# Rigid Pavement

## Standard Details - Maintenance MD.M10.MP

Volume MP - Plain Concrete Pavement

## Related Concrete Pavement Drawings

<table>
<thead>
<tr>
<th>Base Type</th>
<th>Construction</th>
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<tr>
<td>CRCP</td>
<td>CC</td>
<td>MC</td>
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<tr>
<td>JRCP</td>
<td>CJ</td>
<td>MJ</td>
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TABLE 3.3: ABBREVIATIONS

<table>
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<tr>
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<tr>
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<tr>
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<td>NTS</td>
<td>Not To Scale</td>
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<tr>
<td>MIN</td>
<td>Minimum</td>
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<td>MAX</td>
<td>Maximum</td>
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<tr>
<td>LCS</td>
<td>Lean Mix Concrete Subbase</td>
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<td>Selected Material Zone</td>
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<tr>
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<td>MP-R</td>
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<tr>
<td>SFCP</td>
<td>Steel Fibre Reinforced Concrete Pavement</td>
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<td>SFCP-R</td>
<td>Steel Fibre Reinforced Concrete Pavement with mesh added (Discrete Slabs)</td>
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<td>R &amp; R</td>
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<td>Australian Certification Authority for Reinforcing Steels</td>
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TABLE 3.4: SYMBOLS

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TABLE 3.2: JOINT TYPE NUMBERS AND DESCRIPTIONS

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<tr>
<td>P2A</td>
<td>Longitudinal tied and formed</td>
</tr>
<tr>
<td>P2D</td>
<td>Longitudinal drilled and formed</td>
</tr>
<tr>
<td>P3</td>
<td>Longitudinal tied and ribbed</td>
</tr>
<tr>
<td>P4</td>
<td>Longitudinal untied and formed</td>
</tr>
<tr>
<td>P5</td>
<td>Longitudinal untied and sawn</td>
</tr>
<tr>
<td>P6</td>
<td>Longitudinal edge</td>
</tr>
<tr>
<td>P7</td>
<td>Transverse construction: formed and tied</td>
</tr>
<tr>
<td>P7A</td>
<td>Transverse construction: formed and drilled</td>
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<tr>
<td>P8</td>
<td>Transverse construction: sawn (untied)</td>
</tr>
<tr>
<td>P9</td>
<td>Transverse construction: sawn and dowelled</td>
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<td>P10</td>
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<td>Transverse construction: limited and dowelled</td>
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<td>Transverse construction: formed and limited</td>
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<td>Transverse construction: unformed</td>
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<td>Transverse construction: unformed</td>
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<tr>
<td>P16</td>
<td>Expansion: dowelled</td>
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<tr>
<td>P17</td>
<td>Expansion: drilled</td>
</tr>
<tr>
<td>P18</td>
<td>Longitudinal edge and beamed</td>
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TABLE 3.5: GENERAL SLAB DIMENSIONAL LIMITS

<table>
<thead>
<tr>
<th>Slab Type</th>
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<th>SFCP-R</th>
<th>LCS</th>
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<td>75° (70°)</td>
<td>75° (70°)</td>
<td>75° (70°)</td>
</tr>
</tbody>
</table>

Notes:
(a) Values in brackets show compromise limits for exclusive use by designers where use is unavailable. They must not be adopted by field staff without design review and approval.
(b) Where an un-trafficked slab is likely to become trafficked within 20 years, it must be designed for trafficked criteria.
(c) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(d) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(e) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(f) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(g) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
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(i) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(j) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(k) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(l) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(m) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(n) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(o) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(p) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(q) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(r) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(s) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(t) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(u) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(v) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(w) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(x) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(y) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
(z) Where W ≤ 3.4 m for one longitudinal or one transverse load and the loaded slab is subjected to a transverse load only, then the slab may be designed for a transverse load only.
General note:
(a) Steel reinforcement not shown for clarity.
Steel reinforcement must be provided as required for the specific maintenance project.

(1) Development of sawcut and silicone seal joint.

50 minimum or match existing where greater.

3 ± 1 joint dimensions; see note b (s7.1)

3 ± 1 joint dimensions; see note 5 (s7.1)

WIDENING SAWCUT

SEAL FULL FACES

SEE NOTE 2 (S7.1)

SEE DETAIL 9.1

SEE FIGURE 11D.1

SEE FIGURE 11C.3

SEE TABLE 9.2

SEE TABLE 8.1

SILICONE SEALANT

POLYETHYLENE
CLOSED-CELL

BACKER ROD (TYP)

BACKER ROD (TYP)

PCP

PLAIN CONCRETE PAVEMENT

UNIFIED AND FORMED

34 ± 55

300 ± 35

250 ± 75

7 ± 2

SEWN (UNDOWELED)

19/01/2015

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AVAILABE FOR USE

PREPARED BY PAVEMENTS UNIT

ASSET MAINTENANCE DIVISION

ENGINEERING SERVICES BRANCH

G. VOROBIEFF

Slab reinforcement must be provided as required for the specific maintenance project.
Steel grade and supply of reinforcement:

1. Steel must comply with AS/NZS 4671, as follows:
   - Bar reinforcement (including tiebars, deformed ribbed, normal ductility steel of grade 500 MPa (R250D), which is noted in these drawings as 'HC' according to the diameter, for example, N12, N15, N20).
   - Joint reinforcement may be made of B450D (RS250D) or B500D (RS350D).
   - Dowels must be round (normal ductility steel of grade 250 MPa, which is noted in these drawings as "RC" for circular or "RPC" for rectangular) with tolerances as given below.

Joint debonding:

4. All pavement joints are required to hinge to relieve curving stresses. Hence, whilst aggregate interlock is beneficial, intimate microtexture bond must be prevented because it causes joint spalling, particularly at arrises.

N12

5. Cleanliness is critical to achieving good pull-out strength. Drilling dust and other debris must be removed from the holes using an industrial vacuum cleaner or water-free compressed air, as both the tiebar and the concrete.

Drilled-ties in P7d joints

1. Drilled-ties and dowels must be fixed using a suitable two-component epoxy or polyester setting system (erosion which is thoroughly mixed within the injection delivery system). See Note (b).

(a) In longitudinal joints, tiebars must be provided at 500 c/c (and 500 c/c unless otherwise shown on the Drawings, be placed at mid-depth (± 25 mm), which lies within the second-placed slab. See Note (c).

(b) To ensure a minimum vertical clearance of 30 mm to any proposed crack inducer or sawcut.

(c) Tiebars must be straight and free of irregularities which could hinder their movement (such as burrs and protrusions). See Note (f).

(d) The joint dimensions in Details C on MP05 are taken from Table 8.1 and are to ensure that no dust remains in the hole.

(e) Debonding must be on the section which lies within the second-placed slab, unless otherwise shown on the Drawings, be plated at mid-depth (± 25 mm) parallel to the pavement surface and parallel with the local road control line, with tolerances as given below.

(f) Dowels must be installed ahead of paving and must:
   - Be 400 mm long and of diameter in accordance with Table 7.3.
   - Be straight and free of irregularities which could hinder their movement (such as burrs and protrusions).
   - Be fully galvanised.
   - Be coated at one end with a tough, durable debonding agent of thickness 0.75 ± 0.25 mm. At formed joints, the debonding must be on the section which lies within the second-placed slab.

Debonds and dowels

2. Dowels and dowels must be placed not closer than 150 mm to a longitudinal joint or slab edge.

3. Dowels shall be equally positioned about the line of the intended joint within a tolerance of ± 25 mm.

4. The first-placed face must be coated at one end with a tough, durable debonding agent of thickness 0.75 ± 0.25 mm. At formed joints, the debonding must be on the section which lies within the second-placed slab.

5. Dowels shall be placed not closer than 150 mm to a longitudinal joint.

6. Dowels may be installed before the sawcuting or (in the case of formed joints) by fixing a temporary filler to the first-placed face. Where a filler is used, the joint must be prepared for sawing in accordance with MP16-MP18.

