Design principles and Assumptions

The design and use of concrete slabs that utilise ARMOURDECK™ 300 in composite construction may be carried out using either:-

- the relevant Australian and international Standards with the material properties derived from the composite testing as detailed in the following document, or
- the use of the Design Tables presented in this document.

The Design of composite slabs with ARMOURDECK™300 are based on the following assumptions:

Design Loads

The design loads for both strength and serviceability are based on the load combinations as defined in AS1170.0-2002. Under Ultimate Limit State (ULS) the load combination for strength are determined using an Imposed Action factor of 1.5 and a Permanent Actions factor of 1.2. The long term factors utilised for determination of the deflections are as detailed in AS1170.0.

Section and Material Properties

The ARMOURDECK™ 300 has the following nominal section properties based on a unit width of deck equal to one metre.

Thickness (t_{bm}) (mm)	Mass Area (kg/m^2)	Cross section Area (mm^2)	y_{cg} (mm)	Yield Strength (MPa)
0.75	8.64	1075	15.3	550
0.90	11.52	1435	15.3	550
1.00	12.79	1590	15.3	550

The bond strength between the concrete and the steel sheeting were determined through a test program conducted at the University of Western Sydney and assessed in accordance with "*Methods of Test for Elements of Composite Construction; Part 1: Slip-Block Test*", AS/NZS3600-2009 "*Concrete Structures*" and AS2327.1 "*Composite Structures*" to establish the characteristic design parameters for the ARMOURDECK™ 300 under composite action.

These characteristic design parameters were derived as

Mechanical resistance (H_r) kPa $\qquad\qquad$ 58 x √($t_{bm} f_c$)

Coefficient of resistance (μ) $\qquad\qquad$ 0.5,

$\qquad$ where $\quad t_{bm}$ is the base metal thickness (0.75 ≤ t_{bm} ≤ 1.0) and,
$\qquad\qquad\quad f_c'$ is the concrete strength (25 ≤ f_c' ≤ 40).

Positive Moment Regions

The strength of the composite slab and the generation of the presented tables are based on the following methodology along with the requirements of AS/NZS3600-2009.

Positive bending strength

Positive bending capacity is determined taking into account the partial shear connection theory as outlined in the methodology detailed in Design Booklet DB3.1 – Design of Composite Slabs for Strength (1998), where the positive moment capacity is dependent on the degree of shear connection as shown in Figure 1. The degree of shear connection is a function of the distance x from the end of the sheeting that is free to slip.
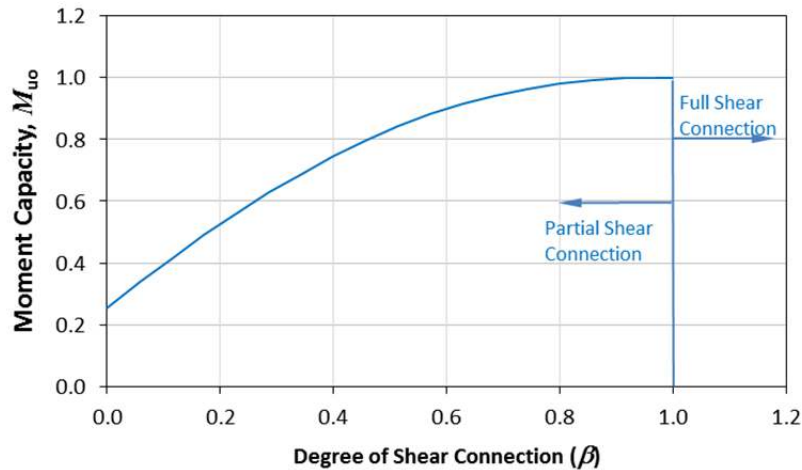

Figure 1 - Positive Moment Capacity Vs Degree of Shear Connection

Full shear connection (β = 1) occurs when the distance x from the end of sheeting that is free to slip to the point of assessment is greater than x_{csc} which is a function of the mechanical resistance (H_r) and the tensile capacity the steel decking.

Table 1 presents the Positive Moment capacities for the ARMOURDECK™ 300 for a number of slab thicknesses and concrete strengths. The capacity is expressed in terms of a unit metre width of slab. Also presented in this table is the required distance from an end to slip to develop the full moment capacity (x_{csc}).

Table 1 - Positive moment capacity ($M_{ou}{}^+$) (β = 1) (kNm/m) (I_{cr} x 10^6 mm^4)

Slab thickness D_c (mm)	Base metal thickness t_{bm} (mm)							
	0.75				1.00			
	f_c' (MPa)				f_c' (MPa)			
	25		32		25		32	
	$\phi M_{uo}{}^+$	I_{cr} x 10^6	$\phi M_{uo}{}^+$	I_{cr} x 10^6	$\phi M_{uo}{}^+$	I_{cr} x 10^6	$\phi M_{uo}{}^+$	I_{cr} x 10^6
100	34.8	37.42	36.7	34.22	42.2	45.74	45.5	42.02
120	45.3	60.47	47.2	55.13	56.2	74.48	59.5	68.19
140	55.8	89.50	57.7	81.41	70.2	110.9	73.5	101.3
160	66.3	124.6	68.2	113.2	84.2	155.2	87.5	141.4
180	76.8	166.0	78.7	150.5	98.1	207.4	101.5	188.7
200	87.3	213.6	89.1	193.4	112.1	267.8	115.5	243.3
220	97.8	267.6	99.6	242.0	126.1	336.5	129.5	305.3
240	108.3	328.0	110.1	296.3	140.1	413.5	143.4	374.7
250	113.5	360.6	115.4	325.6	147.1	455.1	150.4	412.2
x_{csc} (mm)	2180		1930		2520		2230	

Shear strength

The positive shear capacity is calculated in accordance with EN 1992-1-1:2004 Clause 4.3.2.3 and considers the partial connection theory.

