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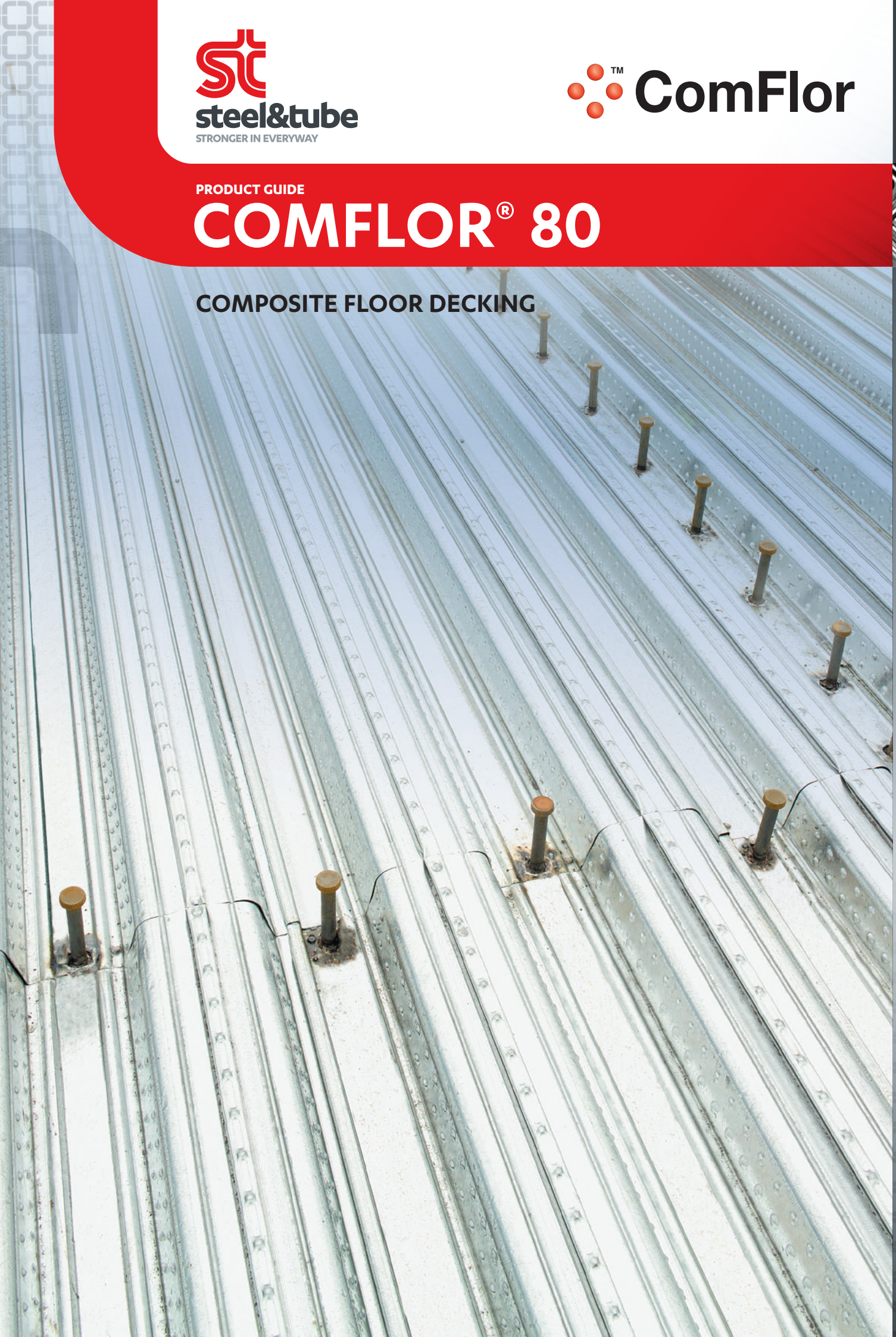
ComFlor™

PRODUCT GUIDE

COMFLOR® 80

COMPOSITE FLOOR DECKING



STEEL

PRODUCT GUIDE › COMFLOR® 80

DEC 2016

Photograph:
Delloite Centre
80 Queen Street, Auckland
Built with ComFlor® 80
19 storey plus 4 basement carpark levels.
30000 sqm.

Introduction

Steel & Tube is pleased to provide this ComFlor® Product Guide for your use.

ComFlor, the new generation in composite steel floor decking systems joins Steel & Tube, New Zealand's leading distributor of steel and stainless steel products and services – bringing the world of steel-framed construction closer to you.

Extensive testing has been undertaken in conjunction with the UK-based Steel Construction Institute to ensure ComFlor meets internationally recognised construction standards.

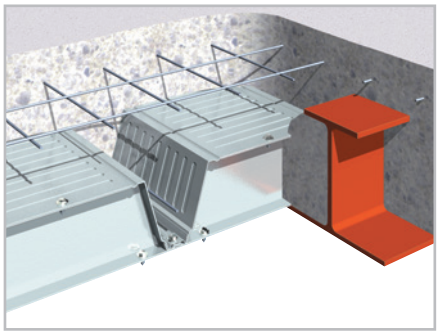
Steel & Tube are applying British research and technology along with New Zealand-made equipment and steel, to manufacture ComFlor right here in New Zealand.

Make ComFlor your first-choice flooring solution for the New Zealand building environment.

To find out more about our range of ComFlor profiles, please visit **www.comflor.co.nz**

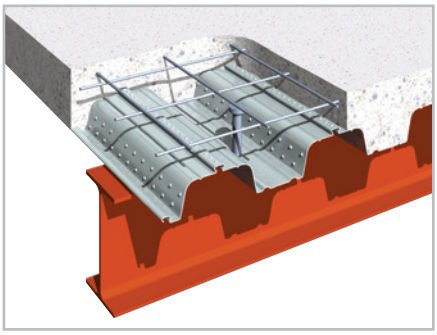
To read about Steel & Tube's extensive range of products and solutions sourced and manufactured to international standards, please visit **www.steelandtube.co.nz**

ComFlor® Composite Floor



ComFlor® 210

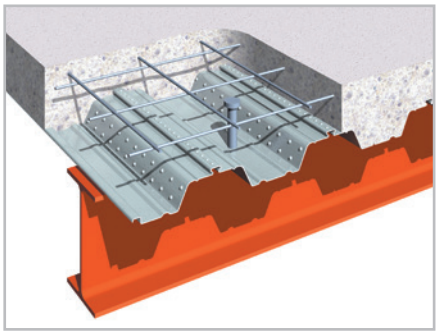
ComFlor 210 is a long span composite deck that offers unpropped spans to 5.5m and propped spans to 9m with a corresponding reduction in steelwork. When combined with asymmetric beams, the deck can be contained within the beam depth, which produces a “slim floor”, leading to reduced overall building height and savings in cladding costs, or enables an extra storey to be added for buildings of 10 storeys plus. The shape of the CF 210 deck permits services to be installed effectively within the slab depth, allowing further reductions to the floor zone.



ComFlor® 80

ComFlor 80 is a new generation composite steel deck that offers longer spans, minimised concrete volumes, and sets new benchmarks for shallow slab construction efficiencies.

The large curved corner, combined with the use of high strength G500 galvanised steel, stretches unpropped continuous spans to 5.3 metres and propped spans to 7.1 metres. Longer spans simplify and reduce the number of support beams in the steel frame, driving down overall construction cost.

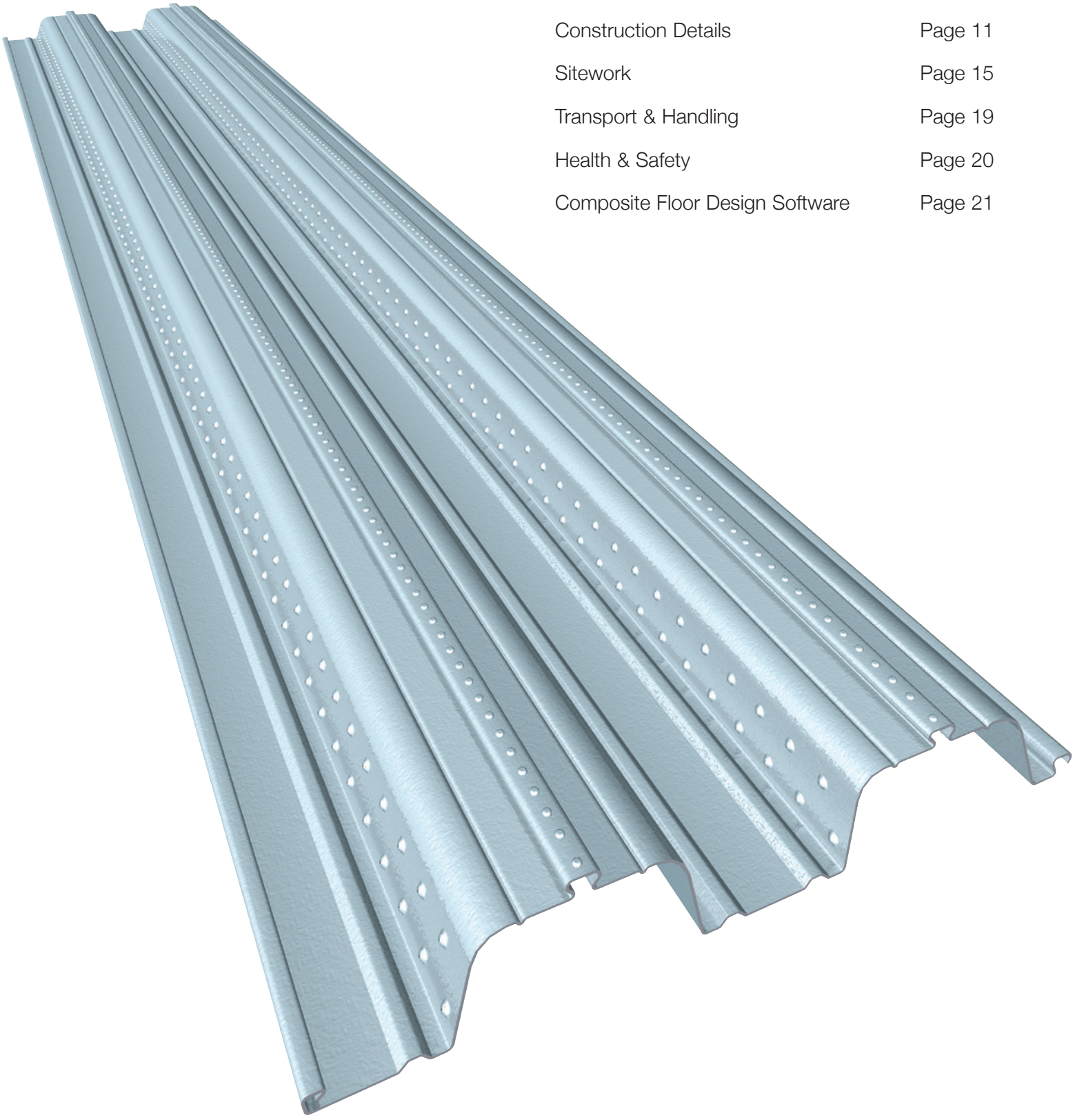


ComFlor® 60

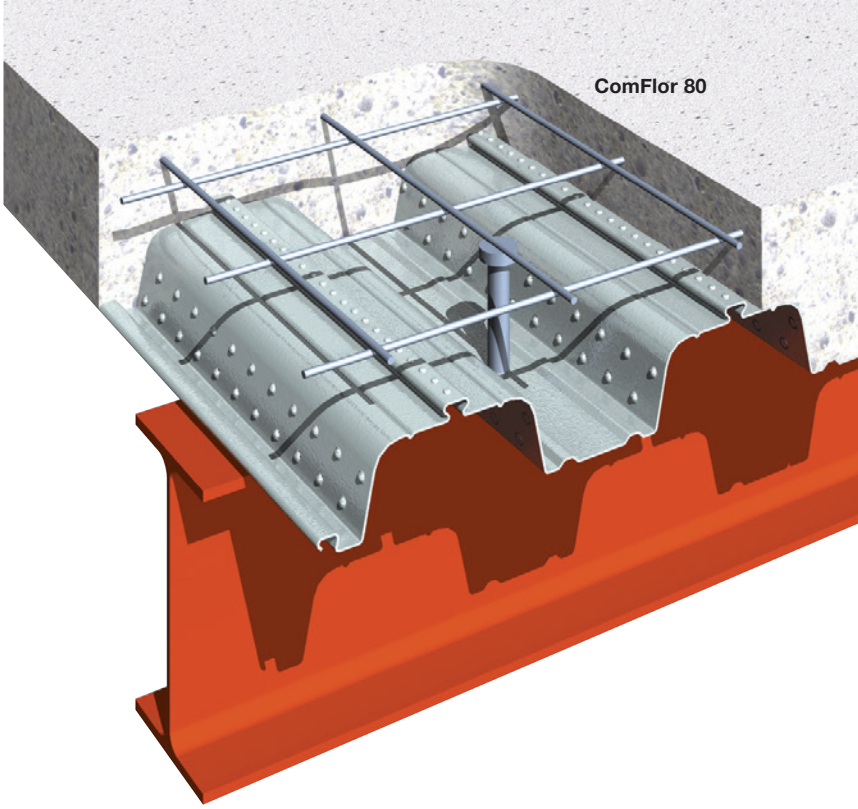
ComFlor 60 composite floor profile offers the ultimate in lightweight steel decking for all multi-rise buildings. It combines exceptional spanning capabilities with reduced concrete usage to provide a cost-effective and attractive floor solution that is easy to install.

