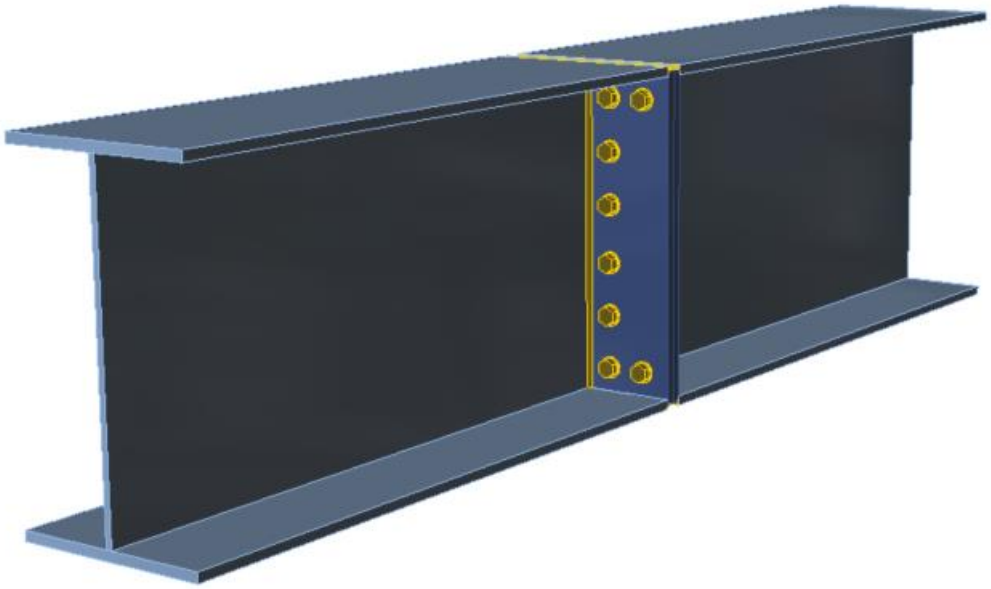
IDEA StatiCa®
Calculate yesterday's estimates

IDEA StatiCa Steel - Tutorial



Design of bolted plate to plate connection

Steel connection design reinvented – any topology, any loading, in minutes. Check of joint/connections acc. to EC/AISC. Unique CBFEM method. Get more resources at www.idea-rs.com and www.ideastatica.com

Welcome to IDEA StatiCa tutorial. We will show how to use software IDEA StatiCa to model, design and check a structural steel joint, example being bolted plate to plate connection.

