PAVEMENT STANDARD DRAWINGS
RIGID PAVEMENT
STANDARD DETAILS - MAINTENANCE MD.M10.MC

Volume MC - Continuously Reinforced Concrete Pavement

RELATED CONCRETE PAVEMENT DRAWINGS

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<td>JRCP</td>
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© COPYRIGHT ROADS AND MARITIME SERVICES
# REVISION REGISTER

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* PRINCIPAL ENGINEER, PAVEMENTS AND GEOTECHNICAL

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# SHEET INDEX

**DRAWING CONTENT**

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(See also MC04)

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**DRAWING CONTENT**

- COVER SHEET
- REVISION REGISTER AND SHEET INDEX
- LEGEND
- INDEX OF SHEETS
- JOINT CATALOGUE
- KERBS AND BARRIER
- TYPICAL PATCH DETAILS
- SLAB REPLACEMENT
- SLAB REPLACEMENT LAPPED SPLICE (FOR NON-DIURNAL CONTROL)
- SLAB REPLACEMENT MECHANICAL SPLICE (FOR DIURNAL CONTROL)
- JOINT RESEALING
- ROUTING AND SEALING OF UNPLANNED CRACKS AND JOINTS
- JOINT SPALL REPAIRS
- CROSS STITCHING OF UNPLANNED CRACKS AND JOINTS - COMPROMISE PRACTICE
- ANCHOR DEFECT REPAIRS
2. Dimensions
All dimensions are in millimetres (mm) unless noted otherwise.

3. Classification of maintenance practices
The maintenance practices shown in these drawings are classified according to whether they are structural or non-structural repairs. A structural repair is one which either fully or partially restores the load carrying capacity of the pavement. Structural repairs are further classified according to Best Practice or Compromise Practice. Best Practice repairs are the preferred option for repair of concrete pavements and must be adopted unless otherwise approved in writing by the Principal.

1. Scope
Definitions of terms is contained in the Specification. These drawings represent "Model" or "Standard" details which are intended for use by project designers. Where design tables are provided (for example, Table 6.1 for binder spacings) they are intended solely as a guide to those designers and must not be reproduced in project-specific drawings for interpretation and/or application by site staff. Project specific drawings must show precise details for items such as slab replacements, jointing, spell repairs, crack repairs, spacings of tiebars, and other reinforcing steel.

4. Referenced Standards
Roads and Maritime Services Specifications
- 2004 Prefab Joint Fillers for Concrete Road Pavements and Structures
- M258 Slab Replacement (Concrete Pavement)
- R15 Kerbs and Gutters
- R83 Concrete Pavement Base

Roads and Maritime Services Test Methods
- T386 Dowel Pull-out Test
- T370 Clearnness of Sewn Concrete Pavement Joints
- T859 Fast Adhesion of Joint Sealant to Concrete

Other Roads and Maritime Services Documents
- Pavement Standard Drawings Rigid Pavement Standard Details - Maintenance
- Volume MP - Plan Concrete Pavement
- Pavement Standard Drawings Rigid Pavement Standard Details - Construction
- Volume CC - Continuously Reinforced Concrete Pavement
- Standard Pavement Subsurface Drainage Details - Volume 5 - Rigid Pavement Details

Application Single Stated Sections and Profiles
- RMC Austroads Guide Supplements - Austroads Guide to Pavement Technology Part 2

Australian/New Zealand Standards
- AS 1799 Specification and Supply of Concrete
- AS 3600 Concrete Structures
- AS/NZS 4671 Steel Reinforcing Materials

Other Documents
- Austroads Guide to Pavement Technology Part 2: Pavement Structural Design
- Australian/New Zealand Standards
- Steel Fibre Reinforced Concrete Pavement
- Jointed Reinforced Concrete Pavement
- Dowelled Plain Concrete Pavement
- Reinforced Plain Concrete Pavement (Discrete Slabs)
- Steel-Tube Reinforced Concrete Pavement
- Steel-Tube Reinforced Concrete Pavement with mesh added (Discrete Slabs)

TABLE 3.1: PRACTICE NOTES

1. Scope
Definitions of terms is contained in the Specification. These drawings represent "Model" or "Standard" details which are intended for use by project designers. Where design tables are provided (for example, Table 6.1 for binder spacings) they are intended solely as a guide to those designers and must not be reproduced in project-specific drawings for interpretation and/or application by site staff. Project specific drawings must show precise details for items such as slab replacements, jointing, spell repairs, crack repairs, spacings of tiebars, and other reinforcing steel.

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- Steel-Tube Reinforced Concrete Pavement
- Steel-Tube Reinforced Concrete Pavement with mesh added (Discrete Slabs)

TABLE 3.2: JOINT TYPE NUMBERS AND DESCRIPTIONS

<table>
<thead>
<tr>
<th>TYPE</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>C1</td>
<td>Longitudinal tied and sawn</td>
</tr>
<tr>
<td>C2</td>
<td>Longitudinal tied and formed</td>
</tr>
<tr>
<td>C2W</td>
<td>Longitudinal: drill-tied and formed</td>
</tr>
<tr>
<td>C3p</td>
<td>CRCP to non-CRCP: longitudinal: cluster tied and formed</td>
</tr>
<tr>
<td>C3d</td>
<td>CRCP to non-CRCP: longitudinal: drill-tied and formed</td>
</tr>
<tr>
<td>C3</td>
<td>Longitudinal tied and ribbed</td>
</tr>
<tr>
<td>C4</td>
<td>Longitudinal: untied and formed</td>
</tr>
<tr>
<td>C5</td>
<td>Longitudinal: untied and sawn</td>
</tr>
<tr>
<td>C6</td>
<td>Longitudinal edge</td>
</tr>
<tr>
<td>C7</td>
<td>Transverse: joint repair</td>
</tr>
<tr>
<td>F7</td>
<td>SCF-PSCP Transverse: formed and tied</td>
</tr>
<tr>
<td>C14</td>
<td>Isolation: with subgrade beam</td>
</tr>
<tr>
<td>C15</td>
<td>Isolation: without subgrade beam</td>
</tr>
<tr>
<td>C18</td>
<td>Longitudinal edge: with subgrade beam</td>
</tr>
</tbody>
</table>

TABLE 3.3: SYMBOLS

<table>
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<th>SYMBOL</th>
<th>DESCRIPTION</th>
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<tr>
<td>C</td>
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<td>Tiesbars</td>
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TABLE 3.4: SYMBOLS

<table>
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<th>SYMBOL</th>
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TABLE 3.5: GENERAL SLAB DIMENSIONAL LIMITS

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<td>84° (80°)</td>
<td>70°</td>
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<td>NA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NA</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.3 (4.5)</td>
<td>4.4 (4.5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.0</td>
<td>0.6</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Table 3.5 Notes:
(a) See Note 1 in Table 3.1
(b) Corner angles should be maximised whenever possible.
(c) Length is the largest edge between transverse contraction joints, or the longest chord on curved slabs.
(d) Width is the largest square measure between longitudinal edges or joints, or the largest radial measure on curved slabs.
(e) Values in brackets show compromise limits for exclusive use by designers where their use is unavoidable. They must not be adopted by field staff without design review and approval.
(f) Where an un-trafficked slab is likely to become trafficked within 20 years, it must be designed to carry a load of 84° (80°), or 70°, or 4.4 (4.5) mm, or 4.3 (4.5) mm, or 1.0 mm, or 0.6 mm as applicable.
This joint type is no longer used for new construction or maintenance work.

(b) An alternative that is used in some projects is to continue the A1 bars across the joint and delete the tiebar.

An alternative that is used in some projects is to continue the A1 bars across the joint and delete the tiebar.
**NOTES**

**Scope**
- Details shown on MC06 and MC08 are indicative of joints which will be encountered in existing pavements, and those which will be used in slab replacement work. They should not be confused with joint details on other sheets which show remedial activities such as joint rescaling (MC16-MC18) or routing (MC19 and MC20).

**Sealing of joint ends**
- Where joints "daylight" at outer edges and formed joints, the sealant must be spread down the vertical faces of the joint and down any underlying cracks. This is required to prevent the ingress of nonpassibles such as verge material (in the case of outer edges) and mortar from subsequent paving courses (in the case of formed joints).

**Formed joint faces**
- Details of formed joints are shown as follows:
  - (a) corrugated: See Table 9.2
  - (b) keyed: See Figure 13.3
  - (c) scotted: See Figure 14.1

**Joint debonding**
- All pavement joints are required to hinge to relieve curling stresses. Hence, while aggregate interlock is beneficial, intimate microtexture bond must be prevented because it causes joint spalling, particularly at transverse joints. Positive debonding is therefore required, as follows:
  - (a) The first placed face must be dense and fully compacted and free of honeycombing and re-entrant angles. Debonds must be repaired before applying concrete is placed. The repair material must not be placed integrally with the adjoining concrete.
  - (b) The first placed face must be sprayed with wax emulsion curing compound as the dosing agent in accordance with MC28.
  - (c) Steel tiebars must not be sprayed with the debonding agent.

**Subgrade beams**
- Subgrade beams must be of Grade N32 concrete and have a steel-float finish.

**Cover to reinforcement**
- (a) Mesh must be placed to provide the following cover unless otherwise shown:
  - To joints and edges: 80 ± 20 mm.
  - To top and bottom: 80 ± 20 mm.
- (b) Top cover to reinforcing bars and mesh must be increased to the extent necessary to achieve 30 mm cover under sawcuts. Bottom cover must not be less than 25 mm.

**Anchors**
- See MC24

**Kerbs**
- Fixtures such as kerbs and slabs must be structurally compatible with the adjoining carriageway. See MC10

**Edge drains**
- Edge drains are normally only provided on the outer side. A geotextile is reserved.

---

**SCHEDULE 7.1**

**NOTES**

**Steel grade and supply and fabrication of reinforcement**
- Steel must comply with AS/NZS 4970, as follows:
  - (a) Bar reinforcement (including tiebars) must be deformed ribbed, normal steel (grade 500 MPa, that is, D500) which is notched in all drawings as 'N' according to the diameter, for example, N12, N16.
  - (b) Mesh reinforcement must be round or deformed, low ductility steel of grade 500 MPa, which is notated in all drawings as 'RL' (rectangular mesh) or 'SL' (square mesh).
  - (c) The reinforcement material supplier must be certified by ACRS for the supply of reinforcement material.
  - (d) The reinforcement fabrication must be certified by ACRS for fabrication of reinforcement material.

**Fixing of tiebars**
- (a) Drilled tiebars must be fixed using a suitable two-component epoxy or polyester setting system (resin) which is thoroughly mixed within the injection delivery system.
  - (b) It must provide an anchorage strength of at least 85% of the yield strength of the tie. Tiebars may be drilled at an interval of up to 10 m to facilitate fixing.
  - (c) Cleanness is critical to achieving good pull-out strength. Drilling dust and other debris must be cleaned out of the holes using an industrial vacuum cleaner or air compressor as an alternate method. In both cases, a nuzzle must be used which reaches the end of the hole to ensure that no dust remains in the holes.
  - (d) A nuzzle must be used which reaches the end of the hole to ensure the resin completely fills the hole when the tiebar is inserted.

**Tiebars and drill-ties**
- (a) In longitudinal joints, tiebars must be designed in accordance with Table 9.1 and both the tiebar and the concrete.
  - (b) It must provide an anchorage strength of at least 85% of the yield strength of the tie. Tiebars may be drilled at an interval of up to 10 m to facilitate fixing.
  - (c) Cleanness is critical to achieving good pull-out strength. Drilling dust and other debris must be cleaned out of the holes using an industrial vacuum cleaner or air compressor as an alternate method. In both cases, a nuzzle must be used which reaches the end of the hole to ensure that no dust remains in the holes.
  - (d) A nuzzle must be used which reaches the end of the hole to ensure the resin completely fills the hole when the tiebar is inserted.

