- Seismic response of bridge with high damping rubber bearings
- How torsional stiffness of closed stiffeners affects EC3 plate buckling
- Mechanical and thermal performance of new liner tray solutions
- Web-crippling equations for C-/Z-sections
- Shear stress transfer at steel-concrete interface: tests/review
- Energy model for distortional buckling of SHS X-joints
Calibration of European web-crippling equations for cold-formed C- and Z-sections

Current design equations given in EN 1993-1-3 for calculating the web-crippling resistance of cross-sections with one web were copied from the AISI’s Specification for the design of cold-formed steel structural members, taking into account the different safety concepts: load and resistance factor design (LRFD), with resistance factors $\phi_w$ applied to nominal values, and limit state design, with partial factors $\gamma_M$ applied to characteristic values as defined in EN 1990. Furthermore, the web-crippling equations of subsequent editions of the AISI specification (then designated AISI S100) were completely revised based on the web-crippling data collected and evaluated by Beshara and Schuster [5].

This paper presents the results of a calibration of a generalized web-crippling equation to be used for cross-sections with one web (i.e. C- and Z-sections). The coefficients of the generalized web-crippling equation were calibrated to comply with the safety concept described in EN 1990, taking into account EN 1990, Annex D, and a partial factor $g_{M1} = 1.1$. This paper therefore provides an introduction to as well as background information on proposed changes and amendments to EN 1993-1-3.

Keywords: cold-formed structures; web crippling; C-section; Z-section; cleat

1 Introduction

Current design provisions for web-crippling in EN 1993-1-3 [1] are based on the 1996 edition of the AISI’s Specification for the design of cold-formed steel structural members [2]. When copying the provisions to EN 1993-1-3, two changes were made in the provisions:

- In the AISI’s 1996 specification, parameter $h$ is defined as the “depth of the flat portion of the web measured along the plane of the web”, i.e. $h$ is always measured in the plane of the web. In EN 1993-1-3 the designation was changed from $h$ to $h_w$ without changing the equations, and its definition was changed to “the web height between the midlines of the flanges”. This difference in the parameter definition results in a difference $\Delta h = 2 \cdot r + t$.

- Equations presented in the AISI’s 1996 specification give nominal resistance, which is to be used with resistance factors $\phi_w = 0.75...0.80$ (corresponding to a partial factor $\gamma_M = 1.35...1.25$). The nominal resistance corresponds to a mean resistance; effects such as scatter of test data, statistical uncertainty associated with the number of tests or prior statistical knowledge (coefficients of variation for materials and fabrication (geometry)) are covered by the resistance factor $\phi_w$. Deviating from this, EN 1993-1-3 is based on characteristic resistance, to which a partial factor $\gamma_{M1} = 1.0–1.1$ (depending on national provisions) is applied. Characteristic value is defined as the 5% fractile value of resistance, i.e. a value with a prescribed or intended probability of being exceeded. The different safety concept is considered only approximately by adjusting the coefficients of the original equations in proportion to the ratio of partial factors.

Following the fundamental revision of the provisions for web-crippling already implemented in the 2001 edition of the AISI specification [3], a comparable revision of the EN 1993-1-3 provisions is currently in preparation. This time, no straightforward adoption of the provisions is intended, instead a complete re-evaluation of the tests forming the basis of the AISI provisions, taking into account the safety concept of EN 1990 [4].

2 Basics

2.1 Cross-sections, loading conditions and fastening

The present evaluation covers stiffened or unstiffened C- and stiffened Z-sections made of steel, as shown in Fig. 1 and Fig. 2.
Edge stiffeners affect the deformation behaviour of the flanges, leading to a small restraining effect that increases the web-crippling resistance. EN 1993-1-3 gives minimum values for the length $c$ of an edge stiffener (lip) to be regarded as effective. These minimum values also apply in the present case.

Flanges of the sections may (see Fig. 3) or may not be fastened to the support. In most applications, sections are fastened to the supporting structure. Resistance for unfastened cases is relevant for points of load introduction. Fastening of flanges affects the deformation behaviour as it results in a clamping of the web adjacent to the attached flange. Fastening flanges to the support reduces the rotation of the web, leading to an increase in the web-crippling resistance. Compared with that, the (positive) effect of flange stiffeners at the free edges is negligible.