Table 7.1: REINFORCEMENT SCHEDULE AND BAR SPACING

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<th>LOCATION / DESCRIPTION</th>
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<th>SPACING (mm)</th>
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<td>E1</td>
<td>N12</td>
<td>7</td>
<td>Teabars in longitudinal joint</td>
<td>1.0</td>
<td>See jointing plan and Table 9.1</td>
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<tr>
<td>E2</td>
<td>N12</td>
<td>7</td>
<td>Teabars in longitudinal joint</td>
<td>1.0</td>
<td>See jointing plan and Table 9.1</td>
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<td>E4</td>
<td>N12</td>
<td>1 or 22</td>
<td>Drilled ties in longitudinal joint</td>
<td>0.75</td>
<td>See jointing plan and Table 9.1</td>
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<tr>
<td>E7</td>
<td>N12</td>
<td>1</td>
<td>Teabars in P7 joints</td>
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<td>500</td>
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<tr>
<td>E8</td>
<td>N12</td>
<td>1 or 22</td>
<td>Drilledties in P7 joints</td>
<td>0.75</td>
<td>500</td>
</tr>
<tr>
<td>J1</td>
<td>N12</td>
<td>21</td>
<td>Karb types SA, SB, SD and SK longitudinal joints. See Note (c)</td>
<td>1.0</td>
<td>1 000 ± 50</td>
</tr>
<tr>
<td>J2</td>
<td>N12</td>
<td>5</td>
<td>Karb types SA and SK longitunad joints</td>
<td>1.0</td>
<td>1 000 ± 50</td>
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Table 7.2: REINFORCEMENT SHAPES

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<td>1/2</td>
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<td>300</td>
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<tr>
<td>500</td>
<td>500</td>
<td>Joint</td>
<td>500 ± 75</td>
<td>300</td>
</tr>
<tr>
<td>500</td>
<td>500</td>
<td>Joint</td>
<td>500 ± 75</td>
<td>300</td>
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Table 7.3: DOWEL DIAMETER

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<th>BASE SLAB THICKNESS (mm)</th>
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<td>150 ± 175</td>
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<tr>
<td>200 ± 0.380</td>
<td>300 ± 0.380</td>
</tr>
<tr>
<td>350 ± 0.380</td>
<td>350 ± 0.380</td>
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Note:
- Dowels are normally only provided on the lower side. A geotextile is adjoining base. See MP10
- Dowels in kerbs (Shape 21) must be bent to satisfy cover requirements. They may be bent estate.
TABLE 8.1: UNTIED JOINTS - SILICONE SEALANT DIMENSIONS

<table>
<thead>
<tr>
<th>Slab Length</th>
<th>Design Joint</th>
<th>Width W(1)</th>
<th>Depth D(1)</th>
<th>Recess(2)</th>
<th>Joint depth(3)</th>
<th>O(13)</th>
<th>Notes</th>
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<tr>
<td>≤ 4.6</td>
<td>3.1</td>
<td>7 (5 - 9)</td>
<td>5 ± 3</td>
<td>8 ± 3</td>
<td>35 ± 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.6 &lt; L ≤ 6.6</td>
<td>2.9</td>
<td>6 (5 - 9)</td>
<td>5 ± 3</td>
<td>8 ± 3</td>
<td>35 ± 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.6 &lt; L ≤ 8.6</td>
<td>2.8</td>
<td>6 (5 - 9)</td>
<td>5 ± 3</td>
<td>8 ± 3</td>
<td>35 ± 5</td>
<td></td>
<td></td>
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<td>8.6 &lt; L ≤ 10</td>
<td>2.7</td>
<td>6 (5 - 9)</td>
<td>5 ± 3</td>
<td>8 ± 3</td>
<td>35 ± 5</td>
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<td>10 &lt; L ≤ 12.5</td>
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<td>6 (5 - 9)</td>
<td>5 ± 3</td>
<td>8 ± 3</td>
<td>35 ± 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L &gt; 12.5</td>
<td>2.1</td>
<td>6 (5 - 9)</td>
<td>5 ± 3</td>
<td>8 ± 3</td>
<td>35 ± 5</td>
<td></td>
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Table 8.1 Notes:
(a) For details of tied joints, refer to Table 8.2.
(b) 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 expelled.
(c) 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 expelled.
(d) Values given for the depth of joint O are indicative only. Allowance must be made for factors such as the depth of the backer rod after lateral compression into the joint.
(e) The backer rod diameter should typically be about 25% larger than the joint width W.
(f) The width of longitudinal silicone joints is limited to 18 mm maximum. See Table 8.2 Note (f) for interpretation of "longitudinal".
(g) 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".
(h) However, inserting is still necessary to enhance the bond. Values given for the depth of joint O are indicative only. Allowance must be made for factors such as the depth of the backer rod after lateral compression into the joint.
(i) Table 8.2 refers to the maximum winter opening, that is, maximum extension of the sealant.
(j) See Table 8.3 for calculation of effective slab length L₁ and width W₁.
(k) 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 expelled.
(l) The width of longitudinal silicone joints is limited to 18 mm maximum. See Table 8.2 Note (f) for interpretation of "longitudinal".
(m) Use a polyurethane sealant

FIGURE 8.1: TYPICAL JOINT TYPES

Table 8.2 Notes:
(a) For untied joints, refer to Table 8.1.
(b) In tied joints, hinging is the only cause of elastic extension and hence its magnitude will typically be small.
(c) 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 expelled.
(d) Values given for the depth of joint O are indicative only. Allowance must be made for factors such as the depth of the backer rod after lateral compression into the joint.
(e) 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".
(f) 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 expelled.
(g) The backer rod diameter should typically be about 25% larger than the joint width W.
(h) Refer to Figure 8.2 for key to dimensions W₁, D₁, R₁, and O₁.
Maximum tiebar spacing is 1,400 mm.

300 ≤ S/2 < 1,000

500

350

450

320

Table 9.1 Notes:
(a) Tiebar spacing based on 12 mm deformed 500N steel and a value of Interlayer friction \( \mu = 1.5 \).
(b) Base Thickness = Concrete base + asphalt surfacing.
(c) Actual tiebar spacing determined as follows:
   - Provide 300 mm to 1,000 mm clearance from the end of the tiebar to transverse contraction joints.
   - Space the remaining tiebars evenly in between.
(d) Tiebars must be placed at the spacing shown, with a tolerance of ± 20% on individual bars subject to the provision of the specified number of bars per slab.
(e) Relief edge distance (RED) is measured from the joint (or section) under design to the nearest relief edge.
   - Tiebar layout shows the number of tiebars for slabs that are not 4.2 m long. Round up the tiebar number to the next whole number (a design chart is provided as Figure 12.1 on CC12 in Volume CC Continuously Reinforced Concrete Pavement). Adjust offset to joints in accordance with Figure 9.1 and tiebar spacing similar to that shown.
   - The total tied width is typically limited to 15 m or 16 m, hence the maximum relief-edge distance is 8 m.
(f) Relief-edge distance (RED) must make allowances for stress contributors such as connected kerbs and for future widening.
(g) The value for RED must make allowances for stress contributors such as connected kerbs and for future widening.

Table 9.2: Joint Corrugation Design

Table 9.2 Notes:
(a) The top and bottom corrugations must be concave in the first placed face (ie convex on the form).
(b) Two alternative form profiles are shown, one suited to slipforming and the other suited to fixed-form work.
(c) It is not necessary to match the corrugation type of existing slabs during full or part slab replacement.
At least one tie must be placed in any discrete section bounded by joints (for example, at kerb noses). Other kerb types (for example, SF) may be extruded. Such kerbs are deemed to satisfy the "with shoulder" criteria for pavement thickness design purposes (as long as they are also tied). Unless otherwise allowed in the Specification, kerb types SA, SB, SC, SE, SK and SL must be strength grade N32. A geotextile fulfills an important function in keeping granular material from entering the base/subbase interface. Edge drains fulfill an important function in draining the water which commonly runs along the base/subbase interface.

The location of base joints relative to the extremities of islands and kerbs is critical. The dimensions so specified must be such as to prevent the occurrence of re-entrant angles in the base. Otherwise, kerb joints must be aligned at 90° ± 6° to the kerb line.

Joints in kerbs (etc.) must be located to coincide with joints in the adjoining base, in accordance with R15. Where the kerb is placed on top of base pavement, the kerb joint must be aligned with the underlying joint. Where a base joint intersects the nose of an adjoining kerb (that is, excluding mounted kerbs such as types SF, SG, SM) the angle of intersection must be 90° ± 6°, and the intersection used as a control for the location of adjacent joints. Where a base joint intersects the nose of an adjoining kerb (that is, excluding mounted kerbs such as types SF, SG, SM) the angle of intersection must be 90° ± 6°, and the intersection used as a control for the location of adjacent joints.

Notes:

(a) Unless otherwise allowed in the Specification, kerb types SA, SB, SC, SE, SK and SL must be strength grade N32 in accordance with AS 1379 and must be either slipformed or fixed-formed (that is, they must not be extruded). Such kerbs are deemed to satisfy the "with shoulder" criteria for pavement thickness design purposes (as long as they are also tied). Other kerb types (for example, SF) may be extruded.

(b) An integral slab widening may be required in order to comply with Austroads Guide to Pavement Technology Part 2 "with shoulder" criteria.