**Procedures**
- 1. Drill holes for tiebar fixing must be thoroughly cleaned of dust using dry oil-free compressed air or a probe inserted into the holes.
  - 2. In Dated Q, on MC06 the executive reserve may be created by sawcutting or in the case of formed joints) by filling a temporary filler to the first drilled face. Where a filler is used, the joint must be repaired for sealing by sawing in (in the case of formed joints) by fixing a temporary filler to the first-placed face.

---

**SCHEDULE 7.2**

**NOTES**

**Steel grade and supply and fabrication of reinforcement**
- Steel must comply with AS/NZS 4970, as follows:
  - (a) Bar reinforcement (including tiebars) must be deformed ribbed, normal steel (grade 500 MPa, that is, D500) which is notated in all drawings as 'N' according to the diameter, for example, N12, N16.
  - (b) Mesh reinforcement must be round or deformed, low ductility steel of grade 500 MPa, which is notated in all drawings as 'RL' (rectangular mesh) or 'SL' (square mesh).
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  - (b) It must provide an anchorage strength of at least 85% of the yield strength of the tie. Tiebars may be drilled at an interval of up to 10 m to facilitate fixing.
  - (c) Cleanness is critical to achieving good pull-out strength. Drilling dust and other debris must be cleaned out of the holes using an industrial vacuum cleaner or air compressor as an alternate method. In both cases, a nuzzle must be used which reaches the end of the hole to ensure that no dust remains in the holes.
  - (d) A nuzzle must be used which reaches the end of the hole to ensure the resin completely fills the hole when the tiebar is inserted.

**TABLE 7.1: REINFORCEMENT SCHEDULE AND BAR SPACING**

**PROCEDURES**
- 1. Drill holes for tiebar fixing must be thoroughly cleaned of dust using dry oil-free compressed air or a probe inserted into the holes.
  - 2. In Dated Q, on MC06 the executive reserve may be created by sawcutting or in the case of formed joints) by filling a temporary filler to the first drilled face. Where a filler is used, the joint must be repaired for sealing by sawing in accordance with MC16/MC18.

---

**SCHEDULE 7.3**

**NOTES**

**Steel grade and supply and fabrication of reinforcement**
- Steel must comply with AS/NZS 4970, as follows:
  - (a) Bar reinforcement (including tiebars) must be deformed ribbed, normal steel (grade 500 MPa, that is, D500) which is notated in all drawings as 'N' according to the diameter, for example, N12, N16.
  - (b) Mesh reinforcement must be round or deformed, low ductility steel of grade 500 MPa, which is notated in all drawings as 'RL' (rectangular mesh) or 'SL' (square mesh).
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  - (d) The reinforcement fabrication must be certified by ACRS for fabrication of reinforcement material.

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  - (b) It must provide an anchorage strength of at least 85% of the yield strength of the tie. Tiebars may be drilled at an interval of up to 10 m to facilitate fixing.
  - (c) Cleanness is critical to achieving good pull-out strength. Drilling dust and other debris must be cleaned out of the holes using an industrial vacuum cleaner or air compressor as an alternate method. In both cases, a nuzzle must be used which reaches the end of the hole to ensure that no dust remains in the holes.
  - (d) A nuzzle must be used which reaches the end of the hole to ensure the resin completely fills the hole when the tiebar is inserted.

**Tiebars and drill-ties**
- (a) In longitudinal joints, tiebars must be designed in accordance with Table 9.1 and both the tiebar and the concrete.
  - (b) It must provide an anchorage strength of at least 85% of the yield strength of the tie. Tiebars may be drilled at an interval of up to 10 m to facilitate fixing.
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  - (d) A nuzzle must be used which reaches the end of the hole to ensure the resin completely fills the hole when the tiebar is inserted.

**Procedures**
- 1. Drill holes for tiebar fixing must be thoroughly cleaned of dust using dry oil-free compressed air or a probe inserted into the holes.
  - 2. In Dated Q, on MC06 the executive reserve may be created by sawcutting or in the case of formed joints) by filling a temporary filler to the first drilled face. Where a filler is used, the joint must be repaired for sealing by sawing in accordance with MC16/MC18.
### Table 8.1: Untied Joints - Silicone Sealant Dimensions

<table>
<thead>
<tr>
<th>Effective Slab Width</th>
<th>Design joint (mm)</th>
<th>Width W(mm)</th>
<th>Depth D(mm)</th>
<th>Recess R(mm)</th>
<th>Backer Rod (mm)</th>
<th>Joint depth of D(mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.6 ± 4.8</td>
<td>2.1</td>
<td>7 (5.5 - 9)</td>
<td>7 (4.5 - 9)</td>
<td>5 ± 3</td>
<td>8 ± 3</td>
<td>8 ± 3</td>
</tr>
<tr>
<td>5 ± 4.8 ± 5</td>
<td>3.6</td>
<td>8 (5.5 - 9)</td>
<td>8 (4.5 - 9)</td>
<td>5 ± 3</td>
<td>7 ± 3</td>
<td>7 ± 3</td>
</tr>
<tr>
<td>5 ± 5 ± 6</td>
<td>3.6</td>
<td>8 (5.5 - 9)</td>
<td>8 (4.5 - 9)</td>
<td>5 ± 3</td>
<td>8 ± 3</td>
<td>8 ± 3</td>
</tr>
<tr>
<td>12 ± 5 ± 6</td>
<td>3.6</td>
<td>12 (5.5 - 9)</td>
<td>8 (4.5 - 9)</td>
<td>5 ± 3</td>
<td>7 ± 3</td>
<td>7 ± 3</td>
</tr>
<tr>
<td>25 ± 6 ± 6</td>
<td>3.6</td>
<td>14 (5.5 - 9)</td>
<td>8 (4.5 - 9)</td>
<td>5 ± 3</td>
<td>8 ± 3</td>
<td>8 ± 3</td>
</tr>
</tbody>
</table>

**Notes:**
- For tied joints, refer to Table 8.2.
- See Table 8.3 for calculation of effective slab width W_{eff}.
- Allowance must be made for factors such as the depth of the backer rod after lateral compression into the joint. It is important that the upward pressure on the sealant (in hot weather) is minimised.
- Values given for the depth of joint D_{j} are indicative only. Allowance must be made for factors such as the depth of the backer rod after lateral compression into the joint.
- The recess varies according to joint type because of the relative potential for joint closure, and the risk (in hot weather) of the sealant being ejected.
- The difference is as follows:
  - In isolation and expansion joints, the joint can close up to a significantly less than its original width, if the recess is inadequate, this will squeeze the sealant above the surface, where it will be damaged by traffic. The values listed in Table 6 are intended as guidelines only. There are many factors which will influence the magnitude of joint closure and as it may vary substantially between different sites.
  - In contraction and penetration joints, the joint cannot close beyond the point at which the concrete slab faces regain contact. Hence, the risk of the sealant ejection is low, being related to the width of the induced crack at the time of sealant installation.

### Table 8.2: Tied Joints - Silicone Sealant Dimensions

<table>
<thead>
<tr>
<th>Effective Slab Width</th>
<th>Design joint (mm)</th>
<th>Width W(mm)</th>
<th>Depth D(mm)</th>
<th>Recess R(mm)</th>
<th>Backer Rod (mm)</th>
<th>Joint depth of D(mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.6 ± 4.8</td>
<td>2.1</td>
<td>7 (5.5 - 9)</td>
<td>7 (4.5 - 9)</td>
<td>5 ± 3</td>
<td>8 ± 3</td>
<td>8 ± 3</td>
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<tr>
<td>5 ± 4.8 ± 5</td>
<td>3.6</td>
<td>8 (5.5 - 9)</td>
<td>8 (4.5 - 9)</td>
<td>5 ± 3</td>
<td>7 ± 3</td>
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<tr>
<td>12 ± 5 ± 6</td>
<td>3.6</td>
<td>12 (5.5 - 9)</td>
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</tr>
<tr>
<td>25 ± 6 ± 6</td>
<td>3.6</td>
<td>14 (5.5 - 9)</td>
<td>8 (4.5 - 9)</td>
<td>5 ± 3</td>
<td>8 ± 3</td>
<td>8 ± 3</td>
</tr>
</tbody>
</table>

**Notes:**
- For tied joints, refer to Table 8.2.
- Allowance must be made for factors such as the depth of the backer rod after lateral compression into the joint.
- The terms "transverse" and "longitudinal" relate to the direction of trafficking. Hence, an isolation joint which runs parallel with the through-carriageway within a median crossing is still "transverse" relative to traffic movements.
- A similar joint separating a ramp from the through-carriageway would be deemed to be "longitudinal".
- The width of longitudinal silicone joints is limited to 18 mm maximum. See Table 8.2 Note (f) for interpretation of "longitudinal".
- The recess varies according to joint type because of the relative potential for joint closure, and the risk (in hot weather) of the sealant being ejected.
- The difference is as follows:
  - In isolation and expansion joints, the joint can close up to a significantly less than its original width, if the recess is inadequate, this will squeeze the sealant above the surface, where it will be damaged by traffic. The values listed in Table 6 are intended as guidelines only. There are many factors which will influence the magnitude of joint closure and as it may vary substantially between different sites.
  - In contraction and penetration joints, the joint cannot close beyond the point at which the concrete slab faces regain contact. Hence, the risk of the sealant ejection is low, being related to the width of the induced crack at the time of sealant installation.

### Table 8.3: Sealant Width Calculations

<table>
<thead>
<tr>
<th>Sealant under design</th>
<th>Calculation of effective size width W_{eff} for input to Table 8.1 Column 1</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>W_{eff}</td>
<td>W_{eff} = (W_{j} + W_{D}) / 2, W_{j}, W_{D}, and W_{eff} are measured to the nearest relief edge, independent of tied joints.</td>
<td></td>
</tr>
<tr>
<td>W_{D}</td>
<td>W_{D} = W_{D} / 2, W_{D} is the depth of the backer rod.</td>
<td></td>
</tr>
<tr>
<td>W_{j}</td>
<td>For joint edges, refer to Table 8.2.</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- The width of silicone sealants is restricted as follows:
  - In longitudinal joints: 18 mm
  - In transverse joints: 24 mm (guide only)
  - For wider lengths, treat in accordance with MC21 and MC22.
- Allowance must be made for factors such as the depth of the backer rod after lateral compression into the joint.

### Diagrams

**Figure 8.1:** TYPICAL JOINT TYPES

**Figure 8.2:** SEALANT DIMENSIONS

**Figure 8.3:** SEALANT WIDTH CALCULATIONS

**Figure 8.4:** JOINT CATALOGUE
TABLE 9.1: PROVISION OF TIEBARS

<table>
<thead>
<tr>
<th>Bar size (mm)</th>
<th>Tiebar spacing / A1 Bar spacing (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>180</td>
<td>250 / 150</td>
</tr>
<tr>
<td>250</td>
<td>220 / 200</td>
</tr>
<tr>
<td>300</td>
<td>250 / 220</td>
</tr>
<tr>
<td>350</td>
<td>220 / 250</td>
</tr>
</tbody>
</table>

Table 9.1 Notes:
(a) Tiebar spacings are maximised at 750 to meet support criteria for the longitudinal steel.
(b) Base Thickness = Concrete Base + asphalt surfacing.
(c) Designers may nominate alternative A1-N16 bars at spacings which are increased in proportion to the sectional area, that is, 200/110 = 1.8

FIGURE 9.1: TIEBAR NUMBERS IN JOINT C2P AND IN PCP AND PCP-R

Maximum allowable spacing = 1400 mm

FIGURE 9.1 Notes:
(a) “Average” tiebar spacings are determined from Table 9.1 or from MP09.
(b) The theoretical designs are indicated by the dashed lines. Design tolerances have been applied to define the shaded zones hence no further tolerance is allowed. Where a value falls on a boundary line, the lesser value may apply. For example, Case 2 requires only 5 tiebars per span.
(c) Actual tiebar spacings are then adjusted as follows:
(i) In C2P joints, the bars must be clustered, see MO06.
(ii) In type P joints, adjust spacings in accordance with the MP series drawings to achieve clearance from adjacent P8 joints.