Negative Moment Region

Negative bending strength

For the negative moment regions the sheeting is effectively in the compression region of the slab and consequently ignored, the impact of the small voids is also considered negligible in the determination of the bending strength. To determine the ultimate capacity in the negative region the provisions as outlined in AS/NZS 3600-2009 are utilised.

It is assumed that reinforcement for negative capacity is conventional N class reinforcement detailed in accordance with the relevant clauses in AS/NZS 3600-2009 treating the slab as a solid reinforced concrete slab. The reinforcement for negative bending is considered independent from the reinforcement that is required for crack control of the slabs.

Shear Capacity

For the shear capaity in neagtive moment regions the provisions from AS 3600 are utilised.

Deflections

The following tables are derived based on deflections resulting from loading applied in accordance with AS/NZS 3600:2009, and calculated using the methods outlined in AS3600-2009 Clause 8.5.3 – Beam Deflections by Simplified calculations.

Crack Control Reinforcement

Crack control reinforcement is determined in accordance with AS 3600-2009 Clause 9.4 Crack Control of Slabs. For the reinforcement in the negative moment regions it is recommended that smaller reinforcing bars that are suitably distributed over the region as specified in AS3600:2009 are utilised.

Fire Design

The provisions for positive reinforcement under fire conditions are based on a plastic collapse mechanism. Hence for the two or multiple spans the negative reinforcement is considered with the fire loads to determine the positive steel requirements to prevent the formation of a mechanism. The tables are developed based on a FRL 120/120/120.

For the design insulation and integrity of the composite slabs the minimum thicknesses of slabs are as defined in Table 2.

Table 2 – Minimum Slab Depth for Fire

FRP Minutes	Depth D (mm)
90	100
120	120

The tables assume that under the fire condition the steel decking does not contribute to the strength of the composite behaviour and is ignored. If additional positive reinforcement is required for fire it is assumed to have 50 mm cover from the soffit of the slab and is at least 85 mm from any rib.

ARMOURDECK™ 300 - Design Tables for Multi-span Composite Construction

The following Design Tables have been developed utilising 'Limit State' principles as detailed in AS/NZS 3600-2009 – Concrete Structures Standards, AS 2327.1 – Composite Structures Standard, AS36100 – Formwork for concrete, AS1170 – Structural Design Actions and AS4600 - Cold Formed Steel Structures.

The design spans and reinforcement are calculated using the defined superimposed permanent and imposed actions detailed for each table and all other required actions in accordance with AS1170 and AS2327.1.

The design parameters for various slab thicknesses are given at the top of each page for the corresponding end span and interior span table. The table presents the span from centre to centre, and the imposed loads. The positive composite design strength ϕM_{ou} for positive bending is given in Table 1 in the preceding page for the various base metal thicknesses.

The tables present the required amounts of reinforcement required in the negative moment region in mm^2/m and are determined on the basis of elastic analysis. If values are not present in the tables a generic solution is not valid based on input parameters. Big River may be contacted for further options.

The following assumptions are made in the presented tables.
- The type of construction is steel frame construction or equivalent
- There is a minimum support width of 100 mm at the permanent supports
- Multiple spans have equal spans, with the span measures from centre to centre of supports
- Concrete strength f'_c = 32 MPa
- Slab is designed for a unit width
- Concrete density is 2450 kg/m^3
- Classification is A1 exposure, with 20mm cover to reinforcement
- Slab deflection limits for L/250 for total loads and L/500 for incremental deflections are imposed
- Negative Reinforcement is D500N and extends at least L/3 beyond the edge of support and has 20 mm cover.
- 1/3 of negative reinforcement is to be continuous across the spans if the ratio of the live action to permanent actions exceeds 2.
- The negative reinforcement shown is additional to the required shrinkage reinforcement.

Table Parameters

In deriving the following tables it is assumed a unit width with the following assumptions and table parameters have been used:

- Slab deflection limits for L/250 for total loads and L/500 for incremental deflections are imposed.
- Deflections are calculated on the assumption that propped construction is utilised.

Design Loads

The type of construction is steel frame construction or equivalent

The tables have been generated on the basis of load combinations in accordance with AS/NZS 3600-2009:

$W_u = 1.2\,G + 1.5\,Q$

where $\quad G = G_{sh} + G_c + G_{sup}$

G_{sh} and G_c are based on defined geometry

$G_{sup} = 1.0$ kPa for all tables

It is assumed there is a minimum support width of 100 mm at the permanent supports

Material properties

The materials are assumed to comply with the requirements of AS/NZS 3600-2009 with the following assumptions made:

Concrete

f_c = 32 MPa

ρ = 2400 kg/m^3

Top Reinforcement

N Class Reinforcement

f_y = 500 MPa

Cover = 25 mm

Reinforcement extends at least L/3 beyond the edge of support

1/3 of negative reinforcement is to be continuous across the spans if the ratio of the live action to permanent actions exceeds 2

