



Construction Issues relating to
Prestressed Rib and
Timber Infill Floors

Prepared by
Precast New Zealand Incorporated

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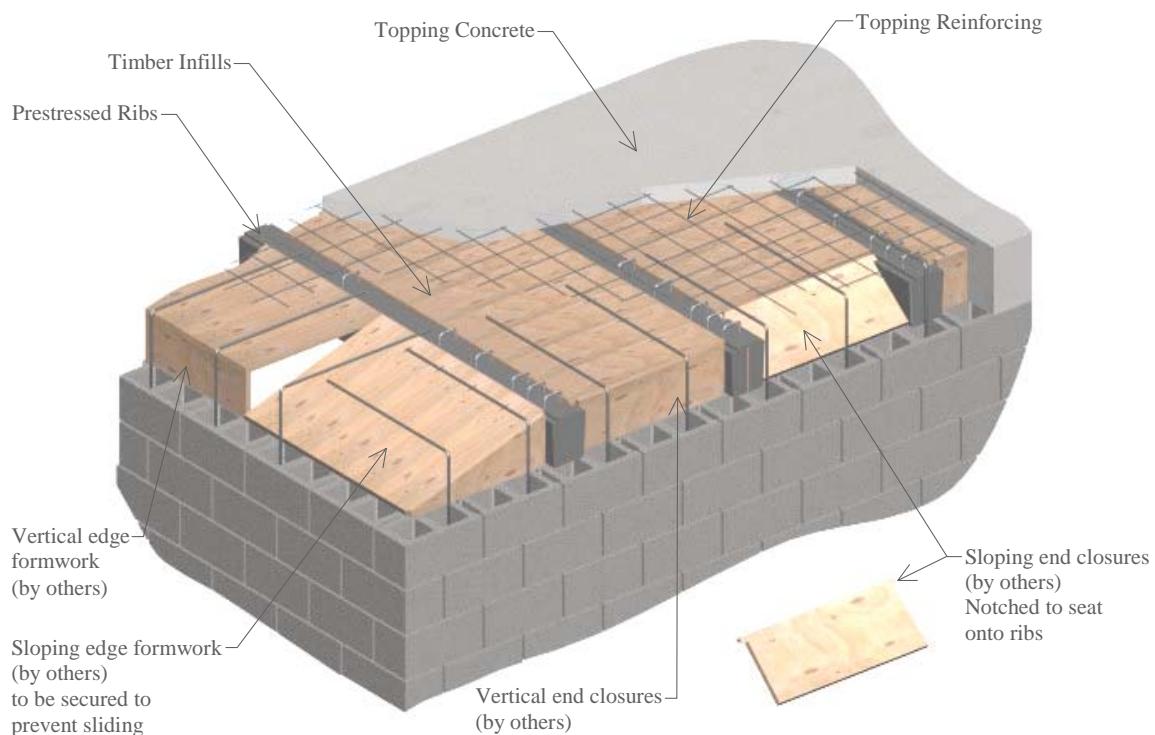
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1.0 BACKGROUND

Since rib and infill floors were introduced to the New Zealand construction industry over 30 years ago, there have been significant changes to the way building sites are run. These changes include a move towards principal contractors filling a coordination role with subcontractors providing an increasing input to the total project.

With this shift towards subcontracting has come tightening margins and fragmented responsibility. Subcontractors are typically smaller, with less resources. There appears to be a lessening of skills in some areas which is accentuated by the cyclical nature of the construction industry and there is a growing need for training newcomers to the industry.

In recognition of the need for this training together with recognition of the importance of safety on building sites, Precast New Zealand has prepared this guide to installation of rib and timber infill flooring systems.



