

Overview of the Evolution of EN1994: Design of Composite Steel and Concrete Structures

Date: 1 June 2020

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Structure of this slide deck

- General overview of the evolution of EN 1994
- Specific overview of the evolution of EN 1994 parts:
 - *Part 1-1: General Rules and Rules for Buildings*
 - *Part 1-2: General Rules – Structural Fire Design*
 - *Part 2: General Rules and Rules for Bridges*

General overview of the Evolution of EN1994: Design of Composite Steel and Concrete Structures

Date June 2020

Agenda – Evolution of EN 1994

- Key changes to EN 1994
- New content included in the scope of EN 1994
- How ease of use has been enhanced

The following slides provide a general overview of the evolution of EN 1994. Complementary slides provide greater details for individual Eurocode Parts.

Key changes to EN 1994

- *Correction of errors identified by users during Systematic Review*
- *Clarifications requested by users*
- *Extensions of scope requested by users, and updates to reflect current practice*
- *Improved alignment between parts and with other Eurocodes*
- *Reduction in possibilities for national variations (NDPs)*

New content included in scope of EN 1994

- *Rules for shallow floor construction*
- *Rules for beams with large web openings*
- *Improved fire design using so-called Tensile Membrane Action*
- *Explicit signage to allow use of advanced methods*

- *We will also produce two CEN Technical Specifications covering;*
 - *Twin-skin composite construction*
 - *Composite dowel shear connection for bridges*

How ease of use has been enhanced

- *Better alignment between Parts and with other Eurocodes*
 - *Technical provisions*
 - *Layout and structure*
 - *Wording*
- *For technical provisions the hierarchy for 'harmonisation' is to:*
 - *Provide rules that agree with other Eurocodes*
 - *Explain why rules that one might imagine should be the same are different (so users appreciate differences are not just a mistake)*
- *Generally we are trying to avoid changing current, familiar rules unless there is a clear need*

Overview of the Evolution of EN1994-1-1: General Rules and Rules for Buildings

Date June 2020

Agenda – Evolution of EN 1994-1-1: General Rules and Rules for Buildings

- Key changes to EN 1994-1-1
- New content included in the scope of EN 1994-1-1
- How ease of use has been enhanced

