Floor Decking, Roof Decking, Purlins & Rails

Designer's Structural Products Guide

Tegral
METAL FORMING

A world of experience

Our Company

Tegral Metal Forming is part of the Tegral Group and a subsidiary of the Etex Group, a world-renowned international building products company. For over 25 years, Tegral Metal Forming has been to the forefront of development with regard to roofing, cladding and flooring systems.

Based in Athy, Co. Kildare, the Tegral Group consists of Tegral Building Products and Tegral Metal Forming. Tegral Building Products is Ireland's largest manufacturer and distributor of roofing products and Tegral Metal Forming Ltd. is a leading manufacturer and supplier of metal roofing and flooring systems for the construction industry.

The comprehensive product range is designed to suit most applications in modern commercial, industrial and agricultural construction. Over the years, Tegral Metal Forming has developed an expertise in every aspect of metal systems application.

Project: The Pavilions Shopping Centre, Swords, Dublin
Architects: OMS Architects
Engineers: ARUP Consulting Engineers
Product: Tegral Roof Decking

Our Partners

Through a long-standing partnership with Corus, a world-renowned manufacturer of steel and aluminium, Tegral customers and specifiers are assured of the highest standards and quality in all Tegral products.

Our Standards

All manufacturing in Athy meets with the stringent requirements of Quality Assurance systems to ISO 9001:2000.

Our People

People really do matter at Tegral Metal Forming. Recently the company proudly embraced and succeeded in achieving the "Excellence Through People" award, Ireland's national standard for human resource development.

Our Industry Associates

Tegral Metal Forming takes an active role in the promotion of the metal industry and is involved in the Roof Manufacturers and Suppliers Association (RMSA) in Ireland, the Metal Cladding and Roofing Manufacturers Association (MCRMA) in the UK and also the Irish Farm Buildings Association.

Using the Guide

This guide covers the key elements, issues and considerations the designer faces when selecting structural products. Tegral Metal Forming offers metal applications that include floor decking, roof decking, purlins & rails. The product range is extensive, innovative and of superior quality. This is strongly supported by a professional team of technical services experts available to assist the designer in the process.

Our guiding principles are objectivity and professionalism, our goal is to help our customer find the right solution and our commitment to quality and excellence in everything we do, remains constant.

For further technical information on all Tegral products, please contact our Technical Services Department:
Tel: 059 86 40750
Email: metaltech@tegral.com

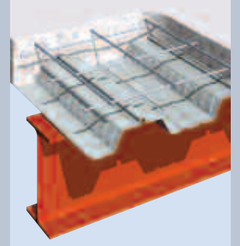
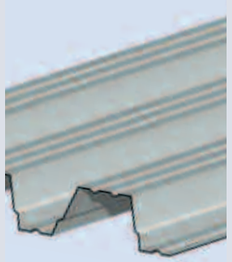
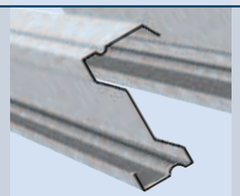
Project: The Helix, Dublin City University, Dublin
Architects: A & D Wejchert
Engineers: O'Connor, Sutton, Cronin
Product: Tegral Roof Decking, Cladding Rails

Product Range

Structural products from Tegral are designed and manufactured to maximise the structural integrity and effectiveness of metal in construction.

Floor Decking, Roof Decking, Purlins & Rails
The Tegral range of structural products includes a large selection of floor decking, roof decking and the Zeta range of purlins.

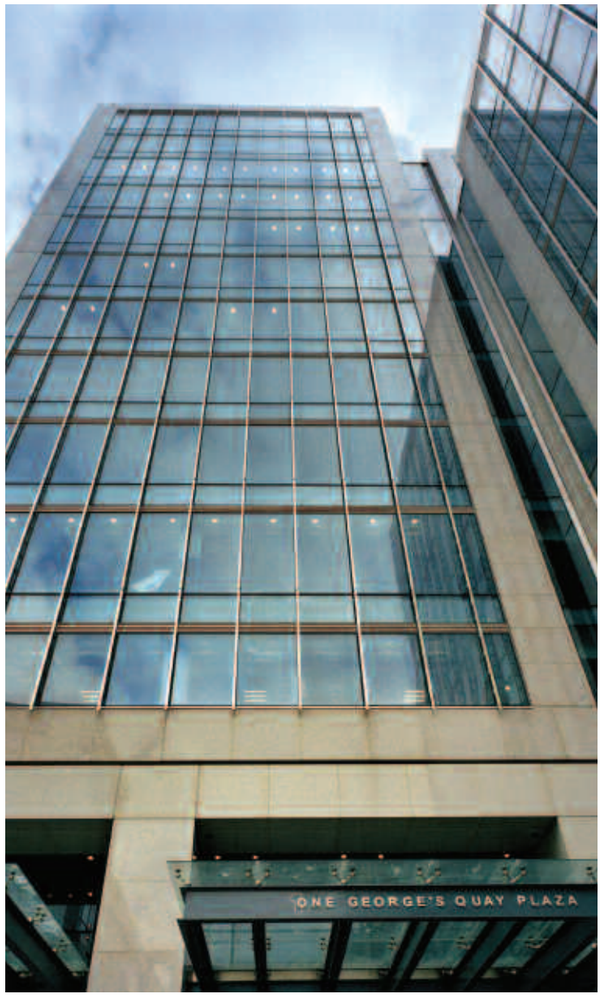
Tegframe Framing System
Light Gauge Steel Framing System combining the benefits of cold-rolled steel framing with innovative design. Tegframe is the lightest, most steel-efficient framing system on the market.

Product	Description		Application
Floor decking • **Two** deep decks ComFlor 210 & Slimdek® SD225 • **Five** shallow decks ComFlor 46, 51, 60 80 and 100 • **Seven** profiles suited to composite flooring • **Ten** profiles suited to permanent formwork	Metal floor decking in a range of profiles for use with wet concrete in the construction of composite flooring		For use in all buildings residential, commercial and industrial.
Roof decking Roof decking profiles include: • **Twelve** profiles D19, D32, D35, D46, D46perf, D60, D60perf, D100, D100perf, D159, D159perf and D210.	Metal flat roof decking for use with weather-proof membranes and insulation. An extensive range designed for maximum efficiency with superior span and load bearing capacities.		Flat roofing in commercial, industrial and residential buildings.
Purlins The Zeta range of purlins includes: • Zeta Purlins & Rails • Zeta 2 Purlins & Rails • Zed Purlins & Rails	Cold rolled galvanised steel purlins and cladding rails that offer increased structural capacity of s390 steel		Used in roofing and cladding both in commercial and industrial buildings.
Tegframe Light Gauge Steel Framing System	Pre-engineered cold rolled framing system manufactured with flush-faced connections and connection holes as required.		Tegframe will support a wide variety of external finishes including brickwork, masonary slips, terracotta tiling, metal and fibre cement rainscreen, insulated render etc. A through -wall warm frame construction is also possible by the additional of thermal insulation.

Tegral Floor Decking

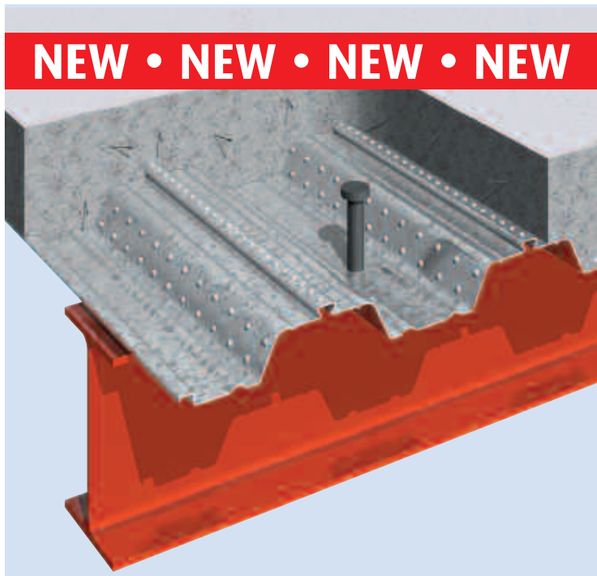
The most comprehensive range of floor decking systems available in Ireland.

Project: George's Quay, Dublin
Architects: Keane, Murphy, Duff
Engineers: Project Management, Group Mechanical & Consulting Engineers.
Project Managers, Cleary McCabe
Product: Tegral Floor Decking



Floor Decking
Tegral's ComFlor range of composite steel floor decking profiles acts as both a permanent formwork and provides shear bond to in-situ poured concrete floors so that the two materials act compositely.

Composite floor construction has contributed significantly to the growth of steel frames in recent years. This is primarily due to the speed and safety of the construction, savings in transport costs, shallower construction depths and ease of building services installation.



Tegral ComFlor 60

Tegral Floor Decking

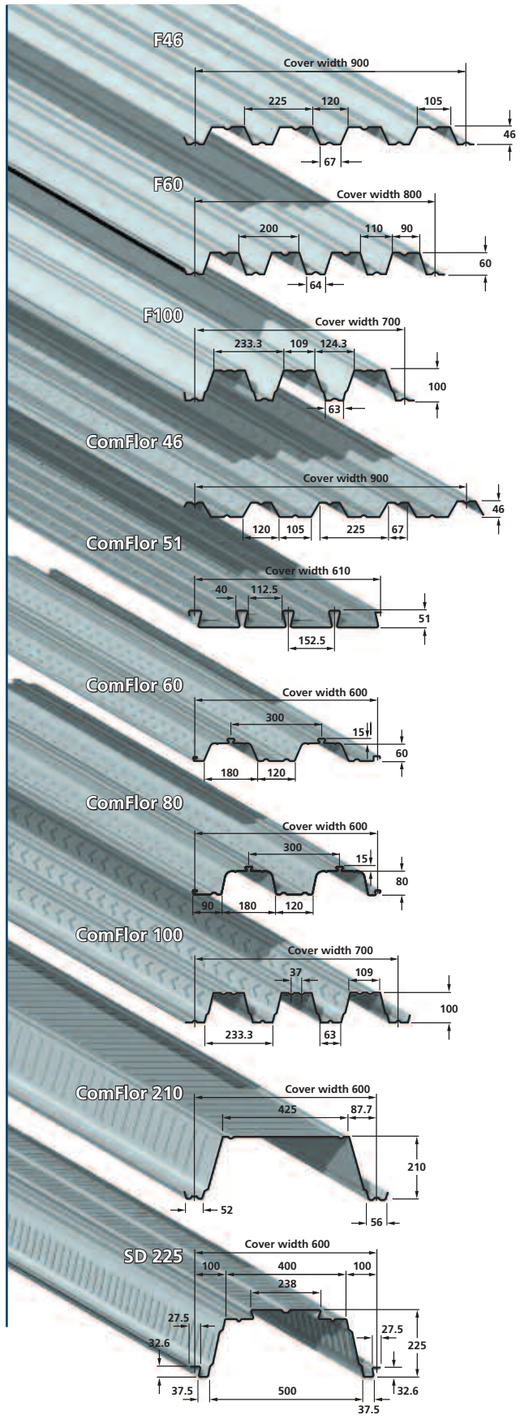
Product Range
The extensive range of floor decking includes:

- TWO deep decks - ComFlor 210 and Slimdek® SD225.
- FIVE shallow composite floor decks - ComFlor 46, 51, 60, 80 and 100.
- SEVEN profiles suited for composite flooring.
- TEN profiles suited for permanent formwork.

Description
Metal floor decking in a range of profiles for use with in-situ poured concrete.

Application
For use in all buildings, residential, commercial and industrial.

Features
- Widest range of composite floor decking available.
- A 20 year proven track record in the Irish construction industry.
- Professional Ireland-based support service
- Use of SD225 with Asymmetrical (ASB) steel beams as part of the unique Corus Slimdek® system. Facilitates building height reduction or bonus of an additional storey.
- Comprehensive 'Comdek' design software available.
- Manufactured locally.



Tegral Purlins & Rails

Tegral Zed purlins

The use of cold-rolled galvanised steel purlins to carry a chosen roofing assembly and cladding rails to support various cladding options, is widespread in all sectors of the construction industry.

Product Range
The Tegral Zeta range of purlins offers increased structural capacity of S390 steel. This combined with the choice of Tegral Zeta purlin and rail systems available, provides the most efficient structural arrangement possible. The range consists of Zeta, Zeta 2 and Zed purlins & rails.

Description
Cold-rolled galvanised steel purlins and cladding that rails support various roofing and cladding applications.

Application
Used in roofing and cladding in both commercial and industrial buildings.

Tegral Zeta purlins

Tegral Purlins and Cladding Rails

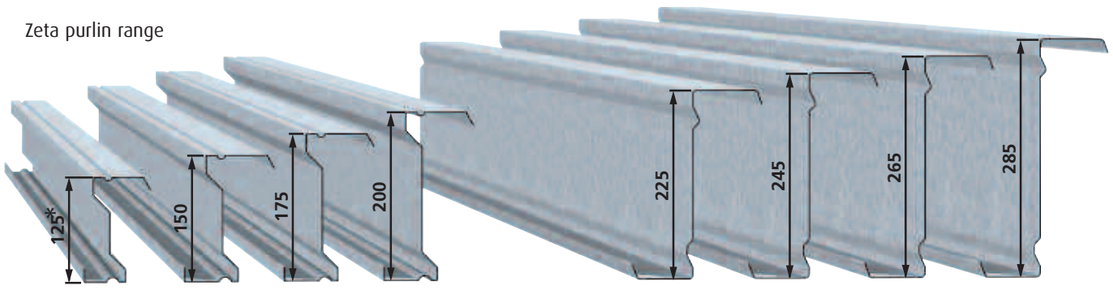
Features

- Economically designed and suitable for all kinds of applications.
- Zeta designs use less steel than comparable systems for any given load/span specification.
- Complete system component supply.
- A 20 year proven track record in the Irish construction industry.
- Tegral's Ireland-based technical support services also includes design service and comprehensive Zeta design software (to BS6399) available.

Irish Based Technical Support

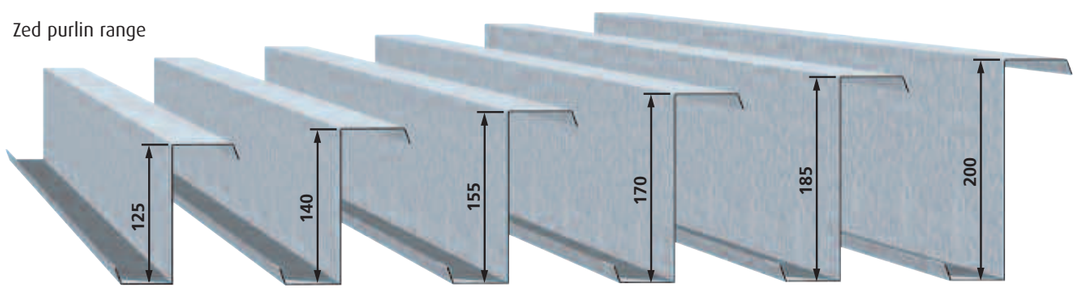
Zeta purlin range

Zeta 2 purlin range



*To Special Order

Zed purlin range



Tegral Roof Decking

Tegral Metal Forming manufactures and supplies the most extensive range of metal roof decking in Ireland. Used primarily to support built-up roof assemblies, Tegral Roof Decks are available in three different materials, galvanised steel, either plain or white enamel soffit, Colorcoat® by Corus pre-finished steel or mill aluminium material.

Product Range

Tegral roof decking profiles include TWELVE profiles – all designed for maximum efficiency and with superior span and load bearing capacities.

The range consists of:
D19, D32, D35, D46, D60, D100, D159, D210, D135, D150, D165 and D200.

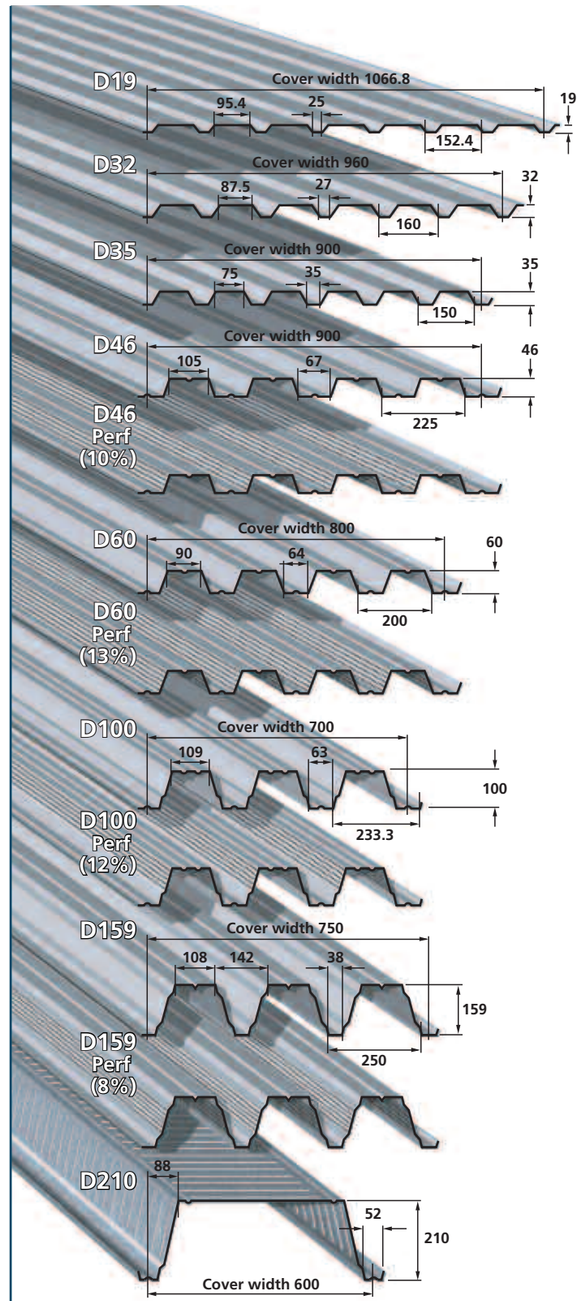
Description

Metal flat roof decking for use with weather-proof membranes and insulation.

Application

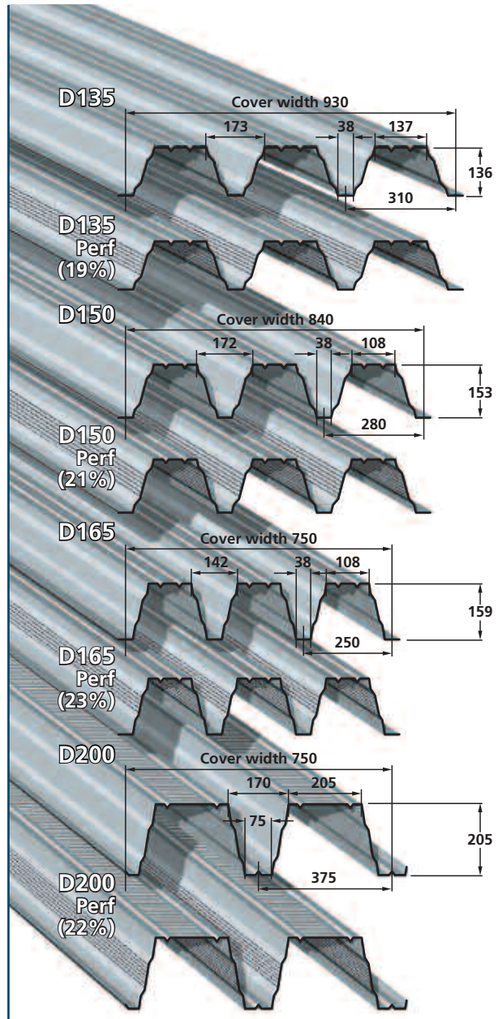
Flat roofing in commercial, industrial and residential buildings.

Tegral D100 perforated



Note: Perf = perforated web (percentage of open air)

Tegral Roof Decking



Note: Perf = perforated web (percentage of open air)

Features

- Widest range of deck profiles in the market
- A proven 20 year track record in the Irish construction industry.
- Tegral Roof Decks can be supplied in Colorcoat®pre-finished steel or coated aluminium, which is particularly useful when the underside of the roof deck is used as an internal finish.
- Web perforation allows for maximum acoustic absorption and is available in certain deck profiles.
- Suitable for use with all membranes in built-up roofing or as support to various pitched roof systems.
- Tegral roof decking design software available

Tegral Floor Decking

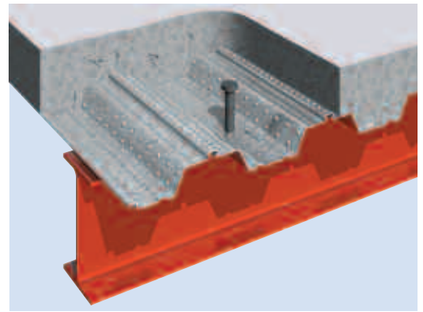
'Strong flooring is the foundation of a sound and safe structure'

Contents

Project: Central Park, Leopardstown, Dublin
Architects: Henry J Lyons & Partners
Engineers: TJ O'Connors & Associates
Product: Tegral Floor Decking

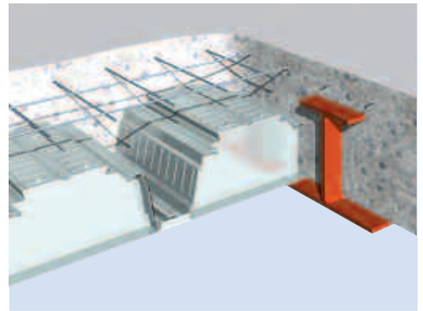
Tegral Floor Decking

Shallow Decking



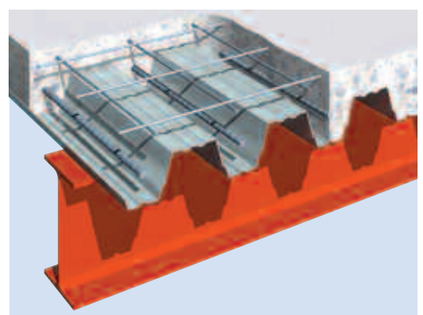
Five different Tegral profiles provide the optimum solution for shallow decking in short to medium unpropped or propped span conditions. In steel construction the composite floor profile is placed on the top flange of the beam. For economies in the frame, the steel beams can be designed to act compositely with the deck.

Deep Decking



Tegral offers **two** deep decking profiles that can span approximately six metres unpropped. Both decks can be used in conjunction with the Corus Asymmetric Slimflor Beam (ASB). The composite floor deck is supported by the lower flange of the ASB, which is wider than the top flange. Refer to Corus Slimdek® manual for full details on ASB.

Formwork (non-composite)



The steel profiles may be used to act as permanent formwork, i.e. they remain in situ for the life of the building, but unlike composite profiles, do not act as reinforcement in the concrete slab. The profiles range in height to offer the optimum solution to every design.

Tegral Floor Decking

Product benefits

Speed
Large areas of deck can be rapidly craned into position and up to 400m² laid by one team per day. With minimal mesh reinforcement and pumped concrete, the completed floor can quickly follow.

