STRUCTURAL SYSTEMS MANUAL

Dimond Structural, a division of Fletcher Steel Ltd.

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0800 DIMOND
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Dimond Structural™

DIMOND STRUCTURAL FLOORING SYSTEMS

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SCOPE OF USE

Dimond Structural Flooring Systems use a roll-formed profiled galvanised steel sheet as a component in reinforced concrete floor systems. The steel decking sheet provides both permanent formwork and positive tensile reinforcement in one way reinforced composite floor slab construction over concrete block walls, poured concrete beams, steel beams or timber beams, subject to the environmental limitations referenced to the appropriate grade of material selected.

The information for Dimond Structural Flooring Systems herein is intended for use by suitably qualified structural engineers for their design and PS1 certification.

It is critical to product performance that the loads applied, spans, formwork material thickness and overall composite floor slab thickness are designed within the appropriate Limit State Loads and limitations published in this manual.

Consideration of construction loads relevant to each project are to be accounted for in design to ensure construction can proceed in a safe manner, and contractors are aware of any constraints.

Before commencing a project using a Dimond Structural Flooring System, the user must refer to the information within this manual and all sections as appropriate, ensuring relevant information is available to the end user. Failure to observe this information may result in a significant reduction in product performance. Dimond Structural accepts no liability whatsoever for products which are used otherwise than in accordance with these recommendations.

The information contained within this manual is only applicable to Dimond Structural Flooring Systems – it cannot be assumed to apply to similar products from other manufacturers.

USE OUTSIDE THE STATED GUIDELINES

If the need arises to use the Dimond Structural Flooring System outside the limitations and procedures given in this manual or if there exists any doubt on product handling or use, written approval should be obtained from Dimond Structural for the specific project, before the project is commenced.

DURABILITY 3.1

SCOPE 3.1.1

The Dimond Structural Flooring Systems described in this manual are subject to the environments in which they are used and the type of coating used as outlined in detail in this section.

COATING MATERIAL SPECIFICATIONS 3.1.2

Dimond Structural Flooring Systems are manufactured from galvanised steel coil in grade Z275 i.e. 275g/m^2 total galvanised zinc coating weight.

Other grades of zinc coating may be available. Contact Dimond Structural on 0800 Dimond (0800 346 663).

ENVIRONMENTS 3.1.3

GENERAL 3.1.3.1

The durability of galvanised zinc coated products is dependent on:

- The environment it will be installed in.
- The grade or weight of the zinc coating used.
- The degree and extent of the maintenance that will be undertaken over the life of the product.

Performance of galvanised zinc coated composite floor slabs is affected by:

- The cumulative effects of the weather to either the underside surface or moisture ingress of the top surface.
- The amount of dust (which can hold moisture) that settles on the product.
- Any other wind-blown deposits that may settle on the product, promoting corrosion.
- Proximity to the ground in subfloor areas with little or no ventilation.

Condensation or other deposits should be prevented from accumulating on the Dimond Structural Flooring System underside by providing adequate ventilation. A protective barrier must be provided if dampness is possible on the underside of the steel decking sheet. Refer Durability Statement 3.1.5.

LIMITATIONS ON USE

The use of galvanised steel decking sheet should be avoided:

- In areas where high concentrations of chemicals are combined with a high humidity, where the system remains wet for long periods of time, causing rapid consumption of the galvanised zinc coating and eventual red rusting of the base metal.
- Where the galvanised surface is being exposed to continuous moisture, without a chance for the surface to dry out for example, where the composite floor slab covers a water tank.
- In or near marine environments, where the prevailing wind carries marine salts which deposit on the steel decking, causing rapid consumption of the galvanised zinc coating and eventual red rusting of the base metal.
- In areas surrounding chemical or industrial storage buildings where any chemical attack may lessen the life of the structure or wind-driven chemical fumes may attack the galvanised coating.
- When in contact with or laid directly on ground.
- When in contact with timber and especially treated timber such as CCA (copper chrome arsenic) without the use of an isolating material such as DPC between the timber and galvanised steel decking sheet.
- When used in sub-floor areas with less than 450mm ground clearance.
- When used in sub-floor areas where ventilation does not comply with NZS 3604 Clause 6.14.

Chemical admixtures may only be used with Dimond Structural Flooring Systems if they are compatible with galvanised steel.

Refer Durability Statement 3.1.5 for guidance on methods of protection.

3.1.4

NZBC COMPLIANCE

Past history of use of Dimond Structural Flooring Systems indicate that provided the system design, product use and maintenance is in line with the guidelines of this manual, Dimond Structural Flooring Systems can reasonably be expected to meet the performance criteria in Clause B1 Structure and B2 Durability of the New Zealand Building Code for a period of not less than 50 years, provided the steel components remain dry and free from contamination.

Dimond Structural Flooring Systems designed using the Fire Design Sections 3.3.4, 3.4.6 and 3.5.6 of this manual and will meet the performance criteria in Clauses C3 and C4 of the New Zealand Building Code (section 3.3.4 is based on testing to EN 1365-2 and sections 3.4.6 and 3.5.6 are based on HERA reports R4-82 and R4-131).

Using the Flooring Acoustic Performance sections 3.3.5, 3.4.7 and 3.5.7, Dimond Structural Flooring Systems can be designed using this manual for guidance to achieve Sound Transmission Class (STC) and Impact Insulation Class (IIC) of 55 meet the requirements of the current New Zealand Building Code Clause G6, airborne and impact sound.

Where products used in Dimond Structural Flooring Systems are manufactured by other suppliers, compliance to the New Zealand Building Code should be checked with that product's manufacturer.

DURABILITY STATEMENT

The use of Dimond Structural Flooring Systems is limited to dry and non-corrosive environments unless further protection of the surfaces is provided.

It is the responsibility of the design engineer to assess the durability requirements and specify accordingly.

The top concrete surface may require additional crack control and/or waterproofing if it is to be exposed to moisture, and the underside surface of the steel decking may require additional protection from suitable protective coatings applied in-situ if exposure to moisture, marine deposits or chemicals is expected.

Concrete surface treatment

Where the top surface of the composite floor slab is exposed to moisture, use of Dimond Structural Flooring Systems is only recommended if there is an appropriate coating system applied to the top surface of the composite floor slab and fully maintained for the design life of the structure, and/or adequate concrete crack control is achieved. Moisture seeping through cracks which are not effectively sealed can combine with oxygen to the extent that corrosion of the steel decking may occur.

As a guide and subject to designers specification and approval,

- To suppress moisture entering the concrete surface, provide the minimum necessary reinforcement in the composite floor slab and apply a suitable proprietary water proofing agent (either mixed into the concrete before pouring or sprayed onto the top surface after curing).
- To prevent moisture entering the concrete, provide the minimum necessary reinforcement in the composite floor slab, and apply a proprietary waterproof membrane to the concrete surface.

Underside surface treatment

Where the underside surface of the steel decking may be exposed to contaminants and/or moisture that will not regularly dry out, the use of Dimond Structural Flooring Systems is only recommended if suitable protection of the galvanised steel underside surface can be achieved with a proprietary coating system applied in-situ. Coating specifications and statements on suitability of use can be obtained from PPG Coatings or Akzo Nobel Coatings.

MAINTENANCE

Dimond Structural Flooring Systems require a minimum degree of maintenance to ensure expected performance is achieved.

As a guide the following should be carried out as often as is needed (this could be as often as every three months).

a) Keep surfaces clean and free from continuous contact with moisture, dust and other debris. This includes areas such as the exposed steel deck underside, e.g. decks or subfloors. Where necessary, regular maintenance should include a wash-down programme to remove all the accumulated dirt or salt buildup on all the galvanised surfaces with a soft brush and plenty of clean water or by water blasting at 15 MPa (2000 psi).

b) Ensure any concrete surface cracking exposed to possible water ingress is fully sealed. Similarly ponding of water on exposed top surfaces must be avoided to ensure durability requirements are met.

c) Periodically inspect the steel decking underside. At the first sign of any underside corrosion, the affected areas should be cleaned down, spot primed with a zinc rich primer and then repainted to an appropriate paint manufacturer's recommendations.

Any cases of severe damage or corrosion must be reported to the structural design engineer.

GENERAL DESIGN CONSIDERATIONS 3.2

FORMWORK 3.2.1

Steel Decking Bearing and Fixing

It is the responsibility of the structural design engineer to determine the bearing and fixing requirements for the steel decking sheets specific to each design case, including consideration of adequate sheet hold down as well as bearing support.

The minimum bearing requirements for sheet ends are given in AS/NZS 2327 (Section 2.2.2). The recommended minimum bearing for steel decking sheets are:

- Sheet ends and side edges on steel or timber beams: 50mm
- Sheet ends and side edges on concrete block walls or in-situ concrete beams or walls: 75mm
- Bearing for internal support (continuous steel decking sheet span) of all types: 100mm

The steel decking sheets must be continuous when laid over temporary bearers.

Fixing to steel beams is usually with shear studs welded through the steel decking sheets whether the beam is designed as a composite beam or not. The size and number of studs and their placement must be specified by the design engineer. Refer Section 3.2.2 Composite Beam Design for more information.

For temporary hold-down the steel decking sheets can be fixed to steel beams with either self-drilling screws or powder actuated fasteners. Fastener strength and spacing must be sufficient to ensure resistance to wind uplift and other expected loads during construction. The recommended maximum fastener spacing along the beam is 300mm (i.e. at least one fastener in every steel decking sheet pan).

For concrete block construction, fixing into the grout cores is recommended as break out of the concrete block is likely if fixings are to the edge of the block. Temporary timber bearers can be used to provide extra bearing support and enable hold down of the steel decking sheet profile with nails. Fixing to tilt slab or in-situ concrete walls is usually by way of a steel angle fixed to the wall, refer to CAD details on-line (**www.dimondstructural.co.nz/products/hibond-80**).

Pre-cambering of Steel Decking Sheets

Pre-cambering of the steel decking sheets will result in less overall deflection of the composite floor slab, and is generally achieved by installing props which are higher than the supporting structure.

Caution is required when using pre-cambered steel decking sheets as the concrete must be poured to constant thickness, as flat screeding will result in less than the minimum design composite floor slab thickness at mid-span.

In any case the pre-camber must not exceed span/350.

Temporary Propping

When required to provide extra support to the steel decking sheets during construction, propping must be adequately braced and installed prior to laying the steel decking sheets. The floor design specifications and drawings must include instructions for the location of the propping lines.

The temporary bearers, props and bracing used must be specifically designed to support wet concrete and construction loads for each build project, taking ground conditions into account.

Suitable propping can be achieved with either Acrow props or braced 100 x 50mm timber props (for prop heights that do not exceed 3m) supporting timber bearers of minimum 100mm bearing width and a depth to suit prop spacing. Refer section 3.6.4.

Propping lines must be continuous and parallel to the permanent supports.

Temporary propping must remain in place until either the concrete has reached 80% of the design strength of the concrete for application of construction loads, or the concrete is fully cured for application of full design loads.

COMPOSITE FLOOR SLAB

Point and Line Loads

Placement of transverse ductile reinforcement is required to distribute point loads and line loads within the composite floor slab. Where a point load is not in a fixed position (e.g. carpark loads) placement of transverse reinforcement is required throughout the composite floor slab.

The effective width of point and line loads, and the required transverse reinforcement are to be designed in accordance with AS/NZS 2327 (Section 2.4.3).

Composite Floor Slab Penetrations

Penetrations of up to 250mm x 250mm square may be formed as part of the composite floor slab construction by formwork or polystyrene infill with the addition of 2 x HD12 ductile reinforcing bars laid in each adjacent steel decking sheet pan. The steel decking sheet is cut away after the concrete has cured.

Larger penetrations will require specific design of additional ductile reinforcement for structural Integrity and crack control, and may also require additional supporting beams to the structural design engineer's specific design. If cutting of the steel decking sheet is required prior to concrete placement, temporary propping will be required.

In-floor Heating

If in-floor Heating is to be incorporated in the composite floor slab, consideration must be given to the structural impact of placing heating systems within the compression zone of the composite floor slab, and the overall composite floor slab thickness increased to compensate for any loss of structural integrity. Commonly available systems include:

- Heated water within 20mm diameter polybutylene tubes at spacing as close as 200mm and with minimum 25mm top cover.
- Electrical wires up to 8mm diameter at spacings as close as 100mm

Heating tubes/wires are recommended to be laid parallel to the span of the steel decking sheets to minimise the impact on structural integrity.

The in-floor heating system must not be used to cure the concrete as it will likely cause excessive cracking in the composite floor slab.

Thermal Insulation

For a composite floor system to comply with the requirements of NZS 4218 using the method of calculation described in NZS 4214 it is necessary to add some form of insulation to the composite floor system. The thermal resistance of a composite floor slab without any covering to the top surface is low (less than 0.1m^2°C/W excluding the thermal resistance of internal and external surfaces), and dependent on concrete density and moisture content, and therefore does not contribute significantly to the overall R value usually required.

Rigid insulation board laminated to the underside of the steel decking sheets is recommended as a suitable solution.

For example, and R value of at least 1.3m^2°C/W can be achieved using either 50mm EPS or 30mm PIR board of appropriate thermal conductivity.

Composite Beam Design

The use of composite beam design can result in significant strength and stiffness gains over non-composite beam design. Composite beam design uses shear connectors to interconnect the composite floor slab and the beam.

The shear connection between the composite floor slab and the beam resists slipping at the interface, resulting in an interaction between the two members. This allows compressive forces to develop in the composite floor slab and tensile forces to develop in the beam.

The strength achieved in the composite beam is generally dependent on the strength of the shear connection provided between the composite floor slab and the beam. It is assumed that the shear connection is ductile.

Three types of construction are commonly used with composite beams.

<u>Unpropped</u>

- Where composite floor slab, secondary and primary beams are all constructed in an unpropped condition.
- Unpropped construction generally uses larger member sizes. However construction time is minimised, on this basis unpropped construction is preferred.
- The composite floor slab is poured to level for unpropped construction.

Propped

- Where secondary and primary beams are propped during construction. The composite floor slab is propped but may also be unpropped.
- Propped construction results in more efficient member sizes. However access to sub-trades is restricted until props have been removed.
- The composite floor slab is poured to level for propped construction.

Pre-cambered

- Where secondary and/or primary beams are fabricated with a pre-camber. The composite floor slab is unpropped for this type of construction.
- Pre-cambered construction provides member size efficiency and minimal soffit deflection and is effective on large spans.
- Pre-cambered construction requires the composite floor slab to be poured to constant thickness.

Timber Structure

Composite floor slabs are not intended for use on permanent supporting timber beams unless the beams have been specifically engineered to ensure undue deflection due to moisture, long term creep or shrinkage do not affect the concrete floor slab performance.

Contact between the galvanised steel decking sheets and the timber beam must be avoided. Refer Section 3.1.3.2.

Shear connectors into timber require specific design by the structural design engineer, and could include galvanised coach screws or reinforcing bar epoxy glued into the timber beams and turned into the composite floor slab.

Two-Way Composite Floor Slabs

Composite floor slabs are intended specifically for use in one-way composite floor slab construction. However, specific design as a two-way composite floor slab may be carried out to the requirements of NZS 3101 provided the concrete strength contribution below the steel decking sheet ribs is ignored in the transverse direction.

Bridge Structures

Composite floor slabs are not intended for use in bridge structures other than as permanent formwork, unless specifically designed outside the scope of this manual.

Earthquakes

Design considerations for composite floor slabs for earthquake are provided in AS/NZS 2327 Section 8 as a modification and supplement to the requirements of NZS 3404.

SPECIFIC DESIGN – HIBOND 80 FLOORING 3.3

DESIGN BASIS 3.3.1

The Hibond 80 flooring system must be designed in accordance with the procedures and limit states specified in AS/NZS 2327:2017 with Hibond 80 as formwork for concrete placement, incorporating the requirements, limitations and information given in this manual.

Compliance is based on detailed analysis by the Heavy Engineering Research Association (HERA) and comprehensive physical testing, enabling load/span capacities to be established for actions, load combinations and performance limitations in accordance with AS/NZS 2327:2017, based on the Hibond 80 steel decking sheet achieving partial shear connection, for

- Ultimate Limit State Capacity Factors to AS/NZS 1170.
- Serviceability Limit State deflection, vibration and cracking control.

Hibond 80 performance testing was carried out by :

- Imperial College London - structural tests to EN 1993-1-3 and EN 1994-1-1
- Exova Warringtonfire - fire resistance tests to EN 1365-2
- University of Auckland - Welded shear stud capacity.
  - Structural tests to AS/NZS 2327:2017

Data presented in this manual is intended for use by qualified structural engineers. Use of Hibond 80 in applications outside the scope of this manual will require specific structural design from first principles.

A minimum 28 day compressive strength of 25MPa for high grade concrete has been assumed.

The self weight of the Hibond 80 Flooring System (including the concrete) has been included in the load tables.

Hibond 80 Composite Floor Design Software

Comprehensive Hibond 80 Composite Floor Design Software is available to structural design engineers for use in optimising a Hibond 80 flooring system design in compliance with the design basis outlined above and covering the following design aspects:

- Construction Stage - formwork bending, crushing and shear load capacity and deflection.
- Composite Floor Slab - load capacity bending and shear, vibration, cantilever, point and line loads and fire ratings.

For the latest software, please download from the Dimond Structural website **www.dimondstructural.co.nz/software**

HIBOND 80 DESIGN CONSIDERATIONS 3.3.2

FORMWORK 3.3.2.1

The Hibond 80 flooring system is intended to support the following loads as formwork:

- Weight of wet concrete and the steel deck
- Construction loads in accordance with AS/NZS 2327:2017
- Effect of concrete ponding due to deflection of the steel decking sheets (typically 6-7% of the concrete volume)

Hibond 80 is designed to enable long spans without the need for additional support from temporary propping.

Verification of Hibond 80 formwork Ultimate Limit State capacity for bending (sagging and hogging), web crushing and vertical shear has been achieved by testing in accordance with AS/NZS 2327:2017.

Verification of Serviceability Limit State capacity deflection has been achieved for Hibond 80 by testing in accordance with AS/NZS 2327:2017.

Hibond 80 sheets must be laid in one continuous length between permanent supports. Short steel decking sheets must never be spliced together to achieve a span length between supports.

Formwork span limits are given in the Hibond 80 Load Span Tables 3.3.4, also refer General Design Considerations 3.2.1 and Handling and Storage 3.6.3 for guidance on steel decking sheet lengths for safe handling.

Cantilevered End Spans

Use of Hibond 80 flooring systems as cantilevered floor structures requires a propping line at the steel decking sheet ends to ensure a stable working platform during construction.

Additional ductile negative reinforcement is required to be designed to NZS 4671 to support all cantilevered composite floor slabs, and the contribution of the steel decking sheets is neglected in design.

Consideration must be given to overall composite floor slab thickness to ensure sufficient cover over the negative reinforcement is achieved in compliance with NZS 3101.

As a guide propping of the Hibond 80 sheets is not required for cantilevered end spans with a clear over-hang of,

Hibond 80 x 0.75mm: 400mm

Hibond 80 x 0.95mm: 500mm

Hibond 80 x 1.05mm: 550mm

Hibond 80 x 1.15mm: 600mm

These cantilever spans assume:

- The Hibond 80 sheets are securely fixed to the edge supporting member and the adjacent internal supporting member
- That Hibond 80 Edge Form at the end of the cantilever is secured with one self-drilling screw (or rivet) per Hibond 80 pan along with Edge Form Support Straps. Refer section 3.3.9.

Further guidance is available in SCI Publication P300 Composite Slabs and Beams using Steel Decking, 2009.

COMPOSITE FLOOR SLAB

Load capacity of the Hibond 80 flooring system is dependent on the shear bond between the concrete and the steel decking sheet. Shear bond is a combination of chemical bond between the concrete and the steel decking sheet surface, and mechanical bond between the concrete aggregate and the steel decking sheet embossments formed specifically for this purpose. It is important that the concrete is placed onto a clean galvanised steel surface free from any contamination or debris.

Information presented in this manual applies only to overall concrete floor slab thicknesses between 150mm and 230mm covering the following design aspects:

- Construction Stage - formwork bending, crushing and shear load capacity and deflection.
- Composite Floor Slab - load capacity bending and shear, vibration and Fire Ratings.

Verification of Ultimate Limit State capacity for bending and longitudinal and vertical shear had been acheived for Hibond 80 by testing and analysis in accordance with AS/NZS 2327 (sections 2.7.2, 2.7.4 and Appendix H) based on partial shear connection.

Verification of Ultimate limit state capacity for punching shear should be determined in accordance with AS/NZS 2327 (section 2.7.5) and NZS 3101.

Verification of Servicability Limit State capacity for short term deflection, creep deflection, shrinkage deflection and crack control has been determined for Hibond 80 in accordance with AS/NZS 2327 (section 2.8) and NZS 3101.

Appropriate imposed floor actions and load combinations should be determined in accordance with AS/NZS 1170. Load capacities for the Hibond 80 flooring system is given in the Hibond 80 Load Span Tables 3.3.4, which assume inclusion of the minimum top reinforcement mesh (refer Additional Reinforcement in this section).

Refer General Design Considerations 3.2.2.

Fire Design

Design of fire resistance of composite floor slabs is based on resistance to collapse (stability) prevention of flames passing through cracks in the composite floor slab (integrity) and limiting the temperature increase on the unexposed side of the composite floor slab (insulation).

Fire resistance of Hibond 80 flooring systems maybe achieved by several methods:

- Testing the fire resistance inherent in the composite floor slab as a basis for resistance ratings for combinations of span, load and composite floor slab thickness.
- Placement of additional reinforcement in a specified location within the composite floor slab.
- Installation of suspended ceilings.

Fire resistance ratings inherent in the Hibond 80 flooring system has been established by testing to EN 1365-2 by Exova Warringtonfire.

Fire Resistance Rating (FRR) of 60 minutes

FFR 60 is acheived for composite floor slabs designed within the limitations of the Hibond 80 Load Span Tables 3.3.4 which include the minimum mesh reinforcement (required also for crack control) and the additional positive fire reinforcement bars required for propped single spans.

The fire design tables include a superimposed dead load (G_{SDL}) of 0.5kPa in order that an imposed action (Q) can be compared with the tables in Section 3.3.4.

Fire Resistance Rating (FRR) of 90 and 120 minutes

FFR 90 and FRR 120 can be achieved with the addition of extra reinforcement mesh and bottom reinforcement bars, contact Dimond Structural on 0800 Roofspec (0800 766 377).

Fire rating of junctions with the composite floor slab underside can be achieved with the use of site-formed insulation that has appropriate tested fire rating, subject to specific design and detailing by the fire engineer.

Additional Reinforcement

The minimum amount of longitudinal and transverse reinforcement required in the top of the composite floor slab as outlined in AS/NZS 2327 (Sections 2.2.1 and 6.3).

The minimum continuous D500MPa mesh or ductile reinforcement bar size each way to be used as top reinforcement for either unpropped or propped metal decking sheets for composite floor slabs enclosed within a building is outlined in the following table.

Hibond 80	Unpropped Metal Decking Sheets[1]		Propped Metal Decking Sheets[2]	
Slab Thickness	Mesh	Bars (Each Way)	Mesh	Bars (Each Way)
150	SE82	HD10 @ 300	SE92	HD10 @ 250
160	SE82	HD10 @ 300	SE72 x 2	HD12 @ 300
170	SE82	HD10 @ 300	SE72 x 2	HD12 @ 300
180	SE92	HD10 @ 250	SE62 + SE92	HD12 @ 250
190	SE92	HD10 @ 250	SE62 + SE92	HD12 @ 250
200	SE92	HD10 @ 250	SE82 x 2	HD12 @ 200
210	SE92	HD10 @ 250	SE82 + SE92	HD12 @ 200
220	SE92	HD10 @ 250	SE82 + SE92	HD12 @ 200
230	SE72 x 2	HD12 @ 300	SE92 x 2	HD16 @ 300

Notes: 1. Based on transverse steel requirements in AS/NZS 2327 Section 2.2.1 2. Based on crack control steel requirements in AS/NZS 2327 Section 6.3

Additional ductile reinforcement in the form of reinforcement bars or mesh may be required to:

- gain full continuity over supporting members in continuous spans.
- achieve the required fire performance.
- achieve the required seismic performance.
- control cracks caused by shrinkage during curing of the concrete, particularly for composite floor slabs exposed to the weather. For propped construction, increasing nominal continuity reinforcement over supports is required as indicated above given crack widths will increase when the props are removed.
- distribute loads around openings in composite floor slabs.
- provide necessary reinforcement for composite floor slabs used as cantilevers.

When specifying additional reinforcement the designer must ensure the composite floor slab thickness is adequate to achieve the required minimum concrete cover over the reinforcement in compliance with NZS 3101.

Shear Stud Design Resistance

Shear stud design resistance for Hibond 80 steel decking has been determined from physical testing of 19mm diameter x 125mm long (120mm LAW (length after welding)) shear connectors in accordance with AS/NZS 2327, as follows.

Shear Stud Design Resistance Per Connector (kN)

Shear Studs Per Pan	Concrete Strength, f'_c		
	25MPa	30MPa	≥ 35MPa
1	50.1	56.8	55.9
2	20.7	23.5	23.1

Note: f_u = 450MPa for through deck welded shear connectors. Where 2 shear studs per pan are used, these are spaced nominally 105mm apart.

Acoustic Performance

Estimated Sound Transmission Class (STC) and Impact Insulation Class (IIC) that can be achieved with different composite floor slab thicknesses and a range of ceiling and surface treatment additions to the Hibond 80 flooring system are provided in section 3.3.5, based on the Marshall Day Acoustics Report (Rp 001 2016284A).

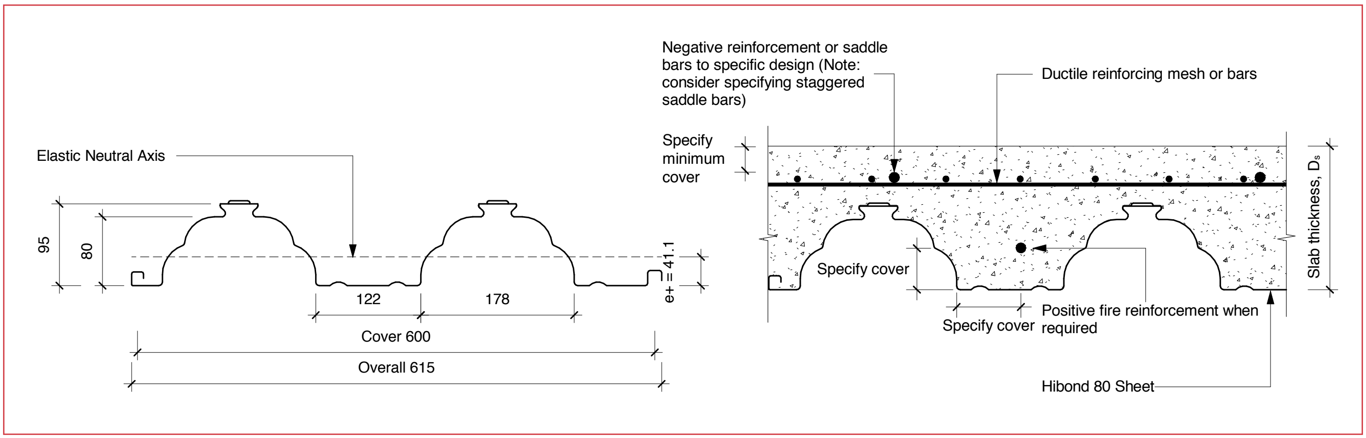
The STC and IIC values are based on tested performance of a 120mm Hibond 55 composite floor slab and known performance of concrete thickness, floor coverings, insulation and suspended ceilings.

As a guide, a bare 150mm Hibond 80 composite floor slab is expected to achieve STC 47dB and IIC 27dB. With the addition of a suspended GIB ceiling and a 75mm acoustic blanket it is reasonable to expect STC 67dB and IIC 46dB. The IIC can be further improved to as much as 80+dB with the addition of appropriate carpet and underlay.

Floor Vibration

As a guide to designers the spans expressed in the Hibond 80 Load Span Tables 3.3.4 represent the maximum span of the Hibond 80 composite floor slab recommended for in-service floor vibration based on a natural frequency limit of 5.0Hz using the cracked dynamic second moment of area and dead loads + 10% of the imposed loads (the proportion of imposed loads that may be considered permanent). This represents the dynamic response of the composite floor slab but does not account for the dynamic response of the supporting structure. Specific design is required to check the other types of floor use.

HIBOND 80 SECTION PROPERTIES



FORMWORK PROPERTIES

Hibond 80 Formwork Reliable Design Properties

Hibond 80 Thickness	0.75mm	0.95mm	1.05mm	1.15mm
Design Strength, fy (MPa)	550	550	500	500
Base metal thickness (mm)	0.75	0.95	1.05	1.15
Self weight (kN/m²)	0.093	0.117	0.129	0.141
Gross Cross Sectional Area (mm²/m)	1155	1463	1617	1771
$M_{c,Rd+}$ (kNm/m)	10.34	15.85	18.31	21.22
$M_{c,Rd-}$ (kNm/m)	8.03	11.81	13.72	15.75
I_{a+} (10^6 mm^4/m)	1.085	1.166	1.178	1.414
I_{a-} (10^6 mm^4/m)	0.910	1.091	1.256	1.527
Elastic Neutral Axis, e+ (mm)	41.1	41.1	41.1	41.1
$R_{w,Rd}$ (kN/m)	14.96	20.20	28.33	36.46

Notes
1. Design Values determined according to EN1990, Annex D.8 to account for material, profile shape and test result variations, except for self weight and cross sectional area which is based on nominal measurements for coil strip width and base metal thickness.
2. $M_{c,Rd+}$ and $M_{c,Rd-}$ are bending moments due to positive and negative bending respectively.
3. I_{a+} and I_{a-} are second moments of area for positive and negative sense respectively.
4. $R_{w,Rd}$ is web crushing resistance for an effective end bearing of 50mm.

COMPOSITE FLOOR SLAB PROPERTIES

0.75mm Hibond 80 Composite Floor Slab Properties (Per Metre Width)

D_s (mm)	Weight (kN/m)	I_g ($10^6 mm^4$)		Y_g (mm)		I_{cr} ($10^6 mm^4$)		Y_{cr} (mm)		I_{av} ($10^6 mm^4$)	
		medium	long	medium	long	medium	long	medium	long	medium	long
150	2.63	12.9	9.2	65.5	68.6	11.8	7.8	45.4	51.9	12.3	8.5
160	2.86	15.7	11.1	70.2	73.4	13.5	9.2	49.9	56.2	14.6	10.1
170	3.09	18.8	13.2	74.9	78.2	15.5	10.8	54.5	60.7	17.2	12.0
180	3.32	22.5	15.7	79.6	83.0	17.6	12.5	59.2	65.3	20.1	14.1
190	3.55	26.8	18.4	84.4	87.9	19.9	14.3	63.9	69.9	23.3	16.4
200	3.78	31.6	21.6	89.2	92.7	22.3	16.3	68.7	74.6	27.0	18.9
210	4.01	37.1	25.1	94.0	97.6	25.0	18.5	73.5	79.3	31.0	21.8
220	4.24	43.3	29.0	98.8	102.5	27.8	20.9	78.3	84.1	35.5	25.0
230	4.47	50.2	33.4	103.7	107.4	30.8	23.4	83.1	88.8	40.5	28.4

0.95mm Hibond 80 Composite Floor Slab Properties (Per Metre Width)

D_s (mm)	Weight (kN/m)	I_g (10^6mm^4)		Y_g (mm)		I_{cr} (10^6mm^4)		Y_{cr} (mm)		I_{av} (10^6mm^4)	
		medium	long	medium	long	medium	long	medium	long	medium	long
150	2.65	14.2	10.3	66.6	70.2	13.7	9.1	47.7	55.2	13.9	9.7
160	2.88	17.1	12.4	71.3	75.1	15.8	10.7	52.2	59.5	16.4	11.5
170	3.11	20.6	14.7	76.0	80.0	18.1	12.5	56.7	64.0	19.3	13.6
180	3.34	24.5	17.4	80.8	84.9	20.6	14.5	61.3	68.5	22.5	15.9
190	3.57	29.0	20.4	85.6	89.8	23.3	16.7	66.0	73.1	26.1	18.5
200	3.81	34.1	23.8	90.4	94.7	26.2	19.1	70.7	77.8	30.2	21.4
210	4.04	39.9	27.6	95.2	99.6	29.4	21.7	75.5	82.5	34.6	24.6
220	4.27	46.4	31.8	100.1	104.6	32.8	24.5	80.3	87.2	39.6	28.1
230	4.50	53.6	36.5	105.0	109.5	36.4	27.5	85.1	92.0	45.0	32.0

1.05mm Hibond 80 Composite Floor Slab Properties (Per Metre Width)

D_s (mm)	Weight (kN/m)	I_g (10^6mm^4)		Y_g (mm)		I_{cr} (10^6mm^4)		Y_{cr} (mm)		I_{av} (10^6mm^4)	
		medium	long	medium	long	medium	long	medium	long	medium	long
150	2.66	14.8	10.9	67.1	71.0	14.5	9.7	48.8	56.7	14.7	10.3
160	2.90	17.9	13.0	71.8	75.9	16.8	11.4	53.2	61.0	17.3	12.2
170	3.13	21.4	15.4	76.6	80.8	19.3	13.3	57.8	65.5	20.3	14.4
180	3.36	25.4	18.2	81.4	85.7	22.0	15.5	62.3	70.0	23.7	16.8
190	3.59	30.0	21.3	86.2	90.7	24.9	17.8	67.0	74.6	27.5	19.6
200	3.82	35.3	24.8	91.0	95.6	28.0	20.3	71.7	79.3	31.7	22.6
210	4.05	41.2	28.8	95.9	100.6	31.4	23.1	76.5	84.0	36.3	25.9
220	4.28	47.9	33.1	100.7	105.5	35.1	26.1	81.3	88.7	41.5	29.6
230	4.51	55.3	38.0	105.6	110.5	39.0	29.3	86.1	93.5	47.1	33.6

1.15mm Hibond 80 Composite Floor Slab Properties (Per Metre Width)

D_s (mm)	Weight (kN/m)	I_g (10^6mm^4)		Y_g (mm)		I_{cr} (10^6mm^4)		Y_{cr} (mm)		I_{av} (10^6mm^4)	
		medium	long	medium	long	medium	long	medium	long	medium	long
150	2.68	15.4	11.4	67.6	71.7	15.4	10.2	49.9	58.1	15.4	10.8
160	2.91	18.6	13.6	72.3	76.7	17.8	12.1	54.3	62.4	18.2	12.8
170	3.14	22.2	16.1	77.1	81.6	20.4	14.1	58.8	66.9	21.3	15.1
180	3.37	26.4	19.0	81.9	86.6	23.3	16.3	63.3	71.4	24.8	17.7
190	3.60	31.1	22.2	86.7	91.6	26.4	18.8	68.0	76.1	28.7	20.5
200	3.83	36.5	25.9	91.6	96.5	29.8	21.5	72.7	80.7	33.1	23.7
210	4.06	42.5	29.9	96.5	101.5	33.4	24.5	77.4	85.4	38.0	27.2
220	4.29	49.3	34.4	101.3	106.5	37.3	27.7	82.2	90.2	43.3	31.0
230	4.52	56.9	39.4	106.2	111.5	41.5	31.1	87.0	94.9	49.2	35.2

Notes

1. D_s is the overall thickness of the composite floor slab.
2. Composite floor slab weights are based on a dry concrete density of 2350kg/m^3 with no allowance for ponding.
3. Section properties are presented in terms of equivalent steel units as follows:
   (a) Medium term superimposed loads are based on ⅔ short term and ⅓ long term load (i.e. modular ratio = 10) and apply to buildings of normal usage.
   (b) Long term superimposed loads are based on all loads being long term (i.e. modular ratio = 18) and apply to storage loads and loads which are permanent in nature.
4. I_g is the second moment of area of the Hibond 80 composite floor slab for the gross section.
5. I_{cr} is the second moment of area of the Hibond 80 composite floor slab for the cracked section.
6. I_{av} is the average value of gross (I_g) and cracked (I_{cr}) sections to be used for deflection calculations.
7. Y_g is the distance from top of composite floor slab to neutral axis of the Hibond 80 composite floor slab for the gross section.
8. Y_{cr} is the distance from top of composite floor slab to neutral axis of the Hibond 80 composite floor slab for the cracked section.

HIBOND 80 LOAD SPAN TABLES

Maximum formwork and composite floor slab spans are presented for composite floor slab thickness between 150mm and 230mm for a range of live load, superimposed dead load combinations and mesh reinforcing arrangements to achieve a Fire Resistance Rating (FRR) of 60 minutes.

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

1) Span: L is the span measured centre to centre between permanent supports.
2) The design superimposed load combination is G_{SDL} + Q must not be greater than the superimposed loads given in the tables.
3) Some values shown in the double span tables are less than corresponding values given in the single span tables. The situation arises as combined effects limit.
4) Linear interpolation is permitted between intermediate composite floor slab thicknesses.
5) Tables for propped spans are based on 1 row of continuous temporary propping at mid-span.

Formwork

a. 150mm support width and a 100mm wide prop width is assumed.
b. Imposed construction loads are to AS/NZS 2327:2017.
c. Normal weight concrete: wet density = 2400kg/m^3.
d. Construction stage deflection span/130 or 30mm (ponding has been taken into account).
e. The design span of the formwork relates closely to the site installation. If the Hibond 80 sheet is designed as an end span or internal span, the minimum nominal steel decking sheet length for construction should be noted clearly in the design documentation to ensure that appropriate steel decking sheet lengths are used by the installer to achieve the span type selected. Refer Flooring Installation 3.6.

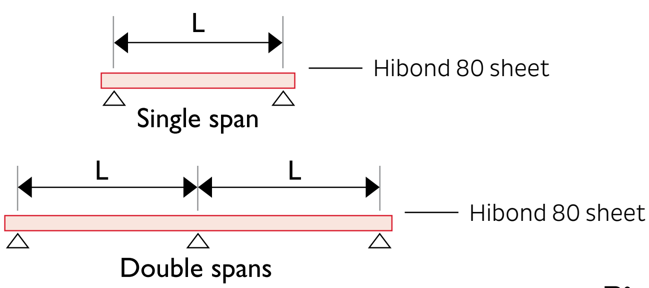
Composite Floor Slab

a. Normal weight concrete: dry density 2350kg/m^3. Modular ratio = 10 used for superimposed live load (Q) 1.5kPa, 2.5kPa and 3.0kPa. Modular ratio = 18 used for superimposed live load (Q) 5.0kPa and above.
b. Composite floor slab moment resistance based on partial connection method with an assumed characteristic shear bond value of $\tau_{u,Rk}$ = 0.107MPa.
c. Composite stage deflection limits: Imposed load, span/350 or 20mm; Total load, span/250 or 30mm:
d. Vibration : Natural frequency limit of 5.0Hz based on the cracked dynamic second moment of area using the dead loads plus 10% of the imposed loads (the proportion of imposed loads that may be considered to be permanent). Propped formwork spans have been limited to 80% utilisation for vibration.
e. The composite floor slab is assumed to be acting as simply supported spans in the tables.

