Rib and In-fill

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Product brochure

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Rib & In-fill

Concrete and timber for a light and versatile suspended flooring system

Stahlton's Rib and In-fill flooring system incorporates pre-stressed concrete ribs, permanent formwork and an in situ concrete topping to give an extremely lightweight and versatile suspended floor. This system is an economical alternative to timber floors while achieving good sound transmission and fire ratings. It has been used in residential and some commercial projects since the 1960's.

The Rib and in-fill system is particularly suited to fit complex geometrically shaped foot prints of residential and commercial projects. They can easily be made to suit irregular shapes and angles, to provide adjustment to the module to trim openings or areas of higher loads, or to accommodate penetrations. The in-fills provide an excellent space for fixing services such as electrical wiring, lights, plumbing and ceilings hangers.

The Stahlton Engineered Concrete Rib and in-fill system is easy to transport and has been used extensively throughout Australasia. Stahlton's Ribs are typically placed at a 900mm module and comes 25mm depth increments from 100mm to 300mm deep. Temporary propping is normally required.

PRECAST NEW ZEALAND INC CERTIFIED PLANT

At Stahlton, we pride ourselves on providing our customers quality, safety driven, products and services. All Fulton Hogan businesses are ISO9001 certified and our Stahlton Auckland and Christchurch plants have been certified by Precast New Zealand Incorporated.

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General

Stahlton Engineered Concrete supplies Rib & in-fill to any location in New Zealand. Stahlton Ribs have a 150mm (Auckland) or 170mm (Christchurch) wide soffit and is available in varying standard depths in 25mm increments from 100mm to 300mm, typically installed at 900mm spacing. Timber in-fills can be visually appealing client selected timbers if they are left exposed. Timber in-fills are generally 200x25mm thick rough sawn pinus radiata, No.1 framing grade, treated to specification H3.2, cut to modular length. Other materials and types and grades of timber can be used including plywood, TG&V, stained and coated dressed timber.

Acoustic rating

The Stahlton Engineered Concrete Rib & in-fill spaced at 900mm centres, with 25mm thick timber in-fill and a minimum 75mm depth of topping concrete, will provide a Standard Transmission Class (STC) rating of 52dB. If a 9.5mm thick suspended ceiling is placed a minimum of 100mm below the ribs a STC rating of 55dB is achievable providing any gaps, eg. recessed lighting, is insulated and limited to one every 8m^2.

Rib & Infill Acoustic Rating

Rib depth (mm)	STC	R_w	D_{nTw}	STC	R_w	D_{nTw}
		75mm topping concrete			plus suspended ceiling	
100	52	53	55	55	54	56
300	52	54	56	60	60	62

Durability

Stahlton Rib & in-fill meet exposure classifications A1, A2, B1 & B2 as per table 3.6 in NZS3101:Part1:2006 for a 50 year life.

Thermal rating

Estimated thermal resistance rating (R rating) for Stahlton ribs at 900mm spacing with 25mm thick pinus radiata timber in-fills and 75mm thick concrete topping is 0.23 Rm^2 °c/w. Higher ratings can be achieved by placing polystyrene on the in-fill providing a structural link and thermal bridge between rib and topping concrete for a composite floor system.

This value is a guide only. If further information is required please contact Stahlton.

Rib & in-fill thermal rating

Concrete Normal density	Timber Softwood	Expanded Polystyrene	R rating (m^2 °c/w) per 100mm thickness
0.045	0.77	2.77	

Fire rating

New Zealand Standards require a minimum of 95 mm of concrete for a 1.5 hour fire rating and 110 mm for a 2 hour fire rating. Variations are permitted in the case of specific proprietary systems where a complete floor is constructed and then fully loaded and subjected to a full scale controlled fire test carried out by an approved authority to an acceptable standard.

Stahlton Rib & in-fill systems have been extensively tested within New Zealand by BRANZ and overseas by the Commonwealth Experimental Building Station. On the basis of these tests, Stahlton timber infill floors qualified for a fire rating of 2 hours with 90 mm of topping and 1.5 hours with 75 mm of topping. Fire ratings in excess of this are also available.