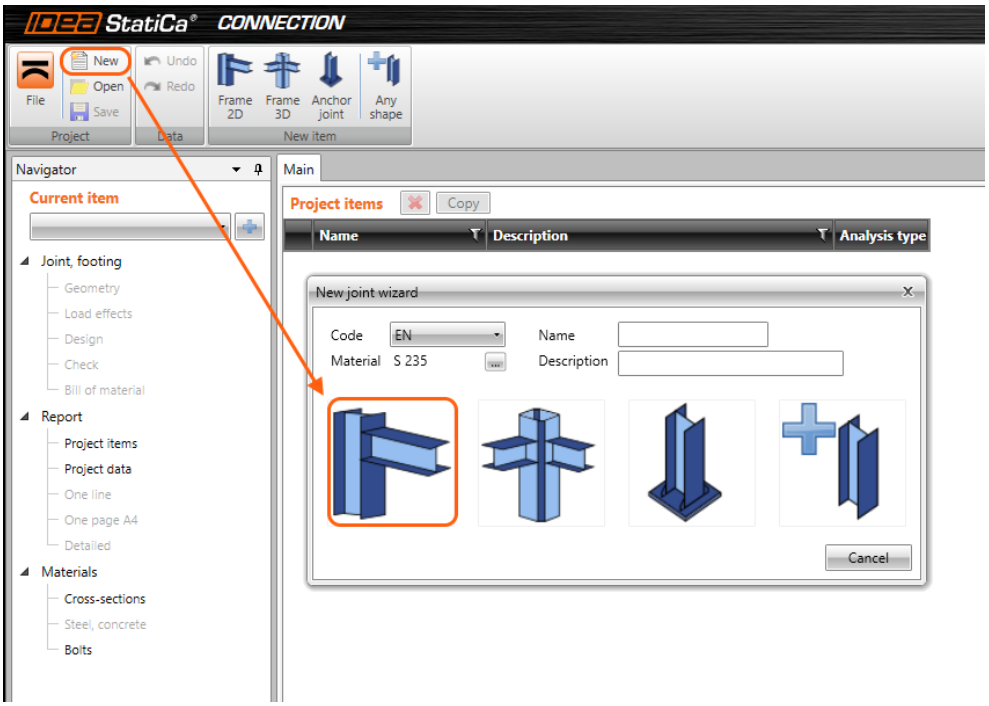
Launching application

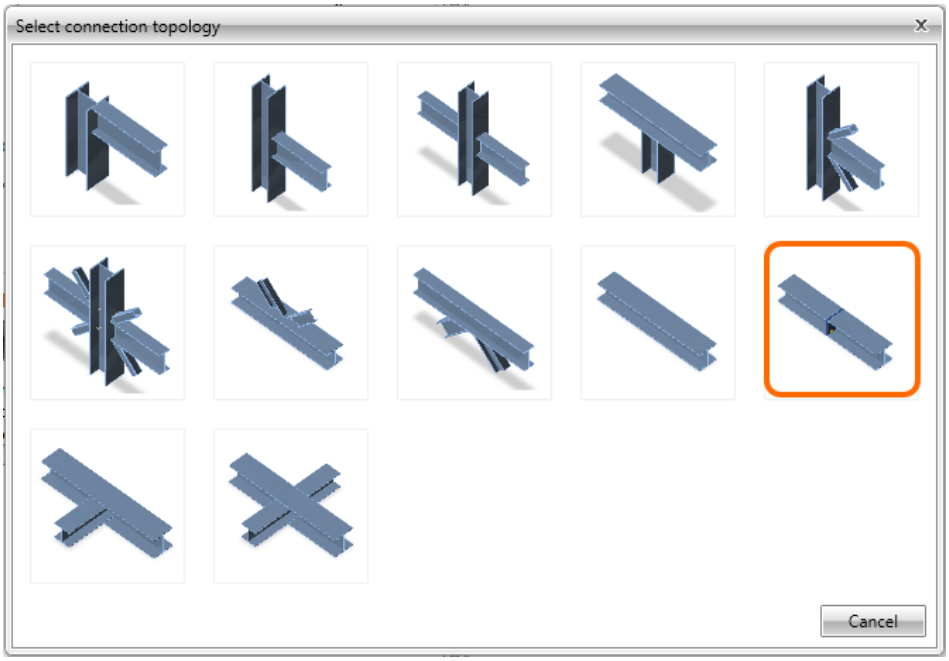
Let's launch IDEA StatiCa and select application **Connection**.

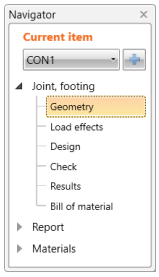
New project

We create a new project by clicking **New.** Wizard window is opened. We select **2D frame shape** and **beam to beam** topology.

Navigator on the left will guide us through the whole project.