DETAIL OF TIMBER INFILL FLOOR

Showing typical details for sloping and vertical end closures and edges of bays

Notes regarding issues and procedures relating specifically to rib and infill flooring and our recommendations follow :-

2.0 TEMPORARY PROPPING

The minimum amount of propping required will be shown on the layout drawings prepared by the supplier. The propping for rib and infill floors must be in place prior to placing the components. Additional propping will be required to accommodate construction or other loads if they will exceed the capacity of the floor system or components at any stage during construction.

3.0 PLACING THE RIBS

The ribs should be spaced by placing a precut timber infill or spacers between adjacent ribs at each end. The ribs should be spaced as specified and to achieve maximum possible seating of the timber onto the ribs otherwise movement due to people working on the floor could cause the infills to lose seating and fall through. This is an important safety issue.

900 mm nominal spacing is the norm and floor suppliers provide timber infills cut to a standard length to suit this spacing. The ribs have a side taper and their width varies slightly with their depth. The precise centre to centre spacing of the ribs may vary slightly with different rib depths.

The slight variations in rib spacing with rib depths are accommodated when cutting the last row of timber infills to fit the particular bay width.

If the precise spacing of ribs is critical, for instance where they are to fit into preformed pockets, the floor supplier should be informed at the time of placing the order.

Long slender concrete ribs are flexible and can be placed with horizontal deflections. These should be straightened before the timber infills are placed otherwise some timber infills may need to be cut to fit to accommodate horizontally bowed ribs. If ribs are left with horizontal or vertical deflections either during storage, transport or when placed on the job, concrete creep can cause the deflections to increase and become permanent.

4.0 PLACING THE TIMBER INFILLS

The placers must reject any timber infills with knots or any other defects exceeding 25% of the width of the board or any with defects which may cause them to fail under a 120 kg load at mid point. This is an important safety issue.

Additional timber is supplied to cover some wastage. If insufficient, the builder should contact the supplier as soon as possible with an estimate of the additional quantity required.

The timber infills should be placed square and tightly together.

Timber left exposed to the sun for a period will tend to curl and shrink. The time between placing the infills and placing the concrete topping should be as short as possible to minimise these exposure effects.

If infills have curled and or shrunk, due to long exposure, they can be covered with plastic sheeting prior to placing the concrete to prevent grout loss. If this is done, it is important to ensure the plastic is kept clear of the tops of the ribs as it would impair bond between the concrete topping and the ribs.

5.0 SUPPLY OF TIMBER

The specifier should ensure the type of infill is suitable for the intended use. This includes type of timber, treatment of it and finishes. Rough sawn radiata pine treated to H3 will normally be supplied. If other timber, finishes, or treatment is required, it should be made clear to the supplier prior to quoting. Refer also to section 9.0 regarding the use of dressed timber.

Precast flooring suppliers purchase their infills in bulk from timber suppliers.

Only by purchasing large quantities of one standard size can precasters offer timber at a competitive price. They have no advantage for purchasing other timber, sections or non standard lengths. For small quantities or non standard lengths or sections, or for different timber, the builder may be able to purchase at better rates from their own sources.

Precasters can give competitive prices for their concrete ribs and standard infills. Quantities of other timber to be used for end closures, side formwork etc may not be precise and may depend on construction methods and procedures used by the individual placers. Precasters do not include supply of any timber other than standard cut to length infills in their quotation.

If labour only subcontractors are to place the floor components, the builder needs to allow to supply whatever other timber is required.

6.0 FINISHING OFF AT THE ENDS OF THE RIBS

Standard length timber infills to seat onto the rebates at the top of precast ribs are normally included in the precasters quote.

The builder should allow to supply all other timber required. This will include any timber required for vertical formwork around the perimeter. End closures are vertical formwork to beams or walls. They are not of standard infill length and they must accommodate the particular rib depth. Their length will vary in angled bays. They are not included in the precasters price.

In rectangular bays, it is sometimes possible with shallow ribs to notch the last timber infill so one edge seats between the rebates in the two ribs and the other edge seats onto the supports effectively forming a sloping end closure.

