Corus International

ComFlor® decking system

Composite floor decks

ComFlor

Introduction

Corus is one of the world's leading steel suppliers, formed in 1999 by the merger of British Steel and Koninklijke Hoogovens. Combining international expertise with local customer service, the Corus brand represents quality and strength, providing innovative solutions to a wide variety of sectors worldwide. Corus became a subsidiary of Tata Steel in April 2007, leading to the creation of the world's fifth largest steel producer. With a combined presence in 50 countries, Tata Steel including Corus has 84,000 employees across six continents and a pro forma crude steel production of 27 million tonnes in 2007. The combined turnover of Corus and Tata Steel stood at US$24.8 billion in 2006.

Corus International is the specialist supply chain management business unit with annual sales of 8 million tonnes of steel and a worldwide network of offices. We are continually expanding our reach and evaluating new markets for which a presence would bring local advantage. Our scope of supply extends across the full range of steel products, but our commercial teams specialise through retaining sector-specific focus. Within this model, our teams have also developed relationships with third-party sources in order to offer a more flexible solution. According to our ISO 9001:2000 quality system, we only procure from companies with audited quality systems. In addition, we have stockholding facilities in North America, Europe, the Middle East and the Far East.

Corus has in-house decking production facilities in the UK, UAE, India and New Zealand, through which we can offer either shallow or deep decks.
The ComFlor range is arguably the most efficient choice of profile currently available anywhere in the world.
Our shallow decks are suitable for conventional composite construction where the deck is placed onto the top flange of the steel support beam and each ComFlor profile offers particular application benefits.

Our deep decks span between beams with typical unpropped spans extending to 6 metres and propped spans to 9 metres. The deck is contained within the beam depth, which provides a very shallow floor zone. The shape of the deck profiles allow for service integration and the whole system provides inherent fire resistance.

The overall service we provide covers design and detailing advice and supply of decking systems coupled with logistical, technical, finance and documentation support. As such, Corus International is in an excellent position to offer tailored decking solutions to projects around the world, as proven by a long and successful track record of supplying these products to customers globally.

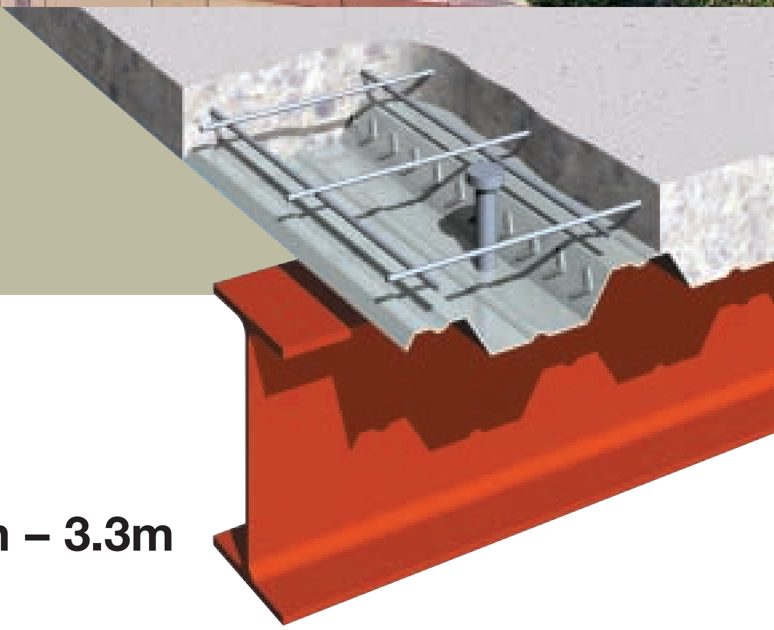
It is by combining our expertise and services innovatively and effectively, that we are able to offer our customers a complete solution, whatever the project requirements, wherever in the world. We provide the flexibility and dynamism of Corus International, whilst retaining our position within Corus as a respected partner. This gives a unique dual strength to our operations, supported by our ability to source materials in established and emerging markets across the globe.

Corus International network

A comprehensive steel supply service delivered throughout our worldwide network.

ComFlor production sites

Tewkesbury, UK	–	Produces CF46, CF51, CF60, CF80 and CF210
Jebel Ali, UAE	–	Produces CF46, CF51 and CF80
Auckland, New Zealand	–	Produces CF60, CF80 and CF210
Mumbai, India	–	Produces CF60 and CF80



ComFlor 46

Shallow composite profile

Typical unpropped span 2.6m – 3.3m

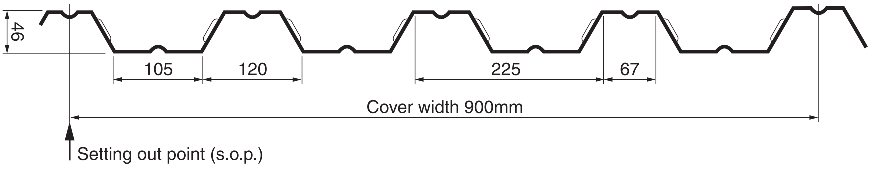
ComFlor 46, first introduced in 1985, is a simple trapezoidal composite deck with a strong and reliable shear bond performance. The profile is economic and nestable, reducing transport and handling costs.

- **Nestable**
  The ultra efficient nesting capability of ComFlor 46 reduces the transport volume of the product. This fact combined with the simplicity of ComFlor 46 means it is an ideal solution worldwide.

- **Easy service suspension**
  Ceilings and lightweight services can easily be attached to the punched hangar tabs, which can be included with ComFlor 46. These must be specified at time of order.

- **Low concrete usage**
  The trapezoidal shape profile of ComFlor 46 reduces the volume of concrete used, with resultant savings in structural and foundation costs.

ComFlor 46 design information



ComFlor 46 composite slab – volume and weight

Slab depth (mm)	Concrete volume (m^3/m^2)	Weight of concrete (kN/m^2) Normal weight concrete Wet	Normal weight concrete Dry	Lightweight concrete Wet	Lightweight concrete Dry
110	0.091	2.14	2.10	1.69	1.60
115	0.096	2.26	2.21	1.79	1.69
120	0.101	2.38	2.33	1.88	1.78
130	0.111	2.61	2.56	2.07	1.96
140	0.121	2.85	2.79	2.25	2.13
145	0.126	2.96	2.90	2.35	2.22
150	0.131	3.08	3.02	2.44	2.31
180	0.161	3.79	3.71	3.00	2.84
200	0.181	4.26	4.17	3.37	3.19
240	0.221	5.20	5.09	4.12	3.90

Volume and weight table notes

1. Deck and beam deflection (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
   Lightweight (wet) 1900 kg/m^3
   Lightweight (dry) 1800 kg/m^3

Section properties (per metre width)

Nominal thickness (mm)	Design thickness (mm)	Profile weight (kN/m^2)	Area of steel (mm^2/m)	Height to neutral axis (mm)	Moment of inertia (cm^4/m)	Ultimate moment capacity (kNm/m) Sagging	Hogging
0.90	0.86	0.09	1137	20.38	41.50	4.63	4.67
1.20	1.16	0.13	1534	20.44	53.00	5.99	6.23

Span table – Normal weight concrete

Props	Span	Fire rating	Slab depth (mm)	Mesh	Maximum span (m) Deck thickness (mm) 0.9 Total applied load (kN/m^2) 3.5	0.9 5.0	0.9 10.0	1.2 3.5	1.2 5.0	1.2 10.0
No temporary props	Single span slab and deck	1 hr	120	A193	2.4	2.4	2.4	2.8	2.8	2.6
		1.5 hrs	130	A193	2.4	2.4	2.7	2.7	2.7	2.3
			145	A252	2.3	2.4	2.2	2.6	2.6	2.2
		2 hrs	200	A393	2.0	2.0	2.0	2.3	2.3	2.3
			240	A393	1.9	1.9	1.9	2.2	2.2	2.2
	Double span slab and deck	1 hr	130	A193	2.7	2.7	2.7	3.2	3.2	3.1
		1.5 hrs	130	A193	2.6	2.6	2.6	3.1	3.1	2.7
			145	A252	2.5	2.5	2.5	2.9	2.9	2.6
		2 hrs	200	A393	2.2	2.2	2.2	2.5	2.5	2.5
			240	A393	2.0	2.0	2.0	2.3	2.3	2.3

Please refer to page 20 for span table parameters.

Design notes

Deck material

Corus Galvatite, hot dip zinc coated steel EN 10326-S280GD+Z275 or equivalent. Guaranteed minimum yield stress 280N/mm^2. Minimum zinc coating mass 275g/m^2 total both sides.

Anti-crack mesh

BS 5950: Part 4 currently recommends that anticrack mesh should comprise 0.1% of slab area. The Eurocode 4 recommendation is that anticrack mesh should comprise 0.2% of slab area for unpropped spans and 0.4% of slab area for propped spans. Where forklift truck (or other similar concentrated loading) is expected 0.5% minimum percentage reinforcement should be used over the supports and 2% elsewhere to control cracking. For further information refer to SCI AD150. Mesh top cover must be a minimum of 15mm, and a maximum of 30mm. Mesh laps are to be 300mm for A142 mesh and 400mm for A193, A252 and A393 mesh.

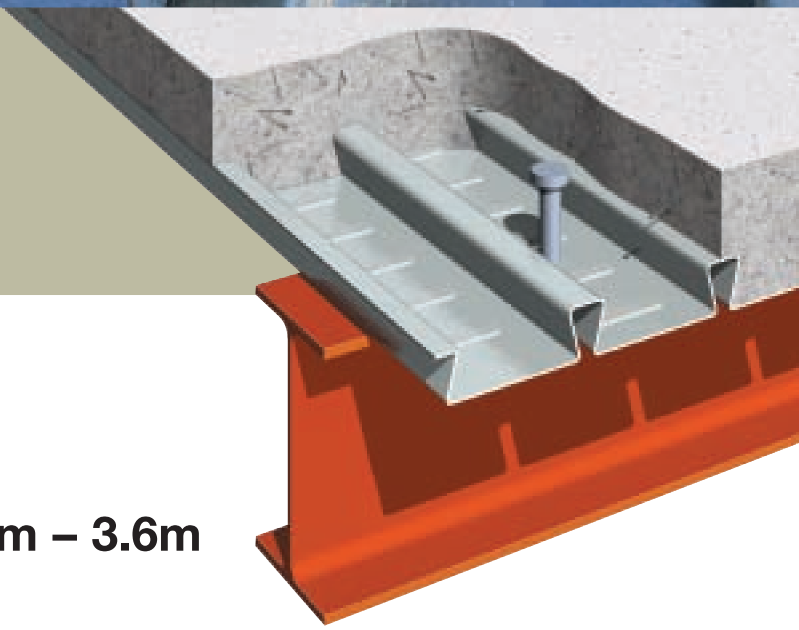
Fire

For details of the performance of composite slabs comprising ComFlor 46 decking in simplified design cases or for full fire engineering, refer to the ComFlor software.

Technical services

Corus International offers a comprehensive advisory service on design of composite flooring, which is available to all specifiers and users. Should queries arise which are not covered by this literature or by the ComFlor software, please contact us.

Details of full design, load spans and profile performance can be found by using the ComFlor software CD. Your free copy can be found on the inside back cover of this publication.



ComFlor 51

Shallow composite profile

Typical unpropped span 2.5m – 3.6m

ComFlor 51 is a traditional dovetail re-entrant composite floor deck. This profile provides an excellent mechanical key into the concrete slab, offering a strong shear bond performance, which is augmented by cross stiffeners located in the profile trough. ComFlor 51 presents a virtually flat soffit and a relatively thin slab which is required to meet fire design requirements.

- **Shear studs**
  The wide trough of ComFlor 51 permits a flexible and efficient placement of shear studs.

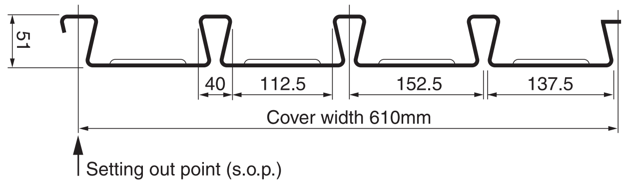
- **Fire performance of the composite beams**
  Even for two hours fire rating, the top flange of the steel beam does not require fire protection, when used with ComFlor 51 composite deck.

- **Under floor services**
  Services are easy to attach to ComFlor 51, with the ribs presenting a dovetailed recessed groove in the concrete slab at 152.5mm centres. This provides the perfect connection for service hangars via a wedge nut or similar type device.

- **Fire performance of the slab**
  The dovetail presents a very small opening and contributes little to the transfer of heat through the slab in the event of fire. Thus a lesser slab depth is needed for fire design purposes.

- **FibreFlor**
  ComFlor 51 is fully tested with the FibreFlor system to provide all the benefits of a mesh-free solution. Please refer to pages 36 and 37 for details.

ComFlor 51 design information



ComFlor 51 composite slab – volume and weight

Slab depth (mm)	Concrete volume (m^3/m^2)	Weight of concrete (kN/m^2) Normal weight concrete Wet	Normal weight concrete Dry	Lightweight concrete Wet	Lightweight concrete Dry
101	0.092	2.16	2.12	1.71	1.62
105	0.096	2.26	2.21	1.79	1.69
110	0.101	2.37	2.32	1.88	1.78
115	0.106	2.49	2.44	1.97	1.87
120	0.111	2.61	2.55	2.07	1.96
125	0.116	2.73	2.67	2.16	2.04
130	0.121	2.84	2.78	2.25	2.13
150	0.141	3.32	3.25	2.62	2.49
200	0.191	4.49	4.40	3.56	3.37
240	0.231	5.43	5.32	4.30	4.08

Volume and weight table notes

1. Deck and beam deflection (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
   Lightweight (wet) 1900 kg/m^3
   Lightweight (dry) 1800 kg/m^3

Section properties (per metre width)

Nominal thickness (mm)	Design thickness (mm)	Profile weight (kN/m^2)	Area of steel (mm^2/m)	Height to neutral axis (mm)	Moment of inertia (cm^4/m)	Ultimate moment capacity (kNm/m) Sagging	Hogging
0.90	0.86	0.13	1579	16.74	55.70	5.69	6.99
1.00	0.96	0.14	1759	16.73	62.10	6.34	7.93
1.10	1.06	0.16	1938	16.73	68.50	7.00	8.88
1.20	1.16	0.17	2118	16.72	74.90	7.65	9.81

Span table – Normal weight concrete

Props	Span	Fire rating	Slab depth (mm)	Mesh	Maximum span (m), Deck thickness (mm) 0.9, Total applied load (kN/m^2) 3.5	0.9 5.0	0.9 10.0	1.2 3.5	1.2 5.0	1.2 10.0
No temporary props	Single span slab and deck	1 hr	101	A142	2.8	2.8	2.5	3.2	3.2	2.8
		1.5 hrs	110	A142	2.7	2.7	2.2	3.1	3.0	2.4
			125	A193	2.6	2.5	2.0	2.9	2.6	2.1
		2 hrs	200	A393	2.2	2.2	2.2	2.6	2.6	2.6
			240	A393	2.1	2.1	2.1	2.4	2.4	2.4
	Double span slab and deck	1 hr	101	A142	3.2	3.2	2.6	3.7	3.7	3.0
		1.5 hrs	110	A142	3.2	3.2	2.4	3.6	3.4	2.7
			125	A193	3.1	3.0	2.3	3.4	3.2	2.5
		2 hrs	200	A393	2.6	2.6	2.6	3.0	3.0	3.0
			240	A393	2.4	2.4	2.4	2.8	2.8	2.8

Please refer to page 20 for span table parameters.

Design notes

Deck material

Corus Galvatite, hot dip zinc coated steel EN 10326-S350GD+Z275 or equivalent. Guaranteed minimum yield stress 350N/mm^2. Minimum zinc coating mass 275g/m^2 total both sides.

Anti-crack mesh

BS 5950: Part 4 currently recommends that anticrack mesh should comprise 0.1% of slab area. The Eurocode 4 recommendation is that anticrack mesh should comprise 0.2% of slab area for unpropped spans and 0.4% of slab area for propped spans. Where forklift truck (or other similar concentrated loading) is expected 0.5% minimum percentage reinforcement should be used over the supports and 2% elsewhere to control cracking. For further information refer to SCI AD150. Mesh top cover must be a minimum of 15mm, and a maximum of 30mm. Mesh laps are to be 300mm for A142 mesh and 400mm for A193, A252 and A393 mesh.

Fire

For details of the performance of composite slabs comprising ComFlor 51 decking in simplified design cases or for full fire engineering, refer to the ComFlor software.

Technical services

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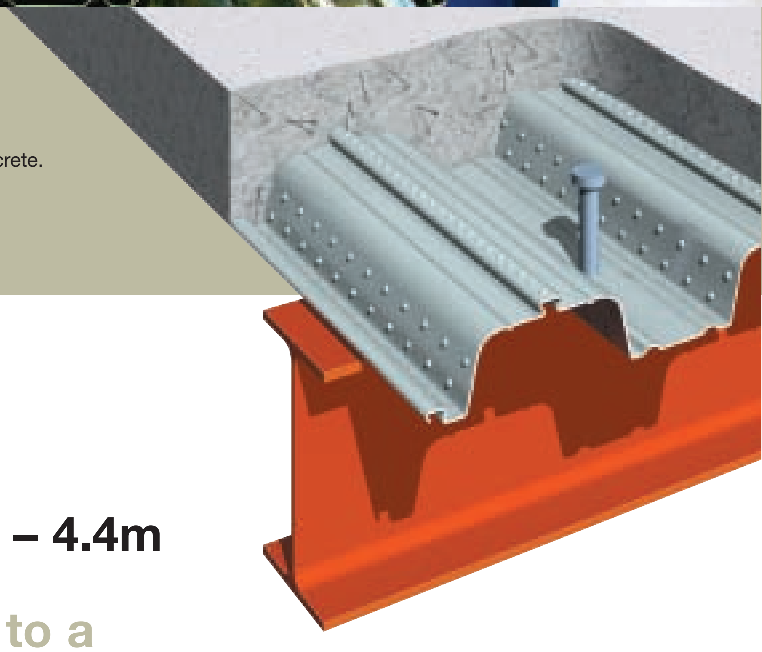


ComFlor 60 shown with FibreFlor reinforced concrete.

ComFlor 60

Shallow composite profile

Typical unpropped span 3.0m – 4.4m

Taking the 60 profile concept to a new dimension.

Increased span: grade 350 steel combined with optimised finite element analysed profile design, gives exceptional unpropped span capability for a 60 profile.

Optimum stud position: the profile design guarantees centrally placed shear studs.

Coated soffit: ComFlor 60 is available with an optional 25-micron flexible polyester coating to the underside, ideal for use in car parks.

Low concrete usage: the profile allows a reduced concrete volume for any slab depth delivering very competitive construction costs.

Lighter sheets: the cover width of ComFlor 60 is 600mm, to reduce sheet weight and improve handling.