The state-of-the-art profile has been developed using modern roll-forming techniques. Capable of unpropped continuous spans to 4.5 metres and propped spans to 6.8 metres.

Contents



ComFlor® 80



Rethinking Construction

ComFlor® 80 is a new generation of steel composite decking that offers longer spans, minimised concrete volumes, and sets new benchmarks for shallow slab construction efficiencies.

The efficiency and spanning capacity of the trapezoidal profile is enhanced by the large curved corner and the use of high strength G500 galvanised steel to give major performance advantages.

Proven construction economies

ComFlor 80 has a wide range of applications, is fast to construct, lightweight, and provides a safe working platform so that the building process can continue without delay

Unpropped spans of up to 5.2m

Design software is available to give unpropped double span options of up to 5.2m. Longer deck spans broaden beam spacing and reduce the number of the support beams, resulting in rapid erection and savings on the cost of the supporting steelwork

Reduced slab depth and concrete usage

The slab depth required for fire and structural design is minimised by the profile design. Concrete usage is further reduced by the profile shape, which eliminates an effective 44mm from the slab depth. Reduced slab depth and concrete volumes results in lower overall floor height, reduced dead loads on the structure and foundations, and savings on the total cost of the building structure

Central stud placement ensures correct stud location

The centralised stud position ensures optimum capacity of the shear connectors, enhancing composite action, while reducing the need for site checking of stud location. The result is saving on beam weights and reduced construction risk

Standard shear studs are effective with ComFlor 80

The Steel Construction Institute confirmed in Note AD147 that the shear connectors should extend at least 35mm above the top of the main trapezoidal section. The CF 80 profile depth is 95mm including the top re-entrant section and the trapezoidal height is 80mm meaning that a standard 125mm stud is suitable for use with the ComFlor 80 profile

Fire properties of the ComFlor 80 profile

Tests have confirmed the top re-entrant dovetail has no effect on the transmission of heat energy through the slab.

The effective profile height of 80mm results in a reduced overall slab depth being required for any particular fire rating. Fire ratings of 3 hours are possible with CF 80

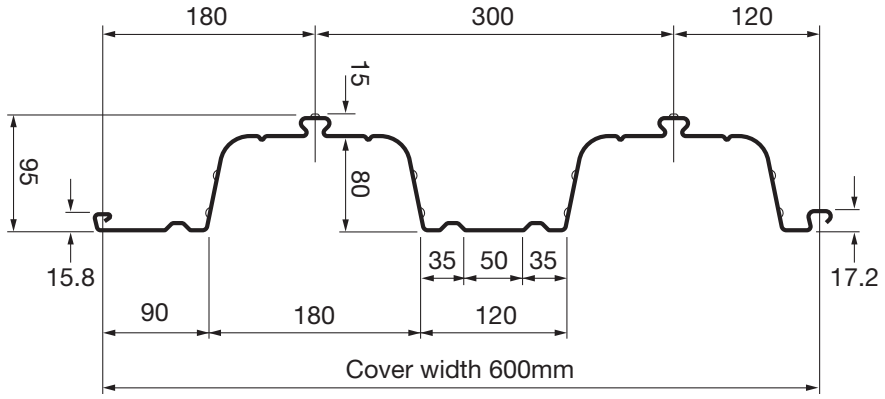
Design software tools

ComFlor Software is available for the design of slabs with up to 3-hour fire rating to BS 5950 or Eurocodes. The profile has been rigorously tested at Imperial College, London. The ComFlor Software has been independently produced and verified by the Steel Construction Institute in the United Kingdom

Low cost ceiling and services hanger systems

The dovetail re-entrant allows for quick and easy suspension of ceilings and services using low cost hanger fixings

ComFlor® 80 Design information



ComFlor 80 Composite Slab - Volume & Weight			
Slab Depth (mm)	Concrete volume (m^3/m^2)	Weight of Concrete (kN/m^2) Normal weight Concrete Wet	Dry
140	0.096	2.26	2.21
150	0.106	2.50	2.44
160	0.116	2.73	2.67
170	0.126	2.97	2.90

Volume & weight table notes

1. Deck and beam deflections (i.e. ponding) is not allowed for in the table.
2. Deck and mesh weight is not included in the weight of concrete figures.
3. Density of concrete is taken as:

Normal weight (wet) 2400 kg/m^3

Normal weight (dry) 2350 kg/m^3

Section Properties (per metre width)					
Nominal thickness (mm)	Profile weight (kN/m^2)	Area of steel (mm^2)	Moment of inertia (cm^4/m)	Ultimate Moment capacity (kNm/m) Sagging	Hogging
0.90	0.11	1387	185	15.4	12.5
1.2	0.15	1871	245	22.2	18.5

Design Notes

Deck material

Zinc coated steel to AS 1397 G500, Z275, with a guaranteed minimum yield stress of 500 N/mm^2. Minimum zinc coating mass is 275 g/m^2 total including both sides.

Quick reference tables

The quick reference load/span and fire design table is intended for initial design based on the parameters stated. It is recommended that the final design should be verified using the ComFlor design software.

For variants of slab depth, loads, including line loads or point loads, please use the ComFlor design software.

Anti-crack mesh

BS 5950: Part 4 currently recommends that anti-crack mesh should comprise 0.1% of slab area. The Eurocode 4 recommendation is that anti-crack mesh should comprise 0.2% of slab area for unpropped spans and 0.4% of slab area for propped spans.

The Steel Construction Institute has agreed to modify the requirement with regard to anti-crack mesh, to comply with the Eurocode 4 recommendations. Accordingly, the mesh shown in the quick reference tables complies with EC4 and the ComFlor design software defaults to these values. Where EC4 mesh rules are used, the mesh may be reduced midspan - see Design Information on page 7.

The reduced BS mesh values may still be used by overriding the default in the ComFlor design software. The mesh top cover default is 30mm in the ComFlor design software and can be overridden to suit the environmental conditions of the slab. See page 7. Mesh laps are to be 300mm for A142 mesh and 400mm for A193, A252 & A393 mesh.

A142 equates to $142mm^2/m$ cross sectional area of the mesh.

For the New Zealand equivalent mesh sizes see page 7.

Fire

Please refer to the ComFlor design software for details of composite slabs under fire conditions.

The capacity of the slab in fire can be calculated using:
The Simple Method using standard anti-crack mesh.

For full fire engineering the Fire Engineering Method using standard mesh, plus bar reinforcement in each rib, should be used.

Technical Services

A comprehensive advisory service for the design of composite flooring is available to all specifiers and users.

Should queries arise which are not covered by this literature or by the ComFlor design software, please contact us at comflor@comflor.co.nz or call +64 9 271 1780.

ComFlor® 80 Quick Reference Tables

Load Span Table - Normal Weight Concrete

Props	Span	Fire Rating	Slab Depth (mm)	Bar No	Mesh Type	MAXIMUM SPAN (m) Deck Thickness 0.9 (mm) Superimposed Live Load (kPa) 1.5	2.5	3.0	4.0	Deck Thickness 1.2 (mm) 1.5	2.5	3.0	4.0
						Superimposed Dead Load (kPa) 0.8	0.1	0.8	1.0	0.8	0.1	0.8	1.0
No Temporary Props	Single span	0.5 hr	140	0	A142	4.10	4.10	4.10	4.10	4.40	4.40	4.40	4.40
		1 hr	150	0	A252	4.00	4.00	4.00	4.00	4.30	4.30	4.30	4.30
	Double span	0.5 hr	140	0	A142	4.55	4.55	4.55	4.55	5.10	5.20	5.05	5.00
		1 hr	150	0	A252	4.55	4.55	4.55	4.55	5.20	5.20	5.20	5.00
1 Row of Temporary Props	Single span	0.5 hr	140	One per tough	A252	5.50	5.60	5.20	4.95	5.70	5.75	5.35	5.10
		1 hr	150	One per tough	A393	5.60	5.70	5.50	5.20	5.80	5.90	5.60	5.35
	Double span	0.5 hr	140	One per tough	A252	5.50	5.60	5.30	5.00	5.70	5.80	5.45	5.30
		1 hr	150	One per tough	A393	5.60	5.60	5.55	5.30	5.80	5.90	5.75	5.45

Parameters assumed for quick reference span tables

All spans are shown in metres.

ComFlor design software is available on CD by contacting us at comflor@comflor.co.nz or call +64 9 271 1780 or online at **www.comflor.co.nz**

Steel Grade In New Zealand ComFlor 80 is manufactured from Grade 500 strip with a minimum yield of 500 MPa. For deck material specification see previous page.

Spans Measured centre to centre of support. The support width is 150mm in tables.

Prop Width Assumed to be 100mm.

Mesh See notes on previous page.

Concrete Grade The concrete is assumed to be Grade 30 (25MPa Cylinder Strength) with a maximum aggregate size of 20mm. The wet weight of concrete is taken to be 2400kg/m^3. The modular ratio is 10 for normal weight concrete.

Construction Load 1.5kN/m^2 is taken into account in accordance with BS5950: Part 4. No allowance has been made for heaping of concrete during the casting of the slab.

Superimposed Live Load In the fire condition the proportion of occupancy imposed load considered as non-permanent is taken as 0.5.

Superimposed Dead Load The loads stated in the table are to cover partitions, finishes, ceilings and services. The dead load of the slab has been taken into account and need not be considered as part of the applied load.

Fire Insulation The minimum slab thickness indicated in the table satisfies the fire insulation requirements of BS5950: Part 8.

Simplified Fire Design Method For unpropped spans the fire ratings in the tables are based on Simplified Design Method.

Fire Engineering Method For propped spans the fire ratings in the table is based on the Fire Engineering Method. To calculate the reinforcement needed for fire, load and span conditions, please use the ComFlor design software

Deflections Construction Stage L/130 or 30mm - ponding has been taken into account.

Composite Stage L/350 but not greater than 20mm.

Total Load Deflection L/250 but not greater than 30mm.

Shallow Composite Floor Decks
-Design information

Composite Floor Decking design is generally dictated by the construction stage condition, the load and span required for service, and the fire resistance required for the slab. The deck design is also influenced by the composite beam design.

Design Parameters

- **Fire rating –** dictates minimum slab depth.
- **Concrete weight –** also dictates minimum slab depth and influences the unpropped deck span.
- **Deck span –** (unpropped) usually dictates general beam spacing.
- **Slab span –** (propped deck) dictates maximum beam spacing.

Two Stage Design

All Composite Floors must be considered in two stages.

- **Wet Concrete and Construction Load** – carried by deck alone.
- **Cured Concrete**

  – carried by composite slab.

General Design Aims

Generally designers prefer to reduce the requirement to provide temporary propping and so the span and slab depth required governs the deck selection.

Fire requirements usually dictate slab depth. For most applications, the imposed load on the slab will not limit the design.