Consulting Engineers

Loadings

Generally common loadings used on residential, office and apartment buildings are suitable for Stahlton Rib & in-fill floor systems. The Load-Span tables assume that there is **maximum strand**, the floor is temporarily propped, and loads are uniformly distributed. Self-weight of the floor system applied with load factors of 1.2G and 1.5Q as per AS/NZS1170.0 have been allowed for in the design analysis, noting that ultimate demands tend **not** to govern. For serviceability, tensile bottom fibre stresses are limited to $0.5^*\sqrt{f'c}$ when short term live load factor, ψs = 0.7, deflections are limited to span/400, vibration limits to meet domestic/office use with damping ratio of 0.05 allows for full height partitions. Simply compare your unfactored superimposed live + dead load with the allowable shown on the table. Please note high dead loads will induce higher creep values than expected. Also loads as per cl 3.4.2(a) AS/NZS 1170.1 2002 have not been allowed for. If this is the case, please contact Stahlton for further advice.

Additional capacity to sustain additional point and line loads can be achieved using Ribs butted together, call up as "double ribs". However, significant loadings should be checked by a Stahlton Engineer at a preliminary design stage.

Intended unfactored loads and load factors should be clearly shown on the Consultant's drawings to avoid any confusion throughout the shop drawing and design process. Contact Stahlton Technical Department if you have special loading cases for design advice.

End seating

All Stahlton Rib & in-fill flooring systems requires a minimum of 75mm or span/180, whichever is greater, seating on concrete walls or beams. If concrete supports are armoured or on steelwork the end seating can be reduced by 15mm as per cl 18.7.4 NZS 3101:Part1:2006. A construction tolerance of 10mm needs to be added to these figures. Stahlton recommends the use of low friction bearing strips under the ends of the ribs. Stahlton do design steel cazaly hanger brackets that are cast into the ends of the Stahlton Ribs to allow the ribs to span between beams rather than seating directly on the beam. If the Stahlton Rib is 150mm deep or greater and with 100mm minimum topping concrete, Stahlton offer our innovative Zeus© Hanger Bracket.

Durability

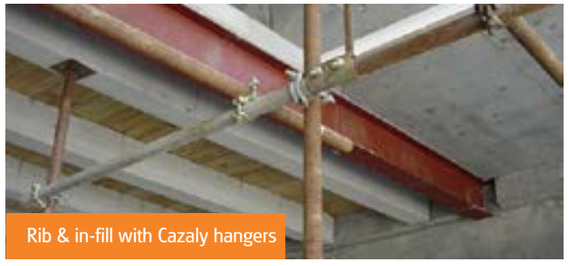
Stahlton Rib & in-fill meet exposure classifications A1, A2, B1 & B2 as per table 3.6 in NZS3101:Part1:2006 for a 50 year life.

Topping

The topping concrete strength should be specified as a minimum of 25MPa as per cl 5.2.1 NZS 3101:Part1:2006. Floor reinforcement and saddle bars should be designed and shown on the Consulting Engineer's drawings. Steps in the topping can be formed using suitable density polystyrene on the in-fills, however the extra topping thickness needs to be accounted for as a gravity load, as well as the benefit of added stiffness, and allowed for in the design.

In-house design

Our capable in-house design team is led by our National Technical and Design Manager. We work with structural designers to provide an economical and bespoke design specifically for the needs of each structure and load case. Our National Technical and Design Manager is a Chartered Professional Engineer, signing off every shop drawing and provides a Producer Statement for the design (PS1) for every product Stahlton designs for your project. Through regular quality audits as part of our ISO9001 Certification Stahlton also provide Producer Statements for the Manufacture (PS3 & PS4).



Rib & in-fill with Cazaly hangers

Cazaly hanger sitting on plastic bearing strip

Contractors

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Temporary propping

Temporary propping is usually required for Stahlton Rib & in-fill to maintain bottom fibre stress limits and control deflections during construction. Under standard uniformly distributed loadings temprary propping would be expected for spans exceeding 2.5m for 100mm ribs and 6m for 300mm deep ribs. However the contractor is advised to secure the deeper ribs from rolling due to uneven construction loads. A suitably qualified Engineer will need to be consulted for the design of the propping system.

