

Reinforced Concrete Column B5+

Contents

Application options	2
Additional option: Hot design B5-HSB	4
Additional option: High-strength steel 670 B5-SAS	4
Basic parameters	5
Structural system	6
Basic system data	6
Supports	9
Foundation	10
Appended hinged column	11
Loading	13
User-defined actions	14
Load groups	14
Design	15
Reinforcement layout	17
Cross-section	18
Plan	19
3-D view	19
Output	20
Load transfer	20

Basic Documentation – Overview

In addition to the individual program manuals, you will find basic explanations on the operation of the programs in the document [Basic operating instructions-PLUS_eng.pdf](#).

Further documentations on our homepage www.frilo.com in the Campus-download-section.

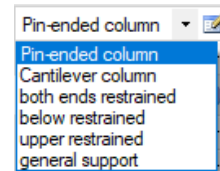
Application options

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

Note: Items of former versions of B5+ can be opened directly via the context menu.

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



Available standards

- DIN EN 1992
- ÖNORM EN 1992
- PN EN 1992
- NTC EN 1992
- BS EN 1992
- EN 1992

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 B5-HSB](#))

Output

- Detailed output control.
- 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

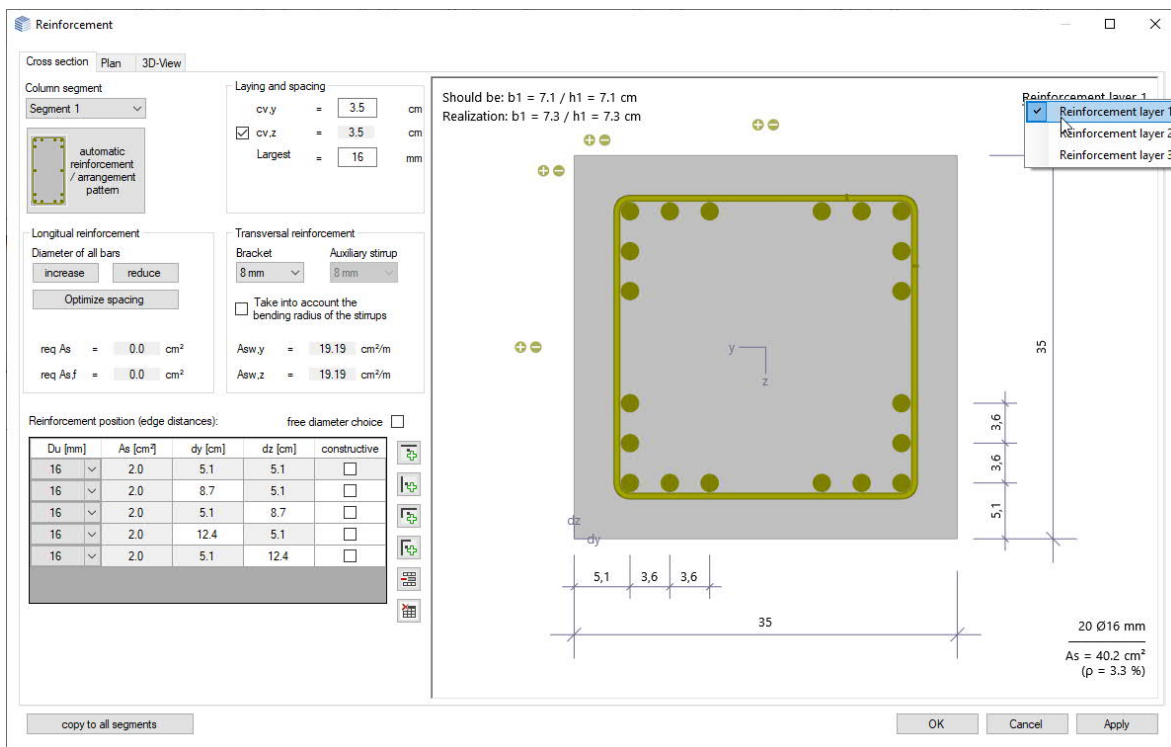
Interfaces to the foundation FD+ and block foundation FDB+ programs.

Validation

According to DIN EN 1992-1-2 / NA:2010, 4.1, a validation is required when using the general calculation method. Therefore, the validation example CC 4.10 was examined with the described procedure (see german documentation [Validierung B5](#)).

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.)

Export to ALLPLAN

The reinforcement image can be transferred to the automatic reinforcement in ALLPLAN - see [Reinforcement layout](#).

Additional option: Hot design B5-HSB

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 B5-HSB

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.

Additional option: High-strength steel 670 B5-SAS

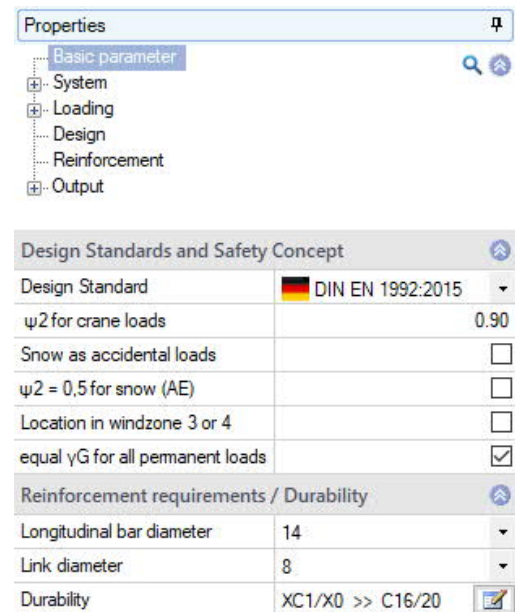
The steel grade SAS 670 from "Annahütte" is available as an additional option for the non-linear calculation (general method) of single storey columns.

