

# Metal Decking Specialists

**Technical Manual and Guidance Notes**

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The Shard - London

## Introduction

This Technical Manual has been developed to assist all parties involved in the successful design & construction of composite floor slabs using metal decking.

The manual contains design tables covering the construction, composite and fire conditions for our entire product range, from our re-entrant R51 profile to the trapezoidal TR80+ profile. Also included is the fibre concrete 'TAB-Deck™' solution, available exclusively to SMD decking products in association with our fibre partner, ArcelorMittal Sheffield Ltd.

An extensive guidance notes section has been produced with the customer in mind, to provide guidance on design details and the methods of best practice for construction.

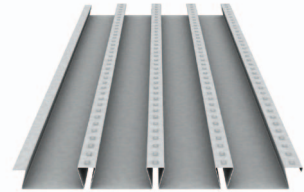
In addition to the guidance outlined in this document, we would refer you to the items of 'further reading' detailed on page 38 of this manual.

Structural Metal Decks have been in the metal decking industry for over 25 years and have been involved in the development of standard details and best practice methods for the design, supply and installation of composite metal decking and associated works.



# SMD Product Selector

## R51 Benefits



- 51mm deep re-entrant floor deck profile
- 101mm minimum slab depth, whilst still achieving 1 hour fire rating
- With minimal voids in the concrete section this allows dense slabs to be constructed providing excellent load carrying capacity and good sound insulation
- TAB-Deck™ fibre concrete solution available
- Wide flat trough provides flexibility for shear stud positioning
- Narrow re-entrant ribs provide virtually flat soffit
- Soffit 'Wedge Nut' fixings available with load capacity of up to 2kN
- Acoustic Robust Solution – Refer Robust Details Handbook ([www.robustdetails.com](http://www.robustdetails.com))

## TR60+ Benefits



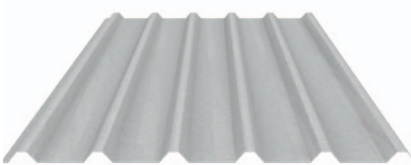
- 60mm deep trapezoidal floor deck profile
- Enhanced speed of installation due to the 1.0m cover width
- Trough stiffeners positioned to ensure central stud position, reducing amount of site checking required
- Soffit 'Wedge Nut' fixings available with load capacity of up to 1kN
- Reduced concrete volume
- The steel cross sectional area of this profile makes it the most economical option of the three available profiles
- Acoustic Robust Solution – Refer Robust Details Handbook ([www.robustdetails.com](http://www.robustdetails.com))
- TAB-Deck™ fibre concrete solution available

## TR80+ Benefits



- 80mm deep trapezoidal floor deck profile
- Reduced concrete volume when compared to other decks available on the market
- 140mm slab depth required to achieve a typical 1 hour fire rating
- Soffit 'Wedge Nut' fixings available with load capacity of up to 1kN
- Excellent un-propped span capability
- Trough stiffeners positioned to ensure central stud position, reducing amount of site checking required
- Acoustic Robust Solution – Refer Robust Details Handbook ([www.robustdetails.com](http://www.robustdetails.com))
- TAB-Deck™ fibre concrete solution available

## SR30 Benefits



- 30mm deep trapezoidal roof deck profile
- Optimised design for use in lightweight roof construction, this profile cannot be used as part of a composite slab
- Enhanced speed of installation due to the 1.0m cover width
- 200mm trough spacing offers an economical solution for our clients
- Suitable as either a structural roof deck or liner sheet
- Available in standard galvanised or coated finish

## SR60 Benefits



- 60mm deep trapezoidal roof deck profile
- Optimised design for use in lightweight roof construction, this profile cannot be used as part of a composite slab
- Enhanced speed of installation due to the 1.0m cover width
- 333mm trough spacing offers an economical solution for our clients
- Good spanning capabilities
- Available in standard galvanised or white coated finish



# Technical and Design Support

## How can SMD help you?...

### NBS Specification

All our composite deck and roofing profiles with associated specification clauses are now available in the NBS Building specification writing tool. The NBS Building platform provides the user with completed specification clauses for all product related areas of the specification.

For non-users of NBS Building, full specification clauses for our composite deck products R51, TR60+ and TR80+ are available in MS word or PDF format – visit our website at [www.smdltd.co.uk](http://www.smdltd.co.uk) or contact [technical@smdltd.co.uk](mailto:technical@smdltd.co.uk) for further details.



### ribaproductselector.com

Product literature, CAD files, case studies and images are also available through [www.ribaproductselector.com](http://www.ribaproductselector.com) simply log on and search 'structural metal decks'.



### CPD

SMD provide a comprehensive series of accredited CPD modules under the global title 'Composite decking: the benefits and associated design considerations'. This CPD provides an in-depth look at different aspects of the composite metal decking industry from design through to installation and, with a range of modules available, enables the delegates to tailor the presentation to suit specific learning objectives.

Modules NOW AVAILABLE include:

- Introduction to SMD and Composite Metal Decking
- Composite Deck Design – Construction, Composite and Fire
- Construction Methods
- Health and Safety including fall arrest
- Benefits and Product Selection
- Construction Details
- Off-Site Construction

Contact us now for a CPD booking form, by email to [technical@smdltd.co.uk](mailto:technical@smdltd.co.uk)



### Library of Standard Details

From our extensive experience working on composite metal decking projects, we have built up a comprehensive library of AutoCAD 2D and Tekla 3D details. These details cover a wide range of configurations from the standard details contained in this manual, to more complex details where building configurations require project specific details.

To assist in the design and specification process, a number of these details are available in both pdf or dwg format to download from our website at [www.smdltd.co.uk](http://www.smdltd.co.uk)

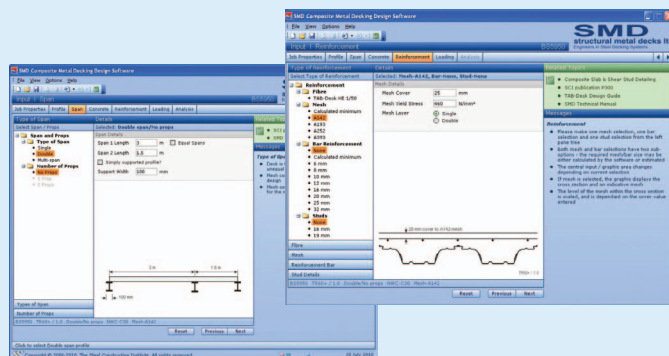


Once downloaded, these details can be inserted directly into project documents and/or drawings.

# Design Software

**SMD's experienced technical department is available to address your technical questions and prepare detailed calculations where required.**

Our in-house detailing department of qualified designers / detailers utilise the latest AutoCAD and Tekla Structures Building Information Modelling (BIM) software solutions to provide an efficient design service for our clients.



Working together with the SCI, SMD maintain the 'SMD Deck' design software to ensure designs are in line with latest code changes and technical developments. Whilst giving the ability to carry out complex composite slab calculations, the software also features intuitive user interfaces, demonstrable quality assurances and integration with current technical excellence via links to related SCI publications.

In addition to this, the software's 'automatic update' feature gives the user added confidence by ensuring the software is in line with the latest version.

SMD also has an extensive on-going programme of research and development to guarantee our products remain market leaders in our field.

For ease of composite steel beam design and specification, all our composite metal deck products are selectable in the industry-leading steel frame design packages.



Contact us now to receive your copy on **+44 (0) 1202 718898** or download from **[www.smdltd.co.uk](http://www.smdltd.co.uk)**

# Design Table Notes

The load/span tables for each product provide a quick reference guide for architects, engineers and specifiers. For ease of use, these tables only cover the more common criteria. More detailed designs should be checked using the SMD Deck design software.

The notes below detail the design parameters used in the preparation of the load/span for our composite metal deck products:

## Spans

Spans shown in the tables are to centres of supports, based on 100mm minimum support widths (maximum clear span = value from table - 100mm). Propped spans assume a 100mm prop width, with props located at mid-span. Spans can be considered as double span providing adjacent spans differ by no more than 15%.

## Deflection

In accordance with BS5950 Part 4 and UK NAD to Eurocode 4, construction stage deflection is limited to the lesser of Span/180 or 20mm when deflection is less than slab depth/10. This limit is increased to the lesser of Span/130 or 30mm, when concrete ponding is considered for deflections greater than slab depth/10. All load/span tables **do not** include for any additional concrete as a result of deflection of the steel frame.

## Construction Stage Loading

In addition to the wet weight of concrete and reinforcement for the specified slab depth, the load/span tables allow for a construction imposed load of 1.5kN/m<sup>2</sup> in accordance with BS5950 Part 4 or 0.75kN/m<sup>2</sup> generally plus 10% slab weight or 0.75kN/m<sup>2</sup> (whichever is greater) over a 3m x 3m 'working area' in accordance with Eurocode 1. Tabulated values for slab self-weight are for concrete only, they do not include the weight of deck or reinforcement.

## Composite / Fire Stage Loading

The applied loads indicated in the load/span tables are unfactored and should include consideration for partitions, ceiling, services and finishes etc. These should not include the slab self-weight, as this has been included (where necessary) in the preparation of these tables.

When determining design loadings, consideration should be given to any loadings that may be applied to the slab during construction (i.e. from plant or material storage), as these may be more onerous than the design loadings for the intended building use. In all cases, slabs are designed as simply-supported and in accordance with BS5950 Part 4 or Eurocode 4.

## Concrete

All design tables assume a typical C25/30 concrete grade, with 20mm aggregate size. The densities used in the preparation of these tables are as follows.

### In accordance with BS5950 Part 4:

- Normal Weight: 2400kg/m<sup>3</sup> (Wet) and 2350kg/m<sup>3</sup> (Dry).
- Lightweight: 1900kg/m<sup>3</sup> (Wet) and 1800kg/m<sup>3</sup> (Dry).

### In accordance with Eurocodes:

- Normal Weight: 2550kg/m<sup>3</sup> (Wet) and 2450kg/m<sup>3</sup> (Dry).
- Lightweight: 2050kg/m<sup>3</sup> (Wet) and 1950kg/m<sup>3</sup> (Dry).

Concrete volumes indicated on the sectional properties pages for each

profile are based on the slab poured to a constant thickness throughout. It is recommended that an additional concrete volume of span/250 m<sup>3</sup>/m<sup>2</sup> be added to these values to account for additional concrete as a result of deflection of the decking.

## Reinforcement

BS5950 Part 4 specifies mesh sizes as at least 0.1% of the gross concrete section. Eurocode 4 differs, as BS EN 1994-1-1 specifies 0.2% of the concrete above the ribs (or 0.4% for propped construction). All tables meet the more onerous requirements of BS EN 1994-1-1. Lower mesh sizes to suit BS5950 Part 4 may be used – Refer to SMD Deck design software.

The top cover to the mesh reinforcement should be a minimum of 15mm and a maximum of 45mm. Generally, minimum laps should be 300mm for A142 and 400 mm for A193, A252 and A393, for more specific guidance refer to SCI Publication P300 – Composite slabs and beams using steel decking: Best practice for design and construction. The mesh must satisfy the elongation requirements of BS4449.

## Fire

The fire resistances indicated in load/span tables use the Simplified 'Mesh Only' Method in accordance with BS5950 or Eurocode NCCI method, with the composite slab and mesh reinforcement (not necessarily the metal deck) continuous over one or more internal supports. Continuity is taken to include all end bay conditions.

A Fire imposed load factor of 1.0 is incorporated in these tables, this may be further reduced for certain applications (i.e. offices where load can be considered as non-permanent during fire – Refer BS5950 Part 8 or Eurocode 4).

For spans outside the scope of these tables download SMD Deck design software from [www.smdltd.co.uk](http://www.smdltd.co.uk), consult SCI Publication P-056 (2nd Edition) for BS5950 Part 8 or Eurocode NCCI document PN005-GB.

## Design Table Limits – Criteria

Typically, spans are governed by the maximum 'un-propped' condition at Construction Stage, except where values are for propped spans and/or are indicated as follows:

Spans shown in **red** indicate where spans are limited by the fire condition, greater spans may be achievable by either increasing mesh size or the addition of bottom reinforcement – Refer SMD Deck Design Software or contact SMD Technical Department.

Spans shown in **blue** indicate where spans are limited by the composite/normal stage condition, greater spans may be achievable where shear studs are provided, refer SMD Deck Design Software or contact SMD Technical Department.

## Situations not covered by load/span tables

For situations not covered by SMD load/span tables (i.e. isolated single span slabs or slabs subjected to concentrated point or line loads), refer to SMD Deck design software developed in conjunction with The Steel Construction Institute.

**More comprehensive tables are available on our website at [www.smdltd.co.uk](http://www.smdltd.co.uk)**

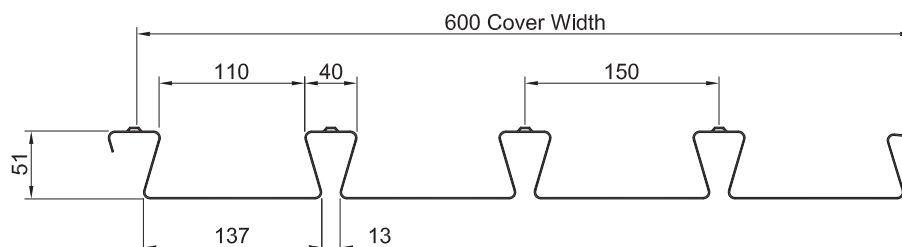


# R51

## Details and Sectional Properties

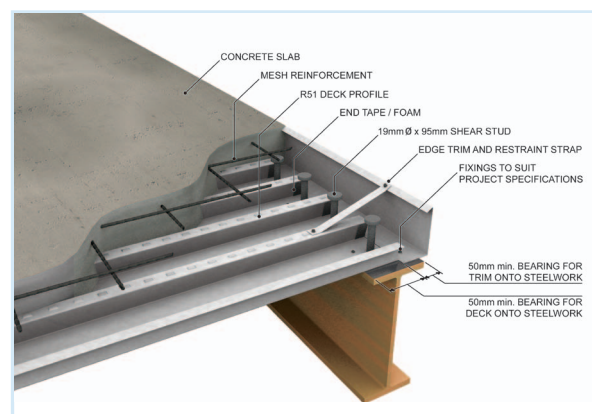
R51 is manufactured from S350 grade steel. This profile is a traditional re-entrant profile and is commonly used on inner city multi-storey projects where the structural zone and storey height is reduced, due to the relatively thin slab depth required to achieve a typical 1 hour fire rating.

## R51 Deck Profile



## R51 Benefits

- 51mm deep re-entrant profile
- 101mm minimum slab depth, whilst still achieving 1 hour fire rating
- Wide flat trough provides flexibility for shear stud positioning
- With minimal voids in the concrete section this allows dense slabs to be constructed providing excellent load carrying capacity and good sound insulation
- Soffit 'Wedge Nut' fixings available with load capacity of up to 2kN
- Narrow re-entrant ribs provide virtually flat soffit
- Acoustic Robust Solution – Refer Robust Details Handbook ([www.robustdetails.com](http://www.robustdetails.com))
- TAB-Deck™ fibre concrete solution now available



R51 Typical Section Detail

## Concrete Volume and Weight


Slab Depth mm	Volume of Concrete m <sup>3</sup> /m <sup>2</sup>	Weight of Concrete (Normal Weight)		Weight of Concrete (Lightweight)	
		Wet (kN/m <sup>2</sup> )	Dry (kN/m <sup>2</sup> )	Wet (kN/m <sup>2</sup> )	Dry (kN/m <sup>2</sup> )
120	0.111	2.61	2.56	2.07	1.96
130	0.121	2.85	2.79	2.26	2.14
140	0.131	3.08	3.02	2.44	2.31
150	0.141	3.32	3.25	2.63	2.49
175	0.166	3.91	3.83	3.09	2.93
200	0.191	4.50	4.40	3.56	3.37
225	0.216	5.09	4.98	4.03	3.81
250	0.241	5.67	5.56	4.49	4.26

Deflection – This table is based on concrete poured to a constant thickness and does not take account for deflection of the decking or supporting beams (as a guide, to account for the deflection of the decking, a concrete volume of span/250 should be added to the figures indicated). Concrete Weight – These tables indicate concrete weight only and do not include the weight of decking or reinforcement. Concrete weights are based on the concrete densities specified in BS5950 Part 4 clause 3.3.3 as follows: Normal Weight Concrete – 2400kg/m<sup>3</sup> (wet) and 2350 kg/m<sup>3</sup> (dry). Lightweight Concrete – 1900kg/m<sup>3</sup> (wet) and 1800 kg/m<sup>3</sup> (dry).




Sectional Properties								
Nominal Thickness mm	Design Thickness (bare steel) mm	Available Grade N/mm <sup>2</sup>	Depth of Profile mm	Weight of Profile kg/m <sup>2</sup> kN/m <sup>2</sup>		Height of Neutral axis mm	Area of Steel mm <sup>2</sup> /m	Moment of Inertia cm <sup>4</sup> /m
0.9	0.86	S350	51	12.90	0.127	16.9	1580	62.3
1.0	0.96	S350	51	14.35	0.141	16.9	1764	71.0
1.2	1.16	S350	51	17.23	0.169	16.8	2131	87.7



# R51 Load Span Tables (BS5950) Steel Grade S350 – Normal Weight Concrete

				Maximum Permissible Span (m)											
Span Type	Fire Rating (hours)	Slab Depth (mm)	Mesh	0.9mm Gauge				1.0mm Gauge				1.2mm Gauge			
				Total Unfactored Applied Load (kN/m <sup>2</sup> )											
				3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0
 Single Span	1.0	101	A142	2.76	2.76	2.76	2.76	3.00	3.00	3.00	2.93	3.27	3.27	3.27	3.13
		130	A193	2.59	2.59	2.59	2.59	2.76	2.76	2.76	2.76	3.04	3.04	3.04	3.04
		150	A252	2.46	2.46	2.46	2.46	2.65	2.65	2.65	2.65	2.90	2.90	2.90	2.90
	1.5	110	A142	2.68	2.68	2.68	2.45	2.92	2.92	2.92	2.51	3.19	3.19	3.07	2.65
		130	A193	2.59	2.59	2.59	2.59	2.76	2.76	2.76	2.76	3.04	3.04	3.04	3.04
		150	A252	2.46	2.46	2.46	2.46	2.65	2.65	2.65	2.65	2.90	2.90	2.90	2.90
	2.0	125	A193	2.60	2.60	2.60	2.32	2.80	2.80	2.70	2.35	3.08	3.08	2.74	2.41
		150	A252	2.46	2.46	2.46	2.46	2.65	2.65	2.65	2.65	2.90	2.90	2.90	2.90
		175	A252	2.32	2.32	2.32	2.32	2.52	2.52	2.52	2.52	2.75	2.75	2.75	2.75
 Double Span	1.0	101	A142	3.23	3.23	3.03	2.67	3.47	3.47	3.13	2.76	3.78	3.78	3.32	2.93
		130	A193	3.05	3.05	3.05	3.05	3.30	3.30	3.30	3.30	3.51	3.51	3.51	3.51
		150	A252	2.89	2.89	2.89	2.89	3.14	3.14	3.14	3.14	3.44	3.44	3.44	3.44
	1.5	110	A142	3.22	3.13	2.67	2.38	3.39	3.22	2.75	2.44	3.69	3.38	2.89	2.57
		130	A193	3.05	3.05	3.05	2.74	3.30	3.30	3.17	2.81	3.51	3.51	3.32	2.94
		150	A252	2.89	2.89	2.89	2.89	3.14	3.14	3.14	3.14	3.44	3.44	3.44	3.35
	2.0	125	A193	3.09	2.94	2.52	2.25	3.33	2.98	2.56	2.29	3.45	3.05	2.63	2.35
		150	A252	2.89	2.89	2.89	2.65	3.14	3.14	3.01	2.68	3.44	3.44	3.07	2.74
		175	A252	2.72	2.72	2.72	2.72	2.98	2.98	2.98	2.84	3.26	3.26	3.26	2.91
 Double Span (Propped)	1.0	101	A252	4.13	3.70	3.21	2.88	4.24	3.80	3.30	2.96	4.45	3.99	3.46	3.11
		130	A393	4.86	4.34	3.76	3.36	4.98	4.52	3.97	3.55	5.19	4.71	4.14	3.74
		150	2 x A252	5.10	4.59	4.00	3.59	5.38	4.84	4.22	3.79	5.66	5.18	4.58	4.15
	1.5	110	A252	3.76	3.38	2.94	2.64	3.84	3.45	3.01	2.70	4.00	3.59	3.13	2.81
		130	A393	4.39	3.97	3.49	3.15	4.47	4.05	3.55	3.21	4.62	4.18	3.67	3.32
		150	2 x A252	4.84	4.42	3.91	3.54	4.92	4.49	3.97	3.60	5.08	4.63	4.10	3.71
	2.0	125	A393	3.85	3.48	3.05	2.75	3.89	3.52	3.08	2.78	3.97	3.59	3.14	2.84
		150	2 x A252	4.35	3.96	3.50	3.17	4.39	4.00	3.53	3.20	4.46	4.07	3.60	3.26
		175	2 x A252	4.49	4.12	3.67	3.34	4.54	4.17	3.71	3.38	4.62	4.24	3.78	3.44


