RIBRAF® X-POD®

INSTALLERS GUIDE
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1 SCOPE

This installation guide has been developed for the exclusive use of Firth customers who are experienced in the construction of residential concrete foundation systems. The Building Act requires that only suitably qualified persons, who are Licensed Building Practitioners (LBP) or working under the supervision of an LBP, can construct foundations systems. Experience in the placing finishing and early age care of concrete in accordance with NZS3109 is mandatory.

The RibRaft® X-Pod® foundation is a specifically designed system and as such all details will be provided in the project drawings. These drawings will have been reviewed as part of the building consent process. Any errors or omissions should be brought to the designers attention for instruction.

Contact your local Firth Representative for supply of Firth RibRaft® X-Pod®s. Pods shall be released to site upon confirmation of the placement of an order for the appropriate Firth concrete mix code (see section 2.1).

2 DESCRIPTION OF THE SYSTEM

The Firth RibRaft® X-Pod® flooring system comprises of:

- Firth concrete mix IP2019X or IP2519X, refer section 2.1
- A matrix of RibRaft® X-Pod® formers to create typically a total floor thickness of 300mm with ribs at 750 or 1500mm centres and a 85mm minimum topping above the RibRaft® X-Pod®s. Note refer to the project drawings as designers have differing preferences for topping thickness, refer section 2.2
- Firth RibRaft® Keystones which lock the X-Pod®s into place
- Mesh in the topping, refer section 2.3
- Reinforcement typically in the form of DH10s or larger diameter in the ribs, perimeter, and load bearing beams, section 2.4
- DPM providing a vapour barrier between ground and flooring system, section 2.5
- Dependent upon soil conditions the flooring system may sit on a compacted gravel raft, section 2.6
- The system is compatible with Firth HotEdge® should slab edge insulation be specified, section 2.7

FIGURE 1 - THE RIBRAFT® X-POD® SYSTEM

1 DPM
2 RibRaft® X-Pod® (215/750 or 215/1500)
3 RibRaft® Keystone 8/16
4 RibRaft® ADJ Pod (215/150.400 and ADJ Pod 215/450.700)
5 Steel reinforcing (bars)
6 Steel reinforcing (mesh)
7 Firth Concrete (mix code IP2019X or IP2519X)
## 2.1 CONCRETE

RibRaft® X-Pod® Foundation systems require a specific Firth designed concrete mix. Choose one of the following:

1. **X-Pod® Mix IP2019X** – a 20MPa 100mm slump mix available as a pump mix suitable for 100mm pump lines available in either a 13mm or more usually a 19mm nominal aggregate size, or as a structural (non-pump) mix.

2. **X-Pod® Mix IP2519X** – a 25MPa 120mm slump mix available as a pump mix suitable for 100mm pump lines available in either a 13mm or more usually a 19mm nominal aggregate size, or as a structural (non-pump) mix. This mix shall be specified for buildings constructed in the ‘sea spray zone’ (i.e. within 500m of the sea including harbours, within 100m of tidal estuaries or inlets, on offshore islands and elsewhere as defined as exposure zone D in 4.2.3.3 of NZS3604).

The X-Pod® system is available across most of NZ, where there is a Firth Concrete plant available to supply the X-Pod® special mix concrete. However in some parts of the county, X-Pod® isn’t available including Kaitaia, Wairarapa, Kaikoura, Motueka and Golden Bay, where there is no Firth Plant or a Firth Plant is too far away to make the supply of X-Pod® concrete feasible. In these cases, please talk to your local Firth rep for more information and to discuss a suitable alternative foundation design.

## 2.2 PODS

The Firth RibRaft® X-Pod® flooring system comprises of 4 pod options which are linked using the X-Pod® Keystone clip to create an efficient and strong flooring system. The pod options are:

- **RibRaft® X-Pod® 215/750.** These units, when laid out and linked with the X-Pod® Keystone create a grid with 100mm ribs at 750 centres. The height of the pods are 215mm which when combined with 85mm of concrete topping give a total floor thickness of 300mm. See Figure 2.

- **RibRaft® X-Pod® 215/1500.** These units, when laid and linked with the X-Pod® Keystone create a grid with 100mm ribs at 1500 centres. The units are designed to form a cross shaped concrete column in the centre of the 1500mm rib grid. The height of the pods are 215mm which when combined with 85mm of concrete topping give a total floor thickness of 300mm. See Figure 3.