Short and Long Term Factors

Short–Term Factor ψ_s = 0.7

Long–Term Factor ψ_l = 0.4

Combination–Term Factor ψ_c = 0.4

Fire Reinforcement

N Class Reinforcement

f_y = 500 MPa

Cover = 25 mm

Shrinkage temperature Reinforcement

Assuming moderate Degree of Crack Control

L Class Reinforcement (AS/NZS 4671)

f_y = 500 MPa

Slab Depth (mm)	Fabric Size
100	SL72
120	SL72
140	SL82
160	SL82
180	SL92
200	SL92
220	SL92
240	SL102
250	RL818

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Interpretation of Tables

The following tables may be interpreted as outlined below:

- An empty cell indicates no solution for the designated span and load.
- A " - " in the cell indicates no requirement for additional fire reinforcement

Double Spans

Span (mm)	5.0
2500	300
	40

Design Live Action (kPa)
Top Reinforcement over supports (mm²/m)
Fire Reinforcement (mm²/m)
Span (mm)

Single Spans

Span (mm)	5.0
2500	RF72
	180

Design Live Action (kPa)
Shrinkage thermal Reinforcement
Fire Reinforcement (mm²/m)
Span (mm)

Single Span, t_{bm} = 0.75 mm

Slab Depth D_c =100 mm

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
1500	SL72	SL72	SL72
1750	SL72	SL72	SL72
2000	SL72	SL72	SL72
2250	SL72	SL72	SL72
2500	SL72	SL72	
2750	SL72		
3000			
3250			
3500			
3750			
4000			

Insufficient Slab depth for FLR

Slab Depth D_c =120 mm

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
1500	SL72	SL72	SL72
	60	70	80
1750	SL72	SL72	SL72
	80	90	110
2000	SL72	SL72	SL72
	110	120	140
2250	SL72	SL72	SL72
	140	160	180
2500	SL72	SL72	SL72
	170	200	230
2750	SL72	SL72	SL72
	210	240	280
3000	SL72	SL72	
	260	290	
3250	SL72		
	310		
3500			
3750			
4000			

Single Span, t_{bm} = 0.75 mm

Slab Depth D$_c$ =140 mm

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
1500	SL82 50	SL82 50	SL82 60
1750	SL82 70	SL82 70	SL82 90
2000	SL82 90	SL82 100	SL82 110
2250	SL82 110	SL82 130	SL82 150
2500	SL82 140	SL82 160	SL82 180
2750	SL82 170	SL82 200	SL82 220
3000	SL82 210	SL82 240	SL82 270
3250	SL82 250	SL82 280	
3500	SL82 290		
3750			
4000			
4250			
4500			
4750			
5000			

Slab Depth D$_c$ =160 mm

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
1500	SL82 40	SL82 50	SL82 50
1750	SL82 60	SL82 60	SL82 70
2000	SL82 80	SL82 90	SL82 100
2250	SL82 100	SL82 110	SL82 130
2500	SL82 120	SL82 140	SL82 160
2750	SL82 150	SL82 170	SL82 190
3000	SL82 180	SL82 200	SL82 230
3250	SL82 220	SL82 240	SL82 270
3500	SL82 250	SL82 280	SL82 320
3750	SL82 290	SL82 330	
4000	SL82 330		
4250			
4500			
4750			
5000			

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Single Span, t_{bm} = 0.75 mm

Slab Depth D_c = 180 mm

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
1500	SL92 40	SL92 40	SL92 50
1750	SL92 50	SL92 60	SL92 70
2000	SL92 70	SL92 80	SL92 90
2250	SL92 90	SL92 100	SL92 110
2500	SL92 110	SL92 120	SL92 140
2750	SL92 140	SL92 150	SL92 170
3000	SL92 160	SL92 180	SL92 200
3250	SL92 190	SL92 210	SL92 240
3500	SL92 230	SL92 250	SL92 280
3750	SL92 260	SL92 290	SL92 330
4000	SL92 300	SL92 330	SL92 370
4250	SL92 340	SL92 380	
4500	SL92 390		
4750			
5000			
5250			
5500			
5750			
6000			

Slab Depth D_c =200 mm

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
1500	SL92 40	SL92 40	SL92 40
1750	SL92 50	SL92 50	SL92 60
2000	SL92 60	SL92 70	SL92 80
2250	SL92 80	SL92 90	SL92 100
2500	SL92 100	SL92 110	SL92 130
2750	SL92 130	SL92 140	SL92 150
3000	SL92 150	SL92 170	SL92 190
3250	SL92 180	SL92 200	SL92 220
3500	SL92 210	SL92 230	SL92 260
3750	SL92 240	SL92 260	SL92 300
4000	SL92 280	SL92 300	SL92 340
4250	SL92 310	SL92 340	SL92 380
4500	SL92 350	SL92 390	
4750	SL92 400		
5000			
5250			
5500			
5750			
6000			

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Single Span, t_{bm} = 0.75 mm

Slab Depth D$_c$ =220 mm

Span	Q Design Live Action (kPa)		
(mm)	1.5	3.0	5.0
2500	SL102 100	SL102 110	SL102 120
2750	SL102 120	SL102 130	SL102 140
3000	SL102 140	SL102 150	SL102 170
3250	SL102 170	SL102 180	SL102 200
3500	SL102 200	SL102 210	SL102 240
3750	SL102 230	SL102 250	SL102 270
4000	SL102 260	SL102 280	SL102 310
4250	SL102 290	SL102 320	SL102 360
4500	SL102 330	SL102 360	SL102 400
4750	SL102 370	SL102 400	
5000	SL102 410	SL102 450	
5250	SL102 460		
5500			
5750			
6000			
6250			
6500			
6750			
7000			

