

# Design of roofs Dach+

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Note: this program with its <u>licensable options</u> is the successor to the previous roof programs D9 -Continuous Rafter, D11 - Purlin and Rafter Roof, D12 - Collar Beam Roof - DGK Hip Rafter / Valley Rafter.

#### Basic documentation - overview

In addition to the individual program manuals, you can find basic explanations on how to operate the programs on our homepage <u>www.frilo.eu</u> ( > Service > Articles Information > Basic Operating Instructions).

Farther documents: <u>Roof-Loads-Design</u> <u>Fire protection analysis timber</u>



## Possible applications

Dach+ calculates according to the licensed option

- Continuous rafters,
- Pent roof rafter,
- Purlin roof
- Rafter roof,
- Collar beam roof,
- Hip rafter,
- Valley rafter.

The roof or rafter type is selected from a selection list in the Wizard right at the beginning. Wizard X Create new structural item Wizard Templates Open Common Roof / Rafter type Continuous Rafter Selection of town Pent Roof Rafter Dead Load (Roofing) g1 Purlin Roof Rafter Roof Ground Snow Load sk sk Collar Beam Roof qp,0 Hip rafter qp,90 [NV/TIT] Wind pressure qp,90 Wind pressure Material 4,04 Timber Softwood --2,02 Material code EN 338:2016 Strength class • C24 \_\_\_\_\_ 30.0° Service class . 2 Cross-section Width b [cm] 10.0 Height d [cm] 20.0 3,50 3,50 System e [cm] 100.0 Rafter Spacing 7,00 [°] 30.0 Rafter Slope α Rafter Length 7.00 [m] 2 Number of spans OK Cancel

#### Standards

- EN 1995:2008/2014
- DIN EN 1995:2010/2013
- ÖNORM EN 1995:2010/2015/2019
- UNI EN 1995:2007
- NTC EN 1995:2008/2018
- BS EN 1995:2012/2019
- PN EN 1995:2010

DIN 1052:2008 is also available.



### Options S / P / K / GK

#### Dach-S option: Continuous Rafter or Pent Roof Rafters

With this option, single and multiple span continuous rafters can be calculated and designed as a single component. Cantilever arms are possible on both sides.

#### Dach-P option: Purlin and Rafter Roof

With this option, purlin roofs and rafter roofs as well as mixed constructions of both systems can be calculated, e.g. purlin roofs with ridge joint. The rafters on the left and right are designed as continuous bending beams.

#### Dach-K option: Collar Beam Roof

Calculation of collar beam roofs with movable / fixed collar beam. The collar beam can consist of one or two parts.

#### Dach GK option: Hip and Valley Rafter

Calculation of hip rafters and optionally valley rafters.

#### Systems Dach-P / Dach-K

- The roof halves can have different roof pitches
- The purlins can be at different heights
- The left and right halves of the house can be of different widths
- Horizontal and vertical bearings can be rigid, spring-loaded or movable

#### Loads

- Area loads, weight, snow and wind loads
- Additional loads as uniform, single or trapezoidal loads
- Man loads and wind currents in overhangs

#### Calculation

The system is treated statically as a framework system, taking into account the normal force deformations and the effect of the real, specified support conditions.

All load combinations are calculated and designed according to the applicable combination regulations.

#### Design settings

Optionally selectable:

- proof against wind suction (see also document <u>Roof Loads-Design</u>)
- earthquake combinations
- fire design

For the permissible span/cantilever deflections of the respective verifications (based on the length L), the recommended values of the respective standard are preset as standard. These can be customized.

Since the negative deflection there usually determines the design result in the case of short cantilevers, this often undesirable influence can be optionally eliminated with the option "only positive deflection on cantilevers".



#### Proofs of stability

For the proof of stability, a continuous tilt bracket and continuous lateral support are used as standard and the buckling length in the rafter level is limited to  $0.9 \cdot$  component length.