Fire

a. Mesh requirements for composite floor slabs enclosed within a building (with 30mm concrete cover) have been provided to achieve a FRR of 60 minutes (in conjunction with nominated bottom reinforcing bars where required for propped spans).
b. A superimposed dead load (G_{SDL}) of 0.5kPa only has been used for all fire rating combinations.
c. FRR of 90 and 120 minutes can achieved with the additional of extra reinforcement mesh and bottom reinforcing bars by using the Hibond 80 Composite Design Software. Other situations or concrete covers require specific design.
d. Live load factor ψ_l = 0.4 for all loads.
e. Reinforcement is grade 500 to AS/NZS4671, assumed continuous over more than one span.
f. Moment capacity determined in accordance with NZS3101.
g. Minimum cover to bottom reinforcing bars is 25mm to the bottom of the steel decking sheet and 40mm to the side of the steel decking sheet rib.

Typical Steel Decking Sheet Span Configurations



0.75mm Hibond 80 – Constructed as Unpropped Single Span Formwork, Ambient Temperature and FRR 60 Minutes

Slab Depth (mm)	Concrete Volume (m^3/m^2)	Dry Slab Weight (kPa)	Minimum Crack Control Mesh[1]	Superimposed Live Load, Q (kPa)				Maximum Superimposed Load (G_{SDL} + Q) for Ambient Temperature[3] (kPa)
				1.5	2.5	3	5	
				Superimposed Dead Load[2], G_{SDL} (kPa)				
				0.8	0.1	0.8	0.5	
				Maximum Composite Floor Span, L (m) for FRR 60 Minutes (using minimum crack control mesh for the loads (G_{SDL} + Q) indicated above)				
150	0.11	2.63	SE82	3.71[4]	3.71	3.71	3.62	8.0
160	0.12	2.86	SE82	3.60	3.60	3.60	3.60	9.0
170	0.13	3.09	SE82	3.52	3.52	3.52	3.52	10.0
180	0.14	3.32	SE92	3.44	3.44	3.44	3.44	11.0
190	0.15	3.55	SE92	3.36	3.36	3.36	3.36	12.0
200	0.16	3.78	SE92	3.30	3.30	3.30	3.30	13.0
210	0.17	4.01	SE92	3.24	3.24	3.24	3.24	14.0
220	0.18	4.24	SE92	3.18	3.18	3.18	3.18	15.0
230	0.19	4.47	SE72 x 2	3.13	3.13	3.13	3.13	16.0

0.75mm Hibond 80 – Constructed as Unpropped Double Span Formwork, Ambient Temperature and FRR 60 Minutes

Slab Depth (mm)	Concrete Volume (m^3/m^2)	Dry Slab Weight (kPa)	Minimum Crack Control Mesh[1]	Superimposed Live Load, Q (kPa)				Maximum Superimposed Load (G_{SDL} + Q) for Ambient Temperature[3] (kPa)
				1.5	2.5	3	5	
				Superimposed Dead Load[2], G_{SDL} (kPa)				
				0.8	0.1	0.8	0.5	
				Maximum Composite Floor Span, L (m) for FRR 60 Minutes (using minimum crack control mesh for the loads (G_{SDL} + Q) indicated above)				
150	0.11	2.63	SE82	3.57	3.57	3.57	3.57	9.0
160	0.12	2.86	SE82	3.45	3.45	3.45	3.45	10.0
170	0.13	3.09	SE82	3.34	3.34	3.34	3.34	11.0
180	0.14	3.32	SE92	3.24	3.24	3.24	3.24	12.0
190	0.15	3.55	SE92	3.14	3.14	3.14	3.14	13.5
200	0.16	3.78	SE92	3.03	3.03	3.03	3.03	15.0
210	0.17	4.01	SE92	2.99	2.99	2.99	2.99	16.5
220	0.18	4.24	SE92	2.92	2.92	2.92	2.92	17.5
230	0.19	4.47	SE72 x 2	2.83	2.91	2.91	2.91	19.0

0.75mm Hibond 80 – Constructed as Propped Single or Double Span Formwork, Ambient Temperature and FRR 60 Minutes

Slab Depth (mm)	Concrete Volume (m^3/m^2)	Dry Slab Weight (kPa)	Minimum Crack Control Mesh[1]	Propped Composite Floor Slab Limitation (minimum one row of continuous propping at mid-span)	Superimposed Live Load, Q (kPa)			
					1.5	2.5	3	5
					Superimposed Dead Load[2], G_{SDL} (kPa)			
					0.8	0.1	0.8	0.5
					Maximum Composite Floor Span, L (m)			
150	0.11	2.63	SE92	Ambient Temperature[4]	5.42	5.68	5.37	4.44
				FRR 60 Minutes[5]	5.38 HD12, 2nd Pan	5.12 HD12, 2nd Pan	5.01 HD12, 2nd Pan	4.44 HD12, 2nd Pan
160	0.12	2.86	SE72 x 2	Ambient Temperature[4]	5.60	5.83	5.54	4.68
				FRR 60 Minutes[5]	5.39 HD12, 2nd Pan	5.14 HD12, 2nd Pan	5.03 HD12, 2nd Pan	4.65 HD12, 2nd Pan
170	0.13	3.09	SE72 x 2	Ambient Temperature[4]	5.76	5.79	5.71	4.83
				FRR 60 Minutes[5]	5.39 HD12, 2nd Pan	5.15 HD12, 2nd Pan	5.05 HD12, 2nd Pan	4.68 HD12, 2nd Pan
180	0.14	3.32	SE62 + SE92	Ambient Temperature[4]	5.60	5.60	5.60	4.92
				FRR 60 Minutes[5]	5.00 HD10, 3rd Pan	5.03 HD12, 3rd Pan	4.93 HD12, 3rd Pan	4.59 HD12, 3rd Pan
190	0.15	3.55	SE62 + SE92	Ambient Temperature[4]	5.41	5.41	5.41	5.04
				FRR 60 Minutes[5]	4.98 HD10, 3rd Pan	5.03 HD12, 3rd Pan	4.93 HD12, 3rd Pan	4.60 HD12, 3rd Pan
200	0.16	3.78	SE82 x 2	Ambient Temperature[4]	5.30	5.30	5.30	5.12
				FRR 60 Minutes[5]	4.97 HD10, 3rd Pan	4.79 HD10, 3rd Pan	4.70 HD10, 3rd Pan	4.89 HD12, 2nd Pan
210	0.17	4.01	SE82 + SE92	Ambient Temperature[4]	5.12	5.12	5.12	5.12
				FRR 60 Minutes[5]	4.96 HD10, 3rd Pan	4.78 HD10, 3rd Pan	4.70 HD10, 3rd Pan	4.63 HD12, 3rd Pan
220	0.18	4.24	SE82 + SE92	Ambient Temperature[4]	4.93	4.93	4.93	4.93
				FRR 60 Minutes[5]	4.93 HD10, 3rd Pan	4.78 HD10, 3rd Pan	4.70 HD10, 3rd Pan	4.42 HD10, 3rd Pan
230	0.19	4.47	SE92 x 2	Ambient Temperature[4]	4.80	4.80	4.80	4.80
				FRR 60 Minutes[5]	4.80 HD10, 3rd Pan	4.80 HD10, 3rd Pan	4.80 HD10, 3rd Pan	4.54 HD10, 3rd Pan

Notes:
1. Crack control steel is the minimum continuous D500 Mesh required for a composite floor slab enclosed within a building.
2. To achieve FRR 60 minutes, a superimposed dead load of 0.5kPa is assumed for all load combinations.
3. Maximum load (G_{SDL} + Q) limited by composite floor slab capacity under ambient temperature conditions.
4. Spans possible to the maximum load (G_{SDL} + Q) indicated under ambient temperature conditions using minimum continuous crack control mesh.
5. Spans possible to the maximum load (G_{SDL} + Q) indicated to achieve FRR 60 minutes using the nominated bottom ductile reinforcing bars in the steel decking sheet pans.

0.95mm Hibond 80 – Constructed as Unpropped Single Span Formwork, Ambient Temperature and FRR 60 Minutes

Slab Depth (mm)	Concrete Volume (m^3/m^2)	Dry Slab Weight (kPa)	Minimum Crack Control Mesh[1]	Superimposed Live Load, Q (kPa)				Maximum Superimposed Load (G_{SDL} + Q) for Ambient Temperature[3] (kPa)
				1.5	2.5	3	5	
				Superimposed Dead Load[2], G_{SDL} (kPa)				
				0.8	0.1	0.8	0.5	
				Maximum Composite Floor Span, L (m) for FRR 60 Minutes (using minimum crack control mesh for the loads (G_{SDL} + Q) indicated above)				
150	0.11	2.65	SE82	3.79	3.79	3.79	3.79	10.5
160	0.12	2.88	SE82	3.69	3.69	3.69	3.69	11.5
170	0.13	3.11	SE82	3.59	3.59	3.59	3.59	13.0
180	0.14	3.34	SE92	3.52	3.52	3.52	3.52	14.0
190	0.15	3.57	SE92	3.44	3.44	3.44	3.44	15.0
200	0.16	3.81	SE92	3.38	3.38	3.38	3.38	16.0
210	0.17	4.04	SE92	3.31	3.31	3.31	3.31	17.0
220	0.18	4.27	SE92	3.26	3.26	3.26	3.26	18.0
230	0.19	4.50	SE72 x 2	3.20	3.20	3.20	3.20	19.0

0.95mm Hibond 80 – Constructed as Unpropped Double Span Formwork, Ambient Temperature and FRR 60 Minutes

Slab Depth (mm)	Concrete Volume (m^3/m^2)	Dry Slab Weight (kPa)	Minimum Crack Control Mesh[1]	Superimposed Live Load, Q (kPa)				Maximum Superimposed Load (G_{SDL} + Q) for Ambient Temperature[3] (kPa)
				1.5	2.5	3	5	
				Superimposed Dead Load[2], G_{SDL} (kPa)				
				0.8	0.1	0.8	0.5	
				Maximum Composite Floor Span, L (m) for FRR 60 Minutes (using minimum crack control mesh for the loads (G_{SDL} + Q) indicated above)				
150	0.11	2.65	SE82	4.28[4]	4.28	4.20	3.88	7.0
160	0.12	2.88	SE82	4.15[4]	4.15	4.15	3.91	9.0
170	0.13	3.11	SE82	4.03[4]	4.03	4.03	3.93	10.0
180	0.14	3.34	SE92	3.91	3.91	3.91	3.91	11.0
190	0.15	3.57	SE92	3.81	3.81	3.81	3.81	12.0
200	0.16	3.81	SE92	3.71	3.71	3.71	3.71	13.0
210	0.17	4.04	SE92	3.62	3.62	3.62	3.62	14.5
220	0.18	4.27	SE92	3.54	3.54	3.54	3.54	15.5
230	0.19	4.50	SE72 x 2	3.46	3.46	3.46	3.46	16.5

0.95mm Hibond 80 – Constructed as Propped Single or Double Span Formwork, Ambient Temperature and FRR 60 Minutes

Slab Depth (mm)	Concrete Volume (m^3/m^2)	Dry Slab Weight (kPa)	Minimum Crack Control Mesh[1]	Propped Composite Floor Slab Limitation (minimum one row of continuous propping at mid-span)	Superimposed Live Load, Q (kPa)			
					1.5	2.5	3	5
					Superimposed Dead Load[2], G_{SDL} (kPa)			
					0.8	0.1	0.8	0.5
					Maximum Composite Floor Span, L (m)			
150	0.11	2.65	SE92	Ambient Temperature[4]	5.46	5.72	5.42	4.54
				FRR 60 Minutes[5]	5.59 HD12, 2nd Pan	5.54 HD16, 3rd Pan	5.20 HD12, 2nd Pan	4.54 HD12, 2nd Pan
160	0.12	2.88	SE72 x 2	Ambient Temperature[4]	5.64	5.88	5.61	4.78
				FRR 60 Minutes[5]	5.60 HD12, 2nd Pan	5.56 HD16, 3rd Pan	5.23 HD12, 2nd Pan	4.78 HD16, 3rd Pan
170	0.13	3.11	SE72 x 2	Ambient Temperature[4]	5.82	6.05	5.78	5.00
				FRR 60 Minutes[5]	5.61 HD12, 2nd Pan	5.58 HD16, 3rd Pan	5.26 HD12, 2nd Pan	4.88 HD12, 2nd Pan
180	0.14	3.34	SE62 + SE92	Ambient Temperature[4]	6.00	6.20	5.93	5.26
				FRR 60 Minutes[5]	5.48 HD12, 3rd Pan	5.53 HD12, 2nd Pan	5.42 HD12, 2nd Pan	5.04 HD12, 2nd Pan
190	0.15	3.57	SE62 + SE92	Ambient Temperature[4]	6.16	6.38	6.10	5.50
				FRR 60 Minutes[5]	5.48 HD12, 3rd Pan	5.54 HD12, 2nd Pan	5.43 HD12, 2nd Pan	5.07 HD12, 2nd Pan
200	0.16	3.81	SE82 x 2	Ambient Temperature[4]	6.30	6.40	6.25	5.73
				FRR 60 Minutes[5]	5.47 HD12, 3rd Pan	5.55 HD12, 2nd Pan	5.45 HD12, 2nd Pan	5.10 HD12, 2nd Pan
210	0.17	4.04	SE82 + SE92	Ambient Temperature[4]	6.15	6.15	6.15	5.83
				FRR 60 Minutes[5]	5.47 HD12, 3rd Pan	5.56 HD12, 2nd Pan	5.46 HD12, 2nd Pan	5.13 HD12, 2nd Pan
220	0.18	4.27	SE82 + SE92	Ambient Temperature[4]	6.00	6.00	6.00	5.88
				FRR 60 Minutes[5]	5.47 HD12, 3rd Pan	5.57 HD12, 2nd Pan	5.19 HD12, 3rd Pan	5.15 HD12, 2nd Pan
230	0.19	4.50	SE92 x 2	Ambient Temperature[4]	5.80	5.80	5.80	5.80
				FRR 60 Minutes[5]	5.33 HD10, 3rd Pan	5.39 HD12, 3rd Pan	5.30 HD12, 3rd Pan	5.00 HD12, 3rd Pan

Notes:
1. Crack control steel is the minimum continuous D500 Mesh required for a composite floor slab enclosed within a building.
2. To achieve FRR 60 minutes, a superimposed dead load of 0.5kPa is assumed for all load combinations.
3. Maximum load (G_{SDL} + Q) limited by composite floor slab capacity under ambient temperature conditions.
4. Spans possible to the maximum load (G_{SDL} + Q) indicated under ambient temperature conditions using minimum continuous crack control mesh.
5. Spans possible to the maximum load (G_{SDL} + Q) indicated to achieve FRR 60 minutes using the nominated bottom ductile reinforcing bars in the steel decking sheet pans.

1.05mm Hibond 80 - Constructed as Unpropped Single Span Formwork, Ambient Temperature and FRR 60 Minutes

Slab Depth (mm)	Concrete Volume (m^3/m^2)	Dry Slab Weight (kPa)	Minimum Crack Control Mesh[1]	Superimposed Live Load, Q (kPa)				Maximum Superimposed Load (G_{SDL} + Q) for Ambient Temperature[3] (kPa)
				1.5	2.5	3	5	
				Superimposed Dead Load[2], G_{SDL} (kPa)				
				0.8	0.1	0.8	0.5	
				Maximum Composite Floor Span, L (m) for FRR 60 Minutes (using minimum crack control mesh for the loads (G_{SDL} + Q) indicated above)				
150	0.11	2.66	SE82	3.80	3.80	3.80	3.80	10.5
160	0.12	2.90	SE82	3.70	3.70	3.70	3.70	11.5
170	0.13	3.13	SE82	3.61	3.61	3.61	3.61	12.5
180	0.14	3.36	SE92	3.53	3.53	3.53	3.53	14.0
190	0.15	3.59	SE92	3.45	3.45	3.45	3.45	15.0
200	0.16	3.82	SE92	3.39	3.39	3.39	3.39	16.0
210	0.17	4.05	SE92	3.32	3.32	3.32	3.32	17.0
220	0.18	4.28	SE92	3.28	3.28	3.28	3.28	18.0
230	0.19	4.51	SE72 x 2	3.21	3.21	3.21	3.21	19.0

1.05mm Hibond 80 - Constructed as Unpropped Double Span Formwork, Ambient Temperature and FRR 60 Minutes

Slab Depth (mm)	Concrete Volume (m^3/m^2)	Dry Slab Weight (kPa)	Minimum Crack Control Mesh[1]	Superimposed Live Load, Q (kPa)				Maximum Superimposed Load (G_{SDL} + Q) for Ambient Temperature[3] (kPa)
				1.5	2.5	3	5	
				Superimposed Dead Load[2], G_{SDL} (kPa)				
				0.8	0.1	0.8	0.5	
				Maximum Composite Floor Span, L (m) for FRR 60 Minutes (using minimum crack control mesh for the loads (G_{SDL} + Q) indicated above)				
150	0.11	2.66	SE82	4.49[4]	4.29	4.20	3.88	6.0
160	0.12	2.90	SE82	4.38[4]	4.30	4.21	3.91	8.0
170	0.13	3.13	SE82	4.25[4]	4.25	4.22	3.94	10.0
180	0.14	3.36	SE92	4.13[4]	4.13	4.13	4.09	11.0
190	0.15	3.59	SE92	4.02	4.02	4.02	4.02	12.0
200	0.16	3.82	SE92	3.92	3.92	3.92	3.92	13.0
210	0.17	4.05	SE92	3.83	3.83	3.83	3.83	14.0
220	0.18	4.28	SE92	3.74	3.74	3.74	3.74	15.0
230	0.19	4.51	SE72 x 2	3.65	3.65	3.65	3.65	16.0

1.05mm Hibond 80 - Constructed as Propped Single or Double Span Formwork, Ambient Temperature and FRR 60 Minutes

Slab Depth (mm)	Concrete Volume (m^3/m^2)	Dry Slab Weight (kPa)	Minimum Crack Control Mesh[1]	Propped Composite Floor Slab Limitation (minimum one row of continuous propping at mid-span)	Superimposed Live Load, Q (kPa)			
					1.5	2.5	3	5
					Superimposed Dead Load[2], G_{SDL} (kPa)			
					0.8	0.1	0.8	0.5
					Maximum Composite Floor Span, L (m)			
150	0.11	2.66	SE92	Ambient Temperature[4]	5.52	5.78	5.46	4.58
				FRR 60 Minutes[5]	5.59 HD12, 2nd Pan	5.54 HD16, 3rd Pan	5.20 HD12, 2nd Pan	4.58 HD16, 2nd Pan
160	0.12	2.90	SE72 x 2	Ambient Temperature[4]	5.70	5.94	5.66	4.82
				FRR 60 Minutes[5]	5.60 HD12, 2nd Pan	5.56 HD16, 3rd Pan	5.23 HD12, 2nd Pan	4.82 HD16, 2nd Pan
170	0.13	3.13	SE72 x 2	Ambient Temperature[4]	5.89	6.09	5.84	5.06
				FRR 60 Minutes[5]	5.61 HD12, 2nd Pan	5.58 HD16, 3rd Pan	5.26 HD12, 2nd Pan	5.06 HD10 Every Pan
180	0.14	3.36	SE62 + SE92	Ambient Temperature[4]	6.06	6.27	6.00	5.30
				FRR 60 Minutes[5]	5.48 HD12, 3rd Pan	5.53 HD12, 2nd Pan	5.42 HD12, 2nd Pan	5.25 HD16, 3rd Pan
190	0.15	3.59	SE62 + SE92	Ambient Temperature[4]	6.19	6.44	6.15	5.54
				FRR 60 Minutes[5]	5.48 HD12, 3rd Pan	5.54 HD12, 2nd Pan	5.43 HD12, 2nd Pan	5.28 HD16, 3rd Pan
200	0.16	3.82	SE82 x 2	Ambient Temperature[4]	6.35	6.56	6.30	5.78
				FRR 60 Minutes[5]	5.47 HD12, 3rd Pan	5.55 HD12, 2nd Pan	5.45 HD12, 2nd Pan	5.31 HD16, 3rd Pan
210	0.17	4.05	SE82 + SE92	Ambient Temperature[4]	6.50	6.70	6.46	6.00
				FRR 60 Minutes[5]	5.47 HD12, 3rd Pan	5.56 HD12, 2nd Pan	5.46 HD12, 2nd Pan	5.13 HD12, 2nd Pan
220	0.18	4.28	SE82 + SE92	Ambient Temperature[4]	6.65	6.65	6.65	6.07
				FRR 60 Minutes[5]	5.47 HD12, 3rd Pan	5.57 HD12, 2nd Pan	5.19 HD12, 3rd Pan	5.15 HD12, 2nd Pan
230	0.19	4.51	SE92 x 2	Ambient Temperature[4]	6.55	6.55	6.55	6.15
				FRR 60 Minutes[5]	5.33 HD10, 3rd Pan	5.39 HD12, 3rd Pan	5.30 HD12, 3rd Pan	5.27 HD12, 2nd Pan

Notes:
1. Crack control steel is the minimum continuous D500 Mesh required for a composite floor slab enclosed within a building.
2. To achieve FRR 60 minutes, a superimposed dead load of 0.5kPa is assumed for all load combinations.
3. Maximum load (G_{SDL} + Q) limited by composite floor slab capacity under ambient temperature conditions.
4. Spans possible to the maximum load (G_{SDL} + Q) indicated under ambient temperature conditions using minimum continuous crack control mesh.
5. Spans possible to the maximum load (G_{SDL} + Q) indicated to achieve FRR 60 minutes using the nominated bottom ductile reinforcing bars in the steel decking sheet pans.

1.15mm Hibond 80 - Constructed as Unpropped Single Span Formwork, Ambient Temperature and FRR 60 Minutes

Slab Depth (mm)	Concrete Volume (m^3/m^2)	Dry Slab Weight (kPa)	Minimum Crack Control Mesh[1]	Superimposed Live Load, Q (kPa)				Maximum Superimposed Load (G_{SDL} + Q) for Ambient Temperature[3] (kPa)
				1.5	2.5	3	5	
				Superimposed Dead Load[2], G_{SDL} (kPa)				
				0.8	0.1	0.8	0.5	
				Maximum Composite Floor Span, L (m) for FRR 60 Minutes (using minimum crack control mesh for the loads (G_{SDL} + Q) indicated above)				
150	0.11	2.68	SE82	3.98	3.98	3.98	3.98	9.5
160	0.12	2.91	SE82	3.90	3.90	3.90	3.90	12.0
170	0.13	3.14	SE82	3.82	3.82	3.82	3.82	13.5
180	0.14	3.37	SE92	3.74	3.74	3.74	3.74	14.5
190	0.15	3.60	SE92	3.66	3.66	3.66	3.66	15.5
200	0.16	3.83	SE92	3.58	3.58	3.58	3.58	16.5
210	0.17	4.06	SE92	3.51	3.51	3.51	3.51	17.5
220	0.18	4.29	SE92	3.45	3.45	3.45	3.45	19.0
230	0.19	4.52	SE72 x 2	3.40	3.40	3.40	3.40	20.0

1.15mm Hibond 80 - Constructed as Unpropped Double Span Formwork, Ambient Temperature and FRR 60 Minutes

Slab Depth (mm)	Concrete Volume (m^3/m^2)	Dry Slab Weight (kPa)	Minimum Crack Control Mesh[1]	Superimposed Live Load, Q (kPa)				Maximum Superimposed Load (G_{SDL} + Q) for Ambient Temperature[3] (kPa)
				1.5	2.5	3	5	
				Superimposed Dead Load[2], G_{SDL} (kPa)				
				0.8	0.1	0.8	0.5	
				Maximum Composite Floor Span, L (m) for FRR 60 Minutes (using minimum crack control mesh for the loads (G_{SDL} + Q) indicated above)				
150	0.11	2.68	SE82	4.62[4]	4.41	4.32	3.99	5.5
160	0.12	2.91	SE82	4.62[4]	4.42	4.34	4.03	6.5
170	0.13	3.14	SE82	4.54[4]	4.44	4.35	4.05	9.0
180	0.14	3.37	SE92	4.41[4]	4.41	4.41	4.21	10.5
190	0.15	3.60	SE92	4.30[4]	4.30	4.30	4.23	11.5
200	0.16	3.83	SE92	4.19	4.19	4.19	4.19	12.5
210	0.17	4.06	SE92	4.09	4.09	4.09	4.09	13.5
220	0.18	4.29	SE92	4.00	4.00	4.00	4.00	14.5
230	0.19	4.52	SE72 x 2	3.93	3.93	3.93	3.93	15.5

1.15mm Hibond 80 - Constructed as Propped Single or Double Span Formwork, Ambient Temperature and FRR 60 Minutes

Slab Depth (mm)	Concrete Volume (m^3/m^2)	Dry Slab Weight (kPa)	Minimum Crack Control Mesh[1]	Propped Composite Floor Slab Limitation (minimum one row of continuous propping at mid-span)	Superimposed Live Load, Q (kPa)			
					1.5	2.5	3	5
					Superimposed Dead Load[2], G_{SDL} (kPa)			
					0.8	0.1	0.8	0.5
					Maximum Composite Floor Span, L (m)			
150	0.11	2.68	SE92	Ambient Temperature[4]	5.54	5.80	5.49	4.64
				FRR 60 Minutes[5]	5.68 HD12, 2nd Pan	5.62 HD16, 3rd Pan	5.29 HD12, 2nd Pan	4.64 HD12, 2nd Pan
160	0.12	2.91	SE72 x 2	Ambient Temperature[4]	5.73	5.97	5.68	4.88
				FRR 60 Minutes[5]	5.70 HD12, 2nd Pan	5.65 HD16, 3rd Pan	5.52 HD16, 3rd Pan	4.88 HD16, 3rd Pan
170	0.13	3.14	SE72 x 2	Ambient Temperature[4]	5.90	6.13	5.85	5.13
				FRR 60 Minutes[5]	5.71 HD12, 2nd Pan	5.67 HD16, 3rd Pan	5.35 HD12, 2nd Pan	5.13 HD16, 3rd Pan
180	0.14	3.37	SE62 + SE92	Ambient Temperature[4]	6.06	6.29	6.02	5.37
				FRR 60 Minutes[5]	5.86 HD12, 2nd Pan	5.62 HD12, 2nd Pan	5.51 HD12, 2nd Pan	5.13 HD12, 2nd Pan
190	0.15	3.60	SE62 + SE92	Ambient Temperature[4]	6.23	6.45	6.18	5.62
				FRR 60 Minutes[5]	5.58 HD12, 3rd Pan	5.63 HD12, 2nd Pan	5.53 HD12, 2nd Pan	5.16 HD12, 2nd Pan
200	0.16	3.83	SE82 x 2	Ambient Temperature[4]	6.39	6.61	6.34	5.85
				FRR 60 Minutes[5]	5.58 HD12, 3rd Pan	5.65 HD12, 2nd Pan	5.55 HD12, 2nd Pan	5.19 HD12, 2nd Pan
210	0.17	4.06	SE82 + SE92	Ambient Temperature[4]	6.54	6.76	6.50	6.07
				FRR 60 Minutes[5]	5.58 HD12, 3rd Pan	5.66 HD12, 2nd Pan	5.56 HD12, 2nd Pan	5.22 HD12, 2nd Pan
220	0.18	4.29	SE82 + SE92	Ambient Temperature[4]	6.70	6.90	6.65	6.30
				FRR 60 Minutes[5]	5.58 HD12, 3rd Pan	5.67 HD12, 2nd Pan	5.58 HD12, 2nd Pan	5.25 HD12, 2nd Pan
230	0.19	4.52	SE92 x 2	Ambient Temperature[4]	6.85	7.05	6.81	6.40
				FRR 60 Minutes[5]	5.69 HD12, 3rd Pan	5.50 HD12, 3rd Pan	5.41 HD12, 3rd Pan	5.36 HD12, 2nd Pan

Notes:
1. Crack control steel is the minimum continuous D500 Mesh required for a composite floor slab enclosed within a building.
2. To achieve FRR 60 minutes, a superimposed dead load of 0.5kPa is assumed for all load combinations.
3. Maximum load (G_{SDL} + Q) limited by composite floor slab capacity under ambient temperature conditions.
4. Spans possible to the maximum load (G_{SDL} + Q) indicated under ambient temperature conditions using minimum continuous crack control mesh.
5. Spans possible to the maximum load (G_{SDL} + Q) indicated to achieve FRR 60 minutes using the nominated bottom ductile reinforcing bars in the steel decking sheet pans.

HIBOND 80 ACOUSTIC PERFORMANCE

SCOPE

This section provides guidelines for specifiers and constructors who require noise control systems for residential applications such as separate multi-unit dwellings or single dwellings, commercial applications such as retail spaces, offices and institutional buildings. It is not intended that these guidelines replace the need for specialist acoustic design to meet the specified sound insulation performance for the building.

A Dimond Structural Noise Control System consists of a Hibond 80 composite floor slab with a selected USG ceiling system, GIB® standard plasterboard ceiling linings, selected floor coverings and the specific inclusion of a cavity absorber. It must be noted that the floor covering is an essential aspect of the performance of the system.

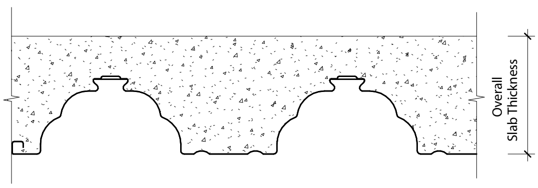
The information in this section is based on laboratory testing of a 120mm Hibond 55 composite floor slab carried out by the University of Auckland, Acoustics Testing Service and opinions on expected acoustic performance by Marshall Day Acoustics Limited Report Rp 001 2016284A. More information is available on request.

The systems set out in this section provide the expected sound transmission performance under laboratory conditions. However in practical applications on site there is a significant element of subjectivity to interpreting noise levels within rooms. No matter how low a sound level might be, if it is intrusive upon a person's privacy, then it is likely to cause annoyance. No practical system can guarantee complete sound insulation and completely satisfy everyone.

Introduction of light fittings, vents or other floor or ceiling penetrations will reduce the acoustic performance of the system, requiring specific assessment in each case.

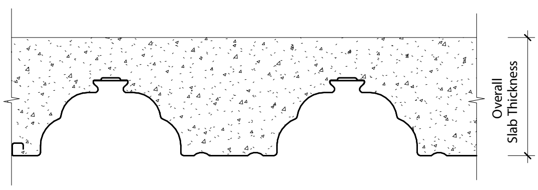
Hibond 80 Composite Floor Slab – Bare Composite Floor Slab

System Description:
Steel Decking: 0.75, 0.95, 1.05, 1.15mm Hibond 80
Composite Floor Slab: Overall thickness (mm)



Overall Composite Floor Slab Thickness (mm)	STC
150	47
175	49
200	51

System Description:
Steel Decking: 0.75, 0.95, 1.05, 1.15mm Hibond 80
Composite Floor Slab: 150mm overall thickness

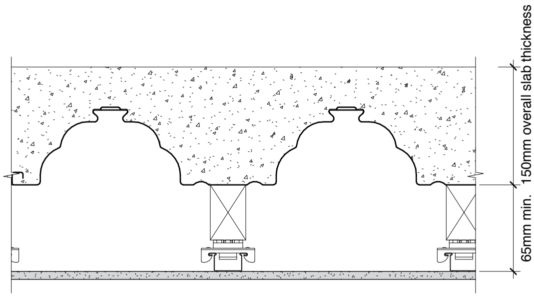


Floor Surface Treatment	STC	IIC
No Covering	47	27
14mm timber on Bostic Ultraset adhesive	47	45
14mm timber on 3mm Acoustimat foam	47	48
6mm Cork flooring	47	45
Gerfloor Taralay Comfort Imprimes 43	47	49
Carpet, Hirst 22oz Stratron Collection	47	57
Carpet, Hirst 28oz Stratron Collection	47	58
Carpet, 40oz with 7lb rebond pad	47	62

Notes:
1. The acoustic opinion has a margin of error of +/- 3 STC/IIC points
2. IIC result depends on the quality of the floor covering material and installation
3. All adhesives must be applied to manufacturers instructions, and Bostic Ultraset adhesive dry film thickness must not be less than 1.9mm
4. It is prudent to allow a 5 point reduction for expected field STC and IIC when compared to the above performance expected in laboratory conditions. This is considered a reasonable compensation to allow for flanking paths at junctions and construction variations.

Hibond 80 Composite Floor Slab with Direct Fix Ceiling System - Non-Insulated

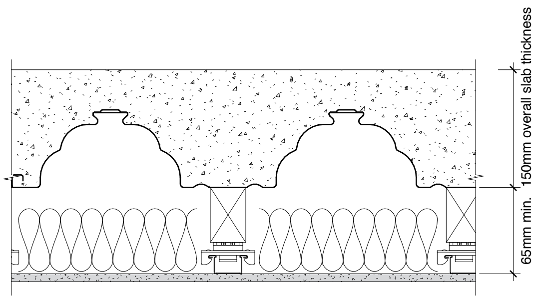
System Description:
Steel Decking: 0.75, 0.95, 1.05, 1.15mm Hibond 80
Composite Floor Slab: 150mm overall thickness
Ceiling System: Potters Direct Fix with sound isolation clips
USG furring channel at maximum 600mm centres
Ceiling Lining: 13mm GIB standard plasterboard in one or two layers



Floor Surface Treatment	Ceiling Lining			
	One Layer 13mm GIB		Two Layers 13mm GIB	
	STC	IIC	STC	IIC
No Covering	59	42	62	44
14mm strip timber on Bostic Ultraset adhesive	59	47	62	49
14mm timber on 3mm Acoustimat foam	59	48	62	50
6mm Cork flooring	59	48	62	50
Gerfloor Taralay Comfort Imprimes 43	59	50	62	52
Carpet, Hirst 22oz Stratron Collection	59	51	62	53
Carpet, Hirst 28oz Stratron Collection	59	52	62	54
Carpet, 40oz with 7lb Rebond pad	59	67	62	69

Hibond 80 Composite Floor Slab with Direct Fix Ceiling System - Insulated

System Description:
Steel Decking: 0.75, 0.95, 1.05, 1.15mm Hibond 80
Composite Floor Slab: 150mm overall thickness
Insulation Blanket: 75mm thick R1.8 Pink Batts
Ceiling System: Potters Direct Fix with sound isolation clips
USG furring channel at maximum 600mm centres
Ceiling Lining: 13mm GIB standard plasterboard in one or two layers

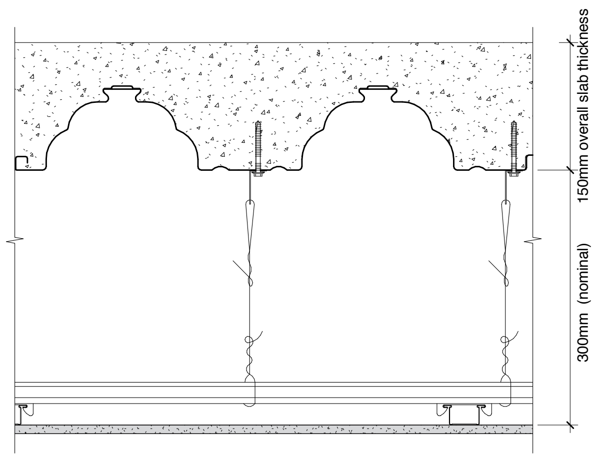


Floor Surface Treatment	Ceiling Lining			
	One Layer 13mm GIB		Two Layers 13mm GIB	
	STC	IIC	STC	IIC
No Covering	68	52	71	54
14mm strip timber on Bostic Ultraset adhesive	68	57	71	59
14mm timber on 3mm Acoustimat foam	68	58	71	60
6mm Cork flooring	68	58	71	60
Gerfloor Taralay Comfort Imprimes 43	68	60	71	62
Carpet, Hirst 22oz Stratron Collection	68	61	71	63
Carpet, Hirst 28oz Stratron Collection	68	62	71	64
Carpet, 40oz with 7lb Rebond pad	68	77	71	79

Notes:
1. The acoustic opinion has a margin of error of +/- 3 STC/IIC points
2. IIC result depends on the quality of the floor covering material and installation
3. All adhesives must be applied to manufacturers instructions, and Bostic Ultraset adhesive dry film thickness must not be less than 1.9mm
4. It is prudent to allow a 5 point reduction for expected field STC and IIC when compared to the above performance expected in laboratory conditions. This is considered a reasonable compensation to allow for flanking paths at junctions and construction variations.

Hibond 80 Composite Floor Slab with Suspended Ceiling System - Non-Insulated

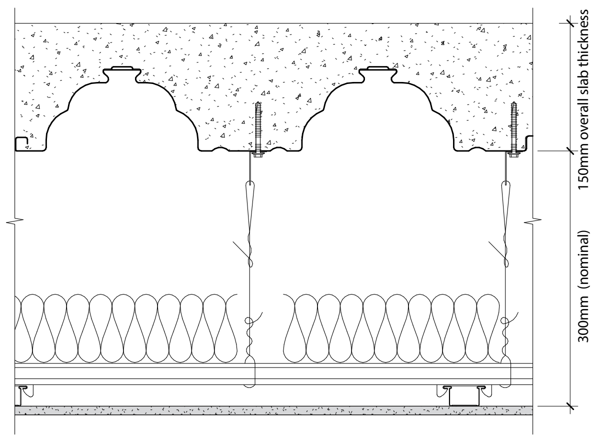
System Description:
Steel Decking: 0.75, 0.95, 1.05, 1.15mm Hibond 80
Composite Floor Slab: 150mm overall thickness
Ceiling System: Don suspended ceiling system
USG furring channel at maximum 600mm centres
Ceiling Lining: 13mm GIB standard plasterboard in one or two layers



Floor Surface Treatment	Ceiling Lining			
	One Layer 13mm GIB		Two Layers 13mm GIB	
	STC	IIC	STC	IIC
No Covering	54	46	57	48
14mm strip timber on Bostic Ultraset adhesive	54	52	57	54
14mm timber on 3mm Acoustimat foam	54	54	57	56
6mm Cork flooring	54	53	57	55
Gerfloor Taralay Comfort Imprimes 43	54	55	57	57
Carpet, Hirst 22oz Stratron Collection	54	56	57	58
Carpet, Hirst 28oz Stratron Collection	54	57	57	59
Carpet, 40oz with 7lb Rebond pad	54	72	57	74

Hibond 80 Composite Floor Slab with Suspended Ceiling System - Insulated

System Description:
Steel Decking: 0.75, 0.95, 1.05, 1.15mm Hibond 80
Composite Floor Slab: 150mm overall thickness
Insulation Blanket: 75mm thick R1.8 Pink Batts
Ceiling System: Don suspended ceiling system
USG furring channel at maximum 600mm centres
Ceiling Lining: 13mm GIB standard plasterboard in one or two layers



Floor Surface Treatment	Ceiling Lining			
	One Layer 13mm GIB		Two Layers 13mm GIB	
	STC	IIC	STC	IIC
No Covering	67	46	70	48
14mm strip timber on Bostic Ultraset adhesive	67	65	70	67
14mm timber on 3mm Acoustimat foam	67	67	70	69
6mm Cork flooring	67	64	70	66
Gerfloor Taralay Comfort Imprimes 43	67	67	70	69
Carpet, Hirst 22oz Stratron Collection	67	70	70	72
Carpet, Hirst 28oz Stratron Collection	67	72	70	74
Carpet, 40oz with 7lb Rebond pad	67	82	70	84

Notes:
1. The acoustic opinion has a margin of error of +/- 3 STC/IIC points
2. IIC result depends on the quality of the floor covering material and installation
3. All adhesives must be applied to manufacturers instructions, and Bostic Ultraset adhesive dry film thickness must not be less than 1.9mm
4. It is prudent to allow a 5 point reduction for expected field STC and IIC when compared to the above performance expected in laboratory conditions. This is considered a reasonable compensation to allow for flanking paths at junctions and construction variations.