The general method is not based on the basic assumptions of the simplified calculation method (nominal curvature method), some of which are strongly on the safe side, and thus allows a significantly economical dimensioning of columns with high-strength reinforcement.

With this additional option, the column is completely calculated by default at the typically decisive start of use / infinite times, and optionally also at all times of load application and up to 5 additional times that can be freely selected. The full load history is taken into account in all calculations on the cross-section to determine the possible strain redistribution (from concrete to steel).

Basic parameters


Design standard	select the desired standard.
ψ_2 for crane loads	determine the combination coefficient ψ_2 for crane loads (= ratio of permanent portion to total crane load)
Snow accidental	when you check this option, snow loads are included automatically as accidental action in addition to the typical design situations. You can either specify a load factor for the accidental snow loads or have it determined automatically by the software.
Load factor for snow	toggles between automatic and user-defined determination of the load factor that should be used to include snow load as an accidental action relative to its characteristic value.
$\psi_2 = 0.5$ for snow	check this option to increase the value of the combination coefficient ψ_2 to 0.5 for snow action in the seismic design situation (AE). (See introductory decrees of the German federal states, e. g. Baden-Württemberg).
Location in wind zone...	specify whether the building is located in wind zone 3 or 4. In this case, you need not consider snow as an accompanying action to wind, which is the leading action.
same γ_G for...	when you check this option, all permanent loads and/or load cases are included with the same partial safety factor ($\gamma_{G,sup}$ or $\gamma_{G,inf}$). Otherwise, all permanent loads and/or load cases are combined with each other using $\gamma_{G,sup}$ and $\gamma_{G,inf}$.
Longitudinal bar/stirrup diameter	specify the diameter of the reinforcement bars. The calculations on the cross-section (exposure classes, reinforcement layer) are first based on this value. The final diameter is determined during the processing of the reinforcement layout that follows the calculation.
Durability	a dialog is displayed, in which the design parameters to be observed with regard to ensuring durability can be determined based on the preselected reinforcement diameters and the environmental conditions. For further explanations concerning durability requirements, exposure classes, creep factor and shrinkage strain, please refer to the document " Durability - Creep and Shrinkage Strain ".



Structural system

Basic system data

Structural system

Select the column type from the selection list. Alternatively, you can also display a well-structured graphical selection screen via the  button.

- Pin-ended column (hinged)
- Cantilever column
- restrained on both sides
- restrained on bottom
- restrained on top
- general support

Alternate directions Specifies the axial direction(s) into which the support system can spread.
biaxial: the support system can spread in both axial directions. A design for biaxial bending follows.

Reinforcement arrangement Specifies the desired reinforcement distribution between the individual sections of a multi-field support.

Constant:

Same reinforcement in all sections

1st order Th:

The reinforcement grading is taken from the calculation according to Th. I. O.

In sections:

The reinforcement grading is taken from the non-linear calculation according to Th. II. O.

Note: *In the case of sections subjected to very different loads or, for example, cross-section jumps, a section-by-section calculation sometimes leads to numerical problems, as a result of which an excessively high required amount of reinforcement is determined. In these cases, it is advisable to first calculate with a constant reinforcement arrangement and only then with a section-by-section calculation. If too much reinforcement is determined in the section-by-section calculation, a reasonable reinforcement should be specified and then the calculation repeated.*

Concrete material

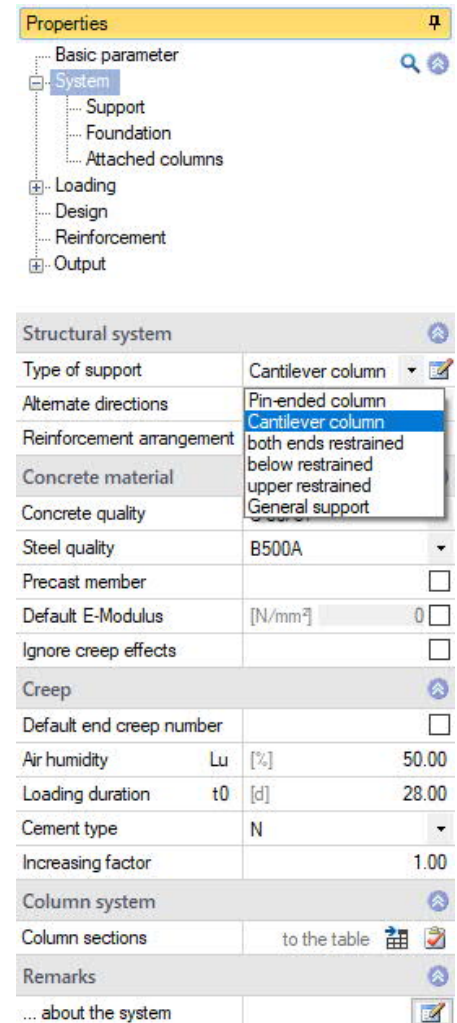
The concrete quality and reinforcing steel options in this section depend on the selected standard. High-strength reinforcing steel SAS 670 from [Stahlwerk Annahütte](#) Max Aicher GmbH & Co. KG can be selected (Nominal curvature method).

If the additional option [B5-SAS](#) is licensed, the general method (non-linear calculation) can also be selected (for single storey columns) – see also [Design - settings](#).

Precast component check this option if the column is to be designed as a precast component. The data-entry field for the precast component parameters is displayed.

Default e-modulus check this option to enter the e-modulus manually. This way, you can take a known deviation resulting from the aggregates used into account.

Ignore creep effects this option disables the inclusion of any creep effects. The data-entry section for creep is hidden.