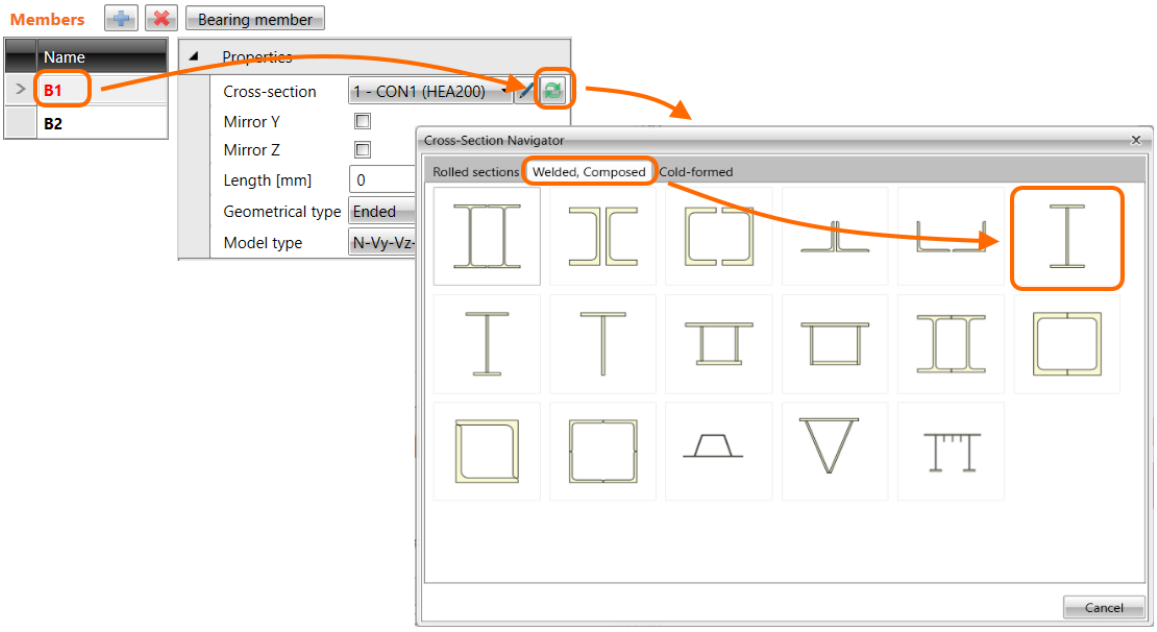


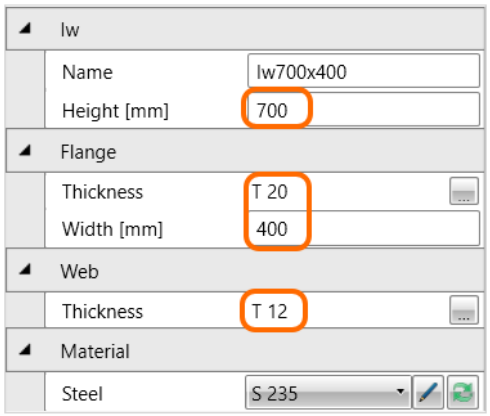


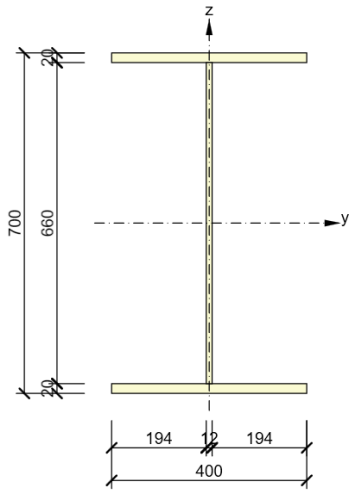


Geometry

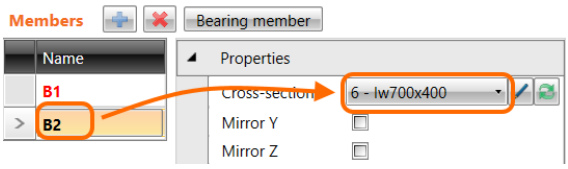
We start with defining the **Geometry**. Two beams were automatically added. Then we change cross-sections of member B1 to welded "I section" and define cross-section dimensions (height, flange thickness and width and thickness of the web).

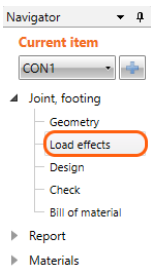






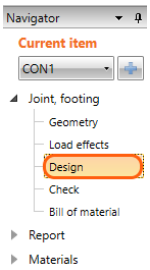
We set this new cross-section for the second member B2 as well.





Load effects

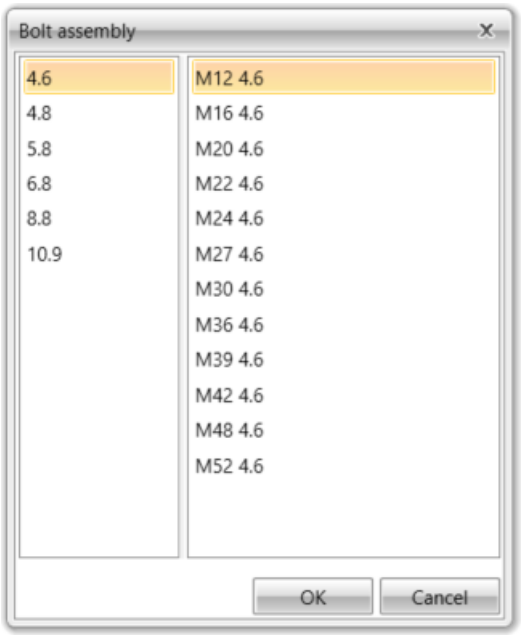
Let's continue with **Load effects**. One load effect was automatically added by the wizard. We input its values into the table (normal force, shear force and bending moment). More load cases can be added.



