3.3.4 FORMWORK DESIGN

3.3.4.1 HIBOND FORMWORK TABLES

Maximum formwork spans for slab thicknesses between 110mm and 300mm are provided in the following tables.

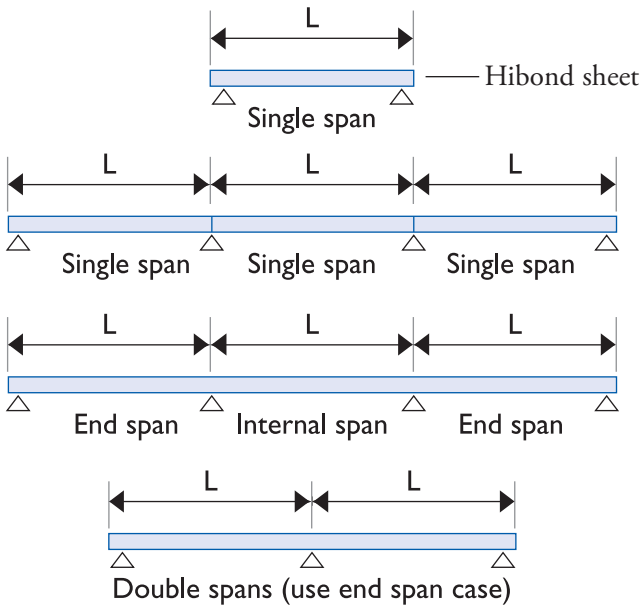
The following notes apply to the formwork tables in this section.

1. D_s is the overall thickness of the slab.
2. Slab weights (G) are based on a wet concrete density of 2400 kg/m^3 with no allowance for ponding.
3. A construction load (Q) taken from BS 5950 is incorporated in these tables. This provides for a minimum of 1.5 kPa and for spans (L) less than 3000mm, 4500/L kPa has been used.
4. L is the maximum span measured centre to centre between permanent or temporary supports.
5. Use of the double or end span tables and internal span tables assumes,
   - All spans have the same slab thickness.
   - The end span is within plus 5% or minus 10% of the internal span and that the end and internal spans are both designed using the appropriate load span table.
   - Double spans are within 10% of each other and the slab design is based on the largest span.
   - Internal spans are within 10% of each other and the slab design is based on the largest internal span.

   Any variations to the above configurations require specific design using the Hibond Formwork Properties table in Section 3.3.3.
6. These tables are based on minimum bearing of Hibond sheet given in Section 3.3.4.3.
7. It should be noted that double or end span capabilities may be less than single spans as the interaction of bending and web crushing create a worse case.
8. Deflection limits incorporated in these tables are as follows:
   a) L/180 maximum due to dead load (G) only.
   b) D_s/10 maximum, to avoid concrete ponding problems.

   These limits are represented in the 'Allow' (allowable) column of the Hibond Formwork Tables. The 5mm limit column should be referred to where soffit deflection is to be reduced.
9. For intermediate values, linear interpolation is permitted.
10. As a guide, formwork deflections of around 15 mm under dead load (G) should be expected within the extent of the tables. Construction loads (Q) will increase deflections.
11. The design span of the formwork relates closely to site installation. If the Hibond sheet is designed as an end span or internal span, the minimum nominal sheet length for construction should be noted clearly in the design documentation to ensure that appropriate sheet lengths are used by the installer to achieve the span type selected. Refer to Section 3.5 Installation.

Typical Formwork Slab Span Configurations



This configuration can only be used where all supports are permanent.

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3.3.4.1 HIBOND FORMWORK TABLES *continued*

0.75mm HIBOND FORMWORK SPAN CAPABILITIES

D_s mm	Slab Weight kPa	Concrete Quantity m^3/m^2	Maximum Span (L) mm					
			Single		Double or End		Internal	
			Allow.	5mm limit	Allow.	5mm limit	Allow.	5mm limit
110	2.03	0.0825	2500	2050	2800	2450	3150	2950
120	2.26	0.0925	2500	2000	2800	2350	3050	2850
130	2.50	0.1025	2500	1950	2750	2300	2900	2800
140	2.74	0.1125	2500	1900	2650	2250	2750	2700
150	2.97	0.1225	2400	1900	2550	2200	2600	2600
160	3.21	0.1325	2350	1850	2450	2150	2500	2500
170	3.44	0.1425	2300	1800	2350	2150	2400	2400
180	3.68	0.1525	2250	1800	2250	2100	2300	2300
190	3.91	0.1625	2200	1750	2150	2050	2250	2250
200	4.15	0.1725	2150	1750	2100	2050	2150	2150
210	4.38	0.1825	2150	1700	2000	2000	2100	2100
220	4.62	0.1925	2100	1700	1950	1950	2000	2000
230	4.85	0.2025	2050	1650	1900	1900	1950	1950
240	5.09	0.2125	2000	1650	1850	1850	1900	1900
250	5.32	0.2225	2000	1600	1800	1800	1850	1850
260	5.56	0.2325	1950	1600	1750	1750	1800	1800
270	5.79	0.2425	1900	1600	1700	1700	1750	1750
280	6.03	0.2525	1900	1550	1650	1650	1700	1700
290	6.26	0.2625	1850	1550	1600	1600	1650	1650
300	6.50	0.2725	1850	1550	1600	1600	1650	1650

