BUSCK
PRESTRESSED CONCRETE LTD

Uniplanx

Product Brochure

Busck's Uniplanx flooring system is made up of pre-stressed concrete ribs, permanent formwork and an in-situ concrete topping resulting in a lightweight, versatile, composite suspended floor. Temporary propping is usually required.

They can easily be made to suit complicated shapes and angles, adjusting spacings to trim openings, to support higher loads and accomodate for services. The space between ribs creates a convenient zone for attaching mechanical services.

Busck's Ribs typically are placed at a 900mm spacing and come in 25mm depth increments from 125mm to 250mm deep. Accelerated curing inside steel moulds allow ribs to be made on a daily production cycle to save you time in your program.

ECAAS ISO 9001 CERTIFIED QUALITY MANAGEMENT

concretenz PRECAST CERTIFIED PLANT

Busck's operations are ISO9001 certified as well as being Certified Plants meeting the high standards set by Concrete NZ.

Architects

General

Busck Prestressed Concrete has grown to the extent that it is now one of the largest precasting operations in New Zealand. Busck also influence the industry delivering high quality performance and standards throughout New Zealand from our plants in Whangarei and Ashburton. Busck precast work ranges from small, niche architectural housing to large, technically challenging commercial and infrastructure projects.

Busck Uniplanx ribs have a 200mm wide soffit in standard depths in 25mm increments between nominally 125mm to 250mm deep to the underside of the in-fill that fits neatly into a formed rebate to prevent potential movement of the in-fill during construction. The ribs are typically spaced at 900mm centres.

Timber In-fills

Busck usually supply 200x25mm thick rough sawn pinus radiata, No.1 framing grade, treated to specification H3.2, cut to modular length. Customer selected species and grades of timber can be used including plywood, tongue and groove, stained and coated dressed timber. Other materials like tray steel decking or compressed fibre sheet are also options. A specific design is required to ensure the in-fills safely support all construction loads. Busck's Uniplanx ribs have a formed rebate for the in-fill to fit into to eliminate the risk of them slipping off the ribs.

Thermal Rating

Estimated thermal resistance ratings for Uniplanx with 75mm concrete topping on 25mm timber in-fills = 0.20m^2.°C/w, plus associated materials are:

Thermal ratings:	
Material (mm)	R rating/100mm thick (m^2.°C/w)
Concrete	0.045
Timber	0.77
Expanded poly.(type2)	2.77
Gypsum plasterboard	0.62

Surface Finishes

NZS3114:1987 prescribes the descriptions and tolerances for formed finishes "F1" to "F6" and manual finishes "U1" to "U11"eg. "U5" for broomed rough top surface quality. Concrete surfaces are influenced by quality of vibration, trowelling and mould material used in production. Cost increases as the expectations of the quality of the surface improves.

Uniplanx generally achieves, at worst, "F4" soffit finish off a steel mould and "U1" screeded slightly roughened top with R10 topping ties to provide good connection with the topping concrete. Contractors should allow for bagging the underside to receive an exposed painted finish.

Fire Rating

Three elements define the fire rating of concrete units in accordance with section 4 of NZS3101:2006.

1) Insulation – thickness of concrete and other materials that separate occupancies in the building.

2) Integrity – the criteria of integrity are considered satisfied if the precast element meets the criteria of both insulation and structural adequacy for that period.

3) Structural adequacy – section geometry of the concrete element, distance from the surface to the centre of the reinforcement and/or strand called "axis distance" and continuity at the supports.

Specified in the form eg. 60/60/60 for a 60 minute fire rating. Seek advice from fire protection suppliers in regards to their tested products when detailing fire rated penetrations through precast elements.

Standard Uniplanx ribs with 75mm topping achieve a minimum of 60 minutes fire rating.

Contact Busck for solutions to increase fire rating.

Acoustic Rating

A major benefit of concrete floors are that they are quiet because they do not creak under load or with changes in temperature.

125 Uniplanx plus a minimum 75mm depth of topping concrete on 25mm thick rough sawn timber in-fills, will provide a Sound Transmission Class (STC) rating of 53dB. If a suspended ceiling using 9.5mm gypsum plasterboard is framed to the underside a STC rating of 54dB is achieved providing any gaps, eg. recessed lighting, is insulated and limited to one every 5m.