Quick Reference and Full Design

The combination of this manual and ComFlor® Design Software makes both quick reference and full design easy. Indicative design may be carried out from the printed tables; however the final design should be verified using the ComFlor Design Software. This also greatly increases the scope available to the Design Engineer and allows the engineer to print a full set of calculations which can be used for submission to a Local Authority.

British Standards and Eurocodes

The ComFlor design software user is offered a choice to design to BS5950: Parts 3 and 4, or to Eurocode 4.

However, New Zealand users are recommended to use the BS5950 option.

The quick reference tables are designed to BS5950: Part 4, with the important exception of the mesh recommendations.

Anti-crack mesh

The flexural reinforcement requirements over supporting beams may be specified by the user to minimise flexural crack widths to suit the use of the floor.

The provisions of BS5950: Part 4 are recommended as the most acceptable for control of shrinkage and temperature cracking in NZS3404 C13.2.2.

BS5950: Part 4 currently recommends that anti-crack mesh should comprise 0.1% of slab area. The Eurocode 4 recommendation is that anti-crack mesh should comprise 0.2% of slab area for unpropped spans and 0.4% of slab area for propped spans.

The Steel Construction Institute has agreed to modify the requirement with regard to anti-crack mesh, to comply with the Eurocode 4 recommendations. Accordingly, the mesh shown in the quick reference tables complies with EC4 and the ComFlor design software defaults to these values. The reduced BS mesh values may still be used by overriding this default in the ComFlor design software.

Reference should be made to NZS3101 to confirm the exposure classification and the cover for the reinforcement mesh. Mesh laps are to be 300mm for A142 mesh and 400mm for A193, A252 & A393.

The New Zealand equivalent mesh sizes are identified as follows:

Mesh Type	Sectional Area mm²/m	HRC Sheet Type
A142	142	665, D147
A193	193	663, D212
A252	252	662, D264
A393	393	333

Reduced Mesh

Where EC4 mesh rules are used, as recommended by the Steel Construction Institute, the full stipulated mesh applies to the slab 1.2m either side of every support. Outside of this, i.e. in the mid-span area, the mesh area may be halved (to 0.2% for propped and 0.1% for unpropped construction), provided there are no concentrated loads, openings etc. to be considered. Also the reduced mid-span mesh must be checked for adequacy under fire, for the rating required.

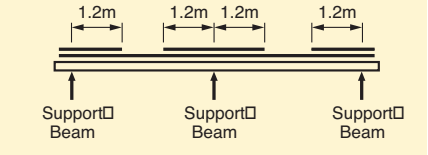


Diagram showing full mesh area over supports

Bar Reinforcement

The Axis Distance of bar reinforcement defines the distance from the bottom of the ribs to the centre of the bar, which has a minimum value of 25 mm, and a maximum value of the profile height. Where used, bar reinforcement is placed at one bar per profile trough.

Transverse Reinforcement

ComFlor composite floor decks contribute to transverse reinforcement of the composite beam, provided that the decking is either continuous across the top flange of the steel beam or alternatively that it is welded to the steel beam by stud shear connectors. For further information refer to BS5950: Part 3: Section 3.1.Clause 5.6.4.

Concrete Choice

In design to BS5950 the cube strength is used. Therefore the concrete grade in the ComFlor design software C30 refers to the cube strength value.
The strength of the concrete must meet the requirements for strength for the composite slab and shall not be less than 25MPa (cube strength) for NWC. Similarly, the maximum value of concrete strength shall not be taken as greater 50MPa (cube strength) for NWC.

In design to Eurocode 4, the cylinder strength is used. The concrete grade (C25/30) defines the (cylinder/cube strength) to EC 4.

In design to NZS3404 and NZS3101, the 28 day cylinder strength is used. Generally a cylinder test strength is around 80% of a cube test strength for a given concrete mix.

The following relative values of cylinder and cube strengths can be used to convert between cylinder and cube strengths for the purposes of the ComFlor design software and this brochure.

Cube Strength	Cylinder Strength
MPa	MPa
25	20
30	25
37	30

Shallow Composite Floor Decks
-Design information

Concrete Density
In the absence of more precise information, the following assumptions may be made:

	Density kg/m³		
	Wet	**Dry**	**Modular Ratio**
LWC	1900	1800	15
NWC	2400	2350	10

The wet density is used in the design of the profiled steel sheets and the dry density in the design of the composite slab.

Fire Design

Fire Insulation
The fire insulation requirements of BS 5950: Part 8 must be satisfied and are taken into account in the tables and design software.

Shear Connectors in Fire Situation
If shear connectors are provided, any catenary forces transferred from the slab to the support beams can be ignored within the fire resistance periods quoted.

Fire Design Methods
There are two requirements for fire design:

Bending resistance in fire conditions.

Minimum slab depth for insulation purposes.

The capacity of the composite slab in fire may be calculated using either the Simple Method or the Fire Engineering Method. The Simple Method will be the most economic. The Fire Engineering Method should be used for design to Eurocodes.

The Simple Method:
The Simple Method may be used for simply supported decks or for decks continuous over one or more internal supports. The capacity assessment in fire is based on a single or double layer of standard mesh. Any bar reinforcement is ignored.

The Fire Engineering Method:
The Fire Engineering Method is of general application.

The capacity assessment in fire is based on a single or double layer of standard mesh at the top and one bar in each rib.

The ComFlor® design software assumes the bar is positioned just below the top of the steel deck. For CF 80 with a raised dovetail in the crest, the bar will be placed below the dovetail.

For unpropped spans the quick reference table uses the Simplified Fire Design Method which utilises the anti-crack mesh as fire reinforcement.

For propped spans the quick reference table uses the increased load span capability under fire realised by including bar reinforcement and using the Fire Engineering Design Method.

Deflection Limits
In the absence of more appropriate information, the following limits should be adopted:

Construction Stage Deflection:
The construction stage deflection is based on unfactored dead loads only. Construction loads are not considered.

Deflection limits for the decking are given in BS5950: Part 4.

The main reason for limiting deflections at the construction stage is to limit the volume of concrete that is placed on the deck; excess deflections will lead to ponding of the concrete, and this will increase the dead loads on the structure. These deflections should not normally exceed the following:

a) Lp/180 (but not greater than 20 mm) when the effects of ponding are not taken into account.

b) Lp/130 (but not greater than 30mm)

According to BS5950, when the deflection exceeds Ds/10, where Ds is the overall depth of the composite slab, the additional weight of concrete due to the deflection of the sheeting is to be taken into account in the self-weight of the composite slab.

Therefore ponding, resulting from the deflection of the decking, is only taken into account by the ComFlor design software for CF 80 if the construction stage deflection exceeds Ds/10. (Excluding non-structural screeds).

For unpropped construction it is recommended the construction stage deflection in the ComFlor design software be maintained at the default Span/130. The deflection limit can be reduced from 30mm as required.

The help function in the ComFlor design software contains all the detailed information that is used to produce the calculations.

Imposed Load Deflection:
Lp/350 (but not greater than 20mm)

The deflection under imposed loads is the deflection of the slab under imposed loads only. This value should be used in assessing the effect of the deflection of the slab on finishes etc.

Total Load Deflection:
Lp/250 (but not greater than 30mm)

The total deflection is the deflection of the slab under all applied loads - dead, imposed and superimposed dead, less the construction stage deflection (see above). This value takes into account the effect of creep of the concrete under dead loads and any additional deflection due to prop removal.

Two values are calculated for the deflection of the slab (composite stage deflection):

- The deflection under imposed loads,
- The total deflection.

For propped construction, the total deflection is the deflection of the slab on removal of temporary props. In this case, all loads are applied to the composite section.

Lp is the span of the decking between effective supports in metres.

Vibration
The ComFlor design software will, in addition, check the dynamic sensitivity of the composite slab in accordance with the SCI publication P076: Design Guide on the Vibration of Floors.

The natural frequency is calculated using the self-weight of the slab, ceilings and services, screed and 10% imposed loads, representing the permanent loads on the floor.

Loads and Load Arrangement
Reference should be made to AS/NZ1170 for live load conditions.

Factored loads are considered at the ultimate limit state. These are obtained by multiplying the characteristic values of the applied loads by partial safety factors.

The ComFlor default partial safety factors on Datasheet 2 are taken from BS5950 Part 4. Reference can made to the help notes in the ComFlor design program.

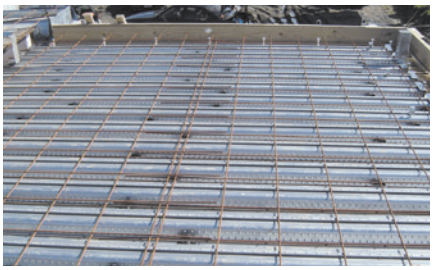
Unfactored loads are considered at the serviceability limit state, and in fire conditions.

Loads considered at the construction stage consist of the slab self weight and the basic construction load. The basic construction load is taken as 1.5kN/m^2 or 4.5/Lp (whichever is greater), where Lp is the span of the decking between effective supports in metres.

For multi span unpropped construction, the basic construction load of 1.5N/m^2 is considered over one span only. On other spans, the construction load considered is half this value (i.e. 0.75kN/m^2).

Construction loads are considered as imposed loads for this check.

Loads considered at the normal service stage consist of the slab self weight, superimposed dead loads and imposed loads.



Shallow Composite Floor Decks
-Design information

Openings

Openings can be accommodated readily in composite slabs by boxing out prior to pouring concrete and cutting out the deck after the concrete has cured (see Sitework section on page 18).

The design of openings depends on their size:

Small
Openings up to 300 mm square do not normally require additional reinforcement.

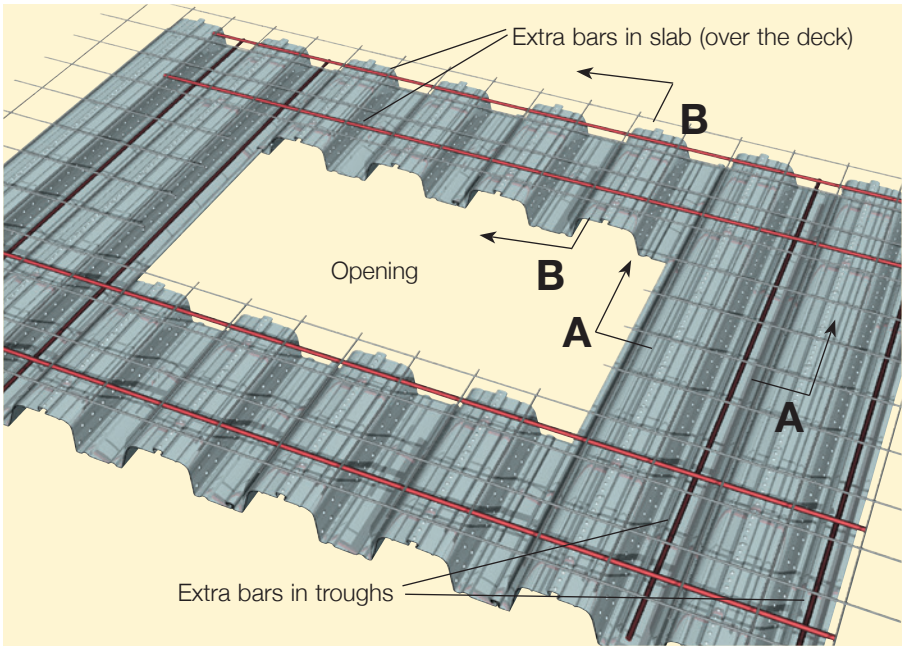
Medium
Openings between 300 mm and 700 mm square normally require additional reinforcement to be placed in the slab. This is also the case if the openings are placed close together.

Large
Openings greater than 700mm square should be fully trimmed with additional permanent support steelwork.

Opening Rules
Where W = width of opening across the span of the deck.

1. The distance between the opening and an unsupported edge must be greater than 500mm or W (whichever is greater).
2. Openings must not be closer together than 1.5W (of the largest opening) or 300mm, whichever is the greater. If they are closer they must be considered as one opening.
3. Not more than ¼ of the width of any bay is to be removed by openings.
4. Not more than ¼ of the deck span is to be removed by openings.