The screenshot shows the 'Properties' tree on the left with 'System' selected. The 'Structural system' dialog box is open, displaying various parameters:


- Type of support: Cantilever column (dropdown menu is open showing options: Pin-ended column, Cantilever column, both ends restrained, below restrained, upper restrained, General support)
- Alternate directions: (checkbox)
- Reinforcement arrangement: both ends restrained
- Concrete material: (dropdown menu)
- Concrete quality: (dropdown menu)
- Steel quality: B500A (dropdown menu)
- Precast member: (checkbox)
- Default E-Modulus: [N/mm²] 0 (input field)
- Ignore creep effects: (checkbox)
- Creep: (checkbox)
- Default end creep number: (checkbox)
- Air humidity: Lu [%] 50.00 (input field)
- Loading duration: t0 [d] 28.00 (input field)
- Cement type: N (dropdown menu)
- Increasing factor: 1.00 (input field)
- Column system: (checkbox)
- Column sections: to the table (button)
- Remarks: ... about the system (button)

Creep

- Default final creep factor check this option to enter the final creep factor manually; otherwise, it will be calculated automatically from the ambient parameters to be entered below: air humidity, load age and cement type.
- Increase factor this factor is applied to the final creep factor to account for non-linear creep.
Background information: The final creep factor as a material parameter is determined for a permanent load level of approx. 45 % of the compressive concrete strength. If the permanent load level is higher, an increased creep factor must be used in the calculation in accordance with EN 1992-1-1, 3.1.4. If the verification whether the inclusion of linear creep is permissible fails in a first calculation run, you can specify the necessary increase factor as per EN 1992-1-1, 3.1.4 (4), Eq. 3.7.

Column system

This takes you to the column/column sections table ("Column Sections" tab below the graphic).

To define an additional section, insert a new row first by activating the  button.

	L	ey	ez	Reinforcement arrangement	As_predef	fy_lim	fz_lim	Deformation limits	CS-type	by	dz	d	di	b1	d1
	[m]	[cm]	[cm]		[cm ²]	[cm]	[cm]			[cm]	[cm]	[cm]	[cm]	[cm]	[cm]
1	1.10	--	--	corner concentrated	0.0	--	--	none	Rectangle	35.0	35.0	--	--	7.3	7.3
2	4.90	0.0	0.0	corner concentrated	0.0	--	--	none	Rectangle	35.0	35.0	--	--	6.1	6.1

Segment length L length of the respective column segment.

Offset ey/ez offset/eccentricity of the column section relative to the section below it in the direction of the y or z axis.

Reinforcement arrangement you can choose between corner-concentrated, circumferential, or side-distributed arrangement of the longitudinal reinforcement for the calculations on the cross-section.


Corner-concentrated: all cross-section calculations assume a concentration of longitudinal reinforcement in the corners (1/4 As per corner).


circumferentially distributed: Specifies that all cross-section calculations should assume a uniform (constant) distribution of longitudinal reinforcement along the sides of the cross-section.

side-distributed: Specifies that all cross-section calculations should assume a distribution of longitudinal reinforcement along the sides of the cross-section such that 1/4 of the total reinforcement is located on each side of the cross-section.

Attention: At least in the case of assumed corner-concentrated reinforcement, it should be checked again after the reinforcement has been laid, whether the calculation assumption for the realised arrangement is still correct, if necessary. Compared to corner-concentrated reinforcement, distributed longitudinal reinforcement leads to lower load-bearing capacities with the same reinforcement ratio and same reinforcement layer b1/d1!

As, predefined You can define a default value for the longitudinal reinforcement (distributed in the cross-section according to the selected reinforcement arrangement), which is considered as a minimum value in the design. In the calculation mode 'Load Factor' or 'Verification' (chapter [Design](#)), the load-bearing capacity of the system is analysed with regard to this longitudinal reinforcement.

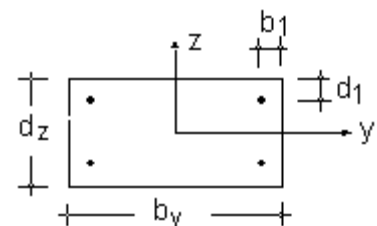
Via the edit button , you can open the "[Reinforcement layout](#)" dialog where you can define a reinforcement arrangement. The area of the longitudinal reinforcement is assumed as default reinforcement in this case.

Limit deformations fy/fz use the edit button  to open a dialog where you can specify limit values for the displacements within the column segment in both axial directions. In the design mode (chapter [Design](#)), the reinforcement is then set in such a way that these deformations are not exceeded in the serviceability limit state. In the load factor or verification calculation mode, the structural system's load-bearing capacity is analysed taking these limit values into account.

CS-type select the type of cross-section, rectangular, circular, or annular. After this, specify the width, height or diameter for the selected cross-section type, as well as the reinforcement layer.

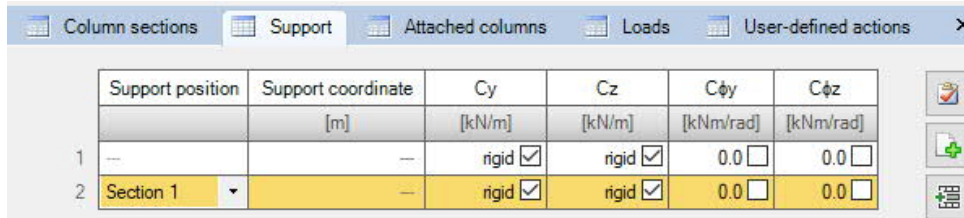
Reinforcement layer b1/d1:

For rectangular cross-sections, use b₁ and d₁ to define the reinforcement layer in the width- or height direction of the cross-section (y- or z-direction) via the distance of the nearest outer face to the centre of gravity of the longitudinal reinforcement bars.