Slab Depth D$_c$ =250 mm

Span	Q Design Live Action (kPa)		
(mm)	1.5	3.0	5.0
2500	RL818 90	RL818 100	RL818 110
2750	RL818 110	RL818 120	RL818 130
3000	RL818 130	RL818 140	RL818 160
3250	RL818 160	RL818 170	RL818 180
3500	RL818 180	RL818 200	RL818 220
3750	RL818 210	RL818 230	RL818 250
4000	RL818 240	RL818 260	RL818 280
4250	RL818 270	RL818 290	RL818 320
4500	RL818 310	RL818 330	RL818 360
4750	RL818 340	RL818 370	RL818 410
5000	RL818 380	RL818 410	RL818 450
5250	RL818 420	RL818 460	RL818 500
5500	RL818 460	RL818 500	
5750	RL818 510		
6000			
6250			
6500			
6750			
7000			

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Single Span, t_{bm} = 1.00 mm

Slab Depth D_c =100 mm

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
1500	SL72	SL72	SL72
1750	SL72	SL72	SL72
2000	SL72	SL72	SL72
2250	SL72	SL72	SL72
2500	SL72	SL72	SL72
2750	SL72	SL72	SL72
3000			
3250			
3500			
3750			
4000			

Insufficient Slab depth for FLR

Slab Depth D_c =120 mm

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
1500	SL72 / 60	SL72 / 70	SL72 / 80
1750	SL72 / 80	SL72 / 90	SL72 / 110
2000	SL72 / 110	SL72 / 120	SL72 / 140
2250	SL72 / 140	SL72 / 160	SL72 / 180
2500	SL72 / 180	SL72 / 200	SL72 / 230
2750	SL72 / 220	SL72 / 240	SL72 / 280
3000	SL72 / 260	SL72 / 300	
3250	SL72 / 310		
3500			
3750			
4000			

Single Span, t_{bm} = 1.00 mm

Slab Depth D_c =140 mm

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
1500	SL82 50	SL82 50	SL82 60
1750	SL82 70	SL82 80	SL82 90
2000	SL82 90	SL82 100	SL82 110
2250	SL82 110	SL82 130	SL82 150
2500	SL82 140	SL82 160	SL82 180
2750	SL82 180	SL82 200	SL82 230
3000	SL82 210	SL82 240	SL82 270
3250	SL82 250	SL82 280	
3500	SL82 290		
3750			
4000			
4250			
4500			
4750			
5000			

Slab Depth D_c =160 mm

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
1500	SL82 40	SL82 50	SL82 50
1750	SL82 60	SL82 70	SL82 70
2000	SL82 80	SL82 90	SL82 100
2250	SL82 100	SL82 110	SL82 130
2500	SL82 120	SL82 140	SL82 160
2750	SL82 150	SL82 170	SL82 190
3000	SL82 180	SL82 200	SL82 230
3250	SL82 220	SL82 240	SL82 270
3500	SL82 250	SL82 280	SL82 320
3750	SL82 290	SL82 330	
4000	SL82 340		
4250			
4500			
4750			
5000			

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Single Span, t_{bm} = 1.00 mm

Slab Depth D_c = 180 mm

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
1500	SL92 40	SL92 40	SL92 50
1750	SL92 50	SL92 60	SL92 70
2000	SL92 70	SL92 80	SL92 90
2250	SL92 90	SL92 100	SL92 110
2500	SL92 110	SL92 120	SL92 140
2750	SL92 140	SL92 150	SL92 170
3000	SL92 170	SL92 180	SL92 200
3250	SL92 200	SL92 220	SL92 240
3500	SL92 230	SL92 250	SL92 280
3750	SL92 260	SL92 290	SL92 330
4000	SL92 300	SL92 330	
4250	SL92 340	SL92 380	
4500	SL92 390		
4750			
5000			
5250			
5500			
5750			
6000			

Slab Depth D_c = 200 mm

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
1500	SL92 40	SL92 40	SL92 40
1750	SL92 50	SL92 50	SL92 60
2000	SL92 70	SL92 70	SL92 80
2250	SL92 80	SL92 90	SL92 100
2500	SL92 100	SL92 110	SL92 130
2750	SL92 130	SL92 140	SL92 160
3000	SL92 150	SL92 170	SL92 190
3250	SL92 180	SL92 200	SL92 220
3500	SL92 210	SL92 230	SL92 260
3750	SL92 240	SL92 270	SL92 300
4000	SL92 280	SL92 300	SL92 340
4250	SL92 320	SL92 350	SL92 390
4500	SL92 360	SL92 390	
4750	SL92 400		
5000			
5250			
5500			
5750			
6000			

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Single Span, t_{bm} = 1.00 mm

Slab Depth D_c =220 mm

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
2500	SL102 100	SL102 110	SL102 120
2750	SL102 120	SL102 130	SL102 140
3000	SL102 140	SL102 160	SL102 170
3250	SL102 170	SL102 180	SL102 200
3500	SL102 200	SL102 210	SL102 240
3750	SL102 230	SL102 250	SL102 270
4000	SL102 260	SL102 280	SL102 310
4250	SL102 300	SL102 320	SL102 360
4500	SL102 330	SL102 360	SL102 400
4750	SL102 370	SL102 410	
5000	SL102 410		
5250	SL102 460		
5500			
5750			
6000			

