

# SUSPENDED CONCRETE FLOOR SYSTEMS

Windeck

Technical Guide



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## ABOUT WINDECK

Windeck is a prestressed concrete, manually assembled, suspended floor system comprising prestressed concrete beams and reinforced concrete tiles. Dimensionally, Windeck is based on a 450mm module (1.5 METRIFOOT)\*. The Windeck assembly results in an off-the-shutter tile top surface, off-the-shutter surfaces to the beams and a self-finished underside to the tiles. Other finishes may be applied if desired. Windeck accepts electrical cabling between tiles before grouting and tooling and is fire-resistant.

Two Beam depths and four tile types together with two types of end panels provide the components to meet most requirements.

Full structural information and component options are contained in this technical profile.

\*The METRIFOOT concept developed by Windeck is a modular dimensioning system which uses the metric system for measurement but draws on the human scale of the imperial system to coordinate building components at the design stage and on the building site. (1 METRIFOOT = 300mm). Details from Windeck.

## APPLICATIONS

The Windeck Suspended Floor System brings a new approach to suspended flooring and is a cost-effective alternative to in-situ concrete slabs and suspended wooden floors for many applications.

There are many situations where Windeck may be used. The following provides just a few possibilities.

- Use Windeck for suspended floors in new double-storey residential and commercial buildings.
- Use Windeck to add additional floors to existing buildings.
- Use Windeck to replace rotten or damaged suspended wooden floors in existing buildings.
- Use Windeck to install mezzanine floors in existing double volumes.
- Use Windeck as a suspended floor in heaving soil conditions. In this situation, Windeck may be directly supported on ground beams under the walls.
- Use Windeck to build external patios, balconies, etc.
- Use Windeck to convert existing accessible flat roofs into usable platforms.
- Use Windeck to install a suspended floor at ground level without the expense and problems of fill and slab methods. This application is particularly useful on steeply sloping sites where access presents problems or where rising dampness is endemic.

## COMPARATIVE ADVANTAGES

How does Windeck compare with some other alternative flooring systems?	Windeck	Rib and Block	Precast Slabs	In-situ Slabs
No shuttering required	X	X	X	
No reinforcing required	X		X	
No propping required	X		X	
No crane required	X	X		X
No in-situ concrete required	X		X	
No in-situ topping required	X			
No skim to soffit required	X		X	
No final floor finish required	X			
Pre-engineered*	X			
<b>Score</b>	<b>9</b>	<b>2</b>	<b>5</b>	<b>1</b>

\* Windeck is pre-engineered and requires no further calculations provided loads and spans are within the limits set out on page 7.

### Windeck and Sound Transmission

The following table illustrates the reduction in the transmission of airborne sound through Windeck tiles compared with other construction media.

Construction Media	Single Value Rw
Windeck Tile	46 dB
170mm Concrete Slab	53 dB
22mm Wooden Floor	24 dB
110mm Brick wall plastered both sides	45 dB

The values of R and Rw (as defined in ISO 140-3 and ISO 717/1 and on which the above table is based) were calculated according to the method of Price and Crocker (1969). For simplicity of presentation the results have been shown as a single value for each media.

## WINDECK TILES

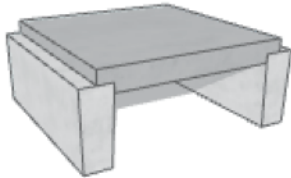
Windeck tiles are dimensioned on a 450mm module in both directions and are 50mm thick and reinforced to withstand a point load. The actual tile size is 435mm in both directions to allow for a 10mm joint between tiles. The sides of the tiles are sloped outwards allowing the tiles to be butted against each other in a longitudinal direction. The joint width is designed to accommodate a twin and earth electrical cable which would be placed before grouting. All 50mm thick tiles may be fitted with an electrical conduit and a connection box. A 20mm thick tile has been designed to match the standard tile in order to be laid on a concrete surface bed. 50mm tiles weigh 22.61kg each which equates to 111.65kg/m<sup>2</sup>.

## COLOUR RANGE

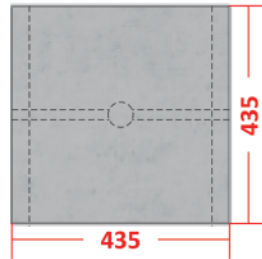


## DT 1 OR DT 1 E (ELECTRICAL)

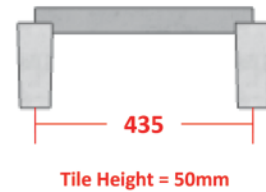
3D Image



Top View



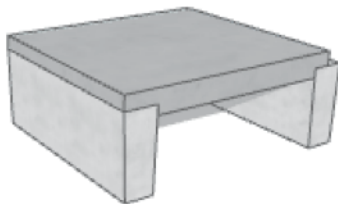
Side View



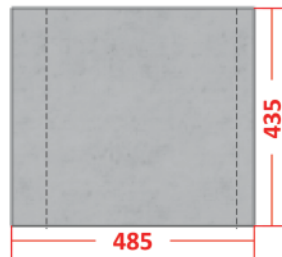
Standard tile, used most commonly. It is 435mm x 435mm x 50mm thick. It has a half beam width rebate on either side of it.

## DT 2 OR DT 2 E (ELECTRICAL)

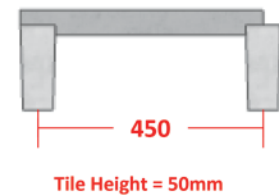
3D Image



Top View



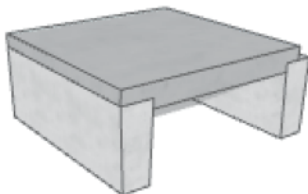
Side View



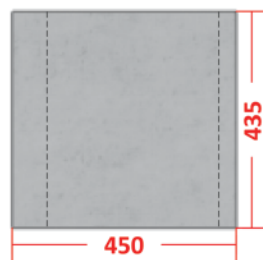
This tile is 435mm x 485mm and is an edge condition tiles, where the module is 450mm x 450mm, but the rebate is extended on one side to cover the entire beam.