Uniplanx + topping Acoustic Rating									
Rib depth (mm)	STC rating	R_w	D_{nTw}	STC rating	R_w	D_{nTw}	STC rating	R_w	D_{nTw}
	75mm topping concrete (dB)			plus suspended ceiling (dB)			plus absorption (dB)		
125	53	54	56	54	55	57	66	66	68
250	53	54	56	58	59	61	66	67	69

Consulting Engineers

Load-Span Tables

Load-Span tables provide the maximum recommended uniformly distributed unfactored superimposed live load for the corresponding span, allowing for maximum number of strand and the floor is temporarily propped. Uniplanx floor systems are well suited for superimposed loadings typically used in residential, office and apartment buildings. Self-weight of the floor system plus superimposed dead load of 0.5kPa is applied along with load factors of 1.2G and 1.5Q as per AS/NZS1170.0 in the design analysis, noting serviceability limits usually govern. For serviceability:

- Tensile bottom fibre stresses are limited to $0.5*\sqrt{f'c}$.
- Short term live load factor, $\Psi s = 0.7$.
- Deflection limit is lesser of span/500 or 10mm sag long term.
- Vibration limit meet domestic/office use with a damping ratio of 0.05 (full height partitions).

You have options to thicken the topping concrete or the Uniplanx ribs to maintain a recommended maximum span/depth ratio of 32 for simply supported spans. For more vibration sensitive type uses in-service with few partitions, damping ratio=0.025, then we suggest a span/depth ratio of 27 is adopted, unless the span has continuity at one end at least.

All specified unfactored loads should be clearly stated on the Consultant's drawings. We recommend significant point & line loads should be checked by a Busck Engineer during the design phase of your project. High dead loads induce higher creep deflection values so if this is the case, please contact Busck's technical people for further advice. Concentrated loads as per cl 3.4.2(a) AS/NZS 1170.1 2002 have not been allowed for.

Seating

In accordance with cl18.7.4.3 NZS 3101:2006 amendment 3 Unipanx flooring systems require a minimum of 75mm end seating after tolerances on support structures. A construction tolerance of 10mm is recommended to be added to these figures.

Clause 18.7.4.3. also provides guidance for more seismically ductile supporting structures to allow for elongation, spalling, shrinkage and temperature effects that may result in longer seating length being required.

All units are to bear on low friction bearing pads or strips with a maximum in-service coefficient of friction of 0.7.

Cast in steel cazaly hangers can be designed by Busck to provide the option of ribs spanning between the beams.

Topping Concrete

Topping concrete is typically specified with a minimum compressive strength of 25MPa after 28 days standard curing as per cl 18.5.5.1 NZS 3101:Part1:2006. Reinforcement is designed and detailed by the projects design engineer. Changes in topping thickness formed on-site

and rib spacings greater than 900mm need to be accounted for as additional gravity load, as well as the potential variation in stiffness, allowed for in the design.

Cantilevered Uniplanx is cast with reinforcement to connect with the topping concrete to form what is essentially permanent formwork. The topping reinforcement over the support, designed by the projects design engineer, provides all the strength.

Design Self Weight including topping concrete

Uniplanx ribs self-weight of varying depths are:

Uniplanx + topping Weights		
Rib depth (mm)	75 topping (kPa)	100 topping (kPa)
125	2.9	3.5
150	3.0	3.6
175	3.2	3.8
200	3.4	4.0
225	3.6	4.2
250	3.7	4.3

Durability

Busck's precast concrete products are typically manufactured with the strength and cover to reinforcement to achieve 50 year design life in exposure classifications A1, A2, B1 & B2 prescribed in section 3 of the New Zealand standard NZS3101:Part 1:2006. Longer design life and/or precast concrete elements in environmentally more extreme environments, such as bridges in coastal marine areas are achievable.

Busck Technical Support

Our own National Technical and Design Manager has a wealth of precast industry experience working with design consultants to provide the most economical solution to a bespoke design specifically for the needs of your project. A Chartered Professional Engineer with Engineering NZ who leads our **ISO9001** certificated quality system process of signing off every shop drawing and provides a Producer Statement for the design (PS1) for every product Busck designs. Experience and capability flows to our factory operations leaders who are proud to maintain **Concrete NZ Plant Certification** for Busck who also provide Producer Statements for the Manufacture (PS3) & by arrangement Manufacture Monitoring (PS4).

