FrameWIN manual

Instructions and theory behind subframe calculation

TRAILER CONSULTATION Tel **+358 (0)10 337 2530**
Kauppatori 2
FIN - 67100 Kokkola FINLAND
www.trailerwin.com E-mail: **info@trailerwin.com**

FrameWIN Subframe Calculation software

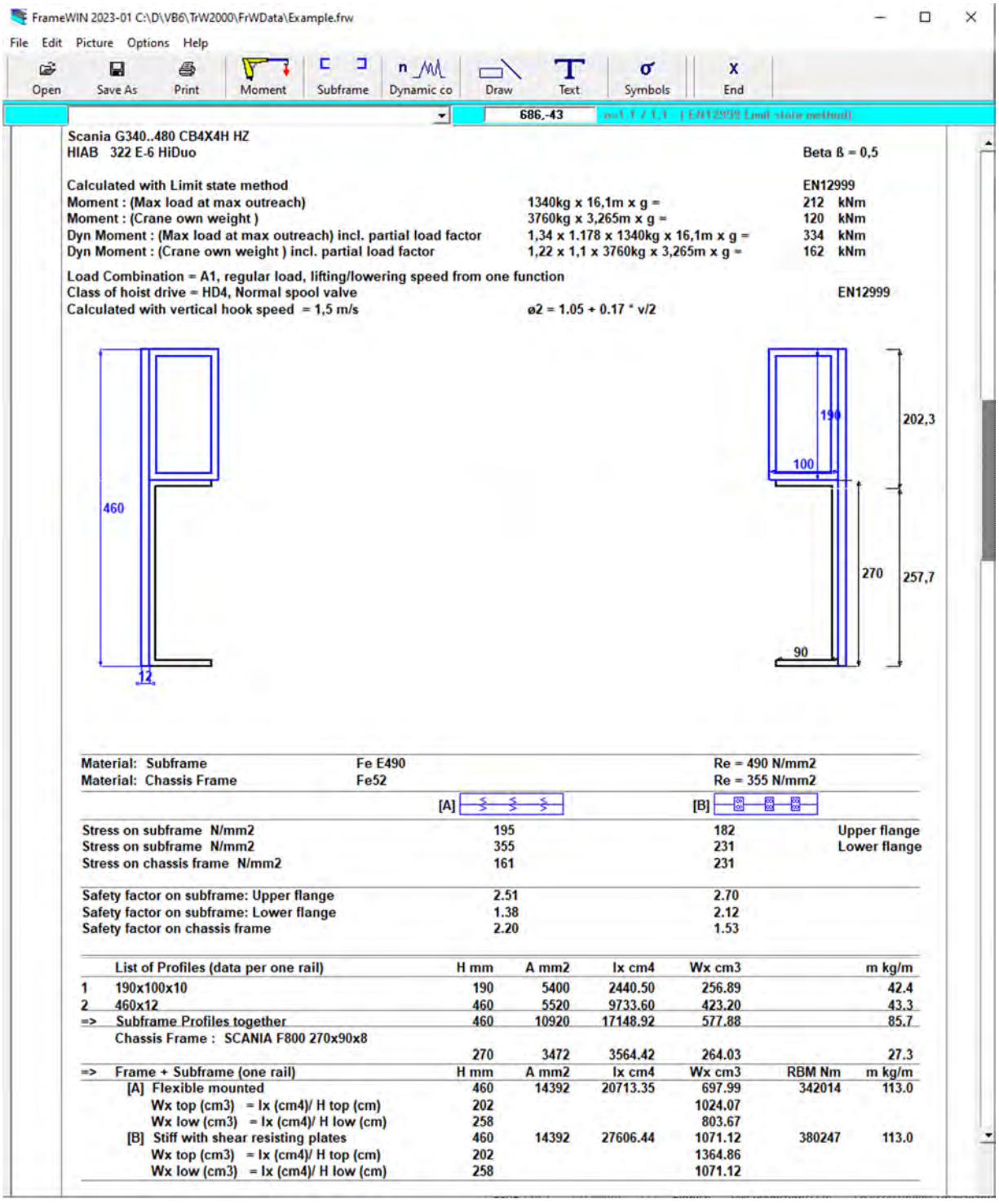

Table of Contents

General instructions

FrameWIN program is an additional module meant to be used together with TrailerWIN software. Used as standalone program will make the use of the program much more complicated as there are no databases with cranes in FrameWIN program. The databases are all in TrailerWIN program.

Program manuals

After installation you will find all Manuals and newsletters in pdf-format in
[trailerWIN directory]\MANUAL\

Latest ”Fix”:es on our homepage

No matter how hard we try to get all our programs Error-free, there is always the possibility something goes wrong. Now we have introduced a new service for downloading fixes for minor Errors on our homepage.
You will now find fixes on our homepage: www.trailerwin.com and click on “Support” and then select “Fixes” in the menu. There You will find latest fixes on top. The pdf-file holds short instruction for installing the fix and the zip-file holds the package to install. To install a correction, download the instructions (pdf-file) and look that the fix is suitable for Your version. Install the correction as described in the instructions.

If an Error occurs, please check here first and inform us if fix not found for the Error. Note that all Error can´t be fixed thru this service and make sure that You have suitable version before installing the fix.

License & Use of software

You may use the **TRAILER CONSULTATION Computer Software** on one or more computers in one office or in one factory area.
You may use the TRAILER CONSULTATION Computer Software on a computer network when the network is working only in one office or in one factory area. Use of software is allowed to use also on remote work but only if the user normally would be at the licensed address of the company.

You may not make any changes or modifications to this or any of the TRAILER CONSULTATION Computer Software
You may not decompile, disassemble, or otherwise reverse engineer the TRAILER CONSULTATION Computer Software.
You may not rent or sell or lease or copy it to anyone.

The license is valid for five (5) years, after the license has expired you need to buy a license reactivation. Also notice that the update fee is cumulative so when ordering update you also need to pay for possible skipped years in between.

TRAILER CONSULTATION Computer Software includes following computer programs: TrailerWIN, CraneWIN, FrameWIN, CornerWIN, BusWIN and BrakeWIN.

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You may use the TRAILER CONSULTATION Computer Software on one or more computers in one office or in one factory area.
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The license is valid for five years (5). When license has expired you need to buy license reactivation. Also note that the update fee is cumulative, if you skip some year you need to pay a cumulative fee for all the years skipped as well.

TRAILER CONSULTATION Computer Software includes following computer programs: TrailerWIN, CraneWIN, FrameWIN, CornerWIN, BusWIN and BrakeWIN.

Updates

Yearly update

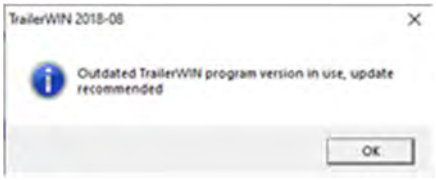
The program is continuously updated with new features and new models. Therefore, the program should be updated regularly once per year. The updating policy is cumulative, which means that you will have to pay for skipped years if you have not ordered an update the previous year(s). The license will expire after 5 years and then it is necessary to buy a license reactivation.

Multiple updates during the year

To meet the request for several updates during the year we have now introduced this as a standard method to keep the software up-to-date. For a small extra fee (20% of the normal update price) you can order additional updates during the year if you need to get new products and trucks into your program. This fee will be charged also when ordering a replacement update on other media (USB instead of DVD) or the company name and/or company logo is changed during the calendar year. Contact your dealer for more information.

Outdated version message

If you are running an old version of TrailerWIN the program will show you a message at startup reminding about updating to new version. When you see this message, contact your dealer for an update.



License expiration

The FrameWIN license is valid for 5 years, if you haven´t updated the program you will get a message of license expiration. You can check the date for expiration in Help-FrameWIN info. After this date the program will terminate and you need to purchase a license re-activation in order to get it running again.

License dongles (one computer versions)

Rockey4ND dongles

We are using Rockey4ND Dongles for one-computer versions. These new dongles doesn´t require separate installation disc, the installation will start automatically when dongle is attached first time to the computer. Just attach the dongle and wait until the light stops blinking.

Sentinel dongles

Old type dongles (Sentinel) will still work on TrailerWIN and they don´t need to be switched, both versions dongles are supported and can be used on same computer. However these Sentinel keys need a separate driver that can be downloaded from our homepage www.trailerwin.com under the button “Support-Drivers”. Use this driver on both updating on old computer and installation on a new PC. Please note that sometimes the installation of a new driver requires you to restart the computer.

Important Notice for FrameWIN Setup

If you see an error message during the first part of installation that says “file operation with *.DLL file cannot be made” the problem is likely to be the level of user access (Administrator rights). (Please note the error message can differ depending on your operating environment.)
In some cases, installation of TrailerWIN to Windows Vista, Win 7, Win 8 & Win 8.1 Win 10 or Win 11 operating environments ***can occur only if you are logged on as Administrator.***

Installing FrameWIN

Hard Disk Space needed for FrameWIN

There are many improvements in this version of TrailerWIN compared to previous versions of the program. New models of trucks and extra equipment have been added to the program. Consequently, the size of the TrailerWIN data files has grown and they will take up more space on the hard disk of your computer.
It is recommended that you have at least 2 GB of free space on the hard disk before installing the FrameWIN and 10Gb for installing TrailerWIN and FrameWIN.

Please note that if your hard disk is almost full it makes your computer slow and unstable.

Installing from USB card from Single-exe setup file

Installing FrameWIN programs first time on a computer or updating the program.

Installation from USB-card doesn't start automatically due to security reasons. The installation must be started manually. This instruction can also be found on the USB-card itself. FrameWIN will automatically install together with TrailerWIN if you have it in your license package.

1 Flip open connector and plug in the USB-card.

Carefully cut the seal* on the label at the marked lines and bend out the USB-contact from the card. Press and bend out the connector and connect to the USB-port on your computer.

Caution! Be careful not to bend the contactor up or down when plugging into USB. The USB port on the computer can be damaged if contactor is bent when plugged in!

Cut to open the seal

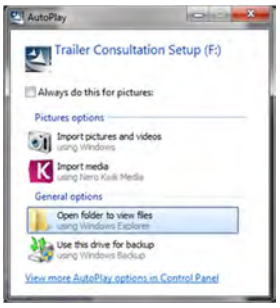
Flip and bend out the connector

Insert the USB card to computer

*) The seal over the connector is to prevent unauthorized use and prevent added/changed files to the USB stick after production. The seal is added immediately when card is prepared.

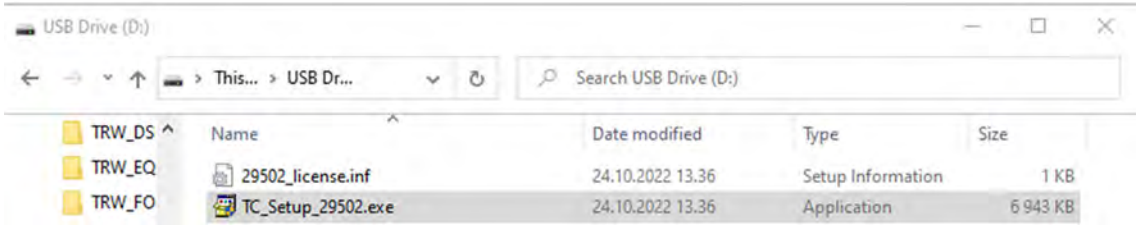
2 Open the folder to view files or use Windows explorer to find the USB drive (see 3)

When the following window appears, please select option "Open folder to view files"



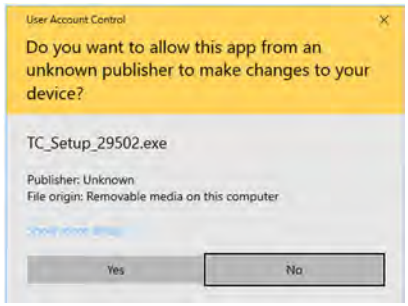
3 Starting the installation

Now You will see install guide pdf files, license.inf file and a single-exe installation file. Please dbl-click on TC_Setup_xxxx.exe to start the installation. The setup-package will extract the installation files and after that the setup will start.



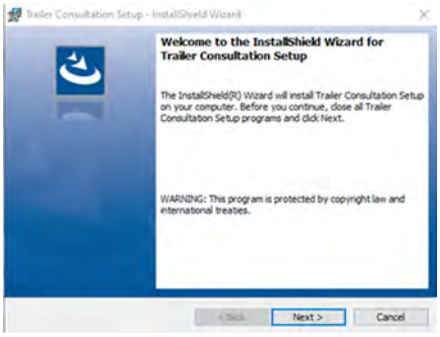
4 User Account Control

Now the installation will bring up a User Account Control Window, click “Yes” to start the installation.



5 Initializing Setup.

Click “Next”

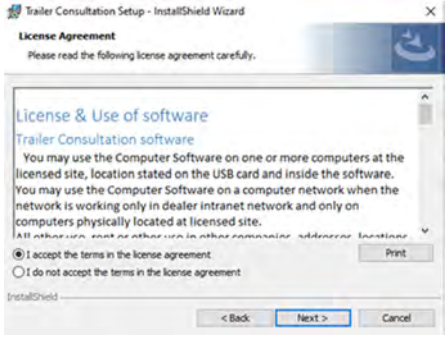


a: Installing programs first time on a computer

b: Updating program

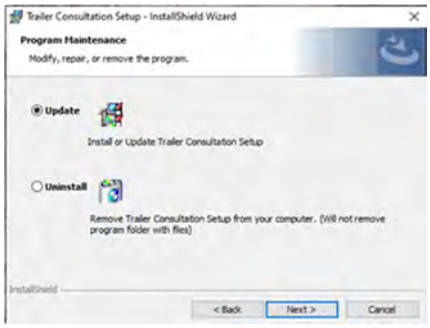
6a License agreement

Click “I agree the terms in license agreement.



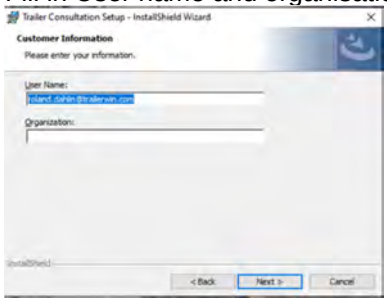
6b Update or Uninstall

Select “Update” and click Next



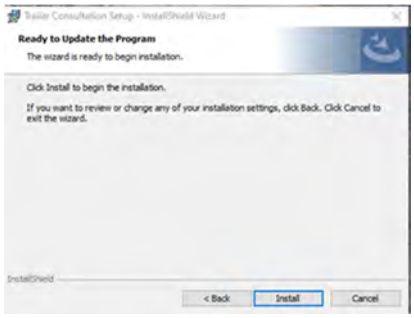
7a Customer information

Fill in User name and organisation



7b Ready to install update

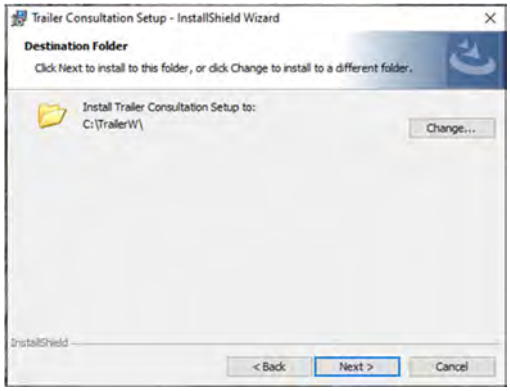
Click “Install to continue



8a Destination folder

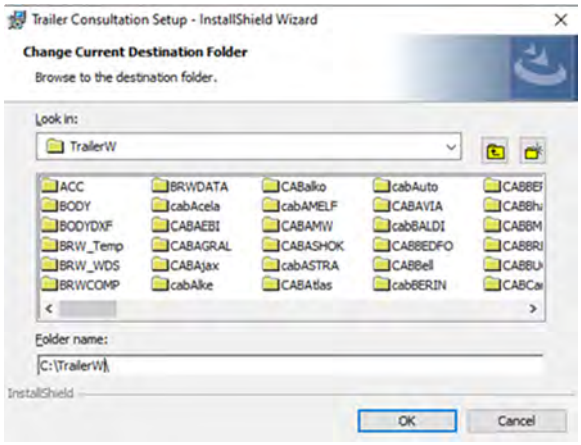
8b When updating jump to position 11 on next page

To install in default folder C:\TrailerW click next (recommended)



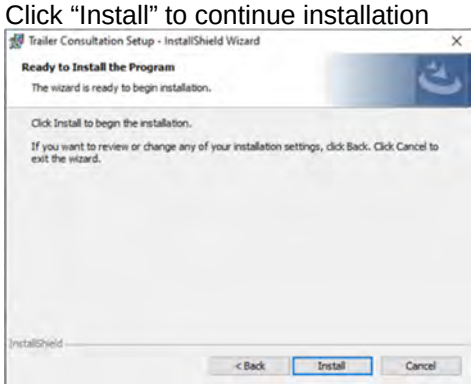
9a Select other destination folder

In previous window select “Change” and you can select another destination to install TrailerWIN programs.



10a Begin installation

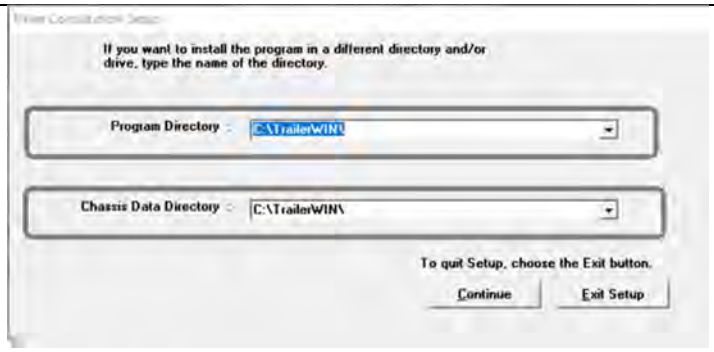
Click “Install” to continue installation



11 Choosing directories

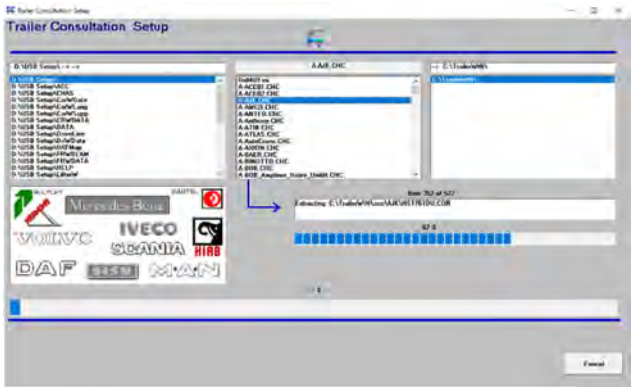
a) You can install program files separately from data for trucks and equipment, to change this you can give other directory name Program directory and Chassis data directory.

b) Otherwise choose “Continue” (Recommended)



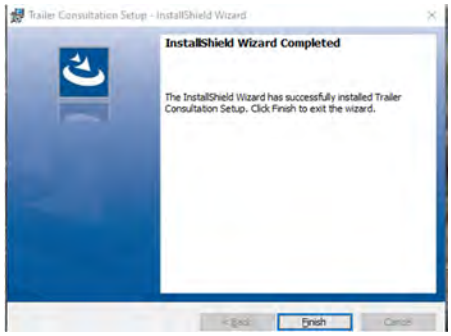
12 Program installation begins

Next window shows progress on installation of program files and database files. This step usually takes several minutes.



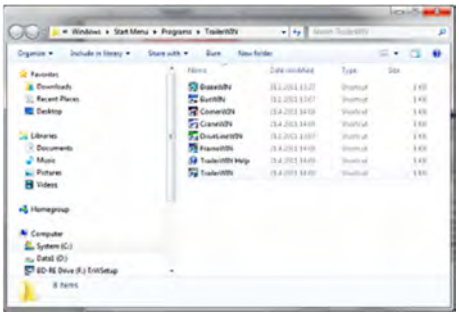
13 Installation complete

Click Finish to complete the installation.



14 Shortcuts

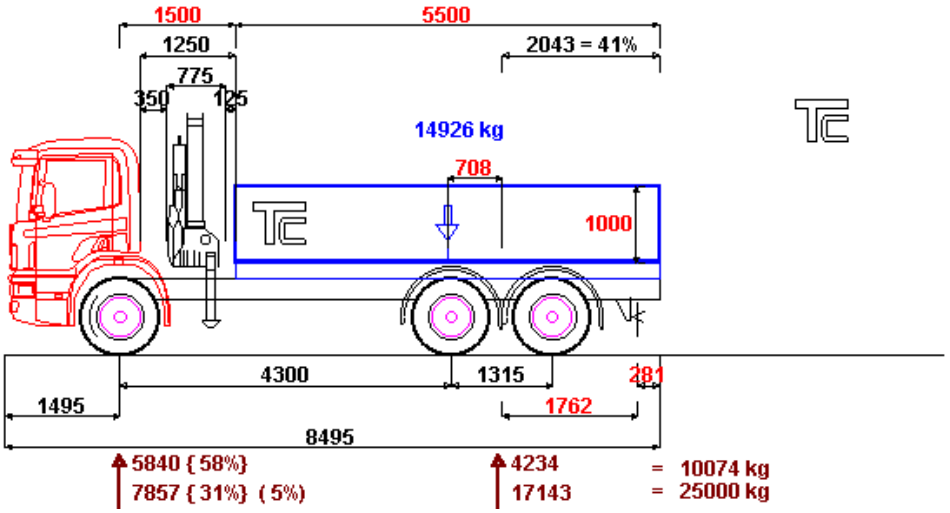
Now you will see a window with shortcuts for the programs installed.



