B5+

Reinforced Concrete Column

B5 is intended for the calculation of reinforced concrete columns and walls under uniaxial and biaxial loading.

Standards

- DIN EN 1992
- ÖNORM EN 1992
- EN 1992

Data entry

- General columns with any number of storey segments
- Fast definition of simple standard systems via a wizard
- Interactive graphical user interface for data entry and editing
- Data entry via characteristic loads and their actions. Automatic combinatorial analyses for all relevant design situations in the ULS and the SLS
- Grouping of loads into alternative and concurrency groups
- Automatic inclusion of standard snow loads as accidental actions
- User-defined actions
- Selection options concerning the durability requirements

Calculation

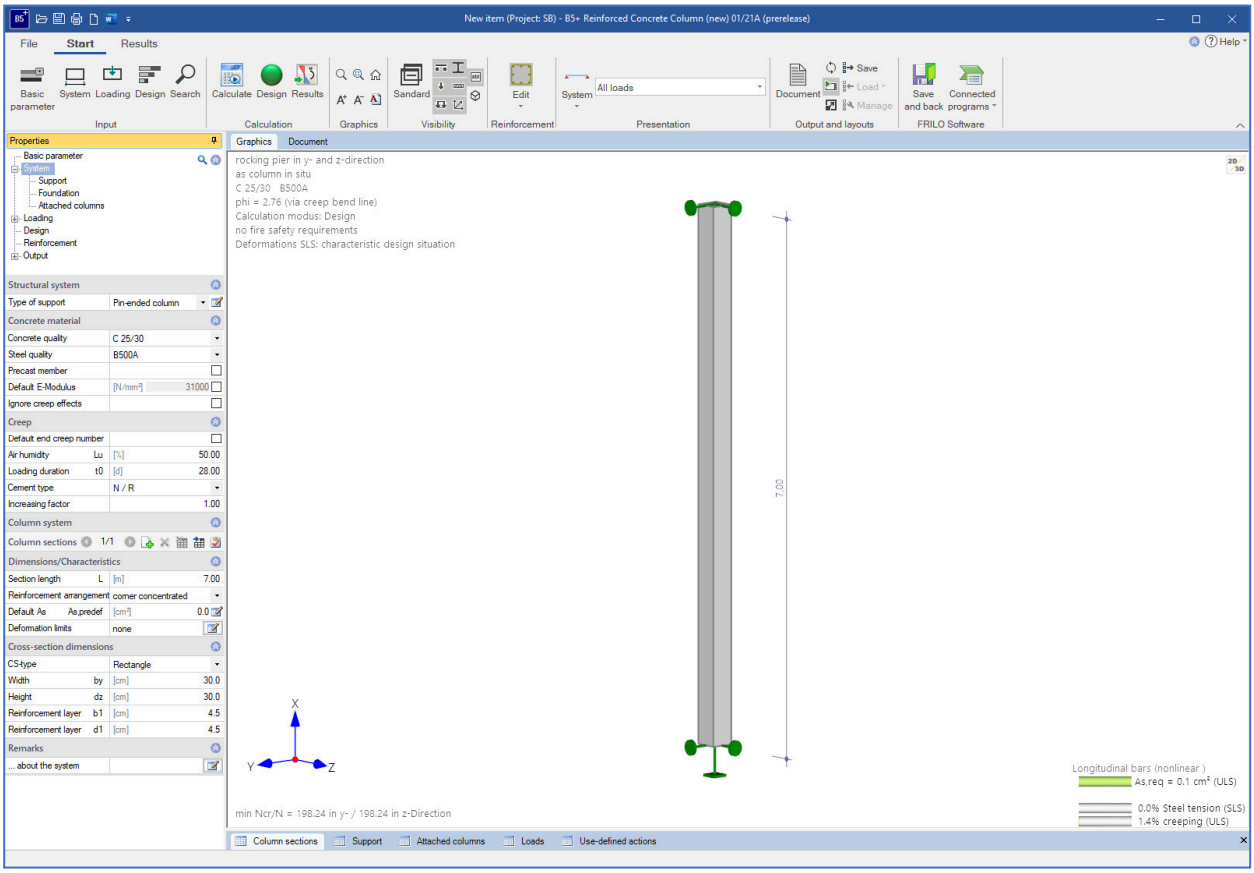
- Non-linear stiffness can be calculated in accordance with the actual stress strain ratio (A_s or the actual reinforcement pattern can be specified!)
- Foundation restraints can optionally be considered
- Verification of all border conditions (minimum reinforcement, necessity of a buckling safety analysis, regular design etc.)
- Calculation modes: design, verification, limit load factor
- Creep influence via explicit calculation of the creep bending line
- Shear force design
- Serviceability analyses (stress analyses, deformations)
- Fire-safety verification or design according to EN 1992-1-2, method A (eq. 5.7)
- General hot design for hinged and cantilever columns (add-on)

