

### Background

Musculoskeletal disorders are the most common occupational health problem in Great Britain, affecting over 1 million people a year. It is unlikely that manual handling in construction can be eliminated in its entirety, but measures can be taken to minimise the exposure of workers to this risk. It is important, therefore, to address issues in the early stages of a project's design.

Steel/concrete composite construction is a popular, cost effective and safe means of forming a concrete slab. There is currently no mechanical handling device to assist with the moving and positioning of decking sheets once loaded out onto steelwork. Typically, the mass of sheets ranges between 9.3 kg/m<sup>2</sup> to 12.98 kg/m<sup>2</sup> (0.9 mm gauge) and 12.3 kg/m<sup>2</sup> to 17.30 kg/m<sup>2</sup> (1.2 mm gauge). This can theoretically result in sheets in excess of 150 kg (e.g. a 9 m span with a 1 m 'cover width') – well in excess of the recommendations of the Guidance published with the Manual Handling Operations Regulations 1992<sup>1</sup> (as amended).

### Manual handling

It is clear from a recent industry survey<sup>2</sup> of metal decking installers that a combination of laying shorter lengths (up to 6m in length) and narrower cover widths (up to 600 mm in width) would make them easier to handle and reduce the risk on site.

The same survey also identified that the job would be less physically demanding, and the manual handling risks reduced, by:

- Better planning around the location and distribution of ancillary items;
- Loading out with one decking bundle in each bay; and
- Mechanical loading out of edge trim bundles.

### What designers are required to undertake: the legal situation

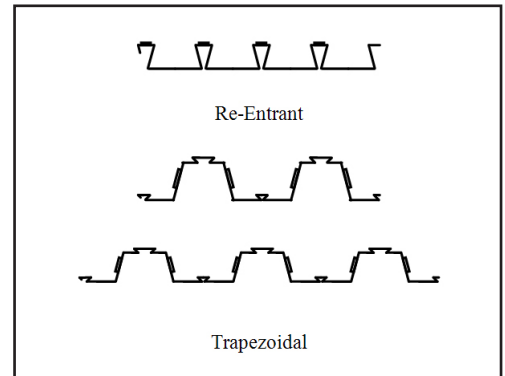
The *Construction (Design and Management) Regulations 2007* (CDM 07)<sup>3</sup> require that designers avoid foreseeable risks to the health and safety of those involved or affected by the construction, use, maintenance and demolition of the structure. In doing so, they must eliminate hazards that may give rise to risk and reduce the remaining risks from any hazards. Both these elements must be done 'so far as is reasonably practicable, taking due account of other relevant design considerations'.

The Industry Guidance<sup>4</sup> states that, "Having identified the foreseeable risks, designers should, so far as is reasonably practicable, eliminate or reduce those risks. The current regulatory view is that this means that a hazard must be eliminated (or the remaining risk reduced) unless, compared to the risk, it is grossly disproportionate in terms of time, cost and effort to do so".

In addition, a designer is required to take all reasonable steps to provide information about the design to assist other duty holders in complying with their duties under CDM 2007 (that is, to identify and manage the remaining risks). Industry guidance illustrates several different ways in which information may be transferred.

An Engineer must not produce a design that cannot be safely constructed. Equally, they are not expected to specify construction methods (except where the design assumes or requires a particular construction or erection sequence, or where a competent contractor might need such information). The regulations do not require 'zero risk' designs; the focus should be on issues that are known to have the potential to cause significant harm, and where there are known solutions that reduce the risks to everyone exposed.

Care should be taken to consider any wider, or 'global', risks when exercising judgement during 'value engineering'. In conclusion, the Structural Engineer - must be able to justify any design decision(s) taken.