Supports

You can define several supports via the "Support" tab.



	Support position	Support coordinate [m]	Cy [kN/m]	Cz [kN/m]	Cφy [kNm/rad]	Cφz [kNm/rad]
1	---	--	rigid <input checked="" type="checkbox"/>	rigid <input checked="" type="checkbox"/>	0.0 <input type="checkbox"/>	0.0 <input type="checkbox"/>
2	Section 1	--	rigid <input checked="" type="checkbox"/>	rigid <input checked="" type="checkbox"/>	0.0 <input type="checkbox"/>	0.0 <input type="checkbox"/>

To define an additional segment, insert a new row first by activating the  button.

Torsion springs Cφy/z

Enter the support condition or spring stiffness for rotation about the y- or z-axis.

For rigid support, tick the box.

Foundation

The application calculates the spring stiffnesses from the entered dimensions and the modulus of elasticity of the subsoil.

General

Foundation active check this option to display the data-entry fields for the foundation.

different mathematical restraintsupport enables the specification of calculated support conditions for the column that deviate from support stiffnesses based on the foundation and subsoil properties. When you tick the checkbox, the calculated elastic restraints are automatically adopted and can subsequently be adjusted.

Foundation

You can enter the weight of the foundation material, the dimensions, reinforcement layer, column eccentricity and the additional load.

Subsoil properties

$\sigma_{R,d}$ Design value of the base pressure resistance for export to the foundation programs.

Consider subgrade reaction (Bedding approach) defines the method (and thus the specific input parameters) used to convert the elastic restraint effect of the soil compliance into discrete spring stiffnesses for the base point of the column.

Stiffness modulus E_s stiffness modulus of the soil (from compression test with impeded transverse strain), which is used as a basis for determining the elastic foundation restraint.

Properties			
Basic parameter			
System			
Support			
Foundation			
Attached columns			
Loading			
Design			
Reinforcement			
Output			
Bottom point			
General			
Foundation active			<input checked="" type="checkbox"/>
	Cy		rigid <input checked="" type="checkbox"/>
	Cz		rigid <input checked="" type="checkbox"/>
	$C\phi_y$	[kNm/rad]	5555.6
	$C\phi_z$	[kNm/rad]	5555.6
different mathematical restraint			<input checked="" type="checkbox"/>
	$C\phi_{y,cal}$	[kNm/rad]	5555.6 <input type="checkbox"/>
	$C\phi_{z,cal}$	[kNm/rad]	5555.6 <input type="checkbox"/>
Foundation			
Density of concrete	γ	[kN/m ³]	25.00
	By	[m]	1.00
	Bz	[m]	1.00
	T	[m]	0.40
	d1,y	[cm]	4.0
	d1,z	[cm]	4.0
	a,y	[m]	0.00
	a,z	[m]	0.00
Additional load	g,k	[kN/m ²]	0.00
	q,k	[kN/m ²]	0.00
Subsoil properties			
Base pressure resistance	$\sigma_{R,d}$	[kN/m ²]	350.00
Bedding approach		Stiffness module	▼
Stiffness module	E_s	[kN/m ²]	30000.00

Appended hinged column

Calculation/data-entry options

Effects from coupled columns:

Determines which effects caused by coupled hinged columns should be taken into account.

Only imperfection:

No structural influences (buckling length or sagging forces) are taken into account.

Only buckling length:

Only the influences of the coupled columns on the buckling lengths of the column are considered. Additional sagging forces must be included in the defined horizontal loads.

Buckling length and sagging forces:

The sagging forces from the inclined position of the coupled columns as well as effects on the buckling length of the column are taken into account.

Do not reduce imperfections:

Disables the possible reduction of the unwanted eccentricity to be applied due to the number of components to be braced in a storey.

Load input

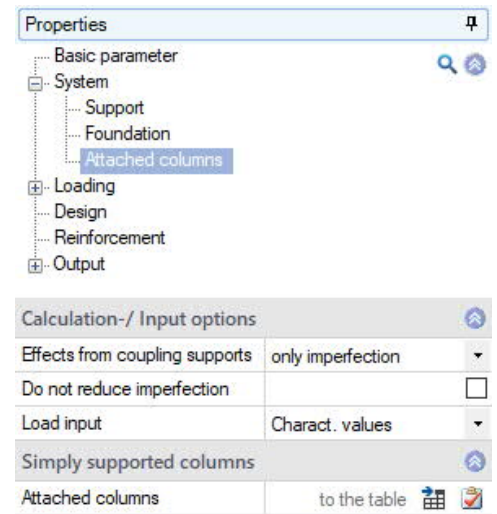
Allows you to set how the loading for the appended hinged column should be determined.

Charact. values


The loads acting on the appended hinged columns are defined in terms of characteristic values of the permanent and variable portions of the vertical loads and the (dominant) action for the variable portion. During the calculation, the design values are then automatically derived for each limit state or design situation.

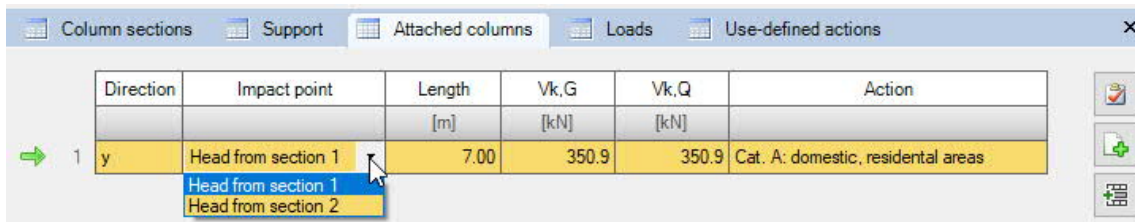
Design values:

The loads of the appended hinged column are defined in terms of design values of the vertical loads for the ULS in the persistent/transient design situation and in terms of reduction factors for all other limit states or design situations.