A distinction is made between four different loading conditions. The distance of a load from a beam edge and the number of loaded flanges affect the web-crippling resistance. A larger edge distance stabilizes the transversely compressed web, leading to an increase in resistance. Resistance is higher if only one flange of the section is loaded compared with both flanges of the section loaded simultaneously. For both cases, a value of 1.5 times the depth of the section may be used as a threshold value to distinguish loading conditions. Fig. 4 to Fig. 7 show the different loading conditions, and Fig. 8 and Fig. 9 show examples of these loading conditions. The designations

- end one-flange loading (EOF),
- interior one-flange loading (IOF),
- end two-flange loading (ETF), and
- interior two-flange loading (ITF)

used in the figures and captions are common in the American codes [2], [3] etc., but are not used in EN 1993-1-3 [1]. Nevertheless, they will be used in the present text for the sake of simplicity. Strictly speaking, when using the symbol $h$, the American codes do not refer to 1.5 times the depth of the section.
the total depth of the section when distinguishing between loading conditions, but 1.5 times the depth of the flat portion of the web. Within the present paper and EN 1993-1-3 [1], $h$ is used to designate the total depth of the section. This inaccuracy has already been accepted when adopting the provisions given in [2] for EN 1993-1-3 [1] and thus changing from designation $h$ (in [2]: “depth of the flat portion of the web measured along the plane of the web”) to $h_w$ (in [1] “the web height between the midlines of the flanges”) without changing the equations.

2.2 Data

The present evaluation is mainly based on [5], which was also the basis for [3] and – with some minor corrections – its subsequent editions. A few additional test results have been included in the evaluation. They are listed in Table 1.

As the evaluation covers data from different sources, with different cross-section series, minor differences in setup, etc., grouped into samples, there is an inherent scatter in the test results, leading to comparatively high standard deviations. Higher standard deviations reduce the ratio of characteristic value to mean value, i.e. lead to a smaller resistance compared with the original test result. For specific cross-sections, a larger resistance may be obtained through specific tests. EN 1993-1-3, Annex A, does not provide information on testing. Setups and procedures given in [26] may be used instead, but results need to be evaluated according to EN 1990 [4], Annex D.

2.3 Design approaches and trial functions

An empirical approach for calculating the web-crippling resistance of linear sections with a single web is based on a generalized function with $\sqrt{(E \cdot f_{yb})}$ and $h$ to cover slenderness effects.

$$R_{w,Rd} = K \cdot \frac{t^2 \cdot \sqrt{E \cdot f_{yb}}}{\gamma_{M1}} \left( 1 - K_r \cdot \frac{r}{t} \right) \left( 1 + K_s \cdot \frac{s_s}{t} \right) \left( 1 - K_h \cdot \frac{h}{t} \right) (1)$$

where:

- $t$ design core sheet thickness
- $E$ Young’s modulus
- $f_{yb}$ basic yield strength
- $h$ total depth
- $r$ internal radius of corners
- $s_s$ nominal length of stiff bearing

See also Fig. 1 to Fig. 7 for geometrical parameters. Comparable approaches have proved worthwhile in the treatment of web-crippling design and, accordingly, are frequently found in publications. Besides covering slenderness effects, the assumption of a dependence on the yield strength in the form of $\sqrt{(E \cdot f_{yb})}$ instead of the quasi-linear dependency on $f_{yb}$ often used leads to a lower scatter (expressed by coefficient of variation $V$) in the statistical evaluation. Numerical investigations published in [27] also support the assumption $\sqrt{f_{yb}}$. The present evaluation considers only sections made of steel with $E = 210000 \text{ N/mm}^2$. Transfer of results to other materials (stainless steel, aluminium) has not been validated yet. The coefficients were designated with “K” to distinguish them from those given in the AISI provisions.