As a guide up to 7m span will need 1 row of props, 7m to 10m span 2 rows and beyond 10m span 3 rows. Precambers to set the level of the props to will be provided on a our shop drawing. Propping should be in place prior to placing the ribs on-site.

For multiple storey buildings back propping should be in place for a minimum of 2 levels below the level being constructed or to solid ground. Load on the "back-props" from the finished floors should be relieved, remaining snug, prior to the props supporting the level being constructed take wet concrete topping load.

The propping can be removed when the topping concrete strength has reached 15MPa.

Camber

Stahlton Ribs may arrive at site with some camber(hog). This is unavoidable due to the nature of pre-stressing. The amount of camber will depend on a number of factors, including amount of prestress, time since the units were manufactured and exposure to the elements and length to name a few variables. Propping set to the required precamber (hog) will eliminate the camber variations between ribs with the weight of the wet concrete topping. As a rule of thumb allow 2mm precamber for every 1m of span. Generally we predict in the design of the floor system that long term deflections will provide a near flat suspended floor. Please contact Stahlton if you have any queries.

Handling & storage

Stahlton Ribs are to be lifted either at the ends or 1/5th of the length from each end depending on the pre-stress level, depth and length of the rib. Specifically designed ifting chains and hooks or lifting clutches can be used to lift the units. The Stahlton Ribs will arrive on site with provision for hooks or lifting clutches. These anchoring points should be used without substitution. All lifting gear should be checked for any wear or damage regularly as concrete elements can be abraisive.

Stahlton Ribs need to be dunnaged near the lifting points if stored on site. The dunnage blocks need to be aligned on top of each other so as to not induce large point loads on the units below.

Care needs to be taken as to the suitability of the ground the units are stored on and should be checked by a suitable qualified engineer.

Handling weights for Stahlton Rib & in-fill

Rib depth (mm)	Unit wt (kg/m)
100	46
125	57
150	69
175	81
200	93
225	105
250	118
275	131
300	144

Penetrations & fixings

An Information Bulletin IB95 Drilling, Cutting or Forming Holes in Suspended Concrete Floor Slabs, published by CCANZ, is available on the Stahlton website. Stahlton recommend this document is read and adhered to.

Stahlton Rib & In-fill spaced at 900mm centres can have penetrations up to 700mm wide and core drilled through the in-fill section of the floor system. Coring through the ribs should be avoided due the concentration of critical reinforcement. If a rib and strand is cut on-site, temporary prop either side of the penetration immediately, then contact Stahlton Engineered Concrete as a design check wiill need to be done to ascertain whether the unit is still structurally sound.

Fixings can be drilled into Stahlton Ribs using a hammer drill or "dyna-drill', maintaining minimum edge distances and avoiding the strands to gain adequate embedment. Advice should be sought from the fixing manufacturer as to the suitability and the load carrying capacity of their products in Stahlton Ribs.

The infill sections of Stahlton Spaced Hollowcore are the ideal place to accommodate penetrations and services. Care should still be taken with placing of penetrations so as not to cause weakness in the floor diaphragm. Fixings can be made into the timber infill for light loads or into the topping concrete for heavier loads. These fixings should be checked by a suitably qualified engineer. Refer to drawings.

Rib & in-fill units on a Stahlton yard

Rib & in-fill units in place on site

Product data sheet

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Rib & in-fill flooring

Rib and in-fill flooring system incorporates prestressed ribs, permanent formwork infills (usually timber) and an insitu concrete topping to give an extremely lightweight and versatile suspended floor relative to other concrete systems. Temporary propping is usually required.

Stahlton's Rib & infill are nominally 200mm wide and manufactured in depths from 100 to 300mm in 25mm modules. Usually the ribs are spaced at 900mm centres.

Our lighter Rib and Infill floor system provides benefits by reducing foundations and support structure,ideal for difficult sites where access is a challenge. For concentrated loads ribs at closer centres can provide even more capacity.

On your drawings call up Stahlton Rib & In-fills as eg. "150mm Stahlton ribs @ 900crs, 250mm0/A". Implies 25mm timber and 75mm depth topping concrete on 150mm deep Stahlton ribs @ 900crs spacing.