The last timber infill in each row between two ribs will normally have to be cut to width to fit the length of the ribs.

Vertical formwork around the perimeter of the floor may be untreated timber if it is to be stripped off after use.

7.0 TIMBER INFILLS FROM THE LAST RIB IN A BAY

Floors are normally set out by spacing the rib nearest the side support to suit a full length timber infill. Subsequent ribs are spaced using standard length infills and the last infill is cut on site to fit the width of the particular bay and the precise module.

Timber infills seated between ribs are contained between rebates or wire cages to prevent them moving. The timber infills at each edge of a bay may seat onto a wall or a beam at one end and are not contained. They may also be sloped down to seat onto the top of formwork or a wall. In these cases they need to be fixed to prevent them sliding off the rib. This is an important safety issue.

The precise fixing method used depends on the particular circumstances and is normally determined by the builder with the tradesmen or subcontractors involved. It may involve battens and nailing, concrete nails, or other fixing methods.

8.0 TOPPING REINFORCING

Placing the topping reinforcing over the timber infills as soon as possible after placing the timber is a valuable safety precaution, particularly where other work is to take place on the floor such as placing beam reinforcing.

Topping reinforcing should be placed over the area of the floor when the timber infills have been placed and prior to other people working on that surface. If beam reinforcing is to be placed after the floor components, the reinforcing needs to cover the area of timber infills and leave the beam formwork accessible. The topping reinforcing will need to be repositioned after the beam reinforcing is placed.

This involves extra work which is resisted by subcontractors bidding minimum prices but it is an important safety issue which not only affects those placing the floor components, but also other trades following on.

The use of reinforcing spaced at more than 150 mm in the commonly used reinforcing mesh is less satisfactory as the gaps become large enough for a person's foot to go through.

Where the designer wishes to use ductile reinforcing in the topping, ductile mesh or a mat formed from reinforcing bars may be used.

Very large sheet sizes are less convenient and therefore less likely to be used effectively.

The use of large reinforcing spacing and very large sheets is a cost issue but it impacts on safety and the builder should be aware of the increased risk and take steps to minimise this.

9.0 EXPOSED FLOOR SOFFITS AND DRESSED TIMBER

Where the underside of the floor is to be left exposed dressed timber infills are sometimes used.

The prestressed ribs are manufactured as a structural item and manufacturing processes are geared around this. They are not sold as architectural precast concrete. They will normally have a smooth off steel mould finish but may have surface or other defects which are acceptable for their structural function. If a higher standard of finish is required, the builder should allow to touch up the surface defects to the standard required.

There are examples of timber infill floors exposed in carparks showing the standards normally obtained without special finishing work.

If a higher standard is required, it may involve bagging to fill surface holes or plastering the top edge on which the timber seats, to fill any chips or irregularities in the formed rebate.

If dressed timber is to be used, the effects of reducing the timber thickness need to be considered. Reducing the thickness from 25 mm to 18 mm will halve the strength and nearly treble the deflection.

The builder, the workers and the end user need to be aware of this and special care needs to be taken or thicker infills specified.

If dressed timber is to be used, it is recommended that the timber be dressed one face and both edges and the exposed corners chamfered about 5 mm. Leaving one face undressed minimises the loss of thickness and the chamfered edges emphasize the joint while making variations in seating level less obvious. It is very important to ensure the boards are square and tightly butted together.

Dressing the edges reduces the coverage of the infills. The cost of machining, the greater number required to cover the same area and the greater reject rate all increase the cost.

Using thicker timber will reduce deflections but carries a significant cost penalty.

TG & V infills can be used, but again one face need not be dressed. The even greater reduction in area covered by each infill impacts further on cost.

Dressed infills can be coated prior to use. This coating can carry a timber stain if required. Coating has the advantage of sealing the timber against water and concrete staining and reducing the effects of exposure. If TG & V timber is to be coated, the tongue and groove should be machined with a greater than normal clearance because the coating can reduce clearance and make tight fitting difficult.