HIBOND 80 DESIGN EXAMPLES

EXAMPLE: FORMWORK

A 200 mm overall thickness composite floor slab is required to span 4000mm c/c between permanent supports using the Hibond 80 sheet as permanent formwork only. Two alternatives are available in design.

a) Using Hibond 80 x 0.75mm from Section 3.3.4 select the maximum formwork span capabilities for a 200mm overall thickness composite floor slab, i.e.

   Single Span 3300mm

   Double Span 3030mm

   Maximum span with 1 row of propping at midspan 5300mm (note this is the maximum span shown for any loading regime under ambient temperature conditions)

   To meet the required span using Hibond 80 x 0.75mm,

   1 row of continuous propping in required at midspan,

   Span with 1 row of propping at midspan = 5300mm > 4000mm ∴ ok

   Therefore Hibond 80 x 0.75 mm with 1 row of continuous propping at mid-span may be considered.

b) Using Hibond 80 x 1.15mm from Section 3.3.4 select the formwork span capabilities for a 200mm overall thickness composite floor slab, i.e.

   Single 3580mm

   Double Span 4190mm

   Maximum span with 1 row of propping at midspan 6610mm (note this is the maximum span shown for any loading regime under ambient temperature conditions)

   To meet the required span using Hibond 80 x 1.15mm, an unpropped double span can be used.

   Double Span = 4190mm > 4000mm ∴ ok

   Therefore Hibond 80 x 1.15mm in an unpropped configuration may also be considered.

EXAMPLE: COMMERCIAL

A suspended composite floor slab in a commercial building is required to achieve spans of 4000mm using unpropped construction, while utilising a minimum composite floor slab thickness of 160mm. A Fire Resistance Rating (FRR) of 60 minutes is also required.

Commercial loading,

live load, Q	3.0kPa
superimposed dead load, G_{SDL}	0.5kPa
design superimposed load, G_{SDL} + Q	3.5kPa

From section 3.3.4 select the corresponding steel decking thickness for a 160mm composite floor slab thickness to achieve an unpropped span of 4000mm.

This gives Hibond 80 x 0.95mm,
Maximum unpropped double span = 4150mm > 4000mm ∴ ok
Maximum design superimposed load for 4150mm double span and FRR 60 minutes = 3.5kPa ∴ ok (Note: 0.5kPa superimposed dead load has been assumed for fire for all load combinations)
FRR 60 minutes (using unpropped double span formwork) - use continuous SE82 mesh (this is the same as the minimum mesh for crack control in an unpropped configuration)

Note: Hibond 80 x 0.75mm could also be considered, however it would require 1 row of props at midspan as the maximum unpropped double span available for a composite floor slab of 160mm overall thickness is 3450mm. To meet FRR 60 minutes, the use of propped double span formwork requires 2 layers of SE72 Mesh.

Therefore, use a Hibond 80 x 0.95mm composite floor slab of 160mm overall thickness in an unpropped double span configuration with continuous SE82 mesh throughout the composite floor slab at minimum cover.

HIBOND 80 MATERIAL SPECIFICATION

Dimond Hibond 80 and accessories are manufactured from galvanised steel coil produced to AS 1397.

	Thickness BMT (mm)	Steel Grade (MPa)	Min. Zinc Weight (g/m^2)
Hibond 80 sheet	0.75 & 0.95	G550	Z 275
Hibond 80 sheet	1.05 & 1.15	G500	Z 275
End cap	0.55	G250	Z 275
Closure strip	0.55	G250	Z 275
Edge form	1.15	G250	Z 275

BMT - Base Metal Thickness

Tolerances

Length: -0mm +10mm
Cover width: -1mm +5mm
Maximum manufactured length of Hibond 80 sheet: 15m.

HIBOND 80 SHORT FORM SPECIFICATION

The flooring system will be Dimond Structural **(1)** mm Hibond 80 manufactured from G550/G500 grade steel, with a 275g/m^2 galvanised zinc weight. The minimum nominal steel decking sheet length to be used in construction shall be .... m, in accordance with the design formwork spans.

Edge form and end caps to be used in accordance with Dimond Structural recommendations.

Specify concrete thickness, and number of rows of propping during construction.

Mesh and any additional reinforcement bar size and spacing should be referred to the design engineer's drawings.

(1) Choose from: 0.75, 0.95, 1.05, 1.15

HIBOND 80 COMPONENTS 3.3.9

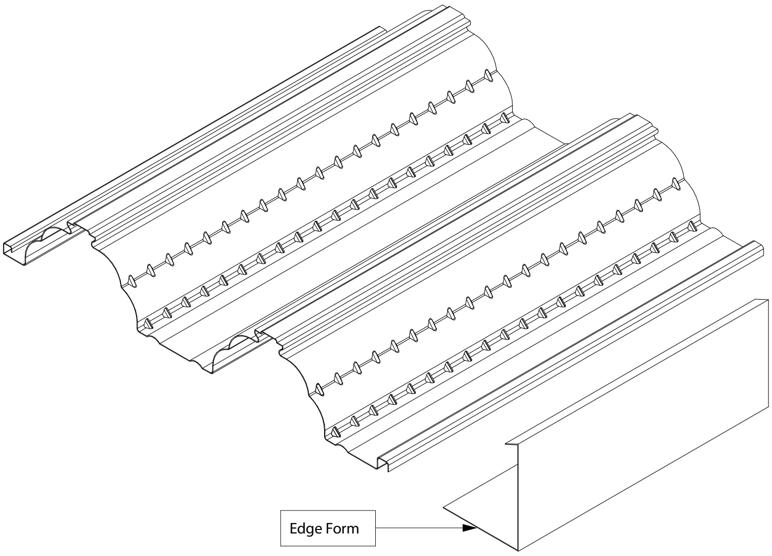
EDGE FORM 3.3.9.1

Manufactured from 1.15mm Base Metal Thickness (BMT) galvanised steel in 6m lengths, providing an edge to screed the concrete to the correct composite floor slab thickness.

Standard sizes are from 150mm to 230mm in 10mm height increments.

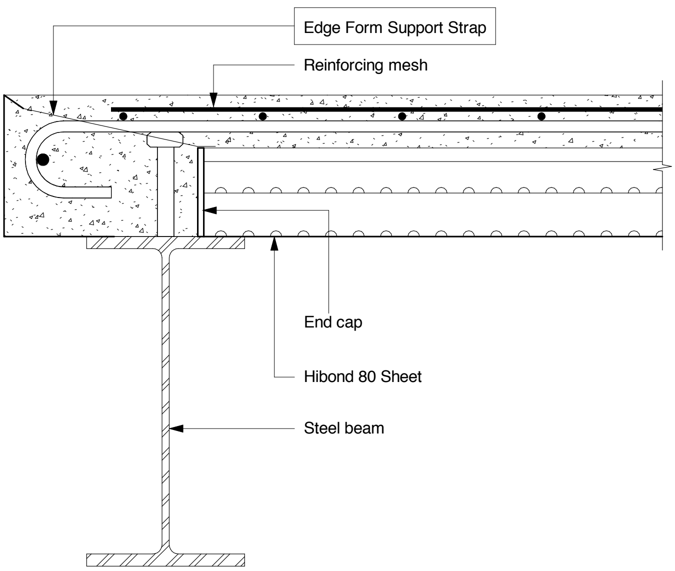
The foot of the Edge Form is typically fixed to structure using powder actuated fasteners (self-drilling screws can also be used, type dependent on support material and thickness).

Where necessary, for example cantilevered steel decking sheets, the foot of the Edge Form may be attached to the Hibond 80 sheets with 10g - 16 x 16mm self-drilling screws. Fasteners are required every pan to steel decking sheet ends and at 750mm centres along steel decking sheets.



EDGE FORM SUPPORT STRAP 3.3.9.2

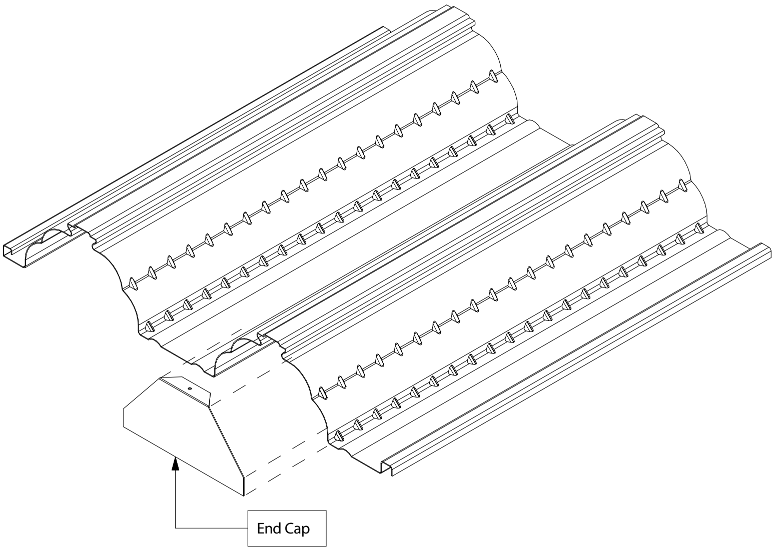
Edge Form is restrained from outward movement during concrete placement by 0.75mm BMT x 25mm galvanised steel Edge Form Support Straps. Fastened with 10g - 16 x 16mm self-drilling screws (2 per strap), Edge Form Support Straps are required every second rib to steel decking sheet ends and at 750mm centres along steel decking sheets.



3.3.9.3

END CAPS

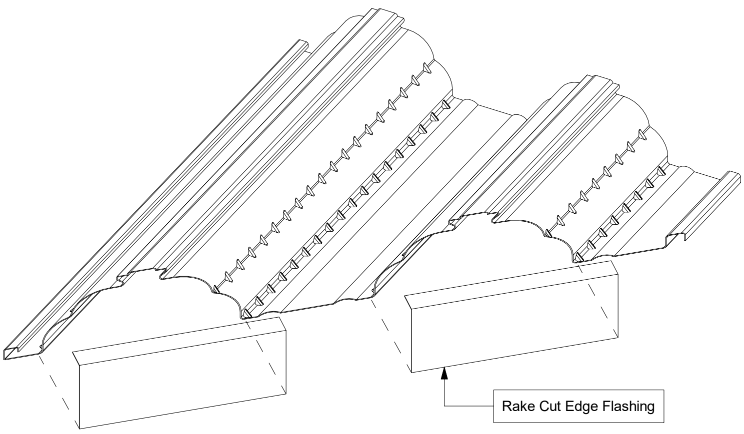
Manufactured from 0.55mm BMT galvanised steel, end caps are used to blank off the ribs (to prevent concrete leakage) at the end of each Hibond 80 sheet, or where openings are created in the deck. Each End Cap is fixed to the Hibond 80 sheet with 1 fastener atop each rib (10g - 16 x 16mm self-drilling screw).



3.3.9.4

RAKE CUT EDGE FLASHINGS

Manufactured from 0.55mm BMT galvanised steel in 95mm x 30mm x 3m lengths which are cut to suit on site (as shown). Rake cut edge flashings are used in place of end caps to close off the end of Hibond 80 sheets when they are cut on an angle or curve. These are cut to length and fixed to the Hibond 80 sheet with 1 fastener atop each rib (10g - 16 x 16mm self-drilling screw).



3.3.10

HIBOND 80 CAD DETAILS

For the latest Hibond 80 CAD details, please download from the Dimond Structural website
www.dimondstructural.co.nz/products/hibond-80

Please note, the Hibond 80 CAD details are to be used as a guide only and are not intended for construction. Specific design details are required to be provided by the design engineer.

SPECIFIC DESIGN – HIBOND 55 FLOORING 3.4

DESIGN BASIS 3.4.1

The Hibond 55 Flooring System has been designed to comply with BS 5950 (Part 4:1994 and Part 6:1995) using the relevant load combinations therein and the relevant clauses of the New Zealand Building Code. Detailed analysis and comprehensive physical testing have enabled load/span tables to be established using the limit states design philosophy.

Data presented in this section is intended for use by structural engineers. Use of the Hibond 55 Flooring System in applications other than uniformly distributed loads or outside the scope of this section will require specific design.

A design yield strength of 550MPa for 0.75mm base metal thickness (BMT) Hibond 55 and 520MPa for 0.95mm BMT Hibond 55 has been used.

A minimum 28 day compressive strength of 25MPa for high grade concrete has been assumed.

A minimum Hibond 55 composite floor slab thickness of 110mm has been used in this section, in accordance with BS 5950.

The self weight of the Hibond 55 Flooring System (including the concrete) has been included in the load tables.

HIBOND 55 DESIGN CONSIDERATIONS 3.4.2

FORMWORK 3.4.2.1

Where the Hibond 55 sheet is used as formwork, the trapezoidal shape of the steel decking sheet provides resistance to wet concrete (G) and construction loads (Q). Refer Hibond 55 Formwork Design Tables 3.4.4.

Hibond 55 Formwork Tables are based on design checks for bending, web crushing, vertical shear, combined actions and deflection.

Hibond 55 sheets must be laid in one continuous length between permanent supports. Short steel decking sheets of Hibond 55 must never be spliced together to achieve the span between temporary or permanent supports.

Where the Hibond 55 composite floor slab is greater than 200mm overall thickness, the Hibond 55 sheets must be used as formwork only and the composite floor slab designed using additional positive reinforcement.

Refer General Design Considerations 3.2.1.

Cantilevered End Spans

The use of Hibond 55 flooring systems as cantilevered floor structures requires a propping line at the steel decking sheet ends to ensure a stable working platform during construction.

Additional ductile negative reinforcement is required to be designed to NZS 4671 to support all cantilevered composite floor slabs, and the contribution of the steel decking sheets is neglected in design.

Consideration must be given to overall composite floor slab thickness to ensure sufficient cover over the negative reinforcement is achieved in compliance with NZS 3101.

As a guide propping of the Hibond 55 sheets is not required for cantilevered end spans with a clear over-hang of,

Hibond 55 x 0.75mm: 300mm

Hibond 55 x 0.95mm: 400mm

These cantilever spans assume:

- The Hibond 55 sheets are securely fixed to the edge supporting member and the adjacent internal supporting member
- That Hibond 55 Edge Form at the end of the cantilever is secured with one self-drilling screw (or rivet) per Hibond 55 pan along with Edge Form Support Straps. Refer section 3.4.11.

Further guidance is available in SCI Publication P300 Composite Slabs and Beams using Steel Decking, 2009.

COMPOSITE FLOOR SLAB

Load capacity of the Hibond 55 flooring system is dependent on the shear bond between the concrete and the steel decking sheet. Shear bond is a combination of chemical bond between the concrete and the steel decking sheet surface, and mechanical bond between the concrete aggregate and the steel decking sheet embossments formed specifically for this purpose. It is important that the concrete is placed onto a clean galvanised steel surface free from any contamination or debris.

Capacities for the Ultimate Limit State were derived for positive bending, shear bond, vertical shear and negative bending as appropriate. Each of these values was back substituted into the design combinations for the applied actions using 1.4 (dead load) + 1.6 (superimposed load).

The minimum resulting superimposed load, from all actions (including deflections), was used in the tables.

Appropriate imposed floor actions (Q) should be determined in accordance with AS/NZS 1170. All superimposed dead load (G_{SDL}) is then added to the imposed action (Q) to give a design superimposed load (G_{SDL} + Q) expressed in kPa for direct comparison with tabulated data in the Hibond Composite Floor Slab Load Span Tables 3.4.5. Refer General Design Considerations 3.2.2.

Fire Design

Design of fire resistance of composite floor slabs is based on resistance to collapse (stability) prevention of flames passing through cracks in the composite floor slab (integrity) and limiting the temperature increase on the unexposed side of the composite floor slab (insulation).

Fire resistance of the Hibond 55 flooring system can be achieved by several methods:

- Testing the fire resistance inherent in the composite floor slab as a basis for resistance ratings for combinations of span, load and composite floor slab thickness.
- Placement of additional reinforcement in a specified location within the composite floor slab.
- Installation of suspended ceilings.

Fire Resistance ratings for the Hibond 55 flooring system has been established by placement of additional positive reinforcement in the steel decking sheets pans.

The fire design tables are based on design checks for bending (shear is rarely critical), in accordance with NZS 3101, based on the load combination G + ψ_lQ for single spans which are effective in fire emergency conditions (where ψ_l is the factor for determining quasi-permanent values for long term actions). Full design methodology is provided in HERA Report R4-82.

The tables include a superimposed dead load (G_{SDL}) of 0.5kPa in order that an imposed action (Q) can be compared with the Fire Design Tables 3.4.6.

Additional Reinforcement

The minimum amount of longitudinal and transverse reinforcement required in the top of the composite floor slab as outlined in AS/NZS 2327 (Sections 2.2.1 and 6.3).

The minimum continuous D500MPa mesh or ductile reinforcement bar size each way to be used as top reinforcement for either unpropped or propped metal decking sheets for composite floor slabs enclosed within a building is outlined in the following table.

Hibond 55	Unpropped Metal Decking Sheets[1]		Propped Metal Decking Sheets[2]	
Slab Thickness (mm)	Mesh	Bars (Each Way)	Mesh	Bars (Each Way)
110	SE62	HD10 @ 300	SE82	HD10 @ 300
120	SE62	HD10 @ 300	SE92	HD10 @ 300
130	SE72	HD10 @ 300	SE92	HD10 @ 250
140	SE72	HD10 @ 300	2 x SE72	HD12 @ 300
150	SE72	HD10 @ 300	2 x SE72	HD12 @ 250
160	SE82	HD10 @ 300	2 x SE82	HD12 @ 250
170	SE82	HD10 @ 300	2 x SE82	HD12 @ 200
180	SE92	HD10 @ 250	2 x SE82	HD12 @ 200
190	SE92	HD10 @ 250	SE82 x SE92	HD12 @ 200
200	SE92	HD10 @ 250	2 x SE92	HD16 @ 300

Notes:
1. Based on transverse steel requirements in AS/NZS 2327 Section 2.2.1
2. Based on crack control steel requirements in AS/NZS 2327 Section 6.3

Additional ductile reinforcement in the form of reinforcement bars or mesh may be required to:

- gain full continuity over supporting members in continuous spans.
- achieve the required fire performance.
- achieve the required seismic performance.
- control cracks caused by shrinkage during curing of the concrete, particularly for composite floor slabs exposed to the weather. For propped construction, increasing nominal continuity reinforcement over supports is required as indicated above given crack widths will increase when the props are removed.
- distribute loads around openings in composite floor slabs.
- provide necessary reinforcement for composite floor slabs used as cantilevers.

When specifying additional reinforcement the designer must ensure the composite floor slab thickness is adequate to achieve the required minimum concrete cover of the reinforcement in compliance with NZS 3101.

Acoustic Performance

Estimated Sound Transmission Class (STC) and Impact Insulation Class (IIC) that can be achieved with different composite floor slab thicknesses and a range of ceiling and surface treatment additions to the Hibond 55 flooring system are provided in section 3.4.7, based on the Marshall Day Acoustics Report (Rp002 R00_2006476).

The STC and IIC values are based on tested performance of a 120mm Hibond 55 composite floor slab and known performance of concrete thickness, floor coverings, insulation and suspended ceilings.

As a guide, a bare 120mm Hibond 55 composite floor slab is expected to achieve STC 42dB and IIC 23dB. With the addition of a suspended GIB ceiling and a 75mm acoustic blanket it is reasonable to expect STC 61dB and IIC 43dB. The IIC can be further improved to as much as 75+dB with the addition of appropriate carpet and underlay.

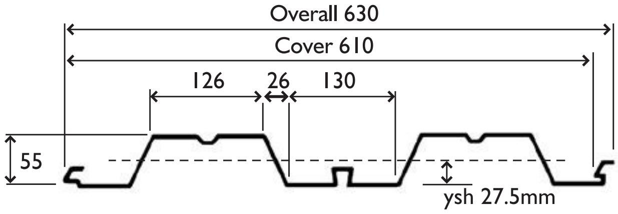
Floor Vibration

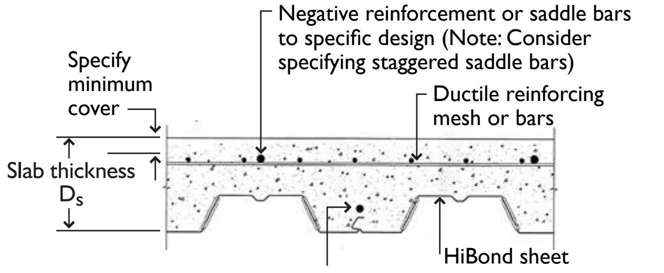
As a guide to designers, the vibration lines expressed in the Hibond 55 Composite Floor Slab Load Span Tables 3.4.5 represent the maximum span of the Hibond 55 composite floor slab recommended for in-service floor vibration for either of an open plan commercial office floor with a low damping ratio (few small partitions) or a residence with higher damping (many full height partitions).

This represents the composite floor slab response of a person traversing the floor, but does not account for the dynamic response of the supporting structure.

Specific design is required for other types of floor use.

HIBOND 55 SECTION PROPERTIES





All dimensions (mm) are nominal

FORMWORK PROPERTIES

Hibond 55 Formwork Properties (Per Metre Width)

Thickness (mm)	Weight (kN/m)	Cross Sectional Area, A_p (mm2)	Design Strength P_y (MPa)	Bending Strength		Web Crushing Strength, P_w (kN)	
				Mc^+ (kNm)	Mc^- (kNm)	End Support	Internal Support
0.75	0.085	1058	550	5.46	6.51	14.52	29.05
0.95	0.108	1340	520	8.93	9.71	21.34	42.68

Thickness (mm)	Shear Strength P_v (kN)	Bending/Web Crushing Interaction Equation at Internal Support Limited by:	Second Moment of Area (10^6 mm4)	
			Single Span I_s	Multispan I_m
0.75	45.1	$F_W/29.05 + M^- / 6.51 < 1.43$	0.493	0.391
0.95	71.6	$F_W/42.68 + M^- / 9.71 < 1.56$	0.605	0.448

Notes:

1. Design strength P_y is 0.84 x ultimate tensile strength.
2. Shear strength values P_v are derived from calculation as per BS 5950.
3. All other values are derived from test results.
4. F_W is the reaction or concentrated load on Hibond 55 rib.
5. M^- is the negative bending moment in the Hibond 55 formwork at the internal support.
6. ysh is the distance from the bottom of the Hibond 55 formwork to the neutral axis.

COMPOSITE FLOOR SLAB PROPERTIES

0.75mm Hibond 55 Composite Floor Slab Properties (Per Metre Width)

D_s (mm)	Weight (kN/m)	I_g (10^6mm^4)		Y_g (mm)		I_{cr} (10^6mm^4)		Y_{cr} (mm)		I_{av} (10^6mm^4)	
		medium	long	medium	long	medium	long	medium	long	medium	long
110	1.99	8.9	5.7	49.1	51.9	4.4	3.7	32.6	40.3	6.6	4.7
120	2.22	11.6	7.3	53.9	56.9	5.5	4.7	35.0	43.4	8.6	6.0
130	2.45	14.7	9.3	58.7	61.8	6.8	5.8	37.3	46.4	10.8	7.5
140	2.68	18.5	11.6	63.6	66.7	8.3	7.1	39.5	49.3	13.4	9.3
150	2.91	22.8	14.2	68.4	71.7	10.0	8.5	41.5	52.0	16.4	11.4
160	3.14	27.9	17.3	73.3	76.6	11.8	10.1	43.5	54.6	19.8	13.7
170	3.37	33.6	20.8	78.2	81.6	13.7	11.8	45.4	57.2	23.7	16.3
180	3.60	40.1	24.7	83.1	86.6	15.9	13.7	47.3	59.6	28.0	19.2
190	3.83	47.4	29.1	88.0	91.5	18.2	15.8	49.1	62.0	32.8	22.4
200	4.06	55.6	34.0	93.0	96.5	20.7	18.0	50.8	64.3	38.2	26.0

0.95mm Hibond 55 Composite Floor Slab Properties (Per Metre Width)

D_s (mm)	Weight (kN/m)	I_g (10^6mm^4)		Y_g (mm)		I_{cr} (10^6mm^4)		Y_{cr} (mm)		I_{av} (10^6mm^4)	
		medium	long	medium	long	medium	long	medium	long	medium	long
110	2.01	9.4	6.1	50.1	53.4	5.2	4.3	35.6	43.6	7.3	5.2
120	2.24	12.1	7.8	54.9	58.4	6.6	5.4	38.3	47.1	9.3	6.6
130	2.47	15.4	9.9	59.8	63.4	8.1	6.8	40.8	50.4	11.8	8.3
140	2.70	19.3	12.3	64.7	68.4	9.9	8.3	43.2	53.6	14.6	10.3
150	2.93	23.8	15.1	69.5	73.4	11.9	9.9	45.6	56.6	17.8	12.5
160	3.16	29.0	18.3	74.5	78.4	14.0	11.8	47.8	59.5	21.5	15.1
170	3.39	34.9	21.9	79.4	83.5	16.4	13.9	49.9	62.4	25.7	17.9
180	3.62	41.6	26.0	84.3	88.5	19.0	16.1	52.0	65.1	30.3	21.1
190	3.86	49.1	30.6	89.2	93.5	21.9	18.6	54.0	67.8	35.5	24.6
200	4.09	57.5	35.8	94.2	98.5	24.9	21.2	56.0	70.4	41.2	28.5

Notes:
1. D_s is the overall thickness of the composite floor slab.
2. Composite floor slab weights are based on a dry concrete density of 2350kg/m^3 with no allowance for ponding.
3. Section properties are presented in terms of equivalent steel units as follows:
   (a) Medium term superimposed loads are based on 2/3 short term and 1/3 long term load (i.e. modular ratio = 10) and apply to buildings of normal usage.
   (b) Long term superimposed loads are based on all loads being long term (i.e. modular ratio = 18) and apply to storage loads and loads which are permanent in nature.
4. I_g is the second moment of area of the Hibond 55 composite floor slab for the gross section.
5. I_{cr} is the second moment of area of the Hibond 55 composite floor slab for the cracked section.
6. I_{av} is the average value of gross (I_g) and cracked (I_{cr}) sections to be used for deflection calculations.
7. Y_g is the distance from top of composite floor slab to neutral axis of the Hibond 55 composite floor slab for the gross section.
8. Y_{cr} is the distance from top of composite floor slab to neutral axis of the Hibond 55 composite floor slab for the cracked section.

HIBOND 55 FORMWORK DESIGN TABLES

Maximum formwork spans for composite floor 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 composite floor slab.
2. Composite floor slab weights (G) are based on a wet concrete density of 2400kg/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 1.5kPa 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 composite floor 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 composite floor slab design is based on the largest span.
   - Internal spans are within 10% of each other and the composite floor slab design is based on the largest internal span.

Any variations to the above configurations require specific design using the Hibond 55 Formwork Properties table in Section 3.4.3.

6. These tables are based on minimum bearing of Hibond 55 sheet given in Section 3.2.1.
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:

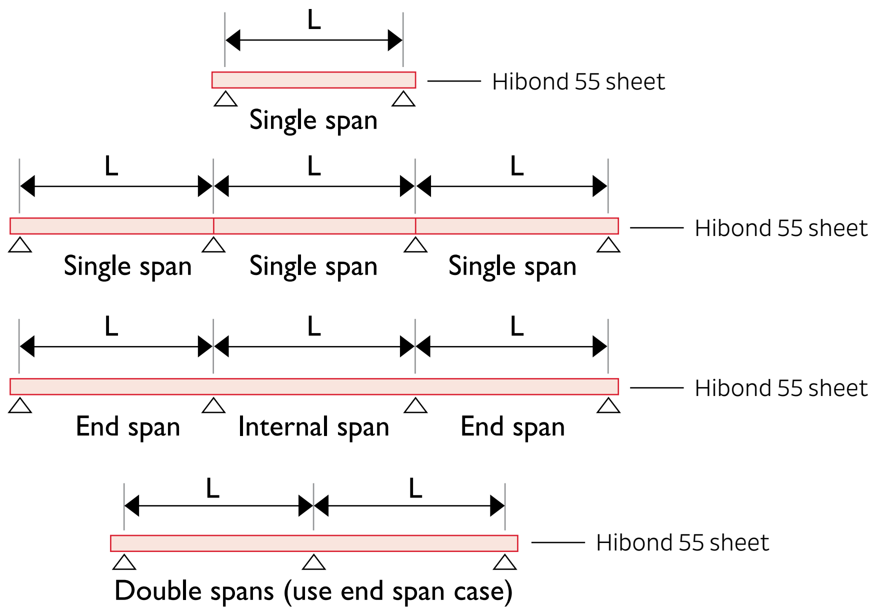
   a) L/180 maximum due to dead load (G) only.

   b) D_S /10 maximum, to avoid concrete ponding problems.

   These limits are represented in the 'Allow' (allowable) column of the Hibond 55 Formwork Tables. The 5mm limit column should be referred to where soffit deflection is to be reduced.
9. For intermediate values of composite floor slab thickness, linear interpolation is permitted.
10. As a guide, formwork deflections of around 15mm 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 55 sheet is designed as an end span or internal span, the minimum nominal steel decking sheet length for construction should be noted clearly in the design documentation to ensure that appropriate steel decking sheet lengths are used by the installer to achieve the span type selected. Refer Flooring Installation 3.6.

Typical Steel Decking Sheet Span Configurations

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



Dimond Structural

0.75mm Hibond 55 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 55 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

HIBOND 55 COMPOSITE FLOOR SLAB LOAD SPAN TABLES

Superimposed loads (G_{SDL} + Q) are presented for composite floor slab thicknesses between 110mm and 200mm and over a range of spans between 2.0m and 6.0m for single spans. For continuous design, negative reinforcement requirements are presented for double or end spans and internal spans, with an extended range of spans to 7.0m for the latter.

The following Notes apply to the composite floor slab load span tables in this Section.

1. Span types

   L_{ss} is the clear single span between permanent supports plus 100mm.
   L is the double/end or internal span measured centre to centre between permanent supports.

2. The design superimposed load combination is G_{SDL} + Q and must not be greater than the superimposed loads given in the tables.

3. a) Medium term superimposed loads are based on $^{2}/_{3}$ short term and $^{1}/_{3}$ long term (i.e. modular ratio = 10) and apply to buildings of normal usage.

   b) Long term superimposed loads are based on all loads being long term (i.e. modular ratio = 18) and apply to storage loads and loads which are permanent in nature.

4. Deflection limits incorporated into these tables are as follows:

   a) L/350 or 20mm maximum due to superimposed load (G_{SDL} + Q).

   b) L/250 maximum due to superimposed load plus prop removal (G + G_{SDL} + Q).

   The designer shall be satisfied that these limits are adequate for the application considered, otherwise additional deflection checks must be made.

5. Propping requirements depend on the Hibond 55 composite floor slab thickness and span configuration as formwork. Refer Hibond 55 Formwork Design Tables 3.4.4 to determine formwork span capabilities.

6. The double or end span and internal span tables allow for 10% moment redistribution where negative bending governs (typically thinner composite floor slabs on end spans), bounded by the shear bond value where this governs.

7. Some values shown in the double or end span tables are less than corresponding values given in the single span tables. This situation arises as,

   a) Negative bending capacity has been limited to avoid compression failure of the concrete in compression at the internal support.

   b) Shear bond is proportional to vertical shear which is higher for a double span than a single span. Also the shear bond span for an end span must be taken as the full span length using BS5950 Part 4 (when normally the span between points of contraflexure would be used).

8. Use of the double or end span tables and internal span tables assumes,

   - All spans have the same composite floor 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 composite floor slab design is based on the largest span.
   - Internal spans are within 10% of each other and the composite floor slab design is based on the largest internal span.
   - Any variations to the above configurations require specific design.

9. Example: For a 0.75mm Hibond 55 composite floor slab of 130mm overall composite floor slab thickness on a double span of 3800mm we have the following:

   4.3 HD12@200

   where:

   4.3 = Superimposed load kPa
   HD12@200 = HD12 negative reinforcing (saddle bars) placed at 200mm centres to achieve the superimposed load.

10. Steel areas in the double or end and internal span tables are calculated based on HD12 reinforcing bars (12mm diameter grade 500 to AS/NZS 4671) placed at 25mm top cover (A1 exposure classification – NZS 3101). Areas for other bar types, covers and sizes require specific design.

11. Negative reinforcement must be placed on top of the mesh parallel with the Hibond 55 ribs at spacings indicated in the tables for the span and composite floor slab thickness considered.
12. Negative reinforcement must extend at least 0.25 of the largest composite floor span plus 450mm each side of the centre line of the support.
13. The same negative reinforcing is required for both propped and unpropped construction.
14. Vibration limits expressed as maximum spans in the tables refer to:

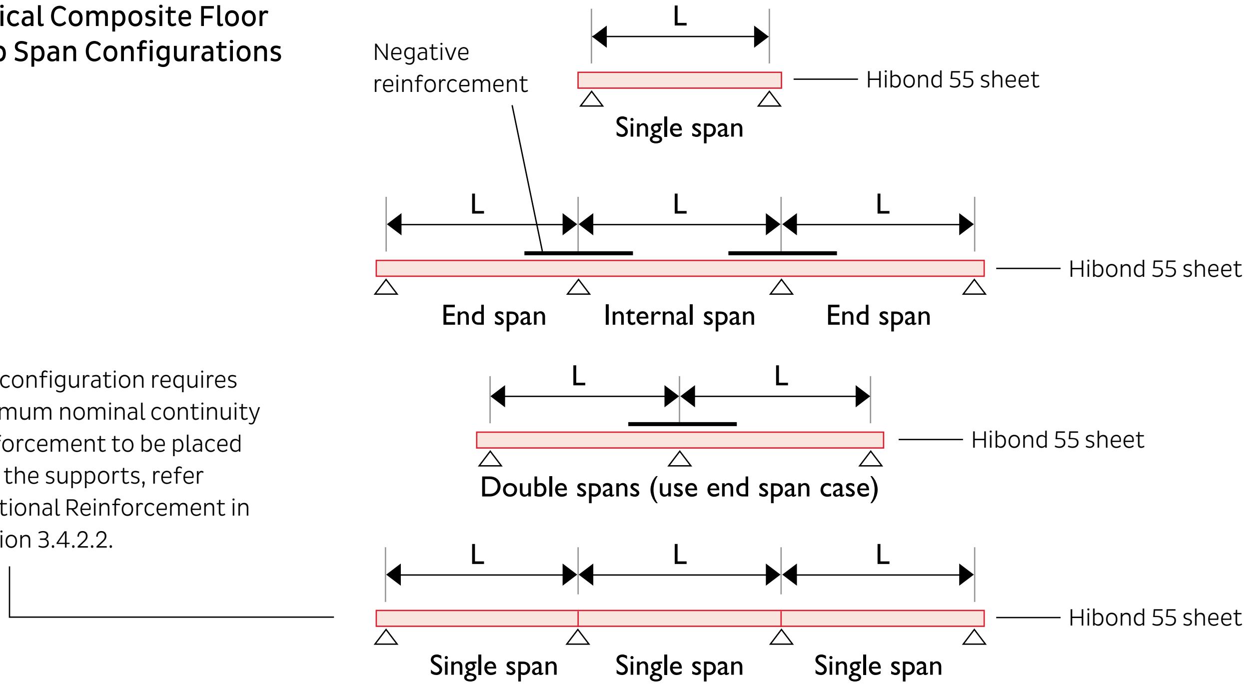
    - - - - - Commercial offices, open plan with few small partitions (damping ratio = 0.025)

    •••••••••• Residences with many full height partitions (damping ratio = 0.05)

    Specific design is required for other floor uses. Refer Hibond 55 Design Examples 3.4.8.
15. For intermediate values, linear interpolation is permitted.

Typical Composite Floor Slab Span Configurations

This configuration requires minimum nominal continuity reinforcement to be placed over the supports, refer Additional Reinforcement in Section 3.4.2.2.



