HIGH PERFORMANCE DOWEL SYSTEMS
For concrete slabs and pavements
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Why use high performance dowels?

Dowels are required at joints in concrete slabs to transfer vertical loads across the joint and minimise differential deflection between slabs under load.

Slabs shrink away from the corners during curing; this shrinkage is diagonal from the intersection of joints, not just perpendicular to the joint. Different concrete batches will shrink at different rates, adjacent slabs poured at different times shrink at different rates and rapid shrinkage occurs during initial curing.

In addition to allowing horizontal slab movement perpendicular to the joint, high performance dowel systems allow horizontal slab movement parallel to the joint as well as being very efficient load transfer devices, compared to other dowel systems, and provide excellent vertical differential deflection characteristics.

Features and benefits of high performance dowels:

- Easy to use.
- Easy to set up.
- Sleeve configurations allow for horizontal slab movement both perpendicular and parallel to joint.
- Dowels are a neat sliding fit within the appropriate sleeves.
- All Danley dowels and dowel plates are saw-cut from steel bar to AS/NZS 3679.1 Grade 300.
- Very efficient load / deformation capacity.
- Dowels or dowel plates available in black and galvanised.
- Stainless steel dowels and dowel plates are also available.
- Can be used at wider centres, reducing cost.
DIAMOND® DOWELS

Features and benefits:
- Available with one-piece sleeves for both 6 mm and 10 mm Diamond® Dowels.
- Sleeves are colour coded:
  - 6 mm are orange
  - 10 mm are blue
- Ideal for perimeter-of-pour dowel applications, i.e. at construction joints.
- No need to drill forms to support dowels during concrete pour.
- Nailing flange provides secure attachment to form boards.
- Flange on sleeve ensures dowel is perpendicular to form board and is stable.
- Each sleeve is fitted with an internal spacer to prevent collapse caused by pressure of concrete, but easily displaced into the apex of the sleeve when inserting the Diamond plate.
- Sleeves moulded from durable, non-compressible material.
- Sleeves fitted with double-headed nails - second head on nail acts as an anchor to help retain the sleeve in the concrete when stripping the form boards.
- Reduced likelihood of sleeve knock-off when placing steel reinforcement mesh.
- Simplifies form removal.
- Dowel plates available in black and galvanised.
- Stainless steel dowel plates are also available.
- Ergonomically designed, user-friendly packaging, complete kit and installation instructions.
- Wide dowel plate at point of maximum load reduces stress on concrete.
- Can be integrated into other formwork systems.

Packaging
Danley™ Diamond® Dowels are packaged in kit format, in cartons that are illustrated with Installation Instructions. Each carton contains 25 sets of 6 mm Diamond® Dowel plates and one-piece sleeves [orange], or 15 sets of 10 mm Diamond® Dowel plates and one-piece sleeves [blue]. Each sleeve is fitted with 2 double-headed steel nails.
Diamond® Dowel plastic sleeves after stripping the timber formwork on a typical driveway set up.

### Installation instructions

**STEP 1**: Mark the form for slab centre and Diamond® Dowel spacing (typically 450 mm to 600 mm). Using the 2 nails, attach the base to the form. Ensure nailing plate is parallel to top of slab.

**STEP 2**: Place concrete. Edge of slab must be vibrated to consolidate concrete around the Diamond® Dowel sleeve (avoid contact with the sleeve with vibrator shaft).

**STEP 3**: Strip the form. This is best accomplished by starting at one end and working along the form.

**STEP 4**: Insert the Diamond® Dowel Plate into the sleeve (at the centre point of sleeve) within 36 hours of concrete pour. The second pour can now be made.

### HOW TO SPECIFY

Specify: Danley™ Diamond® Dowel (dowel size) x (dowel spacing), (finish or material), e.g. Danley™ 6mm Diamond® Dowels at 450 mm centres, galvanised.