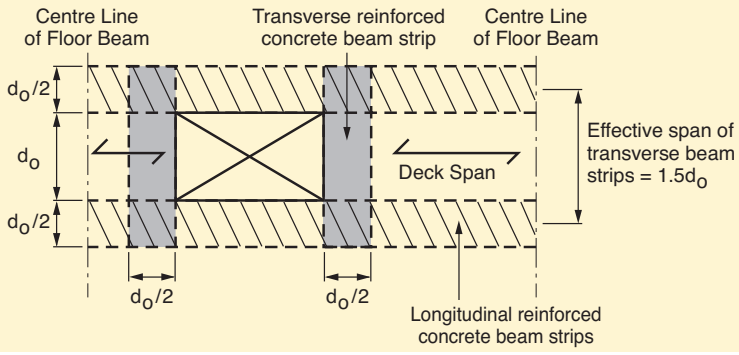
Where these rules are not satisfied, the openings must be fully trimmed with permanent support steelwork.



Reinforcement around opening

If the opening falls within the effective breadth of the concrete flange of any composite beam (typically span/8 each side of the beam centre line), the beam resistance should be checked assuming an appropriately reduced effective breadth of slab.

Slab design around openings
It may be assumed that an effective system of 'beam strips' span the perimeter of the opening. The effective breadth of the beam strips should be taken as $d_o/2$, where 'd_o' is the width of the opening in the direction transverse to the decking ribs. Only the concrete above the ribs is effective. The transverse beam strips are assumed to be simply supported and span a distance of $1.5d_o$. The longitudinal beam strips are designed to resist the load from the transverse beam strips, in addition to their own proportion of the loading.

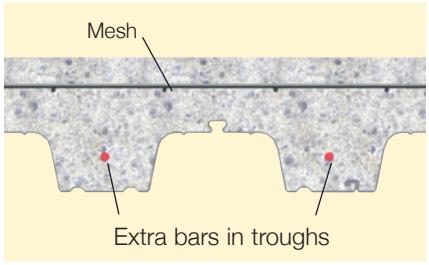


Load paths and beam strips around medium to large openings

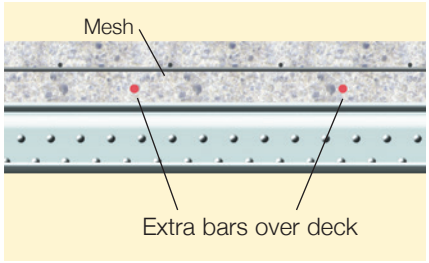
Reinforcement
Extra reinforcement is to be provided within the 'beam strips' to suit the applied loading. This reinforcement often takes the form of bars placed in the troughs of the decking.

Additional transverse or diagonal bars may be used to improve load transfer around the opening.

Section A-A



Section B-B



Shallow Composite Floor Decks
-Design information

Composite Beam Design
Savings in beam weight of up to 50% can be achieved when the composite slab is effectively anchored to the steel beam. The slab will then act as a compression flange to the beam.

The methods of connection between slab and beam is generally by means of through deck welding of 19mm diameter shear studs of varying height, which are fixed to the beam after the decking has been laid. The thickness of the top flange of the steel section must not be less than 0.4 times the stud diameter (e.g. 7.6mm for a 19mm stud).

Headed Stud Capacity
When the decking profile is oriented with the ribs running perpendicular to the steel beam, the welded shear capacity of headed studs (q_r) should be taken as given in the table. The table relates to 125 x19mm shear studs with a length after welding (LAW) of 120mm.

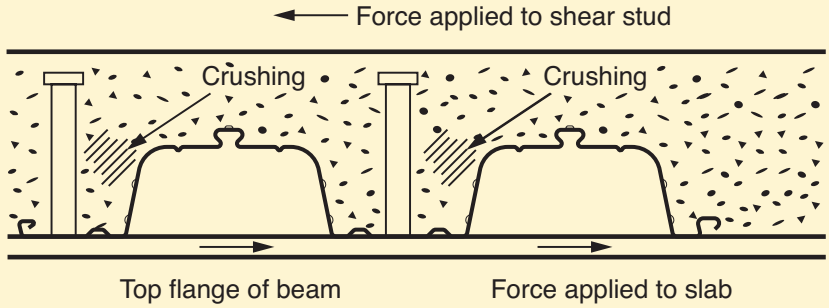
The shear capacity of the welded studs (q_r) has been derived from BS5950 Part 3 for use with the provisions of NZS3404 for composite beam design. As a result the stud capacities may be used with ComFlor® 80, which has a profile depth of 80mm.

Suitability of the CF 80 Deck
For the CF 80 deck, the position of the stiffeners and the offset side-lap rib dictates the centralised placement of studs.

CF 80 studs can only be placed in the centre of the profile, which means they are in the ideal position, ensuring optimum capacity of the stud while site supervision of the stud location is kept to a minimum.

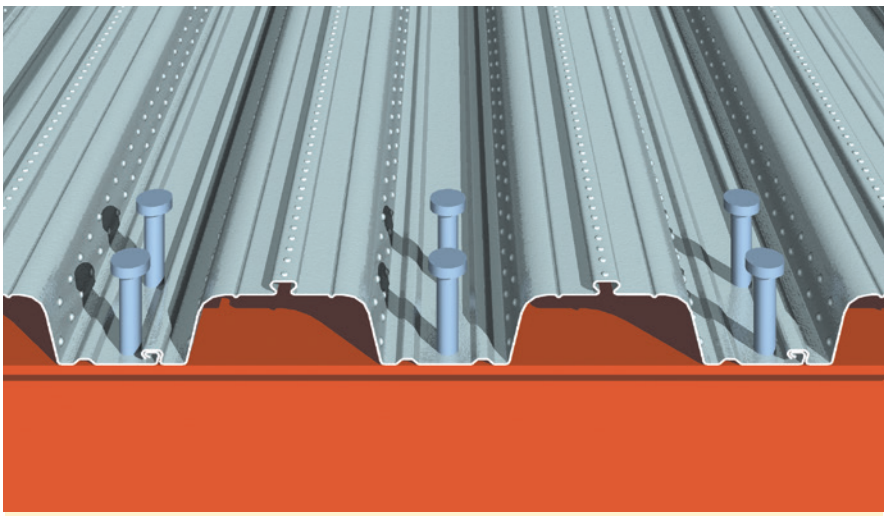
The profile height of the CF 80 profile is taken as 80mm - see page 5. Standard 125 x 19mm diameter shear studs (120mm LAW) are suitable for use with ComFlor 80.

Design Guide
The Steel Construction Institute / Metal Cladding & Roofing Manufacturers Association publication P300 - "Composite Slabs and Beams using Steel Decking: Best Practice for Design and Construction" is recommended for further reference.



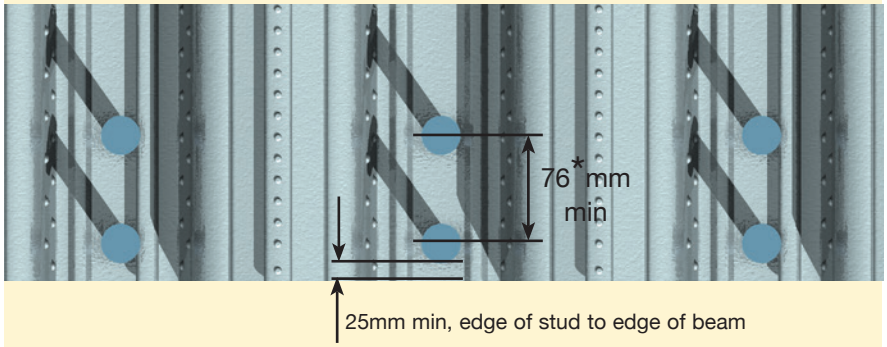
Welding of Shear Connectors with ComFlor 80

THROUGH DECK WELDED SHEAR STUD CAPACITY - q_r (kN/stud)		
NZS 3404	Centrally Placed Studs (19 x 125mm)	
Concrete Cylinder Strength f'_C	1 stud per rib	2 studs per rib
25MPa	62.8	44.2
30MPa	71.1	50.1