Corus International has combined the experience of twenty years in composite floor profile design into the engineering of this state-of-the-art profile. The new roll forming technology pioneered with ComFlor 80 allows coated soffit composite flooring to be made available now on the 60, thus widening the range of choice for car parks and other similar applications.

The profile is specifically designed to enhance shear stud interaction, with the trough stiffeners and side lap making it impossible to put the studs in the wrong place. The cover width has been deliberately limited to 600mm to reduce sheet weight and provide a major health and safety benefit in manual handling. Optimised profile design combined with 350 grade steel provides exceptional spans combined with reduced concrete usage.

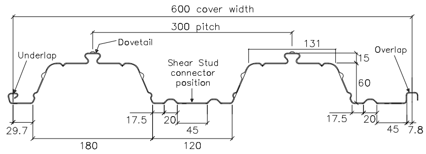
'Closed ends'

- **FibreFlor**
  ComFlor 60 is fully tested with the FibreFlor system to provide all the benefits of a mesh-free solution. Please refer to pages 36 and 37 for details.

ComFlor 60 design information

ComFlor 60 composite slab – volume and weight

Slab depth (mm)	Concrete volume (m^3/m^2)	Weight of concrete (kN/m^2): Normal weight concrete Wet	Normal weight concrete Dry	Lightweight concrete Wet	Lightweight concrete Dry
120	0.089	2.09	2.04	1.65	1.57
130	0.099	2.32	2.28	1.84	1.74
140	0.109	2.56	2.51	2.03	1.92
150	0.119	2.79	2.74	2.21	2.10
160	0.129	3.03	2.97	2.40	2.27
170	0.139	3.27	3.20	2.59	2.45
180	0.149	3.50	3.43	2.77	2.63
190	0.157	3.69	3.62	2.92	2.77
200	0.167	3.93	3.85	3.11	2.95
250	0.217	5.11	5.00	4.04	3.83



Volume and weight table notes

1. Deck and beam deflection (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^2
   Normal weight dry 2350 kg/m^2
   Light weight wet 1900 kg/m^2
   Light weight dry 1800 kg/m^2

Section properties (per metre width)

Nominal thickness (mm)	Design thickness (mm)	Profile weight (kN/m^2)	Area of steel (mm^2/m)	Height to neutral axis (mm)	Moment of inertia (cm^4/m)	Ultimate moment capacity (kNm/m) Sagging	Hogging
0.90	0.86	0.103	1276	29.6	92.77	9.30	7.50
1.00	0.96	0.114	1424	30.5	106.15	11.27	9.36
1.10	1.06	0.125	1572	31.2	119.53	13.24	11.21
1.20	1.16	0.137	1721	31.7	132.91	15.21	13.07

Span table – Normal weight concrete

Props	Span	Fire rating	Slab depth (mm)	Mesh	Maximum span (m), Deck thickness (mm) 0.9, Total applied load (kN/m^2) 3.5	0.9: 5.0	0.9: 10.0	1.2: 3.5	1.2: 5.0	1.2: 10.0
No temporary props	Single span slab and deck	1 hr	130	A142	3.5	3.2	2.3	3.9	3.4	2.5
			130	A252	3.5	3.5	2.6	3.9	3.9	2.8
			160	A252	3.2	3.2	2.9	3.6	3.6	3.1
		1.5 hrs	140	A193	3.4	2.9	2.1	3.7	3.1	2.3
			170	A252	3.1	3.1	2.4	3.5	3.5	2.6
		2 hrs	150	A193	2.9	2.5	1.9	3.0	2.6	1.9
			180	A252	3.1	3.0	2.1	3.5	3.0	2.2
	Double span slab and deck	1 hr	130	A142	3.6	3.6	2.7	4.5	3.9	2.9
			130	A252	3.6	3.6	3.2	4.5	4.5	3.3
			160	A252	3.3	3.3	3.3	4.2	4.2	3.8
		1.5 hrs	140	A193	3.5	3.5	2.6	4.1	3.6	2.7
			170	A252	3.2	3.2	3.2	4.1	4.1	3.3
		2 hrs	150	A193	3.4	3.0	2.3	3.5	3.1	2.4
			180	A252	3.1	3.1	2.8	4.1	3.9	2.9

Please refer to page 20 for span table parameters.

Design notes

Deck material

Corus Galvatite, hot dip zinc coated steel EN10326-S350GD+Z275 or equivalent. Guaranteed minimum yield stress 350N/mm^2. Minimum zinc coating mass 275g/m^2 total both sides.

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. Where forklift truck (or other similar concentrated loading) is expected 0.5% minimum percentage reinforcement should be used over the supports and 2% elsewhere to control cracking. For further information refer to SCI AD150. Mesh top cover must be a minimum of 15mm, and a maximum of 30mm. Mesh laps are to be 300mm for A142 mesh and 400mm for A193, A252 and A393 mesh.

Fire

For details of the performance of composite slabs comprising ComFlor 60 decking in simplified design cases or for full fire engineering, refer to the ComFlor software.

Technical services

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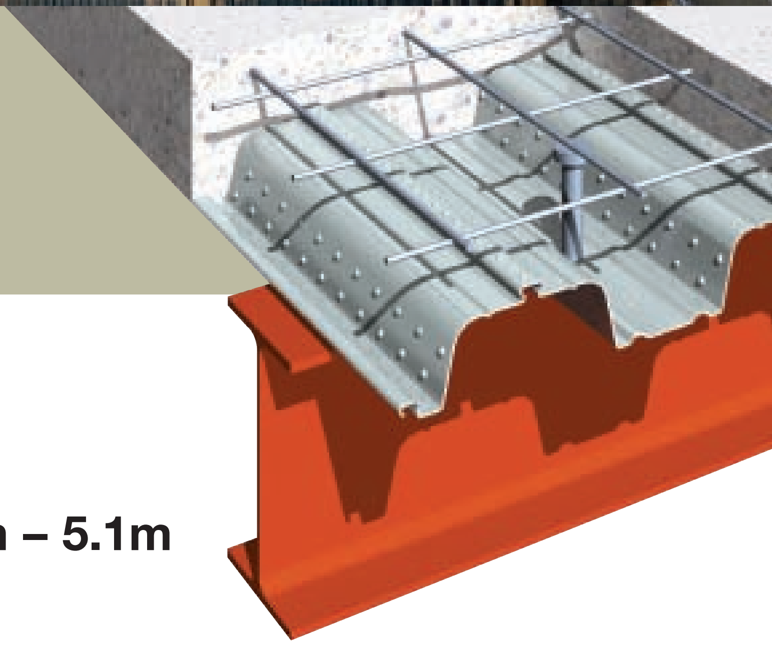


ComFlor 80

Shallow composite profile

Typical unpropped span 3.8m – 5.1m

ComFlor 80 is the next generation of profiled steel composite decks; it is the only 80mm profile utilising the higher grade 450 steel and available in Colorcoat®.

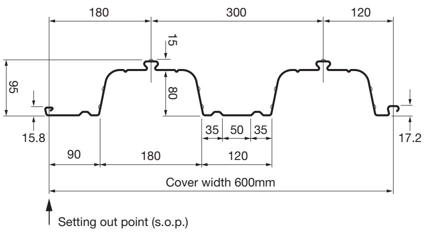
The large corner curvature detail provides a very efficient profile. In conjunction with the higher grade of steel, it ensures typical unpropped spans of 4.4m simply supported and in the continuous condition, spans of 5.1m can be achieved.

The large spans achievable mean less structural steel is used and this provides savings in the overall construction cost, which also offers more scope to architects and engineers in the design process.

The innovative profile design provides real benefits

- **Central stud placement** provides superb composite action between the beam and concrete due to the stud being positioned exactly in the centre of the trough. This ensures the correct concrete cover to the stud and therefore, the full design capacity of the stud is developed. The central location of the stud also reduces on-site checking by ensuring that the stud has been positioned correctly.
- **Ideal for car parks**
ComFlor 80 is available with an optional 25-micron flexible polyester coating to the underside, for use in car parks.
- The use of high grade 450 steel, plus the highly efficient CF80 profile design, provides long span capability.
- **Excellent concrete usage** means that ComFlor 80 is very economical compared to other similar decks.
- **Improved manual handling**
The cover width of ComFlor 80 is 600mm, to reduce sheet weight and improve handling.
- **FibreFlor**
ComFlor 80 is fully tested with the FibreFlor system to provide all the benefits of a mesh-free solution. Please refer to pages 36 and 37 for details.

ComFlor 80 design information



ComFlor 80 composite slab – volume and weight

Slab depth (mm)	Concrete volume (m³/m²)	Weight of concrete (kN/m²) Normal weight concrete Wet	Dry	Lightweight concrete Wet	Dry
130	0.086	2.03	1.99	1.61	1.53
140	0.096	2.27	2.22	1.80	1.70
150	0.106	2.51	2.45	1.98	1.88
160	0.116	2.74	2.68	2.17	2.06
170	0.126	2.98	2.91	2.36	2.23
180	0.136	3.21	3.14	2.54	2.41
190	0.146	3.45	3.38	2.73	2.59
200	0.156	3.68	3.61	2.92	2.76
250	0.206	4.86	4.76	3.85	3.64

Volume and weight table notes

1. Deck and beam deflection (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/m³
   Normal weight (dry) 2350 kg/m³
   Lightweight (wet) 1900 kg/m³
   Lightweight (dry) 1800 kg/m³

Section properties (per metre width)

Nominal thickness (mm)	Design thickness (mm)	Profile weight (kN/m²)	Area of steel (mm²/m)	Height to neutral axis (mm)	Moment of inertia (cm⁴/m)	Ultimate moment capacity (kNm/m) Sagging	Hogging
0.90	0.86	0.12	1387	47.6	185	15.4	12.5
1.20	1.16	0.15	1871	47.6	245	22.2	18.5

Span table – Normal weight concrete

Props	Span	Fire rating	Slab depth (mm)	Mesh	Maximum span (m) with no extra reinforcements — Deck thickness (mm) 0.9 — Total applied load (kN/m²) 3.5	5.0	10.0	1.2 — 3.5	5.0	10.0
No temporary props	Single span slab and deck	1 hr	140	A252	4.2	3.6	2.5	4.5	3.8	2.7
			170	A252	4.0	4.0	2.8	4.2	4.2	3.0
		1.5 hrs	150	A393	4.1	3.6	2.5	4.4	3.7	2.6
			180	A393	3.9	3.9	2.7	4.2	4.2	2.9
		2 hrs	160	A393	4.0	3.1	2.3	3.8	3.1	2.3
			190	A393	3.8	3.6	2.4	4.1	3.5	2.5
	Double span slab and deck	1 hr	140	A252	4.4	4.4	3.2	5.2	4.6	3.4
			170	A252	3.9	3.9	3.6	4.8	4.8	3.8
		1.5 hrs	150	A393	4.2	4.0	3.0	4.8	4.1	3.1
			180	A393	3.8	3.8	3.5	4.7	4.7	3.6
		2 hrs	160	A393	4.1	3.6	2.7	4.2	3.6	2.8
			190	A393	3.7	3.7	3.1	4.7	4.2	3.2

Please refer to page 20 for span table parameters.

Design notes

Deck material

Corus Galvatite, hot dip zinc coated steel EN 10326-S450GD+Z275 or equivalent. Guaranteed minimum yield stress up to 450N/mm². Minimum zinc coating mass 275g/m² total both sides.

Anti-crack mesh

BS 5950: Part 4 currently recommends that anticrack mesh should comprise 0.1% of slab area. The Eurocode 4 recommendation is that anticrack mesh should comprise 0.2% of slab area for unpropped spans and 0.4% of slab area for propped spans. Where forklift truck (or other similar concentrated loading) is expected 0.5% minimum percentage reinforcement should be used over the supports and 2% elsewhere to control cracking. For further information refer to SCI AD150. Mesh top cover must be a minimum of 15mm and a maximum of 30mm. Mesh laps are to be 300mm for A142 mesh and 400mm for A193, A252 and A393 mesh.

Fire

For details of the performance of composite slabs comprising ComFlor 80 decking in simplified design cases or for full fire engineering, refer to the ComFlor software.

Technical services

Corus International offers a comprehensive advisory service on design of composite flooring, which is available to all specifiers and users. Should queries arise which are not covered by this literature or by the ComFlor software, please contact us.

Details of full design, load spans and profile performance can be found by using the ComFlor software CD. Your free copy can be found on the inside back cover of this publication.

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 type** – also dictates minimum slab depth and influences 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 software makes both quick reference and full design easy. Indicative design may be carried out from the printed tables, however the software greatly increases the scope available to the Design Engineer and allows the engineer to print a full set of calculations.

British standards and Eurocodes

The Software user is offered a choice to design to either BS5950 Parts 4 and 3 or to Eurocode 4. The quick reference tables are designed to BS5950 Part 4, with the important exception of the mesh recommendations.

Anti-crack mesh

FibreFlor can be used to replace anti crack mesh. Where mesh is used, BS5950: Part 4 recommends that it comprises 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.

In slabs subject to line loads, the mesh should comprise 0.4% of the cross-sectional area of the concrete topping, propped and unpropped.

These limits ensure adequate crack control in visually exposed applications (0.5mm maximum crack width). The mesh reinforcement should be positioned at a maximum of 30mm from the top surface. Elsewhere, 0.1% reinforcement may be used to distribute local loads on the slab (or 0.2% to EC4).

Mesh laps are to be 300mm for A142 mesh and 400mm for A193, A252 and A393.

Forklift trucks

Where forklift truck (or other similar concentrated loading) is expected 0.5% minimum percentage reinforcement should be used over the supports and 0.2% elsewhere to control cracking. For further information refer to SCI AD150.

Exposed floors

Composite floors are usually covered by finishes, flooring or a computer floor; and because cracking is not visible, light top reinforcement is adequate, typically 0.1% of the gross cross sectional area. However where the composite slab is to be left uncovered, e.g. for power trowelled floor finishes, cracking, particularly over the beams, may not be adequately controlled by the light mesh usually provided. The cracking has no structural significance, but the appearance of it, and the possibility of the crack edge breakdown under traffic, may be perceived as a problem. In this case, refer to Concrete Society publication. 'Cracking In Composite Concrete / Corrugated Metal Decking Floors Slabs' which provides valid mesh sizing and detailing for specific crack width control. Where forklifts are to be used also refer to Steel Construction Institute advisory note 'AD 150, Composite Floors – Wheel Loads from Forklifts'. Both publications are available from our Technical Department.

Reduced mesh

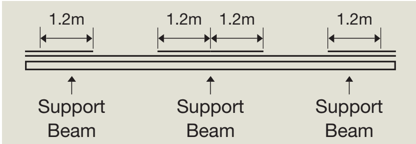


Diagram showing full mesh area over supports

Where EC4 mesh rules are used, as recommended by Steel Construction Institute and Corus, the full stipulated mesh applies to the slab 1.2m either side of every support. Outside of this, i.e. in the midspan 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 midspan mesh must be checked for adequacy under fire, for the rating required.

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 25mm, and a maximum value of the profile height. Where used, bar reinforcement is placed at one bar per profile trough.

Transverse reinforcement

Corus 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

Lightweight concrete (LWC) uses artificially produced aggregate such as expanded pulverised fuel ash pellets. LWC leads to considerable advantages in improved fire performance, reduced slab depth, longer unpropped spans and reduced dead load. However, LWC is not readily available in some parts of the country. Normal weight concrete uses a natural aggregate and is widely available.

The strength of the concrete must meet the requirements for strength for the composite slab and shall not be less than 25N/mm^2 for LWC or 30N/mm^2 for NWC. Similarly, the maximum value of concrete strength shall not be taken as greater than 40N/mm^2 for LWC or 50N/mm^2 for NWC.

The modular ratio defines the ratio of the elastic modulus of steel to concrete, as modified for creep in the concrete.

In design to BS5950 and BS8110, the cube strength is used (in N/mm^2). In design to EC3, the cylinder strength is used (in N/mm^2). The concrete grade (C30/37) defines the (cylinder/cube strength) to EC3.

Concrete density

Density kg/m3

	Wet	Dry	Modular ratio
LWC	1900	1800	15
NWC	2400	2350	10

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

Span/depth ratio

Slab span to depth ratio is limited to a maximum of 30 for lightweight concrete and 35 for normal weight concrete.

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 concrete rib. For the shallow decks, the program assumes the bar is positioned just below the top of the steel deck.

Shallow composite floors generally use the simplified fire design method which utilises the anti-crack mesh as fire reinforcement. Increased load span capability under fire may be realised by including bar reinforcement and using the fire engineering method of design.

Deflection limits

Deflection Limits would normally be agreed with the client. In the absence of more appropriate information, the following limits should be adopted:

Construction stage

Le/130 (but not greater than 30mm)

Imposed load deflection

Le/350 (but not greater than 20mm)

Total load deflection

Le/250 (but not greater than 30mm)

According to BS5950 Part 4, ponding, resulting from the deflection of the decking is only taken into account if the construction stage deflection exceeds Ds/10. Le is the effective span of the deck and Ds is the slab overall depth (excluding non-structural screeds).

The deflection under construction load should not exceed the span/180 or 20mm overall, whichever is the lesser, when the ponding of the concrete slab is not taken into account. Where ponding is taken into account the deflection should not exceed the span/130 or 30mm overall. The quick reference tables do take ponding into account, if deflection exceeds Ds/10, or Le/180, and thus use span/130 or 30mm as a deflection limit.

It is recommended that the prop width should not be less than 100mm otherwise the deck may mark slightly at prop lines.

Vibration

The dynamic sensitivity of the composite slab should be checked in accordance with the Steel Construction Institute publication P076: Design guide on the vibration of floors. The natural frequency is calculated using the selfweight of the slab, ceiling and services, screed and 10% imposed loads, representing the permanent loads and the floor. In the absence of more appropriate information, the natural frequency of the composite slab should not exceed 5Hz for normal office, industrial or domestic usage. Conversely, for dance floor type applications or for floors supporting sensitive machinery, the limit may need to be set higher.

For design to the Eurocodes, the loads considered for the vibration check are increased using the psi-factor for imposed loads (typically 0.5). The natural frequency limit may be reduced to 4Hz, because of this higher load, used in the calculation.

Loads and load arrangement

Loading information would normally be agreed with the clients. Reference should also be made to BS 6399 and to EC1.

Factored loads are considered at the ultimate limit state and unfactored loads at the serviceability limit state. Unfactored loads are also considered in fire conditions.

Partial factors are taken from BS5950, EC3 and EC4.

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

On other spans, the construction load considered is half this value (i.e. 0.75 kN/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.

Openings

Openings can be accommodated readily in composite slabs, by boxing out prior to pouring concrete and cutting out the deck after concrete has cured, see sitework section on page 22. The design of openings depends on their size:

Small

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

Medium

Openings between 300mm and 700mm 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 trimmed with additional permanent steelwork back to the support beams.

Opening rules

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

1. The distance between the opening and unsupported edge must be greater than 500mm or W, whichever is the 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 width of any bay is to be removed by openings.
4. Not more than ¼ width of deck span is to be removed by openings.