<table>
<thead>
<tr>
<th>Dowel Thickness [mm]</th>
<th>Product Code</th>
<th>Finish</th>
<th>Weight ea [kg]</th>
</tr>
</thead>
<tbody>
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<td>6</td>
<td>DDSLBPNW06X110</td>
<td>Black</td>
<td>0.64</td>
</tr>
<tr>
<td>6</td>
<td>DDSLGPNW06X110</td>
<td>Galvanised</td>
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</tr>
<tr>
<td>10</td>
<td>DDSLBPNW10X110</td>
<td>Black</td>
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</tr>
<tr>
<td>10</td>
<td>DDSLGPNW10X110</td>
<td>Galvanised</td>
<td>1.05</td>
</tr>
</tbody>
</table>

Form boards with Diamond® Dowel sleeves attached.
A worker installs Dowelmaster® sleeves to timber formwork ready for pour.

Danley’s Dowelmaster® sleeves allow square dowels to move both parallel and perpendicular to the construction joint as the concrete slab shrinks during curing. Simply secure the sleeves to the construction joint forms with the optional nailing plates, pour the concrete, strip the forms and insert square dowels into the sleeves ready for the second pour.

NOTE: Please contact Danley for details on the Square Dowels with optional Metal Dowel Covers.

Features and benefits:
• Ideal for construction joints.
• Dowelmaster® sleeves available in 16 x 200 mm and 20 x 250 mm sizes.
• Square dowels available for both 16 mm and 20 mm Dowelmaster® sizes.
• Dowels available in black and galvanised.
• Stainless steel dowels are also available.
• Dowelmaster® sleeves supplied complete with support stake and wedge.
• Dowelmaster® sleeves provide expansion joint capability.
• No need to drill forms to support dowels during concrete pour.
• Nailing plate provides secure attachment to form boards.
• Flange on nailing plate ensures dowel is perpendicular to form board and is stable.
• Square Dowels also available with Metal Square Dowel Covers for 16, 20, 25, 32 and 40 mm square dowels (must be specified at time of ordering).

HOW TO SPECIFY
Specify: Danley™ Square Dowel (dowel size) x (dowel length) x (dowel spacing) (dowel material) with Dowelmaster® sleeve (and nailing plate), e.g. Danley™ Square Dowel 20 mm x 400 mm at 450 mm centres, galvanized with 20 mm Dowelmaster sleeve and nailing plate.
Installation instructions

Note: 1. The project drawings will have specified the dowel spacing required.
2. Each Dowelmaster® Nailing Plat has a flat portion across the flange to assist in positioning.

**STEP 1:** At one end of the formboard, mark a point equal to one half of slab thickness – 32 mm (e.g. for 150 slab, mark the point 150/2 = 75 - 32 = 43 mm) down from the top of the formboard. Repeat at other end of formboard. Join both marks with a tight string line. Mark position of the first dowel from the end of formboard, then mark the position of subsequent dowels along the string line. Place the first Nailing Plate at the first position and nail in place – 2 nails diagonally opposite each other should be adequate. Locate and nail in place subsequent Nailing Plates (Fig 1).

**STEP 2:** Place the first Dowelmaster® sleeve over the protruding tabs on the Nailing Plate (Fig 2), then push the sleeve firmly against the back face of the Nailing Plate (Fig 3). This will ensure wet concrete does not seep into the sleeve.

**STEP 3:** Insert the adjustable stake through the hole in the end of the first Dowelmaster® sleeve and hammer it into the ground making sure it is secure (Fig 4). Break the wedge off the sleeve. Accurately level the sleeve and hold in place by inserting the wedge between the stake and the back end of the sleeve (Fig 5). Repeat at last Dowelmaster® sleeve along the formboard.

**STEP 4:** Hammer a stake in at both ends of the formwork and run a string line across the entire length of the joint (Fig 6). Once you have the string line to the correct height you can adjust all of the remaining Dowelmaster® sleeves to the correct height and again lock them into place with stakes and wedges. (Fig 7).

**Notes:**
[1] Length of Dowelmaster® sleeves is nominal; actual sleeve is 10 mm longer to allow for expansion joint capability.
[2] Dowels 25 mm square require a Metal Square dowel Cover - consult Danley for details.
[3] Stainless steel square dowels also available - specify when ordering
[4] Other size square dowels and other lengths are available - consult Danley for details.