Output

- Graphical representation of the system, loads and internal forces charts.
- Extensive graphical preparation of the calculation results (state lines for internal forces, stiffnesses, etc. for all relevant design situations and stages)

Load transfer

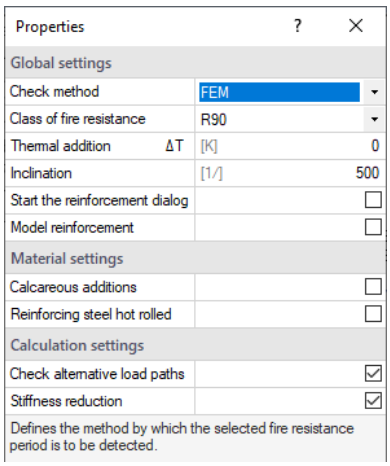
Interfaces to the foundation FD+ and block foundation FDB+ programs.



Hot design add-on

EN 1992-1-2/NA:2010, 4.1 specifies that general methods may be applied in the calculation of the component temperatures and its load-bearing capacity under fire exposure in the hot design.
Therefore, we have implemented a corresponding calculation method for exposure on four sides in the software.

The temperature is assessed with the help of the TA program - Temperature Analysis in the Cross-Section, which calculates temperature distribution in rectangular and circular cross-sections of any dimensions based on the FEM.



Basis of calculation

In combination with the B5-HSB add-on, the software performs fire-safety analyses of cantilever columns based on the general method (temperature determination) using the TA program. In this calculation, thermal expansion is considered in addition.

In order to calculate the internal forces acting on the concrete, the concrete cross-section is divided into elements with an edge length of 1 cm each.

The internal forces resulting for the reinforcing steel depend on the temperatures in the reinforcement points.

Method of calculation

The "cold" design is performed for the persistent, transient, accidental, and seismic design situations, if available. The column is divided into subsegments in this calculation. Subsequently, the stiffnesses in state II are calculated in a second-order analysis. Idealised reinforcement layers or explicitly specified reinforcement patterns are used as a basis.

The internal forces for the hot design have to be calculated for the accidental design situation “fire”. The accidental actions from the cold design are not considered in this analysis. The calculation process corresponds to a great extent to that of the "cold" design. The distribution of the reinforcement, i. e. the precise description of the location of the existing longitudinal reinforcement, has a decisive effect on the result, however, because the reinforcement is located in the hot border zone. The steel strengths are reduced by 10 % to 80 % according to Table 3.2 of EN 1992-1-2; the stiffnesses in the individual member segments decrease accordingly.

You can optionally select whether the calculation should be for the purpose of a design, a verification or determining the realised fire-resistance period.

Validation

DIN EN 1992-1-2 / NA:2010, 4.1 requires a validation if the general calculation method is used. Therefore, the validation example CC 4.10 was examined with the help of the described method.

Reinforcement layout

The reinforcement layout gains particular importance due to the introduction of the hot design in accordance with DIN EN 1992-1-2 because the defined reinforcement is included in the calculation with its precise location and temperature.

The reinforcement dialog automatically suggests a standard-compliant reinforcement arrangement in the cross-section (incl. necessary structural bars and intermediate stirrups or S-hooks) as well as over the column segment height (with optional consideration of compaction areas).

The user can customise these suggestions subsequently using the controls and the interactive GUI (adding/removing/moving individual rebars, diameter changes, etc.)