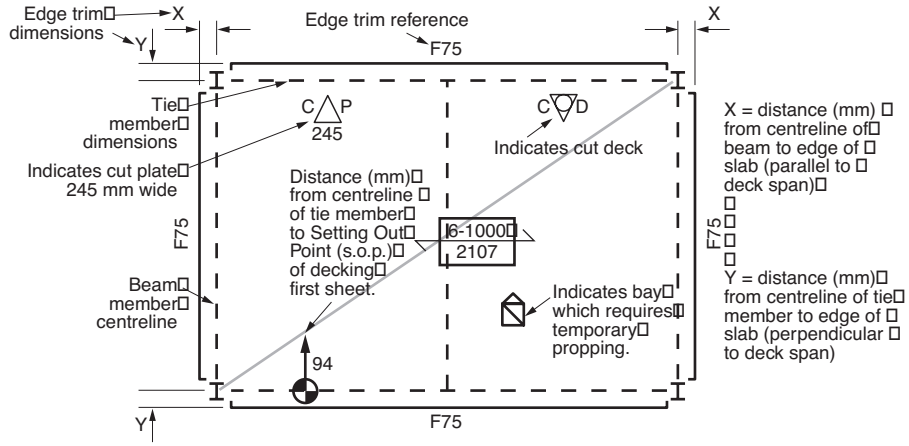
Centrally placed studs on CF 80

*76mm = 4d for 19mm studs

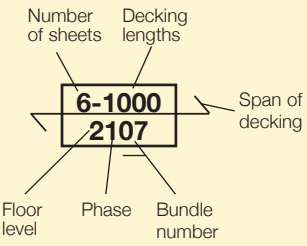


Shallow Composite Floor Decks
-Construction details

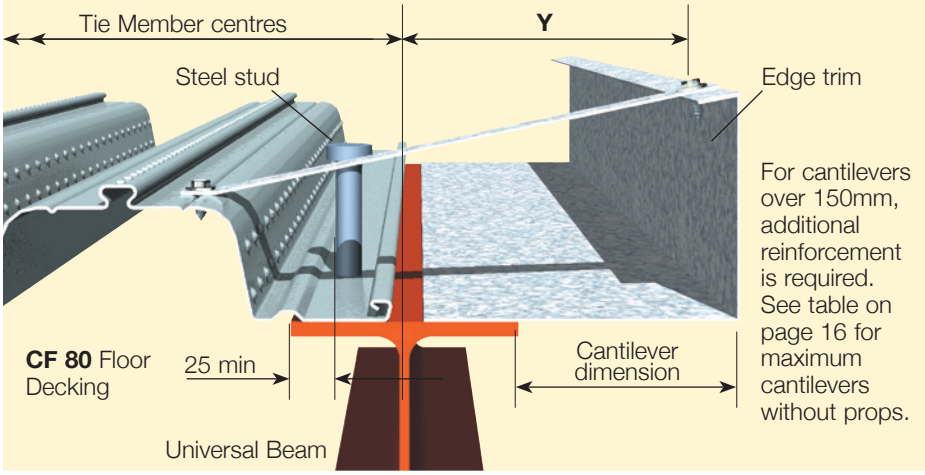
Plan view of typical floor layout



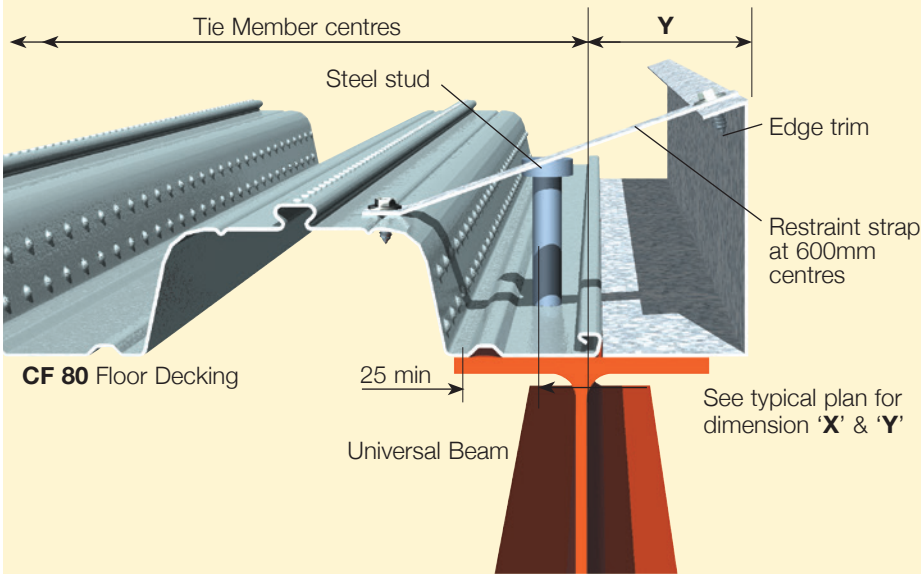
Deck notation



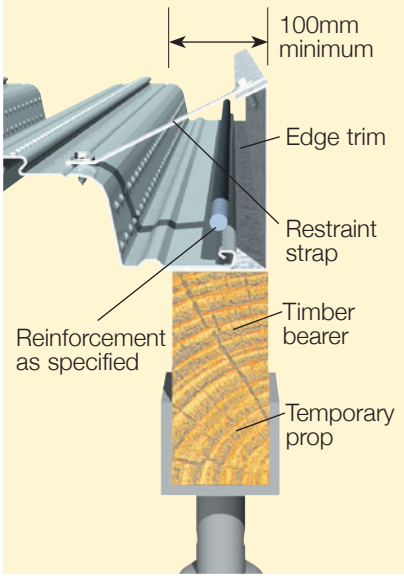
Typical side detail



Typical side detail

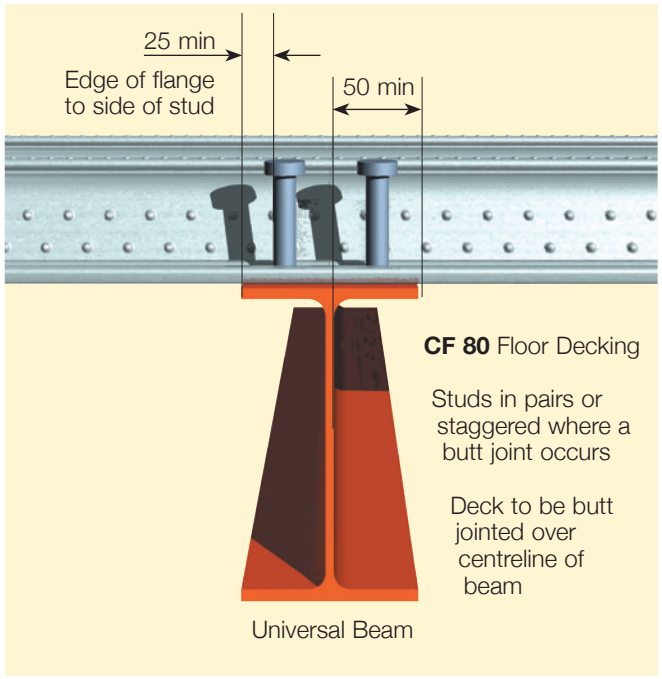


Unsupported edge detail

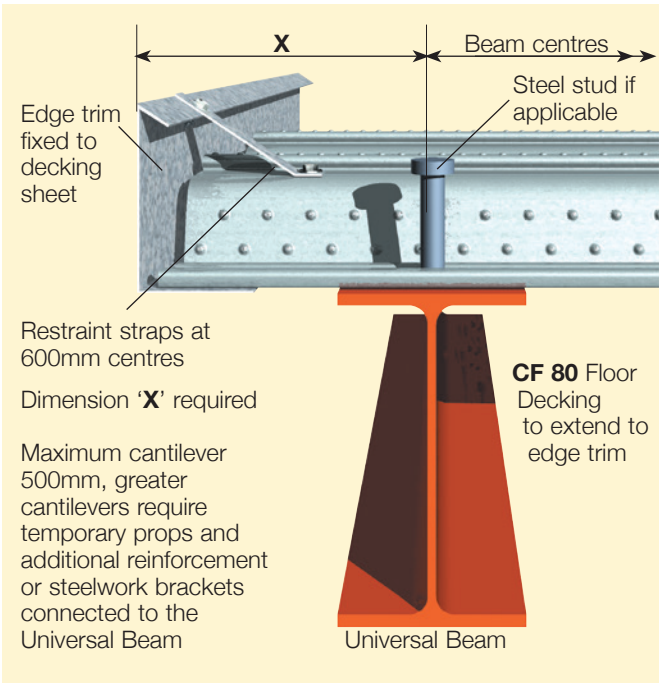


Shallow Composite Floor Decks
-Construction details

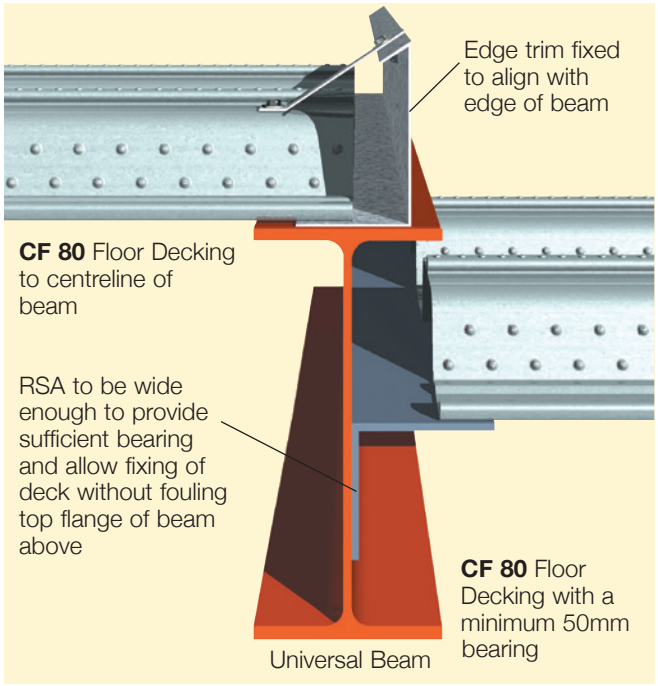
Butt joint



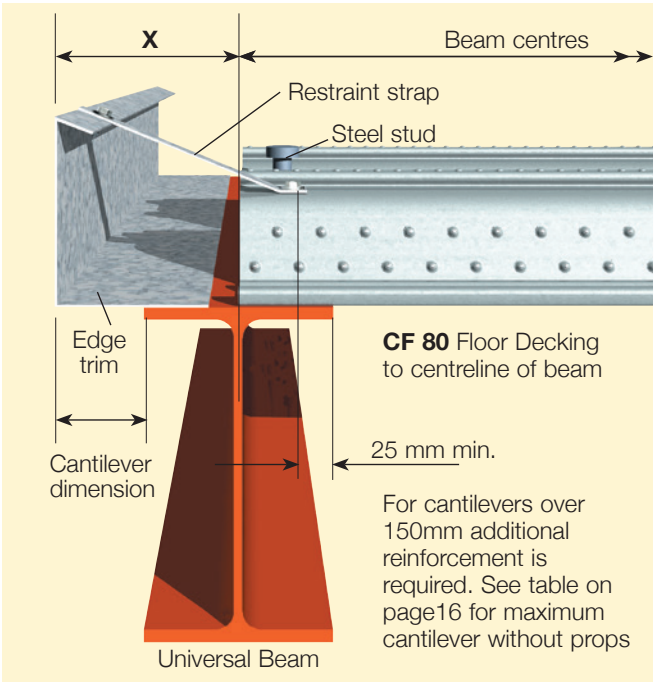
Typical end cantilever



Step in floor

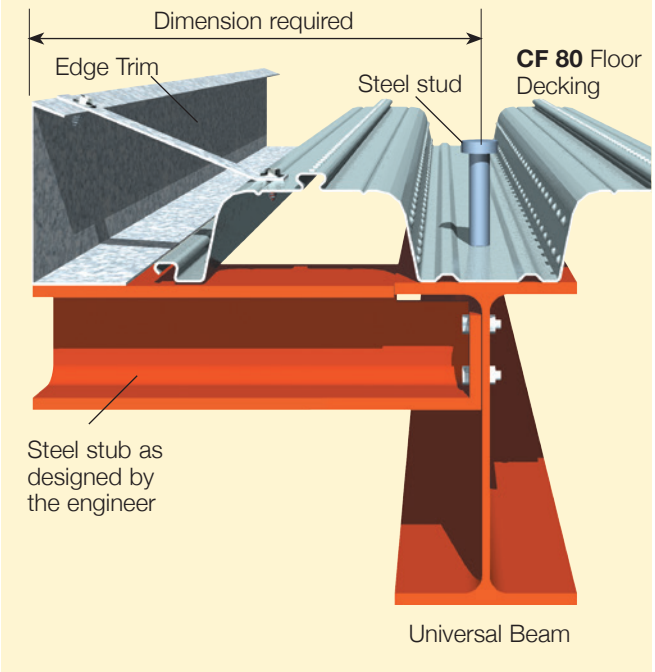


End detail

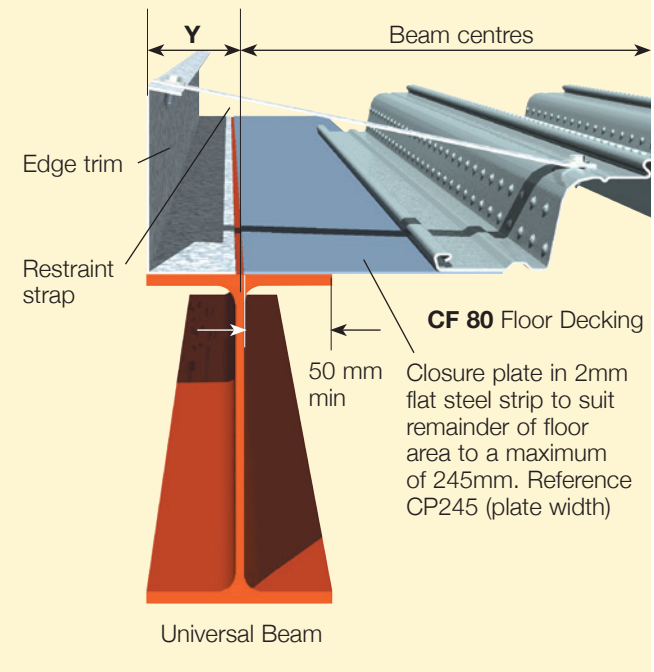


Shallow Composite Floor Decks
-Construction details

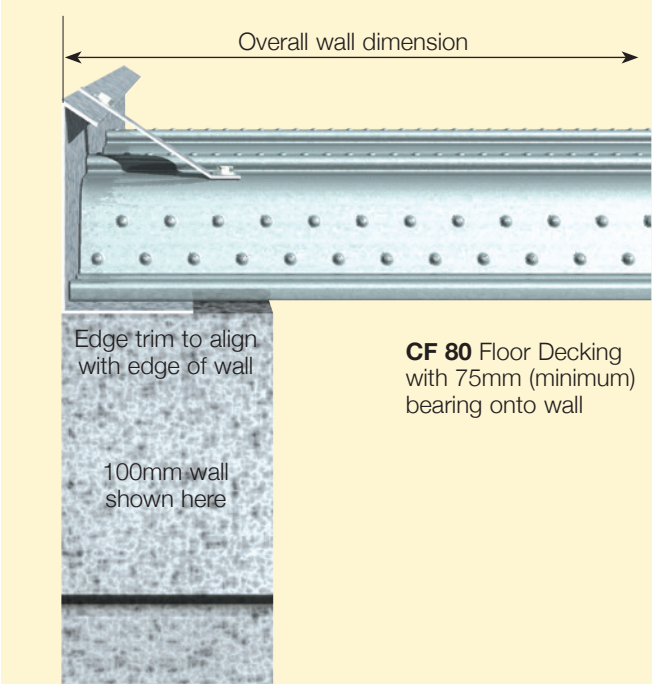
Side cantilever with stub bracket



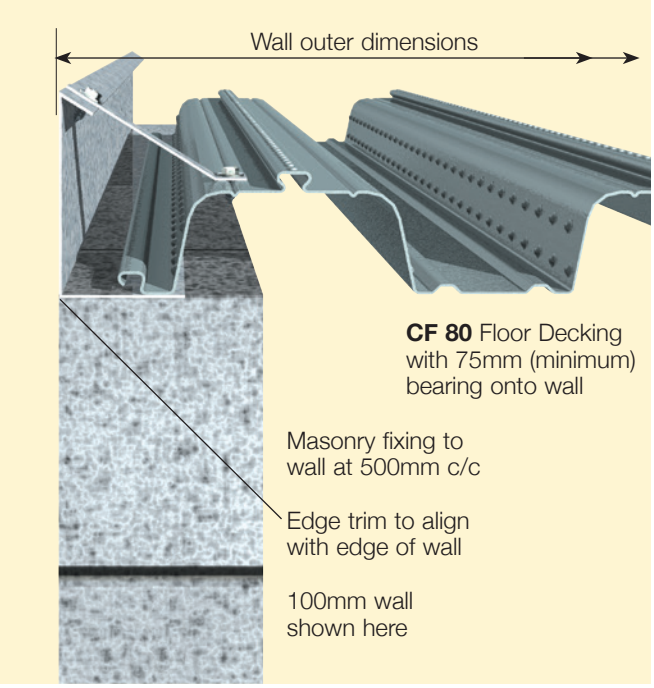
Typical edge with plate



Typical wall end detail

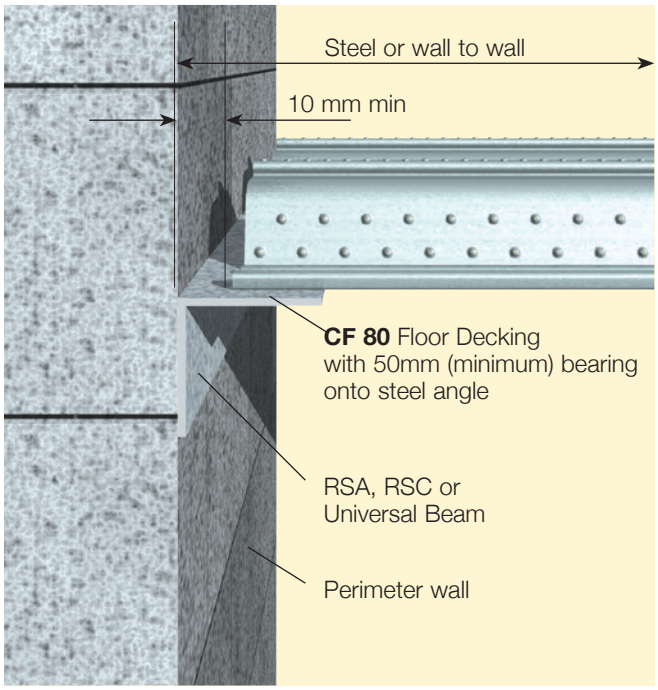


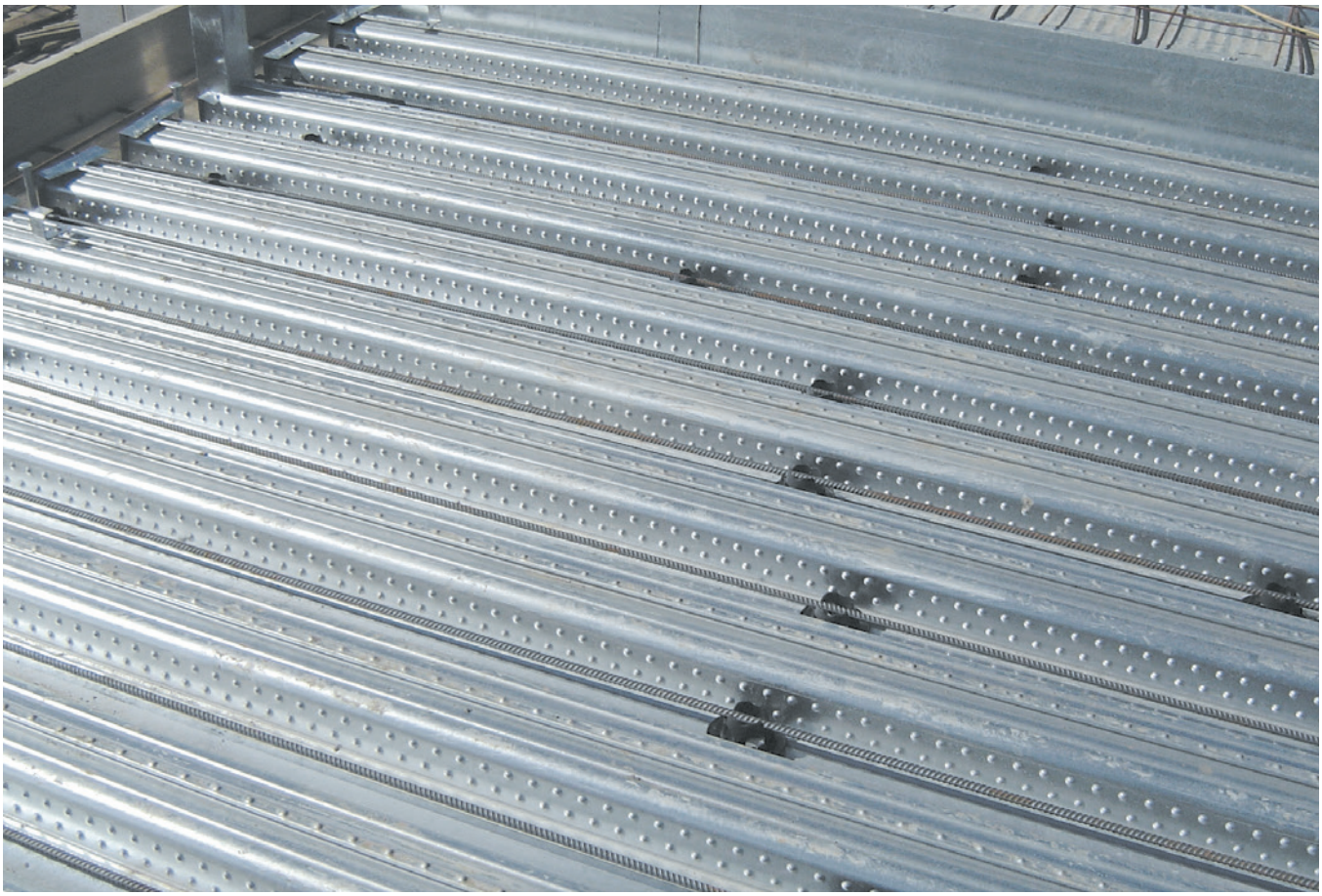
Typical wall side detail



Shallow Composite Floor Decks
-Construction details

Deck inside of wall detail