## DT 3 OR DT 3 E (ELECTRICAL)

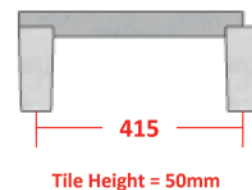
3D Image



Top View

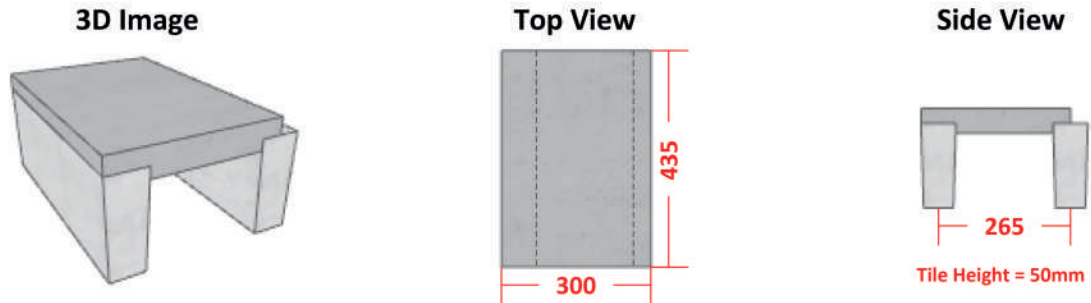


Side View



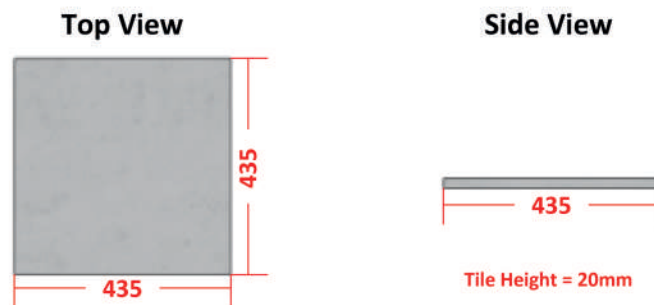
This tile is a 435mm x 435mm and is an edge condition tile, where the module is 450mm in the longitudinal direction and 415mm in the cross direction. The rebate is extended on one side to cover the entire beam. This allows the beam centre on the edge condition to be reduced to 415mm thus maintaining the tile module of 450mm in both directions.

## DT 4 OR DT 4 E (ELECTRICAL)



This tile is 435mm x 300mm and is an edge condition tile, where the module is 450mm in the longitudinal direction and the beam centres are 265mm in the cross direction.

## DT20

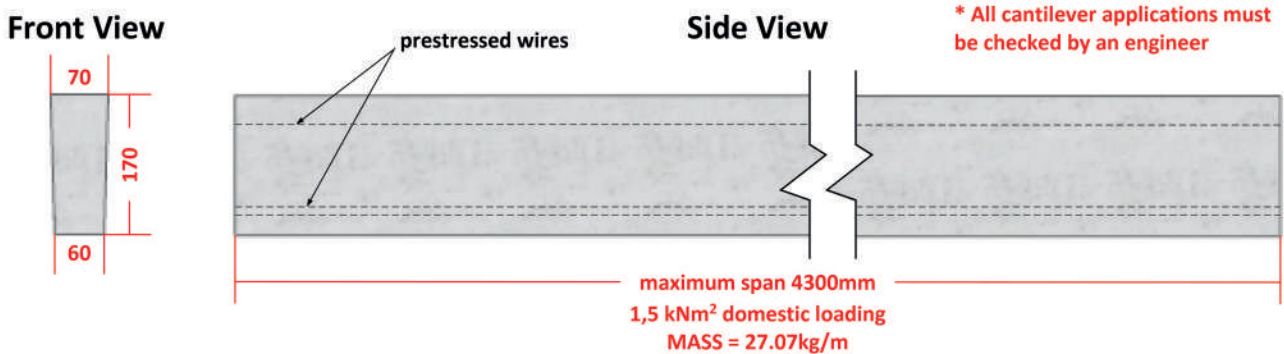


This tile is 435mm x 435mm x 20mm thick. Used for on slab or ground fill use.

## WINDECK BEAMS

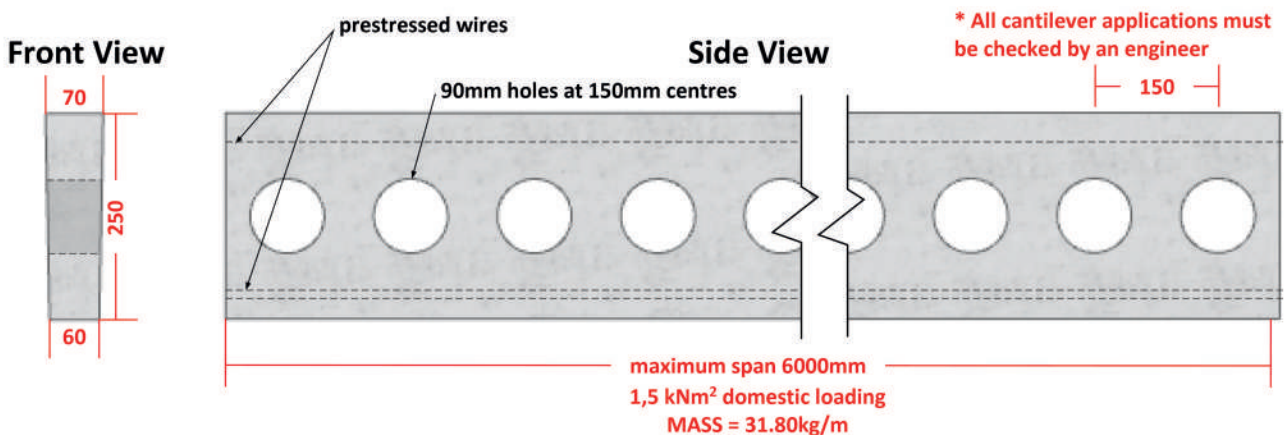
Windeck beams are pre-stressed concrete beams which are dimensioned in depth to coincide with 85mm brick coursing and in width are tapered from the bottom towards the top to allow for extraction from the mould. Beams must be laid with the narrow edge at the bottom, and the wide edge at the top to receive the Windeck tiles.

