8.0 Residential Construction

8.1 Health & Safety Act 1992

The principle objects of the Health & Safety Employment Act 1992 (HSE Act) are to prevent harm to employees at work. To achieve this, the Act imposes duties on employers, employees, principals and others to promote excellent health and safety management by employers. It also provides for the making of regulations and codes of practice. The "Approved Code of Practice for the Safe Handling, Transportation and Erection of Precast Concrete" was developed by construction industry representatives to ensure safe work practices are promoted and become standardised normal work practices in precast factories and on building sites. All Litecrete panels should be installed by persons familiar with precast concrete installation. All of the major craneage companies offer skilled precast concrete riggers as part of their installation service. It is also important that the builder is made familiar with the construction procedures detailed below. Full guidance is available from Litecrete.

8.2 Handling and Storage

As with regular precast concrete, care must be taken with Litecrete panels to protect edges and corners from damage during shipping, craneage and placement. For construction efficiency precast concrete products are usually installed as soon as they are delivered to site. If for some reason the Litecrete panels are to be stored on site they must be placed vertically on A-frames with a resilient type of dunnage (strips of carpet, etc) placed between the panels to protect the panel face. Do not store the panels horizontally in a stack.

8.3 Delivery

Access to the site. Check that the site has appropriate access for a truck/truck and trailer unit and that the ground has sufficient stability to support the weight.

8.4 Craneage

Cranes are one of the most expensive pieces of equipment used during the installation of Litecrete panels. To minimise this cost it is important to plan ahead for the optimum crane size needed and time the unit is on site.

Considerations:

1. The load. Litecrete will supply weight and load dimensions well in advance of panel manufacture so that planning can start early.
2. Proximity of the crane to the lift load. The capacity of the crane is determined by the distance the load is from the centre of rotation.
3. Obstacles which the crane may incur. Power lines, trees and buildings can all impact on the operation of the crane.
4. Ground conditions. Ensure the ground area is big enough to support the weight of the crane when being positioned and working.
5. Impact of crane on the general public. If the operation results in extra traffic control or requires loads being lifted over roadways or other property then permission from the appropriate authority will be required.

8.5 Lifting

Edge lifting is the predominant method used with Litecrete panels. This ensures the panel is vertical for placement over starter bars or other connections; allows panels to be able to be placed close to adjacent structures and also leaves the face of the panel untouched. Because of flexural stresses induced in edge lifting of the panels the maximum residential panel size, with a standard smooth (F5) finish, is approximately 7-8 metres x 3.5 metres, subject to design parameters such as window/door openings. Because of design constraints there may occasionally be the necessity to use face lifters, however these are used as a last resort and in consultation with the customer.

8.6 Horizontal Weather Joints

When lifting panels or lintels which have a staggered horizontal weather joint, the lifting shackles can cause damage to the joint upstands. To mitigate this problem the standard precast method is to cast-in polystyrene block-outs into the upstands, within the area of the lifting eyes, so that the lifting shackle is free to move without breaking out the concrete. Photo at right shows a horizontal weather joint where the polystyrene block-out has been removed from the joint upstand to expose the lifting eye. After panel installation the upstand is remediated to restore the weatherproofing integrity of the joint.

8.7 Propping

Props are used to temporarily support the precast panels until permanent fixing are made. Planning the placement of the props is important as, although they are in place for a relatively short period of time, they take up a significant amount of room and can affect other site works. Typically, external walls are propped from the inside panel face back to the existing floor slab. However, if the construction design requires the walls to sit on footings with the floor slab being poured between the walls later, then the panels will require propping from the exterior face and attached to "dead men" positioned in the ground outside of the floor area, as shown in the photo at right. It is recommend that M16 threaded propping inserts are cast in to the inside panel face of the panels during manufacture.

Two props are required for each single-storey panel, usually at the 2-metre height. Four props are required for a two-storey panel; typically two at 2 metres high and two at 4-5 metres high. Photo (left) shows a Reid TIM threaded insert used for propping. A reinforcing bar goes through the hole near the base of the insert. The open end of the insert is set about 3mm below the panel surface and can be covered over after use. Props are also available that have a G-clamp attachment which fit over the top of the panels, removing the need for cast-in propping inserts.