Working platform
Once fixed, the deck acts as a safe working platform for all following trades. Temporary props can usually be eliminated.

Construction stage bracing
The deck acts as lateral restraint to the beams and serves as a diaphragm, transmitting wind load from the outer steelwork to the core. Thus once the decking is fixed, it contributes significantly to the stability of the structure.

Weight
Due to the intrinsic efficiency of composite construction and the displacement of concrete by the profile shape, considerably less concrete is used than in conventional reinforced concrete construction. This reduces the weight of both the primary structure and foundations.

Floor height
Composite beams use the slab as a compression element, which increases their stiffness and reduces their size. The composite slab itself has a very low centre of reinforcement compared to a conventionally reinforced slab and therefore does not need the same depth. These savings mean reduced floor zone and thus contribute to the overall floor height.

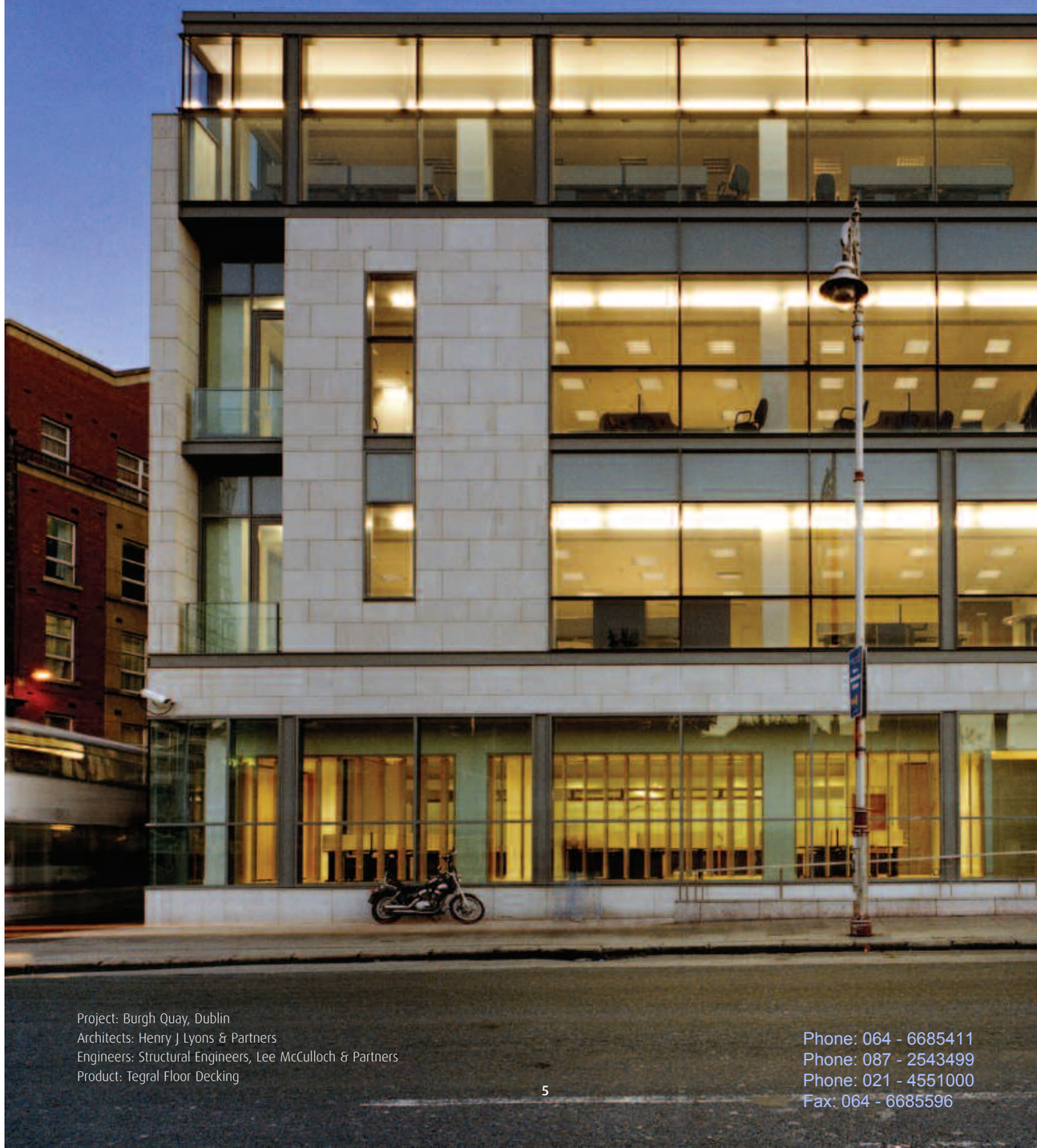
Fire
Extensive testing and fire engineering work by Corus Panels & Profiles and The Steel Construction Institute have resulted in fire ratings of up to 4 hours being available with the use of light mesh fibre within the composite slab and no protection to the deck profile.

Services
Tegral composite floor decking incorporate systems for the easy attachment of services, negating the requirement to fix into concrete.

Fibre concrete
Tegral shallow composite floor decking has been tested for use with fibre-reinforced concrete, avoiding the need for delivery, lifting and installation of welded wire mesh on the floor prior to pouring concrete. Significantly this can reduce installation times by up to 20%.

Multi-storey Car Parks
Tegral CF60 and CF80 composite floor decking may be used for car decks. Please contact Technical Services for further information.

Tegral Shallow Decking



Project: Burgh Quay, Dublin
Architects: Henry J Lyons & Partners
Engineers: Structural Engineers, Lee McCulloch & Partners
Product: Tegral Floor Decking

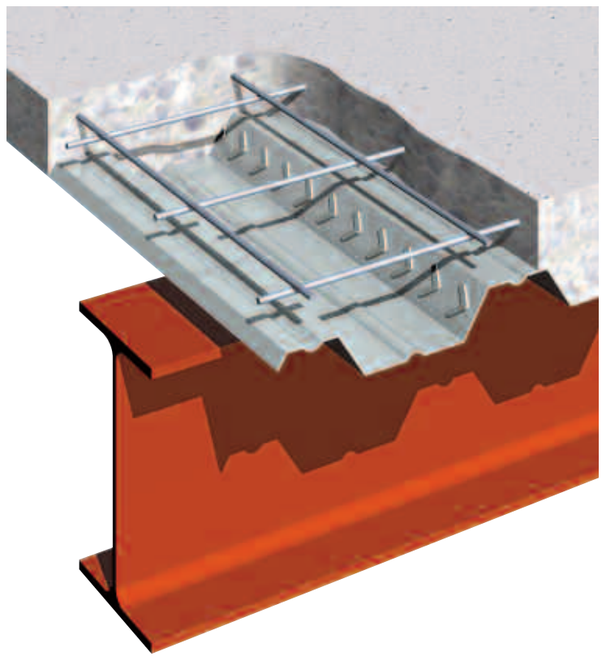
ComFlor® 46 (CF46)

ComFlor® 46 (CF46), first introduced in 1985, is a simple trapezoidal composite deck with a strong and reliable shear bond performance. The profile is economic and stackable, reducing transport and handling costs.

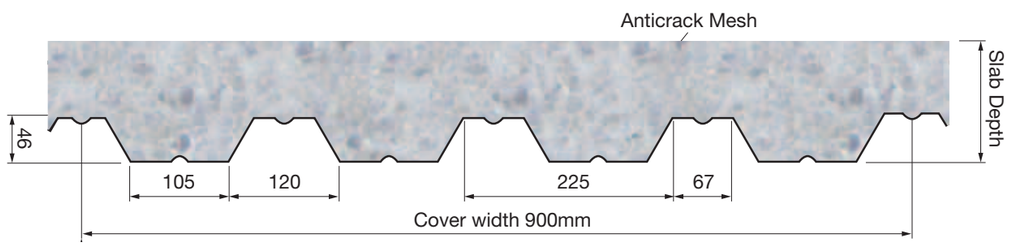
Stackable
The ultra efficient stackability of ComFlor 46 reduces the transport volume of the product.

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.



Section through ComFlor 46 profile deck



DESIGNER'S FLOOR DECKING GUIDE Shallow Decking

ComFlor® 46 (CF46)

ComFlor® 46 Composite Slab - Volume & Weight

Overall Slab Depth (mm)	Concrete volume (m^3/m^2)	Weight of Concrete (kN/m^2)	
		Wet	Dry
110	0.091	2.14	2.10
115	0.096	2.26	2.21
120	0.101	2.38	2.33
130	0.111	2.61	2.56
140	0.121	2.85	2.79
145	0.126	2.96	2.90
150	0.131	3.08	3.02
180	0.161	3.79	3.71
200	0.181	4.26	4.17
240	0.221	5.20	5.09

Volume & weight table notes

1. Deck and beam deflection (i.e. ponding is not allowed for in the table.
2. Deck and mesh weight 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

   Note: For lightweight concrete contact Tegral Technical Services Department.

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

Design Notes

Deck material
Zinc coated steel to BS EN 10147:2000, Fe E 280G, Z275, with a guaranteed minimum yield stress of 280 N/mm^2. Minimum zinc coating mass is 275 g/m^2 total including both sides.

Quick reference tables
The quick reference load/span and fire design tables, are intended as a guide for initial design, based on the parameters stated below the tables.

The Comdek calculation design suite CD provides a full design programme. Please contact Tegral.

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. Corus Panels and Profiles in conjunction with The Steel Construction Institute has agreed to modify the requirement with regard to anti-crack mesh, to comply with the Eurocode 4 recommendations. Accordingly, the mesh shown in the quick reference tables complies with EC4 and the design programme defaults to these values.

Where EC4 mesh rules are used, the mesh may be reduced midspan - see Design Information on page 20. The reduced British Standard mesh values may still be used by overriding this default in the design programme.

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 & A393 mesh.

Fire
For details on the performance of composite slabs comprising ComFlor 46 decking under a fire condition with nominal anti-crack mesh, please refer to the quick reference fire load tables in this guide.

Technical services
Tegral's Technical Services Department offer a comprehensive advisory service on the design of composite flooring.
Should queries arise, please contact us on
00+353 59 86 40750
or email metaltech@tegral.com.

ComFlor® 46 (CF46)

Quick reference table

ComFlor® 46 Span table - Normal Weight Concrete

Props	Span	Fire Rating	Slab Depth (mm)	Mesh	MAXIMUM SPAN (m) Deck Thickness/Gauge (mm)					
					0.9			1.2		
					Total Applied Load (kN/m²)					
					3.5	5.0	10.0	3.5	5.0	10.0
No Temporary props	Simple span slab & deck	1 hr	120	A193	2.4	2.4	2.4	2.8	2.8	2.6
		1.5 hr	130	A193	2.4	2.4	2.2	2.7	2.7	2.3
			145	A252	2.3	2.4	2.2	2.6	2.6	2.2
		2 hr	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 & deck	1 hr	120	A193	2.7	2.7	2.7	3.2	3.2	3.1
		1.5 hr	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 hr	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
1 Line of Temporary props	Simple span slab	1.5 hr	120	A393	3.6	3.2	2.5	3.8	3.4	2.7
		1 hr	130	A393	3.6	3.3	2.6	3.9	3.5	2.7
			145	2xA252	3.5	3.2	2.5	3.8	3.4	2.7
		1.5 hr	130	A393	3.3	3.0	2.3	3.5	3.1	2.5
			145	2xA252	3.2	2.9	2.3	3.3	3.0	2.4
			145	2xA252	2.9	2.6	2.1	3.0	2.7	2.2
		2 hr	200	2xA393	2.7	2.5	2.0	2.8	2.5	2.1
			240	2xA393	2.6	2.4	2.0	2.7	2.5	2.1
	Double span slab		120	A393	4.4	4.0	2.9	4.6	4.1	3.2
		1 hr	130	A393	4.6	4.1	3.1	4.8	4.3	3.4
			145	2xA252	4.7	4.3	3.4	4.9	4.5	3.5
		1.5 hr	130	A393	3.9	3.5	2.8	4.1	3.6	2.9
			145	2xA252	4.0	3.6	2.9	4.1	3.7	3.0
			145	2xA252	3.5	3.2	2.5	3.6	3.3	2.6
		2 hr	200	2xA393	4.0	3.8	3.1	4.2	3.8	3.1
			240	2xA393	3.7	3.7	3.6	4.5	4.4	3.6

Parameters assumed for quick reference span tables

Mesh: See notes on previous page.

Spans: Measured centre to centre of supports.

Deck: Standard deck material specification (see previous page).

Bearing width: The width of the support is assumed to be 150mm.

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 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. Lightweight concrete may be used, please consult Tegral.

Construction load: 1.5 kN/m^2 construction load is taken into account,in accordance with BS 5950:Part 4. No allowance is made for heaping of concrete during the pouring operation. See design notes.

Slab Depth: The depth of slab is measured from the top of the concrete to the base of the profile.

Applied load: The applied load stated in the tables is to cover imposed live load, partition loads, finishes, ceilings and services. However the dead load of the slab itself has already been taken into account and need not be considered as part of the applied load.

Simplified fire design method: The fire recommendations in the tables are based on the simplified design method.

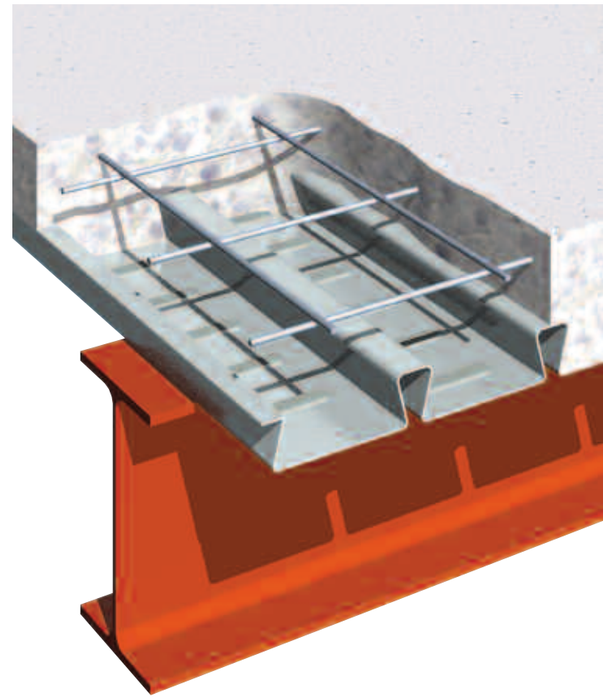
Fire engineering method: The fire engineering (FE) method may be used to calculate the additional reinforcement needed for fire, load and span conditions beyond the scope of these tables. The FE method of design is provided in the design CD.

Fire insulation: 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: Slab span to depth ratio is limited to 35 for normal weight concrete.

ComFlor® 51 (CF51)

ComFlor® 51 (CF51) 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 is required to meet fire design requirements.



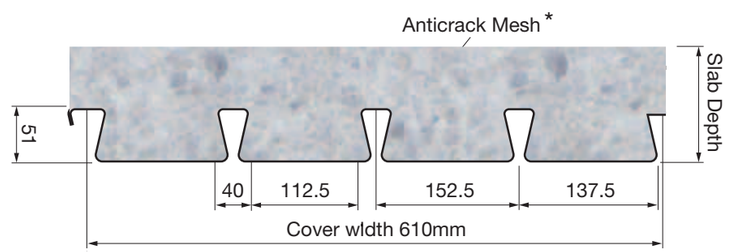
Shear studs
The wide trough of ComFlor 51® permits a flexible and efficient placement of shear studs, when composite beams are specified.

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, refer to page 31.

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.

Section through ComFlor® 51 profile deck



*The use of fibre reinforced concrete eliminates the need for the anticrack mesh.

ComFlor® 51 (CF51)

ComFlor 51 Composite Slab - Volume & Weight

Overall Slab Depth (mm)	Concrete volume (m^3/m^2)	Weight of Concrete (kN/m^2) Wet	Dry
101	0.092	2.16	2.12
105	0.096	2.26	2.21
110	0.101	2.37	2.32
115	0.106	2.49	2.44
120	0.111	2.61	2.55
125	0.116	2.73	2.67
130	0.121	2.84	2.78
150	0.141	3.32	3.25
200	0.191	4.49	4.40
240	0.231	5.43	5.32

Volume & weight table notes

1. Deck and beam deflection (i.e. ponding is not allowed for in the table.
2. Deck and mesh weight 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

   Note: For lightweight concrete contact Tegral Technical Services Department.

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

Design Notes

Deck material

Zinc coated steel to BS EN 10147:2000, Fe E 350G, Z275, with a guaranteed minimum yield stress of 350 N/mm^2. Minimum zinc coating mass is 275 g/m^2 total including both sides.

Quick reference tables

The quick reference load/span and fire design tables, are intended as a guide for initial design, based on the parameters stated below the tables.

The Comdek calculation design suite CD provides a full design programme. Please contact Tegral.

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. Corus Panels and Profiles in conjunction with The Steel Construction Institute has agreed to modify the requirement with regard to anti-crack mesh, to comply with the Eurocode 4 recommendations. Accordingly, the mesh shown in the quick reference tables complies with EC4 and the design programme defaults to these values.

Where EC4 mesh rules are used, the mesh may be reduced midspan - see Design Information on page 20. The reduced British Standards mesh values may still be used by overriding this default in the design programme.

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 & A393 mesh.

Fire

For details on the performance of composite slabs comprising ComFlor 51 decking under a fire condition with nominal anti-crack mesh, please refer to the quick reference fire load tables in this guide. For other simplified design cases or for full fire engineering, refer to the design CD.

Technical services

Tegral's Technical Services Department offer a comprehensive advisory service on the design of composite flooring.
Should queries arise, please contact us on
00+353 59 86 40750
or email metaltech@tegral.com.

DESIGNER'S FLOOR DECKING GUIDE | Shallow Decking

ComFlor® 51 (CF51)

Quick reference table

ComFlor 51 Span table - Normal weight Concrete

Props	Span	Fire Rating	Slab Depth (mm)	Mesh	MAXIMUM SPAN (m) Deck Thickness/Gauge (mm) 0.9 Total Applied Load (kN/m^2) 3.5	5.0	10.0	1.0 3.5	5.0	10.0	1.1 3.5	5.0	10.0	1.2 3.5	5.0	10.0
No Temporary props	Simple span slab & deck	1 hr	101	A142	2.8	2.8	2.5	2.9	2.9	2.6	3.1	3.1	2.7	3.2	3.2	2.8
		1.5 hr	110	A142	2.7	2.7	2.2	2.9	2.9	2.3	3.0	3.0	2.4	3.1	3.0	2.4
			125	A193	2.6	2.5	2.0	2.7	2.5	2.0	2.8	2.6	2.0	2.9	2.6	2.1
		2 hr	200	A393	2.2	2.2	2.2	2.4	2.4	2.4	2.5	2.5	2.5	2.6	2.6	2.6
			240	A393	2.1	2.1	2.1	2.2	2.2	2.2	2.3	2.2	2.3	2.4	2.4	2.4
	Double span slab & deck	1 hr	101	A142	3.2	3.2	2.6	3.4	3.4	2.7	3.5	3.5	2.8	3.7	3.7	3.0
		1.5 hr	110	A142	3.2	3.2	2.5	3.3	3.3	2.6	3.5	3.3	2.7	3.6	3.4	2.7
			125	A193	3.1	3.0	2.4	3.2	3.1	2.4	3.3	3.1	2.5	3.4	3.2	2.5
		2 hr	200	A393	2.6	2.6	2.6	2.8	2.8	2.8	2.9	2.9	2.9	3.0	3.0	3.0
			240	A393	2.4	2.4	2.4	2.6	2.6	2.6	2.7	2.7	2.7	2.8	2.8	2.8
1 Line of Temporary props	Simple span slab	1 hr	101	A252	3.6	3.1	2.4	3.8	3.3	2.5	3.9	3.5	2.7	4.0	3.6	2.8
			110	A252	3.7	3.3	2.5	3.8	3.4	2.6	4.0	3.5	2.8	4.1	3.7	2.9
			125	A393	3.8	3.4	2.6	4.1	3.6	2.8	4.3	3.8	2.9	4.4	4.0	3.1
		1.5 hr	110	A252	3.2	2.9	2.2	3.3	3.0	2.3	3.4	3.0	2.4	3.5	3.1	2.4
			125	A393	3.5	3.2	2.5	3.6	3.3	2.6	3.7	3.3	2.6	3.8	3.4	2.7
			125	A393	3.0	2.7	2.1	3.1	2.8	2.2	3.1	2.8	2.2	3.1	2.8	2.2
		2 hr	200	2xA393	3.0	2.8	2.3	3.1	2.8	2.3	3.2	2.9	2.4	3.2	3.0	2.4
			240	2xA393	3.0	2.8	2.3	3.1	2.9	2.4	3.2	3.0	2.4	3.3	3.0	2.5
	Double span slab	1 hr	101	A252	3.6	3.1	2.4	3.8	3.3	2.5	3.9	3.5	2.7	4.1	3.6	2.8
			110	A252	3.7	3.3	2.5	3.9	3.4	2.6	4.1	3.6	2.8	4.2	3.8	2.9
			125	A393	3.8	3.4	2.6	4.1	3.6	2.8	4.3	3.8	2.9	4.4	4.0	3.1
		1.5 hr	110	A252	3.7	3.3	2.5	3.9	3.4	2.6	4.0	3.5	2.8	4.0	3.6	2.8
			125	A393	3.8	3.4	2.6	4.1	3.6	2.8	4.3	3.8	2.9	4.4	4.0	3.1
			125	A393	3.6	3.2	2.5	3.6	3.3	2.6	3.7	3.3	2.6	3.7	3.3	2.6
		2 hr	200	2xA393	4.4	4.0	3.2	4.7	4.3	3.4	4.8	4.4	3.6	4.8	4.4	3.6
			240	2xA393	4.6	4.3	3.5	4.9	4.5	3.7	5.2	4.7	3.8	5.4	5.0	4.0

Parameters assumed for quick reference span tables

Mesh: See notes on previous page.

Spans: Measured centre to centre of supports.

Deck: Standard deck material specification (see previous page).

Bearing width: The width of the support is assumed to be 150mm.

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 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. Lightweight concrete may be used, please consult Tegral.

Construction load: 1.5 kN/m^2 construction load is taken into account,in accordance with BS 5950:Part 4. No allowance is made for heaping of concrete during the pouring operation. See design notes.

Slab Depth: The depth of slab is measured from the top of the concrete to the base of the profile.

Applied load: The applied load stated in the tables is to cover imposed live load, partition loads, finishes, ceilings and services. However the dead load of the slab itself has already been taken into account and need not be considered as part of the applied load.

Simplified fire design method: The fire recommendations in the tables are based on the simplified design method.

Fire engineering method: The fire engineering (FE) method may be used to calculate the additional reinforcement needed for fire, load and span conditions beyond the scope of these tables. The FE method of design is provided in the design CD.

Fire insulation: 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: Slab span to depth ratio is limited to 35 for normal weight concrete.

ComFlor® 60 (CF60)

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

Long-span capability
Optimised profile design gives exceptional unpropped spanning capability of up to 4.5 metres, reducing structural steel requirements and hence cost.