2.4 Statistical evaluation

Evaluation of the tests is based on the procedures given in EN 1990, Annex D, for the statistical determination of
resistance models, but not using a theoretical resistance \( r_t \) based on a resistance function, because a desired partial factor \( \gamma_{M1} \) was prescribed in advance. Thus, a direct determination of a characteristic resistance \( r_k \) complying with a design reliability level is reliability class RC2 for 50 years and \( \beta = 3.8 \) according to EN 1990. The evaluation according to EN 1990, Annex D, is combined with a least square approach:

\[
\text{min}_{K,K_s,K_r} \left\{ \sum \left( R_{w,\text{test},i} - R_{w,\text{R},i} \right)^2 \right\} 
\]  

(2)

The coefficients were calibrated to justify the use of \( \gamma_{M1} = 1.1 \). For localized loads, \( \gamma_{M1} \) applies because there is no post-critical resistance (see also provisions for patch loading in EN 1993-1-5). The numerical value 1.1 was chosen because it will most likely be recommended in the new editions of both EN 1993-1-1 and EN 1993-1-3.

A more detailed description of the procedure is given in [28].

### 2.5 Families of tests

Some sets of configurations show comparable behaviour and therefore may be evaluated together. For example, fastened C-sections, both with stiffened and unstiffened flanges, may be treated as one sample because effect of fastening dominates over effect of stiffening.

Defining families of tests results in a larger number of samples \( n \), thus a smaller value of the fractile factor \( k_n \).

But as scatter (expressed by coefficient of variation \( V \)) increases, there is no benefit in the end. Thus, definition of families has been omitted.

### 3 Comparison with provisions in other codes

#### 3.1 Comparison with EN 1993-1-3 [1]

Design equations given in the current edition of EN 1993-1-3 have been used for comparison. At least one equation is given for each loading condition. A further distinction is made between EOF (stiffened, unstiffened, length \( s_j \)) and IOF (length \( s_i \)):

EOF, stiffened

\[
R_{w,\text{Rd}} = k_1 \cdot k_2 \cdot k_3 \cdot \frac{t^2 \cdot h_0}{\gamma_{\text{M1}}} \left( 9.04 - \frac{1}{60} \frac{h_w}{t} \right) \left( 1 + 0.01 \cdot \frac{s_j}{t} \right)
\]

(5)

Some additional results to [8] and thus not covered by [5]

IOF-01 to IOF-09 and IOF-19 to IOF-27 not considered (bending is presumably dominant failure)

Just reference tests without holes

Just reference tests without holes

Results also published in [15] and [16]

Summarized in [24]

Some additional results to [8] and thus not covered by [5]
T. Misiek, A. Belica: Calibration of European web-crippling equations for cold-formed C- and Z-sections

and

\[ k = \frac{f_{y}b}{228N^{1.0}} \]  

(15)

where:

- \( h \) web height between midlines of flanges
- \( \phi \) angle of web relative to flanges
- and the other parameters as for Eq. (1).

Equations and coefficients were deduced from the AISI specification [2], but the equations differ from those given there by a factor of 0.9 to allow for the different safety concept (equations give characteristic value in [1], mean value in [2]), and are divided by 33 to allow for different units (US customary system in [1], metric International System of Units in [2]):

\[ C_{EC} = 0.9 \cdot \frac{C_{AISI}}{33} \]  

(16)

3.2 Comparison with DASt-Richtlinie 016 [29]

Additional design approaches suitable for comparison are scarce. Besides EN 1993-1-3, the German DASt-Richtlinie 016 [29] gives an approach for calculating web-crippling resistance which is based on a generalized web-crippling equation originally proposed by Winter and Pian. For EOF, the equation given in [29] reads as follows:

\[ R_{w,Rd} = 0.057 \cdot \frac{t^{2} \cdot E \cdot f_{y}}{\gamma_{M1}} \left( 1 - 0.1 \cdot \frac{r}{\sqrt{t}} \right) \]  

(17)

and

\[ 0.5 + \sqrt{0.02 \cdot \frac{s}{t}} \]  

According to [29], the double value given by Eq. (17) may be applied for IOF. Following the structure of the test function given by Eq. (1), Eq. (17) may also be written thus:

\[ R_{w,Rd} = 0.0285 \cdot \frac{t^{2} \cdot E \cdot f_{y}}{\gamma_{M1}} \left( 1 - 0.1 \cdot \frac{r}{\sqrt{t}} \right) \]  

(18)

with \( K_{h} \) equal to zero because DASt-Richtlinie 016 assumes there is no dependency on \( h/t \).

