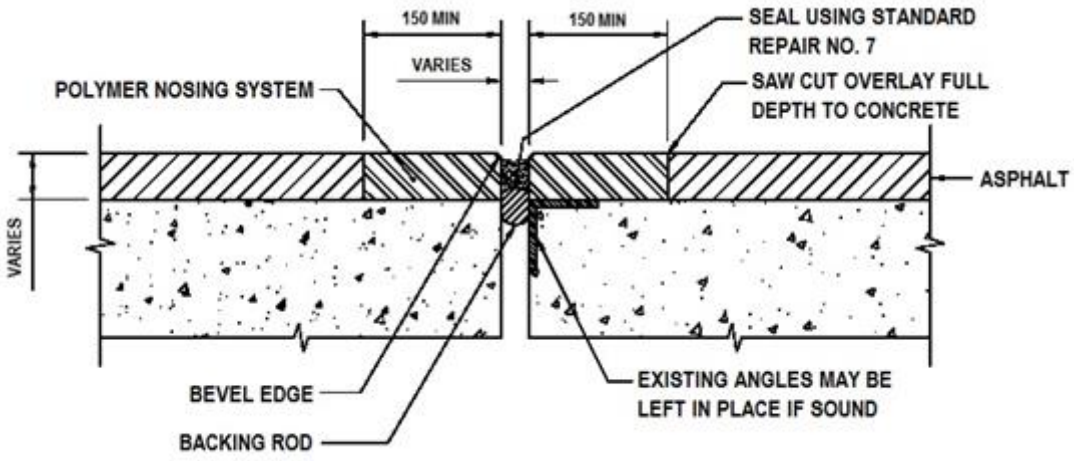

Figure 11: Standard repair no. 16

SR16.2 Limitations

- Minimum existing joint gap 25mm. Maximum existing joint gap 75mm.
- Minimum depth of asphalt 40mm. For asphalt depths deeper than 150mm, nosing width should be increased to maintain minimum width to depth ratio of 1:1.
- Minimum and maximum joint movements to be within the verified ranged for the proprietary system.

SR16.3 Repair Method

1) Remove failed joint device. Any studs extending from the base should be removed if loose, otherwise they can remain in place. Alternatively, saw cut and remove bituminous road surfacing for a minimum width of 150 mm each side of joint. The thickness of the bitumen is usually 25 to 50mm. Remove all damaged or loose material down to the sound concrete.

2) Sandblast sides and bottom of recess to clean/sound concrete or steel. If steel plate is in place, it shall be sandblasted to white metal.

3) Blow joint opening and recess with oil-free compressed air to remove laitance and debris from sandblasting operations.

4) Install polystyrene foam formwork to the same width as the joint, for the length of the joint opening, to a height level with the driving surface.

5) Prime bottom and sides of recess, neat, as compatible and a part of the *POLYMER MORTAR* system.

6) Form the selected *POLYMER MORTAR* by mixing the selected two-component, rapid-curing liquid polymer and compatible blended aggregate as per manufacturer's directions and install accordingly. Make sure to thoroughly consolidate material and to screed material level with top of form and level with driving surface.

7) Allow *POLYMER MORTAR* to cure per manufacturer's proprietary data sheet. *POLYMER MORTAR* must be tack-free and firm to the touch before proceeding or opening to traffic.

8) Once both sides are complete, seal the joint using the backing rod and sealant described in *Standard Repair 7* and compatible with those products and systems used herein.

9) Reinstate bituminous surface beyond new joint nosing.

SR16.3 Material Requirements

The following guidelines are to be read as the minimum requirement for material performance. All products must be compatible with one another and deemed appropriate for the application. All identification, sampling, testing, storage, preparation and application of products are to be as per the manufacturer's technical specification and in accordance with the applicable DPTI specifications. Technical data sheets, product test records and verification of code conformance is to be submitted to DPTI via the online web form at https://www.dpti.sa.gov.au/prequalified_products.

Reference	Material	Master Spec
i	Compressed fibre cement sheet	n/a

Table 43: Material requirements SR16

In addition to that listed above, the selected products must also satisfy the performance criteria as outlined in the following tables.

i. Polymer Mortar

Test Procedure	Performance Metric	Requirement
ASTM C579	Compressive strength	20 MPa min.
ASTM C882	Bond strength	13.8 MPa min.