(c) Edge drains fulfill an important function in draining the water which commonly runs along the base/subbase interface. A geotextile fulfills an important function in keeping granular material from entering the base/subbase interface. See Detail J on MP06 and Schedule S7.1 for further details.

(d) At least one tie must be placed in any discrete section bounded by joints (for example, at kerb roses).

(e) Joints in kerbs (etc.) must be located to coincide with joints in the adjoining base, in accordance with R15. Where the kerb is placed on top of base pavement, the kerb joint must be aligned with the underlying joint. Otherwise, kerb joints must be aligned at 90° ± 6° to the kerb line.

(f) The location of base joints relative to the extremities of islands and kerbs is critical. The dimensions so specified must be used as a control for the location of adjacent joints. Where a base joint intersects the nose of an adjoining kerb (that is, excluding mounted kerbs such as types SF, SG, SM) the angle of intersection must be 90° ± 6°, and the intersection must be such as to prevent the occurrence of re-entrant angles in the base.

(g) Base joints must be extended into the adjoining kerb/median in like type.
SLAB REPLACEMENT - BEST PRACTICE

### Figure 11A.1: Typical Slab Replacements (Best Practice)

- **A** 1.5 m MIN
- **B** 1.0 m MIN
- **C** 0.5 m MIN
- **D** 0.5 m MIN
- **E** See Note 7 (S11A.1)
- **F** See Note 7 (S11A.1)
- **G** See Note 7 (S11A.1)

### Figure 11A.2: Unacceptable Part-Slab R & R

- **F1** See Note 7 (S11A.1)
- **F2** See Note 7 (S11A.1)
- **F3** See Note 7 (S11A.1)

**Legend**
- **Failed Slabs (or Part-Slab)**
- **Area of Replacement: PCP-R**
- **Tiebars, See Note 7 (S11A.1)**

**Schedule 11A.1 (S11A.1)**

**Activities and Method**

See Schedule 11B.1 for a detailed description of activities.

**Notes**

1. **Best practice**
   - MP11A-MP11D inclusive are based on the principle that Type P13 joints are not acceptable within trafficked highway slabs. (Note that they may be used in untrafficked slabs, as shown in Figure 11A.1).
   - MP12A-MP12C show Compromise Practice based on the acceptance of Type P13 joints within trafficked slabs. See also Note 1 Schedule 12A.1

2. Best Practice principles dictate that:
   - R & R be extended into the next slab where a mid-slab tied P8 joint is formed.
   - The P8 joint is then induced by sawcut in accordance with usual practice.

**Part-slab replacement**

3. Under Best Practice principles, part-slab R & R is restricted as follows:
   - longitudinal part-slab must terminate at P10d joints. They cannot terminate at P7d joints, for reasons shown in Figure 11A.2.
   - Figure 11A.1 shows acceptable combinations of transverse part-slab R & R

**Base format**

4. All replacement slabs must be PCP-R unless otherwise specified.
   - Where base thickness is deemed inadequate:
     - extra design life can be gained by replacing failed slabs with JRCP (that is, meshed and dowelled), on condition that:
       - slab lengths must match the existing ones (to avoid mismatched joints; see also Note 5).

**Joints**

5. All untied joints (for example, contraction, isolation) in the replacement slabs must replicate those in the surrounding (original) pavement. All untied joints (for example, contraction, isolation) in the replacement slabs must form matched joints.
   - Contraction joints:
     - must be P8 sawn joints within trafficked slabs.
     - may be P8, P11 or P13 joints within untrafficked slabs.

6. **Tiebars**
   - **Actual tiebar spacings must be designed in accordance with Table 9.1.**
   - **Figure 11A.1 shows acceptable combinations of transverse part-slab R & R**
     - Under Best Practice principles, part-slab R & R is restricted as follows:
   - **Part-slab replacement**
     - longitudinal part-slab must terminate at P10d joints. They cannot terminate at P7d joints, for reasons shown in Figure 11A.2.
   - **Figure 11A.1 shows acceptable combinations of transverse part-slab R & R**

**Drill-dowelled joints**

7. There is a risk that in the process of constructing a P10d joint, the existing slab will be damaged by the action of drilling large holes to install the dowels and that the dowels will not be installed within the tolerance for alignment.

**Date of casting replacement slab**

8. Inspect the date of casting of the replacement slab(s) in a corner of the concrete in the format dd-mm-yyyy.
1. Sawcutting

There are two common methods of slab removal:

(a) Excavator removal
(b) Crane lift

Crane lift

(a) Internal slabs are typically just less than full-depth, but should not be deep enough to touch a concrete subbase. Their location will depend on whether existing tiebars are to be saved or not.
(b) To save tiebars, sawcuts must be located to provide lap lengths of 300 mm for N12 bars and 400 mm for N16 bars. Shorter lengths are allowed (in accordance with AS 3600) foresoil subgrade.
(c) All other tiebar details must be in accordance with Schedule 7.2.

There are two common methods of slab removal:

(a) Excavator removal
(b) Crane lift

Crane lift

(a) Internal slabs are typically just less than full-depth, but should not be deep enough to touch a concrete subbase. Their location will depend on whether existing tiebars are to be saved or not.
(b) To save tiebars, sawcuts must be located to provide lap lengths of 300 mm for N12 bars and 400 mm for N16 bars. Shorter lengths are allowed (in accordance with AS 3600) for soil subgrade.
(c) All other tiebar details must be in accordance with Schedule 7.2.

2. Concrete removal

There are two common methods of slab removal:

(a) Excavator removal
(b) Crane lift

Excavator removal

(a) Internal slabs are used to break the slab into smaller pieces for removal.
(b) The perimeter strip is then removed manually using jack picks (taking great care not to spall the edges of the abutting slabs).

2. Concrete removal

There are two common methods of slab removal:

(a) Excavator removal
(b) Crane lift

Excavator removal

(a) Internal slabs are used to break the slab into smaller pieces for removal.
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(a) Internal slabs are used to break the slab into smaller pieces for removal.
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2. Concrete removal

There are two common methods of slab removal:

(a) Excavator removal
(b) Crane lift

Excavator removal

(a) Internal slabs are used to break the slab into smaller pieces for removal.
(b) The perimeter strip is then removed manually using jack picks (taking great care not to spall the edges of the abutting slabs).
**SCHEDULE 11C.1 (S11C.1): TREATMENT OF JOINTS EXPOSED DURING R & R**

**Case 3: Exposed concave face**

**Notes:**
- Case 3: Exposed concave face
- Table 1: PLOT DRIVER
- Table 2: PAVEMENT PDF modified.png
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**Figure 11C.1: EXISTING JOINT RECESS**

**Figure 11C.2: CORRUGATED JOINTS**

**Figure 11C.3: KEYED JOINTS**

**Table 1:**
- **Description:**
  - P1: Longitudinal bed and sealed
  - P2: corrugated
  - P2, keyed
  - P2, but
  - P3: Longitudinal bed and ribboned
  - P4: Longitudinal untied and formed
  - P5: Longitudinal untied and sawn
  - P5: ribboned
  - P6: Longitudinal edge
  - P7: corrugated
  - P7, keyed
  - P7, but
  - P8: Transverse contraction bed

**Notes:**
- **Transverse contraction bed:**
  - Not valid, except where conversion to a Type P13 is permitted.

**TREATMENT OF JOINTS EXPOSED DURING R & R**

- **Type P1:** Longitudinal bed and sealed
  - Refer to Figure 11C.1.
  - (a) Remove any lip to minimise the diss of crack initiation in the new slab.
  - (b) The joint is effectively converted to a Type P2, sealed.

- **Type P2:** Formed and dowelled
  - Refer to Figure 11C.2.
  - (a) Transverse contraction bed: sawn and dowelled
  - (b) Treat in accordance with Type P10.

- **Type P3:** Longitudinal bed and ribboned
  - Refer to Figure 11C.2.
  - (a) Treat in accordance with Cases 2, 7, and 13 (Table 6.3 Activity 3).
  - (b) Carry out any spall repairs in accordance with MP21 and MP22.

- **Type P4:** Transverse contraction bed
  - (a) Design a sealant in accordance with Table 8.2.

- **Type P5:** Transverse contraction bed
  - (a) Design a sealant in accordance with Table 8.1.

- **Type P6:** Transverse contraction bed
  - (a) Design a sealant in accordance with MP8.

- **Type P7:** Transverse contraction bed
  - (a) Design a sealant in accordance with MP8.

- **Type P8:** Transverse contraction bed
  - (a) Design a sealant in accordance with MP8.