TABLE 9.2: JOINT CORRUGATION DESIGN

<table>
<thead>
<tr>
<th>BASE THICKNESS (mm)</th>
<th>NUMBER OF CORRUGATIONS</th>
<th>MINIMUM CORRUGATION DEPTH (mm)</th>
<th>MINIMUM CORRUGATION HEIGHT (mm)</th>
<th>MINIMUM FLAT SPACING (mm)</th>
<th>MINIMUM VERTICAL SPACING (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 200</td>
<td>3</td>
<td>9 ± 3</td>
<td>20</td>
<td>10</td>
<td>45</td>
</tr>
<tr>
<td>200 - 240</td>
<td>3 or 4</td>
<td>10 ± 3</td>
<td>25</td>
<td>12</td>
<td>50</td>
</tr>
<tr>
<td>&gt; 240</td>
<td>3 or 4</td>
<td>12 ± 3</td>
<td>30</td>
<td>15</td>
<td>50</td>
</tr>
</tbody>
</table>

Table 9.2 Notes:
(a) The top and bottom corrugations must be concave in the first placed face (that is, convex on the form).
(b) Two alternative form profiles are shown, one suited to striplaying and the other suited to strip form work.
(c) It is not necessary to match the corrugation type of existing slabs during full or partial replacement.

TABLE 9.3: REINFORCEMENT COVER

<table>
<thead>
<tr>
<th>REINFORCEMENT COVER UNLESS NOTED OTHERWISE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 BARS N12 - TOP: TIED UNDER 'C' BARS</td>
</tr>
<tr>
<td>'C' BARS N16 - TOP: 100 x 10 D ≥ 200</td>
</tr>
<tr>
<td>TIEBARS: 110 ± 30 MIN AND NOTE 3.572</td>
</tr>
<tr>
<td>SIDES: REFER NOTE 3.572</td>
</tr>
</tbody>
</table>

TABLE 9.3 Notes:
(a) A1 bar spacings are maximised at 750 to meet support criteria for the longitudinal steel.
(b) Where any one number is provided, it applies to tiebars and to A1 bars.
(c) Relief-edge distance (RED) is measured from the joint (or section) under design to the nearest relief edge. The value for RED must make allowances for stress contributors such as connected kerbs and future widening.

NOT TO SCALE,
FIGURE 11.1: TYPICAL CRCP REPAIR OPTIONS

NOTES:
* DENOTES OPTIONAL C2 OR C2d, SEE SCHEDULE S12.1 ITEM 1.
& DENOTES OPTIONAL C7 OR C7d, SEE SCHEDULE S13.1 ITEM 1.

SCHEDULE 11.1 (S11.1)
COMMON JOINT TYPES

<table>
<thead>
<tr>
<th>TYPE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Longitudinal: bed and sawn</td>
</tr>
<tr>
<td>C2</td>
<td>Longitudinal: bed and formed</td>
</tr>
<tr>
<td>C2f</td>
<td>Longitudinal: drill-tied and formed</td>
</tr>
<tr>
<td>C2p</td>
<td>Longitudinal: cluster-tied and formed</td>
</tr>
<tr>
<td>C4</td>
<td>Longitudinal: untied and formed</td>
</tr>
<tr>
<td>C5</td>
<td>Longitudinal: untied and sawn</td>
</tr>
<tr>
<td>C6</td>
<td>Longitudinal: edge</td>
</tr>
<tr>
<td>C7</td>
<td>Transverse: slab repair</td>
</tr>
<tr>
<td>C18</td>
<td>Transverse: slab repair drill and tied</td>
</tr>
<tr>
<td>P6</td>
<td>Transverse contraction; sawn (undowelled)</td>
</tr>
<tr>
<td>C14</td>
<td>Isolation: with subgrade beam</td>
</tr>
<tr>
<td>C15</td>
<td>Isolation: without subgrade beam</td>
</tr>
<tr>
<td>C18</td>
<td>Longitudinal edge with subgrade beam</td>
</tr>
</tbody>
</table>

FIGURE 11.2: RISKS OF CORNER CRACKING

CORNER CRACKING IS A RISK WITHIN THE FRESH PATCH

CRACKING IS UNLIKELY WITHIN THE EXISTING SHOULDER.

SECTION 11.2: RISKS OF CORNER CRACKING

THE EXISTING SHOULDER CRACKING IS UNLIKELY WITHIN

WITHIN THE FRESH PATCH

CORNER CRACKING IS A RISK

FIGURE 11.1: TYPICAL CRCP REPAIR OPTIONS
### SCHEDULE 11.2 (S11.2) KEY AND NOTES (REFER TO FIGURE 11.1)

<table>
<thead>
<tr>
<th>NOTE</th>
<th>SYMBOL</th>
<th>DIMENSION (where applicable)</th>
<th>DESCRIPTION AND COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>9.3 m MIN</td>
<td>A: Length of slab R &amp; R</td>
</tr>
<tr>
<td>2</td>
<td>B</td>
<td>9.5 m preferred</td>
<td>B: Distance between a proposed new C7 joint and the nearest transverse crack outside the limits of the proposed patch that is, a crack which will remain after the R &amp; R. See Note (a). A new C7 joint should not cross an existing crack. See Note (b).</td>
</tr>
<tr>
<td>3</td>
<td>C</td>
<td>9.3 m MIN</td>
<td>C: Width of replacement.</td>
</tr>
<tr>
<td>4</td>
<td>D, O, Dg</td>
<td>9.6 m MIN</td>
<td>D: Width of residual slab measured to the next longitudinal joint or edge.</td>
</tr>
<tr>
<td>5</td>
<td>E</td>
<td>9.1 m MIN</td>
<td>E: Distance between a proposed new C7 joint and the nearest transverse crack which lies within the proposed patch (that is, a crack which will be removed by the R &amp; R). See Note (c).</td>
</tr>
<tr>
<td>6</td>
<td>F</td>
<td>9.0 m MIN</td>
<td>F: Length between adjacent 6 m patches (that is, the length of slab which is retained). See Note (d).</td>
</tr>
<tr>
<td>7</td>
<td>G</td>
<td>0.6 m MIN</td>
<td>G: Corner angle formed by joints and / or edges.</td>
</tr>
<tr>
<td>8</td>
<td>H</td>
<td>0.2 m MIN</td>
<td>H: Offset (separation) between patches in adjoining lanes.</td>
</tr>
<tr>
<td>9</td>
<td>Wc, Wg, Wx, Wy</td>
<td>9.5 m preferred</td>
<td>Wc: The offset between CRCP patch and a contraction joint in an (G  ) offsets as shown in Figure 11.1.</td>
</tr>
<tr>
<td>10</td>
<td>Ø</td>
<td>90° ±6°</td>
<td>Ø: Corner single formed by joints and / or edges.</td>
</tr>
</tbody>
</table>

**SCHEDULE 11.3 (S11.3) CONTINUED**

### CASE STUDIES (REFER TO FIGURE 11.1)

#### GENERAL

In setting these guidelines it is assumed that each of the repairs will be completed independently of others. If the marked patches were undertaking simultaneously, thermal expansion would impose excessive compressive stresses on the adjacent (residual) concrete, and night-time contraction would impose excessive tensile stresses on the residual longitudinal steel. So, for example:

- Cases 3 and 7 (and 6 and 9) could not be repaired simultaneously (because of their separation).
- Cases 3 and 7 would involve greater risk if they were repaired simultaneously, depending on the dimensions D, Dy and Dz.

The cases shown in Figure 11.1 require assessment of the following two aspects:

1. Structural soundness of the finished slabs. The dimension of both the replacement slabs and the residual slabs must provide structural integrity under the stress caused by traffic loading and cyclic and diurnal movements. Schedule 11 provides suggested guidelines.
2. Diurnal control during repairs. Even in the absence of traffic loading, substantial stresses are generated within a CRCP by cyclic thermal movements. These stresses will be significantly increased by the removal of failed sections (as explained in Note (h)). As a general rule, any removal exceeding about 30% of the test width should be treated with caution, but each case will vary depending on the dimensions of the patch and its location relative to free edges. Diurnal controls (see Note (j)) should be applied in accordance with guidelines provided in the following Case Study descriptions.

#### CASE 1: Branch cracking

- No action required until secondary distress occurs.

**CASE 2: Minor shallow failures**

- (a) Failures such as spalling can be repaired in accordance with MC21 and MC22.
- (b) Diurnal control is recommended if:
  - C ≥ 2.0 m, or
  - C/Wc ≥ 0.3.
- (c) Diurnal control is recommended if:
  - C/Wc ≥ 0.3.
- (d) Diurnal control is recommended if:
  - C/Wc ≥ 0.3.

**CASE 3: Central patch with support on both sides**

- Structural criteria (a) Dimensional limits apply in accordance with S11.2.
  - Diurnal control (b) If the C1/C2 joint is sound, it can be assumed that the adjacent slab (Wx) will provide effective restraint on that side of the patch.
  - Structural criteria (a) Dimensional limits apply in accordance with S11.2.
  - Diurnal control (b) If the C1/C2 joint is sound, it can be assumed that the adjacent slab (Wx) will provide effective restraint on that side of the patch.
  - Structural criteria (a) Dimensional limits apply in accordance with S11.2.
  - Diurnal control (b) If the C1/C2 joint is sound, it can be assumed that the adjacent slab (Wx) will provide effective restraint on that side of the patch.
  - Structural criteria (a) Dimensional limits apply in accordance with S11.2.
  - Diurnal control (b) If the C1/C2 joint is sound, it can be assumed that the adjacent slab (Wx) will provide effective restraint on that side of the patch.

**CASE 4: Full-lane patch with a free edge**

- Structural criteria (a) Dimensional limits apply in accordance with S11.2.
  - Diurnal control (b) If the C1/C2 joint is sound, it can be assumed that the adjacent slab (Wx) will provide effective restraint on that side of the patch.

**CASE 5: Partial-width patch abutting a jointed concrete base**

- Structural criteria (a) Dimensional limits apply in accordance with S11.2.
  - Diurnal control (b) If the C1/C2 joint is sound, it can be assumed that the adjacent slab (Wx) will provide effective restraint on that side of the patch.

**CASE 6: Mid-lane patch**

- Structural criteria (a) Dimensional limits apply in accordance with S11.2.
  - Diurnal control (b) If the C1/C2 joint is sound, it can be assumed that the adjacent slab (Wx) will provide effective restraint on that side of the patch.

**CASE 7: Full-lane patch abutting a jointed concrete base**

- Structural criteria (a) Dimensional limits apply in accordance with S11.2.
  - Diurnal control (b) Jointed pavement slabs are assumed not to provide edge restraint because of:
    - the freedom of movement in the P transverse joints.
    - the clustered filler arrangement in the C7p joint.

- A patch which abuts a jointed pavement is likely to experience excessive movement and so diurnal control is recommended unless Wx ≥ 1.5 m in which case Case 6 may apply.

**CASE 8: Partial-width patch abutting a free edge or relief edge**

- Structural criteria (a) Dimensional limits apply in accordance with S11.2.
  - Diurnal control (b) A patch which extends to a free edge or relief edge is likely to experience excessive movement and so diurnal control is recommended except where:
    - C ≤ 1.5 m,
    - C ≤ 0.6 m, or the C1/C2 joint is sound and (D+Wx) ≥ 1.0,
    - (C/Wx) ≥ 0.5.

**CASE 9: Central patch with support on both sides**

- Structural criteria (a) Dimensional limits apply in accordance with S11.2.
  - Diurnal control (b) If the C1/C2 joint is sound, it can be assumed that the adjacent slab (Wx) will provide effective restraint on that side of the patch.

**CASE 10: Partial-lane patch abutting a C7p joint**

- Structural criteria (a) Dimensional limits apply in accordance with S11.2.
  - Diurnal control (b) If the C1/C2 joint is sound, it can be assumed that the adjacent slab (Wx) will provide effective restraint on that side of the patch.

**CASE 11: Central patch with support on both sides**

- Structural criteria (a) Dimensional limits apply in accordance with S11.2.
  - Diurnal control (b) If the C1/C2 joint is sound, it can be assumed that the adjacent slab (Wx) will provide effective restraint on that side of the patch.