Slab Depth D_c =250 mm

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
2500	RL818 90	RL818 100	RL818 110
2750	RL818 110	RL818 120	RL818 130
3000	RL818 130	RL818 140	RL818 160
3250	RL818 160	RL818 170	RL818 190
3500	RL818 180	RL818 200	RL818 220
3750	RL818 210	RL818 230	RL818 250
4000	RL818 240	RL818 260	RL818 290
4250	RL818 270	RL818 290	RL818 320
4500	RL818 310	RL818 330	RL818 370
4750	RL818 340	RL818 370	RL818 410
5000	RL818 380	RL818 410	RL818 450
5250	RL818 420	RL818 460	
5500	RL818 470	RL818 500	
5750	RL818 510		
6000			
6250			
6500			
6750			

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Multiple Span, Slab Depth 100 mm, t_{bm} = 0.75 mm

Internal Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
1500	100	100	100
1750	100	100	140
2000	100	130	180
2250	120	170	230
2500	150	210	300
2750	180	260	360
3000	210	310	
3250	250		
3500			
3750			
4000			
4250			
4500			

End Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
1500	100	100	120
1750	100	120	170
2000	120	170	230
2250	160	210	290
2500	200	270	370
2750	240	330	
3000	290		
3250			
3500			
3750			
4000			
4250			
4500			

Insufficient Slab depth for FLR

Shrinkage Reinforcement   RF72

Multiple Span, Slab Depth 120 mm, t_{bm} = 0.75 mm

Internal Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
2000	120	120	140
	-	-	-
2250	120	130	180
	-	-	-
2500	120	160	220
	-	-	-
2750	140	200	270
	-	-	-
3000	170	240	330
	-	-	-
3250	200	280	390
	-	-	-
3500	230	330	
	-	-	
3750	270		
	-		
4000	310		
	-		
4250			
4500			
4750			
5000			
5250			
5500			

End Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
2000	120	130	170
	20	30	30
2250	130	170	220
	40	40	30
2500	160	210	280
	50	50	40
2750	190	260	340
	70	50	50
3000	230	310	420
	80	70	50
3250	270	370	
	100	80	
3500	320		
	110		
3750			
4000			
4250			
4500			
4750			
5000			
5250			
5500			

Shrinkage Reinforcement   RF72

BigRiver

Multiple Span, Slab Depth 140 mm, t_{bm} = 0.75 mm

Internal Spans

Span	Q Design Live Action (kPa)		
(mm)	1.5	3.0	5.0
2000	150	150	150
	-	-	-
2250	150	150	150
	-	-	-
2500	150	150	180
	-	-	-
2750	150	160	220
	-	-	-
3000	150	200	270
	-	-	-
3250	170	230	320
	-	-	-
3500	200	270	370
	-	-	-
3750	230	320	430
	-	-	-
4000	260	360	
	-	-	
4250	300		
	-		
4500	340		
	-		
4750			
5000			
5250			
5500			
5750			
6000			

End Spans

Span	Q Design Live Action (kPa)		
(mm)	1.5	3.0	5.0
2000	150	150	150
	10	10	20
2250	150	150	180
	20	30	30
2500	150	180	230
	40	40	30
2750	160	210	280
	60	50	40
3000	200	260	340
	70	60	50
3250	230	310	400
	80	70	60
3500	270	360	470
	100	80	70
3750	320	420	
	110	90	
4000	360		
	130		
4250	410		
	140		
4500			
4750			
5000			
5250			
5500			
5750			
6000			

Shrinkage Reinforcement   RF82

Multiple Span, Slab Depth 160 mm, t_{bm} = 0.75 mm

Internal Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
2500	180	180	180
	-	-	-
2750	180	180	190
	-	-	-
3000	180	180	230
	-	-	-
3250	180	200	270
	-	-	-
3500	180	240	320
	-	-	-
3750	200	270	370
	-	-	-
4000	230	310	420
	-	-	-
4250	260	360	480
	-	-	-
4500	300	400	
	-	-	
4750	330	450	
	-	-	
5000	370		
	-		
5250			
5500			
5750			
6000			
6250			
6500			

End Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
2500	180	180	200
	20	30	30
2750	180	190	240
	40	40	40
3000	180	230	290
	60	50	50
3250	210	270	350
	70	60	50
3500	240	310	410
	90	80	60
3750	280	360	470
	100	90	70
4000	320	410	540
	110	100	80
4250	370	470	
	120	110	
4500	410		
	140		
4750	460		
	160		
5000			
5250			
5500			
5750			
6000			
6250			
6500			

Shrinkage Reinforcement   RF82

BigRiver

Multiple Span, Slab Depth 180 mm, t_{bm} = 0.75 mm

Internal Spans

Span	Q Design Live Action (kPa)		
(mm)	1.5	3.0	5.0
2500	210	210	210
	-	-	-
2750	210	210	210
	-	-	-
3000	210	210	210
	-	-	-
3250	210	210	240
	-	-	-
3500	210	210	280
	-	-	-
3750	210	240	320
	-	-	-
4000	210	280	370
	-	-	-
4250	240	320	420
	-	-	-
4500	270	360	480
	-	-	-
4750	300	400	530
	-	-	-
5000	330	440	
	-	-	
5250	370	490	
	-	-	
5500	410		
	-		
5750	450		
	-		
6000			
6250			
6500			
6750			
7000			