Rib & in-fill load/span table (Indicative only).

Unfactored maximum superimposed live load (Qb) in kilopascals (kPa), (assuming no superimposed dead load ie. SDL = 0kPa).

75mm of 25MPa topping concrete on rough sawn 25mm thick pinus radiata timber in-fills on ribs spaced at 900mm centres.

Rib depth (mm)	Self wt (kPa)	Simply supported span (m)														
		4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	10	11	12	13	14
100	2.6	10.3	7.0	6.0	4.0	3.5	2.0									
125	2.8		10.8	7.6	6.7	5.5	4.3	3.7								
150	2.9				8.3	6.4	5.5	4.8	4.0	3.5						
175	3.0						8.4	6.4	5.5	4.8	4.0	2.5				
200	3.2							8.8	7.3	6.3	5.5	4.0	2.5			
225	3.3								9.0	7.8	6.5	4.5	3.0			
250	3.5									8.9	8.0	6.0	4.0	3.0		
275	3.6										9.5	7.0	5.0	3.5	2.5	
300	3.7											8.5	6.5	4.5	3.5	2.0

Product data sheet

Unfactored maximum superimposed live load (Qb) in kilopascals (kPa), (assuming no superimposed dead load ie. SDL = 0kPa).

100mm of 25MPa topping concrete on rough sawn 25mm thick pinus radiata timber in-fills on ribs spaced at 900mm centres.

Rib depth (mm)	Self wt (kPa)	Simply supported span (m)														
		4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	10	11	12	13	14
100	3.2	13.4	9.1	7.8	5.2	4.5	3.3									
125	3.4		14.1	10.3	7.8	7.2	5.6	4.8								
150	3.5				10.8	8.5	7.2	6.2	5.2	4.6						
175	3.7						11.0	8.3	7.2	6.2	5.2	3.2				
200	3.8							11.4	9.5	9.5	7.2	5.2	3.2			
225	3.9								11.7	10.1	8.5	5.9	3.9			
250	4.1									11.6	10.4	7.8	5.2	3.9		
275	4.2										12.4	9.1	6.5	4.6	3.3	
300	4.3											11.1	8.5	5.9	4.6	2.6

Notes regarding load/span tables:

1. Consideration needs to be given to special vibration requirements and long term creep effects due to higher superimposed dead loads. Contact Stahlton's technical people for guidance.
2. The Load Span tables assume loads are uniformly distributed. Consideration is required for shear actions enduced from point loads. Again, conctact Stahlton's technical people for advice.
3. Theoretical cambers have been limited to span/400. Consider higher cambers for situations close to the tabulated load limits.
4. Refer to Stahlton's website www.stahlton.co.nz for more information.
5. Rib sections do vary slightly in width and depth depending on factory location. Refer "Typical Rib & In-fill Section" for this information.
6. The actual prestress used and the capacity of the floor varies according to the design load specified.

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Rib & In-fill section properties

Section properties are based on 900mm rib spacing with 25mm timber plus a 75mm concrete topping. Composite section modular ratio = 0.67.

			Bare Unit					Composite unit				
Rib depth (mm)	Unit wt (kg/m)	Overall depth (mm)	A $x10^3mm^2$	Y_b mm	I $x10^9mm^4$	Z_b $x10^6mm^3$	A' $x10^3mm_2$	Y_b' mm	I' $x10^9mm^4$	Z_b' $x10^6mm^3$	Z_t' $x10^6mm^3$
100	46	200	18	52	0.013	0.250	65	134	0.193	1.44	2.92
125	57	225	22	65	0.026	0.400	69	151	0.277	1.83	3.74
150	69	250	27	77	0.046	0.597	74	167	0.383	2.29	4.61
175	81	275	32	90	0.074	0.822	79	184	0.508	2.76	5.58
200	93	300	36	102	0.111	1.088	83	200	0.658	3.29	6.58
225	105	325	41	115	0.159	1.383	88	214	0.835	3.90	7.52
250	118	350	46	127	0.225	1.772	93	230	1.037	4.51	8.64
275	131	375	51	140	0.295	2.107	98	240	1.270	5.29	9.41
300	144	400	57	152	0.388	2.553	103	256	1.553	6.07	10.78

Rib & in-fill important information

End Seating

Stahlton Rib flooring requires a minimum, and the greater of, 75mm or L/180 seating onto unarmoured concrete beam or wall.