Contractors

Temporary Propping

Busck Uniplanx usually requires temporary propping designed by a suitably qualified engineer employed by the contractor.

As a guide 75mm Uniplanx from 3m up to 7m span will need 1 row of props, 7m to 9m span 2 rows. Propping lines locations, equally spaced with supporting members, and precambers to set the height of the props will be shown on our shop drawing. Props are to be in place prior to placing the Uniplanx on-site.

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

Propping can be removed when the topping concrete strength has reached 15MPa and we suggest you consult your ready-mix concrete supplier for test results.

Cambers

Due to the nature of prestressing Busck Uniplanx may arrive at site with a slight camber. In most cases this is unavoidable. Amount of camber depends on a number of factors including; unit length, practicality of stacking, level of of prestress, the days since units were manufactured, the heat of sun & environment to name a few variables. The weight of wet topping and propping set to the prescribed precamber (hog) should eliminate the camber variations or bring the units down onto their supports. Our designers generally predict the Uniplanx floor system will be near flat long term. Please contact the Busck Technical people if you have any queries.

Safety Alert Timber In-fills

At Busck our highest priority is safety, including beyond our factory gates. Busck Uniplanx timber-in-fills have a maximum clear span of 750mm during construction. Timber being a natural material is prone to hidden defects and a wide range of strength properties. We encourage contractors to be prudent in rejecting timber in-fills with visual defects greater than ¼ of the width of the board and we will replace these if necessary. We also recommend on-site personel resist stepping on the in-fill until topping reinforcement is layed on the working platform.

Refer to our Safety alert for the use of Timber In-fills found on our website: www.busck.co.nz

Handling and Storage

Busck Uniplanx are cast with lifting eyes made from strand offcuts, either located 1/5th of the length from each end or 300mm from each end. Specifically designed lifting chains and hooks are to be used to lift the units. These lifting points should be used without substitution. All lifting gear needs to be certified and regularly checked for any wear or damage as concrete elements can be abrasive.

Busck Uniplanx, if stored on-site, need to be dunnaged near the lifting points and dunnage blocks need to be aligned directly 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 bearing capacity of the ground the units are stored on.

Handling weights of Busck Uniplanx:

Uniplanx rib Weights	
Rib depth (mm)	Self weight (kg/m)
125	76
150	91
175	106
200	126
225	143
250	159

Drilling Penetrations and Installing Fixings

Busck strongly recommends, before any holes are drilled through the suspended floors, contractors read and follow the process described in Information Bulletin IB95 "Drilling, Cutting or Forming Holes in Suspended Concrete Floor Slabs", published by Concrete NZ. This document is available on the Busck website.

Busck Uniplanx floor system easily accomodates for penetrations core drilled between the ribs. Fixings can be installed in specific locations by coordinating the locations with unit cross-sections (refer to our shop drawings) to avoid strand so as to not reduce the floor system's capacity. To maintain durability a zone of 20mm cover to the side of the strand must remain.

If an unintended strand is cut on-site, immediately place a temporary prop either side of the penetration, then contact Busck to obtain a design check confirmation to declare the unit is still structurally sound.

Holes for fixings can be drilled using a hammer drill or "dyna-drill' into Busck Uniplanx, ensuring you maintain minimum edge distances, spacings as well as avoiding the strands to achieve the required embedment. If in doubt seek advice from the fixing manufacturer as to the suitability and the load carrying capacity of their products in Busck Uniplanx.

Early coordination will allow ribs to be designed with additional pre-stressing strands to allow for potential increased rib spacing. Be aware there are limits to adding prestress if the ribs are already at their prestressing limit and extra prestress does induce more camber in the Uniplanx rib.

Uniplanx Tables

Busck's Uniplanx flooring incorporates pre-stressed concrete ribs at 900mm centres typically with 25mm thick timber in-fill formwork to support in-situ concrete topping slab to give a light, cost effective composite suspended floor. Temporary propping is normally required.

Uniplanx are made and accelerated cured on a long steel bed to allow ribs to be made in any achievable length, shape and depth on a daily production cycle.