0.75mm Hibond 55 Composite Floor Slab – Single Spans
Medium Term Superimposed Loads (kPa)

L_{ss} (mm)	Slab Thickness, D_s (mm)									
	110	120	130	140	150	160	170	180	190	200
2000	16.2	19.6	21.0							
2200	13.3	16.1	17.2	19.3	21.4					
2400	11.2	13.5	14.3	16.0	17.7	19.5	21.4			
2600	9.5	11.4	12.1	13.5	14.9	16.4	17.9	19.4	20.8	
2800	8.2	9.8	10.4	11.5	12.7	13.9	15.1	16.3	17.5	18.8
3000	7.1	8.5	9.0	9.9	10.9	11.9	12.9	13.9	14.8	15.9
3200	6.2	7.4	7.8	8.6	9.4	10.3	11.1	11.9	12.7	13.6
3400	5.5	6.5	6.9	7.5	8.2	8.9	9.6	10.3	10.9	11.6
3600	4.9	5.8	6.1	6.6	7.2	7.8	8.4	8.9	9.5	10.1
3800	4.4	5.2	5.4	5.9	6.4	6.9	7.4	7.8	8.3	8.7
4000	4.0	4.7	4.8	5.3	5.7	6.1	6.5	6.9	7.2	7.6
4200	3.6	4.2	4.3	4.7	5.1	5.4	5.8	6.1	6.3	6.7
4400	2.9	3.8	3.9	4.2	4.5	4.8	5.1	5.4	5.6	5.8
4600	2.3	3.3	3.6	3.8	4.1	4.3	4.6	4.8	5.0	5.1
4800	1.8	2.6	3.2	3.5	3.7	3.9	4.1	4.3	4.4	4.5
5000		2.0	2.9	3.2	3.3	3.5	3.7	3.8	3.9	4.0
5200		1.6	2.3	2.9	3.0	3.2	3.3	3.4	3.5	3.6
5400			1.8	2.6	2.8	2.9	3.0	3.1	3.1	3.1
5600				2.1	2.5	2.6	2.7	2.7	2.8	2.8
5800				1.6	2.3	2.4	2.5	2.5	2.5	2.5
6000					1.8	2.2	2.2	2.2	2.2	2.2

0.75mm Hibond 55 Composite Floor Slab – Single Spans
Long Term Superimposed Loads (kPa)

L_{ss} (mm)	Slab Thickness, D_s (mm)									
	110	120	130	140	150	160	170	180	190	200
2000	16.2	19.6	21.0							
2200	13.3	16.1	17.2	19.3	21.4					
2400	11.2	13.5	14.3	16.0	17.7	19.5	21.4			
2600	9.5	11.4	12.1	13.5	14.9	16.4	17.9	19.4	20.8	
2800	8.2	9.8	10.4	11.5	12.7	13.9	15.1	16.3	17.5	18.8
3000	7.1	8.5	9.0	9.9	10.9	11.9	12.9	13.9	14.8	15.9
3200	6.2	7.4	7.8	8.6	9.4	10.3	11.1	11.9	12.7	13.6
3400	5.4	6.5	6.9	7.5	8.2	8.9	9.6	10.3	10.9	11.6
3600	4.3	5.7	6.1	6.6	7.2	7.8	8.4	8.9	9.5	10.1
3800	3.4	4.6	5.4	5.9	6.4	6.9	7.4	7.8	8.3	8.7
4000	2.6	3.6	4.8	5.3	5.7	6.1	6.5	6.9	7.2	7.6
4200	2.0	2.8	3.9	4.7	5.1	5.4	5.8	6.1	6.3	6.7
4400		2.2	3.1	4.2	4.5	4.8	5.1	5.4	5.6	5.8
4600		1.6	2.4	3.3	4.1	4.3	4.6	4.8	5.0	5.1
4800			1.8	2.6	3.5	3.9	4.1	4.3	4.4	4.5
5000				2.0	2.8	3.5	3.7	3.8	3.9	4.0
5200					2.1	2.9	3.3	3.4	3.5	3.6
5400					1.6	2.3	3.0	3.1	3.1	3.1
5600						1.7	2.4	2.7	2.8	2.8
5800							1.8	2.5	2.5	2.5
6000								2.0	2.2	2.2

0.75mm Hibond 55 Composite Floor Slab – Double and End Spans
Medium and Long Term Superimposed Loads (kPa) and Negative Reinforcement (mm²/m width)

L (mm)	Slab Thickness, D_s (mm)																			
	110		120		130		140		150		160		170		180		190		200	
2000	**12.9**	HD12@300	**15.7**	HD12@250	**16.8**	HD12@300	**18.8**	HD12@250	**21.0**	HD12@300										
2200	**10.7**	HD12@250	**12.9**	HD12@250	**13.8**	HD12@250	**15.4**	HD12@250	**17.1**	HD12@300	**18.9**	HD12@250	**20.8**	HD12@250						
2400	**8.9**	HD12@250	**10.8**	HD12@250	**11.5**	HD12@250	**12.8**	HD12@250	**14.2**	HD12@250	**15.6**	HD12@250	**17.1**	HD12@250	**18.6**	HD12@250	**20.1**	HD12@250		
2600	**7.6**	HD12@250	**9.1**	HD12@250	**9.7**	HD12@250	**10.8**	HD12@250	**11.9**	HD12@250	**13.1**	HD12@250	**14.3**	HD12@250	**15.5**	HD12@250	**16.7**	HD12@250	**17.9**	HD12@250
2800	**6.4**	HD12@250	**7.8**	HD12@250	**8.3**	HD12@250	**9.2**	HD12@250	**10.1**	HD12@250	**11.1**	HD12@250	**12.1**	HD12@250	**13.0**	HD12@250	**14.0**	HD12@250	**15.0**	HD12@250
3000	**5.3**	HD12@250	**6.8**	HD12@200	**7.2**	HD12@250	**7.9**	HD12@250	**8.7**	HD12@250	**9.5**	HD12@250	**10.3**	HD12@250	**11.1**	HD12@250	**11.9**	HD12@250	**12.7**	HD12@250
3200	**4.5**	HD12@250	**5.9**	HD12@200	**6.2**	HD12@250	**6.9**	HD12@250	**7.5**	HD12@250	**8.2**	HD12@250	**8.9**	HD12@250	**9.5**	HD12@250	**10.2**	HD12@250	**10.8**	HD12@250
3400	**3.8**	HD12@250	**5.0**	HD12@200	**5.5**	HD12@200	**6.0**	HD12@250	**6.6**	HD12@250	**7.1**	HD12@250	**7.7**	HD12@250	**8.2**	HD12@250	**8.7**	HD12@250	**9.3**	HD12@250
3600	**3.2**	HD12@250	**4.3**	HD12@200	**4.9**	HD12@200	**5.3**	HD12@250	**5.8**	HD12@250	**6.3**	HD12@250	**6.7**	HD12@250	**7.2**	HD12@250	**7.6**	HD12@250	**8.0**	HD12@250
3800	**2.7**	HD12@250	**3.6**	HD12@200	**4.3**	HD12@200	**4.7**	HD12@200	**5.1**	HD12@200	**5.5**	HD12@250	**5.9**	HD12@250	**6.3**	HD12@250	**6.6**	HD12@250	**7.0**	HD12@250
4000	**2.2**	HD12@250	**3.1**	HD12@200	**3.9**	HD12@200	**4.2**	HD12@200	**4.5**	HD12@200	**4.9**	HD12@200	**5.2**	HD12@250	**5.5**	HD12@250	**5.8**	HD12@250	**6.1**	HD12@250
4200	**1.9**	HD12@250	**2.6**	HD12@200	**3.5**	HD12@200	**3.8**	HD12@200	**4.0**	HD12@200	**4.3**	HD12@200	**4.6**	HD12@200	**4.9**	HD12@250	**5.1**	HD12@250	**5.3**	HD12@250
4400			**2.2**	HD12@200	**3.0**	HD12@200	**3.4**	HD12@200	**3.6**	HD12@200	**3.9**	HD12@200	**4.1**	HD12@200	**4.3**	HD12@200	**4.5**	HD12@250	**4.7**	HD12@250
4600			**1.8**	HD12@200	**2.5**	HD12@200	**3.1**	HD12@200	**3.3**	HD12@200	**3.5**	HD12@200	**3.7**	HD12@200	**3.8**	HD12@200	**4.0**	HD12@200	**4.1**	HD12@250
4800					**2.1**	HD12@200	**2.8**	HD12@200	**2.9**	HD12@200	**3.1**	HD12@200	**3.3**	HD12@200	**3.4**	HD12@200	**3.5**	HD12@200	**3.6**	HD12@200
5000					**1.8**	HD12@200	**2.4**	HD12@200	**2.7**	HD12@150	**2.8**	HD12@200	**3.0**	HD12@200	**3.0**	HD12@200	**3.1**	HD12@200	**3.2**	HD12@200
5200							**2.1**	HD12@200	**2.4**	HD12@150	**2.6**	HD12@200	**2.7**	HD12@200	**2.7**	HD12@200	**2.8**	HD12@200	**2.8**	HD12@200
5400							**1.8**	HD12@200	**2.2**	HD12@150	**2.3**	HD12@150	**2.4**	HD12@200	**2.4**	HD12@200	**2.5**	HD12@200	**2.5**	HD12@200
5600									**2.0**	HD12@150	**2.1**	HD12@150	**2.2**	HD12@150	**2.2**	HD12@200	**2.2**	HD12@200	**2.2**	HD12@200
5800									**1.7**	HD12@150	**1.9**	HD12@150	**2.0**	HD12@150	**2.0**	HD12@150	**2.0**	HD12@200	**2.0**	HD12@200
6000											**1.8**	HD12@150	**1.8**	HD12@150	**1.8**	HD12@150	**1.8**	HD12@200	**1.8**	HD12@200

0.75mm Hibond 55 Composite Floor Slab – Internal Spans
Medium and Long Term Superimposed Loads (kPa) and Negative Reinforcement (mm²/m width)

L (mm)	Slab Thickness, D_s (mm)																			
	110		120		130		140		150		160		170		180		190		200	
2000	**17.2**	HD12@250	**22.4**	HD12@200																
2200	**14.0**	HD12@250	**18.2**	HD12@200	**21.6**	HD12@200														
2400	**11.5**	HD12@250	**15.1**	HD12@200	**18.3**	HD12@200	**20.5**	HD12@200	**21.3**	HD12@200	**19.3**	HD12@200	**19.8**	HD12@200	**20.3**	HD12@200				
2600	**9.6**	HD12@250	**12.6**	HD12@200	**15.5**	HD12@200	**16.7**	HD12@200	**17.2**	HD12@200	**17.6**	HD12@200	**18.1**	HD12@200	**18.5**	HD12@200	**18.9**	HD12@200	**19.0**	HD12@200
2800	**8.1**	HD12@250	**10.7**	HD12@200	**13.3**	HD12@200	**14.8**	HD12@200	**15.8**	HD12@200	**16.2**	HD12@200	**16.6**	HD12@200	**16.9**	HD12@200	**17.3**	HD12@200	**17.6**	HD12@200
3000	**6.9**	HD12@250	**9.1**	HD12@200	**11.4**	HD12@200	**12.8**	HD12@200	**14.2**	HD12@200	**14.9**	HD12@200	**15.3**	HD12@200	**15.6**	HD12@200	**15.9**	HD12@200	**16.2**	HD12@200
3200	**5.9**	HD12@250	**7.8**	HD12@200	**9.8**	HD12@200	**11.2**	HD12@200	**12.3**	HD12@200	**13.6**	HD12@200	**14.1**	HD12@200	**14.4**	HD12@200	**14.7**	HD12@200	**15.0**	HD12@200
3400	**5.1**	HD12@250	**6.7**	HD12@200	**8.5**	HD12@200	**9.8**	HD12@200	**10.8**	HD12@200	**11.8**	HD12@200	**12.9**	HD12@200	**13.4**	HD12@200	**13.6**	HD12@200	**13.9**	HD12@200
3600	**4.4**	HD12@250	**5.9**	HD12@200	**7.4**	HD12@200	**8.7**	HD12@200	**9.5**	HD12@200	**10.4**	HD12@200	**11.3**	HD12@200	**12.2**	HD12@200	**12.7**	HD12@200	**12.9**	HD12@200
3800	**3.8**	HD12@250	**5.1**	HD12@200	**6.5**	HD12@200	**7.7**	HD12@150	**8.4**	HD12@200	**9.2**	HD12@200	**10.0**	HD12@200	**10.8**	HD12@200	**11.5**	HD12@200	**12.0**	HD12@200
4000	**3.3**	HD12@250	**4.5**	HD12@200	**5.7**	HD12@200	**6.9**	HD12@150	**7.5**	HD12@200	**8.2**	HD12@200	**8.9**	HD12@200	**9.5**	HD12@200	**10.2**	HD12@200	**10.8**	HD12@200
4200	**2.8**	HD12@250	**3.9**	HD12@200	**5.0**	HD12@200	**6.2**	HD12@150	**6.7**	HD12@150	**7.3**	HD12@200	**7.9**	HD12@200	**8.5**	HD12@200	**9.0**	HD12@200	**9.6**	HD12@200
4400	**2.5**	HD12@250	**3.4**	HD12@200	**4.4**	HD12@200	**5.5**	HD12@150	**6.1**	HD12@150	**6.6**	HD12@200	**7.1**	HD12@200	**7.6**	HD12@200	**8.0**	HD12@200	**8.5**	HD12@200
4600	**2.1**	H1D2@250	**3.0**	HD12@200	**3.9**	HD12@200	**4.8**	HD12@150	**5.5**	HD12@150	**5.9**	HD12@150	**6.4**	HD12@200	**6.8**	HD12@200	**7.2**	HD12@200	**7.6**	HD12@200
4800	**1.9**	HD12@250	**2.6**	HD12@200	**3.4**	HD12@200	**4.3**	HD12@150	**5.0**	HD12@150	**5.4**	HD12@150	**5.8**	HD12@150	**6.1**	HD12@200	**6.4**	HD12@200	**6.8**	HD12@200
5000	**1.6**	HD12@250	**2.3**	HD12@200	**3.0**	HD12@200	**3.8**	HD12@150	**4.5**	HD12@150	**4.9**	HD12@150	**5.2**	HD12@150	**5.5**	HD12@200	**5.8**	HD12@200	**6.1**	HD12@200
5200			**2.0**	HD12@200	**2.7**	HD12@200	**3.4**	HD12@150	**4.1**	HD12@150	**4.4**	HD12@150	**4.7**	HD12@150	**5.0**	HD12@150	**5.2**	HD12@200	**5.5**	HD12@200
5400			**1.8**	HD12@200	**2.3**	HD12@200	**3.0**	HD12@150	**3.8**	HD12@150	**4.1**	HD12@150	**4.3**	HD12@150	**4.5**	HD12@150	**4.7**	HD12@200	**4.9**	HD12@200
5600			**1.5**	HD12@200	**2.1**	HD12@200	**2.7**	H1D2@150	**3.3**	HD12@150	**3.7**	HD12@150	**3.9**	HD12@150	**4.1**	HD12@150	**4.3**	HD12@200	**4.4**	HD12@200
5800					**1.8**	HD12@200	**2.4**	HD12@150	**3.0**	HD12@150	**3.4**	HD12@150	**3.6**	HD12@150	**3.7**	HD12@150	**3.9**	HD12@150	**4.0**	HD12@200
6000					**1.6**	HD12@200	**2.1**	HD12@150	**2.7**	HD12@150	**3.1**	HD12@150	**3.3**	HD12@150	**3.4**	HD12@150	**3.5**	HD12@150	**3.6**	HD12@200
6200							**1.8**	HD12@150	**2.4**	HD12@150	**2.9**	HD12@150	**3.0**	HD12@150	**3.1**	HD12@150	**3.2**	HD12@150	**3.3**	HD12@150
6400							**1.6**	HD12@150	**2.1**	HD12@150	**2.6**	HD12@150	**2.8**	HD12@150	**2.8**	HD12@150	**2.9**	HD12@150	**3.0**	HD12@150
6600									**1.9**	HD12@150	**2.3**	HD12@150	**2.5**	HD12@150	**2.6**	HD12@150	**2.7**	HD12@150	**2.7**	HD12@150
6800									**1.6**	HD12@150	**2.1**	HD12@150	**2.4**	HD12@150	**2.4**	HD12@150	**2.4**	HD12@150	**2.5**	HD12@150
7000											**1.8**	HD12@150	**2.2**	HD12@150	**2.2**	HD12@150	**2.2**	HD12@150	**2.2**	HD12@150

Dimond Structural

0.95mm Hibond 55 Composite Floor Slab – Single Spans Medium Term Superimposed Loads (kPa)

L_{ss} (mm)	Slab Thickness, D_s (mm)									
	110	120	130	140	150	160	170	180	190	200
2000	17.8	21.7								
2200	14.7	17.8	19.1	21.4						
2400	12.3	14.9	15.9	17.8	19.8	21.9				
2600	10.5	12.6	13.5	15.0	16.7	18.4	20.1	21.9		
2800	9.0	10.9	11.5	12.8	14.2	15.6	17.1	18.5	19.9	21.4
3000	7.8	9.4	10.0	11.1	12.2	13.4	14.6	15.8	16.9	18.2
3200	6.9	8.2	8.7	9.6	10.6	11.6	12.6	13.6	14.5	15.6
3400	6.1	7.3	7.6	8.4	9.2	10.1	10.9	11.8	12.6	13.4
3600	5.4	6.4	6.8	7.5	8.1	8.9	9.6	10.3	10.9	11.7
3800	4.9	5.8	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2
4000	4.4	5.2	5.4	5.9	6.4	6.9	7.5	7.9	8.4	8.9
4200	4.0	4.7	4.9	5.3	5.7	6.2	6.6	7.0	7.4	7.8
4400	3.3	4.2	4.4	4.8	5.2	5.5	5.9	6.3	6.6	6.9
4600	2.7	3.8	4.0	4.3	4.6	5.0	5.3	5.6	5.8	6.1
4800	2.1	3.0	3.6	3.9	4.2	4.5	4.8	5.0	5.2	5.4
5000	1.6	2.4	3.3	3.6	3.8	4.1	4.3	4.5	4.7	4.8
5200		1.9	2.8	3.3	3.5	3.7	3.9	4.0	4.2	4.3
5400			2.2	3.0	3.2	3.4	3.5	3.6	3.7	3.9
5600			1.7	2.5	2.9	3.1	3.2	3.3	3.4	3.5
5800				2.0	2.7	2.8	2.9	3.0	3.0	3.1
6000				1.5	2.2	2.6	2.7	2.7	2.7	2.8

0.95mm Hibond 55 Composite Floor Slab – Single Spans Long Term Superimposed Loads (kPa)

L_{ss} (mm)	Slab Thickness, D_s (mm)									
	110	120	130	140	150	160	170	180	190	200
2000	17.8	21.7								
2200	14.7	17.8	19.1	21.4						
2400	12.3	14.9	15.9	17.8	19.8	21.9				
2600	10.5	12.6	13.5	15.0	16.7	18.4	20.1	21.9		
2800	9.0	10.9	11.5	12.8	14.2	15.6	17.1	18.5	19.9	21.4
3000	7.8	9.4	10.0	11.1	12.2	13.4	14.6	15.8	16.9	18.2
3200	6.9	8.2	8.7	9.6	10.6	11.6	12.6	13.6	14.5	15.6
3400	5.9	7.3	7.6	8.4	9.2	10.1	10.9	11.8	12.6	13.4
3600	4.9	6.4	6.8	7.5	8.1	8.9	9.6	10.3	10.9	11.7
3800	3.9	5.3	6.0	6.6	7.2	7.8	8.4	9.0	9.6	10.2
4000	3.0	4.2	5.4	5.9	6.4	6.9	7.5	7.9	8.4	8.9
4200	2.4	3.3	4.6	5.3	5.7	6.2	6.6	7.0	7.4	7.8
4400	1.8	2.6	3.6	4.8	5.2	5.5	5.9	6.3	6.6	6.9
4600		2.0	2.9	3.9	4.6	5.0	5.3	5.6	5.8	6.1
4800		1.5	2.2	3.1	4.2	4.5	4.8	5.0	5.2	5.4
5000			1.7	2.4	3.3	4.1	4.3	4.5	4.7	4.8
5200				1.9	2.6	3.5	3.9	4.0	4.2	4.3
5400					2.0	2.8	3.5	3.6	3.7	3.9
5600					1.5	2.2	3.0	3.3	3.4	3.5
5800						1.7	2.3	3.0	3.0	3.1
6000							1.8	2.5	2.7	2.8

0.95mm Hibond 55 Composite Floor Slab – Double and End Spans
Medium and Long Term Superimposed Loads (kPa) and Negative Reinforcement (mm²/m width)

L (mm)	Slab Thickness, D_s (mm)																			
	110		120		130		140		150		160		170		180		190		200	
2000	**14.2**	HD12@250	**17.3**	HD12@200	**18.6**	HD12@250	**20.9**	HD12@250												
2200	**11.4**	HD12@250	**14.3**	HD12@200	**15.3**	HD12@250	**17.1**	HD12@250	**19.1**	HD12@250	**21.2**	HD12@250								
2400	**9.3**	HD12@250	**11.9**	HD12@200	**12.7**	HD12@250	**14.3**	HD12@250	**15.8**	HD12@250	**17.5**	HD12@250	**19.2**	HD12@250	**20.9**	HD12@250				
2600	**7.7**	HD12@250	**10.1**	HD12@200	**10.8**	HD12@250	**12.0**	HD12@250	**13.3**	HD12@250	**14.7**	HD12@250	**16.1**	HD12@250	**17.5**	HD12@250	**18.9**	HD12@250	**20.0**	HD12@250
2800	**6.4**	HD12@250	**8.4**	HD12@200	**9.2**	HD12@200	**10.3**	HD12@250	**11.3**	HD12@250	**12.5**	HD12@250	**13.6**	HD12@250	**14.8**	HD12@250	**15.9**	HD12@250	**17.2**	HD12@250
3000	**5.3**	HD12@250	**7.1**	HD12@200	**8.0**	HD12@200	**8.9**	HD12@200	**9.8**	HD12@200	**10.7**	HD12@200	**11.7**	HD12@200	**12.6**	HD12@250	**13.5**	HD12@250	**14.6**	HD12@200
3200	**4.5**	HD12@250	**6.0**	HD12@200	**7.0**	HD12@200	**7.7**	HD12@200	**8.5**	HD12@200	**9.3**	HD12@200	**10.1**	HD12@200	**10.9**	HD12@200	**11.6**	HD12@200	**12.5**	HD12@200
3400	**3.8**	HD12@250	**5.1**	HD12@200	**6.1**	HD12@200	**6.8**	HD12@200	**7.4**	HD12@200	**8.1**	HD12@200	**8.8**	HD12@200	**9.4**	HD12@200	**10.0**	HD12@200	**10.7**	HD12@200
3600	**3.2**	HD12@250	**4.3**	HD12@200	**5.4**	HD12@200	**6.0**	HD12@200	**6.5**	HD12@200	**7.1**	HD12@200	**7.7**	HD12@200	**8.2**	HD12@200	**8.7**	HD12@200	**9.3**	HD12@200
3800	**2.7**	HD12@250	**3.7**	HD12@200	**4.8**	HD12@200	**5.3**	HD12@200	**5.8**	HD12@200	**6.3**	HD12@200	**6.7**	HD12@200	**7.2**	HD12@200	**7.6**	HD12@200	**8.1**	HD12@200
4000	**2.2**	HD12@250	**3.1**	HD12@200	**4.1**	HD12@200	**4.7**	HD12@200	**5.1**	HD12@200	**5.6**	HD12@200	**6.0**	HD12@200	**6.3**	HD12@200	**6.7**	HD12@200	**7.1**	HD12@200
4200	**1.9**	HD12@250	**2.6**	HD12@200	**3.5**	HD12@200	**4.2**	HD12@200	**4.6**	HD12@200	**5.0**	HD12@200	**5.3**	HD12@200	**5.6**	HD12@200	**5.9**	HD12@200	**6.3**	HD12@200
4400			**2.2**	HD12@200	**3.0**	HD12@200	**3.8**	HD12@200	**4.1**	HD12@200	**4.4**	HD12@200	**4.7**	HD12@200	**5.0**	HD12@200	**5.3**	HD12@200	**5.5**	HD12@200
4600			**1.9**	HD12@200	**2.6**	HD12@200	**3.4**	HD12@150	**3.7**	HD12@150	**4.0**	HD12@200	**4.2**	HD12@200	**4.5**	HD12@200	**4.7**	HD12@200	**4.9**	HD12@200
4800					**2.2**	HD12@200	**2.9**	HD12@150	**3.4**	HD12@150	**3.6**	HD12@150	**3.8**	HD12@200	**4.0**	HD12@200	**4.2**	HD12@200	**4.4**	HD12@200
5000					**1.8**	HD12@200	**2.5**	HD12@150	**3.1**	HD12@150	**3.3**	HD12@150	**3.4**	HD12@200	**3.6**	HD12@200	**3.7**	HD12@200	**3.9**	HD12@200
5200							**2.1**	HD12@150	**2.8**	HD12@150	**3.0**	HD12@150	**3.1**	HD12@150	**3.2**	HD12@200	**3.3**	HD12@200	**3.5**	HD12@200
5400							**1.8**	HD12@150	**2.4**	HD12@150	**2.7**	HD12@150	**2.8**	HD12@150	**2.9**	HD12@150	**3.0**	HD12@200	**3.1**	HD12@200
5600									**2.1**	HD12@150	**2.5**	HD12@150	**2.6**	HD12@150	**2.6**	HD12@150	**2.7**	HD12@150	**2.8**	HD12@200
5800									**1.7**	HD12@150	**2.2**	HD12@150	**2.3**	HD12@150	**2.4**	HD12@150	**2.4**	HD12@150	**2.5**	HD12@150
6000											**2.0**	HD12@150	**2.1**	HD12@150	**2.2**	HD12@150	**2.2**	HD12@150	**2.2**	HD12@150

0.95mm Hibond 55 Composite Floor Slab – Internal Spans
Medium and Long Term Superimposed Loads (kPa) and Negative Reinforcement (mm²/m width)

L (mm)	Slab Thickness, D_s (mm)									
	110	120	130	140	150	160	170	180	190	200
2000	**17.2** HD12@250	**22.4** HD12@200								
2200	**14.0** HD12@250	**18.2** HD12@200	**23.0** HD12@200							
2400	**11.5** HD12@250	**15.1** HD12@200	**19.1** HD12@200	**22.8** HD12@150						
2600	**9.6** HD12@250	**12.6** HD12@200	**16.0** HD12@200	**19.3** HD12@150	**21.5** HD12@150					
2800	**8.1** HD12@250	**10.7** HD12@200	**13.6** HD12@200	**16.5** HD12@150	**18.4** HD12@150	**19.4** HD12@200	**19.9** HD12@200	**20.3** HD12@200		
3000	**6.9** HD12@250	**9.1** HD12@200	**11.6** HD12@200	**14.1** HD12@150	**15.8** HD12@150	**17.5** HD12@150	**18.3** HD12@150	**18.7** HD12@200	**19.1** HD12@200	**19.5** HD12@200
3200	**5.9** HD12@250	**7.8** HD12@200	**10.0** HD12@200	**12.2** HD12@150	**13.8** HD12@150	**15.2** HD12@150	**16.7** HD12@150	**17.4** HD12@150	**17.7** HD12@200	**18.0** HD12@200
3400	**5.1** HD12@250	**6.7** HD12@200	**8.7** HD12@200	**10.6** HD12@150	**12.1** HD12@150	**13.3** HD12@150	**14.6** HD12@150	**15.8** HD12@150	**16.5** HD12@150	**16.8** HD12@200
3600	**4.4** HD12@250	**5.9** HD12@200	**7.6** HD12@200	**9.3** HD12@150	**10.7** HD12@150	**11.7** HD12@150	**12.8** HD12@150	**13.9** HD12@150	**14.9** HD12@150	**15.6** HD12@150
3800	**3.8** HD12@250	**5.1** HD12@200	**6.6** HD12@200	**8.1** HD12@150	**9.5** HD12@150	**10.4** HD12@150	**11.3** HD12@150	**12.2** HD12@150	**13.1** HD12@150	**14.1** HD12@150
4000	**3.3** HD12@250	**4.5** HD12@200	**5.8** HD12@200	**7.2** HD12@150	**8.5** HD12@150	**9.3** HD12@150	**10.1** HD12@150	**10.8** HD12@150	**11.6** HD12@150	**12.5** HD12@150
4200	**2.8** HD12@250	**3.9** HD12@200	**5.1** HD12@200	**6.3** HD12@150	**7.6** HD12@150	**8.3** HD12@150	**9.0** HD12@150	**9.7** HD12@150	**10.3** HD12@150	**11.1** HD12@150
4400	**2.5** HD12@250	**3.4** HD12@200	**4.5** HD12@200	**5.6** HD12@150	**6.8** HD12@150	**7.5** HD12@150	**8.1** HD12@150	**8.7** HD12@150	**9.2** HD12@150	**9.9** HD12@150
4600	**2.1** HD12@250	**3.0** HD12@200	**4.0** HD12@200	**5.0** HD12@150	**6.0** HD12@150	**6.7** HD12@150	**7.3** HD12@150	**7.8** HD12@150	**8.3** HD12@150	**8.8** HD12@150
4800	**1.9** HD12@250	**2.6** HD12@200	**3.5** HD12@200	**4.4** HD12@150	**5.4** HD12@150	**6.1** HD12@150	**6.6** HD12@150	**7.0** HD12@150	**7.4** HD12@150	**7.9** HD12@150
5000	**1.6** HD12@250	**2.3** HD12@200	**3.1** HD12@200	**3.9** HD12@150	**4.8** HD12@150	**5.6** HD12@150	**6.0** HD12@150	**6.3** HD12@150	**6.7** HD12@150	**7.1** HD12@150
5200		**2.0** HD12@200	**2.7** HD12@200	**3.5** HD12@150	**4.3** HD12@150	**5.1** HD12@150	**5.4** HD12@150	**5.8** HD12@150	**6.1** HD12@150	**6.4** HD12@150
5400		**1.8** HD12@200	**2.4** HD12@200	**3.1** HD12@150	**3.8** HD12@150	**4.6** HD12@150	**5.0** HD12@150	**5.2** HD12@150	**5.5** HD12@150	**5.8** HD12@150
5600		**1.5** HD12@200	**2.1** HD12@200	**2.7** HD12@150	**3.4** HD12@150	**4.2** HD12@150	**4.5** HD12@150	**4.8** HD12@150	**5.0** HD12@150	**5.3** HD12@150
5800			**1.9** HD12@200	**2.4** HD12@150	**3.1** HD12@150	**3.8** HD12@150	**4.2** HD12@150	**4.4** HD12@150	**4.6** HD12@150	**4.8** HD12@150
6000			**1.6** HD12@200	**2.2** HD12@150	**2.7** HD12@150	**3.4** HD12@150	**3.8** HD12@150	**4.0** HD12@150	**4.2** HD12@150	**4.4** HD12@150
6200				**1.9** HD12@150	**2.4** HD12@150	**3.0** HD12@150	**3.5** HD12@150	**3.7** HD12@150	**3.8** HD12@150	**4.0** HD12@150
6400				**1.7** HD12@150	**2.2** HD12@150	**2.7** HD12@150	**3.2** HD12@150	**3.4** HD12@150	**3.5** HD12@150	**3.6** HD12@150
6600					**1.9** HD12@150	**2.4** HD12@150	**3.0** HD12@150	**3.1** HD12@150	**3.2** HD12@150	**3.3** HD12@150
6800					**1.7** HD12@150	**2.1** HD12@150	**2.7** HD12@150	**2.9** HD12@150	**2.9** HD12@150	**3.0** HD12@150
7000						**1.9** HD12@150	**2.4** HD12@150	**2.6** HD12@150	**2.7** HD12@150	**2.8** HD12@150

HIBOND 55 FIRE DESIGN TABLES

Introduction

Fire resistance ratings are given for composite floor slab thicknesses 110mm to 160mm, 180mm and 200mm, for single spans between 2.0m and 6.0m with live loads of 3kPa to 5kPa.

Fire resistance ratings can also be adjusted for loads of 1.5kPa and 2.5kPa, refer Note 5 below.

The following notes apply to the Hibond 55 composite floor slab fire design tables in this section.

1. The fire resistance ratings tabulated are equivalent times in minutes of exposure to the standard fire test (NZS/BS 476) that satisfy the criteria for insulation, integrity and stability based on simply supported spans. Fire resistance ratings shown in ***bold italics*** are limited by insulation criteria. The beneficial effects of continuous spans and/or negative reinforcement at supports may be accounted for by specific design.
2. L is the span measured centre to centre between permanent supports.
3. Spans of up to 4.0m do not require any supplementary fire reinforcing steel to achieve a Fire Resistance Rating (FRR) of up to 30 minutes. Spans greater than 4.0m **require** supplementary fire reinforcing steel as outlined in the following tables.
4. The fire resistance ratings given are based on the following conditions. If design conditions differ from the following, specific design will be required.
   - The minimum cover to the fire reinforcement is 25mm to the bottom of the steel decking sheet and 40mm to the side of the rib.
   - A superimposed dead load (G_{SDL}) of 0.5kPa has been included. Where G_{SDL} is greater than 0.5kPa specific design to HERA Report R4-82 is required.
   - The self weight of the Hibond 55 composite floor slab is based on a concrete density of 2350kg/m^3 and an allowance of 5% for concrete ponding during construction.
   - The long term live load factor (AS/NZS 1170.0) used for 5kPa live load is 0.6. For all other live loads 0.4 has been used.
   - Specified concrete strength, f'_c = 25MPa and Type A aggregate.
   - Reinforcement is grade 500 to AS/NZS 4671 and is assumed to be continuous over the length of the clear span.
   - Design moment capacity of the composite floor slab is calculated in accordance with NZS 3101 and any contribution from the Hibond 55 steel is neglected.
5. Live loads less than 3kPa.
   - For a live load of 2.5kPa, increase FRR by 4 minutes for the corresponding live load, span and composite floor slab thickness published for the 3kPa live load, provided that the fire resistance rating is not limited by insulation criteria.
   - For a live load of 1.5kPa, increase FRR by 10 minutes for the corresponding live load, span and composite floor slab thickness published for the 3kPa live load, provided that the fire resistance rating is not limited by insulation criteria.
6. For intermediate values linear interpolation is permitted provided that the two values are within the extent of the tables. For example, interpolation can be used to derive the fire resistance ratings for 170mm and 190mm overall composite floor slab thicknesses. No interpolation is permitted between 30 minutes and the tabulated values – in this case the next greater steel content given in the fire design tables must be used.
7. Fire resistance ratings have been provided for spans up to where a value of G_{SDL} + Q = 1.5kPa can be achieved from the Load Span tables in Section 3.4.5. Therefore these fire resistance rating tables must be used in conjunction with Hibond 55 Composite Floor Slab Load Span Tables 3.4.5 as satisfaction of fire resistance rating does not always ensure the load capacity and deflection criteria for ambient temperature are met.

0.75mm and 0.95mm Hibond 55 Composite Floor Slab – Fire Resistance Ratings (Minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Hibond Slab, L (mm)														
			2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800
110	3	HD10 every 3rd pan	***71***	69	57	46											
		HD12 every 3rd pan				***71***	61	51									
		HD12 every 2nd pan							***71***	62	53	46					
		HD16 every 3rd pan								***71***	66	57	50				
		HD16 every 2nd pan												***71***	65	58	52
		HD12 every pan													***71***	67	60
		HD16 every pan															***71***
	4	HD10 every 3rd pan	***71***	62	50												
		HD12 every 3rd pan			***71***	64	54	44									
		HD12 every 2nd pan						***71***	63	54	46						
		HD16 every 3rd pan							***71***	67	58	50					
		HD16 every 2nd pan											***71***	64	57	51	
		HD12 every pan												***71***	66	59	53
		HD16 every pan															***71***
	5	HD10 every 3rd pan	55														
		HD12 every 3rd pan	***71***	68	55	44											
		HD12 every 2nd pan				***71***	62	52									
		HD16 every 3rd pan					***71***	64	54	45							
		HD16 every 2nd pan								***71***	66	58	50				
		HD12 every pan									***71***	66	58	51	45		
		HD16 every pan														***71***	***71***

0.75mm and 0.95mm Hibond 55 Composite Floor Slab – Fire Resistance Ratings (Minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Hibond Slab, L (mm)																
			2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200
120	3	HD10 every 3rd pan	***86***	73	61	50													
		HD12 every 3rd pan			***86***	76	65	55	46										
		HD12 every 2nd pan					***86***	84	75	66	57	50							
		HD16 every 3rd pan							***86***	79	70	62	54	47					
		HD16 every 2nd pan										***86***	84	77	70	63	56	50	
		HD12 every pan											***86***	85	78	71	65	59	53
		HD16 every pan																	***86***
	4	HD10 every 3rd pan	80	67	54	43													
		HD12 every 3rd pan		***86***	81	69	58	48											
		HD12 every 2nd pan					***86***	77	68	59	51								
		HD16 every 3rd pan						***86***	81	72	63	55	48						
		HD16 every 2nd pan									***86***	85	77	70	63	56	49		
		HD12 every pan										***86***	85	78	71	64	58	52	46
		HD16 every pan																	***86***
	5	HD10 every 3rd pan	61	47															
		HD12 every 3rd pan	***86***	73	61	49													
		HD12 every 2nd pan			***86***	78	67	57	48										
		HD16 every 3rd pan				***86***	81	70	60	51									
		HD16 every 2nd pan							***86***	81	72	64	56	49					
		HD12 every pan								***86***	80	72	64	57	50	44			
		HD16 every pan														***86***	79	73	66

0.75mm and 0.95mm Hibond 55 Composite Floor Slab – Fire Resistance Ratings (Minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Hibond Slab, L (mm)																	
			2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400
130	3	HD10 every 3rd pan	90	77	64	53														
		HD12 every 3rd pan	***105***	103	91	79	68	58	49											
		HD12 every 2nd pan				***105***	97	88	78	69	61	53								
		HD16 every 3rd pan					***105***	101	92	83	74	66	58	51						
		HD16 every 2nd pan								***105***	104	96	88	81	74	67	60	54	48	
		HD12 every pan									***105***	102	95	88	81	75	68	62	57	51
		HD16 every pan																***105***	99	94
	4	HD10 every 3rd pan	84	70	58	47														
		HD12 every 3rd pan	***105***	97	84	73	62	52												
		HD12 every 2nd pan			***105***	101	91	81	72	63	55	47								
		HD16 every 3rd pan					***105***	95	85	76	67	59	52							
		HD16 every 2nd pan								***105***	97	89	82	74	67	60	54	48		
		HD12 every pan								***105***	104	96	89	82	75	68	62	56	50	45
		HD16 every pan															***105***	99	93	87
	5	HD10 every 3rd pan	65	52																
		HD12 every 3rd pan	92	78	65	54														
		HD12 every 2nd pan		***105***	94	83	72	62	53	44										
		HD16 every 3rd pan			***105***	97	86	75	65	56	48									
		HD16 every 2nd pan						***105***	95	86	78	69	62	54	47					
		HD12 every pan						***105***	102	93	85	77	69	62	55	49				
		HD16 every pan												***105***	98	91	85	78	72	66

0.75mm and 0.95mm Hibond 55 Composite Floor Slab – Fire Resistance Ratings (Minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Hibond Slab, L (mm)																			
			2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600	5800
140	3	HD10 every 3rd pan	93	79	67	56	46															
		HD12 every 3rd pan	118	105	94	82	71	61	52	44												
		HD12 every 2nd pan		***125***	120	110	100	90	81	72	64	56	49									
		HD16 every 3rd pan			***125***	123	114	104	95	86	77	69	61	54	47							
		HD16 every 2nd pan						***125***	122	115	107	99	92	84	77	70	64	58	52	46		
		HD12 every pan							***125***	119	112	105	98	91	84	78	72	65	60	54	49	44
		HD16 every pan													***125***	120	114	108	103	97	92	86
	4	HD10 every 3rd pan	87	73	61	50																
		HD12 every 3rd pan	112	100	88	76	65	55	46													
		HD12 every 2nd pan		***125***	115	104	94	84	75	66	58	50										
		HD16 every 3rd pan			***125***	118	108	98	89	80	71	63	55	48								
		HD16 every 2nd pan						***125***	117	109	101	93	85	78	71	64	57	51	46			
		HD12 every pan						***125***	121	114	107	99	92	85	78	72	65	59	53	48		
		HD16 every pan												***125***	120	114	108	102	96	91	85	80
	5	HD10 every 3rd pan	69	56	44																	
		HD12 every 3rd pan	96	82	70	58	48															
		HD12 every 2nd pan	122	110	98	87	76	66	57	48												
		HD16 every 3rd pan	***125***	123	112	101	90	80	70	61	52											
		HD16 every 2nd pan				***125***	118	109	100	91	82	74	66	59	52	45						
		HD12 every pan				***125***	123	114	106	97	89	81	74	67	60	53	47					
		HD16 every pan									***125***	123	116	109	103	96	90	83	77	71	65	60

0.75mm and 0.95mm Hibond 55 Composite Floor Slab – Fire Resistance Ratings (Minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Hibond Slab, L (mm)																				
			2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600	5800	6000
150	3	HD10 every 3rd pan	95	82	69	58	48																
		HD12 every 3rd pan	≥120	108	96	85	74	64	55	46													
		HD12 every 2nd pan			≥120	112	102	93	84	75	66	59	51	45									
		HD16 every 3rd pan				≥120	116	107	98	89	80	72	64	57	50								
		HD16 every 2nd pan							≥120	117	109	102	94	87	80	73	67	60	55	49			
		HD12 every pan								≥120	114	107	100	94	87	80	74	68	62	57	52	47	
		HD16 every pan														≥120	116	111	105	100	94	89	84
	4	HD10 every 3rd pan	90	76	64	52																	
		HD12 every 3rd pan	115	102	90	79	68	58	49														
		HD12 every 2nd pan		≥120	117	107	97	87	78	69	61	53	46										
		HD16 every 3rd pan				≥120	111	101	92	83	74	66	58	51									
		HD16 every 2nd pan							≥120	112	104	96	88	81	74	67	61	54	49				
		HD12 every pan							≥120	117	109	102	95	88	81	75	68	62	56	51	46		
		HD16 every pan													≥120	117	111	105	100	94	88	83	78
	5	HD10 every 3rd pan	73	59	47																		
		HD12 every 3rd pan	99	86	73	62	51																
		HD12 every 2nd pan	≥120	113	102	91	80	70	60	52	44												
		HD16 every 3rd pan		≥120	116	105	94	84	74	65	56	48											
		HD16 every 2nd pan					≥120	113	104	95	86	78	70	63	56	49							
		HD12 every pan					≥120	117	109	101	93	85	78	70	63	57	51	45					
		HD16 every pan										≥120	119	113	106	100	94	88	81	76	70	64	59

0.75mm and 0.95mm Hibond 55 Composite Floor Slab – Fire Resistance Ratings (Minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Hibond Slab, L (mm)																				
			2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600	5800	6000
160	3	HD10 every 3rd pan	97	84	71	60	50																
		HD12 every 3rd pan	≥120	110	98	87	76	66	57	48													
		HD12 every 2nd pan			≥120	114	104	95	86	77	69	61	53	47									
		HD16 every 3rd pan				≥120	118	109	100	91	83	74	67	59	52	46							
		HD16 every 2nd pan							≥120	119	112	104	97	89	82	76	69	63	57	51	46		
		HD12 every pan								≥120	116	109	103	96	89	83	77	70	65	59	54	49	44
		HD16 every pan														≥120	119	113	108	102	97	92	87
	4	HD10 every 3rd pan	92	78	66	55	45																
		HD12 every 3rd pan	117	105	93	81	71	60	51														
		HD12 every 2nd pan		≥120	119	109	99	90	80	71	63	55	48										
		HD16 every 3rd pan				≥120	113	104	94	85	77	69	61	54	47								
		HD16 every 2nd pan							≥120	114	106	99	91	84	77	70	63	57	51	46			
		HD12 every pan							≥120	119	111	104	97	90	84	77	71	65	59	54	48		
		HD16 every pan													≥120	119	114	108	102	97	91	86	81
	5	HD10 every 3rd pan	76	62	50																		
		HD12 every 3rd pan	102	89	76	65	54	45															
		HD12 every 2nd pan	≥120	116	105	94	83	73	64	55	47												
		HD16 every 3rd pan		≥120	118	108	97	87	77	68	60	52											
		HD16 every 2nd pan					≥120	116	107	98	90	82	74	66	59	46							
		HD12 every pan						≥120	112	104	96	88	81	74	67	60	54	48					
		HD16 every pan											≥120	116	110	103	97	91	85	79	74	68	63

0.75mm and 0.95mm Hibond 55 Composite Floor Slab – Fire Resistance Ratings (Minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Hibond Slab, L (mm)																				
			2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600	5800	6000
180	3	HD10 every 3rd pan	100	87	75	64	53	44															
		HD12 every 3rd pan	≥120	113	101	90	80	70	60	52	44												
		HD12 every 2nd pan			≥120	117	108	99	90	81	72	65	57	50	44								
		HD16 every 3rd pan					≥120	113	104	95	87	78	71	63	56	50							
		HD16 every 2nd pan								≥120	115	108	101	93	87	80	73	67	61	56	50		
		HD12 every pan								≥120	119	113	106	99	93	87	80	74	68	63	58	53	48
		HD16 every pan															≥120	117	112	106	101	96	91
	4	HD10 every 3rd pan	96	82	70	59	48																
		HD12 every 3rd pan	≥120	108	97	85	75	65	55	47													
		HD12 every 2nd pan			≥120	113	103	94	85	76	67	60	52	45									
		HD16 every 3rd pan				≥120	117	108	99	90	81	73	65	58	51								
		HD16 every 2nd pan							≥120	118	110	103	96	88	81	75	68	62	56	50	45		
		HD12 every pan								≥120	115	108	101	95	88	82	75	69	63	58	53	48	
		HD16 every pan														≥120	118	112	107	101	96	91	86
	5	HD10 every 3rd pan	81	67	55	44																	
		HD12 every 3rd pan	107	94	82	70	59	50															
		HD12 every 2nd pan		≥120	110	99	89	79	69	60	52	45											
		HD16 every 3rd pan			≥120	113	103	93	83	74	65	57	50										
		HD16 every 2nd pan						≥120	112	104	95	87	80	72	65	58	52	46					
		HD12 every pan						≥120	117	109	101	94	87	79	73	66	60	54	48				
		HD16 every pan												≥120	115	109	103	97	91	86	80	75	69

0.75mm and 0.95mm Hibond 55 Composite Floor Slab – Fire Resistance Ratings (Minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Hibond Slab, L (mm)																				
			2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600	5800	6000
200	3	HD10 every 3rd pan	103	90	78	66	56	46															
		HD12 every 3rd pan	≥120	115	104	93	83	73	63	55	47												
		HD12 every 2nd pan				≥120	110	101	92	84	75	67	60	53	47								
		HD16 every 3rd pan					≥120	115	107	98	90	82	74	66	59	53	47						
		HD16 every 2nd pan								≥120	118	111	104	96	90	86	77	70	64	59	53	48	
		HD12 every pan									≥120	115	109	102	96	89	83	77	72	66	61	56	51
		HD16 every pan																≥120	114	109	104	99	94
	4	HD10 every 3rd pan	99	85	73	62	51																
		HD12 every 3rd pan	≥120	111	100	89	78	68	59	50													
		HD12 every 2nd pan			≥120	116	106	97	88	79	71	63	55	49									
		HD16 every 3rd pan					≥120	111	102	93	85	77	69	62	55	48							
		HD16 every 2nd pan								≥120	114	106	99	92	85	78	72	66	60	54	49		
		HD12 every pan								≥120	118	111	104	98	91	85	79	73	67	61	56	51	46
		HD16 every pan															≥120	115	110	105	100	94	89
	5	HD10 every 3rd pan	85	72	59	48																	
		HD12 every 3rd pan	111	98	86	75	64	54	45														
		HD12 every 2nd pan		≥120	113	103	93	83	74	65	56	49											
		HD16 every 3rd pan			≥120	117	107	97	88	79	70	62	54	47									
		HD16 every 2nd pan						≥120	116	108	100	92	84	77	70	63	57	51	45				
		HD12 every pan							≥120	113	105	98	91	84	77	71	64	58	53	47			
		HD16 every pan												≥120	119	113	108	102	96	90	85	80	74

HIBOND 55 ACOUSTIC PERFORMANCE

SCOPE

This section provides guidelines for specifiers and constructors who require noise control systems for residential applications such as separate multi-unit dwellings or single dwellings, commercial applications such as retail spaces, offices and institutional buildings. It is not intended that these guidelines replace the need for specialist acoustic design to meet the specified sound insulation performance for the building.