**Notes:**
- **Scheduling the application of treatments:**
  - The recommended treatment for each joint type is given in Table 11C.1.
  - Refer to Figure 11C.1 for a key to figures 11C.1 and 11C.2.

**Removal of lip:**
- To remove any lip which might cause cracking in the new slab.

**Example treatment for Type P7:**
- (a) Treat in accordance with Type P10.

**Scabble:**
- Scabble to the bottom of the corrugation.

**Options:**
- Option 1: Sawcut (if necessary) to provide the specified minimum vertical face dimension.
  - (a) Sawcut and scabble as shown to provide the specified minimum vertical face (to prevent further spalling on the concave side).
  - (b) Sawcut to the bottom of the corrugation.

**Date:**
- 19/01/2015
**Case 1: Model ribboned 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 11D.2 Notes:**

1. Ribboned 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 MP08.
3. Shading indicates the following:
   - Black = material removed from the exposed faces.
   - White = the resulting face after treatment.

---

**Figure 11D.1: Butt and Scabbled Faces**

- **Case 7: Curled and inclined**
- **Case 5: Curled and vertical**
- **Case 4: Curled and inclined**
- **Case 3: Curled and inclined**
- **Case 2: Curled and vertical**
- **Case 1: Model ribboned joint**

---

**Table: PAV _ BLACK _ GREY .t b l**

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**FOR AMENDMENTS REFER TO SHEET No 02**

---

**SCALES:**

- (d)
- (c)
- (b)
- (a)

---

**NOT TO SCALE,**

The face must be debonded in accordance with Activity 9 (S11B.1).

---

**Ribbons**

Where the ribbon was well installed, joint exposure material removed from the exposed faces.

---

**Specifications required that ribbons be placed as shown here.** However, their accuracy was highly variable and they will often be found deeper and/or curled and/or inclined.

---

**Option 1:**

- Sawcut and scabble.

**Option 2:** Carry out a spall repair as shown on MP21 and MP22

---

**Figure 11D.2 Notes:**

1. Ribboned 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 MP08.
3. Shading indicates the following:
   - Black = material removed from the exposed faces.
   - White = the resulting face after treatment.

---

**Figure 11D.1: Butt and Scabbled Faces**

- **Case 7: Curled and inclined**
- **Case 5: Curled and vertical**
- **Case 4: Curled and inclined**
- **Case 3: Curled and inclined**
- **Case 2: Curled and vertical**
- **Case 1: Model ribboned joint**

---

**Table: PAV _ BLACK _ GREY .t b l**

**PlotDriver:** PAV _ PDF _ modified .pltcf

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**FOR AMENDMENTS REFER TO SHEET No 02**

---

**SCALES:**

- (d)
- (c)
- (b)
- (a)

---

**NOT TO SCALE,**

The face must be debonded in accordance with Activity 9 (S11B.1).

---

**Ribbons**

Where the ribbon was well installed, joint exposure material removed from the exposed faces.

---

**Specifications required that ribbons be placed as shown here.** However, their accuracy was highly variable and they will often be found deeper and/or curled and/or inclined.

---

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- Sawcut and scabble.

**Option 2:** Carry out a spall repair as shown on MP21 and MP22

---

**Figure 11D.2 Notes:**

1. Ribboned 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 MP08.
3. Shading indicates the following:
   - Black = material removed from the exposed faces.
   - White = the resulting face after treatment.

---

**Figure 11D.1: Butt and Scabbled Faces**

- **Case 7: Curled and inclined**
- **Case 5: Curled and vertical**
- **Case 4: Curled and inclined**
- **Case 3: Curled and inclined**
- **Case 2: Curled and vertical**
- **Case 1: Model ribboned joint**

---

**Table: PAV _ BLACK _ GREY .t b l**

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**FOR AMENDMENTS REFER TO SHEET No 02**

---

**SCALES:**

- (d)
- (c)
- (b)
- (a)

---

**NOT TO SCALE,**

The face must be debonded in accordance with Activity 9 (S11B.1).

---

**Ribbons**

Where the ribbon was well installed, joint exposure material removed from the exposed faces.

---

**Specifications required that ribbons be placed as shown here.** However, their accuracy was highly variable and they will often be found deeper and/or curled and/or inclined.

---

**Option 1:**

- Sawcut and scabble.

**Option 2:** Carry out a spall repair as shown on MP21 and MP22

---

**Figure 11D.2 Notes:**

1. Ribboned 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 MP08.
3. Shading indicates the following:
   - Black = material removed from the exposed faces.
   - White = the resulting face after treatment.
**Common Joint Types - PCP**

- **Tied and Sawn**
- **Tied and Formed**
- **Drill-Tied**
- **Sawn**
- **Knifed**
- **Existing Slab**
- **Replaced Slab**
- **formed Contraction**

---

**Activities and Method**

See Schedule 12A.1

**Notes**

1. MP12A-MP12C Compromise Practice may only be used with the written approval of the Principal.
2. MP11A-MP11C inclusive are based on the acceptance of Type P13r joints within trafficked slabs. MP11A-MP11D show Best Practice based on the principles that Type P13r joints are not acceptable within trafficked highway slabs.
3. Compromise Practice principles allow the R & R of slabs between existing P8 joints (when these become Type P13r).

**Part-slab Replacement**

4. Part-slab R & R is restricted as follows:
   - **Longitudinal** part-slabs must terminate at P13r joints. They cannot terminate at P7d joints, for reasons shown in Figure 12A.2.
   - Figure 12A.1 shows acceptable combinations of transverse part-slab R & R.

**Base Format**

5. All replacement slabs must be PCP-R unless otherwise specified. Where base thickness is deemed inadequate:
   - extra design life can be gained by replacing failed slabs with JRCP (that is, meshed and dowelled), on condition that:
     - slab lengths must match the existing ones (to avoid mismatched joints; see also Note 6).

**Joints**

6. All united joints (for example, contraction, isolation) in the replacement slabs must replicate those in the surrounding (original) pavement.
   - All united joints (both new and existing) must also be continuous between free edges and must not form mismatched joints.
   - **Contraction joints**:
     - must be P8 sawn joints or P13r formed joints within trafficked slabs.
     - may be P11 knifed joints or P13r formed joints within untrafficked slabs.

**Tiebars**

8. Actual tiebar spacings must be designed in accordance with Table 9.1. Date of casting replacement slab

9. Imprint the date of casting the replacement slab(s) in a corner of the concrete in the format dd-mm-yyyy.

**Future P7d joint**

10. Location of a future P7d joint relative to an existing P7d joint in an adjacent slab to prevent reflection cracking in the freshly placed concrete.

---

**Schedule 12A.1 (S12A.1)**

---

**Legend**

- **Failed Slabs (or Part - Slab)**
- **Area of Replacement: PCP-R**
- **Tiebars, see Note 8 (S12A.1)**

---

*See Note 1 Schedule 12A.1*
1. **Excavating**

   **METHOD**

   - (a) Perimeter cuts along existing joints (or with a minor offset) to:
     - assist slab removal;
     - reduce the risk of edge and joint damage on the slabs which are to remain;

   - (b) internal cuts within the slab to break it into manageable pieces to facilitate removal with a minimum of damage to adjacent slabs / joints and to the subbase.

   - (c) internal cuts are typically just less than full-depth, but should not be deep enough to touch a concrete slab. Their location will depend on whether existing slabs are to be saved or not.

   - (d) to save tiebars, sawcuts must be located to provide lap lengths of 200 mm for H2 bars and 400 mm for H6 bars. Shorter lengths are allowed in accordance with AS 3600 for allowed situations.

   - (e) if existing tiebars are to be replaced by drill-free sawcuts, sawcuts would typically be about 200 mm from joints, but may be varied to suit individual conditions.

   - (f) perimeter cuts may be either full-depth or partial-depth, and their precise location relative to the joint needs consideration. Factors include:
     - (a) whether tiebars are to be saved or not;
     - (b) whether defects in the exposed face need to be corrected (for example, spalling and/or rounding);
     - (c) whether existing corruptions or keyways are to be saved; see also Activity 3. Where existing corruptions are conforming, it is preferable to retain them (perhaps with minor corrections) rather than replacing them with a subjected slab.

   - (g) Longitudinal sawcuts which precisely follow an existing longitudinal joint may extend up to 250 mm beyond the limits of removal.

   - (h) Longitudinal sawcuts which are offset from an existing longitudinal joint must not extend beyond the limits of removal.

   - (i) Transverse cuts are not to extend beyond the limits of removal.

   - (j) Every effort must be made to prevent excavating slurry from entering joints or cracks in the slabs which are to remain.