Shallow Composite Floor Decks
-Sitework

Deck fixing

Immediately after laying, the deck must be fixed through its trough to the top of the supporting structure. Powder actuated pins or self-drilling screws are used.
Side lap fixings are required at 1000mm centres for CF 80.
Where shear studs are being used, the deck requires two fixings per sheet per support at sheet ends and one fixing per sheet at intermediate supports.

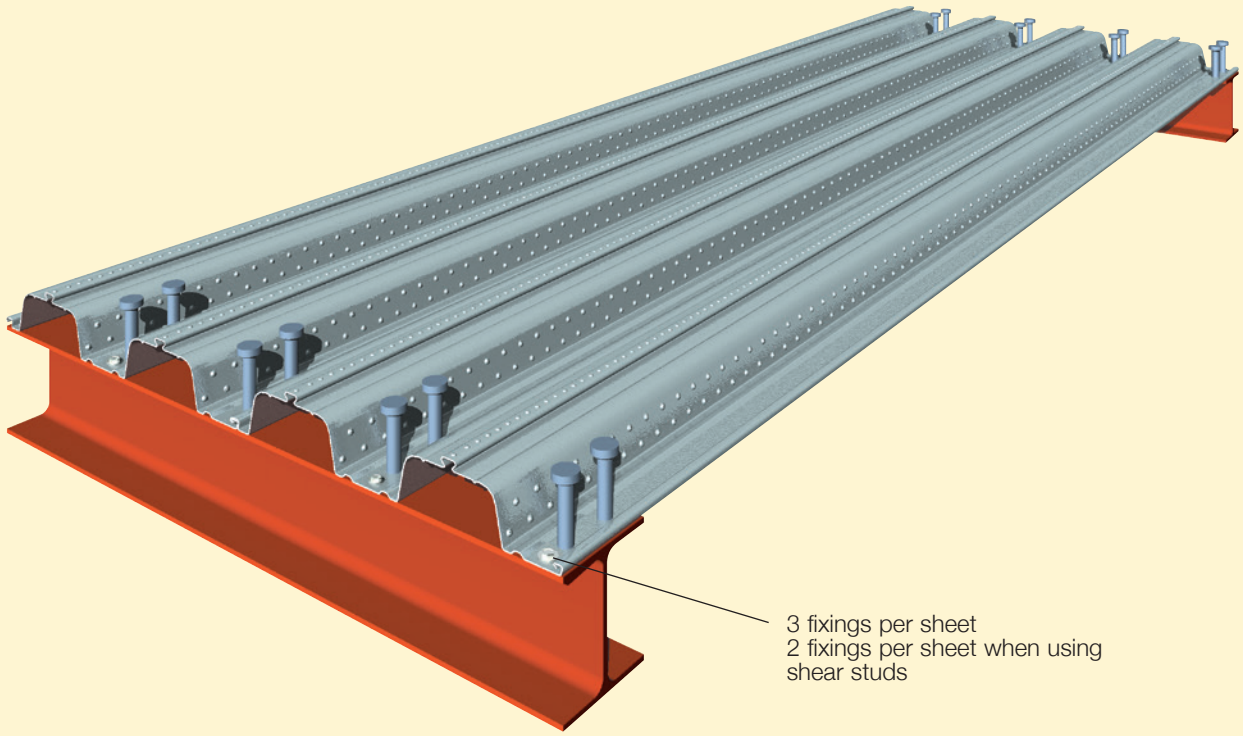
Fixing information for shallow decking

To steel	Heavy duty powder actuated fixings - Hilti ENP2 nail/Spit SBR14 or equivalent
	Self-drilling screws. To steel up to 11mm thick - SFS SD14 - 5.5 x 32 / EJOT HS 38 or equivalent. To steel up to 17mm thick SFS TDC-T-6.3 x 38 or equivalent
To masonry or concrete	Pre drill hole - use self tapping fixing suitable for masonry/ concrete - SFS TB-T range/EJOT 4H32 or equivalent
To side laps or closures etc.	Self drilling stitching screw typically SFS SL range / EJOT SF25 or equivalent

Fixing spacings

	ComFlor® 80
End fixing	3 per sheet (2 per sheet when using shear studs)
Intermediate supports	2 per sheet (1 per sheet when using shear studs)
Side fixing onto support	1 fixing at 600mm c/c