A Dimond Structural Noise Control System consists of a Hibond 55 composite floor slab with a selected USG ceiling system, GIB® standard plasterboard ceiling linings, selected floor coverings and the specific inclusion of a cavity absorber. It must be noted that the floor covering is an essential aspect of the performance of the system.

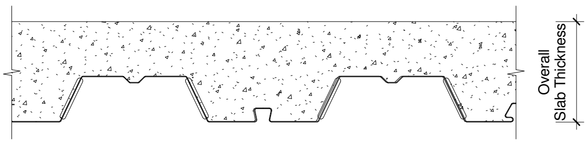
The information in this section is based on laboratory testing of a 120mm Hibond 55 composite floor slab carried out by the University of Auckland, Acoustics Testing Service and opinions on expected acoustic performance by Marshall Day Acoustics Limited Report Rp002 R00_2006476. More information is available on request.

The systems set out in this section provide the expected sound transmission performance under laboratory conditions. However in practical applications on site there is a significant element of subjectivity to interpreting noise levels within rooms. No matter how low a sound level might be, if it is intrusive upon a person's privacy, then it is likely to cause annoyance. No practical system can guarantee complete sound insulation and completely satisfy everyone.

Introduction of light fittings, vents or other floor or ceiling penetrations will reduce the acoustic performance of the system, requiring specific assessment in each case.

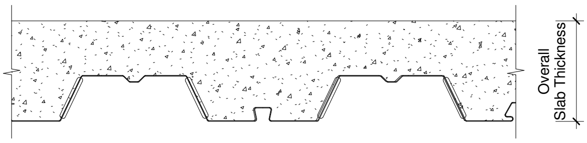
Hibond 55 Composite Floor Slab – Bare Composite Floor Slab

System Description:
Steel Decking: 0.75, 0.95mm Hibond 55
Composite Floor Slab: Overall thickness (mm)



Overall Composite Floor Slab Thickness (mm)	STC
120	42
140	44
160	47
180	49
200	51

System Description:
Steel Decking: 0.75, 0.95mm Hibond 55
Composite Floor Slab: 120mm overall thickness

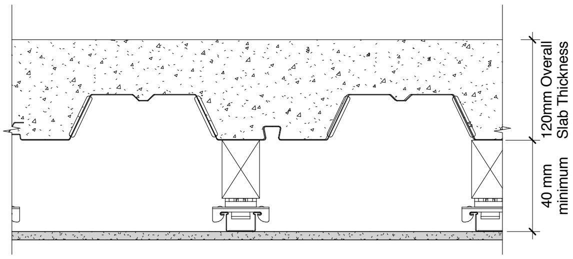


Floor Surface Treatment	STC	IIC
No Covering	42	23
15mm strip timber on Bostic Ultraset adhesive	42	40
15mm strip timber on 1mm polyethylene foam	42	44
6mm Cork flooring	42	42
Gerfloor Taralay Comfort Vinyl, 3.1mm thick	42	43
Carpet, nylon or wool 40oz without underlay	42	66
Carpet, wool 60oz without underlay	42	67
Carpet, wool or nylon on 8mm foam underlay	42	71

Notes:
1. The acoustic opinion has a margin of error of +/- 3 STC/IIC points
2. IIC result depends on the quality of the floor covering material and installation
3. All adhesives must be applied to manufacturers instructions, and Bostic Ultraset adhesive dry film thickness must not be less than 1.9mm
4. It is prudent to allow a 5 point reduction for expected field STC and IIC when compared to the above performance expected in laboratory conditions. This is considered a reasonable compensation to allow for flanking paths at junctions and construction variations.

Hibond 55 Composite Floor Slab with Direct Fix Ceiling System - Non-Insulated

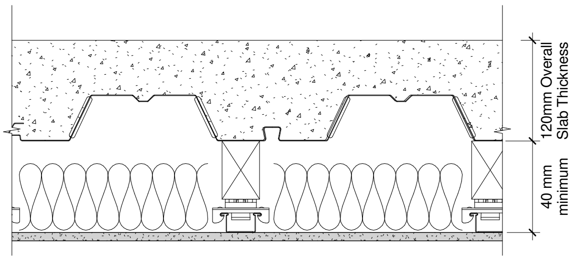
System Description:
Steel Decking: 0.75, 0.95mm Hibond 55
Composite Floor Slab: 120mm overall thickness
Ceiling System: Potters Direct Fix with sound isolation clips
USG furring channel at maximum 600mm centres
Ceiling Lining: 13mm GIB standard plasterboard in one or two layers



Floor Surface Treatment	Ceiling Lining			
	One Layer 13mm GIB		Two Layers 13mm GIB	
	STC	IIC	STC	IIC
No Covering	54	39	57	41
15mm strip timber on Bostic Ultraset adhesive	54	46	57	48
15mm strip timber on 1mm polyethylene foam	54	47	57	49
6mm Cork flooring	54	47	57	49
Gerfloor Taralay Comfort Vinyl, 3.1mm thick	54	49	57	51
Carpet, nylon or wool 40oz without underlay	54	60	57	62
Carpet, wool 60oz without underlay	54	62	57	64
Carpet, wool or nylon on 8mm foam underlay	54	66	57	68

Hibond 55 Composite Floor Slab with Direct Fix Ceiling System - Insulated

System Description:
Steel Decking: 0.75, 0.95mm Hibond 55
Composite Floor Slab: 120mm overall thickness
Insulation Blanket: 75mm thick R1.8 Pink Batts
Ceiling System: Potters Direct Fix with sound isolation clips
USG furring channel at maximum 600mm centres
Ceiling Lining: 13mm GIB standard plasterboard in one or two layers

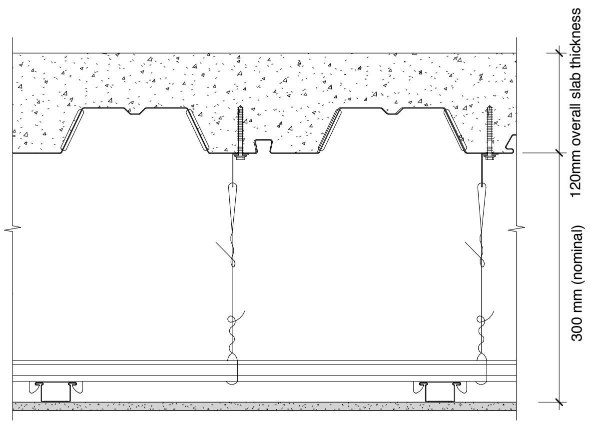


Floor Surface Treatment	Ceiling Lining			
	One Layer 13mm GIB		Two Layers 13mm GIB	
	STC	IIC	STC	IIC
No Covering	61	42	64	44
15mm strip timber on Bostic Ultraset adhesive	61	54	64	56
15mm strip timber on 1mm polyethylene foam	61	57	64	59
6mm Cork flooring	61	56	64	58
Gerfloor Taralay Comfort Vinyl, 3.1mm thick	61	56	64	58
Carpet, nylon or wool 40oz without underlay	61	67	64	69
Carpet, wool 60oz without underlay	61	69	64	71
Carpet, wool or nylon on 8mm foam underlay	61	73	64	75

Notes:
1. The acoustic opinion has a margin of error of +/- 3 STC/IIC points
2. IIC result depends on the quality of the floor covering material and installation
3. All adhesives must be applied to manufacturers instructions, and Bostic Ultraset adhesive dry film thickness must not be less than 1.9mm
4. It is prudent to allow a 5 point reduction for expected field STC and IIC when compared to the above performance expected in laboratory conditions. This is considered a reasonable compensation to allow for flanking paths at junctions and construction variations.

Hibond 55 Composite Floor Slab with Suspended Ceiling System - Non-Insulated

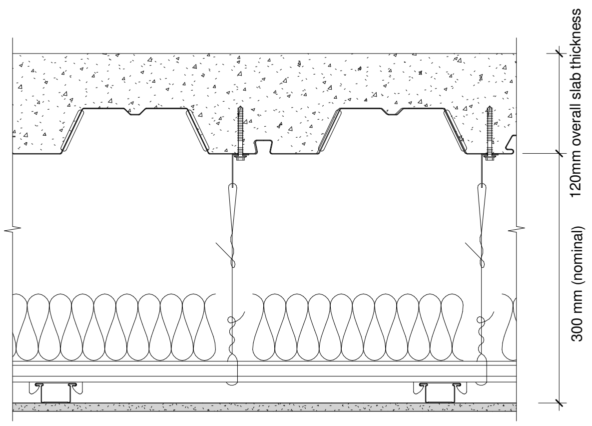
System Description:
Steel Decking: 0.75, 0.95mm Hibond 55
Composite Floor Slab: 120mm overall thickness
Ceiling System: Don suspended ceiling system
USG furring channel at maximum 600mm centres
Ceiling Lining: 13mm GIB standard plasterboard in one or two layers



Floor Surface Treatment	Ceiling Lining			
	One Layer 13mm GIB		Two Layers 13mm GIB	
	STC	IIC	STC	IIC
No Covering	59	35	62	37
15mm strip timber on Bostic Ultraset adhesive	59	50	62	52
Ceramic tile on Bostic Ultraset adhesive	59	51	62	53
6mm Cork flooring	59	53	62	55
Gerfloor Taralay Comfort Vinyl, 3.1mm thick	59	52	62	54
Carpet, nylon or wool 40oz without underlay	59	63	62	65
Carpet, wool 60oz without underlay	59	65	62	67
Carpet, wool or nylon on 8mm foam underlay	59	69	62	71

Hibond 55 Composite Floor Slab with Suspended Ceiling System - Insulated

System Description:
Steel Decking: 0.75, 0.95mm Hibond 55
Composite Floor Slab: 120mm overall thickness
Insulation Blanket: 75mm thick R1.8 Pink Batts
Ceiling System: Don suspended ceiling system
USG furring channel at maximum 600mm centres
Ceiling Lining: 13mm GIB standard plasterboard in one or two layers



Floor Surface Treatment	Ceiling Lining			
	One Layer 13mm GIB		Two Layers 13mm GIB	
	STC	IIC	STC	IIC
No Covering	61	43	64	45
15mm strip timber on Bostic Ultraset adhesive	61	62	64	64
Ceramic tile on Bostic Ultraset adhesive	61	55	64	57
6mm Cork flooring	61	64	64	66
Gerfloor Taralay Comfor Vinyl, 3.1mm thick	61	66	64	68
Carpet, nylon or wool 40oz without underlay	61	75+	64	75+
Carpet, wool 60oz without underlay	61	75+	64	75+
Carpet, wool or nylon on 8mm foam underlay	61	75+	64	75+

Notes:
1. The acoustic opinion has a margin of error of +/- 3 STC/IIC points
2. IIC result depends on the quality of the floor covering material and installation
3. All adhesives must be applied to manufacturers instructions, and Bostic Ultraset adhesive dry film thickness must not be less than 1.9mm
4. It is prudent to allow a 5 point reduction for expected field STC and IIC when compared to the above performance expected in laboratory conditions. This is considered a reasonable compensation to allow for flanking paths at junctions and construction variations.

HIBOND 55 DESIGN EXAMPLES

EXAMPLE: FORMWORK

A 250mm overall thickness composite floor slab is required to span 4800mm c/c between permanent supports using the Hibond sheet as permanent formwork only. Two alternatives are available in design.

a) Using 0.75mm Hibond 55 from Section 3.4.4, select the formwork span capabilities for a 250mm overall thickness composite floor slab, i.e.

single	2000mm
double or end	1800mm
internal	1850mm

Using two rows of props, there are two end spans and one internal span. The maximum span of Hibond in this configuration is,

1850 + 2 x 1800 = 5450mm

≥ the required span of 4800mm ∴ O.K.

Therefore 0.75mm Hibond 55 with two rows of props at third points may be considered.

b) Using 0.95mm Hibond 55 from Section 3.4.4, select the formwork span capabilities for a 250mm overall thickness composite floor slab, i.e.

single	2150mm
double or end	2400mm
internal	2700mm

Using one row of props, there are two end spans only. The maximum span of Hibond 55 in this configuration is,

2 x 2400 = 4800mm

≥ the required span of 4800mm ∴ O.K.

Therefore 0.95mm Hibond 55 with one row of props at midspan may also be considered.

EXAMPLE: RESIDENTIAL

A suspended composite floor slab in a residential dwelling is required to achieve a double span of 2 x 3600mm in the living area.

Living area loading,

live load, Q	1.5kPa
superimposed dead load, G_{SDL}	0.3kPa
design superimposed load, G_{SDL} + Q	1.8kPa

Living Area Floor

From Section 3.4.5, select the double or end span superimposed load and negative reinforcement for a 0.75mm Hibond composite floor slab of 110mm overall thickness, with one row of props at midspan. This gives,

superimposed load = 3.2kPa

≥ G_{SDL} + Q = 1.8kPa ∴ O.K.

Minimum mesh requirement throughout the Hibond 55 composite floor slab from Additional Reinforcement in Section 3.4.2.2 for propped construction is one layer of SE82 mesh at minimum cover.

From Section 3.4.5, 0.75mm Hibond 55 – Double and End Spans, the area of negative reinforcement required over the internal support is HD12 bars at 250mm c/c.

Length of reinforcement required is 3600 / 4 + 450 = 1350mm each side of the support centre line.

For the living area floor use a 0.75mm Hibond 55 composite floor slab of 110mm overall thickness with one row of props at midspan. SE82 mesh is required throughout the composite floor slab plus HD12 x 2700mm longitudinal top reinforcement at 250mm c/c, laid atop the mesh at minimum cover, over the internal support.

EXAMPLE: INSTITUTIONAL BUILDING DEFLECTION

A heavy equipment floor in a hospital is required to form a single span of 4800mm given a long term superimposed load of 3.5kPa.

Using Section 3.4.5, 0.75mm Hibond 55 – Single Spans long term superimposed loads table, select the single span superimposed load for a 0.75mm Hibond 55 composite floor slab of 150mm overall thickness, with one row of props at midspan (Section 3.4.4). This gives,

superimposed load = 3.5kPa
$\geq G_{SDL} + Q = 3.5$kPa ∴ O.K.

This configuration borders the region of the table where vibration becomes critical with a minimum damping ratio of 0.025 (commercial offices, open plan with few small partitions) and the equipment is likely to be vibration sensitive. Therefore a detailed vibration analysis of the composite floor slab and all supporting structure would be required by the design engineer.

As an option, the composite floor slab thickness could be increased for the purposes of this example to, say, 190mm using 0.75mm Hibond 55 with two rows of props at third points, or 180mm using 0.95mm Hibond 55 with one row of props at midspan.

Deflection of the composite floor slab is to be minimised by reducing the allowable limit from $L_{ss}/250$ to $L_{ss}/400$. For this limit, deflection is made up of two components. Dead load deflection from prop removal is (for one or two props),

$$5\,G\,L_{ss}{}^4 \,/\, (384\,E_s\,I)$$

and the superimposed load deflection is,

$$5\,(G_{SDL} + Q)\,L_{ss}{}^4 \,/\, (384\,E_s\,I)$$

For the 0.95mm Hibond 55 composite floor slab of 180mm overall thickness, refer Hibond 55 Section Properties 3.4.3 for long term superimposed loads,

G = 3.62kPa, $I_{av} = 21.1 \times 10^6$mm^4/m
Hence $G + (G_{SDL} + Q)$ = 3.62 + 3.5 = 7.12kPa

and δ_{G+Q} = Combined dead and superimposed load deflection at midspan
= $5 \times 7.12 \times 4800^4 / (384 \times 205 \times 10^9 \times 21.1)$
= 11mm (or $L_{ss}/435$)
≤ the limit of $L_{ss}/400$ ∴ O.K.

For a 0.75mm Hibond 55 composite floor slab of 190mm overall thickness, refer Hibond 55 Section Properties 3.4.3 for long term superimposed loads,

G = 3.83kPa, $I_{av} = 22.4 \times 10^6$mm^4/m
Hence $G + (G_{SDL} + Q)$ = 3.83 + 3.5 = 7.33kPa

and δ_{G+Q} = $5 \times 7.33 \times 4800^4 / (384 \times 205 \times 10^9 \times 22.4)$
= 11mm (or $L_{ss}/435$)
≤ the limit of $L_{ss}/400$ ∴ O.K.

Therefore, use a 0.75mm Hibond 55 composite floor slab of 190mm overall thickness with two rows of props at third points and for minimum crack control using propped construction, use 1 layer SE82 mesh plus 1 layer SE92 mesh (or HD12 bars @ 200mm centres each way) at minimum cover throughout, *or* use a 0.95mm Hibond 55 composite floor slab of 180mm overall thickness with one row of props at midspan and for minimum crack control using propped construction, use 2 x layers SE82 mesh (or HD12 bars @ 200mm centres each way) at minimum cover throughout.

3.4.9

HIBOND 55 MATERIAL SPECIFICATION

Dimond Hibond 55 and accessories are manufactured from galvanised steel coil produced to AS 1397.

	Thickness BMT (mm)	Steel Grade (MPa)	Min. Zinc Weight (g/m^2)
Hibond 55 sheet	0.75 & 0.95	G550	Z 275
End cap	0.55	G250	Z 275
Closure strip	0.55	G250	Z 275
Edge form	1.15	G250	Z 275

BMT - Base Metal Thickness

Tolerances

Length -0mm +10mm
Cover width -1mm +5mm
Maximum manufactured length of Hibond 55 sheet 18m.

3.4.10

HIBOND 55 SHORT FORM SPECIFICATION

The flooring system will be Dimond Structural **(1)** mm Hibond 55 manufactured from G550 grade steel, with a $275g/m^2$ galvanised zinc weight. The minimum nominal steel decking sheet length to be used in construction shall be .... m, in accordance with the design formwork spans.

Edge forms and end caps should be used in accordance with Dimond Structural recommendations.

Specify concrete thickness, and number of rows of propping during construction.

Mesh and any additional reinforcement bar size and spacing should be referred to the design engineer's drawings.

(1) Choose from: 0.75, 0.95

HIBOND 55 COMPONENTS

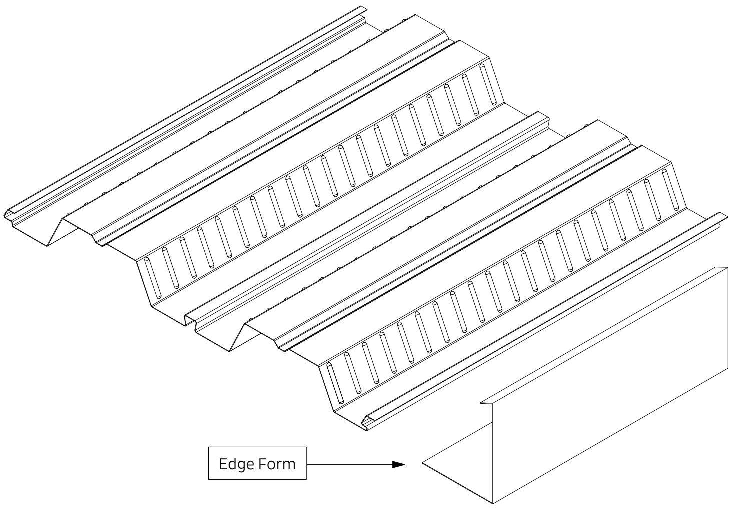
EDGE FORM

Manufactured from 1.15mm Base Metal Thickness (BMT) galvanised steel in 6m lengths, providing an edge to screed the concrete to the correct composite floor slab thickness.

Standard sizes are from 110mm to 200mm in 10mm height increments.

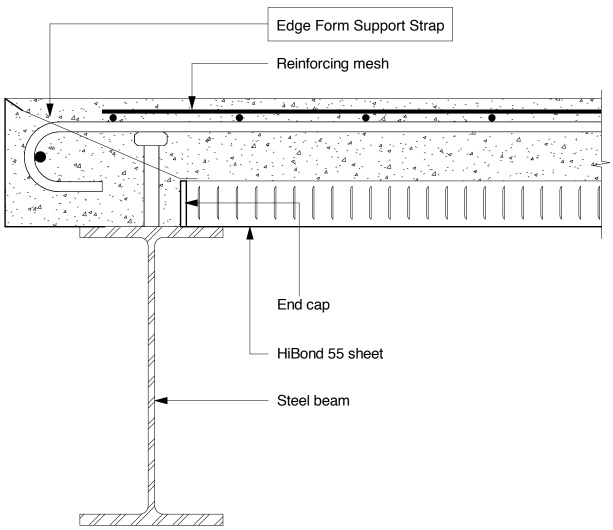
The foot of the Edge Form is typically fixed to structure using powder actuated fasteners (self-drilling screws can also be used, type dependent on support material and thickness).

Where necessary, for example cantilevered steel decking sheets, the foot of the Edge Form may be attached to the Hibond 55 sheets with 10g - 16 x 16mm self-drilling screws. Fasteners are required every pan to steel decking sheet ends and at 750mm centres along steel decking sheets.



EDGE FORM SUPPORT STRAP

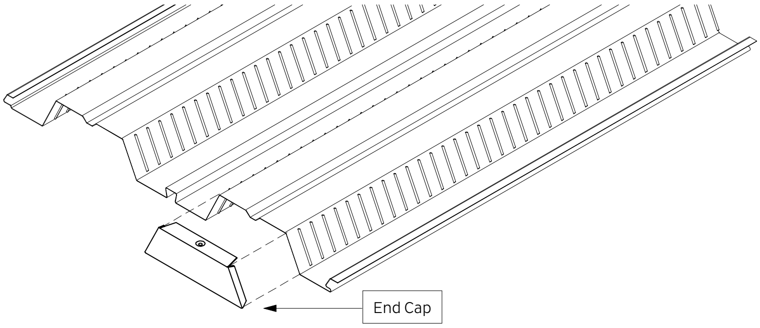
Edge Form is restrained from outward movement during concrete placement by 0.75mm BMT x 25mm galvanised steel Edge Form Support Straps. Fastened with 10g - 16 x 16mm self-drilling screws (2 per strap), Edge Form Support Straps are required every second rib to steel decking sheet ends and at 750mm centres along steel decking sheets.



3.4.11.3

END CAPS

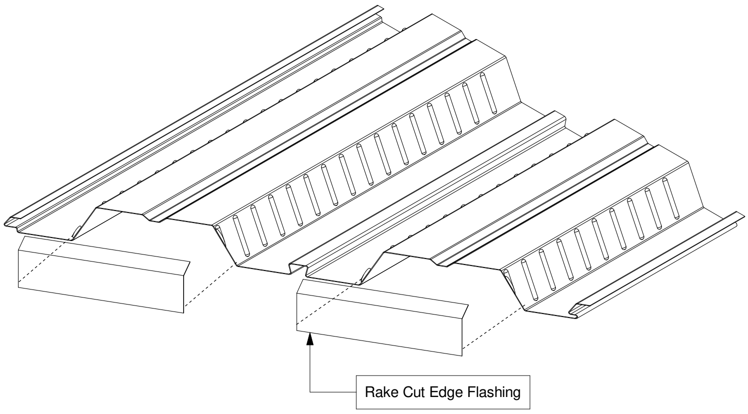
Manufactured from 0.55mm BMT galvanised steel, end caps are used to blank off the ribs (to prevent concrete leakage) at the end of each Hibond 55 sheet, or where openings are created in the deck. Each End Cap is fixed to the Hibond 55 sheet with 1 fastener atop each rib (10g - 16 x 16mm self-drilling screw).



3.4.11.4

RAKE CUT EDGE FLASHINGS

Manufactured from 0.55mm BMT galvanised steel in 55mm x 30mm x 3m lengths which are cut to suit on site (as shown). Rake cut edge flashings are used in place of end caps to close off the end of Hibond 55 sheets when they are cut on an angle or curve. These are cut to length and fixed to the Hibond 55 sheet with 1 fastener atop each rib (10g - 16 x 16mm self-drilling screw).



3.4.12

HIBOND 55 CAD DETAILS

For the latest Hibond CAD details, please download from the Dimond Structural website
www.dimondstructural.co.nz/products/hibond-55

Please note, the Hibond 55 CAD details are to be used as a guide only and are not intended for construction. Specific design details are required to be provided by the design engineer.

SPECIFIC DESIGN – FLATDECK FLOORING 3.5

DESIGN BASIS 3.5.1

The Flatdeck Flooring System has been designed to comply with AS/NZS 4600:1996 for formwork strength, AS 3600:2001 for composite floor slab strength and BS 5950 (Part 4:1994 and Part 6:1995) for formwork and composite floor slab deflections, using the relevant load combinations therein and the relevant clauses of the New Zealand Building Code. Detailed analysis and physical testing have enabled load/span tables to be established using the limit states design philosophy.

Data presented in this manual is intended for use by structural engineers. Use of the Flatdeck Flooring System in applications other than uniformly distributed loads or outside the scope of this manual will require specific design.

A design yield strength of 550MPa for 0.75mm and 0.95mm base metal thickness (BMT) Flatdeck has been used.

A minimum 28 day compressive strength of 25MPa for high grade concrete has been assumed.

A minimum Flatdeck composite floor slab thickness of 110mm has been used in this section, in accordance with BS 5950.

The self weight of the Flatdeck Flooring System (including the concrete) has been included in the load tables.

FLATDECK DESIGN CONSIDERATIONS 3.5.2

FORMWORK 3.5.2.1

Where the Flatdeck sheet is used as formwork, the steel decking sheet provides resistance to wet concrete (G) and construction loads (Q). Refer Flatdeck Formwork Design Tables 3.5.4.

Flatdeck Formwork Tables are based on design checks for bending, web crushing, vertical shear, combined actions and deflection.

Flatdeck sheets must be laid in one continuous length between permanent supports. Short steel decking sheets of Flatdeck must never be spliced together to achieve the span between temporary or permanent supports.

Where the Flatdeck composite floor slab is greater than 200mm overall thickness, the Flatdeck sheets must be used as formwork only and the composite floor slab designed using additional positive reinforcement.

Refer General Design Considerations 3.2.1.

Cantilevered End Spans

The use of Flatdeck flooring systems as cantilevered floor structures requires a propping line at the steel decking sheet ends to ensure a stable working platform during construction.

Additional ductile negative reinforcement is required to be designed to NZS 4671 to support all cantilevered composite floor slabs, and the contribution of the steel decking sheets is neglected in design.

Consideration must be given to overall composite floor slab thickness to ensure sufficient cover over the negative reinforcement is achieved in compliance with NZS 3101.

As a guide propping of the Flatdeck sheets is not required for cantilevered end spans with a clear over-hang of,

Flatdeck x 0.75mm: 300mm

Flatdeck x 0.95mm: 400mm

These cantilever spans assume:

- The Flatdeck sheets are securely fixed to the edge supporting member and the adjacent internal supporting member
- That Flatdeck Edge Form at the end of the cantilever is secured with one self-drilling screw (or rivet) per Flatdeck pan along with Edge Form Support Straps. Refer section 3.5.11.

Further guidance is available in SCI Publication P300 Composite Slabs and Beams using Steel Decking, 2009.

COMPOSITE FLOOR SLAB

Load capacity of the Flatdeck flooring system is dependent on the shear bond between the concrete and the steel decking sheet. Shear bond is a combination of chemical bond between the concrete and the steel decking sheet surface, and mechanical bond between the concrete and the Flatdeck steel decking sheet ribs. It is important that the concrete is placed onto a clean galvanised steel surface free from any contamination or debris.

Capacities for the Ultimate Limit State were derived for positive bending, shear bond, vertical shear and negative bending as appropriate. Each of these values was back substituted into the design combinations for the applied actions using 1.2 (dead load) + 1.5 (superimposed load).

The minimum resulting superimposed load, from all actions (including deflections), was used in the tables.

Appropriate imposed floor actions (Q) should be determined in accordance with AS/NZS 1170. All superimposed dead load (G_{SDL}) is then added to the imposed action (Q) to give a design superimposed load (G_{SDL} + Q) expressed in kPa for direct comparison with tabulated data in the Flatdeck Composite Floor Slab Load Span Tables 3.5.5.

Refer General Design Considerations 3.2.2.

Fire Design

Design of fire resistance of composite floor slabs is based on resistance to collapse (stability) prevention of flames passing through cracks in the composite floor slab (integrity) and limiting the temperature increase on the unexposed side of the composite floor slab (insulation).

Fire resistance of the Flatdeck flooring system can be achieved by several methods:

- Testing the fire resistance inherent in the composite floor slab as a basis for resistance ratings for combinations of span, load and composite floor slab thickness.
- Placement of additional reinforcement in a specified location within the composite floor slab.
- Installation of suspended ceilings.

Fire Resistance ratings for the Flatdeck flooring system has been established by utilising the Flatdeck steel decking sheet ribs embedded in the concrete and placement of additional positive reinforcement in the Flatdeck steel decking sheet pans where required.

The fire design tables are based on design checks for bending (shear is rarely critical), in accordance with NZS 3101, based on the load combination G + ψ_lQ for single spans which are effective in fire emergency conditions (where ψ_l is the factor for determining quasi-permanent values for long term actions). Full design methodology is provided in HERA Report R4-82, except that for Flatdeck the contribution of that portion of the steel decking sheet rib that is embedded into the composite floor slab and therefore shielded from direct exposure to the fire is calculated by determining the temperature due to conduction of heat from the exposed pan of the decking.

The rib element is subdivided into 10 elements and the temperature of each element is determined using the method from HERA Report R4-131 Slab Panel Method (3rd edition). The strength at elevated temperature (yield strength as function of temperature) is also determined in accordance with this report. The contribution of each element to the overall moment capacity of the composite floor slab is calculated in accordance with normal reinforced concrete design procedures.

The tables include a superimposed dead load (GSDL) of 0.5kPa in order that an imposed action (Q) can be compared directly with the Fire Design Tables 3.4.6.

Additional Reinforcement

The minimum amount of longitudinal and transverse reinforcement required in the top of the composite floor slab is outlined in AS/NZS 2327 (Section 2.2.1 and 6.3).

The minimum continuous D500MPa mesh or ductile reinforcement bar size each way to be used as top reinforcement for either unpropped or propped metal decking sheets for composite floor slabs enclosed within a building is outlined in the following table.

Flatdeck	Unpropped Metal Decking Sheets[1]		Propped Metal Decking Sheets[2]	
Slab Thickness (mm)	Mesh	Bars (Each Way)	Mesh	Bars (Each Way)
110	SE62	HD10 @ 300	SE82	HD10 @ 300
120	SE62	HD10 @ 300	SE92	HD10 @ 300
130	SE72	HD10 @ 300	SE92	HD10 @ 250
140	SE72	HD10 @ 300	2 x SE72	HD12 @ 300
150	SE72	HD10 @ 300	2 x SE72	HD12 @ 250
160	SE82	HD10 @ 300	2 x SE82	HD12 @ 250
170	SE82	HD10 @ 300	2 x SE82	HD12 @ 200
180	SE92	HD10 @ 250	2 x SE82	HD12 @ 200
190	SE92	HD10 @ 250	SE82 x SE92	HD12 @ 200
200	SE92	HD10 @ 250	2 x SE92	HD16 @ 300

Notes:
1. Based on transverse steel requirements in AS/NZS 2327 Section 2.2.1
2. Based on crack control steel requirements in AS/NZS 2327 Section 6.3

Additional ductile reinforcement in the form of reinforcement bars or mesh may be required to:

- gain full continuity over supporting members in continuous spans.
- achieve the required fire performance.
- achieve the required seismic performance.
- control cracks caused by shrinkage during curing of the concrete, particularly for composite floor slabs exposed to the weather. For propped construction, increasing nominal continuity reinforcement over supports is required as indicated above given crack widths will increase when the props are removed.
- distribute loads around openings in composite floor slabs.
- provide necessary reinforcement for composite floor slabs used as cantilevers.

When specifying additional reinforcement the designer must ensure the composite floor slab thickness is adequate to achieve the required minimum concrete cover over the reinforcement in compliance with NZS 3101.

Acoustic Performance

Estimated Sound Transmission Class (STC) and Impact Insulation Class (IIC) that can be achieved with different composite floor slab thicknesses and a range of ceiling and surface treatment additions to the Flatdeck flooring system are provided in section 3.5.7, based on the Marshall Day Acoustics Report (Rp001 R00_2006476).

The STC and IIC values are based on tested performance of a 120mm Hibond 55 composite floor slab and known performance of concrete thickness, floor coverings, insulation and suspended ceilings.

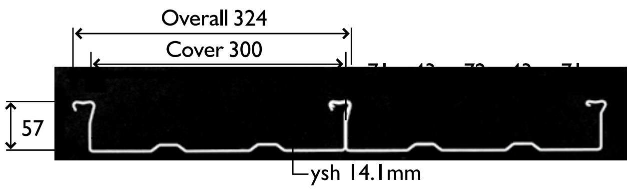
As a guide, a bare 120mm Flatdeck composite floor slab is expected to achieve STC 48dB and IIC 23dB. With the addition of a suspended GIB ceiling and a 75mm acoustic blanket it is reasonable to expect STC 66dB and IIC 42dB. The IIC can be further improved to as much as 75+dB with the addition of appropriate carpet and underlay.

Floor Vibration

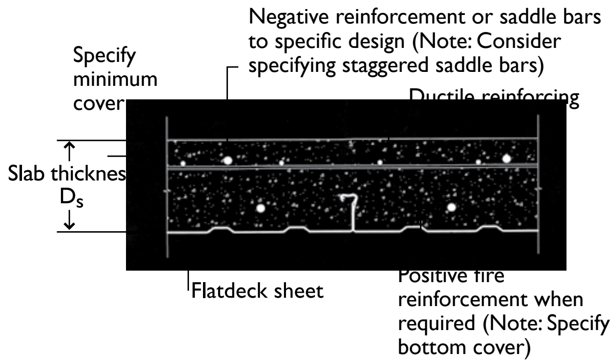
As a guide to designers, the vibration lines expressed in the Flatdeck Composite Floor Slab Load Span Tables 3.5.5 represent the maximum span of the Flatdeck composite floor slab recommended for in-service floor vibration for either of an open plan commercial office floor with a low damping ratio (few small partitions) or a residence with higher damping (many full height partitions).