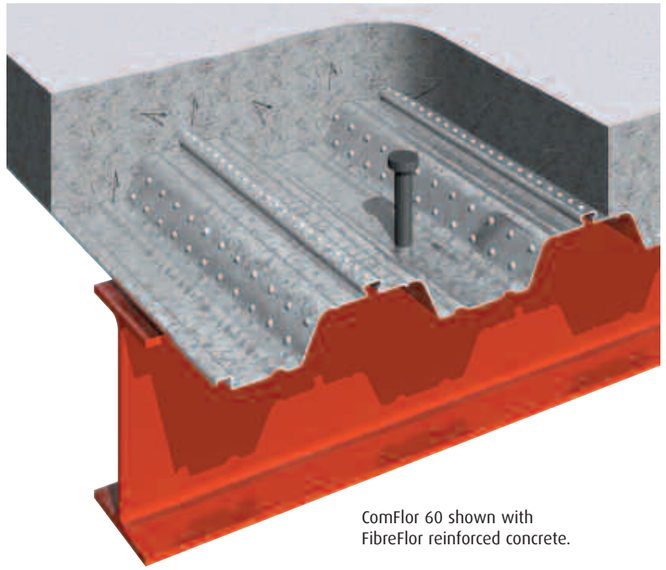
Reduced concrete usage
ComFlor 60® requires a reduced concrete volume for any slab depth, providing a more sustainable solution and reducing costs.

Enhanced shear-stud interaction
Profile design guarantees central shear-stud positioning to optimise composite action, reducing the need for on-site checking.

Excellent acoustic and fire performance
Manufactured with closed ends to give exceptional fire protection and acoustic performance, while simplifying installation.

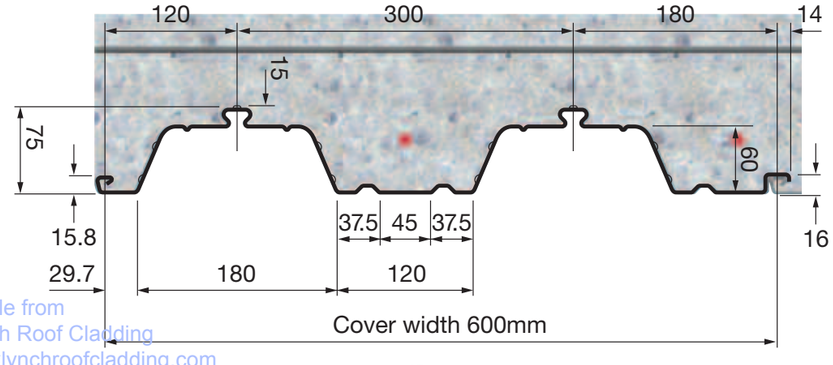
Minimal maintenance
Available with Colorcoat® pre-finished steel for durability and improved appearance.

Safer manual handling
With a cover width of 600mm, sheets are lightweight, making them safer and easier to handle.



ComFlor 60 shown with FibreFlor reinforced concrete.

Section through ComFlor 60 profile deck



ComFlor® 60 (CF60)

ComFlor 60® Composite Slab - Volume & 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	0.087	2.05	2.00	1.62	1.53
130	0.097	2.28	2.23	1.81	1.71
140	0.107	2.52	2.46	1.99	1.89
150	0.117	2.75	2.69	2.18	2.06
160	0.127	2.99	2.93	2.36	2.24
170	0.137	3.22	3.16	2.55	2.42
180	0.147	3.46	3.39	2.74	2.59
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 & weight table notes

1. Deck and beam deflection (i.e. ponding is not allowed for in the table.
2. Deck and mesh weight 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	0.103	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

Design Notes

Note: this is the current spec. in the CP&P brochure. Which is correct?

EN 10326-S350GD+Z275

Deck material
Zinc coated steel to BS EN 10147:2000, Fe E 350G, Z275, with a guaranteed minimum yield stress of 350 N/mm^2. Minimum zinc coating mass is 275 g/m^2 total including both sides.

Quick reference tables
The quick reference load/span and fire design tables, are intended as a guide for initial design, based on the parameters stated below the tables.

The Comdek calculation design suite CD provides a full design programme. Please contact Tegral.

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. Corus Panels and Profiles in conjunction with The Steel Construction Institute has agreed to modify the requirement with regard to anti-crack mesh, to comply with the Eurocode 4 recommendations. Accordingly, the mesh shown in the quick reference tables complies with EC4 and the design programme defaults to these values.

Where EC4 mesh rules are used, the mesh may be reduced midspan - see Design Information on page 20. The reduced British Standards mesh values may still be used by overriding this default in the design programme.

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 & A393 mesh.

Fire
For details on the performance of composite slabs under a fire condition with nominal anti-crack mesh, please refer to the quick reference fire load tables. For other simplified design cases or for full fire engineering, refer to the design CD.

Technical services
Tegral's Technical Services Department offer a comprehensive advisory service on the design of composite flooring.
Should queries arise, please contact us on
00+353 59 86 40750
or email metaltech@tegral.com.

ComFlor® 60 (CF60)

Quick reference table

FibreFlor® 60 - Span table

Props	Span	Fire Rating	Slab Depth (mm)	FibreFlor	MAXIMUM SPAN (m) Deck Thickness/Gauge (mm) 0.9			1.0			1.1			1.2		
					Total Applied Load (kN/m²) 3.5	5.0	10.0	3.5	5.0	10.0	3.5	5.0	10.0	3.5	5.0	10.0
No Temporary props	Simple span slab & deck	1 hr	130	26	3.5	3.5	2.9	3.6	3.6	3.0	3.7	3.7	3.1	3.9	3.9	3.2
			160	26	3.2	3.2	3.2	3.4	3.4	3.3	3.5	3.5	3.5	3.6	3.6	3.6
		1.5 hr	140	31	3.2	2.9	2.3	3.3	3.1	2.4	3.5	3.2	2.5	3.6	3.3	2.6
			170	31	3.1	3.1	2.7	3.3	3.3	2.8	3.4	3.4	2.9	3.5	3.5	3.0
		2 hr	150	36	2.8[10]	3.1[12]	3.2[16]	2.8[10]	3.0[12]	3.2[16]	3.4[12]	3.1[12]	3.2[16]	3.4[12]	3.0[12]	3.2[16]
			180	36	3.0[10]	3.1[12]	3.1[16]	3.0[10]	3.2[12]	3.2[16]	3.3[12]	3.2[12]	3.3[16]	3.5[12]	3.2[12]	3.5[16]
	Double span slab & deck	1 hr	130	26	3.6	3.6	3.0	3.9	3.9	3.1	4.2	4.1	3.2	4.5	4.2	3.3
			160	26	3.3	3.3	3.3	3.7	3.7	3.5	4.0	4.0	3.6	4.2	4.2	3.7
		1.5 hr	140	31	3.5	3.1	2.5	3.6	3.2	2.5	3.8	3.4	2.6	3.9	3.5	2.8
			170	31	3.2	3.2	2.7	3.6	3.6	2.9	3.9	3.8	3.0	4.1	3.9	3.1
		2 hr	150	36	3.3[12]	3.4[16]	3.1[16]	3.3[12]	3.8[16]	3.1[16]	3.3[12]	4.0[16]	3.1[16]	3.3[12]	4.0[16]	3.1[16]
			180	36	3.1[12]	3.1[12]	3.1[16]	3.5[12]	3.2[12]	3.4[16]	3.5[12]	3.2[12]	3.4[16]	3.5[12]	3.2[12]	3.4[16]
1 Line of Temporary props	Double span slab	1 hr	130	26	4.3	3.8	3.0	4.5	3.9	3.1	4.6	4.2	3.2	4.8	4.3	3.3
			160	26	4.7	4.2	3.3	4.9	4.4	3.5	5.0	4.6	3.6	5.2	4.7	3.7
		1.5 hr	140	31	3.5	3.1	2.5	3.6	3.2	2.5	3.8	3.4	2.6	3.9	3.5	2.8
			170	31	3.9	3.6	2.7	4.1	3.7	2.9	4.2	3.8	3.0	4.3	3.9	3.1
		2 hr	150	36	4.3[16]	4.7[20]	3.7[20]	4.3[16]	4.7[20]	3.7[20]	4.3[16]	4.7[20]	3.7[20]	4.3[16]	4.7[20]	3.7[20]
			180	36	4.5[16]	5.1[20]	4.1[20]	4.5[16]	5.1[20]	4.1[20]	4.5[16]	5.1[20]	4.1[20]	4.5[16]	5.1[20]	4.1[20]

* XX[16] The superscript is the size of bar required (2hr FibreFlor)

XX[15] The superscript is the size of bar required (2hour fire ratings); one bar per deck trough - cover 25mm

FibreFlor dosage

26 – Steel fibres 25kg/m³, Polypropylene fibres 0.9kg/m³

31 – Steel fibres 30kg/m³, Polypropylene fibres 0.9kg/m³

36 – Steel fibres 35kg/m³, Polypropylene fibres 0.9kg/m³

Parameters assumed for quick reference span tables

Mesh: See notes on previous page. (Mesh is not required for FibreFlor)

Spans: Measured centre to centre of supports.

Deck: Standard deck material specification (see previous page).

Bearing width: The width of the support is assumed to be 150mm.

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 to be Grade 35 with a maximum aggregate size of 20mm. The wet weight of concrete is taken to be normal weight 2400kg/m³. The modular ratio is 10. Lightweight concrete may be used, please consult Tegral.

Construction load: 1.5 kN/m² construction load is taken into account,in accordance with BS 5950:Part 4. No allowance is made for heaping of concrete during the pouring operation. See design notes.

Slab Depth: The depth of slab is measured from the top of the concrete to the base of the profile.

Applied load: The applied load stated in the tables is to cover imposed live load, partition loads, finishes, ceilings and services. However the dead load of the slab itself has already been taken into account and need not be considered as part of the applied load.

Simplified fire design method: The fire recommendations in the tables are based on the simplified design method.

Fire engineering method: The fire engineering (FE) method may be used to calculate the additional reinforcement needed for fire, load and span conditions beyond the scope of these tables. The FE method of design is provided in the design CD.

Fire insulation: 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: Slab span to depth ratio is limited to 35 for normal weight concrete.

ComFlor® 60 (CF60)

Quick reference table

ComFlor® 60 with mesh - Span tables

Props	Span	Fire Rating	Slab Depth (mm)	Mesh	MAXIMUM SPAN (m) Deck Thickness/Gauge (mm) 0.9			1.0			1.1			1.2		
					Total Applied Load (kN/m²) 3.5	5.0	10.0	3.5	5.0	10.0	3.5	5.0	10.0	3.5	5.0	10.0
No Temporary props	Simple span slab & deck	1 hr	130	A142	3.5	3.2	2.3	3.6	3.3	2.3	3.7	3.4	2.4	3.9	3.4	2.5
			130	A252	3.5	3.5	2.6	3.6	3.6	2.7	3.7	3.7	2.7	3.9	3.9	2.8
			160	A252	3.2	3.2	2.9	3.4	3.4	3.0	3.5	3.5	3.0	3.6	3.6	3.1
		1.5 hr	140	A193	3.4	2.9	2.1	3.5	3.0	2.2	3.6	3.1	2.2	3.7	3.1	2.3
			170	A252	3.1	3.1	2.4	3.3	3.3	2.5	3.4	3.4	2.5	3.5	3.5	2.6
		2 hr	150	A193	2.9	2.5	1.9	3.0	2.5	1.9	3.0	2.5	1.9	3.0	2.6	1.9
			180	A252	3.1	3.0	2.1	3.2	3.0	2.1	3.3	3.0	2.2	3.5	3.0	2.2
	Double span slab & deck	1 hr	130	A142	3.6	3.6	2.7	3.9	3.8	2.8	4.2	3.9	2.9	4.5	3.9	2.9
			130	A252	3.6	3.6	3.2	3.9	3.9	3.2	4.2	4.2	3.3	4.5	4.5	3.3
			160	A252	3.3	3.3	3.3	3.7	3.7	3.7	4.0	4.0	3.8	4.2	4.2	3.8
		1.5 hr	140	A193	3.5	3.5	2.6	3.8	3.6	2.6	4.1	3.6	2.7	4.1	3.6	2.7
			170	A252	3.2	3.2	3.2	3.6	3.6	3.2	3.9	3.9	3.3	4.1	4.1	3.3
		2 hr	150	A193	3.4	3.0	2.3	3.5	3.1	2.3	3.5	3.1	2.4	3.5	3.1	2.4
			180	A252	3.1	3.1	2.8	3.5	3.5	2.8	3.8	3.8	2.9	4.1	3.9	2.9
1 Line of Temporary props	Double span slab	1 hr	130	A393	4.6	4.1	3.2	4.7	4.2	3.3	4.8	4.3	3.3	4.8	4.3	3.4
			160	2xA252	5.0	4.5	3.6	5.1	4.6	3.7	5.2	4.7	3.7	5.2	4.7	3.8
		1.5 hr	140	A393	4.1	3.7	2.9	4.1	3.7	2.9	4.2	3.8	2.9	4.2	3.8	3.0
			170	2xA252	4.3	3.9	3.1	4.4	4.0	3.2	4.5	4.1	3.2	4.5	4.1	3.3
		2 hr	150	A393	3.7	3.3	2.6	3.7	3.4	2.6	3.8	3.4	2.7	3.8	3.4	2.7
			180	2xA252	3.9	3.5	2.8	3.9	3.6	2.9	4.0	3.6	2.9	4.0	3.6	2.9

Closed ends: Produced on line during the roll-forming operation, ideal for single-span construction, acoustic reduction, fire stopping and to avoid filler blocks.

ComFlor® 80 (CF80)

The latest addition to Tegral's comprehensive range of flooring profiles.

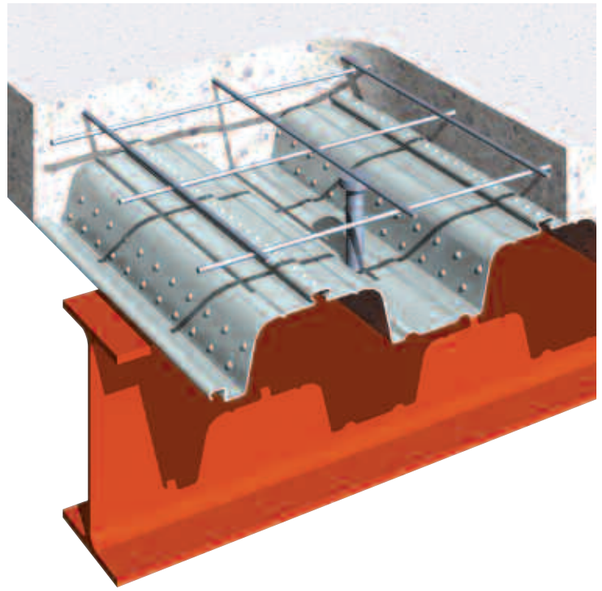
ComFlor® 80 – first of the next generation of profiled steel composite decks; it is the only 80mm profile utilising the higher grade 440 steel.

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 5m can be achieved.

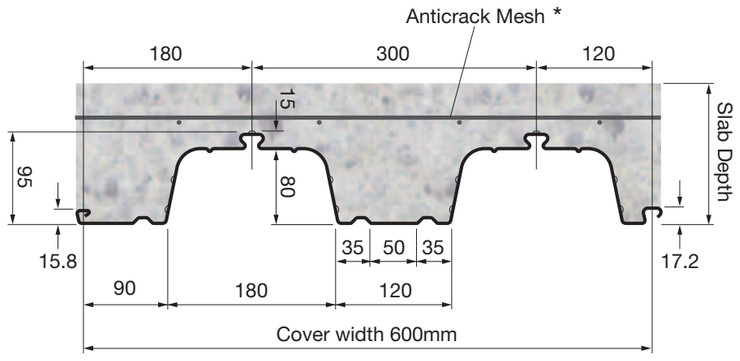
The large spans achievable means less structural steel and thus cost saving in the overall construction cost, providing more scope for Architects & Engineers in their design process.

The innovative profile design provides real benefits.

- **Central stud placement** provides superb composite action between the beam and concrete. The central location of the stud also reduces on-site checking to ensure correct stud positioning.
- **Ideal for car parks.** ComFlor® 80 is available with an optional 25-micron flexible polyester coating to the underside, for use in car parks.
- **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.



Section through ComFlor 80 profile deck



*The use of fibre reinforced concrete eliminates the need for the anticrack mesh.

ComFlor® 80 (CF80)

Section Properties (per metre width)

Nominal Thickness (mm)	Design thickness (mm)	Profile Weight (kN/m²)	Area of steel (mm²)	Height to neutral axis (mm)	Moment of inertia (cm⁴/m)	Ultimate Moment capacity (kN/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

Quick reference table

ComFlor® 80 Span table - Normal Weight Concrete

Props	Span	Fire Rating	Slab Depth (mm)	Mesh Type	Bar No	MAXIMUM SPAN (m) Deck Thickness (mm)					
						0.9			1.2		
						Total Applied Load (kN/m²)					
						3.5	5.0	10.0	3.5	5.0	10.0
No Temporary props	Simple span slab & deck	1 hr	150	A142	0	3.70	3.22	2.41	4.10	3.57	2.67
		1 hr	160	A252	0	4.08	3.90	2.75	4.36	4.28	2.99
		1.5 hr	160	A252	0	3.75	3.17	2.35	3.92	3.36	2.51
		2 hr	170	A393	0	4.00	3.46	2.42	4.29	3.41	2.48
		1 hr	150	A193	0	4.16	-	-	4.44	-	-
		1 hr	150	A142	1	4.16	4.16	4.16	4.44	4.44	4.44
	Double span slab & deck	1 hr	150	A142	0	4.29	3.85	2.94	4.70	4.10	3.10
		1.5 hr	160	A252	0	4.10	3.94	2.98	4.68	4.07	3.10
		2 hr	170	A393	0	3.97	3.92	2.93	4.55	3.93	2.98
		1 hr	150	A193	0	4.28	4.28	-	5.06	-	-
		1 hr	150	A142	1	4.28	4.28	4.28	5.06	5.08	-

Parameters assumed for quick reference span tables

ComFlor® 80 Composite Slab - Volume

Overall Slab Depth (mm)	Concrete volume (m³/m²)
150	0.106m³/m²
160	0.116m³/m²
170	0.126m³/m²
180	0.136m³/m²
190	0.146m³/m²

Volume notes:

1. Deck and beam deflection (i.e. ponding) is not allowed for in the table.
2. Density of concrete is taken as:

   Normal weight (wet) 2400 kg/m²

   Normal weight (dry) 2350 kg/m²

   Note: For lightweight concrete, contact Tegral Technical Services Department.

Quick Reference Tables: All spans are shown in metres and are based on supported unpropped conditions.

The load/span table above shows typical spanning condition for the ComFlor 80 profile. For variations of slab depth, loading conditions (including point loads), support conditions and the use of lightweight concrete we recommend the use of the Comdek software, available from Tegral.

Spans: Spans are measured centre to centre of support, support width is 150mm in tables.

Construction Load: of 1.5kN/m² is taken into account in accordance with BS5950: Part 4 no allowance has been made for heaping of concrete during the casting of the slab.

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

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

ComFlor® 80 (CF80)

FibreFlor CF80 - Span table - Normal Weight Concrete

Props	Span	Fire Rating	Slab Depth (mm)	FibreFlor	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	MAXIMUM SPAN (m) with a bar in the trough** Deck Thickness (mm) 0.9 — 3.5	5.0	10.0	1.2 — 3.5	5.0	10.0
No Temporary props	Single span deck & slab	1 hr	140	26	4.2	3.8	3.0	4.5	4.3	3.4	4.2^{o}	4.2^{12}	4.2^{20}	4.5^{o}	4.5^{12}	4.2^{20}
			170	26	4.0	4.0	3.4	4.2	4.2	3.8	4.0^{o}	4.0^{o}	4.0^{12}	4.2^{o}	4.2^{o}	4.2^{16}
		1.5 hr	150	31	3.4	3.1	2.4	3.8	3.4	2.7	4.1^{12}	4.1^{16}	4.1^{20}	4.4^{16}	4.4^{16}	4.4^{20}
			180	31	3.8	3.5	2.8	4.1	3.8	3.1	3.8^{o}	3.9^{12}	3.9^{16}	4.1^{o}	4.2^{16}	4.2^{16}
		2 hr	160	36	3.4	3.1	2.5	3.8	3.5	2.8	4.0^{16}	4.1^{16}	4.1^{20}	4.3^{16}	4.3^{20}	4.3^{25}
			190	36	3.8	3.5	2.8	4.1	3.8	3.1	3.8^{o}	3.8^{16}	3.8^{20}	4.1^{o}	4.1^{16}	4.1^{20}
	Double span deck & slab	1 hr	140	26	4.4	4.2	3.2	5.1	4.7	3.7	4.4^{o}	4.4^{12}	4.2^{20}	5.1^{o}	5.2^{16}	4.3^{20}
			170	26	3.9	3.9	3.6	4.8	4.8	4.1	3.9^{o}	3.9^{o}	3.9^{16}	4.8^{o}	4.8^{o}	4.8^{16}
		1.5 hr	150	31	3.7	3.3	2.6	4.1	3.7	2.9	4.2^{12}	4.2^{16}	4.2^{20}	5.0^{16}	5.0^{16}	4.5^{20}
			180	31	3.8	3.7	3.0	4.5	4.1	3.3	3.8^{o}	3.7^{o}	3.8^{16}	4.7^{16}	4.7^{16}	4.7^{20}
		2 hr	160	36	3.8	3.4	2.7	4.2	3.7	3.0	4.1^{16}	4.1^{16}	4.1^{20}	4.8^{20}	4.8^{20}	48^{25}
			190	36	3.7	3.7	3.0	4.6	4.1	3.3	3.7^{o}	3.7^{o}	3.7^{20}	4.6^{o}	4.7^{20}	4.7^{25}
1 Line of Temporary props	Double span slab	1 hr	140	26	4.7	4.2	3.2	5.1	4.7	3.7	5.3^{16}	4.9^{16}	4.1^{16}	5.4^{16}	5.1^{16}	4.2^{16}
			170	26	5.1	4.6	3.6	5.7	5.1	4.1	6.2^{20}	5.8^{20}	5.0^{20}	6.3^{20}	6.0^{20}	5.1^{20}
		1.5 hr	150	31	3.7	3.3	2.6	4.1	3.7	2.9	5.3^{16}	5.3^{20}	4.6^{25}	5.8^{20}	5.4^{20}	4.7^{25}
			180	31	4.1	3.7	3.0	4.5	4.1	3.3	6.3^{20}	6.1^{20}	5.4^{25}	6.5^{20}	6.2^{20}	5.5^{25}
		2 hr	160	36	3.8	3.4	2.7	4.2	3.7	3.0	5.5^{20}	5.8^{25}	4.8^{25}	5.5^{20}	5.9^{25}	5.2^{25}
			190	36	4.2	3.8	3.0	4.6	4.1	3.3	6.1^{25}	6.1^{25}	6.0^{32}	6.9^{25}	6.5^{25}	6.0^{32}

XX^{ss} The superscript is the diameter of bar required. One bar per deck trough - cover 25mm.