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

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

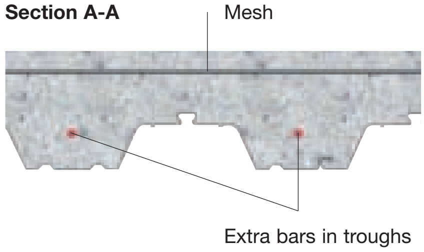
Slab design around openings

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 1.5 d_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.

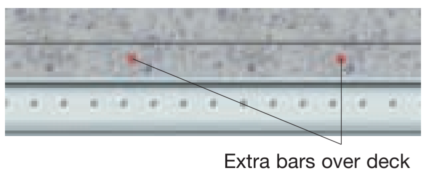
Reinforcement

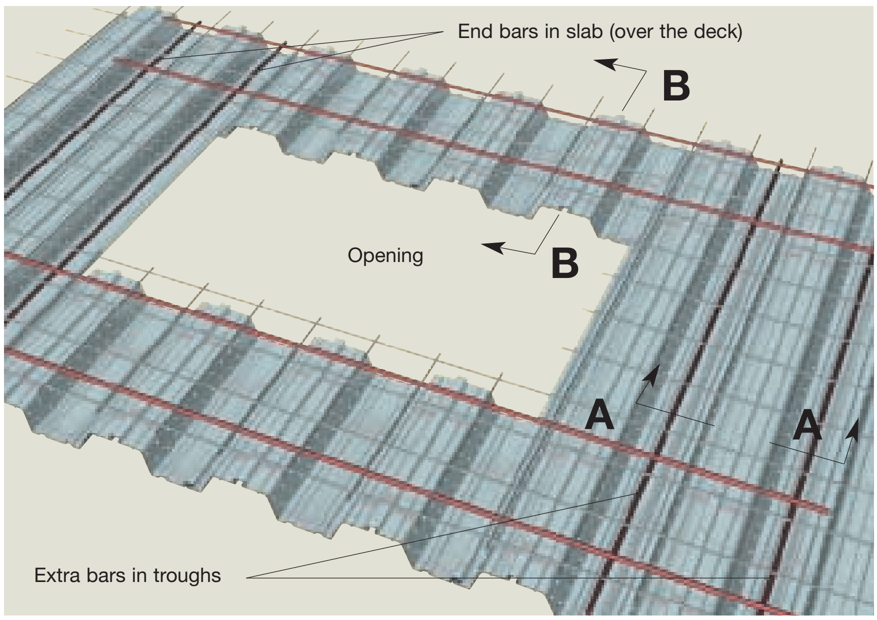
Extra reinforcement is provided within the 'beam strips' to suit the applied loading. This reinforcement often takes the form of bars placed in the troughs of the decking. Additional transverse or diagonal bars may be used to improve load transfer around the opening.

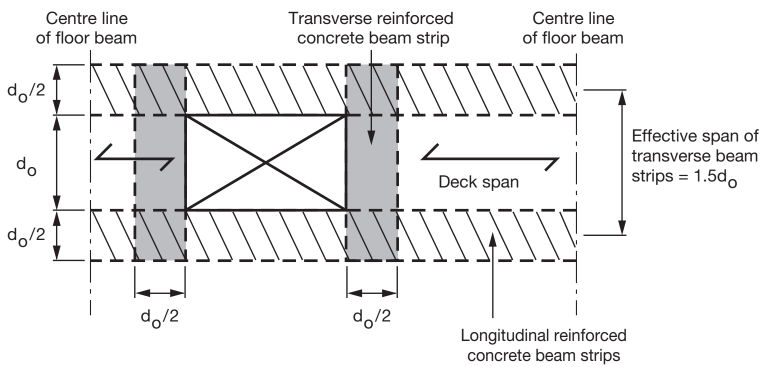
Section A-A



Section B-B





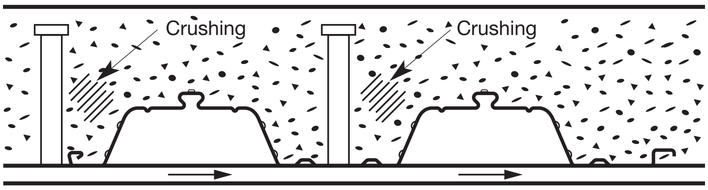


Load paths and beam strips around medium to large openings

Design of shear studs

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.



Centre welding of shear-connectors

Shear stud specification

19mm x 95mm studs are used with CF46, CF51 and CF60.
19mm x 125mm studs are used with CF80.

Headed studs

When deck profile ribs are running perpendicular to the steel beam i.e. compositely connected to the composite slab, the capacity of headed studs should be taken as their capacity in a solid slab but multiplied by the reduction factor "k". The calculation method for "k" differs between BS5950 Part 3 and Eurocode 4.

Through deck welded stud reduction factor k – see note 1 below

BS5950 Part 3	**Centre placed, favourably placed or offset placed studs (2)**		**Unfavourably placed studs**	
	1 stud/rib	**2 studs/rib**	**1 stud/rib**	**2 studs/rib**
CF46 and CF51	1.00	0.80	1.00	0.80
CF60	1.00	0.80	N/A*	N/A*
CF80 (125mm stud)	0.80	0.56	N/A*	N/A*

*CF60 and 80 profile ensures centre placed studs.

EC4	**Ribs perpendicular (transverse) to beam**		**Ribs parallel to beam**
	1 stud/rib	**2 studs /rib**	
CF46 and CF51 – 1mm or less	0.85	0.70	1.00
CF60 – 1mm or less	0.85	0.70	0.85
CF46 and CF51	1.00	0.80	1.00
CF46 and CF51 – greater than 1mm	1.00	0.80	1.00
CF80	0.66	0.46	0.56

Suitability of decks

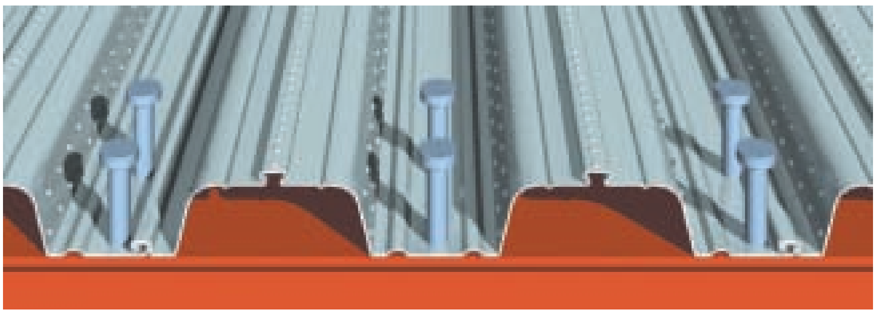
Shear studs cannot be placed on profile stiffeners, however with CF60 and CF80 the position of the stiffeners and side lap allows central placement of studs.

Non-welded shear connectors

Hilti shear connectors may be used. Refer to Hilti for further information.

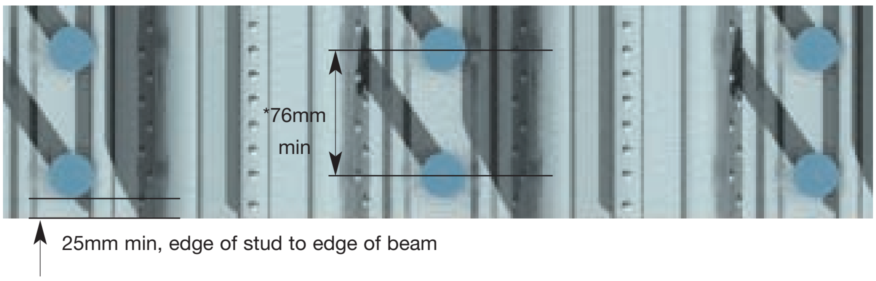
Design guide

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



Central studs

*76mm = 4d for 19mm studs



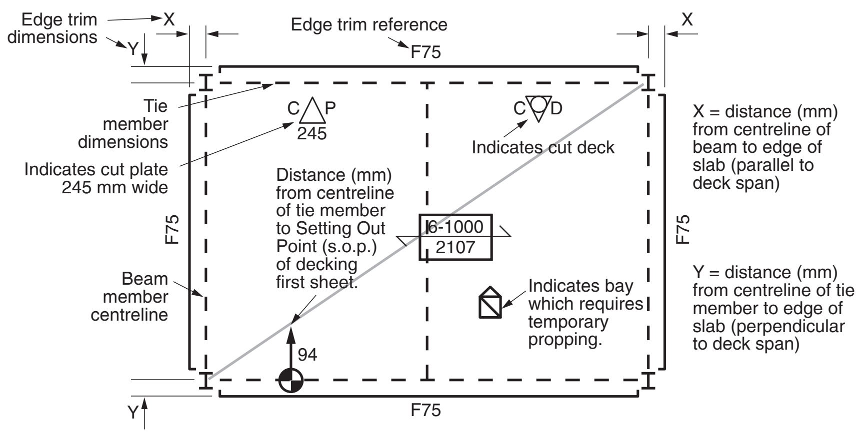
25mm min, edge of stud to edge of beam

Note 1

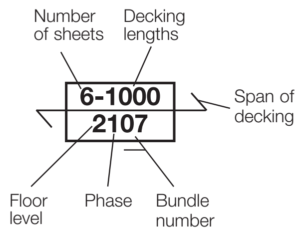
At the time of print, the stud reduction factors in BS5950 Part 3 and in the National Annex for EC4 are subject to review, please check with our Technical Department to see if these figures are still current.