# R51 Load Span Tables (BS5950) Steel Grade S350 – Lightweight Concrete

				Maximum Permissible Span (m)											
Span Type	Fire Rating (hours)	Slab Depth (mm)	Mesh	0.9mm Gauge				1.0mm Gauge				1.2mm Gauge			
				Total Unfactored Applied Load (kN/m <sup>2</sup> )											
				3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0
 Single Span	1.0	101	A142	2.97	2.97	2.97	2.85	3.19	3.19	3.19	2.95	3.48	3.48	3.48	3.14
		130	A193	2.74	2.74	2.74	2.74	2.99	2.99	2.99	2.99	3.26	3.26	3.26	3.26
		150	A252	2.67	2.67	2.67	2.67	2.85	2.85	2.85	2.85	3.13	3.13	3.13	3.13
	1.5	105	A142	2.93	2.93	2.84	2.45	3.16	3.16	2.91	2.52	3.44	3.44	3.06	2.64
		130	A193	2.74	2.74	2.74	2.74	2.99	2.99	2.99	2.99	3.26	3.26	3.26	3.23
		150	A252	2.67	2.67	2.67	2.67	2.85	2.85	2.85	2.85	3.13	3.13	3.13	3.13
	2.0	115	A193	2.85	2.85	2.69	2.34	3.09	3.09	2.71	2.37	3.36	3.36	2.77	2.43
		150	A252	2.67	2.67	2.67	2.67	2.85	2.85	2.85	2.85	3.13	3.13	3.13	3.06
		175	A252	2.53	2.53	2.53	2.53	2.71	2.71	2.71	2.71	2.99	2.99	2.99	2.99
 Double Span	1.0	101	A142	3.43	3.43	3.09	2.71	3.69	3.69	3.19	2.81	4.02	4.02	3.39	2.98
		130	A193	3.26	3.26	3.26	3.26	3.51	3.51	3.51	3.37	3.76	3.76	3.76	3.56
		150	A252	3.12	3.12	3.12	3.12	3.37	3.37	3.37	3.37	3.68	3.68	3.68	3.68
	1.5	105	A142	3.41	3.20	2.70	2.39	3.65	3.28	2.77	2.46	3.98	3.45	2.92	2.58
		130	A193	3.26	3.26	3.21	2.83	3.51	3.51	3.29	2.90	3.76	3.76	3.43	3.03
		150	A252	3.12	3.12	3.12	3.12	3.37	3.37	3.37	3.33	3.68	3.68	3.68	3.46
	2.0	115	A193	3.38	3.04	2.58	2.29	3.56	3.07	2.61	2.32	3.60	3.14	2.68	2.38
		150	A252	3.12	3.12	3.12	2.78	3.37	3.37	3.18	2.81	3.68	3.68	3.24	2.87
		175	A252	2.97	2.97	2.97	2.95	3.21	3.21	3.21	2.98	3.52	3.52	3.44	3.05
 Double Span (Propped)	1.0	101	A252	4.19	3.84	3.30	2.95	4.25	3.91	3.39	3.03	4.35	4.01	3.51	3.17
		130	A393	5.06	4.52	3.87	3.44	5.11	4.72	4.09	3.63	5.19	4.89	4.29	3.85
		150	2 x A252	5.39	4.80	4.14	3.69	5.54	5.06	4.36	3.89	5.64	5.35	4.76	4.27
	1.5	105	A252	3.93	3.50	3.02	2.69	4.01	3.57	3.08	2.75	4.17	3.71	3.20	2.86
		130	A393	4.70	4.22	3.67	3.29	4.78	4.29	3.73	3.35	4.93	4.43	3.85	3.46
		150	2 x A252	5.21	4.72	4.13	3.69	5.30	4.79	4.19	3.78	5.46	4.93	4.32	3.89
	2.0	115	A393	4.12	3.68	3.18	2.85	4.16	3.71	3.21	2.88	4.23	3.78	3.27	2.93
		150	2 x A252	4.76	4.30	3.76	3.39	4.80	4.34	3.80	3.42	4.88	4.41	3.86	3.48
		175	2 x A252	4.91	4.47	3.94	3.56	4.96	4.51	3.97	3.59	5.05	4.59	4.05	3.66

Refer to page 07 for notes associated with these load/span tables. For more comprehensive tables covering a wider range of slab depths, loadings, fire ratings and mesh sizes visit our website at [www.smdltd.co.uk](http://www.smdltd.co.uk).


# R51 Fire Tables (BS5950) – TAB-Deck™ Fibres

## Normal Weight Concrete

Normal Weight Concrete				Maximum Permissible Span (m)											
Span Type	Fire Rating (hours)	Slab Depth (mm)	Steel Fibre	0.9mm Gauge				1.0mm Gauge				1.2mm Gauge			
				Total Unfactored Applied Load (kN/m <sup>2</sup> )											
				3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0
 Double Span	1.0	101	HE 1.0/50	3.23	3.23	3.23	3.18	3.47	3.47	3.47	3.34	3.78	3.78	3.78	3.46
		130	HE 1.0/50	3.05	3.05	3.05	3.05	3.30	3.30	3.30	3.30	3.51	3.51	3.51	3.51
		150	HE 1.0/50	2.89	2.89	2.89	2.89	3.14	3.14	3.14	3.14	3.44	3.44	3.44	3.44
	1.5	110	HE 1.0/50	3.22	3.21	2.82	2.54	3.39	3.34	2.93	2.64	3.69	3.58	3.14	2.83
		130	HE 1.0/50	3.05	3.05	3.05	2.79	3.30	3.30	3.19	2.89	3.51	3.51	3.42	3.10
		150	HE 1.0/50	2.89	2.89	2.89	2.89	3.14	3.14	3.14	3.14	3.44	3.44	3.44	3.35
	2.0	125	HE 1.0/50	3.09	2.95	2.60	2.35	3.33	3.07	2.70	2.44	3.45	3.27	2.88	2.61
		150	HE 1.0/50	2.89	2.89	2.89	2.71	3.14	3.14	3.09	2.81	3.44	3.44	3.28	2.98
		175	HE 1.0/50	2.72	2.72	2.72	2.72	2.98	2.98	2.98	2.98	3.26	3.26	3.26	3.19

## Lightweight Concrete

Lightweight Concrete

				Maximum Permissible Span (m)											
Span Type	Fire Rating (hours)	Slab Depth (mm)	Steel Fibre	0.9mm Gauge				1.0mm Gauge				1.2mm Gauge			
				Total Unfactored Applied Load (kN/m <sup>2</sup> )											
				3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0
 Double Span	1.0	101	HE 1.0/50	3.43	3.43	3.39	3.08	3.69	3.69	3.44	3.12	4.02	4.02	3.53	3.21
		130	HE 1.0/50	3.26	3.26	3.26	3.26	3.51	3.51	3.51	3.51	3.76	3.76	3.76	3.76
		150	HE 1.0/50	3.12	3.12	3.12	3.12	3.37	3.37	3.37	3.37	3.68	3.68	3.68	3.68
	1.5	105	HE 1.0/50	3.41	3.19	2.76	2.47	3.65	3.32	2.87	2.57	3.98	3.57	3.09	2.77
		130	HE 1.0/50	3.26	3.26	3.23	2.91	3.51	3.51	3.34	3.01	3.76	3.76	3.56	3.21
		150	HE 1.0/50	3.12	3.12	3.12	3.12	3.37	3.37	3.37	3.27	3.68	3.68	3.68	3.47
	2.0	115	HE 1.0/50	3.33	2.99	2.60	2.33	3.46	3.10	2.70	2.42	3.69	3.31	2.88	2.58
		150	HE 1.0/50	3.12	3.12	3.12	2.86	3.37	3.37	3.27	2.96	3.68	3.68	3.45	3.11
		175	HE 1.0/50	2.97	2.97	2.97	2.97	3.21	3.21	3.21	3.20	3.52	3.52	3.52	3.35

For further guidance on the design of TAB-Deck™ fibre reinforced slabs, download the TAB-Deck™ design manual at [www.smdltd.co.uk](http://www.smdltd.co.uk)

## R51 Fire Insulation Thickness



Minimum Insulation Thickness (x) of Concrete (mm)					
Fire Rating	1 hr	1.5 hr	2 hr	3 hr	4 hr
NWC	90	110	125	150	170
LWC	90	105	115	135	150

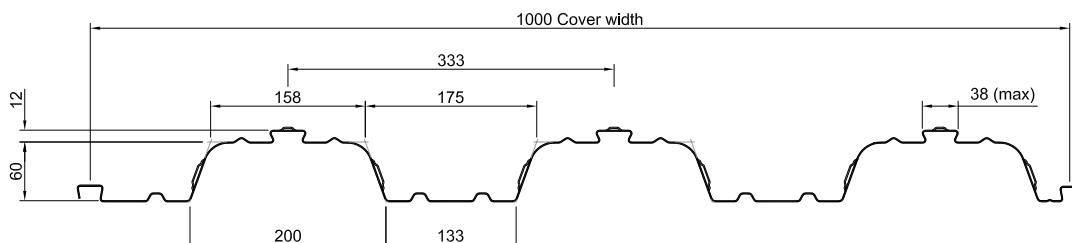
The image and table above details the minimum insulation thickness required to suit fire design criteria – in accordance with BS5950 Part 8.

# TR60+

## Details and Sectional Properties

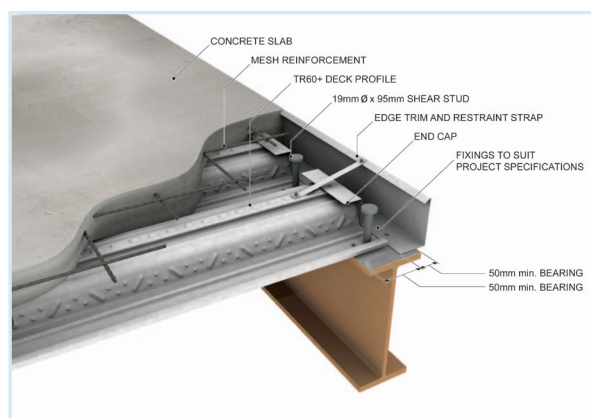
The TR60 profile was SMD's first trapezoidal profile, added to our product range in 1992. Further research and development in recent years has seen our trapezoidal products evolve into the TR+ range. The TR60+ profile enables un-propped spans in excess of 3.5m and is available in 0.9mm, 1.0mm and 1.2mm gauges in both S350 and S450 grade steel.

### TR60+ Deck Profile



### TR60+ Benefits

- 60mm deep trapezoidal profile
- Reduced concrete volume
- Enhanced speed of installation due to the 1.0m cover width
- Trough stiffeners positioned to ensure central stud position, reducing amount of site checking required
- The steel cross sectional area of this profile makes it the most economical option of the three available profiles
- Soffit 'Wedge Nut' fixings available with load capacity of up to 1kN
- Acoustic Robust Solution – Refer Robust Details Handbook ([www.robustdetails.com](http://www.robustdetails.com))
- TAB-Deck™ fibre concrete solution now available



TR60+ Typical Section Detail

### Concrete Volume and Weight

Slab Depth mm	Volume of Concrete m <sup>3</sup> /m <sup>2</sup>	Weight of Concrete (Normal Weight)		Weight of Concrete (Lightweight)	
		Wet (kN/m <sup>2</sup> )	Dry (kN/m <sup>2</sup> )	Wet (kN/m <sup>2</sup> )	Dry (kN/m <sup>2</sup> )
120	0.086	2.02	1.98	1.60	1.52
130	0.096	2.26	2.21	1.79	1.70
140	0.106	2.50	2.44	1.98	1.87
150	0.116	2.73	2.67	2.16	2.05
175	0.141	3.32	3.25	2.63	2.49
200	0.166	3.91	3.83	3.09	2.93
225	0.191	4.50	4.40	3.56	3.37
250	0.216	5.09	4.98	4.03	3.81

Deflection – This table is based on concrete poured to a constant thickness and does not take account of deflection of the decking or supporting beams (as a guide, to account for the deflection of the decking, a concrete volume of span/250 should be added to the figures indicated). Concrete Weight – These tables indicate concrete weight only and do not include the weight of decking or reinforcement. Concrete weights are based on the concrete densities specified in BS5950 Part 4 clause 3.3.3 as follows: Normal Weight Concrete – 2400kg/m<sup>3</sup> (wet) and 2350 kg/m<sup>3</sup> (dry). Lightweight Concrete – 1900kg/m<sup>3</sup> (wet) and 1800 kg/m<sup>3</sup> (dry).




Sectional Properties								
Nominal Thickness mm	Design Thickness (bare steel) mm	Available Grades N/mm <sup>2</sup>	Depth of Profile mm	Weight of Profile kg/m <sup>2</sup> kN/m <sup>2</sup>		Height of Neutral axis mm	Area of Steel mm <sup>2</sup> /m	Moment of Inertia cm <sup>4</sup> /m
0.9	0.86	S350 or S450	60 / 72*	10.03	0.098	33.6	1216	93.5
1.0	0.96	S350 or S450	60 / 72*	11.12	0.109	33.6	1355	102.1
1.2	1.16	S350 or S450	60 / 72*	13.33	0.131	33.7	1633	119.8

Refer to page 07 for notes associated with these load/span tables. For more comprehensive tables covering a wider range of slab depths, loadings, fire ratings and mesh sizes visit our website at [www.smdltd.co.uk](http://www.smdltd.co.uk).

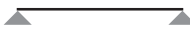


Note: Figures against depth of profile indicate the nominal depth, with overall depth (including height of re-entrant) marked \*.



TR60+ Load Span Tables (BS5950) Steel Grade S350 – Normal Weight Concrete


				Maximum Permissible Span (m)											
Span Type	Fire Rating (hours)	Slab Depth (mm)	Mesh	0.9mm Gauge				1.0mm Gauge				1.2mm Gauge			
				Total Unfactored Applied Load (kN/m <sup>2</sup> )											
				3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0
 Single Span	1.0	130	A142	3.15	3.15	3.15	2.74	3.40	3.40	3.28	2.81	3.71	3.71	3.43	2.93
		150	A193	2.99	2.99	2.99	2.99	3.24	3.24	3.24	3.24	3.53	3.53	3.53	3.53
		200	A393	2.71	2.71	2.71	2.71	2.90	2.90	2.90	2.90	3.20	3.20	3.20	3.20
	1.5	140	A193	3.06	3.06	3.06	2.76	3.28	3.28	3.28	2.79	3.62	3.62	3.35	2.87
		150	A193	2.99	2.99	2.99	2.88	3.24	3.24	3.24	2.91	3.53	3.53	3.53	2.99
		200	A393	2.71	2.71	2.71	2.71	2.90	2.90	2.90	2.90	3.20	3.20	3.20	3.20
	2.0	150	A193	2.99	2.99	2.91	2.55	3.24	3.24	2.92	2.56	3.53	3.53	2.95	2.60
		175	A252	2.89	2.89	2.89	2.89	3.06	3.06	3.06	3.06	3.35	3.35	3.35	3.25
		200	A393	2.71	2.71	2.71	2.71	2.90	2.90	2.90	2.90	3.20	3.20	3.20	3.20
 Double Span	1.0	130	A142	3.59	3.53	3.00	2.66	3.83	3.61	3.07	2.73	4.34	3.77	3.21	2.85
		150	A193	3.38	3.38	3.38	3.09	3.70	3.70	3.57	3.15	4.12	4.12	3.71	3.28
		200	A393	2.97	2.97	2.97	2.97	3.18	3.18	3.18	3.18	3.76	3.76	3.76	3.76
	1.5	140	A193	3.48	3.48	2.99	2.66	3.80	3.56	3.03	2.70	4.22	3.66	3.12	2.77
		150	A193	3.38	3.38	3.10	2.75	3.70	3.69	3.14	2.79	4.12	3.78	3.23	2.87
		200	A393	2.97	2.97	2.97	2.97	3.18	3.18	3.18	3.18	3.76	3.76	3.76	3.76
	2.0	150	A193	3.38	3.23	2.77	2.47	3.69	3.25	2.79	2.49	3.73	3.29	2.83	2.53
		175	A252	3.16	3.16	3.16	2.94	3.44	3.44	3.33	2.96	3.91	3.91	3.37	2.99
		200	A393	2.97	2.97	2.97	2.97	3.18	3.18	3.18	3.12	3.76	3.76	3.55	3.16
 Double Span (Propped)	1.0	130	A393	4.78	4.37	3.80	3.24	4.84	4.43	3.85	3.34	4.96	4.54	3.95	3.53
		150	A393	5.04	4.56	4.00	3.60	5.12	4.63	4.06	3.66	5.26	4.76	4.17	3.76
		200	2 x A393	4.42	4.42	4.42	4.42	4.88	4.88	4.88	4.56	5.70	5.70	5.31	4.79
	1.5	140	A393	4.54	4.09	3.57	3.21	4.59	4.13	3.61	3.25	4.67	4.21	3.68	3.31
		150	A393	4.65	4.20	3.68	3.32	4.70	4.25	3.72	3.35	4.79	4.33	3.79	3.42
		200	2 x A393	4.42	4.42	4.42	4.21	4.88	4.88	4.65	4.24	5.70	5.29	4.72	4.30
	2.0	150	A393	4.31	3.89	3.41	3.07	4.33	3.92	3.43	3.09	4.38	3.96	3.47	3.13
		175	2 x A252	4.78	4.49	3.97	3.59	4.95	4.52	3.99	3.62	5.00	4.56	4.03	3.65
		200	2 x A393	4.42	4.42	4.15	3.78	4.88	4.68	4.17	3.80	5.14	4.72	4.20	3.83

TR60+ Load Span Tables (BS5950) Steel Grade S350 – Lightweight Concrete

				Maximum Permissible Span (m)											
Span Type	Fire Rating (hours)	Slab Depth (mm)	Mesh	0.9mm Gauge				1.0mm Gauge				1.2mm Gauge			
				Total Unfactored Applied Load (kN/m <sup>2</sup> )											
				3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0
 Single Span	1.0	120	A142	3.44	3.44	3.07	2.67	3.72	3.72	3.14	2.74	4.05	4.05	3.28	2.86
		150	A193	3.20	3.20	3.20	3.20	3.47	3.47	3.47	3.47	3.79	3.79	3.79	3.63
		200	A393	2.95	2.95	2.95	2.95	3.14	3.14	3.14	3.14	3.44	3.44	3.44	3.44
	1.5	130	A193	3.35	3.35	3.26	2.78	3.63	3.63	3.29	2.81	3.97	3.97	3.32	2.88
		150	A193	3.20	3.20	3.20	2.99	3.47	3.47	3.47	3.02	3.79	3.79	3.68	3.10
		200	A393	2.95	2.95	2.95	2.95	3.14	3.14	3.14	3.14	3.44	3.44	3.44	3.44
	2.0	140	A193	3.27	3.27	3.03	2.63	3.55	3.55	3.04	2.65	3.88	3.88	3.07	2.69
		175	A252	3.12	3.12	3.12	3.12	3.29	3.29	3.29	3.29	3.60	3.60	3.60	3.43
		200	A393	2.95	2.95	2.95	2.95	3.14	3.14	3.14	3.14	3.44	3.44	3.44	3.44
 Double Span	1.0	120	A142	3.94	3.52	2.96	2.62	4.18	3.60	3.03	2.68	4.41	3.75	3.16	2.79
		150	A193	3.63	3.63	3.61	3.17	3.97	3.97	3.68	3.24	4.43	4.43	3.82	3.36
		200	A393	3.23	3.23	3.23	3.23	3.54	3.54	3.54	3.54	4.10	4.10	4.10	4.10
	1.5	130	A193	3.83	3.63	3.05	2.70	4.06	3.68	3.09	2.73	4.44	3.76	3.17	2.81
		150	A193	3.63	3.63	3.24	2.87	3.97	3.91	3.29	2.91	4.43	4.00	3.38	2.99
		200	A393	3.23	3.23	3.23	3.23	3.54	3.54	3.54	3.54	4.10	4.10	4.10	4.10
	2.0	140	A193	3.73	3.42	2.89	2.56	3.97	3.44	2.92	2.58	4.00	3.48	2.96	2.63
		175	A252	3.42	3.42	3.42	3.12	3.74	3.74	3.56	3.13	4.19	4.19	3.59	3.17
		200	A393	3.23	3.23	3.23	3.23	3.54	3.54	3.54	3.54	4.10	4.10	4.10	4.10
 Double Span (Propped)	1.0	120	A252	4.32	3.92	3.37	3.00	4.38	3.99	3.43	3.05	4.48	4.10	3.54	3.15
		150	A393	5.09	4.75	4.17	3.74	5.14	4.82	4.23	3.79	5.23	4.93	4.34	3.89
		200	2 x A393	4.89	4.89	4.89	4.53	5.39	5.39	5.34	4.69	6.18	5.89	5.52	4.98
	1.5	130	A393	4.58	4.23	3.70	3.32	4.64	4.29	3.75	3.35	4.75	4.39	3.81	3.40
		150	A393	5.03	4.51	3.91	3.51	5.08	4.55	3.95	3.54	5.17	4.64	4.02	3.61
		200	2 x A393	4.89	4.89	4.89	4.53	5.39	5.39	5.06	4.57	6.18	5.81	5.12	4.64
	2.0	140	A393	4.62	4.13	3.57	3.19	4.68	4.18	3.61	3.23	4.77	4.26	3.68	3.30
		175	2 x A252	5.09	4.59	4.02	3.62	5.12	4.62	4.04	3.64	5.18	4.68	4.09	3.68
		200	2 x A393	4.89	4.89	4.83	4.37	5.39	5.39	4.85	4.38	6.07	5.53	4.88	4.42