- **RibRaft® two part adjustment pod. ADJ Pod (215/150.400 and ADJ Pod 215/450.700).** These units can be used when the required spacing between beams and ribs is less than 750mm. The 215/150.400 unit contains a top mounted clip which allows it to be securely connected to other X-Pod® units. Without modification the unit fills a 400mm void. With cutting and overlapping the unit can fill voids of between 150 and 400mm. When combined with the ADJ 215/450.700 unit, voids of between 450 to 700mm can be filled. Figure 4 illustrates the units.
Firth RibRaft® X-Pod®s are placed directly on levelled ground and are arranged in such a way as to form a reinforced concrete floor slab with a grid of reinforced concrete ribs and edge beams when concrete is placed onto them. The RibRaft® ADJ Series X-Pod®s may be used to suit specific architecture layout and also to accommodate services.

*Figure 5* shows how the various X-Pod® components might be utilised on a complex floor arrangement where liquefaction or expansive soils are not a consideration.
2.3 MESH

Mesh shall be Grade 500 and comply with AS/NZS 4671:2001. Typically the mesh will be 665 mesh (Class L) or SE62 ductile mesh (Class E). The Design Engineer shall specify the required mesh.

Class L mesh can be used when the sole purpose is limitation of crack widths and the ground conditions are defined as good in terms of NZS3604. The Class E reinforcing bars in the ribs and beams provides adequate ductility of the system which allow the use of Class L mesh.

Class E shall be used when the mesh preforms a structural function such as a slab on ground prone to liquefaction or expansive soils.

Mesh shall be lapped in accordance with NZS3101.

Two options are available for supporting the mesh which shall be defined on the drawings:

1. The mesh can be supported on mesh chairs to achieve cover to the top surface of 35mm. This methodology minimises the cover and therefore enhances the crack width limiting ability of the mesh.

2. The mesh can alternatively be laid on upstands provided in the corners of the pods. The 15mm upstands on the pods mean that cover from the concrete surface to the mesh (SE62) is 58mm and slightly less at mesh overlaps.

2.4 STEEL

The reinforcing bars in the ribs and edge beams shall conform to AS/NZS 4671:2001 Grade 500, Class E “Steel Reinforcing Materials”. The volume of reinforcement shall be documented on the approved building consented drawings.

The Firth RibRaft® X-Pod® Keystones hold the reinforcement in positon without the need for tying. The X-Pod® Keystone can accommodate up to two DH16 bars at a lap positon.
2.5 DPM
The damp proof membrane (DPM) material shall be polyethylene sheet in accordance with NZS 3604:2011. The DPM shall be laid over the entire building platform directly on top of a sand blinding layer, extending to the outside of the edge beam. The joints shall be lapped not less than 50mm and sealed with pressure sensitive tape not less than 50mm wide. All penetrations of the DPM by plumbing and services or punctures during construction shall also be sealed with pressure sensitive tape. The DPM may extend beyond the edge of the slab i.e. underneath the formwork, or may be folded and stapled up the inside of the formwork. The minimum requirement is that the DPM extends to the outside of the edge beam. It is very important that the DPM is not bunched up at the formwork.

Where enhanced thermal performance is required, ThermoX DPM can be used as the DPM.

2.6 OPTIONAL GRAVEL RAFT
Often a gravel raft is not required below the DPM where ground bearing conditions permit, although a sand blinding layer may be required to provide puncture resistance to the DPM. Where ground conditions are soft, a compacted gravel raft can be provided to reduce the bearing pressures in the natural ground to acceptable levels. Details of any gravel raft shall be provided on the project drawings.

2.7 FIRTH HOTEDGE®
Where additional thermal efficiency is required, Firth HotEdge® can be incorporated into the design. Refer Firth web page for more information.

3 INSTALLATION OF THE SYSTEM
The following provides an overview of the installation of the Firth RibRafT® X-Pod® system. Where conflict exists between the information provided in this document and the approved building consent drawing set, the drawings shall take precedence. However, it is mandatory that the concrete used is supplied by Firth Industries to allow management of quality control.

3.1 SITE/earth works
The building footprint shall be excavated to a suitable depth to ensure all organic material is removed (top soil, roots etc). Excavation shall extend beyond the footprint a distance shown on the drawings which is typically twice the depth of compacted hardfill beneath the concrete slab. Precautions shall be taken to prevent silt laden runoff from leaving the site should rain occur.

3.2 PLUMBING
Various Territorial Authorities have their own preferences for plumbing details so always check with the local council.