**CASE 12: Partial-width patch abutting a jointed concrete base**

- Structural criteria (a) Dimensional limits apply in accordance with S11.2.
  - Diurnal control (b) If the C1/C2 joint is sound, it can be assumed that the adjacent slab (Wx) will provide effective restraint on that side of the patch.

- Diurnal control is recommended if:
  - C ≥ 2.0 m, or
  - C/Wx ≥ 0.3.
  - C/Wx ≥ 0.3.
  - (C/Wx) ≥ 0.3.

**CASE 13: Central patch with support on both sides**

- Structural criteria (a) Dimensional limits apply in accordance with S11.2.
  - Diurnal control (b) If the C1/C2 joint is sound, it can be assumed that the adjacent slab (Wx) will provide effective restraint on that side of the patch.

- Diurnal control is recommended if:
  - C ≥ 2.0 m, or
  - (C/Wx) ≥ 0.3.
There are two common methods of slab removal:

1. **Longitudinal joints**
   - **Crane lift**
   - **Excavator removal**

2. **Transverse sawing**
   - Internal cuts within the slab to break it into manageable sections to facilitate removal with a minimum of damage to adjacent slabs and joints.
   - **Cleaning out**
   - **Debonding**
   - **Reinforcement**

3. **Preparation of exposed joint faces continued**
   - **General**
     - **Exposed faces must be assessed and treated in accordance with MC13 and MC14.**
     - **Where remedial treatment (such as spall repair) is needed, it must be completed in accordance with the adjacent concrete.**
   - **Longitudinal joints**
     - **Joints**
       - **General**
         -**Exposed joints must be buffered or jointed.**
         - **Joints**
           - **within patches which are shorter than 1.5 m**
           - **which are located 0.3 m or more outside a transfret line (for example, 0.5 m or more outside an edge line).**
   - **Subbase**
     - **Debonding**
     - **cleaning out**
     - **Debonding and sawing**

4. **Reinforcement of transverse joints**
   - **Longitudinal joints**
     - **(a) Between two CPCP slabs**
     - **Crane lift**
     - **Excavator removal**
   - **Transverse joints**
     - **Tiebars must be provided in accordance with Table 6.1.**
   - **General**
     - **All other slab details (such as flexing) must be in accordance with Schedule 7.2.**

5. **Reserved**

6. **Subbase repairs**
   - **Seals special advice for assessment and repair of subbase.**
   - **Cracks in the subbase should be examined for spalls or excessive crack widths.**
   - **The major risks associated with such defects are:**
     - **Reflection of subbase cracks into the base.**
     - **High interlayer bonding, which may initiate unplanned base cracking.**
   - **The major risks associated with such defects are:**
     - **Reflection of subbase cracks into the base.**
     - **High interlayer bonding, which may initiate unplanned base cracking.**
   - **Cleaning out the slab face.**
   - **Debonding.**
   - **Sawing the slab edge.**

7. **Openings to traffic**
   - **The pavement should not be opened to traffic until the concrete has attained insitu compressive strength of 20 MPa.**
   - **In patches longer than 2.5 m, there is a high risk (because of the high tensile strength of SFRC) that transverse cracking will not develop in the CRCP at the desired span.**
   - **The loss of tiebars may result in the jointed slabs drifting away from the CRCP.**
   - **Between CRCP and PCP slabs, tiebars must be clustered within the central one-third of the PCP slab length.**
   - **Where remedial treatment (such as spall repair) is needed, it must be completed in accordance with Activity 4 above.**

8. **Concrete mix design**
   - **The concrete mix must be designed with consideration of:**
     - **structural and thickness design requirements.**
     - **Compressive strength of 20 MPa.**
   - **Steel-fibre reinforced concrete (SFRC) should be used.**
   - **In patches longer than 2.5 m, there is a high risk (because of the high tensile strength of SFRC) that transverse cracking will not develop in the CRCP at the desired span.**
   - **The major risks associated with such defects are:**
     - **Reflection of subbase cracks into the base.**
     - **High interlayer bonding, which may initiate unplanned base cracking.**
   - **Cleaning out the slab face.**
   - **Debonding.**
   - **Sawing the slab edge.**

9. **Joint debonding and sawing**
   - **Before the replacement base is placed, the full face of all joints must be thoroughly cleaned and then treated with a debonding agent in accordance with Activity 3.4 above.**
   - **Joints and cracks**
     - **(a) Where existing face corrugations or keys are to be saved, see Activity 3.**
     - **Whether defects in the exposed face need correction (for example, spalling and/or rounding).**
     - **(b) Where existing tiebars are to be saved.**
     - **(c) Whether the existing face corrugations or keys are to be saved.**

10. **Reinforcement**
    - **Reinforcement within the patch area must be rebated as follows:**
      - **Longitudinal Steel:**
        - **Reinforcing steel to match the existing steel.**
      - **Transverse Steel:**
        - **Removes reinforcement equal to that in the adjoining CRCP except that, for patches shallower than 1.5 m, transverse reinforcement is not mandatory on structural grounds.**

11. **Concrete mix design**
    - **The concrete mix must be designed with consideration of:**
      - **structural and thickness design requirements.**
      - **Compressive strength of 20 MPa.**
    - **Steel-fibre reinforced concrete (SFRC) should be used.**
    - **In patches longer than 2.5 m, there is a high risk (because of the high tensile strength of SFRC) that transverse cracking will not develop in the CRCP at the desired span.**
    - **The major risks associated with such defects are:**
      - **Reflection of subbase cracks into the base.**
      - **High interlayer bonding, which may initiate unplanned base cracking.**
    - **Cleaning out the slab face.**
    - **Debonding.**
    - **Sawing the slab edge.**

12. **Paving of new concrete**
    - **The concrete mix must be in accordance with MC8.26-29.**
    - **The concrete mix must be in accordance with MC8.26-29.**
    - **The concrete mix must be in accordance with MC8.26-29.**
    - **The concrete mix must be in accordance with MC8.26-29.**
    - **The concrete mix must be in accordance with MC8.26-29.**
    - **The concrete mix must be in accordance with MC8.26-29.**
    - **The concrete mix must be in accordance with MC8.26-29.**
    - **The concrete mix must be in accordance with MC8.26-29.**

13. **Jointing**
    - **New joints must be designed and constructed in accordance with MC8.26-29.**

14. **Openings to traffic**
    - **The pavement should not be opened to traffic until the concrete has attained insitu compressive strength of 20 MPa.**
    - **In order to monitor the rate of strength gain, weight on each section will be removed.**
    - **Testing of these cylinders will provide the best guidance for time of access to the repair area.**
    - **In cases where the requirements of Note 14.2 are not practicable, experience with particular materials and work processes may be used for guidance.**

Note:**

- **Note:** in this Schedule are referred to by both Activity and Method number. For example, Note 14.1 relates to trafficking strength.
SCHEDULE 13.1 (S13.1): TREATMENT OF JOINTS EXPOSED DURING R & R

**EXPOSED JOINT TYPE** | DESCRIPTION | NOTES
--- | --- | ---
C1 | Longitudinal: tied and sewn | Refer to Figure 13.1
[a] Treat in accordance with Type C14
[b] Leave any lip to minimise the risk of crack initiation in the new slab.
[c] The joint effectively converts to a Type C2, scabbled.

C2 | Corrugated | Further remedial treatment may be required on the underlying corrugations if they depart substantially from the advice provided on MC05-MC09.

C2, keyed | Longitudinal: tied and formed | Refer to Figure 13.2
[a] Treat in accordance with Type C14
[b] Leave any lip to minimise the risk of crack initiation in the new slab.
[c] The joint effectively converts to a Type C2, scabbled.

C2, butt | Longitudinal: tied and formed | Refer to Figure 13.1
[a] Leave any lip to minimise the risk of crack initiation in the new slab.
[b] The joint effectively converts to a Type C2, scabbled.

C3 | Longitudinal: tied and bonded | Where an existing C4 face is exposed, the required treatment will depend on whether the new joint will be tied or untied. The alternatives are as follows:
[a] New untied joints
[b] (i) Treat in accordance with Case 3
[c] (ii) Treat in accordance with Schedule 12 Activity 3
[d] (iii) Carry out any spall repairs in accordance with MC11 and MC22
[e] (iv) Design a sealant in accordance with Table 8.2
[f] Where widening is required at a Type C6, treat the edge according to the new joint type.
[g] Untied joints are not expected to transfer shear loads and so do not need to be scabbled.

C4 | Longitudinal: untied and bonded | Where an existing C4 face is exposed, the required treatment will depend on whether the new joint will be tied or untied. The alternatives are as follows:
[a] New untied joints
[b] (i) Treat in accordance with Cases 3-7
[c] (ii) Treat in accordance with Schedule 12 Activity 3
[d] (iii) Carry out any spall repairs in accordance with MC11 and MC22
[e] (iv) Design a sealant in accordance with Table 8.2
[f] Where widening is required at a Type C6, treat the edge according to the new joint type.
[g] Untied joints are not expected to transfer shear loads and so do not need to be scabbled.

C5, sawn | Longitudinal: untied and sawn | Refer to Figure 14.2
[a] Treat in accordance with Cases 3-7
[b] (i) Treat in accordance with Schedule 12 Activity 3
[c] (ii) Carry out any spall repairs in accordance with MC11 and MC22
[d] (iii) Design a sealant in accordance with Table 8.2
[e] Where widening is required at a Type C6, treat the edge according to the new joint type.
[f] Untied joints are not expected to transfer shear loads and so do not need to be scabbled.

C6, ribbed | Longitudinal: untied and ribbed | Refer to Figure 14.2
[a] Treat in accordance with Cases 3-7
[b] (i) Treat in accordance with Schedule 12 Activity 3
[c] (ii) Carry out any spall repairs in accordance with MC11 and MC22
[d] (iii) Design a sealant in accordance with Table 8.2
[e] Where widening is required at a Type C6, treat the edge according to the new joint type.
[f] Untied joints are not expected to transfer shear loads and so do not need to be scabbled.

C14 | Isolation, with subgrade beam | (a) Scabbling is not required.
(b) Carry out any spall repairs in accordance with MC11 and MC22.
(c) Design a sealant in accordance with MC08.

**NOTE:** Treatments are based on the joint types encountered in the field, not the intended joint type.

---

**FIGURE 13.1: EXISTING JOINT RECESS**

**Case 1: Exposed concave face**
- Design a filler and sealant in accordance with MC08.
- Treat in accordance with Type C14
- Leave any lip to which might cause cracking in the new slab.
- Scabbling is not required.

**Case 2: Exposed convex face**
- Design a sealant in accordance with Table 8.1.
- Treat in accordance with Type C14
- Leave any lip to which might cause cracking in the new slab.
- Scabbling is not required.

---

**FIGURE 13.2: CORRUGATED JOINTS**

**Case 1:** Exposed concave face
- Design a filler and sealant in accordance with MC08.
- Treat in accordance with Type C14.
- Leave any lip to which might cause cracking in the new slab.
- Scabbling is not required.

**Case 2:** Exposed convex face
- Design a sealant in accordance with Table 8.2.
- Treat in accordance with Type C14.
- Leave any lip to which might cause cracking in the new slab.
- Scabbling is not required.

---

**FIGURE 13.3: KEYED JOINTS**

**Case 1:** Exposed concave face
- Design a filler and sealant in accordance with MC08.
- Treat in accordance with Type C14.
- Leave any lip to which might cause cracking in the new slab.
- Scabbling is not required.

**Case 2:** Exposed convex face
- Design a sealant in accordance with Table 8.2.
- Treat in accordance with Type C14.
- Leave any lip to which might cause cracking in the new slab.
- Scabbling is not required.

---

**FIGURE 13.4: TYPICAL KEYED JOINT**

**Case 1:** Exposed concave face
- Design a filler and sealant in accordance with MC08.
- Treat in accordance with Type C14.
- Leave any lip to which might cause cracking in the new slab.
- Scabbling is not required.