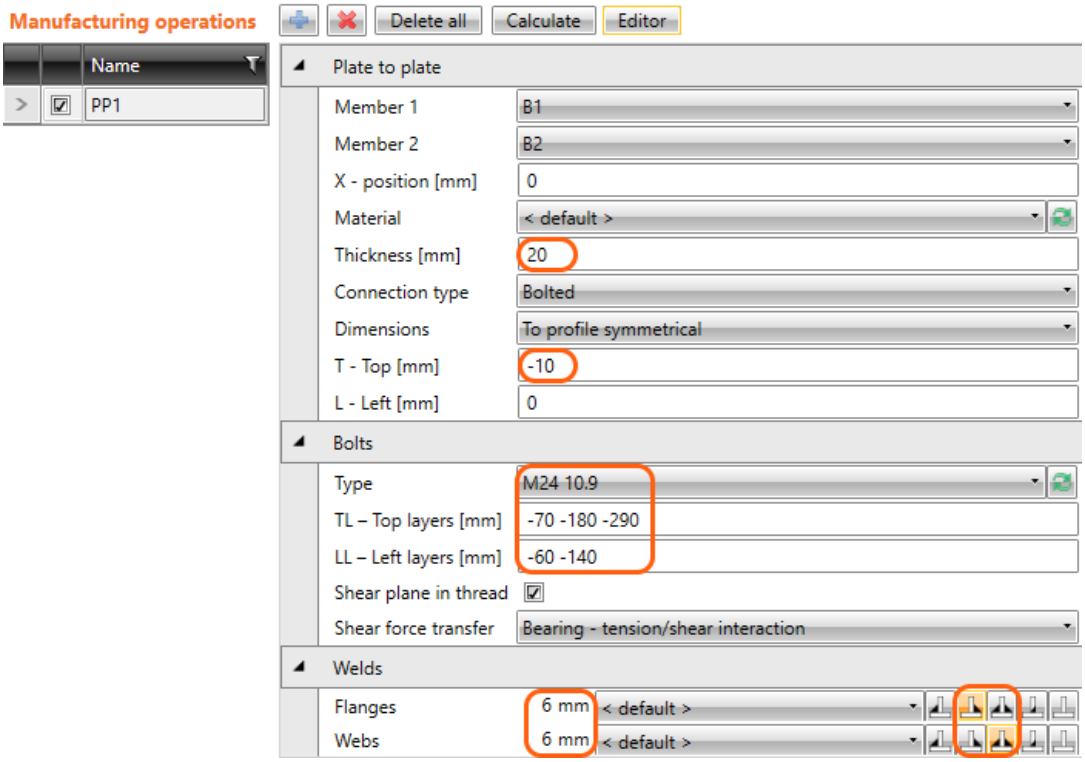
Design

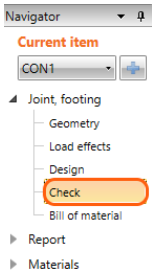
Next step is the **Design**. To model connection between beams, we click on **Add button** and select operation **Plate to plate**.

We select default bolt type.



Operation is added and we update its parameters (plate thickness, top offset, bolt pattern and type, weld size and type)

