B8

Prestressed Concrete Girder

B8 is suitable for the calculation of reinforced concrete beams and pre-tensioned girders (long-line method). The software performs all required verifications of the load-bearing capacity (also for the accidental and earthquake design situations) as well as serviceability verifications. The comprehensive data-entry work is facilitated by several well-structured data-entry screens and supported by help files that include information about permissible and required values as well as plausibility checks.

Available standards

- DIN EN 1992-1-1/NA
- NA to BS EN 1992-1-1
- EN 1992-1-1
- PN EN 1992-1-1
- ÖNORM B 1992-1-1

Girder types

You can calculate the following girder types with the help of B8:

- Girder with parallel flanges
- Symmetrical and asymmetrical girders with saddle or groove
- Single-pitch roof girder

In addition to calculating the entire girder system, you can also calculate individual cross sections.

Shapes of cross sections

B8 allows you to calculate all relevant cross sections. In addition to the simplified definition of

- rectangular cross sections
- T-beams and
- Two-webbed T-beams

you can also define any type of compact single and double-symmetrical cross section with the help of the so-called

- layer cross section

You can optionally supplement the defined cross sections with cast-in-place complements such as

- solid slabs
- solid slabs with pre-fabricated formwork or
- complements to the slab

You can define enlarged bearing cross sections for the support area at the end of the girder.

Structural systems

You can calculate the girder in the final state, during its storage, as a single-span girder or as a cantilevered single-span girder.
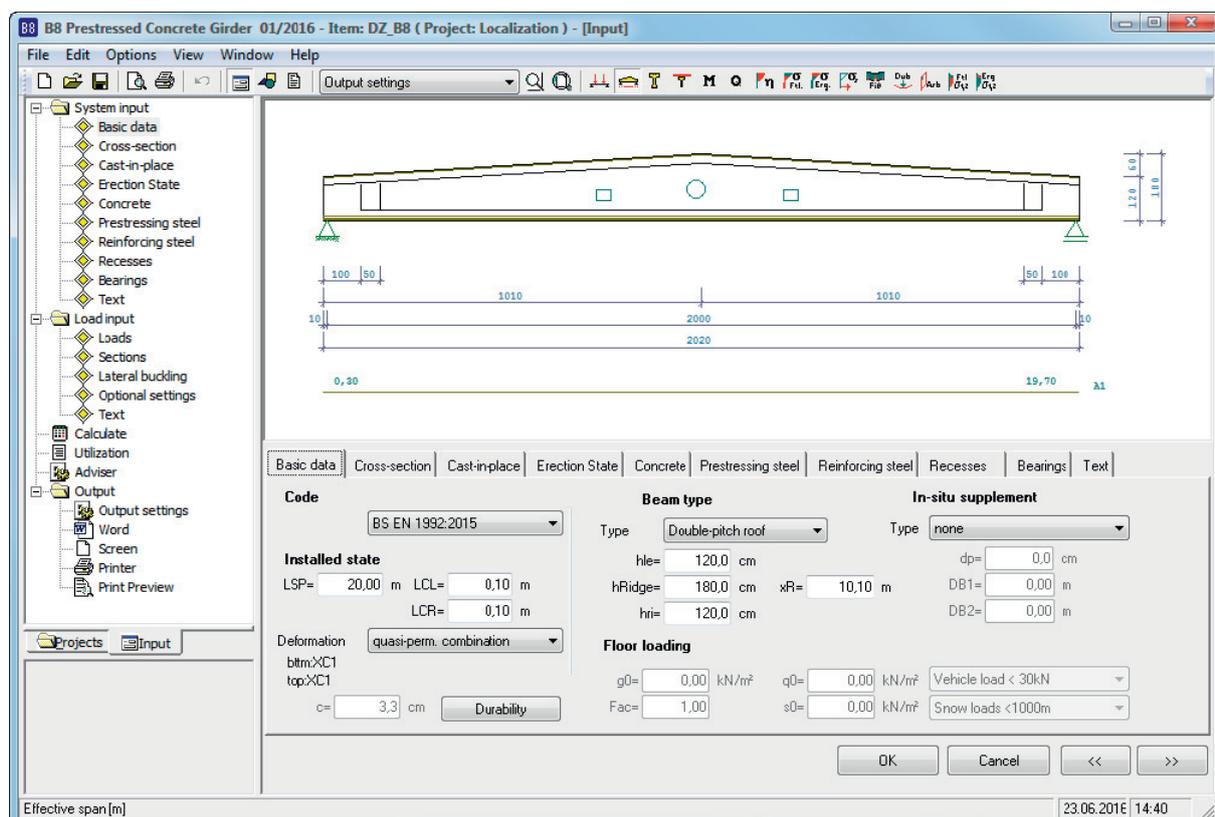
For the erecting state, you can examine a separate structural system aligned to the location of the suspension points.