### DB170



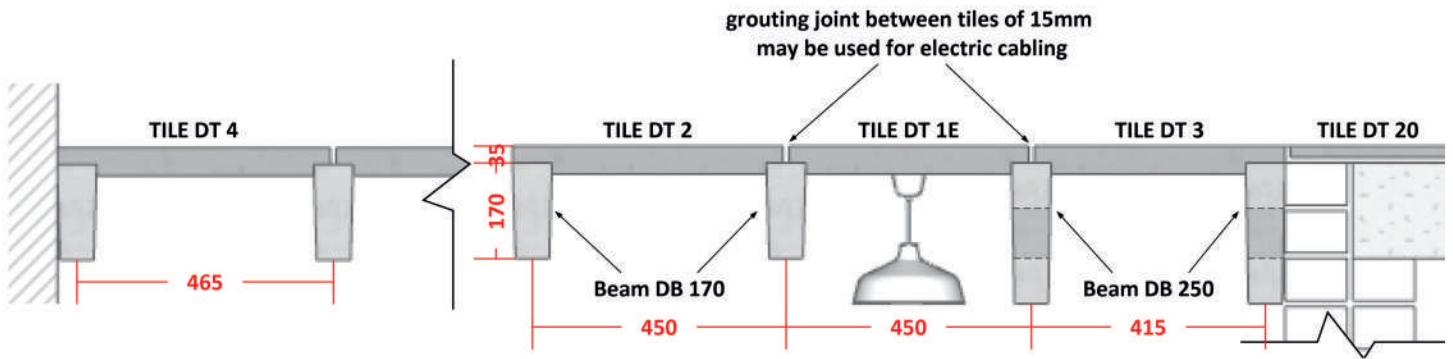
This beam is 170mm deep and designed to coincide with two brick courses. This beam weighs 27.07kg per meter which equates to 60.16kh/m<sup>2</sup> and is designed to span a maximum of 4400mm with domestic loading (1.5kN/m<sup>2</sup>). Total mass of Windeck floor including tiles equals 171.81kg/m<sup>2</sup>.

### DB250



This beam is 250mm deep and designed to coincide with three brick courses. It is perforated with 90mm diameter holes at 150mm centres to reduce mass and provide apertures for services and easy handling. This Beam weighs 31.08kg per meter which equates to 70.67kg/m<sup>2</sup> and is designed to span a maximum of 6050mm with domestic loading (1.5kN/m<sup>2</sup>). Total mass of Windeck floor including tiles equals 182.32kg/m<sup>2</sup>.

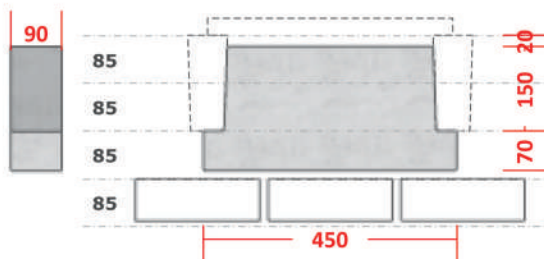
## VARIOUS TILE APPLICATIONS



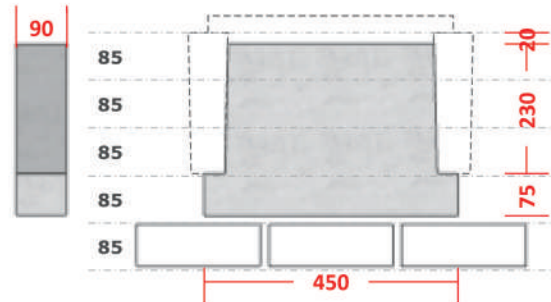
## BEAM FILL PANELS

Beam fill panels provide a neat finish between beams on unplastered blockwork or face brick walls. Panels may be cut to size to suit 415mm and 265mm beam centres.

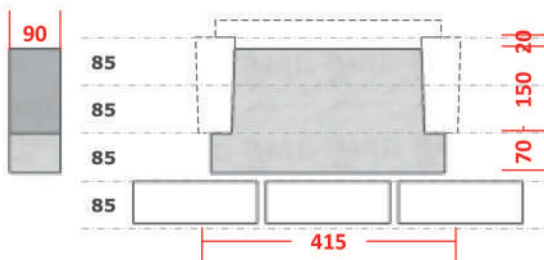
### BFS 170/450



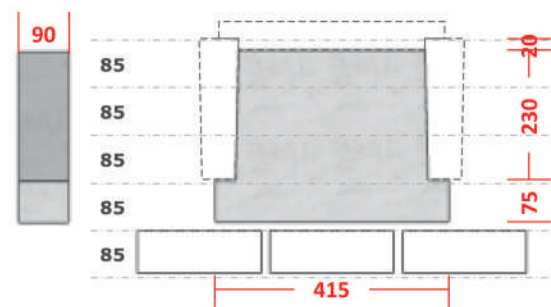
### BFS 250/450



### BFS 170/415

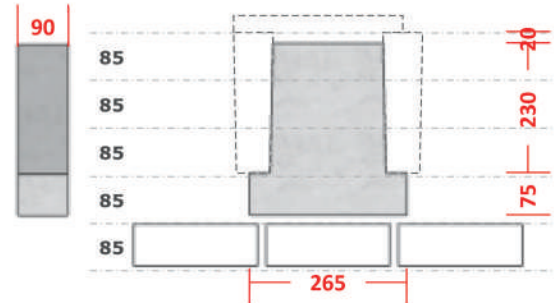
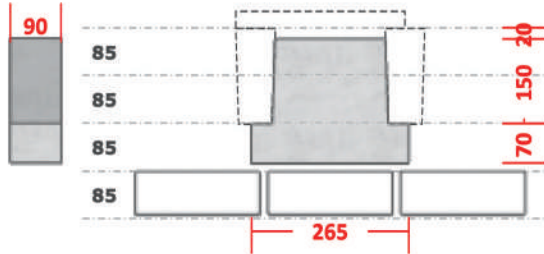


