

# Steel code check - EN 1993

## esasd.01.01 Steel code check - EN 1993

Stress and stability verification of steel members according to EN 1993 with profile optimisation. The check can be carried out for each member, for each profile section or for the entire structure. By using the colours corresponding to certain input percentages of the admissible stress, the user can immediately detect the weak or overdimensioned parts of the structure. Buckling lengths are automatically calculated. All profile classes are checked, i.e. also class 4 profiles (e.g. thin-walled profiles). All stresses and instability effects are checked: buckling, lateral-torsional buckling and local buckling due to lateral force. Optionally, the output can contain cross-references to the used normative formulae. The user can reinforce the profiles, amongst others with buckling shorteners, steel deck ... in order to obtain an optimal stress distribution.



Datasheet Scia Engineer

esasd.01.01



Scia  
Engineer



The EC3 - EN 1993 Steel code check module fully checks steel construction designs and is part of the Scia Engineer structural analysis system. The structural engineer can use this interactive graphical tool to carry out automatic stress and stability checks - covering buckling, lateral torsional buckling and shear buckling - according to EC 3 - EN 1993 regulations.

## Working with the steel code check

The Scia Engineer system provides a graphical environment within which steel profiles can be designed and checked. The engineer can use the mouse pointer to select the beams to be checked, thus eliminating the need to work with time-consuming node and member calculations. Computer graphical functions as Pan, Zoom in/out, Zoom Window and free viewpoint make the work easy, even for complex structures.

Following beam selection, the program can instantly show the results of a code check in a clear dialogue window. The screen can display overviews and detailed stress and stability calculations (with output from the corresponding formulae), and the determining internal forces.

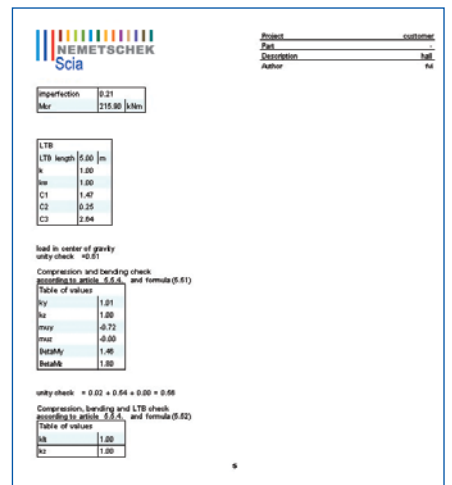
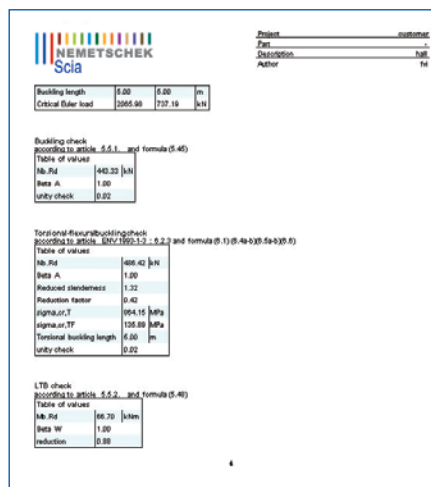
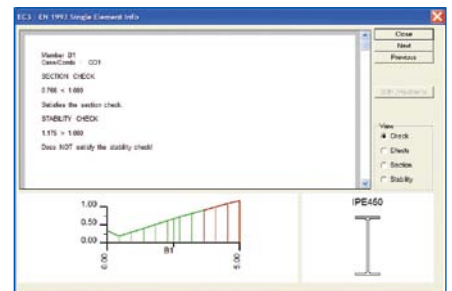
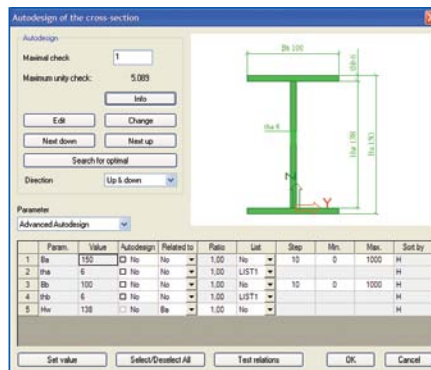
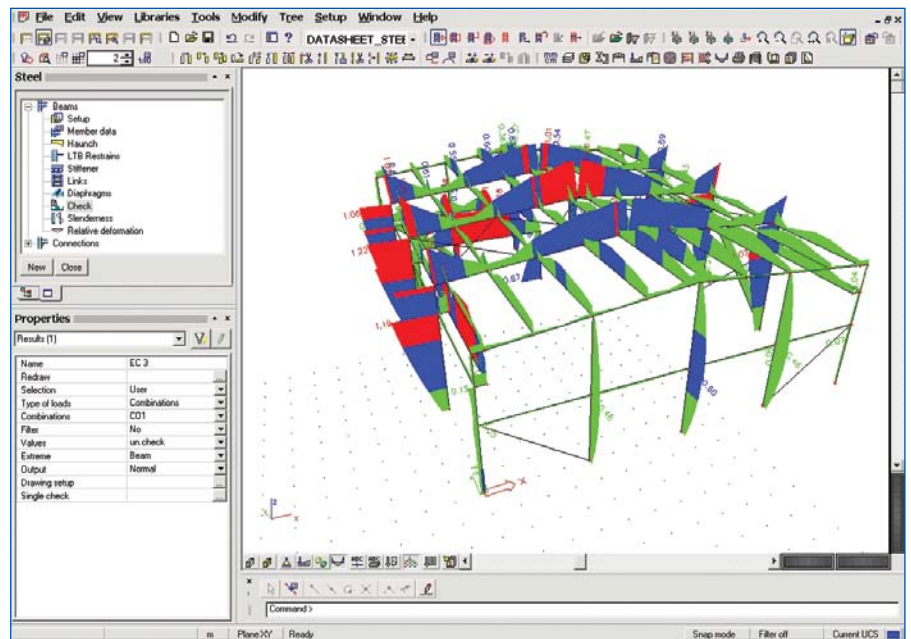
The user can use the dialogue window to edit beam data and immediately bring up displays showing the effect of any changes.