The structural systems that result from auxiliary supports installed during the installation of the cast-in-place concrete complements are automatically taken into account in the calculation of the cross sections.

Loads

B8 allows you to define permanently vertical, subsequent permanent and variable loads as

- uniformly distributed linear loads
- concentrated loads and moments
- trapezoidal loads and triangular loads

The assignment of standard-specific or user-defined actions is supported by a dialog.

B8 performs automatically the calculation of the self-weight including that of the cast-in-place concrete complement.

Reinforcement

- Multi-layer pre-tensioned reinforcement with insulation, if applicable
- Multi-layer untensioned reinforcement

In B8, the reinforcement is assumed parallel to the top or bottom flange.

Durability requirements

The combination of all decisive exposition classes produces the following results:

- Minimum concrete class
- Minimum concrete cover
- Permissible crack width
- Whether a decompression analysis is required

The results are produced separately for the top and bottom of the girder.

In addition to this, you can find special features such as air-entrained concrete, aggregate for wear, decrease of the dimensional allowance for pre-fabricated components.

Verifications

Ultimate limit state (USL):

- Bending with longitudinal force (including resisting tensile force coverage)
- Shear resistance, for cast-in-place supplements inclusive bearing capacity of the joints
- Lateral buckling in the installed state and in the erecting state (method by Stiglat and Mann)
- Determination of the tensile splitting reinforcement
- Anchorage of the prestressing reinforcement

Serviceability limit state (SLS):

- Concrete stresses, steel stresses (prestressed steel, reinforcing steel)
- Crack width (loading, minimum reinforcement), verification of the decompression, if required
- Deflection for a selectable load combination of the SLS with consideration of state II including tension stiffening and shrinkage
- Changes in length due to temperature, creep and shrinkage

All verifications are performed at the beginning and the end of creep stages, which are determined by the casting and the usage of the girder. The creep factor and the shrinkage strain are calculated in detail and are taken into account in the verifications. The pretension remaining after the deduction of losses due to creep, shrinkage and relaxation is considered effective.

Results

The calculation is based on a section grid laid over the girder. Every verification is performed on each individual cross section of the grid. The result list reveals the section with the highest utilization or the lowest safety reserve, which is the critical section for this verification.

A quick overview is available via the view of the critical cross sections, which also shows the utilization of the respective verification.

The graphical representation of the utilization behaviour allows the easy identification of points where a limit is exceeded. The values processed in the graphical representation can also be displayed in the form of a table.

In order to find out why the limit in a verification was exceeded, you can display each calculation step in detail. An advisor suggests appropriate corrections.

Design settings

The user can control the inclusion of calculation assumptions that are permissible in particular cases of application. The control options include:

- Definition of independent imposed and live loads
- Combination of permanent loads for each span separately
- Verification of the crack width limitation without minimum reinforcement
- Definition of a gradual application of the pre-tensioning force
- Definition of reduced material safety coefficients for pre-cast components
- The consideration of a thermal treatment allows the utilization of increased strength at the moment when tensioning force applies and the reduction of the creep factors.
- At the moment when the tensioning force applies, a higher permissible compressive stress and an increased compressive resistance of the concrete can be taken into account, if the corresponding prerequisites are satisfied.