2. **Concrete removal**

   - There are two common methods of slab removal:

     - (a) Crane lift
     - (b) Excavator removal

     - (c) Where two adjoining slabs (joined by a common longitudinal joint) are to be replaced by new slabs, tiebar drilling can be avoided by placing L-shaped tiebars into the perimeter strip to allow transverse construction joints: 500 c/c.

     - (d) Where remedial sawing is required (to correct defects in adjoining joint faces), it may be easier to carry out before removal of the failed slab. However, the defect repair itself may be best deferred until after the slab is removed (because the R & R may cause additional spalling).

     - (e) Where remedial sawing is required, the exposed face must be dense and fully compacted, and be free of honeycombing and re-entrant angles. Minor defects may be corrected by placing a cast-in-place material, after the slabs are removed.

     - (f) In addition to these defects listed in Schedule 11C.1 (and related Detail drawings) minor areas requiring repair may require treatment in accordance with Figure 22.1.

3. **Preparation of exposed joint faces**

   - (a) General

     - (i) Exposed faces must be assessed and treated in accordance with Schedule 11C.1.

     - (ii) Where remedial treatment (such as saw repair) is required, it must be completed independently of the placement of adjoining concrete (that is, the repair material must not be placed integrally with the adjoining concrete).

     - (iii) Spall repairs must be completed in accordance with MP21 and MP22.

     - (iv) Where remedial sawing is required (to correct defects in adjoining joint faces), it may be easier if carried out before removal of the failed slab. However, the defect repair itself may be best deferred until after the slab is removed because the R & R may cause additional spalling.

     - (v) The exposed face must be dense and fully compacted, and be free of honeycombing and re-entrant angles. Minor defects may be corrected by placing a cast-in-place material, after the slabs are removed.

     - (vi) In addition to these defects listed in Schedule 11C.1 (and related Detail drawings) minor areas requiring repair may require treatment in accordance with Figure 22.1.

4. **Renotation of remnant slabs**

   - (a) General

     - (i) Drill-deck must be provided to replace or supplement remnant slabs. The final tier spacing must be as follows:

       - transverse construction joints: 500 c/c

     - (ii) longitudinal joints: design spacings in accordance with Table 9.1.

   - (b) All other interior details must be in accordance with Schedule 7.2.

     - (c) Where two adjoining slabs (joined by a common longitudinal joint) are to be replaced by single-lane R & R, tiebar drilling can be avoided by placing L-shaped tiebars into the first-placed slab for later strengthening before the second pour. They are not to be placed closer to the form to minimize edge damage during recovery.

   - (d) Dowels must be provided in accordance with Schedule 7.2.

     - (e) At formed joints the dowel length within the second-placed slab must be deburred to minimize early stress on the (now) concrete.

5. **Dowels**

   - (a) Dowels must be provided in accordance with Schedule 7.2.

     - (b) At formed joints the dowel length within the second-placed slab must be deburred to minimize early stress on the (now) concrete.

6. **Subbase repairs**

   - (a) Subbase must be assessed and treated in accordance with Roads and Maritime Services guidelines provided elsewhere.

   - (b) Cracks in the subbase should be examined for spalling, spalling and for excessive crack widths.

     - (c) The major risks associated with such defects are:

       - (i) reflection of subbase cracks into the new base.

       - (ii) high interlayer bonding, which may initiate ungraded base cracking.
Table 12C.1 Notes:

(a) Refer to Figure 12C.1 for key to dimensions.

(b) Dimension 'A' (pitch-bar offset) is consistent with MP15.

(c) B₁ need not equal B₂.

(d) 'E' is the residual slab thickness after removal of the corner patches. This limitation is intended to minimise the risk of transverse cracking in that section.

Table 12C.1: Dimensional Limits

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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A[6]</td>
<td>250 mm TYPICAL AND MINIMUM</td>
</tr>
<tr>
<td>C</td>
<td>500 mm MINIMUM, 500 mm MAXIMUM</td>
</tr>
<tr>
<td>R₁</td>
<td>0.4C MINIMUM [6]</td>
</tr>
<tr>
<td>R₂</td>
<td>0.4C MINIMUM [6]</td>
</tr>
<tr>
<td>S</td>
<td>2.0 mm [6]</td>
</tr>
<tr>
<td>E</td>
<td>75° ± 5°</td>
</tr>
</tbody>
</table>

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TABLE 15.1: STITCHING NOTES

- 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.
- Cross stitching may only be used with the written approval of the Principal.
- This method is applicable to cracks or tied joints which are not normally intended to open, but which have opened (or are likely to open) due to absence of inadequate performance of beams.
- Stitching is unlikely to be effective where:
  - the slab has been heavily damaged, or
  - the concrete has low strength (is less than 20 - 25 MPa), or
  - the slab thickness is less than 180 mm.
- Crack stitching will be most successful if it is completed very soon after formation of the crack, before it widens. Poorly tied joints should also be stitched before they widen. Early stitching will:
  - maximise load transfer between slabs, hence:
  - significantly reduce the chances of secondary slab cracking.
  - keep and preserve structural elements and weakness.
  - avoid the need for routing and sealing.
- For the same reason, stitch-bones should be fixed (that is, spalled) during warmer weather (or during the middle of the day) when the crack is most tightly closed.
- The decision to stitch (in preference to alternatives such as slab replacement) should be taken in consideration factors such as:
  - the quality of the concrete (as indicated by distress additional to cracking, such as assuring, surface abrasion, condition of adjacent slabs).
  - intensity of heavy vehicle traffic.
  - previous success under similar conditions.
- Protection must be provided in accordance with Figure 15.2 if the crack is wider than 0.5 mm. Suitable protection is provided by bituminous paint with a thickness of 0.2 to 0.5 mm.
- Use compressible self-expanding polyurethane resin (TPU) to seal water cracks and joints only.

SCHEDULE 15.1 (S15.1)

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.
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   - significantly reduce the chances of secondary slab cracking.
   - keep and preserve structural elements and weakness.
   - avoid the need for routing and sealing.
6. For the same reason, stitch-bones should be fixed (that is, spalled) during warmer weather (or during the middle of the day) when the crack is most tightly closed.
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   - the quality of the concrete (as indicated by distress additional to cracking, such as assuring, surface abrasion, condition of adjacent slabs).
   - intensity of heavy vehicle traffic.
   - previous success under similar conditions.
8. Protection must be provided in accordance with Figure 15.2 if the crack is wider than 0.5 mm. Suitable protection is provided by bituminous paint with a thickness of 0.2 to 0.5 mm.
9. Use compressible self-expanding polyurethane resin (TPU) to seal water cracks and joints only.

**TABLE 15.1: STITCHING LENGTHS**

<table>
<thead>
<tr>
<th>Base thickness D (mm)</th>
<th>Offset drill hole to crack Lh (mm)</th>
<th>Length of drill hole Lh (mm)</th>
<th>Length of stitch-bar Lb (mm)</th>
<th>Length of protection Lp (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>190</td>
<td>156</td>
<td>330</td>
<td>280</td>
<td>405</td>
</tr>
<tr>
<td>200</td>
<td>175</td>
<td>350</td>
<td>300</td>
<td>455</td>
</tr>
<tr>
<td>210</td>
<td>190</td>
<td>380</td>
<td>340</td>
<td>455</td>
</tr>
<tr>
<td>220</td>
<td>220</td>
<td>410</td>
<td>460</td>
<td>505</td>
</tr>
<tr>
<td>240</td>
<td>240</td>
<td>430</td>
<td>500</td>
<td>555</td>
</tr>
<tr>
<td>280</td>
<td>280</td>
<td>470</td>
<td>560</td>
<td>705</td>
</tr>
<tr>
<td>320</td>
<td>320</td>
<td>510</td>
<td>630</td>
<td>805</td>
</tr>
<tr>
<td>360</td>
<td>360</td>
<td>550</td>
<td>700</td>
<td>950</td>
</tr>
<tr>
<td>400</td>
<td>400</td>
<td>590</td>
<td>750</td>
<td>1050</td>
</tr>
</tbody>
</table>

**TABLE 15.2 Notes**

- To util the angle α = 30° and cover t = 25 mm.
- See Figure 15.2 for protection details.