Two options exist for running plumbing:
• The pipes are installed in the ground below the slab and then rise up through the slab at the desired location within the building, referred to as “below slab installation”. This is the preferred option in most situations.
• The pipes run within the plane of the X-Pod® flooring system, referred to as “in floor installation”.

3.2.1 BELOW SLAB PLUMBING INSTALLATION METHODOLOGY
This option is applicable for most situations but should not be used on liquefaction sites for which lateral spread is expected. In most situations this is the norm and most cost effective solution.

For this option, pipes shall be conveyed underground to their plan location then brought up through the X-Pod® and the concrete floor slab. The trenching, placing and bedding of the pipes/ducts and the backfilling shall conform to the requirements of the consent documentation. Services shall not be placed within any concrete except to cross that section of concrete i.e. services shall not run along ribs or edge beams. In accordance with AS/NZS3500.4:2015 pipes penetrating through concrete shall be:
• Installed at right angles to the slab surface
• Lagged with an impermeable material for the full depth of the concrete penetration
• Lagging must be at least 6mm thick

Any services horizontally crossing ribs or the edge beams shall be placed only within the middle third of the member. At no stage shall any of the reinforcement bars be relocated or cut to allow for the services (it is acceptable, however to cut the mesh). In some instances this will dictate the location of the pods.

The X-Pod® ADJ spacers can be used to trim around plumbing penetrations if required.
Below slab installation showing lagging of pipes

Details where large diameter pipe required through perimeter beam

Use of X-Pod® ADJ pods to create zone for pipes to penetrate slab
3.3 IN FLOOR PLUMBING INSTALLATION METHODOLOGY

This is the preferred methodology for sites where lateral spread associated with liquefaction is expected as it provides enhanced protection for the pipes compared to the below slab methodology. However, it can be used for all ground conditions.

Pipes services can be run within the plane of the RibRaft® X-Pod™s either exiting out of the side of the perimeter ring beam or going underground near the edge beam. Pipes shall be laid at a fall to comply with NZBC G13/AS1. For pipe up to 65mm diameter the minimum gradient is typically 1 in 40, while for 100mm pipes its 1 in 60, however greater falls may be required dependent upon the required number of discharge units. Table 1 provides distances from the edge of the slab to pipe surface penetration to achieve minimum pipe gradients. Where gradients cannot be achieved, then services will be required to be run under the slab.

**Pipes shall either be:**

1. Located to pass perpendicular to the ribs and beams and shall not be laid along the length of ribs or beams. X-Pod™s can be cut and sealed as required to achieve the required fall and position.

2. The adjustable X-Pod™ can be used to create beams to run services through. Pipes shall be laid to ensure 15mm concrete cover between pipe and reinforcement in the perimeter beam. The width of the rib containing the pipes shall be greater than the specified rib width (typically 100mm) plus the pipe diameter. This ensures the rib width is maintained even though plumbing pipes run through it. All pipes in contact with concrete shall be lagged with an impermeable material of at least 6mm thickness.

**TABLE 1 MAXIMUM DISTANCE FROM EXTERIOR TO ENTRANCE POINT OF PLUMBING PIPES**

<table>
<thead>
<tr>
<th>Pipe Diameter (ID) mm</th>
<th>Gradient</th>
<th>Maximum distance to edge with 215mm thick pod</th>
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<tr>
<td>40</td>
<td>1 in 40</td>
<td>3400</td>
</tr>
<tr>
<td>50</td>
<td>1 in 40</td>
<td>3000</td>
</tr>
<tr>
<td>65</td>
<td>1 in 40</td>
<td>2400</td>
</tr>
<tr>
<td>100</td>
<td>1 in 60</td>
<td>1200</td>
</tr>
</tbody>
</table>

**TYPICAL DETAILS ARE SHOWN BELOW**

In slab installation pipes cut through rib walls
Use of X-Pod® ADJ pods to create zone for pipes to run without compromising Ribs

Typical drop down detail for sewer line to prevent it being visible at exterior of slab

- Ø110 (MAX) PIPE
- COMPRRESSIBLE LAGGING MATERIAL
- FLEXIBLE SEALANT AROUND THE PIPE
- STOP BARS EACH SIDE OF Pipe, INSTALL HD12 BARS X 1500 mm LONG
- SEAL DPM PENETRATION
- FLEXIBLE JOINT
- USE ADJUSTABLE EDGE PODS LOCALLY TO GIVE PIPE SLEEVE A MIN. OF 100 mm CONCRETE COVER
- F.F.L.