# TR60+ Fire Tables (BS5950) – TAB-Deck™ Fibres

## Normal Weight Concrete

Normal Weight Concrete				Maximum Permissible Span (m)											
Span Type	Fire Rating (hours)	Slab Depth (mm)	Steel Fibre	0.9mm Gauge				1.0mm Gauge				1.2mm Gauge			
				Total Unfactored Applied Load (kN/m <sup>2</sup> )											
				3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0
 Double Span	1.0	130	HE 1.0/50	3.59	3.42	2.99	2.68	3.83	3.54	3.09	2.78	4.19	3.80	3.33	2.99
		150	HE 1.0/50	3.38	3.38	3.30	2.98	3.70	3.70	3.42	3.10	4.12	4.10	3.63	3.28
		200	HE 1.0/50	2.99	2.99	2.99	2.99	3.20	3.20	3.20	3.20	3.78	3.78	3.78	3.78
	1.5	140	HE 1.0/50	3.21	2.90	2.54	2.12	3.29	2.98	2.61	2.18	3.47	3.14	2.75	2.48
		150	HE 1.0/50	3.37	3.06	2.69	2.26	3.46	3.15	2.77	2.50	3.63	3.30	2.90	2.62
		200	HE 1.0/50	2.99	2.99	2.99	2.92	3.20	3.20	3.20	3.20	3.78	3.78	3.63	3.32
	2.0	150	HE 1.0/50	3.21	2.91	2.56	2.14	3.31	3.01	2.64	2.20	3.46	3.14	2.76	2.32
		175	HE 1.0/50	3.17	3.17	2.64	2.40	3.45	3.28	2.71	2.46	3.72	3.42	2.83	2.57
		200	HE 1.0/50	2.99	2.99	2.99	2.79	3.20	3.20	3.20	2.85	3.78	3.78	3.48	2.95

## Lightweight Concrete

Lightweight Concrete

				Maximum Permissible Span (m)											
Span Type	Fire Rating (hours)	Slab Depth (mm)	Steel Fibre	0.9mm Gauge				1.0mm Gauge				1.2mm Gauge			
				Total Unfactored Applied Load (kN/m <sup>2</sup> )											
				3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0
<div>Double Span</div> 	1.0	120	HE 1.0/50	3.81	3.39	2.93	2.61	3.95	3.52	3.03	2.71	4.21	3.76	3.24	2.89
		150	HE 1.0/50	3.64	3.64	3.39	3.05	3.98	3.98	3.52	3.16	4.43	4.32	3.78	3.40
		200	HE 1.0/50	3.25	3.25	3.25	3.25	3.56	3.56	3.56	3.56	4.12	4.12	4.12	4.07
	1.5	130	HE 1.0/50	3.25	2.90	2.51	2.24	3.34	2.98	2.58	2.31	3.54	3.16	2.74	2.45
		150	HE 1.0/50	3.64	3.31	2.88	2.59	3.76	3.39	2.95	2.65	3.92	3.53	3.08	2.76
		200	HE 1.0/50	3.25	3.25	3.25	3.25	3.56	3.56	3.56	3.36	4.12	4.12	3.84	3.49
	2.0	140	HE 1.0/50	3.34	2.99	2.59	2.15	3.42	3.07	2.66	2.20	3.58	3.21	2.78	2.49
		175	HE 1.0/50	3.43	3.43	3.07	2.57	3.75	3.56	3.13	2.62	4.08	3.71	3.26	2.73
		200	HE 1.0/50	3.25	3.25	3.25	3.21	3.56	3.56	3.56	3.26	4.12	4.12	3.71	3.36

For further guidance on the design of TAB-Deck™ fibre reinforced slabs, download the TAB-Deck™ design manual at [www.smdltd.co.uk](http://www.smdltd.co.uk)

## TR60+ Fire Insulation Thickness

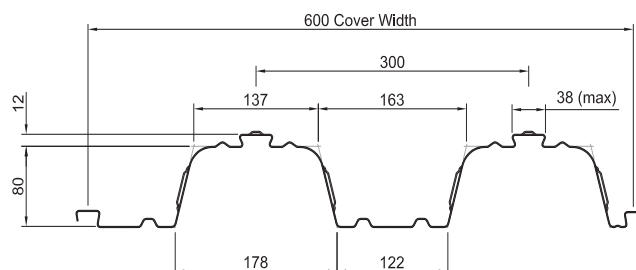


Minimum Insulation Thickness (x) of Concrete (mm)					
Fire Rating	1 hr	1.5 hr	2 hr	3 hr	4 hr
NWC	70	80	90	115	130
LWC	60	70	80	100	115

The image and table above details minimum insulation thickness required to suit fire design criteria – in accordance with BS5950 Part 8.

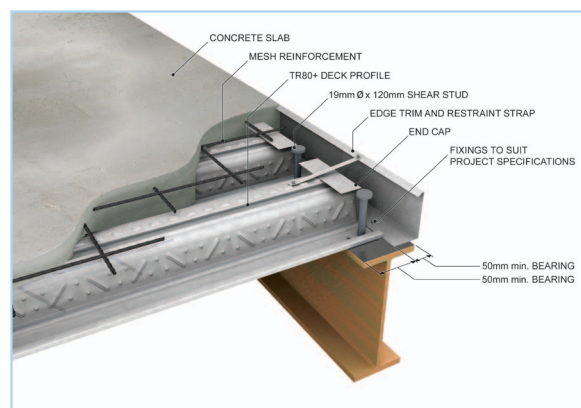
Initially added to our product range in 2002, the original TR80 has undergone further research and development, evolving to the now revised profile, renamed TR80+. This 80mm deep trapezoidal profile is available in 0.9mm, 1.0mm and 1.2mm gauges in both S350 and S450 grade steel.

### TR80+ Deck Profile



### TR80+ Benefits

- 80mm deep trapezoidal profile
- Reduced concrete volume compared to other decks available
- 140mm slab depth required to achieve a typical 1 hour fire rating
- Excellent un-propped span capability
- Trough stiffeners positioned to ensure central stud position, minimizing site checking required
- Soffit 'Wedge Nut' fixings available with load capacity of up to 1kN
- Acoustic Robust Solution – Refer Robust Details Handbook ([www.robustdetails.com](http://www.robustdetails.com))
- TAB-Deck™ fibre concrete solution now available



TR80+ Typical Section Detail

### Concrete Volume and Weight

Slab Depth mm	Volume of Concrete m³/m²	Weight of Concrete (Normal Weight)		Weight of Concrete (Lightweight)	
		Wet (kN/m²)	Dry (kN/m²)	Wet (kN/m²)	Dry (kN/m²)
140	0.096	2.26	2.21	1.79	1.70
150	0.106	2.50	2.44	1.98	1.87
160	0.116	2.73	2.67	2.16	2.05
170	0.126	2.97	2.90	2.35	2.22
180	0.136	3.20	3.14	2.53	2.40
200	0.156	3.67	3.60	2.91	2.75
225	0.181	4.26	4.17	3.37	3.20
250	0.206	4.85	4.75	3.84	3.64




Deflection – This table is based on concrete poured to a constant thickness and does not take account for deflection of the decking or supporting beams (as a guide, to account for the deflection of the decking, a concrete volume of span/250 should be added to the figures indicated). Concrete Weight – These tables indicate concrete weight only and do not include the weight of decking or reinforcement. Concrete weights are based on the concrete densities specified in BS5950 Part 4 clause 3.3.3 as follows: Normal Weight Concrete – 2400kg/m³ (wet) and 2350 kg/m³ (dry). Lightweight Concrete – 1900kg/m³ (wet) and 1800 kg/m³ (dry).

Sectional Properties								
Nominal Thickness mm	Design Thickness (bare steel) mm	Available Grades N/mm <sup>2</sup>	Depth of Profile mm	Weight of Profile kg/m <sup>2</sup> kN/m <sup>2</sup>		Height of Neutral axis mm	Area of Steel mm <sup>2</sup> /m	Moment of Inertia cm <sup>4</sup> /m
0.9	0.86	S350 or S450	80 / 92*	11.33	0.111	42.3	1385	172.9
1.0	0.96	S350 or S450	80 / 92*	12.54	0.123	42.4	1539	192.3
1.2	1.16	S350 or S450	80 / 92*	15.06	0.148	42.5	1860	231.1




Refer to page 07 for notes associated with these load/span tables. For more comprehensive tables covering a wider range of slab depths, loadings, fire ratings and mesh sizes visit our website at [www.smdtd.co.uk](http://www.smdtd.co.uk).



# TR80<sup>+</sup> Load Span Tables (BS5950) Steel Grade S350 – Normal Weight Concrete


				Maximum Permissible Span (m)											
Span Type	Fire Rating (hours)	Slab Depth (mm)	Mesh	0.9mm Gauge				1.0mm Gauge				1.2mm Gauge			
				Total Unfactored Applied Load (kN/m <sup>2</sup> )											
				3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0
 Single Span	1.0	140	A193	3.92	3.92	3.47	3.04	4.21	4.21	3.54	3.10	4.39	4.39	3.67	3.22
		160	A193	3.73	3.73	3.73	3.28	4.02	4.02	3.92	3.35	4.23	4.23	4.06	3.48
		200	A252	3.42	3.42	3.42	3.42	3.69	3.69	3.69	3.69	3.98	3.98	3.98	3.98
	1.5	150	A193	3.82	3.78	3.10	2.74	4.12	3.81	3.15	2.78	4.31	3.88	3.23	2.87
		175	A193	3.61	3.61	3.42	3.01	3.89	3.89	3.46	3.05	4.13	4.13	3.55	3.14
		200	A252	3.42	3.42	3.42	3.42	3.69	3.69	3.69	3.68	3.98	3.98	3.98	3.73
	2.0	160	A193	3.73	3.36	2.85	2.53	3.98	3.37	2.87	2.56	3.96	3.41	2.92	2.60
		175	A193	3.61	3.61	3.02	2.68	3.89	3.63	3.04	2.71	4.13	3.61	3.09	2.75
		200	A252	3.42	3.42	3.42	3.21	3.69	3.69	3.69	3.22	3.98	3.98	3.74	3.24
 Double Span	1.0	140	A193	4.42	3.90	3.33	2.96	4.59	3.98	3.40	3.02	4.70	4.13	3.53	3.14
		160	A193	4.18	4.16	3.55	3.17	4.49	4.24	3.63	3.24	5.02	4.41	3.78	3.37
		200	A252	3.78	3.78	3.78	3.78	4.12	4.12	4.12	3.85	4.62	4.62	4.48	3.99
	1.5	150	A193	3.95	3.50	3.01	2.69	4.00	3.55	3.06	2.73	4.11	3.65	3.15	2.82
		175	A193	4.01	3.78	3.26	2.92	4.31	3.83	3.32	2.97	4.42	3.94	3.42	3.07
		200	A252	3.77	3.77	3.77	3.37	4.12	4.12	3.82	3.41	4.62	4.54	3.91	3.51
	2.0	160	A193	3.60	3.21	2.78	2.49	3.63	3.24	2.81	2.52	3.68	3.30	2.86	2.57
		175	A193	3.77	3.37	2.92	2.63	3.79	3.40	2.95	2.65	3.85	3.45	3.01	2.71
		200	A252	3.77	3.77	3.41	3.06	4.12	3.97	3.44	3.08	4.48	4.01	3.48	3.13
 Double Span (Propped)	1.0	140	A393	5.02	4.49	3.67	3.15	5.09	4.57	3.80	3.27	5.23	4.70	4.05	3.50
		160	A393	5.24	4.74	4.04	3.48	5.32	4.81	4.18	3.61	5.47	4.95	4.33	3.86
		200	2 x A252	5.42	5.40	4.67	4.05	5.98	5.48	4.82	4.19	6.14	5.63	4.99	4.47
	1.5	150	A393	4.64	4.18	3.65	3.28	4.69	4.22	3.69	3.31	4.78	4.31	3.76	3.38
		175	A393	4.92	4.47	3.93	3.55	4.97	4.52	3.97	3.59	5.08	4.61	4.06	3.67
		200	2 x A252	5.25	4.81	4.26	3.87	5.32	4.87	4.32	3.92	5.54	5.07	4.50	4.09
	2.0	160	A393	4.39	3.97	3.47	3.13	4.42	3.99	3.50	3.15	4.47	4.04	3.54	3.19
		175	2 x A252	4.58	4.16	3.66	3.31	4.61	4.19	3.69	3.33	4.72	4.29	3.78	3.42
		200	2 x A252	4.85	4.43	3.93	3.57	4.88	4.47	3.96	3.60	4.95	4.53	4.02	3.65

# TR80<sup>+</sup> Load Span Tables (BS5950) Steel Grade S350 – Lightweight Concrete

				Maximum Permissible Span (m)											
Span Type	Fire Rating (hours)	Slab Depth (mm)	Mesh	0.9mm Gauge				1.0mm Gauge				1.2mm Gauge			
				Total Unfactored Applied Load (kN/m <sup>2</sup> )											
				3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0
 Single Span	1.0	140	A193	4.19	4.19	3.58	3.12	4.44	4.44	3.65	3.18	4.64	4.64	3.79	3.31
		160	A193	4.00	4.00	3.95	3.36	4.28	4.28	4.01	3.43	4.47	4.47	4.16	3.56
		200	A252	3.69	3.69	3.69	3.69	3.99	3.99	3.99	3.99	4.21	4.21	4.21	4.21
	1.5	150	A193	4.09	4.09	3.32	2.91	4.36	4.16	3.36	2.95	4.55	4.22	3.45	3.03
		175	A193	3.88	3.88	3.58	3.13	4.18	4.18	3.62	3.18	4.36	4.36	3.71	3.27
		200	A252	3.69	3.69	3.69	3.69	3.99	3.99	3.99	3.82	4.21	4.21	4.21	3.84
	2.0	160	A193	4.00	3.78	3.11	2.74	4.28	3.73	3.13	2.76	4.47	3.76	3.17	2.80
		180	A252	3.84	3.84	3.81	3.24	4.14	4.14	3.78	3.25	4.33	4.33	3.74	3.28
		200	A252	3.69	3.69	3.69	3.39	3.99	3.99	3.99	3.40	4.21	4.21	3.98	3.43
 Double Span	1.0	140	A193	4.67	4.08	3.45	3.05	4.86	4.16	3.52	3.11	5.02	4.31	3.65	3.23
		160	A193	4.50	4.34	3.67	3.25	4.75	4.42	3.75	3.32	5.39	4.60	3.90	3.46
		200	A252	4.09	4.09	4.09	3.90	4.47	4.47	4.47	3.97	4.97	4.97	4.66	4.12
	1.5	150	A193	4.32	3.78	3.22	2.86	4.38	3.83	3.26	2.90	4.48	3.93	3.36	2.98
		175	A193	4.34	4.01	3.42	3.05	4.62	4.06	3.48	3.10	4.74	4.17	3.58	3.19
		200	A252	4.09	4.09	3.98	3.52	4.47	4.47	4.02	3.57	4.97	4.89	4.12	3.66
	2.0	160	A193	4.01	3.53	3.02	2.69	4.03	3.56	3.05	2.72	4.09	3.61	3.10	2.76
		180	A252	4.28	4.13	3.51	3.12	4.67	4.14	3.53	3.14	4.76	4.18	3.57	3.18
		200	A252	4.09	4.09	3.64	3.24	4.47	4.29	3.66	3.26	4.97	4.32	3.71	3.31
 Double Span (Propped)	1.0	140	A393	4.92	4.54	3.79	3.23	4.99	4.61	3.92	3.35	5.09	4.73	4.14	3.59
		160	A393	5.32	4.98	4.20	3.59	5.38	5.06	4.34	3.72	5.48	5.18	4.51	3.97
		200	2 x A252	6.01	5.70	4.91	4.21	6.11	5.80	5.06	4.36	6.22	5.91	5.23	4.64
	1.5	150	A393	5.11	4.56	3.95	3.41	5.16	4.61	3.98	3.54	5.25	4.69	4.06	3.63
		175	A393	5.32	4.78	4.17	3.75	5.37	4.83	4.21	3.79	5.48	4.93	4.30	3.86
		200	2 x A252	5.71	5.18	4.55	4.10	5.79	5.25	4.61	4.16	5.93	5.37	4.72	4.26
	2.0	160	A393	4.82	4.32	3.75	3.36	4.86	4.35	3.77	3.38	4.93	4.41	3.83	3.43
		180	2 x A252	5.21	4.70	4.10	3.69	5.25	4.73	4.13	3.71	5.31	4.78	4.18	3.76
		200	2 x A252	5.36	4.86	4.26	3.85	5.39	4.89	4.29	3.87	5.47	4.95	4.35	3.93


# TR80+ Fire Tables (BS5950) – TAB-Deck™ Fibres

## Normal Weight Concrete

Normal Weight Concrete				Maximum Permissible Span (m)											
Span Type	Fire Rating (hours)	Slab Depth (mm)	Steel Fibre	0.9mm Gauge				1.0mm Gauge				1.2mm Gauge			
				Total Unfactored Applied Load (kN/m <sup>2</sup> )											
				3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0
 Double Span	1.0	140	HE 1.0/50	4.35	3.93	3.43	3.09	4.50	4.07	3.56	3.20	4.84	4.39	3.84	3.45
		160	HE 1.0/50	4.19	4.18	3.68	3.33	4.49	4.35	3.84	3.47	5.02	4.66	4.12	3.72
		200	HE 1.0/50	3.78	3.78	3.78	3.78	4.13	4.13	4.13	4.03	4.63	4.63	4.63	4.31
	1.5	150	HE 1.0/50	3.57	3.23	2.82	2.54	3.72	3.37	2.94	2.65	3.98	3.60	3.15	2.84
		175	HE 1.0/50	3.88	3.54	3.13	2.63	3.99	3.64	3.22	2.71	4.22	3.85	3.40	3.08
		200	HE 1.0/50	3.78	3.78	3.54	3.22	4.13	4.07	3.63	3.31	4.63	4.27	3.81	3.47
	2.0	160	HE 1.0/50	3.58	3.24	2.85	2.38	3.69	3.35	2.94	2.46	3.91	3.55	3.12	2.62
		175	HE 1.0/50	3.68	3.35	2.96	2.50	3.79	3.46	3.05	2.58	4.02	3.67	3.24	2.73
		200	HE 1.0/50	3.78	3.78	3.41	2.88	4.13	3.92	3.50	2.96	4.45	4.10	3.66	3.33

## Lightweight Concrete

Lightweight Concrete

				Maximum Permissible Span (m)											
Span Type	Fire Rating (hours)	Slab Depth (mm)	Steel Fibre	0.9mm Gauge				1.0mm Gauge				1.2mm Gauge			
				Total Unfactored Applied Load (kN/m <sup>2</sup> )											
				3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0	3.5	5.0	7.5	10.0
<div>Double Span</div> 	1.0	140	HE 1.0/50	4.54	4.07	3.52	3.15	4.71	4.22	3.65	3.27	5.05	4.53	3.93	3.51
		160	HE 1.0/50	4.51	4.38	3.82	3.43	4.76	4.51	3.94	3.54	5.34	4.84	4.23	3.80
		200	HE 1.0/50	4.10	4.10	4.10	4.03	4.48	4.48	4.48	4.13	4.98	4.98	4.86	4.41
	1.5	150	HE 1.0/50	3.78	3.39	2.94	2.63	3.92	3.51	3.05	2.73	4.17	3.73	3.24	2.90
		175	HE 1.0/50	4.09	3.70	3.23	2.77	4.21	3.80	3.33	2.85	4.44	4.01	3.51	3.16
		200	HE 1.0/50	4.10	4.10	3.79	3.43	4.48	4.39	3.88	3.51	4.98	4.59	4.06	3.67
	2.0	160	HE 1.0/50	3.83	3.44	2.99	2.53	3.97	3.57	3.10	2.60	4.24	3.81	3.32	2.98
		180	HE 1.0/50	4.22	3.82	3.35	2.80	4.33	3.92	3.44	2.88	4.55	4.12	3.61	3.25
		200	HE 1.0/50	4.10	4.10	3.63	3.28	4.48	4.22	3.72	3.36	4.83	4.41	3.89	3.52

For further guidance on the design of TAB-Deck™ fibre reinforced slabs, download the TAB-Deck™ design manual at [www.smdltd.co.uk](http://www.smdltd.co.uk)

## TR80+ Fire Insulation Thickness



Minimum Insulation Thickness (x) of Concrete (mm)					
Fire Rating	1 hr	1.5 hr	2 hr	3 hr	4 hr
NWC	60	70	80	115	130
LWC	60	70	80	100	115

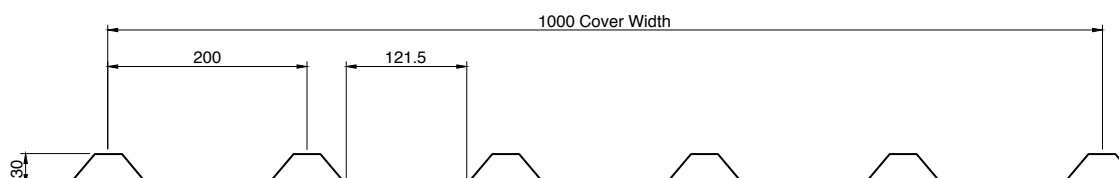
The image and table above details minimum insulation thickness required to suit fire design criteria – in accordance with BS5950 Part 8 or clarified by further test information.