Construction details

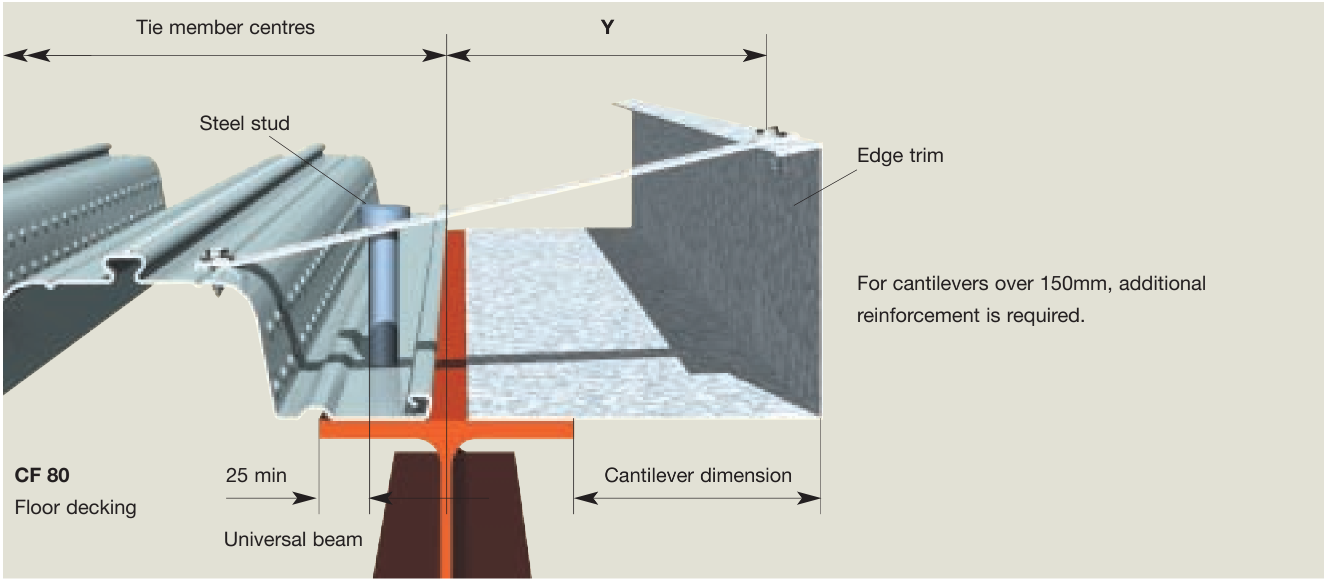
Plan view of typical floor layout



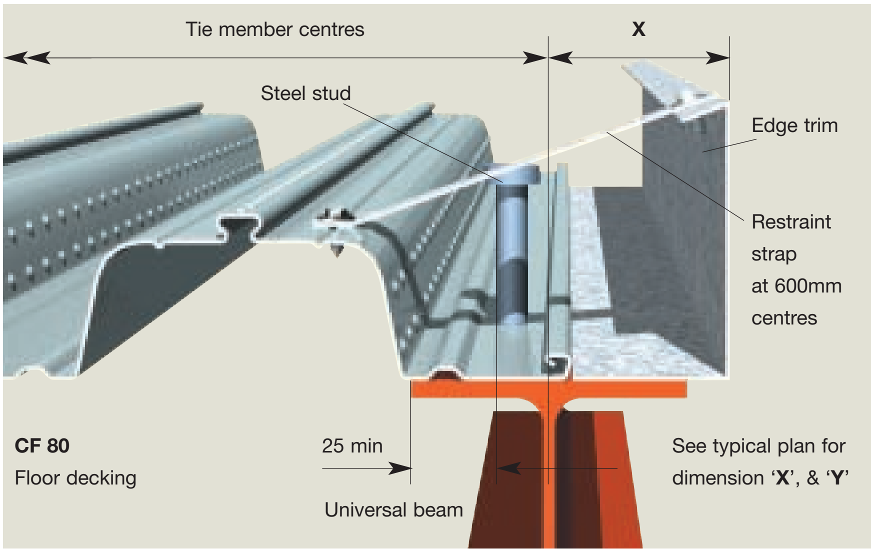
Deck notation



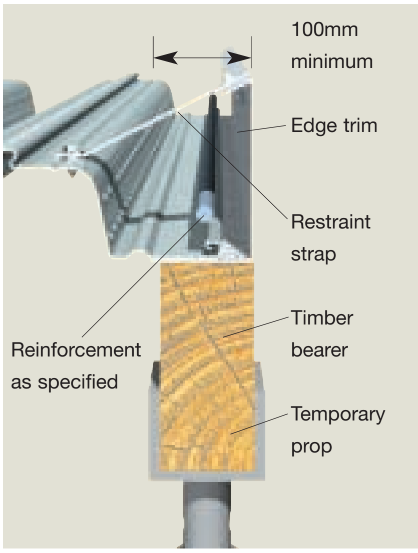
Typical side detail



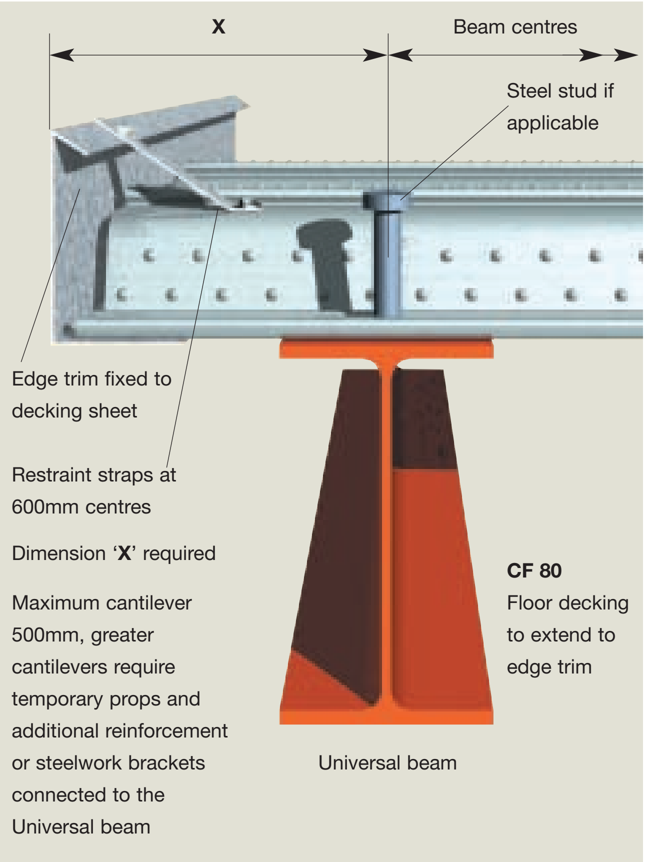
Typical side detail



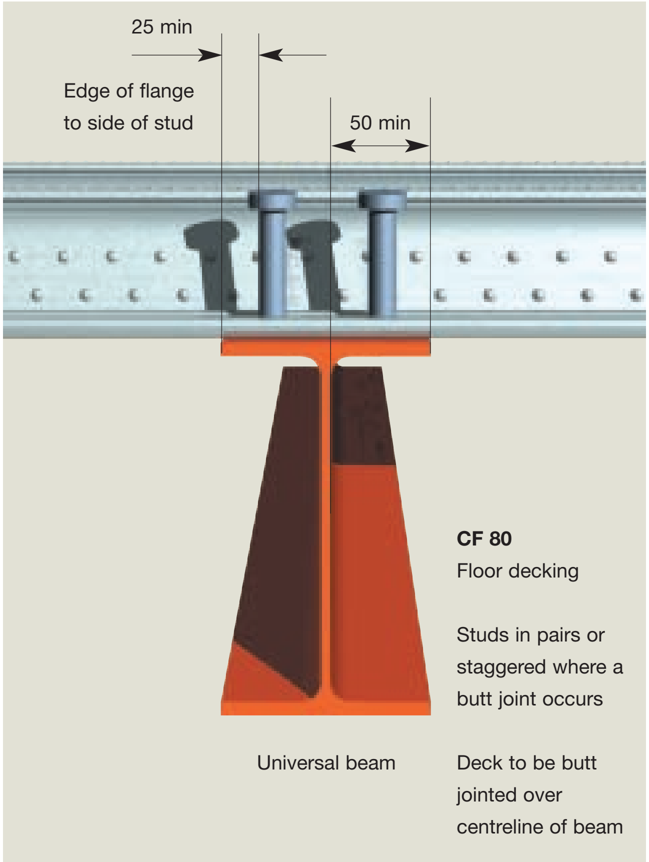
Unsupported edge detail



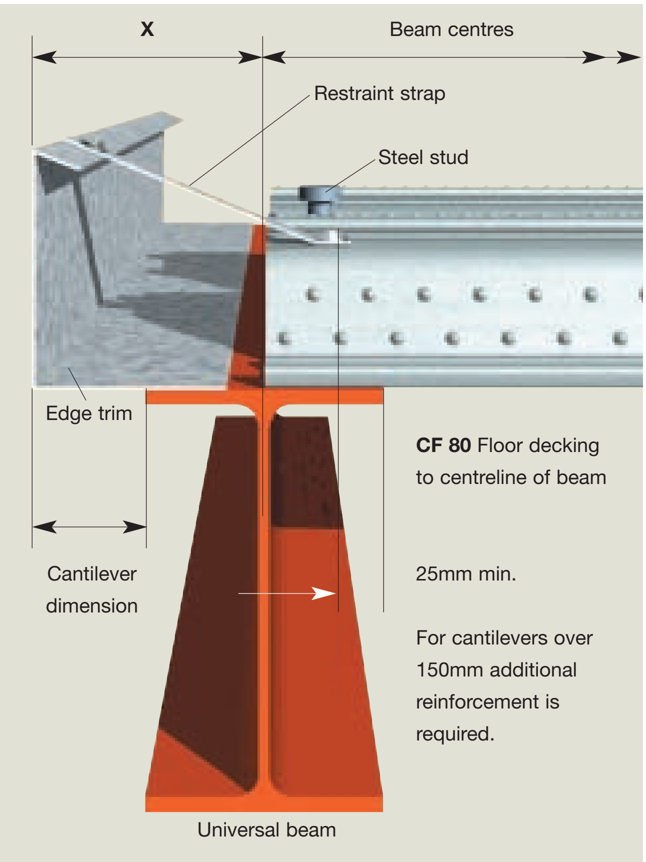
Typical end cantilever



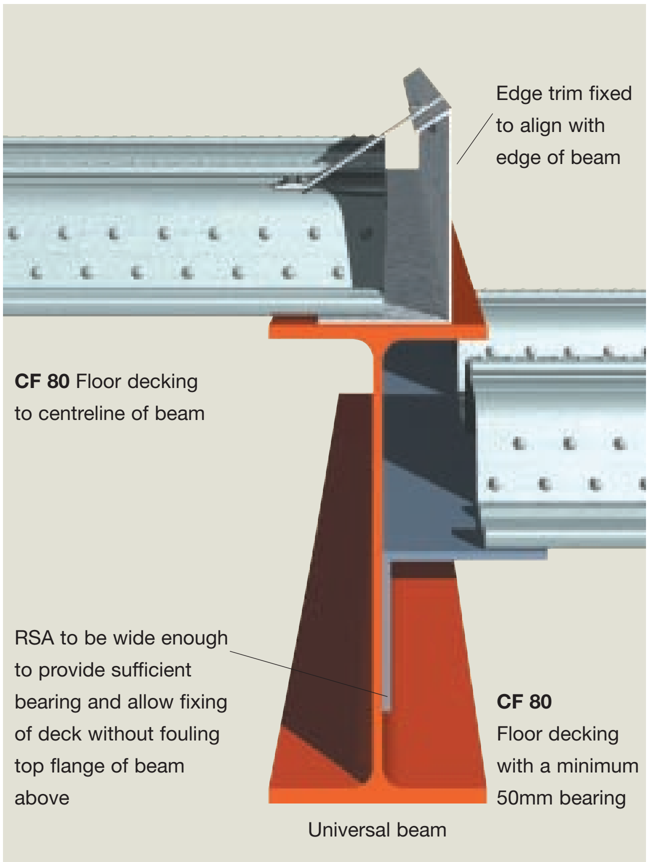
Butt joint



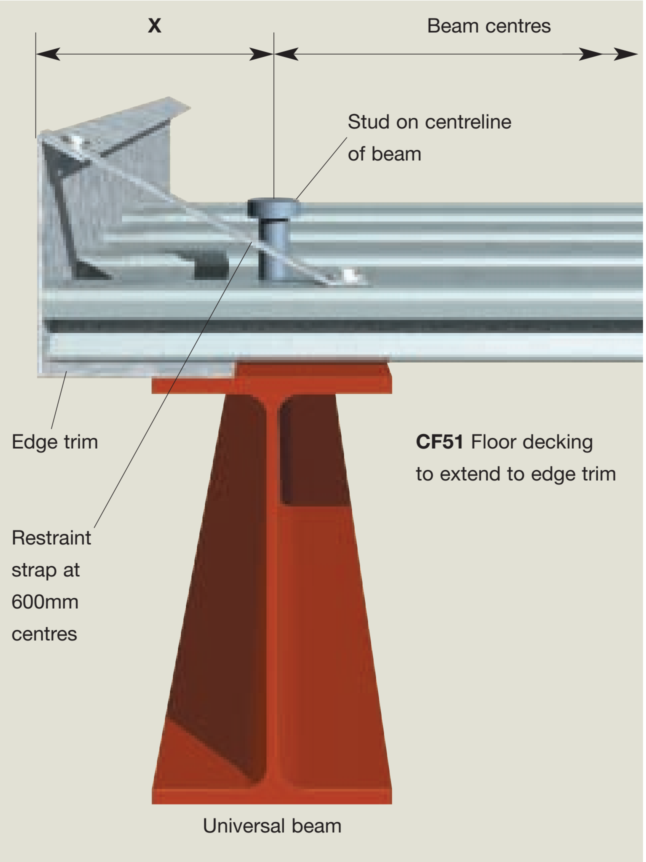
End detail



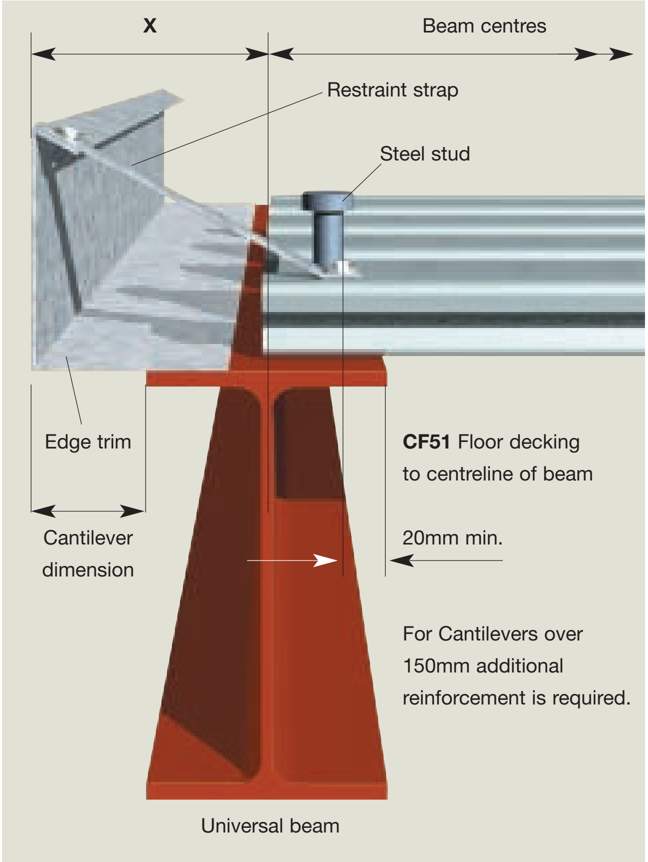
Step in floor



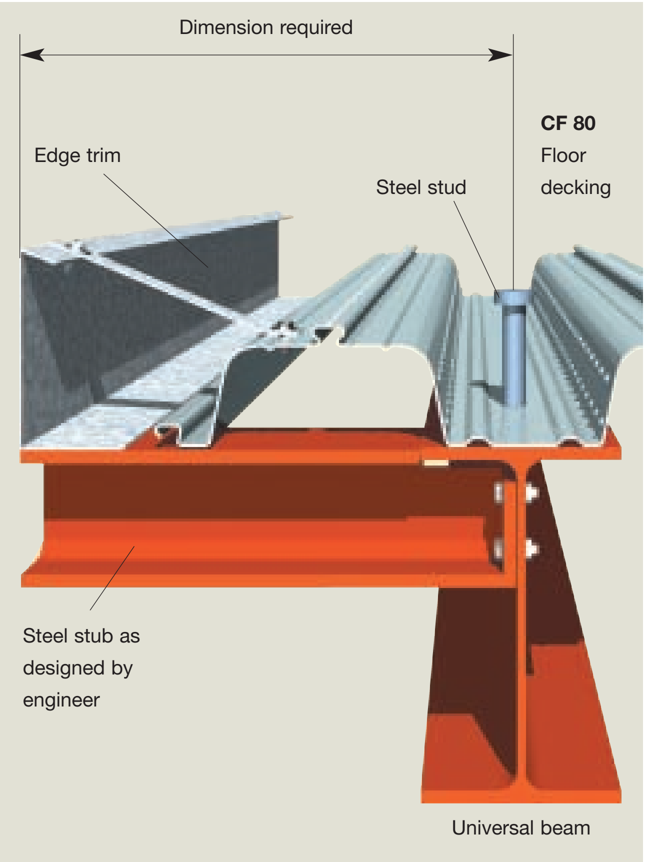
End detail alternative 1



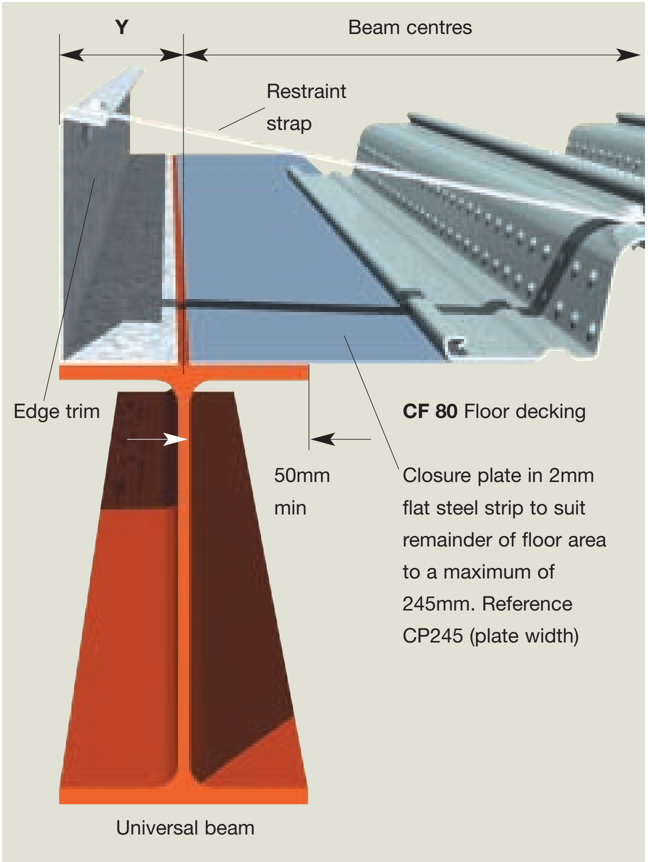
End detail alternative 2



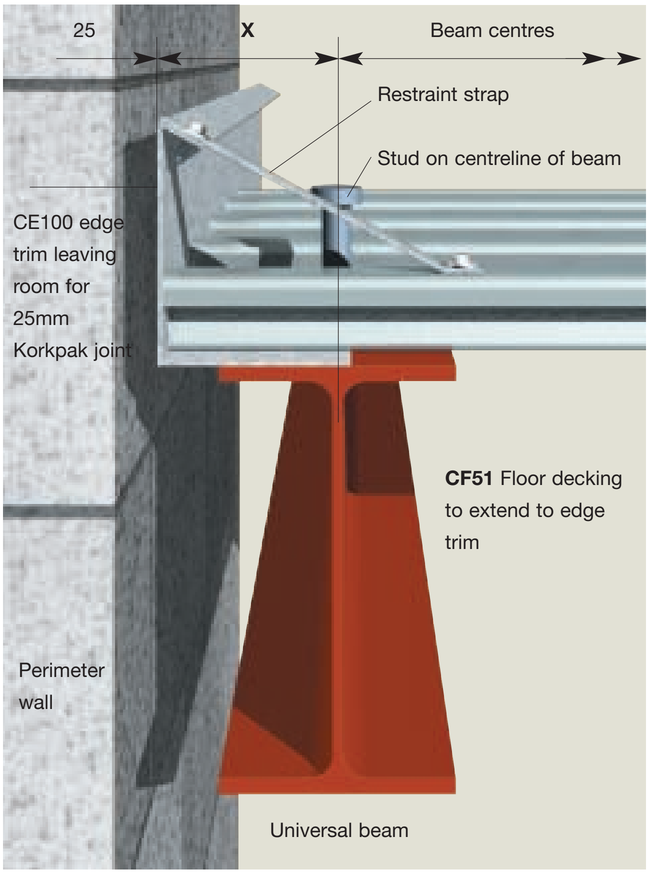
Side cantilever with stub bracket



Typical edge with plate

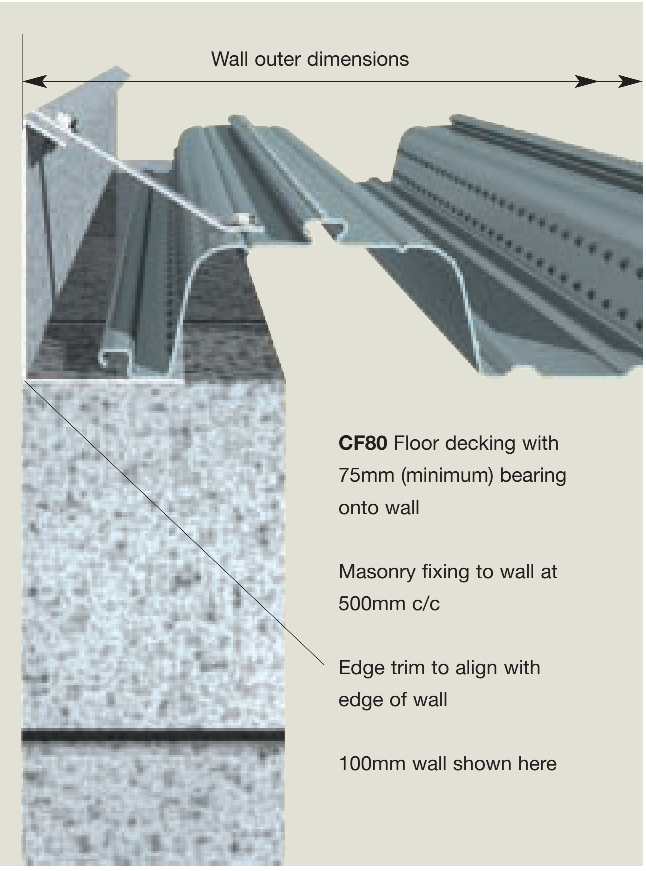


Beam at perimeter wall

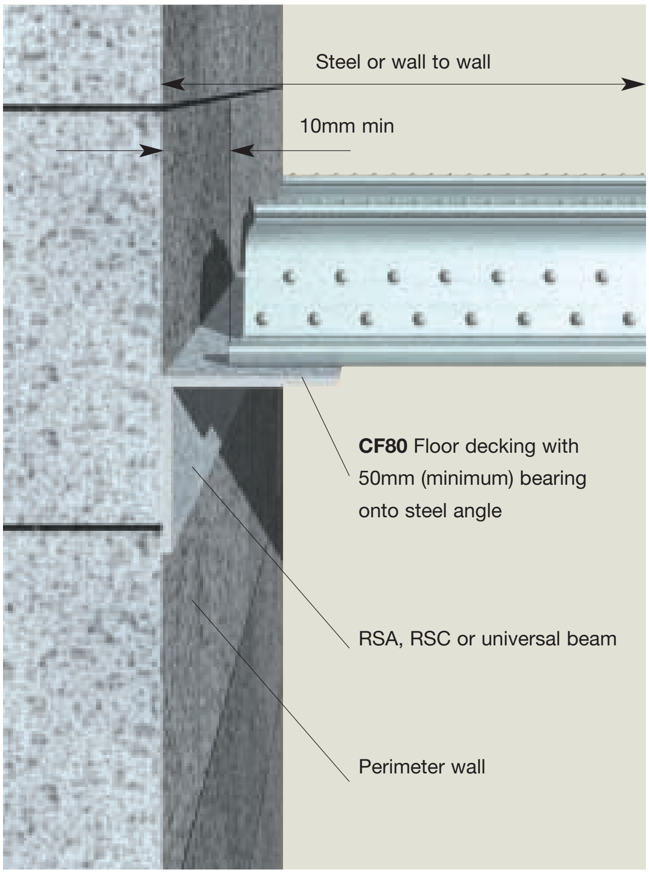


Typical wall end detail

Typical wall side detail



Deck inside of wall detail



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 CF46, CF60 and CF80. 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.

Where shear studs are not employed, the deck must be fixed as follows:

Wind loading*

Where temporary fixings, such as PINDAK, are used, wind loading should be checked, especially on exposed sites.

Fixing information for shallow decking

To steel	Heavy duty powder actuated fixings – Hilti ENP2 X-ENP-19 L15 nail/Spit SBR14 or equivalent. For temporary fixing (i.e. where weld through shear studs are to be used) – Hilti PINDAK16*
	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 46 and ComFlor 60	ComFlor 51 ComFlor 80
End fixing	3 per sheet (2 per sheet when using shear studs)	2 per sheet
Intermediate supports	2 per sheet (1 per sheet when using shear studs)	1 per sheet
Side laps	1 fixing at 1000mm c/c (not required for CF 51)	
Side fixing onto support	1 fixing at 600mm c/c	

Parameters assumed for shallow deck quick reference span tables

Mesh
See notes on profile pages.

Spans
Measured centre to centre of supports.

Deck
Standard deck material specification.

Bearing width
The width of the support is assumed to be 200mm.

Prop width
Assumed to be 100mm.

Deflection
Construction stage L/130 or 30mm (ponding has been taken into account).

Deflection
Composite stage L/350.

Concrete grade
The concrete is assumed to be grade 35 with a maximum aggregate size of 20mm. The wet weight of concrete is taken to be normal weight 2400kg/m^3. The modular ratio is 10 for normal weight.

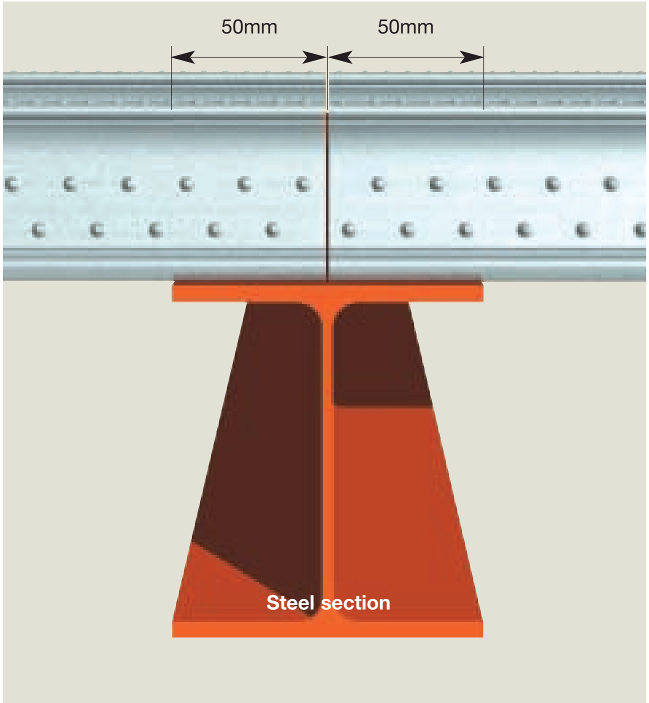
Construction load
No allowance is made for heaping.