Hinged (attached) columns

For each hinged column, insert a new row first by activating the  button (an empty data-entry mask is displayed each time).



Direction	Impact point	Length	Vk,G	Vk,Q	Action
		[m]	[kN]	[kN]	
1 y	Head from section 1	7.00	350.9	350.9	Cat. A: domestic, residential areas
	Head from section 1				
	Head from section 2				

Direction define the (global) axis direction in which the hinged column should be appended.

Impact point column segment to whose head the hinged column is to be coupled.

Length length of the appended hinged column.

Top Loads the input values are displayed depending on the [type of load](#) input

- characteristic: permanent $V_{k,G}$ / variable $V_{k,Q}$, action
- design values: design value, reduction factors for the situations accidental, seismic, characteristic, frequent, quasi-permanent

Loading

Self-weight

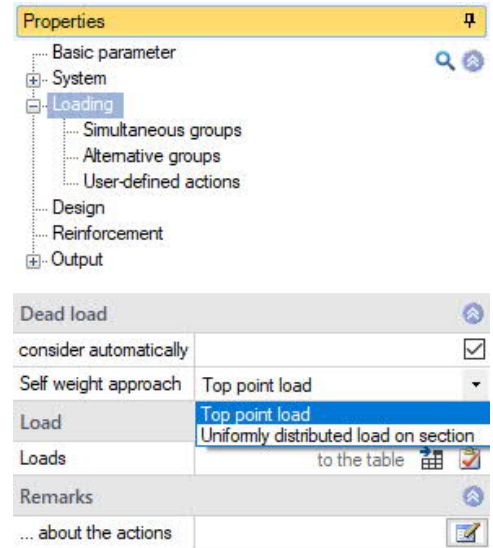
Consider automatically check this option to take self-weight automatically into account.

Self-weight ... the self-weight of the column can be considered as a concentrated load applying at the head or as a UDL distributed load over the section.

Loads

Click on the Loads tab.

To add loads, always set up a new row first by activating the button (an empty data-entry mask is displayed each time).



Action select the action that is assigned to this load from a list. You can also define your own [user-defined actions](#).

Structural member defines the component (entire column/column section) on which the load acts and to which all distances to be defined relate.

Type select the load type: top load, base load, UDL, UDL (limited), trapezoidal load, trapezoidal load (limited), concentrated load.

Direction define the direction of action of the load. A moment input is possible for single, top or bottom loads if "around y-axis" or "around z-axis" is switched on as direction.

F enter the load value directly or call up the [load value compilation](#) via the "arrow icon" .

Action	Structural memb...	Type	Direction	Distance [m]	Length [m]	F [kN]	ey [cm]	ez [cm]	M [kNm]	p0 [kN/m]	p1 [kN/m]	Simultaneous	Alternate group	Description
Permanent loads	Entire column	Top load	vertical	---	---	125.0	0.0	0.0	---	---	---	none	none	
Snow loads H < 1000 m	Entire column	Top load	vertical	---	---	35.0	0.0	0.0	---	---	---	none	none	
Wind loads	Entire column	Point load	about z-axis	6.00	---	---	---	---	11.00	---	---	ZusGrp 1	AltGrp 1	wy
Wind loads	Entire column	Uniformly distributed load (limited)	in y-direction	0.00	5.00	---	---	---	---	2.40	---	ZusGrp 1	AltGrp 1	wy

Eccentricity ey/ez eccentricity of the load application point for vertical loads (distance to the cross-sectional centre of gravity in the direction of the y- or z-axis).

p0/p1 characteristic value of a line load at the lower/upper end of the loaded section.

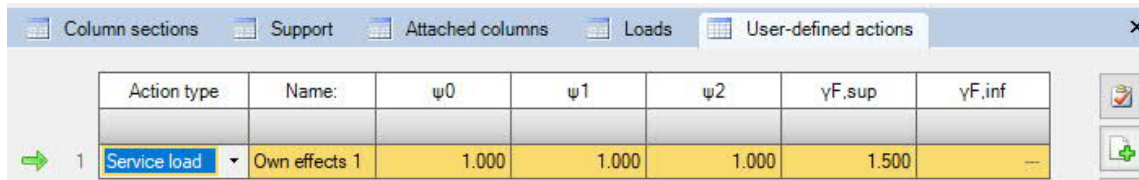
Simultaneous group you can assign loads to groups that always act simultaneously. You can create new groups. Names are assigned automatically. The loads of a group must be assigned to an action. ▶ See the chapter [Load groups](#).

Alternative group the loads of an alternative group are always assumed to act individually, i. e. only one load of the alternative group applies at a time. You can create new groups. Names are assigned automatically. ▶ See the chapter [Load groups](#).


Designation allows a (short) name to be assigned so that it can be found more easily in the program interface and in the text output.

User-defined actions

You can define your own actions via the "User-defined actions" tab.



Action type	Name:	ψ_0	ψ_1	ψ_2	$\gamma_{F,sup}$	$\gamma_{F,inf}$
Service load	Own effects 1	1.000	1.000	1.000	1.500	---

Use the  symbol to create a new line/action. Select the basic type of action and edit the given name if necessary.

$\psi_0/1/2$ Factors for determining the combined value of a variable action/the frequent value/the quasi-permanent value of a variable action.