# SR30

## Roof Deck Details and Sectional Properties

Building upon our already successful range of trapezoidal composite deck profiles, the SR30 has been developed to complement our existing product range and services. The 200mm trough spacing offers a competitive solution as a structural liner or cladding for common purlin spacings. The 1.0m cover width of the SR30 maximizes speed of installation to meet on site programme requirements.

### SR30 Roof Deck Profile



### SR30

Sectional Properties										
Nominal Thickness mm	Design Thickness mm	Available Grades N/mm <sup>2</sup>	Depth of profile mm	Weight of profile		Area of steel mm <sup>2</sup> /m	Top flange in compression		Bottom flange in compression	
				kg/m <sup>2</sup>	kN/m <sup>2</sup>		Moment Capacity kNm/m	Moment of Inertia cm <sup>4</sup> /m	Moment Capacity kNm/m	Moment of Inertia cm <sup>4</sup> /m
0.7	0.66	S280	30	6.66	0.065	805	1.3	9.8	1.2	6.4
0.9	0.86	S280	30	8.57	0.084	1049	TBC	TBC	TBC	TBC
1.2	1.16	S280	30	11.44	0.112	1415	TBC	TBC	TBC	TBC

- This 30mm deep structural roof deck/liner can be used as the internal skin in a number of lightweight roof solutions.
- Manufactured from S280 grade steel with a minimum galvanised coating mass of 275g/m<sup>2</sup>, SR30 is available in 0.7mm.
- The SR30 roof deck is to be fixed to supports at 200mm centres (1 per trough) using either shot-fired fixings or self-tapping screws depending on support type. For exact fixing specification or project specific requirements, contact SMD Technical Department.

### SR30 Roof Deck Load / Span Tables

Span Type		Gauge (mm)	Maximum GRAVITY Load (kN/m <sup>2</sup> )							Maximum UPLIFT Load (kN/m <sup>2</sup> )						
			Span (m)							Span (m)						
			1.0	1.25	1.5	1.75	2.0	2.25	2.5	1.0	1.25	1.50	1.75	2.0	2.25	2.5
Single Span 	0.7		6.84	4.38	3.04	1.99	1.34	0.94	0.68	6.22	3.98	2.45	1.55	1.04	0.73	0.53
	0.9		TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
	1.2		TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
Double Span 	0.7		3.73	2.66	2.00	1.57	1.26	1.04	0.87	3.90	2.80	2.12	1.66	1.34	1.10	0.88
	0.9		TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
	1.2		TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
Multi-Span 	0.7		4.43	3.18	2.41	1.89	1.52	1.25	1.05	4.62	3.34	2.53	1.99	1.61	1.21	0.88
	0.9		TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC
	1.2		TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC	TBC

These load/span tables are calculated in accordance with BS EN 1993-1-3 and include a safe working load factor of 1.5.

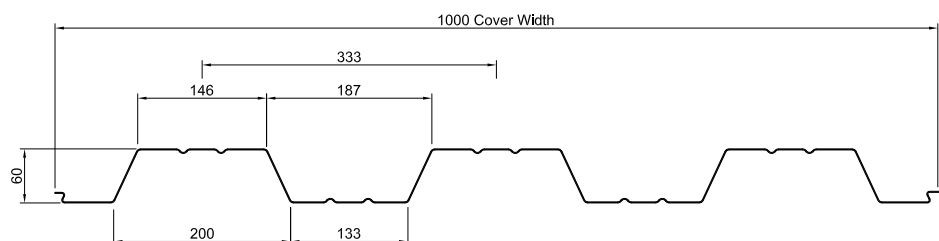


# SR60

## Roof Deck Details and Sectional Properties

Building upon our already successful range of trapezoidal composite deck profiles, the SR60 has been developed to complement our existing product range and services. The 333mm trough spacing offers a competitive solution with good spanning capabilities. The 1.0m cover width of the SR60 maximizes speed of installation to meet on site programme requirements.

### SR60 Roof Deck Profile



Sectional Properties

Nominal Thickness mm	Design Thickness mm	Available Grades N/mm <sup>2</sup>	Depth of profile mm	Weight of profile		Area of steel mm <sup>2</sup> /m	Top flange in compression		Bottom flange in compression	
				kg/m <sup>2</sup>	kN/m <sup>2</sup>		Moment Capacity kNm/m	Moment of Inertia cm <sup>4</sup> /m	Moment Capacity kNm/m	Moment of Inertia cm <sup>4</sup> /m
0.7	0.66	S280	60	7.00	0.069	840	2.9	41.4	3.1	41.4
0.9	0.86	S280	60	8.99	0.088	1095	4.2	57.6	4.5	58.0
1.2	1.16	S280	60	11.96	0.117	1473	6.0	80.8	6.5	81.8

- This 60mm deep structural roof deck can be used as the structural base in a number of lightweight roof and mezzanine floor solutions
- Manufactured from S280 grade steel with a minimum galvanised coating mass of 275g/m<sup>2</sup>, SR60 is available in 0.7mm, 0.9mm and 1.2mm gauges to suit specific project requirements
- The SR60 roof deck is to be fixed to supports at 333mm centres (1 per trough) using either shot-fired fixings or self-tapping screws depending on support type. For exact fixing specification or project specific requirements, contact SMD Technical Department

### SR60 Roof Deck Load / Span Tables

Span Type	Gauge (mm)	Maximum GRAVITY Load (kN/m <sup>2</sup> )								Maximum UPLIFT Load (kN/m <sup>2</sup> )							
		Span (m)								Span (m)							
		1.5	1.75	2.0	2.25	2.5	2.75	3.0		1.5	1.75	2.0	2.25	2.5	2.75	3.0	
Single Span 	0.7	4.73	4.06	3.55	2.86	2.09	1.57	1.21		5.41	4.64	4.06	2.86	2.09	1.57	1.21	
	0.9	7.63	6.54	5.20	3.98	2.90	2.18	1.68		8.72	7.47	5.70	4.01	2.92	2.19	1.69	
	1.2	13.04	9.71	7.44	5.58	4.07	3.06	2.35		14.90	12.01	8.05	5.65	4.12	3.10	2.38	
Double Span 	0.7	3.05	2.47	2.05	1.73	1.48	1.29	1.13		3.41	2.75	2.28	1.92	1.64	1.42	1.24	
	0.9	4.73	3.82	3.15	2.65	2.27	1.96	1.72		5.25	4.22	3.48	2.92	2.49	2.15	1.88	
	1.2	7.57	6.06	4.98	4.17	3.55	3.06	2.66		8.33	6.65	5.45	4.55	3.86	3.32	2.89	
Multi-Span 	0.7	3.59	2.91	2.42	2.05	1.76	1.53	1.35		4.01	3.25	2.69	2.28	1.95	1.69	1.49	
	0.9	5.57	4.51	3.73	3.15	2.70	2.34	2.05		6.19	4.99	4.13	3.48	2.97	2.57	2.25	
	1.2	8.94	7.19	5.92	4.97	4.24	3.66	3.20		9.86	7.90	6.49	5.44	4.63	3.99	3.48	

These load/span tables are calculated in accordance with BS5950-6 and include a safe working load safety factor of 1.6.

# Guidance Notes

## Design

### General

SMD's metal decking products are commonly used as part of a composite floor slab, where the decking acts as both permanent formwork and tensile reinforcement (sagging) in the bottom of the slab (basis of design in accordance with BS5950: Parts 4 & 6 or Eurocodes 3 and 4).

Alternatively, our decking profiles may be used as permanent formwork only. In this situation any reinforcement required to support the specified imposed loads is to be designed by the project structural engineer, ignoring any contribution from the metal decking.

All our profiles use steel strip in compliance with BS EN 10143 & BS EN 10346 with guaranteed minimum yield strengths of 350 and 450 N/mm<sup>2</sup> and a minimum coating mass of 275g/m<sup>2</sup>.

### Construction Stage

At Construction Stage the decking is designed to support the weight of the wet concrete, reinforcement and an allowance for temporary construction load in accordance with BS5950 Part 4 or Eurocode 1. Where this load is likely to be exceeded, SMD Technical Department should be consulted.

The best practice guidance for concrete placement outlined in this manual should be adopted to avoid overloading of the decking.

Where necessary to position materials directly on to the metal decking for short periods, the following recommendations should be followed:

- a. Any load applied to the metal decking during its temporary construction stage should be restricted to 1.5kN/m<sup>2</sup>. Special attention is required regarding this load if the decking requires propping during construction. Temporary propping must be in place before any construction traffic is allowed over the deck.
- b. Materials should always be positioned directly over a supporting steel member.
- c. Materials should be positioned in a workmanlike manner.
- d. Materials should be placed onto timbers or pallets etc. to spread any load. These should be positioned directly over supporting steel members.
- e. Timbers or pallets should be positioned with the main support running at right angles to the ribs of the decking.

**NOTE:** Metal decking is not designed to accommodate the storage of materials during its construction stage, therefore until the structural concrete topping is placed, any such storage undertaken is to be carried out with due regard to the above notes.

### Deflection (Construction Stage)

Metal decking is designed to deflect under the weight of wet concrete as it is placed, in accordance with BS5950 Parts 4 & 6 or Eurocodes 3 and 4. The decking is designed for the slab thickness

specified, based on constant thickness. No allowance is made for any additional loading due to excessive concrete thickness as a consequence of deflection of the structural steel frame during construction. This must be considered by the designer when specifying the slab surface tolerance required, to avoid experiencing deflections far greater than that designed.

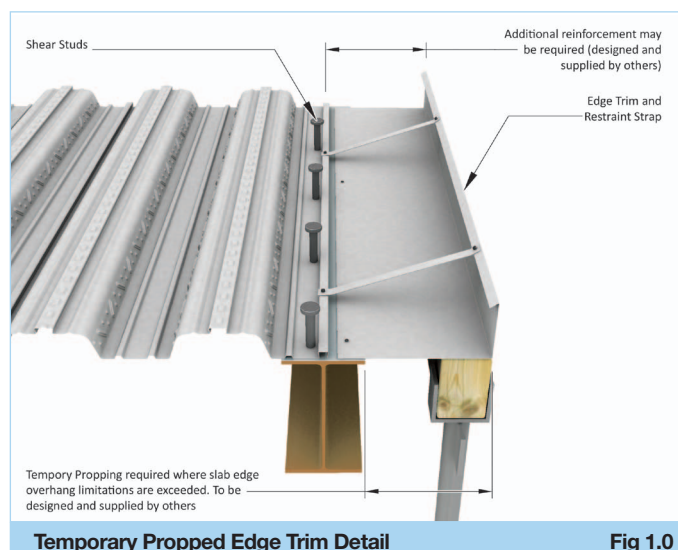
The best practice guidance for concreting outlined in this manual (and more comprehensively given in The Concrete Society – Good Concrete Guide 5: Composite concrete slabs on steel decking) should be followed to avoid excessive deflection. Refer page 07 – Design Table Notes for further information on deflection limits.

### Temporary Propping

Decking is usually designed un-propped, however for longer or single span locations (i.e. temporary crane void infills) temporary propping may be required during construction to support the wet weight of the concrete and any construction imposed loads. When supplied, SMD decking layout drawings will indicate all areas where temporary propping is required with a chain-dotted line and the notation 'TP'. **If in doubt ASK.**

Should a project require tighter control of decking deflection at construction stage, the structural engineer may specify temporary propping to spans within the limits of the un-propped tables provided in this document.

Where temporary props are required to spans exceeding 4.0m for R51 and TR60+ and 5.0m for TR80+ (and at any unsupported or large edges – Refer Fig 1.0), the propping arrangement is to be in position, levelled and adequately braced **prior** to installation of the decking. Consideration should be given to the method of fall arrest used in this situation.



Temporary Propped Edge Trim Detail

Fig 1.0

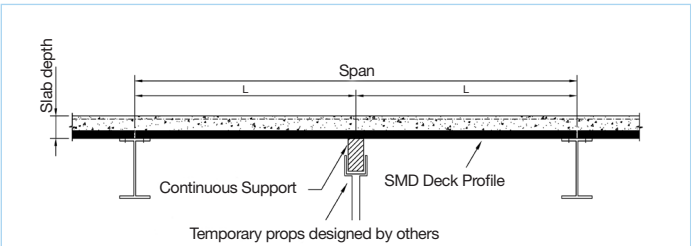
Props normally consist of a length of timber and/or steel plate supported by adjustable steel props. The minimum bearing length of the timber and/or plate depends upon the thickness of the slab, these are typically in the range of 75-100mm (Refer Table 1 on page 20).

# Guidance Notes

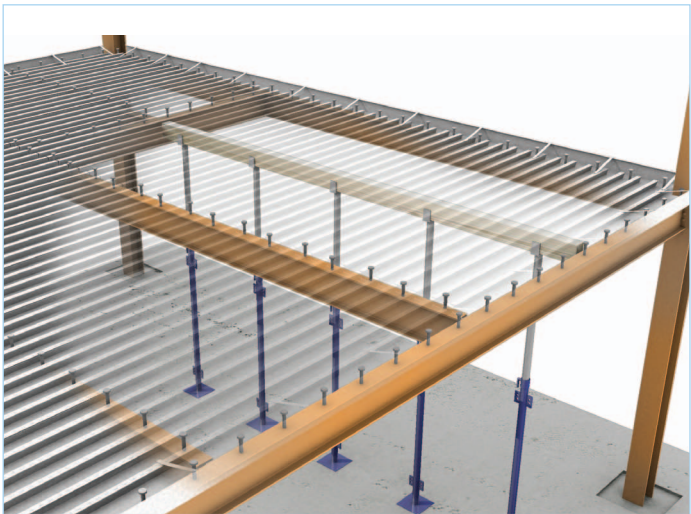
Slab depth (mm)	Span (m)	Runner Size	
		Depth	Width (min.)
120	3.25	175mm	50mm
130	3.75	200mm	50mm
150	4.25	225mm	50mm
200	4.75	225mm	75mm

**Guidance for Timber Runner Size – Table 1**

The timber/steel bearer and sole plates should be continuous and should extend the full width of the bay to ensure no deflection at propped points. Typically the continuous supporting timbers are propped at maximum 1m centres along its length (Refer Figs 1.1 and 1.2).



Temporary Propping Detail – Section Fig 1.1



Temporary Propping Detail Fig 1.2

Temporary propping should not be removed until the concrete has achieved 75% of its design strength.

The above information is for guidance only, the design and installation of the temporary propping is the responsibility of others and should be of adequate strength and construction to sustain the dead weight of the concrete plus any construction live loads.

## Lateral Restraint and Diaphragm Action

Metal decking may also be used as lateral restraint to stabilise the beams during construction and, through diaphragm action,

to stabilise the building as a whole by transferring wind loads back to the walls or columns (where designed by the structural engineer) – for guidance refer to SCI Publication 093 and SCI Advisory Desk Note AD 175, BS5950: Part 9 or Eurocode 3.

The decking is fixed to the beam flange using either Hilti X-U15, Spit SDK9 or the more robust Hilti X-ENP19 or Spit SBR14 (or similar approved), all of which can resist lateral forces in accordance with BS5950: Part 1 or Eurocode 3.

The safe working shear resistances (per nail) are indicated in Table 2 – Note: In some instances the value differs depending on the decking gauge used.

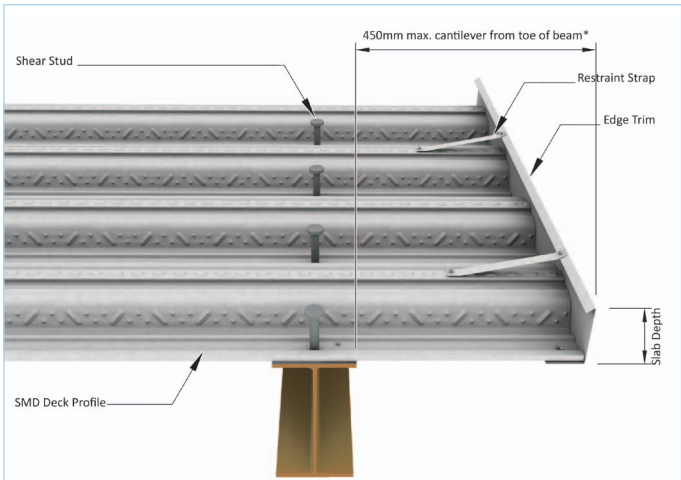
Decking Thickness (mm)	Spit SDK9 (kN)	Hilti X-U15 (kN)	Spit SBR 14 (kN)	Hilti X-ENP19 (kN)
0.9	2.3	0.8	2.8	2.9
1.0	2.5	0.8	3.4	3.2
1.2	3.05	0.8	4.45	4.0

**Safe Working Shear Resistances (per nail) – Table 2**

## Cantilevers

The guidance below is for cantilevered decking and edge trim acting as permanent formwork only. All cantilevers will need to be assessed by the structural engineer as to whether any additional reinforcement is required to support the final imposed loads. The design and detailing of such reinforcement is the responsibility of others.

Where the deck spans perpendicular to the edge beam in the direction of the cantilever, a maximum dimension of 450mm is recommended (Refer Fig 2.0). For cantilevers greater than 450mm consult SMD Technical Department, as temporary propping may be required.

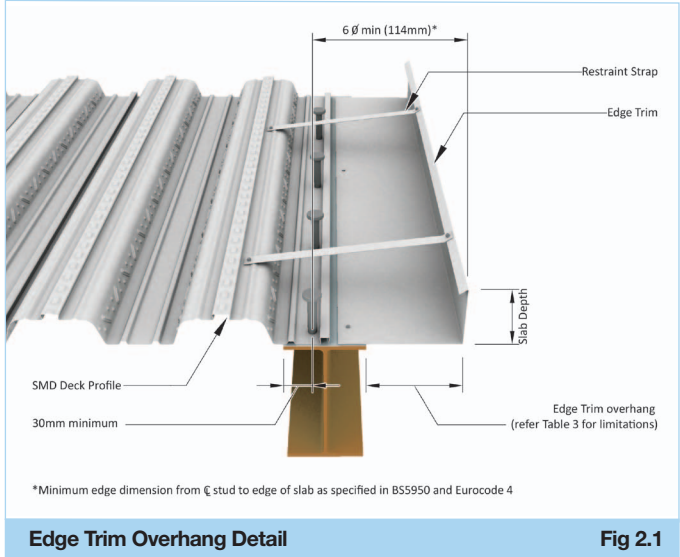


\* For cantilevers greater than 450mm contact SMD Technical Department.

**Cantilevered Deck Detail** Fig 2.0



Where the decking spans parallel to the edge beam, cantilevers are achieved with edge trim (Refer Fig 2.1). Decking should not be cantilevered at side locations without additional supports in place. (Refer Fig 16.4). The maximum achievable cantilever from edge of beam depends on the slab depth and material gauge (Refer Table 3 for typical situations). For cantilevers or slab depths outside of this table consult SMD Technical Department.



Overall Slab Depth	Edge Trim			
	Dimension from toe of Beam			
	1.0mm	1.2mm	1.6mm	2.0mm
130 mm	105mm	125mm	160mm	200mm
150 mm	95mm	115mm	150mm	185mm
175 mm	90mm	110mm	145mm	175mm
200 mm	85mm	100mm	135mm	165mm
250 mm	Propping Required			

**Guide for Maximum Unpropped Slab Edges – Table 3**

### Composite Stage

During the Composite, or Normal Stage, the composite slab is checked for super-imposed Dead (Permanent) and Imposed Live (Variable) loads as specified by the client / engineer. Composite slabs are usually designed as simply supported and in accordance with BS5950 Part 4 or Eurocode 4.

Concentrated loads (i.e. line loads from walls) should be checked separately to ensure the specified slab criteria is adequate for the required loadings. Specific checks for concentrated loads can be carried out using SMD Deck design software.

Consideration should be given to any loadings that may be applied to the slab during construction (i.e. from plant or material storage), as these may be more onerous than the design loadings for the intended building use.

### Reinforcement

Composite slabs require crack control and distribution reinforcement in the top of the slab in accordance with BS5950 Part 4 clauses 6.7, 6.8 and 6.9 or BS EN 1994-1-1. This reinforcement is usually in the form of steel fabric in accordance with BS4483. Alternatively, the steel fibre reinforced 'TAB-Deck™' solution can be used in some design cases – for technical information on this solution and the benefits of this form of construction refer 'TAB-Deck™ Fibre Concrete' section of this document, TAB-Deck™ Design Guide (downloadable from [www.smdltd.co.uk](http://www.smdltd.co.uk)) and SMD corporate brochure.

