# B5

## Reinforced Concrete Column

B5 is intended for the calculation of reinforced concrete columns and walls exposed to uniaxial and biaxial effects of actions.

### Input

- General columns including up to 10 storey sections
- Simple systems (pin-ended, cantilever and frame columns) are directly selectable
- Definition of the loading as node and/or line loads. Automatic combination of loads, also for accidental actions
- Loads can be assigned to alternative groups (wind from the left/right) or concurrency groups (wind as line and concentrated load acting together)
- Selection options concerning the durability requirements

### Standards

- DIN EN 1992
- ÖNORM EN 1992
- BS EN 1992
- NTC EN 1992
- EN 1992
- DIN 1045 / DIN 1045-1
- ÖNORM B 4700

### Calculation

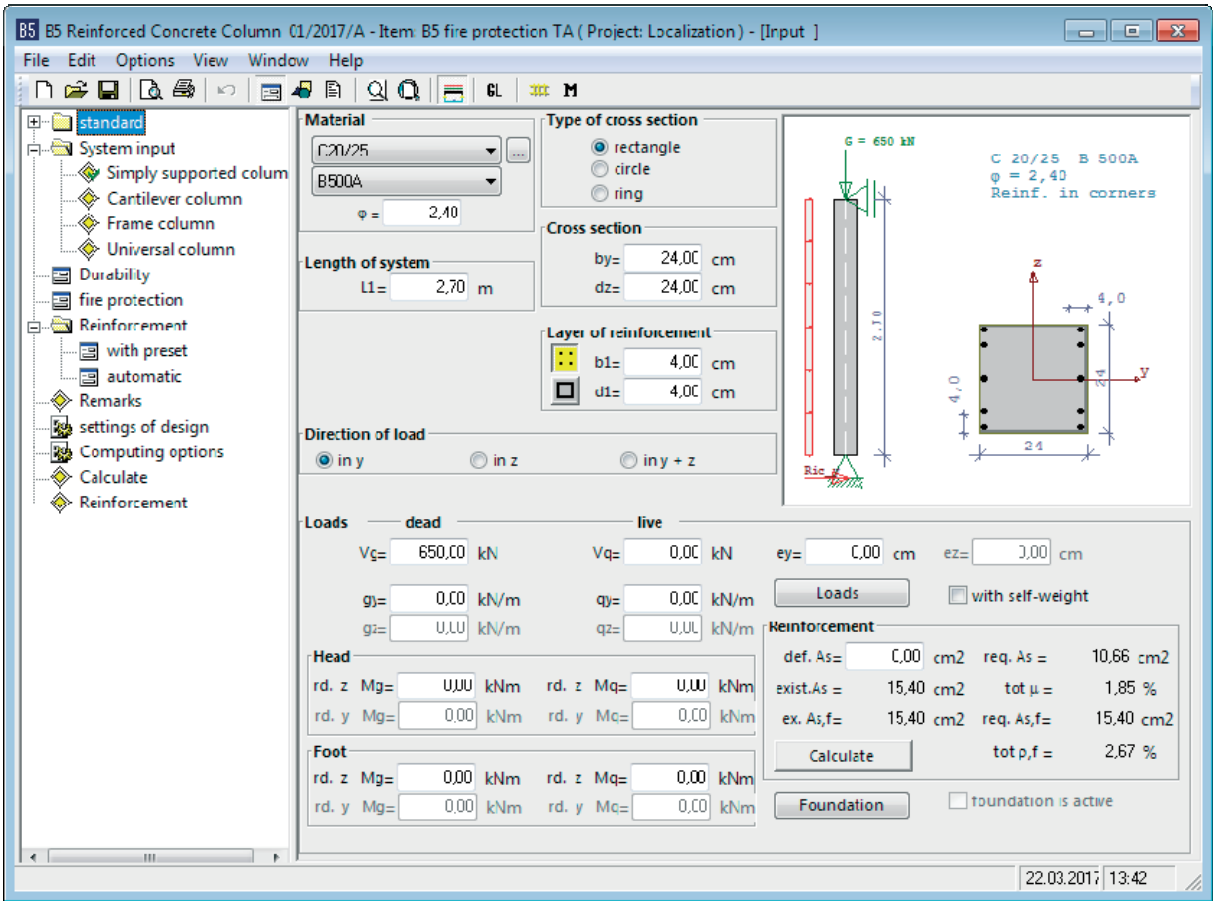
- Non-linear rigidity calculation according to the real stress strain ratio (As can be set by default!)
- Foundation restraints can be considered optionally
- Verification of all boundary conditions (minimum reinforcement, necessity of a buckling safety analysis, regular design etc.)
- Shear force design
- Serviceability analysis (steel stress analysis, deformations)
- Structural fire design for pin-ended and universal cantilever columns.

### Output

- Detailed output control including an additional "summary print" option
- Graphic representation of the moment area, the system and the loading
- Output of an editable reinforcement drawing for hinged and cantilever columns including a CAD interface

### Load transfer

Interfaces to the foundation applications FD+ and FDB+



## Additional option: structural fire design

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

The temperature is assessed with the help of the application TA - Temperature Analysis Cross Section, which calculates the exact temperature distribution for rectangular and circular cross sections in any dimensions.

