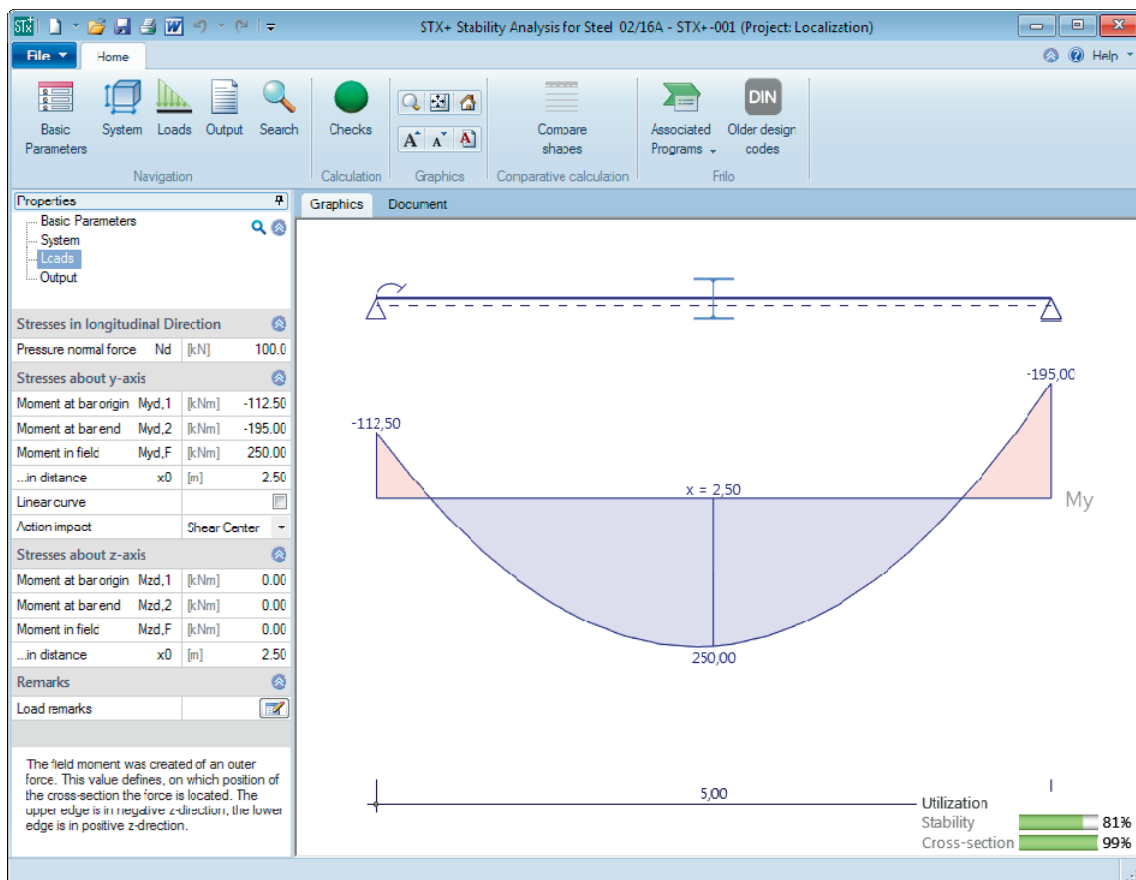


STX+ Stability Analysis for Steel

FRILO Software GmbH
www.friilo.com
info@friilo.com
 Software Version 2/2016
 As of 15/07/2016



Frilo Application: STX+ - Stability Analysis for Steel

Contents

Application options	4
Data entry	5
Basic parameters	5
Structural system	6
Member properties	6
Supports	6
Loads	7
Comparative calculation of profile sections	8
Output	9
Reference literature	9

Further information and descriptions are available in the relevant documentations:

Basic Operating Instructions-PLUS	General instructions for the manipulation of the user interface
FDC – Menu items	General description of the typical menu items of Frilo software applications
FDC – Output and printing	Output and printing
FDC - Import and export	Interfaces to other applications (ASCII, RTF, DXF ...)
FCC	Frilo.Control.Center - the easy-to-use administration module for projects and items
FDD	Frilo.Document.Designer - document management based on PDF
Frilo.System.Next	Installation, configuration, network, database

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

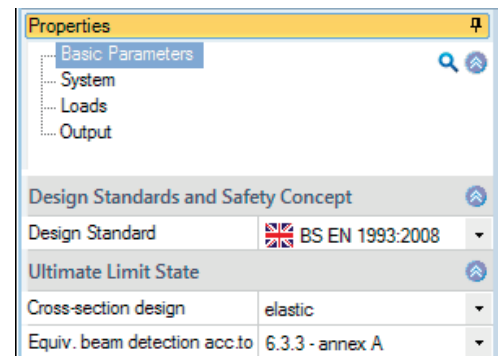
Cross section design

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 eng.pdf](#)




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.