Busck's Uniplanx come in 25mm depth increments from 125mm to 250mm deep.

Uniplanx Flooring **Product Data Sheet**

Temporary propping is required for spans greater than 3.0m for the 125mm Uniplanx and for longer spans for deeper Uniplanx.

On your drawings call up Busck Uniplanx as eg. "Busck 125 Uniplanx at 900crs, 220mm overall"

Span is calculated by adding the average end seating to the clear span = distance between centre of the seating.

Spans beyond the heavy **black line** exceed depth<span/32, not recommended for simply supported end conditions.

Values to the left of the **green line** (depth<span/27) meet vibration limits for residential and office occupancies where the damping ratio is 0.025.

Add 5% to the maximum spans if continuity applies at one end, 10% if continuity applies both ends.

Uniplanx Load/Span Tables (indicative only).

Uniplanx ribs at 900crs with 25mm timber in-fills and 75mm topping concrete (25MPa).

Unfactored maximum superimposed live load (Q_b) in kilopascals (kPa), allowing for superimposed dead load **SDL = 0.5kPa**.

Rib	Self wt	Simply supported span (m)														
depth (mm)	(kPa)	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5
125	2.9	15.0	12.1	9.5	7.4	5.3	4.6	2.5								
150	3.0			11.8	9.2	7.8	7.0	5.5	4.4	2.6						
175	3.2				12.2	9.3	7.2	6.5	5.7	4.6	3.0	2.6				
200	3.4					12.6	9.9	9.0	7.9	7.0	5.6	4.4	3.5			
225	3.6							10.5	9.6	8.1	7.1	5.8	4.9	3.9	3.5	
250	3.7								11.2	9.1	7.4	6.7	5.9	4.8	3.9	3.3

Uniplanx ribs at 900crs with 25mm timber in-fills and 100mm topping concrete (25MPa).

Unfactored maximum superimposed live load (Q_b) in kilopascals (kPa), allowing for superimposed dead load **SDL = 0.5kPa**.

Rib	Self wt	Simply supported span (m)																
depth (mm)	(kPa)	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5
125	3.5		14.4	11.3	9.0	7.2	5.6	3.6	3.0	1.5								
150	3.6				11.7	10.0	7.9	7.0	4.8	3.3	2.5	2.0						
175	3.8					10.8	8.6	8.1	6.8	5.5	4.3	3.2	2.4					
200	4.0						12.7	10.1	8.4	7.7	6.6	5.8	4.1	3.4	2.4			
225	4.2							12.3	10.0	8.8	8.1	7.2	6.4	4.6	4.0	3.0		
250	4.3								12.3	10.5	8.8	7.6	6.9	6.1	5.0	3.8	3.0	2.3

Note: As a guide 1 row of props required for spans greater than 3.0m for 125 ribs, 4.5m for 250 ribs, 2 rows for spans greater than 7.0m, 3 rows for spans greater than 9.5m.

NB:

Refer to the technical literature contained in this document to be informed on the criteria of which these tables are based upon. Please contact the Busck Technical people if you have any queries.

Uniplanx Section Properties

Section properties are based on Uniplanx ribs at 900crs with **75mm topping concrete**.

			Bare unit				Composite unit				
Rib depth (mm)	Rib weight (kg)	Overall depth (mm)	A $x10^3mm^2$	Y_b mm	I $x10^6mm^4$	Z_b $x10^6mm^3$	A' $x10^3mm^2$	Y_b' mm	I' $x10^6mm^4$	Z_b' $x10^6mm^3$	Z_t' $x10^6mm^3$
125	76	220	31.4	71.3	52.1	0.73	78.6	138.6	309.0	2.23	3.78
150	91	245	37.9	83.8	85.5	1.02	84.4	153.3	424.6	2.77	4.64
175	106	270	43.8	96.6	131.5	1.36	90.3	168.0	568.3	3.38	5.57
200	126	295	50.4	109.9	193.0	1.76	96.7	182.3	739.3	4.06	6.56
225	143	320	57.1	123.0	270.9	2.20	103.3	196.3	941.5	4.80	7.61
250	159	345	63.5	136.0	368.6	2.71	109.6	210.3	1175.4	5.59	8.73

Section properties are based on Uniplanx ribs at 900crs with **100mm topping concrete**.