A construction tolerance of up to 15mm needs to be compensated for as per cl.18.74 NZS3101:Part 1:2006. Stahlton and the code requires the use of low-friction bearing strips.

Temporary propping

Stahlton Rib flooring does usually require propping. As a guide spans 3 to 7m require 1 row, 7 to 10m 2 rows and greater than 10m 3 rows of props. Refer to the safe operating procedure for propping of timber in-fills.

Camber

Stahlton Ribs will arrive on site with a positive camber or "hog". This is unavoidable due to prestressing. Hogging will vary and be influenced by the amount of prestress required to resist the induced loads, length and age of the units exposed to the elements.

Handling & storage

Stahlton Ribs are designed to be lifted using hooks and chains to strand lifting eyes located at ends or length divided by 5 from each end. Ribs need to be dunnaged as close as possible to the lifting location and with blocks in line with the block below, on solid and even ground. Ensure lifting equipment is regularly checked.

Penetrations

Stahlton Rib & in-fill flooring does allow flexibility for accommodating penetrations up to 700mm wide through the timber section and avoiding the ribs. If a strand is cut through rib on site, place a prop either side and contact Stahlton's Technical Department for a design review. Also refer to our standard drawings for acceptable details for attaching fixings to the soffit of the ribs.

Specifications

Drawing call-up

To specify the Stahlton Rib & in-fill system on your drawings, we suggest you use the following designation:

Stahlton depth Rib at 900 spacing with 25mm thick timber in-fill

For example if the project is to be made from 100mm deep Stahlton Rib with a 75mm topping, then the specification would read:

Stahlton 100mm Rib at 900 with 75mm topping (200mm o/a)

Written specification clauses

Stahlton Rib & in-fill products in general comply with the following standards:

(i) NZS 3101:2006 'Concrete Structures Standard Part 1 & 2'

(ii) NZS 3109:1997 'Concrete Construction'

(iii) AS/NZS 4671:2001 'Steel Reinforcing Materials'

(iv) BS 5896:1980 'Specification for High Tensile Steel Wire and Standard for the Prestressing of Concrete'

Design

(i) The design of Stahlton Rib & in-fillshall be in accordance with the requirements and recommendations of NZS 3101:2006 'Concrete Structures Standard Part 1 & 2' and/or any recognised international Standard or part thereof, for example BS 8110:2007 'The Structural Use of Concrete'.

(ii) The prestress strand pattern in the Stahlton Rib & in-fill shall be designed to sustain the loadings shown on the Consulting Engineer's drawings and allowance will be made for self weight of the unit, timber in-fill and topping concrete.

(iii) The Stahlton Rib & in-fill shall be designed for exposure classification A1/A2/B2/B2 as per table 3.6 in NZS 3101:2006.

(iv) The Stahlton Rib & in-fill unit shall have a FRR (Fire Resisting Rating) of 90/90/90. Penetrations through the flooring system shall be reinstated to the required FRR by an approved fire protection system.

(v) Stahlton Rib & in-fill shall be designed to have a maximum crack width of 0.3mm under full live load conditions.

(vi) The acoustic STC (Sound Transmission Class) and IIC rating of the floor system shall meet or exceed 52dB as tested at a registered institution or a field test of 50dB measured in 'on-site conditions'. These ratings apply to the finished floor system, including any carpeting and suspended ceiling systems.

(vii) The Stahlton Rib & in-fill units shall have a minimum of 75mm end seating or L/180, whichever is greated, as per clause 18.74 in NZS 3101:2006 plus tolerance of 15mm if seated on an unarmoured concrete beam.

Materials

(i) Concrete shall be specifically mixed depending on environmental conditions and should have a 28 day cylinder strength of 45MPa as a minimum.

(ii) All concrete shall show signs of thorough compaction otherwise rejected if repair cannot be undertaken to bring the unit back to the original specification.