These boundary conditions can be adapted individually.

There are various options available for determining the stability lengths.

For each superposition, the associated effective lengths for the individual bars are determined from the eigenvalue solution. Due to numerical problems, however, the effective lengths of bars with a low normal force can be too great.

For precisely such cases, there is the option of limiting the buckling length to a maximum value.

Optionally, the buckling and tilting lengths can be specified individually for each bar.

Alternatively, the buckling/tilting length can always be set to the bar length, component length or a specified value.

#### Serviceability

The serviceability verification is carried out according to the rules of EN 1995-1-1 with initial and final deformation and consideration of creep deformation.

#### Support forces

Support forces are output as characteristic maximum values and sum per action.

Characteristic support forces are transferred to the subsequent components for each load case, for which the decisive combinations are then created in the program called up.

In addition, the load cases per individual load case and the superpositions can optionally be output.

#### Load Forwarding / Associated Programs

The bearing loads can (with Roof-S /P/K) be passed on to the multi-span timber beam HTM+.

See also document Roof Loads-Design.

The interface to the RSX Framework enables an alternative calculation.

Entered <u>connection details</u> (rafter base point) can optionally be passed on to the corresponding toolbox module for calculation (the corresponding item "TB Toolbox" is then displayed here).

#### SEMA import/export

"\*.sema" files can be imported/exported via File > Import or Export.

Find out more about this in the SEMA manual.



## Input

#### General information on the input fields

This program can be used to calculate according to various standards or national annexes. These standards differ considerably in terms of load approaches, combination rules, determination of the decisive internal forces and verification.

The input fields and selection options described below can therefore differ from one another depending on the selected standard.

### Wizard

After starting the program, the <u>wizard</u> opens automatically, with which you can quickly and easily create a calculable basic system.

Here you select the type of roof or rafter: continuous or pent roof rafters, purlin or collar beam roof, hip and valley rafters.

Furthermore, the necessary/most important parameters are queried here.

An item can then be further developed on this basis.

Note: the other roof types can also be called up using the "Other roof types" button in the upper menu ribbon.

## **Basic parameters**

Selection of the standard and the material. You can also enter the strength and service class as well as the specific weight here.

#### Strength class

The strengths and stiffnesses can be adjusted. To do this, click in the input field and press the F5 key. You can enter/edit/save/load new material in the "User-defined material" pop-up menu.

Properties	<b>4</b>
Basic parameter 	۹ 🕲
🗄 - Design	
Output	

Basic parameters		0
Design code	EN 1995:2013	-
Consequence class	2	-
Ductility class	Low	•
Material		0
Timber	Softwood	-
Material code	EN 338:2016	-
Strength class	C24	•
Service class	2	-
Specific weight y	[kN/m³] 6.0	0



## System

Note: the following entries differ depending on the selected roof or rafter type.

#### Remarks

You can enter remarks about the system that optionally appear in the output.

## General

Here you define the other properties <u>depending on the selected roof type</u>.

Center distance of the rafters
Choice of continuous or pent roof rafters
Symmetrical or asymmetrical roof
Rigid, pinned or open
Yes/no
Yes/no

## Geometry

Depending on the selected roof type and symmetry, the appropriate input fields are displayed.

### Rafters (left / right)

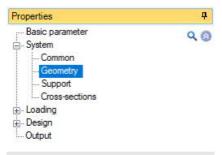
- Slope α	The angle of slope of the rafters - can also be changed directly in the graphic.
- Number of fields	Up to 5 fields/sections are possible.
- Span 1, 2	Lengths of the individual spans. Span 1, Span 2, etc.
- Cantilever	Length of the cantilever.
- Overhangs	Definition of a free roof overhang.
	The overhang plays a role above all for the approach of wind <u>underneath currents</u> , but also for the consideration of the extension loads.
	Overhang = start of the rafter to the edge of the house.