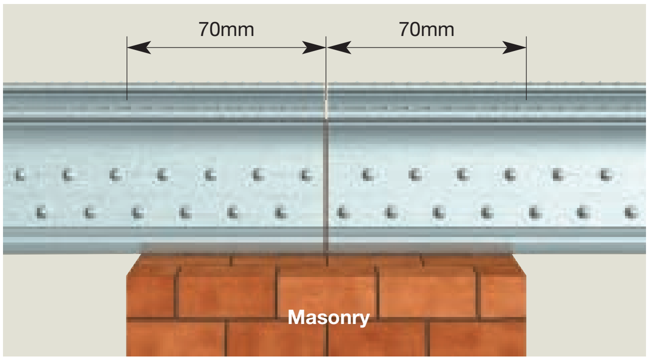
Fire
The fire engineering method (FE) has been used to calculate the reinforcement needed to achieve the fire rating. The minimum slab thickness indicated in each table for each fire rating satisfies the fire insulation requirements of BS 5950: Part 8.

Span/depth ratio
This is limited to 30 for lightweight concrete and 35 for normal weight concrete.

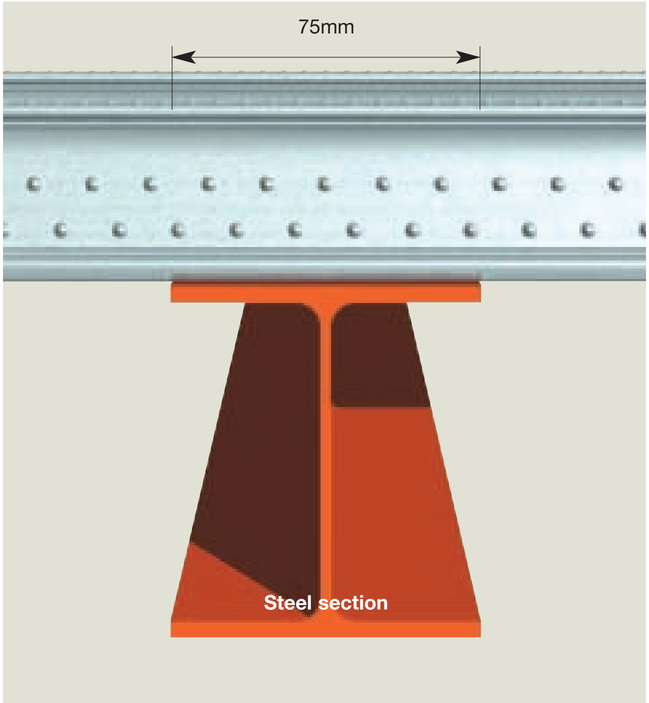
Bearing requirements

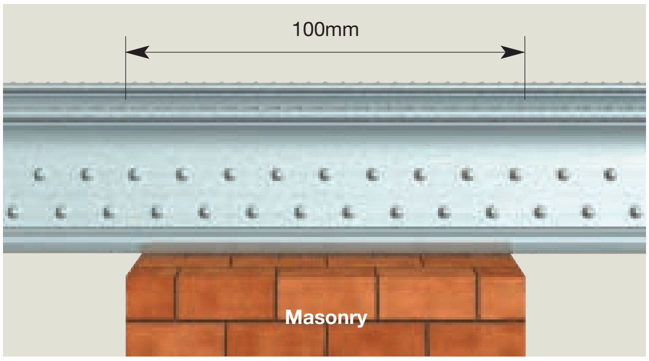
End bearing and shared bearing (minimum)





Continuous bearing (minimum)





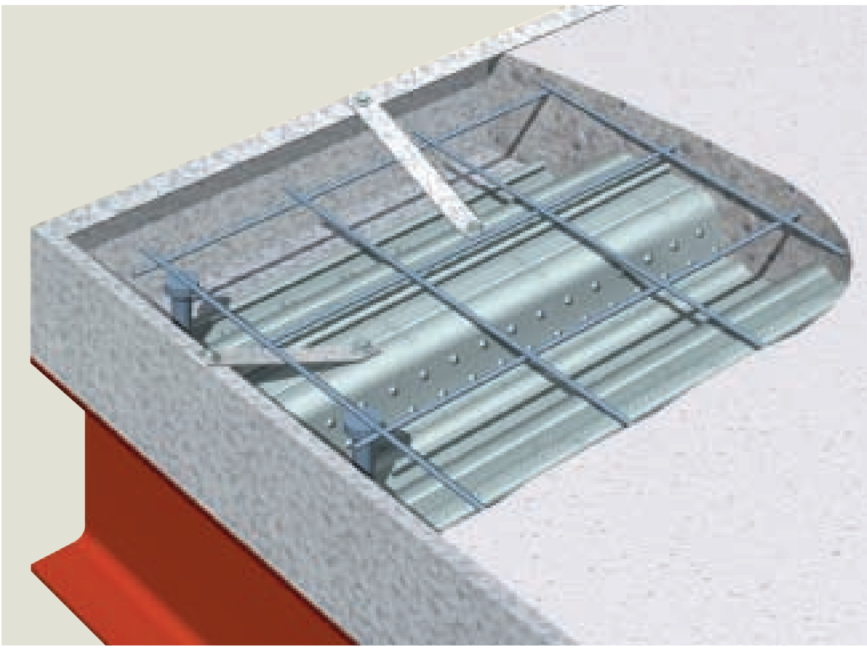
Edge trim

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



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 20mm to the edge of the beam. Further guidance on shear studs for designers and installers may be found in The Steel Construction Institution 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

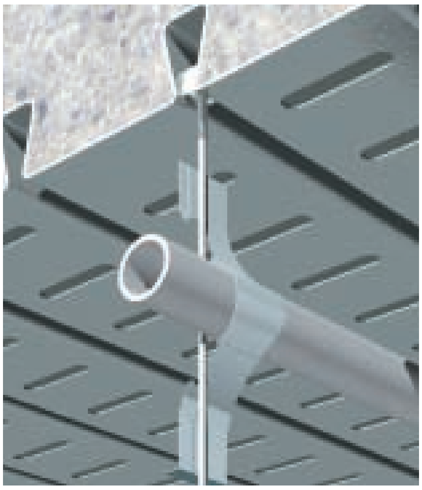
FibreFlor can be used in place of anti crack mesh, which eliminates all mesh position issues. However if reinforcing mesh is used, it is positioned towards the top of the slab. The top cover to the reinforcement mesh should be a minimum of 15mm and a maximum of 30mm. Support stools are required to maintain 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

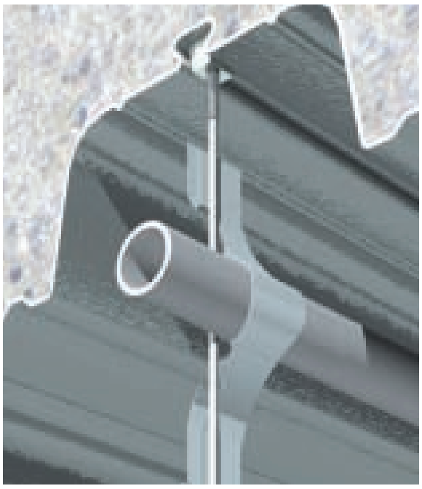
Before the concrete is poured, the decking must be cleared of all dirt and grease, which could adversely influence the performance of the hardened slab. The oil left on the decking from the roll forming process does not have to be removed. Concrete should be poured evenly, working in the direction of 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 dovetail shaped re-entrant rib on ComFlor 51 and the 15mm high raised minidovetail re-entrant stiffener on the ComFlor 60 and ComFlor 80 profiles allow for the quick and easy suspension of ceiling and services, using either of the two following suspension systems.



ComFlor 51



ComFlor 80

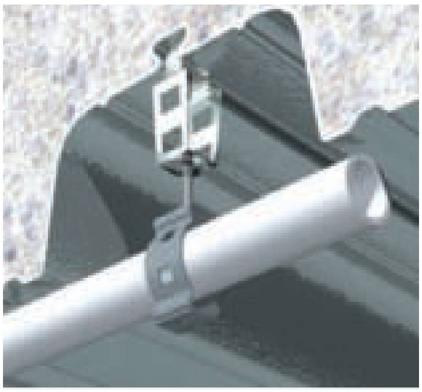
(a) Threaded wedge nut fixings

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.

(b) GTD-clip hangar fixings



GTD-clip hangar fixings are cold formed thin steel hangers with circular openings in the soffit to take metric bolts, threaded rods or further pipe clamp hangers. The system is installed after the composite slab has been poured and the concrete is sufficiently hardened.

Installation

To install the GTD-clips, the two dovetail shaped ends are compressed by hand and inserted into the dovetail re-entrant of the profile, before being rotated 90 degrees. One then lets go of the two ends and the clip will snap into position and is tightly connected. Finally, bolts, threaded rods or pipe clamps are connected into the soffit opening of the GTD-clip.

Loadbearing capacities

System	Thread size	Maximum static working load (kg)
Wedge Nut	4	100
	6	100
	8	100
GTD – Clip 6 90	8	90
	10	90
GTD – Clip and Pipe Clamp	N/A	45

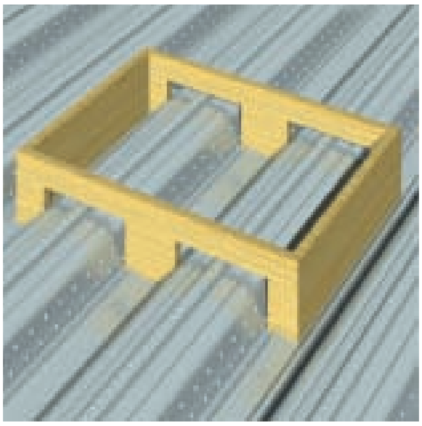
A minimum safety factor of 4 has been applied to the safe working load capacities

Sitework construction details

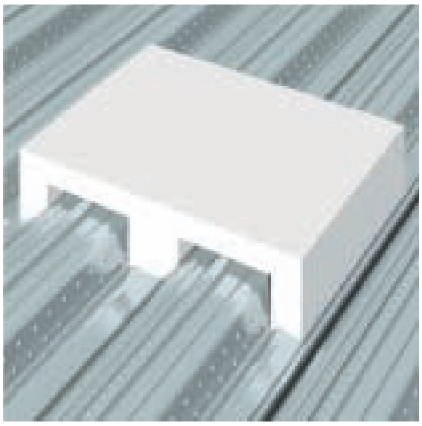
Openings

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

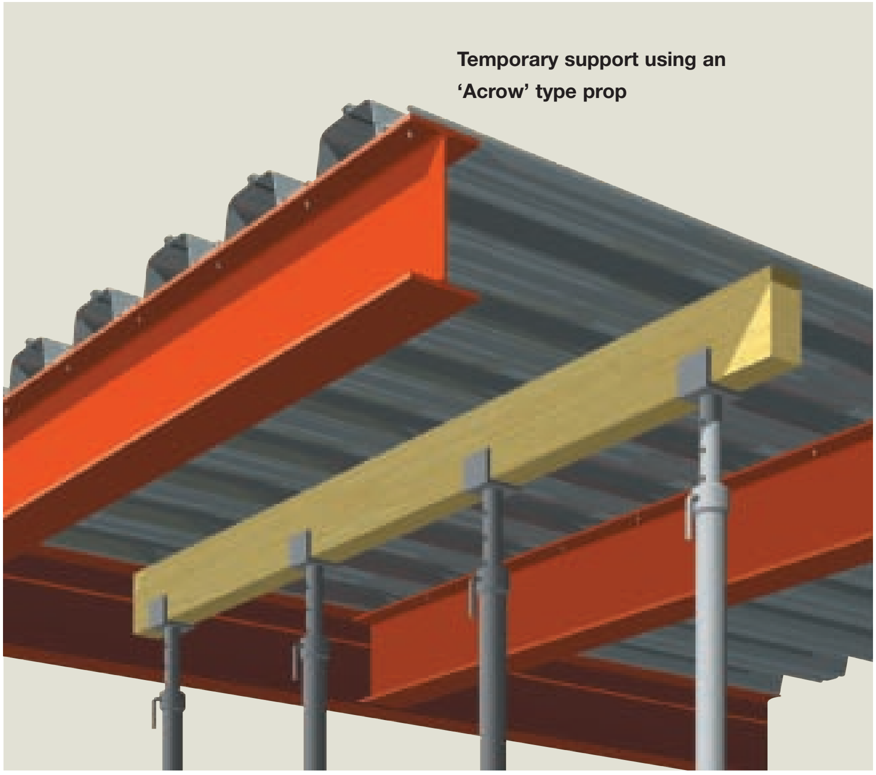


Dense polystyrene block

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 100mm. 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. The horizontal bearer timbers must be at least 100mm wide and should be propped at no more than 1m centres. Sometimes the specification may call for 150mm wide bearers, as determined by the structural engineer or concreting contractor.

Props should be stable without relying on friction with the deck for laterial stability. The end props in a row should be self supporting, and braced to the internal props.



Temporary support using an 'Acrow' type prop

Percussive drilling

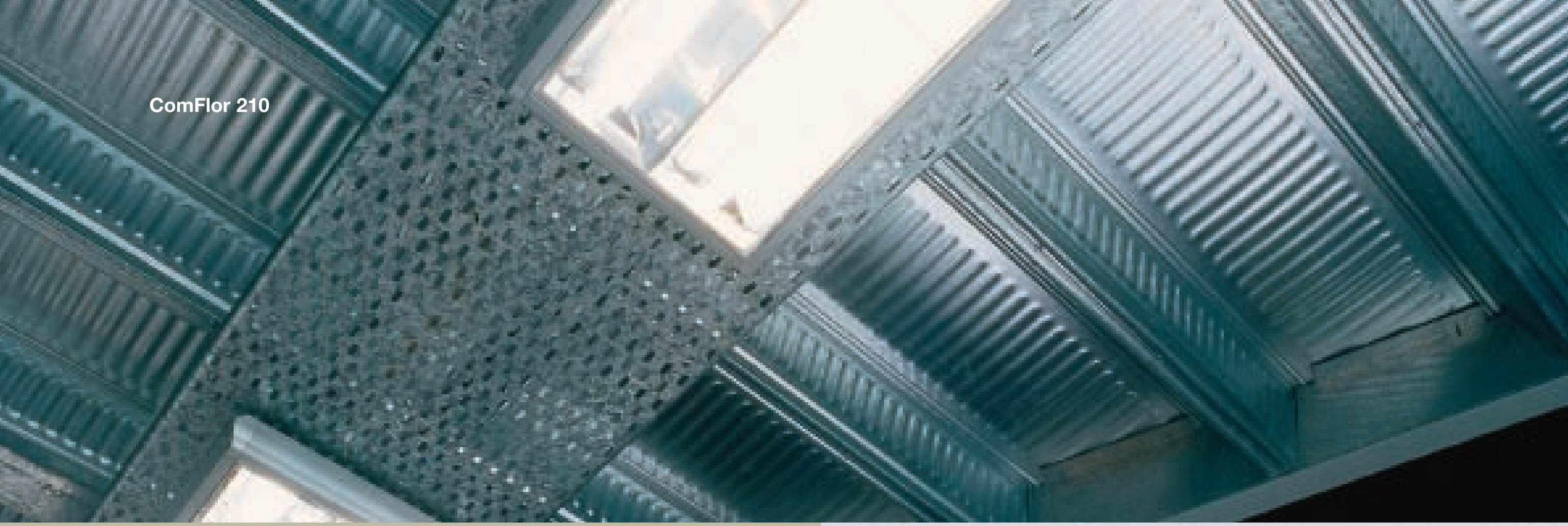
Percussive drilling into composite concrete slabs is not recommended, however small scale rotary hammer drills are considered to be satisfactory.

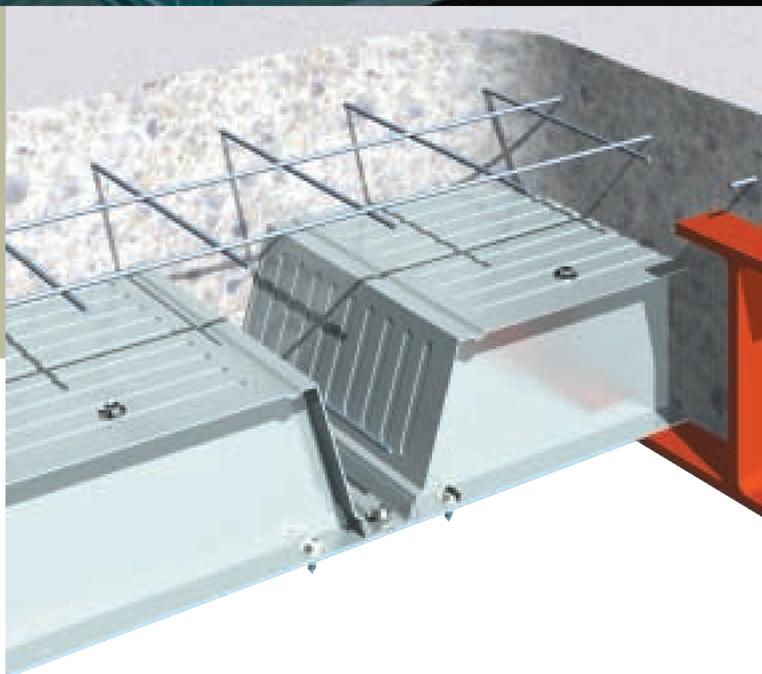
Temporary props

Timber bearer guide (shallow decks)

All to be min. 100mm wide

Slab depth (mm)	Bearer depth (mm)
up to 120	150
130 – 160	200
170 – 200	250





ComFlor 210

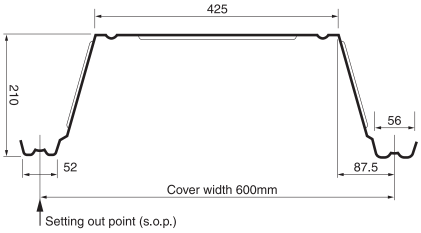
Deep composite profile

Typical unpropped span 4.5m – 6.0m

The original SlimFlor long span steel deck, ComFlor 210 has the capability to span up to 6 metres in unpropped construction. Suitable for use in Corus Slimdek® construction, which offers minimal structural depth, fast construction and many other benefits.

- With cross and longitudinal stiffeners, CF210 is structurally efficient and offers excellent composite action with the concrete.
- Simple single bar reinforcement in each trough, combined with anti-crack mesh near the top of the concrete slab gives the composite slab superb structural strength and fire properties.
- The nestable profile shape reduces transport and handling costs.
- Up to 2 hours fire rating with unprotected soffit.