In many cases, the reinforcement provided for crack control and distribution may be suitable to achieve the required fire resistance, this should be checked against the load/span tables contained in this document. Where designs are outside the scope of these tables, additional bottom reinforcement may be required – Refer SMD Deck design software, SCI Publication P-056 or Eurocode NCCI PN005-GB.

Any additional reinforcement requirements not associated with the composite action of the deck and concrete (i.e. cantilevers, void trimming, composite beams, building regulation compliance) are to be designed and specified by others.

**The detailing of all reinforcement within the composite slab is the responsibility of others.**

### Fire

The fire design of a composite slab uses either the Simplified Method to BS5950, Eurocode NCCI Method or Fire Engineering Approach (Refer SCI Publication P056 or Eurocode NCCI PN005-GB for further information). The Simplified and Eurocode NCCI Methods are based on mesh only, with the mesh continuous over at least one internal support. This will usually give the most economic design.

The Fire Engineering method uses additional reinforcement in the troughs of the decking to achieve the required fire rating. The SMD Deck Design Software enables the user to check designs using any of these methods to suit the design standard adopted, BS5950 or Eurocodes.

The recommended top cover to the mesh reinforcement is a minimum of 15mm and a maximum of 45mm. Generally, minimum laps should be 300mm for A142 and 400mm for A193, A252 and A393. The mesh must satisfy the elongation requirements of BS4449, for more specific guidance refer to SCI Publication P300 – Composite Slabs and Beams using Steel Decking: Best Practice for Design and Construction.

In addition to the requirements of BS5950 Part 4 or Eurocode 4 with regard to structural behaviour under normal design loads, the slab must also meet the minimum insulation requirement specified in BS5950 Part 8, Eurocode 4 or Eurocode NCCI PN005-GB.

The composite slab and mesh reinforcement (not necessarily the metal deck) should be continuous over one or more internal supports. Continuity is taken to include all end bay conditions. The fire resistance of a single span in isolation is taken as 30 minutes, unless otherwise demonstrated by fire engineering or by a fire test.

# Guidance Notes

## Vibration

The recommended minimum natural frequency of a composite slab is 5Hz when used in office or domestic type applications. This limit may need to be increased in areas such as gyms, dance studios or plant areas supporting machinery, where rhythmic loading is expected. For further guidance refer SCI Publications P076: Design guide on the vibration of floors and P354: Design of floors for vibration – A New Approach.

## Durability

All SMD decks are manufactured from galvanised steel coil to BS EN 10346 with a standard 275g/m<sup>2</sup> coating. The design life to first maintenance that can be expected for different environments is:

Internal, Dry & Unpolluted: (Typical for most common applications – offices, warehouses, hospitals, airports)	20 – 50 years
Suburban & Rural:	5 – 10 years
Coastal:	2 – 5 years
Industrial and Urban:	2 – 5 years

Should greater periods be required, additional site applied protection to the underside of the profile may be required. Refer SMD Technical Department for further guidance.

## Composite Beam Design

Composite beams with steel decking should be designed in accordance with BS5950 Part 3: Section 3.1 or Eurocode 4. Thru' deck welded shear studs are commonly used to transfer horizontal shear forces between the steel beam and concrete slab, as required in the relevant design standard. These studs are welded to the supporting beams through the troughs in the decking, therefore it is essential that the decking and beam geometries are considered by the structural engineer when specifying stud quantities on beams running perpendicular to the decking span (Refer pages 27-28 for limitations).

The resistance of shear studs in solid concrete is outlined in BS5950 Part 3: Section 3.1 and Eurocode 4. When used in composite decked slabs, these stud resistances may need to be reduced due to the decking geometry and/or orientation. For calculation of shear stud reduction factors, refer to BS5950 Part 3: Section 3.1 or Eurocode 4.

Transverse reinforcement is required in the concrete flange of composite beams to resist splitting forces. This will usually be in the form of mesh and/or additional bars running perpendicular to the beam centre line. In locations where the decking spans perpendicular to the beam centre line, the deck can also be considered, providing it is either continuous across the beam flange or securely anchored to the beam flange with thru' deck welded studs at butt joints. Where perimeter beams are designed as composite, additional 'U' bars may be required depending on edge dimensions, refer SCI Publication P300: Composite slabs and beams using steel decking: Best practice for design and construction.

## Supply

### Delivery and Access

Decking and edge trim are delivered on 25 tonne capacity articulated vehicles with trailers up to 13.50m long. On supply and fix contracts, SMD's site manager will contact the client to arrange deliveries allowing seven days notice. Where site access restrictions apply, deliveries can be arranged on alternative vehicles (i.e. 10 tonne rigid or hi-ab). Contact SMD contracts team for further advice.

Upon arrival at site, the driver will allow a maximum 2 hour off-loading period – unless agreed otherwise with the SMD contracts team. It is normal for the offloading to be undertaken by the steelwork contractor in conjunction with the erection of the steel frame. SMD do not undertake any offloading of delivery vehicles.

#### Maximum Pack Size for R51

24 No Sheets with a max weight of approx. 2.5 tonnes

#### Maximum Pack Size for TR60+

18 No sheets with a max weight of approx. 2.5 tonnes

#### Maximum Pack Size for TR80+

15 No Sheets with a max weight of approx. 2.5 tonnes

Sheet lengths are determined on the SMD layout drawing to suit the requirements of the building footprint. Normally they will be designed to give the most effective use of the decking, reducing any propping requirements and with Health & Safety for unloading and installation in mind. Where possible, sheet lengths are restricted to 7.5m for R51, 8.0m for TR60+ and 10.0m for TR80+ due to manual handling restrictions.

## Pack Labels and Locations

Decking bundles are identified on SMD's layout drawings and will have a unique identification tag (Refer Fig 3.0 showing a typical pack label with all relevant information). The packs are also marked with a spray stripe down one side to indicate how they should be loaded onto the steel frame. The spray line should face in the direction of the setting out point as indicated on the relevant SMD drawing.

For site control, the colour of the spray line on the pack differs to indicate the decking gauge:

- Green – 0.9mm gauge
- Blue – 1.0mm gauge
- Red – 1.2mm gauge

The loading out positions for decking packs are clearly detailed on SMD decking layout drawings. It is essential that all packs are loaded out in the correct position and orientation to avoid any H&S issues and to minimise manual handling required.

For further guidance refer to industry best practice sheet SIG.03, developed in conjunction with HSE. Visit [www.smdltd.co.uk](http://www.smdltd.co.uk) for download.

**A/1/01**

Project No: **XXXX**  
Project Name: **Sample Contract**

Load No: **Load 4**  
Load Name: **Phase A Level 1**

Product: **TR60+ 1.2 S350**

Qty		Length	Qty		Length
1	x	5,710	5	x	4,850
1	x	5,500	5	x	3,350
1	x	5,010	5	x	1,800

Weight of Pack (Tonnes): 0.65

**Note:** All packs to be loaded out with paint mark facing towards the setting out point as indicated on SMD decking layout drawings.

**SMD Pack Labels**

**Fig 3.0**

## Offloading, Hoisting and Storage

During offloading and hoisting, care should be taken to avoid damage to the decking sheets caused by excessive pressure from slings or chains. Decking bundles should **NEVER** be dropped (in any way) from delivery vehicles.

It is normal for the packs to be loaded directly from the delivery vehicle onto the steel frame. Whilst loading packs onto the steel frame consideration should be given to pack positions to avoid overloading.

When necessary to store decking packs at ground level for prolonged periods of time, the packs should be sat on timber bearers to avoid direct contact with the ground.

## Installation

### SMD Service

SMD provide a highly professional installation service. All operatives are fully trained and competent, with directly employed installation teams based throughout the UK.

Where decking is supplied on a 'Supply Only' basis it is the clients responsibility to ensure the works are executed in a safe manner. Any person/s contracted to either install or work in the proximity of decking should be made aware of the guidance and recommendations contained in this Technical Manual.

## Method of Installation

SMD products should only be installed by those competent and trained to do so. Specific reference should also be given to the BCSA Code of Practice for Metal Decking and Stud Welding, but as a minimum the following procedure should be followed.

- **Pre Start:** Prior to commencement of deck installation, a system of fall protection and safe access must be in place.
- **Weather conditions:** Decking bundles should not be opened if all the sheets in the bundle cannot be fixed or left in a safe condition at the end of the shift. Consideration must be given during periods of bad weather and any unfixed sheets should be secured at the end of each day by using a temporary strap secured to the frame or decking.
- **Supporting structure:** Refer to Fixings section (page 24) for guidance on minimum bearings.
- **Access to Level:** Wherever possible the decking installation should be planned to commence from the corner of a building or phase, so that the number of leading edges are limited.
- **Laying decking sheets:** Using the access provided, the installer should straddle the first bundle of decking to remove the banding. The first decking sheet will then be pushed out onto the steelwork to be used as a working platform from which to lay the remaining sheets in that bay. Decking sheets should then be lapped together, lined up and fixed into place once the adjacent bay has been laid and the troughs of the decking have been lined through.
- **Cutting / Notching:** Decking sheets are detailed to be delivered to site at the correct square cut length. Where decking ribs sit over beams that are to receive welded shear studs, around columns and other protrusions, notching is required. This should be carried out by trained operatives using petrol driven disc cutters with appropriate blade or plasma cutters.
- **Decking fixings:** Fixing of the deck and edge trim to the supporting steelwork will be carried out using low velocity powder actuated cartridge tools ('shot firing') or in certain circumstances using self tapping screws. Refer to Fixings section (page 24) for fixing type and spacing centres.
- **Side Laps:** The side laps of decking sheets are stitched together using self tapping screws, installed with 110v screw guns, provided to side laps at maximum 1.00m centres.
- **Sealing and finishing off:** Gaps up to 5mm are acceptable as they are not sufficient to allow concrete aggregate to escape. **Note:** The decking is not intended to provide a watertight finish and a degree of fines and water seepage can be expected from the panel ends and joints.
- **Edge trims:** Generally supplied in 3.00m standard lengths, each length should be fixed at the perimeter and straps fixed at centres as indicated in Edge Trim & Flashings section (page 25) with self-tapping screws.

# Guidance Notes

- Forming holes and openings:** Where trimming steels are provided, the decking sheets may be cut to suit the size of the opening and edge trim installed. Where there is no supporting steelwork the voids will need to be decked over. The opening should then be formed by the concreting contractor who will box out the opening prior to pouring the concrete. For further information refer to page 30 of this manual or SCI Publication P300.

It is the Steelwork Contractors responsibility to ensure the supporting structure is in a stable condition and adequately restrained prior to proceeding with the decking installation. Any additional support plates or angles required around columns, penetrations or splices should also be provided by the Steelwork Contractor – For advice on locations where additional support may be required, contact SMD Technical Department.

## Fixings

The minimum bearing requirements for the decking are 50mm on steelwork (this is increased to 60mm where sheets are to receive thru' deck welded shear studs) and 70mm on masonry or concrete.

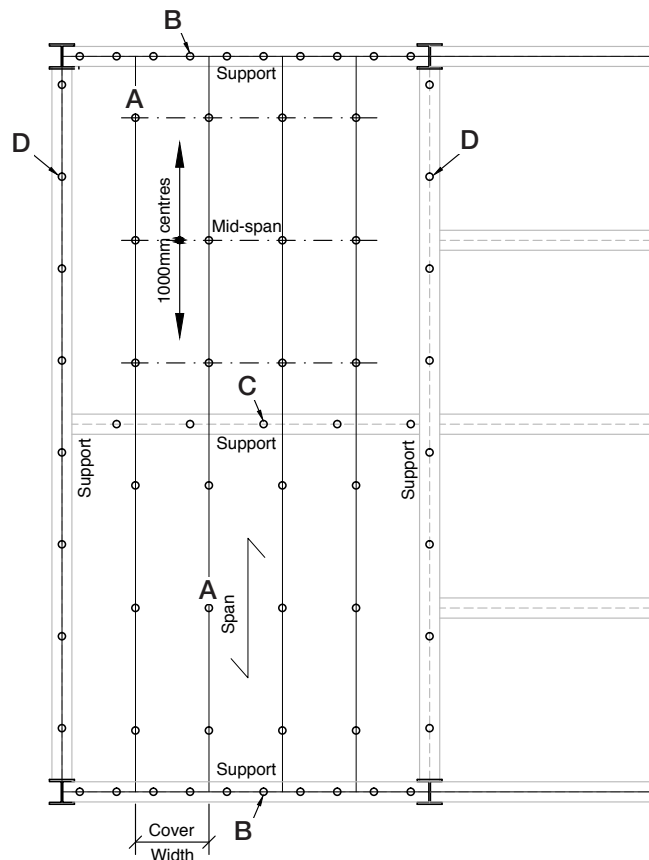
Recommended fixing types as follows:

- Where beams are to receive thru' deck welded shear studs Hilti X-U 15 (DAK) or Spit SDK9 shot-fired nails or similar approved
- Where no shear studs are specified, Hilti X-ENP 19 or Spit SBR 14 shot-fired nails or similar approved
- Fixings to masonry should be Drill & Hammer Anchors, Spit P370 or P560, or similar approved. Hilti X-SW or Spit CR9 shot-fired nails or similar approved (Refer Fig 4.1)
- Where shot-fired fixings are not permitted, self-drilling screws Fixfast DF12 5.5 x 38, Hilti S-MD55Z 5.5 x 40 or similar approved, can be used. Beam flanges will require pre-drilling where thickness exceeds 12mm.
- At side stitching of sheets and/or restraint strapping of edge trim, Hilti S-MD01Z 4.8 x 19 , Fixfast DF3 HEX 4.8 x 20 or similar approved.

Decking must be fixed at 300mm centres at each end and at 600mm centres over intermediate supports, or closest multiples to suit trough centres (for TR60+ 333mm and 666mm respectively).

Side stitching for R51, TR60+ and TR80+ deck is to be provided at maximum 1.0m centres from mid-span using self-tapping screws.

Where decking is required to provide lateral restraint and no thru' deck welded shear studs are specified, the fixing type should be checked by the engineer. (Refer to BS5950: Part 3 or Eurocode 4 and Table 2 on page 20).



- A = Stitching at side laps
- B = End of deck sheet
- C = Intermediate supports
- D = Side supports

Spacings (No. per sheet width)					
Product	A	B	C	D	Endcaps
R51	1000	300 <sup>(2)</sup>	600 <sup>(1)</sup>	750	✗
TR60+	1000	333 <sup>(3)</sup>	666 <sup>(2)</sup>	750	✓
TR80+	1000	300 <sup>(2)</sup>	600 <sup>(1)</sup>	750	✓

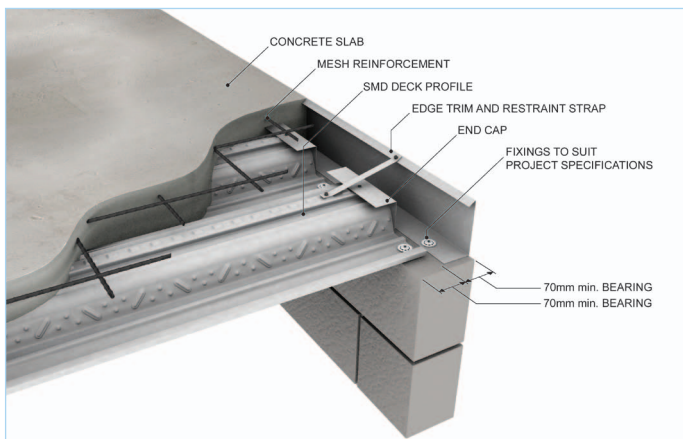
Spacings			
Product	B	D	Straps
Edge trim <200mm high	750	750	750
Edge trim 201 - 300mm	750	750	500
Edge trim 301 - 450mm	750	750	250*

\*Two sets of restraint straps are necessary (Refer Fig 16.8).

Fixing Layout – Quick Reference

Fig 4.0





**Decking to Blockwork Perimeter Fixing Detail**

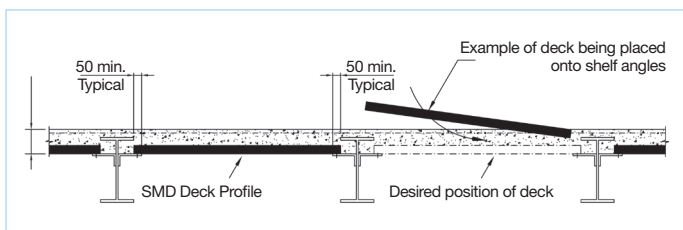
**Fig 4.1**

## Cartridge Tools

Fixing of decking and edge trim is typically carried out using low velocity powder actuated cartridge tools ('shot firing'). This provides a fast and efficient method of securing the decking sheets. The tools used are generally Hilti DX460 or DX76, Spit P370 or P560, or similar approved. All operators must be fully trained, competent to use these tools and at least 18 years of age.

## Decking on Shelf Angles (or bottom flanges)

Where decking sheets are supported on shelf angles or bottom flanges between beam webs, the shelf angles /bottom flanges should be designed to extend a minimum of 50mm beyond the toe of the beam top flange. This minimum dimension of 50mm is essential to enable the sheets to be physically positioned between toes of top flanges and a cartridge tool to be used to secure the decking into place (Refer Fig 5.0).



**Decking Bearing on Shelf Angles Detail**

**Fig 5.0**

## Concrete Encased Beams

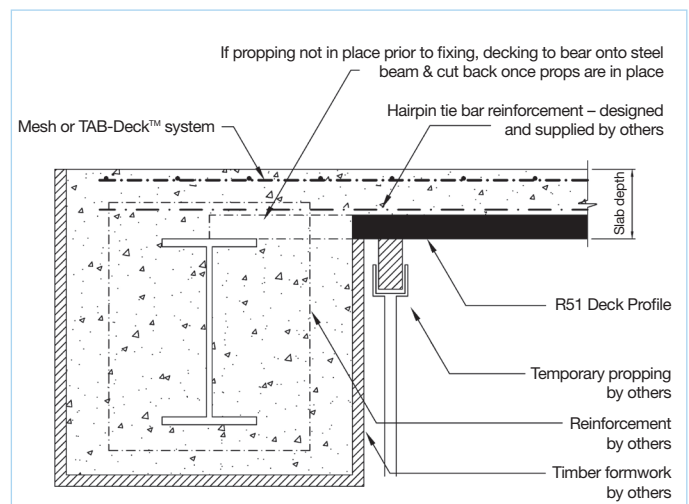
In some instances concrete encased perimeter beams may be specified as part of the fire design. It is recommended that the beam is encased to the top flange level off site, therefore enabling the decking to be installed to the beam top flange as normal.

Where it is not possible to carry out the concrete encasement off site, the following procedure is possible using our R51 profile only:

- Decking installed to top flange of perimeter beam as normal.
- The shuttering is then provided by others, this must be designed by the structural engineer to sustain the weight of

the decking, wet concrete and construction imposed loads to avoid the temporary propping requirement indicated in Fig 6.0.

- Decking is then cut back to the line of the shuttering, with temporary propping in place (if required).
- In this detail the decking will not contribute to the shear resistance of the finished slab. Hairpin/tie bar reinforcement in the troughs of the decking profile will need to be designed/ specified by the engineer.



**Concrete Encased Beam Detail**

**Fig 6.0**

## Decking Around Columns

Decking around columns is achieved by notching the deck into the web and sealing with tape/foam/flashing to minimise grout loss. Where columns are not framed by incoming beams, angle brackets (provided by the steel contractor) may be required to the relevant column face to support the free end of the decking.

## Edge Trim and Flashings

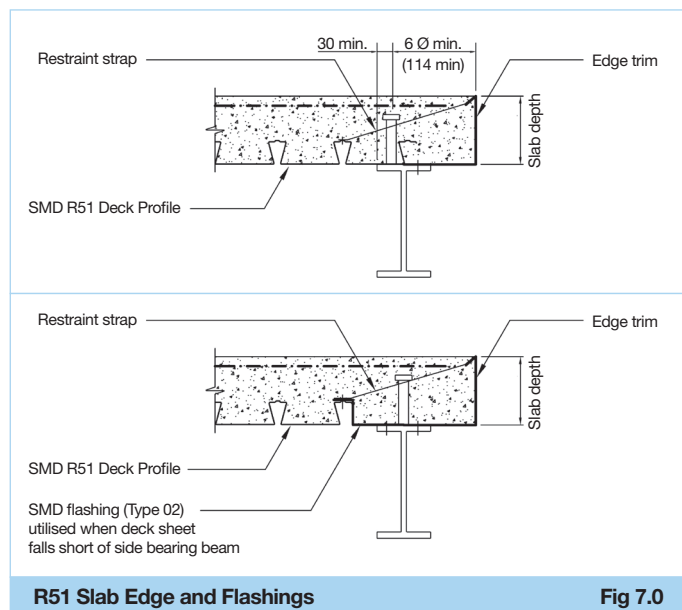
Galvanised edge trim is provided where requested around perimeter and void edges. This edge trim acts as permanent formwork only, to support the wet weight of concrete during construction.

Typically edge trim is supplied to site in lengths of 3.0m where it is then cut to suit. Edge trims are available in varying gauges; 1.0mm, 1.2mm, 1.6mm and 2.0mm. The material gauge is determined by the depth of the concrete slab and the extent of the slab overhang (Refer Table 3 on page 21).