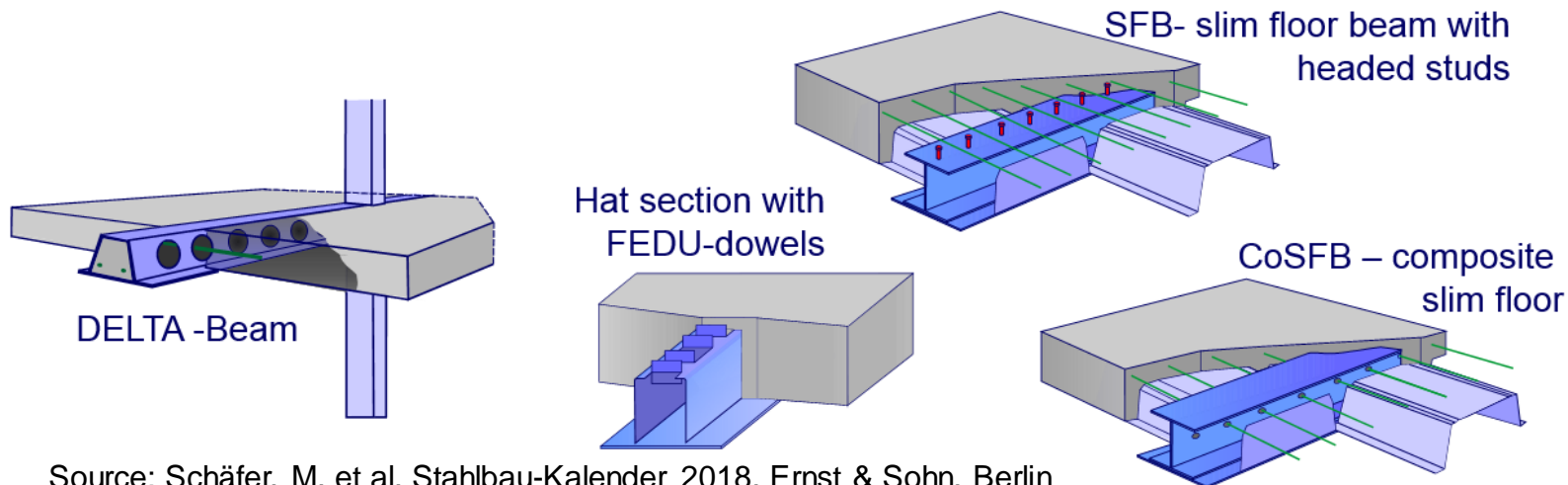
Key changes to EN 1994-1-1

- *Correction of errors identified by users*
 - *Feedback from Systematic Review*
- *Clarification of clauses identified by users as unclear*
 - *Feedback from Systematic Review*
- *Modification of shear connection rules to reflect modern forms of composite decking*
 - *Previous rules were empirical, based on products in the market <1990*
- *Inclusion of rules to extend scope (as requested by users)*
 - *Beams with large web openings*
 - *Shallow floor construction*

New content included in scope of EN 1994-1-1

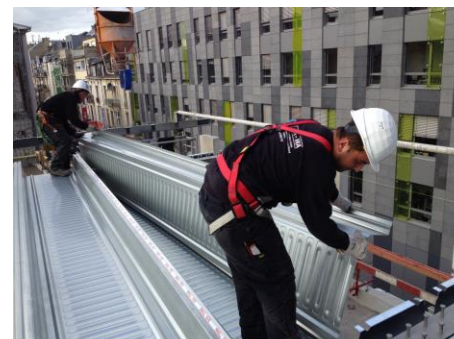
→ Rules for shallow floor construction

„composite“ solutions in combination with solid concrete, semi pre-cast elements or ribbed metal sheets



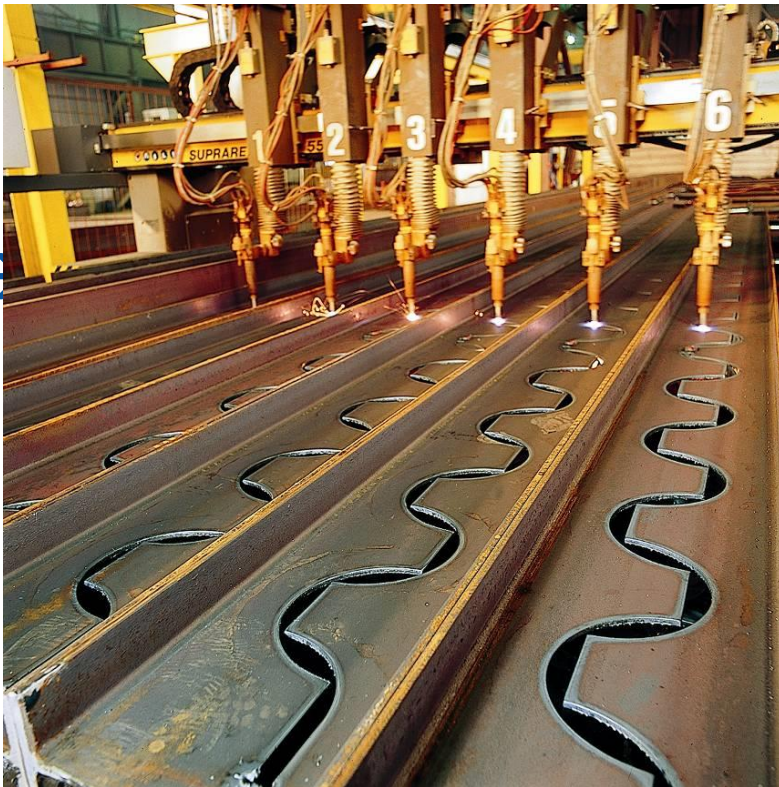
Source: Schäfer, M. et al. Stahlbau-Kalender 2018, Ernst & Sohn, Berlin

photos: Schäfer, Rademacher, Source: Schäfer, M. et al. Stahlbau-Kalender 2018, Ernst & Sohn, Berlin