ComFlor 210 design information



ComFlor 210 composite slab – volume and weight

Slab depth (mm)	Concrete volume (m³/m²)	Weight of concrete (kN/m²) Normal weight concrete Wet	Normal weight concrete Dry	Lightweight concrete Wet	Lightweight concrete Dry
270	0.100	2.36	2.31	1.87	1.77
280	0.110	2.60	2.54	2.05	1.95
290	0.120	2.83	2.77	2.24	2.12
300	0.130	3.07	3.00	2.43	2.30
305	0.135	3.18	3.12	2.52	2.39
310	0.140	3.30	3.23	2.61	2.48
330	0.160	3.77	3.69	2.99	2.83
350	0.180	4.24	4.16	3.36	3.18
375	0.205	4.83	4.73	3.83	3.62
400	0.230	5.42	5.31	4.29	4.07

Volume and weight table notes

1. Deck and beam deflection (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/m³
   Normal weight (dry) 2350 kg/m³
   Lightweight (wet) 1900 kg/m³
   Lightweight (dry) 1800 kg/m³

Section properties (per metre width)

Nominal thickness (mm)	Design thickness (mm)	Profile weight (kN/m²)	Area of steel (mm²/m)	Height to neutral axis (mm)	Moment of inertia (cm⁴/m)	Ultimate moment capacity (kNm/m) Sagging	Ultimate moment capacity (kNm/m) Hogging
1.25	1.21	0.16	2009	95.00	816.00	23.20	23.20

Span table – Normal weight concrete

Props	Span	Fire rating	Slab depth (mm)	Mesh	Maximum span (m), Total applied load (kN/m²), Bar size (mm): 3.5kN/m² 12	3.5kN/m² 16	3.5kN/m² 20	3.5kN/m² 25	5kN/m² 12	5kN/m² 16	5kN/m² 20	5kN/m² 25	10kN/m² 12	10kN/m² 16	10kN/m² 20	10kN/m² 25
No temporary props	Single span slab	1 hr	280	A142	4.8	5.4	5.4	5.4	4.3	5.4	5.4	5.4	3.4	4.5	5.4	5.4
			300	A193	4.8	5.2	5.2	5.2	4.4	5.2	5.2	5.2	3.5	4.6	5.2	5.2
			350	A393	4.7	4.7	4.7	4.7	4.5	4.7	4.7	4.7	3.7	4.7	4.7	4.7
		1.5 hrs	290	A193	3.7	4.9	5.3	5.3	3.4	4.4	5.3	5.3	2.7	3.5	4.3	5.3
			300	A193	3.7	4.9	5.2	5.2	3.4	4.5	5.2	5.2	2.7	3.6	4.4	5.2
			350	A393	3.8	4.7	4.7	4.7	3.5	4.6	4.7	4.7	2.8	3.8	4.6	4.7
		2 hrs	305	A193	2.0	2.7	3.3	4.1	1.8	2.4	3.0	3.7	1.5	1.9	2.4	3.0
			350	A393	2.1	2.7	3.4	4.2	1.9	2.5	3.1	3.8	1.5	2.0	2.5	3.1
			400	A393	2.1	2.7	3.4	4.2	1.9	2.6	3.2	3.9	1.6	2.1	2.6	3.3

Please refer to page 29 for span table parameters.

Design notes

Deck material

Corus Galvatite, hot dip zinc coated steel EN 10326-S350GD+Z275 or equivalent. Guaranteed minimum yield stress 350N/mm². Minimum zinc coating mass 275g/m² total both sides.

Anti-crack mesh

BS 5950: Part 4 currently recommends that anticrack mesh should comprise 0.1% of slab area. The Eurocode 4 recommendation is that anticrack mesh should comprise 0.2% of slab area for unpropped spans and 0.4% of slab area for propped spans. Where forklift truck (or other similar concentrated loading) is expected 0.5% minimum percentage reinforcement should be used over the supports and 2% elsewhere to control cracking.

For further information refer to SCI AD150. Mesh top cover must be a minimum of 15mm, and a maximum of 30mm. Mesh laps are to be 300mm for A142 mesh and 400mm for A193, A252 and A393 mesh.

Technical services

Corus International offers a comprehensive advisory service on design of composite flooring, which is available to all specifiers and users. Should queries arise which are not covered by this literature or by the ComFlor software, please contact us.

Fire

For details of the performance of composite slabs comprising ComFlor 210 decking in simplified design cases or for full fire engineering, refer to the ComFlor software.

Bar reinforcement

End anchorage for bar reinforcement. All cases require properly anchored L-bars at the supports, except for those indicated in yellow. Cases indicated in yellow may have straight bars, with an anchorage length of 70mm from the edge of the support. One bar is placed in each profile trough, the cover to deck soffit is assumed at 70mm.

Details of full design, load spans and profile performance can be found by using the ComFlor software CD. Your free copy can be found on the inside back cover of this publication.

Design information

Deep Composite Floor Decks will be considered where longer span (4m plus) floor slabs are required. When combined with Corus Slimdek® system, deep decks are designed to achieve a very shallow overall structural floor.

Deep composite floor decks

Our Deep Composite Floor Decks will be used in one of these applications:

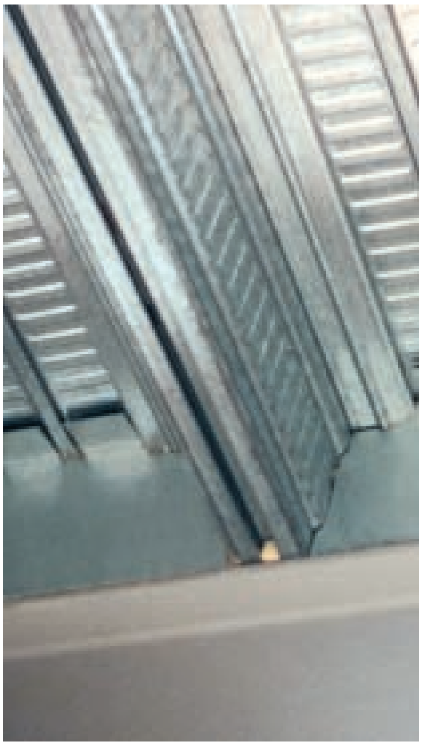
1 Corus Slimdek® system.
2 Long span composite concrete/steel floor deck in composite steel construction.
3 Long span composite concrete/steel floor deck in masonry construction.

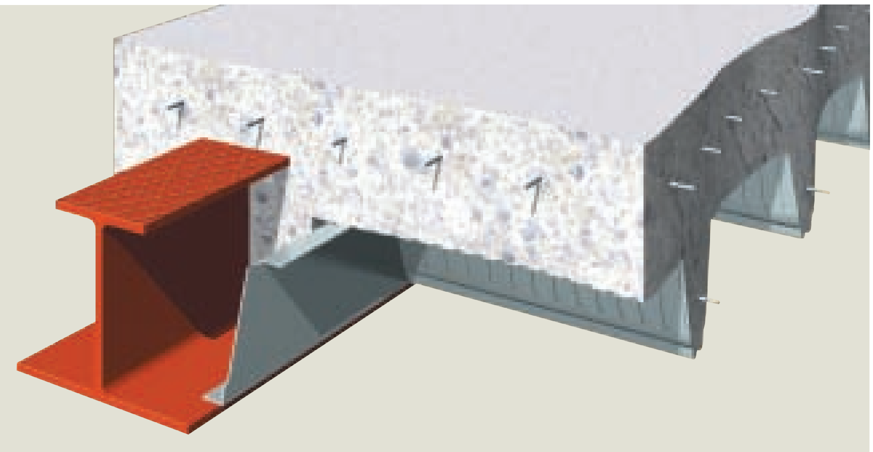
The design considerations relating to the decking are similar for all these applications.

Corus Slimdek® system

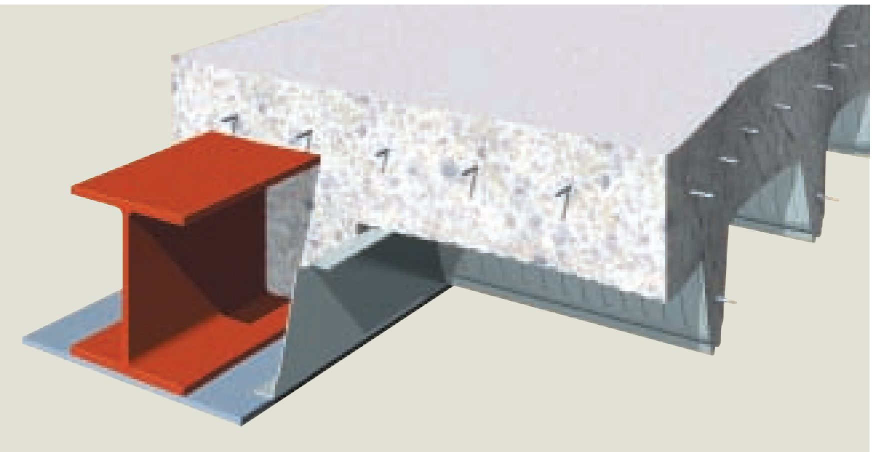
This system comprises Asymmetric Slimflor® Beams (ASB) and deep CF210 decking.

The principle of Slimdek® is that the steel deck (and thus the composite concrete slab) bears on the lower flange of the beam, thus containing the beam within the floor slab. Three different types of Slimflor® beam are produced:

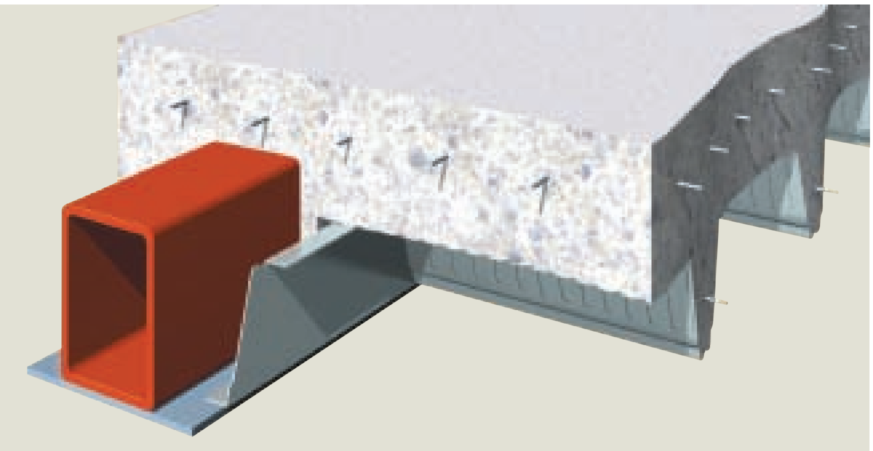




Asymmetric Slimflor® Beam (ASB), which is a hot rolled section with a narrower top flange than bottom flange.



Slimflor® Fabricated Beam (SFB), which is a Universal Column section with a wide flange plate welded to its underside.



Rectangular Hollow Slimflor® Beam (RHSFB), which is a rectangular hollow section with a flange plate welded to its lower face (generally used for edge beams).

Slimdek® design procedure
There are two distinct stages for which the elements of the Slimdek® system must be designed. The first is the construction stage, during which the beams and decking support the loads as non-composite sections. During the second stage the decking and concrete act together to form composite slabs, as do (generally) the ASBs and slab. SFBs and RHSFBs will act compositely if shear studs have been provided.

The key design points are:
- Consideration of the required spans will allow the depth of the beams to be determined.

- Consideration of the required fire resistance will allow the depth of slab to be determined, as a function of the cover required for the beams and the decking.

Having established these scheme design parameters, detailed design of the beams and slab can be undertaken. The following slab depths should be considered as typical:
280 ASB sections – 290-320mm deep slab
300 ASB sections – 315-340mm deep slab.

These depths will provide adequate cover to the ASB for it to act compositely with the slab. For SFBs a greater range of slab depths may be considered for a given depth of beam; the slab depth requirement will depend on whether shear studs must be accommodated to make the SFB act compositely.

Slimdek® beam design
The design of the beams in the Slimdek® system is presented in The Corus Slimdek® Manual and Design Software which is available from Corus Construction Centre +44 (0)1724 405060. Further detailed design information is available 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. Please see references section on page 38 for further information.

Decking design
In addition to considering the self-weight of the slab, the design of the deep decking should take into account temporary construction loads. These construction loads differ slightly from those that should be considered for shallow decking, because of the considerably greater spans that can be achieved with deep decking.

Construction stage loading
The 1.5 kN/m² construction load required by BS 5950-4 should only be applied over the middle 3m of the span, as shown below.

A reduced load of 0.75 kN/m² (as specified in EC4) may be applied outside this region, as it would be overly conservative to apply the full load of 1.5kN/m² over the entire span. The effect of concrete ponding should be taken into account (by increasing the self weight of the slab) if the deflection under self-weight alone exceeds the lesser of span/180 or 20mm.

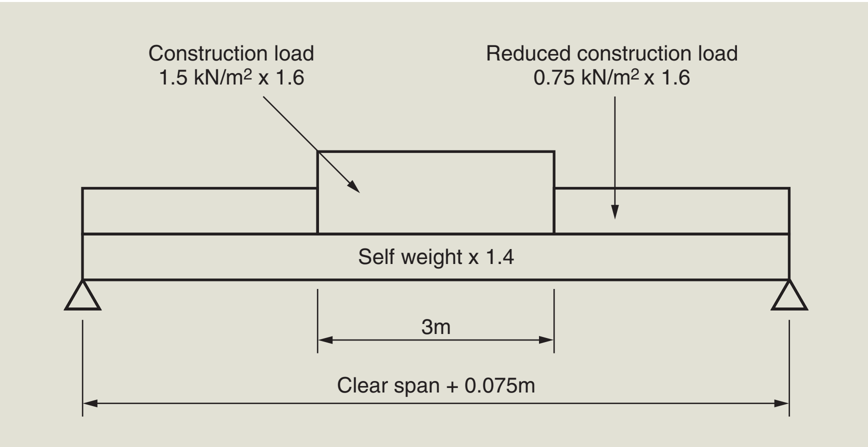
If temporary props are used to support the decking during construction, a construction load of 1.5 kN/m² should be considered as acting over the complete span (between permanent supports). Although a lower value might be justifiable over parts of the span, a constant load should be considered for design simplicity.

Temporary propping (when required)
The spacing of temporary props is governed by the ability of the decking to resist combined bending and shear in the hogging (negative) moment regions over the lines of props.

It is recommended that the spacing between the props should be relatively close, so that local loads do not cause damage to the decking (2.5m to 3.5m spacing depending on the slab weight).

A 100mm wide timber bearer should be used to distribute the load at these points.

End bearing
The end bearing of the sheets should be specified as 50mm. The flange widths are such that this bearing can be achieved, whilst still allowing the sheets to be dropped vertically into position (i.e. without having to 'thread' them between the top and bottom flanges).



Slab design
The design of composite slabs using deep decking differs from that for shallow decking in the following ways:

Placing bar reinforcement in the troughs of the decking increases the ultimate load resistance of the slab. The benefit of these bars is considered in both the 'normal' and fire conditions.

The slab depth may need to be chosen not only to satisfy the structural, durability and fire resistance requirements of the slab itself, but also to provide appropriate cover over ASB or Slimflor beams.

The reinforcing bars in the troughs of the decking provide additional tensile area to that provided by the decking, and thus enhance the bending resistance of the composite slab.

Bar diameters range from 8mm to 32 mm, depending on the span and fire resistance requirements.

Straight bars may be used to achieve 60 minutes fire resistance (provided that shear stresses are low). In other cases, L bars should be used to provide sufficient end anchorage in fire conditions.

Cracking
It is normal for some cracking to occur in the slab over the beams. These cracks run parallel with the beams and are not detrimental to the structural behaviour of the slab. They may be controlled by mesh reinforcement provided across the tops of the beams. Guidance on the detailing of reinforcement to control cracking may be found in the Corus Slimdek® manual.

Additional reinforcement may be required to fulfil the following roles:
- Transverse reinforcement adjacent to shear connectors.
- U-bars at composite edge beams.
- Additional crack control reinforcements
- Strengthening around openings.
- Strengthening at positions of concentrated loads.

Fire resistance
One of the principal considerations governing the choice of slab depth is the required fire resistance period. Minimum depths are given above as a function of the concrete type and fire resistance required and are based on insulation requirements.
The Fire Engineering Method: The capacity assessment in fire is based on a single or double layer of standard mesh at the top and one bar in each concrete rib. For CF210 decking, the bar is placed at an axis distance, dependent on the fire resistance period. The axis distance must not be less than 70mm. To maximise fire resistance capacity the axis distance needs to be 70, 90 and 120mm (from the soffit of the deck) for 60, 90 and 120 minutes fire resistance, respectively. However where fire resistance is not the limiting factor it may be more effective for the axis distance to be at the minimum.

	Concrete thickness above deck	
Fire resistance	**NWC**	**LWC**
60min	70mm	60mm
90min	80mm	70mm
120min	95mm	80mm

Reduced mesh
Where EC4 mesh rules are used, as recommended by The Steel Construction Institute and Corus, the full stipulated mesh applies to the slab 1.2m either side of every support. Outside of this, i.e. in the midspan 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 midspan mesh must be checked for adequacy under fire, for the rating required.

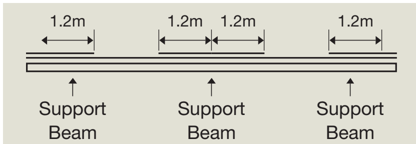
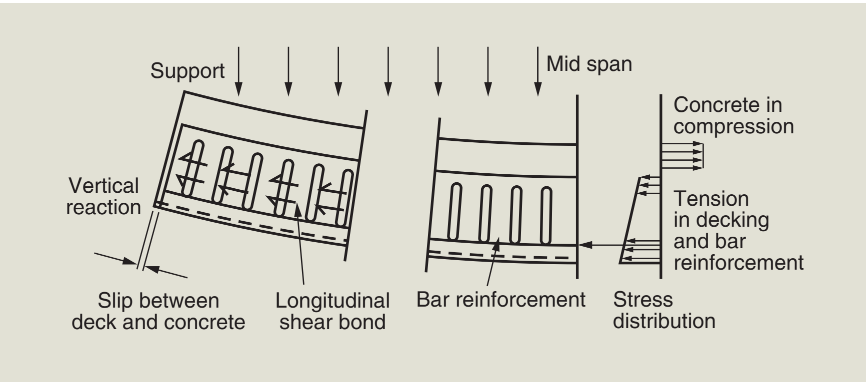
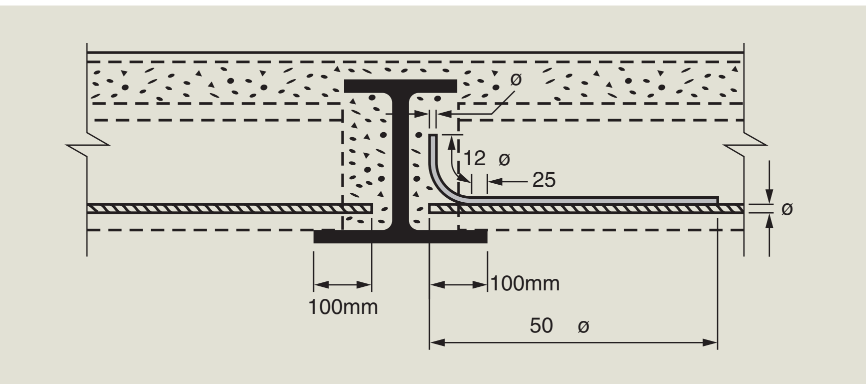


Diagram showing full mesh area over supports





Vibration
The dynamic sensitivity of the composite slab should be checked 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, ceiling and services, screed and 10% imposed loads, representing the permanent loads and the floor self weight.