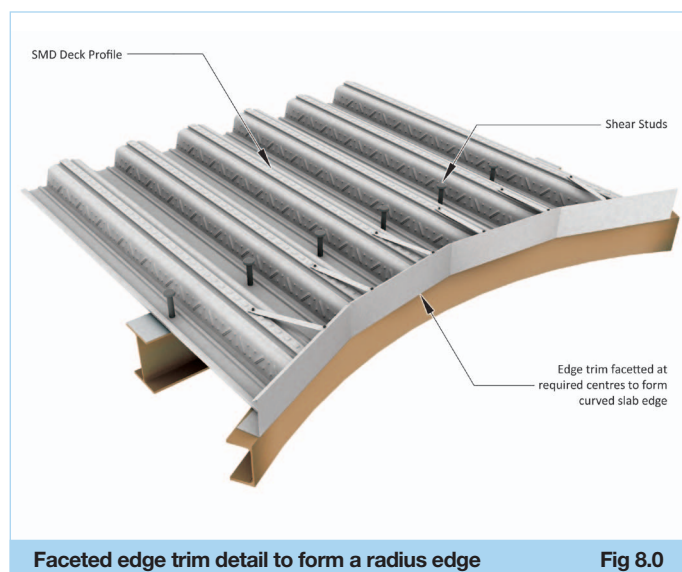
Edge trim can be either fixed to the end of the decking with self tapping screws (Refer Fig 2.0) or to the main supporting structure using similar fixings as used to secure the decking (Refer Fig 2.1).

Edge trim is to be fixed with a bearing of 50mm on steelwork or 70mm on masonry or concrete. It should be fixed at both ends and at 750mm centres along its length, with restraint straps fixed to the top edge at 750mm centres, or 500mm centres for slab depths of 200-300mm – (Refer Fig 7.0). For slab depths greater than 300mm consult SMD Technical Department.

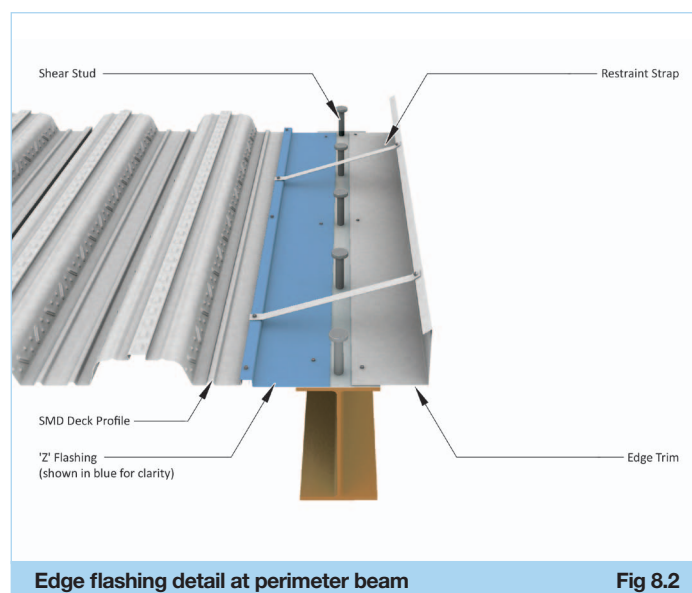
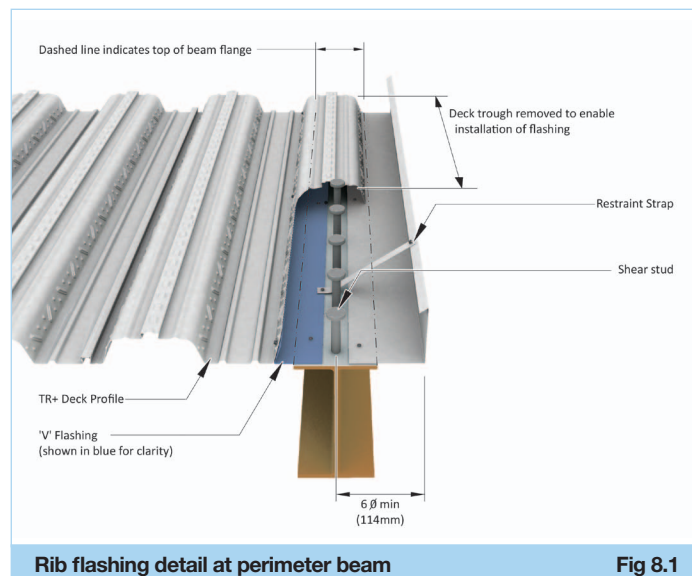
# Guidance Notes



Where edge trim is required to form a curve, straight lengths are provided to site and the edge trim is faceted on site to form the desired radius (Refer Fig 8.0).



At perimeter beams and intermediate beams parallel to the deck span (where shear studs are required), should the deck fall short or be positioned such that a trough is not located over the beam flange, galvanised mild steel flashings are provided to form a closure to the profile (Refer Figs 8.1 and 8.2). Flashings are available in 1.2mm, 1.6mm and 2.0mm gauges and are supplied to site in standard 3m lengths. The exact geometry and requirement for these flashings is detailed on SMD decking layout drawings where provided.



## Studwelding

### General

Shear studs are manufactured from low carbon steel with a minimum yield strength of 350 N/mm<sup>2</sup> and a minimum ultimate tensile strength of 450 N/mm<sup>2</sup> in accordance with BS EN ISO 13918. Standard 19mm diameter studs are available to achieve the following length after weld (LAW) 70mm, 95mm, 120mm, 145mm and 170mm. At the present time thru' deck welding of shear studs is restricted to 19mm dia studs or less.

Shear studs are welded through the decking trough onto the beam flange. Where possible, the shear studs should be placed on the centre line of the beam directly over the web to avoid burn through.

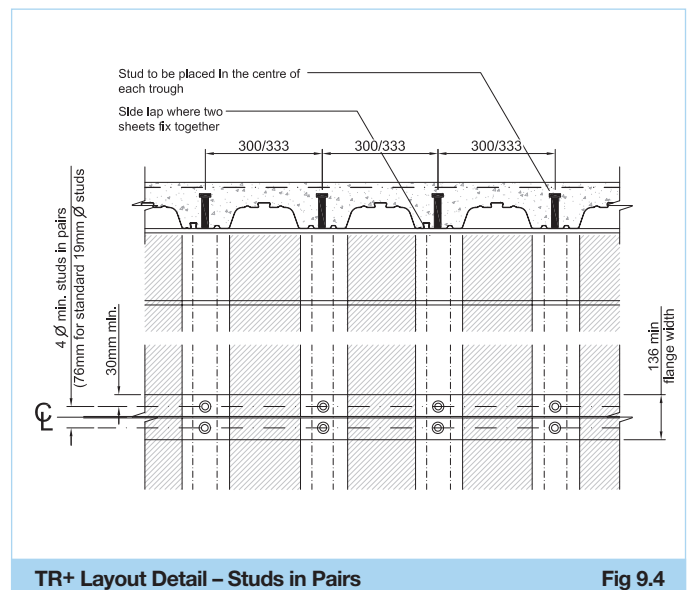
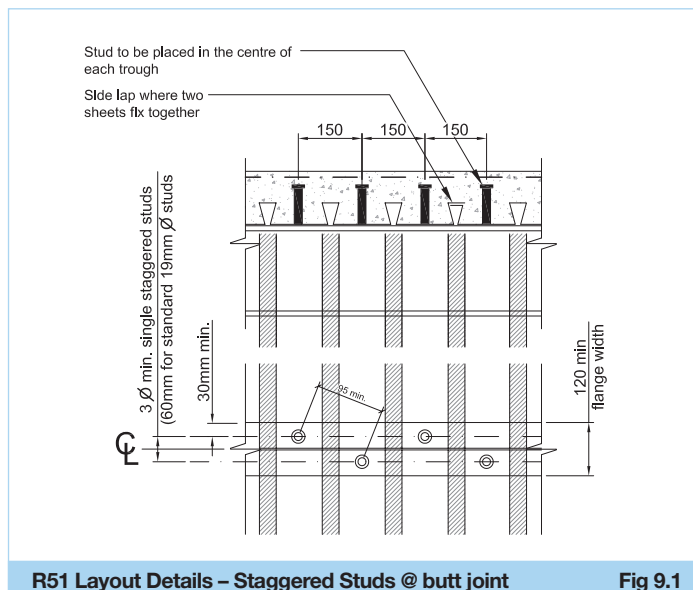
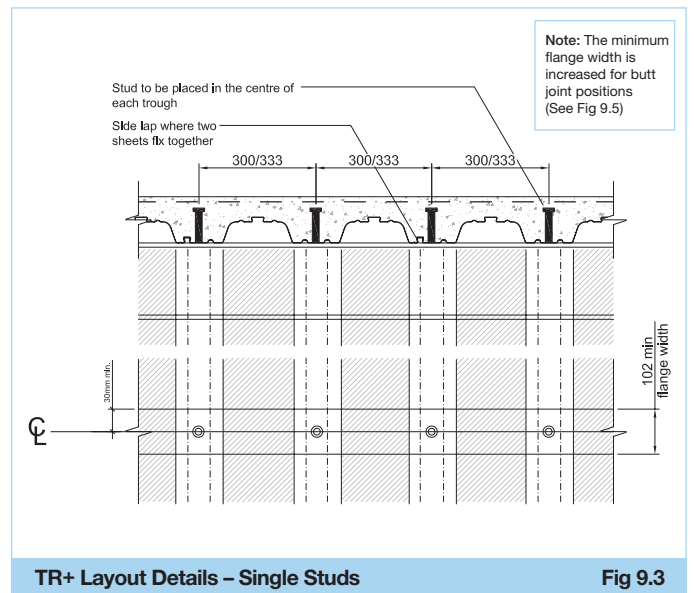
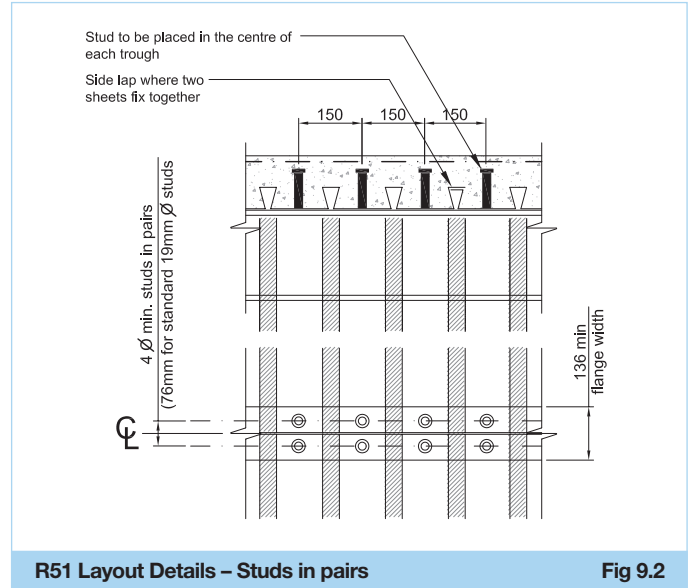
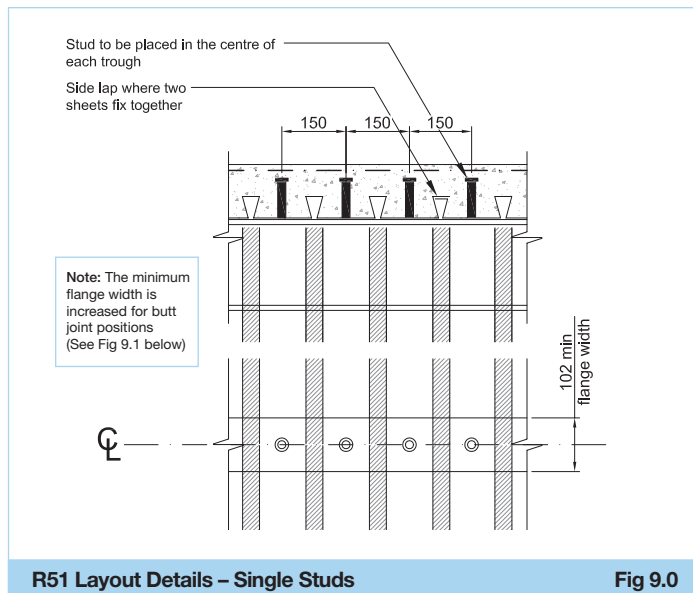
For a beam to be studwelded the flange thickness must be a minimum of  $0.4 \times \text{the stud diameter} = 7.6\text{mm}$  for standard 19mm diameter studs.

In some instances site welding may not be possible (i.e. due to fire hazard or galvanised beams). One alternative is the Hilti HVB shear connector, fixed to the beam with shot-fired fixings using a DX750 or DX76 cartridge tool. The technical properties of the Hilti HVB differ greatly from the standard welded shear stud and therefore, should not be used in place of traditional welded shear studs without approval from the structural engineer. With Hilti HVB shear connectors, for the same degree of shear connection far greater quantities are required when compared to that of welded shear studs.

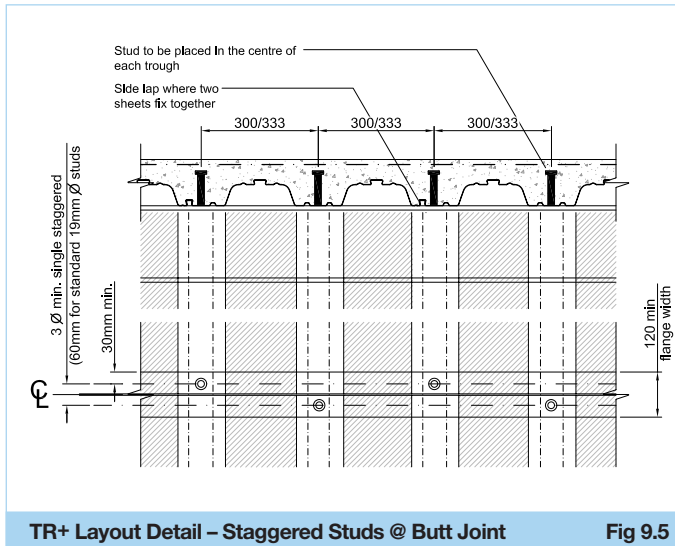
For further information on Hilti HVB Shear Connectors contact Hilti (UK) on 0800 886 100.

## Shear Stud Spacing

To ensure the most effective use of shear studs, the dimensions and configurations shown in Figs 9.0-9.5 should be used (In accordance with BS5950 Part 3 Section 3.1 or BS EN 1994-1-1).



# Guidance Notes



## Unpainted Top Flanges

Where beams are to receive thru' deck welded shear studs, the top flanges are to be free from any type of paint, grease, loose rust or any other coating, as this prevents effective welding and will subsequently reduce the final weld strength. Refer SMD Best Practice Sheet DATA/13 available at [www.smdltd.co.uk](http://www.smdltd.co.uk) for further information.

## Studwelding Equipment

Studwelding is undertaken using purpose built mobile studwelding plant, operating Nelson rectifiers and diesel generators of up to 250 KVa. The plant measuring 7.0m long, 2.5m wide and 4.0m high, requires access to within 6.5m of the steel frame to enable it to be safely earthed. The distance between the generator and the stud welding tool is restricted to a maximum of 80 metres. Where site logistics prevent access to within 6.5m of the frame, additional steel angle (approx. 50mm x 50mm) will be required to achieve earthing. Contact SMD contracts team for further guidance.

Static generators approximately 3.0m long, 2.0m wide and 2.0m high, weighing 6 tonnes can also be provided as an alternative. Where a static generator is required, it should be positioned in a well ventilated area and consideration should be given by the Structural Engineer to its location to avoid overloading of the steel frame.

However, in many locations the more preferable option due to its low environmental impact is a 415 volt 3 phase (150 amp per phase) mains supply. Refer SMD Best Practice Sheet DATA/05 available at [www.smdltd.co.uk](http://www.smdltd.co.uk) for further information.

## Length After Weld

When installing shear studs the length after weld should extend at least 35mm above the top of the main ribs in the decking, therefore the minimum stud height after weld should be 95mm for TR60+ & R51 and 115mm for TR80+. The recommended minimum concrete cover to the top of the stud is 15mm, this should be increased to 20mm if the shear stud is to be protected against corrosion.

## Testing

At the start of a new shift a bend test should be carried out on at least the first two shear studs welded, this is to ensure that the welding procedure and current are correct. These studs need to be bent to an angle of 30 degrees from their original axis by placing a pipe over the stud and manually bending the stud in the direction of the span of the beam towards the nearest column. If any failure occurs, the equipment should be reset, replacement studs welded and tests repeated to ensure acceptable quality.

After welding, the ferrules will be broken away from the base of the stud to allow a visual inspection. The broken ferrules will be left on the deck to be absorbed into the concrete and treated as inert aggregate. Bend testing will then be carried out as described above, but to an inclination of 15 degrees (1 in 4). This bend test should be carried out on two studs per beam or 5% (whichever is greater). If a shear stud fails in any location, the studs on either side should also be tested. Any failing studs will need to be replaced.

When testing shear studs reference should be made to the manufacturers instructions, BS5950: Part 3: Section 3.1 or Eurocode 4, BCSA Code of Practice for Metal Decking and Stud Welding and National Structural Steelwork Specification.

## Health and Safety

The design, installation and completion of metal decking projects must be arranged so that the Health & Safety of the operatives undertaking the work, of other trades on site, and of members of the public is ensured.

A number of key factors are paramount in achieving this goal:

## Management & Supervision

Ensure supervision is experienced in metal decking and that a suitable qualification such as SMSTS is held. Pre-start visits allow agreement of programme, sequence and co-ordination with other trades. The planning and arrangement of deliveries to allow effective positioning on the steel frame (usually by the erectors) is essential in minimising issues with manual handling. Robust management of the workforce in relation to Safety, Quality and Production ensures safe completion. Handover procedures should be used to ensure works are complete for following trades.

## Documentation

All companies should have a framework of Policies & Procedures relating to the management of Health & Safety. SMD have developed a specific on site Health & Safety guide to assist operatives with trade specific guidance notes, available to download from [www.smdltd.co.uk](http://www.smdltd.co.uk)

Contract specific safety documentation, including Method Statements, Risk Assessments and COSHH data sheets are available for all hazards / activities associated with the handling and fixing of metal decking and associated accessories. The communication of this to the work force, ensures that all operatives understand the risks and preventative measures that have been



agreed. An initial toolbox talk on the method statement, followed by further weekly talks ensures procedures on site are appropriate to the ever changing construction environment. Records of inductions and all toolbox talks should be maintained.

Typical hazards associated with metal decking and associated preventative measures are:

- Falls from Height – handrails, safety nets, suitable access to level
- Hot Works – exclusion zones, removal of flammable materials, fire extinguishers
- Use of Cartridge Tools – competency and training, PPE
- Hand Arm Vibration – management procedures
- Noise – PPE, management procedures, suitable work equipment
- Cuts to Hands – PPE
- Electrical Equipment – maintenance and 110v tools
- Falling Materials from Height – trim and tool tethers, loading out procedures
- Removal of Waste – skips, loading bays etc.
- Adverse Weather – management control

## Personal Protective Equipment (PPE)

Task Specific PPE will be detailed in Risk Assessments, however the minimum requirements are:

- Hard Hat to BS EN 397
- Safety Boots with heavy duty steel toecap and steel mid sole
- Hi Vis clothing to BS EN 471 Class 1
- Cut Resistant Gloves to BS EN 388 – Reflex K+ Kevlar Coated
- Hearing protection to BS EN 352-1
- Tinted Welding Goggles
- Eye Protection to BS EN 166 class 1 – clear lenses for cutting/shot firing, smoked lenses for stud welding

## Protection of Falls from Height

In accordance with the Work at Height Regulations 2005 and given that for metal deck installation 'avoid work at height' and 'use work equipment to prevent falls' is not reasonably practicable, all contracts need to adopt a system of work that 'minimises the distance and consequence of a fall'. Methods of fall arrest used are safety netting for steel frame structures and airbags or similar for all other situations. Where safety netting is provided by SMD, this will be undertaken by FASET trained personnel. The contract specific method statement and risk assessment will detail the preferred methods for both fall arrest and installation.

## Trained and Competent Workforce

Ensure that all operatives have received manufacturers training in the use of cartridge tools and together with that for abrasive

wheels, stud welding equipment, fire safety training and have achieved the appropriate level of CSCS qualification. Safety netters will be FASET trained and hold IPAF certificates and using MEWPs.

## Information and Guidance for Other Trades

### **DON'T land packs on the frame in the incorrect position –**

It is essential that the decking packs are loaded out in the position indicated on SMD's decking layout drawings.

**DON'T leave any decking sheet unfixed** – Unfixed decking sheets pose a danger to others on site, ensure that as areas are being laid that they are not left unattended until fixed. Also at the end of each day, any unfixed sheets in decking packs should be secured down.

**DON'T put heavy loads on unprotected deck** – Other trades must be made aware of the storage capacity of decking prior to concrete and the appropriate procedures for locating heavy loads on timbers laid on beam lines.

### **DON'T cut holes/voids in the deck before concreting –**

If additional holes are required to be cut into the decking before concreting, contact SMD Technical Department for guidance.

