FRILO

STX+ - Stability Analysis for Steel

Contents

Basic Documentation – Overview

In addition to the individual program manuals, you will find basic explanations on the operation of the programs on our homepage www.frilo.com in the Campus-download-section.

Tip: Go back - e.g. after a link to another chapter / document - in the PDF with the key combination "ALT" + "left arrow key".

Application options

The STX+ application allows you to verify the stability of single-piece members with fork supports in accordance with EN 1993 (equivalent member method).

Optionally, you can put out either the elastic cross-section verifications on the stress level or the analysis of the plastic internal limit forces.

Systematic central compression, uniaxial bending with or without axial force and biaxial bending are the definable actions.

The stability verifications are limited to double-symmetrical cross sections.

Available standards

- DIN EN 1993
- ÖNORM EN 1993
- BS EN 1993
- EN 1993

Note: DIN EN 1993-1-1 does not specify any design rules for eccentrically loaded beams with U-channel section (i.e. not loaded in the centre of shear). These beams are not only under bending but also under systematic torsional loading.

Data entry

Help texts and information on each parameter to be defined are an integral part of the user interface. Clicking in an input field displays a description of the corresponding value in the information area.

A general description of the user interface is available in the document:
▸ Basic operating instructions-PLUS

Basic parameters

Standard and safety concept

Definition of the design standard and its national annex

Ultimate limit state

Cross section design | plastic: verification of the cross section in accordance with the theory of elasticity (stress analysis).

elastic: verification of the cross section with utilisation of the plastic cross-sectional resistance (limit internal forces).

Equivalent member method as per | the calculation of the interaction factors for the component verification under compression and bending loads (eq. 6.61 and 6.62) is performed in accordance with Annex A or B of DIN EN 1993-1-1.
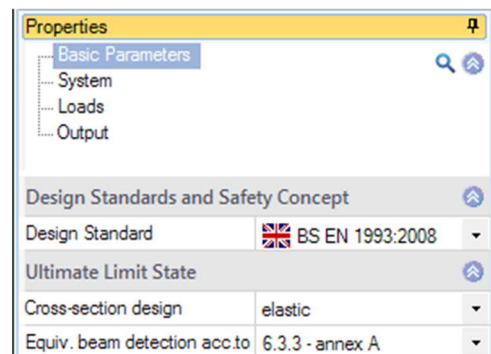
Structural system

In this section, you can define the material properties, the system dimensions and the support conditions.

Member properties

Length l specification of the length of the individual member

Cross-section you can select among all standards shapes of the FRILO profile selection file such as double-symmetrical I-profiles (double T), rectangular pipes etc. Just click on the ⌐…⌐ button.

You can find a description of the profile selection dialog in the document ▸ Select - edit cross section

Buckling length The buckling lengths can be specified optionally. In this case the buckling lengths determined from the boundary conditions will be ignored.

Supports

The specification of "0.0" defines a free support in the corresponding direction.

An elastic support is defined by specifying a spring stiffness in the corresponding direction.

The horizontal support at the front end of the member is always rigid.

Properties
- Basic Parameters
- System
- Loads
- Output

Steel Material		
Type	structural steel	▾
Grade	S235	▾
Characteristic values		✎
Member Properties		
Length	l	[m]	5.00
Cross-section	HEA 320	✎
Default buckling length		☐
Support at Member Start		
Displacement in y-direction	uy	rigid ☑
Displacement in z-direction	uz	rigid ☑
Rotation about z-axis	phiy	[kNm/rad]	5.0
Rotation about z-axis	phiz	[kNm/rad]	2.0
Support at Member End		
Displacement in y-direction	uy	rigid ☑
Displacement in z-direction	uz	rigid ☑
Rotation about z-axis	phiy	[kNm/rad]	0.0
Rotation about z-axis	phiz	[kNm/rad]	0.0

Loads

All actions are specified as internal design forces.

Stresses in longitudinal Direction			
Pressure normal force	N_d	[kN]	100.0
Stresses about y-axis			
Moment at bar origin	$M_{yd,1}$	[kNm]	-112.50
Moment at bar end	$M_{yd,2}$	[kNm]	-195.00
Moment in field	$M_{yd,F}$	[kNm]	250.00
...in distance	x_0	[m]	2.50
Linear curve			☐
Action impact			Shear Center ▾
Stresses about z-axis			
Moment at bar origin	$M_{zd,1}$	[kNm]	0.00
Moment at bar end	$M_{zd,2}$	[kNm]	0.00
Moment in field	$M_{zd,F}$	[kNm]	0.00
...in distance	x_0	[m]	2.50
Remarks			
Load remarks			▨

Nd   axial force N_d - compressive force shall be defined with a positive sign.