### BFS 250/415



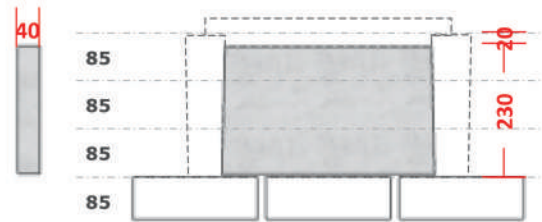
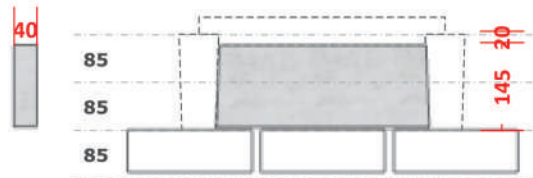
## BFS 170/265

## BFS 250/265

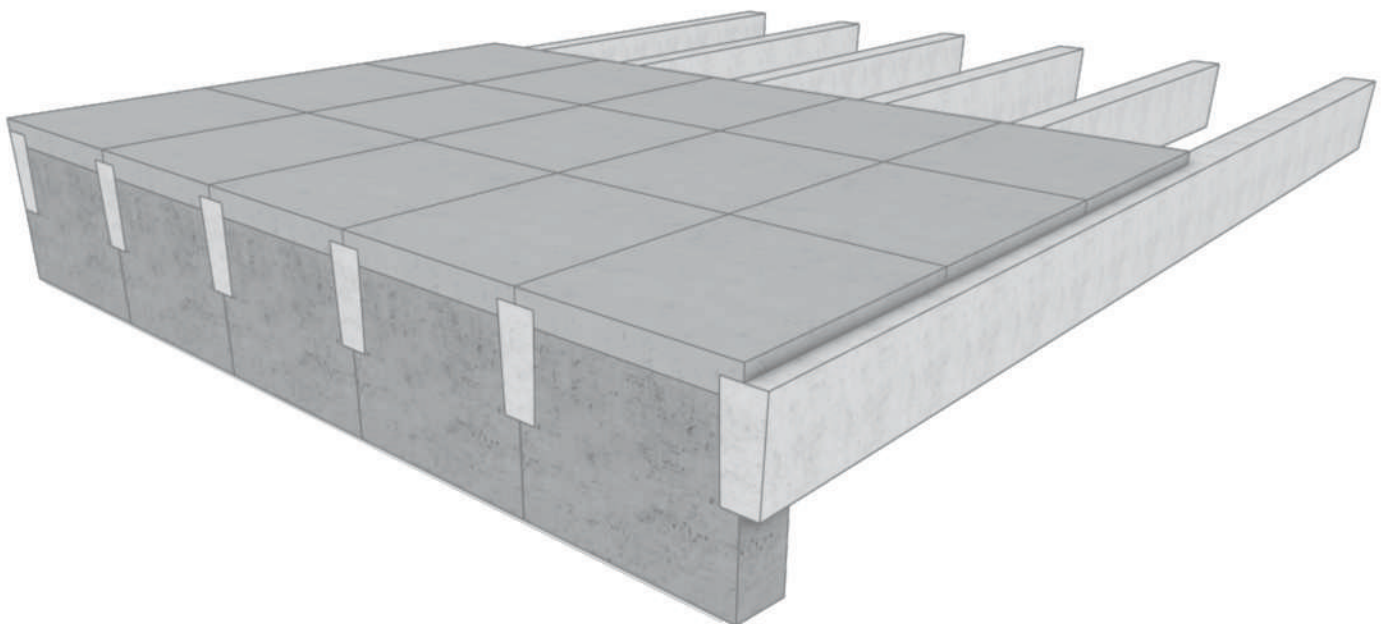


## BFP 170

## BFP 250



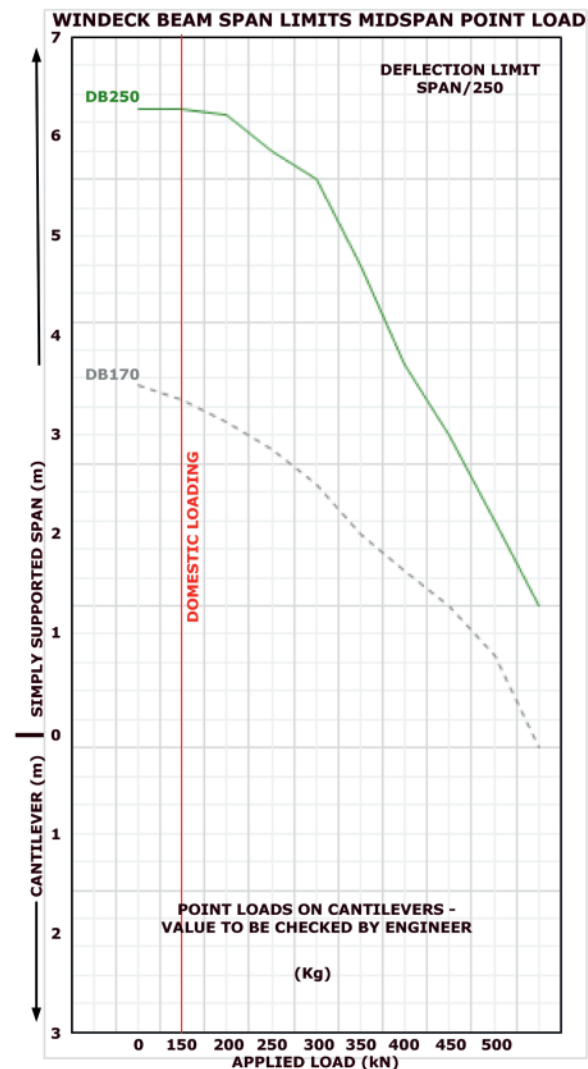
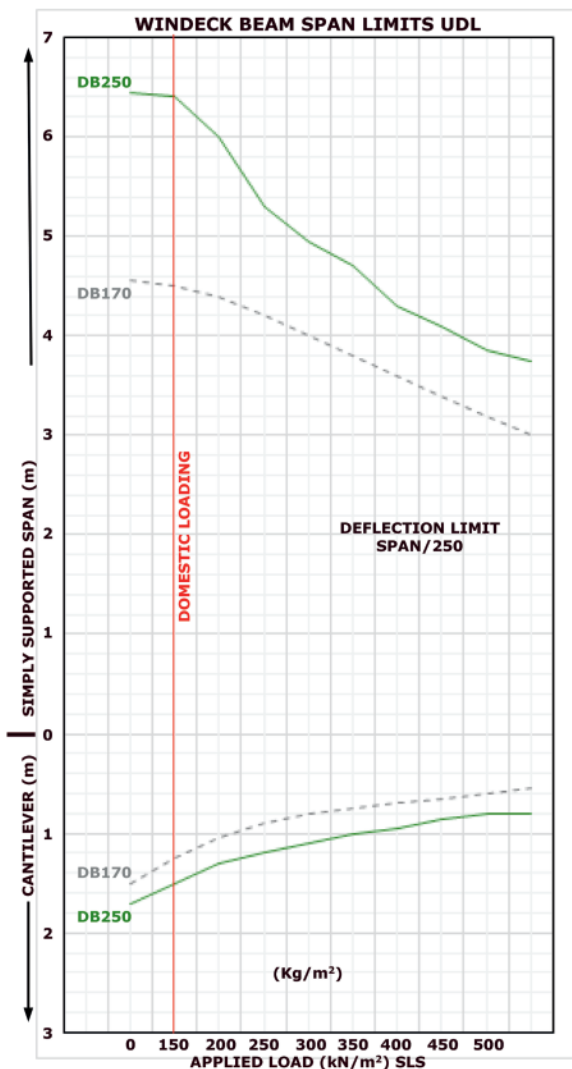
## 3D EXAMPLE