**Case 2:** Exposed convex face
- Design a sealant in accordance with Table 8.2.
- Treat in accordance with Type C14.
- Leave any lip to which might cause cracking in the new slab.
- Scabbling is not required.

---

**FIGURE 13.5: KEYED JOINTS**

**Case 1:** Exposed concave face
- Design a filler and sealant in accordance with MC08.
- Treat in accordance with Type C14.
- Leave any lip to which might cause cracking in the new slab.
- Scabbling is not required.

**Case 2:** Exposed convex face
- Design a sealant in accordance with Table 8.2.
- Treat in accordance with Type C14.
- Leave any lip to which might cause cracking in the new slab.
- Scabbling is not required.
**FIGURE 14.1: BUTT AND SCABBLED FACES**

- Case 1: Model ribbed joint
- Case 2: Curled and vertical
- Case 3: Curled and inclined
- Case 4: Curled and inclined
- Case 5: Curled and vertical
- Case 6: Curled and inclined
- Case 7: Curled and inclined

**FIGURE 14.2: RIBBONED JOINTS**

- Case 1: Model ribbed joint
- Case 2: Curled and vertical
- Case 3: Curled and inclined
- Case 4: Curled and inclined
- Case 5: Curled and vertical
- Case 6: Curled and inclined
- Case 7: Curled and inclined

### Notes:
1. Ribbed joints are no longer used for new construction or maintenance work.
2. Where the new joint will be tied, a sealant will not be required in most cases. Where the new joint will be untied, a sealant must be designed in accordance with MC08.
3. Shading indicates the following:
   - The material removed from the exposed faces.
   - The resulting face after treatment.
   - Sawcut

### Specifications:
- The width of the ribbons can be varied to suit the requirements of the joint.
- The height of the ribbons should be such that the resulting joint is not likely to cause damage from heaving or settlement.
- The ribbons should be placed in such a way that they are not likely to interfere with the traffic flow or pedestrian movement.

### Construction:
- Sawcut and scabble.
- Where deep sawing is used, the face must be scabbled below the line D/3+10 mm from the top (as shown in Figure 14.1).
- The location of the sawcut is dictated by the vertical face dimension of 45 mm minimum and the need to transition the underlying face at a slope not greater than 1 in 3.
- The location of the sawcut is dictated by the vertical face dimension, and the limiting slope may be impractical over longer lengths.

### Repair:
- Carry out a spall repair as shown on MC21 and MC22.

### References:
- Specifications required that ribbons be placed as shown.
- The limitations on the use of ribbons are discussed in Activity 3 (S12.1).
- The accuracy of the sawing and scabbling is essential for a good joint.
- The new slab must be placed in accordance with Case 2 (S12.1).

### Additional Information:
- The new slab must be placed as shown in Figure 14.1.
- The sawcut and scabble must be carried out as shown in Figure 14.2.
- The new slab must be placed in accordance with Cases 2-7.
- The new slab must be placed in accordance with Cases 2-7.
- The new slab must be placed in accordance with Cases 2-7.
### FIGURE 15.2: OPTIONS FOR REMOVAL OF CONCRETE

#### Option 1: Retain lap lengths on existing steel

- **KEY**
  - NEAR FULL-DEPTH BASE SAWCUT
  - PART-FULL DEPTH SAWCUT
- **SECTION 1**
  - **NTS**
  - See S15.2 for dimensions of L
- **PART-FULL DEPTH SAWCUT**
  - See Activity 1 (S12.1)
- **NEW DRILL-TIES**
  - See Activity 4 (S12.1)
- **TRANSVERSE SLAB REPAIR:**
  - DRILL-TIED
- **REPLACE CORNER CONCRETE**
  - See Activity 1 (S12.1)
- **TIEBARS OR TIE DRILLS**
  - See Activity 4 (S12.1)
- **EXISTING LONGITUDINAL JOINT**
  - REMOVE CORNER CONCRETE
- **NEAR FULL-DEPTH BASE SAWCUT**
  - N16 BARS LAPPED TO EACH TIEBAR
  - N12 (MIN) BARS LAPPED TO EACH TIEBAR
- **FULL-DEPTH SAWCUT**
  - See Activity 4 (S12.1)
- **OPTIONAL PART OR FULL DEPTH BASE SAWCUT**
  - See Activity 3.2(b) (S12.1)

#### Option 2: Cut all existing steel

- **SECTION 2**
  - **NTS**
  - See S15.2 for dimensions of L
- **PART-FULL DEPTH SAWCUT**
  - See Activity 1 (S12.1)
- **NEW DRILL-TIES**
  - See Activity 4 (S12.1)
- **TRANSVERSE SLAB REPAIR**
  - DRILL-TIED
- **REPLACE CORNER CONCRETE**
  - See Activity 1 (S12.1)
- **TIEBARS OR TIE DRILLS**
  - See Activity 4 (S12.1)
- **EXISTING LONGITUDINAL JOINT**
  - REMOVE CORNER CONCRETE
- **NEAR FULL-DEPTH BASE SAWCUT**
  - N16 BARS LAPPED TO EACH TIEBAR
  - N12 (MIN) BARS LAPPED TO EACH TIEBAR
- **FULL-DEPTH SAWCUT**
  - See Activity 4 (S12.1)
- **OPTIONAL PART OR FULL DEPTH BASE SAWCUT**
  - See Activity 3.2(b) (S12.1)

### SCHEDULE 15.2 (S15.2)

#### Key to drawings for Options 1 and 2

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>DESCRIPTION</th>
<th>DIMENSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>L₁</td>
<td>Lap length in longitudinal bar</td>
<td>Tied lapped splice: 525 mm minimum&lt;br&gt;Welded splice: as per AS1600, or Mechanical splice: 100 mm nominal and as per AS3600. See sheet 153.</td>
</tr>
<tr>
<td>L₂</td>
<td>Lap length in transverse bar</td>
<td>N12: 360 mm minimum&lt;br&gt;N16: 525 mm minimum</td>
</tr>
<tr>
<td>S₀</td>
<td>Offset of sawcut from joint</td>
<td>Not specified, see Activity 3.2(b) (S12.1)</td>
</tr>
</tbody>
</table>
REINSTATING LONGITUDINAL REINFORCEMENT

SECTION T

STAGE 1

REINSTATING LONGITUDINAL REINFORCEMENT

STAGE 2

REINSTATING TRANSVERSE REINFORCEMENT AND TIEBARS

NOTES

(a) Figure 15.2 shows a full-width slab replacement between two longitudinal joints, in which case the offset $S_1$ is applicable. The offset $S_1$ does not apply to the case where the slab replacement is of part-width where the sawcut is not close to the longitudinal joints. $S_1 = \frac{H_1}{2}$.

(b) A transverse slab repair joint is created as a result of the sawcut.

(c) The existing transverse reinforcement may be discontinuous across a joint. Continuous transverse reinforcement is shown in Figure 15.2.

STAGE 3

NEW A-N12 COUPLED TO RETAINED A-N12 STUBS. THE NEW A-N12 REINFORCEMENT MAY BE COUPLED EITHER ABOVE, BELOW, OR BESIDE THE RETAINED A-N12 REINFORCEMENT. A COUPLING BELOW THE RETAINED REINFORCEMENT IS SHOWN FOR CLARITY.

TIEBARS WITH A MECHANICAL LAP COUPLER THAT IS APPLIED WITH A PURPOSE-BUILT APPLICATION TOOL.

OVERLAP NEW TRANSVERSE N12 REINFORCEMENT WITH EXISTING TRANSVERSE REINFORCEMENT STUBS BY AT LEAST 65 mm. CONNECT THE REINFORCEMENT WITH A MECHANICAL LAP COUPLER THAT IS APPLIED WITH A PURPOSE-BUILT APPLICATION TOOL. PLACE THE TRANSVERSE REINFORCEMENT BEFORE THE BASE SAWCUT.

OVERLAP NEW HALF-LENGTH TIEBARS WITH EXISTING TIEBAR STUBS BY AT LEAST 65 mm. CONNECT THE TIEBARS WITH A MECHANICAL LAP COUPLER THAT IS APPLIED WITH A PURPOSE-BUILT APPLICATION TOOL.

REPLACE CORNER CONCRETE.
### Schedule 16.1 (S16.1)

**NOTES**

- 1. This procedure is suitable for the resealing of transverse and longitudinal joints in CRCP. It is not suitable for cracks, see MC10 and MC12 for cracking and sealing of cracks. (It is also suitable for sealing of joints of which were previously unseen or were sealed.) Examples are transverse construction joints; longitudinal formed tied joints; kerb joints. (Some of the reasons for seeing these joints are to continue or improve water ingress and to protect timbers against corrosion.)
- 2. Sealant performance is critically affected by the adhesion with the concrete, hence:
  - (a) the old sealant must be fully removed because it may be incompatible with the new one,
  - (b) compressed air must be used to make sure it will not exceed a pressure of about 600 kPa,
  - (c) cleaning (preferably by washing) should be undertaken immediately after sawing (before the dry stage) or immediately after the joint faces;
  - (d) if the time of sawing, the reservoir must be thoroughly clean and dry, and must be free from all loose debris (such as dust from sawn concrete) and any other material which may reduce the bond.
- 3. The cleanliness of the joint faces must be tested in accordance with T319. An acceptable result is when Grade 3 (None) visual rating category is achieved. The adhesion of the sealant must be tested in accordance with T380.
- 4. Seal blinding should not be required if all cleaning has been satisfactory. Grit blowing may create further dust, in which case the joint must be thoroughly reblinded before sawing.
- 5. Ingress of solids into existing joints (and underlying cracks) should be minimised. If there is a spill in the old sawcut below the reservoir, it should not be disturbed. Where no spill is found, the sawblade below the reservoir should be thoroughly flushed out with high pressure air or water during the cleaning process. In order to maximise the progression of flushing out debris, cutting should proceed from the high side of the pavement towards the low side.
- 6. Sealants and their backer rods should be continuous between longitudinal joints. At joint junctions, priority must be given to the joint which will undergo the greatest movement. For example:
  - (a) transverse contraction joints must be continuous across longitudinal tied joints;
  - (b) longitudinal isolation joints should be continuous, with priority over contraction joints.
- 7. Sealants must extend down the vertical face of joints at all edges to prevent the ingress of water into the joint. At longitudinal points, the edge sealant must prevent the ingress of concrete into the transverse joints during subsequent paving cuts.
- 8. In selecting the width of resealing, it is not necessary to remove all spalling. Even in new construction, minor spalling (0.6 mm) is unavoidable and does not usually affect the performance of silicone sealants. RB3 contains suitable criteria. If wider spalling is present, refer to Table 21.1 for guidance on treatment of joint spalls.
- 9. A limit of 18 mm has been imposed on longitudinal silicone seals (see Table 16.1, for example).
- 10. In tied joints, polyurethane (alone) is unlikely to have adequate extension capacity.
- 11. In untied joints, polyurethane sealant can be used for greater widths.
- 12. In Table 16.1, select the row corresponding to the nominated W' .
- 13. The joint width W' must be made for factors such as the depth of the backer rod after dries) to minimise adherence of fines to the joint faces.
- 14. Sealant performance is critically affected by the adhesion with the concrete, hence:
- 15. Values given for the depth of joint D' are indicative only. Allowance must be made for factors such as the depth of the backer rod after dries) to minimise adherence of fines to the joint faces.
- 16. In Table 16.2, select the row corresponding to the nominated W' .
- 17. The backer rod diamet should typically be about 25% larger than the joint width W' .

**DISCLAIMER**

- The production of creep concrete joints is an experienced trade. Specialist advice should be sought in this situation.