**DON'T heap concrete or drop from any height** – Following concrete trades must be aware of good practice principles when pouring on suspended metal decks, so that overloading is avoided and any propping requirements are in place.

For additional guidance on installation methods and safe working systems, refer to Further Reading section on page 38.

## Guidance for Following Trades

### Cleaning the Decking

Prior to the concrete being placed, the decking should be cleared by others of any debris, grease and/or dirt which could adversely affect the bond between the concrete and the decking. Typically, ceramic ferrules left over from the shear studding process can be left distributed over the decking surface and lost within the concrete pour. Final clarification should be sought from the project structural engineer (Refer Concrete Society – Good Concrete Guide 5 for further guidance).

### Damaged Decking

Care should be taken when utilising the decking as a working platform, or storing materials for following trades. As any damage resulting from this will require a site inspection and the damaged sheets may require replacement.

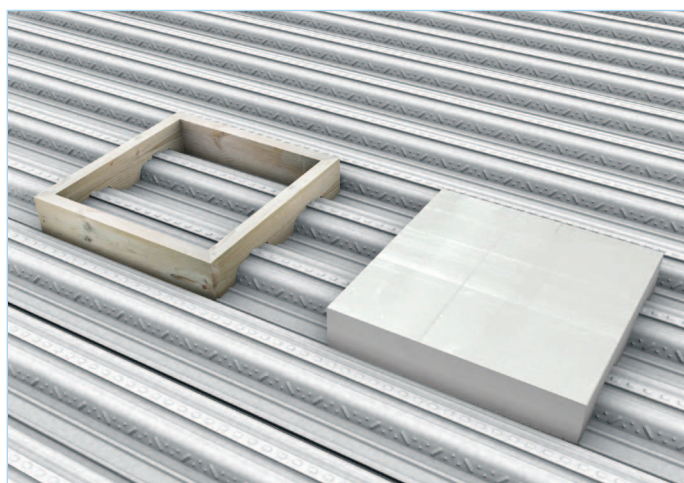


# Guidance Notes

## Forming Service Holes

When it is necessary to form service holes in a composite slab, following general rules are recommended. For openings at right angles to the deck span:

**1.** Up to 250mm (for R51) or 300mm (for TR+ profiles): Openings such as these require no special treatment. Prior to placing of concrete the opening is boxed out. When the slab has cured the deck is cut by others, using a non-percussive tool. (Refer Fig 10.0).



Options for Forming Voids

Fig 10.0

**2.** Greater than 250mm (for R51) or 300mm (for TR+ profiles), but less than 700mm: Additional reinforcement is required around the opening, SMD recommend the design be generally in accordance with BS8110 or Eurocode 2. The forming of the hole is as item 1 (Refer Fig 10.0).

Items 1 and 2 relate to holes in isolation and not to a series of holes transverse to the direction of span, which should be considered as one large void. In these cases the metal decking should only be cut after the slab has cured.

**3.** Greater than 700mm: Structural trimming steelwork designed by others and supplied by the steelwork fabricator, will be required.

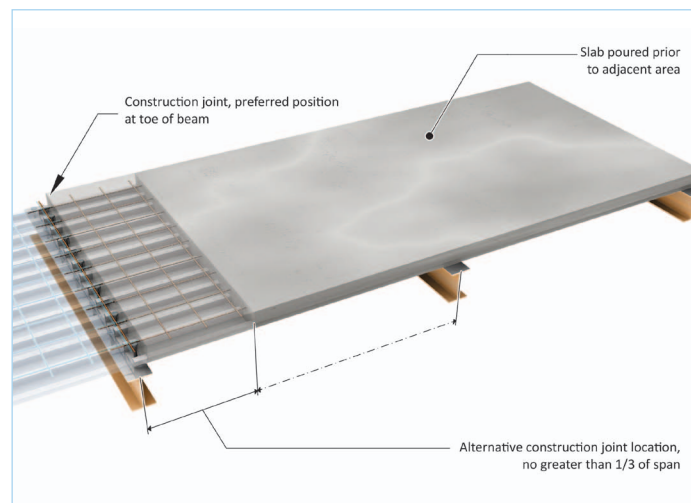
These are guidelines only and particular requirements should be checked by the project structural engineer. SMD's responsibility excludes the design of any additional framing or slab reinforcement for holes or openings.

When forming holes in the decking, consideration needs to be given to Health & Safety. Due consideration should be given to protect against falling through holes. If possible, handrail should be erected around the void. Alternatively, SMD can provide a temporary cover to the opening by decking over the void (unconcreted) for removal by others at a later date. For further guidance regarding service voids, including limitations for positioning and trimming reinforcement design, refer to SCI Publication P300: Composite Slabs and Beams using Steel Decking: Best Practice for Design and Construction.

## Construction Joints

With composite floor slabs, it is possible to achieve continuous concrete pours in excess of 1,000m<sup>2</sup>.

Where construction joints are required, these should always be formed as close as possible to the deck support over which the decking sheets are butt-jointed. The distance from the centre of the end support to the stop end should never exceed one-third of the span between the supports (Refer Fig 11.0).



Construction Joint Detail

Fig 11.0

## Concrete – 'The Complete Composite Floor Package'

Combining both the composite metal decking and associated concrete topping works as a 'Complete Composite Floor Package' can provide significant and tangible benefits.

SMD have an experienced management structure and specialist placing / finishing teams solely responsible for integrating the concrete topping element into the decking package ensuring that these benefits become reality.

Benefits include:

- Economic solution
- Single point responsibility
- Greater programme certainty
- Reduced conflict between two sub-contract trades
- Minimises site co-ordination
- Less contract administration
- Competence (concrete undertaken by people who understand decking)

Associated concrete toppings are co-ordinated in conjunction with the decking and shear stud installation operations, which not only maintains continuity of service for the client but also ensures a quick, seamless process for delivering 'The Complete Composite Floor Package'.

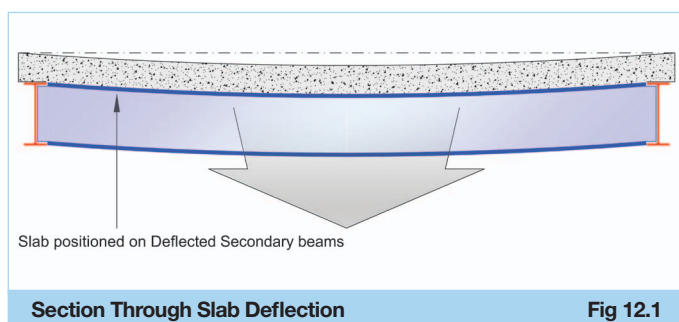
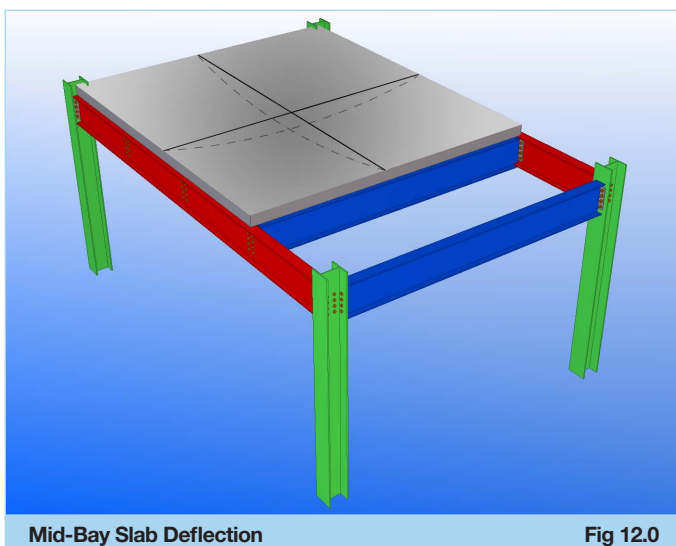
## Concrete – Key Considerations

### Temporary Propping

Temporary propping will be identified on SMD drawings where required. It is the responsibility of the Principal Contractor to obtain a temporary works design approval for any propping that is required and ensure the props are installed prior to concreting. Refer to page 19 for further guidance notes on this subject.

### Datum / Deflection

Concrete toppings installed on suspended upper floors cannot be laid to a defined datum due to deck and steel deflections. It is vitally important to understand when installing concrete on metal decking that the supporting structure (both deck and steelwork) will deflect under load during the construction process and this generally occurs for several hours following installation as the structure creeps under the weight of the concrete – Refer to Figs 12.0 and 12.1.



Thought must also be given to rolling deflection during the concrete topping installation process. As the pour progresses and the metal decking is loaded in accordance with our recommendations, the decking deflects in the loaded section, which as a consequence alters adjacent decking panels to some degree. It is impossible to then go back into these sections and try and re-level again, as more concrete results in more deflection. It should be understood that deflection in the structure is beyond the control of a flooring contractor and due consideration should

be given to this aspect by the Project Team when considering what effects this may have on supplementary trades / finishes (i.e. level to datum specifications are unachievable and therefore subsequent levelling screeds may be necessary to attain such requirements)

### Surface Finish

The required concrete finish should relate to the floor finishes being applied so as to provide a key, where required, or compatibility with any curing membranes being applied.

Normally a 'trowel' finish is applied to suspended upper floor concrete using a skip float (defined as U1 in 3rd edition of the National Structural Concrete Specification for building construction). Project Teams should note that this type of surface finish will leave fat ridges / trowel marks and occasionally reinforcement ripple visible in the final surface appearance and areas may require some minor remedial attention prior to receiving subsequent floor finishes.

Where a 'pan' or 'power float' finish is required, this can be provided although it must be specified in the context of the previous deflection section i.e. power floating will make the surface appear smoother and flatter but not level to datum.

### Surface Regularity

Generally, the surface regularity achievable for concrete toppings on metal decking is SR3 (+/-10mm under a 2m straight edge as outlined in BS8204-01). In some instances, depending on pour size, concrete volume and only when a full powerfloat finish is carried out, it may be possible to achieve a surface regularity of SR2 (+/-5mm under a 2m straight edge as outlined in BS8204-01). SR1 (+/-3mm under a 2m straight edge as outlined in BS8204-01) is not achievable.

### Concrete and Reinforcement

Concrete should be specified by the structural engineer so that it is suitable for the intended method of installation (e.g. pumpable) and finishing. Concrete with a minimum consistence class of S3 should be utilised. Mesh fabric and loose bar reinforcement (i.e. 'U' bars or straight bars in troughs) should be detailed by the structural engineer and in sufficient time to allow for procurement, delivery and installation. Mesh fabric reinforcement is intended as a method of crack control however, it will not eliminate cracking.

### Placement

SMD's recommendation, which is further explained in MCRMA Technical Paper 13 – Composite Slabs & Beams Using Steel Decking: Best Practice For Design & Construction, is to pour concrete toppings on metal decking to a constant thickness rather than to a datum as this...

- Reduces the risk of overloading the deck and possible collapse
- Eliminates additional cost for over consumption of concrete

# Guidance Notes

- Enables commitment to achieving a recognised finished surface regularity.

The recommended means of pouring concrete onto metal decking is by pumping. Where the concrete is being transferred into position using barrows or by lines of pipe for pumping, boards should be used to provide a load-spreading platform across the deck, thus reducing the risk of accidental damage to the profile.

The wet concrete must not be heaped, or dropped from a height exceeding 1.0m in any area during the laying sequence. When poured in the same direction as the decking span, concrete should be poured evenly over two spans starting at beam positions.

When concrete is poured in a direction at right angles to the span it should be placed first at the edge where a decking sheet is supported by the underlap of an adjacent sheet. This helps to ensure that the longitudinal side laps between sheets remain closed and hence minimises grout loss. The concrete should be well compacted using either a vibrating beam or plate vibrator, particularly locally around shear studs. Needle head vibrating pokers are not recommended as these encourage grout loss.

## Curing

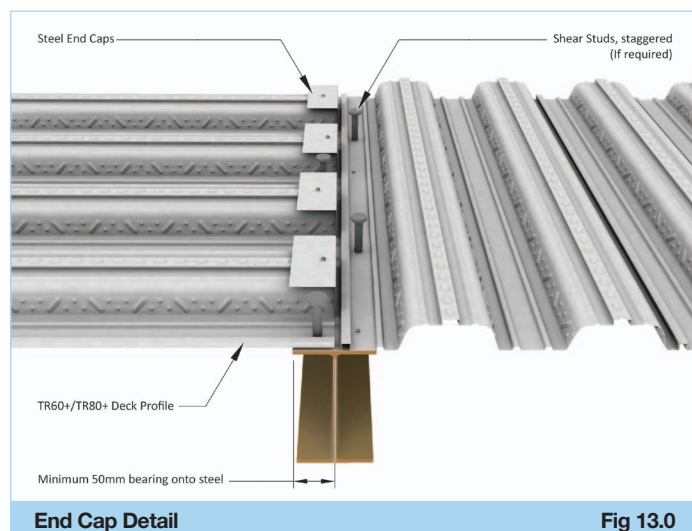
Curing should take place in line with good concrete practice. Ideally curing should be applied immediately after pouring / finishing. However, on large area pours where a trowel / skip float finish has been carried out it may not be possible to apply a curing membrane immediately following installation due to access and is therefore carried out the following day after installation. The use of spray applied curing agents are generally the most practical option.

## Minimising Grout Loss

Decking sheets are designed to butt join with the ribs lined through to avoid gaps and excessive grout loss. Gaps in excess of 5mm should be sealed using either tape or expanding foam. Where gaps are less than 5mm no special provision is required as minimal leakage is experienced.

Where trapezoidal (TR60+ or TR80+) decking sheets end at the perimeter of the building or at internal voids, the ends of the sheets are sealed with 0.7mm gauge galvanised end caps or polystyrene inserts. These end caps will also be required where you have a change in span direction (Refer Fig 13.0). Due to the small re-entrant rib size of the R51 profile, sheets are typically sealed using tape or expandable foam.

As decking is not intended to provide a fully tanked solution there will be small quantities of grout and water loss. If the soffit and trim is intended to be fully exposed in its final condition then consideration should be given, at tender stage, to the taping of all joints prior to concreting or jet washing the underside of steel work post concrete pours. Contact SMD Construction Department for further information.



## Other Considerations:

- Weatherproof Envelope – provide suitable weatherproofing to ensure that the pour area is free of sun, wind, surface water and driving rain. Provide an environment that is maintained at a temperature suitable for concrete placing and finishing. This may require the use of heaters/insulation materials to the top and underside of the slabs. Project Teams should note that areas insufficiently protected will be more susceptible to possible surface defects which are beyond the control of the flooring contractor.
- Wash Out Facility – provision of an adequate wash down area, either a hole in the ground or polythene lined skips, including a water supply for cleaning of plant and equipment.
- Hoisting Facilities / Loading Platforms – to facilitate plant/material access at all levels incorporating safety handrails/kick boards.
- Ground Conditions – hard standing area typically with minimum 500 KN/m<sup>2</sup> for a 32m sized mobile concrete pump.
- Access / Egress Facilities – at the start and end of each pour area.

**For further detailed guidance on the concreting process, refer to the following publications:**

Concrete Society's Good Concrete Guide 5: Composite Concrete Slabs on Steel Decking (Published February 2008)

MCRMA Technical Paper 13 – Composite Slabs & Beams Using Steel Decking: Best Practice For Design & Construction

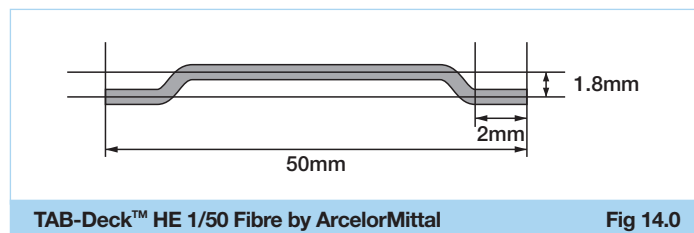


## TAB-Deck™ – Fibre Concrete

Developed in partnership with  
ArcelorMittal Sheffield Ltd



TAB-Deck™ fibre reinforced concrete should be installed, cured and finished in exactly the same way as non-fibre reinforced concrete. The only fibre that has been extensively tested for use on TAB-Deck™ projects is Arcelor Mittal Sheffield Ltd. HE 1/50 steel fibre (Refer Fig 14.0) at a dosage of 30kg/m<sup>3</sup>.



TAB-Deck™ HE 1/50 Fibre by ArcelorMittal

Fig 14.0

### Concrete Design

The specific mix design will always depend on the local materials available but should follow these basic guidelines:

**Cement** – minimum 350kg/m<sup>3</sup> of CEM I or CEM IIIA

**Aggregates** – maximum 20mm

**Fines Content** – minimum 450kg/m<sup>3</sup> of smaller than 200µ including cementitious content

**Water/Cement Ratio** ≤ 0.50

**Minimum Slump** – 70mm (before the addition of steel fibres and super-plasticizer)

ArcelorMittal Sheffield Ltd can provide advice on individual mix designs and check suitability for specific projects.

### Mixing

The best method for integrating the HE 1/50 steel fibre into the fresh concrete is by blast machines, available on request from ArcelorMittal Wire Solutions. This is a self sufficient operation where the steel fibres are blown into the preloaded ready mix truck allowing for easy homogenisation of the steel fibres into the concrete mix.

Alternatively, the steel fibres may be loaded via mobile conveyor belts or placed on the aggregate belt at the ready mix plant.

### Finishing

Where a power float finish is specified when using steel fibres, consideration should be given by the Project Team for an application of a fibre suppressant dry shake topping which would significantly reduce the likelihood of exposed/protruding fibres becoming apparent in the final surface finish.

## HE 1/50 Technical Specification

Wire dimension	1.0mm (+/- 0.04mm)
Fibre Length	50mm (+/- 2-3mm)
Number of Fibres per kg	3100 No
Total fibre length per 10kg	1575m
Tensile strength of drawn wire	1100 N/mm <sup>2</sup>
Rod wire C4D or C7D according to EN 10016-2	

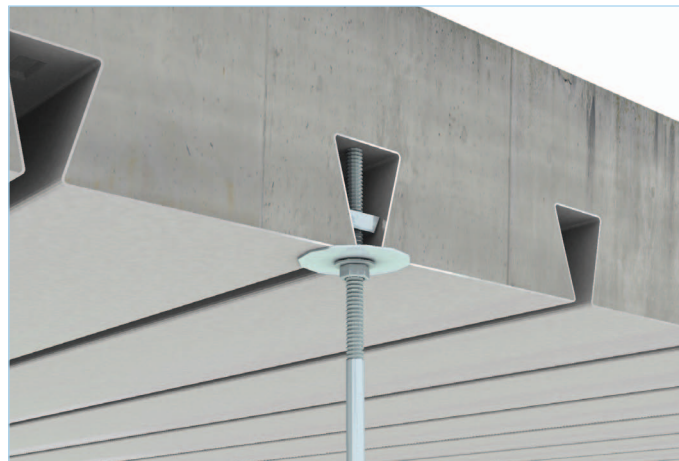
For further information and design guidance contact ArcelorMittal Sheffield Ltd or SMD for a copy of the TAB-Deck™ Design Guide. Alternatively, this can be downloaded at [www.smdltd.co.uk](http://www.smdltd.co.uk).

## Service Fixings Specification

**Please note: Soffit fixings are only to be installed/loaded after the concrete slab has gained specified design strength.**

SMD profiles offer the opportunity of utilising soffit fixings for services, ceilings etc. to suit drop rod thread sizes of 6mm, 8mm and 10mm for loads up to 2.0kN. To avoid possible localised overloading of the slab, fixings should not be locally grouped. As a general guide it is recommended that fixings be on a nominal 600mm grid. Design advice for closer groupings should be sought from SMD Technical Department as this depends on slab depths, loadings etc.

Refer Figs 15.0 and 15.1 for details.



R51 'Wedge Nut' Detail

Fig 15.0

# Guidance Notes

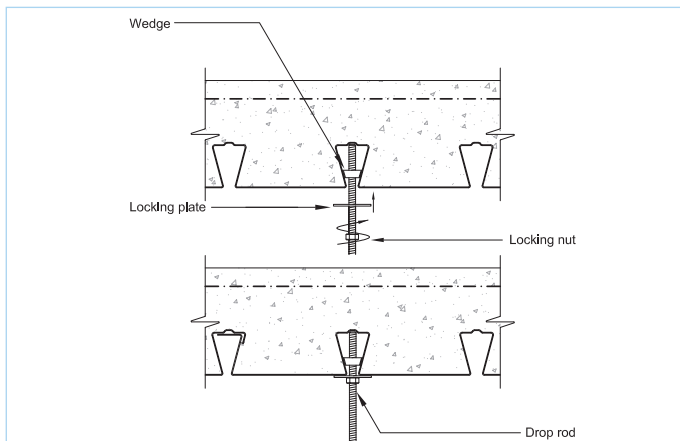


TR+ 'Wedge Nut' Detail

Fig 15.1

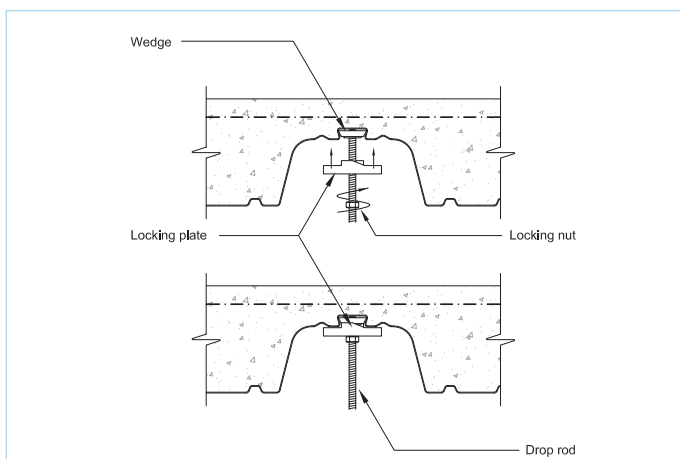
## Installation of Service Fixing

- 1 Ensure you have selected the correct wedge nut.
- 2 Thread wedge onto the required rod.
- 3 Insert wedge into the dovetail rib from below and rotate through 90 degrees so that the sloped face of the wedge bears on the decking rib.
- 4 The rod should then be finger tightened up to the roof of the dovetail or a washer set against the soffit of the decking.
- 5 Use mechanical tightening to finish, refer Figs 15.2 and 15.3.