STOP BARS EACH SIDE OF PIPE, INSTALL HD12 BARS X 1500 mm LONG

SEAL DPM PENETRATION

FLEXIBLE JOINT

USE ADJUSTABLE EDGE PODS LOCALLY TO GIVE PIPE SLEEVE A MIN. OF 100 mm CONCRETE COVER

F.F.L.
3.4 RECESSES FOR SHOWERS

The following figures provide typical details for recesses and large penetrations.

Shower recess distant from slab edge

Shower recess close to slab edge

Large penetration through slab

LARGE PENETRATION THROUGH SLAB

\[ B < 450 \]

\[ 1+1 \text{ HD10 STRAIGHT BARS} \]
\[ L = 1500 \]

TO EACH SIDE OF THE VOID

(*) IF \( B > 450 \text{ mm} \) PLACE 2 HD10 CRACK CONTROL BARS @ 200 L = 2000 AT EACH CORNER OF THE PENETRATION
3.5 SUB-BASE/SUBGRADE

Excavated material shall be replaced with hardfill material compacted in maximum layers of 150mm or as specified by the design engineer. Refer specific project drawings/ specification for minimum hardfill layer under slab. A blinding layer of 0-5 mm sand or crusher dust shall cover base material to a maximum thickness of 25mm (for final hand screeding). The finished level of compacted hardfill shall be determined specifically by the designer for each site. The subgrade/sub-base should be inspected by the design engineer when this is a condition of the building consent, or where concerns exist that the ground conditions are not those implied by the design.

3.6 FORMWORK SETUP

Perimeter shutters shall be set to profiles or string lines with top edge at Finished Floor level. Setting level of shutters must allow for variation across prepared base and final hand screed of sand blinding layer (to +/- 5mm). Shutters shall be adequately braced to ensure minimal movement occurs under full load of wet vibrated concrete and construction loadings. Forms shall prevent the leakage of grout at joints which can result in a bony surface finish.

The finished floor level shall ensure that the height above ground level satisfies the greater requirements of:

- E1/AS1, refer section 2 in particular
- E2/AS1, refer section 9.1 in particular
- any local flood management clearance criteria

The specified levels shall be shown on the project drawings.

3.7 DPM PLACEMENT

The DPM shall be laid over the entire building platform directly on top of a sand blinding layer, extending to the outside of the edge beam. The joints shall be lapped not less than 50mm and sealed with pressure sensitive tape not less than 50mm wide. All penetrations of the DPM by plumbing and services or punctures during construction shall also be sealed with pressure sensitive tape. The DPM may extend beyond the edge of the slab i.e. underneath the formwork, or may be folded and stapled up the inside of the formwork. The minimum requirement is that the DPM extends to the outside of the edge beam. It is very important that the DPM is not bunched up at the formwork.

ThermoX DPM is highly reflective and sunglasses should be used when installing on sunny days. The reflective side is placed upwards.

3.8 POD INSTALLATION

The drawing should be reviewed to determine whether the symmetrical RibRaft®.

X-Pod® 750/215 is specified or the non-symmetrical 1500/215 pod. Review of the 1500/215 pod will show that only two of the sides only will create a 100mm rib.

Place a row of RibRaft® X-Pod®s the specified distance away from the formwork (refer consent drawings). Click in X-Pod keystones along perimeter beam to secure in place. Align second row of X-Pod®s and clip together in groups of four pods with X-Pod® Keystone in the holes provided. The X-Pod® Keystones click into place. Continue placing X-Pod®s and clicking together with X-Pod® Keystones. Note the pods are securely held together and modest realignment can occur by pushing. However, take care to avoid damage to the DPM.

Where adjustment pods are specified, or where required to frame around a plumbing penetration, follow the following procedure, refer Figure 6.

FIGURE 6 RIBRAFT® X-POD® TWO PART ADJUSTMENT PODS

Illustration: © Ribraftdesign.co.nz

FIRTH RIBRAFT® X-POD® INSTALLERS GUIDE
Where a 400mm gap needs filling use the ADJ/215/150.400 pod. Simply clip the alignment clip into the recess provided in the RibRaft® X-Pod®.

Where the required extension width is between 150 and 350mm (in 50mm increments), the ADJ 215/150.400 pod requires cutting. The location of the required cuts are shown on the side of the adjustment pod. For 150 to 200mm extensions two cuts are required, while for 250 to 350mm extensions only one is required. Once cut, clip the clip end into the recess in the X-Pod® and overlay the other end to provide a stop end.