**TABLE 15.3: STITCH-BAR SPACINGS FOR CORNER CRACKS AND JOINTS**

<table>
<thead>
<tr>
<th>Corner cracks</th>
<th>Stitching bar Spacing (b) mm</th>
<th>Joint offset A (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>MIN</td>
<td></td>
</tr>
<tr>
<td>280</td>
<td>MAX</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 15.4: STITCH-BAR SPACINGS FOR CONCRETE JOINTS**

<table>
<thead>
<tr>
<th>Joint offset A (mm)</th>
<th>Stitching bar Spacing (b) mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>MIN</td>
</tr>
<tr>
<td>230</td>
<td>MAX</td>
</tr>
</tbody>
</table>

**FIGURE 15.2: STITCH-BAR PROTECTION**

SEE NOTE 7 (S15.1)

**METHOD**

1. Investigate base thickness, determine the required length of stitch-bar, and offset of drill holes.
2. Mark hole locations.
3. Drill holes (if hole vertically for the first 10 mm to start, if crack sealing is required, the initial hole diameter must be less than the final hole diameter of 16 mm)
4. Where the crack exceeds 1.2 to 2 mm, seal it (by sealing the edge of the stitch-bar with self-expanding resin) to prevent escape of the resin.
5. Where sealing has been undertaken, ream the hole after the self-expanding resin (foam) has set using a 16 mm diameter drill bit to ensure that a clean concrete face results.
6. Thermally clean holes using a vacuum cleaner.
7. Inject the resealant (to the manufacturer's instructions) to fill approximately 1/3 depth of the hole.
8. Install the stitch-bar while gently oscillating the bar. Push the bar to the required depth.
9. Inject further resin if required:
   - a) to the surface if the resin is the capping material, or
   - b) to approximately 25 mm below the surface.
10. If the capping material is different from the resin, top off with the capping material after the resin has set.
11. After the capping material has set, open to traffic.
1. This procedure is suitable for the resealing of transverse and longitudinal joints in PCP. (It is not suitable for some (e.g. BP7) and MP7 or MP8 joints.) It is also suitable for the resealing of joints which were previously unsealed or unsealed. Example are: transverse construction joints; longitudinal formed tied joints; kerb joints. Some of the reasons for resealing these joints are to: minimize asset spalling, minimize water ingress, and to protect against corrosion.

2. Sealant performance is critically affected by the adhesion to the concrete, hence:
   (a) the old sealant must be fully removed because it may be incompatible with the new one.
   (b) compress air must be clean and dry and must be free of all loose debris (such as dust from new concrete) and any other material which may reduce the bond.
   (c) all of the time of cleaning, the reservoir must be thoroughly clean and dry, and must be free from all loose debris (such as dust from new concrete).
   (d) the tightness of the joint face must be tested in accordance with T319. An acceptable result is: when Grade 1 (None) visual rating category is achieved. The adhesion of the sealant must be tested in accordance with T380.

3. Joint bleeding should not be required if wet cleaning has been satisfactory. Grit blasting may create further dust, in which case the joint must be thoroughly resealed before sealing.

4. Ingress of solids into existing joints (and underlying cracks) should be minimised. If there is any residue the selected below the reservoir should be thoroughly flushed out with high pressure air or water during the cleaning process. In order to maximise the progressive flushing of sealing dusts, cutting should proceed from the high side of the pavement towards the low side.

5. Sealants and their backer rods must 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.
   (c) Sealants must extend down the vertical face of joints at all edges to prevent the ingress of vage materials into the joint. At longitudinal joints, the edge sealant must prevent the ingress of concrete dust into the transverse joints during subsequent paving cycles.

6. In selecting the width of (res)awing, 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. RT33 contains suitable criteria. If water is present, refer to Table 21.1 for guidance on treatment of joint spalls.

7. A limit of 18 mm has been imposed on longitudinal silicone seals (see Table 16.1, for example). In selecting the width of (res)awing, 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. RT33 contains suitable criteria. If water is present, refer to Table 21.1 for guidance on treatment of joint spalls.

8. Table 16.1 Notes:
   (a) For tied joints, refer to Table 16.2.
   (b) The backer rod diameter should typically be about 25% larger than the joint width W'.
   (c) Joint bleeding should not be required if wet cleaning has been satisfactory. Grit blasting may create further dust, in which case the joint must be thoroughly resealed before sealing.

9. For untied joints:
   (a) Determine the effective slab length (or width) using the method shown on Figure 8.1.
   (b) From Table 16.1, read the design joint width W' which corresponds to the calculated W' or L'.
   (c) If the (res)awing exceeds the existing joint width, adjust the values in row for the (res)awing.

10. For untied joints:
    (d) If the existing joint width exceeds W', move down Column 3 to the smallest value which exceeds the current width. Adopt the values in row for the joint width.

11. For tied joint:
    (a) Select a (res)awing width W' which only just exceeds (by 1 or 2 mm) the existing width, or the width required to remove the desired amount of spalling.
    (b) In Table 16.2, select the row corresponding to the nominated W'.
**FIGURE 17.1: LONGITUDINAL SAWN AND TIED JOINTS**

Longitudinal sawn and tied joints (Type P1)

**FIGURE 17.2: LONGITUDINAL FORMED AND TIED JOINTS**

(a) Butt face (Type P2a)
(b) Corrugated face (Type P2c)

**FIGURE 17.3: LONGITUDINAL RIBBONED AND TIED JOINTS (Type P3)**

(a) Conforming ribbon
(b) Curled ribbon
(c) Inclined ribbon

**FIGURE 17.4: LONGITUDINAL FORMED AND UNTIED JOINTS (Type P4)**

Also applicable to longitudinal induced and untied joints (Type P5)

---

**Figure 17.1 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 MP15 before resawing.
(b) Select the resawing dimensions in accordance with Note 3 Schedule 16.2.

**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 MP15 before resawing.
(b) Where the existing joint is inclined beyond the range 90° ± 5° (to the surface), resawing should aim to minimise future arris spalling. Case 1 is the clearly preferred option because Case 2 does not reduce the scale arris.
(c) Also, the existing joint intersects the side of the new sealant which will impose concentrated stresses at the top of the sealant; see Figure 18.4 for explanation.

**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).
(b) Where there are early signs of joint spalling, resawing can be used to relieve stresses on the arris in order to minimise further failure.
(c) Spalling is often related to an inadequate vertical top flow (which should be 50 ± 5).
(d) Failure is typically on the concave side, hence the resawing line should be selected within this zone (Case 2) to maximise spall removal and to minimise potential loose wedges.
(e) Select the resawing dimensions in accordance with Note 3 Schedule 16.2 unless variations are warranted to address issues raised above.

**Figure 17.2(c) Note:**
(a) 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 required that they be placed as shown above. By contrast, they must be removed, possibly by localised routing.
(b) The residual piece is certain to spall under traffic. Where the optimal sawing line leaves residues like this, they should be placed as shown above. By contrast, they must be removed, possibly by localised routing.
(c) 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 MP15 before resawing.

**Figure 17.3(b) Notes:**
(a) Case 1 should be avoided because the silicone could be damaged if it bridges the ribbon's point of entry to the new sawcut; see Figure 18.4 for explanation.
(b) Case 2 is the preferred option because it minimises the risk noted under (a).
(c) As a general rule, it appears that the preferred line will be the one which intersects the surface crack and also maximises the depth of ribbon to be removed.

**Figure 17.3(c) Notes:**
(a) Case 1 should be avoided because the silicone could be damaged if it bridges the ribbon’s point of entry to the new sawcut; see Figure 18.4 for explanation.
(b) Case 2 is the preferred option because it minimises the risk noted under (a).

**Figure 17.4 Notes:**
(a) Select the resawing dimensions in accordance with Note 2 Schedule 16.2.
**FIGURE 18.1: TRANSVERSE FORMED AND TIED JOINTS (Type P7)**

- **Figure 18.1(a): Butt face**
- **Figure 18.1(b): Corrugated face**

**CASE 1** (PREFERRED)

- NEW SAWCUT
- POTENTIAL SPALL
- SEE NOTE (a)
- ORIGINAL JOINT

**CASE 2** (POOR)

- NEW SAWCUT
- POTENTIAL LOOSE WEDGE

---

**FIGURE 18.2: TRANSVERSE SAWN CONTRACTION JOINTS (Type P8)**

- Also applicable to Type P9, P10, P11, and P12

**CASE 1**

- ORIGINAL JOINT

**CASE 2**

- NEW JOINT

---

**FIGURE 18.3: ISOLATION JOINTS (Type P14)**

- Also applicable to Types P15 and P16

---

**FIGURE 18.4: SEALANT RESERVOIR FAULTS**

**Figure 18.4(a): Ineffective reseal**

- WEAK WEDGE
- RIBBON INDUCER
- SLAB CONTRACTION

**Figure 18.4(b): Short lived reseal**

- WEAK WEDGE
- RIBBON INDUCER
- SLAB CONTRACTION

**Figure 18.4(c): Effective reseal**

- WEAK WEDGE
- RIBBON INDUCER
- SLAB CONTRACTION

---

**FIGURE 18.5: SEALANT INSTALLATION - GENERAL**

**Figure 18.5(a): Good practice**

- CLOSED-CELL POLYETHYLENE BACKER ROD (TYP)

**Figure 18.5(b): Poor practice**

- CLOSED-CELL POLYETHYLENE BACKER ROD (TYP)

---

**FIGURE 18.6: SEALANT INSTALLATION - POOR EXAMPLES**

- ONE POSSIBLE REMEDY IS TO BREAK OFF THE WEDGE OF CONCRETE AS SHOWN.

