Shallow Composite Floor Decks

Design information

steel to concrete, as modified for creep in the concrete. In design to BS5950 and BS8110, the cube strength is used (in N/mm²). In design to EC3, the cylinder strength is used (in N/mm²). The concrete grade (C30/37) defines the (cylinder/cube strength) to EC3.

Concrete density

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

Without the precise information you should assume that wet density is used in the design of the profiled steel sheets and that dry density in the design of the composite slab.

Fire Design

Fire insulation

You must take the fire insulation requirements of BS 5950: Part 8 into account in the tables and design software.

Span/depth ratio

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

Shear connectors in fire situation

If shear connectors are provided you can ignore any catenary forces transferred from the slab to the support beams within the fire resistance periods quoted.

Fire Design Methods

There are two requirements here:

- Bending resistance in fire conditions
- Minimum slab depth for insulation purposes

You can calculate the capacity of the composite slab in fire using the **simple method** or the **fire engineering method**:

Simple method

The simple method is most economic and can be used for simply supported decks or for decks continuous over one or more internal supports. The capacity assessment in fire is based on a single or double layer of standard mesh. Any bar reinforcement is ignored.

Fire engineering method

The fire engineering method is for general application and should be used for design to Eurocodes. The capacity assessment in fire is based on a single or double layer of standard mesh at the top and one bar in each concrete rib. For the shallow decks, the program assumes the bar is positioned just below the top of the steel deck. For MetFloor® 60 with a raised dovetail in the crest the bar will be placed below the dovetail.

The quick reference tables for shallow composite floors generally use the simplified fire design method, which utilises the anticrack mesh as fire reinforcement. You can increase load span capability under fire by including bar reinforcement and using the fire engineering design method.

Deflection limits

You would normally agree deflection limits with the client. In the absence of precise information adopt the following limits:

- **Construction stage**
  Le/130 (but not greater than 30mm)
- **Imposed load deflection**
  Le/350 (but not greater than 20mm)
- **Total load deflection**
  Le/250 (but not greater than 30mm)

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

When the ponding of the concrete slab is not taken into account, the deflection under construction load should not exceed the span/180 or 20mm overall – whichever is the lesser.

Where ponding is taken into account the deflection should not exceed the span/130 or 30mm overall. The quick reference tables do take ponding into account, if deflection exceeds Ds/10, or Le/180, and thus use span/130 or 30mm as a deflection limit. We recommend that the prop width should not be less than 100mm otherwise the deck may mark slightly at prop lines.

Vibration

Check the dynamic sensitivity of the composite slab by referring to the Steel Construction Institute publication P076: Design guide on the vibration of floors. Calculate the natural frequency using the self-weight of the slab, ceiling and services, screed and 10% imposed loads, representing the permanent loads and the floor.

Where there is no specific information you should ensure that the natural frequency of the composite slab is not greater than 5Hz for normal office, industrial or domestic usage. For applications such as dance floors or those which support sensitive machinery you may need to set the limit higher.

For design to the Eurocodes, the loads considered for the vibration check are increased using the psi-factor for imposed loads (typically 0.5). You can reduce the natural frequency limit to 4Hz, because of the higher load used in the calculation. To determine the vibration response of sensitive floors with greater accuracy look at the calculation methods in the SCI / CMF publication P354 "Design of Floors for Vibration: A New Approach". These figures enable designers to compare the response with the acceptance levels in BS 6472 and ISO 10137 for building designs and in the NHS performance standard for hospitals, HTM 2045.