If a good standard of finish to the underside without grout or concrete runs or staining is required, allowance should be made to have the underside of the floor hosed and brushed during placing of the concrete topping and again immediately on completion. This still applies when coated timber is used. Plastic sheeting can be laid over and fixed to the infills to reduce the grout loss but it must be kept clear of the tops of the ribs.

10.0 NON STANDARD SPACING

Where wider than standard spacing is used, the timber infills may require temporary propping.

Because only standard infill lengths can be economically supplied by the precaster, non standard infill lengths will normally have to be cut on site. Infills for wider spacing will be cut from random lengths of timber, and narrower spacing may be cut from either random lengths or standard infills.

Non standard spacing has an impact on costs. Not only is there the additional on site labour for cutting, but longer infills may involve extra propping while closer rib spacing results in additional precast ribs.

Structural design standards and fire ratings are based around 900 mm rib centres.

11.0 OTHER SAFETY ISSUES WITH TIMBER INFILLS

Supply of timber in some areas is limited to fast growing and weaker plantation timber of poorer quality than was formerly available

This lead to concern regarding the safety of the traditional 25 mm thick infills for the people working on the floors.

Different manufacturers have adopted different responses.

Some have reduced the spacing of the ribs below 900 mm so the infills span a lesser distance.

Others have increased the infill thickness, some by going from 25 mm to 28 mm which gives a 25% increase in strength, while others are using 40 mm thick infills.

In some areas the suppliers are more confident about the quality of timber they are able to source and have chosen to retain the 25 mm timber infills and 900 mm rib spacing.

The differences can affect the floor configuration or finished thickness and details should be obtained from the particular supplier.

12.0 SEATING RIBS INTO PREFORMED POCKETS OR LEDGES

A floor with the ends fully built in and unable to rotate or slide at the support will have significantly less deflection than a floor with the ends of the ribs seated into preformed pockets or onto preformed ledges where movement can take place as a result of load changes or temperature fluctuations. Movements at the supports can have very damaging effects on both the ribs and the supports and special steps should be taken to counter this where ribs are seated into preformed pockets or onto preformed ledges.

To minimize movement at the supports, it is common to pack the vertical gaps between the ends of the ribs and the face of the support with high strength drypack mortar or fill with a high strength and preferably non shrink grout.

This work should be completed while the floor is fully propped and before the concrete topping is placed. Care must be taken to ensure movement of the ribs does not occur to damage the integrity of the packing before it is up to strength and the floor topping is completed.

13.0 BUILDERS CHECK LIST

Has allowance been made :-

- For additional timber around the perimeter, end closures, side formwork, forming steps etc ?
- To have the temporary propping in place prior to placing the floor components.
- For temporary propping where required for longer infills ?
- For touching up of the ribs if a higher standard of finish is required ?
- To pack behind the ends of ribs if seated into preformed pockets or ledges ?
- For additional propping if loads during construction will exceed the capacities of the ribs or infills ?

If dressed timber is being used, are the client and placers aware of the implications of this ?

Has the placer allowed to:

- ⇒ Reject unsuitable infills during installation
- ⇒ Cut the last infill in each row to suit the lengths of the ribs
- ⇒ Cut and fix end closures if required
- ⇒ Cut one row of infills in each bay to suit the bay width
- ⇒ Fix infills to prevent sliding where not seated between cages or rebates in ribs
- ⇒ Cut all infills to all non standard rib spacings
- ⇒ Place more infills if they are dressed or TG & V
- ⇒ Provide a higher standard of finish if exposed. Tight joints and aligned infills.
- ⇒ Wash and brush the underside if the underside of the floor is to be left exposed.
- ⇒ Provide on site touching up of the ribs if a higher standard of finish is required.
- ⇒ Place 150 mm mesh over the timber infills prior to other workers using the floor or to provide precautions against workers falling through.

END OF DOCUMENT