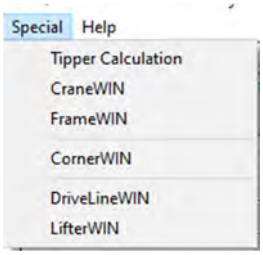
FrameWIN : Starting the program

Using with TrailerWIN computer software

Subframe calculating computer software **FrameWIN** is designed for to be used with **TrailerWIN-program**.



Vehicle measuring, the weight calculation, the crane choosing and the crane mounting in the vehicle are made first by using **TrailerWIN**.
By choosing Menu: **Special - FrameWIN** from the TrailerWIN menu you can go to subframe calculating software FrameWIN.



When you start FrameWIN it will automatically read the crane data from the last made TrailerWIN calculation and it will do the first calculations by using this data as loading moment.
Frame Beam Profile and Subframe Beam Profile you have to choose manually. The software does not know, which is the correct profile for various chassis.

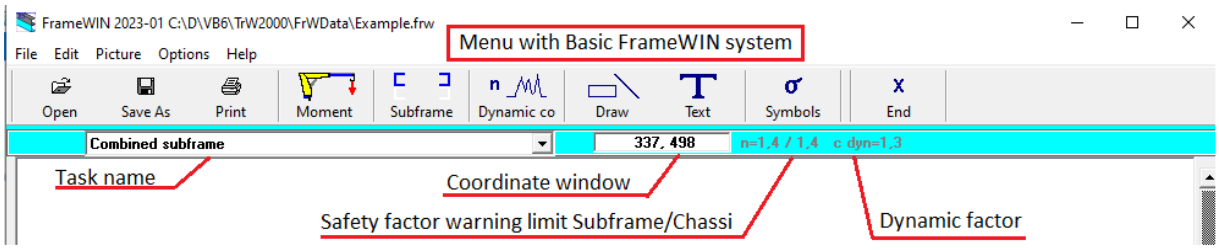
Start the FrameWIN from Windows icon

You can also start the **FrameWIN** from the **Windows Program Manager** by choosing the **FrameWIN**-icon.

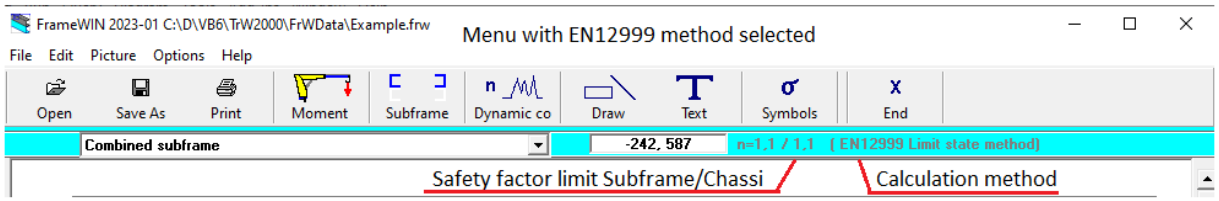
Also in this case the software first reads and shows the data from the previous TrailerWIN-calculation.
If you want to use some other calculation, you can change the data of that previous calculation.

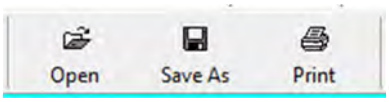
Toolbar

Toolbar when FrameWIN basic system selected:



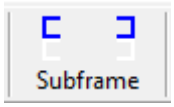
Toolbar when EN12999 calculation method selected:





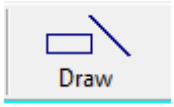
Open, Save or Print Calculation

The Data of Loading Moments: Crane Load and Outreach



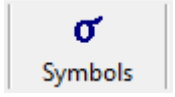
Choosing the Subframe Profiles

Set values for Dynamic Coefficient and Safety Factor warning limit and choose calculation method

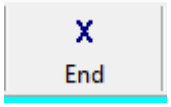


Draw objects: line, rectangle, etc.

Draw Text

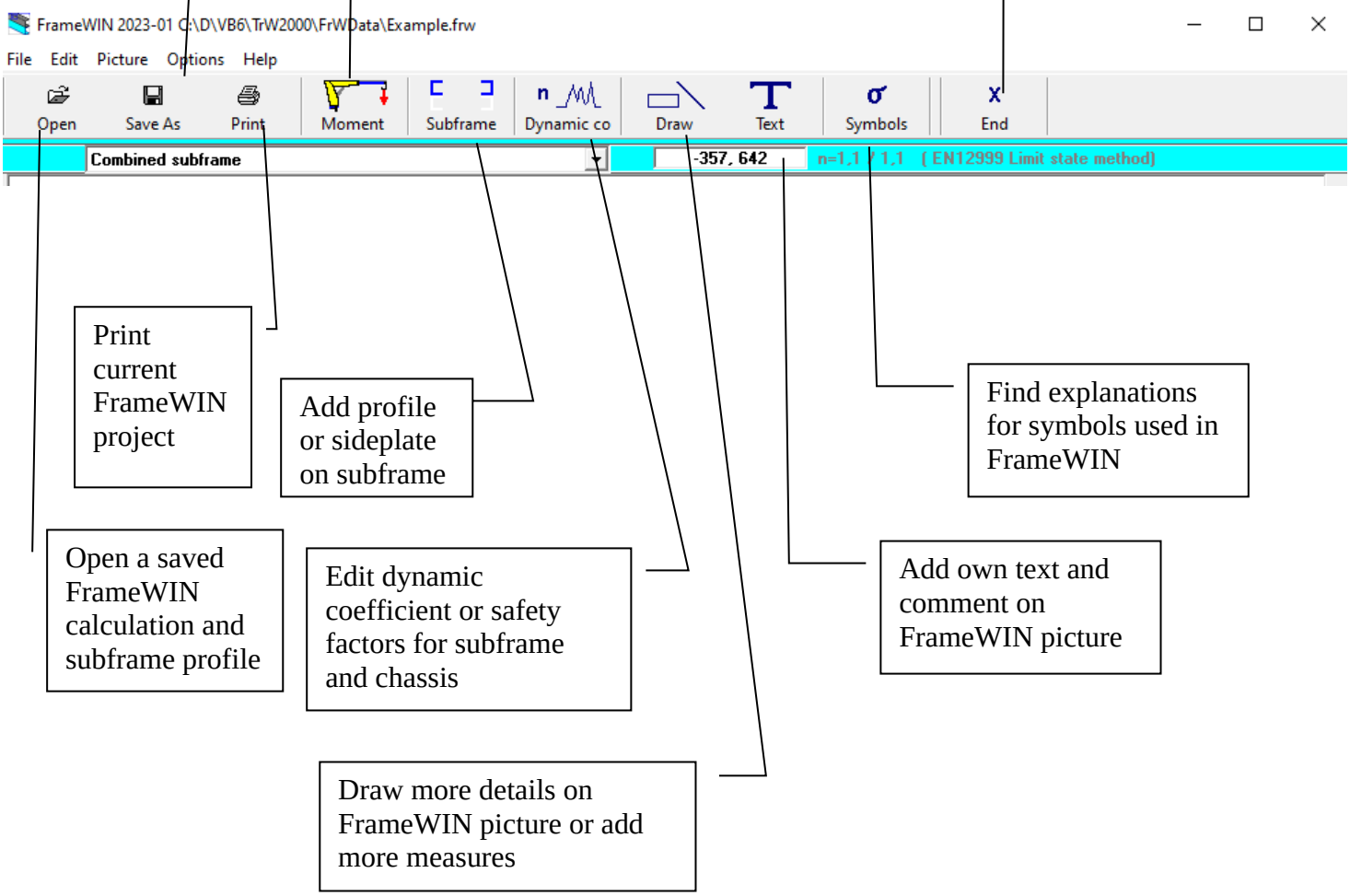


Symbols in FrameWIN and explanations for them



Exit FrameWIN

Buttons on FrameWIN program

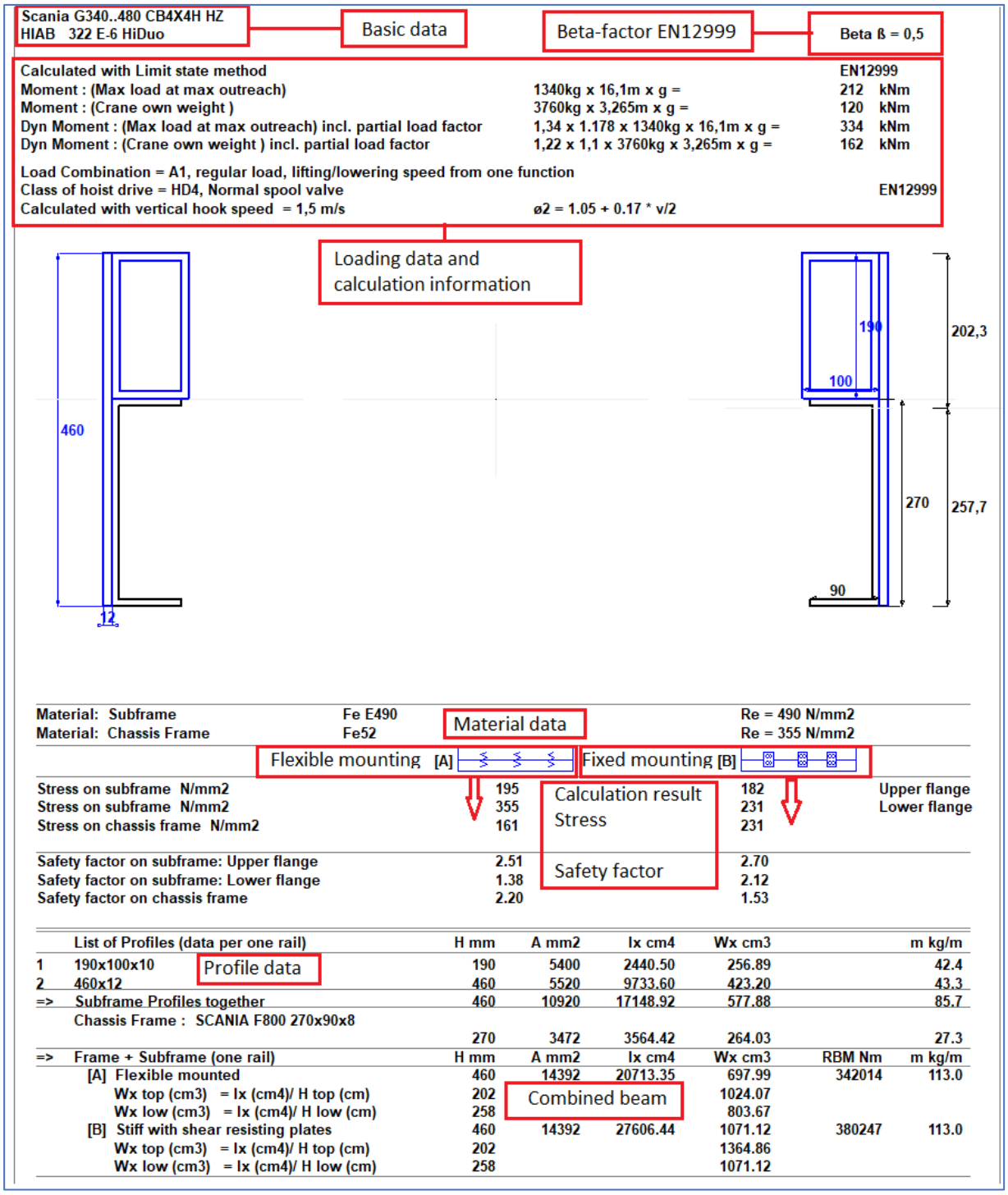


Info on FrameWIN Screen and outprint

On the screen you will find the Basic Data, Data of Loading (Moment), Data of Material and calculation method selected
You also find following Calculating results: Stress and Safety Factor, Details of Profiles (Dimensions and Cross Area Values) and Calculated Cross Area Values for Combined Beam (Chassis Frame + Subframe Profiles).

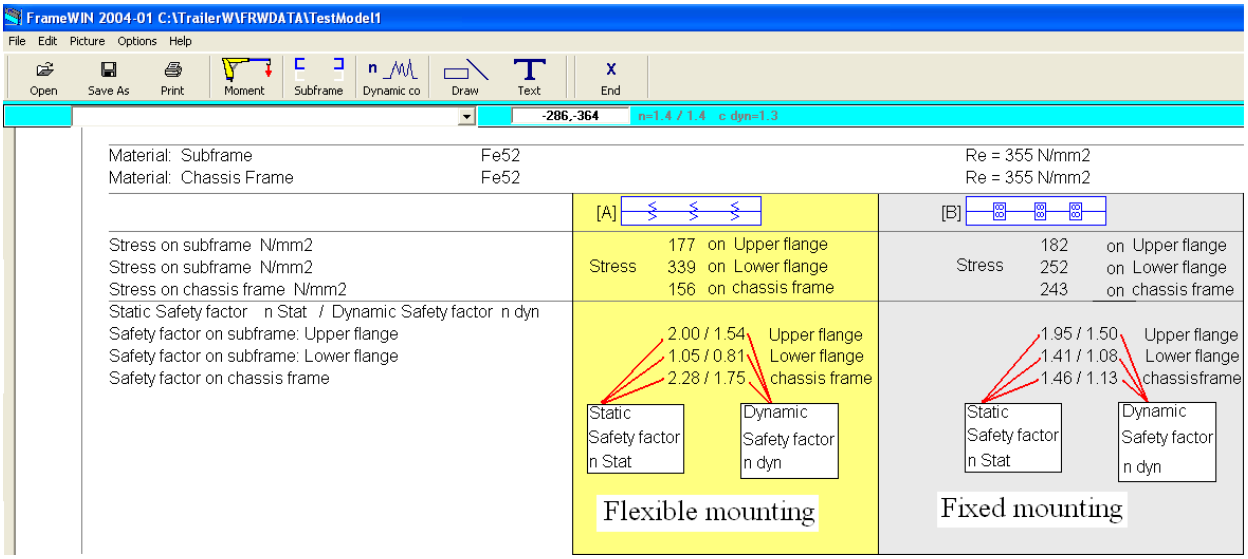
EN12999:13001

When using EN12999 method (picture below) you will also see information for selected options used in EN12999 standard.. For more information about calculation systems see Dynamic Loading Factor and Calculation system on page 39.



Standard FrameWIN system

When using Basic FrameWIN System calculation method, here you can also see Static safety factor and Dynamic safety factor separately. See picture below.



Loading Data

Loading Data is taken from the last TrailerWIN Calculation (Calculation with Crane) or you have edited the data.

Moment : (Max load at max outreach)	4350kg x 7,5m x g =	320	kNm
Moment : (Crane own weight)	3020kg x 1,565m x g =	46	kNm
M dyn = 366416 Nm * 1.30 = 476341 Nm			

You can edit loading data selecting Menu: **Edit - Moment**, or selecting Toolbar Button: **Moment**.

Material Data

Material: Subframe	Fe52	Re = 355 N/mm2
Material: Chassis Frame	Fe52	Re = 355 N/mm2

Re = Yield strength in N/mm2

You can edit Material data selecting **Menu: Edit - Material**.
You can choose different steel qualities for Subframe and for Chassis frame.
Notice that both Subframe Profiles and Chassis Frame Profiles must be same material. For example if Subframe Profile is steel should Chassis Frame Profile be steel as well (or if Subframe Profile is aluminium should Chassis Frame Profile be aluminium also etc). The Program cannot calculate combination with Materials with different E-values (E=modulus of elasticity).

Stress Data

	Flexible mounting [A]	Shear resisting mounting [B]	
Stress on subframe N/mm2	151	705	Upper flange
Stress on subframe N/mm2	151	-468	Lower flange
Stress on chassis frame N/mm2	679	602	
Static Safety factor n Stat	0,52	0,5	
Dynamic Safety factor n dyn	0,4	0,38	

FrameWIN calculates stress using two different methods:
Combined beam data with Flexible mounting [A] and
Combined beam data with mounting with shear resisting plates [B].
The Method of calculating is explained in the Appendix SUBFRAME CALCULATION.

Profile Data

The table shows Cross Area Data of all the chosen profiles:

	Profile	H mm	A mm2	Ix cm4	Wx cm3	M kg/m
1	U 60x40x3	60	402	23.45	7.82	3.2
	Chassis Frame					
0	FODEN 2000R 270 x 92 x 8.0	270	3504	3619.36	268.10	27.5
=>	Frame + Subframe	330	3906			30.7
	[A] Flexible mounted			3642.80	269.84	
	[B] Stiff with shear resisting plates			4624.61	259.78	

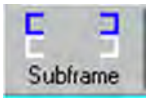
These Cross section dimensions are given for one beam:

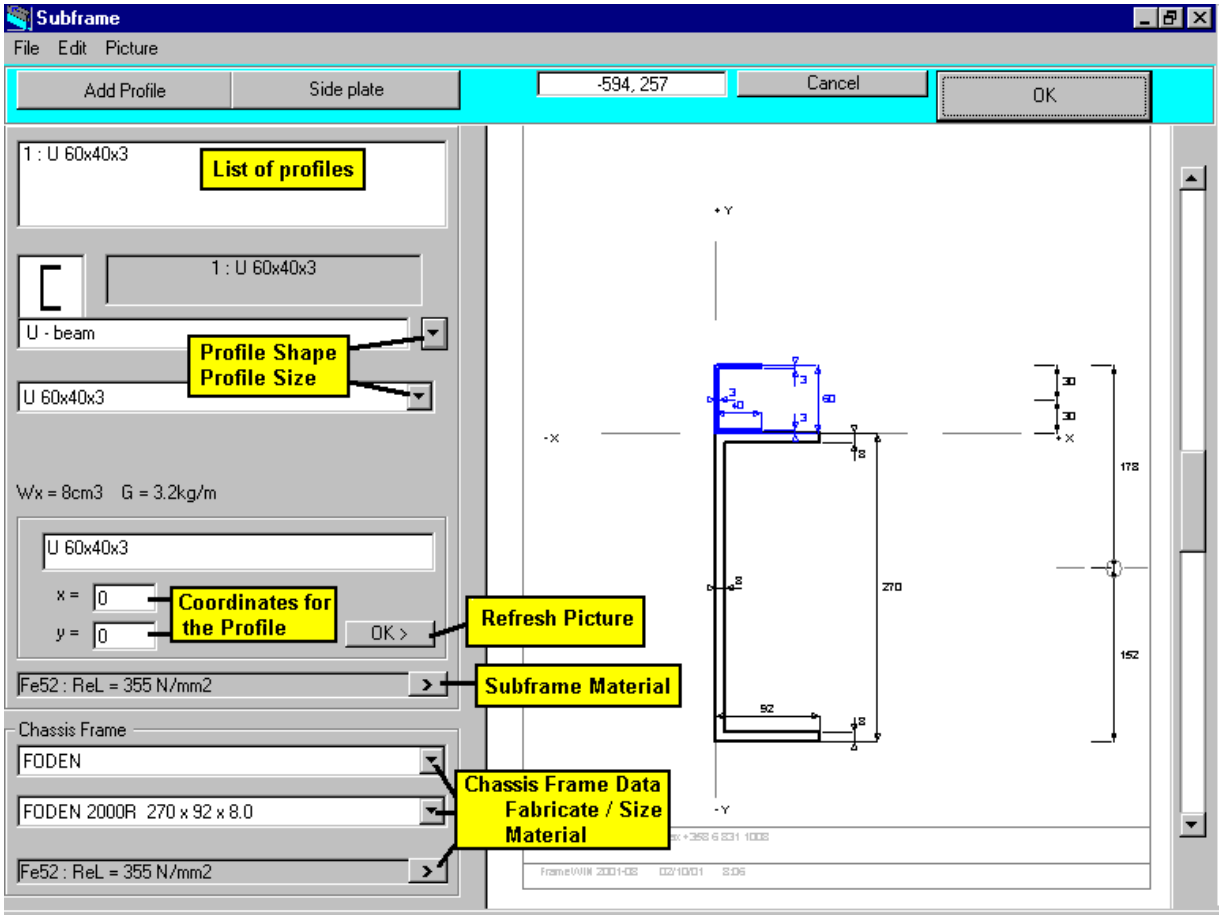
Height	H	(mm)
Cross section area	A	(mm^2)
Second moment of area	I_x	(cm^4)
Section modulus	W_x	(cm^3)
Beam weight / meter	G	(kg/m)

Two last rows show the I_x and W_x for combined beam, [A] Flexible mounting and [B] Shear resisting mounting.

Choosing and Editing Subframe Profiles

Click the Subframe-button
or select the menu EDIT - SUBFRAME or CHASSIS FRAME.