This calculation method is considerably more flexible in regard to the border conditions than the procedure based on temperature profiles used until recently.

Fire resistance class options are available.

## Basis of calculation

In combination with the additional option B5-HSB, the fire protection analysis of cantilever columns is performed in accordance with the general method (assessment of the temperatures) via the TA application. Thermal expansion is taken into account 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 permanent, transient, and accidental design situation, if available. The column is divided into subsections in this calculation. Subsequently, the stiffnesses in state II are calculated in a second-order analysis that is based on idealized reinforcement locations.

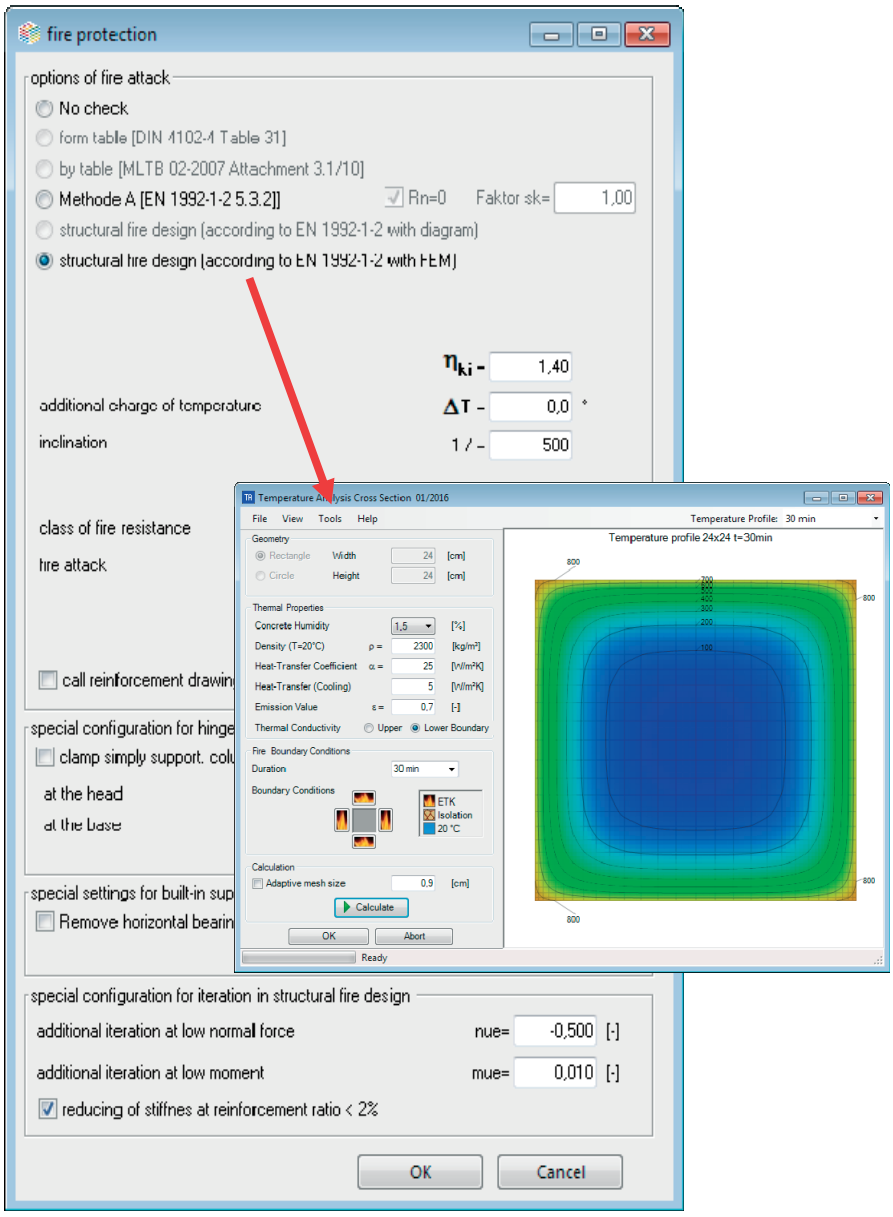
The internal forces for the structural fire design have to be calculated for the accidental design situation caused by fire exposure. The accidental actions from the “cold” design are not considered in this analysis. The calculation process corresponds largely to that of the "cold" design. The distribution 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 EN 1992-1-2; the stiffness of the bar sections decreases accordingly.

The selection of a layout and a preferable diameter defines the existing reinforcement that is included in the analysis.

Additional options also allow you to define the location or diameter of individual bars of the proposed reinforcement in detail.

## 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 method described above (see validation B5, *in German*).



## Reinforcement layout

The reinforcement layout gains particular importance due to the introduction of the structural fire design in accordance with DIN EN 1992-1-2 [2006-10] because the defined reinforcement is included in the calculation with its precise location and temperature.

Accordingly, the definition options in this dialog have been considerably enhanced.

The application offers several reinforcement layout options for instance.

The selection of a layout and a preferable diameter defines the existing reinforcement that is included in the analysis.

Additional options also allow you to define the location or diameter of individual bars of the proposed reinforcement in detail.