---

### Dowelmaster®, Square Dowels and Accessories

<table>
<thead>
<tr>
<th>Part</th>
<th>Product Code</th>
<th>Size [mm]</th>
<th>Length [mm]</th>
<th>Material or Finish</th>
<th>Weight ea [kg]</th>
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</thead>
<tbody>
<tr>
<td>Dowelmaster® Sleeve [with wedge and steel stake]</td>
<td>SODWMAST16MM</td>
<td>16</td>
<td>200 [1]</td>
<td>Polypropylene</td>
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<td>500</td>
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<td>25</td>
<td>600</td>
<td>HDG Steel</td>
<td>3.04</td>
</tr>
</tbody>
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Dowelmaster® sleeves must be placed on the first-pour side of the formboard. After the concrete has cured, remove the formwork and the Nailing Plates and insert the appropriate Danley Square Dowels into the Dowelmaster® sleeves before the second concrete pour is made.
PLATE DOWEL CRADLE

Features and benefits:
- Available for both 6 mm and 10 mm plate dowel sizes.
- Available heights to suit slabs 100 to 300 mm thick.
- Sleeves are colour coded:
  - 6 mm are orange
  - 10 mm are blue
- Dowel plates are 300 mm long, dowel sleeves are 165 mm long.
- Dowel plates available in black and galvanised.
- Stainless steel dowel plates are also available.
- Ideal for sawn contraction joints.
- Supplied in 3 m lengths.
- Simple installation.
- Minimises set up time.
- Excellent deflection capabilities.

Danley Plate Dowel Cradles are well suited for contraction joints in concrete slabs and pavements. As well as the Plate Dowel Cradle efficiently limiting deflection, the 3 m long fabricated cradles ensure the dowels are set at the exact height for the specified slab thickness, and at precise spacing to minimize installation time.

HOW TO SPECIFY
Specify: Danley™ Plate Dowel Cradle (dowel size) x (dowel spacing) x (slab thickness) and (dowel material),
e.g. Danley™ Plate Dowel Cradles 6 mm at 450 mm centres, for 150 mm slab, galvanised dowels.

Cutting the cross wire at site.
Typical set up of Plate Dowel Cradles and slab reinforcing prior to concrete pour (reinforcing mesh yet to be placed on bar chairs at correct height)

Commonly available Plate Dowel Cradles

<table>
<thead>
<tr>
<th>Product Code</th>
<th>Dowel Size [mm]</th>
<th>Dowel Spacing [mm]</th>
<th>Slab Thickness [mm]</th>
<th>Approx. Weight [kg]</th>
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<tbody>
<tr>
<td>DCP6450125</td>
<td>6 X 50</td>
<td>450</td>
<td>125</td>
<td>8.4</td>
</tr>
<tr>
<td>DCP6450150</td>
<td>6 X 50</td>
<td>450</td>
<td>150</td>
<td>8.5</td>
</tr>
<tr>
<td>DCP6450175</td>
<td>6 X 50</td>
<td>450</td>
<td>175</td>
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<td>DCP6450200</td>
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<td>200</td>
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<td>200</td>
<td>9.5</td>
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</tbody>
</table>

Note: 1. Plate Dowel Cradles with other dowel spacings and for other slab thicknesses are available as custom orders.
2. Engineer to confirm exact requirements for projects.
3. Add postscript “G” to Product Code for galvanised dowels, e.g. DCP10450200G

Installation instructions

**STEP 1:** Mark the position of contraction joint with string line or a paint line on the sub-grade (or on top of poly sheet if used). If the Danley™ Ground Crack Inducer is to be used, place this directly over the marked line, then place the first Danley Plate Dowel Cradle centrally over the marked line. Place the second Plate Dowel Cradle over the marked line, spacing the first dowel of the second cradle from the last dowel on the first cradle an equal distance to the dowel spacing on the cradles. Place subsequent cradles similarly.

**STEP 2:** Once the cradle is correctly positioned, cut the cross restraints to allow independent movement of the two cradle halves contained within the adjacent concrete slabs.