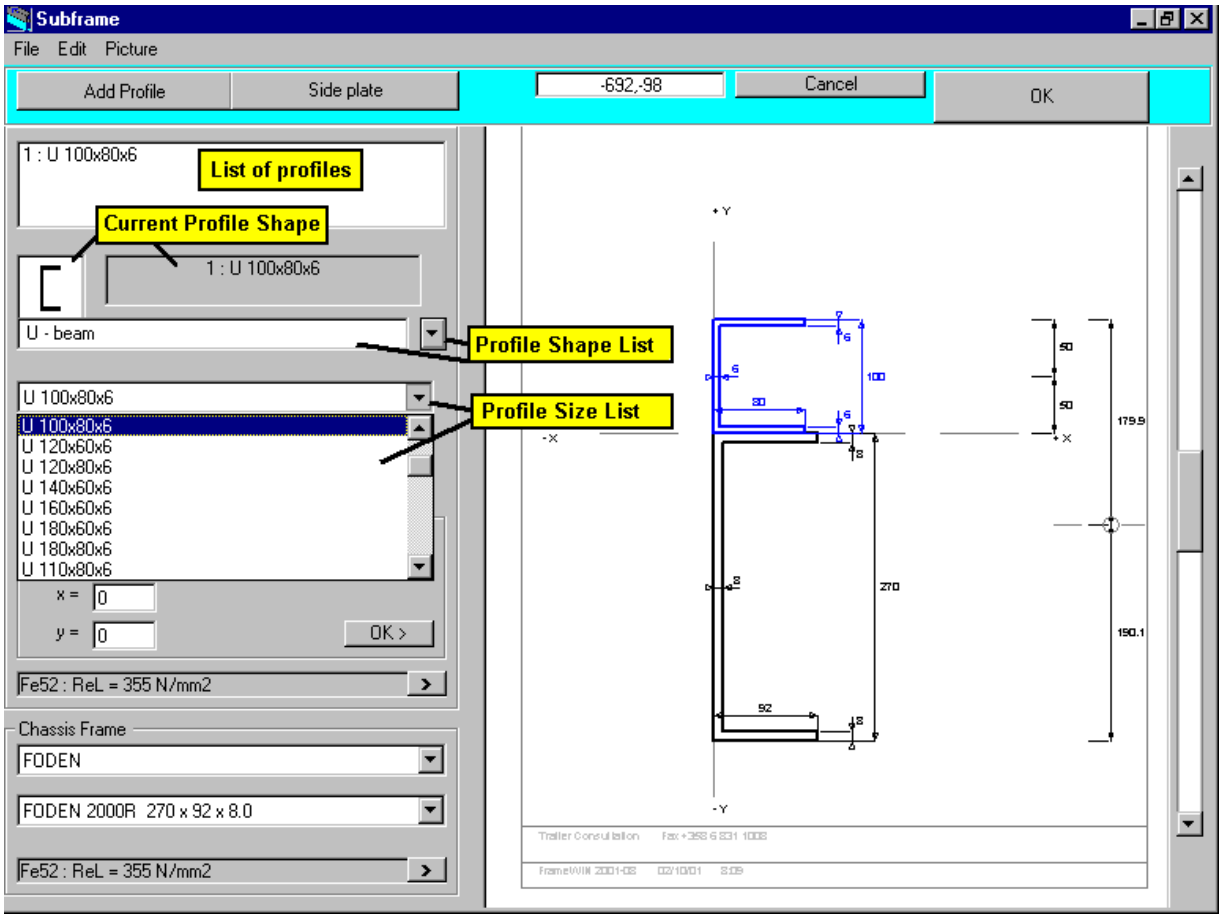




Choosing the Subframe Profile

You can change the profile shape by choosing shape from the Profile Shape List.
Choosing the shape changes profile list in Profile Size List.

When the shape is correct, you can choose Profile Size from the Profile Size List.



Profiles

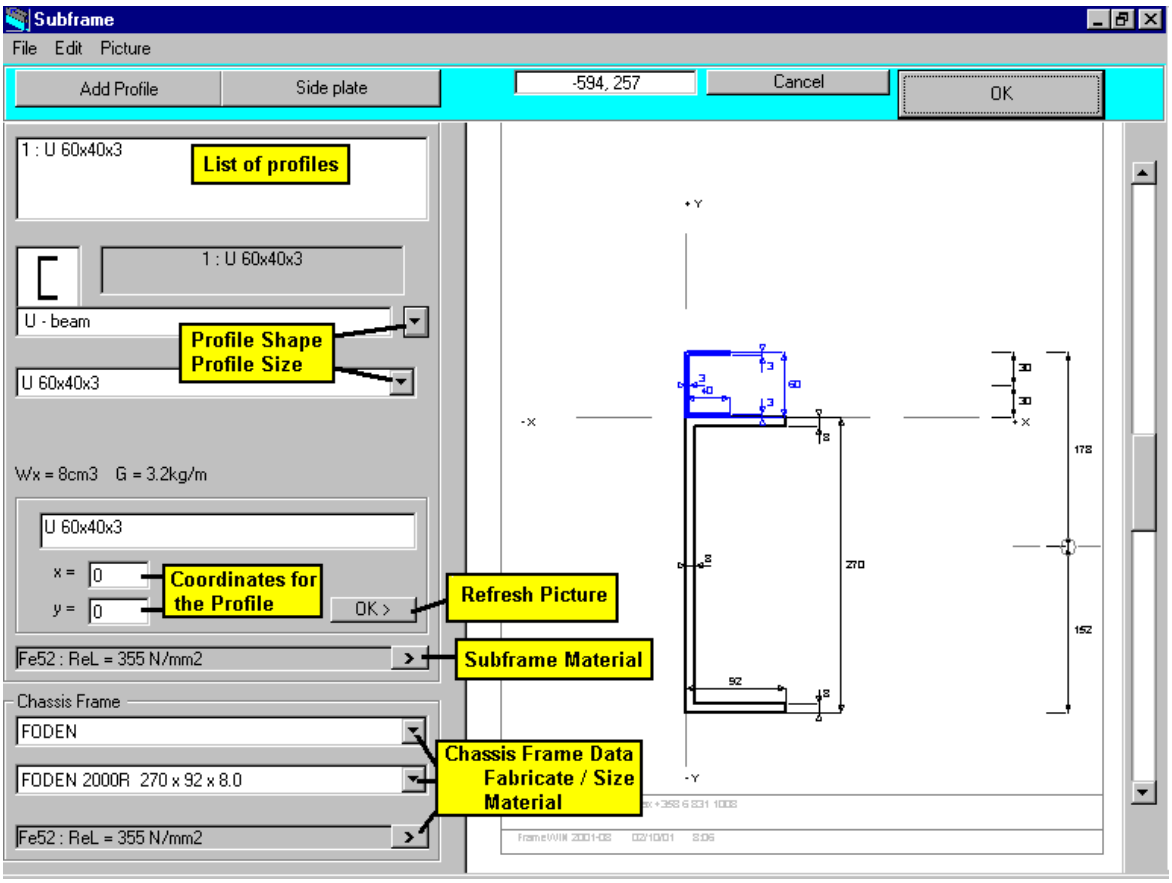
From subframe menu You can add more profiles on subframe or add a sideplate on subframe.

You can choose shape of profile, measures for height, width & length and material and give exact coordinates for each added new profile

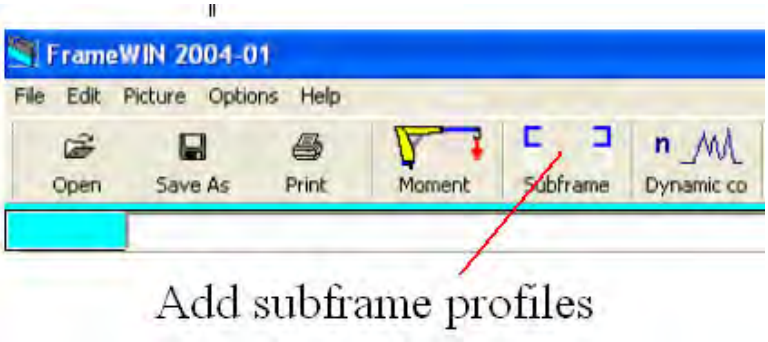
All added profiles will be taken into consideration in FrameWIN stress and safety factor calculation.

Calculation are made for fixed mounting and for flexible mounting.

Safety factors are calculated for dynamic coefficients and for static coefficients.

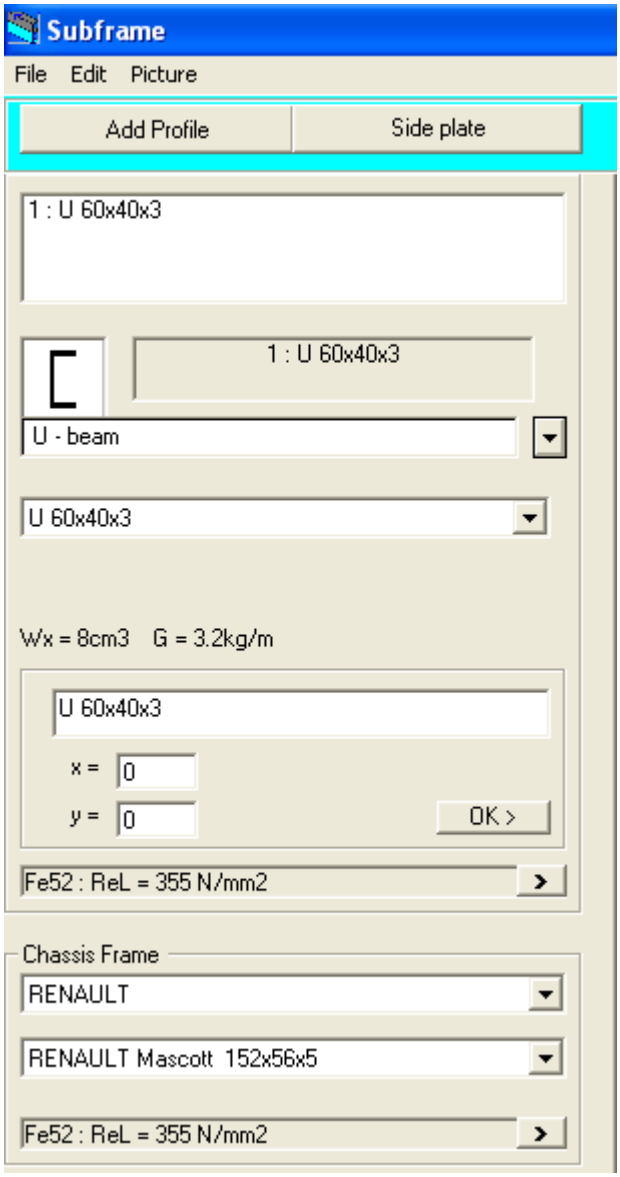


Add new profile for subframe



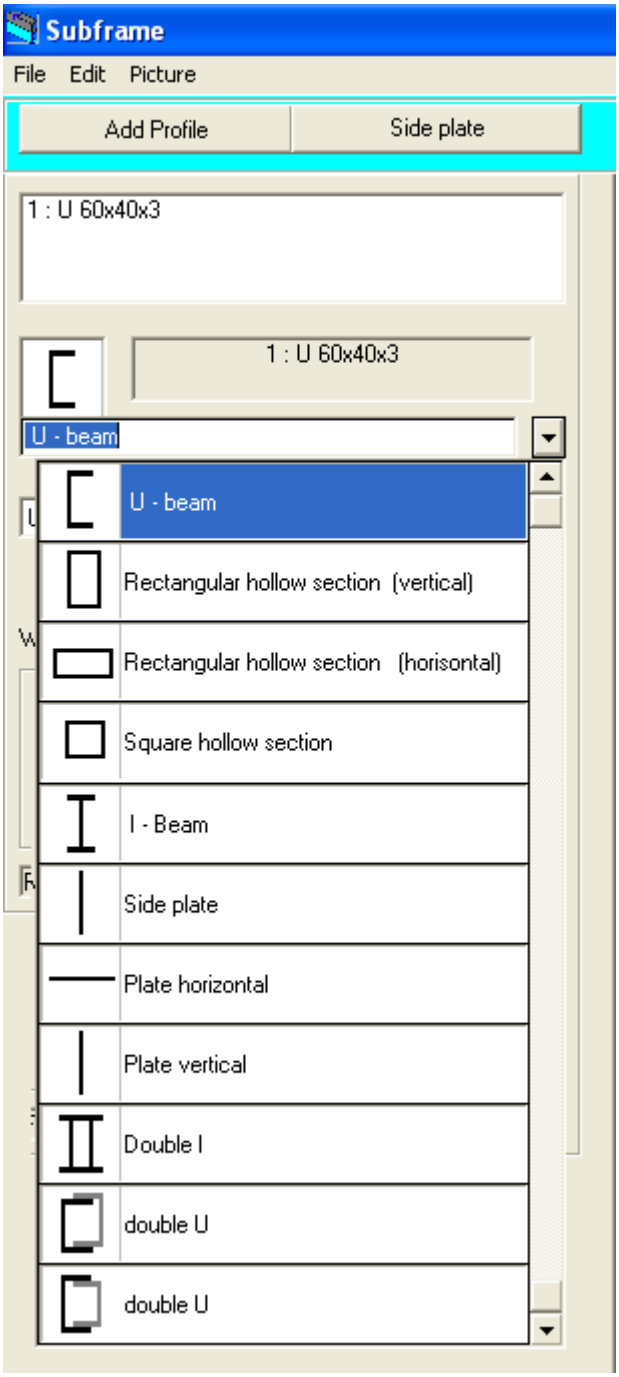
You can add profiles to the subframe by clicking on Subframe button in menu.

Select “Add profile” to add a new profile to the list or “Side plate” to add a side plate to the chassis frame/subframe construction.



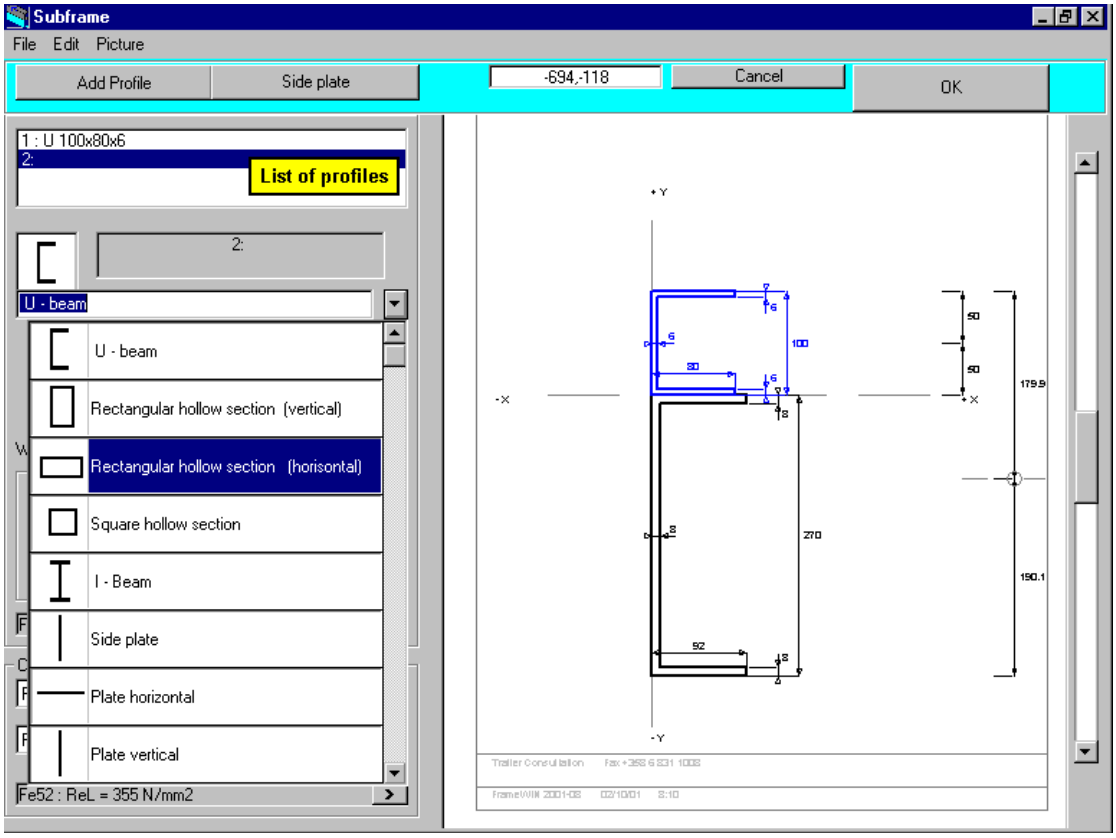
You can choose shape of profile for each added new profile. List of profile types include:

1. U - beam
2. Rectangular hollow section (vertical)
3. Rectangular hollow section (Horizontal)
4. Square hollow section
5. I - beam
6. Side plate
7. Plate Horizontal
8. Plate vertical
9. Double I
10. Double U (version 1)
11. Double U (version2)

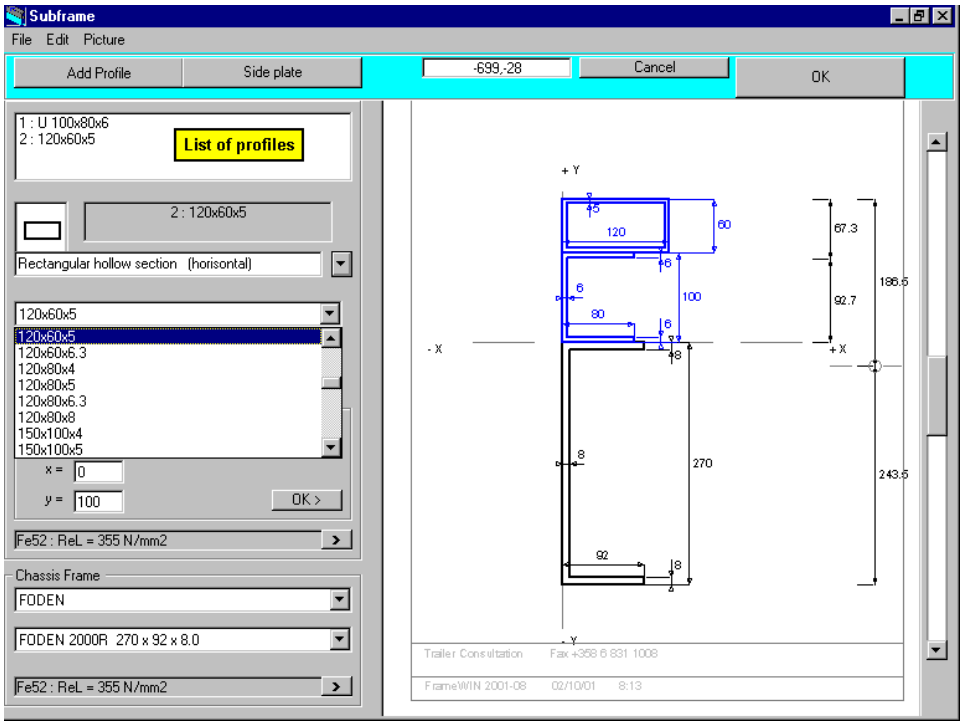


For adding a profile, click the **Add Profile** button or use **Menu:Edit - Add Profile**.
You will get a new profile number (2) on the List of Profiles on the top of the screen.

Choose profile Shape from the Profile Shape List.
Take for example a Rectangular Hollow Section (horizontal)

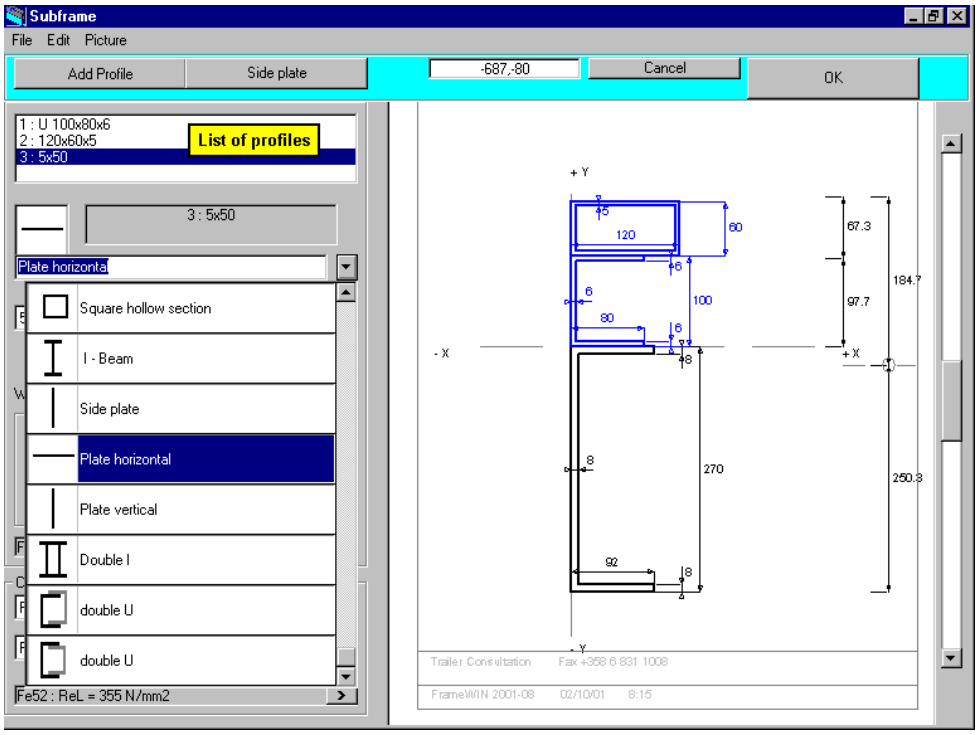


As next step you have to choose the Profile Size from the Profile Size List.