In the absence of more appropriate information, the natural frequency of the composite slab should not exceed 5Hz for normal office, industrial or domestic usage. For designs using CF210 decking, this limit may be reduced to 4Hz if the design has been carried out on the assumption of simple supports at the ends. Conversely, for dance floor type applications or for floors supporting sensitive machinery, the limit may need to be set higher.

In the Slimdek system, consideration should be given to the system frequency of the floor as a whole if the natural frequency of the slab and/or the supporting beam is less than 5Hz.

For design to the Eurocodes, the loads considered for the vibration check are increased using the psi-factor for imposed loads (typically 0.5). The natural frequency limit may be reduced to 4Hz, because of this higher load used in the calculation.

Partial continuity
Partial continuity for deep decking: Tests have shown that the CF210 composite slabs supported on a steel beam and provided with adequately detailed continuity mesh reinforcement over the steel beam support exhibits a degree of continuity at the support. The beneficial effect of partial continuity at the supports may be taken into account by specifying CONTINUOUS in the Span Type field. When this option is specified, the following assumptions are made by the design software;

- a 20% reduction in the deflections of the composite slab at the normal design stage.
- a 30% reduction in the deflections when assessing the natural frequency of the slab. This is justified by the lower stress levels during vibration.
- stresses in the composite slab in fire conditions are derived from a model which assumes full continuity at one end and a simple support at the other (i.e a propped cantilever condition).

In this case, the amount of mesh reinforcement is increased to a minimum of 0.4% of the cross-sectional area of the concrete topping in order to develop sufficient continuity in the slab.

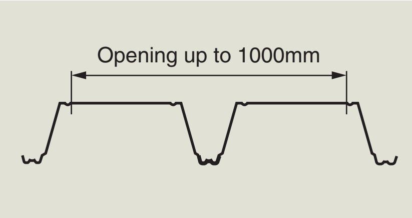
Note that in all cases, partial continuity is ignored in assessing the capacity of the composite slab at the normal design stage.

Openings in the slab
Provision for vertical service openings within the floor slab will necessitate careful design and planning. The following summarises the options that are available to the designer:

Openings up to 300mm x 300mm can be accommodated anywhere in the slab over a crest section of the deck, normally without needing additional reinforcement.

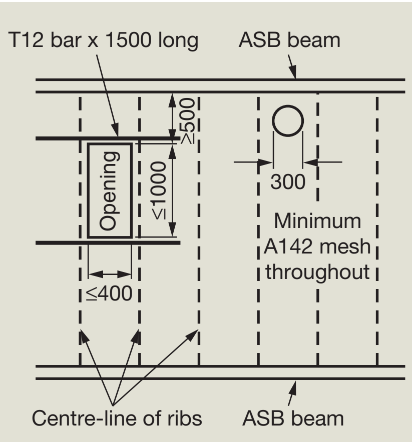
Openings up to 400mm wide x 1000mm long may be taken through the crest of the deep decking. Additional reinforcement, which should be designed in accordance with BS 8110, may be required around the opening.

Openings up to 1000mm wide x 2000mm long may be accommodated by removing one rib (maximum) of the decking, fixing suitable edge trims and providing additional reinforcement to transfer forces from the discontinuous rib. The slab should be designed as a ribbed slab in accordance with BS 8110, with decking being used as permanent formwork. Guidance may be found in the Corus Slimdek Manual.



Larger openings will generally require trimming by secondary beams.

If an opening greater than 300mm x 300mm lies within the effective width of slab adjacent to a beam (L/8), the beam should be designed as non-composite. A close grouping of penetrations transverse to the span direction of the decking should be treated as a single large opening.



Design of small and medium size openings in the slab

Service integration
The Slimdek system offers considerable opportunity for the integration of services. This is covered in detail in Corus Construction Centre publication Slimdek – Structure and services integration.

Parameters assumed for deep deck quick reference span tables

Mesh
See notes on page 25.

Spans
Measured centre to centre of supports.

Deck
Standard deck material specification.

Bearing width
The width of the support is assumed to be 200mm.

Prop width
Assumed to be 100mm.

Deflection
Construction stage L/130 or 30mm (ponding has been taken into account).

Deflection
Composite stage L/350.

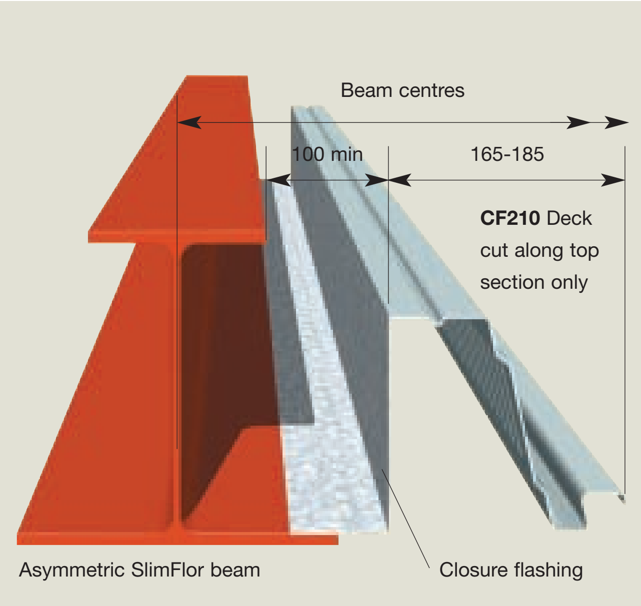
Concrete grade
The concrete is assumed to be grade 35 with a maximum aggregate size of 20mm. The wet weight of concrete is taken to be normal weight 2400kg/m^3. The modular ratio is 10 for normal weight.

Construction load
No allowance is made for heaping.

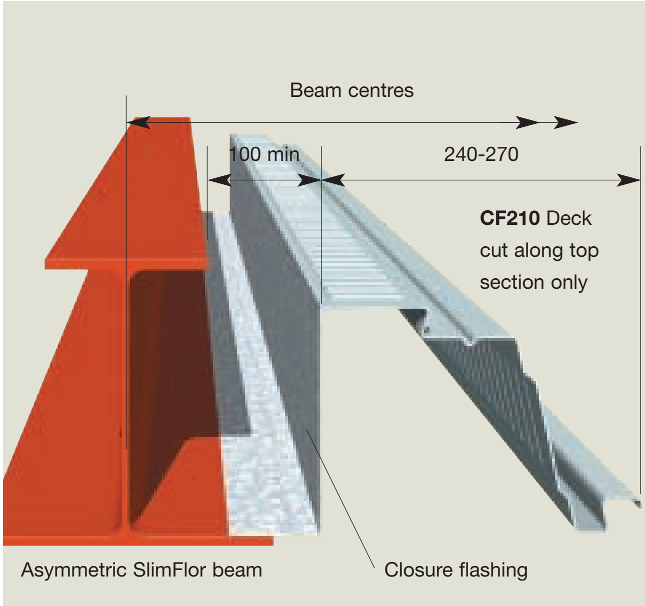
Fire
The fire engineering method (FE) has been used to calculate the reinforcement needed to achieve the fire rating. The minimum slab thickness indicated in each table for each fire rating satisfies the fire insulation requirements of BS 5950: Part 8. Span/depth ratio. This is limited to 30 for lightweight concrete and 35 for normal weight concrete.

Construction details

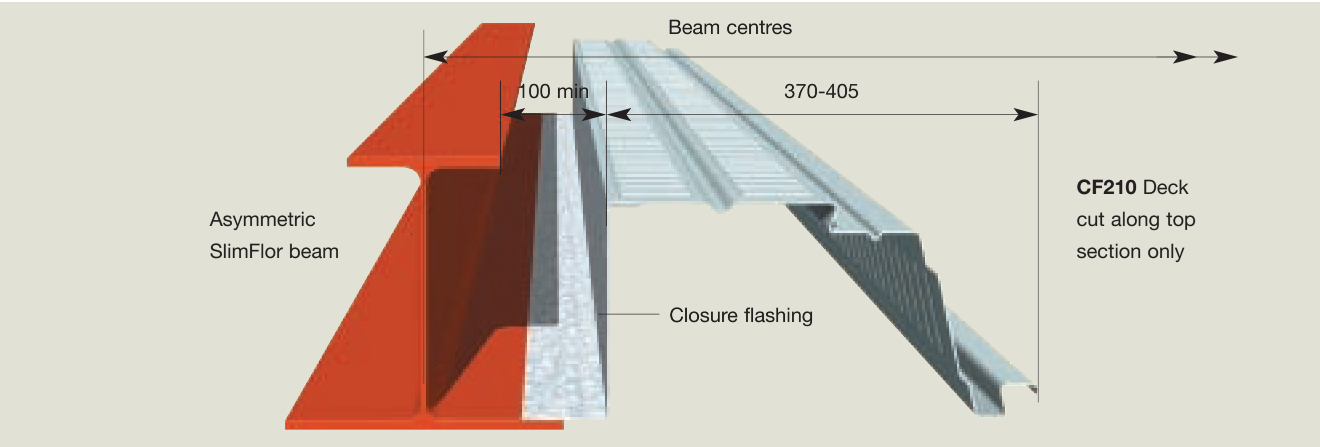
Cut deck – Option 1



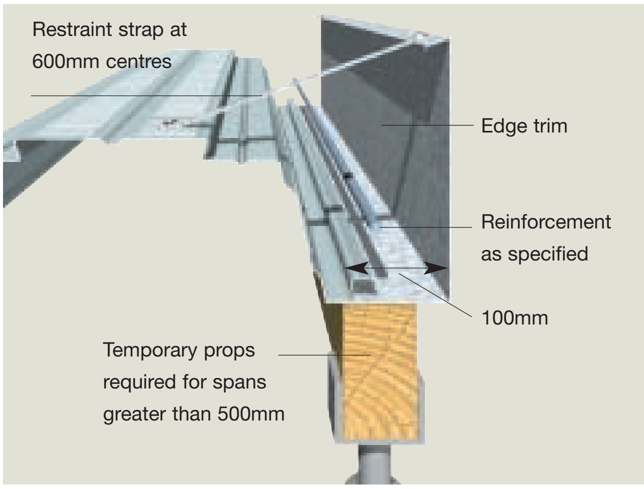
Cut deck – Option 2



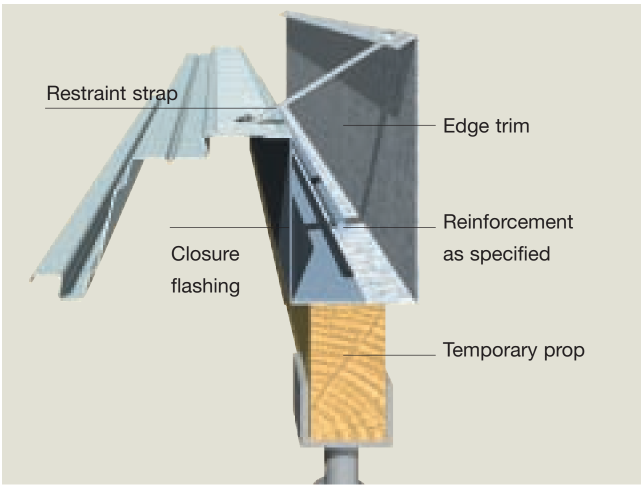
Cut deck – Option 3



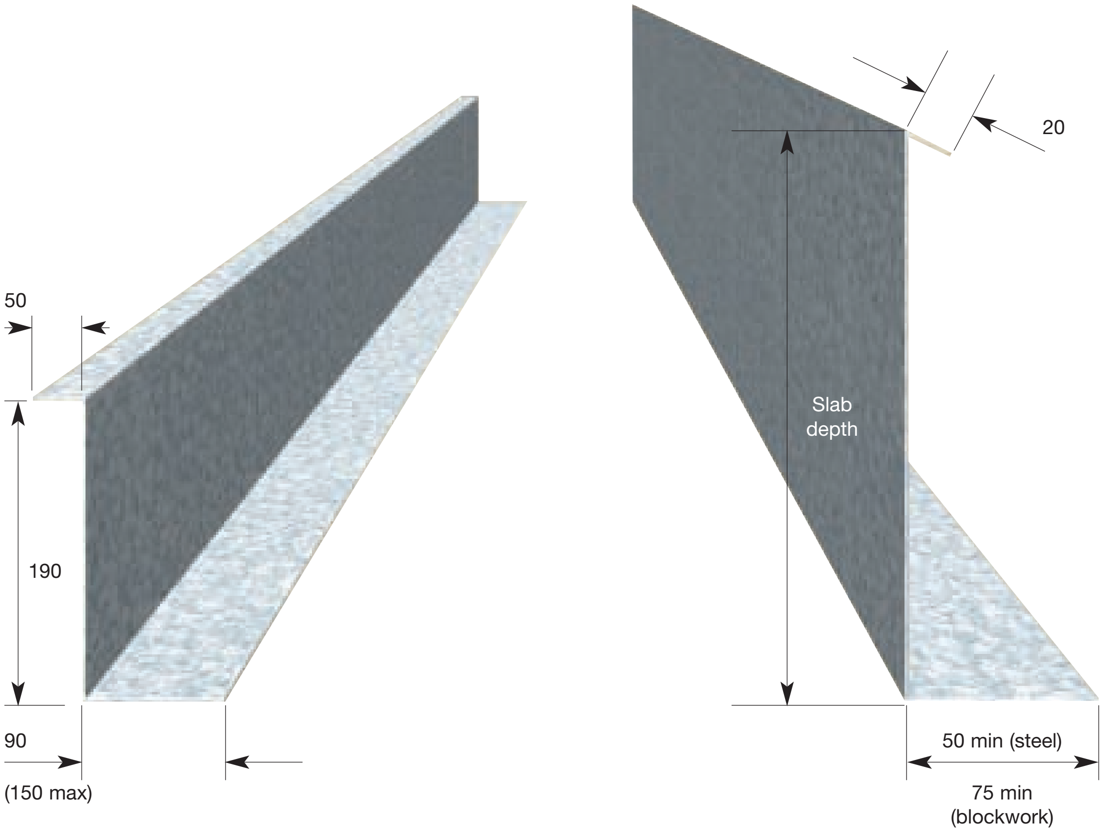
Unsupported edge



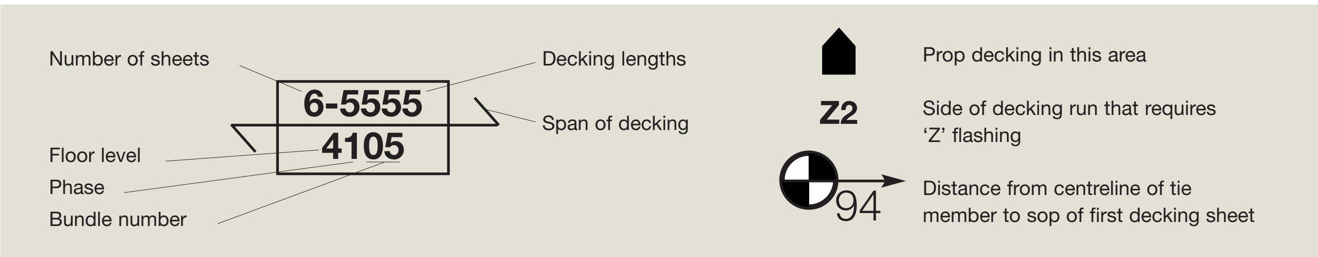
Unsupported edge with closure flashing



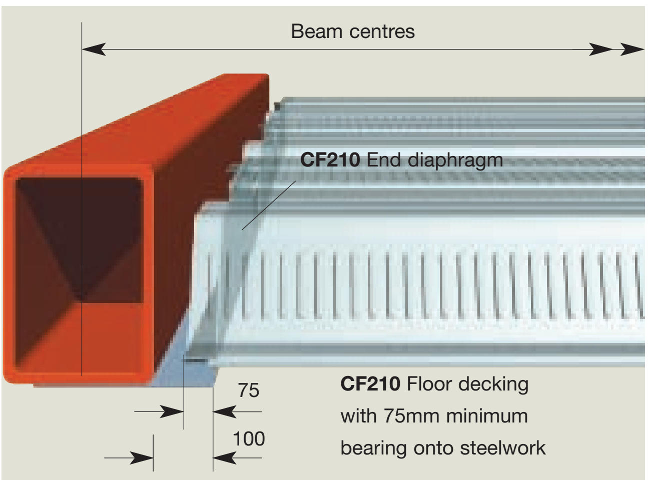
Steel trims



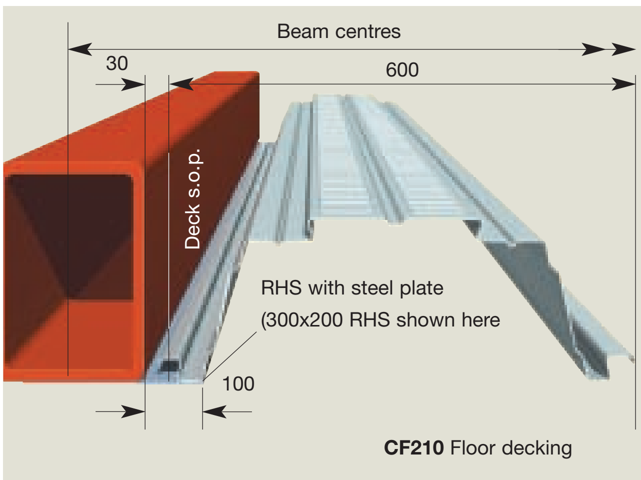
Notations used on deck layout drawing



End fixing onto RHS



Side fixing onto RHS



Sitework

Health and safety
ComFlor 210 should only be installed by contractors experienced in fixing long span steel decking.

It is the responsibility of the contractor to provide safe working procedures for the installation of deep decking on any particular project and to provide a risk assessment to the main contractor.

Reference should be made to the BCSA Code of Practice for Metal Decking and Stud Welding, with special reference to the addendum for long span decking.

The following general guidelines should also be followed to maximise health and safety on site

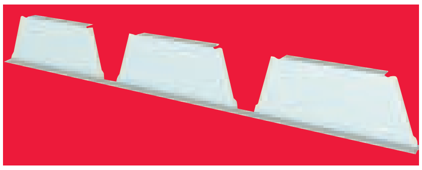
1. Diaphragms should where reasonably practicable be fitted from a safe working platform or from below from a MEWP or a platform access system.
2. Deck cutting should be carried out as the last operation in each bay. Thus it can be carried out on a safe working platform of previously laid deck.

End diaphragms
Steel end diaphragms, as manufactured by Corus, are essential for both deep deck systems to ensure the structural integrity of the deck. The end diaphragms, are fixed first and are supplied in lengths of 1800mm, to cover three of our deep deck profiles. They are fixed using at least two shot-fired pins for each length; in the Slimdek system the end diaphragms align with the edge of the lower flange of the beam.

