ST10

Bolted Beam-to-Column Connection

ST10 is a software application for the calculation of screwed moment-resisting frame joints.

Component method

Component model in accordance with the method specified in EN 1993-1-8.

The design resistance of the connection is determined under the assumption of a plastic distribution of the bolt forces. The internal forces can be determined with the help of the rotational stiffness of the connection calculated by the application.

See also the description on the next page.

System

You can verify typical variants of T-corners and knee corners of double T-profile sections:

- T-corner without corner reinforcement
- T-corner with corner reinforcement (haunch), on one or both sides
- Knee corner with/without corner reinforcement
- Knee corner with welded / screwed butt strap and corner reinforcement

In all variants, you can increase the bearing capacity of the shear field by applying cross strips or a web reinforcement to one side. In addition to this, you can fit web ribs in the column and also the ledger if a corner bracing was defined.

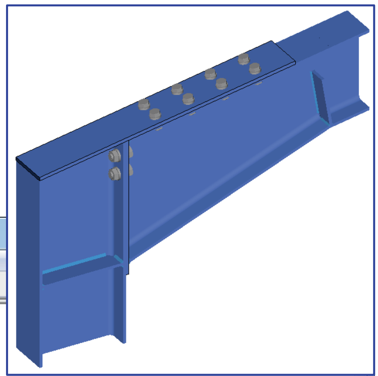
Loading (actions)

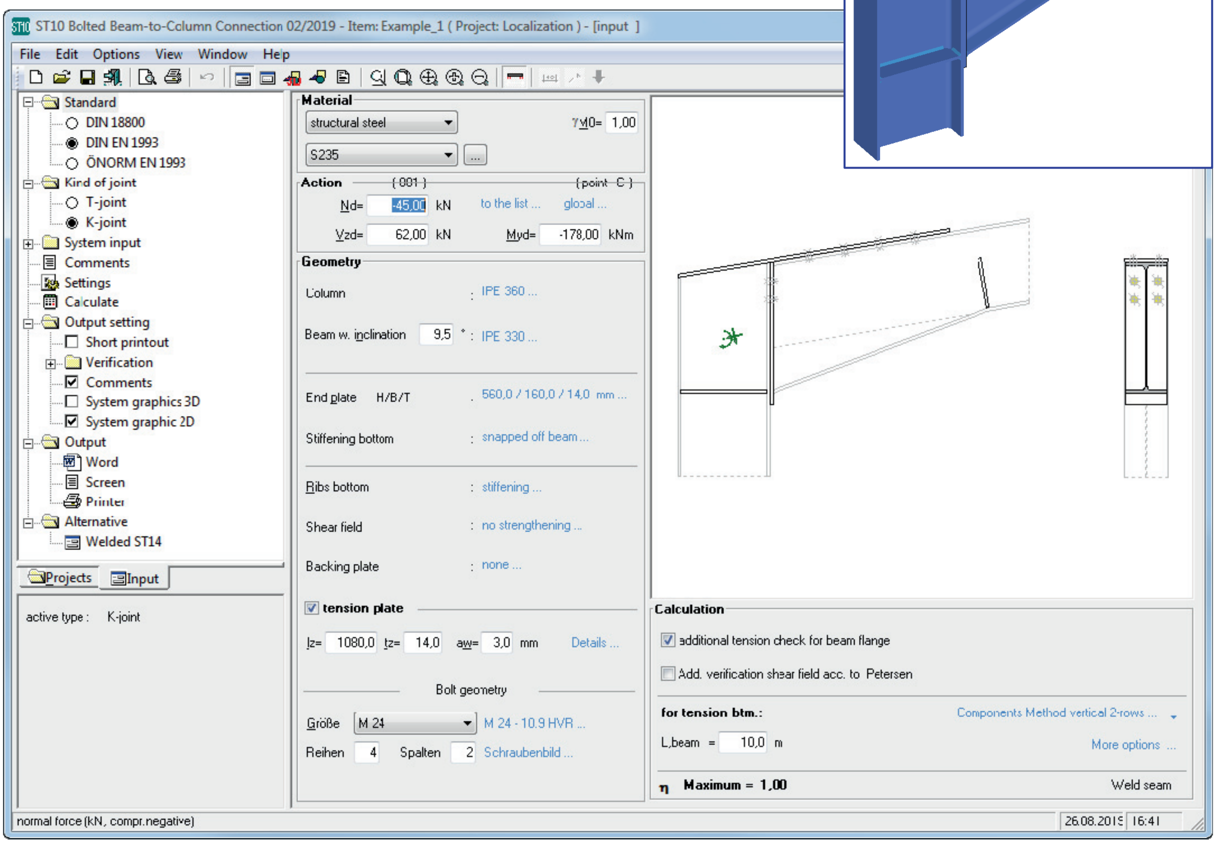
You have to enter the design values of the internal forces N, My and Vz. The internal forces must result for the biggest part from dead loads. You can enter several combinations of actions in the form of tables.