The equation given in DASt-Richtlinie 016 is assigned to be used with a partial factor \( \gamma_{M} = 1.1 \) (limit state design). It was copied from the AISI specification [30], but differs from the one given there by a factor of 0.6 because [30] is based on allowable stress design.
We may assume that both provisions were developed based on the results with unfastened specimens because this was common practice at that time.

4 Results for C-sections

4.1 Stiffened C-sections (lipped channels)

Table 2 gives the coefficients for stiffened C-sections obtained from the statistical evaluation.

Comparing the coefficients reveals a clear systematic; for example, the basic coefficient $K$ for internal loading is always about twice as high as for end loading, and the coefficient $K_h$ varies with the loading condition, but is approximately the same regardless of whether the section is fastened or unfastened. The sole exception is the coefficients for an unfastened section under ITF loading: The ITF configuration has a large basic coefficient $K$, with a large coefficient $K_h$ reducing the resistance as height increases.

![Graph](image1.png)

![Graph](image2.png)

![Graph](image3.png)

![Graph](image4.png)

Fig. 10. C-sections, stiffened, fastened

<table>
<thead>
<tr>
<th>C-sections, stiffened</th>
<th>$K$</th>
<th>$K_e$</th>
<th>$K_a$</th>
<th>$K_h$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a EOF fastened</td>
<td>0.266</td>
<td>0.165</td>
<td>0.155</td>
<td>0.032</td>
</tr>
<tr>
<td>1b unfastened</td>
<td>0.251</td>
<td>0.211</td>
<td>0.148</td>
<td>0.039</td>
</tr>
<tr>
<td>2a IOF fastened</td>
<td>0.627</td>
<td>0.151</td>
<td>0.098</td>
<td>0.036</td>
</tr>
<tr>
<td>2b unfastened</td>
<td>0.594</td>
<td>0.143</td>
<td>0.049</td>
<td>0.033</td>
</tr>
<tr>
<td>3a ETF fastened</td>
<td>0.200</td>
<td>0.109</td>
<td>0.142</td>
<td>0.046</td>
</tr>
<tr>
<td>3b unfastened</td>
<td>0.291</td>
<td>0.383</td>
<td>0.095</td>
<td>0.041</td>
</tr>
<tr>
<td>4a ITF fastened</td>
<td>0.558</td>
<td>0.102</td>
<td>0.053</td>
<td>0.028</td>
</tr>
<tr>
<td>4b unfastened</td>
<td>1.202</td>
<td>0.232</td>
<td>0.000</td>
<td>0.051</td>
</tr>
</tbody>
</table>
when defining the application range of Eq. (1) and the coefficients given in Table 2.

Note that the minimum requirement \( f_{yb} = 160 \text{ N/mm}^2 \) prevents the use of the equations with steels DX51D to DX53D, which were originally developed for deep-drawing for “white goods” (household appliances).

If higher values of parameters \( t, f_{yb}, \) or \( s_s/t \) occur, the calculation procedure is applicable, but the values should be reduced to corresponding upper limits of the application range. If larger values of the parameters \( r/t \) or \( h/t \) occur, tests should be performed according to [26].

### 4.2 Unstiffened C-sections (plain channels)

Table 4 gives the coefficients for unstiffened C-sections obtained from the statistical evaluation.
No data are available for fastened unstiffened C-sections under ETF or ITF loading conditions because, historically, these tests have generally been performed with unfastened sections. At that time, the positive effect of fastening was taken into account through multiplication factors, if at all. Resistance calculated for unfastened C-sections will give a conservative estimate of resistance for fastened C-sections.

The mean ratio of test result to characteristic value lies between 1.40 and 1.60, depending on configuration. The overall tendencies are the same as for stiffened C-sections. The most relevant configurations (fastened EOF and IOF) again have a ratio of 1.40 to 1.45.