End Spans

Span	Q Design Live Action (kPa)		
(mm)	1.5	3.0	5.0
2500	210	210	210
	10	10	20
2750	210	210	220
	20	30	40
3000	210	210	260
	40	50	40
3250	210	240	310
	60	60	50
3500	220	280	360
	80	70	60
3750	260	320	410
	90	80	70
4000	290	370	480
	110	90	80
4250	330	420	540
	120	110	90
4500	370	470	610
	140	120	100
4750	420	530	
	150	130	
5000	470		
	160		
5250	520		
	180		
5500			
5750			
6000			
6250			
6500			
6750			
7000			

Shrinkage Reinforcement   RF92

BigRiver

Multiple Span, Slab Depth 200 mm, t_{bm} = 0.75 mm

Internal Spans

Span	Q Design Live Action (kPa)		
(mm)	1.5	3.0	5.0
3000	240	240	240
	-	-	-
3250	240	240	240
	-	-	-
3500	240	240	250
	-	-	-
3750	240	240	290
	-	-	-
4000	240	250	330
	-	-	-
4250	240	290	380
	-	-	-
4500	250	320	430
	-	-	-
4750	280	360	480
	-	-	-
5000	310	400	530
	-	-	-
5250	340	450	590
	-	-	-
5500	380	490	
	-	-	
5750	410	540	
	-	-	
6000	450		
	-		
6250	490		
	-		
6500			
6750			
7000			
7250			
7500			

End Spans

Span	Q Design Live Action (kPa)		
(mm)	1.5	3.0	5.0
3000	240	240	240
	20	30	40
3250	240	240	280
	40	50	50
3500	240	260	320
	60	70	60
3750	240	300	370
	80	80	70
4000	270	340	430
	100	90	80
4250	310	380	490
	110	100	90
4500	350	430	550
	120	110	100
4750	390	490	620
	140	120	110
5000	430	540	690
	160	140	120
5250	480	600	
	170	160	
5500	530		
	190		
5750	580		
	210		
6000			
6250			
6500			
6750			
7000			
7250			
7500			

Shrinkage Reinforcement   RF92

Multiple Span, Slab Depth 220 mm, t_{bm} = 0.75 mm

Internal Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
3500	270	270	270
	-	-	-
3750	270	270	270
	-	-	-
4000	270	270	300
	-	-	-
4250	270	270	350
	-	-	-
4500	270	300	390
	-	-	-
4750	270	330	440
	-	-	-
5000	290	370	490
	-	-	-
5250	320	410	540
	-	-	-
5500	350	450	590
	-	-	-
5750	390	500	650
	-	-	-
6000	420	540	
	-	-	
6250	460	590	
	-	-	
6500	500		
	-		
6750	540		
	-		
7000			
7250			
7500			
7750			
8000			

End Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
3500	270	270	300
	40	50	60
3750	270	270	340
	60	80	70
4000	270	310	390
	90	90	80
4250	290	360	450
	110	100	90
4500	330	400	500
	120	110	100
4750	360	450	570
	140	120	110
5000	410	500	630
	150	140	120
5250	450	550	700
	160	150	130
5500	490	610	770
	180	170	150
5750	540	670	
	200	180	
6000	590		
	220		
6250	650		
	230		
6500			
6750			
7000			
7250			
7500			
7750			
8000			

Shrinkage Reinforcement   RF102

BigRiver

Multiple Span, Slab Depth 240 mm, t_{bm} = 0.75 mm

Internal Spans

Span	Q Design Live Action (kPa)		
(mm)	1.5	3.0	5.0
3500	300 / -	300 / -	300 / -
3750	300 / -	300 / -	300 / -
4000	300 / -	300 / -	300 / -
4250	300 / -	300 / -	320 / -
4500	300 / -	300 / -	360 / -
4750	300 / -	310 / -	400 / -
5000	300 / -	350 / -	450 / -
5250	300 / -	380 / -	500 / -
5500	330 / -	420 / -	550 / -
5750	360 / -	460 / -	600 / -
6000	400 / -	510 / -	660 / -
6250	430 / -	550 / -	720 / -
6500	470 / -	600 / -	
6750	510 / -	650 / -	
7000	550 / -		
7250	590 / -		
7500			
7750			
8000			

End Spans

Span	Q Design Live Action (kPa)		
(mm)	1.5	3.0	5.0
3500	300 / 20	300 / 30	300 / 50
3750	300 / 40	300 / 60	320 / 70
4000	300 / 70	300 / 80	370 / 70
4250	300 / 90	330 / 100	420 / 80
4500	310 / 120	380 / 100	470 / 90
4750	350 / 130	420 / 120	520 / 110
5000	380 / 150	470 / 130	580 / 120
5250	430 / 160	520 / 150	650 / 130
5500	470 / 170	570 / 160	710 / 140
5750	510 / 190	630 / 170	780 / 160
6000	560 / 210	690 / 190	
6250	610 / 230	750 / 210	
6500	660 / 250		
6750			
7000			
7250			
7500			
7750			
8000			

Shrinkage Reinforcement   RF102

BigRiver

Multiple Span, Slab Depth 250 mm, t_{bm} = 0.75 mm

Internal Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
3500	310	310	310
	-	-	-
3750	310	310	310
	-	-	-
4000	310	310	310
	-	-	-
4250	310	310	310
	-	-	-
4500	310	310	350
	-	-	-
4750	310	310	390
	-	-	-
5000	310	340	430
	-	-	-
5250	310	370	480
	-	-	-
5500	320	410	530
	-	-	-
5750	350	450	580
	-	-	-
6000	390	490	630
	-	-	-
6250	420	540	690
	-	-	-
6500	460	580	750
	-	-	-
6750	490	630	
	-	-	
7000	530	680	
	-	-	
7250	570		
	-		
7500	620		
	-		
7750			
8000			

End Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
3500	310	310	310
	20	30	40
3750	310	310	310
	40	50	60
4000	310	310	350
	60	70	80
4250	310	330	400
	80	90	80
4500	310	370	450
	110	100	100
4750	340	410	510
	130	120	100
5000	380	460	570
	140	130	110
5250	420	510	630
	150	140	130
5500	460	560	690
	170	160	140
5750	500	610	760
	190	170	150
6000	550	670	830
	200	190	170
6250	600	730	
	220	200	
6500	650	790	
	240	220	
6750	700		
	260		
7000			
7250			
7500			
7750			
8000			

Shrinkage Reinforcement   RF81

BigRiver

Multiple Span, Slab Depth 100 mm, t_{bm} = 1.0 mm

Internal Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
1500	70	70	100
1750	70	100	140
2000	90	130	180
2250	120	170	240
2500	150	210	300
2750	180	260	360
3000	220	310	
3250	260		
3500			
3750			
4000			
4250			
4500			

End Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
1500	70	90	120
1750	90	120	170
2000	120	170	230
2250	160	220	290
2500	200	270	370
2750	240	330	460
3000	290		
3250			
3500			
3750			
4000			
4250			
4500			

Shrinkage Reinforcement   RF72

BigRiver

Multiple Span, Slab Depth 120 mm, t_{bm} = 1.0 mm

Internal Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
2000	100 -	100 -	140 -
2250	100 -	130 -	180 -
2500	120 -	160 -	220 -
2750	140 -	200 -	270 -
3000	170 -	240 -	330 -
3250	200 -	280 -	390 -
3500	240 -	330 -	
3750	270 -		
4000			
4250			
4500			
4750			
5000			
5250			
5500			

End Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
2000	100 30	130 30	170 30
2250	130 40	170 40	220 30
2500	160 50	210 50	280 40
2750	190 70	260 60	350 50
3000	230 80	310 70	420 60
3250	280 90	370 80	
3500	320 110		
3750			
4000			
4250			
4500			
4750			
5000			
5250			
5500			

Shrinkage Reinforcement   RF72

BigRiver

Multiple Span, Slab Depth 140 mm, t_{bm} = 1.0 mm

Internal Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
2000	120	120	120
	-	-	-
2250	120	120	150
	-	-	-
2500	120	130	180
	-	-	-
2750	120	160	220
	-	-	-
3000	140	200	270
	-	-	-
3250	170	230	320
	-	-	-
3500	200	270	370
	-	-	-
3750	230	320	430
	-	-	-
4000	260	360	
	-	-	
4250	300		
	-		
4500			
4750			
5000			
5250			
5500			
5750			
6000			

End Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
2000	120	120	140
	10	20	20
2250	120	140	180
	30	30	30
2500	140	180	230
	40	40	40
2750	170	220	280
	60	50	40
3000	200	260	340
	70	60	50
3250	240	310	410
	80	70	60
3500	280	360	480
	90	80	70
3750	320	420	
	110	90	
4000	370		
	120		
4250			
4500			
4750			
5000			
5250			
5500			
5750			
6000			

Shrinkage Reinforcement   RF82

Multiple Span, Slab Depth 160 mm, t_{bm} = 1.0 mm

Internal Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
2500	150	150	160
	-	-	-
2750	150	150	190
	-	-	-
3000	150	170	230
	-	-	-
3250	150	200	270
	-	-	-
3500	180	240	320
	-	-	-
3750	200	270	370
	-	-	-
4000	230	310	420
	-	-	-
4250	260	360	480
	-	-	-
4500	300	400	
	-	-	
4750	330		
	-		
5000	370		
	-		
5250			
5500			
5750			
6000			
6250			
6500			

End Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
2500	150	150	200
	30	40	30
2750	150	190	240
	50	50	40
3000	180	230	290
	60	50	50
3250	210	270	350
	70	60	50
3500	240	310	410
	90	80	60
3750	280	360	470
	100	90	80
4000	320	420	540
	110	100	90
4250	370	470	
	130	110	
4500	410		
	150		
4750			
5000			
5250			
5500			
5750			
6000			
6250			
6500			

Shrinkage Reinforcement   RF82

Multiple Span, Slab Depth 180 mm, t_{bm} = 1.0 mm

Internal Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
2500	180	180	180
	-	-	-
2750	180	180	180
	-	-	-
3000	180	180	200
	-	-	-
3250	180	180	240
	-	-	-
3500	180	210	280
	-	-	-
3750	180	240	320
	-	-	-
4000	210	280	370
	-	-	-
4250	240	320	420
	-	-	-
4500	270	360	480
	-	-	-
4750	300	400	530
	-	-	-
5000	340	450	
	-	-	
5250	370		
	-		
5500	410		
	-		
5750			
6000			
6250			
6500			
6750			
7000			

End Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
2500	180	180	180
	10	20	30
2750	180	180	220
	30	40	40
3000	180	200	260
	50	50	50
3250	190	240	310
	70	60	50
3500	220	280	360
	80	70	60
3750	260	320	420
	90	80	70
4000	290	370	480
	110	90	80
4250	330	420	540
	120	110	90
4500	380	480	610
	130	120	110
4750	420	530	
	150	140	
5000	470		
	170		
5250			
5500			
5750			
6000			
6250			
6500			
6750			
7000			