This represents the composite floor slab response of a person traversing the floor, but does not account for the dynamic response of the supporting structure. Specific design is required for other types of floor use.

FLATDECK SECTION PROPERTIES



All dimensions (mm) are nominal



FORMWORK PROPERTIES

Flatdeck Formwork Properties (Per Metre Width)

Thickness (mm)	Weight (kN/m)	Cross Sectional Area, A_p (mm2)	Design Strength P_y (MPa)	Bending Strengths M_c+ (kNm)	Bending Strengths M_c– (kNm)
0.75	0.094	1180	550	4.2	2.73
0.95	0.118	1495	550	5.10	3.61
Thickness (mm)	**Shear Strength P_v (kN)**	**Second Moment of Area ($10^6 mm^4$): Single Span (I_x+ve)**	**Second Moment of Area ($10^6 mm^4$): Multispan (I_x-ve)**	**Web Crushing Strength, P_w (kN): End Support**	**Web Crushing Strength, P_w (kN): Internal Support**
0.75	95.1	0.503	0.369	68.3	90.5
0.95	123.6	0.670	0.502	95.0	126.5

Notes:
1. Design strength Py is 0.84 x ultimate tensile strength.
2. ysh is the distance from the bottom of the Flatdeck formwork to the neutral axis.

COMPOSITE FLOOR SLAB PROPERTIES

0.75mm Flatdeck Composite Floor Slab Properties (Per Metre Width)

D_s (mm)	Weight (kN/m)	I_g (10^6mm^4)		Y_g (mm)		I_{cr} (10^6mm^4)		Y_{cr} (mm)		I_{av} (10^6mm^4)	
		medium	long	medium	long	medium	long	medium	long	medium	long
110	2.63	13.4	8.3	59.0	61.7	6.3	5.3	37.4	46.2	9.9	6.8
120	2.86	17.2	10.6	64.2	67.0	7.8	6.6	39.8	49.3	12.5	8.6
130	3.09	21.6	13.3	69.3	72.2	9.5	8.0	42.0	52.3	15.6	10.7
140	3.32	26.8	16.4	74.4	77.4	11.4	9.6	44.2	55.2	19.1	13.0
150	3.55	32.7	20.0	79.5	82.6	13.4	11.4	46.3	57.9	23.1	15.7
160	3.78	39.5	24.0	84.6	87.8	15.6	13.3	48.3	60.6	27.6	18.7
170	4.01	47.1	28.6	89.7	93.0	18.1	15.4	50.2	63.2	32.6	22.0
180	4.24	55.6	33.7	94.7	98.1	20.7	17.8	52.1	65.7	38.1	25.7
190	4.47	65.0	39.3	99.8	103.2	23.5	20.2	54.0	68.1	44.3	29.8
200	4.70	75.5	45.5	104.8	108.3	26.5	22.9	55.8	70.5	51.0	34.2

0.95mm Flatdeck Composite Floor Slab Properties (Per Metre Width)

D_s (mm)	Weight (kN/m)	I_g (10^6mm^4)		Y_g (mm)		I_{cr} (10^6mm^4)		Y_{cr} (mm)		I_{av} (10^6mm^4)	
		medium	long	medium	long	medium	long	medium	long	medium	long
110	2.65	14.0	8.8	59.9	63.1	7.5	6.1	40.8	50.0	10.7	7.5
120	2.88	17.9	11.2	65.1	68.5	9.3	7.6	43.5	53.4	13.6	9.4
130	3.12	22.5	14.0	70.3	73.8	11.3	9.3	46.0	56.8	16.6	11.7
140	3.35	27.8	17.3	75.5	79.1	13.5	11.2	48.4	59.9	20.6	14.3
150	3.58	33.9	21.0	80.6	84.4	16.0	13.3	50.8	63.0	24.9	17.2
160	3.81	40.8	25.2	85.7	89.6	18.7	15.6	53.0	66.0	29.7	20.4
170	4.04	48.6	29.9	90.8	94.8	21.6	18.1	55.2	68.9	35.1	24.0
180	4.27	57.3	35.2	95.9	100.0	24.8	20.9	57.3	71.6	41.0	28.0
190	4.50	67.0	41.1	101.0	105.1	28.2	23.9	59.4	74.4	47.6	32.5
200	4.73	77.7	47.5	106.0	110.3	31.8	27.0	61.4	77.0	54.7	37.3

Notes:
1. D_s is the overall thickness of the composite floor slab.
2. Composite floor slab weights are based on a dry concrete density of 2350 kg/m^3 with no allowance for ponding.
3. Section properties are presented in terms of equivalent steel units as follows:
   (a) Medium term superimposed loads are based on 2/3 short term and 1/3 long term load (i.e. modular ratio = 10) and apply to buildings of normal usage.
   (b) Long term superimposed loads are based on all loads being long term (i.e. modular ratio = 18) and apply to storage loads and loads which are permanent in nature.
4. I_g is the second moment of area of the Flatdeck composite floor slab for the gross section.
5. I_{cr} is the second moment of area of the Flatdeck composite floor slab for the gross section.
6. I_{av} is the average value of gross (I_g) and cracked (I_{cr}) sections to be used for deflection calculations.
7. Y_g is the distance from top of composite floor slab to neutral axis of the Flatdeck composite floor slab for the gross section.
8. Y_{cr} is the distance from top of composite floor slab to neutral axis of the Flatdeck composite floor slab for the cracked section.

FLATDECK FORMWORK DESIGN TABLES

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

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

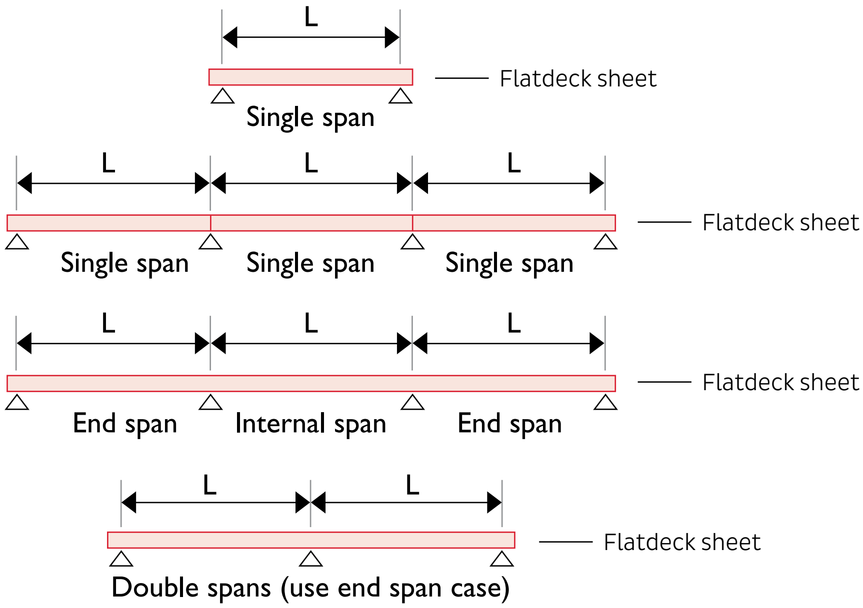
1. D_S is the overall thickness of the composite floor slab.
2. Composite floor slab weights (G) are based on a wet concrete density of 2400kg/m^3 with no allowance for ponding.
3. A construction load (Q) of 1.5kPa is incorporated in these tables.
4. L is the maximum span measured centre to centre between permanent or temporary supports.
5. Use of the double or end span tables and internal span tables assumes,
   - All spans have the same composite floor 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 composite floor slab design is based on the largest span.
   - Internal spans are within 10% of each other and the composite floor slab design is based on the largest internal span.

   Any variations to the above configurations require specific design using the Flatdeck Formwork Properties table in Section 3.5.3.
6. These tables are based on minimum bearing of Flatdeck sheet given in Section 3.2.1.
7. Deflection limits incorporated in these tables are L/180 maximum due to dead load (G) only.

   These limits are represented in the 'Allow' (allowable) column of the Flatdeck Formwork Tables. The 5mm limit should be referred to where soffit deflection is to be reduced.
8. For intermediate values of composite floor slab thickness, linear interpolation is permitted.
9. As a guide, formwork deflections of around 15mm under dead load (G) should be expected within the extent of the tables. Construction loads (Q) will increase deflections.
10. The design span of the formwork relates closely to site installation. If the Flatdeck sheet is designed as an end span or internal span, the minimum nominal steel decking sheet length for construction should be noted clearly in the design documentation to ensure that appropriate steel decking sheet lengths are used by the installer to achieve the span type selected. Refer Flooring Installation 3.6.

Typical Steel Decking Sheet Span Configurations

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



0.75mm Flatdeck 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	2.68	0.11	2300	1950	2700	2200	2700	2050
120	2.92	0.12	2200	1900	2650	2150	2650	2000
130	3.15	0.13	2200	1900	2550	2100	2550	2000
140	3.39	0.14	2150	1850	2500	2050	2500	1950
150	3.63	0.15	2100	1800	2450	2050	2450	1900
160	3.86	0.16	2050	1800	2400	2000	2400	1900
170	4.10	0.17	2000	1750	2350	2000	2350	1850
180	4.33	0.18	2000	1750	2350	1950	2300	1850
190	4.57	0.19	1950	1700	2300	1900	2300	1800
200	4.80	0.20	1900	1700	2250	1900	2250	1800
210	5.04	0.21	1900	1700	2200	1900	2200	1750
220	5.27	0.22	1850	1650	2200	1850	2150	1750
230	5.51	0.23	1850	1650	2150	1850	2150	1750
240	5.74	0.24	1800	1650	2100	1800	2100	1700
250	5.98	0.25	1800	1600	2100	1800	2100	1700
260	6.22	0.26	1750	1600	2050	1800	2050	1700
270	6.45	0.27	1750	1600	2000	1750	2000	1650
280	6.69	0.28	1700	1600	2000	1750	2000	1650
290	6.92	0.29	1700	1550	1950	1750	1950	1650
300	7.16	0.30	1650	1550	1950	1750	1950	1650

0.95mm Flatdeck 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	2.71	0.11	2500	2050	3000	2350	2950	2200
120	2.94	0.12	2450	2000	2900	2300	2900	2150
130	3.18	0.13	2400	2000	2850	2250	2850	2150
140	3.41	0.14	2350	1950	2800	2250	2800	2100
150	3.65	0.15	2300	1900	2750	2200	2700	2050
160	3.89	0.16	2250	1900	2700	2150	2650	2050
170	4.12	0.17	2200	1850	2650	2150	2600	2000
180	4.36	0.18	2150	1850	2600	2100	2550	2000
190	4.59	0.19	2150	1800	2550	2050	2550	1950
200	4.83	0.20	2100	1800	2500	2050	2500	1950
210	5.06	0.21	2050	1800	2450	2000	2450	1900
220	5.30	0.22	2050	1750	2400	2000	2400	1900
230	5.53	0.23	2000	1750	2400	2000	2350	1850
240	5.77	0.24	2000	1750	2350	1950	2350	1850
250	6.00	0.25	1950	1700	2300	1950	2300	1850
260	6.24	0.26	1900	1700	2250	1900	2250	1800
270	6.47	0.27	1900	1700	2250	1900	2250	1800
280	6.71	0.28	1850	1650	2200	1900	2200	1800
290	6.95	0.29	1850	1650	2200	1850	2200	1750
300	7.18	0.30	1850	1650	2150	1850	2150	1750

FLATDECK COMPOSITE FLOOR SLAB LOAD SPAN TABLES

Superimposed loads (G_{SDL} + Q) are presented for composite floor slab thicknesses between 110mm and 200mm and over a range of spans between 2.0m and 7.2m for all span configurations. For continuous design, negative reinforcement requirements are presented for double or end spans and internal spans.

The following Notes apply to the composite floor slab load span tables in this Section.

1. Span types
   L_{SS} is the clear single span between permanent supports plus 100mm.
   L is the double/end or internal span measured centre to centre between permanent supports.
2. The design superimposed load combination is G_{SDL} + Q and must not be greater than the superimposed loads given in the tables.
3. a) Medium term superimposed loads are based on 2/3 short term and 1/3 long term (i.e. modular ratio = 10) and apply to buildings of normal usage.

   b) Long term superimposed loads are based on all loads being long term (i.e. modular ratio = 18) and apply to storage loads and loads which are permanent in nature.
4. Deflection limits incorporated into these tables are as follows:

   a) L/350 or 20mm maximum due to superimposed load (G_{SDL} + Q).

   b) L/250 maximum due to superimposed load plus prop removal (G + G_{SDL} + Q).

   The designer shall be satisfied that these limits are adequate for the application considered, otherwise additional deflection checks must be made.
5. Propping requirements depend on the Flatdeck composite floor slab thickness and span configuration as formwork. Refer Flatdeck Formwork Design Tables 3.5.4 to determine formwork span capabilities.
6. Use of the double or end span tables and internal span tables assumes,

   • All spans have the same composite floor 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 composite floor slab design is based on the largest span.

   • Internal spans are within 10% of each other and the composite floor slab design is based on the largest internal span.

   Any variation to the above configurations requires specific design.
7. Example: For a 0.75mm Flatdeck composite floor slab of 130mm overall composite floor slab thickness on a double span of 3800mm we have the following:

   8.9 HD16@200

   where:

   8.9 = Superimposed load kPa

   HD16@200 = HD16 negative reinforcing (saddle bars) placed at 200mm centres to achieve the superimposed load
8. Steel areas in the double or end and internal span tables are calculated based on H16 reinforcing bars (i.e. 16mm diameter grade 500 to AS/NZS 4671) placed at 25mm top cover (A1 exposure classification – NZS 3101). Areas for other bar types, covers and sizes require specific design.
9. Negative reinforcement must be placed on top of the mesh parallel with the Flatdeck ribs at spacings indicated in the tables for the span and composite floor slab thickness considered.
10. Negative reinforcement must extend at least 0.25 of the largest composite floor span plus 450mm each side of the centre line of the support.

11. The same negative reinforcing is required for both propped and unpropped construction.

12. Vibration limits expressed as maximum spans in the tables refer to:

- - - - Commercial offices, open plan with few small partitions (damping ratio = 0.025)

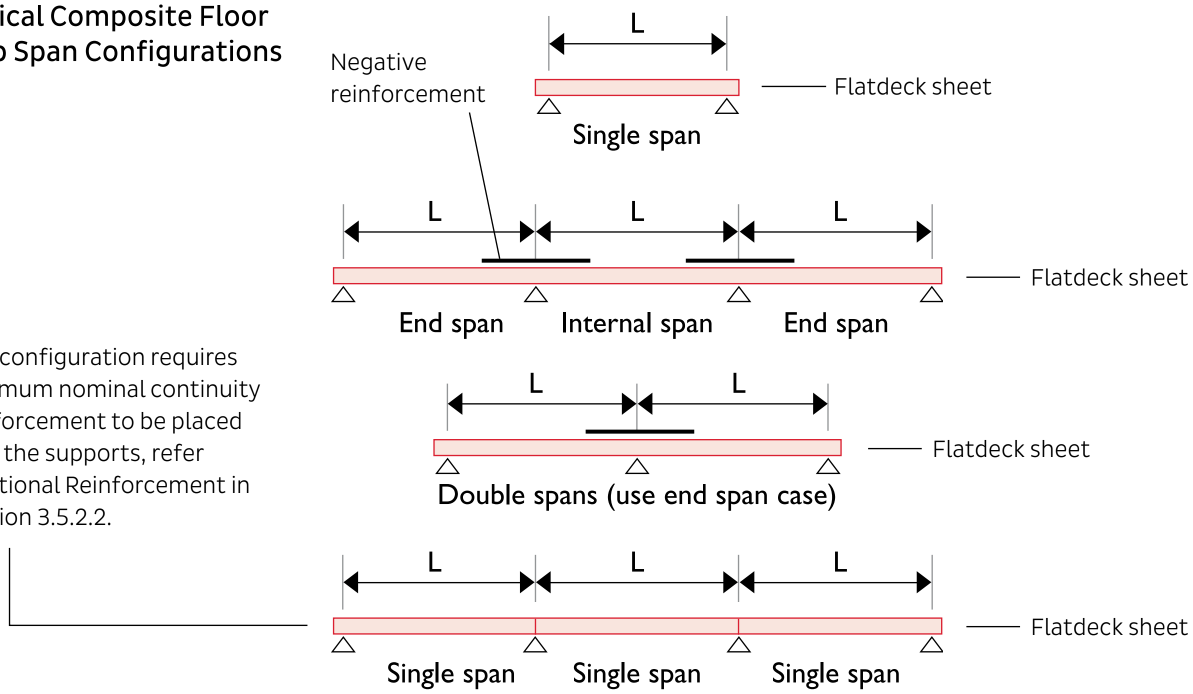
•••••••• Residences with many full height partitions (damping ratio = 0.05)

Specific design is required for other floor uses. Refer Flatdeck Design Examples 3.5.8.

13. For intermediate values, linear interpolation is permitted.

Typical Composite Floor Slab Span Configurations

This configuration requires minimum nominal continuity reinforcement to be placed over the supports, refer Additional Reinforcement in Section 3.5.2.2.



0.75mm Flatdeck Composite Floor Slab – Single Spans

Medium Term Superimposed Loads (kPa)

L_{ss} (mm)	Slab Thickness, D_s (mm)									
	110	120	130	140	150	160	170	180	190	200
2000	18.6	20.3	21.8	-	-	-	-	-	-	-
2200	16.0	17.3	18.8	20.3	21.8	-	-	-	-	-
2400	13.9	15.2	16.4	17.7	19.0	20.3	21.6	-	-	-
2600	12.2	13.4	14.4	15.6	16.7	17.8	19.0	20.2	21.3	-
2800	10.9	11.8	12.8	13.8	14.8	15.8	16.9	17.9	18.9	20.0
3000	9.7	10.6	11.5	12.4	13.3	14.2	15.1	16.0	17.0	17.9
3200	8.8	9.5	10.3	11.1	11.9	12.8	13.6	14.4	15.3	16.1
3400	7.9	8.6	9.3	10.1	10.8	11.6	12.3	13.1	13.8	14.6
3600	7.1	7.8	8.5	9.2	9.8	10.5	11.2	11.9	12.6	13.3
3800	6.5	7.1	7.8	8.3	9.0	9.6	10.2	10.9	11.5	12.1
4000	5.9	6.5	7.1	7.6	8.2	8.8	9.4	9.9	10.5	11.1
4200	5.4	5.9	6.5	7.0	7.5	8.1	8.6	9.1	9.7	10.2
4400	4.6	5.4	6.0	6.4	6.9	7.4	7.9	8.4	8.9	9.4
4600	3.7	5.0	5.5	5.9	6.4	6.8	7.3	7.7	8.3	8.8
4800	2.9	4.2	5.1	5.4	5.9	6.3	6.8	7.3	7.7	8.1
5000	2.3	3.4	4.6	5.0	5.5	5.9	6.3	6.7	7.1	7.5
5200	1.7	2.7	3.8	4.7	5.1	5.5	5.9	6.2	6.6	7.0
5400	-	2.1	3.1	4.4	4.7	5.1	5.4	5.8	6.1	6.5
5600	-	1.6	2.4	3.4	4.4	4.7	5.0	5.4	5.7	6.0
5800	-	-	1.9	2.8	4.1	4.4	4.7	5.0	5.3	5.6
6000	-	-	-	2.2	3.1	4.1	4.4	4.6	4.9	5.2
6200	-	-	-	1.7	2.5	3.4	4.1	4.4	4.6	4.9
6400	-	-	-	-	1.9	2.8	3.7	4.0	4.3	4.6
6600	-	-	-	-	-	2.2	3.0	3.7	4.1	4.3
6800	-	-	-	-	-	1.7	2.4	3.3	3.8	4.1
7000	-	-	-	-	-	-	1.9	2.7	3.5	3.7
7200	-	-	-	-	-	-	-	2.1	2.9	3.5

0.75mm Flatdeck Composite Floor Slab – Single Spans
Long Term Superimposed Loads (kPa)

L_{ss} (mm)	Slab Thickness, D_s (mm)									
	110	120	130	140	150	160	170	180	190	200
2000	18.6	20.3	21.8	–	–	–	–	–	–	–
2200	16.0	17.3	18.8	20.3	21.8	–	–	–	–	–
2400	13.9	15.2	16.4	17.7	19.0	20.3	21.6	–	–	–
2600	12.2	13.4	14.4	15.6	16.7	17.8	19.0	20.2	21.3	–
2800	10.9	11.8	12.8	13.8	14.8	15.8	16.9	17.9	18.9	20.0
3000	9.7	10.6	11.5	12.4	13.3	14.2	15.1	16.0	17.0	17.9
3200	8.8	9.5	10.3	11.1	11.9	12.8	13.6	14.4	15.3	16.1
3400	7.7	8.6	9.3	10.1	10.8	11.6	12.3	13.1	13.8	14.6
3600	6.5	7.8	8.5	9.2	9.8	10.5	11.2	11.9	12.6	13.3
3800	5.1	6.9	7.8	8.3	9.0	9.6	10.2	10.9	11.5	12.1
4000	4.0	5.5	7.1	7.6	8.2	8.8	9.4	9.9	10.5	11.1
4200	3.1	4.4	5.9	7.0	7.5	8.1	8.6	9.1	9.7	10.2
4400	2.3	3.4	4.7	6.2	6.9	7.4	7.9	8.4	8.9	9.4
4600	1.7	2.6	3.7	5.0	6.5	6.8	7.3	7.7	8.3	8.8
4800	–	1.9	2.9	4.0	5.3	6.3	6.8	7.3	7.7	8.1
5000	–	–	2.2	3.2	4.3	5.5	6.3	6.7	7.1	7.5
5200	–	–	1.6	2.4	3.4	4.5	5.8	6.2	6.6	7.0
5400	–	–	–	1.8	2.6	3.6	4.7	5.8	6.1	6.5
5600	–	–	–	–	2.0	2.8	3.8	4.9	5.7	6.0
5800	–	–	–	–	–	2.2	3.0	4.0	5.0	5.6
6000	–	–	–	–	–	1.6	2.3	3.2	4.1	5.2
6200	–	–	–	–	–	–	1.7	2.5	3.3	4.2
6400	–	–	–	–	–	–	–	1.8	2.6	3.4
6600	–	–	–	–	–	–	–	–	2.0	2.7
6800	–	–	–	–	–	–	–	–	–	2.1
7000	–	–	–	–	–	–	–	–	–	1.5
7200	–	–	–	–	–	–	–	–	–	–

0.75mm Flatdeck Composite Floor Slab – Double and End Spans

Medium and Long Term Superimposed Loads (kPa) and Negative Reinforcement (mm2/m width)

L (mm)	Slab Thickness, D_s (mm)									
	110	120	130	140	150	160	170	180	190	200
2000	**21.1** HD16@300	**22.9** HD16@300								
2200	**18.1** HD16@250	**19.7** HD16@300	**21.2** HD16@300	**22.9** HD16@300						
2400	**15.8** HD16@250	**17.2** HD16@250	**18.5** HD16@300	**19.9** HD16@300	**21.4** HD16@300	**22.8** HD16@300				
2600	**13.9** HD16@250	**15.1** HD16@250	**16.3** HD16@250	**17.6** HD16@300	**18.8** HD16@300	**20.1** HD16@300	**21.3** HD16@300			
2800	**12.4** HD16@250	**13.4** HD16@250	**14.5** HD16@250	**15.6** HD16@250	**16.7** HD16@300	**17.8** HD16@300	**18.9** HD16@300	**20.1** HD16@300	**21.3** HD16@300	**22.0** HD16@300
3000	**11.1** HD16@200	**12.1** HD16@250	**13.0** HD16@250	**14.0** HD16@250	**15.0** HD16@250	**16.0** HD16@250	**17.0** HD16@300	**18.1** H1D6@300	**19.1** H1D6@300	**20.2** HD16@300
3200	**10.0** HD16@200	**10.9** HD16@200	**11.8** HD16@250	**12.7** HD16@250	**13.6** HD16@250	**14.5** HD16@250	**15.4** HD16@200	**16.3** HD16@250	**17.3** HD16@250	**18.2** HD16@250
3400	**8.6** HD16@200	**9.9** HD16@200	**10.7** HD16@200	**11.5** HD16@250	**12.3** HD16@250	**13.2** HD16@250	**14.0** HD16@200	**14.8** HD16@250	**15.7** HD16@250	**16.5** HD16@250
3600	**7.1** HD16@200	**9.0** HD16@200	**9.7** HD16@200	**10.5** HD16@200	**11.3** HD16@200	**12.0** HD16@250	**12.8** HD16@200	**13.5** HD16@250	**14.3** HD16@250	**15.1** HD16@250
3800	**5.8** HD16@200	**7.5** HD16@200	**8.9** HD16@200	**9.6** HD16@200	**10.3** HD16@200	**11.0** HD16@200	**11.7** HD16@200	**12.4** HD16@250	**13.1** HD16@250	**13.8** HD16@250
4000	**4.8** HD16@200	**6.3** HD16@200	**7.9** HD16@200	**8.9** HD16@200	**9.5** HD16@200	**10.1** HD16@200	**10.8** HD16@200	**11.4** HD16@200	**12.1** HD16@200	**12.7** HD16@200
4200	**3.9** HD16@200	**5.2** HD16@200	**6.6** HD16@200	**8.2** HD16@200	**8.7** HD16@200	**9.3** HD16@200	**9.9** HD16@200	**10.5** HD16@200	**11.2** HD16@200	**11.8** HD16@200
4400	**3.1** HD16@200	**4.3** HD16@200	**5.5** HD16@200	**6.9** HD16@200	**8.1** HD16@200	**8.6** HD16@200	**9.2** HD16@200	**9.8** HD16@200	**10.3** HD16@200	**10.9** HD16@200
4600	**2.5** HD16@200	**3.5** HD16@200	**4.6** HD16@200	**5.8** HD16@200	**7.2** HD16@200	**8.0** HD16@200	**8.5** HD16@200	**9.1** HD16@200	**9.7** HD16@200	**10.2** HD16@200
4800	**1.9** HD16@200	**2.8** HD16@200	**3.7** HD16@200	**4.8** HD16@200	**6.1** HD16@200	**7.4** HD16@200	**8.0** HD16@200	**8.5** HD16@200	**9.0** HD16@200	**9.5** HD16@200
5000	**1.4** HD16@200	**2.2** HD16@200	**3.0** HD16@200	**4.0** HD16@200	**5.3** HD16@200	**6.5** HD16@200	**7.4** HD16@200	**7.9** HD16@200	**8.4** HD16@200	**8.9** HD16@200
5200		**1.6** HD16@200	**2.4** HD16@200	**3.5** HD16@200	**4.4** HD16@200	**5.5** HD16@200	**6.6** HD16@200	**7.2** HD16@200	**7.8** HD16@200	**8.3** H1D6@200
5400			**2.1** HD16@200	**2.8** HD16@200	**3.7** HD16@200	**4.7** HD16@200	**5.7** HD16@200	**6.4** HD16@200	**6.9** HD16@200	**7.5** HD16@200
5600			**1.6** HD16@200	**2.3** HD16@200	**3.0** HD16@200	**3.9** HD16@200	**4.8** HD16@200	**5.7** HD16@200	**6.1** HD16@200	**7.3** HD16@100
5800				**1.8** HD16@200	**2.5** HD16@200	**3.2** HD16@200	**4.1** HD16@200	**5.0** HD16@200	**5.5** HD16@200	**6.8** HD16@100
6000					**1.9** HD16@200	**2.6** HD16@200	**3.9** HD16@100	**4.2** HD16@200	**4.8** HD16@200	**6.4** HD16@100
6200						**2.1** HD16@200	**3.2** HD16@100	**3.5** HD16@200	**4.3** HD16@200	**5.9** HD16@100
6400						**1.5** HD16@200	**2.6** HD16@100	**3.3** HD16@100	**3.6** HD16@200	**5.2** HD16@100
6600							**2.0** HD16@100	**2.7** HD16@100	**3.7** HD16@100	**4.5** HD16@100
6800							**1.7** HD16@100	**2.4** HD16@100	**3.1** HD16@100	**3.8** HD16@100
7000								**1.8** HD16@100	**2.5** HD16@100	**3.2** HD16@100
7200									**2.0** HD16@100	**2.6** HD16@100

0.75mm Flatdeck Composite Floor Slab – Internal Spans

Medium and Long Term Superimposed Loads (kPa) and Negative Reinforcement (mm²/m width)

L (mm)	Slab Thickness, D_s (mm)																			
	110		120		130		140		150		160		170		180		190		200	
2000	**20.0**	HD16@300	**21.7**	HD16@300	**23.4**	HD16@300														
2200	**17.1**	HD16@300	**18.6**	HD16@300	**20.1**	HD16@300	**21.6**	HD16@300	**23.1**	HD16@300										
2400	**15.0**	HD16@300	**16.2**	HD16@300	**17.5**	HD16@300	**18.8**	HD16@300	**20.2**	HD16@300	**21.4**	HD16@300	**22.8**	HD16@300						
2600	**13.2**	HD16@300	**14.3**	HD16@300	**15.4**	HD16@300	**16.6**	HD16@300	**17.7**	HD16@300	**18.9**	HD16@300	**20.1**	HD16@300	**21.3**	HD16@300	**22.6**	HD16@300		
2800	**11.6**	HD16@250	**12.7**	HD16@300	**13.7**	HD16@300	**14.7**	HD16@300	**15.8**	HD16@300	**16.8**	HD16@300	**17.9**	HD16@300	**19.0**	HD16@300	**20.1**	HD16@300	**21.2**	HD16@300
3000	**10.5**	HD16@250	**11.3**	HD16@250	**12.3**	HD16@300	**13.2**	HD16@300	**14.1**	HD16@300	**15.1**	HD16@300	**16.0**	HD16@300	**17.0**	HD16@300	**18.0**	HD16@300	**19.1**	HD16@300
3200	**9.4**	HD16@250	**10.2**	HD16@250	**11.1**	HD16@250	**11.9**	HD16@300	**12.8**	HD16@300	**13.6**	HD16@300	**14.5**	HD16@300	**15.4**	HD16@300	**16.3**	HD16@300	**17.2**	HD16@300
3400	**8.3**	HD16@250	**9.3**	HD16@250	**10.1**	HD16@250	**10.8**	HD16@250	**11.6**	HD16@300	**12.4**	HD16@300	**13.2**	HD16@300	**14.0**	HD16@300	**14.8**	HD16@300	**15.6**	HD16@300
3600	**6.4**	HD16@200	**8.3**	HD16@250	**9.2**	HD16@250	**9.9**	HD16@250	**10.6**	HD16@250	**11.3**	HD16@250	**12.0**	HD16@300	**12.8**	HD16@300	**13.5**	HD16@300	**14.3**	HD16@300
3800	**5.2**	HD16@200	**6.8**	HD16@200	**8.4**	HD16@250	**9.1**	HD16@250	**9.7**	HD16@250	**10.4**	HD16@250	**11.0**	HD16@250	**11.7**	HD16@250	**12.4**	HD16@300	**13.1**	HD16@300
4000	**4.2**	HD16@200	**5.6**	HD16@200	**7.2**	HD16@200	**8.3**	HD16@250	**8.9**	HD16@250	**9.5**	HD16@250	**10.1**	HD16@250	**10.8**	HD16@250	**11.4**	HD16@250	**12.0**	HD16@250
4200	**3.4**	HD16@200	**4.6**	HD16@200	**5.9**	HD16@200	**7.4**	HD16@200	**8.2**	HD16@250	**8.8**	HD16@250	**9.4**	HD16@250	**9.9**	HD16@250	**10.5**	HD16@250	**11.1**	HD16@250
4400	**2.7**	HD16@200	**3.7**	HD16@200	**4.9**	HD16@200	**6.2**	HD16@200	**7.6**	HD16@200	**8.1**	HD16@250	**8.7**	HD16@250	**9.2**	HD16@250	**9.7**	HD16@250	**10.3**	HD16@250
4600	**2.1**	HD16@200	**2.9**	HD16@200	**4.0**	HD16@200	**5.1**	HD16@200	**6.4**	HD16@200	**7.5**	HD16@200	**8.0**	HD16@250	**8.5**	HD16@250	**9.1**	HD16@250	**9.6**	HD16@250
4800	**1.5**	HD16@200	**2.3**	HD16@200	**3.2**	HD16@200	**4.2**	HD16@200	**5.3**	HD16@200	**6.6**	HD16@200	**7.5**	HD16@200	**8.0**	HD16@200	**8.5**	HD16@200	**8.9**	HD16@250
5000			**1.7**	HD16@200	**2.5**	HD16@200	**3.4**	HD16@200	**4.6**	HD16@200	**5.7**	HD16@200	**7.0**	HD16@200	**7.5**	HD16@200	**7.9**	HD16@200	**8.3**	HD16@200
5200					**1.8**	HD16@200	**2.9**	HD16@200	**3.8**	HD16@200	**4.8**	HD16@200	**5.9**	HD16@200	**7.0**	HD16@200	**7.4**	HD16@200	**7.8**	HD16@200
5400					**1.5**	HD16@200	**2.3**	HD16@200	**3.1**	HD16@200	**4.0**	HD16@200	**5.5**	HD16@100	**6.0**	HD16@200	**6.9**	HD16@200	**7.3**	HD16@200
5600							**1.7**	HD16@200	**2.5**	HD16@200	**3.2**	HD16@200	**4.6**	HD16@100	**5.6**	HD16@100	**6.1**	HD16@200	**6.8**	HD16@200
5800									**1.8**	HD16@200	**2.6**	HD16@200	**3.8**	HD16@100	**4.7**	HD16@100	**5.8**	HD16@100	**6.2**	HD16@200
6000											**2.0**	HD16@200	**3.1**	HD16@100	**3.9**	HD16@100	**4.9**	HD16@100	**5.9**	HD16@100
6200													**2.5**	HD16@100	**3.2**	HD16@100	**4.1**	HD16@100	**5.0**	HD16@100
6400													**1.8**	HD16@100	**2.6**	HD16@100	**3.3**	HD16@100	**4.3**	HD16@100
6600															**1.9**	HD16@100	**2.6**	HD16@100	**3.6**	HD16@100
6800															**1.5**	HD16@100	**2.2**	HD16@100	**3.0**	HD16@100
7000																	**1.6**	HD16@100	**2.3**	HD16@100
7200																			**1.7**	HD16@100

0.95mm Flatdeck Composite Floor Slab – Single Spans
Medium Term Superimposed Loads (kPa)

L_{ss} (mm)	Slab Thickness, D_s (mm)									
	110	120	130	140	150	160	170	180	190	200
2000	19.8	21.5	23.1	–	–	–	–	–	–	–
2200	16.9	18.4	19.8	21.2	22.7	–	–	–	–	–
2400	14.6	15.9	17.1	18.6	19.8	21.1	22.4	–	–	–
2600	13.0	14.1	15.2	16.3	17.4	18.6	19.7	20.9	22.1	–
2800	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.6	19.6	20.6
3000	10.3	11.2	12.0	12.9	13.9	14.8	15.7	16.6	17.5	18.5
3200	9.2	10.0	10.8	11.7	12.5	13.3	14.1	14.9	15.8	16.6
3400	8.3	9.1	9.8	10.5	11.3	12.0	12.8	13.5	14.3	15.1
3600	7.5	8.2	8.9	9.6	10.3	10.9	11.6	12.3	13.0	13.7
3800	6.9	7.5	8.1	8.7	9.4	10.0	10.6	11.2	11.9	12.5
4000	6.3	6.8	7.4	8.0	8.6	9.2	9.7	10.3	10.9	11.5
4200	5.7	6.3	6.8	7.3	7.9	8.4	8.9	9.5	10.0	10.5
4400	5.2	5.8	6.2	6.7	7.2	7.7	8.2	8.7	9.2	9.7
4600	4.2	5.3	5.7	6.2	6.7	7.1	7.6	8.0	8.5	9.0
4800	3.4	4.8	5.3	5.7	6.1	6.6	7.0	7.4	7.9	8.3
5000	2.7	3.9	4.9	5.3	5.7	6.1	6.5	6.9	7.3	7.8
5200	2.1	3.1	4.4	4.9	5.2	5.6	6.0	6.5	6.8	7.2
5400	1.6	2.5	3.6	4.5	4.8	5.2	5.7	6.0	6.4	6.7
5600	–	1.9	2.9	4.0	4.6	4.9	5.3	5.6	5.9	6.2
5800	–	–	2.3	3.3	4.3	4.6	4.9	5.2	5.5	5.8
6000	–	–	1.7	2.6	3.6	4.3	4.5	4.8	5.1	5.4
6200	–	–	–	2.1	3.0	4.0	4.2	4.5	4.8	5.0
6400	–	–	–	1.6	2.4	3.3	3.9	4.2	4.4	4.7
6600	–	–	–	–	1.8	2.6	3.6	3.9	4.1	4.4
6800	–	–	–	–	–	2.1	2.9	3.6	3.8	4.1
7000	–	–	–	–	–	1.6	2.3	3.2	3.6	3.8
7200	–	–	–	–	–	–	1.8	2.6	3.4	3.6

0.95mm Flatdeck Composite Floor Slab – Single Spans
Long Term Superimposed Loads (kPa)

L_{ss} (mm)	Slab Thickness, D_S (mm)									
	110	120	130	140	150	160	170	180	190	200
2000	19.8	21.5	23.1	–	–	–	–	–	–	–
2200	16.9	18.4	19.8	21.2	22.7	–	–	–	–	–
2400	14.6	15.9	17.1	18.6	19.8	21.1	22.4	–	–	–
2600	13.0	14.1	15.2	16.3	17.4	18.6	19.7	20.9	22.1	–
2800	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.6	19.6	20.6
3000	10.3	11.2	12.0	12.9	13.9	14.8	15.7	16.6	17.5	18.5
3200	9.2	10.0	10.8	11.7	12.5	13.3	14.1	14.9	15.8	16.6
3400	8.3	9.1	9.8	10.5	11.3	12.0	12.8	13.5	14.3	15.1
3600	7.2	8.2	8.9	9.6	10.3	10.9	11.6	12.3	13.0	13.7
3800	5.9	7.5	8.1	8.7	9.4	10.0	10.6	11.2	11.9	12.5
4000	4.7	6.3	7.4	8.0	8.6	9.2	9.7	10.3	10.9	11.5
4200	3.7	5.1	6.8	7.3	7.9	8.4	8.9	9.5	10.0	10.5
4400	2.8	4.0	5.5	6.7	7.2	7.7	8.2	8.7	9.2	9.7
4600	2.1	3.2	4.4	5.8	6.7	7.1	7.6	8.0	8.5	9.0
4800	1.6	2.4	3.5	4.7	6.1	6.6	7.0	7.4	7.9	8.3
5000	–	1.8	2.7	3.8	5.0	6.1	6.5	6.9	7.3	7.8
5200	–	–	2.1	3.0	4.1	5.3	6.0	6.5	6.8	7.2
5400	–	–	1.5	2.3	3.2	4.3	5.5	6.0	6.4	6.7
5600	–	–	–	1.7	2.5	3.5	4.5	5.6	5.9	6.2
5800	–	–	–	–	1.9	2.7	3.7	4.7	5.5	5.8
6000	–	–	–	–	–	2.1	2.9	3.9	4.9	5.4
6200	–	–	–	–	–	1.5	2.3	3.1	4.0	5.0
6400	–	–	–	–	–	–	1.7	2.4	3.2	4.2
6600	–	–	–	–	–	–	–	1.8	2.6	3.4
6800	–	–	–	–	–	–	–	–	1.9	2.7
7000	–	–	–	–	–	–	–	–	–	2.1
7200	–	–	–	–	–	–	–	–	–	1.5