9.0 Installation

There are two typical methods of installing single-storey and two-storey Litecrete wall panels in conjunction with concrete floor slabs:

Option 1: Panels sit in a rebate in the floor slab and are attached using Drossbach tubes. The wall panels are manufactured with cast-in 40 mm diameter Drossbach tubes, 800-900 mm high, typically at 600 mm (design by structural engineer). These tubes fit over D12 starter bars which have previously been cast-in to a 230 mm wide x 50 mm deep perimeter rebate when the floor slab was poured, prior to the panels arriving on site. See detail *D(3)2 Panel/Floor Slab Connection.* Once the panels are installed and properly aligned the tubes are filled with epoxy grout. The grout holes are plastered over after filling.

Option 2: Panels sit on concrete footings below the floor level, prior to the floor slab being poured. The Litecrete wall panels are manufactured with one or two rows of cast-in Reid brand RB12ti inserts at the bottom of the panel, at centres as designed by the engineer. The panels are positioned on concrete footings, Reid brand RB12 starters are screwed into the inserts and the concrete floor slab is poured. See detail *D(3)3 Panel/Floor Slab Connection.* While single-storey walls are usually trucked standing up, panels over 3 metres high are delivered sitting on their long edge and require pitching to the vertical during the lifting process using rollers attached to the crane boom.

9.1 Installation using Drossbach Tubes

9.1.1 The floor slab is poured with a 20 mm deep rebate set around the perimeter slightly wider than the specified width of the panel. Starters are cast-in to the perimeter rebate at nominated centres. The base of the rebate must be level to within +/- 5mm in 5m.

9.1.2 Before beginning panel installation, usually well before the delivery truck arrives, mark chalk lines around the perimeter of the floor slab rebate for correct alignment of the panels. Also, mark chalk lines for the internal Litecrete walls, if applicable. Spray chalk lines with clear polyurethane so that they do not scuff or wash off. Perimeter levels should be determined and shims placed prior panel installation. The first panel is usually installed at a corner furthest away from the crane.

9.1.3 Position the panel correctly on the shims, with the inside edge of the panel sitting on the chalk line and the outside panel edge flush with the outer edge of the foundation.

9.1.4 Panels are manufactured with cast-in Drossbach tubes (which are typically 3 x diameter of the starter bars) at nominated centres. These tubes fit over the starter bars, which are cast into the slab and extend 600 mm above the slab.

9.1.5 Panels are lifted into position, ensuring the starter bars in the slab are guided into the Drossbach tubes in the panel. See detail *D(3)2 Panel/Floor Slab Connection.*

9.1.6 Attach adjustable props to upright panel with a threaded bolt attached to the cast-in inserts on the panel face and to the floor slab using Trubolts. If the floor slab is to have a polished surface, props should be attached to the external panel face and secured to “dead men” in the ground outside the perimeter of the floor slab. Adjust props until panel is plumb. Epoxy grout is gravity-fed into the tubes through grout holes after the panels are fully aligned. Apply same procedure to the other external wall panels, working progressively around foundation perimeter

9.1.7 Ensure that nominal 12 mm vertical gaps are left between each panel. Install lintels, if necessary.

9.1.8 When the timber top plates are in place, weld plates are secured and the panel joints are sealed both sides, the props can be removed. Plaster grout holes.

9.2 Installation using Reid Screw-In Starter Bars

9.2.1 Footings are poured to engineer's design to support the Litecrete panels, nominally 400 mm below the floor level.

9.2.2 Levels for the footings should be determined and shims placed in position prior to the panels being installed.

9.2.3 Lift panel and position in place on top of the footings. Align panel and attach adjustable props with a threaded bolt attached to the cast-in inserts on the internal/external panel face and secure to (a) "dead men" in the ground outside the perimeter of the floor slab or (b) prop off other panels already secured.

9.2.4 Adjust props until panel is plumb. Apply same procedure to the other external wall panels, working progressively around the foundation perimeter. See detail *D(3)3 Panel/Floor Slab Connection.* Props should not obstruct the pouring of the floor slab.

9.2.5 Ensure that nominal 12 mm vertical gaps are left between each panel. Screw RB12 starters into inserts at the bottom of the panels. The panels are now ready for pouring of the floor slab. Photo (above) shows panel with a row of cast-in inserts prior to Reidbars being fitted and the floor slab being poured.