** Where ° is shown no bar is required, in these cases extra reinforcement does not increase the span.

FibreFlor dosage

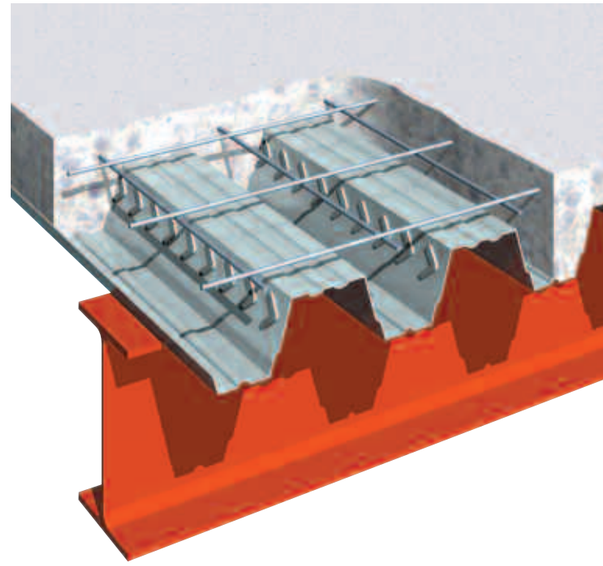
26 – Steel fibres 25kg/m³, Polypropylene fibres 0.9kg/m³ 31 – Steel fibres 30kg/m³, Polypropylene fibres 0.9kg/m³ 36 – Steel fibres 35kg/m³, Polypropylene fibres 0.9kg/m³

ComFlor® 80 with mesh - 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 & 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 hr	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 hr	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 & 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 hr	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 hr	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
1 Line of Temporary props	Double span slab	1 hr	140	A393	4.8	4.3	3.2	5.0	4.5	3.5
			170	A393	5.3	4.8	3.8	5.6	5.0	4.0
		1.5 hr	150	A393	4.1	3.7	2.9	4.3	3.9	3.0
			180	A393	4.6	4.2	3.3	4.8	4.3	3.4
		2 hr	160	A393	3.7	3.4	2.6	3.8	3.4	2.8
			190	A393	4.1	3.8	3.0	4.2	3.9	3.1

ComFlor® 100 (CF100)

ComFlor® 100 (CF100), has a very strong profile shape and offers the capability to span up to 4.5metres without props. Designed particularly for longer unpropped spans. However, the profile is not suitable for use with shear stud connectors.



No temporary props

ComFlor® 100 can carry wet concrete and construction loads to 4.5m without temporary propping, (depending on slab depth) thereby leaving a clear area beneath the floor under construction. Further savings of labour and prop hire are also realised.

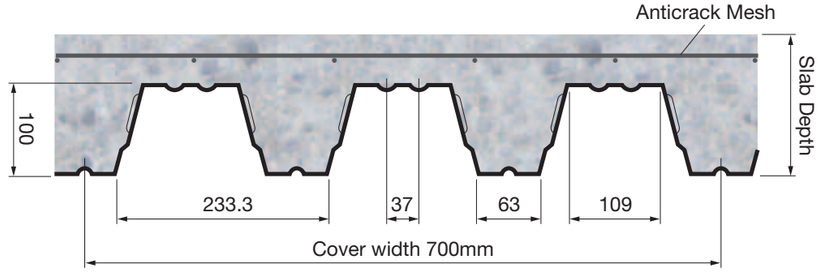
Large concrete volume reduction

Although a deep slab is required, the ComFlor® 100 profile greatly reduces the volume of concrete needed and thus the cost and weight of concrete.

Suitable for traditional construction

ComFlor® 100 is suitable to be placed onto masonry walls or standard design non-composite steel beams. As shear studding is not possible with ComFlor 100 Composite beam design may not be considered.

Section through ComFlor 100 profile deck



ComFlor® 100 (CF100)

ComFlor® 100 Composite Slab - Volume & Weight

Overall Slab Depth (mm)	Concrete volume (m^3/m^2)	Weight of Concrete (kN/m^2) Wet	Dry
160	0.100	2.36	2.31
170	0.110	2.59	2.54
180	0.120	2.83	2.77
190	0.130	3.06	3.00
195	0.135	3.18	3.12
200	0.140	3.30	3.23
210	0.150	3.53	3.46
220	0.160	3.77	3.69
230	0.170	4.01	3.92
250	0.190	4.48	4.38

Volume & weight table notes

1. Deck and beam deflection (i.e. ponding is not allowed for in the table.
2. Deck and mesh weight 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

ComFlor 100 is not designed for use with shear studs (i.e. not for composite beam design)

Note: For lightweight concrete contact Tegral Technical Services Department.

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
1.00	0.96	0.14	1687	58.00	257.0	11.84	14.96
1.10	1.06	0.15	1855	58.00	278.0	12.08	16.80
1.20	1.16	0.16	2022	58.00	298.0	12.40	18.64

Design Notes

Deck material

Zinc coated steel to BS EN 10147:2000, Fe E 350G, Z275, with a guaranteed minimum yield stress of 350 N/mm^2. Minimum zinc coating mass is 275 g/m^2 total including both sides.

Quick reference tables

The quick reference load/span and fire design tables, are intended as a guide for initial design, based on the parameters stated below the tables.

The Comdek calculation design suite CD provides a full design programme. Please contact Tegral.

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. Corus Panels and Profiles in conjunction with The Steel Construction Institute has agreed to modify the requirement with regard to anti-crack mesh, to comply with the Eurocode 4 recommendations. Accordingly, the mesh shown in the quick reference tables complies with EC4 and the design programme defaults to these values.

Where EC4 mesh rules are used, the mesh may be reduced midspan - see Design Information on page 20. The reduced British Standards mesh values may still be used by overriding this default in the design programme.

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 & A393 mesh.

Fire

For details on the performance of composite slabs under a fire condition with nominal anti-crack mesh, please refer to the quick reference fire load tables. For other simplified design cases or for full fire engineering, refer to the design CD.

Technical services

Tegral's Technical Services Department offer a comprehensive advisory service on the design of composite flooring.
Should queries arise, please contact us on
00+353 59 86 40750
or email metaltech@tegral.com.

DESIGNER'S FLOOR DECKING GUIDE Shallow Decking

ComFlor® 100 (CF100)

Quick reference table

ComFlor® 100 Span table - Normal Weight Concrete

Props	Span	Fire Rating	Overall Slab Depth (mm)	Mesh	Bar Reinforcement 12mm	MAXIMUM SPAN (m) Deck Thickness/Gauge (mm) 1.0 Total Applied Load (kN/m^2) 3.5	5.0	10.0	1.1 3.5	5.0	10.0	1.2 3.5	5.0	10.0
No Temporary props	Simple span slab & deck	1 hr	170	A252	None	3.9	3.5	2.8	4.0	3.6	2.8	4.0	3.7	2.9
		1.5 hr	180	A393	None	3.8	3.5	2.8	3.9	3.6	2.8	3.9	3.6	2.9
		2 hr	195	A393	None	3.6	3.2	2.6	3.6	3.3	2.6	3.6	3.3	2.6
			250	A393	None	3.3	3.2	2.6	3.3	3.2	2.6	3.3	3.2	2.6
	Double span slab & deck	1 hr	170	A142	None	4.3	3.9	3.1	4.4	4.0	3.1	4.5	4.1	3.2
		1.5 hr	180	A252	None	4.3	3.8	3.0	4.3	3.9	3.9	4.4	4.0	3.1
		2 hr	195	A393	None	4.2	3.8	3.1	4.2	3.9	3.1	4.3	3.9	3.1
			250	A393	None	3.5	3.5	3.4	3.8	3.8	3.5	3.8	3.8	3.5
1 Line of Temporary props	Simple span slab & deck	1 hr	170	A393	One per trough	5.9	5.3	4.2	5.9	5.3	4.2	5.9	5.3	4.2
			250	2xA393	One per trough	5.8	5.8	4.9	6.3	6.0	4.9	6.5	6.0	4.9
		1.5 hr	180	A393	One per trough	4.8	4.4	3.4	4.8	4.3	3.4	4.8	4.3	3.4
			250	2xA393	One per trough	3.5	4.8	3.9	5.2	4.8	3.9	5.2	4.8	3.9
		2 hr	195	A393	One per trough	4.0	3.7	2.9	4.0	3.6	2.9	4.0	3.6	2.9
			250	2xA393	One per trough	4.3	3.9	3.2	4.3	3.9	3.2	4.3	3.9	3.2
	Simple span slab & deck	1 hr	170	A393	One per trough	5.9	5.0	4.2	5.9	5.3	4.2	5.9	5.3	4.2
			250	2xA393	One per trough	5.9	5.9	4.9	6.5	6.0	4.9	6.5	6.0	4.9
		1.5 hr	180	A393	One per trough	4.8	4.4	3.4	4.8	4.3	3.4	4.8	4.3	3.4
			250	2xA393	One per trough	5.2	4.8	3.9	5.2	4.8	3.9	5.2	4.8	3.9
		2 hr	195	A393	One per trough	4.0	3.7	2.9	4.0	3.6	2.9	4.0	3.6	2.9
			250	2xA393	One per trough	4.3	3.9	3.2	4.3	3.9	3.2	4.3	3.9	3.2

Parameters assumed for quick reference span tables

Mesh: See notes on previous page.

Spans: Measured centre to centre of supports.

Deck: Standard deck material specification (see previous page).

Bearing width: The width of the support is assumed to be 150mm.

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 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. Lightweight concrete may be used, please consult Tegral.

Construction load: 1.5 kN/m^2 construction load is taken into account,in accordance with BS 5950:Part 4. No allowance is made for heaping of concrete during the pouring operation. See design notes.

Slab Depth: The depth of slab is measured from the top of the concrete to the base of the profile.

Applied load: The applied load stated in the tables is to cover imposed live load, partition loads, finishes, ceilings and services. However the dead load of the slab itself has already been taken into account and need not be considered as part of the applied load.

Simplified fire design method: The fire recommendations in the tables are based on the simplified design method.

Fire engineering method: The fire engineering (FE) method may be used to calculate the additional reinforcement needed for fire, load and span conditions beyond the scope of these tables. The FE method of design is provided in the design CD.

Fire insulation: 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: Slab span to depth ratio is limited to 35 for normal weight concrete.

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.

Deck span – (unpropped) usually dictates beam spacing.

Slab span – (propped deck) dictates maximum beam spacing.

Two Stage Design

All Composite Floors must be considered in two stages.

1 Wet Concrete and Construction load – carried by deck alone.

2 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 guide and the Corus Panels and Profiles calculation design CD available from Tegral makes both quick reference and full design easy. Indicative design may be carried out from the printed tables, however the software on the CD greatly increases the scope available to the Design Engineer as it allows for a full set of printed 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

BS5950 : Part 4 currently recommends that anti-crack mesh should comprise 0.1% of slab area. The Eurocode 4 recommendation is that anti-crack mesh should comprise 0.2% of slab area for unpropped spans and 0.4% of slab area for propped spans. Corus Panels and Profiles in conjunction with The Steel Construction Institute has agreed to modify the requirement with regard to anti-crack mesh, to comply with the Eurocode 4 recommendations. Accordingly, the mesh shown in the quick reference tables complies with EC4 and the design programme defaults to these values. The reduced BS mesh values may still be used by overriding this default in the design programme.

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 & A393.

Reduced Mesh

Where EC4 mesh rules are used, as recommended by Steel Construction Institute and Corus Panels and Profiles, 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.

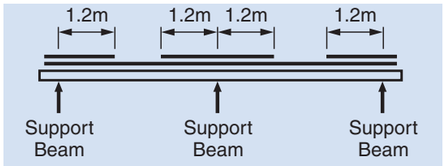


Diagram showing full mesh area over supports

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.

DESIGNER'S FLOOR DECKING GUIDE Shallow Decking

Design information

Transverse Reinforcement

Tegral 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

The strength of the concrete must meet the requirements for strength of the composite slab and shall not be less than 30N/mm^2 for Normal Weight Concrete (NWC). The maximum value of concrete strength shall not be taken as greater than 50 N/mm^2 for NWC where design is done using software.

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

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

Density kg/m^3

	Wet	Dry	Modular Ratio
NWC	*2400*	*2350*	*10*

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

Fire Design

Fire insulation

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

Span/depth ratio

Slab span to depth ratio is limited to a maximum of 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:

1 Bending resistance in fire conditions.

2 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 for 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 programme assumes the bar is positioned just below the top of the steel deck. For CF70 with a raised dovetail in the crest, the bar will be placed below the dovetail.

The quick reference tables for shallow composite floors generally use the simplified fire design method (except CF100), 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)

Design information

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 self-weight 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.

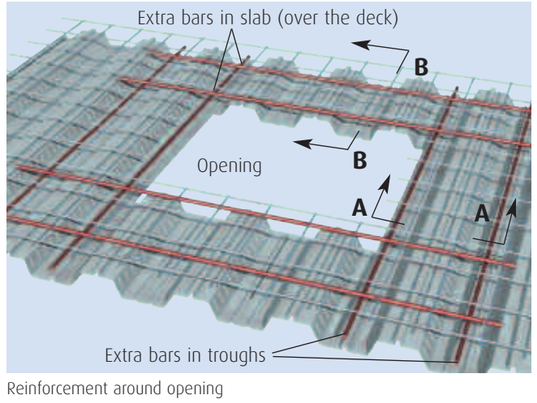
Factored loads are considered at the ultimate limit state and unfactored loads at the serviceability limit state. Unfactored loads are also considered in fire conditions.

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 33. The design of openings depends on their size:



Reinforcement around opening

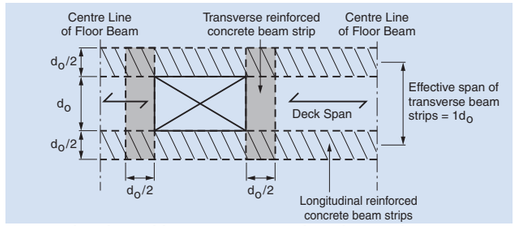
Small
Openings up to 300mm square - do not normally require additional reinforcement.

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.

Design Information

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.



Load paths and beam strips around medium to large openings

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.

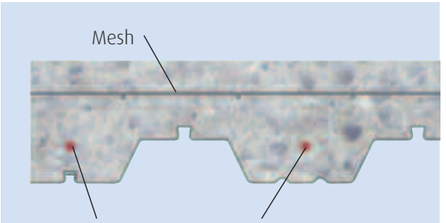
Where these rules are not satisfied, the openings must be fully trimmed with support steelwork.

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.

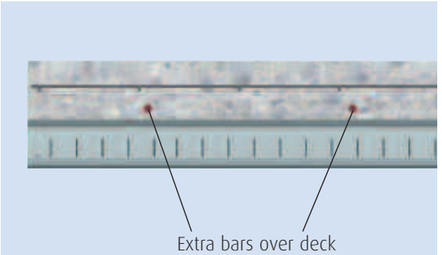
Slab design around openings
It may be assumed that an effective system of 'beam strips' span the perimeter of the opening. The effective breadth of the beam strips should be taken as $d_o/2$, where d_o is the width of the opening in the direction transverse to the decking ribs. Only the concrete above 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.

Section A-A (see previous page)



Section B-B (see previous page)



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

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.

Design using Shear Studs
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.

Design Information

Suitability of decks

Shear studs cannot be placed on profile stiffeners, and with CF70 and CF46, the position of the stiffeners dictates the shear stud position. With CF70, the trough containing the side lap rib prevents central placement of studs but the other two troughs have twin stiffeners, which allow central placement of studs. The profile height of CF70 is taken as 55mm (see page 12). In the case of CF80, central stud placement provides superb composite action between the beam and concrete which ensures the correct concrete cover of the stud. The central location of the stud also reduces on-site checking to ensure correct stud positioning.

NB: CF100 is not suitable for use with shear studs.

Non-welded shear connectors

Hilti shear connectors (installed with Hilti ENP2 decking nails) may be used.

NOTE: This system may be installed in wet weather using small (hand held) installation equipment. Refer to Hilti or Tegral for further information.

Design guidance

BS 5950: Part 3: Section 3.1: Code of Practice for Design of Simple and Continuous Composite Beams and BS 5550: Part 4: Code of Practice for Design of Floors with Profiled Steel Sheeting and The Steel Construction Institute/Metal Cladding & Roofing Manufacturers Association "Composite Slabs and Beams using Steel Decking: Best Practice for Design and Construction" (SCI P300) are recommended by Tegral for further reference.

Fibre Reinforced Concrete

SI Concrete Systems

SI Concrete Systems pioneered the creation of fibre reinforcement more than 20 years ago and is now the world's largest supplier of fibre solutions for concrete reinforcement, with fibre specialists and distributors in almost every country in the world.

With over two decades of innovating and perfecting fibre reinforcement solutions SI Concrete Systems offers performance benefits over the entire life span of concrete - from simplifying placement to minimising cracks in the plastic state to controlling cracks in the hardened state to providing years of exceptional durability and fire resistant benefits.

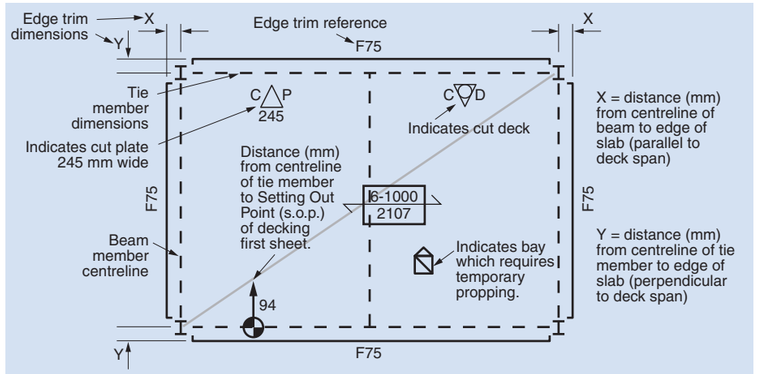
An international staff of fibre reinforced concrete specialists have expanded their quest to solve concrete construction's greatest challenges in virtually every application imaginable: slab-on-ground, elevated slab, poured-in-place walls, sprayed concrete, precast and many more. The resulting solutions have spawned a continually growing list of pioneering firsts, including fibrillated, monofilament and macro-synthetic fibres as well as engineered fibre combinations for multifaceted applications.

A long-standing philosophy of solutions-orientated innovations ensures the delivery of the ultimate combination of world-class concrete reinforcement products and world-class concrete specialists.

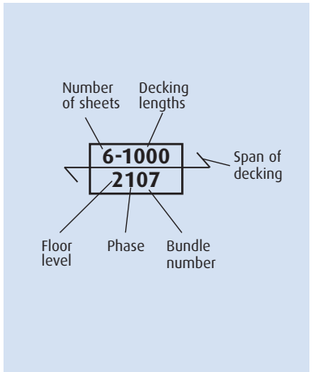
Independently tested at a Namas certified fire test facility. Full information on fibremesh micro-synthetic fibres and Novocon steel fibres available from SI Concrete Systems.

Construction Details - CF46, CF51, CF60, CF80, CF100

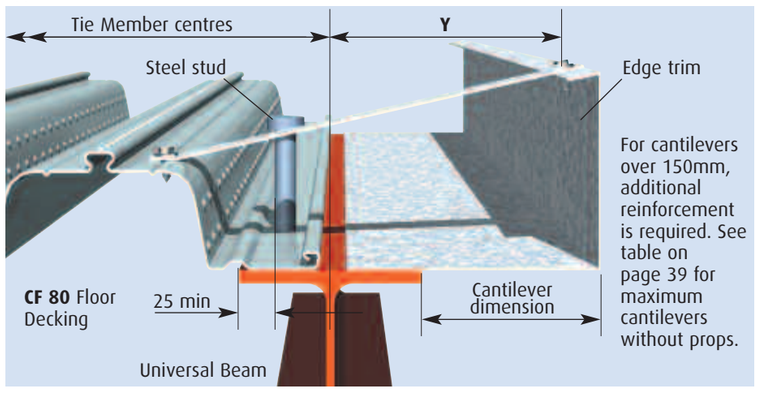
Plan view of typical floor layout



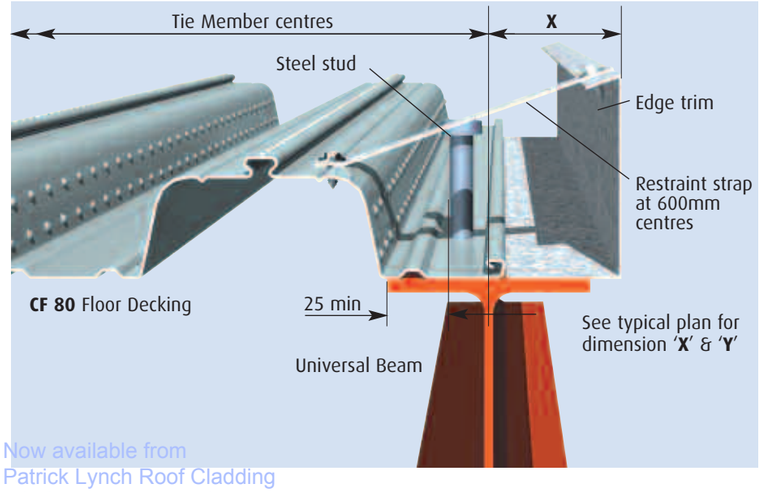
Deck notation



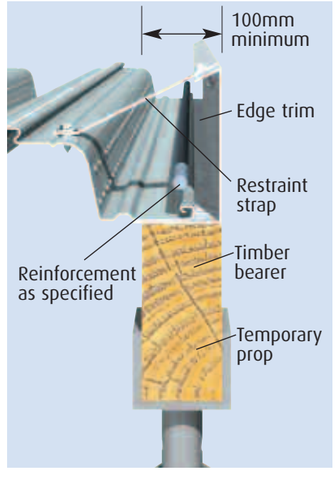
Typical side detail



Typical side detail



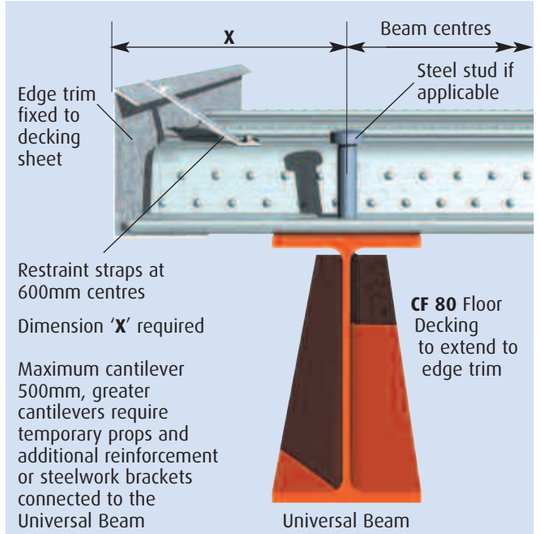
Unsupported edge detail



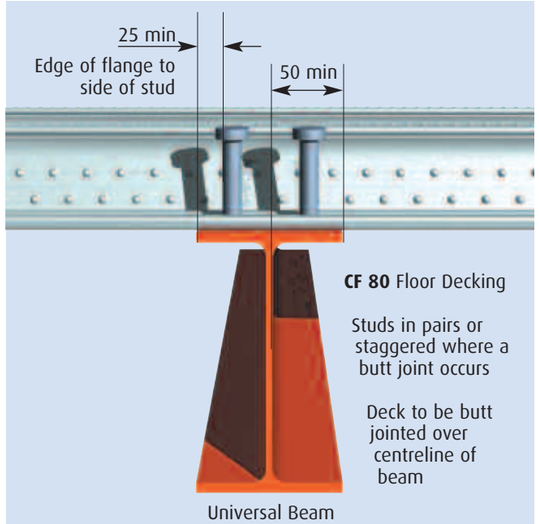
DESIGNER'S FLOOR DECKING GUIDE Shallow Decking