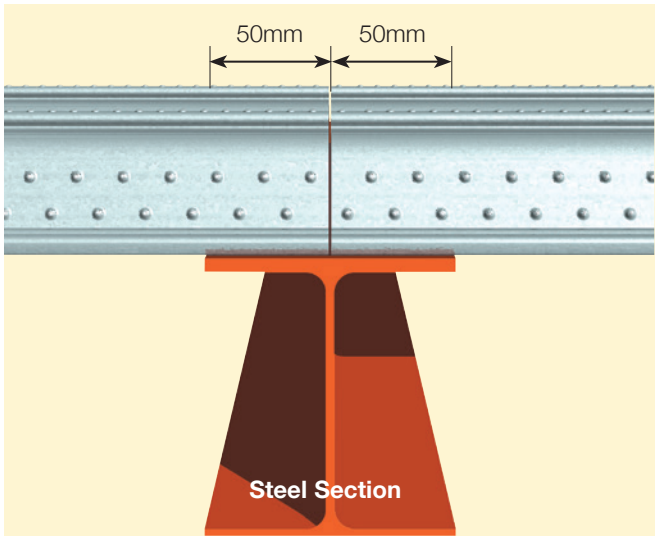
Deck fixing on CF 80



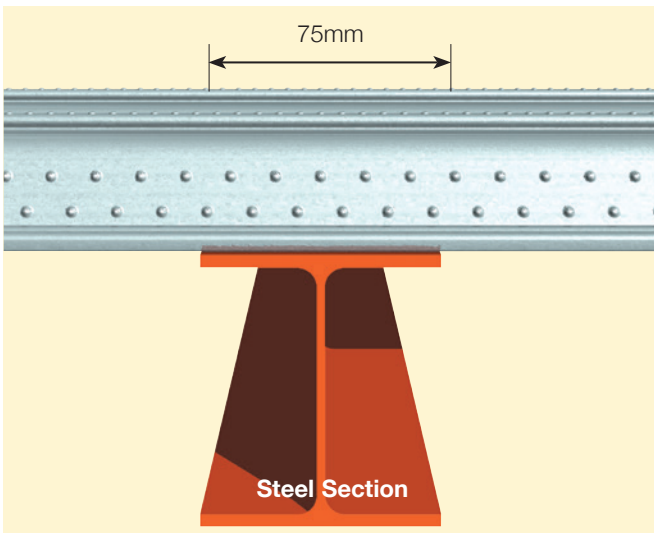
Shallow Composite Floor Decks
-Sitework

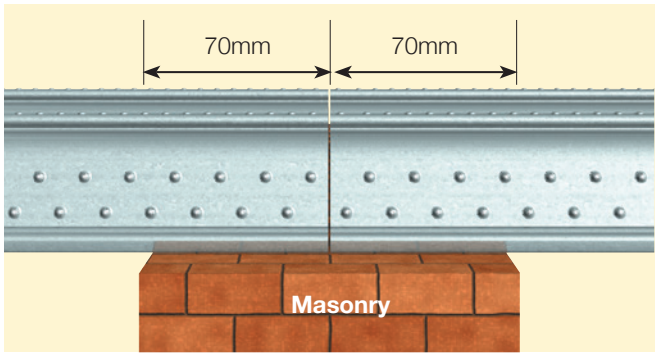
Bearing requirements

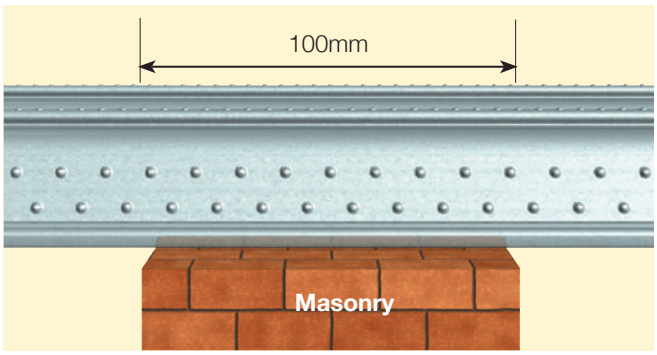
End bearing and shared bearing (minimum)



Continuous bearing (minimum)







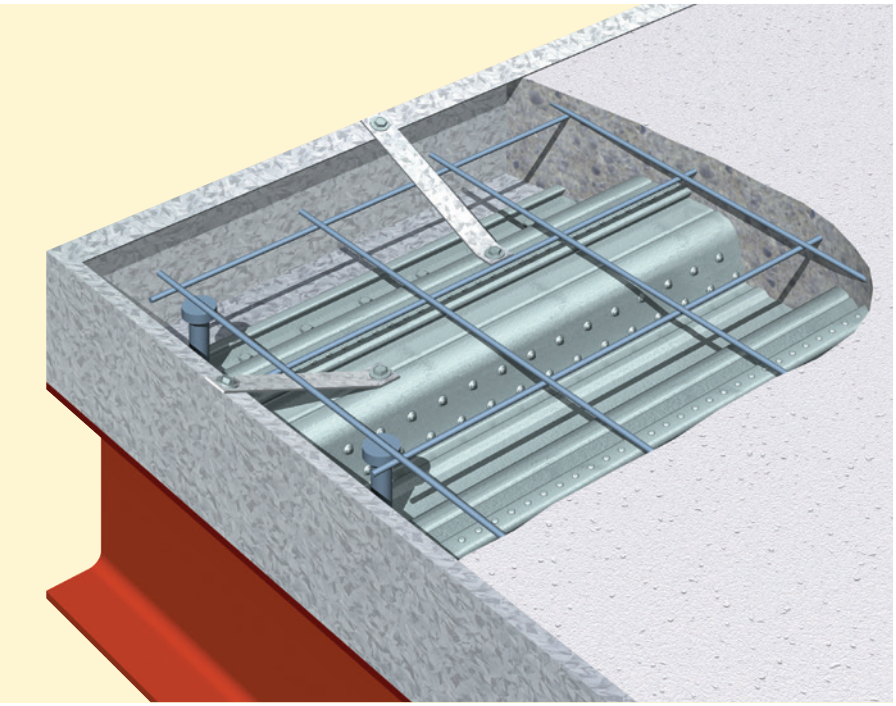
Edge Trim

This is used to retain the wet concrete to the correct level at the decking perimeters. It is fixed to the supports in the same manner as the deck and the top is restrained by straps at 600mm centres, which are fixed to the top of the deck profile, by steel pop rivets or self-drilling screws.

Edge Trim Selector

Edge Trim Depth	Maximum Cantilever (mm) Galv. Steel Edge Trim Thickness (mm) 0.9	1.2	1.6	2.0
130	100	125	160	195
150	0	115	150	185
200	x	100	130	160
250	x	0	100	135
300	x	x	0	100
350	x	x	x	0

x - not recommended



Shallow Composite Floor Decks -Sitework

Shear connectors

Most commonly used shear connectors are 19mm diameter headed studs, which are welded to the support beam through the deck, a process carried out by specialist stud welding contractors.
Site conditions must be suitable for welding and bend tests carried out as appropriate.
The spacing and position of the shear connectors is important and must be defined by the design engineer on the deck set out drawings.

Minimum Spacing: The minimum centre-to-spacing of stud shear connectors should be 5d along the beam and 4d between adjacent studs, where d is the nominal shank diameter.
Where rows of studs are staggered, the minimum transverse spacing of longitudinal lines of studs should be 3d.
The shear stud should not be closer than 25mm to the edge of the beam. See page 10.
Further guidance on shear studs for designers and installers may be found in the Steel Construction Institute publications: P300 Composite Slabs and Beams Using Steel Decking: Best Practice for Design and Construction, P055 Design of Composite Slabs and Beams with Steel Decking.

Mesh placement

Standard reinforcing mesh, such as A142, A193 and A252 is usually required, positioned towards the top of the slab. The top cover to the reinforcement mesh should be as specified by the design engineer. Support stools are required to maintain the correct mesh height.
The mesh must be lapped by 300mm for A142 and A193 mesh, and by 400mm for A252 and A393 mesh.

Casting concrete

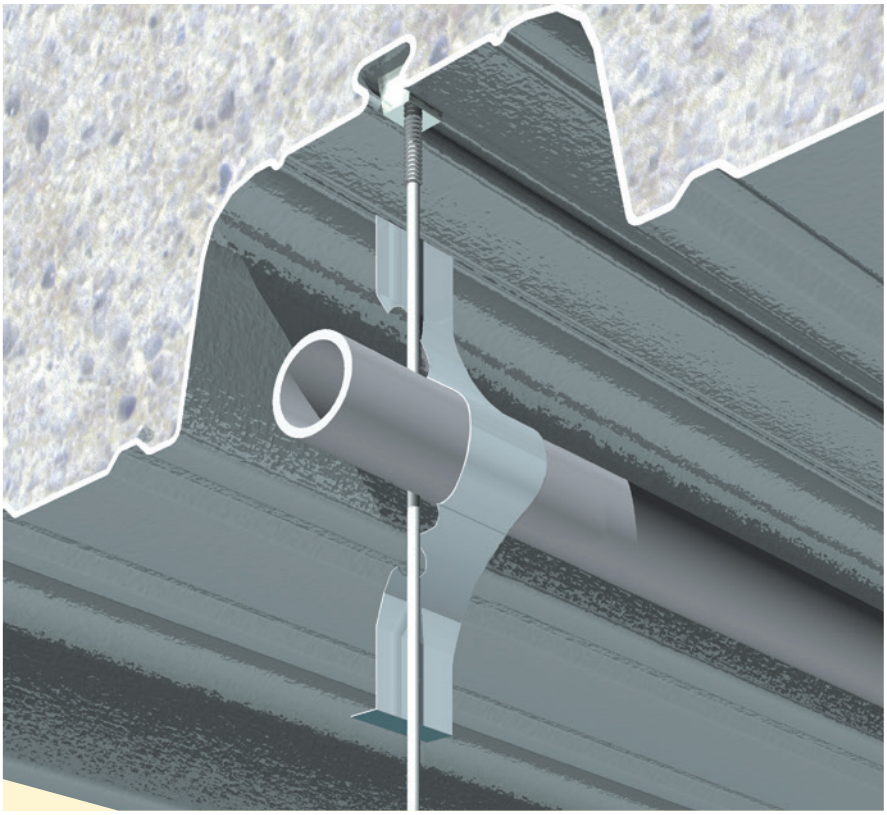
Before the concrete is poured, the decking must be cleared of all dirt and grease, which could adversely influence the performance of the hardened slab. The oil left on the decking from the roll forming process does not have to be removed. Concrete should be poured evenly, working in the direction of span.
Care should be taken to avoid heaping of concrete in any area during the casting sequence.
Construction and day joints should occur over a support beam, preferably also at a deck joint.

Ceilings and services hanger systems

The 15mm high raised mini-dovetail re-entrant stiffener on ComFlor 80 profile allow for the quick and easy suspension of ceiling and services, using a suspension system.

Threaded wedge nut fixings

Wedges are dovetail shaped steel blocks, which are threaded to take metric bolts or threaded rods. The wedge nut hanger system is installed after the concrete of the composite slab has been poured and is hardened.



Installation

For installation of the system, wedge nuts are inserted into the raised re-entrants of the profile before being rotated 90 degrees, after which the dovetail shaped wedge nuts will lock into the dovetail re-entrants under vertical loading. Finally, the bolts or threaded rods are finger tightened up to the roof of the re-entrants and mechanically tightened.

Loadbearing capability

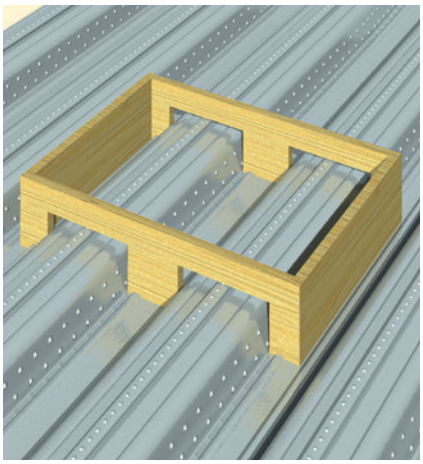
Contact us for the safe working load capacities of wedge nut fixings.

Shallow Composite Floor Decks
-Sitework

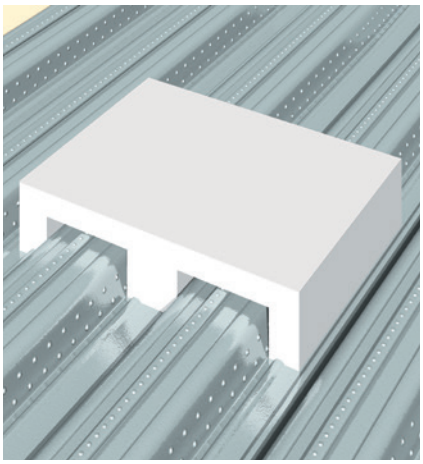
Openings

Openings greater than 300mm must be designed by the engineer, with extra reinforcement placed around the opening. Openings up to 700mm can be accommodated readily in composite slabs, by boxing out prior to pouring concrete and cutting out the deck after concrete has cured. Larger openings require support trimming steel, which must be installed prior to the decking. The decking is cut away immediately and the opening edges are then treated like any other perimeter with edge trim.

Note: do not cut the opening in the steel deck prior to concreting, or before the concrete has cured.



Timber shutter



Dense polystyrene block

Temporary supports

The safe design and installation of temporary props is the responsibility of the main contractor or designated sub-contractor. Where temporary supports are required by the design, these must provide continuous support to the profiled sheeting. Spreader beams (timbers) are used, supported by temporary props at one metre centres.

[a] The timbers and props must be of adequate strength and construction.