**STEP 3:** Install the slab reinforcement mesh (if specified) as directed by the slab designer.

**STEP 4:** Pour the concrete as usual ensuring that concrete placement and minimum reinforcement coverage is achieved as per slab design. Install Crack-A-Joint® or saw cut as directed.

NOTE: When placing concrete, care should be taken not to move the cradles, nor stand on them.
Danley Square Dowel Cradles are suitable for contraction joints in concrete slabs and pavements. The 3 m long fabricated cradles ensure the dowels are set at the exact height for the specified slab thickness, and at precise spacing to minimise installation time. The standard range of 16 and 20 mm Square Dowel Cradles with Dowelmaster® sleeves is supplemented by the availability of optional Square Dowel Cradles with Metal Dowel Covers for 16, 20, 25, 32 and 40 mm square dowels.

Features and benefits:
- Available for both 16 mm and 20 mm square dowel sizes.
- Available heights to suit slabs 100 to 300 mm thick.
- Dowel plates available in black and galvanised.
- Stainless steel dowel plates are also available.
- Supplied with Dowelmaster® sleeves as standard.
- Ideal for sawn contraction joints.
- High load capacities.
- Supplied in 3 m lengths
- Simple installation.
- Minimises set up time.
- Also available with Metal Dowel Covers for 16, 20, 25, 32 and 40 mm square dowels (must be specified at time of ordering).

How to specify
Specify: Danley™ Square Dowel Cradle (dowel size) x (dowel length) x (dowel spacing) x (slab thickness) and (dowel material), e.g. Danley™ Square Dowel Cradle 20 mm x 400 mm at 450 mm centres for 200 mm slab, galvansied dowels.

Note: Please contact Danley for details on the optional Square Dowel Cradles with Metal Square Dowel Covers.

Note: When placing concrete, care should be taken not to move the cradles, nor stand on them.
Commonly available Square Dowel Cradles [with Dowelmaster® sleeves]

<table>
<thead>
<tr>
<th>Part</th>
<th>Product Code</th>
<th>Dowel Size [mm]</th>
<th>Dowel Length [mm]</th>
<th>Dowel Centres [mm]</th>
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<td></td>
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<td>450</td>
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<td></td>
<td>DCS20X400X600G [2]</td>
<td>20</td>
<td>400</td>
<td>600</td>
<td>15.1</td>
</tr>
</tbody>
</table>

Notes: [1] Square Dowel Cradles are fitted with DowelMaster® sleeves as standard.
[2] Thickness of slab MUST be specified
[3] Square Dowel Cradles with stainless steel dowels are also available - specify when ordering.
[4] Other combinations of square dowel cradles are available as special order.
[5] Square dowel cradles with Metal Dowel Covers can be supplied as special orders.

Installation instructions

**STEP 1:** Mark the position of contraction joint with string line or a paint line on the sub-grade (or on top of poly sheet if used). If the Danley™ Ground Crack Inducer is to be used, place this directly over the marked line, then place the first Danley Square Dowel Cradle centrally over the marked line. Place the second Square Dowel Cradle over the marked line, spacing the first dowel of the second cradle from the last dowel on the first cradle a distance equal to the dowel spacing on the cradles. Place subsequent cradles similarly.

**STEP 2:** Once the cradle is correctly positioned, cut the cross restraints to allow independent movement of the two cradle halves contained within the adjacent concrete slabs.

**STEP 3:** Install the slab reinforcement mesh (if specified) as directed by the slab designer.

**STEP 4:** Pour the concrete as usual ensuring that concrete placement and minimum reinforcement coverage is achieved as per slab design. Install Crack-A-Joint or saw cut as directed.