Construction Details - CF46, CF51, CF60, CF80, CF100

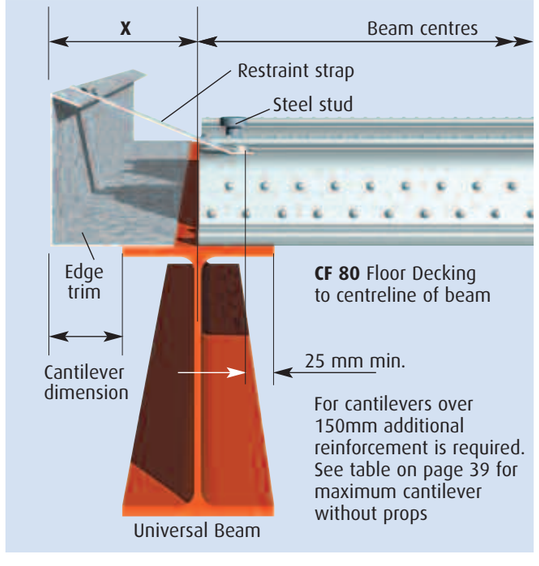
Typical end cantilever



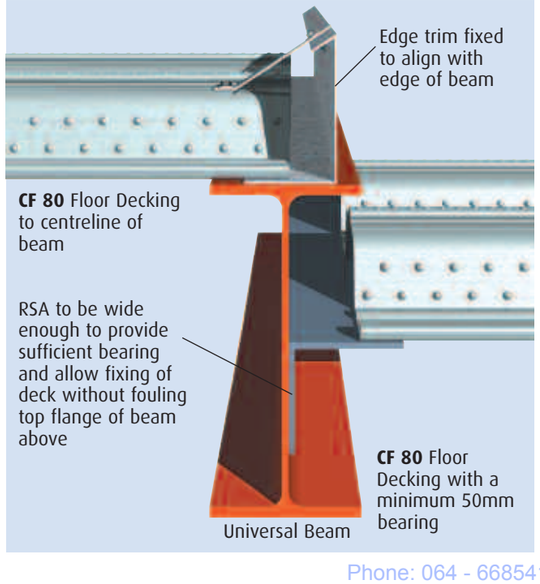
Butt joint



End detail

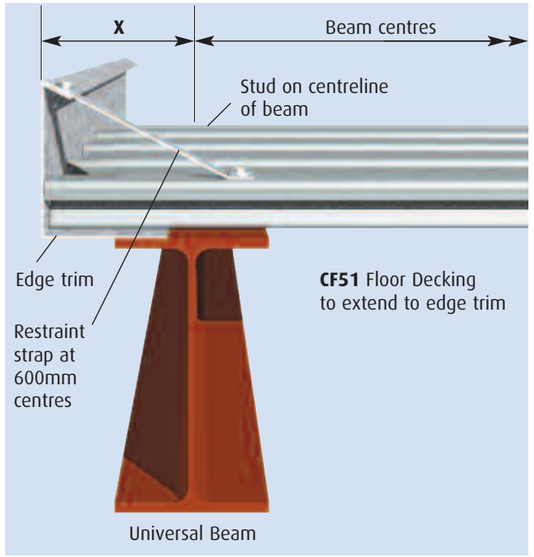


Step in floor

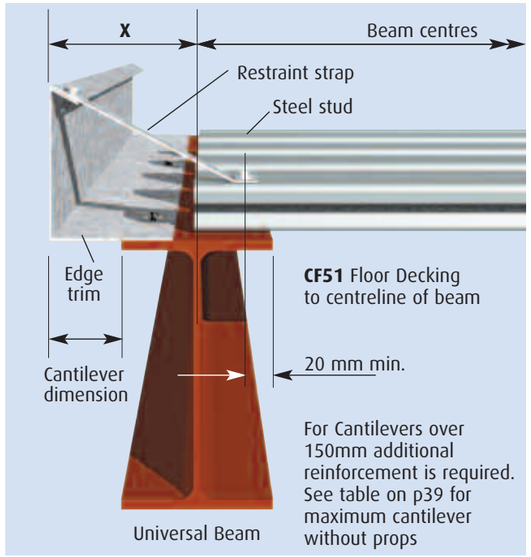


Construction Details - CF46, CF51, CF60, CF80, CF100

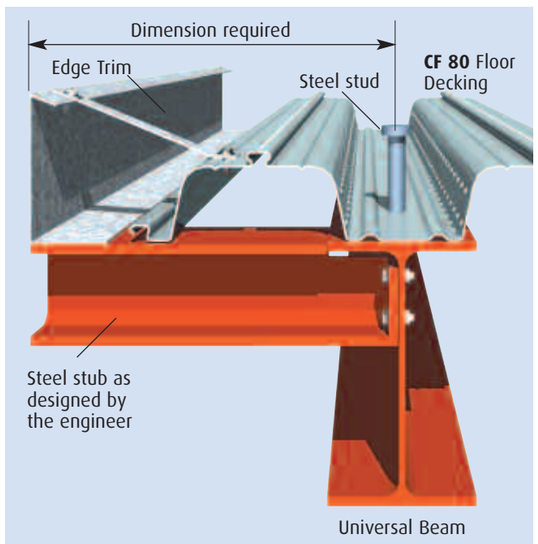
End detail alternative 1



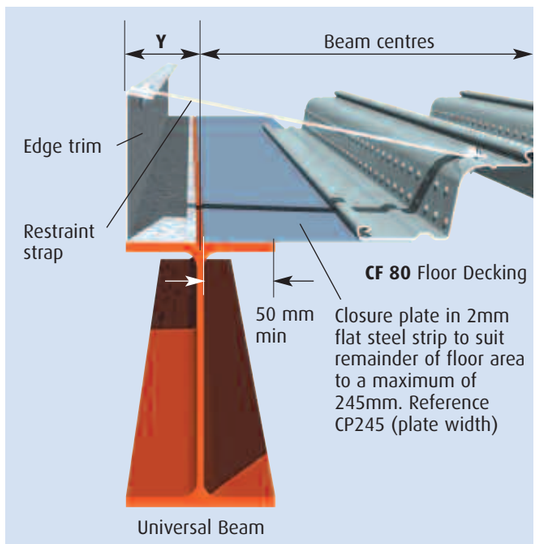
End detail alternative 2



Side cantilever with stub bracket

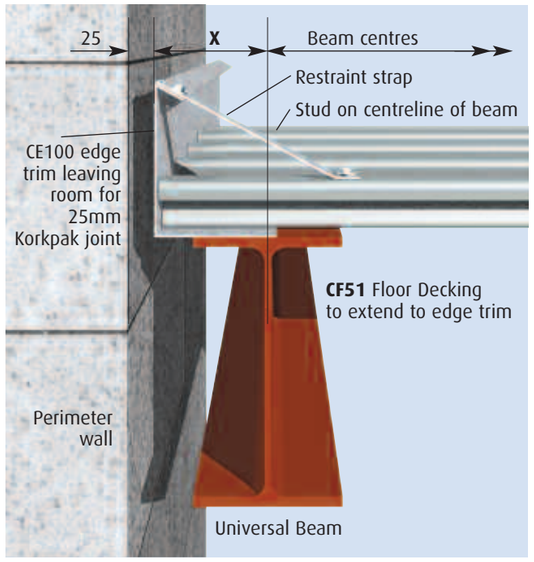


Typical edge with plate

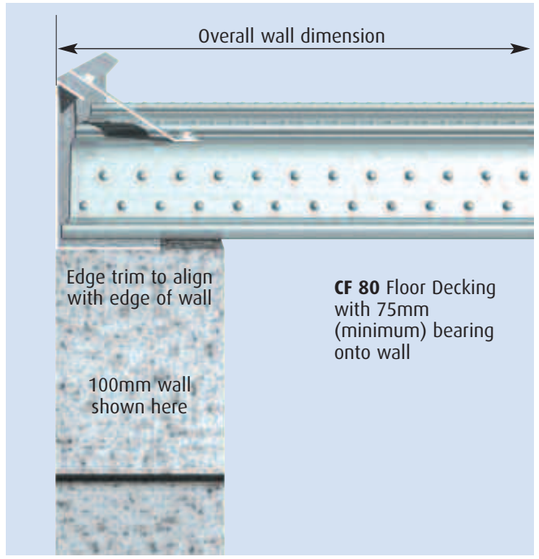


Construction Details - CF46, CF51, CF60, CF80, CF100

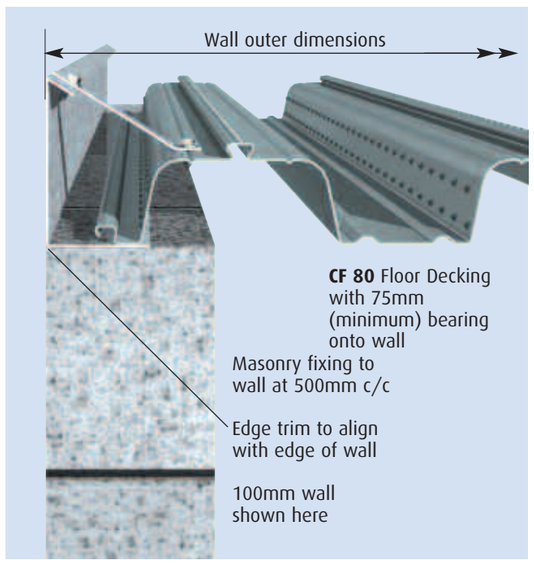
Beam at perimeter wall



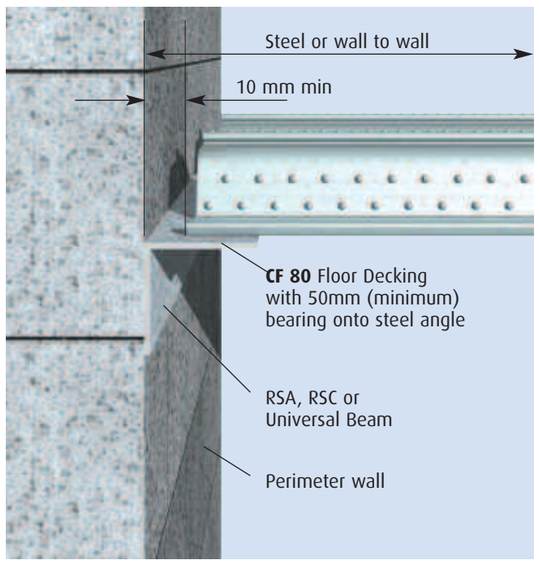
Typical wall end detail



Typical wall side detail



Deck inside of wall detail



Site Work

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, CF80 and CF100.
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 s PINDAK, are used, wind loading should be checked, especially on exposed sites.

Telephone numbers of fixings suppliers

EJOT 0113 247 0880
Erico 0118 958 8386
Hilti 0161 886 1000
SFS 0113 208 5500

Filler Blocks

Profiled foam fillers to close profiles are available from Paulamar 0141 776 2588. Dense rockwool profile fillers for fire and acoustic stopping may be sourced from AIM 01342 893 381.

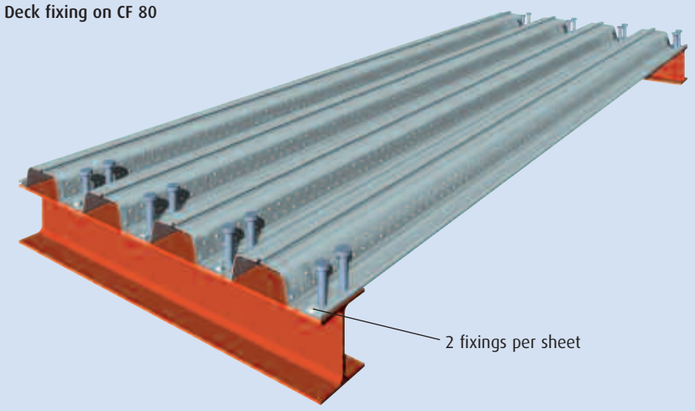
FIXING INFORMATION FOR SHALLOW DECKING

To Steel	*Heavy duty powder actuated fixings - Hilti ENP2 X-ENP-19 L15 nail/Spit SBR14 or equivalent. Fo 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 ComFlor 60	ComFlor 51 ComFlor 80	ComFlor 100
End fixing	*3 per sheet (2 per sheet when using shear studs)*	*2 per sheet*	*2 per sheet*
Intermediate supports	*2 per sheet (1 per sheet when using shear studs)*	*1 per sheet*	*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*		

Deck fixing on CF 80

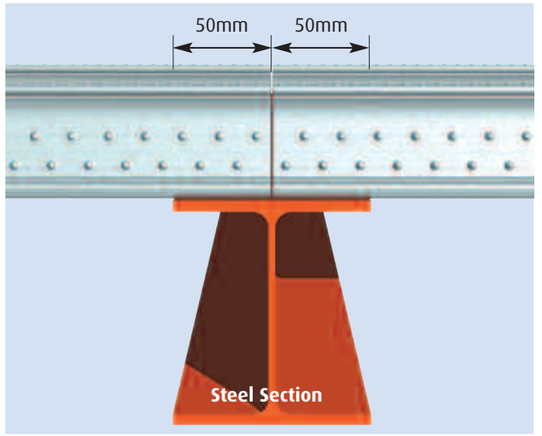


DESIGNER'S FLOOR DECKING GUIDE Shallow Decking

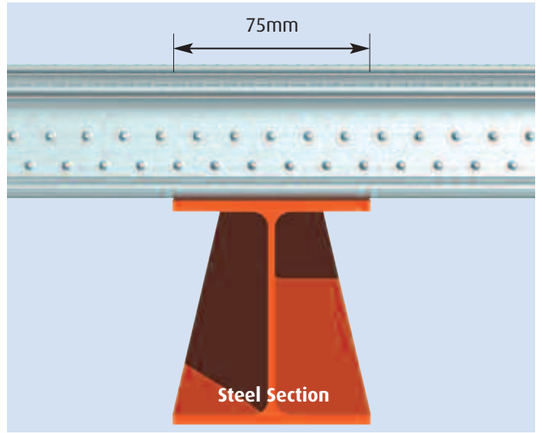
Site Work

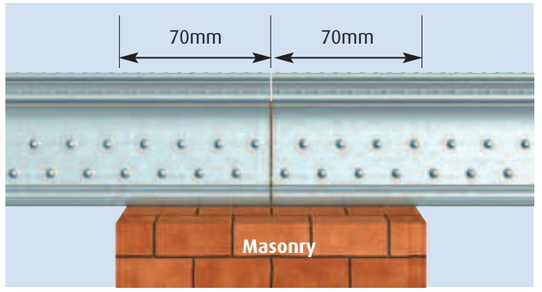
Bearing requirements

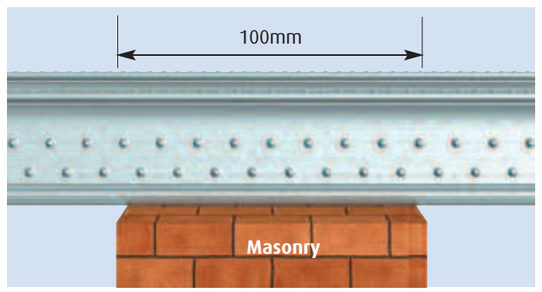
End bearing and shared bearing (minimum)



Continuous bearing (minimum)







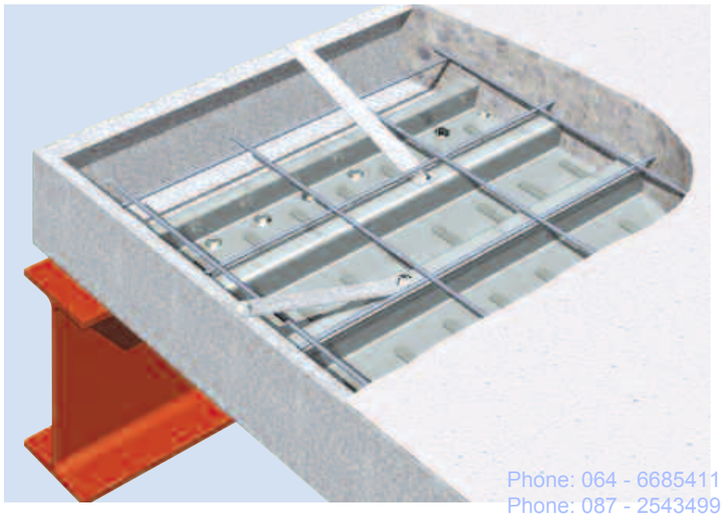
Edge trim

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	50	115	150	185
200	x	100	130	160
250	x	50	100	135
300	x	x	50	100
350	x	x	x	50

x - not recommended



Site Work

Mesh placement

Standard reinforcing mesh, such as A142, A193 and A252 is usually required, positioned towards the top of the slab. The top cover to the reinforcement mesh should be 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.

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. See page 24.

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.

Pouring concrete

Before the concrete is poured ensure temporary props are in position (if required by the design) - see page 34. 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 mini-dovetail re-entrant stiffener on ComFlor 70 profiles allow for the quick and easy suspension of ceiling and services, using either of the two following suspension systems.

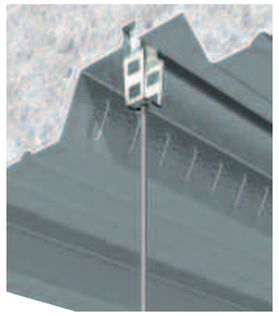
(a) Threaded wedge nut fixings

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 hanger fixings



GTD-clip hanger fixings are cold formed thin steel hangers with circular openings in the soffit to take metric bolts, threaded rods or further pipe clamp

DESIGNER'S FLOOR DECKING GUIDE Shallow Decking

Site Work

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 & Pipe Clamp	*N/A*	*45*

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

Openings

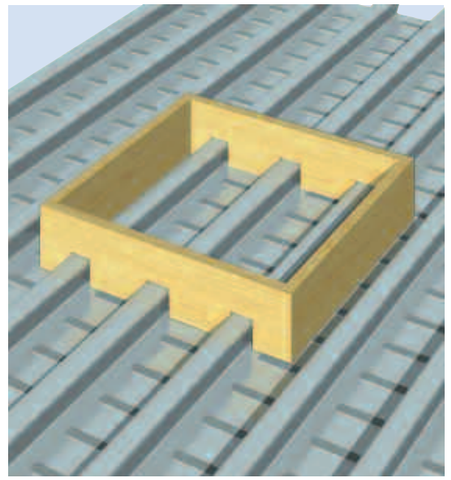
All openings must be specified by the Engineer.

Further information is contained in the BSRIA/SCI publication "Supporting Services from Structure".

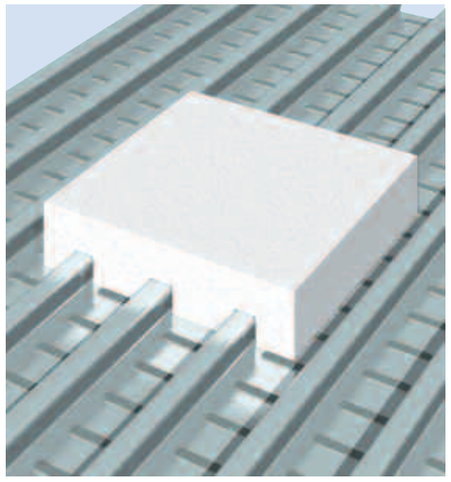
Openings greater than 300mm must be designed with extra reinforcement placed around the opening. Openings up to 700mm can be accommodated by boxing out prior to pouring concrete and cutting out the deck after concrete has cured, refer to page22 for details.

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

Site Work

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 Tegral's Technical Services Department.

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

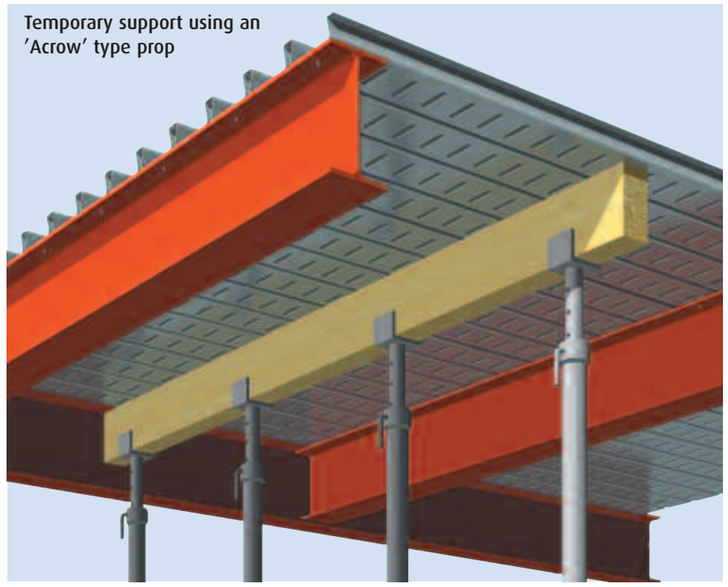
[d] The propping structure is not to be removed until the concrete has reached at least 70% of its characteristic strength.

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.

Temporary Props

Timber Bearer Guide (shallow decks) All to be min. 100mm wide	
Slab depth (mm)	Bearer depth(mm)
up to120	*150*
130 - 160	*200*
170 - 200	*250*

Temporary support using an 'Acrow' type prop



Tegral Deep Decking

Project: Georges Quay, Dublin
Architects: Keane, Murphy, Duff
Engineers: Project Management Group Mechanical & Consulting Engineers,
Project Managers Cleary McCabe
Product: Tegral Floor Decking

ComFlor 210 & Slimdek® 225

Tegral Deep Composite Floor decking used in Slimdek® construction offers all the benefits of shallow deck composite construction, with some significant additional benefits.

Long span decks
The deck can be designed to span 6m unpropped and up to 9m propped with corresponding reduction in steelwork.

Shallow floor depth
The deck is contained within the beam depth, which produces a "slim floor". This leads to savings in cladding costs and either helps to reduce the overall building height or enables an extra floor to be added for buildings of 10 storeys plus.