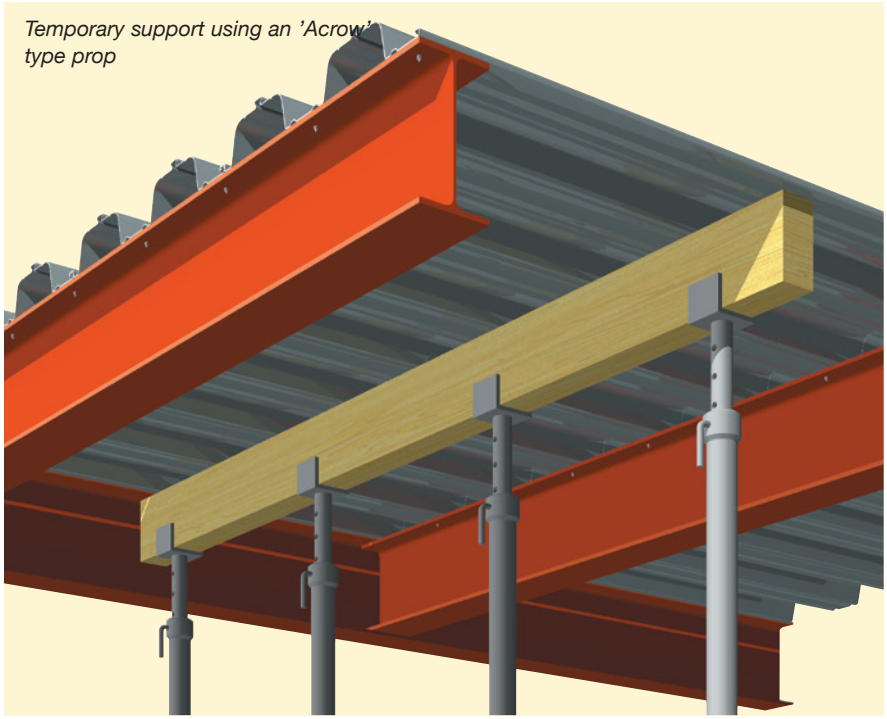
[b] The temporary supports are placed at midspan or at other suitable centres if more supports per span are required. Please contact our Technical Department.

[c] The spreader beams or timbers are to provide a minimum bearing width of l00mm. The spreaders must not deflect more than 10mm and should be placed narrow edge up, see diagram.

[d] The propping structure is not to be removed until the concrete has reached at least 70% of its characteristic strength.

Temporary Props	
Timber Bearer Guide for CF 80 All to be min. 100mm wide	
Slab depth (mm)	Bearer depth(mm)
130 - 160	200
170 - 200	250

Temporary support using an 'Acrow' type prop



Transport & Handling

Information of particular interest to Composite Flooring Contractors is given below.

Receiving Decking

Composite Floor Decking is packed into bundles of up to 25 sheets, and the sheets are secured with metal banding. Each bundle is 650mm wide (the overall width of a single sheet) by up to 650 mm deep, and may weigh up to 2.5 tonnes, depending on sheet length (average weight is about 1.5 tonnes). Loads are normally delivered by an articulated truck approximately 16 m long with a maximum gross weight of up to 40 tonnes, and a turning circle of approximately 19 m. The Main Contractor should ensure that there is suitable access and appropriate standing and off-loading areas.

Each bundle has an identification tag. The information on each tag should be checked by operatives from the decking contractor (or, if they are not on site, the Main Contractor) immediately upon arrival. In particular, the stated sheet thickness should be checked against the requirement specified on the contract drawings, and a visual inspection should be made to ensure that there is no damage.

Lifting Bundles

The bundles should be lifted from the truck. Bundles should never be off-loaded by tipping, dragging, dropping or other improvised means.

Care is needed when lifting the decking bundles; protected chain slings are recommended. Unprotected chain slings can damage the bundle during lifting; when synthetic slings are used there is a risk of severing them on the edges of the decking sheets.

If timber packers are used, they should be secured to the bundle before lifting so that when the slings are released they do not fall to the ground (with potentially disastrous results). Bundles must never be lifted using the metal banding.

Positioning the Decking

The support steelwork should be prepared to receive the decking before lifting the bundles onto it. The top surface of the underlying beams should be reasonably clean. When thru-deck welding of shear studs is specified, the tops of the flanges should be free of paint or galvanising.

The identification tags should be used to ensure that bundles are positioned on the frame at the correct floor level, and in the nominated bay shown on the deck layout drawing. The bundles should be positioned such that the interlocking side laps are on the same side. This will enable the decking to be laid progressively without the need to turn the sheets. The bundles should also be positioned in the correct span orientation, and not at 90^{o} to it. Care should be taken to ensure that the bundles are not upside down, particularly with trapezoidal profiles. The embossments should be oriented so that they project upwards.

Placement of Decking

The breaking open of bundles and installation of decking should only begin if all the sheets can be positioned and secured. This will require sufficient time and suitable weather. The decking layout drawing should also be checked to ensure that any temporary supports that need to be in position prior to deck laying are in place.

Access for installation will normally be achieved using ladders connected to the steel frame. Once they have started laying out the sheets, the erectors will create their own working platform by securely fixing the decking as they progress.

The laying of sheets should begin at the locations indicated on the decking layout drawings. These would normally be at the corner of the building at each level; to reduce the number of ‘leading edges’, i.e. unprotected edges, where the decking is being laid. When the bundles have been properly positioned, as noted above, there should be no need to turn the sheets manually, and there should be no doubt which way up the sheet should be fixed.

Individual sheets should be slid into place and, where possible, fixed to the steelwork before moving onto the next sheet. This will minimise the risk of an accident occurring as a result of movement of a sheet when it is being used as a platform. (However, for setting-out purposes, it may be necessary to lay out an entire bay using a minimum number of temporary fixings before fully securing the sheets later).

Sheets should be positioned to provide a minimum bearing of 50mm on the steel support beams. The ends of adjacent sheets should be butted together. A gap of up to 5mm is generally considered not to allow excessive seepage, but, if necessary, the ends of the sheets may be taped together. When end gaps are greater than 5mm, it is normally sufficient to seal them with an expanding foam filler. The longitudinal edges should be overlapped, to minimise concrete seepage.

Cutting Sheets

Where necessary, sheets may be cut using a grinder or a nibbler. However, field cutting should be kept to a minimum and should only be necessary where a column or other obstruction interrupts the decking. Gaps adjacent to the webs of columns should be filled in with off-cuts or thin strips of steel. Decking sheets shown as continuous on the decking layout drawing should never be cut into more than one length. Also, sheets should never be severed at the location of a temporary support, and the decking should never be fastened to a temporary support.

As the work progresses, unwanted scraps and off-cuts should be disposed of in a skip placed alongside the appropriate level of working. The skip should be positioned carefully over a support beam to avoid overloading the decking. If a skip is not available, scraps should be gathered for collection by the Main Contractor as soon as is possible. Partially used bundles should be secured, to avoid individual sheets moving in strong winds.

References - Health & Safety

British Standards

The design guidance given in this brochure and in the ComFlor® design software is in accordance with the following Standards.

Composite Floor Deck

1. BS 5950: Part 4. Structural use of steelwork in building: Code of practice for design of composite slabs with profiled steel sheeting.

Composite Steel Beams

2. BS 5950: Part 3: Design in composite construction: Section 3.1. Code of practice for design of simple and continuous composite beams.

Profiled Steel Deck

3. BS 5950: Part 6. Structural use of steelwork in building: Code of practice for design of light gauge profiled steel sheeting.

Fire Resistance

4. BS 5950: Part 8. Structural use of steelwork in building: Code of practice for fire resistant design.

Concrete

5. BS 8110: Part 1. Structural use of concrete: Code of practice for design and construction.
6. BS 8110: Part 2. Structural use of concrete: Code of practice for special circumstances.

Reinforcement

7. BS 4483. Specification for steel fabric for the reinforcement of concrete.
8. BS4449. Specification for carbon steel bars for the reinforcement of concrete.

Eurocode 4

9. ENV 1993 - 1 - 3: Design of steel structures. Supplementary rules for cold formed thin gauge members and sheeting.
10. ENV 1994 - 1 - 1: Design of composite steel and concrete structures. General rules for building.
11. ENV 1994 - 1 - 2: Design of composite steel and concrete structures. Structural fire design.
12. SCI - P - 076 : Design guide on the vibration of floors.
    SCI in association with CIRIA (1989).

New Zealand Standards

The following Standards are referenced in this brochure.

13.AS/NZ 1170 Structural Design Actions

14. NZS 3101 Concrete Structures Standard

15. NZS 3404 Steel Structures Standard

Health & Safety

Handling Hazards

Zinc coated steel decking should be handled with care; it may be delivered with soluble protective layer of oil, which can cause contamination to lacerated skin. Decking will have sharp edges and corners. Adequate gloves and protective clothing should be worn when handling decking.

Eye Hazards

Eye protectors conforming to the specification in BS 2092 should always be worn when breaking the strapping around bundles because the sudden release of tension creates a risk to eyes.
Particles of metal also create eye hazards when cutting steel, and eye protection should be worn during this activity.

Noise Hazards

Noise may be hazardous whilst handling or cutting decking, shot firing, etc. Adequate ear defenders should be worn.

Respiratory Hazards

Fumes containing oxides of iron and zinc are produced during welding or flame cutting and if inhaled these may cause metal fume fever; this is a short-lasting condition with symptoms similar to those of influenza. In conditions of exposure to such hazards, the use of respiratory equipment is recommended.

Explosives and Fumes

When using shot fired fixings explosives and fumes may create a hazard.

Occupational Exposure Limits

Limits for iron and zinc oxides are 5g/m≥ (8 hours TWA) and 10mg/m≤ (10 minutes TWA). (OE recommendation)

Summary of Protective Measures

Wear adequate gloves and protective clothing and safety goggles.
Ensure adequate ventilation and use personal protective equipment.
Follow instructions for safe handling, use, disposal and control of cartridges issued by equipment supplier.
Ensure adequate ventilation and / or use personal respiratory protective equipment.
Use appropriate ear defenders or earplugs.

General Safety Points

Follow the good practice outlined here and in SCI publications.

- Always fix deck securely before using as a working platform.
- Rigorously employ all personal safety measures such as hard hats, protective clothing.
- Rigorously employ all site safety measures such as safety lines, edge protection, properly tied ladders.
- **Don't** leave any unfixed decking sheets.
- **Don't** heap concrete or drop from any height.
- **Don't** put heavy loads on unprotected deck.
- **Don't** place props on uncured concrete.
- **Don't** cut holes/voids in the deck prior to concreting.

Composite Floor Design Disc-

ComFlor® Design Software

The ComFlor composite floor design program is available on disc or can be down loaded from www.comflor.co.nz.

Please note that the software will be updated from time to time without prior notice.
The ComFlor program was developed by the Steel Construction Institute based in the United Kingdom.

Use of the design program

Choose BS5950.
In design to BS5950, the cube strength is used.

Therefore the concrete grade in the ComFlor design software C30 refers to the cube strength value.
Please refer to page 7.

All the variables start with a default value. Check or input new variables on both Datasheet 1 and Datasheet 2.

When satisfied, click 'analyse' to run the calculations.

Job details may be entered for a formal printout.
Before accepting a particular design as satisfactory, it is highly advisable to print out the calculations and check that all the input parameters are correct.

Design criteria and methods

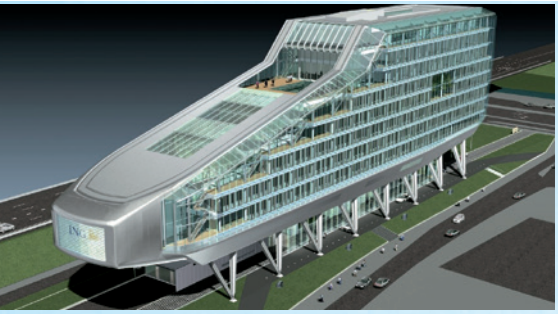
The design program has been produced by the Steel Construction Institute, UK.

Help function on ComFlor design software

The Help function on the design program contains all the detailed information that is used to produce the calculations.

Support

For hands on support when using the ComFlor design software contact us on 09 271 1780.



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ASB – ComFlor 100/210

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SCNZ STEEL CONSTRUCTION NEW ZEALAND

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