#### Collar beams

- Distance to the ridge	Distance of the collar beam to the ridge.
- Collar Beam Length	Display of the calculated collar beam length.
- Number of fields	Up to 4 fields with different lengths (field 1, field 2) are possible.
- Fixed	If the option is marked, the collar beam roof cannot be moved, otherwise it can be moved.
- With support	Optional supports at the collar beam ends.

Properties	<b>4</b>
Basic parameter	0.0
🚊 System	~ ~
Common	
Geometry	
Support	
Cross-sections	
🗄 - Loading	
🗄 - Design	
Output	

		8
Rafter Spacing e	[cm]	100.0
Symmetric		
Connection of Ridge	Pinned	+
With purlin at ridge	Rigid	
With collar beam	Pinned Open	1



Rafter left			0
Slope	α	[1]	30.0
Number of fields		1	•
Span 1	L,1	[m]	5.00
Cantilever bottom	L,btm	[m]	0.00
Overhang bottom	L,btm	[m]	0.00
Rafter right			0
Slope	α	[1]	30.0
Number of fields		1	•
Span 1	L,1	[m]	5.00
Cantilever bottom	L,btm	[m]	0.00
Overhang bottom	L,btm	[m]	0.00
Collar beam			0
Distance to the ridg	е	[m]	0.96
Collar Beam Length		[m]	3.33
Number of fields		1	•
Fixed			
With support at left			
With support at right	t.		



**ņ** 

0

0.00

0.00

3.00

0

0.00

0.00

3.00

-

-

90

#### Hip or valley rafters

Various input options are available for defining the roof envelope. The dimensions/values are displayed in the graphic for checking and can also be changed there directly.

S١	/st	ter	n l	im	its
- ,					

Туре

#### Single span system:

the simplest entry with a 90-degree angle, without span subdivisions, cantilever arms, floor plan angles, etc.

<u>Right-angled and symmetrical:</u> As with the single-span system, however, the top can be subdivided into spans as a result of purlins. Both sides are symmetrical. The input fields for the shift rafters can be expanded.

<u>Right-angled:</u> an asymmetrical span division is possible here.

<u>Floor plan angle freely selectable:</u> as right-angled, in addition, the input field for the plan angle can be edited.

#### Crippled hip-like:

A one-sided overhang is also offered here

 $(\rightarrow$  greater length of the shift rafters for the load introduction area).

Properties

System

⊕ Loading ⊕ Design

Output

System borders

Angel in floor plan

Main roof base length

Adjacent Roof Pitch

Adjacent roof Base length

Jack Rafter Main Roof

Jack Rafter Adjacent Roof

Cantilever bottom

Cantilever top

Span 1

Span 1

Number of fields

Cantilever bottom

Cantilever top

Number of fields

Height of ridge hipped/valley [m]

Main roof pitch

Right-angled Single spam system

Crippled hip-like

[m]

[m]

1

[m]

[m]

[m]

1

[m]

Right angled and symmetrical

Overhang on both verges

Floor plan angle freely selectable

At right angles across heights and lengths

Right angles across heights and angles

Туре

Basic parameter

Support Cross-sections

At right angles over heights and lengths:

Input about the height and projection length of the marginal planes.

At right angles across heights and angles:

Input about the height and angle of the marginal shift planes.

Angle in the floor plan	The angle between the eaves is illustrated in the graphic and can also be changed there directly.
Main roof pitch	Angle of slope on the main or secondary roof.
Main roof base length	Basic length in the direction of the main roof or the secondary roof.
Main roof projection length	edge shifters With the type "right-angled over heights and lengths/angles, the projection lengths for the main and secondary roofs are entered here.
Ridge height	Informative display or changeable value for the height of the ridge.
Main roof overhang	Overhang on the hipped roof.

#### Schifters rafters (main or secondary roof)

Cantilever	Length of the cantilever arms above or below.
Number of fields	Die Eingabe von bis zu 3 Feldern ist möglich.
Span 13	Length of the individual spans.