Table 44: Polymer mortar test procedure

SR16.5 Revision Status

Revision Status: Standard Repair No. 16			
Revision Status	**Revision Date**	**Clause**	**Details**
1	Aug 2006	All	First Issue
2	Mar 2018	All	Converted to Performance Based Specifications
2.1	Nov 2019	16.2	Added additional detail for nosing widths

Table 45: Revision Status SR16

SCHEDULE OF PRODUCTS

Standard Repair No	Product Purpose	Master Spec	Material Requirements	Table	Product Name	References	Comments
SR01	Concrete	CC20 CC25 CC26	Y	Y	n/a	VicRoads 689	
SR01	Zinc Rich Primer	S36	Dry Film Thickness	Y		RMS B220	
SR02 SR03 SR05	Elastomeric Sealant	R37	hot applied, flexible, water-tight, rubberised joint and crack sealant with elastomeric polymers.	n/a	SAMIFILLA	RMS 3263 * provides tabulated performance spec. requirements	
SR02	Bitumen Impregnated Polyurethane Foam	n/a	Proven for durability to resist weathering and disintegration.	Y	n/a	RMS 3204	
SR02 SR03	Polymer Modified Binder	R25 R26	n/a	Y	SAMIPRIME	RMS 3252	
SR02 SR03 SR08	Composite Reinforcing Geotextile	R85	n/a	n/a	TENSAR AR-G POLYESTER FABRIC	n/a	
SR02 SR03	Medium duty coarse asphalt mix (AC10)	R27	n/a	n/a	n/a	n/a	
SR02 SR03	10E modified binder / 35P modified binder	R25 R26	n/a	n/a	n/a	n/a	
SR02	Graded spray sealing aggregate	R26	n/a	n/a	n/a	n/a	

Standard Repair No	Product Purpose	Master Spec	Material Requirements	Table	Product Name	References	Comments
SR05	Epoxy Resin	n/a	n/a	Y	TRAFFICRETE 105 - Bauer Epoxies EPIREZ - Epirez BICS - Australasian Concrete Services MEGAPOXY HX - Resimax	VicRoads 687	
SR06	Waterproofing Cement	CC20 CC25	Waterproofing cement slurry must not be applied during temperatures less than 4°C. This product must be kept dry in storage, and also not allowed to freeze.		VANDEX BB 75 – Parchem XYPEX SLURRY COAT - Bianco XYPEX GAMMA CURE	n/a	
SR07	Polyethylene backing rod	n/a	Y	Y	n/a		
SR07	Silicone Sealant	n/a	• Two-part rubber sealant • Rapid cure • Self-levelling and therefore appropriate for horizontal (road) applications	Y	DOW CORNING 902 RCS	RMS M212 * adopted these tabulated performance spec. requirements	RMS does not have the same level of (tabulated performance spec) detail for polyurethane as it does for silicone. RMS: *designated as highway grade by the manufacturer, UV stable and must form a permanent bond with the base concrete consistent with the service life of the sealant.*

Standard Repair No	Product Purpose	Master Spec	Material Requirements	Table	Product Name	References	Comments
SR07 SR08 SR15	Polyurethane Sealant	n/a	• One-part polyurethane sealant • Gun-grade • Rapid cure • Non-sag (0mm sag flow) appropriate for vertical (kerb) applications	Y	SIKAFLEX PRO 2HP EMER-SEAL 40 - Parchem	RMS M212	RMS: *must be a non-sag, heavy duty, one component, designated as highway grade by the manufacturer, UV stable, and must form a permanent bond with the base concrete consistent with the service life of the sealant.*
SR09	Polymer Modified Cementitious Grout	n/a	Compressive > 20MPa. Bond > 2.5 MPa.	Y	40 C LONG LIFE GROUT FIVE STAR INSTANT GROUT	RMS R53 (No performance spec. provided.)	
SR09	Epoxy Grout	n/a	Compressive > 20MPa. Bond > 2.5 MPa.	Y	RAMSET EPOXY GROUT EPIREZ 133	RMS R53 (No performance spec. provided.)	
SR11	Mortar	n/a	Y	N	n/a		
SR11	Lime Mortar	n/a	Y	N	n/a		
SR11	Cement Mortar	n/a	Y	N	n/a		
SR13	Corrosion Inhibitor	S36	DFT	Y	BOESHIELD T9	RMS B220, VicRoads 631	
SR13 SR14	Zinc Rich Paint	S35 S36	DFT	Y	ZINGA	VicRoads 631	
SR14	Steel Plate	S30	The grade of the steel plate is to be equal to or greater than that of the web, satisfying Part S30 and AS 3678.	n/a			
SR15	Compressed Fibre Cement Sheet	n/a	Type A Flat Sheet – Category 5 in accordance with AS 2908.2	Y	n/a		
SR16	Polymer Mortar	n/a	n/a	Y	SILSPEC 900 PNS (Granor Rubber)		

Table 46: Product references

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