$\gamma_{F,sup/inf}$ Upper/lower value of the partial safety factor taking into account model uncertainties and size deviations for the action (limit state STR).

Load groups

The load grouping has only an effect on the p-loads.

g-loads are always considered.

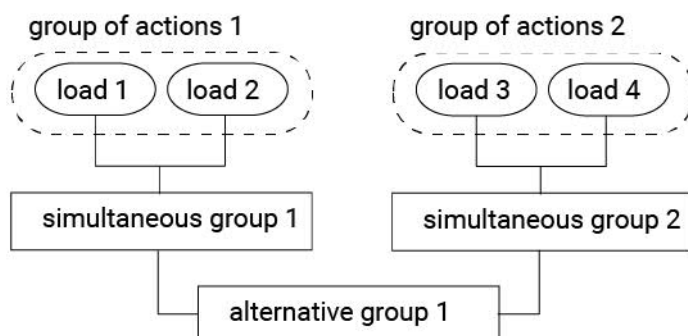
Loads that belong to the same group of actions can be defined as "always acting simultaneously".

In addition, loads or load groups can be set as mutually exclusive (alternative).

This method corresponds to the typical superposition load case.

Note: In the event of conflicting inputs in the data-entry fields "Simultaneous group" and "Alternative group", the entries in the simultaneous group fields have priority.

Example of groups of actions and load groups within an item



The loads 1 and 2 are assigned to the group of actions 1.

Correspondingly, the loads 3 and 4 are assigned to the group of actions 2.

Load 1 and 2 are assumed to be wind loads in the same direction that always apply together.

The loads 3 and 4 are wind loads in the opposite direction.

As wind can only blow in one or the other direction, the concurrency groups 1 and 2 are assigned to the alternative group 1.

The effect is that either the concurrency group 1 or 2 or none of both is considered depending on whether the loads become decisive for the design or not.

Design

Cold design

Set the basic calculation mode. The method with nominal curvatures is only available in the "Design" calculation mode.

Design

The required longitudinal and transverse reinforcement is determined. The serviceability is assessed via verifications. To ensure serviceability, the selected reinforcement must possibly be increased and the design or verification must be repeated.

Check

For the pre-set longitudinal reinforcement, it is checked whether a stable state of equilibrium establishes under the given load. If it does, a shear force design and all serviceability verifications are performed.

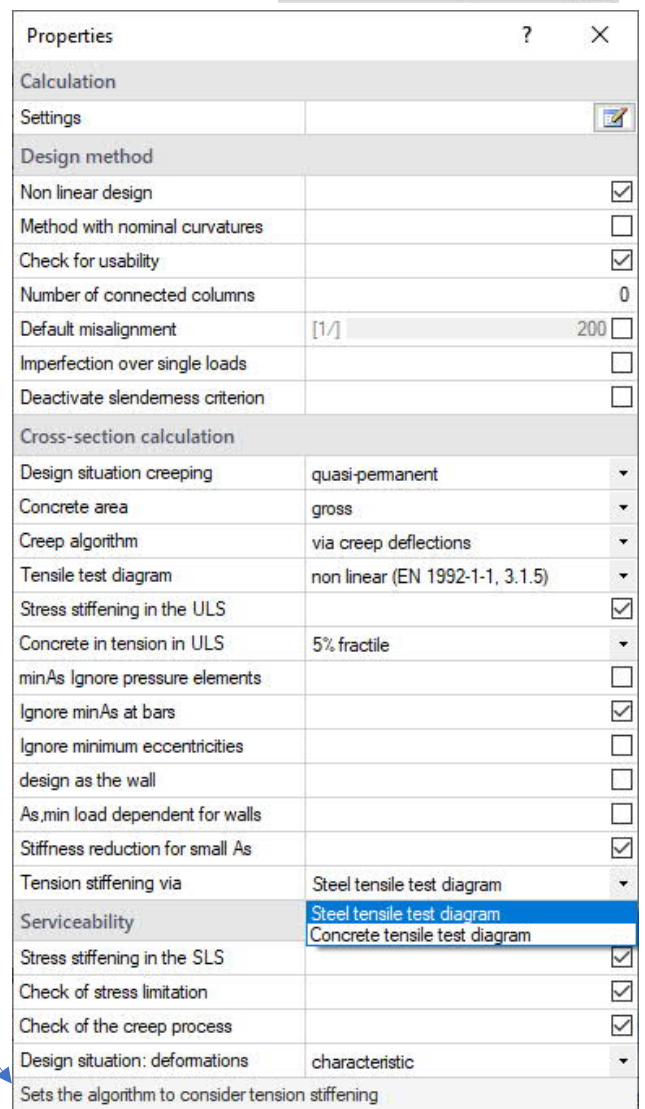
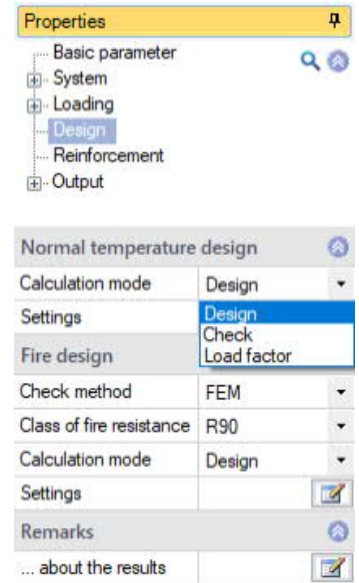
Load factor

The minimum load factor is determined at which, when applied to the design values of the external loads and the specified longitudinal reinforcement, a stable state of equilibrium still establishes. The serviceability verification and the shear force design are performed for the load modified with the minimum load factor.

Settings

Displays a dialog with all setting options for the cold design. See figure on the right.