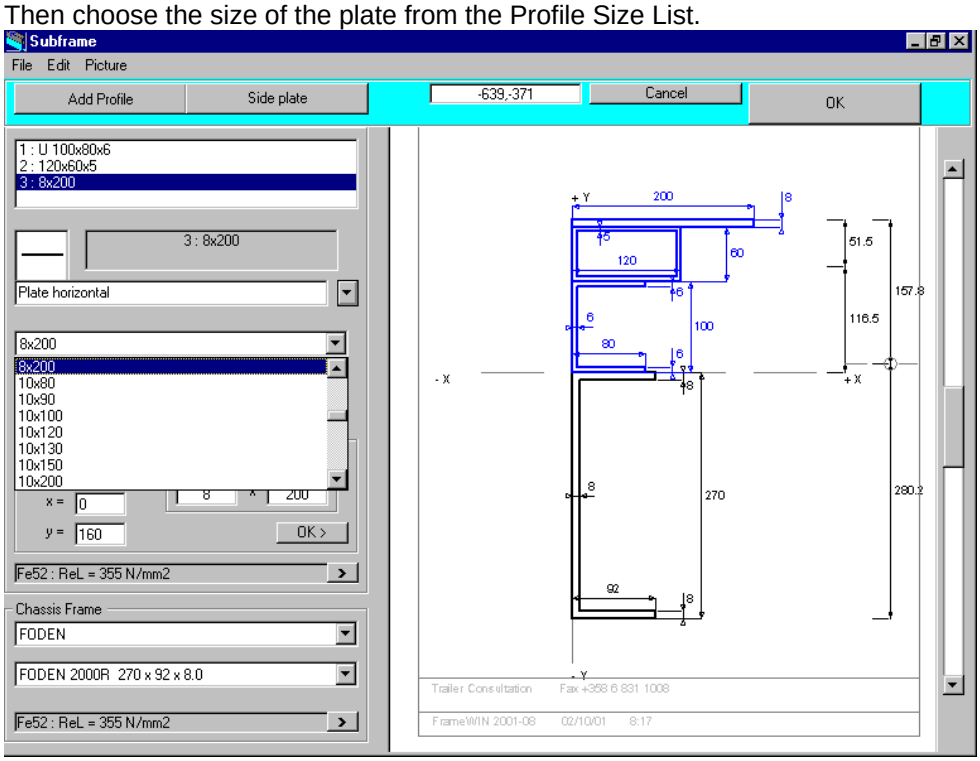


Adding top plate on the subframe

Add a horizontal plate as the top of the subframe.
For adding a profile, click the **Add Profile** button or use **Menu:Edit - Add Profile**.
You will get a new profile number (3) on the List of Profiles on the top of the screen.
Choose profile Shape from the Profile Shape List, now **"Plate horizontal"**.

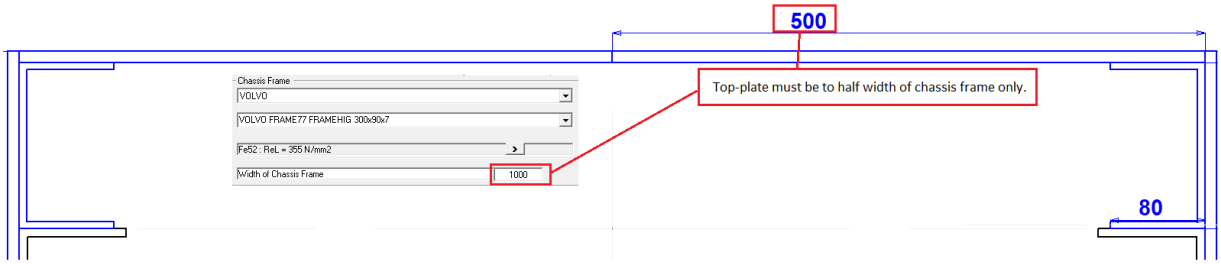


Then choose the size of the plate from the Profile Size List.



Note if you add horizontal plate between frame beams

If you are using a top-plate between the frame beams you need to set the width of the top-plate to **half the distance** between the frame beams. Otherwise you will calculate the top-plate twice. You can see on the picture that the top-plate measureline must end at centerline of the chassis.



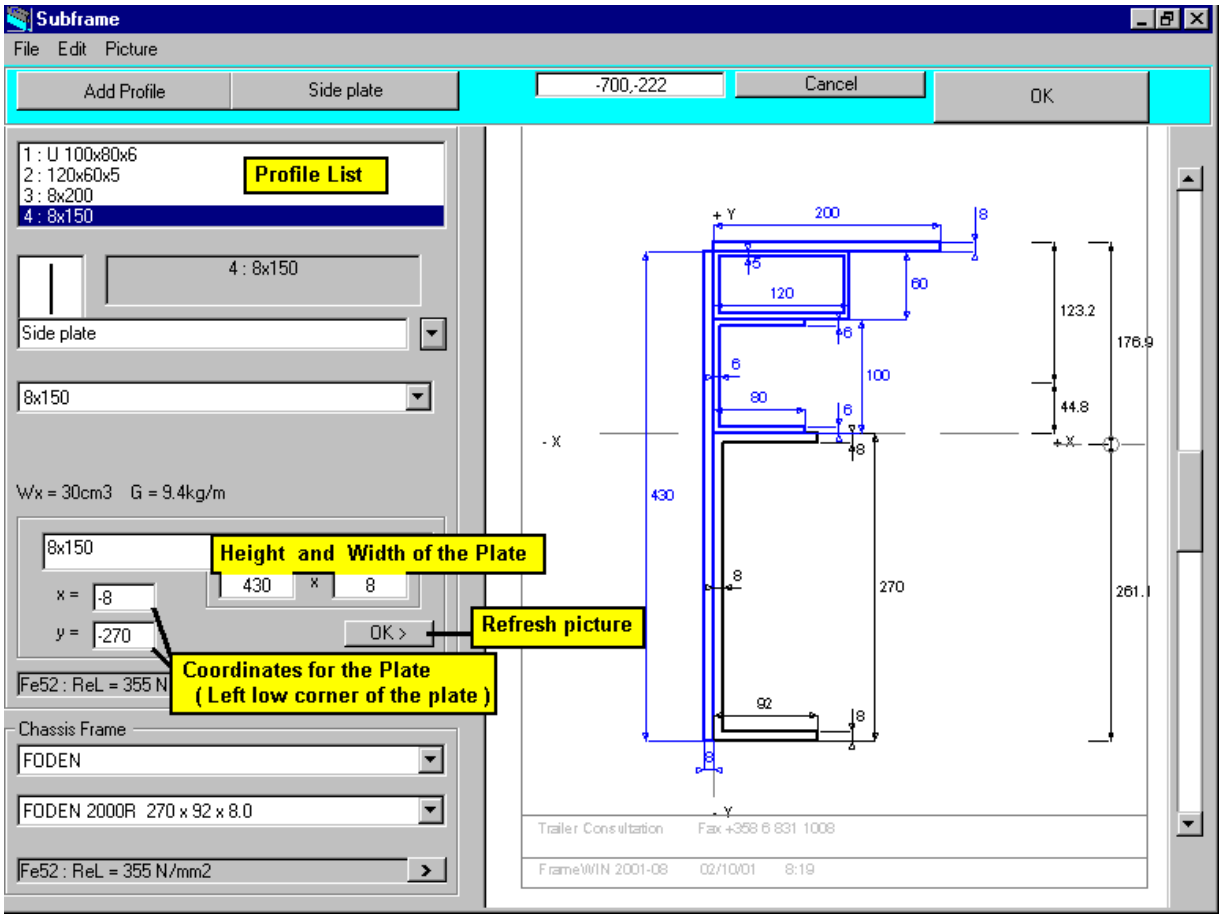
Add the Side Plate

For adding a profile, click **Side Plate** Button or use **Menu:Edit - Add Side Plate**.
You will get a new profile number (4) on the Profile list on the top of the screen.
The Profile Shape List shows **"Side Plate"**.

Choose the size of the Side Plate from the Profile Size List.
If you do not find suitable plate size from the list you can type the dimensions to "Height" and "Width" textboxes (Look at the picture).
You can locate the side plate by typing the x- and y-coordinates in "Coordinates for the plate" textboxes.

The coordinates mean the lower left corner of the cross area of the plate or profile.

After typing the coordinates x and y click small OK button (Refresh picture) to get the picture redrawn.



Add reinforcement plate under Chassis Frame

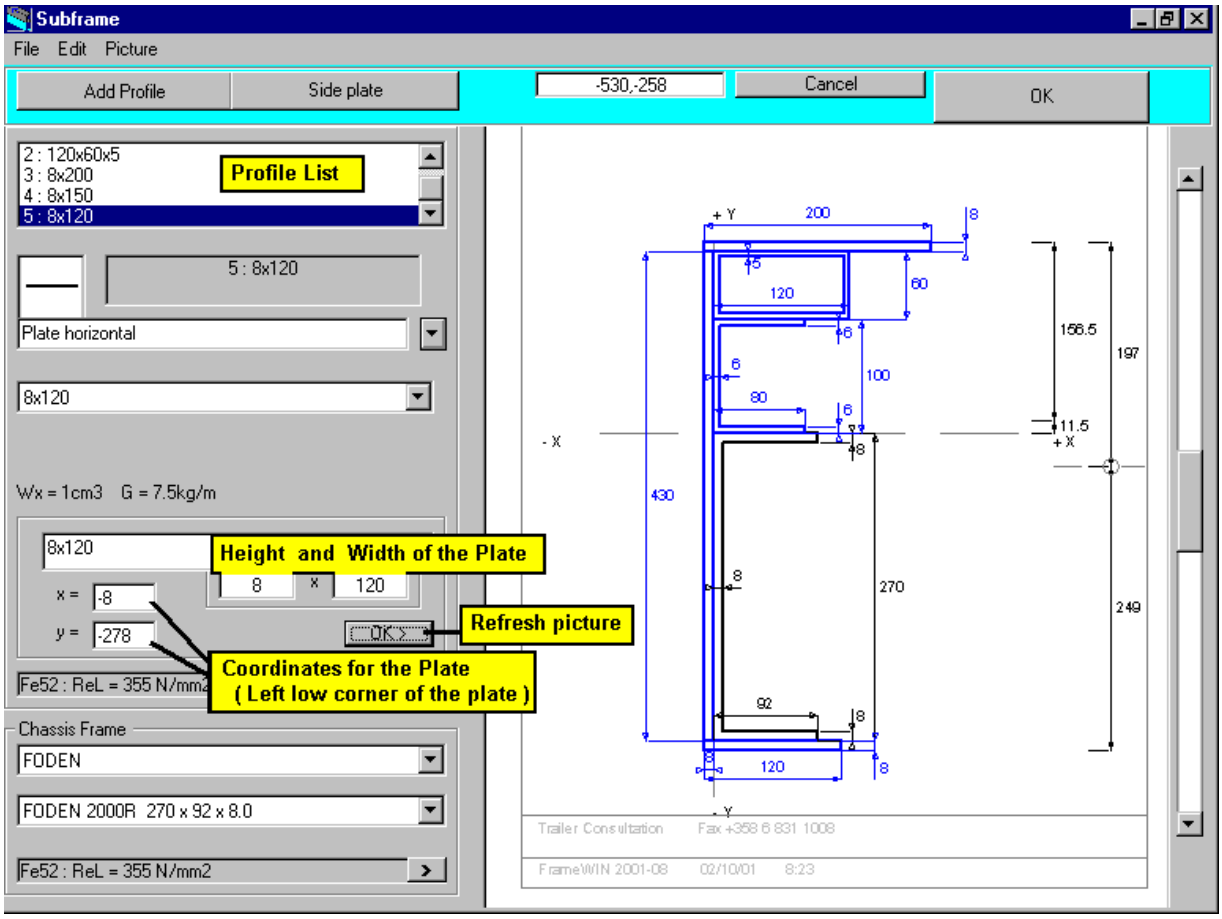
For adding a profile, click the **Add Profile button** or use **Menu:Edit - Add Profile**.
You will get a new profile number (5) on the Profile list.
Choose profile Shape from the Profile Shape List, now **"Plate horizontal"**.

Choose the size of the Plate from the Profile Size List.
If you do not find suitable plate size from the list you can type the dimensions to "Height" and "Width" textboxes (Look at the picture).

You can locate the side plate by typing the x- and y-coordinates in "Coordinates for the plate" textboxes.

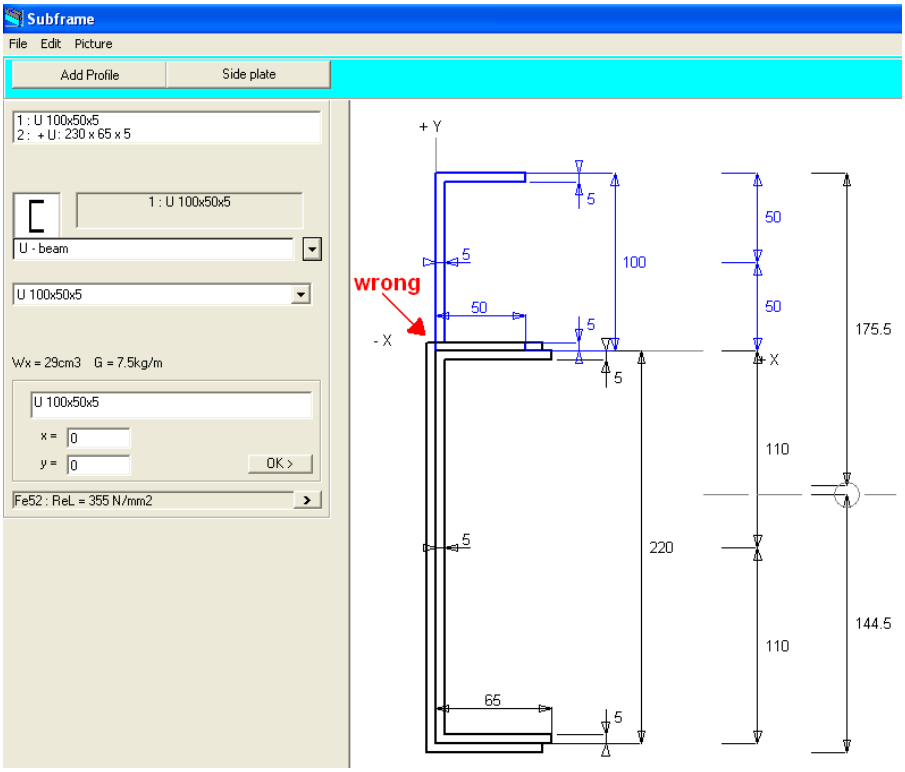
The coordinates mean the lower left corner of the cross area of the plate or profile.

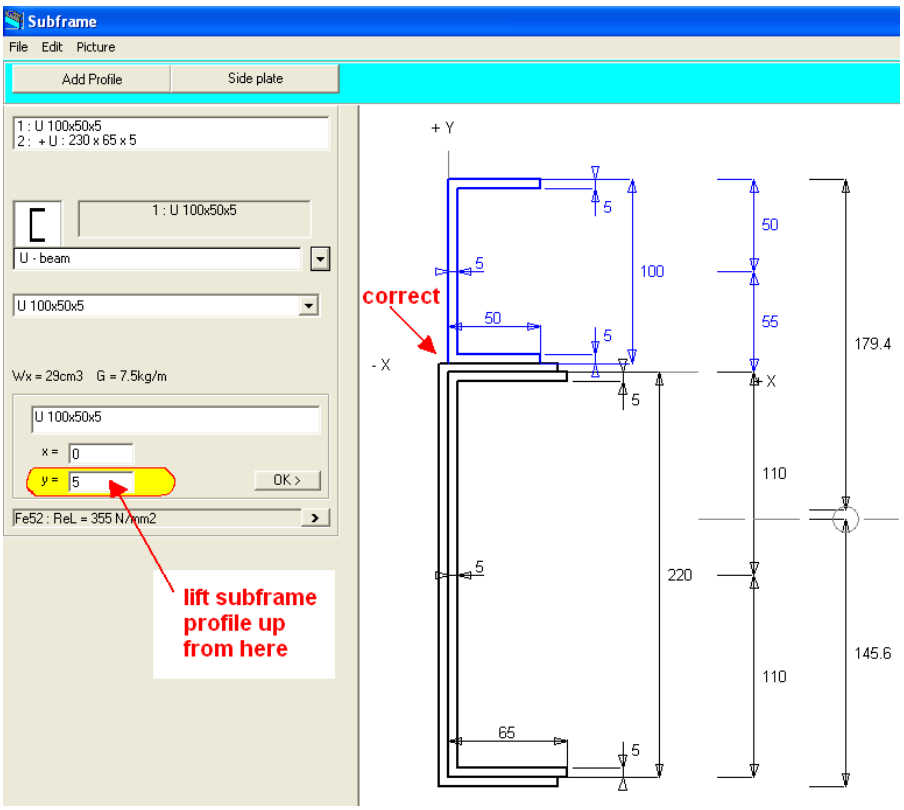
After typing the coordinates x and y click small OK button (Refresh picture) to get the picture redrawn.



Reinforcement profiles for chassis frame:

If you in FrameWIN choose a reinforcement, which is outside of chassis beam, you have to check manually, that subframe parts will be on a correct height above the chassis beam.
FrameWIN can not automatically check, if the profiles are "inside each other".
You need to lift subframe profiles using the dimension of reinforcement upper flange thickness.





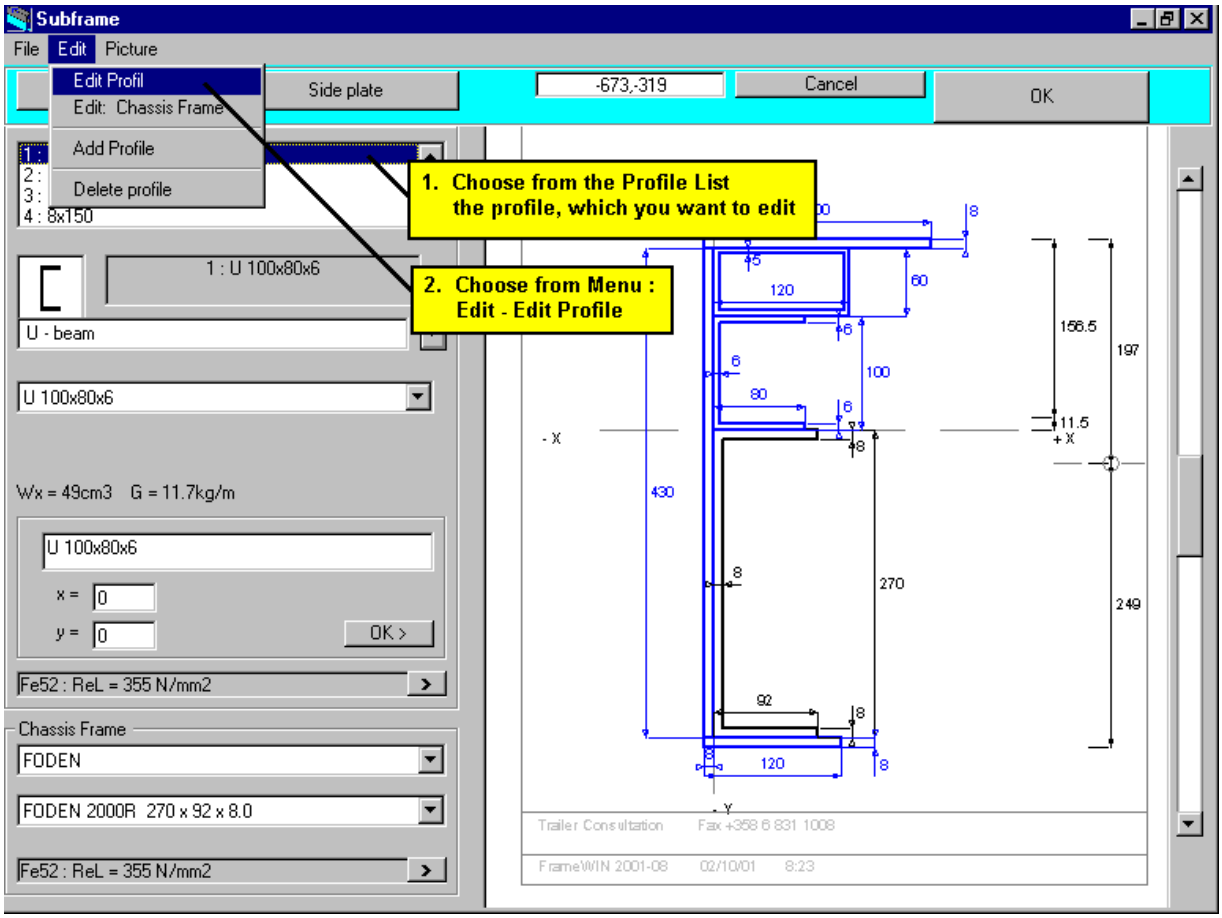
Edit the dimensions of the Profile

You can edit the dimensions of the profiles manually if you do not find any profile with suitable dimensions from the profile list.

