



# Evolution of Eurocodes: General overview of horizontal aspects for EN 1999: *Design of Aluminium Structures*

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# General overview of horizontal aspects concerning the evolution of Eurocode 9

- The coordination activity of Sub-committee 9 was mainly related to the following aspects:
- Structural fire design
- Design of bridges
- Reliability
- Seismic design

# Evolution of Eurocodes: General overview of changes in EN1999-1-2: *Structural Fire Design*

# Agenda – Evolution of EN1999-1-2: *structural fire design*

- Key changes to EN1999-1-2: structural fire design
- New content included in the scope of EN1999-1-2: structural fire design
- How ease of use has been enhanced

# Key changes to EN1999-1-2

- *Some reorganization of the text and its coherence with other Eurocodes (EN199x-1-2 and EN1991)*
- *Improvement of some figures*
- *Updating of symbols*



# New content included in scope of EN1999-1-2

→ *No significant changes respect to the old version*

## How ease of use has been enhanced

- *Improved clarity and consistency*
- *Harmonisation of existing contents according to the new template provided by HGF (Horizontal Group Fire), which has been applied for the Fire Part of all Eurocodes (EN 199x-1-2)*
- *Updating of many symbols according to Eurocodes related to other structural materials (EN 199x-1-2) and Eurocode 1*
- *Harmonisation of wording and terminology with Eurocode 1993-1-2*





# Evolution of Eurocodes: General overview of changes in EN1999-1-1 Annex S: *Bridge Design*



# Agenda – Evolution of *bridge design*

- Key changes to *bridge design*
- New content on *bridge design*
- How ease of use has been enhanced



## Key changes to *bridge design*

- *Not applicable, as bridge design is a new subject which has not been covered in EN 1999, but is now included in the Annex S of EN1999-1-1*

# New content on *bridge design*

## → A new annex (*Annex S*) included in *prEN1999-1-1*

- *Its structure and content inspired by EN1993-2 and by the Japanese aluminium bridge standard:*

- 3. General rules (robustness, design service life, durability)*
- 4. Bridge components outside the scope of the standard (tension members, bearings)*
- 5. Structural analysis (modelling, imperfection, torsional and distortional effects)*
- 6. ULS (global partial factor, strength and stability checks, shear lag)*
- 7. SLS (general, performance criteria for rail, road and foot-bridges)*
- 8. Fatigue design situation (loading, partial factors, damage equivalence factors, strength, post-weld treatment)*
- 9. Structural detailing and execution (road and foot- bridge decks, aluminium deep girders)*

## How ease of use has been enhanced

- *Mainly by referring to the main text in the standard*
- *Referring to prEN1990 A2 whenever possible*
- *Repeating sometimes the prescriptions of prEN1990 A2 in order to have certain procedures “integrally described”*

# Evolution of Eurocodes: General overview of changes in EN1999-1-1: *Reliability Issues*



# Agenda – Evolution of *reliability issues*

- Key changes to *reliability issues*
- New content on *reliability issues*
- How ease of use has been enhanced

## Key changes to *reliability issues*

- *Not applicable, as reliability analysis has not been performed within the development of the new version of Eurocode 9*
- *Consequently, the values of the partial factors remain the same as in the present version of EN 1999-1-1*
- *Review has been undertaken of the background for the selection of the current partial factors. The factors have been confirmed. Further work has been initiated in cooperation with the industry to achieve background data for improved analysis to underline the reliability and partial factors*



## New content on *reliability issues*

- *New content about statistical models of mechanical and geometrical properties of aluminium alloys are going to be introduced through the work of CEN/TC 250/SC 10 Ad-hoc group "Reliability background in the Eurocodes"*
- *For the moment, a statistical analysis of more than 4.000 tension test results has been done (gather from the European aluminium industry and Universities around Europe)*
- *This completely new pool of data, sorted by alloys, tempers, product type and thickness, represents a statistical database for the reliability analysis of new design procedures given in the Eurocode 9*

## How ease of use has been enhanced

- *For a time being there is no practical effect of the work that is running regarding reliability issues within Eurocode 9*
- *The first practical effect will be probabilistically based revision of the mechanical properties values in EN 1999-1-1 in relation to the values given in product standards (EN 755 set)*
- *The ease of use will be enhanced by calibration of partial factors values and revision of the aluminium alloys list that are mostly used for structural applications*

# Evolution of Eurocodes: General overview of changes in EN1998: *Seismic Design of Aluminium Structures*



# Agenda – Evolution of *seismic design of aluminium structures*

- Key changes of *seismic design of aluminium structures*
- New content on of *seismic design of aluminium structures*
- How ease of use has been enhanced

# Key changes to seismic design of aluminium structures

- *Not applicable, as this subject is not covered in EN1999*
- *This subject is included in a new Chapter “Design of aluminium structures in seismic areas” of Eurocode 1998, which has been set-up through the horizontal cooperation between the SC8 and SC9 sub-committees*

# New content on seismic design of aluminium structures

- *The text is completely new*
- *Due to the lack of background documents in Europe and in USA, the basic reference has been the Japanese code*
- *The Chapter on seismic design of steel structures in Eurocode 8 has been considered as reference format*



## How ease of use has been enhanced

- *The format of the Chapter on seismic design of steel structures has been followed for sake of homogeneity*