BUSCK
PRESTRESSED CONCRETE LTD

Unispan

Product Brochure

Busck Prestressed Concrete Ltd supplies Unispan throughout New Zealand. Unispan is manufactured to a standard width of 1225mm and 2400mm in our Whangarei and Ashburton operations.

Unispan typically is 75mm thick. It is also available in varying standard depths in 25mm increments 75mm to 150mm to provide the thinnest floor system.

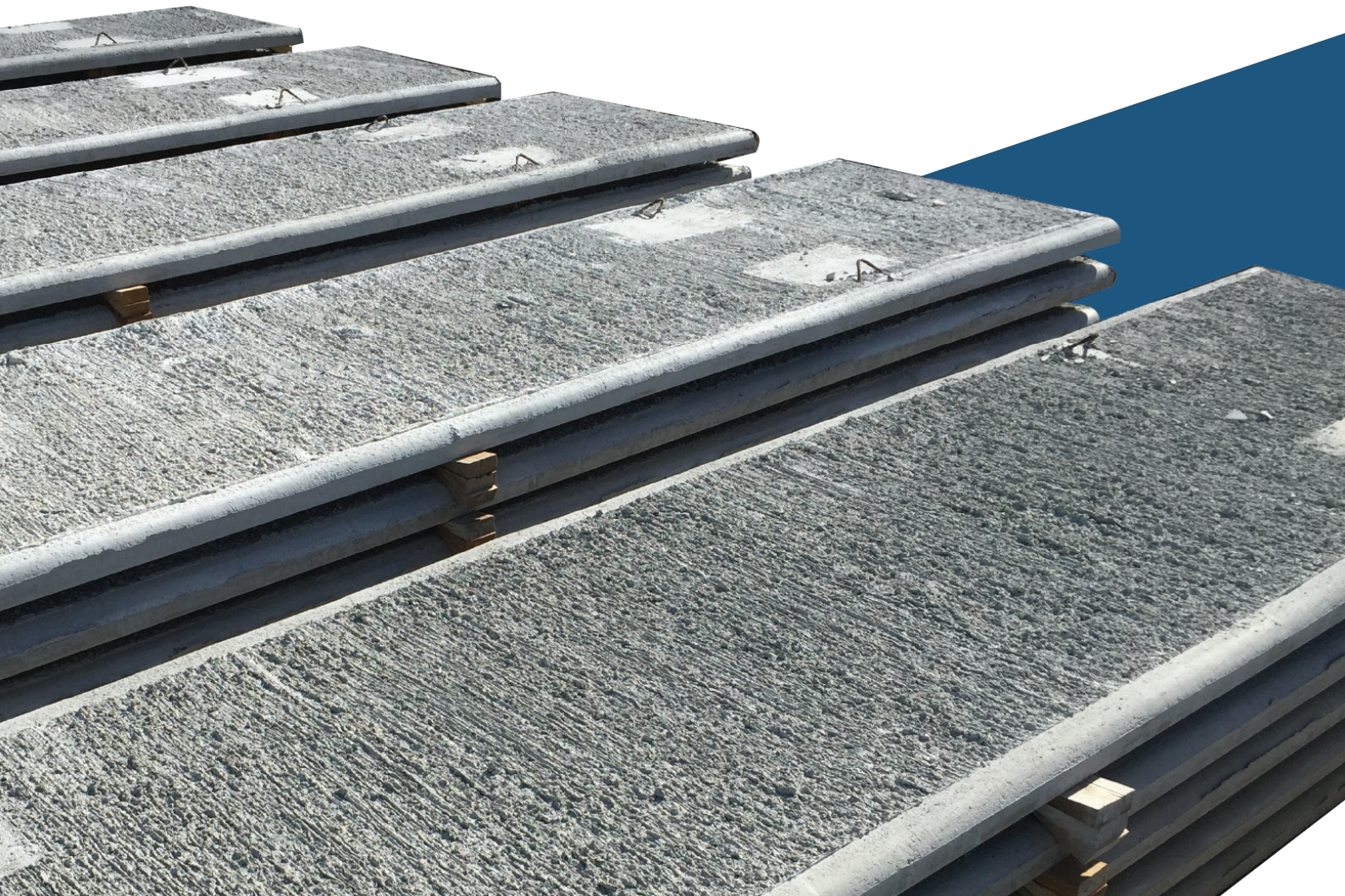
The manufacturing process allows the shape to be flexible within the standard width and achievable lengths to suit your building.

They are made and accelerated cured on a long steel bed to allow units to be made in any achievable length, shape and thickness on a daily production cycle.