9.2.6 When the timber top plates are in place and weld plates are secured the props can be removed.

9.3 Installing Litecrete Panels on top of Retaining Walls

Litecrete panels can be stacked on top of standard precast or masonry retaining walls. A typical connection is shown in detail *D3(4) Panel to Masonry Connection*.

9.4 Installing Suspended First Floor Walls

Some houses are designed with first storey Litecrete walls inset from the vertical line of the ground floor walls. A steel beam is required to support the weight of the Litecrete, as shown in detail *D17 Suspended First Floor Wall Panel Installation.*

9.5 Installing Internal Litecrete Walls (if applicable)

As Litecrete internal wall panels are not required to be insulated, a 150 mm panel thickness is suitable. The panels can be installed using either Drossbach tubes – as for external walls; see detail *D3(7) Typical Internal Wall/Floor Slab Connection,* or sitting on purpose-built footings in the ground prior to the floor slab being poured, see detail *D3(6) Typical Internal Wall/Floor Slab Connection*. In detail D3(7) the starter bars may be (a) cast-in to the floor slab when it is poured prior, or (b) installed by drilling into the slab using Chemset adhesive, 24 hours prior to panel arrival.

9.6 Installing Weatherboards

Designer will sometimes specify weatherboards as a feature, maybe on a particular elevation, to be fixed over Litecrete panels. For this application we can cast-in vertical H3 treated timber fillets at 600 mm centres which provide fixing for horizontal battens to which the weatherboards are nailed *(see detail D23 Cast-in Timber Fillet for Weatherboard Attachment).*

9.7 Supplementary External Cladding

Additional exterior cladding systems, such as brick or stone veneer, can be attached to Litecrete exterior wall panels to create feature walls. Such systems must be fit for purpose and must comply with the relevant provisions of the New Zealand Building Code. In all cases the manufacturers' installation, application and maintenance instructions must be followed.

Stone veneer adhesive-fixed to Litecrete panels

9.8 Litecrete/Weatherboard Transition

Vertical connection showing typical weatherboards butting up to Litecrete. See detail *D10(1) Panel to Weatherboard Connection.*

9.9 Litecrete/Fibre-cement Transition

Vertical connection showing fibre-cement panels butting up to Litecrete. See detail *D10(2) Panel to Fibre-cement Board Connection.*

9.10 External Plant-Ons

There are proprietary products available, which can be attached to the exterior surfaces of Litecrete walls to replicate classic architectural styles with features such as windowsills, quoins, cornices and mouldings. These can be manufactured from lightweight concrete, expanded polystyrene or plaster and attached according to manufactures' recommendations *(see www.accumen.co.nz)*.

9.11 Timber/Ply Mid-floor Installation

Attach continuous ex 200 x 50 timber joists to wall using Ramset M12 Chemset Anchors at 800 mm centres. See detail *D8 Litecrete Wall/Timber Floor Connection.*

9.12 Insitu Concrete Mid-floor Installation

Attach continuous steel supporting bracket to wall, to engineer's design, using Ramset M16 Chemset Anchors at centres as specified by the engineer. For an example of an insitu concrete system see detail *D8A Litecrete Wall/Insitu Concrete (Metal Tray System) Floor Connection.*

Photo shows "rib and infill" midfloor system prior to pouring insitu concrete topping. Reid starter bars have been screwed in to threaded inserts (shown on left) which were cast-in during panel manufacture. When the topping is poured the bars will tie the walls into the floor.

9.13 Wall Panel/Floor/Deck Connection

See detail *D3(5) Typical Wall Panel/Floor/Deck Connection.*

9.14 Door and Window Openings

Litecrete wall panels will have openings for windows and doors cast-in during manufacture. A weatherstrip is created at the window head and a sloping sill at the bottom (see detail *D5 Litecrete Window Details).* Residential windows are installed as per recommendations of the Window Manufacturers' Association with regard to precast concrete (see detail *D6 Litecrete Window Installation - single glazing* and detail *D6(1) Window Installation - double glazing).*

9.15 Ventilation Grilles

Where a suspended ground floor is designed, say 600 mm above the ground level, the cavity space underneath requires ventilation. Cast-in openings can be provided through the Litecrete panels for the installation of proprietary concrete or metal vermin-proof grilles (see detail *D23 Typical Ventilation Grille Opening).*

9.16 Internal timber-framed walls

Internal timber frame walls adjoining Litecrete exterior or interior wall panels are connected by fixing the vertical end stud against the Litecrete wall panel using chemical anchors (see detail *D9 Litecrete Wall/Timber Frame Connection).*