Shrinkage Reinforcement   RF92

BigRiver

Multiple Span, Slab Depth 200 mm, t_{bm} = 1.0 mm

Internal Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
3000	210	210	210
	-	-	-
3250	210	210	220
	-	-	-
3500	210	210	250
	-	-	-
3750	210	220	290
	-	-	-
4000	210	250	330
	-	-	-
4250	220	290	380
	-	-	-
4500	250	320	430
	-	-	-
4750	280	360	480
	-	-	-
5000	310	400	530
	-	-	-
5250	340	450	590
	-	-	-
5500	380	490	
	-	-	
5750	410		
	-		
6000	450		
	-		
6250			
6500			
6750			
7000			
7250			
7500			

End Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
3000	210	210	240
	30	40	40
3250	210	220	280
	50	60	50
3500	210	260	330
	70	70	60
3750	240	300	380
	90	80	70
4000	270	340	430
	100	90	80
4250	310	390	490
	110	100	90
4500	350	430	550
	130	120	100
4750	390	490	620
	140	130	110
5000	430	540	
	160	140	
5250	480	600	
	170	160	
5500	530		
	190		
5750			
6000			
6250			
6500			
6750			
7000			
7250			
7500			

Shrinkage Reinforcement   RF92

Multiple Span, Slab Depth 220 mm, t_{bm} = 1.0 mm

Internal Spans

Span (mm)	Q Design Live Action (kPa) 1.5	3.0	5.0
3500	240	240	240
	-	-	-
3750	240	240	270
	-	-	-
4000	240	240	310
	-	-	-
4250	240	270	350
	-	-	-
4500	240	300	390
	-	-	-
4750	260	340	440
	-	-	-
5000	290	370	490
	-	-	-
5250	320	410	540
	-	-	-
5500	350	460	590
	-	-	-
5750	390	500	
	-	-	
6000	420	550	
	-	-	
6250	460		
	-		
6500	500		
	-		
6750			
7000			
7250			
7500			
7750			
8000			

End Spans

Span (mm)	Q Design Live Action (kPa) 1.5	3.0	5.0
3500	240	240	300
	50	60	60
3750	240	280	350
	80	70	70
4000	260	320	400
	90	80	70
4250	290	360	450
	110	100	90
4500	330	400	510
	120	110	100
4750	370	450	570
	130	120	110
5000	410	500	630
	150	140	120
5250	450	560	700
	170	150	130
5500	500	610	
	180	170	
5750	540	670	
	200	180	
6000	600		
	220		
6250			
6500			
6750			
7000			
7250			
7500			
7750			
8000			

Shrinkage Reinforcement   RF102

BigRiver

Multiple Span, Slab Depth 240 mm, t_{bm} = 1.0 mm

Internal Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
3500	260	260	260
	-	-	-
3750	260	260	260
	-	-	-
4000	260	260	280
	-	-	-
4250	260	260	320
	-	-	-
4500	260	280	360
	-	-	-
4750	260	310	400
	-	-	-
5000	270	350	450
	-	-	-
5250	300	390	500
	-	-	-
5500	330	420	550
	-	-	-
5750	360	470	600
	-	-	-
6000	400	510	660
	-	-	-
6250	430	550	
	-	-	
6500	470	600	
	-	-	
6750	510		
	-		
7000	550		
	-		
7250			
7500			
7750			
8000			

End Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
3500	260	260	280
	40	50	60
3750	260	260	320
	60	70	70
4000	260	300	370
	80	80	70
4250	280	340	420
	100	90	80
4500	310	380	470
	120	110	100
4750	350	420	530
	130	120	110
5000	390	470	590
	140	130	120
5250	430	520	650
	160	150	130
5500	470	570	720
	180	160	140
5750	520	630	790
	190	180	160
6000	560	690	
	210	190	
6250	610		
	230		
6500	670		
	250		
6750			
7000			
7250			
7500			
7750			
8000			

Shrinkage Reinforcement   RF102

Multiple Span, Slab Depth 250 mm, t_{bm} = 1.0 mm

Internal Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
3500	280	280	280
	-	-	-
3750	280	280	280
	-	-	-
4000	280	280	280
	-	-	-
4250	280	280	310
	-	-	-
4500	280	280	350
	-	-	-
4750	280	300	390
	-	-	-
5000	280	340	430
	-	-	-
5250	290	370	480
	-	-	-
5500	320	410	530
	-	-	-
5750	360	450	580
	-	-	-
6000	390	490	630
	-	-	-
6250	420	540	690
	-	-	-
6500	460	580	
	-	-	
6750	500	630	
	-	-	
7000	530		
	-		
7250	580		
	-		
7500			
7750			
8000			

End Spans

Span (mm)	Q Design Live Action (kPa)		
	1.5	3.0	5.0
3500	280	280	280
	30	40	50
3750	280	280	310
	50	60	70
4000	280	290	360
	70	80	70
4250	280	330	400
	100	90	90
4500	300	370	450
	120	100	100
4750	340	410	510
	130	120	110
5000	380	460	570
	140	130	120
5250	420	510	630
	160	140	130
5500	460	560	690
	170	160	140
5750	500	610	760
	190	180	160
6000	550	670	830
	210	190	170
6250	600	730	
	220	210	
6500	650		
	240		
6750	700		
	270		
7000			
7250			
7500			
7750			
8000			

Shrinkage Reinforcement   RF81