The fully automatic profile optimisation facility (Autodesign) considerably reduces the time needed to select appropriate sections. The user can select the maximum allowable integrity check and type of cross section, including I-sections and angles. The program determines the lightest profile that satisfies the code check for the selected members. Automatic profile optimisation can be applied to all standard and parametric sections. For parametric sections, the user chooses which parameter - whether height, flange thickness or other - to adapt.

The program displays integrity checks graphically on the 3D view of the structure. Colours give a clear overview of over-dimensioned and unsatisfactory parts of the construction.

The user controls the output to the printer or document, using the following facilities:

- Automatic search for extremes in critical load case/combination or critical beam cases;
- Three levels of output format as follows:
  - Brief: stress integrity and stability checks only;
  - Normal: half-page containing main beam data;
  - Detailed: two or more pages per beam, with output from corresponding formulae.



## Highlights

- ▶ Full integration into the main graphical user interface.
- ▶ Graphical input of all required data. Clear graphical and tabular output.
- ▶ Classification of cross-sections, stress checks, stability check, warping.

## Seamless integration with structural analysis

Researchers can directly take the results of the first or second order calculations from the Scia Engineer modules for structural analysis, and can directly change cross-sections on the calculation model. The results are available in the project document.

## Input facilities

The program offers all the significant factors and coefficients involved in code checks, and the user can edit these as follows:

- Basic data such as safety factors and required checks;
- Buckling data such as buckling length figures and sway system information (with or without bracing);
- Lateral Torsional Buckling (LTB) data: length, load position (centre, top, bottom), effective length factors  $k$  and  $k_w$ , and LTB stiffeners on top and bottom flanges;
- Shear buckling stiffeners;
- Diaphragms;
- Inactive parts to examine the influence of haunches and external reinforcements;
- Profile type and steel quality.