## Support

In the Common section, to simplify the entry, you can specify whether the same (standard) mouth depth should apply to all supports or whether you want to enter this value yourself (then check the box) and whether the horizontal and vertical supports should all be rigid.

Depending on the selected roof type, you can call up the corresponding support tables.

Call up the support table(s) via the table symbol <sup>an</sup> or via the tab below the graphic.

The horizontal and vertical supports are entered. If the option is marked, the support is rigid. To enter a custom value, remove the check mark.

An (optional) mouth or incision depth [cm] weakens the rafter cross-section in the support areas.

Active

With hip/valley rafters, the supports are created

automatically as a result of the purlins of the shift rafters - if you do not want this, you can set the supports inactive using this option (you can find the option in the table entry under the tab "Supports due to purlins").

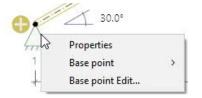
Additional supports In the case of hip/valley rafters, additional supports (e.g. as a result of supports) can be created in the table using the "+-" symbol.

📃 Left F	RafterSupport	Right Rafter Support	Standard Load Cases	s 📃 Additional Load Cases	×
ſ	No.	Horizontal Support	Vertical Bearing	Depth of Birth Mouth	3
		[kN/m]	[kN/m]	[cm]	
<b>→</b> 1	2	nigid 🗹	rigid 🗹	0.0	

Fig .: Tab under the graphic.

## Connection details of the rafter base points

The functions/dialogs for the rafter bases can be called up via the context menu of the supports.



Via "Connected programs" (in the menu above), the connection details can optionally be forwarded to the corresponding toolbox module (rafter base) for calculation.

See also Design ► <u>Connection Details</u>.

Properties	<del>р</del>
Basic parameter	٩.۵
🚊 - System	and the second se
Common	
Geometry	
Support	
Cross-sections	
🗄 - Loading	
🗄 - Design	
Output	

Common		0
Depth of birth mouth for all bearings tv	[cm]	0.0
All support translations fixed		
Left RafterSupport		0
Left RafterSupport	to the table	1 2
Right Rafter Support		0
Right Rafter Support	to the table	1 2



## **Cross-sections**

Number	Number of cross-sections (1 or 2).	Propertie
Width/Height	Display of the selected or input of the cross-section dimensions.	Basic ⊟Syste
Different cantilever	If necessary, other cross-sections than for the rafters can be selected for the cantilever arms. Check this option to display the corresponding input fields.	G S  ⊕ Loadi

Properties		<b>д</b>	
Basic parameter System Common Geometry Support Cross-sections Design Output			۹ 🕲
Rafter left			0
Number		1	•
Width	b	[cm]	10.0
Height	d	[cm]	20.0
Different cantilever			
Rafter right			0
Number		1	-
Width	b	[cm]	10.0
Height	d	[cm]	20.0
Different cantilever			
Collar beam			0
Collar beam			-
		1	
Number Width	b	[cm]	10.0



## Loading

See also document Roof Loads-Design.

Dead Load	
Dead weight autom.	Here you choose whether you want to calculate with or without dead weight.
Rafter	
g1/g2/g3	The loads "g1" and "g2" act over the entire length of the rafter. Your load coordinates are related to the roof area. The loft conversion load "g3" acts from the edges of the house ground to the ridge or between the edges of the house ground.
Loft conversion botttom gb	The program applies the lower load on the collar beam roof between the bottom support and the collar beam.
Roof payload (man load)	No or only single load.
PV-system	Photovoltaic system: select this option to show the corresponding parameters.

### Collar beam

Both permanent loads gk and live loads pk can be specified for collar beams. The live loads are assumed to be one-sided for the asymmetrical load cases.