R51 'Wedge Nut' Installation

Fig 15.2



TR+ 'Wedge Nut' Installation

Fig 15.3

## Availability

These fixings are available from Lindapter International Ltd on 01274 521444. The 'V' Nut is to be used on the SMD R51 profile and the 'TR60' Nut is to be used for both the TR60+ and TR80+ profiles. Guidance on the use of these fixings is available from Lindapter International Ltd – [www.lindapter.com](http://www.lindapter.com)

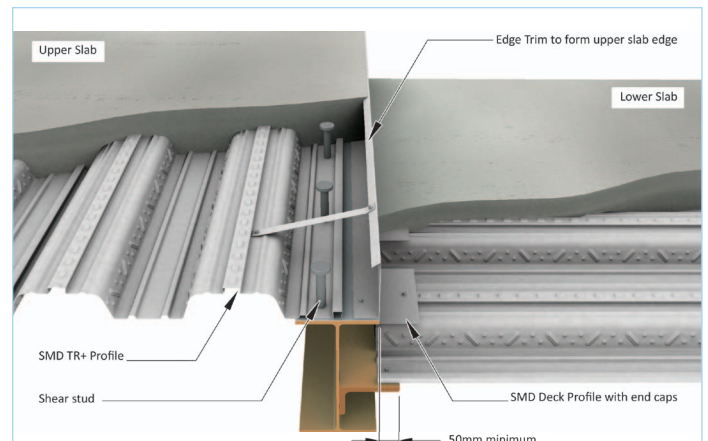
Other fixings and proprietary anchors are also available. These should be used in accordance with fixing manufacturers guidance. The approval of such fixings should be sought from the project structural engineer.

## Further Construction Details

This section covers further standard details that are often used to meet specific requirements and are not already covered in this document.

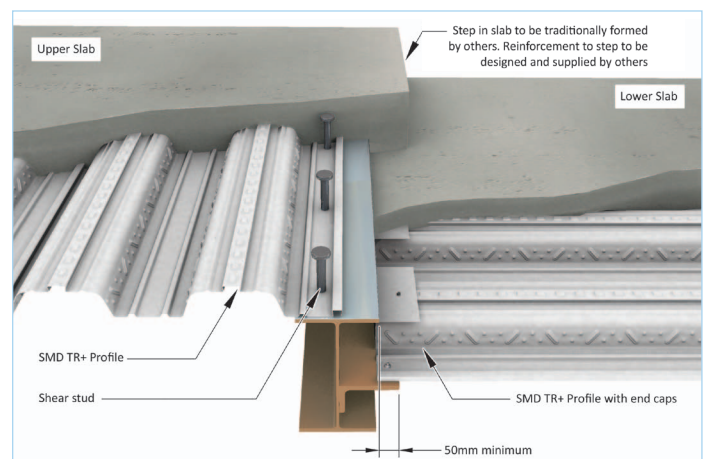
### Step in deck level at beam position

Where a step in the deck/slab level is required. This should be located at supporting beam positions, with angles provided to support the lower level decking. Depending on the difference in level and requirement for slab continuity, the higher level slab may be formed using standard edge trim (Refer Fig 16.0) or formed traditionally by following trades (Refer Fig 16.1). **Note:** The detail in Fig 16.1 would require a two stage concrete pour.



Step with high level formed with Edge Trim

Fig 16.0



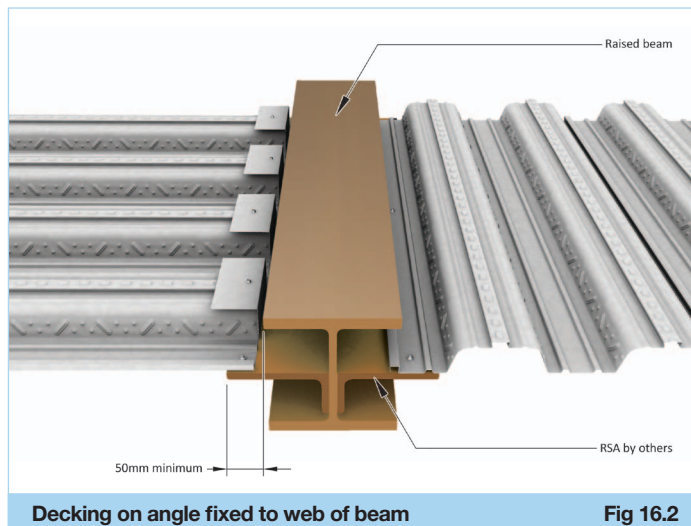
Step with high level formed traditionally

Fig 16.1



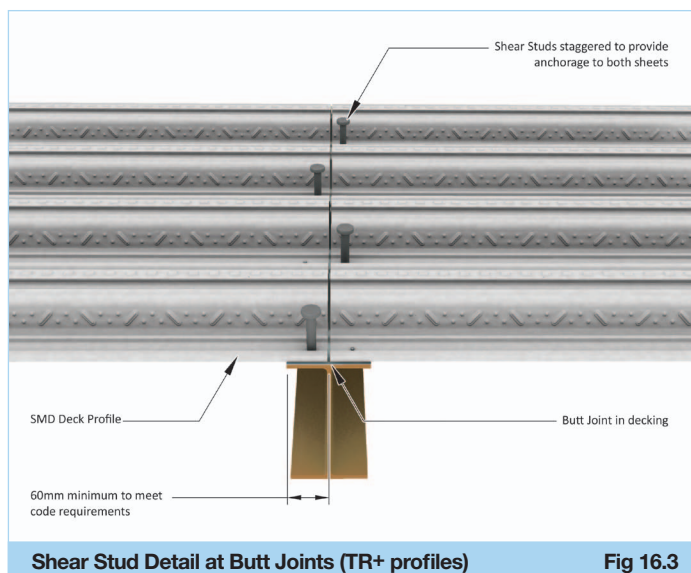
### Decking on angles to beam webs

To reduce the structural zone it is sometimes necessary to install the decking onto angles fixed to the beam webs (Refer page 25 and Fig 16.2). Where the decking spans parallel to the beam web, it may be possible depending on spacing of secondary beams to utilise a 2.0mm gauge flashing to avoid the requirement for a structural angle.



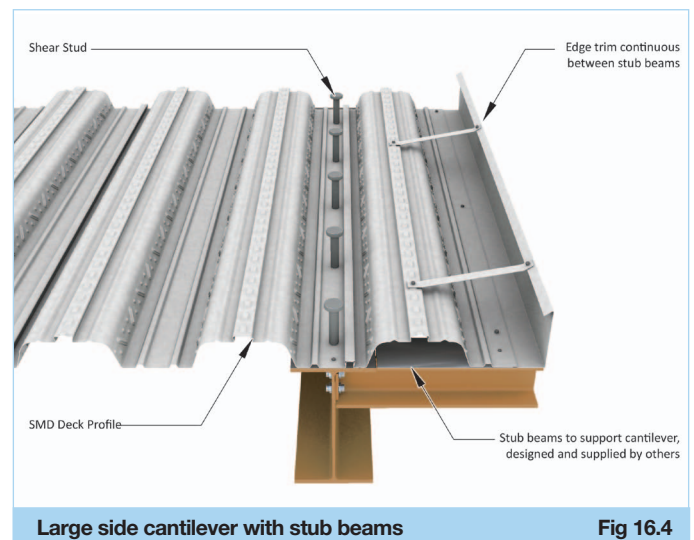
### 3D Stud Detail at Butt Joints

Pages 27-28 of this document shows the 2D standard details for shear stud configurations in accordance with BS5950 and Eurocode 4. Fig 16.3 is a 3D detail of the typical staggered stud configuration used at butt joints.



### Alternative detail for large overhangs

Where overhangs are required on edges parallel with the deck span, these are typically formed with standard edge trim (Refer pages 20 and 21). Where edge dimensions are in excess of figures shown in Table 3, temporary propping is required to the edge prior to installation. Alternatively, additional stub beams in line with secondary steels can be provided by the steelwork contractor. These large edges can then be formed in decking with trim stitched to the side (Refer Fig 16.4).



### Support detail at Existing Concrete / Core Walls

Shelf angles are required where decking spans up against existing concrete or core walls (Refer Fig 16.5)

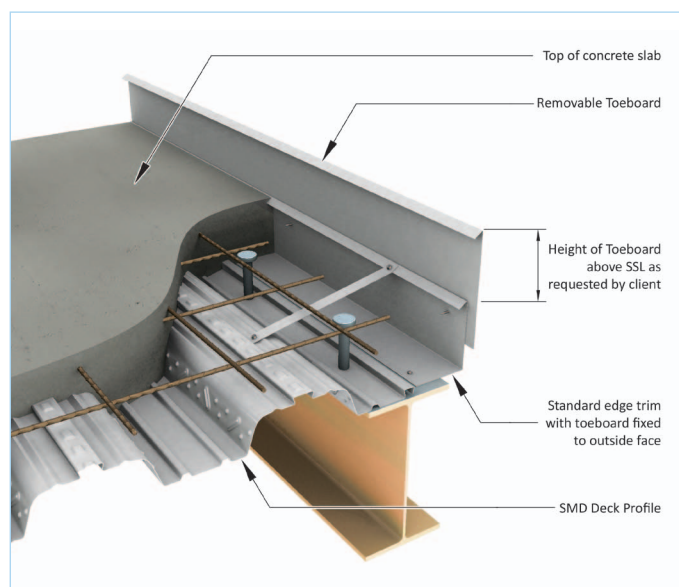


# Guidance Notes

## Perimeter Toeboard

Perimeter toeboard is usually provided as part of the edge protection system. However, in some instances it is necessary for this to be provided as an addition to the perimeter edge trim. When required, there are two common options:

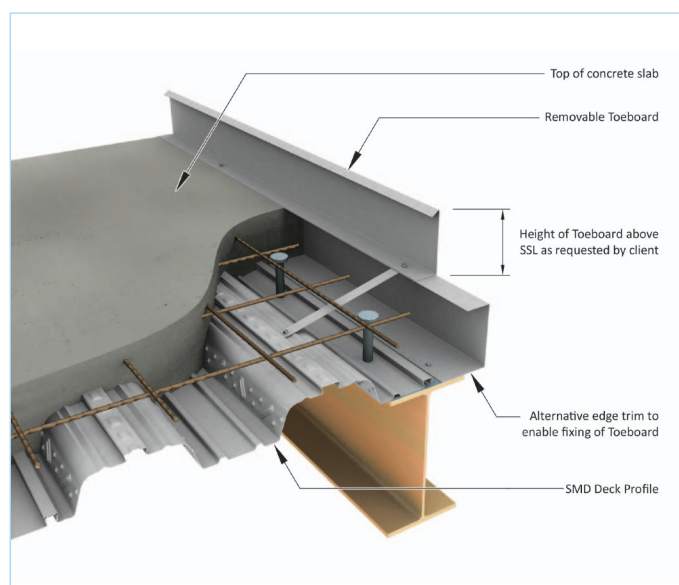
Fig 16.6 – the toeboard consists of a flat trim fixed flush to the outer vertical face of the edge trim, for removal by others.



Perimeter Toeboard fixed to vertical face of trim

Fig 16.6

Fig 16.7 – the toeboard is a secondary trim fixed to a horizontal leg provided along the top of the standard trim. This has limitations due to the access required to fix the edge trim to supporting steelwork, but is easier to remove upon completion.

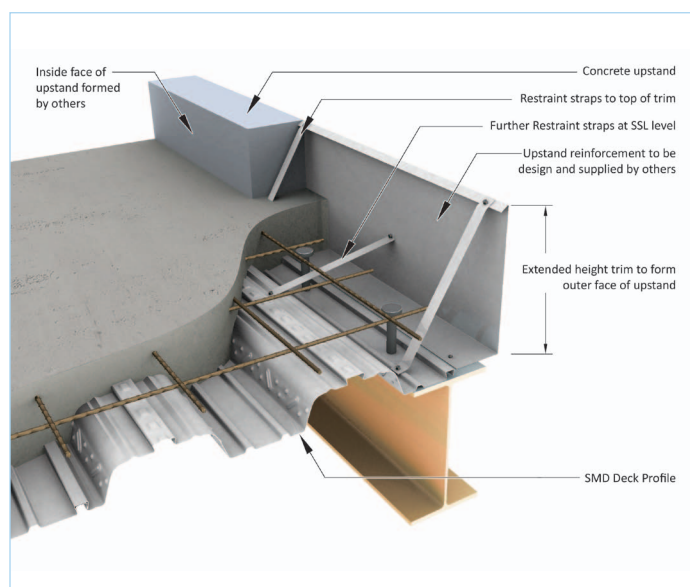


Perimeter toeboard fixed to top leg of trim

Fig 16.7

## Edge trim to form outer face of upstand

Although not a recommended detail, as it is easier for the outer and inner faces of perimeter upstands to be formed traditionally. In some instances where this is not practical, it is possible to provide extended height trim to form the outer face of the upstand (Refer Fig 16.8). The internal face of the upstand will still require traditional formwork by others. There are limitations on trim height and gauge, for further advice contact SMD Technical Department.



Edge trim to form outer face of upstand

Fig 16.8

## Not covered in this manual? Need further guidance

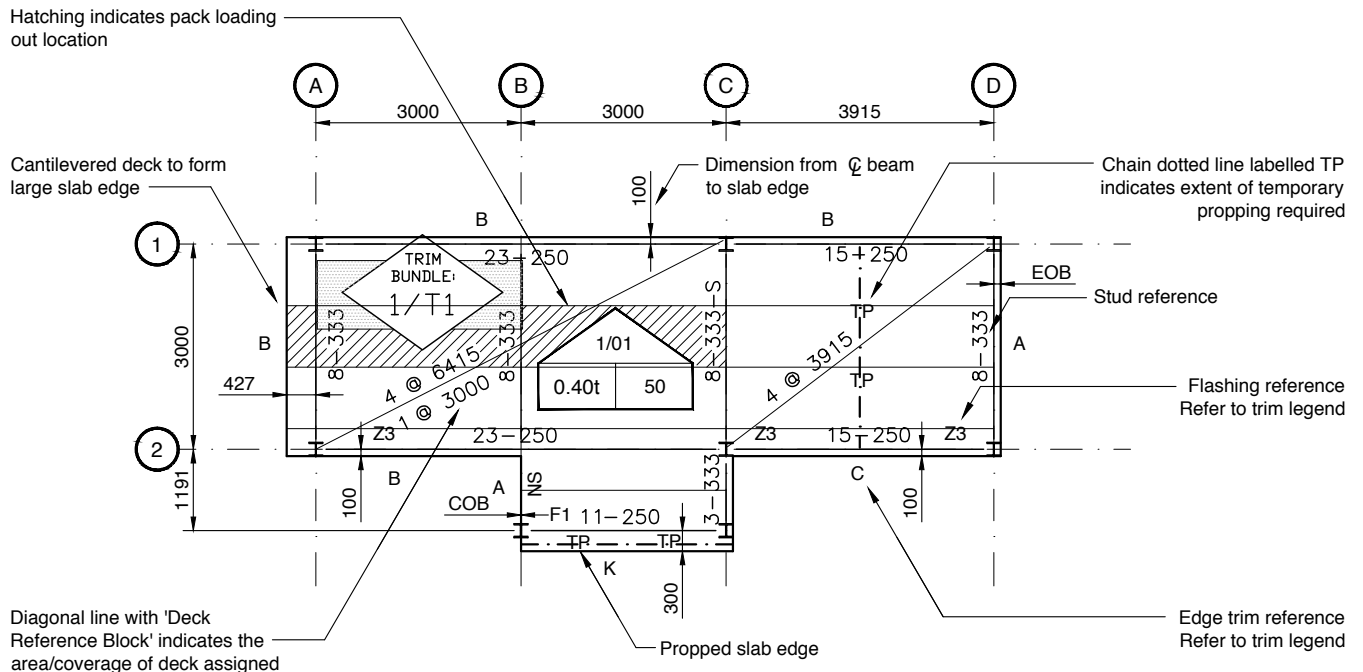
"We hope this Technical Manual has been a useful reference for your composite beam and slab design queries. Whilst every effort has been made in the preparation of this manual to ensure the most common technical queries are comprehensively covered, if the answer to your query is not sufficiently covered, we have a team of technical staff on hand to answer your design and detailing queries.

Answering your queries enables us to keep this manual and our website guidance up to date to ensure it covers the most common technical issues. If necessary, we can also attend your offices to provide a CPD presentation tailored to your learning objectives."

– SMD Technical Director

**Contact the SMD Technical Department on  
+44 (0)1202 718898 or email [technical@smdltd.co.uk](mailto:technical@smdltd.co.uk)**

## Typical Drawing Layout



### Deck reference block

No. of deck sheets      Sheet length  
10 @ 6000

### Stud reference block

No. of studs      Pitch / c/c's of studs  
11-250  
15-333-P 'P' indicates studs in pairs  
12-333-S 'S' indicates staggered studs  
22-333-R 'R' Remainder studs to be distributed starting at beam ends

### Deck pack reference symbol

Pack No  
Floor / Phase No  
1/01  
0.40t 50  
Pack weight  
SMD Site managers Ref

### Trim pack reference symbol

Trim Pack No  
Floor / Phase No  
1/T1  
FLASHING BUNDLE  
X/F1  
Flashing Pack No  
Floor / Phase No

### Abbreviated terms found on SMD drawings:-

EOB = Edge of beam	SOP = Setting out point
COB = Centre of beam	TOS = Top of steel
ecc = Eccentric (distance from grid or other)	SSL = Structural slab level
(This will indicate beam or SOP, <u>not slab</u> )	TP = Temporary Propping

Standard SMD Deck Drawing Layout

Fig 17.0

# Guidance Notes

## Further Reading

### Industry Best Practice – Steelwork and Decking

**BCSA Publication 37/04:** Code of practice for Metal Decking and Stud Welding

**BCSA National Structural Steelwork Specification (5th Edition)**

**MCRMA/SCI Technical Paper No. 13/SCI P300 REVISED EDITION.** Composite slabs and beams using steel decking: Best practice for design and construction

### Design Standards

**British Standard BS5950:** Structural use of steelwork in building  
Part 3: Design in composite construction, Section 3.1: 1990 +A1:2010 Code of Practice for design of simple and continuous composite beams

Part 4: Code of Practice for design of composite slabs with profiled sheeting

Part 6: Code of Practice for design of light gauge profiled steel sheeting

Part 8: Code of practice for fire resistant design

**Eurocodes and all relevant National Annex Documents:**  
BS EN 1994 – Design of Composite Steel and Concrete Structures

### SCI Publications

**SCI Publication 056: (2nd Edition).** The Fire Resistance of Composite Floors with Steel Decking

**SCI PN005-GB NCCI:** Fire resistance design of composite slabs

**SCI Publication 076:** Design guide on the vibration of floors

**SCI Publication 137:** Comparative cost of modern commercial buildings

**SCI Publication 285:** Benefits of Composite Flooring

**SCI Publication 322:** Acoustic performance of composite floors

**SCI Publication 331:** Design guide on the vibration of floors

**SCI Publication 354:** Design of floors for Vibration: A New Approach

**SCI Publication 359:** Composite Design of Steel Framed Buildings

**SCI Publication 372:** Acoustic Detailing for Steel Construction

### SCI Advisory Desk Notes

**SCI AD Note 150** – Composite Floors: Wheel loads from Forklift Trucks

**SCI AD Note 175** – Diaphragm action of steel decking during construction

**SCI AD Note 247** – Use of Composite Construction in an aggressive environment

**SCI AD Note 343** – Position of reinforcing mesh relative to stud shear connectors in composite slabs

**SCI AD Note 347** – Saw cutting of composite slabs to control cracking

**SCI AD Note 350** – Heating pipes in composite floors – effects on slab and beam design

**SCI AD Note 362** – Headed shear studs – Resistance and minimum degree of shear connection in composite beams with decking

### Industry Best Practice – Concrete

**Concrete Society Good Concrete Guide 5:** Composite concrete slabs on steel decking – Guidance on construction and associated design considerations





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Engineers in Steel Decking Systems

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