For extension requirements of 450 to 700mm clip the ADJ 215/150.400 into the X-Pod® and overlay the ADJ 215/450.700 to achieve the required extension. Aligning the extension number on the side of 215/450.700 pod with the location nib on the ADJ 215/150.400 pod will achieve the required extension in 50mm increments.

The holes on the sides of the extension pods are designed to accommodate the X-Pod® Keystone if required.

### 3.9 REINFORCEMENT PLACEMENT

The X-Pod® Keystones have been designed to securely hold reinforcement in position without the need for tying. Place reinforcement in the location and to the details shown on the drawing. Clip reinforcement into place in X-Pod® Keystones.

Mesh can either be placed on reinforcement chairs or supported on the upstands in the corner of each X-Pod®. Refer to the drawings to determined which mesh support mechanism is specified for a particular project to determine the preference of the design engineer.

### 3.10 CONCRETE PLACEMENT

Firth concrete mix IP2019X or IP2519X are the most commonly specified mix designs for X-Pod® floors. The volume of the concrete floor above the pods can be estimated by calculating the overall volume including the pods (typically 750x750x300) and deducting the volume of the X-Pod®s provided in Table 2.

#### TABLE 2 VOLUME OF RIBRAFT® X-POD®S

<table>
<thead>
<tr>
<th>Type of X-Pod®</th>
<th>Volume (litres)</th>
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</thead>
<tbody>
<tr>
<td>215/750</td>
<td>83</td>
</tr>
<tr>
<td>215/1500</td>
<td>91</td>
</tr>
</tbody>
</table>

The Firth concrete mix is designed to have a suitable strength at a higher slump. The mix has been formulated to achieve appropriate filling of the X-Pod® foundation system. Pumping concrete is the recommended method of delivering the fresh concrete to the work face. Other methods of delivery may be suitable however approval from Firth or project engineer is required. For placing and finishing guidelines refer below and to CCANZ’s posters number 3 and 5.

1. It is generally preferable to start pour at the garage (allows a harder, flatter finish) and work away. Controlling the flow from the pump nozzle is important to ensure even coverage.

2. Follow behind pour face with immersion (spud) type vibrator to all concrete (beams, ribs and top slab).

3. Care must be taken around plumbing to ensure damage, or movement does not occur.

4. Following vibration, normal concrete finishing techniques shall be carried out (refer poster number 5). Screed off concrete using normal screeding tools or vibrating screeds. Bull float to push down aggregates left at the surface during the screeding operation. Finish the edges with steel trowel and the interior of the slab surface with troweling machines. It is important that final troweling does not commence until all the bleed water has evaporated as premature commencement of troweling can lead to surface delamination or dusting.
5  Hot and/or windy conditions present during pouring/finishing require steps be taken for the protection of the concrete to prevent plastic cracking. Protection measures include:
   a  Aliphatic alcohol sprays
   b  Water vapour misting over surface (ie from water blaster directed upward, and wind carrying mist over slab surface). However this water must be fully evaporated from the surface before commencing trowelling.
   c  Positioning wind breaks
6  Curing the slab is crucial to ensure strength gain of concrete and protection from early age cracking. Suitable methods of curing include:
   a  Water spraying/ponding
   b  Curing membrane sprays
   c  Polythene covering
7  If environmental conditions forecast greater than 12 degrees variation of day time to overnight temperatures, then measures to protect slab from thermal shock shall be employed, these include:
   a  Planning the pour time to minimise the temperature variations the concrete will experience
   b  Covering surface with fabric, plastic covers or polythene
   c  Using early entry saws
   Forms shall not be struck on the day of the pour, and consideration should be given to leaving forms in place for 2-3 days following pour in very cold or shaded locations.

3.11  SHRINKAGE CONTROL JOINTS
Shrinkage control joints reduce the risk of unwanted cracks, and their placement needs to be carefully considered where uncontrolled cracking could be unacceptable. Two types are described here, saw cut joints (which are tied joints) and free joints.

3.11.1  SAW CUT JOINTS
Saw cuts are located at positions in which the concrete is likely to crack due to stresses induced by restrained shrinkage. The aim of providing them is for the concrete to crack at the bottom of the saw cut thus minimizing the potential for a visible crack wandering over the surface. The level of reinforcement provided in a RibRaft® X-Pod® flooring system mean that cracks have no structural implications being only an aesthetics issue. Factors to consider are the type of floor finish, the location of ribs and ground beams.