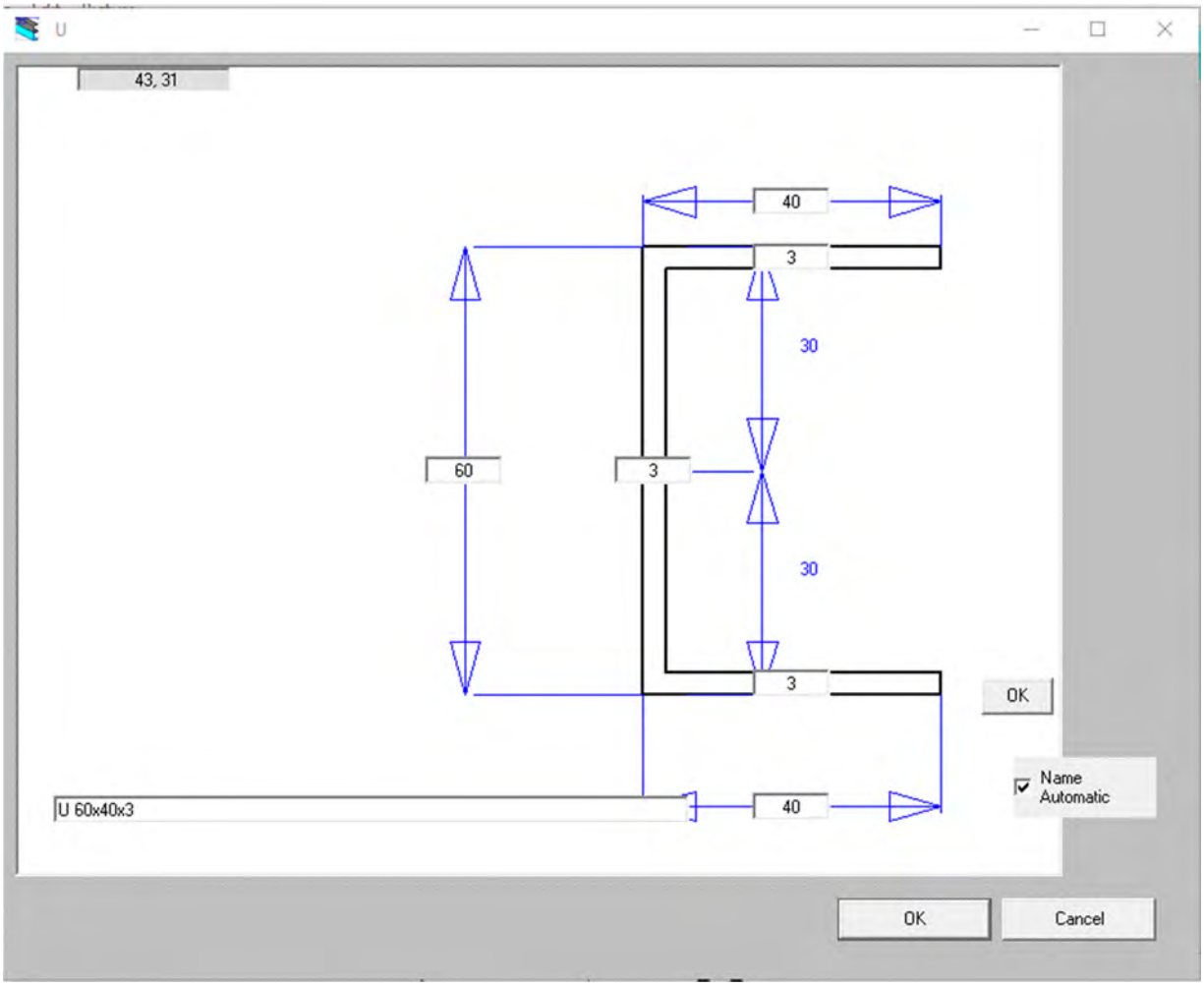
Follow the instructions to edit the dimensions manually:

Step 1. **Choose from the Profile List** the profile, which you want to edit.

Step 2. Choose from Menu:**Edit - Edit Profile**



You get Profile Editing Window on the screen.



You get a picture of a profile cross-area shape. You can edit dimension of the cross area by typing new dimensions on the textboxes. After the dimensions have been given, click the small OK-button on the picture, and the program redraws the cross area with new dimension values.

Furthermore on the right side on the picture are the dimension s1 and s2 (mm), that show the Centroid of the cross area.

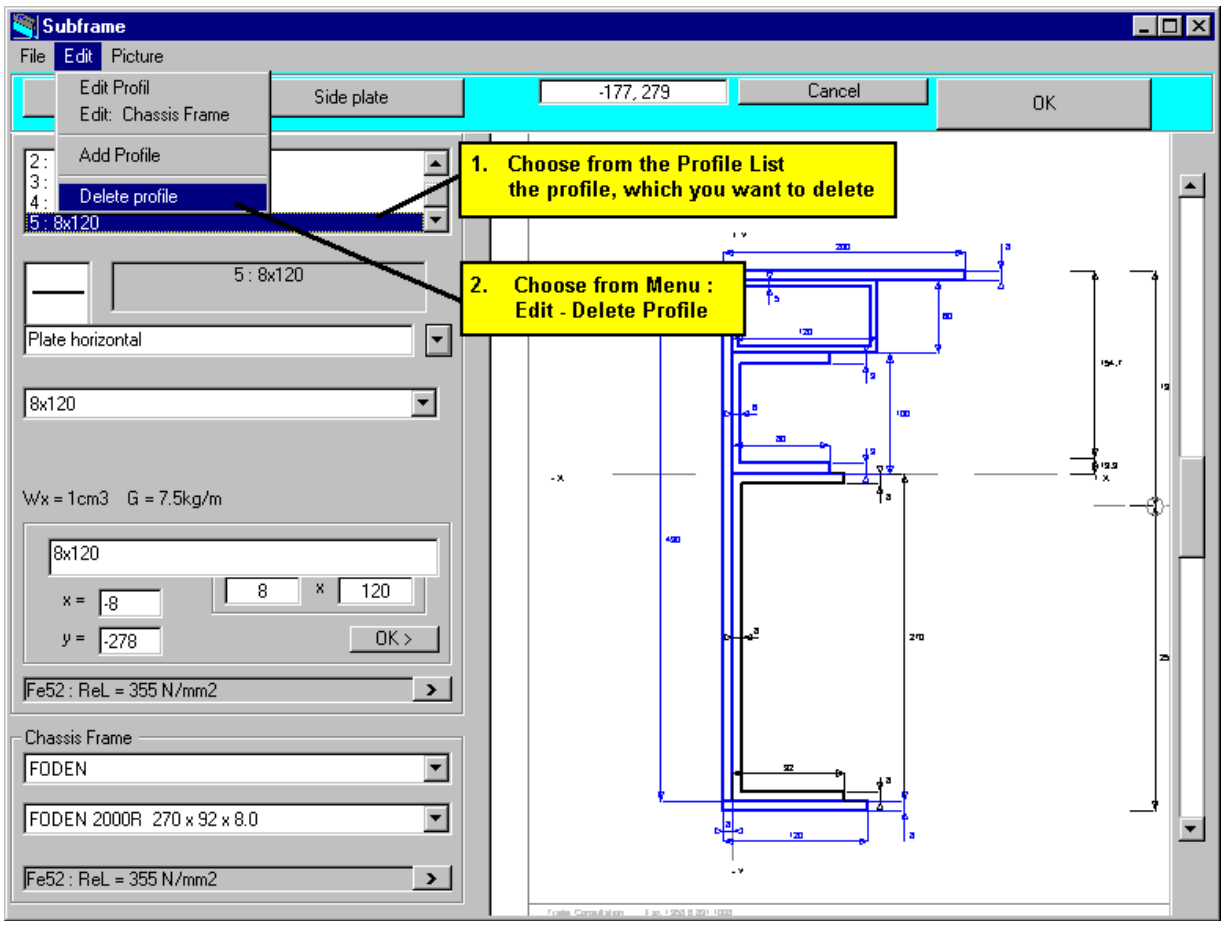
To give a name for the edited profile, type the new name, or use **Name Automatic**.
Click the Check Box **Name Automatic** for turning automatic on or off.

Delete Profiles

To delete a subframeprofile do as follows:

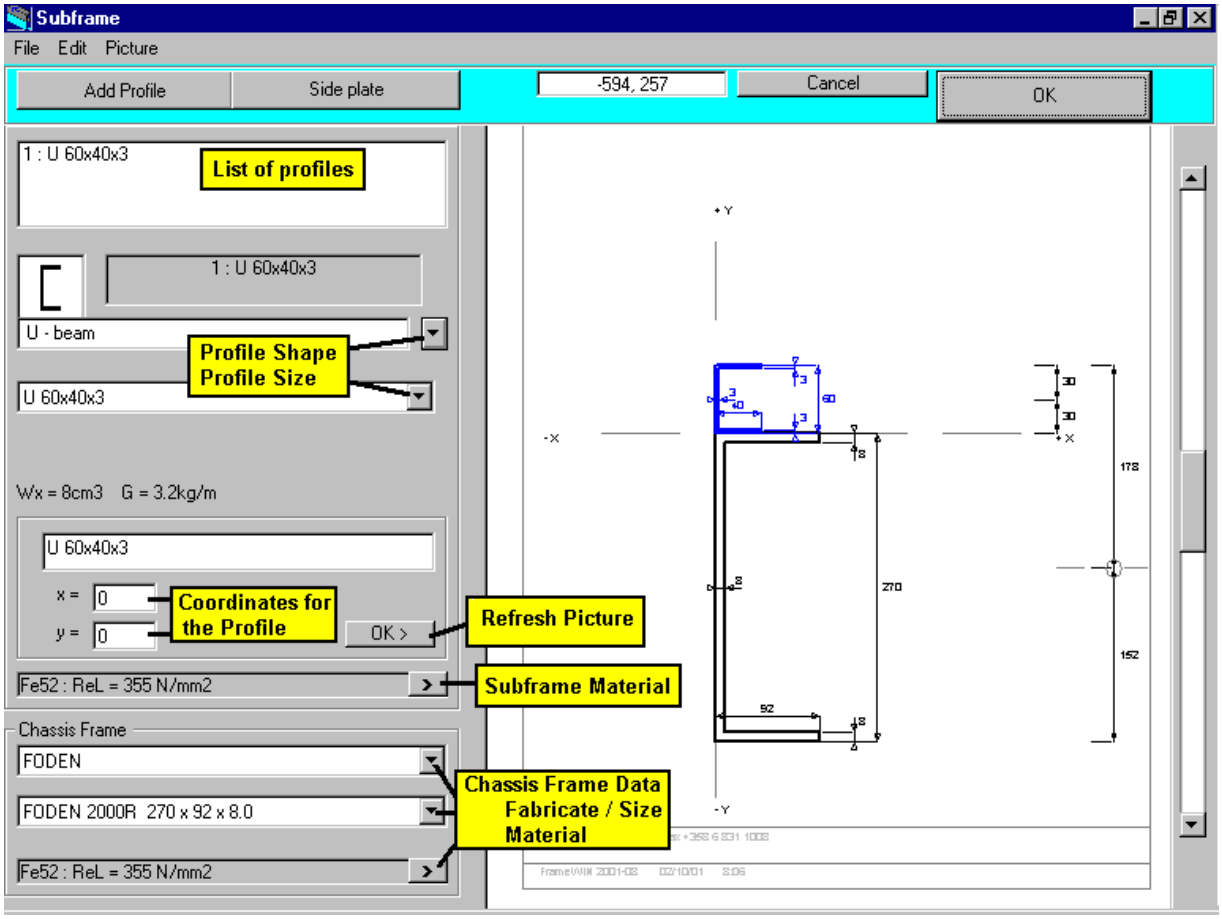
Step 1. Choose from the **Profile List** the profile, which you want to delete.

Step 2. Choose from Menu:**Edit - Delete Profile**

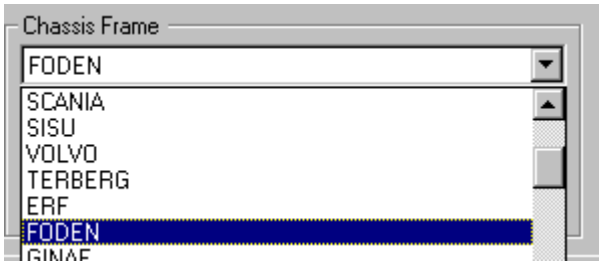


After that confirm the deleting by clicking **Yes.** If you want to cancel the deleting click **No.**

Selecting chassis frame

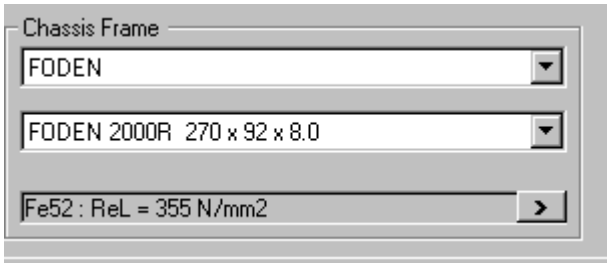


On the left - lower corner on the Subframe Window you find Lists for **Chassis Frame**:



You can choose **Chassis Fabricate** and then the **Profile Size**.
Notice that choosing of the Profile Size comes not automatically from TrailerWIN. Chassis database in TrailerWIN does not include data of frame profiles. You have to choose manually the correct profile size.

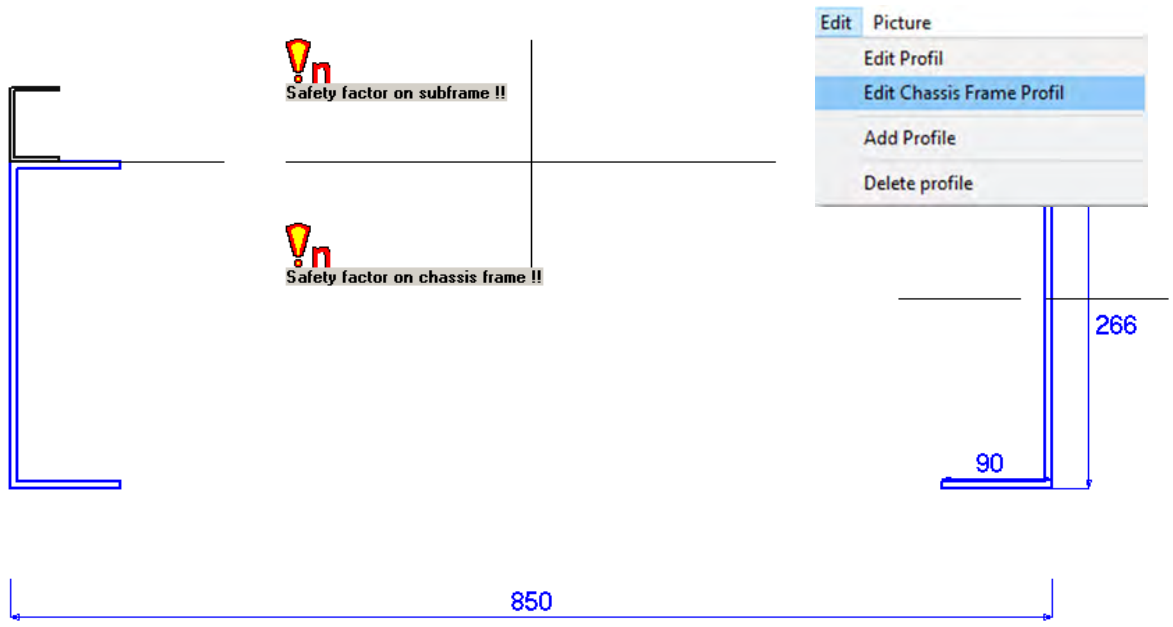
From the upper list box you can choose the truck make. The program knows the frame profiles of the trucks on the list.

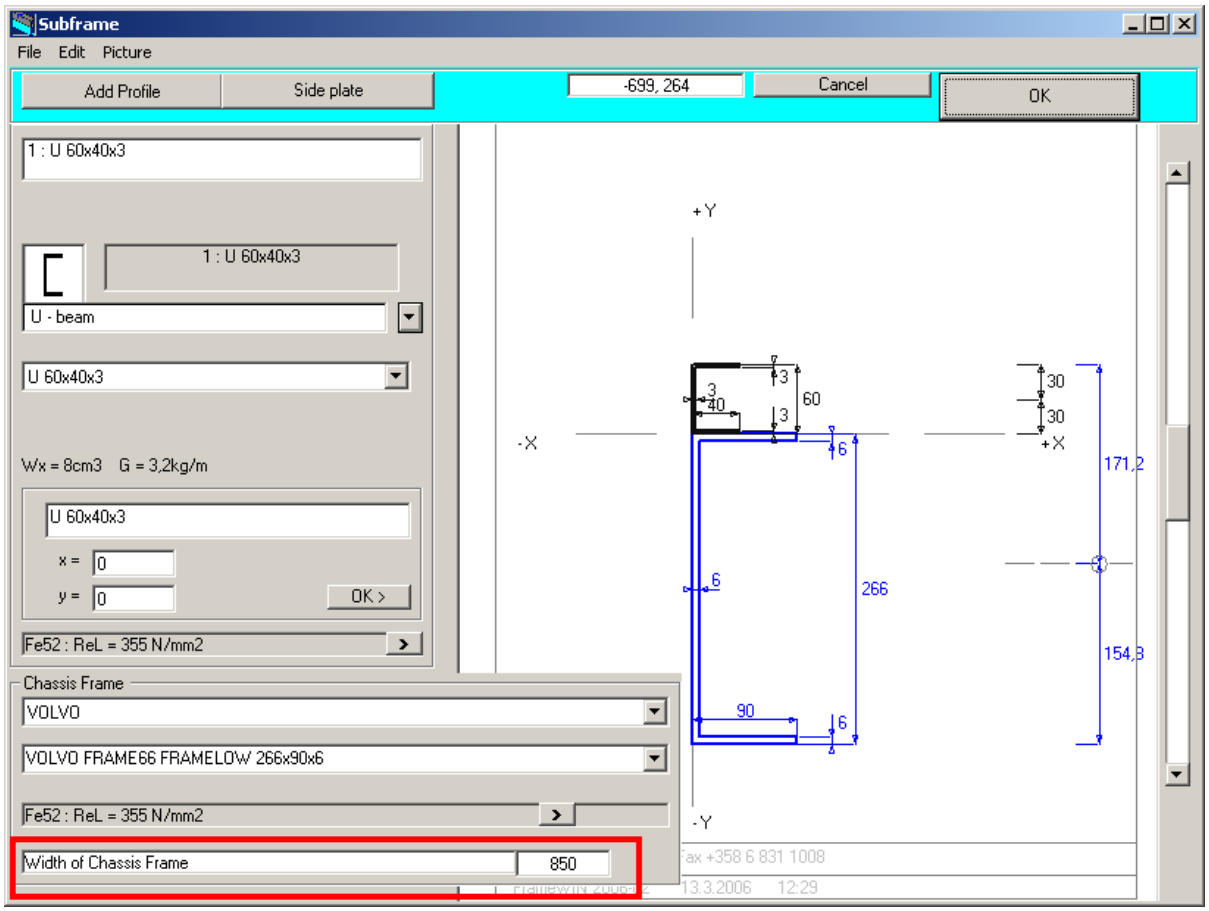


If you do not find the wanted truck make from the list, or wanted profile size from the lower list, you can edit the beam dimensions manually.
For this editing dimensions for Chassis Frame; use Menu: **Edit - Edit:Chassis Frame**
(menu in Subframe Window)

Frame width in FrameWIN

In FrameWIN you need to set the correct width of Chassis frame, this data doesn´t automatically come from TrailerWIN data.

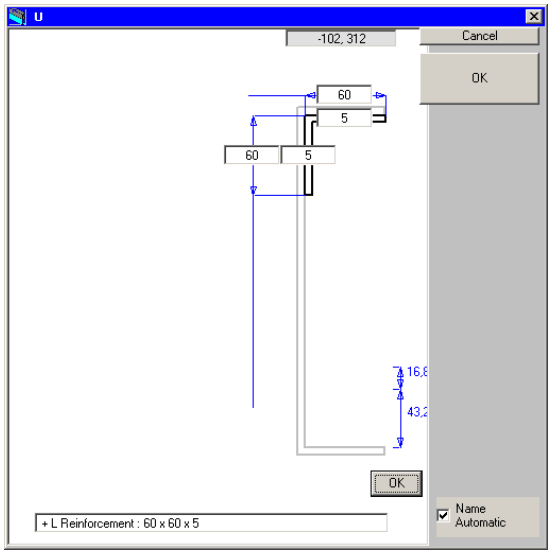


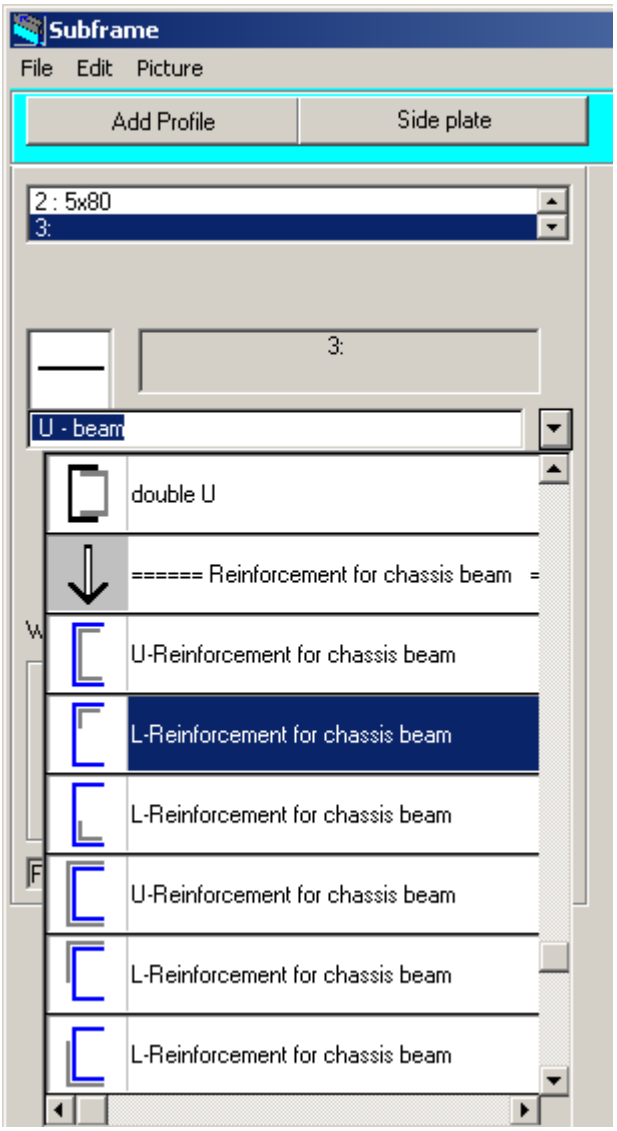


Even though you have entered the Subframe calculation in TrailerWIN, where you have already chosen a specific Truck model, the TrailerWIN does not know which beam profile shape belongs to this truck model. You have to choose the Beam Profile model separately. TrailerWIN Truck Data files do not contain frame beam dimension data.

Chassis frame reinforcement

In the Profile Shape List you find some Reinforcements for chassis beam. Choosing from this "reinforcement" group means, that these profiles will be technically calculated as part of chassis frame and not as part of subframe.