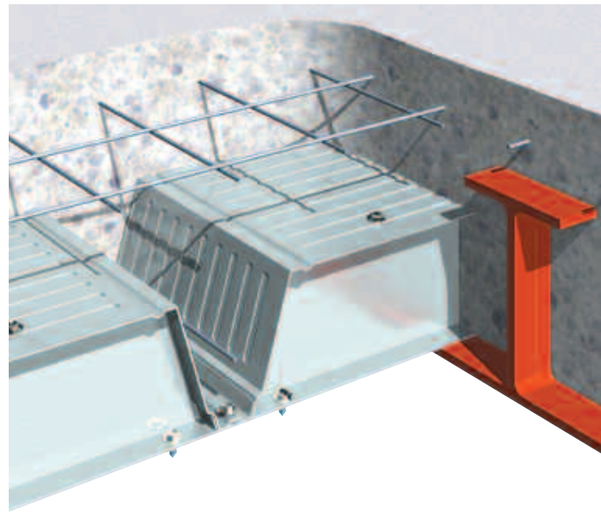
Service integration
The shape of the deep decking permits services to be installed between the deck ribs, effectively within the slab depth. This leads to further reductions in the floor zone.

Inherent fire resistance
A fire resistance of 60 minutes can be achieved without fire protection to the steelwork or deck profile.

Project: Bank of Scotland, Dublin
Architects: RKD Architects
Engineers: O'Connor, Sutton, Cronin
Product: Tegral Floor Decking

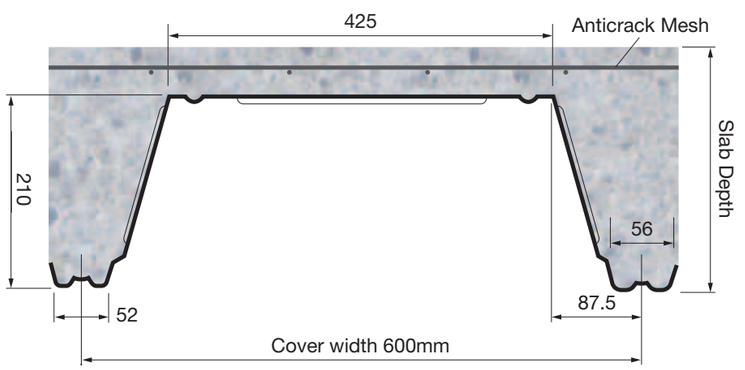
ComFlor 210 (CF210)

The original SlimFlor long span steel deck, ComFlor 210 (CF210) 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 Stackable profile shape reduces transport and handling costs.
- Up to 2 hours fire rating with unprotected soffit.

Section through ComFlor 210 profile deck



ComFlor 210

ComFlor 210 Composite Slab - Volume & Weight

Overall Slab Depth (mm)	Concrete volume (m^3/m^2)	Weight of Concrete (kN/m^2) Wet	Dry
270	0.100	2.36	2.31
280	0.110	2.60	2.54
290	0.120	2.83	2.77
300	0.130	3.07	3.00
305	0.135	3.18	3.12
310	0.140	3.30	3.23
330	0.160	3.77	3.69
350	0.180	4.24	4.16
375	0.205	4.83	4.73
400	0.230	5.42	5.31

Volume & weight table notes

1. Deck and beam deflection (i.e. ponding is not allowed for in the table.
2. Deck and mesh weight 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

   Note: For lightweight concrete contact Tegral Technical Services Department.

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
1.25	1.21	0.16	2009	95.00	816.00	23.20	23.20

Design Notes

Deck material

Zinc coated steel to BS EN 10147:2000, Fe E 350G, Z275, with a guaranteed minimum yield stress of 350 N/mm^2. Minimum zinc coating mass is 275 g/m^2 total including both sides.

Quick reference tables

The quick reference load/span and fire design tables, are intended as a guide for initial design, based on the parameters stated below the tables.

The Comdek calculation design suite CD provides a full design programme. Please contact Tegral.

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. Corus Panels and Profiles in conjunction with The Steel Construction Institute has agreed to modify the requirement with regard to anti-crack mesh, to comply with the Eurocode 4 recommendations. Accordingly, the mesh shown in the quick reference tables complies with EC4 and the design programme defaults to these values.

Where EC4 mesh rules are used, the mesh may be reduced midspan - see Design Information on page 48. The reduced British Standards mesh values may still be used by overriding this default in the design programme.

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 & A393 mesh.

Technical services

Tegral's Technical Services Department offer a comprehensive advisory service on the design of composite flooring, Should queries arise, please contact us on 00+353 59 86 40750 or email metaltech@tegral.com.

DESIGNER'S FLOOR DECKING GUIDE Deep Decking

ComFlor 210

Quick reference table

ComFlor 210 Span table - Normal Weight Concrete

Props	Span	Fire Rating	Overall Slab Depth (mm)	Mesh	MAXIMUM SPAN (m) Total Applied Load (kN/m^2) 3.5kN/m^2 Bar Size (mm) 12	16	20	25	5kN/m^2 12	16	20	25	10kN/m^2 12	16	20	25
No Temporary props	Simple span slab		280		4.8	5.4	5.4	5.4	4.3	5.4	5.4	5.4	3.4	4.5	5.4	5.4
		1 hr	300		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		4.7	4.7	4.7	4.7	4.5	4.7	4.7	4.7	3.7	4.7	4.7	4.7
			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
		1.5 hr	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
			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
		2 hr	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
1 Line of Temporary props	Simple span slab		280	A393	4.9	6.4	7.3	7.3	4.4	5.8	7.2	7.3	3.4	4.5	5.6	6.2
		1 hr	300	A393	4.9	6.5	6.7	6.7	4.5	5.9	6.7	6.7	3.5	4.7	5.8	6.6
			350	2xA393	5.1	5.6	5.6	5.6	4.6	5.6	5.6	5.6	3.7	4.9	5.6	5.6
			290	A393	3.7	5.0	6.2	7.0	3.4	4.5	5.5	6.9	2.7	3.5	4.4	5.4
		1.5 hr	300	A393	3.8	5.0	6.2	6.7	3.4	4.5	5.6	6.7	2.7	3.6	4.4	5.5
			350	2xA393	3.8	5.1	5.6	5.6	3.5	4.7	5.6	5.6	2.9	3.8	4.7	5.6
			305	A393	2.0	2.7	3.3	4.1	1.8	2.4	3.0	3.7	1.5	1.9	2.4	3.0
		2 hr	350	2xA393	2.1	2.7	3.4	4.2	1.9	2.5	3.1	3.9	1.5	2.0	2.5	3.1
			400	2xA393	2.1	2.8	3.4	4.3	1.9	2.6	3.2	3.9	1.6	2.1	2.6	3.3
	Continuous span slab		280	A393	5.7	7.1	7.3	7.3	5.1	6.3	7.3	7.3	4.0	4.9	5.9	6.7
		1 hr	300	A393	5.8	6.7	6.7	6.7	5.3	6.5	6.7	6.7	4.2	5.1	6.2	6.7
			350	2xA393	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	4.6	5.6	5.6	5.6
			290	A393	4.3	5.4	6.5	7.0	3.9	4.8	5.8	7.0	3.0	3.8	4.6	5.6
		1.5 hr	300	A393	4.4	5.4	6.6	6.7	3.9	4.9	5.9	6.7	3.1	3.9	4.7	5.7
			350	2x A393	4.7	5.6	5.6	5.6	4.3	5.3	5.6	5.6	3.5	4.2	5.1	5.6
			305	A393	2.6	3.1	3.7	4.4	2.3	2.8	3.3	4.0	1.9	2.2	2.6	3.2
		2 hr	350	2xA393	2.8	3.4	3.9	4.6	2.6	3.1	3.6	4.3	2.1	2.5	2.9	3.4
			400	2xA393	3.1	3.6	4.2	4.8	2.9	3.4	3.9	4.5	2.4	2.8	3.2	3.7
2 Lines of Temporary props	Simple span slab		280	A393	4.9	6.4	7.6	7.8	4.4	5.8	7.2	7.4	3.4	4.5	5.6	6.2
		1 hr	300	A393	4.9	6.5	7.7	8.0	4.5	5.9	7.3	7.7	3.5	4.7	5.8	6.6
			350	2xA393	5.0	6.6	8.0	8.3	4.6	6.1	7.6	8.2	3.7	4.9	6.1	7.4
			290	A393	3.7	5.0	6.2	7.6	3.4	4.5	5.6	6.9	2.7	3.5	4.4	5.4
		1.5 hr	300	A393	3.8	5.0	6.2	7.7	3.4	4.5	5.6	6.9	2.7	3.6	4.4	5.5
			350	2x A393	3.8	5.1	6.3	7.8	3.5	4.7	5.8	7.2	2.9	3.8	4.7	5.8
			305	A393	2.0	2.7	3.3	4.1	1.8	2.4	3.0	3.7	1.5	1.9	2.4	3.0
		2 hr	350	2xA393	2.1	2.7	3.4	4.2	1.9	2.5	3.1	3.9	1.5	2.0	2.5	3.1
			400	2xA393	2.1	2.8	3.4	4.3	1.9	2.6	3.2	3.9	1.6	2.1	2.6	3.3
			280	A393	5.7	7.1	8.0	8.3	5.1	5.3	7.8	7.9	4.0	4.9	5.9	6.7
		1 hr	300	A393	5.8	7.2	8.3	8.5	5.3	6.5	7.8	8.1	4.2	5.2	6.2	7.1
			350	2xA393	6.2	7.6	8.7	8.7	5.7	7.0	8.6	8.7	4.6	5.6	6.7	7.5
	Continuous span slab		290	A393	4.3	5.4	6.5	7.9	3.9	4.8	5.9	7.1	3.0	3.8	4.6	5.6
		1.5 hr	300	A393	4.4	5.4	6.6	8.0	3.9	4.9	5.9	7.4	3.1	3.9	4.7	5.2
			350	2x A393	4.7	5.7	6.9	8.3	4.3	5.3	6.3	7.6	3.5	4.3	5.1	5.8
			305	A393	2.6	3.1	3.7	4.4	2.3	2.8	3.3	4.0	1.9	2.2	2.6	3.2
		2 hr	350	2xA393	2.8	3.4	3.9	4.6	2.6	3.1	3.6	4.3	2.1	2.5	2.9	3.4
			400	2xA393	3.1	3.6	4.2	4.9	2.9	3.4	3.9	4.5	2.4	2.8	3.2	3.7

ComFlor 210

Parameters assumed for quick reference span tables

Mesh: See notes on page 38.

Spans: Measured centre to centre of supports.

Deck: Standard deck material specification (see page 38).

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 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. Lightweight concrete may be used, please consult Tegral.

Construction load: 1.5 kN/m^2 construction load is taken into account,in accordance with BS 5950:Part 4. No allowance is made for heaping of concrete during the pouring operation. See design notes.

Slab Depth: The depth of slab is measured from the top of the concrete to the base of the profile.

Bar reinforcement: End Anchorage for bar reinforcement. All cases require properly anchored L-bars at the supports, except for those boxed in red. Cases boxed in red may have straight bars, with an anchorage length of 70mm from the edge of the support. See Design Notes on page 47 for further information. One bar is placed in each profile trough, the cover to deck soffit is assumed at 70mm.

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.

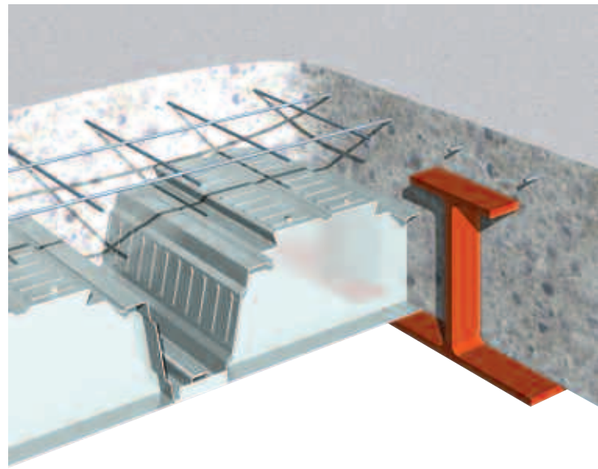
Span/depth ratio: This is limited to 35 for normal weight concrete.

Project: Georges Quay, Dublin
Architects: Keane, Murphy, Duff
Engineers: Project Management Group Mechanical & Consulting Engineers, Project Managers Cleary McCabe
Product: Tegral Floor Decking

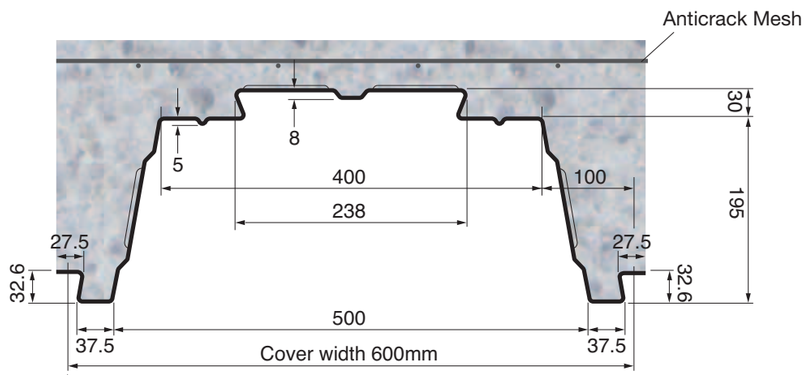
Slimdek® 225 (SD225)

Slimdek® 225 (SD225) is an important addition to Tegral's flooring range. Developed specifically for the Corus Slimdek® system, SD225 offers up to 6.5 metres unpropped span.

Corus Slimdek® engineered flooring solution is a unique structural floor system which uses Asymmetric SlimFlor Beams, where the bottom flange is wider than the top flange. The SD225 steel deck bears on the lower flange of the beam which results in a minimal overall floor depth, the concrete that surrounds the beam provides composite action without the need for shear studs, and fire protection to the beam.



- SD225 deck is a state of the art cold-formed profile design offering fully optimised composite and load carrying characteristics.
- The re-entrant section to the top flange of the profile enhances composite action and offers easy services attachment.
- The deck is designed to offer flexible service integration (as described in Steel Construction Institute publication "Service Integration in Slimdek®").
- Up to 2 hours fire rating with unprotected soffit.
- The Slimdek® system is fast, normally eliminates temporary props, is structurally optimised and saves on cladding costs.
- The system also reduces building height or enables extra floors to be built.



SD225

ComFlor 225 Composite Slab - Volume & Weight

Overall Slab Depth (mm)	Concrete volume (m^3/m^2)	Weight of Concrete (kN/m^2) Wet	Dry
285	0.116	2.74	2.68
290	0.121	2.85	2.79
295	0.126	2.97	2.91
300	0.131	3.09	3.02
305	0.136	3.21	3.14
310	0.141	3.32	3.26
320	0.151	3.56	3.49
350	0.181	4.27	4.18
380	0.211	4.97	4.87
400	0.231	5.44	5.33

Volume & weight table notes

1. Deck and beam deflection (i.e. ponding is not allowed for in the table.
2. Deck and mesh weight 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

   Note: For lightweight concrete contact Tegral Technical Services Department.

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
1.25	1.21	0.18	2186	107.00	968.00	30.80	30.80

Design Notes

Deck material

Zinc coated steel to BS EN 10147:2000, Fe E 350G, Z275, with a guaranteed minimum yield stress of 350 N/mm^2. Minimum zinc coating mass is 275 g/m^2 total including both sides.

Quick reference tables

The quick reference load/span and fire design tables, are intended as a guide for initial design, based on the parameters stated below the tables.

The Comdek calculation design suite CD provides a full design programme. Please contact Tegral.

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. Corus Panels and Profiles in conjunction with The Steel Construction Institute has agreed to modify the requirement with regard to anti-crack mesh, to comply with the Eurocode 4 recommendations. Accordingly, the mesh shown in the quick reference tables complies with EC4 and the design programme defaults to these values.

Where EC4 mesh rules are used, the mesh may be reduced midspan - see Design Information on page 48. The reduced British Standards mesh values may still be used by overriding this default in the design programme.

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 & A393 mesh.

Technical services

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DESIGNER'S FLOOR DECKING GUIDE Deep Decking

SD225

Quick reference table

SD 225 Span table - Normal Weight Concrete

Props	Span	Fire Rating	Overall Slab Depth (mm)	Mesh	MAXIMUM SPAN (m) Total Applied Load (kN/m^2) 3.5kN/m^2 Bar Size (mm) 16	20	25	32	5kN/m^2 16	20	25	32	10kN/m^2 16	20	25	32
No Temporary props	Simple span slab		295	A142	5.9	5.9	5.9	5.9	5.7	5.9	5.9	5.9	4.6	5.7	5.9	5.9
		1 hr	320	A193	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	4.7	5.6	5.6	5.6
			350	A252	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	4.9	5.3	5.3	5.3
			305	A193	5.8	5.8	5.8	5.8	5.4	5.8	5.8	5.8	4.4	5.4	5.8	5.8
		1.5 hr	320	A193	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	4.5	5.5	5.6	5.6
			350	A252	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	4.6	5.3	5.3	5.3
			320	A193	4.5	5.5	5.6	5.6	4.2	5.1	5.6	5.6	3.3	4.1	5.1	5.6
		2 hr	350	A393	4.6	5.3	5.3	5.3	4.2	5.2	5.3	5.3	3.4	4.3	5.3	5.3
			400	A393	4.6	4.9	4.9	4.9	4.3	4.9	4.9	4.9	3.6	4.4	4.9	4.9
1 Line of Temporary props	Simple span slab		295	A393	6.5	7.3	7.3	7.3	5.9	7.3	7.3	7.3	4.6	5.7	6.6	7.0
		1 hr	320	A393	6.6	6.6	6.6	6.6	6.0	6.6	6.6	6.6	4.8	5.9	6.6	6.6
			350	2xA252	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	4.9	5.9	5.9	5.9
			305	A393	6.1	7.0	7.0	7.0	5.5	6.9	6.9	6.9	4.4	5.5	6.8	6.9
		1.5 hr	320	A393	6.2	6.6	6.6	6.6	5.6	6.6	6.6	6.6	4.5	5.6	6.6	6.6
			350	2xA252	5.9	5.9	5.9	5.9	5.7	5.9	5.9	5.9	4.6	5.7	5.9	5.9
			320	A393	4.6	5.7	6.6	6.6	4.2	5.2	6.5	6.6	3.4	4.2	5.2	6.5
		2 hr	350	2xA252	4.6	5.8	5.9	5.9	4.3	5.3	5.9	5.9	3.5	4.3	5.3	5.9
			400	2xA393	4.7	5.0	5.0	5.0	4.4	5.0	5.0	5.0	3.6	4.5	5.0	5.0
	Continuous Slab		295	A393	7.3	7.3	7.3	7.3	6.6	7.3	7.3	7.3	5.2	6.2	7.0	7.3
		1 hr	320	A393	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	5.4	6.5	6.6	6.6
			350	2xA252	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.7	5.9	5.9	5.9
			305	A393	6.7	7.0	7.0	7.0	6.0	7.0	7.0	7.0	4.8	5.8	7.0	7.0
		1.5 hr	320	A393	6.6	6.6	6.6	6.6	6.2	6.6	6.6	6.6	4.9	5.9	6.6	6.6
			350	2xA252	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.2	5.9	5.9	5.9
			320	A393	5.2	6.2	6.6	6.6	4.7	5.6	6.6	6.6	3.7	4.5	5.4	6.6
		2 hr	350	2xA252	5.3	5.9	5.9	5.9	4.9	5.8	5.9	5.9	3.9	4.7	5.6	5.9
			400	2xA393	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.3	5.0	5.0	5.0
2 Lines of Temporary props	Simple span slab		295	A393	6.5	7.7	8.0	8.4	5.9	7.3	7.7	8.0	4.6	5.7	6.6	7.0
		1 hr	320	A393	6.6	7.9	8.1	8.5	6.0	7.4	8.0	8.3	4.8	5.9	7.0	7.4
			350	2xA252	6.7	8.0	8.3	8.7	6.1	7.6	8.2	8.6	4.9	6.1	7.5	7.8
			305	A393	6.1	7.6	8.1	8.4	5.6	6.9	7.8	8.1	4.4	5.5	6.8	7.1
		1.5 hr	320	A393	6.2	7.7	8.1	8.5	5.6	7.0	8.0	8.3	4.5	5.6	6.9	7.4
			350	2xA252	6.2	7.7	8.3	8.7	5.7	7.1	8.2	8.6	4.6	5.7	7.1	7.8
			320	A393	4.6	5.7	7.1	8.5	4.2	5.2	6.5	8.2	3.4	4.2	5.2	6.5
		2 hr	350	2xA252	4.6	5.8	7.2	8.7	4.3	5.3	6.6	8.4	3.5	4.3	5.3	6.8
			400	2xA393	4.7	5.9	7.3	7.9	4.4	5.4	6.8	7.9	3.6	4.5	5.6	7.1
	Continuous Slab		295	A393	7.3	8.3	8.5	8.9	6.6	7.8	8.1	8.5	5.2	6.2	7.0	7.3
		1 hr	320	A393	7.5	8.5	8.8	9.2	6.8	8.1	8.4	8.8	5.4	6.5	7.4	7.7
			350	2xA252	7.7	8.8	9.1	9.2	7.1	8.4	8.8	9.2	5.7	6.8	7.9	8.0
			305	A393	6.7	8.0	8.6	9.0	6.0	7.3	8.2	8.6	4.8	5.8	7.0	7.5
		1.5 hr	320	A393	6.8	8.2	8.8	9.2	6.2	7.41	8.4	8.8	4.9	5.9	7.2	7.7
			350	2xA252	7.0	8.4	9.1	9.2	6.4	7.7	8.8	9.2	5.2	6.2	7.5	8.0
			320	A393	5.2	6.2	7.5	9.2	4.7	5.6	6.8	8.4	3.7	4.5	5.4	6.7
		2 hr	350	2xA252	5.3	6.3	7.6	9.2	4.9	5.8	7.0	8.7	3.9	4.7	5.6	7.0
			400	2xA393	5.6	6.6	7.8	7.9	5.2	6.1	7.3	7.9	4.3	5.0	6.0	7.4

SD225

Parameters assumed for quick reference span tables

Mesh: See notes on page 42.

Spans: Measured centre to centre of supports.

Deck: Standard deck material specification (see page 42).

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 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. Lightweight concrete may be used, please consult Tegral.