Construction joint dowels
Load and deflection characteristics in 10 mm wide joints

**In 40 MPa Slabs**

- 10 mm DD
- 6 mm DD

Recommended max. deflection = 1.2 mm

In 32 MPa Slabs

- 10 mm DD
- 6 mm DD

Recommended max. deflection = 1.2 mm

Deflection = 0.75 mm

DANLEY Construction Products
The Concrete Joint Specialist...
LEGEND:

- denotes dowels at 600 mm centres
- denotes dowels at 450 mm centres
- denotes dowels at 300 mm centres

10 mm DD = 10 mm Diamond® Dowel [with sleeve]
6 mm DD = 6 mm Diamond® Dowel [with sleeve]
S20 = 20 mm Square Dowel with either Dowelmaster® sleeve or metal dowel cover

HOW TO USE MONOGRAMS:

1. Select slab thickness, and project line upwards.
2. Select applied load to be transferred across joint, and project horizon line across both graphs.
3. Where line 2 crosses preferred dowel deflection curve, project line downwards to determine predicted deflection.

NOTES:

1. Design loads $\phi V$ include $\phi = 0.6$ for fixings in accordance with AS 3600 Table 2.3. (j) for loads controlled by concrete; or $\phi = 0.9$ in accordance with AS 4100 Table 3.4 for loads controlled by steel strength.
2. Data for 20 mm Square Dowels and 6 mm Diamond® Dowels is based on testing. Data for 10 mm Diamond® Dowels is approximated.
3. Design loads apply to concrete strength at dowel for that particular slab thickness.
4. DO NOT USE THESE MONOGRAMS FOR SLAB DESIGN.
5. Deflection characteristics are based on dowel properties and are not influenced by slab thickness, concrete strength or dowel spacing.
6. Contact Danley for guidance on load capacities for other joint widths, other dowel spacings and other concrete strengths.
Contraction joint dowels
Load and deflection characteristics in 10 mm wide joints

![Graph showing load vs. deflection for 40 MPa and 32 MPa slabs with different plate thicknesses and slab thicknesses.](image)
**Contraction joint dowels**

**LEGEND:**
- denotes dowels at 600 mm centres
- denotes dowels at 450 mm centres
- denotes dowels at 300 mm centres

10 mm Plate D = 10 mm Plate Dowel cradles
6 mm Plate D = 6 mm Plate Dowel cradles
S20 = 20 mm Square Dowel cradles with either DowelMaster® sleeve or metal dowel cover

**HOW TO USE MONOGRAMS:**
1. Select slab thickness, and project line upwards.
2. Select applied load to be transferred across joint, and project horizontal line across both graphs.
3. Where line 2 crosses preferred dowel deflection curve, project line downwards to determine predicted deflection.

**NOTES:**
1. Design Loads [$fV$] include $f = 0.6$ for fixings in accordance with AS 3600 Table 2.3.(j) for loads controlled by concrete; or $f = 0.9$ in accordance with AS 4100 Table 3.4 for loads controlled by steel strength.
2. Data for 20 mm Square Dowels, 6 mm and 10 mm Plate Dowels is based on testing.
3. Design Loads apply to concrete strength at dowel for that particular slab thickness.
4. DO NOT USE THESE MONOGRAMS FOR SLAB DESIGN.
5. Deflection characteristics are based on dowel properties and are not influenced by slab thickness, concrete strength or dowel spacing.
6. Contact Danley for guidance on load capacities for other joint widths, other dowel spacings and other concrete strengths.
Installation tolerances
It is vital that the dowels be placed:
• In the centre of the slab
• Evenly spaced along the joint
• At the correct depth of embedment
• Parallel to the top surface
• Square to the face of the joint

Misalignment of dowels will result in inferior performance of dowelled joints, will frequently cause premature failure of the surrounding concrete under loads much smaller than design loads, or lock up joints rendering the dowels ineffective and initiating unplanned cracks.

Placement using the following tolerances will ensure the optimum performance of dowels and the surrounding concrete.

1. Location - 1/2 x slab thickness +/- 5% of slab thickness e.g. for 200 mm thick slab, location is 100 mm +/- 10 mm from top of slab. This positions the dowel in the most effective location in the concrete, maximising shear load transfer.