			Bare unit				Composite unit				
Rib depth (mm)	Rib weight (kg)	Overall depth (mm)	A $x10^3mm^2$	Y_b mm	I $x10^6mm^4$	Z_b $x10^6mm^3$	A' $x10^3mm^2$	Y_b' mm	I' $x10^6mm^4$	Z_b' $x10^6mm^3$	Z_t' $x10^6mm^3$
125	76	245	31.4	71.3	52.1	0.73	94.5	154.2	427.2	2.77	4.70
150	91	270	37.9	83.8	85.5	1.02	100.3	169.8	570.5	3.36	5.70
175	106	295	43.8	96.6	131.5	1.36	106.2	185.2	746.4	4.03	6.80
200	126	320	50.4	109.9	193.0	1.76	113.0	199.8	955.5	4.78	7.95
225	143	345	57.1	123.0	270.9	2.20	119.2	214.5	1198.2	5.59	9.18
250	159	370	63.5	136.0	368.6	2.71	125.5	228.9	1477.3	6.45	10.47

Specifications

Drawing call-up

To specify the Busck Uniplanx system on your drawings, we suggest you use the following designation:

Busck depth Uniplanx at spacing, overall depth

For example if the project is to be made from 150mm deep Busck Uniplanx rib at 900 centres with a 75mm topping, on 25mm timber in-fill, then the specification would read:

Busck 150 Uniplanx @900mm, 245mm o/a

Written specification clauses

Busck Uniplanx products in general comply with the following standards:

(i) NZS 3101:2006 'Concrete Structures Standard Part 1 & 2' Amendment 3.

(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'

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 Busck Uniplanx shall be 9.6mm or 12.7mm 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.

Design

(i) The design of Busck Uniplanx shall 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 Busck Uniplanx shall be designed to sustain the loadings shown on the Consulting Engineer's drawings and allowance will be made for self weight of the ribs and topping concrete.

(iii) The Busck Uniplanx shall be designed for exposure classification A1/A2/B1/B2 as per table 3.6 in NZS 3101:2006.

(iv) The Busck Uniplanx ribs shall have a FRR (Fire Resisting Rating) of 60/60/60. Penetrations through the flooring system shall be reinstated to the required FRR by an approved fire protection system.

(v) Busck Uniplanx 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 53dB measured in 'on-site conditions'. These ratings apply to the finished floor system, including any carpeting and suspended ceiling systems.

(vii) The Busck Uniplanx ribs shall have a minimum of 75mm end seating or L/180 per clause 18.7.4.3 in NZS 3101:2006 A3 plus tolerance of 10mm if seated on an unarmoured concrete beam.

Manufacture

(i) Materials, execution of stressing prestress strand and workmanship of the Busck Uniplanx ribs shall conform with Busck Prestressed Concrete ISO 9001 Quality Assurance Operating Procedures.

(ii) Busck Uniplanx ribs shall be nominally 200mm wide and made in the following nominal depths 125mm, 150mm, 175mm, 200mm, 225mm or 250mm.

(iii) The top surface of the Busck Uniplanx ribs shall have a nominal roughness of 5mm free of laitance or as stipulated in NZS3101:2006 clause 18.5.4.1(a).

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

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 15MPa.

(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 Busck 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 Uniplanx ribs shall be clean and free of all dust, oil or any deleterious substances which may adversely affect the wet topping bond to the Uniplanx ribs.

(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.

(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.

Fixing & Penetrations

(i) Fixing to the Uniplanx ribs shall be in accordance with the approved details only and shall not impair or reduce the strength of the rib 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 Uniplanx rib or topping concrete shall be in accordance with the details agreed by the Specifying Engineer and Busck prior to any work being undertaken on site.

Timber In-fills

(i) Timber in-fills shall be 200x25mm thick rough sawn pinus radiata, No.1 framing grade, treated to specification H3.2.

(ii) Other client selected species and grades of timber and materials can be used provided a specific design is carried out to ensure in-fills support all construction loads.

Whangarei

8 Fraser Street
Whangarei 0110
phone: 09 438 3059

Ashburton

7 Malcolm Mcdowell Road
Ashburton 7772
phone: 03 928 8013

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email: info@busck.co.nz
BUSCK website: http://busck.co.nz/