Subject	Cellular beams
Clause N°/ Subclause N° / Annex	N/A

Reason for change

It is predicted to incorporate new design rules for Cellular beams in EN 1993-1-X and EN 1994-1-X.

This method, not yet available as a final draft, will need to be defined in case of fire and comply with the principle and the material properties of the other Eurocodes

Original content

No clause about cellular beams

Change

For fire design, the resistance of the section at the opening positions may be obtained as follows:

I. Determine the resistance of the elements at the opening at a particular elevated temperature θ by replacing f_y by $f_y(\theta)$, E by $E(\theta)$ and γ_{M0}, γ_{M1}, γ_{M2} by $\gamma_{M,fi}$ according to EN 1993-1-2.

II. For weld verification, paragraph D.2 of EN 1993-1-2 applies.

III. At elevated temperatures, the cross-sections may be classified as for normal temperature design with a reduced value for ε following EN 1993-1-2 as given by

$$\varepsilon = 0{,}85\ [235 / f_y\ ]^{0,5}$$

where f_y is the yield strength at 20 °C

IV. When calculating instabilities for fire conditions χ should be replaced by χ_{fi}, the reduction factor for flexural buckling given in EN1993-1-2.

V. For steel temperature development, 4.2.5 of EN 1993-1-2 applies and the real section factors should be considered for the different failure modes.

- Flexural bending in a gross section (no opening) (1);
- Flexural bending in a net section (with an opening) (2);
- Vierendeel bending in the top (3) or bottom chord (4);
- Web post buckling in the top (5) or bottom (6) chord;
- Web horizontal shear or weld shear at the junction of the chords (7);
- Web vertical shear (8).

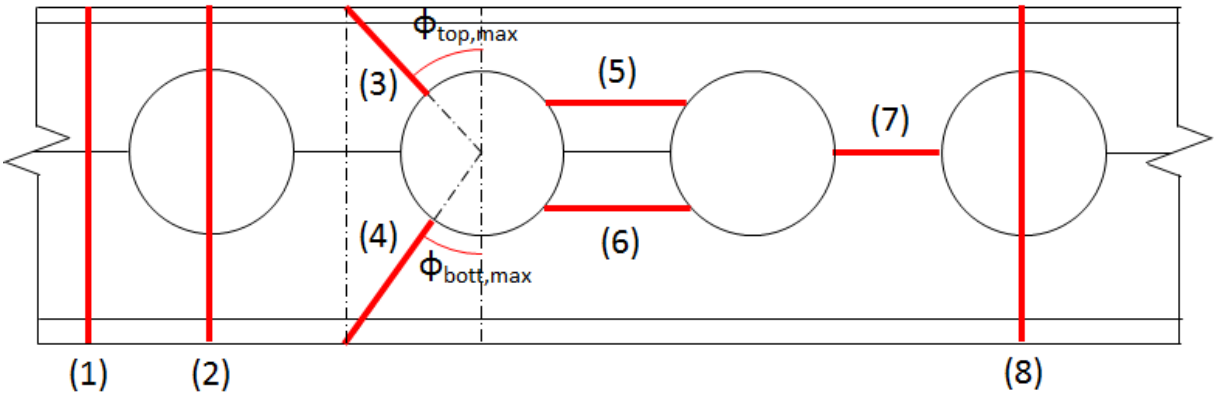

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Figure 1: Cross-sections affected by likely failure modes of a cellular beam

VI. For protected beams with regular openings, the thickness of the protection is determined according to EN 13381-4 or EN 13381-8 based on the section factor defined in (V) and here above and on the critical temperatures obtained from (1) to (6) here above for the different failure modes.

VII. In addition to (VI), for beams with regular openings protected by reactive coating, EN 13381-9 applies. EN 13381-9 provides a web modification factor which is product specific and function of the web post length.

Background information

This document contains general guidelines to be followed to ensure consistency between any method developed for beams with large web openings and the fire parts of the Eurocodes.

Ease of use justification

N/A