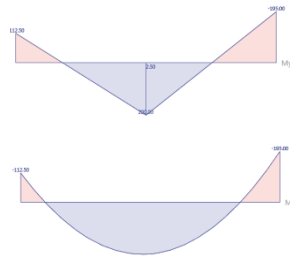
The horizontal support at the front end of the member is always rigid.

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	<input checked="" type="checkbox"/>
Displacement in z-direction	uz	rigid	<input checked="" type="checkbox"/>
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	<input checked="" type="checkbox"/>
Displacement in z-direction	uz	rigid	<input checked="" type="checkbox"/>
Rotation about z-axis	phiy	[kNm/rad]	0.0
Rotation about z-axis	phiz	[kNm/rad]	0.0

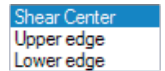
Loads

All actions are specified as internal design forces.

- 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 front end of the member
- Myd,2** design value of the internal moment about the y-axis at the rear end of the member
- Myd,F** design value of the internal moment about the y axis at point x_0 in the span
- ...in distance** Defines the distance x_0 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.



- Mz...** Moment behaviour M_d about z (at the front/rear end of the member, in the span, in accordance with Myd)

Stresses in longitudinal Direction			
Pressure normal force	Nd	[kN]	100.0
Stresses about y-axis			
Moment at bar origin	Myd,1	[kNm]	-112.50
Moment at bar end	Myd,2	[kNm]	-195.00
Moment in field	Myd,F	[kNm]	250.00
...in distance	x0	[m]	2.50
Linear curve			<input type="checkbox"/>
Action impact		Shear Center	▼
Stresses about z-axis			
Moment at bar origin	Mzd,1	[kNm]	0.00
Moment at bar end	Mzd,2	[kNm]	0.00
Moment in field	Mzd,F	[kNm]	0.00
...in distance	x0	[m]	2.50
Remarks			
Load remarks			

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.

The screenshot shows a software interface for comparative calculation. At the top, there are buttons for "Compare shapes", "Associated Programs", and "Older design codes". Below these is a "Comparative calculation" section with a "Filo" button. The main area is a table titled "Comparative calculation" with the following data:

Name	Cross section	Stability	Se
HEA 240	1.71	1.71	
HEA 260	1.50	1.35	
HEA 280	1.30	1.10	
HEA 300	1.11	0.87	
HEA 320	0.99	0.74	
HEA 340	0.88	0.65	
HEA 360	0.79	0.58	
HEA 400	0.64	0.47	
HEA 450	0.54	0.38	

Below the table, there are controls: a dropdown menu set to "Max (stability, cross section)", a checked "Select criterion" checkbox, a text input field with "9" and "Values", and an "Apply" button.

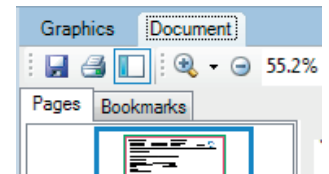
Output

A general description of the output options is available in the document:

▶ [FDC - Output and printing_eng.pdf](#)

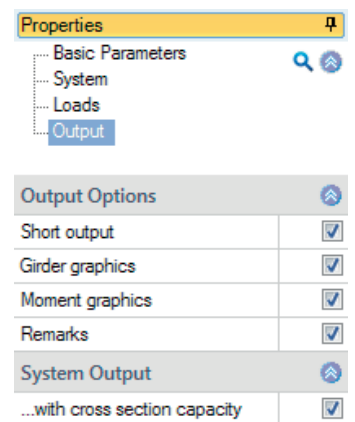
View selection

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.



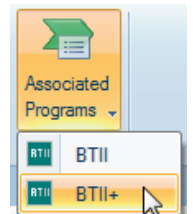
Output options

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