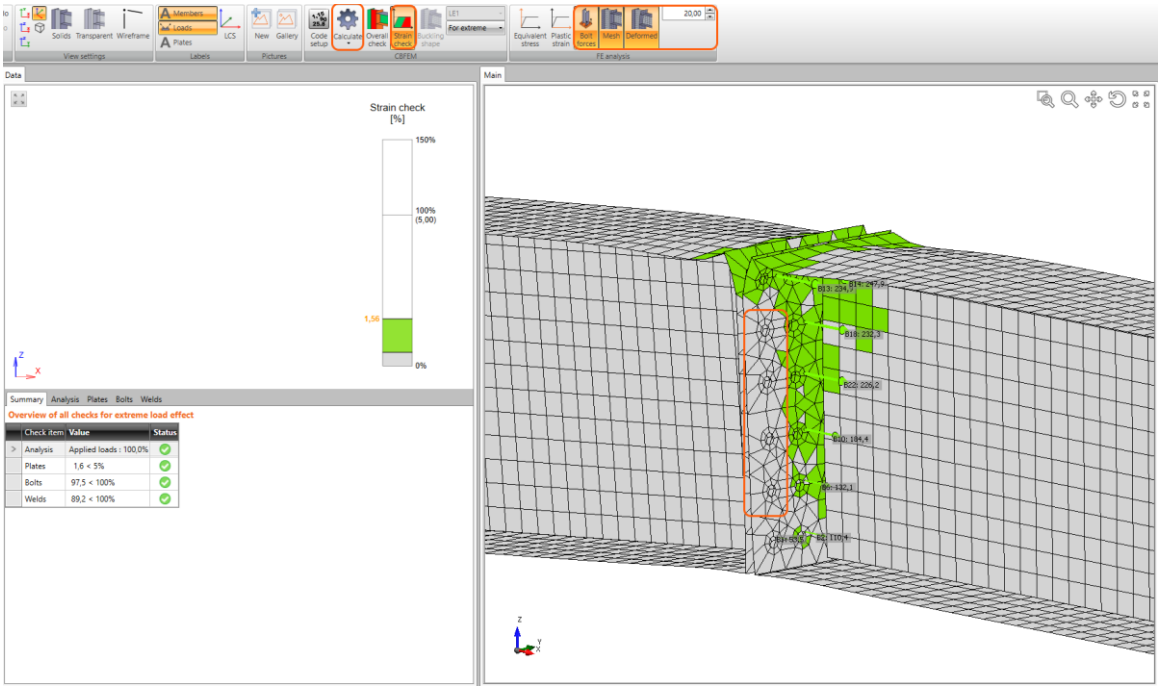




Check of a structural steel joint

Now we move to the **Check** section of the Navigator. We start nonlinear analysis by clicking **Calculate** in the ribbon. Analysis model is automatically generated, calculation is performed and we can check results.

We activate **Strain check**, **Bolt forces**, **Mesh** and **Deformed** from the ribbon to get a full picture of what is happening in the joint. Everything is displayed in the 3D window. We can see that there are some unused bolts.



Values of bolt checks and forces are displayed in the table tab Bolts/Anchors.

Summary Analysis Plates Bolts Welds

Check of bolts for extreme load effect

	Item	Loads	Ft [kN]	V [kN]	Utt [%]	Uts [%]	Utts [%]	Status
>	B1	LE1	53,5	3,5	21,1	2,5	17,5	✓
	B2	LE1	110,4	3,8	43,4	2,7	33,7	✓
	B3	LE1	52,8	3,5	20,8	2,5	17,4	✓
	B4	LE1	112,3	3,8	44,2	2,7	34,3	✓
	B5	LE1	0,0	3,7	0,0	2,6	2,6	✓
	B6	LE1	132,1	4,1	52,0	2,9	40,1	✓
	B7	LE1	0,0	3,7	0,0	2,6	2,6	✓
	B8	LE1	130,7	4,1	51,4	2,9	39,7	✓
	B9	LE1	0,0	3,6	0,0	2,6	2,6	✓
	B10	LE1	184,4	4,1	72,5	2,9	54,7	✓
	B11	LE1	0,0	3,6	0,0	2,6	2,6	✓
	B12	LE1	188,8	4,1	74,3	2,9	56,0	✓
	B13	LE1	234,9	2,0	92,4	1,4	67,5	✓
	B14	LE1	247,9	1,2	97,5	0,8	70,5	✓
	B15	LE1	235,3	1,9	92,6	1,4	67,5	✓
	B16	LE1	247,1	1,1	97,2	0,8	70,2	✓
	B17	LE1	0,0	3,5	0,0	2,5	2,5	✓
	B18	LE1	232,3	3,2	91,4	2,3	67,6	✓
	B19	LE1	0,0	3,6	0,0	2,5	2,5	✓
	B20	LE1	232,2	3,2	91,4	2,3	67,6	✓
	B21	LE1	0,0	3,5	0,0	2,5	2,5	✓
	B22	LE1	226,2	3,9	89,0	2,7	66,3	✓
	B23	LE1	0,0	3,5	0,0	2,5	2,5	✓
	B24	LE1	230,3	3,8	90,6	2,7	67,4	✓