9.17 Parapet Wall and Flush Fascia Details
See details *D11 Litecrete Parapet Wall and detail D12 Litecrete Flush Fascia*

9.18 Wall/Roof (Apron Flashing)
See detail *D13 Litecrete Wall/Roof Junction.*

9.19 Gutter/Wall Junction
See detail *D14 Litecrete Gutter/Wall Junction.*

9.20 Meter Box Installation
See detail *D15 Litecrete Meter box Installation.*

9.21 Attaching Top Plates
Fixings for all structural and non-structural fittings, where applicable, should be embedded in the Litecrete panels during manufacture. Threaded rods for the attachment of a 50 mm thick timber top plate (if required) should extend 75 mm out of the top of the panel (see detail *D4 Litecrete Wall/Roof Connection).*

9.22 Services and Wall Penetrations
In some instances through-services such as plumbing and electrical, are required to penetrate through Litecrete panels. The advantage of precast panels is that openings can cast in at the time of manufacture. For smaller service holes the Litecrete panels can be easily drilled out on site. Care should be taken when drilling to avoid hitting reinforcing bars. Note that the maximum allowable non-specific dimension of such openings is 400 mm x 400 mm. See detail *D16 Litecrete Pipe Penetrations*.

10.0 External & Internal Finishing

10.1 External plaster and coatings
The smooth exterior surface of the panel (F5) is produced off a steel casting bed. This means that once installed the panels are ready be painted. In this instance the V-joints between the panels are “expressed” and become a feature. If a plaster finish is specified to hide the joints, they would be filled in and treated as “control joints” - to cope with any seismic movement - *(see detail D18)*. However, any paint or plaster system should be of the vapour-permeable variety. We recommend systems that have been BRANZ appraised and/or meet the NZBC requirements. There are numerous proprietary exterior plaster/paint/stain systems available. In all cases the manufacturers’ application and maintenance instructions must be followed, with particular attention given to the following areas:

- Weathering, flashing and sealing systems at door and window openings, junctions with other materials and any other penetrations of the exterior envelope. The ground/foundation/floor/wall interface. Particular care needs to be given to ensure that minimum distances between ground and floor level, as stated in NZS 3604:2011, are met.
- External plaster systems are installed and cured within the temperature limitations, climatic and curing conditions set by the manufacturer. The finished external plaster system is sealed and protected from the weather with a vapour-permeable coating system.

10.2 “Clear” Concrete
Where a clear natural concrete look is specified for Litecrete panels we recommend the application of a matt finish clear sealer after installation; eg: Markham NZ’s “Aquron 2000” or STO NZ’s “Sto Pur”, both of which comply with *CCANZ CP 01:2014 – Code of Practice for Weathertight Concrete and Concrete Masonry Construction, Section 4.4 Clear Coating System, when tested in accordance with AS/NZS 4456.16:2003.* The following aspects should also be considered:

10.2.1 The pumice aggregate contains minerals which can sometimes result in heavier surface figuring than is the case with normal precast. On rare occasions mafic (iron-bearing) particles can also occur. This can present as small rust spots on the panel surface. It does not have any effect on the structural integrity of the panels and is not considered a defect.

10.2.2 Any transit or site damage (chips) to panels can be repaired but the remedial material, being of a different composition, usually apparent, particularly if a clear sealer is being used.

10.2.3 There is the propensity for hairline cracking to occur from the corners of any openings in ALL precast concrete when the panels are stressed during craneage in the plant, transportation to or during installation on site. Even when temporary steel bracing is installed in panels with large openings prior to leaving the factory, surface cracks from corners of openings may occur despite all precautions being taken to prevent them. While these cracks do not affect the structural integrity - typically not more than 1 mm deep - they are often a concern to the client and remedial work will in most cases be visible.

10.2.4 As with any type of concrete, the mix can vary slightly in colour from batch to batch. If a consistent, blemish-free surface is required, then a vapour-permeable masonry paint or stain should be considered. We strongly recommend that designers and their clients visit the Wilco factory and view typical Litecrete panel surfaces prior to the start of manufacture.