	List of Profiles (data per one rail)	H mm	A mm2	Ix cm4	Wx cm3	M kg/m
1	U 100x50x5	100	950	143.29	28.66	7.5
2	5x80	5	400	0.08	0.33	3.1
=>	Subframe Profiles together	111	1350	220.96	30.88	10.6
	Chassis Frame : MB ATEGO 260*65*6					
		260	2268	2020.95	155.46	17.8
3	+ U Reinforcement : 272 x 65 x 6	272	2340	2258.78	166.09	18.4
4	+ L Reinforcement : 60 x 60 x 5	60	575	19.91	4.61	4.5
=>	Chassis Frame total	272	5183	4886.58	330.43	40.7

Materials

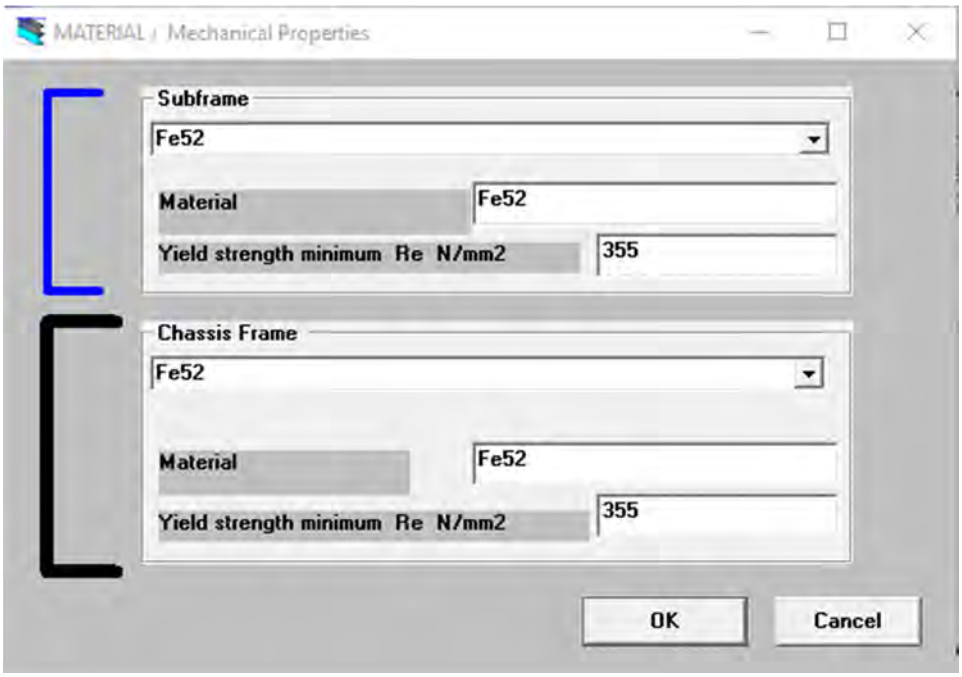
List of materials in FrameWIN include:
Fe52 (*default material*), Fe510, St52, Gr50, S690, S420, Fe E 420, Fe E490, Fe 44, Fe430, St44, Gr43, Fe37, Fe360, St37, Gr40

You can also give own material and yield strength for the material, but it will not saved into program. Next time You want to use same material, You will need to give yield strength values again.

All materials in chassis frame, subframe and added subframe profiles must be steel. All must have same *elastic modulus* value. FrameWIN can not calculate correctly if *elastic modulus* is different for different parts. (for example steel and aluminium).

Material of the Beams

Menu: **Edit - MATERIAL**

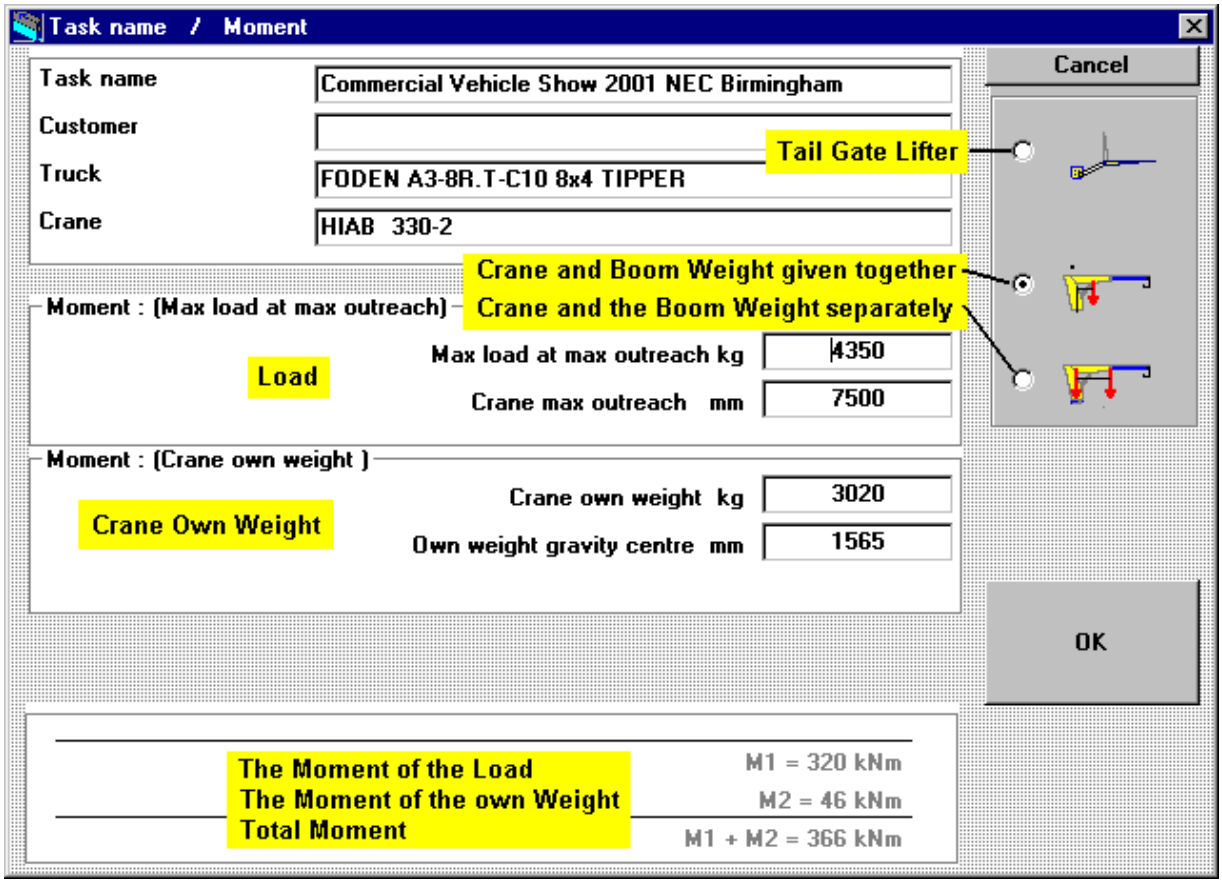


By choosing the materials from list boxes, you automatically get the material name and the Yield strength minimum for the chosen material on specific textboxes. You can edit both of these separately, but in this case for example changing the material name from the textbox does not change Yield strength minimum. You have to change that manually too.

Load / Frame Bending Moment

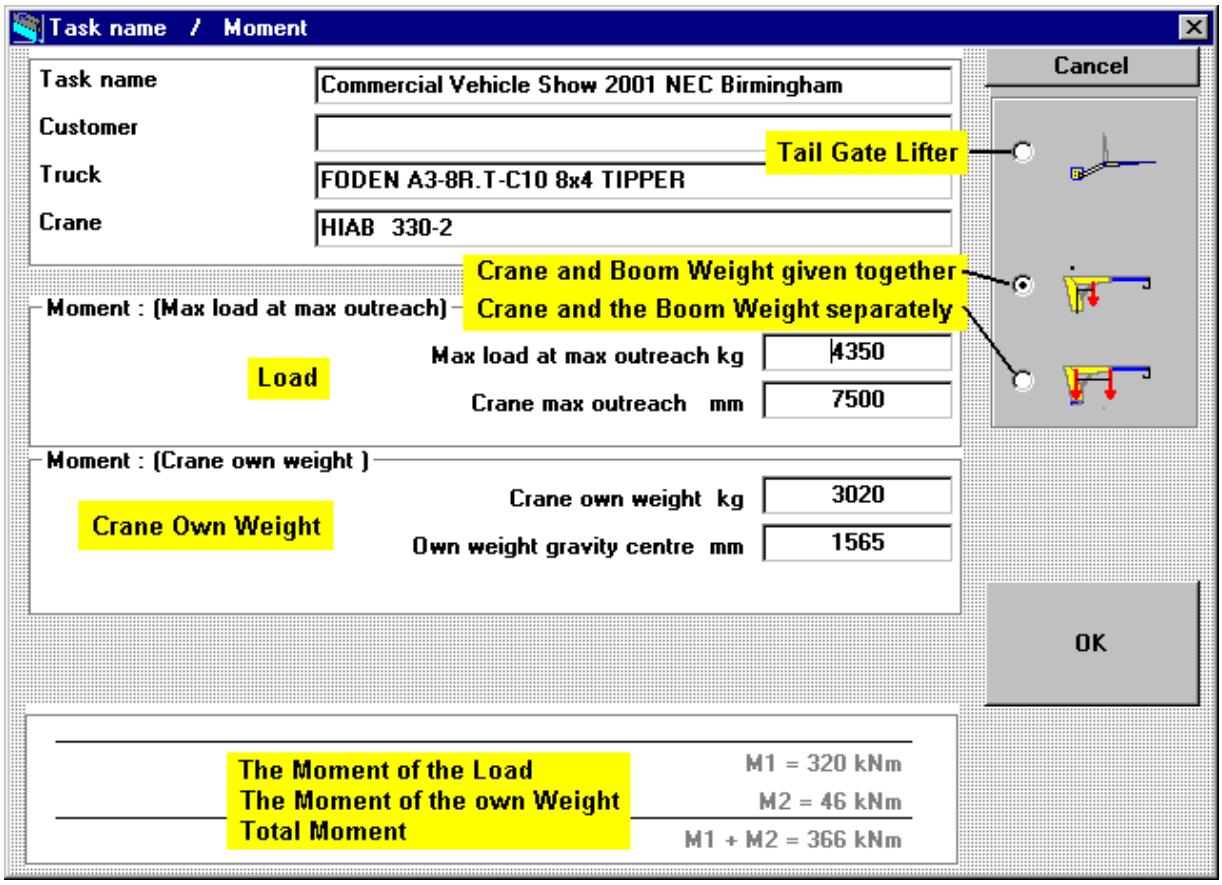
In the Calculation the Crane or the Tail gate lifter causes the Bending Moment.
The Bending Moment is calculated by using the load and the outreach and also by using the cranes own weight and the center of the gravity.

The Moment caused by the Crane



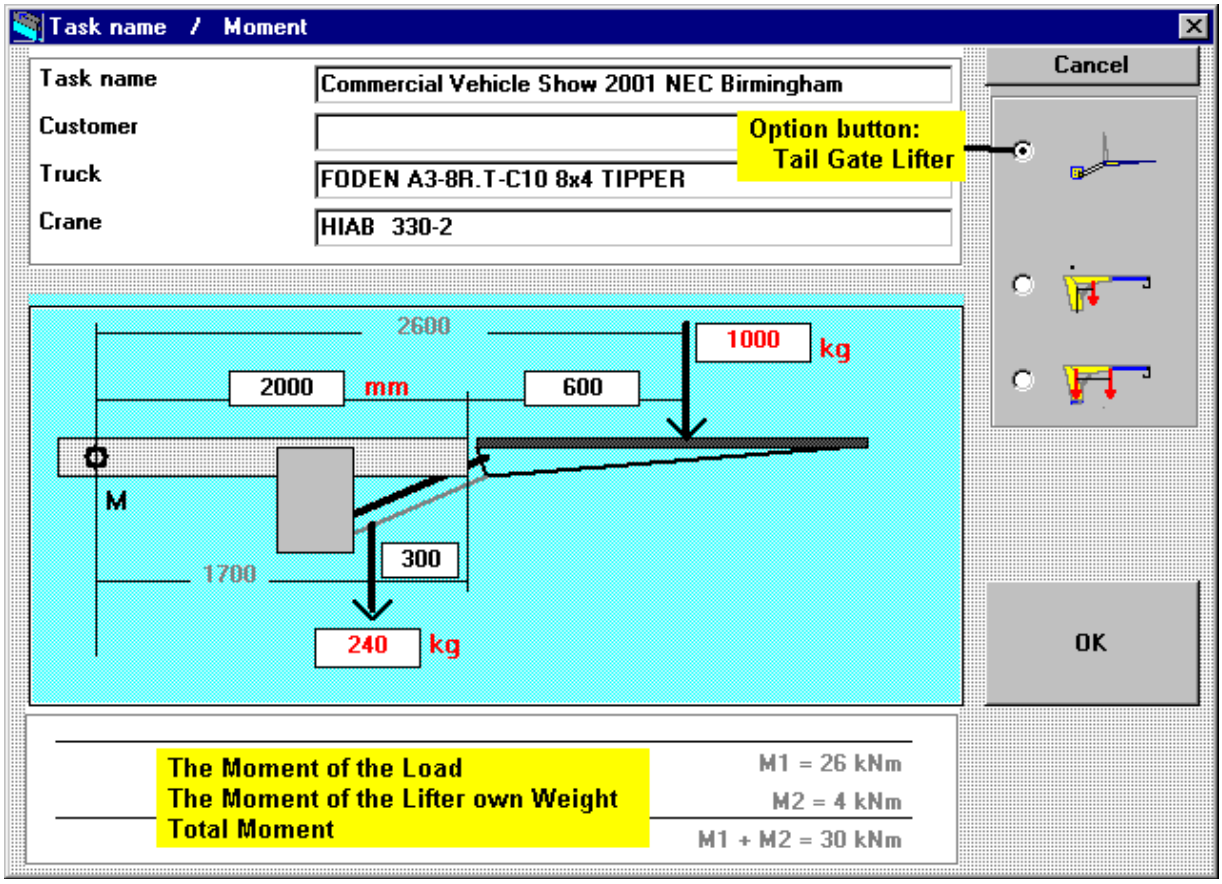
In the Calculation the Crane or the Taillift causes the Bending Moment.
The Bending Moment is calculated by using the load and the outreach and also by using the crane own weight and the center of the gravity.

The Moment caused by the Crane

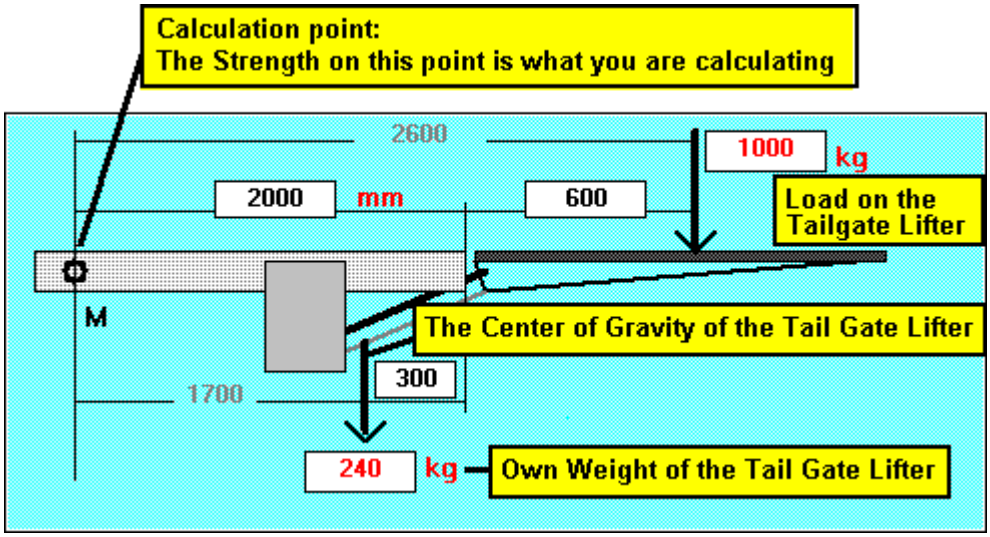


The Moment caused by the Tailgate Lifter

By choosing the option button: **Tail Gate Lifter**
you can give the Moment caused by the Tail Gate Lifter.



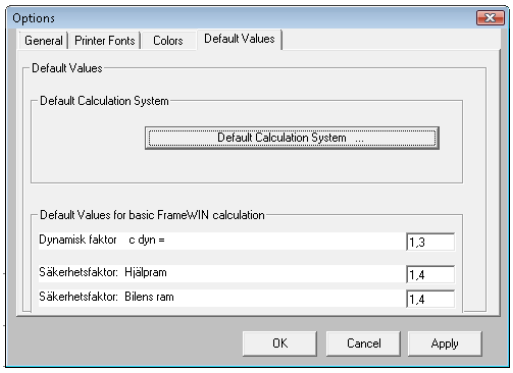
The data on Tail Gate Lifter and Load on the Lifter are given by typing on textboxes on the screen:

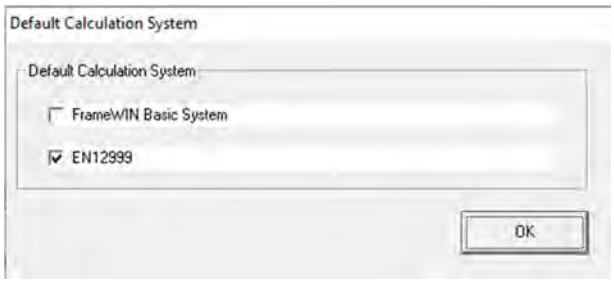


Dynamic Loading Factor and Calculation system

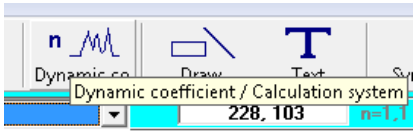
Choosing calculation system

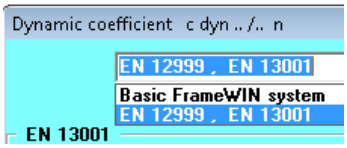
At first program start You will be asked to choose which calculation system the program will use as default. It is possible to modify this setting later using menu Options->Options->Default Values->Default Calculation System.
This setting will then be the default setting every time You begin a new calculation..

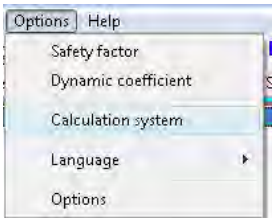




By choosing Options->Calculation System from menu or by clicking Dynamic coefficient-button You will get the opportunity to set calculation method and also setting options for the calculation.

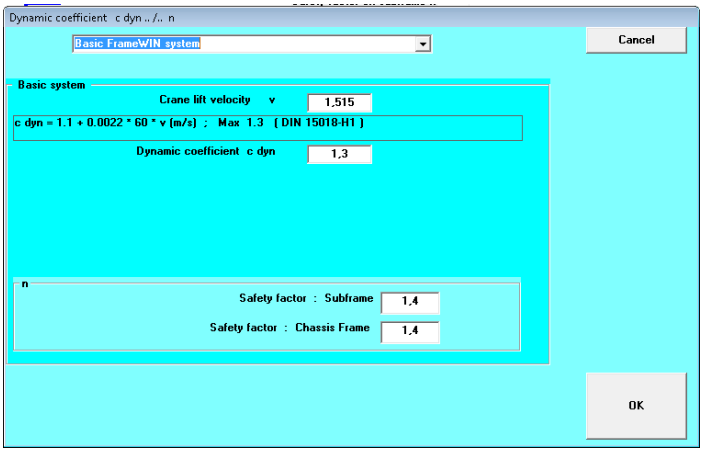






Calculation by "Basic FrameWIN system"

Dynamic coefficient c dyn



Default value for Dynamic Coefficient in FrameWIN is c dyn = 1.3. You can anyway change the default value from Menu: Options - Default Values

Dynamic Coefficient can be calculated using the formula

c dyn = 1.1 + 0.0022 x 60 x v (m/s)
c dyn no more than 1.3
v = crane lift velocity

If You type a new value in the textbox for crane lift velocity (m/s) , the program calculates the corresponding Dynamic Coefficient. On the other hand you can also type the wanted Dynamic Coefficient into the textbox. Dynamic Coefficient increases the Moment used in the calculation:

M dyn = c dyn x M static

Safety factor n means here the warning limit for the safety factor. The Program calculates the safety factor for the specific case. If this is lower than the the warning limit, which You choose here, the program shows a warning **!n**.