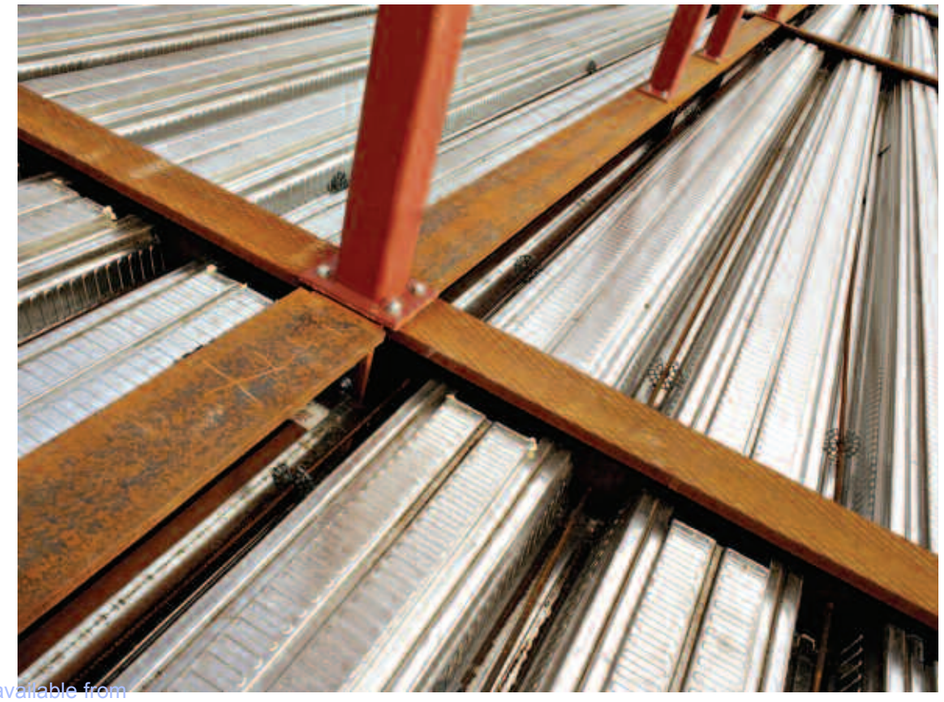
Construction load: 1.5 kN/m^2 construction load is taken into account,in accordance with BS 5950:Part 4. No allowance is made for heaping of concrete during the pouring operation. See design notes.

Slab Depth: The depth of slab is measured from the top of the concrete to the base of the profile.

Bar reinforcement: End Anchorage for bar reinforcement. All cases require properly anchored L-bars at the supports, except for those boxed in red. Cases boxed in red may have straight bars, with an anchorage length of 70mm from the edge of the support. See Design Notes on page 47 for further information. One bar is placed in each profile trough, the cover to deck soffit is assumed at 70mm.

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 35 for normal weight concrete.



Design Information

Deep Composite Floor Decks are used where longer span (4m plus) floor slabs are required. When combined with the Corus Slimdek® system, deep decks are designed to achieve a very shallow overall structural floor-hence the term Slim Floor Construction.

Deep Decking

Tegral Deep Composite Floor Decks can be used in one of these applications:

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

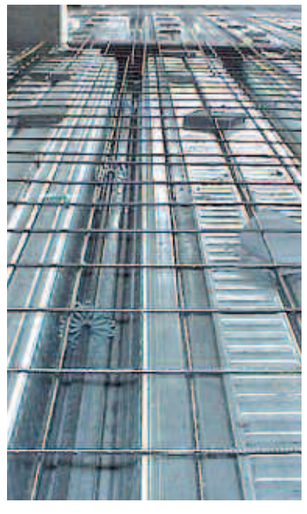
The design considerations relating to the decking are similar for all these applications.

Corus Slimdek® System

The most recent slim floor development produced by Corus is the Slimdek® system. This system comprises Asymmetric Slimflor® beams and deep SD225 decking.

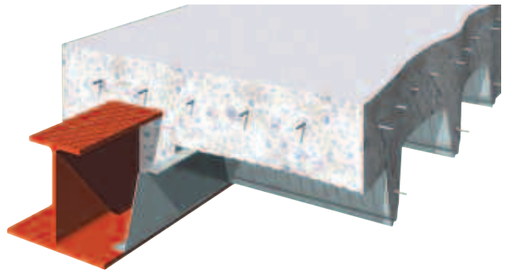
The principle of Slimdek® is that the steel deck (and thus the composite concrete slab) bears on the lower flange of the beam, thus containing the beam within the floor slab.

Three different types of Slimflor® beam are produced:



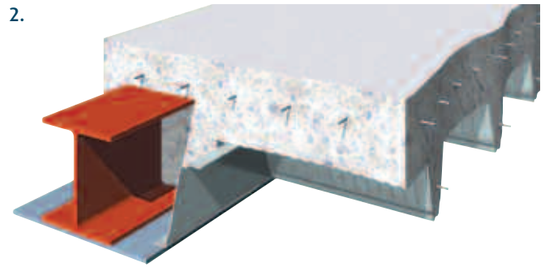
Three different types of Slimflor® beam are produced:

1.



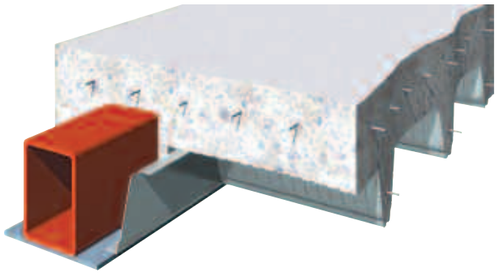
Asymmetric Slimflor® Beam (ASB), which is a hot rolled section with a narrower top flange than bottom flange.

2.



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

3.



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).

Design Information

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. The second is the final stage, during which 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.

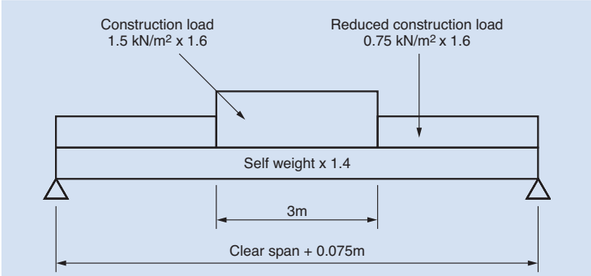
Slimdek® Beam Design

The design of the beams in the Slimdek® system is presented in The Corus Slimdek® Manual and Design Software which is available from Corus. 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 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/m^2 construction load required by BS 5950-4 should only be applied over the middle 3m of the span, as shown above.

A reduced load of 0.75 kN/m^2 (as specified in EC4) may be applied outside this region, as it would be overly conservative to apply the full load of 1.5kN/m^2 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/m^2 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 100 mm 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).

DESIGNER'S FLOOR DECKING GUIDE Deep Decking

Design Information

Slab Design

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

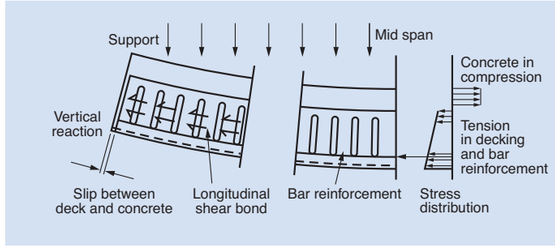
1. Placing bar reinforcement in the troughs of the decking increases the ultimate load resistance of the slab. The benefit of these bars is considered in both the 'normal' and fire conditions.

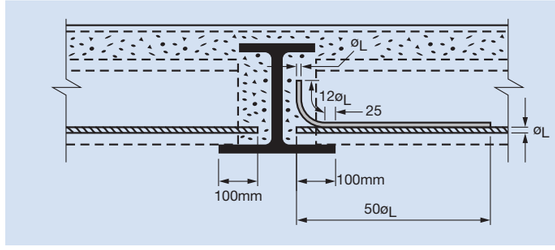
2. The slab depth may need to be chosen not only to satisfy the structural, durability and fire resistance requirements of the slab itself, but also to provide appropriate cover over ASB or Slimflor beams.

3. 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.

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

5. 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

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

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 or SD 225 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 mins. 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.

Design Information

Reduced Mesh

Where EC4 mesh rules are used, as recommended by The Steel Construction Institute and Corus Panels and Profiles , 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.

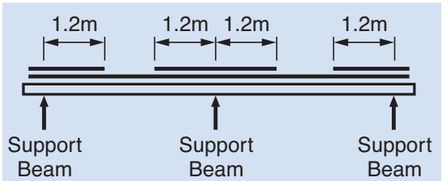


Diagram showing full mesh area over supports

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 SD225 or 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

Tests have shown that the SD 225 or 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: In all cases, partial continuity is ignored in assessing the capacity of the composite slab at the normal design stage.

Service Attachments

The SD225 decking facilitates the fixing of services and suspended ceilings. Hangars can be used to support services running either parallel or perpendicular to the decking span. Special fixing clips (available from Lindapter) can achieve a safe working load of 1kN per fixing. These allow service pipes to be suspended directly from the decking between the ribs. Alternatively, self-drilling self-tapping screws may be used to attach hangers to the decking after the concrete has been placed.

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

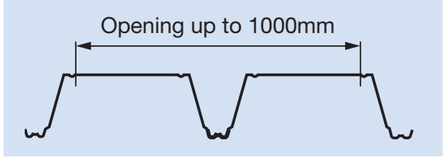
DESIGNER'S FLOOR DECKING GUIDE Deep Decking

Design Information

section of the deck, normally without needing additional reinforcement.

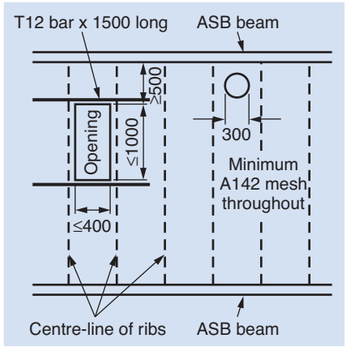
Openings up to 400mm wide x 1000mm long may be taken through the crest of the deep decking. Additional reinforcement, which should be designed in accordance with BS 8110, may be required around the opening.

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.



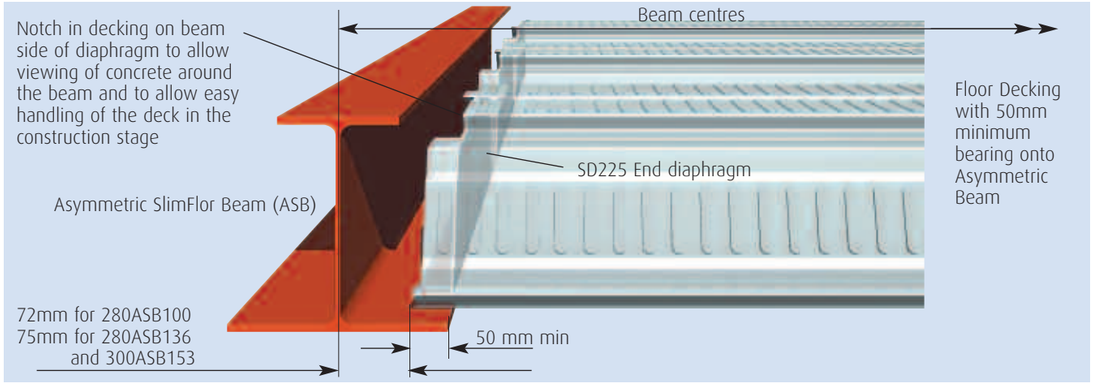
Design of small and medium size openings in the slab

Service Integration

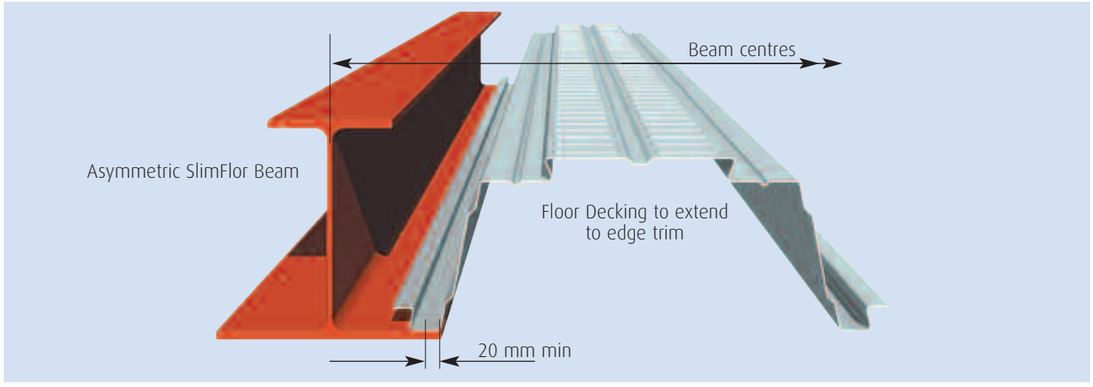
The Slimdek® system offers considerable opportunity for the integration of services. This is covered in detail in Corus Construction Centre publication Slimdek® - Structure and Services Integration.

Construction Details – CF210, SD225

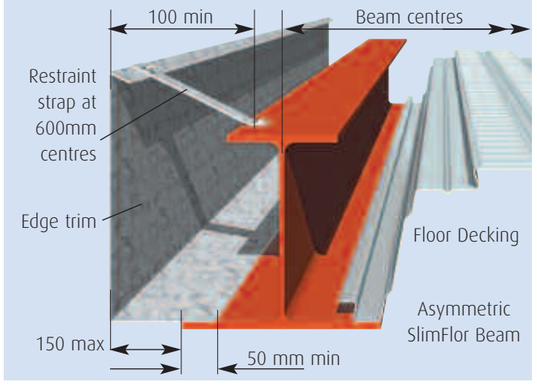
End fixing onto ASB (SD225 illustrated)



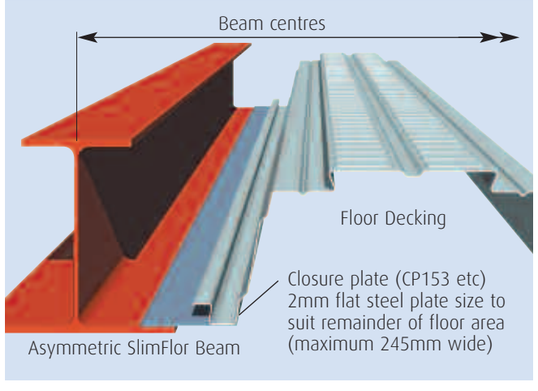
Side fixing onto ASB (SD225 illustrated)



Perimeter with trim (SD225 illustrated)



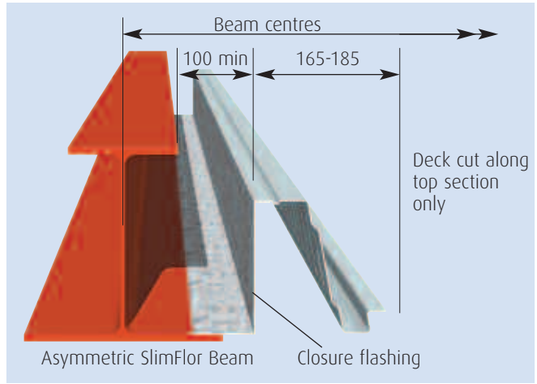
Cut plates (SD225 illustrated)



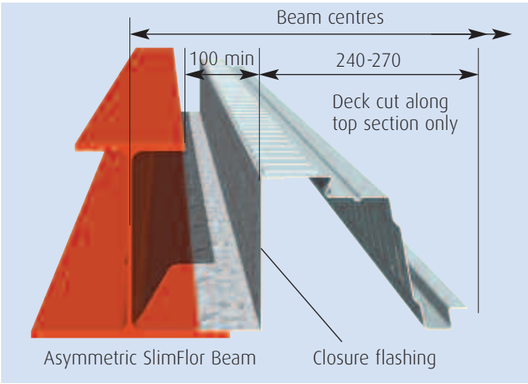
DESIGNER'S FLOOR DECKING GUIDE Deep Decking

Construction Details – CF210, SD225

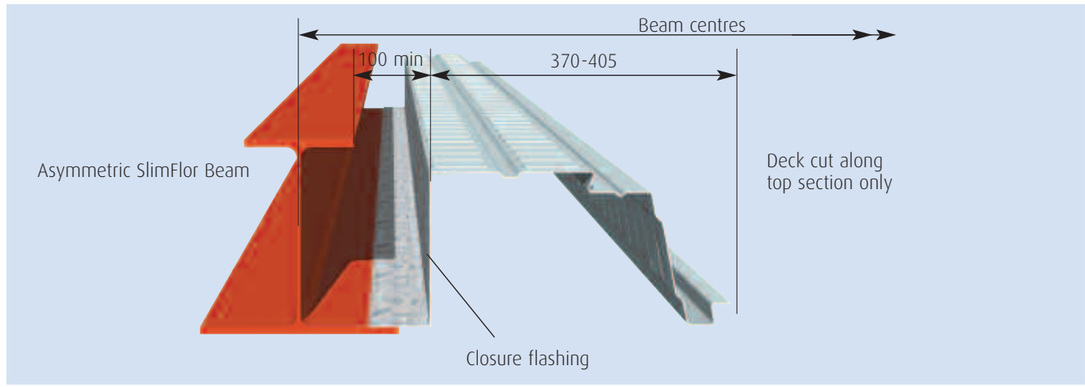
Cut deck - Option 1 (SD225 illustrated)



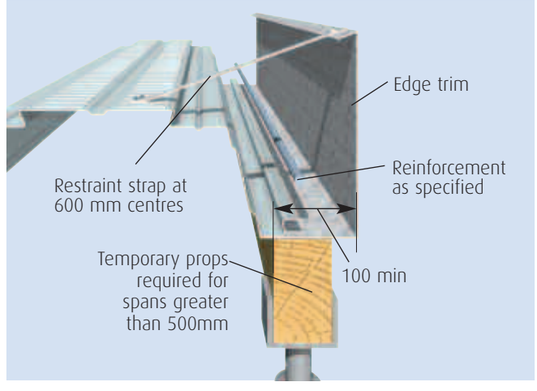
Cut deck - Option 2 (SD225 illustrated)



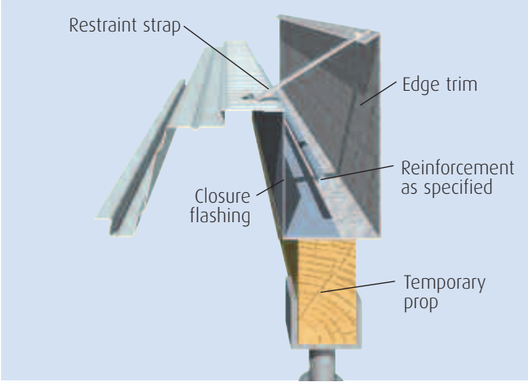
Cut deck - Option 3 (SD225 illustrated)



Unsupported edge (SD225 illustrated)

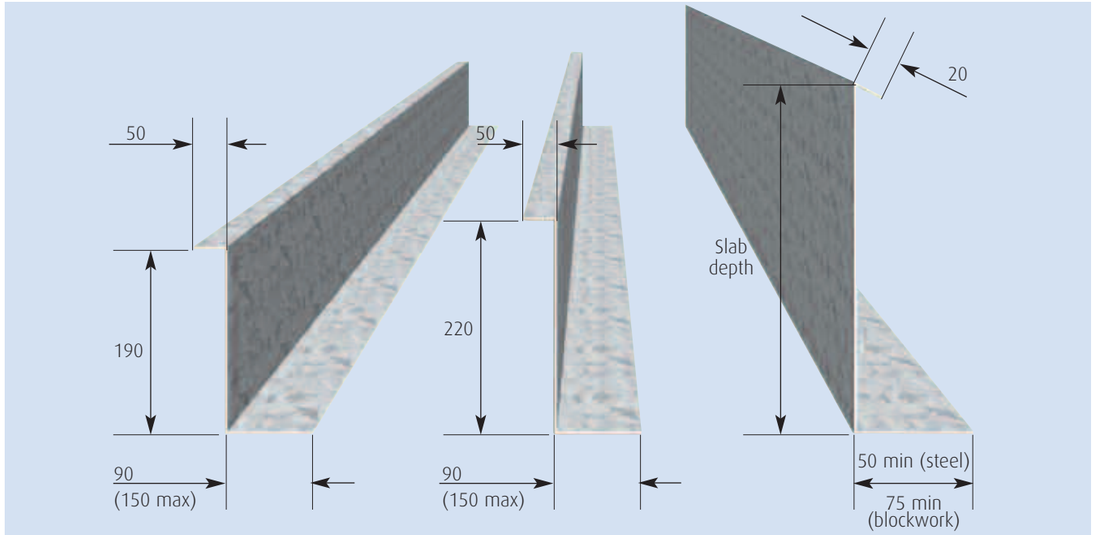


Unsupported edge with closure flashing

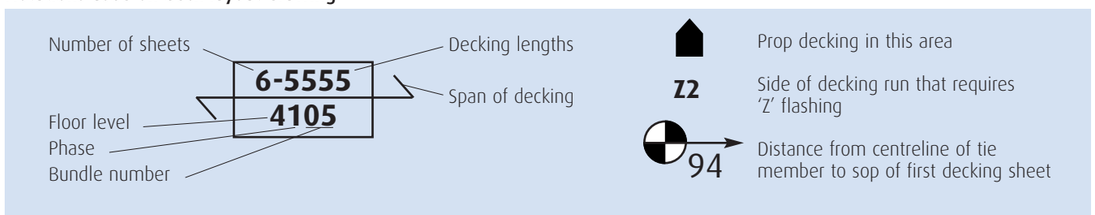


Construction Details – CF210, SD225

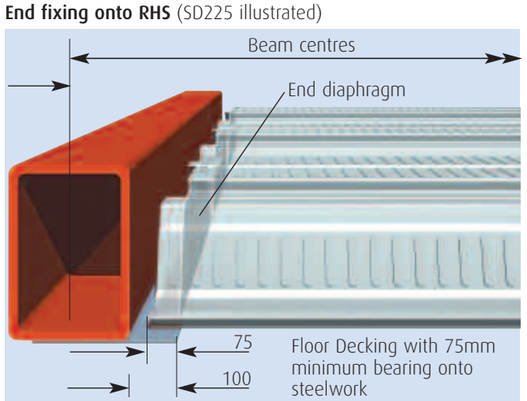
Steel trims



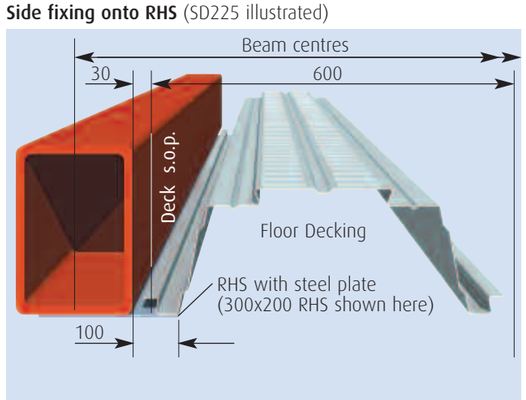
Notations used on deck layout drawing



End fixing onto RHS (SD225 illustrated)