When warm sunny days are followed by cool nights, the change in temperature can cause cracking. Hence preference should be given to using early entry saws which are used immediately after finishing. Shrinkage control joints cut using diamond blades shall be cut as early as possible which is typically within 24 hours of hardening in summer, and 48 hours in winter. They shall be cut to a depth of 25mm. Shrinkage control joints do not guaranteed to eliminate all visible or unwanted cracks.

Joints shall be positioned to coincide with major changes in floor plan. Where concrete is to be exposed, for example in a garage, or brittle covering placed over, the maximum intermediate bay sizes shall be limited to 5m. Bay dimensions formed by shrinkage control joints shall be limited to a maximum ratio of length:width of 1.5:1. Where a shrinkage control joint runs along the line of a load bearing rib, then the joint shall be located directly above one edge of that rib.

In order to limit the width of cracks at re-entrant, or internal corners, extra steel is often specified and is placed on top of the mesh. These are typically 2-HD12 bars (grade 500E), 1200mm long tied to the top of the mesh at 200mm centres, with 50mm cover to the internal corner - refer Building Consent drawing for details.

3.11.2  FREE JOINTS
For large plan areas the designer may specify free joints. These are typically joints which allow unrestrained movement, but are doweled to prevent vertical movement. If specified then follow details shown on the building consent drawings.
3.12 FINISH EXPECTATIONS

The Building Amendment Act 2013 introduced new consumer protection measures which became effective on 1 January 2015. MBIE has developed guidance to the industry on what constitutes a defect and the definition of acceptable/unacceptable defects. The MBIE guidance document suggest that for a concrete floor it is recognised that some cracking in concrete is common and not necessarily a sign of poor workmanship. The document suggests that cracks up to 3mm wide are acceptable.

It is also recognised that the levelness of the floor is important. NZS3114 requires an even plane within ±5mm for every 3m direction for a carpeted floors and ±3mm for tiled and vinyl floors. Individual mounds should be less than 3mm high and depressions less than 3mm deep. In addition, no abrupt deviations greater than specified in NZS3114 should exist.

Visible reinforcing or bony concrete should not exist along the slab edge.

Concrete is a natural material and shade variation can be expected. Often slight colour variations will fade with time.

4 INSTALLATION DOCUMENTATION

When requested, the installation contractor shall provide a PS3 for the installation of the Firth RibRaft® X-Pod® floor. Confirming that construction was in accordance with the project drawings and that the concrete used for the project was supplied by Firth Industries.
PLACING AND COMPACTING

PLACING

1. Concrete mixers can place the concrete exactly where it is needed.
2. Tubs attached to skips can aim the concrete in the right direction.
3. Concrete pumps can move the concrete long distances to where it is needed.
4. Slump check the slump for the job.
5. Don't place concrete in piles out in flat, even layers.
6. Don't make the second layer too thick. The poker must go 100mm into the first layer.
7. Baffle boards protect the formwork from being damaged by dropped concrete.
8. Double beam vibrators require no finishing on some jobs.
9. Always have a surcharge of concrete in front of the beam vibrator.
10. For thin slabs use a beam vibrator. For columns, walls and thick slabs use poker vibrators.
11. For small job slabs up to 100mm thick a hand tamper may be used.
12. Poker vibrators should be used along the edges of slabs when compacting with a beam.

COMPACTING

- Air is always trapped in concrete when it is being mixed.
- The aim of compaction is to remove as much of this air as possible.
- Why does getting rid of the air matter?
  - Air holes reduce the strength of concrete.
  - If you don't compact concrete, it may only be half as strong as it should be.
  - Air holes in the concrete stop a good bond forming between the concrete and the reinforcing steel making the structure weaker.
  - Large air holes can cause ugly marks on the surface.
- Use the right compaction equipment for each job.
  - Poker vibrators for beams, columns, walls and thin slabs.
  - Beam vibrators for thick slabs.
- Clamp-on vibrators can be used on special formwork, especially in the precast industry.
- Always have spare compacting equipment in case of a breakdown.
- For more information on the use of poker vibrators see Poster No 4 "Using a Poker Vibrator".

SAFETY ON SITE:

- Suitable protective clothing should be worn when handling wet concrete.

Cement & Concrete Association, PO Box 448, Wellington • Telephone 04 499 8820, Facsimile 04 499 7760 • www.cca.org.nz