## Checks

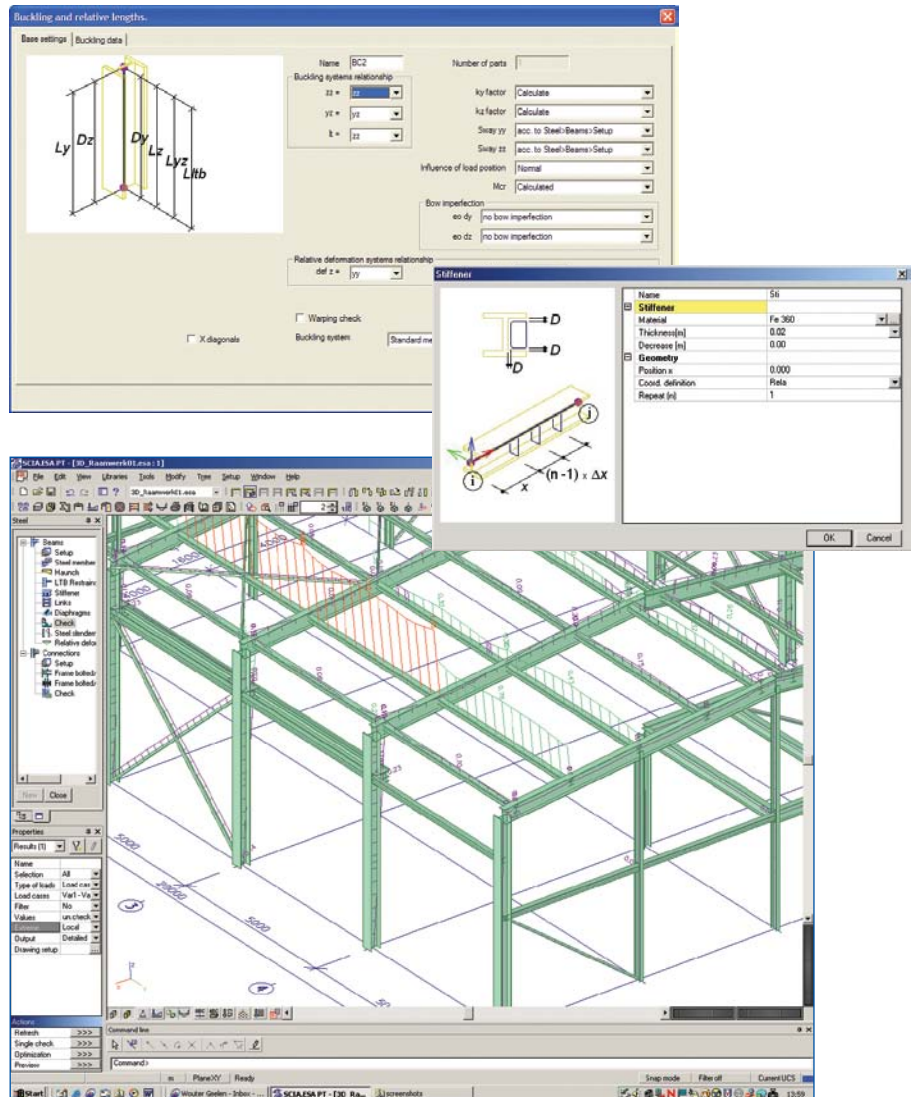
The program determines the buckling length for each beam, depending on the sway system used (Wood method). It implements special formulae to calculate the buckling length of crossing diagonals (DIN 18800, Part 2, Table 15). It also calculates the elastic critical moment for lateral torsional buckling  $M_{cr}$  according to EC 3 - ENV 1993 Annex F regulations. In addition a detailed calculation of  $M_{cr}$  through an eigenvalue solution can be derived (esasd.14).

The module allows the user to check beam parameters according to "Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings - EN 1993-1-1:2005" regulations.

Table 5.2 classifies all cross-sections. For class 4 - sections (slender sections) the module calculates the effective section at each intermediary point according to EN 1993-1-5:2006, Chapter 4.4.

Art. 6.2 sets out the stress check, which includes checking tension (art. 6.2.3.), compression (art. 6.2.4.), bending (art. 6.2.5.), shear (art. 6.2.6.), torsion (art.6.2.7.) and combined bending, shear and axial force (art. 6.2.8., art.6.2.9. and art.6.2.10.).

Art. 6.3 sets out the stability check. This includes checking for buckling (art. 6.3.1.), lateral torsional buckling (art. 6.3.2.) and combined bending and axial compression (art. 6.3.3.).



Document EN 1993-1-5:2006, Chapter 5 sets out the shear buckling checking process.

Testers can check for warping in any I, U and cold formed sections.

The codes also provide for a check on a critical slenderness and a torsional moment.

Regulations also take into account local plate bending in integrated beams, in terms of the plastic moment capacity and bending stresses in the section. They can also check for out-of-balance loading.

## Supported cross-sections

The module can check the following cross-sections:

Symmetric and asymmetric I, rectangular hollow, circular hollow, angle, U, T, rectangular, circular, all Scia Engineer-composed sections, haunches, I section with variable height (tapered sections), single plate cold formed sections, digital sections entered by static property and integrated (built-in) beams such as IFB, SFB and THQ.

## National annexes (esa.00)

It is possible to define a specific national Annex for the new Eurocodes. In these national annexes the user can find the values of the parameters defined on a national level in Scia Engineer. The system library collects all national annexes for Eurocode 199X series: combinations (1990), loads (1991) and steel (1993). Clicking on a specific setup button, the user goes directly to a specific setup part in which the individual national parameters can be reviewed, changed and stored.