## IMPORTANT GENERAL CAUTIONS

For normal domestic situations, where loading does not exceed 150kg/m<sup>2</sup>, Windeck may be applied in accordance with the span and cantilever limits shown in the main diagram on this page. When using cantilevers, a minimum of 3 beams must be linked by an end trimmer steel beams. For applications involving loads exceeding 150kg/m<sup>2</sup>, the graphs, tables and notes on this page provide engineers with information for detailed design calculations. In all applications, support walls must be adequate to carry beam loads. This may require checking, especially over openings. Installation of damaged components or uses of the system which are at variance with this brochure or affect the structural integrity of the components invalidates the warranty. Windeck beams are prestressed. **If users wish to drill or nail beams, advice must be sought from TFSD beforehand.**

## ENGINEERING INFORMATION



### NOTE:

1. Self weight of Windeck Beams and Tiles is allowed for in the design graphs.
2. The design graphs and tables satisfy BS 8140: 1985 requirements for ultimate moment capacity and ultimate shear capacity, serviceability limit states for Class 2 members and deflection limits of span/250 for simple spans and span 180 for cantilevers.

## LIMIT STATE CAPACITIES FOR WINDECK BEAM ELEMENTS

DESIGN STRENGTH	LIMIT STATE	SAGGING MOMENT	HOGGING MOMENT	LIMIT STATE	SHEAR - UNCRACKED SECTION (M<mO)	SHEAR - WITH CRACKED SECTION (M<Mo) SAGGING MOMENT	SHEAR - WITH CRACKED SECTION (M<Mo) HOGGING MOMENT
<b>SOLID BEAM DB 170</b>	SLS	3.7 kNm	1.5 kNm	ULS	19.0 kN	Mo = 2.2 4.9 + 2.2 V/M kN	Mo = 0.44 3.9 + 4.4 V/M kN
	ULS	7.0 kNm	3.5 kNm				
<b>SOLID BEAM DB 250</b>	SLS	7.5 kNm	3.7 kNm	ULS	19.1 kN	Mo = 4.5 4.2 + 4.5 V/M kN	Mo = 1.3 3.3 + 1.3 V/M kN
	ULS	12.0 kNm	6.0 kNm				

## LIMIT STATE CAPACITIES FOR WINDECK TILES

DESIGN STRENGTH	LIMIT STATE	SAGGING MOMENT	SHEAR	MAXIMUM POINT LOAD ANYWHERE ON TILE
<b>50mm REINFORCED CONCRETE TILES</b>	SLS	N/A	4.5 kNm	5.2 kNm
	ULS	0.9 kNm	7.2 kNm	8.4 kNm

SLS = Serviceability Limit State

ULS = Ultimate Limit State

V and M = design shear forces and bending moment at the section being considered due to ultimate load conditions

The structural design information on the Windeck Suspended Floor System was prepared by HSC Consulting CC., East London, from whom confirmation of its compliance with the relevant statutory codes may be obtained.

## SPECIAL ENGINEERING CONSIDERATIONS

- Under cantilever conditions the tables and graphs assume loads sharing of beams via an end trimmer beam (a minimum of three beams is required to spread the point load). All cantilever applications and combined loading conditions not covered by the graphs must be checked by an Engineer.
- Because there is limited load sharing between elements, the point loading condition, as defined by SABS 0160 loading code, will often govern the design of the system.
- Limited load sharing between elements may also determine the suitability of the Windeck system for certain applications, e.g. parking areas.