Properties	<b></b>
Basic parameter	0 @
⊕. System	20
🗄 - Loading	
- Dead Load	
Snow and Wind	
Load Cases	
🗄 - Design	
Output	

Settings				0
Dead weight automatically				$\checkmark$
Rafter		0		
Roofing	g1	[kN/m]	1.	00
construction	g2	[kN/m²]	0.	00
Loft conversion	<b>g</b> 3	[kN/m²]	0.00	
Loft Conversion bottom gb		[kN/m²]	0	00
Roof payload (man load)		single load	only	•
PV-system left		[kN/m <sup>2</sup> ]	0.00	
PV-System right		[kN/m²]	0.00	
Collar beam				0
Persistent load	gk	[kN/m <sup>2</sup> ]	0	60
Live load	pk	[kN/m]	1.	50
Action		Cat. A: domestic, 1 🝷		•

## Snow and wind

#### **Basic values**

Basic values	This button opens the snow and wind load dialog.
Town selection	Display of the municipality selected under "Base values". If you would like to enter your own values instead, uncheck this option and enter the values below.

#### Boundary conditions for snow loads

Snow skirt and snow accumulation can be selected left and right. Since the factors for exceptional snow loads can differ between the National Annexes, the *Cesl* value can be modified if necessary.

#### Boundary conditions for wind loads

Ridge height	Height of the ridge above the terrain.
Roof length	Roof length as the width of the wind attack b.
Building length	Building length as the length of the wind attack for walls.
Approach wind	Pressure and suction alternatively, only pressure, only suction.

Land for loads		
Land for loads	German	y •
Basic Values		
Town selection		
height of terrain Altitud	le [m]	0.00
Snow action group	Snow loads H	H < 1000 m ▼
Ground Snow Load s	<b>k</b> [kN/m²]	1.00 🗹
Wind pressure qp.0(	h) [kN/m²]	1.00 🗹
Wind pressure qp,90(	h) [kN/m²]	1.00 🗹
Boundary conditions for	snow loads	0
With snow guard left		
With snow accumulation le	ft	
With snow guard right		
With snow accumulation rig	ght	
With accidental snow Ce	sl	2.30
Boundary conditions for	wind loads	0
Total ridge height	<b>h</b> [m]	6.00
Length of Roof b,Ro	of [m]	20.00
Building length b, Wa	[m] lle	20.00
Approach wind	Pressure and	Suction alte
Loads for Calculation		Suction alternat
Load values acc to code	Only pressure Only suction	



무

Wind range	With the ridge/valley rafter, you can optionally choose which wind range is to be used as
	the basis for the averaged wind load on the main/secondary roof. Otherwise the program
	automatically takes the area with the greatest wind pressure.

#### Loads for Calculation

Load values acc. to code Deactivate this option to be able to enter your own values.

#### Load cases

You can use the "to the table" <sup>and</sup> symbol or the tabs under the graphic to access the tables for the standard load cases or the additional load cases.



Equal $\gamma G$ for permanent loads	If the option is selected, permanent loads are also combined, otherwise they are all applied the same.	
as dependent load cases	If the option is selected, the loads are assumed to be "dependent" and combined. Note that when you choose a dependency, you must ensure that the loads always occur together at the same time!	e e V
Live load on Collar Beam	If the option is selected, the live load on the collar beam is considered independently span by span.	0
Omit opposing	If the option is selected, standard load cases/combinations with loads whose expected deformations are in opposite directions are omitted.	9 7 0 0
		1

## Standard Load Cases

Wind and snow loads are automatically generated as "Standard Load Cases" in accordance with the applicable standards. These load cases can be switched on and off in the table individually or as a whole in the "Active" column, but they cannot be edited.

"Standard load cases" can be copied to "<u>Additional load cases</u>" and edited there ("Copy all snow, wind, man load cases").

To display the table, click on the "Standard Load Cases" tab below the graphic.