10.3 Exterior maintenance

External coating systems must be maintained in accordance with the respective manufacturer's instructions and all damage repaired promptly to ensure the ongoing weathertight properties of the coating system and thermal performance of the Litecrete wall. In addition to these system-specific requirements, the following general maintenance procedures must also be implemented:

- Any dirt accumulation or organic growth that may occur should be regularly removed from the external surface by cleaning with warm water and detergent and a soft bristled broom.
- Solvent-based cleaners must not be used.
- The external cladding system should be checked yearly for damage to the system itself, deterioration of seals and possible water entry at junctions and joints.
- Any damage to the coatings which does occur must be repaired in accordance with the manufacturer's instructions. Where exterior plaster finish systems are used, it may be necessary to recoat the top paint coating, after 8-15 years, in accordance with the manufacturer's instructions, to restore the visual appearance.

Photo shows typical surface figuring on a Litecrete panel

10.4 Internal Surface finishing

Some designers specify Litecrete panels in their natural (raw) state as the finished interior wall surface, to achieve an "industrial" or "honest" ambiance. Be aware that the interior face of the panel has a rougher, trowelled finish (U3) as opposed to the exterior face, which is off a smooth steel mould. Because Litecrete is manufactured from natural materials no one panel is exactly the same colour and variations must be accepted from one batch of concrete to another. Litecrete recommend that the trowelled exposed interior panel surface has a 1-2 mm thick cementitious skim coat (eg Mapei Planitop 200) as the base, which can then be finished with paint or plaster systems. If the panels are to be plastered, control joints should be installed over each vertical panel joint so that they can cope with any seismic or structural movements without fracturing the plaster *(see detail D18)*. We strongly recommend that designers and their clients visit the Wilco factory and view typical Litecrete panel surface finishes prior to the start of panel manufacture. If the Litecrete panels are to be left exposed on the internal face a matt finish sealer should be applied to prevent dusting of the surface and prevent grime build-up, particularly around light switches, etc.

10.5 Weld Plates

Often weld plates are specified by the engineer to connect panels at corners or to attach suspended panels, such as garage door lintels, between walls. They are installed on the internal face of the panels and in most cases are hidden by ceilings, etc. However, sometimes for structural design reasons they will be visible. If requested, the weld plates can be rebated 20mm deep into the surface of the Litecrete panel so that they can be plastered over after being welded together. See detail *D21 Typical Cast-in Weld Plates – Flush and Recessed.* When exposed, the plates can be treated with "Fishoilene" brand rust inhibitor (which smells a bit for a few days) or similar which results in a charcoal grey ("blued") colour.

10.6 Internal Lining

Plasterboard.
Plasterboard can be either glue-fixed direct to Litecrete panels, or attached to timber battens fixed to the walls. Use Sikacil C or Selleys Liquid Nails (or similar) adhesive in beads at 250mm centres. Lining materials can be screw fixed into 40 x 20 mm vertical timber battens attached to Litecrete panels at 600 mm centres. The battens provide a cavity for the installation of through services. Coarse thread screws 32mm x 6mm are required at max 300mm centres around the sheet edges and at max 450mm centres horizontally and vertically within the body of the sheet, or as recommended by the manufacturer. The sheet/edge distance is usually a minimum of 12mm.

Insulating board
Aerated phenolic resin-based insulating board (Kingspan), with a plasterboard panel already attached, can be glue-fixed to the Litecrete walls. After joints are stopped the surface is painted or decorated to suit. Note that placing insulation on the inside of a concrete wall negates the benefits of thermal mass.

Adhesives
Adhesives used for the fixing of internal linings must be suitable for use on lightweight concrete surfaces. Approved products are: Sikacil C, Fullers Maxbond, Gib® Allbond, Holdfast Gorilla Glue and Selleys Liquid Nails.

Ceramic tiles
Litecrete provides an excellent surface for the direct fix of ceramic tiles for wet areas, etc.

10.7 Attaching Fittings/Cabinets to Walls

When attaching such items as mirrors, towel rails, picture supports, shelves or light fittings to any Litecrete wall, mechanical fasteners should be used. Do not use nails. We suggest fasteners such as Mungo brand (or similar) MN10 x 50 mm long metric screw, from Powers Fasteners Ltd. For heavier objects, such as kitchen cabinets, M8 Ramset Chemset Anchors or similar should be used. These fixings should be installed strictly in accordance with their respective manufacturers' recommendations.

Rough-sawn timber finish on Awhitu beach house panels