## GENERAL NOTES

Windeck Beams are designed to interface with a variety of brick and block wall systems. The illustrations below show typical examples:

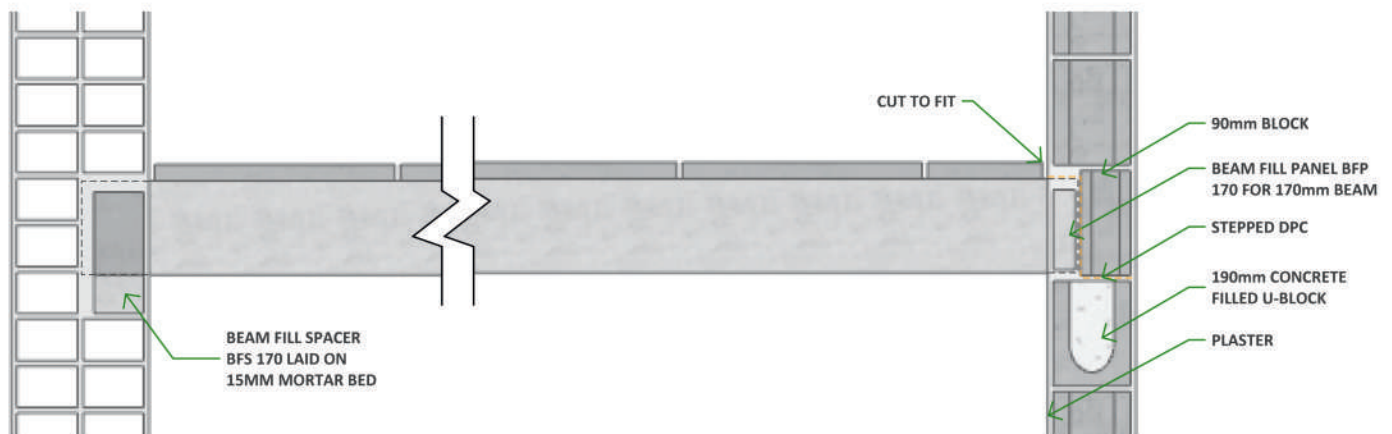
Various methods of filling spaces between beams may be adopted. Windeck provides two types of beam fill methods.

**1. Windeck Beam Fill Spacers (BFS Range)** designed for use with brick walls built to an 85mm brick gauge and;

**2. Windeck Beam Fill Panels (BFP Range)** designed for general beam fill purposes.  
in General a minimum bearing of 90mm must be used.

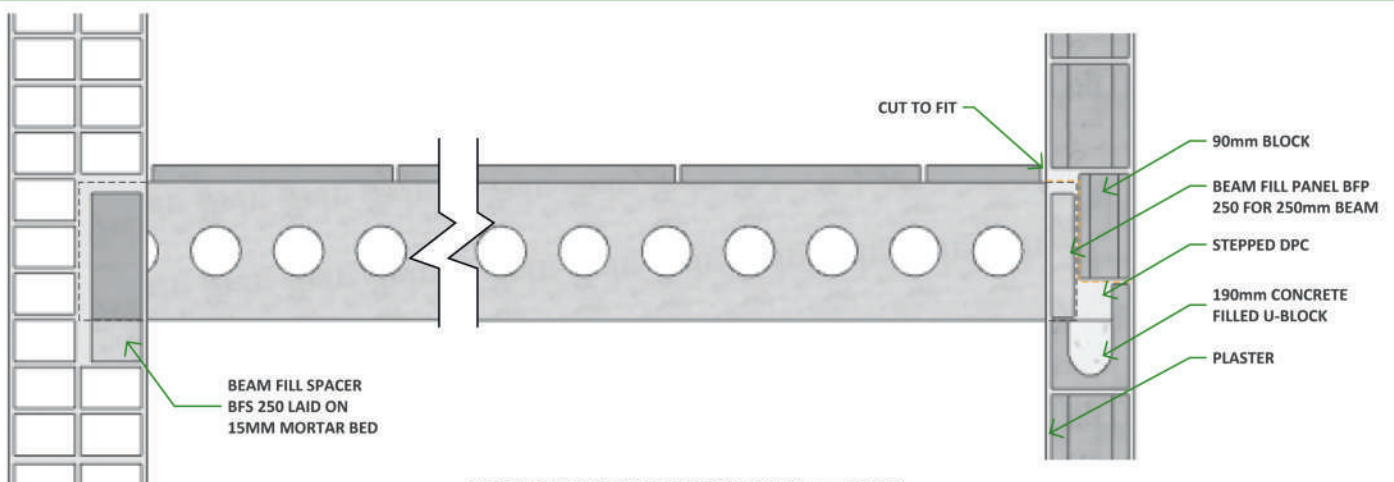
Concrete U-blocks carrying beams must be filled with concrete.

## BEAM DB170



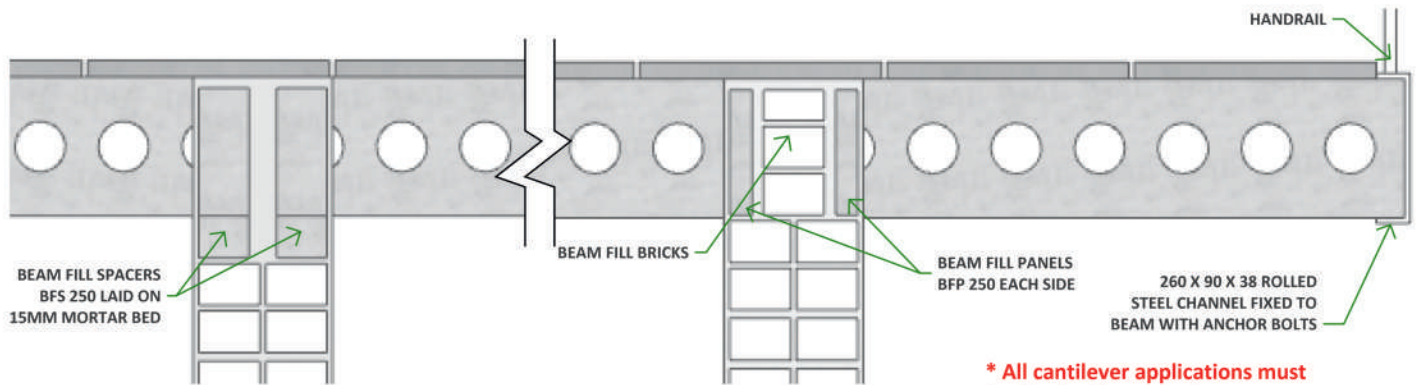
LONG SECTION SHOWING THE 170mm BEAM BEARING 90mm ON A 190mm BLOCK WALL