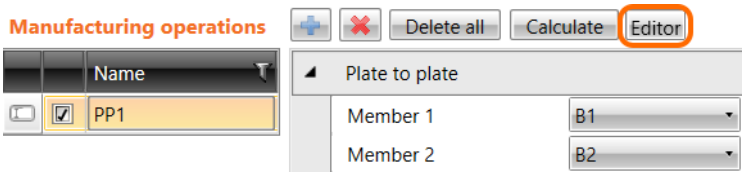
Design data

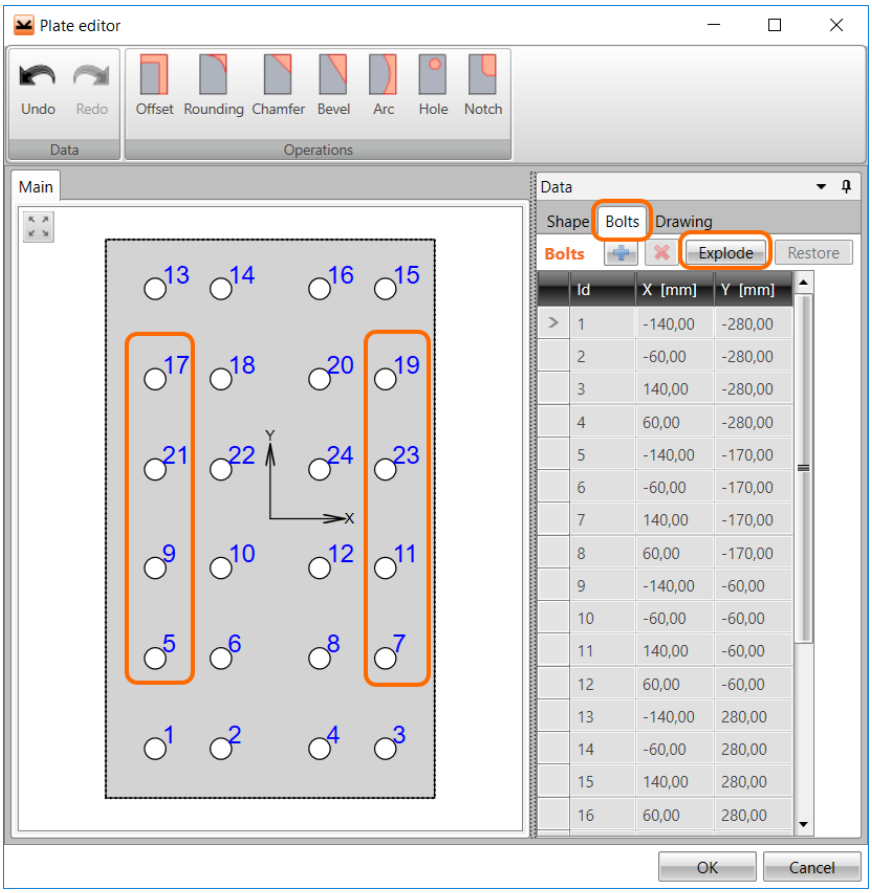
	Item	Ft,Rd [kN]	Bp,Rd [kN]	Fv,Rd [kN]	Fb,Rd [kN]
>	M24 10.9 - 1	254,2	445,2	141,2	345,6

Optimization – bolts reduction

IDEA StatiCa Connection enables optimization of the joint. We showed that usage of some bolts is almost zero. We can remove them and make our design more economical.

We need go back to **Design**, select manufacturing operation **plate to plate** and open **Editor**, select tab **Bolts** and click on **Explode**. Now we can select and delete bolts 5,7,9,11,17,19,21 and 23 using **Delete** button.

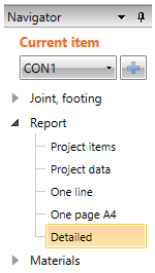




We can run the analysis again and check updated results. The new design passes all the checks and we saved 1/3 of bolts.