---

**NOTES:**

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

(b) Resawing should aim to minimise potential loose wedges.

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

---

**REFERENCES:**

See Figure 17.3(b) Note (c) regarding wedge treatment.

---

**NOT TO SCALE:**

- (b) The detail is applicable to longitudinal and transverse P14, P15, and P16.
**TABLE 19.1: ROUT Dimensions - Tied and Stitched Cases**

<table>
<thead>
<tr>
<th>Rout width (mm)</th>
<th>Sealer type</th>
<th>Rout depth (mm)</th>
<th>Sealer rod shape and size</th>
<th>Sealer thickness (mm)</th>
<th>Sealer recession (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 ± 3</td>
<td>Silicone or Polyurethane</td>
<td>15 (+1, -0)</td>
<td>15 mm cut to ½ round ( (L = 6 \text{ mm}) )</td>
<td>3 (+0, -0)</td>
<td>3 (+2, -0)</td>
</tr>
<tr>
<td>20 ± 5</td>
<td>Polyurethane</td>
<td>30 (+1, -0)</td>
<td>30 mm cut to ½ round ( (L = 15 \text{ mm}) )</td>
<td>10 (+5, -0)</td>
<td>3 (+2, -0)</td>
</tr>
<tr>
<td>40 ± 7</td>
<td>Polyurethane</td>
<td>92 mm, all segment of height 14 mm ( (L = 14 \text{ mm}) )</td>
<td>11 (+5, -0)</td>
<td>4 (+2, -0)</td>
<td></td>
</tr>
</tbody>
</table>

**Table 19.1 Notes:**
(a) For untied/untied cases, the table may be used on the condition that the sealant is a thickness of width less than 18 mm and that all dimensions satisfy criteria in accordance with Table 19.1.
(b) In tied joints, polyurethane is preferable to silicone where distillate fuels are likely to be in contact.
(c) Routing depths 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.
(d) The maximum width of 90 mm should only be varied after careful consideration and after suitable trialling.

**NOTE**
1. This procedure is mainly applicable to treatment of cracks but may also be used for joints where sealing is unsuitable. Where the joint is to be routed it is Indented and/or cut, the treatments detailed in MP16-MP18 are equally applicable to routing by substitution of a rout cut for the sawcut.
2. The purpose of routing and sealant is:
   (a) to produce a reservoir shape with vertical sides which is suitable for sealing
   (b) to clean the faces to maximise sealant adhesion.
3. Wherever possible, cracks should be stitched, see MP15. Stitching should be completed before routing to reduce the stress on sealants.
4. For (re)sealing of joints, sealant should be considered in preference to routing, but sawing will rarely be feasible for cracks.
5. The resawing/routing width is typically governed by two criteria:
   (a) the width of the crack
   (b) the required opening parameters of the sealer.
6. The design of sealants in tied joints will be different to those in non-tied joints because of the differing magnitude of movement.
7. Crack widths should be assessed in the warmer part of the day because they will increase at other times due to contraction and curing.
8. At the time of sealant installation, the reservoir walls of the reservoir must be thoroughly clean and free from all loose debris, dust, and other material which may be deleterious to the adhesion of the sealant. Grit blasting is not required when the routed concrete faces have been prepared in accordance with the guidelines. This cleanliness of the joint faces must be tested in accordance with T324. An acceptable result is when Grade 1 (None) visual rating category is achieved.
9. The depth of the reservoir must be tested in accordance with T320.
10. The backer rod shown in Table 19.1 must be continuous closed-cell polyethylene. It must be accurately slit in a jig to the required shape. The backer rod is to be depressed to the bottom of the reservoir so as to seat the exposed crack, if necessary, the backer rod must be held in place by a suitable flexible adhesive such that the rod will not be dislodged with the actions of wind or sealant installation.
11. All seal edges and tied joints, sealants must extend down the vertical face of the routed section, including any underlying cracks.
12. Where a polyurethane sealant is used on an untied joint, a joint filler must be placed within that joint so that the polyurethane is discontinuous.
13. Where a polyurethane is used in a longitudinal joint, its surface must be blinded with sand to increase friction values.

**SCHEDULE 19.1**

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, \( W_R > W_a \).
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/cutting and before the residue dries.
6. Inspect to ensure effective removal of all loose debris.
7. Install backer rod to provide the required sealant length.
8. In routings, install sealant in accordance with Table 19.1.
9. Allow trafficking only after sealant has become tack free.

**SCHEDULE 19.2**

1. Repair joints and cracks in accordance with Schedule 20.1.
2. Clean out joints/cracks with high pressure water. This must be done immediately after sawing/cutting and before the residue dries.
3. Inspect to ensure effective removal of all loose debris.
4. Install backer rod to provide the required sealant length.
5. In routings, install sealant in accordance with Table 19.1.
6. Allow trafficking only after sealant has become tack free.
SCHEDULE 20.1 (S20.1)

Typical Routing Procedure  DETAIL T

(a) This procedure is applicable to joints and cracks where sawcutting is not feasible. It is applicable to both longitudinal and transverse cases. It is applicable only to tied and/or stitched applications where structural repair is not required. 

(b) The width of rout should generally be such that it will impact on about 85% of the total length of spalled crack within a selected section. This is referred to as the "85th percentile spalled width", which is approximated to "85% spalled width" or Wsp. However, selection criteria for the rout width may differ between sites, depending on factors such as:

(i) the curvature (or "crookedness") of the spalled crack, in terms of the capacity of the router to follow its path; 
(ii) the economics of doing a single rout versus multiple passes.

(c) Routing will generally not be warranted where:

(i) the crack width W0 < 0.5 mm; 
(ii) the 85% spalled width Wsp < 5 mm (NOM).

SCHEDULE 20.2 (S20.2)

Tied Longitudinal Joint Routing Procedure  DETAIL U

(a) This procedure is applicable to longitudinal joints which are tied or stitched, 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 it will 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 economics of doing a single cut versus multiple passes.

(d) For rout and seal dimensions: see Table 19.1.

(e) W0 ≤ 16 mm: Seal with silicone

(f) W0 > 16 mm: Seal with polyurethane

SCHEDULE 20.3 (S20.3)

Tied Transverse Joint Routing Procedure  DETAIL V

(a) This procedure is applicable to transverse joints which are tied and/or stitched 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 it will 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 economics of doing a single cut versus multiple passes.

(d) For rout and seal dimensions: see Table 19.1.

(e) W0 ≤ 22 mm: Seal with silicone

(f) W0 > 22 mm: Seal with polyurethane

SCHEDULE 20.4 (S20.4)

Combined Routing and Repairing Procedure  DETAIL W

(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 stitched joints and cracks.

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

(i) Rout (or sawcut) the length of crack (or joint) adjoining the wide spall. (Routing or sawing at a later date may damage the repair).

(ii) Insert a temporary filler to width W0. 

(iii) Repair the wide spall in accordance with MP21 and MP22.

(iv) Install the assist 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  DETAIL X

(a) This procedure is applicable to untied joints, either longitudinal or transverse (such as isolation, expansion, untied but) 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 (of width designed in accordance with MP16-MP18).

(c) For W0 ≤ 18/22 mm: reseal and seal in accordance with MP16-MP18

(d) For W0 > 18/22 mm: treat in accordance with DETAIL X for W0 > 57 mm: treat in accordance with MP21 and MP22.

(e) For W0 > 57 mm: treat in accordance with MP21 and MP22, for W0 > 18/22 mm: adopt:

(f) 18 mm in longitudinal joints

22 mm in transverse joints

(g) The suggested sequence of operations (following routing) is as follows:

(i) Insert a temporary filler to width W0.

(ii) Prepare and repair the wide spall in accordance with MP21 and MP22. Allow adequate curing time.

(iii) Sawcut (or rout) the length of crack (or joint) adjoining the wide spall. (Routing or sawing at a later date may damage the repair).