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Basic parameter	20
i System	
🚊 - Loading	
Dead Load	
Snow and Wind	
Load Cases	
🕀 Design	
Output	
200 J. T. T. T. T	
Settings	0
Equal yG for permanent loads	

Properties

bettings	6
Equal yG for permanent loads	
Snow eave loads as dependent load cas	ses 🗌
Wind undercurrent as dependent load ca	ases 🗹
Live load on Collar Beam independent of	f field 🗹
Omit opposing standard load cases	$\checkmark$
Omit opposing combinations	
Load Cases	0
Standard Load Cases	able 🔠 遂
Additional Load Cases	able 🔠 🌌
Copy all snow load cases	
Copy all load cases	
Copy all man-load cases	
Alternative Groups	0
Alternate Groups 0 1/3 (	) 📴 🗙 🗿 🌏
Name	H < 1000 m
Remark	Alter
Number of load cases	3



## Additional Load Cases

Here you can create your own load cases or copy "Standard Load Cases" in order to add or change them.

Note: for a new table row click on the right 📴 symbol.

Name	Short Name	Action	Alternate Group	Remark	Active	Copy from load case		Loads
							-	
Copy of Drifftet snow	v (1)	Snow loads H < 1000 m	110 (Snow loads H < 1000 m)	This is a copy AND NOT a link		Drifftet snow on rafter leftsides	N	Edit (2)
						 Dead Load	43	

Name Enter a (own) load case name.

Short Name Enter a short name, eg for display in tables.

Action Selection of the action from a list.

Alt. group Load cases to which you assign the same alternative group number (>0) do <u>not</u> act simultaneously (but rather "alternative"). Example: Wind loads from different directions.

Remark Free comment text.

Active Load cases can be set temporarily inactive here (remove tick). During the calculation, all load cases marked as "active" are automatically superimposed according to the applicable combination rules, taking into account the alternative groups.

Copy from load case Here you can select previously entered load cases. The selected load case is then copied and can then be edited/adjusted.

Loads With this button you call up the input table of the loads for the load case.

ads											_ [
	Relation	Member	load type	Orientation	Dist	L	W1	W2	Dimension	Factor	Remark
				0	[m]	[m]					
1	Area load	Rafter left Uniform load vertical to projection 0.32 - kN/m <sup>2</sup> 1.00 sLd									
2	Area load	Rafter right	Uniform load, in sections Concentrated load	vertical to projection	0.00	5.00	0.63 🔛	-	kN/m²	1.00	sR
			Uniform load Uniform load, in sections								
			Trapezoidal load Trapezoidal load, in sections								
latio	on f	Reference f	or the load: line load	(component-rela	ted) or a	irea loa	ad (area	relate	d).		
emb	er (	Component	: Rafters left, right, co	ollar beam.							
ad t	ype S	Single load									
		0	d (continuous or in s	ections)							
	-	Frapezoidal	l load (continuous or	in sections)							
ienta	ation l	.oad alignn	nent depending on lo	ad type:							
		Point load:									
	-	vertical (gl	obal down)								
	-	horizontal	(global)								
			e (to the member axis	•							
	-	longitudina	al (in the direction of	the member axis	5)						
	<u>l</u>	ine load:									
	-	vertical to	beam (global down o	on member)							
	-	vertical to	projection (global do	wn on projection	)						
						(in)					
	-	transverse	to the beam (perper	idicular to the me	ember av	(IS)					
st.			e to the beam (perper ne distance of the loa				the cor	npone	nt.		
st.		Specifies th		d in x-direction fr	om the s		the cor	npone	nt.		
st. 1, W		Specifies th Specifies th	e distance of the loa	d in x-direction fr ad in x-direction.	om the s		the cor	npone	nt.		



Factor The load value is multiplied by this freely definable factor.

Remark Optional entry of free text.

See also document Roof Loads-Design.



## Design

## Design settings

#### Calculation rules

- Only positive deflection on cantilever arms

For short cantilever arms the negative deflection there usually determines the design result, this often undesired influence can be eliminated by selecting the option "Only positive deflections on cantilever arms".