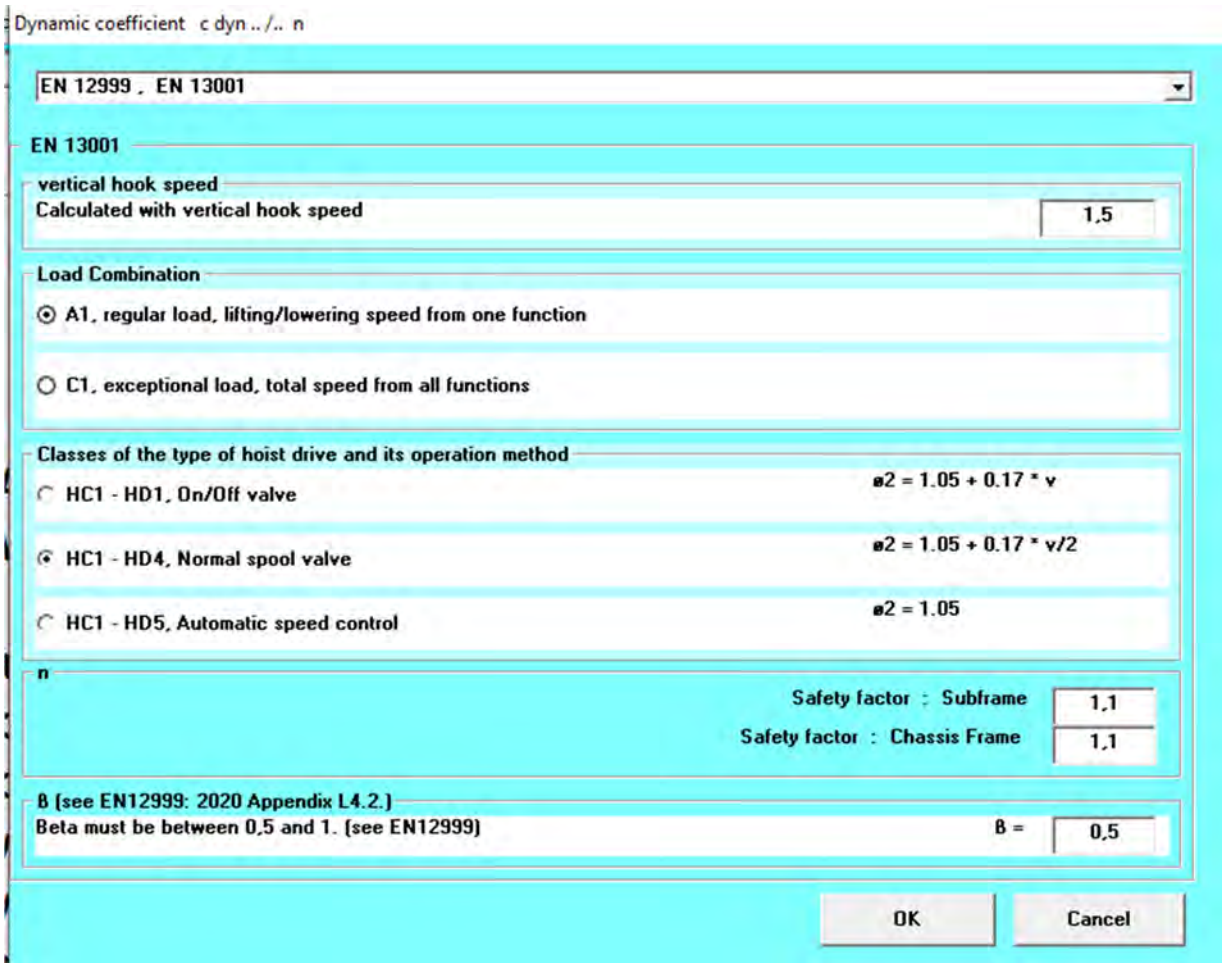
You can anyway change the default value for Safety Factor from **Menu: Options - Default Values**

Calculation by EN12999 system

FrameWIN program calculates using

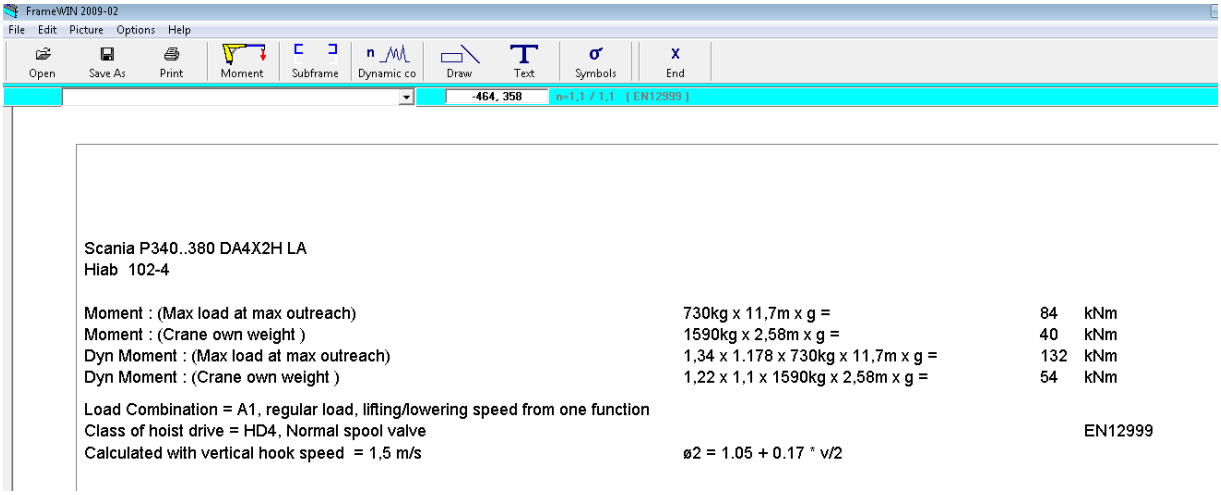
When You choose calculation by EN12999, EN13001 You will get the following options to set:

- Vertical hook speed – highest possible hook-speed lifting or lowering the hook.



- Load combination
  - A1-normal lifting/lowering from one function
  - C1-exceptional load, total speed from all functions activated
    - HC1-HD1..5 Hoist Drive Class. Select correct HD-class depending on the valve-system on the crane.
    - HD1- On/Off-valve type.
    - HD4- Normal spool valve, speed can be manipulated directly by user
    - HD5- Automatic speed control of crane movements.
- Safety factor for Chasis Frame and Subframe. Normally 1.1, that is also recommended by the standard. Safety Factor can be set by user.
- The factor β. The max dynamic moment of the crane is assumed to act along the middle of the truck and therefore provide an uniform distribution of the load moment between the frame beams (β =0,5). For more details see EN12999:2020 Annex L 4.2.
  However when we have an offset of the crane slewing centre this moment can act more on one side of the chassi giving more moment on one beam. How this moment will be shared between the beams can´t be given as a default value for each crane. This distribution need to be calculated for each subframe construction and crane model separately. A box-type subframe typically shares the load more even between the subframes while only longitudiual subframe beams gives more load on the side closer to the slewing centre. This value can be from 0,5 to 1 (1 is a situation wherre slewing centre is above one frame beam of the chassis.)

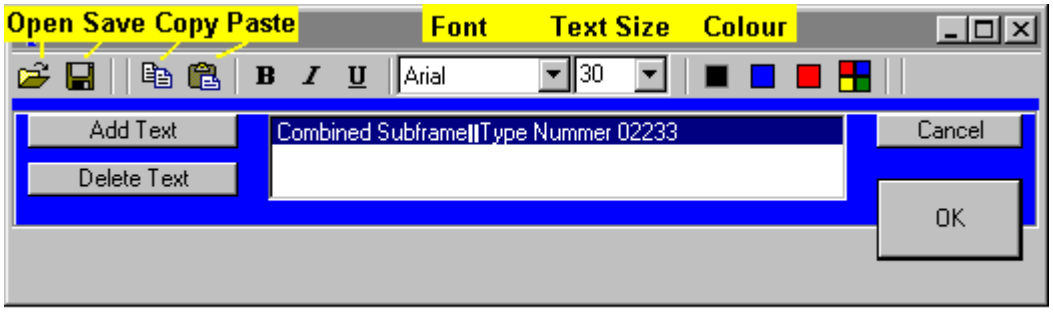
In this window You can see the formulas for calculating Φ2-factor. These formulas will change depending on which Load Combination (A1, C1) You have chosen. These settings and formulas will also be printed out.

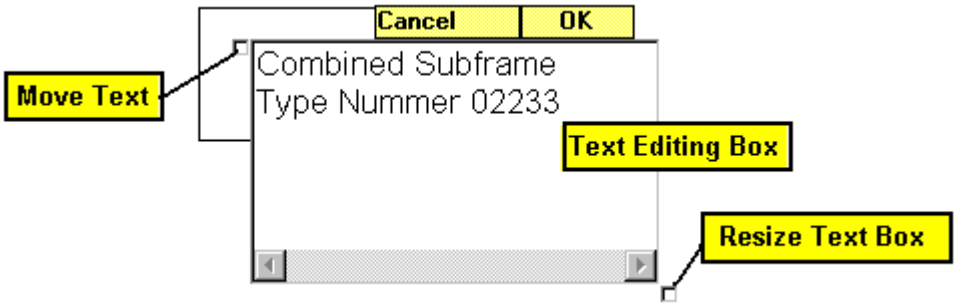


Drawing tools

Draw text onto the picture

You can write own texts onto the picture. Following picture shows the possibilities. The size of the text depends on the size of the picture.

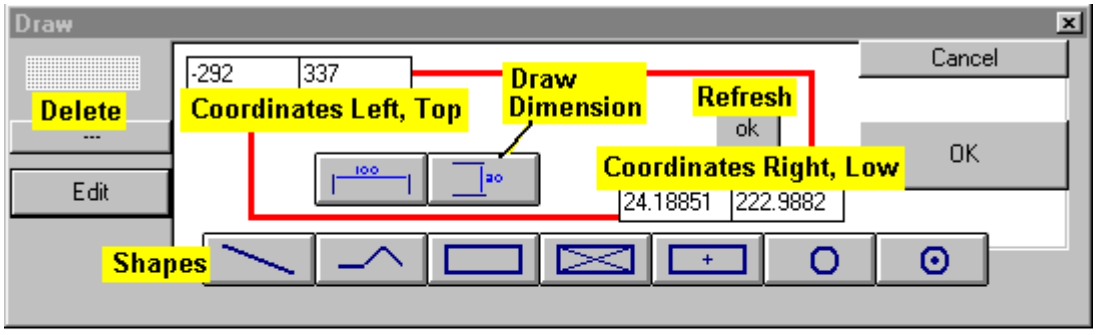


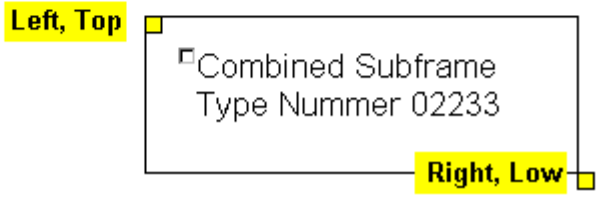


On the Text List you see all the text you have in this calculation. With mouse-click on the text line you can choose the text for editing. Press Enter to change the line.

Draw Lines, Rectangles, Dimensions, etc

You can draw simple drawings on the picture.

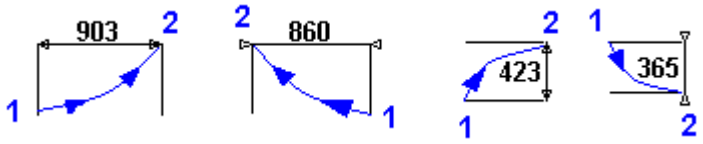




Choose the type of the object by using Shape Buttons “LINE”, “RECTANGLE”, “CIRCLE”.
Then draw the line or rectangle or circle with mouse onto the picture.
You can drag point with dragging the grips (yellow rectangles).
When you click OK, the grips disappear. Click the Edit-Button to get the grips back.

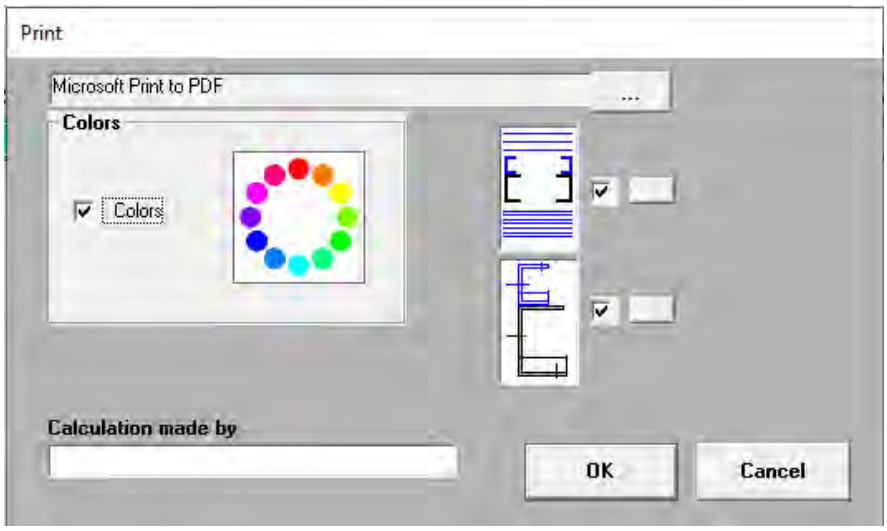
Draw Dimensions: horizontal and vertical.

When you draw a dimension with mouse, you will get the correct dimension text automatically. You can anyway change the dimension text; you only write a new text on the dimension editing box, and click the small ok button on the right side of the editing box.
If you later edit this dimension with the mouse, you get again automatically new dimension text.
You can choose arrow position with direction, when you are drawing a dimension with dragging mouse. The example shows the result and the mouse movement direction, from point 1 to point 2.



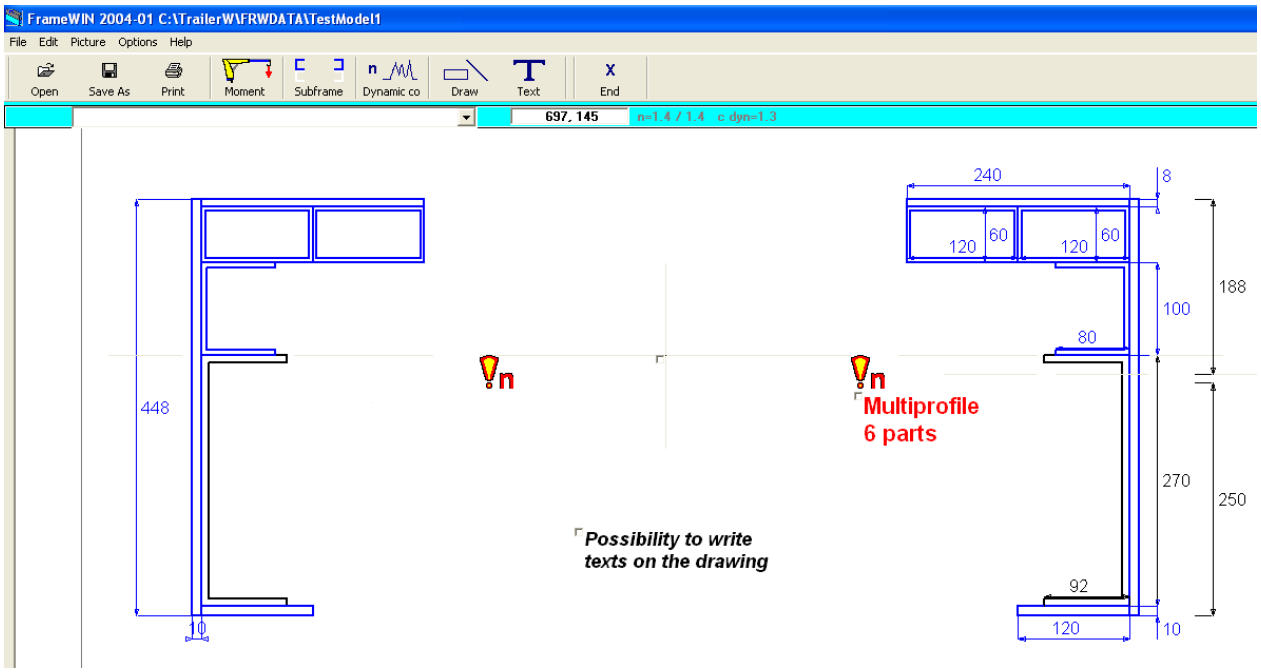
Printout

The printout on paper or to PDF.



Using small blank buttons, you can print only one page, frame with calculation results or only profile combination in bigger scale.
The big OK button prints both pages if both checkboxes are marked, or only one of the pages, depending on which one is marked.

For printing you must give your name in field: "Calculation made by".
With checkbox Colors you can choose printing in colours.



FrameWIN picture on chassis frame and subframe.

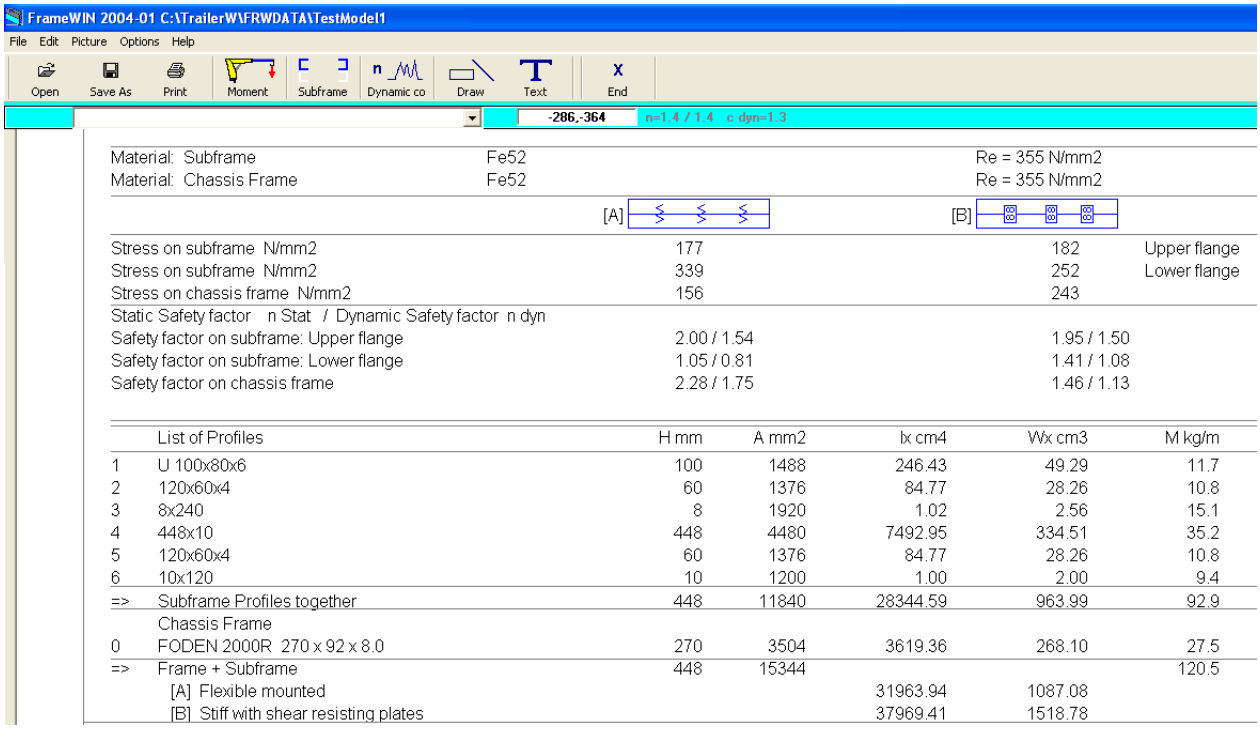
Chassis frame of a truck can be seen on this picture above in black color.

Subframe profiles are presented on blue color.

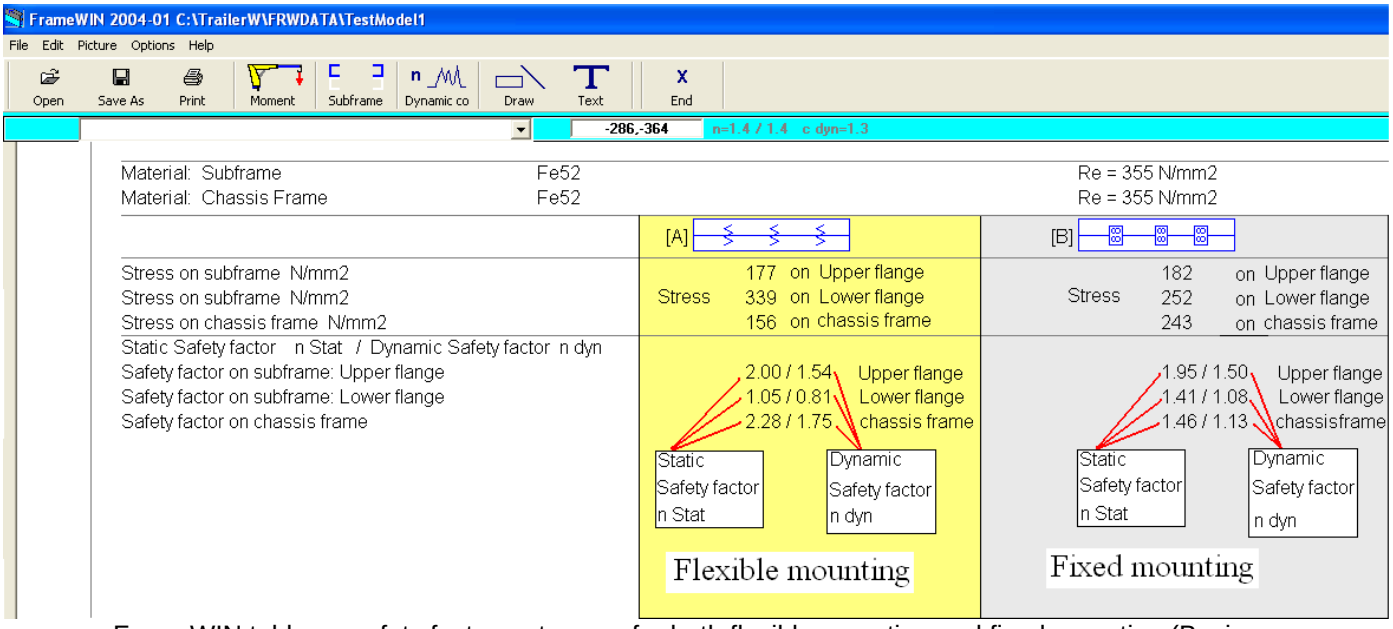
You can draw more details on this picture with the drawing tool, in same way that You use drawing tool also in TrailerWIN and CraneWIN.

You can add more horizontal and vertical measures on this picture with the drawing tool, in same way that You add new measures in drawing tool also in TrailerWIN and CraneWIN.
(TrailerWIN drawing tool for adding some new horizontal and vertical measures)

You can write text and comments on this picture with the Text tool, in same way that You use Text tool also in TrailerWIN and CraneWIN.