Fig. 12 and Fig. 13 show individual test results with the calculated resistance based on proposed Eq. (1) and based on the code provisions introduced in section 3. For fastened sections under EOF and IOF loading conditions, the results of the proposed Eq. (1) and DASt 016 [29] are similar. This is different for ETF and ITF loading conditions, but, as mentioned, the equations given in DASt 016 [29] do not claim to cover these loading conditions. Comparing the test results with the current provisions in
Table 5. Unstiffened C-sections – parameter range

<table>
<thead>
<tr>
<th>C-sections, unstiffened</th>
<th>t [mm]</th>
<th>( f_y [\text{MPa}] )</th>
<th>( r/t )</th>
<th>( s_y/t )</th>
<th>( h/t )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a EOF fastened</td>
<td>1.5–6.0</td>
<td>457–534</td>
<td>1.0–3.0</td>
<td>17–66</td>
<td>38–132</td>
</tr>
<tr>
<td>1b unfastened</td>
<td>0.9–6.0</td>
<td>250–450</td>
<td>0.8–4.1</td>
<td>5.2–140</td>
<td>19–197</td>
</tr>
<tr>
<td>2a IOF fastened</td>
<td>0.6–6.0</td>
<td>449–534</td>
<td>0.9–3.0</td>
<td>8.4–66</td>
<td>25–130</td>
</tr>
<tr>
<td>2b unfastened</td>
<td>0.9–6.0</td>
<td>250–450</td>
<td>0.8–4.3</td>
<td>5.1–62</td>
<td>19–196</td>
</tr>
<tr>
<td>3a ETF fastened</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3b unfastened</td>
<td>1.0–6.1</td>
<td>250–550</td>
<td>0.5–2.1</td>
<td>5.2–62</td>
<td>19–197</td>
</tr>
<tr>
<td>4a ITF fastened</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4b unfastened</td>
<td>1.1–6.1</td>
<td>250–550</td>
<td>0.5–1.9</td>
<td>5.2–62</td>
<td>19–198</td>
</tr>
<tr>
<td>Proposal fastened</td>
<td>0.6–6.0</td>
<td>250–600</td>
<td>( \leq 4 )</td>
<td>( \leq 100 ) &amp; ( s_y \leq 200 ) mm</td>
<td>( \leq 200 )</td>
</tr>
<tr>
<td>Proposal unfastened</td>
<td>1.0–6.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 13. C-sections, unstiffened, unfastened
EN 1993-1-3 [1] reveals a large scatter. Using the latter provisions for unstiffened C-sections is questionable.

Table 5 gives the parameter range of the C-sections included in the evaluation. This range has to be considered when defining the application range of Eq. (1) and the coefficients given in Table 4.

The comments regarding Table 5 also apply here.

5 Results for Z-sections

Table 6 gives the coefficients for stiffened Z-sections obtained from the statistical evaluation.

Only limited data are available for fastened Z-sections under the IOF loading condition. As with unfastened Z-sections, doubling the resistance calculated for the...
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EOF loading condition leads to a conservative, but still economical, estimate of resistance. No data are available for unfastened Z-sections under the two-flange loading condition. However, as this might result in twist or rotation of the section, such an application is not recommended.

The mean ratio of test result to characteristic value lies between 1.35 and 1.50 for fastened applications and is 1.70 for unfastened applications.

Fig. 14 and Fig. 15 compare individual test results with the calculated resistance based on the proposed equation and the code provisions introduced in section 3. For fastened sections under the EOF and IOF loading conditions, the results of the proposed equations and DASt 016 [29] are similar. This is different for the ETF and ITF loading conditions, but, as mentioned, the equations given in DASt 016 [29] do not claim to cover these loading conditions. Comparing the test results with the current provisions of EN 1993-1-3 [1] reveals a large scatter. Using the latter provisions for stiffened Z-sections is questionable.

For nested Z-sections under IOF loading, see [28]. The coefficients given there result in a web-crippling resistance between that for EOF and IOF loadings. There are several reasons for this:
- Connecting two Z-sections with sloping lips leads to local bending and distortion of the cross-section, see Fig. 16. This affects the behaviour at the overlap, but not necessarily in a positive way.
- Coefficients given in [28] may be used for both fastened and unfastened Z-sections.
- The scatter of the results for nested Z-sections is comparatively high (also as a result of the aforementioned points), leading to a “punishment” in the statistical evaluation. The mean ratio of test result to characteristic value for nested Z-sections is 1.70 for the IOF loading condition leads to a conservative, but still economical, estimate of resistance. No data are available for unfastened Z-sections under the two-flange loading condition. However, as this might result in twist or rotation of the section, such an application is not recommended.