ECAAS
ISO 9001 CERTIFIED
QUALITY MANAGEMENT

concretenz
PRECAST
CERTIFIED PLANT

Busck's operations are ISO900 certified as well as being a Certified Plant 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 influences 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's Unispan flooring system incorporates propped prestressed concrete slabs designed in-house. Unispan allows easy and fast placement by crane to provide an instant working platform. With the addition of an in situ concrete topping, gives a suspended floor with a flat, steel formed soffit.

Unispan is ideal to form cantilevered balconies. Temporary propping is usually required for spans greater than 2.5m.

For spans greater than 6.0m (span/depth < 40 = 150mm overall) and less than 8.0m the option is to specifiy 75mm Unispan with thicker toppings to maintain the span/depth ratio as a guide. For greater spans and/or higher loads Busck manufacture 100, 125 or 150mm Unispan units.

Unispan provides architects with the thinnest prestressed concrete floor system commonly found in residential and smaller commercial buildings.

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.

Unispan plus a minimum 75mm depth of topping concrete, will provide a Sound Transmission Class (STC) rating of 55dB. If a suspended ceiling using 9.5mm gypsum plasterboard is framed to the underside a STC rating of 58dB is achieved providing any gaps, eg. recessed lighting, is insulated and limited to one every 5m.

Unispan + topping Acoustic Rating

Overall depth (mm)	STC rating (dB)	STC with ceiling (dB)
150	55	58
225	58	61

Thermal Rating

Estimated thermal resistance ratings for Unispan with concrete topping plus associated materials are:

Unispan + topping Thermal Rating	
Overall depth (mm)	R rating ($m^2.°C/w$)
150	0.09
175	0.11
200	0.13
225	0.15

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

These values are a guide only. If further information is required please contact the Busck Technical people.

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 Unispan achieves 60 minute fire rating. By increasing Unispan thickness and cover to strand higher fire ratings are possible. Contact Busck for solutions.

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.

Unispan generally achieves, at worst, "F4" soffit finish off a steel mould and "U5" broomed top roughened to 5mm amplitude to provide good bond with the topping concrete. Contractors should allow for bagging the underside to receive an exposed painted finish.

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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. Unispan 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 meets domestic/office use with a damping ratio of 0.05 (full height partitions).

You have options to thicken the topping concrete or the Unispan units to 100, 125 or 150mm to maintain a recommended maximum span/depth ratio of 40 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 35 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 Unispan flooring systems less than 190mm overall thickness require a minimum of 50mm end seating after tolerances on support structures. Greater thickness increases minimum seating to 75mm. A construction tolerance of 10mm is recommended to be added to these figures. Busck recommends a side seating of 25mm on edge walls is allowed for to eliminate gaps for in-situ topping concrete to fall through. Side seating is not necessary.

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.

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.

Topping Concrete

Topping concrete is typically specified with a minimum compressive strength of 25MPa after 28 days standard curing. Reinforcement is designed and detailed by the projects design engineer. Changes in topping thickness and in-situ strips formed on-site needs to be accounted for as additional gravity load, as well as the potential benefit of added stiffness, allowed for in the design.

Cantilevered Unispan 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 project's design engineer, provides all the strength.

Design Self Weight including topping concrete

Unispan floor units self-weight of varying thickness are:

Unispan + topping Weights	
Overall depth (mm)	Self weight (kPa)
150	3.8
165	4.1
175	4.4
200	5.0
225	5.6

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 operation 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 Unispan usually requires temporary propping designed by a suitably qualified engineer employed by the contractor.

As a guide 75mm Unispan from 2.5m up to 6m span will need 1 row of props, 6m to 8m span 2 rows. 150mm Unispan will need 1 row of propping for spans exceeding 5.5m. Propping lines locations, equally spaced with supporting members, and precambers to set the height of the props will be shown our shop drawing. Props are to be in place prior to placing the Unispan 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 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.

Topping Concrete

Care needs to be taken to not mound up the concrete in one place while pouring concrete as this can exceed normal construction loads.

Shorter spans can be poured level. For spans longer than 5m, topping concrete thickness should generally remain parallel with the camber of the Busck Unispan, unless instructed otherwise.

Cambers

Due to the nature of prestressing Busck Unispan 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 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 Unispan floor system will be near flat long term. Please contact the Busck Technical people if you have any queries.

Handling and Storage

Busck 75mm Unispan are cast with lifting eyes made from strand offcuts, usually located 1/5th of the length from each end. Thicker Unispan, depending on the pre-stress level, depth and length, may require lifters located near the ends of the Unispan units. 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 Unispan, if stored on-site, needs 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 Unispan:

Unispan Weights		
Unispan depth (mm)	Self weight (kg/m) 1.225m wide	Self weight (kg/m) 2.400m wide
75	245	480
100	306	600
125	383	750
150	459	899

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 Unispan can have penetrations core drilled through the unit and fixings installed in specific locations. Coordinate by referring to unit cross-sections on our shop drawings, avoiding strand that will reduce the floor system's capacity if cut. To maintain durability a zone of 20mm cover to the side of the strand must remain. In general, up to 20% of the strand can be cut in the end third portions of the span.