New content included in scope of EN 1994-1-1

→ *Rules for beams with large web openings*



How ease of use has been enhanced

→ *Better alignment between Parts and with other Eurocodes*

- *Technical provisions*
- *Layout and structure*
- *Wording*

→ *For technical provisions our hierarchy is to:*

- *Provide rules that agree with other Eurocodes*
- *Explain why rules that one might imagine should be the same are different (so users appreciate differences are not just a mistake)*

Overview of the Evolution of EN1994-1-2: General Rules – Structural Fire Design

Date June 2020

Agenda – Evolution of EN 1994-1-2: General Rules – Structural Fire Design

- Key changes to EN 1994-1-2
- New content included in the scope of EN 1994-1-2
- How ease of use has been enhanced

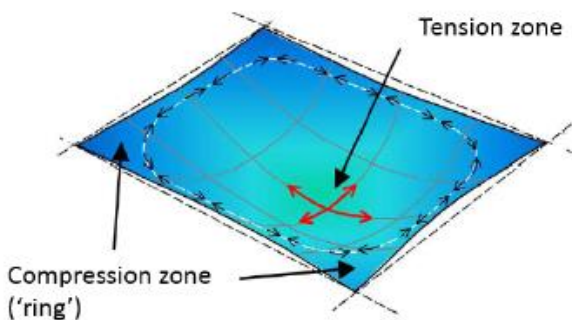
Key changes to EN 1994-1-2

- *Correction of errors identified by users*
 - *Feedback from Systematic Review*
- *Clarification of clauses identified by users as unclear*
 - *Feedback from Systematic Review*
- *New Annex covering concrete filled hollow sections*
 - *Previous Informative Annex was widely disallowed.*
 - *New annex is based on extensive new research*
- *Provision of rules for Tensile Membrane Action*

New content included in scope of EN 1994-1-2

→ Rules for so-called *Tensile Membrane Action* added

- *Such action reduces the requirement for fire protection of some beams*
- *Different methods have been used by practitioners (in some countries) for over a decade*
- *One such method is given in detail in an Informative Annex*



How ease of use has been enhanced

- *Better alignment between Parts and with other Eurocodes*
 - *Technical provisions*
 - *Layout and structure*
 - *Wording*

- *For technical provisions our hierarchy is to:*
 - *Provide rules that agree with other Eurocodes*
 - *Explain why rules that one might imagine should be the same are different (so users appreciate differences are not just a mistake)*

- *The new annex on composite column design went through several iterations to make it less ‘academic’ and more ‘user friendly’*

Overview of the Evolution of EN1994-2: General Rules and Rules for Bridges

Date June 2020

Agenda – Evolution of EN 1994-2: General Rules and Rules for Bridges

- Key changes to EN 1994-2
- New content included in the scope of EN 1994-2
- How ease of use has been enhanced

Key changes to EN 1994-2

- *Correction of errors identified by users*
 - *Feedback from Systematic Review*
- *Clarification of clauses identified by users as unclear*
 - *Feedback from Systematic Review*
- *Format has been modified to better align with other Eurocodes*
 - *Previous format reproduced all general rules to provide one self-contained document and reduce cross-referencing*

New content included in scope of EN 1994-2

→ Rules for composite dowel shear connectors

- *A draft annex was prepared, but it has now been decided to place this content into a CEN Technical Specification*
- *The annex is based on existing practice for bridges, and will therefore be widely used*
- *The decision to place it (initially) in a TS is so that it can be expended to cover buildings and included in the next version of EN1994*



How ease of use has been enhanced

→ *Better alignment between Parts and with other Eurocodes*

- *Technical provisions*
- *Layout and structure*
- *Wording*

→ *For technical provisions our hierarchy is to:*

- *Provide rules that agree with other Eurocodes*
- *Explain why rules that one might imagine should be the same are different (so users appreciate differences are not just a mistake)*

→ *Extensive restructuring of the document*