Standards / Calculation

The application performs the required verifications concerning the structural safety and the welded connections in accordance with:

- DIN EN 1993
- ÖNORM EN 1993
- DIN 18800





Various calculation methods are available depending on the configuration of the system and the chosen standard:

- In accordance with *the component method* for optionally pre-tensioned screws fitted in two vertical rows and distributed variably over the connecting height:

- EN 1993
- DIN 18800 (according to DIN ENV 1993-1-1:1992 /A2; 1998)

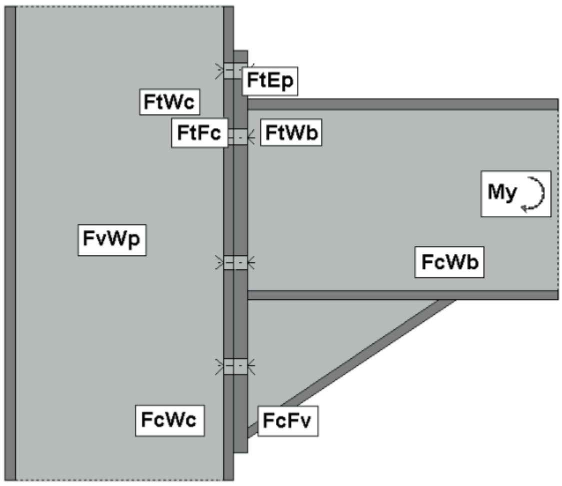
  and for vertical four-row screws distributed around the outer girder according to AiF model in the DASt Research Report 3/2009 [13]

- In accordance with the *DSTV*[1] *guideline* (1984) - *only DIN 18800* - for flush/projecting face plates with two or four rows of high-strength, pre-tensioned screws
- In accordance with *Schineis* - *only DIN 18800*: Simplified calculation of screwed frame corners described in "Der Bauingenieur", edition 12/1969 (44th year) for two or more vertical rows of non-pre-tensioned screws distributed evenly over the connecting height. A sufficient stiffness of the flanges and the faceplate is a precondition to this. The calculation is based on the elastic-elastic method and the front plate is assumed to maintain its evenness in the deformation. From a pure practical point of view, it is impossible to identify the internal forces exactly because panel, plate and bar parts act together. Therefore, the calculation should be considered as an approximation in each case.

[1] German Steel Construction Association

The component method

This method is used to determine the design resistance of the connection under the assumption of a plastic distribution of the bolt forces. The design bending resistance of the components faceplate and column flange is determined with the help of ideal equivalent T-stub models, the failure mechanism of which is described by flow line patterns.



As a basic principle, the connection is decomposed into individual components with the associated resistance limit states that are calculated by the application in accordance with the chosen standard. The design resistance of the entire connection results from the distribution of the connecting forces over the components and their balance in the connection. The following component loading is considered in the T-stubs: column web in tension (FtWc), column flange in bending (FtFc), faceplate in bending (FtEp) and beam web in tension (FtWb). Additional component verifications are column web in shear (FvWp) and in compression (FcWc), beam flange in compression (FcFb) and/or haunch flange in compression (FcFv).

The more accurate description of the component behaviour improves the design of the connection with a higher utilization.

In addition to rigid connections, the method is also suitable for moment-resisting joints that are classified as deformable connections. The internal forces must correspond to the stiffness of the connection, i.e. the previously calculated spring stiffness Sj of this joint is used in the calculation of the internal forces. Therefore, the internal forces are determined in an iterative calculation. The increase in calculation work is made up for by the optimization of the material and installation costs achieved through this calculation.

You can easily adjust the joint characteristics to given border conditions through manipulation of the individual components by modelling a joint classified as rigid in order to be able to calculate internal forces independently of the joint stiffness, for instance.