The mean ratio of test result to characteristic value lies between 1.35 and 1.50 for fastened applications and is 1.70 for unfastened applications.

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- Coefficients given in [28] may be used for both fastened and unfastened Z-sections.
- The scatter of the results for nested Z-sections is comparatively high (also as a result of the aforementioned points), leading to a “punishment” in the statistical evaluation. The mean ratio of test result to characteristic value for nested Z-sections is 1.70 for the IOF load-

![Z-sections, stiffened, unfastened](image)

**Table 7. Stiffened Z-sections – parameter range**

<table>
<thead>
<tr>
<th>Z-sections, stiffened</th>
<th>$t$ [mm]</th>
<th>$f_y$ [MPa]</th>
<th>$r/t$</th>
<th>$s/t$</th>
<th>$h/t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a EOF fastened</td>
<td>1.4–2.6</td>
<td>392–508</td>
<td>3.0–4.8</td>
<td>26–45</td>
<td>77–162</td>
</tr>
<tr>
<td>1b unfastened</td>
<td>1.4–2.6</td>
<td>392–508</td>
<td>3.0–4.8</td>
<td>26–45</td>
<td>77–162</td>
</tr>
<tr>
<td>2a IOF fastened</td>
<td>see EOF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2b unfastened</td>
<td>see EOF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3a ETF fastened</td>
<td>1.1–1.5</td>
<td>323–446</td>
<td>4.8–13</td>
<td>20–55</td>
<td>82–208</td>
</tr>
<tr>
<td>3b unfastened</td>
<td>may not be used unfastened (rotates)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4a ITF fastened</td>
<td>0.9–1.5</td>
<td>323–446</td>
<td>1.6–13</td>
<td>20–107</td>
<td>82–209</td>
</tr>
<tr>
<td>4b unfastened</td>
<td>may not be used unfastened (rotates)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proposal fastened</td>
<td>1.0–3.0</td>
<td>320–500</td>
<td>$\leq 10$</td>
<td>$\leq 100$ &amp; $s_t \leq 200$ mm</td>
<td>$\leq 200$</td>
</tr>
<tr>
<td>Proposal unfastened</td>
<td>1.5–3.0</td>
<td></td>
<td>$\leq 5$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 16. Comparison of nested Z-purlins with different lips and flanges:**

a) sloping lips and equal flange widths (local bending and distortion);
b) vertical lips and unequal flange widths
6 Connecting sections with cleats

Sections may be connected to the supporting structure via cleats; the section is connected to the cleat by bolts through the web (Fig. 17). Usually, there is a gap between the lower flange and the supporting structure, and the support reaction is transferred via the bolts. If the gap is sufficiently large, web-crippling resistance does not have to be checked. In the case of large or oversized bolt holes, providing considerable clearance for the bolts, the lower flange may settle and the support reaction is then transferred via contact. However, with a cleat of sufficient stiffness, web rotation is prevented and the deformation behaviour corresponds to that observed for the built-up I-sections treated in [28], i.e. the coefficients $K$ given there may be used for the application discussed, provided that parameter $s_i$ is taken as the minimum value of the length of the stiff bearing and the width of the cleat, see Fig. 18. These coefficients apply for both C-sections with (additionally) fastened or unfastened flanges. Although they were derived for C-sections, they may also be used for single and nested Z-sections because with cleats the effects of section geometry and the resulting differences in deformation behaviour become negligible.

7 Summary

Design provisions for web-crippling will be subject to changes in the next revision of EN 1993-1-3 as some deficits in target safety level had become apparent. An approach is sought which is both simpler as well as more realistic with regard to failure loads. The design provisions presented here are a first proposal developed by two members of the Working Group CEN TC250/SC3/WG3 responsible for the revision work. Therefore, this paper provides an introduction to as well as background information on proposed changes and amendments to EN 1993-1-3.
References


Authors
Dr.-Ing. Thomas Misiek
Breinlinger Ingenieure Tuttlingen/Stuttgart
Kanalstr. 1–4
78532 Tuttlingen
Germany
thomas.misiek@breinlinger.de
Andrei Belica, Ing. PhD
Astron Buildings S.A.
Route d’Ettelbruck
9230 Diekirch
Luxembourg
a.belica@astron.biz