0.95mm Flatdeck Composite Floor Slab – Double and End Spans

Medium and Long Term Superimposed Loads (kPa) and Negative Reinforcement (mm²/m width)

L (mm)	Slab Thickness, D_s (mm) 110		120		130		140		150		160		170		180		190		200	
2000	**22.6**	HD16@250	**24.4**	HD16@300																
2200	**19.3**	HD16@250	**20.8**	HD16@250	**22.4**	HD16@300														
2400	**16.7**	HD16@250	**18.1**	HD16@250	**19.5**	HD16@250	**21.0**	HD16@300	**22.4**	HD16@300										
2600	**14.8**	HD16@200	**16.0**	HD16@250	**17.2**	HD16@250	**18.4**	HD16@250	**19.7**	HD16@300	**21.0**	HD16@300	**22.2**	HD16@300						
2800	**13.1**	HD16@200	**14.2**	HD16@250	**15.3**	HD16@250	**16.4**	HD16@250	**17.5**	HD16@250	**18.5**	HD16@300	**19.8**	HD16@300	**20.9**	HD16@300	**22.1**	HD16@300		
3000	**11.8**	HD16@200	**12.7**	HD16@200	**13.7**	HD16@250	**14.7**	HD16@250	**15.7**	HD16@250	**16.7**	HD16@250	**17.7**	HD16@250	**18.7**	HD16@250	**19.8**	HD16@250	**20.8**	HD16@300
3200	**10.6**	HD16@200	**11.5**	HD16@200	**12.4**	HD16@200	**13.3**	HD16@250	**14.2**	HD16@250	**15.1**	HD16@250	**16.0**	HD16@250	**16.9**	HD16@250	**17.8**	HD16@250	**18.8**	HD16@250
3400	**9.3**	HD16@200	**10.4**	HD16@200	**11.2**	HD16@200	**12.0**	HD16@200	**12.9**	HD16@200	**13.7**	HD16@250	**14.5**	HD16@250	**15.4**	HD16@250	**16.2**	HD16@250	**17.1**	HD16@250
3600	**7.7**	HD16@200	**9.5**	HD16@200	**10.2**	HD16@200	**11.0**	HD16@200	**11.7**	HD16@200	**12.5**	HD16@200	**13.3**	HD16@250	**14.1**	HD16@250	**14.8**	HD16@250	**15.6**	HD16@250
3800	**6.3**	HD16@200	**8.2**	HD16@200	**9.4**	HD16@200	**10.1**	HD16@200	**10.8**	HD16@200	**11.5**	HD16@200	**12.2**	HD16@200	**12.9**	HD16@200	**13.6**	HD16@250	**14.3**	HD16@250
4000	**5.2**	HD16@200	**6.8**	HD16@200	**8.6**	HD16@200	**9.3**	HD16@200	**9.9**	HD16@200	**10.6**	HD16@200	**11.2**	HD16@200	**11.8**	HD16@200	**12.5**	HD16@200	**13.2**	HD16@200
4200	**4.3**	HD16@200	**5.7**	HD16@200	**7.2**	HD16@200	**8.5**	HD16@200	**9.1**	HD16@200	**9.7**	HD16@200	**10.3**	HD16@200	**10.9**	HD16@200	**11.5**	HD16@200	**12.2**	HD16@200
4400	**3.5**	HD16@200	**4.7**	HD16@200	**6.0**	HD16@200	**7.6**	HD16@200	**8.5**	HD16@200	**9.0**	HD16@200	**9.6**	HD16@200	**10.1**	HD16@200	**10.7**	HD16@200	**11.3**	HD16@200
4600	**2.8**	HD16@200	**3.9**	HD16@200	**5.0**	HD16@200	**6.4**	HD16@200	**7.6**	HD16@200	**8.4**	HD16@200	**8.9**	HD16@200	**9.4**	HD16@200	**9.9**	HD16@200	**10.5**	HD16@200
4800	**2.2**	HD16@200	**3.1**	HD16@200	**4.2**	HD16@200	**5.3**	HD16@200	**6.7**	HD16@200	**7.5**	HD16@200	**8.2**	HD16@200	**8.7**	HD16@200	**9.2**	HD16@200	**9.7**	HD16@200
5000	**1.7**	HD16@200	**2.5**	HD16@200	**3.4**	HD16@200	**4.4**	HD16@200	**5.6**	HD16@200	**6.6**	HD16@200	**7.3**	HD16@200	**7.9**	HD16@200	**8.6**	HD16@200	**9.2**	HD16@200
5200			**2.0**	HD16@200	**2.8**	HD16@200	**3.7**	HD16@200	**4.7**	HD16@200	**5.8**	HD16@200	**6.4**	HD16@200	**7.1**	HD16@200	**7.7**	HD16@200	**8.3**	HD16@200
5400					**2.2**	HD16@200	**3.0**	HD16@200	**3.9**	HD16@200	**4.9**	HD16@200	**5.8**	HD16@200	**6.4**	HD16@200	**6.9**	HD16@200	**7.4**	HD16@200
5600					**1.6**	HD16@200	**2.4**	HD16@200	**3.4**	HD16@200	**4.3**	HD16@200	**5.2**	HD16@200	**5.6**	HD16@200	**6.1**	HD16@200	**7.5**	HD16@100
5800							**2.1**	HD16@200	**2.8**	HD16@200	**3.6**	HD16@200	**4.5**	HD16@200	**5.0**	HD16@200	**5.5**	HD16@200	**7.1**	HD16@100
6000							**1.6**	HD16@200	**2.3**	HD16@200	**3.0**	HD16@200	**3.8**	HD16@200	**4.4**	HD16@200	**4.8**	HD16@200	**6.6**	HD16@100
6200									**1.7**	HD16@200	**2.4**	HD16@200	**3.6**	HD16@100	**3.9**	HD16@200	**4.3**	HD16@200	**6.2**	HD16@100
6400											**1.9**	HD16@200	**3.0**	HD16@100	**3.8**	HD16@100	**3.8**	HD16@200	**5.6**	HD16@100
6600													**2.4**	HD16@100	**3.2**	HD16@100	**3.9**	HD16@100	**4.8**	HD16@100
6800													**1.9**	HD16@100	**2.6**	HD16@100	**3.3**	HD16@100	**4.1**	HD16@100
7000															**2.0**	HD16@100	**2.7**	HD16@100	**3.4**	HD16@100
7200																	**2.4**	HD16@100	**3.0**	HD16@100

0.95mm Flatdeck Composite Floor Slab – Internal Spans

Medium and Long Term Superimposed Loads (kPa) and Negative Reinforcement (mm^2/m width)

L (mm)	Slab Thickness, D_s (mm)									
	110	120	130	140	150	160	170	180	190	200
2000	**21.3** HD16@300	**23.0** HD16@300								
2200	**18.2** HD16@300	**19.7** HD16@300	**21.2** HD16@300	**22.6** HD16@300						
2400	**15.7** HD16@300	**17.0** HD16@300	**18.5** HD16@300	**19.8** HD16@300	**21.1** HD16@300	**22.4** HD16@300				
2600	**14.0** HD16@250	**15.1** HD16@300	**16.2** HD16@300	**17.4** HD16@300	**18.6** HD16@300	**19.8** HD16@300	**21.0** HD16@300	**22.1** HD16@300		
2800	**12.4** HD16@250	**13.4** HD16@250	**14.5** HD16@300	**15.5** HD16@300	**16.6** HD16@300	**17.6** HD16@300	**18.6** HD16@300	**19.7** HD16@300	**20.8** HD16@300	**21.9** HD16@300
3000	**11.1** HD16@250	**12.0** HD16@250	**12.9** HD16@250	**13.9** HD16@300	**14.9** HD16@300	**15.7** HD16@300	**16.7** HD16@300	**17.7** HD16@300	**18.6** HD16@300	**19.6** HD16@300
3200	**10.0** HD16@250	**10.8** HD16@250	**11.6** HD16@250	**12.5** HD16@250	**13.3** HD16@300	**14.2** HD16@300	**15.1** HD16@300	**16.0** HD16@300	**16.8** HD16@300	**17.8** HD16@300
3400	**8.5** HD16@200	**9.8** HD16@250	**10.6** HD16@250	**11.4** HD16@250	**12.2** HD16@250	**12.9** HD16@250	**13.7** HD16@300	**14.5** HD16@300	**15.3** HD16@300	**16.1** HD16@300
3600	**6.9** HD16@200	**8.9** HD16@200	**9.7** HD16@250	**10.4** HD16@250	**11.1** HD16@250	**11.8** HD16@250	**12.5** HD16@250	**13.3** HD16@250	**14.0** HD16@300	**14.7** HD16@300
3800	**5.7** HD16@200	**7.4** HD16@200	**8.8** HD16@200	**9.5** HD16@250	**10.2** HD16@250	**10.8** HD16@250	**11.5** HD16@250	**12.2** HD16@250	**12.8** HD16@250	**13.5** HD16@250
4000	**4.6** HD16@200	**6.1** HD16@200	**7.8** HD16@200	**8.7** HD16@200	**9.3** HD16@250	**10.0** HD16@250	**10.6** HD16@250	**11.2** HD16@250	**11.8** HD16@250	**12.4** HD16@250
4200	**3.7** HD16@200	**5.0** HD16@200	**6.5** HD16@200	**8.0** HD16@200	**8.6** HD16@200	**9.2** HD16@250	**9.7** HD16@250	**10.3** HD16@250	**10.9** HD16@250	**11.4** HD16@250
4400	**3.0** HD16@200	**4.1** HD16@200	**5.3** HD16@200	**6.8** HD16@200	**8.0** HD16@200	**8.5** HD16@200	**9.0** HD16@250	**9.5** HD16@250	**10.1** HD16@250	**10.6** HD16@250
4600	**2.3** HD16@200	**3.3** HD16@200	**4.4** HD16@200	**5.6** HD16@200	**7.0** HD16@200	**7.9** HD16@200	**8.3** HD16@200	**8.8** HD16@200	**9.3** HD16@250	**9.8** HD16@250
4800	**1.8** HD16@200	**2.6** HD16@200	**3.6** HD16@200	**4.6** HD16@200	**5.9** HD16@200	**7.2** HD16@200	**7.8** HD16@200	**8.2** HD16@200	**8.7** HD16@200	**9.1** HD16@200
5000		**2.0** HD16@200	**2.8** HD16@200	**3.8** HD16@200	**4.9** HD16@200	**6.1** HD16@200	**7.2** HD16@200	**7.6** HD16@200	**8.1** HD16@200	**8.6** HD16@200
5200			**2.2** HD16@200	**3.0** HD16@200	**4.0** HD16@200	**5.0** HD16@200	**6.2** HD16@200	**7.2** HD16@200	**7.6** HD16@200	**8.0** HD16@200
5400			**1.6** HD16@200	**2.4** HD16@200	**3.2** HD16@200	**4.1** HD16@200	**5.4** HD16@200	**6.6** HD16@200	**7.1** HD16@200	**7.5** HD16@200
5600				**1.7** HD16@200	**2.8** HD16@200	**3.6** HD16@200	**4.6** HD16@200	**5.6** HD16@200	**6.7** HD16@200	**7.0** HD16@200
5800					**2.2** HD16@200	**3.0** HD16@200	**3.8** HD16@200	**4.7** HD16@200	**6.3** HD16@100	**6.6** HD16@200
6000					**1.6** HD16@200	**2.4** HD16@200	**3.5** HD16@100	**3.9** HD16@200	**5.4** HD16@100	**6.2** HD16@100
6200						**1.7** HD16@200	**2.9** HD16@100	**3.7** HD16@100	**4.5** HD16@100	**5.8** HD16@100
6400						**1.1** HD16@200	**2.2** HD16@100	**3.0** HD16@100	**3.8** HD16@100	**4.6** HD16@100
6600							**1.6** HD16@100	**2.3** HD16@100	**3.1** HD16@100	**3.9** HD16@100
6800								**1.7** HD16@100	**2.4** HD16@100	**3.2** HD16@100
7000									**1.7** HD16@100	**2.4** HD16@100
7200										**2.1** HD16@100

FLATDECK FIRE DESIGN TABLES

Introduction

Fire resistance ratings are given for composite floor slab thicknesses 110mm to 160mm, 180mm and 200mm, for single spans between 2.0m and 7.2m with live loads of 3kPa to 5kPa.

Fire resistance ratings can also be adjusted for loads of 1.5kPa and 2.5kPa, refer Note 4 below.

The following notes apply to the Flatdeck composite floor slab fire design tables in this section.

1. The fire resistance ratings tabulated are equivalent times in minutes of exposure to the standard fire test (NZS/BS 476) that satisfy the criteria for insulation, integrity and stability based on simply supported spans. Fire resistance ratings shown in ***bold italics*** are limited by insulation criteria. The beneficial effects of continuous spans and/or negative reinforcement at supports may be accounted for by specific design.
2. L is the span measured centre to centre between permanent supports.
3. The fire resistance ratings given are based on the following conditions. If design conditions differ from the following, specific design will be required.
   - The minimum cover to the fire reinforcement is 25mm to the bottom of the steel decking sheet.
   - A superimposed dead load (G_{SDL}) of 0.5kPa has been included. Where G_{SDL} is greater than 0.5kPa specific design to HERA Report R4-82 is required.
   - The self weight of the Flatdeck composite floor slab is based on a concrete density of 2350kg/m^3 and an allowance of 5% for concrete ponding during construction.
   - The long term live load factor (AS 1170.0) used for 5kPa live load is 0.6. For all other live loads 0.4 has been used.
   - Specified concrete strength, f'_c = 25MPa and Type A aggregate.
   - Reinforcement is grade 500 to AS/NZS 4671 and is assumed to be continuous over the length of the clear span.
   - Design moment capacity of the composite floor slab is calculated in accordance with NZS 3101.
   - Contribution to fire resistance from the Flatdeck steel decking has been included as noted in Section 3.5.2.2.
4. Live loads less than 3kPa.
   - For a live load of 2.5kPa, increase FRR by 4 minutes for the corresponding live load, span and composite floor slab thickness published for the 3kPa live load, provided that the fire resistance rating is not limited by insulation criteria.
   - For a live load of 1.5kPa, increase FRR by 12 minutes for the corresponding live load, span and composite floor slab thickness published for the 3kPa live load, provided that the fire resistance rating is not limited by insulation criteria.
5. For intermediate values linear interpolation is permitted provided that the two values are within the extent of the tables. For example, interpolation can be used to derive the fire resistance ratings for 170mm and 190mm overall composite floor slab thicknesses.
6. Fire resistance ratings have been provided for spans up to where a value of G_{SDL} + Q = 1.5kPa can be achieved from the Load Span tables in Section 3.5.5. Therefore these fire resistance rating tables must be used in conjunction with the Flatdeck Composite Floor Slab Load Span Tables 3.5.5 as satisfaction of fire resistance rating does not always ensure the load capacity and deflection criteria for ambient temperature are met.

0.75mm Flatdeck Composite Floor Slab – Fire Resistance Ratings (minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Flatdeck Slab, L (mm)																
			2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200
110	3	no additional reinforcing										***120***	114	104	93	82	71	58	
		HD10 every 3rd pan												***120***	116	108	97	88	78
		HD12 every 3rd pan													***120***	117	108	98	88
		HD12 every 2nd pan															***120***	112	102
		HD16 every 3rd pan																***120***	112
		HD16 every 2nd pan																	***120***
	4	no additional reinforcing									***120***	116	105	94	83	71	57		
		HD10 every 3rd pan											***120***	117	108	97	87	77	
		HD12 every 3rd pan												***120***	117	108	97	87	77
		HD12 every 2nd pan														***120***	111	102	92
		HD16 every 3rd pan															***120***	111	101
		HD16 every 2nd pan																	***120***
	5	no additional reinforcing							***120***	113	100	88	75	60					
		HD10 every 3rd pan									***120***	112	100	89	77				
		HD12 every 3rd pan										***120***	110	99	88	76			
		HD12 every 2nd pan											***120***	113	102	91	80		
		HD16 every 3rd pan												***120***	112	101	90		
		HD16 every 2nd pan														***120***	111	101	90
		HD12 every pan														***120***	115	105	95
		HD16 every pan																	***120***

0.75mm Flatdeck Composite Floor Slab - Fire Resistance Ratings (minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Flatdeck Slab, L (mm)																	
			2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600
120	3	no additional reinforcing										≥120	114	105	94	83	72	60		
		HD10 every 3rd pan												≥120	117	108	99	89	80	
		HD12 every 3rd pan													≥120	117	109	99	90	81
		HD12 every 2nd pan															≥120	113	104	95
		HD16 every 3rd pan																≥120	114	105
		HD16 every 2nd pan																		≥120
	4	no additional reinforcing									≥120	116	106	95	84	73	59			
		HD10 every 3rd pan											≥120	118	109	99	89	79		
		HD12 every 3rd pan												≥120	118	109	99	89	78	
		HD12 every 2nd pan														≥120	113	104	94	85
		HD16 every 3rd pan															≥120	113	104	95
		HD16 every 2nd pan																	≥120	116
	5	no additional reinforcing							≥120	113	101	89	76	62						
		HD10 every 3rd pan									≥120	113	102	90	79					
		HD12 every 3rd pan										≥120	112	101	90	79				
		HD12 every 2nd pan											≥120	114	104	94	83			
		HD16 every 3rd pan												≥120	114	103	93			
		HD16 every 2nd pan														≥120	114	105	95	85
		HD12 every pan														≥120	118	108	99	89
		HD16 every pan																		≥120

0.75mm Flatdeck Composite Floor Slab - Fire Resistance Ratings (minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Flatdeck Slab, L (mm)																			
			2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600	5800
130	3	no additional reinforcing												≥120	113	104	93	83	72	59		
		HD10 every 3rd pan														≥120	116	108	98	89	80	
		HD12 every 3rd pan															≥120	117	109	99	90	81
		HD12 every 2nd pan																	≥120	113	105	96
		HD16 every 3rd pan																		≥120	114	106
		HD16 every 2nd pan																				≥120
	4	no additional reinforcing											≥120	115	105	94	83	72	59			
		HD10 every 3rd pan													≥120	117	108	99	89	79		
		HD12 every 3rd pan														≥120	117	109	99	90	80	
		HD12 every 2nd pan																≥120	113	104	95	86
		HD16 every 3rd pan																	≥120	114	105	96
		HD16 every 2nd pan																			≥120	117
		HD12 every pan																				≥120
	5	no additional reinforcing									≥120	112	100	88	75	62						
		HD10 every 3rd pan											≥120	112	101	91	80					
		HD12 every 3rd pan												≥120	111	101	90	80				
		HD12 every 2nd pan													≥120	114	105	95	85			
		HD16 every 3rd pan														≥120	114	105	94	84		
		HD16 every 2nd pan																≥120	116	107	97	88
		HD12 every pan																≥120	119	110	101	92
		HD16 every pan																				≥120

0.75mm Flatdeck Composite Floor Slab - Fire Resistance Ratings (minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Flatdeck Slab, L (mm)																				
			2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600	5800	6000	6200
140	3	no additional reinforcing												≥120	111	101	91	81	70	57			
		HD10 every 3rd pan														≥120	115	106	97	88	79		
		HD12 every 3rd pan															≥120	116	108	98	89	81	
		HD12 every 2nd pan																	≥120	112	104	95	87
		HD16 every 3rd pan																		≥120	114	106	96
		HD16 every 2nd pan																				≥120	118
		HD12 every pan																					≥120
	4	no additional reinforcing											≥120	112	103	92	81	70	57				
		HD10 every 3rd pan													≥120	115	107	97	88	78			
		HD12 every 3rd pan														≥120	116	108	98	89	80		
		HD12 every 2nd pan																≥120	112	104	95	86	77
		HD16 every 3rd pan																	≥120	113	105	96	87
		HD16 every 2nd pan																			≥120	117	109
		HD12 every pan																				≥120	112
		HD16 every pan																					≥120
	5	no additional reinforcing								≥120	119	109	98	86	74	60							
		HD10 every 3rd pan											≥120	111	100	89	79						
		HD12 every 3rd pan												≥120	110	100	90	79					
		HD12 every 2nd pan													≥120	113	104	94	84				
		HD16 every 3rd pan														≥120	114	104	94	85			
		HD16 every 2nd pan																≥120	116	107	98	89	
		HD12 every pan																	≥120	110	102	93	84
		HD16 every pan																					≥120

0.75mm Flatdeck Composite Floor Slab – Fire Resistance Ratings (minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Flatdeck Slab, L (mm)																				
			2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600	5800	6000	6200	6400
150	3	no additional reinforcing											≥120	117	108	98	88	78	67				
		HD10 every 3rd pan														≥120	112	104	95	86	77		
		HD12 every 3rd pan															≥120	113	105	96	88	79	
		HD12 every 2nd pan																≥120	118	110	102	94	86
		HD16 every 3rd pan																		≥120	112	104	96
		HD16 every 2nd pan																				≥120	117
		HD12 every pan																					≥120
	4	no additional reinforcing										≥120	119	110	100	89	79	67					
		HD10 every 3rd pan													≥120	113	105	95	86	76			
		HD12 every 3rd pan														≥120	114	106	96	88	78		
		HD12 every 2nd pan															≥120	118	110	102	93	85	76
		HD16 every 3rd pan																	≥120	112	104	95	86
		HD16 every 2nd pan																			≥120	116	109
		HD12 every pan																			≥120	119	112
		HD16 every pan																					≥120
	5	no additional reinforcing								≥120	116	106	95	83	71	56							
		HD10 every 3rd pan										≥120	118	108	98	88	77						
		HD12 every 3rd pan											≥120	117	108	98	88	78					
		HD12 every 2nd pan													≥120	112	103	94	84				
		HD16 every 3rd pan														≥120	112	103	94	84			
		HD16 every 2nd pan																≥120	115	107	98	89	
		HD12 every pan																≥120	118	110	101	93	84
		HD16 every pan																					≥120

0.75mm Flatdeck Composite Floor Slab - Fire Resistance Ratings (minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Flatdeck Slab, L (mm)																				
			2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600	5800	6000	6200	6400	6600	6800
160	3	no additional reinforcing										≥120	113	104	94	85	74	62					
		HD10 every 3rd pan												≥120	117	110	101	92	83	74			
		HD12 every 3rd pan													≥120	118	111	103	94	85	77		
		HD12 every 2nd pan															≥120	116	108	100	92	84	76
		HD16 every 3rd pan																≥120	118	110	102	94	86
		HD16 every 2nd pan																			≥120	116	108
		HD12 every pan																			≥120	118	111
		HD16 every pan																					≥120
	4	no additional reinforcing									≥120	115	106	96	86	75	63						
		HD10 every 3rd pan											≥120	118	110	102	92	83	74				
		HD12 every 3rd pan												≥120	119	111	103	94	85	76			
		HD12 every 2nd pan														≥120	116	108	100	91	83		
		HD16 every 3rd pan															≥120	118	110	102	93	85	
		HD16 every 2nd pan																		≥120	115	108	99
		HD12 every pan																		≥120	117	110	103
		HD16 every pan																					≥120
	5	no additional reinforcing							≥120	113	102	91	79	67									
		HD10 every 3rd pan									≥120	114	105	95	85	74							
		HD12 every 3rd pan										≥120	115	106	96	86	76						
		HD12 every 2nd pan											≥120	118	110	100	91	82					
		HD16 every 3rd pan												≥120	119	111	101	92	83				
		HD16 every 2nd pan															≥120	114	106	97	88		
		HD12 every pan															≥120	116	109	100	92	84	76
		HD16 every pan																					≥120

0.75mm Flatdeck Composite Floor Slab – Fire Resistance Ratings (minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Flatdeck Slab, L (mm)																				
			3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600	5800	6000	6200	6400	6600	6800	7000	7200
180	3	no additional reinforcing									≥120	113	105	95	85	75	64						
		HD10 every 3rd pan											≥120	118	110	102	93	85	76				
		HD12 every 3rd pan												≥120	119	112	104	95	87	79			
		HD12 every 2nd pan														≥120	117	110	102	94	86	78	
		HD16 every 3rd pan															≥120	119	112	104	96	89	
		HD16 every 2nd pan																		≥120	118	111	104
		HD12 every pan																			≥120	113	107
		HD16 every pan																					≥120
	4	no additional reinforcing								≥120	115	107	97	87	77	65							
		HD10 every 3rd pan										≥120	119	111	103	94	85	76					
		HD12 every 3rd pan												≥120	113	105	96	87	79				
		HD12 every 2nd pan													≥120	117	110	102	94	86	78		
		HD16 every 3rd pan															≥120	112	104	96	88		
		HD16 every 2nd pan																	≥120	117	110	103	95
		HD12 every pan																		≥120	113	106	99
		HD16 every pan																					≥120
	5	no additional reinforcing						≥120	114	104	93	82	70	55									
		HD10 every 3rd pan								≥120	116	107	98	88	78								
		HD12 every 3rd pan									≥120	116	108	98	88	79							
		HD12 every 2nd pan											≥120	112	104	95	86	77					
		HD16 every 3rd pan												≥120	113	104	96	87					
		HD16 every 2nd pan														≥120	117	110	101	93	85		
		HD12 every pan															≥120	112	105	97	89	81	
		HD16 every pan																				≥120	119

0.75mm Flatdeck Composite Floor Slab - Fire Resistance Ratings (minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Flatdeck Slab, L (mm)																				
			3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600	5800	6000	6200	6400	6600	6800	7000	7200
200	3	no additional reinforcing										≥120	112	103	94	84	74	63					
		HD10 every 3rd pan												≥120	117	110	101	93	84	76			
		HD12 every 3rd pan													≥120	118	111	103	95	87	79		
		HD12 every 2nd pan															≥120	116	109	102	94	86	79
		HD16 every 3rd pan																≥120	119	112	105	97	89
		HD16 every 2nd pan																			≥120	118	112
		HD12 every pan																				≥120	114
		HD16 every pan																					≥120
	4	no additional reinforcing									≥120	114	106	96	86	76	65						
		HD10 every 3rd pan											≥120	118	111	103	94	85	76				
		HD12 every 3rd pan													≥120	112	105	96	88	79			
		HD12 every 2nd pan														≥120	117	110	102	94	86	79	
		HD16 every 3rd pan																≥120	112	105	97	89	
		HD16 every 2nd pan																		≥120	118	111	104
		HD12 every pan																			≥120	114	107
		HD16 every pan																					≥120
	5	no additional reinforcing							≥120	113	103	93	82	70	56								
		HD10 every 3rd pan									≥120	116	108	98	88	79							
		HD12 every 3rd pan										≥120	116	108	99	90	81						
		HD12 every 2nd pan												≥120	113	105	96	87	79				
		HD16 every 3rd pan													≥120	115	107	98	89				
		HD16 every 2nd pan															≥120	119	111	104	96	88	
		HD12 every pan																≥120	114	107	99	91	84
		HD16 every pan																					≥120

0.95mm Flatdeck Composite Floor Slab – Fire Resistance Ratings (minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Flatdeck Slab, L (mm)																	
			2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400
110	3	no additional reinforcing												***120***	117	108	98	89	79	68
		HD10 every 3rd pan														***120***	117	109	99	90
		HD12 every 3rd pan															***120***	116	108	98
		HD12 every 2nd pan																***120***	118	110
		HD16 every 3rd pan																	***120***	118
		HD16 every 2nd pan																		***120***
	4	no additional reinforcing											***120***	118	109	98	88	78	67	
		HD10 every 3rd pan													***120***	117	108	98	89	79
		HD12 every 3rd pan														***120***	116	107	97	88
		HD12 every 2nd pan															***120***	118	109	100
		HD16 every 3rd pan																***120***	117	108
		HD16 every 2nd pan																		***120***
	5	no additional reinforcing									***120***	113	101	90	78	66				
		HD10 every 3rd pan										***120***	119	110	99	88	77			
		HD12 every 3rd pan											***120***	117	107	96	86	75		
		HD12 every 2nd pan												***120***	118	108	98	88	78	
		HD16 every 3rd pan													***120***	116	106	95	85	
		HD16 every 2nd pan															***120***	114	104	94
		HD12 every pan															***120***	117	108	98
		HD16 every pan																		***120***

0.95mm Flatdeck Composite Floor Slab – Fire Resistance Ratings (minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Flatdeck Slab, L (mm)																	
			2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600
120	3	no additional reinforcing												≥120	118	110	100	91	81	71
		HD10 every 3rd pan														≥120	118	111	102	93
		HD12 every 3rd pan															≥120	118	110	101
		HD12 every 2nd pan																	≥120	113
		HD16 every 3rd pan																		≥120
	4	no additional reinforcing											≥120	119	110	100	91	81	70	58
		HD10 every 3rd pan													≥120	118	110	101	92	83
		HD12 every 3rd pan														≥120	118	109	100	91
		HD12 every 2nd pan																≥120	112	103
		HD16 every 3rd pan																	≥120	112
		HD16 every 2nd pan																		≥120
	5	no additional reinforcing									≥120	114	104	92	81	69				
		HD10 every 3rd pan											≥120	112	101	91	81			
		HD12 every 3rd pan											≥120	119	110	99	89	79		
		HD12 every 2nd pan													≥120	111	101	92	82	
		HD16 every 3rd pan													≥120	119	110	100	90	
		HD16 every 2nd pan															≥120	118	109	99
		HD12 every pan																≥120	112	103
		HD16 every pan																		≥120

0.95mm Flatdeck Composite Floor Slab - Fire Resistance Ratings (minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Flatdeck Slab, L (mm)																				
			2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600	5800	6000
130	3	no additional reinforcing														≥120	118	110	101	91	82	72	61
		HD10 every 3rd pan																≥120	119	111	103	94	85
		HD12 every 3rd pan																	≥120	118	111	102	94
		HD12 every 2nd pan																			≥120	114	106
		HD16 every 3rd pan																				≥120	114
		HD16 every 2nd pan																					≥120
	4	no additional reinforcing													≥120	119	110	101	91	81	71	59	
		HD10 every 3rd pan															≥120	119	111	102	93	84	75
		HD12 every 3rd pan																≥120	118	110	101	93	84
		HD12 every 2nd pan																		≥120	113	105	96
		HD16 every 3rd pan																			≥120	113	105
		HD16 every 2nd pan																					≥120
	5	no additional reinforcing											≥120	114	104	93	82	71	57				
		HD10 every 3rd pan													≥120	112	102	92	82	72			
		HD12 every 3rd pan														≥120	111	101	91	81			
		HD12 every 2nd pan															≥120	112	103	94	84		
		HD16 every 3rd pan																≥120	112	102	93	83	
		HD16 every 2nd pan																		≥120	112	103	93
		HD12 every pan																		≥120	114	106	97
		HD16 every pan																					≥120

0.95mm Flatdeck Composite Floor Slab – Fire Resistance Ratings (minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Flatdeck Slab, L (mm)																				
			2400	2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600	5800	6000	6200	6400
140	3	no additional reinforcing													≥120	117	109	100	91	81	72	61	
		HD10 every 3rd pan															≥120	118	110	102	94	85	77
		HD12 every 3rd pan																≥120	118	110	102	94	86
		HD12 every 2nd pan																		≥120	113	106	98
		HD16 every 3rd pan																			≥120	114	107
		HD16 every 2nd pan																					≥120
	4	no additional reinforcing												≥120	118	109	100	91	81	71	59		
		HD10 every 3rd pan														≥120	118	110	102	93	84	75	
		HD12 every 3rd pan															≥120	118	110	101	93	84	76
		HD12 every 2nd pan																	≥120	113	105	97	89
		HD16 every 3rd pan																		≥120	113	105	97
		HD16 every 2nd pan																				≥120	116
		HD12 every pan																				≥120	118
		HD16 every pan																					≥120
	5	no additional reinforcing										≥120	113	103	92	82	70	57					
		HD10 every 3rd pan												≥120	112	102	92	83	73				
		HD12 every 3rd pan												≥120	119	110	101	91	82				
		HD12 every 2nd pan														≥120	112	104	94	85	76		
		HD16 every 3rd pan															≥120	112	103	94	85		
		HD16 every 2nd pan																	≥120	113	104	95	87
		HD12 every pan																	≥120	115	107	99	90
		HD16 every pan																					≥120

0.95mm Flatdeck Composite Floor Slab – Fire Resistance Ratings (minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Flatdeck Slab, L (mm)																				
			2600	2800	3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600	5800	6000	6200	6400	6600
150	3	no additional reinforcing													≥120	115	107	98	89	80	70	59	
		HD10 every 3rd pan															≥120	116	109	101	92	84	76
		HD12 every 3rd pan																≥120	116	109	101	93	85
		HD12 every 2nd pan																		≥120	112	105	97
		HD16 every 3rd pan																			≥120	113	106
		HD16 every 2nd pan																					≥120
	4	no additional reinforcing												≥120	116	108	98	89	80	69	57		
		HD10 every 3rd pan														≥120	117	109	100	92	83	74	
		HD12 every 3rd pan															≥120	116	109	101	92	84	75
		HD12 every 2nd pan																≥120	119	112	104	96	88
		HD16 every 3rd pan																		≥120	113	105	97
		HD16 every 2nd pan																				≥120	115
		HD12 every pan																				≥120	118
		HD16 every pan																					≥120
	5	no additional reinforcing										≥120	111	101	91	80	69	55					
		HD10 every 3rd pan											≥120	119	110	101	91	82	72				
		HD12 every 3rd pan												≥120	118	109	100	91	81				
		HD12 every 2nd pan														≥120	112	103	94	85	76		
		HD16 every 3rd pan															≥120	112	103	94	85		
		HD16 every 2nd pan																	≥120	113	105	96	88
		HD12 every pan																	≥120	115	107	99	91
		HD16 every pan																					≥120

0.95mm Flatdeck Composite Floor Slab – Fire Resistance Ratings (minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Flatdeck Slab, L (mm)																				
			3000	3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600	5800	6000	6200	6400	6600	6800	7000
160	3	no additional reinforcing												≥120	113	105	95	87	77	68	55		
		HD10 every 3rd pan														≥120	114	107	99	90	82	74	
		HD12 every 3rd pan															≥120	114	108	99	91	83	75
		HD12 every 2nd pan																≥120	118	111	104	96	88
		HD16 every 3rd pan																	≥120	119	112	105	97
		HD16 every 2nd pan																				≥120	116
		HD12 every pan																				≥120	118
		HD16 every pan																					≥120
	4	no additional reinforcing											≥120	113	105	96	87	77	67				
		HD10 every 3rd pan													≥120	114	107	98	90	81	73		
		HD12 every 3rd pan														≥120	115	107	99	91	82		
		HD12 every 2nd pan															≥120	118	110	103	95	87	79
		HD16 every 3rd pan																≥120	118	111	104	96	88
		HD16 every 2nd pan																			≥120	114	108
		HD12 every pan																			≥120	117	110
		HD16 every pan																					≥120
	5	no additional reinforcing								≥120	117	109	99	88	78	67							
		HD10 every 3rd pan										≥120	117	109	99	90	80						
		HD12 every 3rd pan											≥120	116	108	99	89	80					
		HD12 every 2nd pan												≥120	118	110	102	93	84	76			
		HD16 every 3rd pan													≥120	118	110	102	93	84			
		HD16 every 2nd pan																≥120	112	104	96	88	
		HD12 every pan																≥120	114	107	99	91	83
		HD16 every pan																					≥120

0.95mm Flatdeck Composite Floor Slab – Fire Resistance Ratings (minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Flatdeck Slab, L (mm)																				
			3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600	5800	6000	6200	6400	6600	6800	7000	7200
180	3	no additional reinforcing												≥120	114	106	97	89	80	70	59		
		HD10 every 3rd pan														≥120	116	109	101	93	85	77	
		HD12 every 3rd pan															≥120	116	109	102	94	86	79
		HD12 every 2nd pan																	≥120	113	106	99	91
		HD16 every 3rd pan																		≥120	114	108	100
		HD16 every 2nd pan																				≥120	118
		HD12 every pan																					≥120
	4	no additional reinforcing											≥120	115	107	98	89	80	70	59			
		HD10 every 3rd pan													≥120	116	109	101	93	85	76		
		HD12 every 3rd pan														≥120	116	110	102	94	86	78	
		HD12 every 2nd pan																≥120	113	106	98	91	83
		HD16 every 3rd pan																	≥120	114	107	100	92
		HD16 every 2nd pan																			≥120	118	111
		HD12 every pan																				≥120	113
		HD16 every pan																					≥120
	5	no additional reinforcing								≥120	119	111	102	92	82	71	59						
		HD10 every 3rd pan										≥120	119	111	103	93	84	75					
		HD12 every 3rd pan											≥120	119	111	102	93	85	76				
		HD12 every 2nd pan													≥120	113	106	97	89	81			
		HD16 every 3rd pan														≥120	114	106	98	90			
		HD16 every 2nd pan																≥120	116	109	101	93	86
		HD12 every pan																≥120	118	111	104	96	89
		HD16 every pan																					≥120

0.95mm Flatdeck Composite Floor Slab – Fire Resistance Ratings (minutes)

Slab Thickness D_s (mm)	Q (kPa)	Fire Reinforcing Steel	Span of Flatdeck Slab, L (mm)																				
			3200	3400	3600	3800	4000	4200	4400	4600	4800	5000	5200	5400	5600	5800	6000	6200	6400	6600	6800	7000	7200
200	3	no additional reinforcing													≥120	113	106	97	89	80	71	60	
		HD10 every 3rd pan															≥120	116	109	101	93	86	78
		HD12 every 3rd pan																≥120	116	110	102	95	87
		HD12 every 2nd pan																		≥120	113	107	100
		HD16 every 3rd pan																			≥120	115	109
		HD16 every 2nd pan																					≥120
	4	no additional reinforcing												≥120	114	107	98	90	81	71	60		
		HD10 every 3rd pan														≥120	116	110	102	94	86	78	
		HD12 every 3rd pan															≥120	117	110	103	95	87	79
		HD12 every 2nd pan																	≥120	114	107	100	92
		HD16 every 3rd pan																		≥120	115	109	101
		HD16 every 2nd pan																				≥120	119
		HD12 every pan																					≥120
	5	no additional reinforcing									≥120	119	111	102	93	83	73	61					
		HD10 every 3rd pan												≥120	112	104	95	87	78				
		HD12 every 3rd pan												≥120	119	112	104	96	87	79			
		HD12 every 2nd pan														≥120	115	108	100	91	83	75	
		HD16 every 3rd pan															≥120	116	109	101	92	84	
		HD16 every 2nd pan																	≥120	118	112	104	97
		HD12 every pan																		≥120	114	107	100
		HD16 every pan																					≥120

FLATDECK ACOUSTIC PERFORMANCE

SCOPE

This section provides guidelines for specifiers and constructors who require noise control systems for residential applications such as separate multi-unit dwellings or single dwellings, commercial applications such as retail spaces, offices and institutional buildings. It is not intended that these guidelines replace the need for specialist acoustic design to meet the specified sound insulation performance for the building.