## BEAM DB250



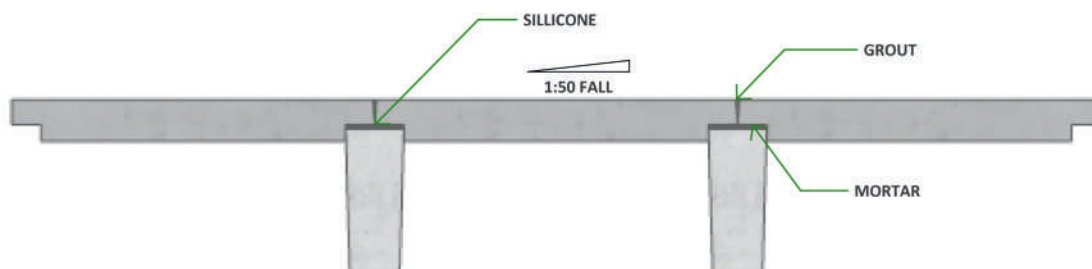
LONG SECTION SHOWING THE 250mm BEAM BEARING 90mm ON A 190mm BLOCK WALL

## CANTILEVER



LONG SECTION SHOWING THE 250mm BEAM CANTILEVERED OVER A 230MM BRICK WALL PLASTERED BOTH SIDES

## WATERPROOFING

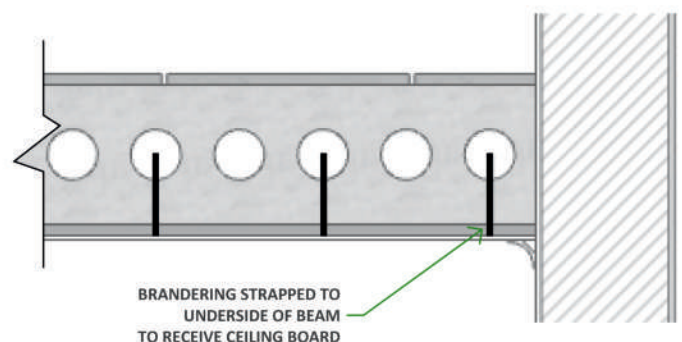
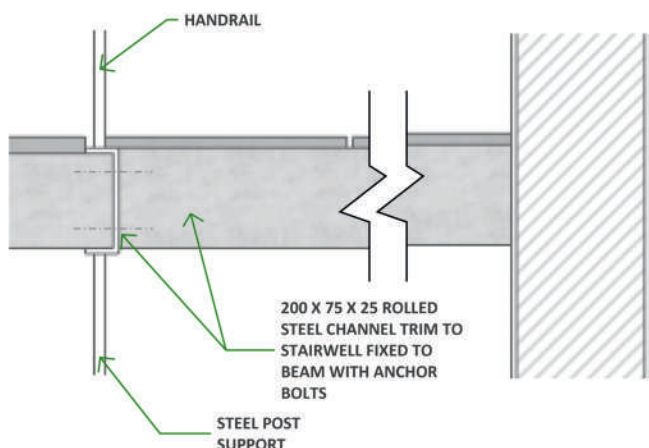


The Windeck system may be waterproofed by first of all laying the floor to a 1:50 fall. The joints may then be sealed with silicone and checked for leaks prior to grouting. Or alternatively the floor may be screeded to falls and waterproofed conventionally. Waterproofing is dependant on the quality of workmanship.

**NOTE: SCREED ADDS DEAD LOAD AND REDUCES SPAN CAPACITY.**

## STAIRWELL CONDITIONS

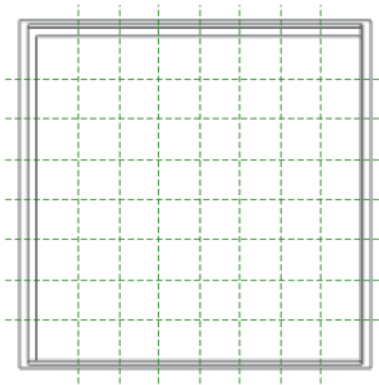
## CEILING INSTALLATION



## HANDLING COMPONENTS

Carry Windeck beams only in the upright position. Pass straps under the beam (or timber branding through the holes of the 250mm deep beam). Stack beams on site in the upright position i.e. taper downwards. Stack Windeck tiles on edge and under cover prior to laying. Take care to protect the tile top, soffit surfaces and edges to avoid abrasion, unsightly chipping or other damage. (N.B. The top surface of all beams must be swept and kept clean at all times. All filling between beams at the wall ends must be completed and all cantilever trimmer beams must be securely fixed in their final position before any tiles are laid permanently.)

### 1. DESIGN IS THE KEY



In general the desired final tile layout will determine beam positioning. Establish the overall layout of the tiles with regard to room edge conditions, squareness and leftover spaces. How tiles are to meet other finishes at doorways and how they are to run through other to other rooms or levels must be planned at this stage. Thorough planning will help to determine the most cost effective and pleasing layout as well as the type, quantities and cost of components.

### 2. INSTALLING THE BEAMS ON SITE



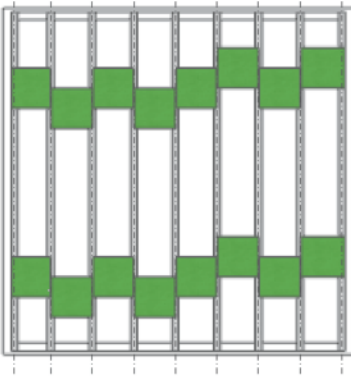
Ensure that all beam bedding surfaces are level and swept clean.

### 3.



Using an accurate gauge-rod, mark walls at 450mm beam centres determined according to your plan.