(iii) An air entraining agent complying with BS EN 934-2-2001 may be included in the concrete mix to improve workability.

(iv) The strand reinforcement used in Stahlton Rib & in-fill shall be 9.6mm, 11.3mm, 12.7mm or 12.9mm diameter complying with the requirements of AS/NZS 4671:2001.

(v) Prestressing strand shall be clean and free from deleterious substances. Superficial rust is acceptable, however strand with corrosion that has caused surface pitting shall be rejected for the main longitudinal reinforcement of the unit.

Manufacture

(i) Materials, execution of stressing prestress strand and workmanship of the Stahlton Rib & in-fill units shall conform with Stahlton Engineered Concrete ISO 9001 Quality Assurance Operating Procedures.

(ii) Stahlton Rib units shall be nominally 170mm wide and made in the following nominal depths: 100mm, 125mm, 150mm, 175mm, 200mm, 225mm, 250mm,275mm, 300mm.

(iii) The top surface of the Stahlton Rib & in-fill unit shall have a nominal roughness of 5mm or more as stipulated in NZS3101:2006 clause 18.5.4.1(a).

(iv) The tolerance for length of the Stahlton Hollowcore units shall be in accordance with NZS 3109 Table 5.1 (usually +/- 10mm).

Handling, protection & placing units

(i) The Rib units shall to be designed to sustain all lifting stresses.

(ii) The Rib shall be lifted only at the lifting position as nominated by the manufacturer.

(iii) Rib units shall be handled using certified lifting hooks or clutches. Chain angles must not exceed 30 degrees to the vertical and must be checked regularly for wear and tear.

(iv) Dunnage used for storing the Rib units needs to be of suitable quality and placed on 'good' ground at the correct points in from the end of the units.

(v) Where units are stacked one above the other, bearing dunnage shall be positioned in vertical lines.

(vi) The Rib shall be handled and placed according to references contained in the Occupational Safety & Health approved code of practice entitled 'Safe Handling, Transportation and Erection of Precast Concrete'

(vii) The units shall not be damaged in any way including chips and cracks during the erection and placing phase. Any damage should be brought to the attention of the supervising Engineer immediately.

Temporary propping

(i) Design of temporary propping, back propping, bracing systems and ground conditions to support prop loads shall be carried out by a suitably qualified Engineer.

(ii) Propping shall not be removed until the topping concrete has reached at least 60% of the 28 day strength.

(iii) It is the Contractor's responsibility to ensure the propping system used on site meets the criteria as detailed in the aforementioned design and any additional requirements shown on the Stahlton Engineered Concrete drawings.

(iv) All proposed systems with supporting calculations shall be submitted to the Specifying Engineer prior to erection on site for approval.

Topping concrete

(i) The top surface of the Rib & in-fill units shall be clean and free of all dust, oil or any deleterious substances which may adversely affect the wet topping bond to the Rib & in-fill units.

(ii) Pre-wet precast concrete surfaces prior to placing the topping concrete.

(iii) Free water shall be broomed away before the topping is applied.

(iv) Topping reinforcement shall be laid and supported to the Specifying Engineer's requirements and shall be supported to prevent displacement during concreting.

(v) Topping concrete shall have a maximum aggregate size of _____ (normally 13mm) and a 28 day strength of _____ (minimum of 25MPa) and be well compacted with mechanical vibrators.

(vi) Topping concrete shall be poured to a true surface so that the specified thickness of _____ (minimum of 75mm) is achieved at the centre of the span. The key-ways between each Rib & in-fill unit must also be filled with well-compacted topping concrete.

(vii) In-situ concrete shall be cured by the application of an approved curing membrane or by being kept continuously wet for not less than seven days.

Fixings & penetrations

(i) Fixing to the Rib & in-fill units shall be in accordance with the approved details only and shall not impair or reduce the strength of the unit in any way.

(ii) Documentation of tested fixings proposed for the project shall be submitted to the Specifying Engineer prior to installation.

(iii) Penetrations, setdowns or chases to the Rib & in-fill unit or topping concrete shall be in accordance with the details agreed by the Specifying Engineer and the Rib & in-fill manufacturer prior to any work being undertaken on site.

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