A Dimond Structural Noise Control System consists of a Flatdeck composite floor slab with a selected USG ceiling system, GIB® standard plasterboard ceiling linings, selected floor coverings and the specific inclusion of a cavity absorber. It must be noted that the floor covering is an essential aspect of the performance of the system.

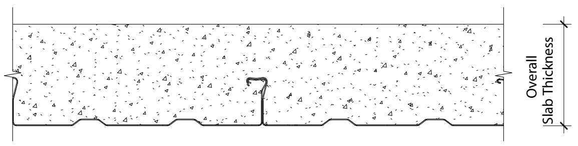
The information in this section is based on laboratory testing of a 120mm Hibond 55 composite floor slab carried out by the University of Auckland, Acoustics Testing Service and opinions on expected acoustic performance by Marshall Day Acoustics Limited Report Rp001 R00_2006476. More information is available on request.

The systems set out in this section provide the expected sound transmission performance under laboratory conditions. However in practical applications on site there is a significant element of subjectivity to interpreting noise levels within rooms. No matter how low a sound level might be, if it is intrusive upon a person's privacy, then it is likely to cause annoyance. No practical system can guarantee complete sound insulation and completely satisfy everyone.

Introduction of light fittings, vents or other floor or ceiling penetrations will reduce the acoustic performance of the system, requiring specific assessment in each case.

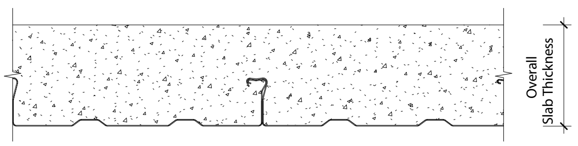
Flatdeck Composite Floor Slab - Bare Composite Floor Slab

System Description:
Steel Decking: 0.75, 0.95mm Flatdeck
Composite Floor Slab: Overall thickness (mm)



Overall Composite Floor Slab Thickness (mm)	STC
120	48
140	52
160	53
180	56
200	57

System Description:
Steel Decking: 0.75, 0.95mm Flatdeck
Composite Floor Slab: 120mm overall thickness

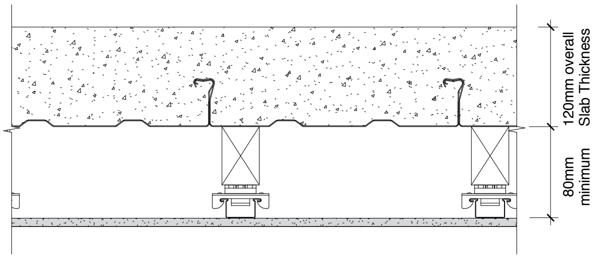


Floor Surface Treatment	STC	IIC
No Covering	48	23
15mm strip timber on Bostic Ultraset adhesive	48	40
15mm strip timber on 1mm polyethylene foam	48	44
6mm Cork flooring	48	41
Gerfloor Taralay Comfor Vinyl, 3.1mm thick	48	46
Carpet, nylon or wool 40oz without underlay	48	66
Carpet, wool 60oz without underlay	48	67
Carpet, wool or nylon on 8mm foam underlay	48	71

Notes:
1. The acoustic opinion has a margin of error of +/- 3 STC/IIC points
2. IIC result depends on the quality of the floor covering material and installation
3. All adhesives must be applied to manufacturers instructions, and Bostic Ultraset adhesive dry film thickness must not be less than 1.9mm
4. It is prudent to allow a 5 point reduction for expected field STC and IIC when compared to the above performance expected in laboratory conditions. This is considered a reasonable compensation to allow for flanking paths at junctions and construction variations.

Flatdeck Composite Floor Slab with Direct Fix Ceiling System - Non-Insulated

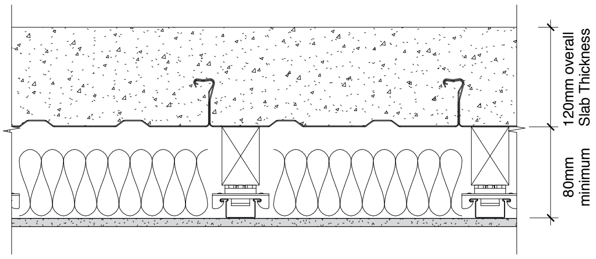
System Description:
Steel Decking: 0.75, 0.95mm Flatdeck
Composite Floor Slab: 120mm overall thickness
Ceiling System: Potters Direct Fix with sound isolation clips
USG furring channel at maximum 600mm centres
Ceiling Lining: 13mm GIB standard plasterboard in one or two layers



Floor Surface Treatment	Ceiling Lining			
	One Layer 13mm GIB		Two Layers 13mm GIB	
	STC	IIC	STC	IIC
No Covering	55	39	58	41
15mm strip timber on Bostic Ultraset adhesive	55	46	58	48
15mm strip timber on 1mm polyethylene foam	55	47	58	49
6mm Cork flooring	55	48	58	50
Gerfloor Taralay Comfort Vinyl, 3.1mm thick	55	52	58	54
Carpet, nylon or wool 40oz without underlay	55	60	58	62
Carpet, wool 60oz without underlay	55	62	58	64
Carpet, wool or nylon on 8mm foam underlay	55	66	58	68

Flatdeck Composite Floor Slab with Direct Fix Ceiling System - Insulated

System Description:
Steel Decking: 0.75, 0.95mm Flatdeck
Composite Floor Slab: 120mm overall thickness
Insulation Blanket: 75mm thick R1.8 Pink Batts
Ceiling System: Potters Direct Fix with sound isolation clips
USG furring channel at maximum 600mm centres
Ceiling Lining: 13mm GIB standard plasterboard in one or two layers

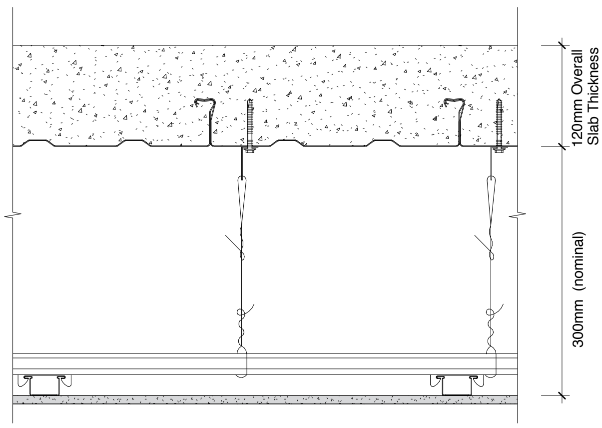


Floor Surface Treatment	Ceiling Lining			
	One Layer 13mm GIB		Two Layers 13mm GIB	
	STC	IIC	STC	IIC
No Covering	67	46	70	48
15mm strip timber on Bostic Ultraset adhesive	67	54	70	56
15mm strip timber on 1mm polyethylene foam	67	57	70	59
6mm Cork flooring	67	59	70	61
Gerfloor Taralay Comfor Vinyl, 3.1mm thick	67	62	70	64
Carpet, nylon or wool 40oz without underlay	67	70	70	72
Carpet, wool 60oz without underlay	67	72	70	74
Carpet, wool or nylon on 8mm foam underlay	67	75	70	75+

Notes:
1. The acoustic opinion has a margin of error of +/- 3 STC/IIC points
2. IIC result depends on the quality of the floor covering material and installation
3. All adhesives must be applied to manufacturers instructions, and Bostic Ultraset adhesive dry film thickness must not be less than 1.9mm
4. It is prudent to allow a 5 point reduction for expected field STC and IIC when compared to the above performance expected in laboratory conditions. This is considered a reasonable compensation to allow for flanking paths at junctions and construction variations.

Flatdeck Composite Floor Slab with Suspended Ceiling System - Non-Insulated

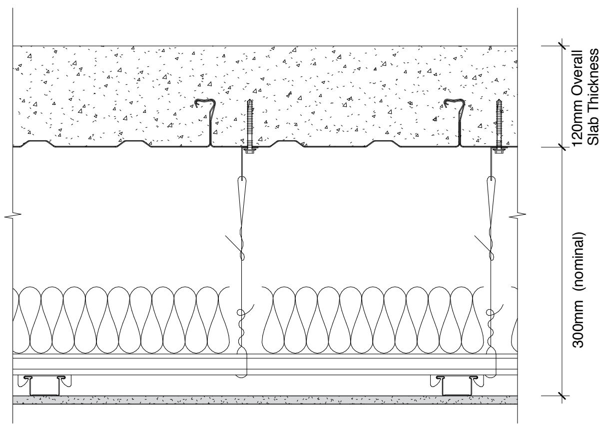
System Description:
Steel Decking: 0.75 or 0.95mm Flatdeck
Composite Floor Slab: 120mm overall thickness
Ceiling System: Don suspended ceiling system
USG furring channel at maximum 600mm centres
Ceiling Lining: 13mm GIB standard plasterboard in one or two layers



Floor Surface Treatment	Ceiling Lining			
	One Layer 13mm GIB		Two Layers 13mm GIB	
	STC	IIC	STC	IIC
No Covering	60	41	63	43
15mm strip timber on Bostic Ultraset adhesive	60	50	63	52
Ceramic tile on Bostic Ultraset adhesive	60	51	63	53
6mm Cork flooring	60	53	63	55
Gerfloor Taralay Comfort Vinyl, 3.1mm thick	60	55	63	57
Carpet, nylon or wool 40oz without underlay	60	63	63	65
Carpet, wool 60oz without underlay	60	65	63	67
Carpet, wool or nylon on 8mm foam underlay	60	69	63	71

Flatdeck Composite Floor Slab with Suspended Ceiling System - Insulated

System Description:
Steel Decking: 0.75 or 0.95mm Flatdeck
Composite Floor Slab: 120mm overall thickness
Insulation Blanket: 75mm thick R1.8 Pink Batts
Ceiling System: Don suspended ceiling system
USG furring channel at maximum 600mm centres
Ceiling Lining: 13mm GIB standard plasterboard in one or two layers



Floor Surface Treatment	Ceiling Lining			
	One Layer 13mm GIB		Two Layers 13mm GIB	
	STC	IIC	STC	IIC
No Covering	66	42	69	44
15mm strip timber on Bostic Ultraset adhesive	66	62	69	64
Ceramic tile on Bostic Ultraset adhesive	66	55	69	57
6mm Cork flooring	66	64	69	66
Gerfloor Taralay Comfor Vinyl, 3.1mm thick	66	68	69	70
Carpet, nylon or wool 40oz without underlay	66	75+	69	75+
Carpet, wool 60oz without underlay	66	75+	69	75+
Carpet, wool or nylon on 8mm foam underlay	66	75+	69	75+

Notes:
1. The acoustic opinion has a margin of error of +/- 3 STC/IIC points
2. IIC result depends on the quality of the floor covering material and installation
3. All adhesives must be applied to manufacturers instructions, and Bostic Ultraset adhesive dry film thickness must not be less than 1.9mm
4. It is prudent to allow a 5 point reduction for expected field STC and IIC when compared to the above performance expected in laboratory conditions. This is considered a reasonable compensation to allow for flanking paths at junctions and construction variations.

FLATDECK DESIGN EXAMPLES

EXAMPLE: FORMWORK

A 230mm overall thickness composite floor slab is required to span 4800mm c/c between permanent supports using the Flatdeck sheet as permanent formwork only. Two alternatives are available in design.

a) Using 0.75mm Flatdeck from Section 3.5.4, select the formwork span capabilities for a 230mm overall thickness composite floor slab, i.e.

single	1850mm
double or end	2150mm
internal	2150mm

Using two rows of props, there are two end spans and one internal span. The maximum span of Flatdeck in this configuration is,

2 x 2150 + 2150 = 6450mm
≥ the required span of 4800mm ∴ O.K.

Therefore 0.75mm Flatdeck with two rows of props at third points may be considered.

b) Using 0.95mm Flatdeck from Section 3.5.4, select the formwork span capabilities for a 230mm overall thickness composite floor slab, i.e.

single	2000mm
double or end	2400mm
internal	2350mm

Using one row of props, there are two end spans only. The maximum span of Flatdeck in this configuration is,

2 x 2400 = 4800mm
≥ the required span of 4800mm ∴ O.K.

Therefore 0.95mm Flatdeck with one row of props at midspan may also be considered.

EXAMPLE: RESIDENTIAL

A suspended composite floor slab in a residential dwelling is required to achieve a double span of 2 x 3600mm in the living area.

Living area loading,

live load, Q	1.5kPa
superimposed dead load, G_{SDL}	0.3kPa
design superimposed load, G_{SDL} + Q	1.8kPa

Living Area Floor

From Section 3.4.5, select the double or end span superimposed load and negative reinforcement for a 0.75mm Flatdeck composite floor slab of 110mm overall thickness, with one row of props at midspan. This gives,

superimposed load = 7.1kPa
≥ G_{SDL} + Q = 1.8kPa ∴ O.K.

Minimum mesh requirement throughout the Flatdeck composite floor slab from Additional Reinforcement in Section 3.5.2.2 for propped construction is one layer of SE82 mesh at minimum cover.

From Section 3.5.5, 0.75mm Flatdeck – Double and End Spans, the area of negative reinforcement required over the internal support is HD16 bars at 200mm c/c.

Length of reinforcement required is 3600 / 4 + 450 = 1350mm each side of the support centre line.

For the living area floor use a 0.75mm Flatdeck composite floor slab of 110mm overall thickness with one row of props at midspan. SE82 mesh is required throughout the composite floor slab plus HD16 x 2700mm longitudinal top reinforcement at 200mm c/c, laid atop the mesh at minimum cover, over the internal support.

EXAMPLE: INSTITUTIONAL BUILDING DEFLECTION

A heavy equipment floor in a hospital is required to form a single span of 5200mm given a long term superimposed load of 4.0kPa.

Using Section 3.5.5, 0.75mm Flatdeck – Single Spans Long Term Superimposed Loads table, select the single span superimposed load for a 0.75mm Flatdeck composite floor slab of 160mm overall thickness, with two rows of props at midspan (Section 3.5.4). This gives,

superimposed load = 4.5kPa
$\geq G_{SDL} + Q$ = 4.0kPa ∴ O.K.

Although this configuration lies in the region of the table where vibration is not critical with a minimum damping ratio of 0.025 (commercial offices, open plan with few small partitions) and the equipment is likely to be vibration sensitive. Therefore a detailed vibration analysis of the composite floor slab and all supporting structure would be required by the design engineer.

Deflection of the composite floor slab is to be minimised by reducing the allowable limit from $L_{ss}/250$ to $L_{ss}/400$. For this limit, deflection is made up of two components. Dead load deflection from prop removal is (for one or two props),

$$5\,G\,L_{ss}^4 / (384\,E_s\,I)$$

and the superimposed load deflection is,

$$5\,(G_{SDL} + Q)\,L_{ss}^4 / (384\,E_s\,I)$$

For the 0.75mm Flatdeck composite floor slab of 160mm overall thickness, refer Flatdeck Section Properties 3.5.3 for long term superimposed loads,

G = 3.78kPa, $I_{av} = 18.7 \times 10^6 mm^4/m$

Hence $G + (G_{SDL} + Q)$ = 3.78 + 4.0 = 7.78kPa

and δ_{G+Q} = Combined dead and superimposed load deflection at midspan
= $5 \times 7.78 \times 5200^4 / (384 \times 205 \times 10^9 \times 18.7)$
= 19.3mm (or $L_{ss}/269$)
> the limit of $L_{ss}/400$ ∴ No good

The deflection of the 0.75mm Flatdeck composite floor slab of 160mm overall thickness is greater than the limit of $L_{ss}/400$, therefore a greater composite floor slab thickness is required.

Try a 0.75mm Flatdeck composite floor slab of 200mm overall thickness, refer Flatdeck Section Properties 3.5.3 for long term superimposed loads,

G = 4.7kPa, $I_{av} = 34.2 \times 10^6 mm^4/m$

Hence $G + (G_{SDL} + Q)$ = 4.7 + 4.0 = 8.7kPa

and δ_{G+Q} = $5 \times 8.7 \times 5200^4 / (384 \times 205 \times 10^9 \times 34.2)$
= 11.8mm (or $L_{ss}/440$)
≤ the limit of $L_{ss}/400$ ∴ O.K.

Therefore, use a 0.75mm Flatdeck composite floor slab of 200mm overall thickness with two rows of props at third points and for minimum crack control using propped construction, use 2 x layers SE92 mesh (or HD16 bars @ 300mm centres each way) at minimum cover throughout.

FLATDECK MATERIAL SPECIFICATION

Dimond Flatdeck and accessories are manufactured from galvanised steel coil produced to AS 1397.

	Thickness BMT (mm)	Steel Grade (MPa)	Min. Zinc Weight (g/m^2)
Flatdeck sheet	0.75 & 0.95	G550	Z 275
Edge form	1.15	G250	Z 275

BMT – Base Metal Thickness

Tolerances
Length -0mm +10mm
Cover width -1mm +5mm
Maximum manufactured length of Flatdeck sheet 18m.

FLATDECK SHORT FORM SPECIFICATION

The flooring system will be Dimond Structural **(1)** mm Flatdeck manufactured from G550 grade steel, with a 275g/m^2 galvanised zinc weight. The minimum nominal steel decking sheet length to be used in construction shall be .... m, in accordance with the design formwork spans.

Edge forms should be used in accordance with Dimond Structural recommendations.

Specify concrete thickness, and number of rows of propping during construction.

Mesh and any additional reinforcement bar size and spacing should be referred to the design engineer’s drawings.

(1) Choose from: 0.75, 0.95

3.5.11

FLATDECK COMPONENTS

3.5.11.1

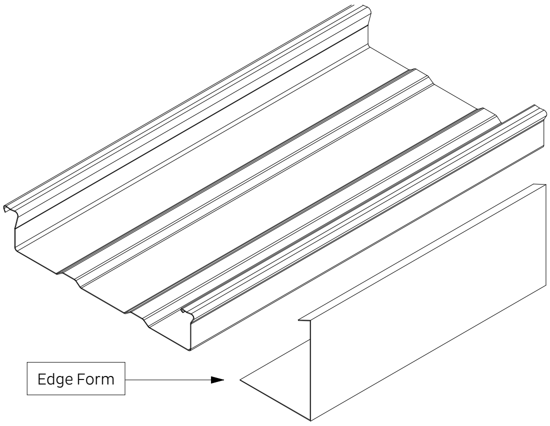
EDGE FORM

Manufactured from 1.15mm Base Metal Thickness (BMT) galvanised steel in 6m lengths, providing an edge to screed the concrete to the correct composite floor slab thickness.

Standard sizes are from 110mm to 200mm in 10mm height increments.

The foot of the Edge Form is typically fixed to structure using powder actuated fasteners (self-drilling screws can also be used, type dependent on support material and thickness).

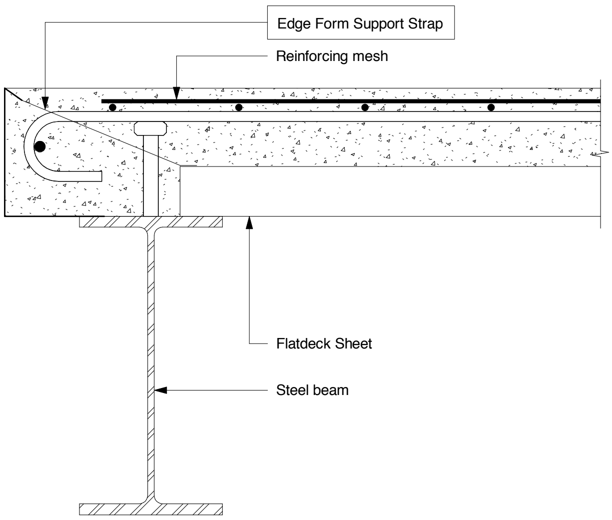
Where necessary, for example cantilevered steel decking sheets, the foot of the Edge Form may be attached to the Flatdeck sheets with 10g - 16 x 16mm self-drilling screws. Fasteners are required every pan to steel decking sheet ends and at 750mm centres along steel decking sheets.



3.5.11.2

EDGE FORM SUPPORT STRAP

Edge Form is restrained from outward movement during concrete placement by 0.75mm BMT x 25mm galvanised steel Edge Form Support Straps. Fastened with 10g - 16 x 16mm self-drilling screws (2 per strap), Edge Form Support Straps are required every second rib to steel decking sheet ends and at 750mm centres along steel decking sheets.



3.5.12

FLATDECK CAD DETAILS

For the latest Flatdeck CAD details, please download from the Dimond Structural website
www.dimondstructural.co.nz/products/flatdeck

Please note, the Flatdeck CAD details are to be used as a guide only and are not intended for construction. Specific design details are required to be provided by the design engineer.

INSTALLATION – FLOORING SYSTEMS 3.6

GENERAL 3.6.1

The placing and fixing of Dimond Structural Flooring Systems is carried out by specialist flooring installers, who lay the steel decking sheets and weld shear connectors through into the supporting beams using specialised equipment.

Installation can also be carried out by construction companies and builders experienced in the installation of Dimond Structural Flooring Systems, depending on the complexity of the design and support structure. Dimond Structural Flooring Systems are not intended to be installed by home owners, handymen etc. without appropriate experience.

On site, through deck welded shear connectors using the longest practical steel decking sheet lengths is the preferred method based on efficiency gains in both design and construction.

Dimond Structural Flooring Systems must not be subject to or installed on spans that are excessive for the construction loads. All construction loads must have the design engineer's approval, prior to loading.

SAFETY CONSIDERATIONS 3.6.2

It is important to follow Health and Safety protocol established for the site as well as identifying on-site hazards and hazards during handling and installation of Dimond Structural Flooring Systems, which may include (but are not limited to) the following:

- Weather conditions can cause the steel decking surface to become slippery.
- Working at height requires suitable fall arrest or perimeter barriers, including barriers around penetrations.
- The risk of fall through is managed by ensuring adequate support and fixing of the steel decking sheets with reference to design specifications, and this section 3.6 Installation.
- Muscle or back strain from manual handling.
- Rough sawn timber used for temporary propping can cause splinters.
- Inadequate bearing of the steel decking sheets on the support structure can result in collapse during construction, particularly if steel decking sheets are not fixed in place and can move during the construction process.
- Handling of steel decking sheets requires the use of gloves made from appropriate material to resist cuts from sharp steel edges and corners.
- Lifting of bundles of steel decking sheets requires attention to correct lifting equipment and attention to hazards with bundles lifted overhead.
- Contact with hot particles is possible during stud welding and suitable protection must be worn.
- Excessive concentration (heaping) of concrete placement can cause the steel decking sheet to collapse.

Pre-installation safety checks must include (but are not limited to) the following:

- Ensure all personnel involved on site are aware of the potential hazards and appropriate safety equipment, and PPE is available and all personnel are trained in its use.
- PPE should include at least: safety boots, hard hat, Hi viz vest, gloves (long sleeves and long pants are advised).
- If temporary propping is to be used, ensure that the props, bearers and bracing have been specifically designed and are available for installation to support each steel decking sheet securely prior to placement.
- Measure steel decking sheet lengths to ensure they can be installed with correct bearing of the steel decking sheet ends on the permanent supports. Install additional temporary end support if necessary prior to steel decking sheet placement.

HANDLING AND STORAGE

Correct handling and storage is critical to ensure the Dimond Structural Flooring System is not damaged on site. The following points must be adhered to for maximum product durability and performance over the expected life of the product.

- When delivery is taken on site, a visual inspection of the materials supplied is required to ensure the product is free from damage and the galvanised coating is in good condition to protect the steel substrate.
- Replace any damaged product. Steel decking sheets with a distorted or buckled section shape must not be installed.
- Site storage must be clear of the ground on dunnage to allow the free movement of air around each bundle. When product is stored on site, it must be kept dry using covers over each product bundle. Any product showing white or red rust corrosion is required to be replaced and must not be used without Dimond Structural approval. Contact Dimond Structural on 0800 Roofspec (0800 766 377).
- Move steel decking sheets by lifting rather than dragging as damage to the galvanised coating will occur.
- The following weights can be used to assess steel decking sheet lengths for practical safe on-site handling:

Hibond 80

0.75mm	5.7kg/m
0.95mm	7.1kg/m
1.05mm	7.9kg/m
1.15mm	8.6kg/m

Hibond 55

0.75mm	5.3kg/m
0.95mm	6.7kg/m

Flatdeck

0.75mm	2.9kg/m
0.95mm	3.7kg/m

- Bundle labels should be checked to ensure the correct lengths are placed in the designated area.
- Where there are multiple bundles in the same area, care should be taken that all bundles are orientated the same way. This will ensure that male and female side laps fit together correctly avoiding the need to rotate steel decking sheets.
- Where the underside appearance of the steel decking sheets is important (e.g. where used as an exposed ceiling) and to preserve the galvanised coating of the steel decking sheets for durability, care should be taken during the construction phase to minimise damage or deflections to the underside.

PROPPING

- When temporary propping is required it must run in continuous lines and be specifically designed to provide adequate support and stability for the specific site conditions and spans of the steel decking sheets.
- The spacing between rows of propping and between propping rows and permanent supports must be specified by the design engineer and clearly detailed on the plans used for construction. Design of the propping system is usually the responsibility of the contractor installing the Dimond Structural Flooring System.
- It is critical that steel decking sheet lengths match the type of span designed for. As an example, for an unpropped Hibond 55 x 0.75mm composite floor slab of 120mm overall thickness with beams laid out at 2.80m centres, a minimum steel decking sheet length of approximately 5.60m is required to achieve a double span. If 2 x 2.8m steel decking sheet lengths are used as single spans, the Hibond formwork will fail during construction (a Hibond 55 x 0.75mm composite floor slab of 120mm overall thickness can only achieve a maximum single span of 2.50m without propping).
- Temporary propping must be placed in position prior to placement of the steel decking sheets to provide a safe and solid working platform during the construction phase. Sections 3.2.4, 3.3.4 and 3.4.4 give the maximum spans as formwork for different composite floor slab thicknesses and span conditions. As a practical maximum, propping lines should be placed not more than 2.0m apart.
- Bearers and props must consist of either Machine Stress Graded MSG8 timber for load-bearing situations or structural steel sections sized for the construction loads. Bearers used must be a minimum dimension of 100mm x 100mm (2 - 100mm x 50mm on edge nailed together), fully supporting all steel decking sheets, refer guidelines below.
- Where timber propping is used a continuous 100mm x 50mm strap fixed to timber studs at mid-height attached at one end to a permanent wall is required to avoid buckling of the studs during the concrete pour.
- Propping lines must have a solid foundation and be seated on good ground as defined in NZS3604, cross braced or held in position by nailing through the steel decking sheets into the bearer. Propping lines must be continuous and parallel to the permanent supports.
- Temporary propping must remain in place until either the concrete has reached 80% of the design compressive strength of the concrete for application of construction loads, or the concrete is fully cured for application of full design loads.

While specific design of the propping system is required, the following guidelines for prop and bearer selection provide a starting point for design. These are based on propping lines spaced not more than 2.0m apart (or not more than 1.5m apart for Hibond 55 on composite floor slab thicknesses between 200mm and 300mm), allowing for wet concrete and construction loads to BS EN 1991-1-6:2005.

Timber Propping Guideline

Prop Type and Size	Prop Spacing	Timber Bearer Size	Maximum Slab Thickness (mm) (limited by prop or bearer capacity)		
			Hibond 80	Hibond 55	Flatdeck
Timber (max prop height 3m)					
1 x 100 x 50	600	2 x 100 x 50	230	220	160
2 x 100 x 50	600	2 x 100 x 50	-	300	260
Timber (max prop height 2.7m)					
1 x 100 x 50	600	2 x 100 x 50	-	300	260
1 x 100 x 50	600	2 x 150 x 50	-	-	300

Acrow Propping Guideline

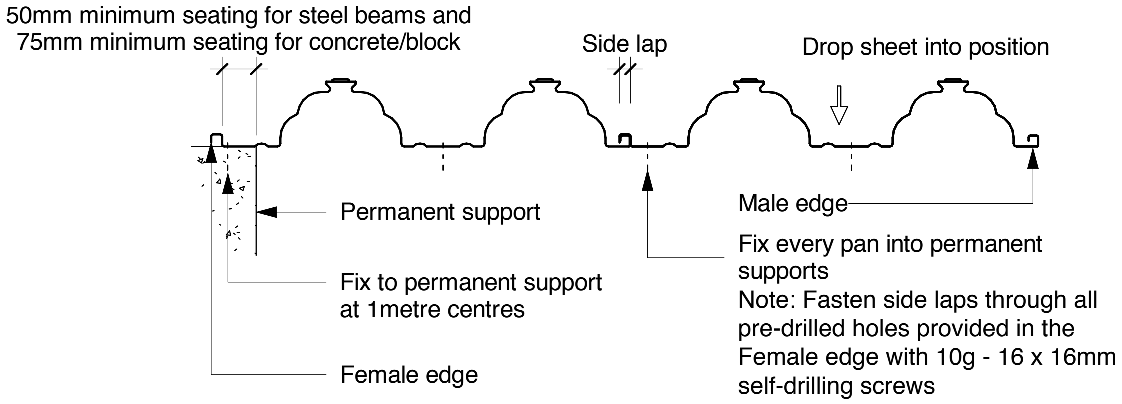
Prop Type and Size	Prop Spacing	Timber Bearer Size	Maximum Slab Thickness (mm) (limited by prop or bearer capacity)		
			Hibond 80	Hibond 55	Flatdeck
Steel Acrow Prop	1200	2 x 150 x 50	160	-	-
	1100	2 x 150 x 50	190	130	110
	1000	2 x 150 x 50	210	170	130
	900	2 x 150 x 50	230	220	160
	800	2 x 150 x 50	-	290	250
	700	2 x 150 x 50	-	300	300

LAYING STEEL DECKING SHEETS

- Steel decking sheets must be laid in one continuous length between permanent supports. Short steel decking sheets must never be spliced together to achieve the span between temporary or permanent supports.
- For steel decking sheets bearing (or seating) onto steel or timber permanent structure 50mm minimum end bearing is required, and for concrete/block 75mm minimum end bearing is required. Where steel decking sheets are continuous over permanent support structure, 100mm minimum internal bearing is required.

Hibond 80

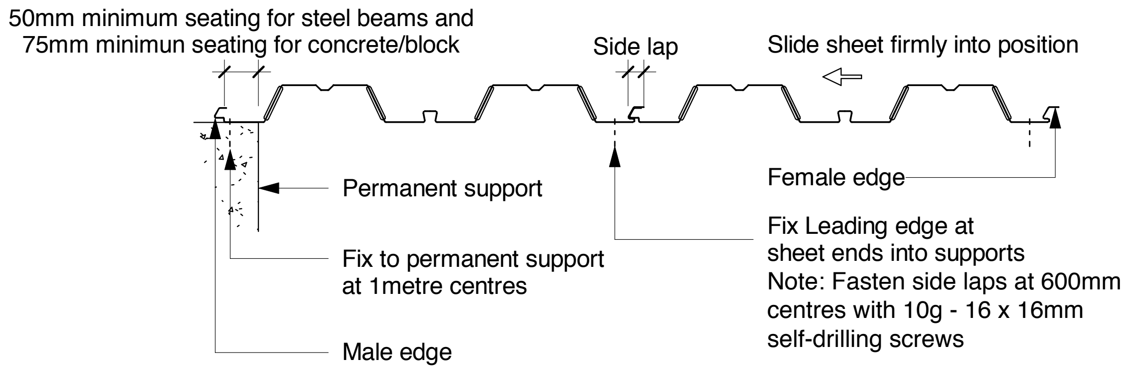
- Align the first Hibond 80 sheet with the female edge of the side lap sitting on permanent support. This will ensure the side laps fit correctly together. Apply hold down fixings and lay Hibond 80 sheets as shown.



Note: Where the Hibond 80 sheet is continuous over multiple steel beams, consideration should be given to additional fixings into intermediate beams to avoid issues due to wind uplift. Care should be taken with location of fixings to ensure these do not clash with shear stud locations.

Hibond 55

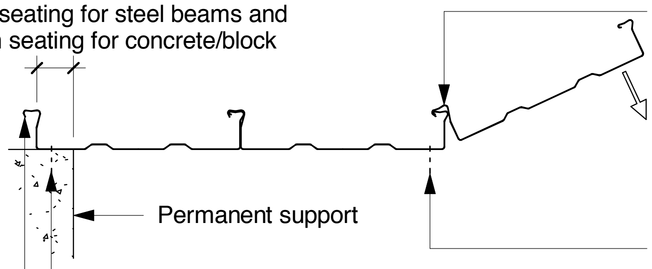
- Align the first Hibond 55 sheet with the male edge of the side lap sitting on the permanent support. This will ensure the side laps fit correctly together. Apply hold down fixings and lay Hibond 55 sheets as shown.



Note: Where the Hibond 55 sheet is continuous over multiple steel beams, consideration should be given to additional fixings into intermediate beams to avoid issues due to wind uplift. Care should be taken with location of fixings to ensure these do not clash with shear stud locations.

Flatdeck

- Align the first Flatdeck sheet with the female edge of the side lap sitting on the permanent support. Apply hold down fixings and lay Flatdeck sheets as shown.



Note: Where the Flatdeck sheet is continuous over multiple steel beams, consideration should be given to additional fixings into intermediate beams to avoid issues due to wind uplift. Care should be taken with location of fixings to ensure these do not clash with shear stud locations.

- Where supports are steel beams, shear connectors are welded through the steel decking sheets onto the steel beam beneath, located to engineers design details. Where this is required the top flange of the beam must be unpainted or have the paint stripped clean. Where shear connectors are pre-welded to beams, they must be located in line with the bottom pan of the steel decking sheets in order to gain the required shear capacity.
- Where fixing into solid filled concrete block (especially when using powder actuated drive pins), edge breakout of the block can be avoided by increasing the steel decking sheet bearing (or seating) to 75mm and fixing into the grout.
- Where tilt slab construction is being used, the steel decking sheets are fixed to a steel angle bolted onto the tilt slab to provide a minimum 50mm seating.
- When laying over timber supports, the steel decking sheets must be isolated from the timber using DPC or similar. Galvanised nails must be used to hold down steel decking sheets during installation. Where permanent shear connectors are required they must be specifically designed and specified by the engineer.
- When forming penetrations, temporary propping is required around the opening to maintain the integrity of the steel decking sheets during the concrete pour. The area of steel decking removed for penetrations must be replaced by an equivalent strength of reinforcing to the design engineer's specification.
- Penetrations greater than 250mm x 250mm require specific design by the design engineer.
- Where on-site cutting of the steel decking sheets is necessary, use a metal-cutting power saw. After cutting, ensure all swarf is cleaned off the steel decking sheets affected (recommended at the end of each day's work) to avoid corrosion.
- Periodic checks should be made on large runs to ensure the steel decking sheets are parallel and true to the first steel decking sheet. Stretching of the steel decking sheets to increase coverage must be avoided.

Edge Form and End Caps

Where required Edge Forms, End Caps or Rake Edge Flashings are installed as permanent formwork to contain the concrete during the pour. Refer Sections 3.3.9, 3.4.11 and 3.5.11 for each steel decking system.

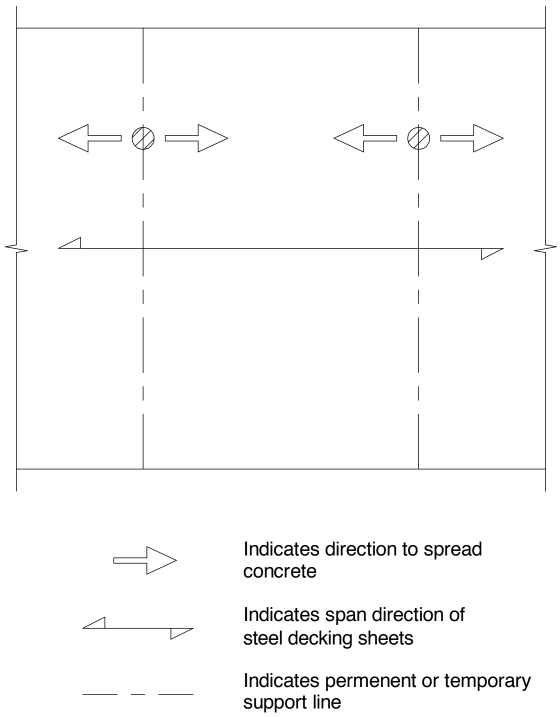
- Edge Forms are supplied to match the composite floor slab thickness and provide a screeding edge. The foot of the Edge Form is typically fixed to the structure with powder actuated fasteners and the top edge is restrained from outward movement by a 25mm x 0.75mm BMT galvanised metal edge form support strap which is fixed to the top of the steel decking ribs with 10g - 16 x 16mm self-drilling screws. The straps are spaced to ensure adequate restraint of the Edge Form, i.e. fastened every second rib to the steel decking sheet ends and at 750mm where fastened along steel decking sheets, at a minimum.
- End Caps are supplied specifically to fit to the Hibond 55 and Hibond 80 steel decking sheets and are used to blank off the ribs at sheet ends or where openings are created in the steel decking sheets. End Caps are secured with 10g - 16 x 16mm self-drilling screws.
- Rake Cut Flashings can be supplied in place of End Caps and are folded from 0.55mm BMT galvanised steel to suit the dimensions required for each specific case. The flashings are fixed to the Hibond 55 or Hibond 80 ribs with 10g - 16 x 16mm self-drilling screws.

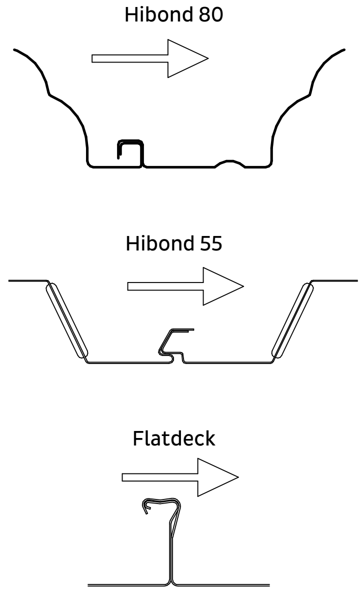
Other Considerations 3.6.5

- Mesh and/or additional reinforcing must be placed in accordance with the design engineer's specifications to ensure minimum top cover. Reinforcing mesh should be orientated so the top bar runs in the same direction as the steel decking sheet.
- Consideration should be given to laying planks as walkways to minimise localised loading of the steel decking sheets by foot traffic or equipment.

CONCRETE PLACEMENT 3.6.6

- Before concrete placement commences, ensure that the steel decking surface is clean and any debris is removed. Performance of the composite floor slab requires that there is adequate bond between the galvanised steel decking surface and the concrete.
- Avoid dumping of wet concrete in a heap and when using a concrete pump, ensure the height of the discharge nozzle is not more than 300mm above the top of the steel decking sheets. This will avoid overloading of the steel decking sheets causing buckling and/or opening of the side laps.
- Begin the pour over a beam or propping line (shown as ⌀ in the diagram below) to minimise deflections. Spread the wet concrete away from the beams and into the span. Work wet concrete across the steel decking sheets as illustrated below.
- It is recommended that concrete placers do not crowd together during the pouring sequence, but maintain a one square metre "zone" to avoid overloading the steel decking sheets.





- Use of a concrete vibrator will help eliminate air voids and ensure full contact between the steel decking sheets and the concrete.
- Where the steel decking underside is visible, concrete leakage on the underside must be washed off once concrete placement is complete and before the concrete slurry dries off.
- On large jobs it may be necessary to form construction joints in the concrete topping. Construction joints should be positioned no more than one third of the span from a butt joint in the steel decking sheets, and should be clear of the line of shear studs.