![](image)

2. Spacing – specified pitch +/- 5% e.g. for 450 pitch, tolerance is +/- 22 mm.

3. Embedment depth – 1/2 x specified length of the dowel +/- 25 mm e.g. for 300 mm long dowel, embedded length in each slab = 150 mm +/- 25 mm. The centre line of Plate Dowel and Square Dowel Cradles must be positioned on the line of the sawcut +/- 25 mm. Diamond® Dowel plates should be fully inserted into the sleeve. Square Dowels should be inserted into the Dowelmaster® sleeves for 1/2 the specified length +0, -25 mm – this allows for up to 10 mm of expansion capability for the longest dowel appropriate for the Dowelmaster® sleeve.

4. Parallel to top face of the slab – nailing plates should be securely fastened to the form boards, and the form boards must be square to the face of the concrete. For Diamond® Dowels, one end of the nailing plate to be no more than 3 mm higher than the other end. For Plate Dowel Cradles and Square Dowel Cradles, the sub-grade must be smooth and parallel to the intended top face of the slab. If the dowel is severely misaligned and not parallel to the top edge of the slab, the misaligned dowel could restrict the slabs from moving parallel to each other.

5. Perpendicular to the face of the dowel joint - the top of the sleeve at the extreme end should be no more than 3 mm higher or lower than the face of the sleeve behind the nailing flange. For cradles, the top face of the dowel at one end should be no more than 3 mm higher or lower than the other end of the adjacent dowels. Misalignment here can severely restrict joint opening during concrete curing and lead to failure of the concrete surrounding the dowels, or unplanned cracking of the slab remote from the joints.

Expansion joint load transfer
Square dowels, when used with Dowelmaster® sleeves, have 10 mm expansion capability built into the sleeves. Expansion capabilities greater than 10 mm can be achieved by reducing the depth of embedment of the square dowel in the Dowelmaster® sleeve. A compressible filler should be used between adjacent slabs.

Diamond® Dowels can also be used in expansion joints if the dowel plates are first inserted to full depth then pulled back a distance equal to the anticipated expansion. A compressible filler should be used between adjacent slabs.

Plate Dowel Cradles and Square Dowels Cradles are not normally appropriate for expansion joint conditions.
**Research**

A Queensland University of Technology research program on different dowel systems, funded by Danley Construction Products, confirmed the efficiency of Diamond® Dowels, Plate Dowels and Square Dowels compared to other dowelling systems. Over 90 test blocks 1m square x 150 mm thick were cast with different types of dowels spanning 10 mm joints. Some blocks 225 mm thick were also cast. Each test block was instrumented to record load and deflection while being loaded to failure.

The engineering design data presented on pages 12 to 15 of this brochure has been developed from the data generated by this research program, combined with analysis methods contained in documents referenced by Australian Standard AS 3600-2001, and additional tools such as finite-element analysis.

The loading and deflection data presented in the monograms on pages 12 to 15 recognises eight variables that need to be considered when designing for load transfer. These are:

- Construction joint or sawn contraction joint
- Load to be transferred
- Concrete slab thickness
- Concrete compressive strength
- Joint width
- Dowel type
- Dowel spacing
- Dowel deflection

Additionally, the following observations have been made:

- Diamond® Dowels and Plate Dowels have superior load carrying capacity and are efficient at minimising differential deformation.
- Failure patterns indicate that the optimum spacing of dowels is approximately 3 times the slab thickness for slabs in the 150 to 225 mm range. So for 150 slabs, the most efficient spacing is 450 mm.
- Close spacing of dowels (e.g. at 300 mm centres) reduces the capacity of the adjacent concrete to absorb the loads generated by the dowels.
- Finite element analysis has shown that maximum stresses on a loaded Diamond® Dowel are located at approximately 1/6th of the depth of embedment.
Companion products

CRACK-A-JOINT®
As an option to saw cutting, place Crack-A-Joint® into the wet concrete along the joint line (above the Plate Dowel Cradles or Square Dowel Cradles), to induce a crack for the full depth of the concrete. Available in 3 m long lengths, formed from galvanised steel in heights of 25 and 45 mm. Can be supplied with Rip-A-Strip® capping in 4 colours.

METAL DOWEL COVERS
Metal Dowel Covers are normally used with square dowels in situations where slab shrinkage parallel to the joint is expected to be greater than the +/- 5 mm allowed by Dowelmaster® sleeves. Can be substituted for Dowelmaster® sleeves at construction joints, and can be used on Square Dowel Cradles. Are also appropriate for larger size square dowels.