### What designers can do: considerations

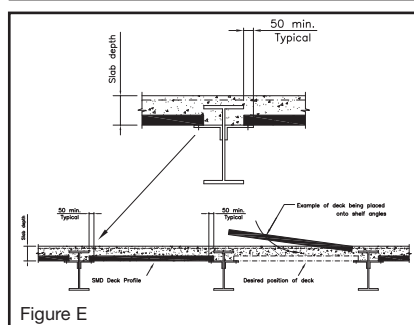
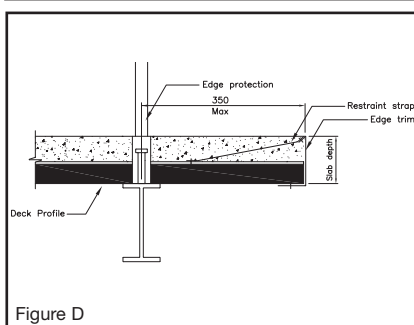
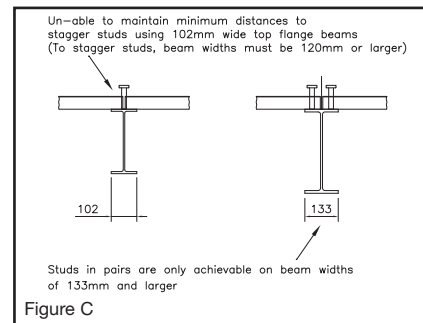
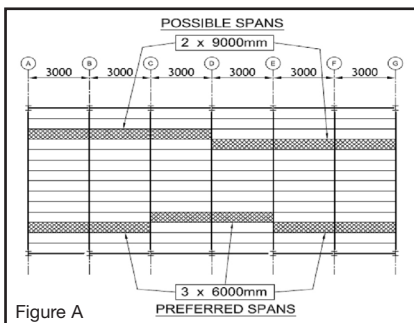
Designers have to consider many factors as they develop their designs. Health and safety aspects must be included in this process, along with 'other relevant design considerations' including cost, fitness for purpose, aesthetics, buildability, maintainability and environmental impact.

The Structural Engineer's primary influence comes in the 'framing' of the structure. It is their duty to seek the optimum combination of floor span, number of spans (single, multiple or propped), slab depth, decking sheet profile/gauge and concrete density (normal or lightweight), etc..

### What designers can do: practical examples

Practical examples of what Structural Engineers can do include:

- Specifying two-span sheets, where possible, rather than three-span and keeping overall length of decking sheet below 9m spans where this does not increase the risk elsewhere, eg back propping
- Single-span sheets are often best avoided to reduce the risks associated with decking sheets/operatives falling into nets, additional manual handling, unnecessary temporary works and concrete overloading. Figure A represents an optimal arrangement of decking spans.
- Using structural layouts with rectangular bays and parallel beams to avoid the need for the cutting of deck panels (see Figure A);
- Avoiding odd-shaped bays that require the multiple cutting of individual rectangular decking panels (see Figure B);
- Avoid using narrow (102 mm wide) top flange beams (50mm end bearing is required for decking panels, leaving very little tolerance for manufacturing and erection imperfections. Shear stud welding standards may also be compromised by the position of the decking butt joint on a narrow flange beam (see Figure C));
- Wherever possible avoid cantilevered decking panels beyond 350mm from centre of beam. (see Figure D).
- Where a cantilever of greater than 350mm is required the edge protection must also cantilever to allow safe installation of the edge trims, to minimise associated risks.
- Where decking is required to span between opposing beam webs the required supporting shelf angle must extend a minimum of 50mm beyond the toe of the top flange (See Figure E).
- Consult specialist decking suppliers for advice during the initial design stage.



1 *Manual handling. Manual Handling Operations Regulations 1992 (as amended). Guidance on Regulations L23 (Third edition) HSE Books 2004 ISBN 0 7176 2823 X*  
 2 *Health and Safety Laboratory (HSL), Human Factors Group, RSU/09/05 (2009)*  
 3 *Construction (Design and Management) Regulations 2007*  
 4 *Industry Guidance for Designers, ConstructionSkills, CDM07/4*