Myd,1   design value of the internal moment about the y-axis at the <u>front end of the member</u>

Myd,2   design value of the internal moment about the y-axis at the <u>rear end of the member</u>

Myd,F   design value of the internal moment about the y axis at point x0 <u>in the span</u>

...in distance   Defines the distance x0 of the field moment from origin.

Linear curve   allows you to specify whether the moment behaviour is linear or parabola-shaped. If you do not define a span moment, the behaviour is always linear.
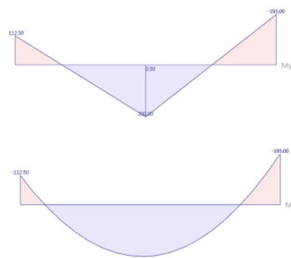
Action impact   load application point of the transverse loading which is responsible for the span moment. The upper edge of the cross section always runs in the negative x-direction, the lower edge in the positive z-direction.

Shear Center
Upper edge
Lower edge
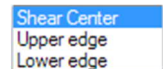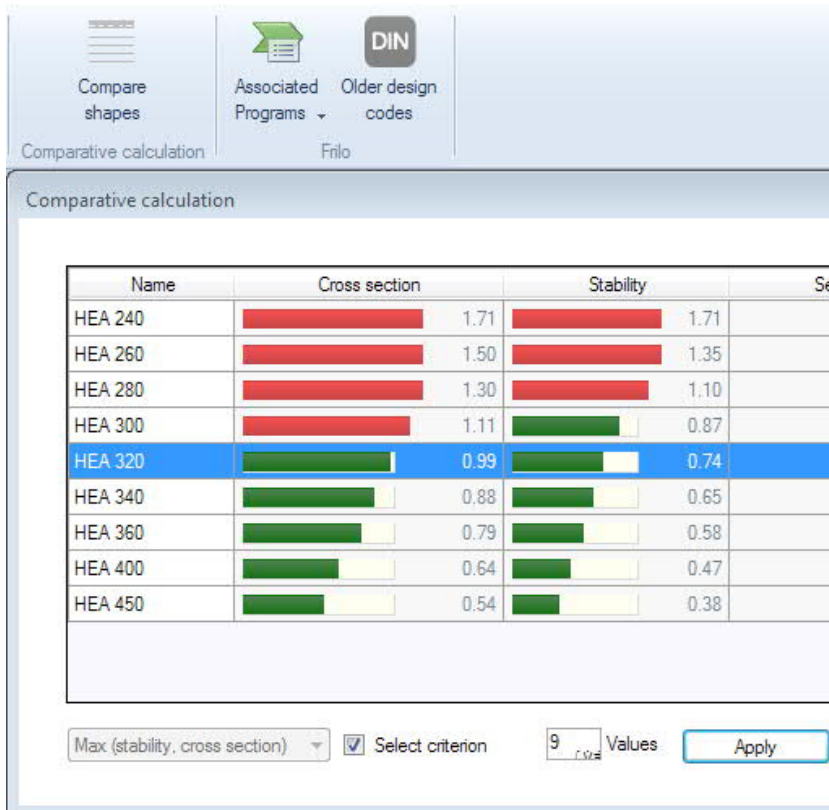
Mz...   Moment behaviour M_d about z (at the front/rear end of the member, in the span, in accordance with Myd)

Comparative calculation of profile sections

Click on the "Compare shapes" button to perform a comparative calculation with the next smaller/large profile of the series.

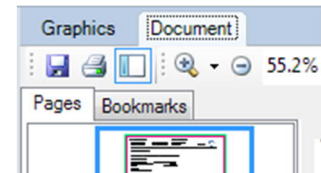Click on one of the listed profiles to integrate it into the system.

Output

A general description of the output options is available in the document:
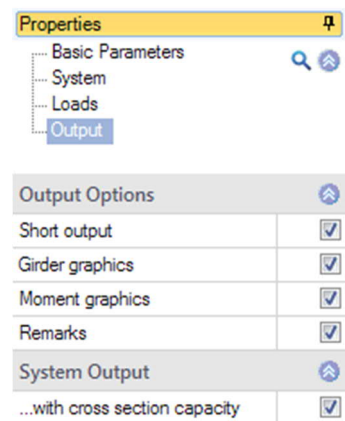
▸ Output and printing

View selection

The Graph/Document tabs of the view selection allow you to toggle between the graphical representation in the GUI and the preview of the output document.

Output options

The dialog offers comprehensive options for the control of the output scope.

Transfer of the system and the loading

If you have a valid licence for the BTII+ application (2nd Order Buckling Torsion Analyses) you can transfer the structural system to BTII+ for further calculations. BTII+ allows the calculation of more complex systems with consideration of e.g. lateral supports.
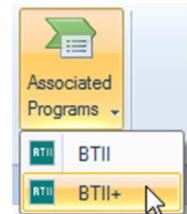
Reference literature

DIN EN 1993-1-1, Eurocode 3: Design of steel structures - Part 1 - 1: General rules and rules for buildings, December 2010