GROUND CRACK INDUCER
An inverted V-shaped PVC extrusion 3 m long available in 25 and 50 mm heights, it is positioned on the sub-grade before the Plate Dowel Cradles or Square Dowel Cradles are placed. Produces a weakening in the slab that initiates a crack in the slab from the bottom up. Ground Crack Inducer should only be used when Crack-A-Joint® is used, or when saw cuts are to be made in the slab on the same day as the slab is poured.

KEYJOINT
Danley’s Dowelmaster® sleeves and square dowels may be used with Danley’s preformed metal Keyjoint profiles, to combine the performance of square dowels with the efficiency of 3 m or 6 m long stay-in-place forming system for slabs 100 to 250 mm thick. Keyjoint is formed from galvanized steel, secured with unique stakes that provide adjustability during set-up, and is available with PVC capping.
1. What is the connection between concrete shrinkage, joints in concrete slabs, and dowels?

- Chemical reactions begin as soon as concrete has been poured, and the concrete begins to gain strength. During the first few hours of curing, rapid strength build-up and the natural tendency of concrete to shrink creates stresses in the concrete.
- Shrinking during curing is the main cause of cracking in concrete, and concrete will crack wherever a defect is present.
- Good work practices such as protecting the pour from wind or high temperatures by having walls and roofs in place prior to pouring, well-trained, well-equipped and adequately sized paving crews, and controlled curing will help minimise cracking problems.
- Deliberately placing defects (e.g. saw cutting the slab) will result in controlled cracks.
- Relieving the stresses built up during curing as early as possible by making the saw cuts as soon as practical after the concrete pour.
- Joints [as well as uncontrolled cracks] will continue to open up for months after a slab has been poured.
- When vehicles or equipment travel from one slab over a joint onto the adjacent slab, dowels assist in distributing the stresses from the loaded slab into the adjacent slab – this is sometimes called load transfer or shear transfer across the joint.
- Appropriate dowels sharing the loads adjacent to or travelling over joints enhances the life and durability of the slab or pavement.
- And finally, appropriate dowels provide a smooth transition for the wheels of equipment travelling across the joint.

2. Why not space dowels as closely as possible – the more steel the better, right?

- No, there are two factors to consider; the ability of the concrete surrounding the dowel to accommodate the loads, as well as the strength and stiffness of the steel in the dowel.
- In almost all circumstances, the loads applied on a slab will be distributed onto two or more dowels.
- If dowels are closely spaced, the shear cones developed in the concrete that resist the loads will intersect neighbouring shear cones, reducing the overall capacity of the concrete in the region of the loaded dowels.
- In relatively thin slabs, it has been shown by physical testing that the optimum dowel spacing to maximise concrete capacity is at least 3 times the thickness of the slab (e.g. in a 150 slab, space the dowels at least 450 mm apart). So the further apart the dowels are, the more load that can be absorbed by the concrete in the region of the load.
- However, it is also necessary to check that the strength of the steel in the dowel has not been exceeded.
- And finally, there is a point where the deflection capacity of the steel in the dowel may be the limiting factor – both the concrete and the steel in the dowels may be strong enough, but the flexibility of the dowel may exceed appropriate differential deflections between adjacent slabs.

3. Why not carry steel through the joint?

- If reinforcing mesh is not cut at the joint line, it will hinder the natural shrinkage of the concrete; but more importantly, the mesh has very little capacity to assist with load transfer across the joint.
- If reinforcing bars cross the joint, they will prevent the contraction joint from activating, and also do not have sufficient strength to provide adequate load transfer.
First-pour slab on right with Diamond® Dowels sleeves cast in and dowel plates in place for second pour. At left, form board with dowel sleeves attached, ready for concrete pour.

Close-up view during concrete placement. Note the cut cross wire and the reinforcing mesh supported on chairs (not on the cradles).

Finishing a freshly placed slab, and saw cutting the contraction joins with an early-entry saw.

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