When clicking on the individual data-entry options, a corresponding explanatory text is displayed at the bottom of the window.



Fire design

Specifies the method according to which the selected fire-resistance period is to be verified.

No check

No verification of the fire-resistance period is performed.

Eq. 5.7 (EN 1992-1-2, method A)

The fire-resistance period is calculated using the simplified method EN 1992-1-1, Clause 5.3.2, eq. (5.7).

FEM

The verification of the load-bearing capacity under fire exposure is performed on the basis of a second-order non-linear structural component calculation and non-linear temperature-dependent material behaviour, whereby the temperature distribution within the cross-sections is determined as a function of the fire duration by means of thermal FEM analysis.

Fire-resistance class fire-resistance class for which the load-bearing capacity is to be verified.

Calculation mode calculation mode for hot design.

Design:

The required longitudinal and transverse reinforcement is determined. The serviceability is assessed via verifications. To ensure serviceability, the selected reinforcement must possibly be increased and the design or verification must be repeated.

Verification:

For the pre-set longitudinal reinforcement, it is checked whether a stable state of equilibrium establishes under the given load. If it does, a shear force design and all serviceability verifications are performed.

Fire-resistance period:

The fire-resistance period is determined at which, when applied to the design values of the external loads and the specified longitudinal reinforcement, a stable state of equilibrium still establishes.

Settings

Displays a dialog with all setting options for the hot design.

Properties		?	×
Global settings			
Check method	FEM		
Class of fire resistance	R90		
Thermal addition	ΔT [K]		0
Inclination	[1/]		500
Start the reinforcement dialog			<input type="checkbox"/>
Skip temperature dialog			<input type="checkbox"/>
Model reinforcement			<input type="checkbox"/>
Material settings			
Calcareous additions			<input type="checkbox"/>
Reinforcing steel hot rolled			<input type="checkbox"/>
Calculation settings			
Check alternative load paths			<input checked="" type="checkbox"/>
Stiffness reduction			<input checked="" type="checkbox"/>

Reinforcement layout

The reinforcement layout can be either created automatically or specified manually.

Create reinforcement (automatically)

Automatically generates a reinforcement arrangement (graphics) for each column segment based on the default settings (without explicitly calling up "Reinforcement manual").

Reinforcement manual

Opens the [reinforcement layout dialog](#) for creating or editing the reinforcement patterns for each column segment.

Remove reinforcement

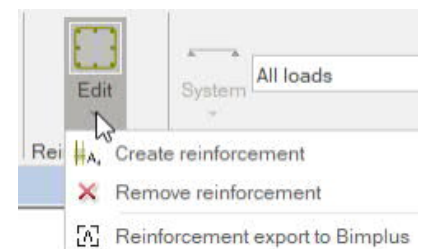
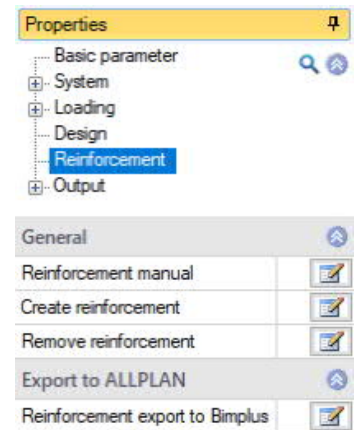
Removes all existing reinforcement graphics.

Export to ALLPLAN

The reinforcement image is transferred to the automatic reinforcement in ALLPLAN via Bimplus.

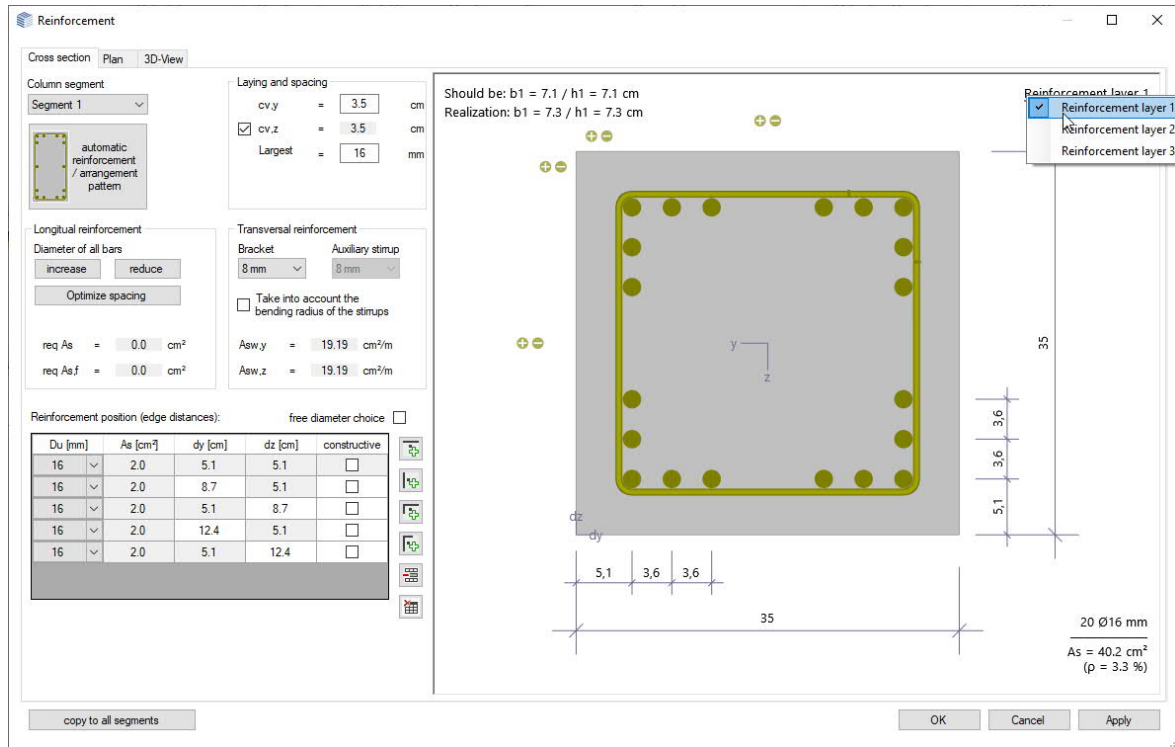
[BIMPLUS](#) is the open data and project collaboration platform based on BIM models for all disciplines involved in construction projects.