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 Unispan, 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 Unispan.

Early coordination will allow units to be designed with additional pre-stressing strands to allow for the removal of some strands. Be aware there are limits to adding prestress if the units are already at our prestressing limit and extra prestress does induce more camber in the Unispan unit.

Unispan Tables

Busck's Unispan flooring system incorporates pre-stressed concrete solid slabs with an in-situ concrete topping slab to give a cost effective, thin, composite suspended floor. Temporary propping is normally required.

Unispan can be used for cantilever balconies as permanent formwork. They are made and accelerated cured on a long steel bed to allow units to be made in any achievable length, shape and thickness on a daily production cycle.

Busck's Unispan typically are placed at 1225mm or 2400mm modules and come in 25mm depth increments from 75mm to 150mm deep.

Unispan Flooring

Temporary propping is usually required for spans greater than 2.5m for the 75mm Unispan and for longer spans for deeper Unispan.

On your drawings call up Busck Unispan as eg. "Busck 75Unispan with 75mm concrete topping".

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

Spans beyond the dark line exceed depth<span/40 where the maximum live load value provided implies continuity present at least at one end.

Values to the left of the green line depth<span/35 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.

Unispan Load/Span Tables (indicative only).

75mm Unispan + various topping concrete thickness

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

Topping depth (mm)	Self wt (kPa)	Simply supported span (m)									
		3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0
75	3.8	20.5	15.0	11.1	8.3	6.3	4.7	3.5			
90	4.1			13.2	10.0	7.6	5.8	4.4	3.1		
100	4.4					8.5	6.5	5.0	3.7	2.8	
125	5.0						8.3	6.4	4.9	3.7	2.5

Note: 1 row of props required for spans greater than 3.0m, 2 rows for spans greater than 6m.

75mm topping concrete on various depths of Unispan

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

Unispan depth (mm)	Self wt (kPa)	Simply supported span (m)											
		4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5
100	4.4	19.6	14.7	11.1	8.5	6.5	5.0	3.8	2.8				
125	5.0		18.3	15.0	12.9	10.2	9.5	7.5	6.0	4.8	3.2		
150	5.6				15.5	10.8	9.9	9.4	7.6	5.6	4.5	3.2	2.1

Note: Indicates propping not usually required for these spans.

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.

Unispan Section Properties

Section properties are based on standard widths of 2400mm of 75mm deep Unispan + various topping depths.

			Bare unit				Composite unit				
Topping depth (mm)	Unit 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' $x10^6mm^3$
75	480	150	179.5	37.4	84.4	2.26	317.0	69.2	583.0	8.42	7.22
90	480	165	179.5	37.4	84.4	2.26	343.8	76.1	776.3	10.20	8.73
100	480	175	179.5	37.4	84.4	2.26	361.7	80.8	926.4	11.47	9.83
125	480	200	179.5	37.4	84.4	2.26	406.5	92.5	1382.2	14.94	12.86

Section properties are based on standard widths of 2400mm of varying depths of Unispan + 75mm topping concrete.

			Bare unit				Composite unit				
Unispan depth (mm)	Unit 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' $x10^6mm^3$
100	600	175	239.5	49.8	200.8	4.03	361.7	81.0	927.8	11.45	9.87
125	750	200	299.5	62.0	393.5	6.35	406.5	93.0	1390.2	14.95	13.00
150	899	225	359.5	74.6	679.9	9.11	496.4	105.2	1987.1	18.89	16.58

Specifications

Drawing call-up

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

Busck depth Unispan with depth topping

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

Busck 100 Unispan with 75mm topping

Written specification clauses

Busck Unispan 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 Unispan 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 Unispan 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 Unispan 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 and topping concrete.

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

(iv) The Busck Unispan unit 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 Unispan 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 55dB measured in 'on-site conditions'. These ratings apply to the finished floor system, including any carpeting and suspended ceiling systems.

(vii) The Busck Unispan units shall have a minimum of 50mm end seating or L/180 per clause 18.7.4.3 in NZS 3101:2006 A3 plus tolerance of 10mm.

Manufacture

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

(ii) Busck Unispan units shall be nominally 1225mm or 2400mm wide and made in the following nominal depths 75mm, 100mm, 125mm or 150mm.

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

(iv) The tolerance for length of the Busck Unispan units 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 Unispan units shall be clean and free of all dust, oil or any deleterious substances which may adversely affect the wet topping bond to the Unispan 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.

(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 Unispan 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 Unispan unit or topping concrete shall be in accordance with the details agreed by the Specifying Engineer and the Unispan manufacturer prior to any work being undertaken on site.

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