## 4.



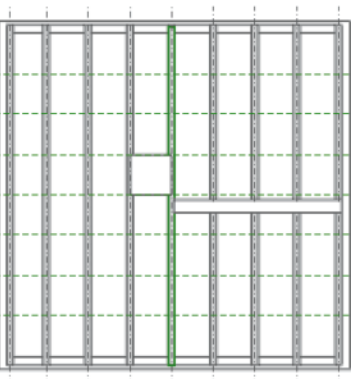
Align the centre of the end of each beam (narrow edge down) with the 450mm centres marked on the wall. Set each beam directly onto the level bearing surface (no mortar bed). If height adjustment is necessary use shims made of a suitable non-compressible material (e.g. steel). Firmly wedge each beam end in its final vertical position with beam fill spacers, panels or conventional beam fill techniques. Doing this correctly will provide precise horizontal and vertical beam alignment. Cantilever end must be permanently fixed at this stage. Use loose-laid tiles between beams to help with lateral stability but NEVER to determine beam centres as this changes essential design tolerances between beams and causes tile fitting problems. Beams must be accurately fixed at 450mm centres at each wall by measuring.

## 5. LAYING THE TILES



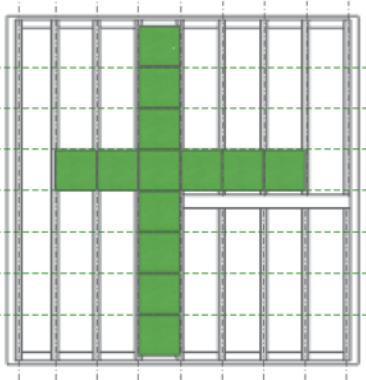
Identify a suitable "centre" beam, (datum) against which the first row of tiles is to be laid. Keep this beam straight by bracing it with a sturdy timber strut against a side wall. This will ensure that the first row of tiles is laid straight. Place the first tile at or near the centre of the floor against the braced "centre" beam (as determined by desired floor edge conditions - see 1). The correct lacing of this tile critical.

## 6.



Taking the front edge of this tile (where it makes contact with the beam top) as the reference line, strike a chalk line at right angles to the braced "centre" beam, and across all other beams at 450mm centres.

7.

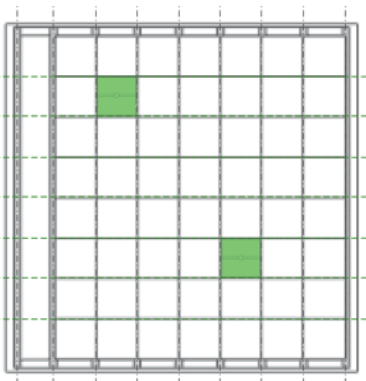


Lay the tiles in a cross pattern, using the chalk line as the guide in one direction and braced "centre" beam in the other.

The following method should be used to lay each tile:

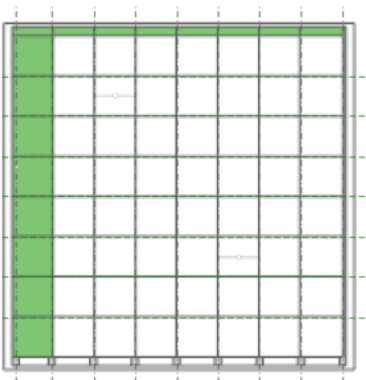
1. Using a creamy cement / sand slurry mixed in batches to suit the job and speed of working, make sure that the beam top is level and free of debris. Pour a thin layer of this slurry onto the top of the beam ahead of each tile.
2. Check each tile to make sure that its rebates have no "proud" areas.
3. Keep small stones and other foreign materials away from all the bearing surfaces.
4. Place each tile, directly against the edge of the previously laid tile and gently tap down to level with a rubber mallet.
5. Check the line of lay in both directions regularly.

8.



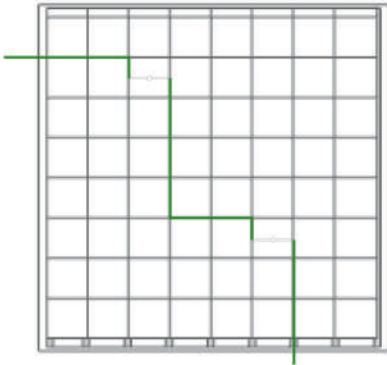
Identify a suitable "centre" beam, (datum) against which the first row of tiles is to be laid. Keep this beam straight by bracing it with a sturdy timber strut against a side wall. This will ensure that the first row of tiles is laid straight. Place the first tile at or near the centre of the floor against the braced "centre" beam (as determined by desired floor edge conditions - see 1). The correct lacing of this tile critical.

## 9. LAYING EDGE-CONDITION TILES & ELECTRICAL CONDUIT



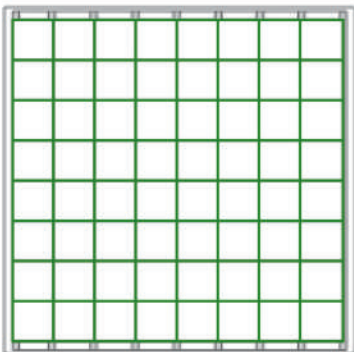
Cut and lay the edge condition tiles to complete the layout.

## 10.



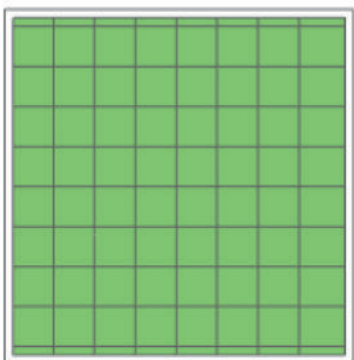
Route flat Twin-and-earth, armoured cable between tiles to connect with the Windeck conduit tiles. Press cables firmly into the bottom of the joint before grouting.

## 11. GROUTING THE JOINTS



Mix the tile grout material in small batches and tool into the joints in accordance with good tiling practice.

## 12. FINISHING THE FLOOR



After all the joints have been tooled, strew damp sawdust over the floor and sweep up together with all excess grout material. Allow the joints to dry completely before floor sealers are applied according to maker's instructions. (N.B. Make sure that tile surfaces are protected from damage during later building work. Old carpeting, underfelt, cardboard and similar materials are suitable for this purpose.)

### **Alternative Skimming for Other Flooring Coverings**

It is possible to lay other floor coverings over the Windeck tiles. A layer of self-levelling screed may be skimmed lightly over all the joints to flush up the surface to receive carpets or other floor finishes.

# 3D EXAMPLE

