Focus:

Slim Floor Beams

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27–29 May 2015, Rio de Janeiro/Brazil

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3–7 June 2015, Chicago / USA

30. Österreichischer Stahlbautag
11–12 June 2015, Salzburg / Austria

8th Stessa Int. Conference Behavior of Steel Structures in Seismic Areas
1–3 July 2015, Shanghai / China

Products & Projects

Company news about products and projects in constructional steelwork
Deadline for press releases: April 17th 2015

Editorial Content

Ulrike Kuhlmann:

Editorial: “Slim Floor Beams”

Dennis Lam, Xianghe Dai, Ulrike Kuhlmann, Jochen Raichle, Matthias Braun:

Ultimate Limit State Design of Slim Floor Construction

This paper presents the design method of slim floor construction that comprises of a steel beam and a concrete or composite floor slab in which the beam is integrated within the depth of the slab. The slabs are either supported on a plate attached to the bottom flange or the bottom flange of the beam itself. The main design parameters and load transfer mechanisms are discussed. Plastic analysis has been adopted for the design of the bending capacity at ultimate loads condition and the design procedures described are in accordance with the principles given in the Eurocode 4. Focus is given to the type of shear connection between steel and concrete.

Mark Lawson, Philippe Beguin, Renata Obiala, Mathias Braun:

Slim Floor Construction using Hollow Core and Composite Decking Systems

This article reviews the performance characteristics and some recent development of slim floor and integrated beam construction. This form of construction provides a flat floor using precast concrete slabs or deep composite decking and offers advantages over other forms of construction in many sectors. Composite slim floor beams have improved stiffness and can achieve longer spans.
**Design methods for Slim Floor Constructions**

Dennis Lam, Ulrike Kuhlmann, Florian Eggert, Matthias Braun:

The steadily growing world trade leads to a demand of increasing port facilities. One of the most common construction types of deep harbour quays is the combined steel piling wall. It consists of up to 45 m long H-shapes king piles and Z-shaped intermediate infill elements. The intermediate elements and the quay both transfer all forces to the king piles, which as a result are loaded with (bi-)axial bending and axial force, so stability is a risk. Up to now, the effect of the soil surrounding the piles was used just in terms of best practise: buckling about the weak axis and lateral torsional buckling were neglected completely. Considering these stability phenomena in design without taking the soil into account would lead to a very conservative approach. As the verification of lateral torsional buckling according to EN 1993-1-1 (EC3-1-1) becomes relevant when the embedment is neglected, a more refined verification has been developed. This publication presents simplified criteria to quickly exclude stability phenomena (flexural buckling around the weak axis and lateral torsional buckling) while taking into account the effects of the soil. For the cases in which the criteria are not fulfilled, the publication presents economic solutions also considering the embedment of the king piles by soil in the stability design process.

**Deformation calculation methods for Slim Floor Constructions**

Gunter Hauf, Dennis Lam:

**Fire design methods for slim floor constructions**

Slim-floor beams are well known, sustainable and economical solution in residential, commercial and industrial buildings. However, despite of its common use no specific simplified calculation methods for the fire resistance of integrated and shallow floor beams exist in the Eurocode 4. There is a clear need for improved understanding of structures performance in fire and to provide clear and cost-effective design guidance. This paper presents a set of simplified rules to determine thermal fields in lower flange, web, rebars and slab of slim or integrated floor beams. This calculation methodology is based on existing formulas from different parts of Eurocode 4 except for the temperature calculation in the lower flange that is deduced from a parametrical study using software SAFIR.

**Design of Slim Floor Construction Against Human-induced Vibrations**

Stephen Hicks, Simo Peltonen:

A simplified design method for evaluating the vibration response of composite floors using slim floor beams is presented. The methodology is amenable to hand calculations and is appropriate for floors with regular spaced grids, and vibrations that are occasioned by walking activities. From in situ tests that have been undertaken on 6 floors, it is shown that slim floor construction can easily satisfy the demanding ISO 10137 response limits for operating theatres and laboratories together with industry recommended limits for car-parks and shopping malls. Comparisons with measurements show that the simplified method presented in this paper provides conservative predictions, and may therefore be used with confidence in design.

**Composite interaction in shallow floor beams with different shear connections**

Matti V. Leskela, Simo Peltonen, Renata Obiala:

Shallow floor beams, abbreviated as SF-beams and also known as Slim floor beams, are such where most of the beam member is embedded in the concrete decking of the floor, which is supported on the lower flange or outward ledge of the beam. SF-beams are composite members, in which composite interaction can be utilized in serviceability and ultimate limit state conditions as well, or only in serviceability limit state, depending on the deck type. The paper discusses the composite interaction in SF-beams when the decking is of solid type, i.e. it consists of reinforced concrete slab or composite slab with profiled sheeting making it possible to benefit from the composite behaviour in all important limit states. Hollow core decking supported on SF-beams is a special case in which the composite interaction can only be employed in the design for serviceability conditions. Another paper is provided for the special issues included for the design of such shallow floors.

**Effect of unzipping connection behaviour on the composite interaction of shallow floor beams**

Matti V. Leskela, Simo Peltonen:

Unzipping connection behaviour is not referred to in EN 1994-1-1, but only ductile and non-ductile shear connections are classified. It may be clear that unzipping connections belong to non-ductile ones, but not all of the non-ductile connections are unzipping. Characteristic of the unzipping connection behaviour is that initially the connection stiffness is high and composite interaction is efficient. However, on the course of increasing loads the connection loses its shear stiffness very rapidly and when entering plastic behaviour of the beam, the decking does not contribute to the bending resistance of the initially composite member. The behaviour is most typically seen in shallow floor beams (abbreviated as SF-beams) supporting hollow core decking. This is a companion paper for the one where the composite interaction in SF-beams with ductile shear connections is discussed.
General Information

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