(iv) Install silicone sealant over the full length of joint in accordance with MP16-MP18.
**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>Minor spall M</td>
<td>W = 50 mm</td>
<td>Thin bonded repairs Using Figure 21.2.</td>
</tr>
<tr>
<td></td>
<td>(no limit on depth)</td>
<td></td>
</tr>
<tr>
<td>Shallow spall</td>
<td>W = 50 mm</td>
<td>Thin bonded repairs</td>
</tr>
<tr>
<td></td>
<td>H ≤ D/2</td>
<td>Using Figure 21.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deep spall</td>
<td>W = 50 mm</td>
<td>Full-depth repairs</td>
</tr>
<tr>
<td></td>
<td>H ≤ D/2</td>
<td>Using Figure 21.3</td>
</tr>
</tbody>
</table>

**Notes:**

- Width of spall: W
- Depth of spall: D
- Thickness of base: T

**Figure 21.1:** Shallow Discrete (SD)
- Dimensions
- Treatment

**Figure 21.2:** Type SD - Shallow Discrete Spalls
- Diagram showing the repair process:
  - Referring to Table 21.1:
    - **Mark out of perimeter**
    - **Sealant removed**
    - **Joint former**
    - **Concrete patch**
    - **Perimeter groove**
    - **Remove failed area**
    - **Curing and protection**

**Figure 21.3:** Type SC - Shallow Continuous Spalling
- Diagram showing the repair process:
  - Referring to Table 21.1:
    - **Existing slab joint**
    - **Perimeter of repair**
    - **Defined with straight sawcuts**
    - **Thin bonded concrete patch**
    - **Minimum width of repair**

**Notes:**

- **Mark out the square or rectangular perimeter area to be repaired.**
- **Curing and protection** should be maintained for a minimum of 24 hours, but preferably three days.
- **Remove the concrete within the perimeter groove to produce a reasonably even surface.**
- **Mark out the perimeter groove so that the top is flush with the finished surface level.**
- **Fix a joint former securely into the forming groove so that the top is flush with the finished surface level.**
- **Caulk all edges and corners.**
- **Weatherproof the joint former.**
- **Remove any existing sealant to a minimum of 100 mm beyond the patch perimeter.**
- **Remove failed area down to sound concrete.**
- **Clean out the patch using a vacuum cleaner and/or oil-free compressed air (plus wire brush if required).**
- **For cementitious repairs, saturate all patch faces with water (or wet rags) for at least 10 hours (to ensure that the patch material is not sucked dry).**
- **For epoxy resin patches, prime the exposed surfaces in accordance with the manufacturer's recommendations.**
- **Prime all surfaces by brushing with cement grout or other notified bonding agent.**
- **Thoroughly compact the material using a vibrating hammer, taking special care to work fine material into all faces, edges, and corners.**
- **Sealant is recommended for minimising ingress of grit into joints and cracks.**
- **Scabbling tool is suitable for this removal.**
- **The forming groove must:**
  - Be at least 10 mm deeper than the deeper patch (where 2-sided).
  - Be at least 100 mm beyond each end of the patch perimeter.
  - Be of a width suitable for the specific joint type, and diagonally 2 to 5 mm wider than the existing joint, hence:
    - For isolation and expansion joints: 20 - 30 mm (Typ) wide.
    - For PCP contraction joints: 9 - 12 mm (Typ) wide.
    - For test construction joints: 5 - 10 mm (Typ) wide.
  - **Chase out a perimeter groove around the other three sides, to a minimum depth of 15 mm.**
  - **Mark out the perimeter groove so that the top is flush with the finished surface level.**
  - **Caulk all paths and gaps where repair material could escape or contact adjoining slabs.**
  - **Fix a joint former securely into the forming groove so that the top is flush with the finished surface level.**
  - **Caulk all edges and corners.**
  - **Weatherproof the joint former.**
  - **Remove any existing sealant to a minimum of 100 mm beyond the patch perimeter.**
  - **Remove failed area down to sound concrete.**
  - **Clean out the patch using a vacuum cleaner and/or oil-free compressed air (plus wire brush if required).**
  - **For cementitious repairs, saturate all patch faces with water (or wet rags) for at least 10 hours (to ensure that the patch material is not sucked dry).**
  - **For epoxy resin patches, prime the exposed surfaces in accordance with the manufacturer's recommendations.**
  - **Prime all surfaces by brushing with cement grout or other notified bonding agent.**
  - **Thoroughly compact the material using a vibrating hammer, taking special care to work fine material into all faces, edges, and corners.**
  - **Sealant is recommended for minimising ingress of grit into joints and cracks.**
  - **Scabbling tool is suitable for this removal.**
  - **The forming groove must:**
  - **Mark out the square or rectangular perimeter area to be repaired.**
  - **Curing and protection** should be maintained for a minimum of 24 hours, but preferably three days.
  - **Remove the concrete within the perimeter groove to produce a reasonably even surface.**
  - **Mark out the perimeter groove so that the top is flush with the finished surface level.**
  - **Caulk all edges and corners.**
  - **Weatherproof the joint former.**
  - **Remove any existing sealant to a minimum of 100 mm beyond the patch perimeter.**
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  - **Remove the concrete within the perimeter groove to produce a reasonably even surface.**
  - **Mark out the perimeter groove so that the top is flush with the finished surface level.**
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  - **Weatherproof the joint former.**
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  - **Scabbling tool is suitable for this removal.**
  - **The forming groove must:**
  - **Mark out the square or rectangular perimeter area to be repaired.**
  - **Curing and protection** should be maintained for a minimum of 24 hours, but preferably three days.
**NOTE**

The practical minimum depth is:

1. 10 mm for epoxy resin repairs
2. 35 mm for cementitious repairs

Beyond these thicknesses, there is no value in making the repair deeper than necessary and so scalloping should be limited 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 compatibility
   - curing
   - protection against early weather

   It is critical that a thorough bond be achieved over all patch faces. This requires that mortar be worked into the microtexture of scabbled faces and into corners and edges. It is therefore preferable that failed concrete be chased out rather than sawn. Sawn faces are difficult to scabble without causing further splintering.

2. All bonded faces (both vertical and horizontal) must be roughened by scarifying with a jackhammer. To facilitate the removal of the filler without damaging the patch, it must be debonded and also preferably collapsible.

3. Joint formers

   a. All temporary joint formers or fillers must be flexible and compressible enough to absorb movement without transferring stress into the patch. Some situations may require a composite formliner comprising after material against the patch that is bonded to flexibly material against adjacent slabs. To facilitate the removal of the filler without damaging the patch, it must be debonded and also preferably collapsible.

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

   ii. For untied longitudinal joints:
      - For design widths < 18 mm, use a silicone in accordance with Table 16.1.
      - For design widths > 18 mm: not feasible, assess alternatives. Seek specialist advice.

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

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

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

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

   vii. For untied longitudinal joints:
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   viii. For untied longitudinal joints:
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   ix. For untied longitudinal joints:
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   x. For untied longitudinal joints:
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CASE 1: Shrinkage cracking over anchors

CASE 2: Transverse joint spalls

CASE 3: Corner cracking

CASE 4: Anchor rotation / sliding

CASE 5: Transverse cracking

CASE 6: Longitudinal cracking

CASE 7: Longitudinal joint spalls

NOTES

Anchors
1. Figures 23.2 and 23.3 show typical anchor designs in service since about 1985.
2. Details may vary in situations such as large abutment skew or extreme approach grades. Refer to Volume CP Plain Concrete Pavement for standard details of various anchor designs. Terminal anchors in PCP are typically Type 12.
3. Type 6 anchors (800 mm deep) are used where the length of the pavement restrained by the anchor is less than 25 metres such as in approach roads.
4. Figure 23.4 shows a design (previously used) which was used in small numbers before about 1985 but suffered a high failure rate.

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 deleted and the subbase is extended to the anchor. The depth of the drain is nominally 250 mm and is adjusted to suit grade and drainage requirements.

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

This defect usually manifests itself in the form of faulting and/ or crushing at the P14 or F14 and/ or F7 joints. It may also lead to buckling of the PCP-R and/ or SFRP-R terminal slabs and/ or bridge approach slab.

This defect usually manifests itself in the form of faulting and/ or crushing of the PCP-R and/ or SFRP-R terminal slabs and/ or bridge approach slab at the P14 or F14 and/ or F7 joints. It may also lead to bucking of the PCP-R terminal slabs and/ or bridge abutment/ deck damage. Due to the serious repercussions of this defect, seek specialist advice.

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 deleted and the subbase is extended to the anchor. The depth of the drain is nominally 250 mm and is adjusted to suit grade and drainage requirements.

Regular routine maintenance and inspection is important to ensure the integrity of the anchor system. Refer to Volume CP Plain Concrete Pavement for standard details of various anchor designs.

Rout and seal cracks in accordance with MP19 and MP20 if warranted.

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