Single diaphragms are available with pre-punched service holes in two types. Type 1 has one 160mm diameter hole; Type 2 has one elongated 160mm diameter hole to make opening 320mm wide x 160mm high.

Unpunched single diaphragms are also available. Where the deep deck lands onto a support at a rake, the single diaphragms are used doubled up, and adjusted on site to take up the extra length required due to the fact that the end of the deck is at a raked angle to the support rather than at right angles.

The concrete that the diaphragms entrap around the Asymmetric Slimflor Beam, give the beam its fire rating, therefore the diaphragms must be placed strictly according to specification.



End diaphragm for ComFlor 210

Deck fixing
The decking sheets are manually lowered individually onto the beams. In the Slimdek system, the end bearing of the sheets should be 50mm; the flange widths are such that this can be achieved, whilst still being able to drop the sheets vertically into position (i.e. without having to thread them between the top and bottom flanges).

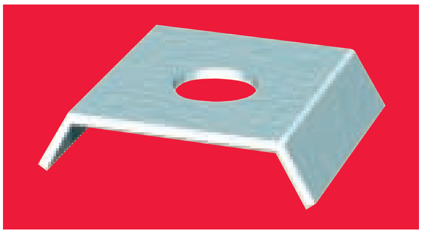
Once the sheets for the whole bay are in place, they are secured to the beam flanges using heavy duty shot-fired fixings. CF 210 requires one main fixing per trough.

Where CF210 deck is being used with Asymmetric SlimFlor Beams, the top flange of the profile must be notched back by 50mm, so that the concrete can be observed passing between the end diaphragm and the beam to allow concrete to flow into the beam.

The crown of the deck sheet is fixed to the top of the diaphragms using one self drilling screw for CF210.

When fixing to other types of supports such as reinforced concrete, or load bearing walls, 1 suitable fixing must be used in each CF210 trough as for the steel supports.

Side laps
CF210 side laps are to be stitched at 350mm centres with 5.5mm diameter self drilling screw, the location is marked by an indentation in the overlap tail. Every side lap fastener must fix and locate a trough shear connector clip into position. The clip is partly responsible for the composite action of the decking and must not be omitted unless the CF210 is being used as formwork only.

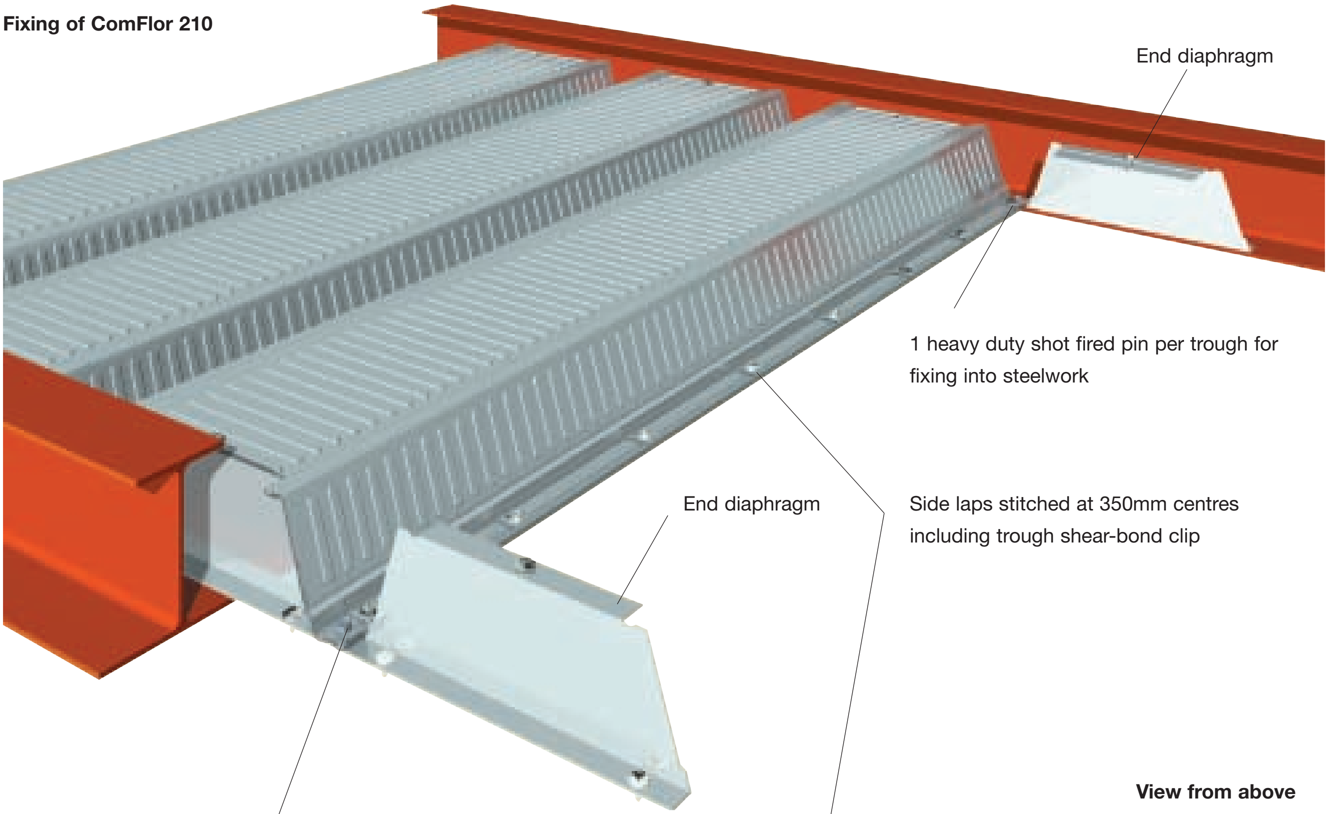


ComFlor 210 shear clip

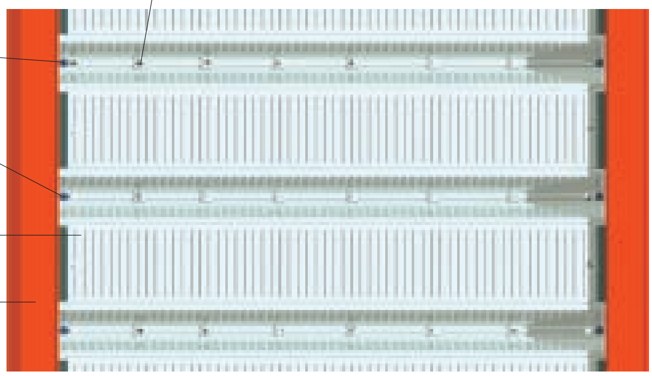
Fixing information for deep decking

To steel	Heavy duty powder actuated fixings – Hilti ENP2 X-ENP-19 L15 nail/Spit SBR14 or equivalent. For temporary fixing (i.e. where weld through shear studs are to be used) – Hilti PINDAK16
	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 of ComFlor 210



View from above



Fixing spacings	
	ComFlor 210
End fixing	1 per trough
Side laps	1 fixing with shear clip at 350mm c/c
Side fixing onto support	1 fixing at 600mm c/c

Edge details

The steelwork must be stable and adequately restrained with support for the deck around columns and openings. Corus deep decking can be easily cut, and fitted, to accommodate columns and other awkward shapes. Where there is no supporting steelwork, brackets fixed to the column will have to be used for local support to the deck.

Light steel edge trim is used to form the edges of the slab and to infill where the 600mm profile of the deck does not align with the parallel supports. Supplied in 3m lengths as standard, and offered in thickness of 1.2mm to 2.0mm, the edge trims are fixed to the perimeter steel beams, using the same shot fired fasteners that secure the deck. The upper leg is strapped to the crown of the profile, to prevent buckling during the concrete pouring operation.

Cantilevers

Our deep decks can be Cantilevered in its length up to 500mm during construction. When Cantilevers are required perpendicular to the span of the profile, stub beams or some similar type of support has to be supplied. In both cases, the Cantilever must be assessed, for the final stage, in accordance with BS8110 Part 1, to determine whether additional reinforcement is required.

Reinforcement

The decking forms a part of the slab reinforcement, with the remainder being supplied by a bar in each trough of the decking and a mesh placed near to the top of the slab. Reinforcement should be fixed in accordance with the requirements of the Structural Designer. Normally, circular plastic spacers are used to position the bars 70mm from the base of the trough. This distance can increase to 90 or 120mm (respectively) when 90 or 120 minutes fire resistance are required. There may be additional mesh or bar requirements to fix adjacent to the supports or edge beams, or above beams for crack control purposes.

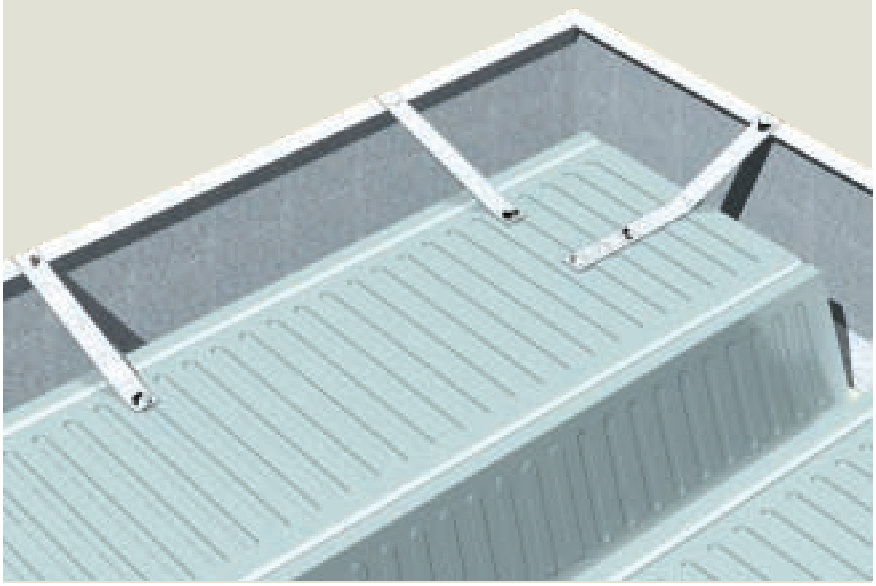
Any shear studs that are required (to make SFBs or RHSFBs composite) may be welded to these sections during fabrication, because they do not interfere with the decking. If they are to be welded on site, the precautions and procedures outlined on page 32 should be considered.

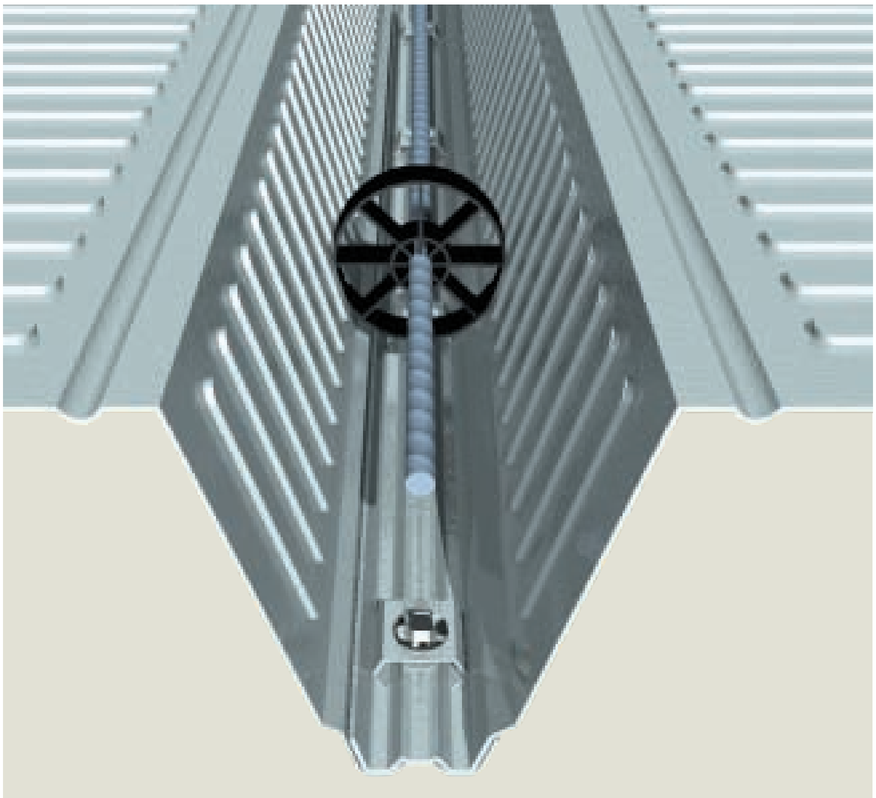
Edge trims selector

Edge trim depth (mm)	Maximum Cantilever (mm)	
	Galv. Steel Edge Trim Thickness (mm)	
	1.6	2.0
270	100	135
300	0	100
350	x	0
400	x	0

x – not recommended

Fit restraint straps at 600mm c/c to prevent any bowing of edge trim.





Transport and handling

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

Receiving decking

Composite Floor Decking is packed into bundles of up to 24 sheets, and the sheets are secured with metal banding. Each bundle may be up to 950mm wide (the overall width of a single sheet) by 750mm 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 articulated lorries approximately 16m long with a maximum gross weight of up to 40 tonnes, and a turning circle of approximately 19m. 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 lorry. 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 the 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° 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.

FibreFlor mesh free composite floor system

FibreFlor is a partnership between Corus and Propex Concrete Systems, the world's largest supplier of fibre reinforcement for concrete.

FibreFlor uses a combination of high performance steel fibres and polypropylene micro-synthetic fibres to provide a three dimensional fibre reinforced concrete composite slab.

Traditionally composite metal deck construction utilises mesh fabric reinforcement. This involves the delivery, lifting and installation of welded wire mesh on to the floor prior to the pouring of concrete. The time and costs involved make mesh relatively unpopular with contractors and the mesh itself is a hindrance to other site operations. Maintaining the correct mesh height, position, concrete cover and laps can be difficult during mesh placement and concrete pouring.

FibreFlor reinforcement is provided within the concrete, delivered and ready to pump at site. Significantly this can reduce installation times by up to 20%.

FibreFlor is a certified floor deck system that eliminates the need for steel wire mesh and is currently available as FibreFlor CF51, FibreFlor 60 and FibreFlor CF80.

Benefits of FibreFlor

Cost savings

- Labour cost savings
- Up to 20% programme savings
- No mesh to purchase, transport or store
- Reduction in crane hire costs
- Potential concrete volume savings.

Easier to install

- No hoisting/lifting or manual handling of mesh
- No steel fixing/tying requirements
- No spacer requirements
- 3-Dimensional reinforcement delivered ready mixed in concrete
- Easier concrete application (No trip hazards or snagging from mesh)
- Fibre reinforcement always in the correct position.

Technical superiority

- Independent testing proves that the FibreFlor system provides equivalent or superior performance to traditional welded wire mesh solutions
- Quality assured concrete reinforcement system
- FibreFlor is proven to reduce plastic shrinkage and settlement cracking
- Unlike macro-synthetic fibres, the micro-synthetic fibres in FibreFlor are also proven to mitigate the explosive spalling tendency of concrete during fires
- The inclusion of steel fibres in FibreFlor provides load bearing capabilities, increased toughness and long term crack control.

FibreFlor

Independent testing of ComFlor composite floor deck at the Namas certified fire test facility.

In recognition of the many practical difficulties associated with the use of traditional welded wire fabric in upper floor construction and in response to the ever increasing demands for improved speed of construction, improved quality and cost effectiveness, Corus and Propex Concrete Systems have joined forces to develop FibreFlor.

FibreFlor is a combination of Novocon high performance steel fibres and Fibermesh micro-synthetic fibres providing a unique three dimensional concrete reinforcement solution for composite metal decks and designed to replace traditional welded wire mesh.

By combining the attributes of both types of fibre, FibreFlor provides performance benefits over the entire life span of the concrete – from simplifying placement, to minimising cracks in the plastic state, to controlling cracks in the hardened state, to providing years of exceptional durability.

In the development of FibreFlor, it was identified that many properties were required to provide both an optimum technical solution for the necessary fire rating, but also practically in providing a concrete solution that is easily handled, pumped and finished. The world leading brand of Fibermesh micro-synthetic fibres are proven to inhibit both plastic shrinkage and settlement cracking. Additional benefits include increased impact and abrasion resistance together with reduced permeability of the concrete. Fibermesh micro-synthetic fibres are also internationally proven to provide resistance to explosive spalling, in the event of fire.

Novocon high performance steel fibres are proven to provide both a high level of ductility to the concrete and long term crack control. This allows the load carrying capability to replace traditional mesh reinforcement. Testing approved by the Steel Construction Institute confirmed that FibreFlor also provided longitudinal shear resistance in excess of that provided by A393 steel wire fabric.

FibreFlor reinforced composite metal deck systems have been extensively tested in accordance with BS EN 1365-2:2000 standards at NAMAS certified fire test facilities, under the guidance of the Steel Construction Institute (SCI).

Results, analysed and approved by the SCI, show that FibreFlor reinforced composite metal deck systems provide equivalent or superior performance to traditional wire mesh solutions with fire ratings of up to two hours.

References

Health and Safety

British standards

The design guidance given in this brochure and on the attached software complies, where relevant, with the following Standards.

Composite floor deck

1. BS 5950: Part 4 1994. 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: 1990. Design in composite construction: Section 3.1: 1990. Code of practice for design of simple and continuous composite beams.

Profiled steel deck

3. BS 5950: Part 6 1995. Structural use of steelwork in building: Code of practice for design of light gauge profiled steel sheeting.

Fire resistance

4. BS 5950: Part 8 1990. Structural use of steelwork in building: Code of practice for fire resistant design.

Concrete

5. BS 8110: Part 1: 1997 Structural use of concrete: Code of practice for design and construction.
6. BS 8110: Part 2: 1985 Structural use of concrete: Code of practice for special circumstances.

Reinforcement

7. BS 4483: 1998 Specification for steel fabric for the reinforcement of concrete.
8. BS4449:1997 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 ans 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).

Health and 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 2092:1987 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.

Installation of deep decks

See advice on page 32 for special health and safety considerations regarding installation of deep decks.

General safety points

Follow the good practice outlined here and in SCI publications.

- Always fix deck securely before using as a working platform.
- Steel end diaphragms, as manufactured by Corus Panels and Profiles, are essential for both deep deck systems to ensure the structural integrity of the deck.
- 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.

ComFlor
Software

Download instructions
The comprehensive ComFlor software for the design of composite floor slabs, is freely available, to all professionals who register, at
http://www.comflor.com

Another link to ComFlor is also available from
http://www.corusinternational.com

Use of the design program
All the variables start with a default value, however 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.

It is not necessary to put in shear connectors (shear studs) for the composite slab design (shear connectors are used primarily for the benefit of the beam not the slab). However if shear connectors are to be used, then the design software allows end anchorage to be accounted for which in some cases will improve the load capacity of the composite slab.

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 on behalf of Corus International.

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

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Corus cares about the environment – this brochure is printed with biodegradable vegetable inks and using material with at least 80% recycled content.

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