- The reference length for the total deflection

For the serviceability verifications, you can specify whether the member or the component length should be taken into account as the reference length for the total deflection design.

For the local (member-by-member) deflection verification, the member length is always automatically used as the reference length.

- kmod Wind averaged

If the option is selected, the kmod coefficient for wind is used as the mean value for the classes of load durations short and very short.

- With equilibration check

If the option is checked, proof against withdrawal is provided. The cpe1 values are used as a basis for determining the wind loads. The verifications are carried out in the design situation "Equ".

The case that the load application area of the rafter is underflowed by the wind like a cantilever when the wind flows on the gable side can be taken into account with the option "With gable-side overhang".

- Influence of creep under pressure:

The influence of creep can optionally be taken into account as follows for components subject to compression:

- The stiffnesses should not be reduced as a result of creep.
- The stiffness should be reduced as a result of creep from a constant load component.
- The stiffness should be reduced as a result of creep from permanent and quasi-permanent load components.

## Ultimate Limit State

- Fire protection design:

Check this option to display the input fields for the fire design. If this option is selected, the stress verifications are also carried out in the event of a fire.

- Check method:
  - no defaults The program chooses the procedure
  - Simplified method Process with reduced cross-sections
  - Exact method Process with reduced properties

Properties	д
Basic parameter	9.0
庄 - System	
🗄 - Loading	
- Design	
Design settings	
Connection Details	
Output	

Calculation Rules		0		
Only positive deflections on cantilever		$\checkmark$		
Reference length for total deflection	Member Length	-		
kmod Mean wind		•		
With equilibration check				
Influence of creeping under pressure	Depending on pe	a .		
Ultimate Limit State		0		
Fire design		$\square$		
Check method	no defaults			
Fire resistance class	R 30	•		
Charring all sides		$\checkmark$		
Chaming acc.to code		$\checkmark$		
Buckling-/Tilt- Lengths		0		
Selected member	Rafter left	-		
Cold Design		0		
Buckling in plane	limited from einge	er T		
limited to L*	Continuous fixed	l		
Buckling out of plane	Member Length Member length			
Tilting	from eigenvalue limited from einge	nvali		
Fire Design	Constant value Member wise use			
Buckling in plane	Member length	T Val		
Buckling out of plane	Member Length	-		
Tilting	Member Length	•		
Serviceability		0		
w,inst	[/] 30	0		
w,net,fin	[1/] 30	0		
w,fin	[/] 20	0		



- Fire resistance class:

Selection of the desired fire resistance class or user-defined input of the burn time.

- Charring all sides:

Uncheck to select individual sides for fire exposure.

- Charring according to code:

Remove the tick if you want to specify the charring rates  $\beta$ n for the individual sides yourself, otherwise the standard values will be used.

See also document Fire protection analysis timber.

#### Buckling and tilting lengths

- Selected member Selection of the component (rafter, collar beam).

#### Cold Design

The boundary conditions for the buckling lengths in and out of the rafter plane as well as the tilting length or the lengths themselves can be specified separately for each component.

The following conditions are available:

- continuously fixed
- Buckling/tilting length = bar length
- Buckling/tilting length = component length
- from the determination of the eigenvalue for each load combination, optionally with an upper limit
- Specification of a constant value for each bar
- Specification of the values for each individual bar

In the event of a fire, the option of determining the eigenvalues is not applicable, since the cross-section values would vary depending on the design method for the individual verifications!

#### Serviceability

w,inst	Limit of elastic deflection
w,net,fin	Limit value of the sum of elastic deflection and creep deformation
w,fin	Limit of the final deformation



## **Connection Details**

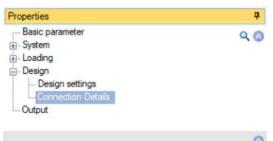
Connection details of rafter base points

- nothing selected,
- with notch and threshold,
- with straight collar,
- with haunched collar.

