

S9+

Crane Runway Girder

The S9+ application is suitable for the calculation of crane runways in accordance with EN 1993-1-1 and EN 1993-6.

Crane system

One or two

- top-mounted cranes (overhead travelling cranes - CFF, IFF, CFM, IFM system)
- underslung cranes (below the runway beams)
- monorail hoist blocks

Available standards

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

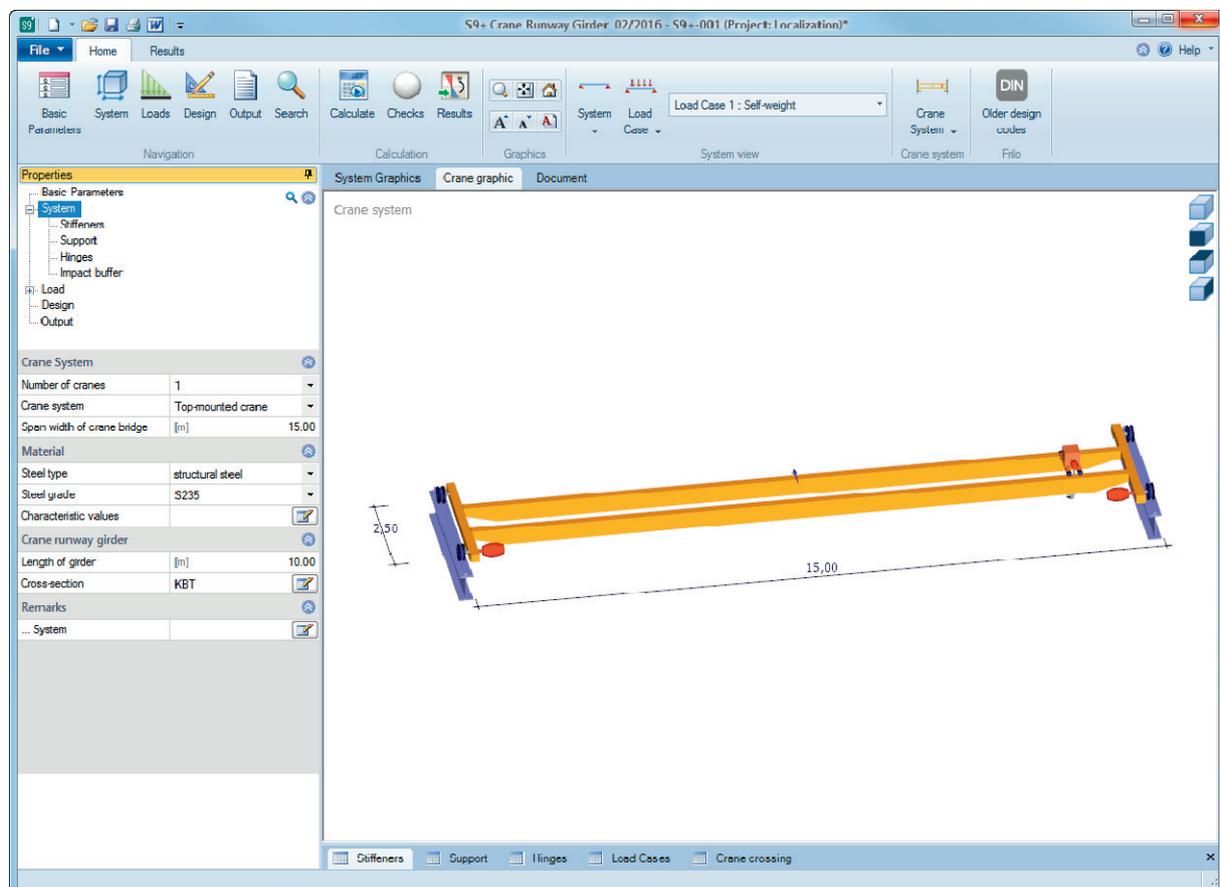
Verifications

- Verification of the stability against lateral torsional buckling in a second-order analysis
- Stress analyses for the cross section and the weld seams
- Analysis of the local wheel load transfer at the top or bottom flange
- Verifications in the fatigue limit state for the cross section and the weld seams
- Verifications in the fatigue limit state for the local wheel load transfer on the upper and lower flange
- Verification of the stability against buckling in accordance with the method of effective cross sections
- Serviceability verifications

Definition of the structural system

After having selected the crane system, you must define discrete supporting conditions, pinned joints and buckling stiffeners along the crane runway girder. The total length of the girder must be specified. Any type of support can be defined with consideration of horizontal stiffening bracings.

- Material: S235, S275, S355...
- Constant cross section: rolled-shaped sections: I, IPE, HE-A, -B, -M, user-defined I-sections with or without reinforcing top flange angles on both sides.
- Crane rail: A-type, F-type or block rail (w/h) with structural effect, if applicable



- Elastic base of top-mounted crane rails
- Bumpers can optionally be fitted outside of the crane runway.

Loading

You can define one or two cranes that are operated independently of each other and optionally assign

- one of the lifting classes H1 to H4 and
- one of the duty groups S0 to S9 as per EN 1991-3

to them.

S9+ allows the calculation of lateral horizontal loads as per EN 1991-3.

Automatic generation of loads for special cases:

The following actions on the crane runway are automatically derived from the specified crane parameters:

- Self-weight
- Vertical wheel loads
- Horizontal lateral loads

In special cases, you can edit these actions. By defining other variable loads, for instance, you can work around a limitation to particular crane systems.

The S9+ application is distinguished by an easy and simple definition of standard cases on the one hand and a maximum of flexibility in special cases on the other hand.

In addition, wind and earthquake loads can be taken into account.

S9+ determines and puts out the bumper forces.

The combinations of actions are generated automatically. You can also directly influence this process.

Imperfection is taken into account in accordance with the horizontal supporting conditions right from the beginning.

Verification process

- Calculation of internal forces, deformations and stresses with imperfections in accordance with the second order bending torsion theory including warping torsion
- Automatic assessment of the most unfavourable load positions for each verification
- Verification of the ultimate (e-e method) and serviceability limit states
- Verification of the fatigue strength as per EN 1993-6
- Calculation of the stresses produced by the global supporting effects and by local loading due to the load transfer
- Calculation of the design support reactions, the support reactions with a reduced dynamic coefficient or without such coefficient for the connected structures and/or foundations

Output / interfaces

- Additional output sections showing particular calculation results
- Variable output profile optionally structured according to the system, the loads, the general structural safety verifications or special verifications of the crane runway
- 3-dimensional graphical representation of the results of each superposition for the structural safety, the serviceability and the service strength
- Graphical representation of the limit line of the internal forces Q_z , M_y , Q_y , M_z , M_t and M_w
- Graphical representation of axial, shear and comparison stresses in each relevant point of the cross section over the entire crane runway girder, selectable per mouse click

- Graphical representation of the fatigue strength verifications of the entire crane runway girder.
- If the PLII+ and/or BTII+ applications are installed, you can transfer the system and the loading for the web buckling and/or stability analyses.

Limitations

- Constant cross section
- No hollow boxes
- Forces produced by start-up and braking operations of the crane bridge are not considered in the present software version.
- You might be required to adjust subsequently the imperfection produced by the decisive action.