**METHOD**

- 1. Establish traffic control and job safety in accordance with Safe Work Method Statements (SWMS), including "Wet Road" signs where water will flow across traffic lanes.
- 2. Refer to Figure 16.1 for typical joint resealing applications.
- 3. Install sedimentation controls around drainage pits for saw slurry and debris.
- 4. Immediately after sawing, clean joints and pavement surfaces with high pressure air or water to remove all debris.
- 5. Install closed-cell polyethylene backer rod or temporary seal as soon as possible after cleaning.
- 6. Trafficing may be necessary before sealing. Any damaged backer rod must be replaced.
- 7. Depress the temporary seal to provide the required sealant thickness.
- 8. Place the sealant in accordance with the specification and in accordance with manufacturer's Instructions (including a binder, where required).
- 9. Tool to enhance the bond and to provide the required recess. Extend the sealant down all edges in accordance with Note 7 Schedule 16.1.
- 10. Allow trafficking only after the sealant has become tack free.

### Table 16.1: Untied Joints - Silicone Sealant Dimensions

<table>
<thead>
<tr>
<th>Width (W') (mm)</th>
<th>Design Joint Opening (O)</th>
<th>Depth (D) (mm)</th>
<th>Recess (R) (mm)</th>
<th>Joint Depth (D') (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.4 ≤ W' ≤ 6.5</td>
<td>2.1</td>
<td>7 ± 3</td>
<td>8 ± 2</td>
<td>7.0 ± 0.5</td>
</tr>
<tr>
<td>6.5 ≤ W' ≤ 8.0</td>
<td>2.5</td>
<td>6 ± 3</td>
<td>8 ± 2</td>
<td>6.8 ± 0.5</td>
</tr>
<tr>
<td>8.0 ≤ W' ≤ 10</td>
<td>3.0</td>
<td>5 ± 3</td>
<td>8 ± 2</td>
<td>10 ± 0.5</td>
</tr>
<tr>
<td>10.0 ≤ W' ≤ 12.5</td>
<td>4.5</td>
<td>4 ± 3</td>
<td>8 ± 2</td>
<td>12 ± 0.5</td>
</tr>
<tr>
<td>12.5 ≤ W' ≤ 15.0</td>
<td>5.0</td>
<td>3 ± 3</td>
<td>8 ± 2</td>
<td>15 ± 0.5</td>
</tr>
</tbody>
</table>

**Note:**

- For tied joints, refer to Table 16.2.
- (a) See Table 8.3 for calculation of effective slab width W_s.
- (b) Tooling is necessary to force the sealant against the faces, thereby enhancing its bond.
- (c) The backer rod diameter should be about 25% larger than the joint width W'.
- (d) Values given for the depth of joint D' are indicative only. Allowance must be made for factors such as the depth of the backer rod after dries) to minimise adherence of fines to the joint faces.
- (e) In this context, the terms "transverse" and "longitudinal" refer to the direction of trafficking.
- (f) The backer rod diameter should typically be about 25% larger than the joint width W'.
**Figure 17.2(a) Notes:**
(a) Assess the integrity of existing tiebars. Variability in joint width could indicate inadequate tying (for example, by pull-out and/or yielding, and/or corrosion). Where warranted, cross-stitch in accordance with MC23 before resawing.
(b) Where the existing joint is inclined beyond the range 90° ± 5° to the surface, resawing should aim to maximise future arris spalling. Case 1 is the clearly preferred option because Case 2 does not reduce the acute arris. Also, the existing joint intersects the side of the new sealant which will impose concentrated stresses at the top of the sealant, see Figure 18.3 for explanation.
(c) Select the resawing dimensions in accordance with Note 3 Schedule 16.2.

**Figure 17.2(b) Notes:**
(a) Assess the integrity of existing tiebars. Variability in joint width could indicate inadequate tying (for example, by pull-out and/or yielding, and/or corrosion). Where warranted, cross-stitch in accordance with MC23 before resawing.
(b) Where the existing joint is inclined beyond the range 90° ± 5° to the surface, resawing should aim to maximise future arris spalling. Case 1 is the clearly preferred option because Case 2 does not reduce the acute arris. Also, the existing joint intersects the side of the new sealant which will impose concentrated stresses at the top of the sealant, see Figure 18.3 for explanation.
(c) Select the resawing dimensions in accordance with Note 3 Schedule 16.2.

**Figure 17.3(a) Notes:**
(a) The accuracy of ribbon insertion was highly variable. Specifications are required that they be placed as shown above. By contrast, they will often be found much deeper and/or inclined, and/or missed.
(b) Where the ribbon was reasonably well placed, resawing should be in accordance with Figure 17.2(a).
(c) Where the ribbon is curled and/or inclined, see Figure 17.2(b) and Figure 17.3(c).
(d) The accuracy of ribbon insertion was highly variable. Specifications are required that they be placed as shown above. By contrast, they will often be found much deeper and/or inclined, and/or missed.
(e) Where the ribbon was reasonably well placed, resawing should be in accordance with Figure 17.2(a).
(f) Where the ribbon is curled and/or inclined, see Figure 17.2(b) and Figure 17.3(c).

**Figure 17.3(b) Notes:**
(a) This sawcut leaves the following potential problems:
- Potential wedge
- Certain spall
- Induced crack
(b) See Figure 17.3(c) regarding wedge treatment.
(c) This sawcut leaves the following potential problems:
- Potential wedge
- Certain spall
- Induced crack
(d) See Figure 17.3(c) regarding wedge treatment.

**Figure 17.3(c) Notes:**
(a) The accuracy of ribbon insertion was highly variable. Specifications are required that they be placed as shown above. By contrast, they will often be found much deeper and/or inclined, and/or missed.
(b) Where the ribbon is reasonably well placed, resawing should be in accordance with Figure 17.2(a).
(c) Where the ribbon is curled and/or inclined, see Figure 17.2(b) and Figure 17.3(c).
(d) The accuracy of ribbon insertion was highly variable. Specifications are required that they be placed as shown above. By contrast, they will often be found much deeper and/or inclined, and/or missed.
(e) Where the ribbon was reasonably well placed, resawing should be in accordance with Figure 17.2(a).
(f) Where the ribbon is curled and/or inclined, see Figure 17.2(b) and Figure 17.3(c).

**Figure 17.4 Notes:**
(a) Select the resawing dimensions in accordance with Note 2 Schedule 16.2.
**FIGURE 18.1: TRANSVERSE FORMED AND TIED CONSTRUCTION JOINTS (Type C7)**

<table>
<thead>
<tr>
<th>Figure 18.1(a)</th>
<th>Figure 18.1(b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butt face</td>
<td>Corrugated face</td>
</tr>
</tbody>
</table>

**Figure 18.1(a) Notes:**

(a) Where the existing joint is inclined beyond the range 90° ± 5° (to the surface), resealing should aim to minimise future distress.

Case 1 is the clearly preferred option because Case 2 does not reduce the acute angle. Also, the existing joint intersects the side of the new sealant, which will impose concentrated stresses on it; see Figure 18.3 for explanation.

(b) Select the resawing dimensions in accordance with Note 2 Schedule 16.2.

(c) Where there are early signs of joint spalling, resawing may be used to relieve stresses on the joint to minimise further failure.

(d) If the sealant is bonded along the bottom face, the concentrated strain at the joint will tear the sealant.

**CASE 1 (PREFERRED)**

- **NEW SAWCUT**
- **ORIGINAL JOINT**
- **WEAK WEDGE**
- **RIBBON INDUCER**
- **SLAB CONTRACTION**

**CASE 2 (POOR)**

- **NEW SAWCUT**
- **ORIGINAL JOINT**
- **WEAK WEDGE**
- **RIBBON INDUCER**
- **SLAB CONTRACTION**

**FIGURE 18.3: SEALANT RESERVOIR FAULTS**

<table>
<thead>
<tr>
<th>Figure 18.3(a)</th>
<th>Figure 18.3(b)</th>
<th>Figure 18.3(c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ineffective reseal</td>
<td>Short lived reseal</td>
<td>Effective reseal</td>
</tr>
</tbody>
</table>

**Figure 18.3(a) Notes:**

(a) The sealant must bridge the moving joint and so selection of the resealing line is important.

(b) If the sealant exceeds the joint, the joint remains unsealed.

**Figure 18.3(b) Note:**

(a) Where the sealant is bonded along the bottom face, the concentrated strain at the joint will destroy the joint.

(b) Care is required to prevent the fragments falling into the joint.

(c) If the sealant is bonded along the bottom face, the concentrated strain at the joint will tear the sealant.

**Figure 18.3(c) Notes:**

(a) If the moving joint intersects the side of the sealant (as shown), the sealant will either tear or debond.

(b) A possible remedy is to break off the wedge of concrete as shown.

(c) Care is required to prevent the fragments falling into the joint.

**FIGURE 18.2: ISOLATION JOINTS (Type C14)**

**Figure 18.2 Notes:**

(a) This detail is applicable to longitudinal and transverse C14.

(b) Select the resawing dimensions in accordance with Note 2 Schedule 16.2.

(c) Reuse of joint filler:

- there are signs of deterioration,
- it is permanently compressed to a width significantly less than the existing joint width and can admit incompressible material.

**FIGURE 18.4: SEALANT INSTALLATION - GENERAL**

<table>
<thead>
<tr>
<th>Figure 18.4(a)</th>
<th>Figure 18.4(b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good practice</td>
<td>Poor practice</td>
</tr>
</tbody>
</table>

**Figure 18.4(a) Note:**

(a) Good sealant design and installation ensures that expansion and compression movements are spread evenly throughout the sealant.

**Figure 18.4(b) Note:**

(a) If the sealant is bonded along the bottom face, the concentrated strain at the joint will tear the sealant.

**FIGURE 18.4: SEALANT INSTALLATION - GENERAL**

**Figure 18.4(a) Note:**

(a) Good sealant design and installation ensures that expansion and compression movements are spread evenly throughout the sealant.

(b) Care is required to prevent the fragments falling into the joint.

(c) If the sealant is bonded along the bottom face, the concentrated strain at the joint will tear the sealant.
TABLE 19.1: ROUT Dimensions - Tied and Stitched Cases

<table>
<thead>
<tr>
<th>Rout width (mm)</th>
<th>Sealant type</th>
<th>Rout depth (mm)</th>
<th>Stacker rod shape and size (Hg)</th>
<th>Sealer thickness (mm)</th>
<th>Sealer nocess (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 ± 3</td>
<td>Silicone or Polyurethane</td>
<td>15 mm cut to ½ round (Hg = 5 mm)</td>
<td>7 (+ 3, - 0)</td>
<td>3 (+ 2, - 0)</td>
<td></td>
</tr>
<tr>
<td>30 ± 5</td>
<td>Polyurethane</td>
<td>30 mm cut to ½ round (Hg = 10 mm)</td>
<td>10 (+ 5, - 0)</td>
<td>3 (+ 2, - 0)</td>
<td></td>
</tr>
<tr>
<td>50 ± 7</td>
<td>Polyurethane</td>
<td>50 mm, all alignment of height 14 mm (Hg = 14 mm)</td>
<td>11 (+ 5, - 0)</td>
<td>4 (+ 2, - 0)</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
(a) For untied/unstitched cases, this table may be used on the condition that the sealer is silicone of width less than 18 mm and that all dimensions satisfy criteria in Table 16.1.
(b) In tied joints, polyurethane is preferable to silicone where distillate fuels are likely to be in contamination.
(c) Routing widths listed in Table 19.1 are limited to 3 categories. The values (and the number of 3) are suggested for logistical purposes only and may be varied if deemed desirable. However, the maximum width of 50 ± 7 mm should only be varied after careful consideration and after suitable testing.