0.95mm HIBOND FORMWORK SPAN CAPABILITIES

D_s mm	Slab Weight kPa	Concrete Quantity m^3/m^2	Maximum Span (L) mm					
			Single		Double or End		Internal	
			Allow.	5mm limit	Allow.	5mm limit	Allow.	5mm limit
110	2.05	0.0825	2650	2200	2900	2500	3700	3050
120	2.29	0.0925	2650	2100	2850	2450	3650	2950
130	2.52	0.1025	2600	2050	2850	2400	3650	2850
140	2.76	0.1125	2600	2000	2850	2350	3650	2800
150	2.99	0.1225	2600	2000	2850	2300	3600	2750
160	3.23	0.1325	2500	1950	2800	2250	3500	2700
170	3.46	0.1425	2450	1900	2750	2200	3400	2650
180	3.70	0.1525	2400	1850	2700	2150	3300	2600
190	3.93	0.1625	2350	1850	2650	2150	3200	2550
200	4.17	0.1725	2300	1800	2600	2100	3100	2550
210	4.40	0.1825	2300	1800	2550	2100	3050	2500
220	4.64	0.1925	2250	1750	2500	2050	2950	2450
230	4.88	0.2025	2200	1750	2450	2000	2850	2450
240	5.11	0.2125	2150	1750	2400	2000	2800	2400
250	5.35	0.2225	2150	1700	2400	2000	2700	2400
260	5.58	0.2325	2100	1700	2350	1950	2650	2350
270	5.82	0.2425	2100	1650	2300	1950	2600	2350
280	6.05	0.2525	2050	1650	2300	1900	2500	2300
290	6.29	0.2625	2000	1650	2250	1900	2450	2300
300	6.52	0.2725	2000	1600	2250	1900	2400	2250

3.3.4.2 PROPPING

Where spans require propping of the Hibond sheet as shown in 3.3.4.1, adequately braced propping must be installed prior to laying the Hibond sheets and shall be designed to support wet concrete and construction loads. Refer to Section 3.5 Installation for further information.

Propping loads are given below for all slab thicknesses considered in Section 3.3.4.1.

PROPPING LOADS

Thickness mm	Serviceability (Safe) Load	Ultimate (Strength) Load
0.75	17.6 kN/m	25.5 kN/m
0.95	23.5 kN/m	34.3 kN/m

The Hibond sheet must be supported by continuous propping lines parallel to the permanent supports. The minimum width required for bearers is 100mm.

Propping lines must remain in place until:
- The concrete has reached a compressive strength of 20 MPa where construction loads are applied.
- The concrete is fully cured where full design loads are applied.

Refer to NZS 3109 for further details.

3.3.4.3 BEARING AND FIXING REQUIREMENTS

It is the responsibility of the design engineer to determine the bearing and fixing requirements for the Hibond Flooring System specific to each case.

Minimum bearing requirements for different span types are shown below.

The Hibond sheet does not require as much bearing as the composite slab. However the issue of sheet hold down, prior to the placement of the concrete, may determine Hibond bearing requirements.

MINIMUM BEARING REQUIREMENTS

	Bearing of Hibond Slab		Bearing of Hibond Sheet	
	Slab End	Continuous	Sheet End	Continuous
Steel beam	50mm	100mm	30mm	100mm
In situ concrete beam or wall	50mm	100mm	30mm	N/A
Concrete block	70mm	100mm	30mm	N/A

Where steel beams are the main support system, Hibond sheets can be fixed to supports by shear connectors (shear studs) welded through the Hibond sheet (refer also to 3.5 Installation). Shear studs should be placed as close to the middle of each Hibond pan as practicable. Where there is more than one shear stud per pan it is desirable to stagger them diagonally across the width of the beam. Hibond sheets can also be fixed to supports with self-drilling screws or powder-actuated fasteners.

Fixing into the edge of concrete block is not recommended as any breakout of the edge will reduce the effective support.

Where insufficient or inadequate support is available for the Hibond sheet, temporary bearers and props can be used to support the ends. Nails can be driven through the Hibond sheet into timber bearers to provide temporary hold down. Hibond sheets must be continuous when laid over temporary supports.

Where the Hibond sheet is used with tilt slab construction, it is common to fix the Hibond sheet to a steel angle which is bolted to the tilt slab.

While technically a Hibond floor slab does not require support along the edge (edge bearing), it is standard practice to tie the edges of the slab to the support structure. Edge bearing requirements follow that of the end bearing as shown in the minimum bearing requirements table.

Refer to Section 3.5 Installation for further information on:
- Side lap crimping.
- Placement of end caps and edge forms.

3.3.4.4 PENETRATIONS

Penetrations of up to 250mm x 250mm square may be formed as part of the slab construction by formwork or polystyrene infill with the addition of 2 – H12 reinforcing bars laid in each adjacent Hibond sheet pan, the remaining Hibond sheet being cut away after curing.

Penetrations larger than 250mm x 250mm will require additional reinforcement to control cracking and provide structural integrity and may also require independent supporting beams to the design engineer's specific design.

The area of Hibond removed for penetrations must be replaced by an equivalent strength of reinforcement.

If cutting of the Hibond sheet is required prior to pouring the concrete, temporary propping is required to maintain the integrity of the sheet.