These functions can also be accessed via the reinforcement icon in the top menu.



Reinforcement manual

Opens the reinforcement layout dialog for creating or editing the reinforcement images for each column section.



Reinforcement layer

If you click on "Reinforcement layer 1", you can optionally define a multi-row reinforcement (e.g. select reinforcement layer 2 and add bars using the "+" symbols). Right-click on a bar to increase/decrease its diameter. Multi-row reinforcement is particularly important when using [SAS 670](#) Annahütte high-strength reinforcing steel.

Cross-section

Graphical view of the cross-section. Setting of reinforcement parameters such as longitudinal and transverse reinforcement, spacing/layer etc.

Column segment

For multi-part columns, select the column segment for which the reinforcement layout is to be created.

Automatic reinforcement laying/arrangement

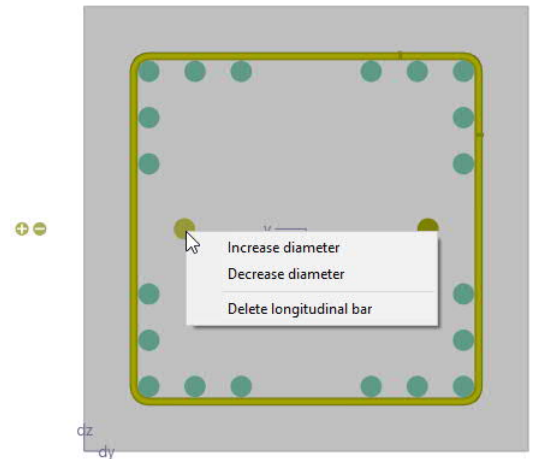
Opens the dialog for selecting the reinforcement arrangement - the options available for selection are self-explanatory.

In the right dialog area, select the spacing, the diameters of the longitudinal bars and stirrups as well as the maximum grain.

As and req. As are shown.

Reinforcement layer

Add or remove side/corner bars using the corresponding icons. Optionally, a free diameter selection of the longitudinal reinforcement is possible.



Interactive reinforcement GUI

The graphical user interface is interactive, i. e. you can add/ remove bars or increase/reduce diameters using the +/- icons or the context menu (right mouse button).

Plan

Side view of the column.

Check the option "Reinforce as wall" if you want to make sure that the cross-section is treated like a wall.

Ceiling d thickness of the slab at the column section head

Connecting length lap length of the longitudinal reinforcement above the column head or the top edge of the floor slab

Compression regions:

acc. to standard controls the automatic determination of the compaction areas of the transverse reinforcement

lv,top/bottom length of the compaction areas of the transverse reinforcement at the top/bottom segment end

Steel amount prev. Asw default value for the referenced cross-sectional area of the transverse reinforcement. The distribution of the stirrups can be controlled indirectly via the value "prev. asw". Otherwise, the maximum design spacing or the required reinforcement of the section is applied.

It may be necessary to define several sections so that any statically required stirrup reinforcement is only inserted in the section where it is required.

The option "...bending radius of stirrups" controls the stirrups when positioning the corner bars.

The round steel list shows the steel items with their masses and the total for the selected column segment.

3-D view

The right mouse button can be used to rotate and tilt the view.

Output

Output of system data, results, and graphics.

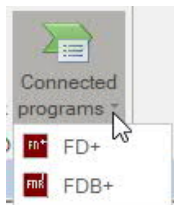
Call up the output document via the "Document" tab. You can view and print the output data in PDF format.

See also the document [Output and Printing](#).

You can customise the output scope via the displayed options.

Load transfer

Call up the desired program via the icon "Connected programs" (FD+, FDB+) and the data is transferred.



Properties	
Basic parameter	
System	
Loading	
Design	
Reinforcement	
Output	
Results	
Global settings	
Output scope	Standard
Remarks	<input checked="" type="checkbox"/>
System and boundary conditions	
Requirement durability	<input checked="" type="checkbox"/>
Material properties	<input checked="" type="checkbox"/>
System graphic 2D	<input checked="" type="checkbox"/>
System graphic 3D	<input type="checkbox"/>
Load groups graphics	<input type="checkbox"/>
Draw consoles	<input type="checkbox"/>
Scale	[1:] 50
Load	
Actions	<input checked="" type="checkbox"/>
Results in general	
All interfaces	<input checked="" type="checkbox"/>
Calculated superposition	Detailed output
Reactions characteristic	<input type="checkbox"/>
Reactions ULS	<input checked="" type="checkbox"/>
Reactions SLS	<input type="checkbox"/>
Output bearing reactions in full	<input type="checkbox"/>
Temperature profile	only Isolines
Reinforcement	
Choice of reinforcement (Tab.)	<input checked="" type="checkbox"/>
Sketch - plan view	<input checked="" type="checkbox"/>
Rebar list	<input type="checkbox"/>
Sketch - sectional view	<input type="checkbox"/>
Sketch - 3D view	<input type="checkbox"/>