TABLE 19.2: NOMENCLATURE

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>DESCRIPTION</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wc</td>
<td>Width of crack (without spalling)</td>
<td>Refer to Note (b) Schedule 20.1 for applicability.</td>
</tr>
<tr>
<td>Wp</td>
<td>Width of crack plus spalling</td>
<td>Refer to Details T-X, MC20 for applicability.</td>
</tr>
<tr>
<td>Wc1</td>
<td>Width of rout - 1st pass</td>
<td>Refer to Note (b) Schedule 20.1 for applicability.</td>
</tr>
<tr>
<td>Wc2</td>
<td>Width of rout - 2nd pass</td>
<td>Refer to Note (b) Schedule 20.1 for applicability.</td>
</tr>
<tr>
<td>Ws</td>
<td>% spalled width</td>
<td>Refer to Note (b) Schedule 20.1 for applicability.</td>
</tr>
<tr>
<td>Wd</td>
<td>Width of dowel</td>
<td>Refer to Note (b) Schedule 20.1 for applicability.</td>
</tr>
<tr>
<td>Wh</td>
<td>Width of polyurethane sealant</td>
<td>Refer to Note (b) Schedule 20.1 for applicability.</td>
</tr>
</tbody>
</table>

METHOD
1. Establish traffic control and work safely in accordance with Safe Work Method Statements (SWMS).
2. Mark areas to be treated.
3. Determine required rout width, Wc = Wd + Ws.
4. Repair joints and cracks in accordance with Schedule 20.1 to Schedule 20.5 as applicable.
5. Clean out joints/cracks with high pressure water. This must be done immediately after sawing/routing and before the residue dries.
6. Inspect to ensure effective removal of all loose debris.
7. Install backer rod to provide the required sealant depth.
8. In routings, install sealant in accordance with Table 19.1.
9. Allow trafficking only after sealant has become tack free.
10. Install base course with suitably compacted mix.
11. Install pavement in accordance with MC16-MC18.
SCHEDULE 20.1 (S20.1)

**Tied Longitudinal Joint Routing Procedure**

(a) This procedure is applicable to longitudinal joints which are tied or untied, and have only minor spalling.

(b) Sawcutting should always be considered before routing.

(c) The cutting width (either sawn or routed) should generally be such that the fill impact on about 85% of the total length of spalled joint within a selected section. However, the width may differ between sites depending on factors such as:

- The curvature of the spalled crack, in terms of the capacity of the crack to tolerate fill.
- The economics of doing a single cut versus multiple passes.

For saw and seal dimensions: see Table 19.1.

For rout and seal dimensions: see Table 19.1.

**SCHEDULE 20.2 (S20.2)**

**Untied Joint Routing Procedure**

(a) This procedure is applicable to multiple spalling types where a combination of routing and structural repair is needed. It is applicable only to tied or untied joints and cracks.

(b) The suggested sequence of operations is as follows:

- Insert a temporary filler to width W_e.
- Repair the wide spall in accordance with MC21 and MC22.
- Install the sealant over the full length of routed crack plus repair, in accordance with Detail T, U, or V as applicable.
- Insert a temporary filler to width W_e.
- Repair the wide spall in accordance with MC21 and MC22.
- Install the sealant over the full length of routed crack plus repair, in accordance with Detail T, U, or V as applicable.

**SCHEDULE 20.3 (S20.3)**

**Tied Transverse Joint Routing Procedure**

(a) This procedure is applicable to transverse joints which are tied or untied and which have only minor spalling.

(b) Sawcutting should always be considered before routing.

(c) The cutting width (either sawn or routed) should generally be such that the fill impact on about 85% of the total length of spalled joint within a selected section. However, the width may differ between sites depending on factors such as:

- The curvature of the spalled crack, in terms of the capacity of the crack to tolerate fill.
- The economics of doing a single cut versus multiple passes.

For saw and seal dimensions: see Table 19.1.

For rout and seal dimensions: see Table 19.1.

**SCHEDULE 20.4 (S20.4)**

**Combined Routing and Repairing Procedure**

(a) This procedure is applicable to multiple spalling types where a combination of routing and structural repair is needed. It is applicable only to tied or untied joints and cracks.

(b) The suggested sequence of operations is as follows:

- Insert a temporary filler to width W_e.
- Repair the wide spall in accordance with MC21 and MC22.
- Install the sealant over the full length of routed crack plus repair, in accordance with Detail T, U, or V as applicable.
- Insert a temporary filler to width W_e.
- Repair the wide spall in accordance with MC21 and MC22.
- Install the sealant over the full length of routed crack plus repair, in accordance with Detail T, U, or V as applicable.

**SCHEDULE 20.5 (S20.5)**

**Untied Joint Routing Procedure**

(a) This procedure is applicable to untied joints, either longitudinal or transverse (such as isolation, expansion, untied butt) and which contain sections of substantial spalling.

(b) Because of the magnitude of cyclic movement, at least part of the repair width must be a silicone expansion, untied butt) and which contain sections of substantial spalling.

- Insert a temporary filler to width W_e.
- Repair the wide spall in accordance with MC21 and MC22.
- Install the sealant over the full length of routed crack plus repair, in accordance with Detail T, U, or V as applicable.
- Insert a temporary filler to width W_e.
- Repair the wide spall in accordance with MC21 and MC22.
- Install the sealant over the full length of routed crack plus repair, in accordance with Detail T, U, or V as applicable.
### Table 21.1: Classification of Spalls and Selection of Repair Method

<table>
<thead>
<tr>
<th>Type</th>
<th>Dimensions</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-rolling AR</td>
<td>W ≤ 10 mm</td>
<td>See Figure 21.1 for options</td>
</tr>
<tr>
<td>Minor spall M</td>
<td>W &gt; 10 mm</td>
<td>At Joints: Reaver and seal, see MC16-MC18 or Round and seal, see MC19 and MC20</td>
</tr>
<tr>
<td></td>
<td>(no limit on depth)</td>
<td>At Cracks: Round and seal, see MC19 and MC20</td>
</tr>
<tr>
<td>Shallow spall</td>
<td>W &gt; 10 mm</td>
<td>Thin bonded repairs</td>
</tr>
<tr>
<td>- Discrete SC</td>
<td>H ≤ D/2</td>
<td>See Figure 21.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For spall material on one side only</td>
</tr>
<tr>
<td>Deep spall D</td>
<td>W &gt; 10 mm</td>
<td>Full-depth repairs</td>
</tr>
<tr>
<td></td>
<td>H ≤ D/2</td>
<td>See Figure 21.3</td>
</tr>
</tbody>
</table>

### Table 21.2: Type SD - Shallow Discrete Spalls

- **Figure 21.2(a):** Plan view
  - **Figure 21.2(b):** Stage 1 (Section view)
    - **Figure 21.2(c):** Stage 2 (Section view)

- **Figure 21.2(a):** Plan view
  - **Figure 21.2(b):** Stage 1 (Section view)
    - **Figure 21.2(c):** Stage 2 (Section view)

- **Figure 21.3:** Type SC - Shallow Continuous Spalling

### Figures

- **Figure 21.1(a):** Minor (M)
- **Figure 21.1(b):** Shallow Discrete (SD)
- **Figure 21.1(c):** Shallow Continuous (SC)
- **Figure 21.2(a):** Plan view
  - **Figure 21.2(b):** Stage 1 (Section view)
    - **Figure 21.2(c):** Stage 2 (Section view)
- **Figure 21.3:** Type SC - Shallow Continuous Spalling
**FIGURE 22.1: TREATMENT OF MINOR ARRISS ROUNDING**

**STAGE 1**
- **NEW MATERIAL**
- **EXISTING SLAB**
- **EXISTING JOINT FACE**
- **EXPOSED FACE**

**STAGE 2**
- **NEW MATERIAL**
- **EXISTING SLAB**
- **EXISTING JOINT FACE**
- **EXPOSED FACE**

**STAGE 3**
- **NEW MATERIAL**
- **EXISTING SLAB**
- **EXISTING JOINT FACE**
- **EXPOSED FACE**

**NOTES**
- The practical minimum depth is 10 mm for epoxy resin repairs.
- 30 mm for cementitious repairs.
- Beyond these thicknesses, there is no value in making the repair deeper than necessary and no sealing should be used to the extent necessary to remove all unsound concrete.

**MC**
- **STAGE 2**
- **STAGE 2**
- **STAGE 2**
- **STAGE 2**

**SCHEDULE 22.1 (S22.1)**

**METHOD**

1. The critical factors for success include:
   - roughness and cleanliness of the parent concrete.
   - bond strength.
   - concrete/mortar compaction.
   - curing.
   - protection against early stress.

This method is suitable where the rounding and/or spalling exceeds the recommended operating range (in shape and/or dimensions) for the silicone option in Figure 22.1(a).

- For untied transverse joints:
  - Use a silicone in accordance with Table 16.1.
- For widths > 18 mm: not feasible, assess alternatives. Seek specialist advice.

**SCHEDULE 22.2 (S22.2)**

**NOTES**
- The practical minimum depth is 10 mm for epoxy resin repairs.
- 30 mm for cementitious repairs.
- Beyond these thicknesses, there is no value in making the repair deeper than necessary and no sealing should be used to the extent necessary to remove all unsound concrete.

**METHOD**

1. The critical factors for success include:
   - roughness and cleanliness of the parent concrete.
   - bond strength.
   - concrete/mortar compaction.
   - curing.
   - protection against early stress.

This method is suitable where the rounding and/or spalling exceeds the recommended operating range (in shape and/or dimensions) for the silicone option in Figure 22.1(a).

- For untied longitudinal joints:
  - For widths ≤ 16 mm, use a silicone in accordance with Table 16.1.
  - For ≥ 18 mm: not feasible, assess alternatives. Seek specialist advice.

---

**REFERENCES**

1. This method applies to joints, cracks, and edges. The diagrams show repairs in situations which do not involve full-depth slab removal. However, they are intended to cover many applications and so can be used in conjunction with slab removal (as shown on MC11-MC14) with only minor adaptation.

2. Spall repairs are very sensitive to standards of workmanship and will yield a low success rate unless close attention to detail is given to every aspect. Also refer to Schedule 22.2.

3. Joint formers are typically classified as shown in Table 21.1.
   - Each spall type is treated differently: see Table 21.1.
   - It is desirable to determine the extent of failure before commencing repairs. The early stages of deep spalling may look similar to shallow spalling.
   - Simple investigation techniques include tapping around the failure with a steel rod, and removal of voids to view the extent of cracking.

4. The practical minimum depth is:
   - 10 mm for epoxy resin repairs.
   - 30 mm for cementitious repairs.

---

**FIGURE 22.1(a): Option 1**

(a) This option is suitable where the rounding is only minor, but placement of concrete against that rounding will result in spalling of the new edge.

(b) This method is suitable for both longitudinal and transverse joints, either tied or untied.

(c) The sealant type and width must be designed in accordance with MC16-MC18.

- Recommendations are as follows:
  - For tied joints: transverse or longitudinal:
    - Use a silicone designed in accordance with Table 16.2. Adopt W' as low as feasible.
  - For untied transverse joints:
    - Use a silicone in accordance with Table 16.1.
  - For untied longitudinal joints:
    - For design widths ≤ 16 mm, use a silicone in accordance with Table 16.1.
    - For ≥ 18 mm: not feasible, assess alternatives. Seek specialist advice.

---

**FIGURE 22.1(b): Option 2**

(a) This option is suitable where the rounding and/or spalling exceeds the recommended operating range (in shape and/or dimensions) for the silicone option in Figure 22.1(a).

(b) This treatment is generally consistent with MC21 but assumes the spalling and/or rounding is much less advanced than in MC21.

(c) A polyurethane may be used in lieu of the epoxy resin.

- For the sealant design, refer to Figure 22.1(a).

---

**FIGURE 22.1(c): Option 3**

(a) This option is suitable where the rounding and/or spalling exceeds the recommended operating range (in shape and/or dimensions) for the silicone option in Figure 22.1(a).

(b) This method is the same as Figure 22.1(b) except that it removes the step of placing an epoxy resin patch.

- The controlling factor for the use of this option is likely to be the limit on silicone width, namely 18 mm maximum in longitudinal joints.

- In tied joints, a polyurethane can be used in lieu of the silicone, in which cases higher width limits apply.