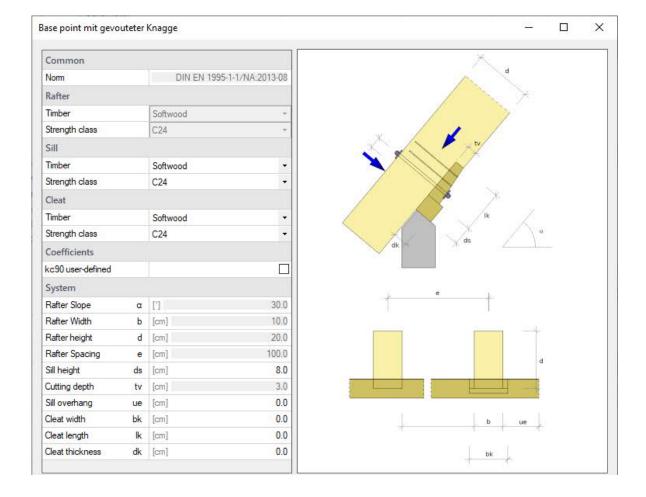
With the Edit button you can open the corresponding dialog.

Optional forwarding of connection details to the toolbox (connected programs in the ribbon).

For graphical input, see also the "<u>Support</u>" chapter.



Rafter base point on the left	mit Ausklinkung und Schwelle
Edit	nichts gewählt mit Ausklinkung und Schwelle
	mit gerader Knagge mit gevouteter Knagge





## Calculation

To calculate, click on the "Calculate" button in the upper menu bar.

#### Auto calculation option

The option for automatic calculation after each input can be switched on under File - Settings if the runtime behavior of your computer is satisfactory, so that a new calculation can be carried out immediately with each input change.

For more information see the document Roof\_Loads-Design: Calculation





## Output

Before the output click on the symbol "Calculate" in the upper menu ribbon.

After the calculation, the utilization is displayed at the bottom right in the graphics window and offers a good overview of the economic efficiency of the system entered.

#### Output profile

By clicking on the various output options, you determine the scope of the output.

#### Results

You can view the result graphics via the "Results" tab in the upper menu ribbon.

Here you can also the options of scaling graphics and taking snapshots for the output.

#### Output as a PDF document

The output document is displayed in PDF format via the "Document" tab and can be printed.

See also document Output and printing.

Properties	<b>4</b>
Basic parameter	0.0
⊕ System	
- Output	

	0
Output Profile	Standard -
System Graphics	User defined Short
Material Characteristics	Standard
Cross-section Properties	Detailed
Loads table	$\checkmark$
Standard Load Cases	
Additional Load Cases	$\checkmark$
Load cases with loads in table	
Load Combinations	~
only decisive load combinations	~
Results separated by situation	$\checkmark$
Results witch coefficients	
Support Reactions per load case	
Support Reactions per load combination	
Support Reactions Max/Min per action	~
Support Reactions Max/Min per load combination	
Support reactions per [m]	~
Connection forces at ridge per LC	
Connection forces at ridge per combination	
Connection forces ridge Max/Min	~
Connection forces Collar beam fro each load case	
Connection forces Collar Beam per combi	
Connection Forces Collar Beam Max/Min	~
Graphics Exploitation	
Graphics Stresses	
Graphics Normal Forces	
Graphics Deformations	
Graphics Support Reactions	
Tables with legends	~

	New	New item (Project: RSX)* - Dach+ Design of Roofs 01/22C (R-2022-1/P04)														$\times$
File Start Results															0?	) Help
ULS					Â	<u></u>		σ	σ	τ	η	η	η		i) 🔁	R
Envelope Max/Min	Nx	My	Vz	Suppor [kN]		Support [kN/m]	Rotated Support [kN/m]		Bending Stress	Shear	Eta Stress	Eta Equilibrium	Eta Shear	Scaling		
Situation		Internal forces							Stresses			Levels of Capacity			ictures	1