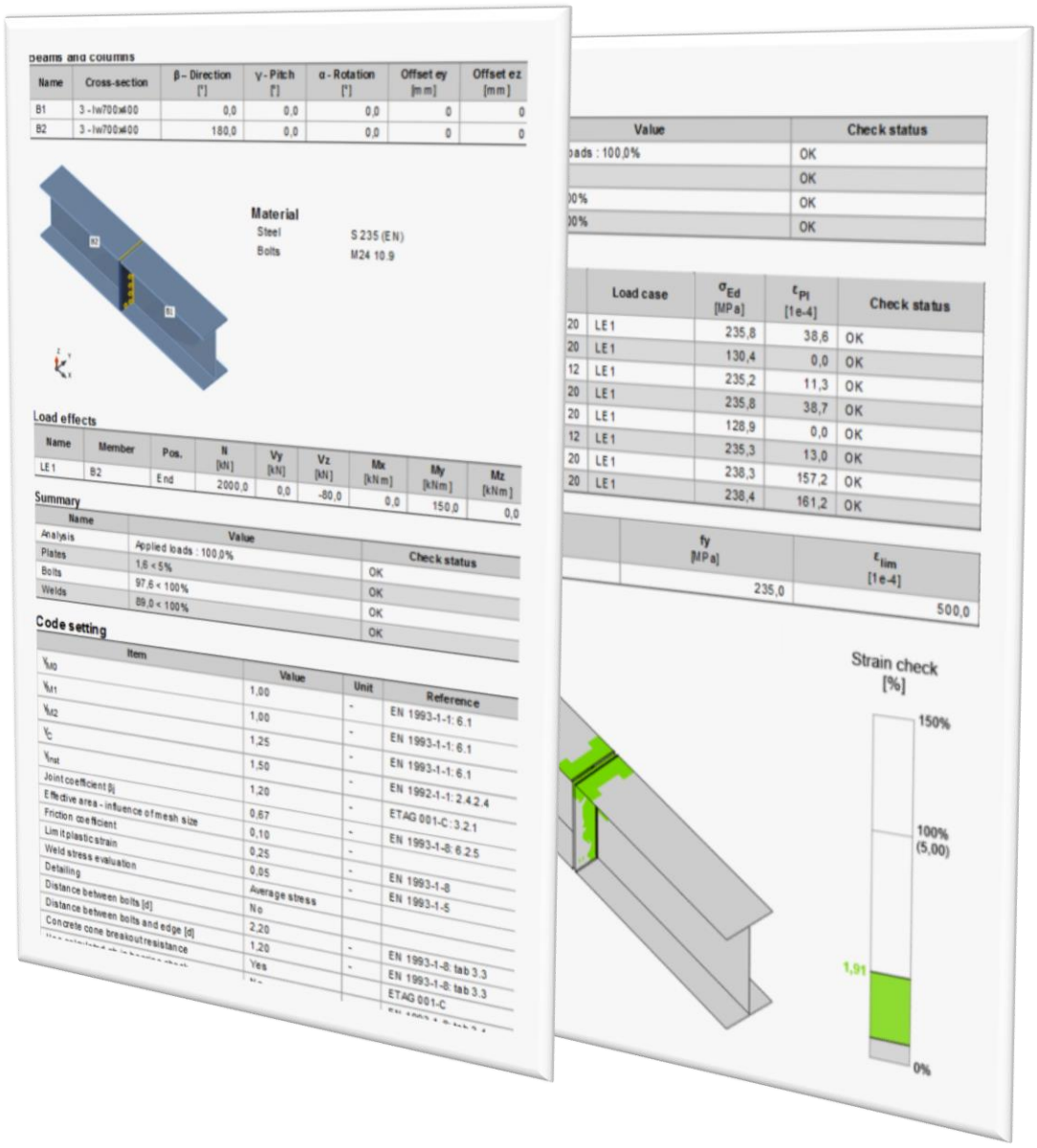
Overview of all checks for extreme load effect

Check item	Value	Status
Analysis	Applied loads : 100,0%	✓
Plates	1,5 < 5%	✓
Bolts	97,6 < 100%	✓
Welds	89,0 < 100%	✓



Report

The final step of the project is to generate the **Report.** IDEA StatiCa offers three types of output reports – one line, one page and detailed. We will choose the **Detailed** report that contains materials, geometry, all checks. We can also add bill of material and theoretical background to explain underlying methods and references to selected design code.



Structural steel joint was modelled, designed and checked

Thank you for spending time on this tutorial. For further information please visit our website.