---

**TABLE 21.1: Polyurethane Patching**

<table>
<thead>
<tr>
<th>Patch</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyurethane</td>
<td>Self-adhesive pastes or liquids that can be applied in situ.</td>
</tr>
<tr>
<td>Epoxy Resin</td>
<td>Three-component systems that require mixing on site.</td>
</tr>
</tbody>
</table>

---

**TABLE 19.1: polyurethanes**

<table>
<thead>
<tr>
<th>Width</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 18 mm</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>18 mm</td>
<td>1, 2</td>
</tr>
<tr>
<td>&gt; 18 mm</td>
<td>1, 2, 3</td>
</tr>
</tbody>
</table>

---

**REFERENCES**

- These methods are based on work by the Road Construction Authority (RCA) and the Polyurethane Jointing Group (PUG).
- The RCA method is particularly suitable for small cracks, cracks in joints, and cracks in longitudinal or transverse cracks.
TABLE 23.1: STITCHING NOTES

CASE 1: Longitudinal cracking
(a) Stitching not warranted.

CASE 2: Sheared longitudinal cracking
(a) Stitching not warranted.
(b) Secondary corner cracking is likely if β is less than 70°.

CASE 3: Longitudinal cracking (at joint or CP joints)
(a) Not suitable for stitching. Should spalling occur, treat in accordance with MC21 and MC22.
(b) Suitable for stitching to supplement existing barriers
(c) Do not stitch joints which are intended to be unsealed.

CASE 4: Anchored edge
(a) Stitching is not required or warranted in reinforced anchor slabs.

CASE 5: Anchor Slabs
(a) Stitching not required or warranted in reinforced anchor slabs.

Table 23.2: STITCHING LENGTHS

<table>
<thead>
<tr>
<th>Case</th>
<th>Fabrication Hole to Crack (mm)</th>
<th>Offset drill hole to crack (mm)</th>
<th>Length of stitch-bar (mm)</th>
<th>Length of protection (a) (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>165</td>
<td>330</td>
<td>260</td>
<td>40.5</td>
</tr>
<tr>
<td>150</td>
<td>175</td>
<td>345</td>
<td>275</td>
<td>45.0</td>
</tr>
<tr>
<td>200</td>
<td>180</td>
<td>370</td>
<td>300</td>
<td>50.5</td>
</tr>
<tr>
<td>250</td>
<td>200</td>
<td>410</td>
<td>360</td>
<td>55.5</td>
</tr>
<tr>
<td>300</td>
<td>210</td>
<td>430</td>
<td>380</td>
<td>60.5</td>
</tr>
<tr>
<td>350</td>
<td>220</td>
<td>450</td>
<td>400</td>
<td>65.5</td>
</tr>
</tbody>
</table>

Table 23.2 Notes:
(a) To suit drill angle ±30° and cover t = 25 mm
(b) See Fig. 23.2 for protection details

Table 23.3: STITCH-BAR SPACINGS FOR LONGITUDINAL JOINTS

<table>
<thead>
<tr>
<th>Relief distance (mm)</th>
<th>0-100</th>
<th>100-200</th>
<th>200-300</th>
<th>300-400</th>
<th>400-500</th>
<th>500-600</th>
<th>600-700</th>
<th>700-800</th>
<th>800-900</th>
<th>900-1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>200</td>
<td>230</td>
<td>260</td>
<td>290</td>
<td>320</td>
<td>350</td>
<td>380</td>
<td>410</td>
<td>440</td>
<td>470</td>
</tr>
<tr>
<td>1.2</td>
<td>210</td>
<td>240</td>
<td>270</td>
<td>300</td>
<td>330</td>
<td>360</td>
<td>390</td>
<td>420</td>
<td>450</td>
<td>480</td>
</tr>
<tr>
<td>1.3</td>
<td>220</td>
<td>250</td>
<td>280</td>
<td>310</td>
<td>340</td>
<td>370</td>
<td>400</td>
<td>430</td>
<td>460</td>
<td>490</td>
</tr>
<tr>
<td>1.4</td>
<td>230</td>
<td>260</td>
<td>290</td>
<td>320</td>
<td>350</td>
<td>380</td>
<td>410</td>
<td>440</td>
<td>470</td>
<td>500</td>
</tr>
<tr>
<td>1.5</td>
<td>240</td>
<td>270</td>
<td>300</td>
<td>330</td>
<td>360</td>
<td>390</td>
<td>420</td>
<td>450</td>
<td>480</td>
<td>510</td>
</tr>
<tr>
<td>1.6</td>
<td>250</td>
<td>280</td>
<td>310</td>
<td>340</td>
<td>370</td>
<td>400</td>
<td>430</td>
<td>460</td>
<td>490</td>
<td>520</td>
</tr>
<tr>
<td>1.7</td>
<td>260</td>
<td>290</td>
<td>320</td>
<td>350</td>
<td>380</td>
<td>410</td>
<td>440</td>
<td>470</td>
<td>500</td>
<td>530</td>
</tr>
<tr>
<td>1.8</td>
<td>270</td>
<td>300</td>
<td>330</td>
<td>360</td>
<td>390</td>
<td>420</td>
<td>450</td>
<td>480</td>
<td>510</td>
<td>540</td>
</tr>
<tr>
<td>1.9</td>
<td>280</td>
<td>310</td>
<td>340</td>
<td>370</td>
<td>400</td>
<td>430</td>
<td>460</td>
<td>490</td>
<td>520</td>
<td>550</td>
</tr>
<tr>
<td>2.0</td>
<td>290</td>
<td>320</td>
<td>350</td>
<td>380</td>
<td>410</td>
<td>440</td>
<td>470</td>
<td>500</td>
<td>530</td>
<td>560</td>
</tr>
</tbody>
</table>

Table 23.3 Notes:
(a) This table is based on a coefficient of friction of 1.5 at the underside of base and on the use of N2 stitch-bars.
(b) Spacings may be varied by ±10% to suit site conditions
(c) Relief-edge distance (REO) is measured from the joint or crack being attached to the nearest relief edge.
(d) It must include tied knots.

Notes:
1. Cross Stitching Compromise Practice is a technique which may extend the service life of a slab before more extensive repairs such as slab replacement are necessary.
2. Cross stitching may only be used with the written approval of the Principal.
3. Cross stitching of CRCP cracks or tied joints is only needed where the cracked joint opens up beyond 0.5 mm, due to causes such as inadequate or corridor mesh reinforcement. Cracks that are not opening (that is, are static) should not be stitched and may also not need to be routed.
4. Stitching is unlikely to be effective where:
(a) the pavement is extensively cracked, or
(b) the concrete has low strength (less than 25 MPa), or
(c) base thickness is less than 180 mm.
5. Crack stitching will be most successful if it is performed very soon after formation of the crack, before it widens. Poorly tied joints should also be stitched before they crack. Early stitching will:
(a) maximize load transfer between slabs, hence:
(b) significantly reduce the chances of secondary slab cracking,
(c) keep out corrosive materials, hence:
(d) avoid the need for routine sealing.
For the same reason, stitch-bars are best fixed (that is, epoxied) during warmer weather (or until the middle of the day) when the crack is most likely to close.
6. The decision to stitch (in preference to alternatives such as slab replacement) should take into consideration factors such as:
(a) the quality of the concrete (as indicated by distress additional to cracking, such as arris spalling, surface abrasion, condition of adjacent slabs),
(b) intensity of heavy vehicle traffic,
(c) previous success under similar conditions.
7. Protection must be provided in accordance with Figure 23.3 if the crack is wider than 0.5 mm. Suitable protection is provided by biomorphic paint with a thickness of 0.2 to 0.5 mm.
8. Use compressible self-expanding polyurethane resin (foam) to seal wider cracks and joints only.
ANCHOR DEFECT REPAIRS

**CASE 1: Shrinkage cracking over anchors**

Arrows only and is adjusted to suit grade and drainage requirements. Is deleted and the subbase is extended to the anchor. The depth of the drain is nominal anchor falls towards the anchor. Where the grade falls away from the anchor, the drain is denoted and the subbase is extended to the anchor. The depth of the drain is nominal only and is adjusted to suit grade and drainage requirements.

**CASE 2: Transverse joint spalls**

Due to the serious repercussions of this defect, seek specialist advice.

**CASE 3: Anchor rotation / sliding**

CRCP anchors constructed after 2003 contain additional transverse reinforcement to control longitudinal cracking at anchors. Terminal anchor rods in CRCP are generally Type 12. Refer to Volume CC Continuously Reinforced Concrete Pavement for standard details of various anchor designs.

**CASE 4: Longitudinal cracking**

This defect usually manifests itself in the form of faulting and/or crushing of the CRCP, PCP-R, SFRP-R terminal slabs and/or bridge approach slab at the C14 or F7/F72 and/or F14 joints. It may also lead to buckling of the CRCP, PCP-R, SFRP-R terminal slabs and/or bridge approach slab due to the serious repercussions of this defect, seek specialist advice.

**TABLE**

<table>
<thead>
<tr>
<th>SHEET No</th>
<th>NO OF SHEETS</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td></td>
</tr>
</tbody>
</table>

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**SCHEDULE 24.1**

<table>
<thead>
<tr>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Feege 24.2 and 24.3 show typical CRCP anchor designs in use since about 1986. CRCP anchors constructed after 2003 contain additional transverse reinforcement to control longitudinal cracking at anchors. Terminal anchor rods in CRCP are generally Type 12. Refer to Volume CC Continuously Reinforced Concrete Pavement for standard details of various anchor designs.</td>
</tr>
<tr>
<td>2. Anchor drains are constructed only where the longitudinal grade on that side of the anchor falls towards the anchor. Where the grade falls away from the anchor, the drain is denoted and the subbase is extended to the anchor. The depth of the drain is nominal only and is adjusted to suit grade and drainage requirements.</td>
</tr>
</tbody>
</table>

**SCHEDULE 24.2**

<table>
<thead>
<tr>
<th>CRCP ANCHOR DEFECT CASES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CASE 1: Shrinkage cracking over anchors</td>
</tr>
<tr>
<td>(a) Rout and seal cracks in accordance with MC19 and MC20 if warranted.</td>
</tr>
<tr>
<td>CASE 2: Transverse joint spalls</td>
</tr>
<tr>
<td>(a) Repair in accordance with MC21 and MC22 if warranted.</td>
</tr>
<tr>
<td>CASE 3: Anchor rotation / sliding</td>
</tr>
<tr>
<td>(a) This defect usually manifests itself in the form of faulting and/or crushing of the CRCP, PCP-R, SFRP-R terminal slabs and/or bridge approach slab at the C14 or F7/F72 and/or F14 joints. It may also lead to buckling of the CRCP, PCP-R, SFRP-R terminal slabs and/or bridge approach slab due to the serious repercussions of this defect, seek specialist advice.</td>
</tr>
<tr>
<td>CASE 4: Longitudinal cracking</td>
</tr>
<tr>
<td>(a) Rout and seal cracks in accordance with MC19 and MC20 if warranted.</td>
</tr>
<tr>
<td>CASE 5: Longitudinal joint spalls</td>
</tr>
<tr>
<td>(a) Repair in accordance with MC21 and MC22 if warranted.</td>
</tr>
<tr>
<td>CASE 6: Branch cracking</td>
</tr>
<tr>
<td>(a) Repair in accordance with MC14-MC15 if secondary cracking occurs.</td>
</tr>
</tbody>
</table>

**FIGURE 24.1: TYPICAL CRCP TERMINAL ANCHOR DEFECTS**

**FIGURE 24.2: SCHEMATIC CRCP TERMINAL ANCHOR 1 DESIGN AT BRIDGES**

<table>
<thead>
<tr>
<th>C14 FOR ROAD SKID</th>
<th>C14 FOR ROAD SKID</th>
<th>C14 FOR ROAD SKID</th>
</tr>
</thead>
<tbody>
<tr>
<td>F14 FOR ROAD SKID</td>
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<td>F14 FOR ROAD SKID</td>
</tr>
<tr>
<td>#72 FOR ROAD SKID</td>
<td>#72 FOR ROAD SKID</td>
<td>#72 FOR ROAD SKID</td>
</tr>
</tbody>
</table>

See Notes 1 (S24.1)

**FIGURE 24.3: SCHEMATIC CRCP TERMINAL ANCHOR 1 AT FLEXIBLE PAVEMENT**

See Note 1 (S24.1)