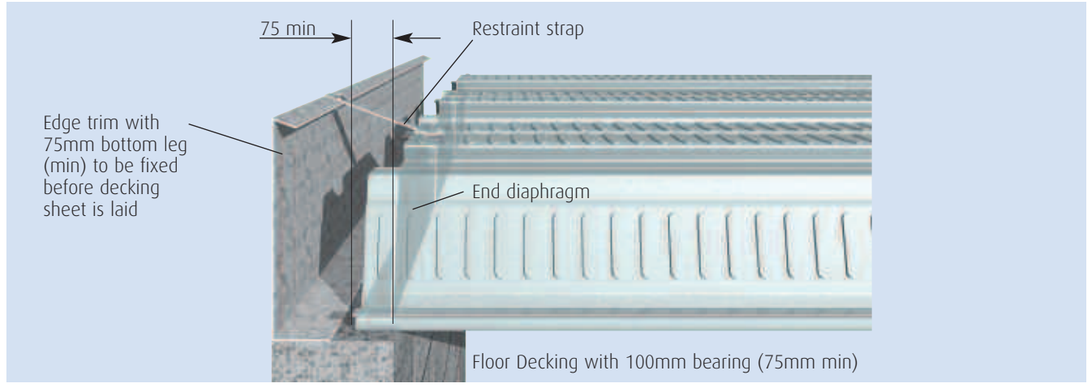
Side fixing onto RHS (SD225 illustrated)



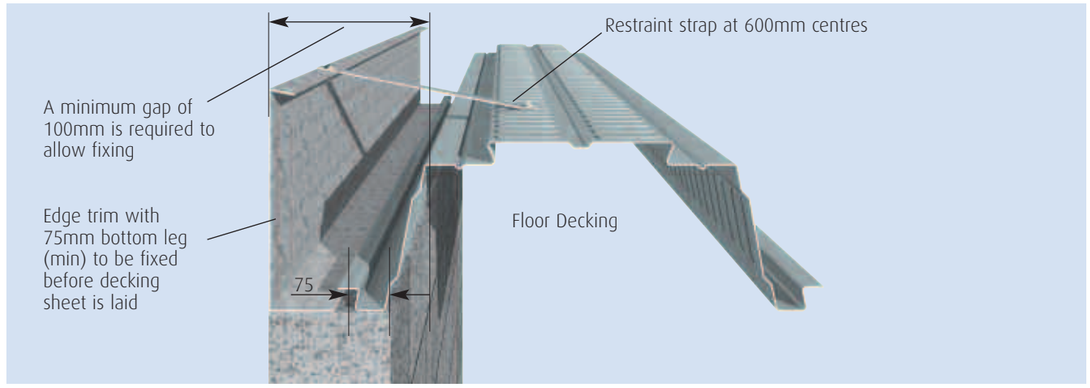
DESIGNER'S FLOOR DECKING GUIDE Deep Decking

Construction Details – CF210, SD225

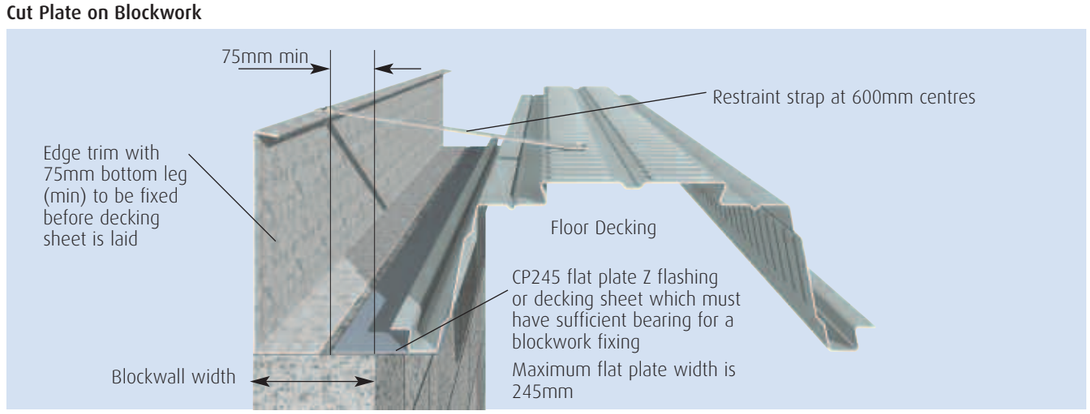
End fixing onto blockwork (SD225 illustrated)



Side fixing onto blockwork (SD225 illustrated)



Cut Plate on Blockwork



Site Work – CF210, SD225

End Diaphragms

Steel end diaphragms, as manufactured by Tegral, 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 1800 mm, to cover three Tegral 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.

End diaphragm for SD225

End diaphragm for ComFlor 210

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.

Deck Fixing

The decking sheets are then manually lowered individually onto the beams. In the Slimdek® system, the end bearing of the sheets should be 50 mm; 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. The required number of main fixings for SD225 is two per trough, one on both sides of the centre dovetail section. CF210 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. (SD225 is supplied pre-punched).

The crown of the deck sheet is fixed to the top of the diaphragms using two self drilling screws for SD225, or one self drilling screw for CF210.

When fixing to other types of supports such as reinforced concrete, or load bearing walls, 2 suitable fixings must be used in each SD225 trough (one per CF210 trough), as for the steel supports.

FIXING INFORMATION FOR DEEP DECKING

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

FIXING SPACINGS

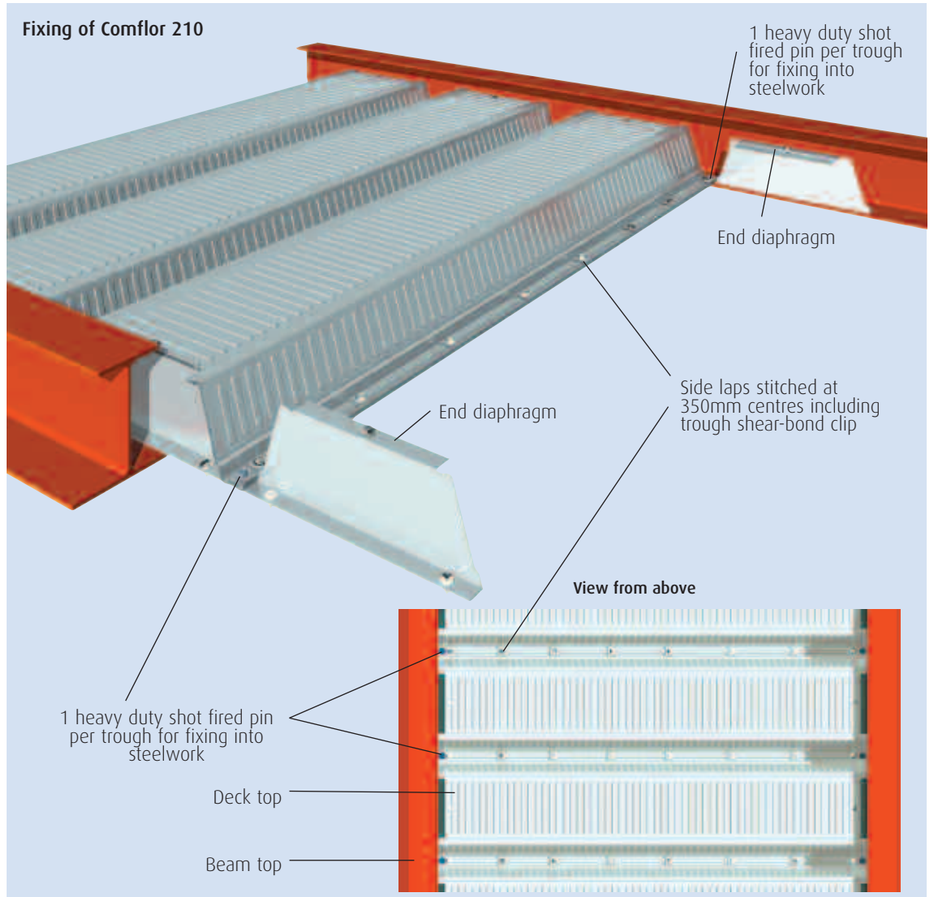
	SD225	ComFlor 210
End fixing	*2 per trough*	*1 per trough*
Side laps	*1 fixing through top flat of small dovetail at 1000mm c/c*	*1 fixing with shear clip at 350mm c/c*
Side fixing onto support	*1 fixing at 600mm c/c*	*1 fixing at 600mm c/c*
End diaphragm	*Min. 2 per length to steel 2 to crown of deck*	*Min. 2 per length to steel 1 to crown of deck*

Telephone numbers of fastener suppliers:

EJOT	00 44 113 247 0880
Hilti	00 44 161 886 1000
Lindapter	00 44 127 452 1444
SFS	00 44 113 208 5500
Spit	00 44 141 764 2700

DESIGNER'S FLOOR DECKING GUIDE Deep Decking

Site Work – CF210, SD225

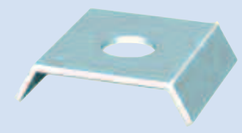


Side Laps

The SD225 dovetail shaped side lap detail offers a positive interlock and once engaged should be stitched using self drilling fasteners through the top flat of the dovetail at 1000mm centres.

With both profiles, where the first and last sheet lands on a support, the edge of the sheet must be fixed to the support at 600mm centres.

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.



ComFlor 210 shear clip

Site Work – CF210, SD225

Edge Details

The steelwork must be stable and adequately restrained with support for the deck around columns and openings. The Tegral 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

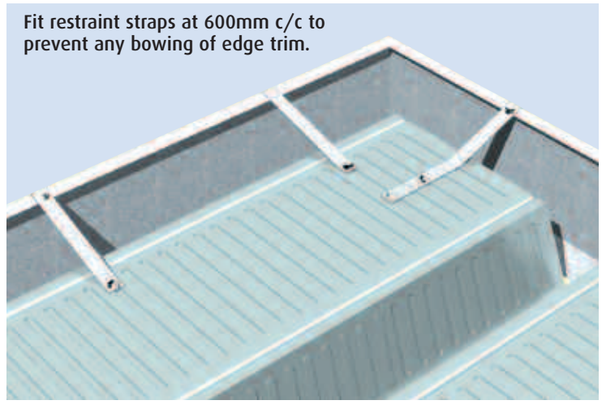
Tegral deep decking can be cantilevered in its length up to 500mm during construction. When cantilevers are required perpendicular to the span of the profile, stub beams or some similar type of support has to be supplied. In both cases, the cantilever must be assessed, for the final stage, in accordance 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 70 mm from the base of the trough. This distance can increase to 90 or 120 mm (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.

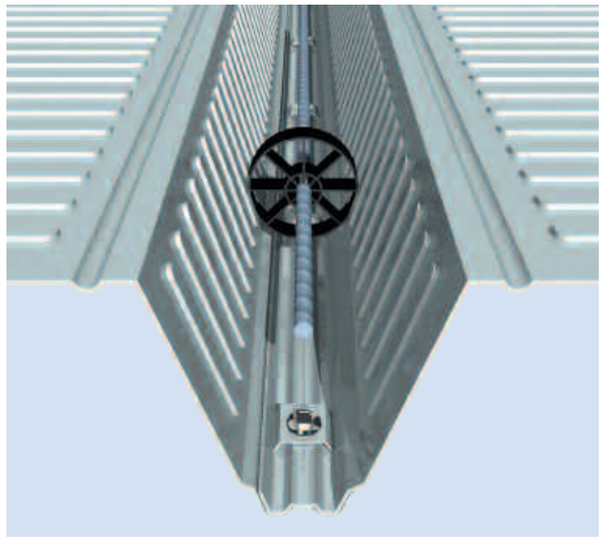
Fit restraint straps at 600mm c/c to prevent any bowing of edge trim.



(CF210 Illustrated)

Edge trim depth (mm)	Edge trims selector 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



DESIGNER'S FLOOR DECKING GUIDE Deep Decking

Site Work – CF210, SD225

Temporary Props

When the spans exceed the construction stage capacity of the decking, it is necessary to support the weight of the wet concrete and construction loads, by using temporary propping. The propping should offer a continuous bearing of at least 100mm width to the underside of the deck. Where temporary propping is used it is important that: the timbers and supports are of adequate strength. The props are placed at mid-span, or at third span, as required. The propping structure is not to be removed until the concrete has achieved 75% of its design 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.

Penetrations

Openings should be made through the wide crown of the profile. The openings should be boxed out prior to the pouring of the concrete, and the metal of the deck only cut once the concrete has achieved 75% of its design strength.

Pouring Concrete

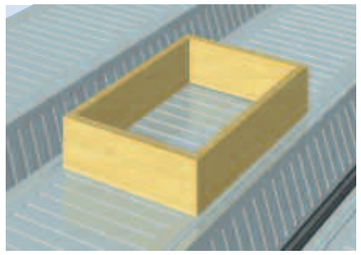
All grease, dirt and debris, which could have an adverse effect upon the performance of the cured slab, must be cleared before the application of the concrete can commence. The deck may have some lubricant from the roll forming process on its surface. This does not have to be removed. Care should be taken during the application of the concrete, to avoid heaping, and the close working of unnecessarily large number of operatives.

Sealing Joints

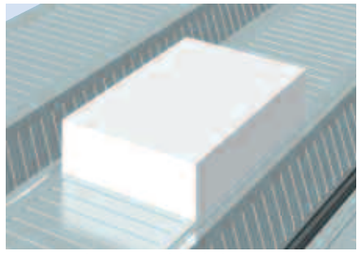
Normally, providing the decking installation has been carried out with reasonable accuracy, joints between decking and closures should be tightly fitting and do not require sealing to prevent great loss. Small gaps tend to close and seal when the weight of concrete is applied. In situations where large gaps occur or where great loss has to be eliminated for visual reasons, a foam sealant can be used. It is easier to carry out the operation prior to fixing of reinforcement.

Unsupported Edges

All unsupported edges must be propped, and may require additional reinforcement.



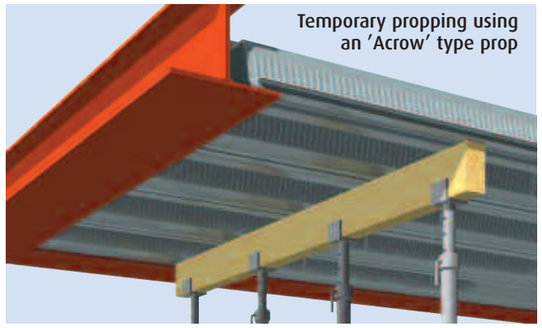
Timber shutter for opening



Dense polystyrene block for opening

TEMPORARY PROPS

Timber Bearer Guide (deep decks) All to be min. 100mm wide	
Slab Depth (mm)	*Bearer Depth (mm)*
280	*150*
320	*200*
360	*250*



Temporary propping using an 'Acrow' type prop

Permanent Formwork

Tegral Permanent Formwork

Tegral also supplies a range of permanent formwork decks. These decks are designed to support the weight of wet in-situ concrete and a construction load of 1.5kM/m^2. Sheets are available in standard gauges of 0.9mm and 1.2mm and in Tegral F46mm, F60mm and F100mm profiles.

Tegral Permanent Formwork systems provide a rapid, economic alternative to conventional timber shuttering. They are quickly installed and provide a safe working platform without the debris associated with the stripping of timber shuttering. In some instances, temporary propping in the form of continuous runners may be necessary. It is important that the consulting engineer be informed in advance of any installation so that advice in relation to propping can be forwarded to the installer.

The use of profiled formwork creates savings in the amount of concrete required and reduces the dead load on the structure and foundations.
Tegral Formwork has a short lead-time and is delivered in easy to handle bundles.

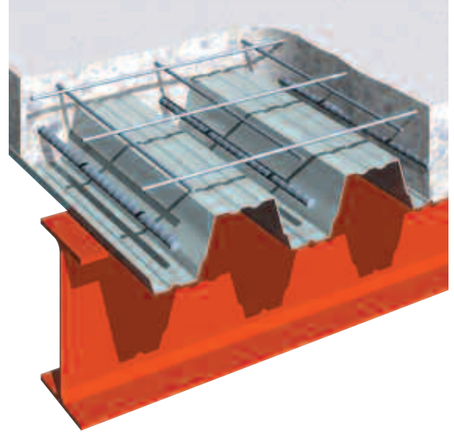
Note: *Tegral Permanent Formwork is designed for use as shuttering only and does not act as reinforcement in the concrete slab.*

Project: Central Park, Leopardstown, Dublin
Architects: Henry J Lyons & Partners
Engineers: TJ O'Connors & Associates
Product: Tegral Floor Decking

Formwork - (non-composite)

Permanent formwork remains in situ for the life of the building but, unlike composite flooring profiles, it does not act as reinforcement in the concrete slab. Tegral offers a total of ten profiles that are used as permanent formwork for reinforced concrete slabs. The Tegral permanent formwork profile range consist of three specific profiles - F46, F60 and F100 as well as the existing seven floor decking profiles - CF210, SD225, CF46, CF51, CF80, CF100.

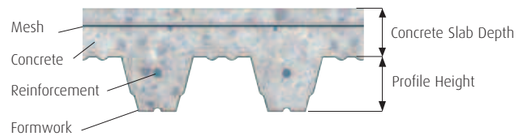
- The steel decking supports the wet concrete and construction loads.
- Temporary propping can be eliminated.
- The concrete slab requires full structural bar or mesh reinforcement.
- The wide range of Tegral formwork profiles ensure the optimum solution is available.



Maximum Spans of Permanent Single or Double span

Profile	Steel Thickness (mm)	Profile Weight (kN/m^2)	Concrete Slab Depth above profile 100mm	150mm	200mm	250mm
F46	*0.9*	*0.09*	*2.37*	*2.13*	*1.96*	*1.84*
	1.2	*0.13*	*2.55*	*2.30*	*2.12*	*1.99*
F60	*0.9*	*0.11*	*2.81*	*2.53*	*2.31*	*2.14*
	1.2	*0.14*	*3.06*	*2.80*	*2.58*	*2.43*
F100	**0.9**	**0.12**	**3.69**	**3.31**	**3.04**	**2.82**
	1.2	*0.16*	*4.16*	*3.85*	*3.52*	*3.27*

Cross Section

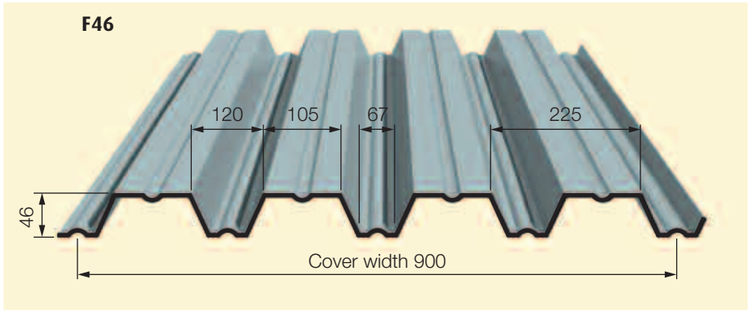


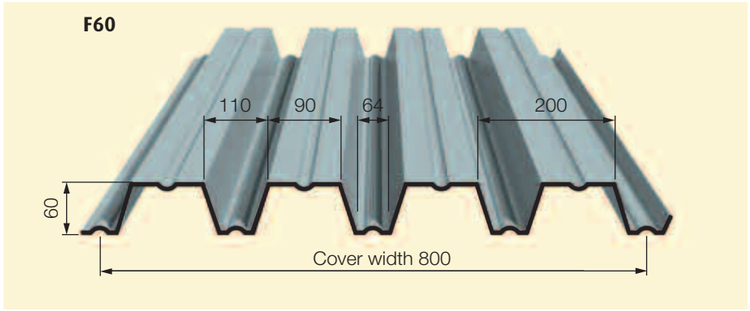
Concrete Usage Table

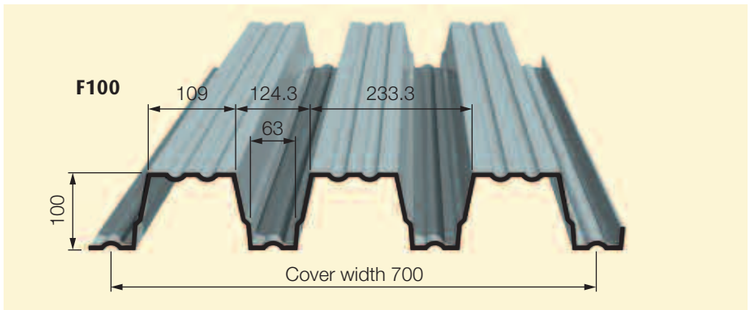
Profile	Weight of Concrete (kN/m^2) Slab Depth above profile (mm) 100mm	150mm	250mm	"ED" (mm)
F46	*2.90*	*4.11*	*5.33*	*19*
F60	*3.11*	*4.33*	*5.55*	*28*
F100	*3.40*	*4.62*	*5.84*	*40*
To determine concrete usage increase slab depth above profile by "ED" mm.				

For construction and sitework details please refer to Shallow Decking section page 30.

Formwork - (non-composite)







Deck material

Zinc coated steel to BS EN 10147:2000, Fe E 280G, Z275, with a guaranteed minimum yield stress of 280 N/mm^2. Minimum zinc coating mass is 275 g/m^2 total including both sides.

Additional profiles suitable for permanent formwork include CF210, SD225, CF46, CF51, CF70, CF80, CF100

Transport and Handling

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^o to it. Care should be taken to ensure that the bundles are not upside down, particularly with trapezoidal profiles. The embossments should be oriented so that they project upwards.

Placement of Decking

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

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

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

Individual sheets should be slid into place and, where possible, fixed to the steelwork before moving onto the next sheet.

This will minimise the risk of an accident occurring as a result of movement of a sheet when it is being used as a platform. However, for setting-out purposes, it may be necessary to lay out an entire bay using a minimum number of temporary fixings before fully securing the sheets later.

Transport and Handling

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.

DESIGNER'S FLOOR DECKING GUIDE Shallow/Deep/Formwork Decking

Health and Safety

Standards

The design guidance given in this manual, 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. BS 4449:1997 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 and sheeting.

10. ENV 1994-1-1: Design of Composite steel and concrete structures. General rules for building.

11. ENV 1994-1-2: Design of composite steel and concrete structures. Structural fire design.

12. SCI-P-076 : Design guide on the vibration of floors. SCI in association with CIRIA (1989).

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)

Health and Safety

General Safety Points and Protective Measures

- Wear adequate gloves, 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.
- Always fix deck securely before using as a working platform.
- Steel end diaphragms, as manufactured by Tegral, 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.

Follow the good practice outlined here and in SCI publications. Ensure compliance with regulatory health & safety requirements.

DESIGNER'S FLOOR DECKING GUIDE Shallow/Deep/Formwork Decking

Floor Decking Design Disc

The Tegral Comflor Composite Flooring Design Disc can be downloaded from our website at www.tegral.com www.tegral.com. Alternatively, please email Tegral at metaltech@tegral.com for a replacement.

Instruction for use

The disc is for use on Windows based PCs and does not Auto-start. Place CD in drive, click Start - Run - Browse. When in CD drive, double click ComDek folder - setup. The software must be installed, i.e. will not run directly from the CD; it requires less than 2MB of disc space once installed.

The programme COMDEK was developed by the Steel Construction Institute for Corus Panels and Profiles.

Use of the design programme

Choose BS5950 or Eurocodes.
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 programme has been produced by the Steel Construction Institute on behalf of Corus Panels and Profiles .

Help function on disc

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

To order the Floor Decking Design Disc, contact Tegral's Technical Services Department:
Tel: 00+353 59 86 40750
Email: metaltech@tegral.com