FrameWIN table on safety factors, stresses, material and list of profiles



FrameWIN table on safety factors, stresses for both flexible mounting and fixed mounting (Basic FrameWIN system).

Static & dynamic safety factors should all be more than values 1.25 or 1.4.
In this example stress on lower flange is critical, but upper flange chassis frame are ok.

The table shows **Cross Area Data of** all the chosen **profiles**:

	List of Profiles (data per one rail)	H mm	A mm2	Ix cm4	Wx cm3		m kg/m
1	U 60x40x3	60	402	23.45	7.82		3.2
	Chassis Frame : U 60x40x3						
		60	402	23.45	7.82		3.2
=>	Frame + Subframe (one rail)	H mm	A mm2	Ix cm4	Wx cm3	RBM Nm	m kg/m
	[A] Flexible mounted	120	804	46.90	15.63	5550	6.3
	Wx top (cm3) = Ix (cm4)/ H top (cm)	60			7.82		
	Wx low (cm3) = Ix (cm4)/ H low (cm)	60			7.82		
	[B] Stiff with shear resisting plates	120	804	119.26	19.88	7056	6.3
	Wx top (cm3) = Ix (cm4)/ H top (cm)	60			19.88		
	Wx low (cm3) = Ix (cm4)/ H low (cm)	60			19.88		

These Cross section dimensions are given for one beam:
Height H (mm)
Cross section area A (mm^2)
Second moment of area I_x (cm^4)
Section modulus W_x (cm^3)
Beam weight / meter G (kg/m)

The I_x and W_x value s for the combined beam:
All subframe profiles + chassis frame together in two different mounting systems:

[A] Flexible mounting
[B] Shear resisting mounting (Fixed mounting).

FrameWIN is a helping tool program to choose the profile for subframe and to calculate cross-section values on one point.

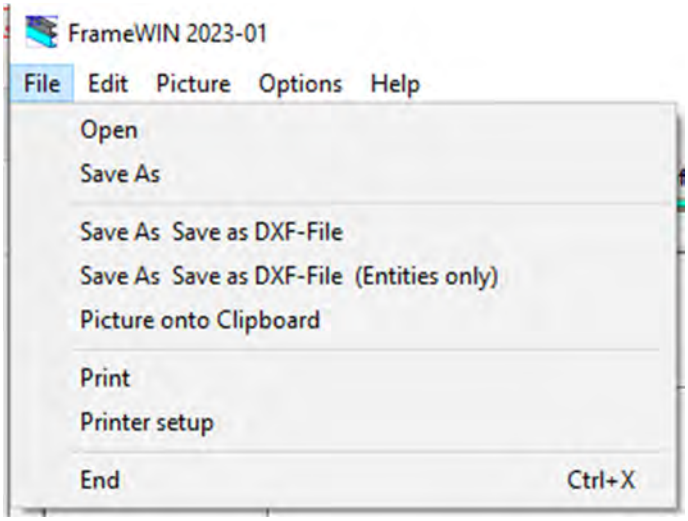
These one cross-section values are calculated for
A) Flexible mounting B) Fixed mounting (shear resisting).

FrameWIN does not calculate the whole subframe in longitudinal direction and does not calculate the distribution of the chassis bending moment on different places.

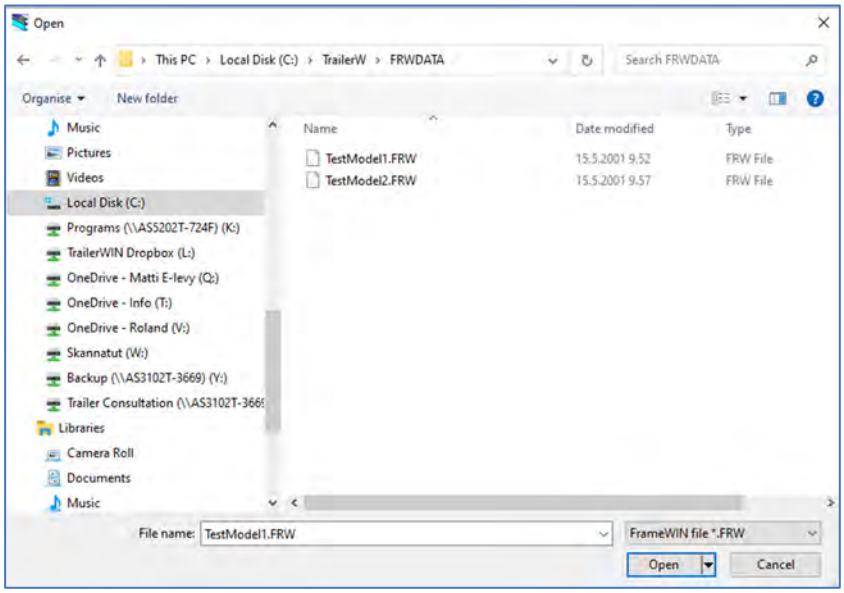
FrameWIN user must self make the choice if subframe mounting is flexible or fixed.

For more detailed subframe and frame calculation is needed to use a FEM strength calculation program (Finite Elements Method).

File Functions



Open



Open the saved calculation. FrameWIN uses the same loading moment, which was processed in TrailerWIN for the last time.

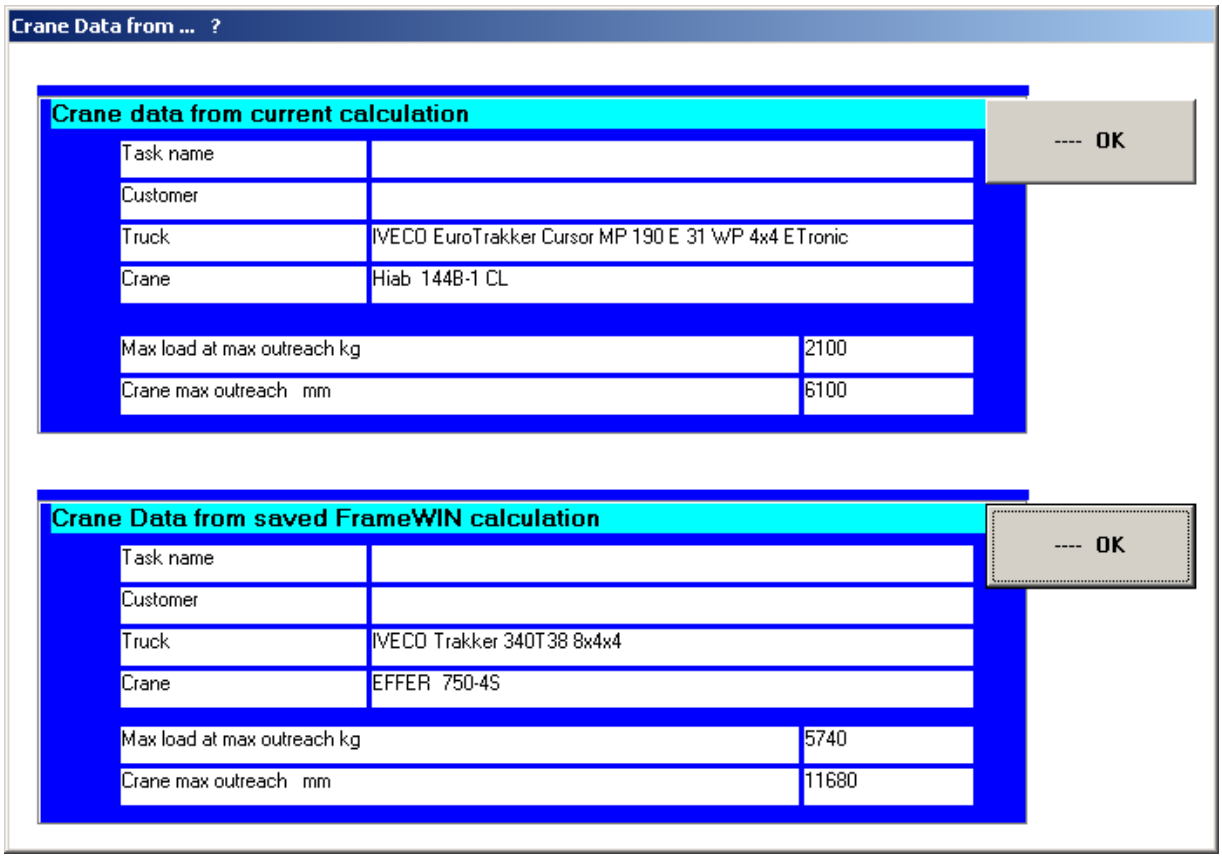
Opening the file does not change loading moment data but the profile data.

When you open a file, you will get a window for choosing:

1: do you want to use crane and loading data from the current case,
which you already have on the screen.
in this case you take only beam profiles from the saved calculation.

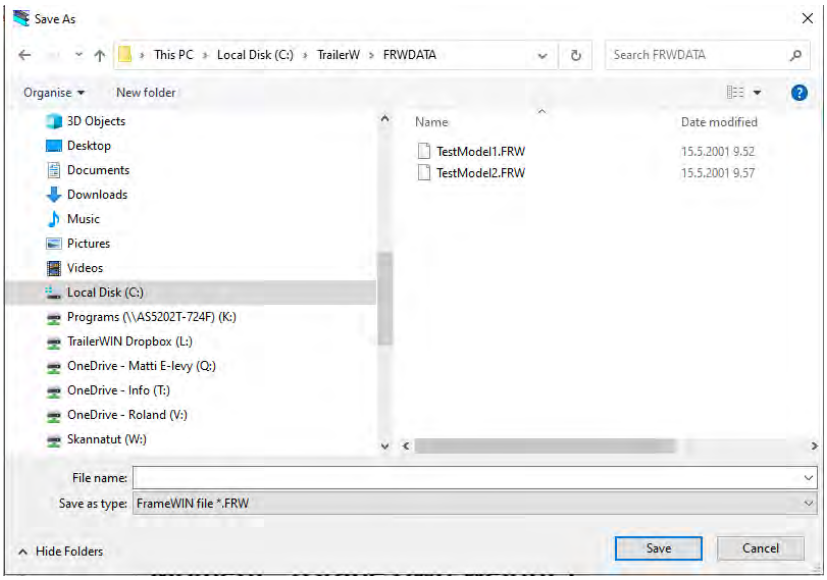
2: do you want to use also crane and loading data from this saved file

Possibility 2 is available only with FrameWIN data files, which are made with FrameWIN version 2005-07 or newer version.



Save As

Save the profile combination.
The loading data will not to be saved.



Save As DXF-File and Save As DXF-File (Entities only)

Save the Picture of the Frame (Combined Profile) in DXF format.
Choosing "Entities only" means, that the file includes only the drawing objects.

DXF file can be used in CAD software and also some other computer software can read DXF-files.
In DXF format you will get the drawing as vector drawing in CAD software.

List of Symbols

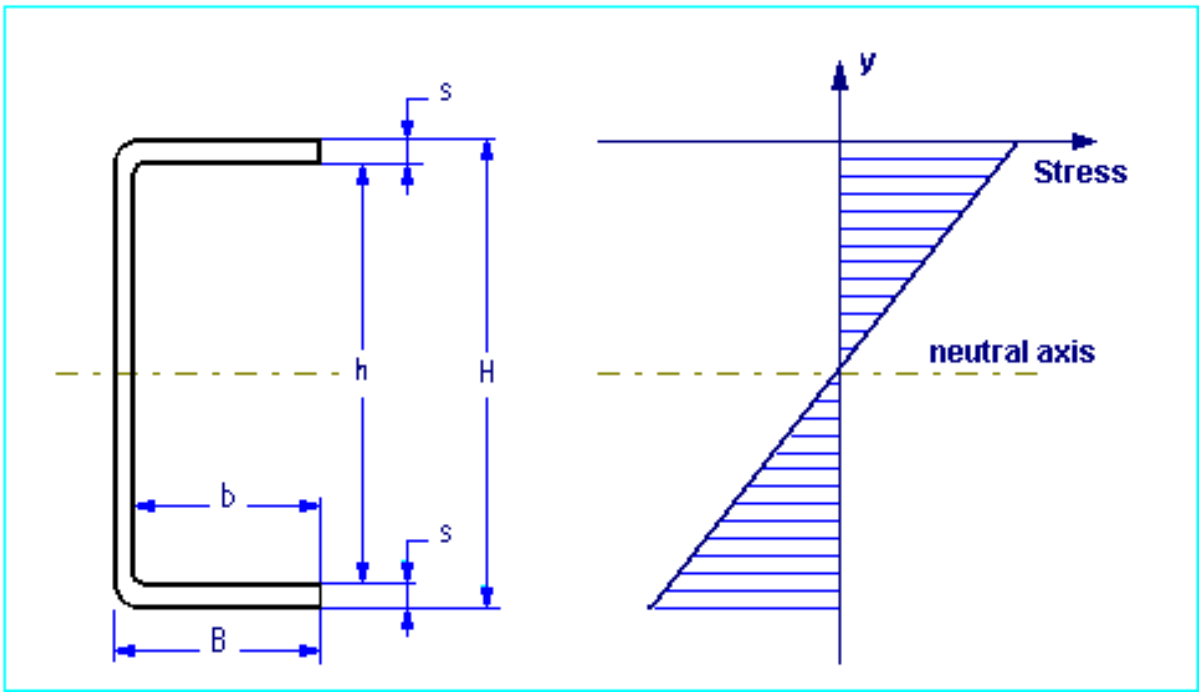
Yield strength minimum	R_{eL}	(N/mm^2)
Cross section area	**A**	(mm^2)
Second moment of area	I_x	(cm^4)
Section modulus	W_x	(cm^3)
Beam weight / meter	**G**	(kg/m)
Stress	**s**	(N/mm^2)
Safety Factor Static	**n stat**	
Safety Factor Dynamic	**n dyn**	
Dynamic Coefficient	**c dyn**	(1 ... 1.3)
Crane lift velocity	**v**	(m/s)
Beta-factor	**β**	

SUBFRAME CALCULATION THEORY IN FRAMEWIN

STRESS CALCULATION : BENDING MOMENT ON U-BEAM :

Bending moment ***M*** at a certain cross-section makes the normal stress σ on a longitudinal fiber at a distance y from the neutral axis of the beam:

$$\sigma = \frac{M\,y}{I} = \frac{M}{W}$$



The **second moment** I_X (moment of inertia) and **section modulus** W_X of a symmetrical U-cross-section area can be calculated as follows:

$$I_x = \frac{B\,H^3}{12} - \frac{b\,h^3}{12}$$

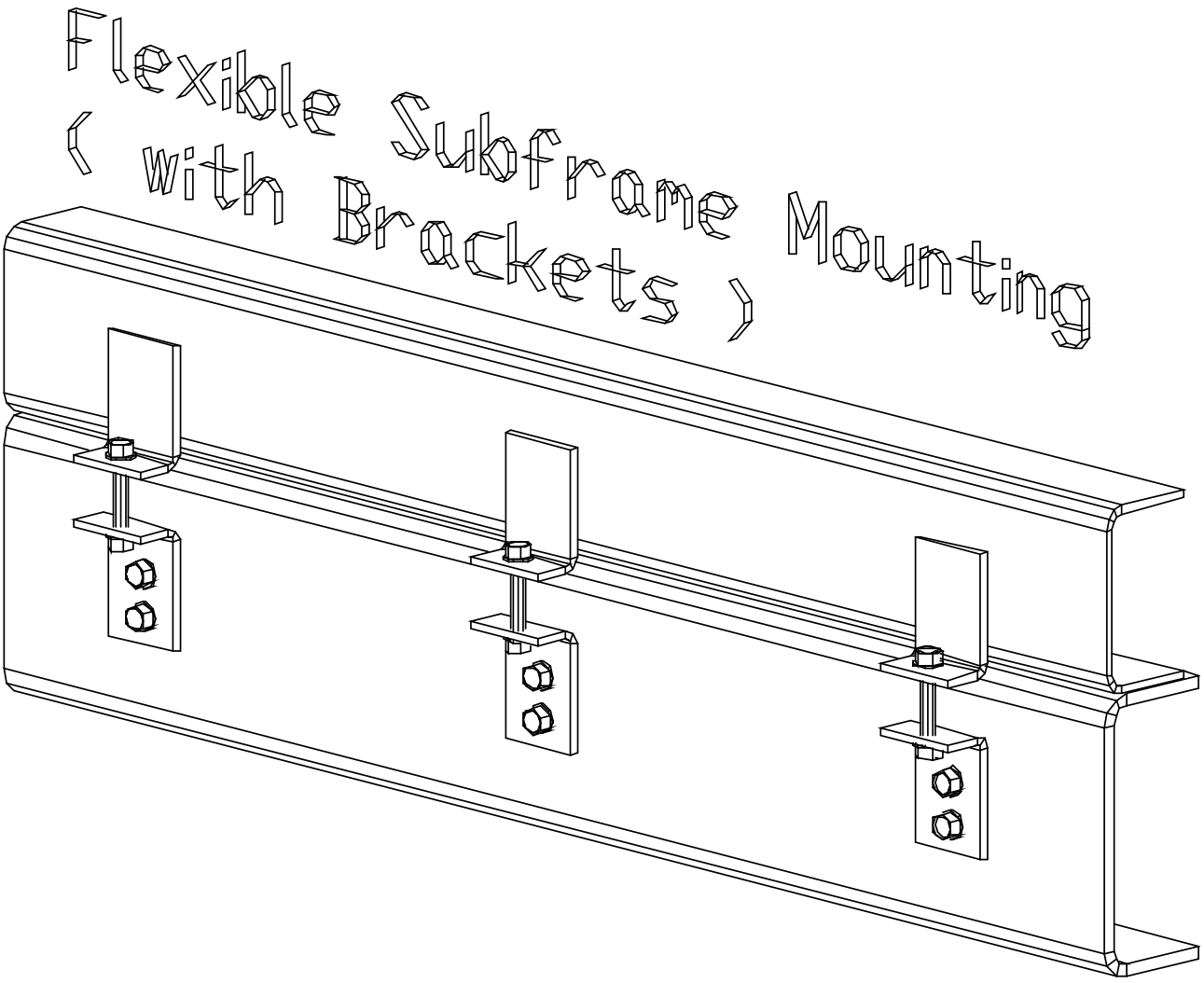
$$W_x = \frac{I_x}{H/2} = \frac{I_x\,2}{H}$$

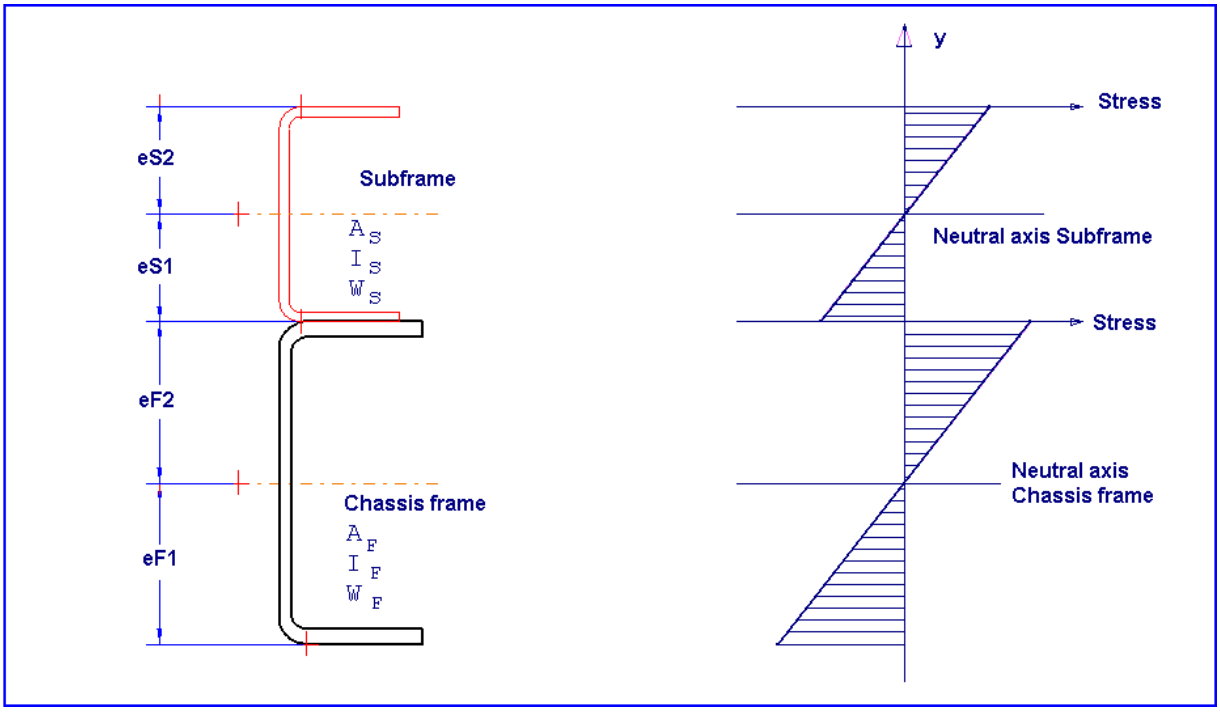
COMBINED BEAM : CHASSIS FRAME + SUBFRAME

Subframe can be mounted on different systems:

- Flexible mounting : subframe mounted with brackets or clamps
- Rigid mounting : subframe mounted with shear resisting plates

Flexible mounting : subframe mounted with brackets or clamps





With a flexible mounting I_x and W_x can be calculated for a combined beam as follows:

$$I_C = I_F + I_S$$

$$W_C = \frac{I_F + I_S}{e_C} \qquad e_C = \max\ e_{F1}\ ,\ e_{F2}\ ,\ e_{S1}\ ,\ e_{S2}$$

Maximum normal stresses σ with bending moment M at a combined beam cross-section with flexible mounting are :

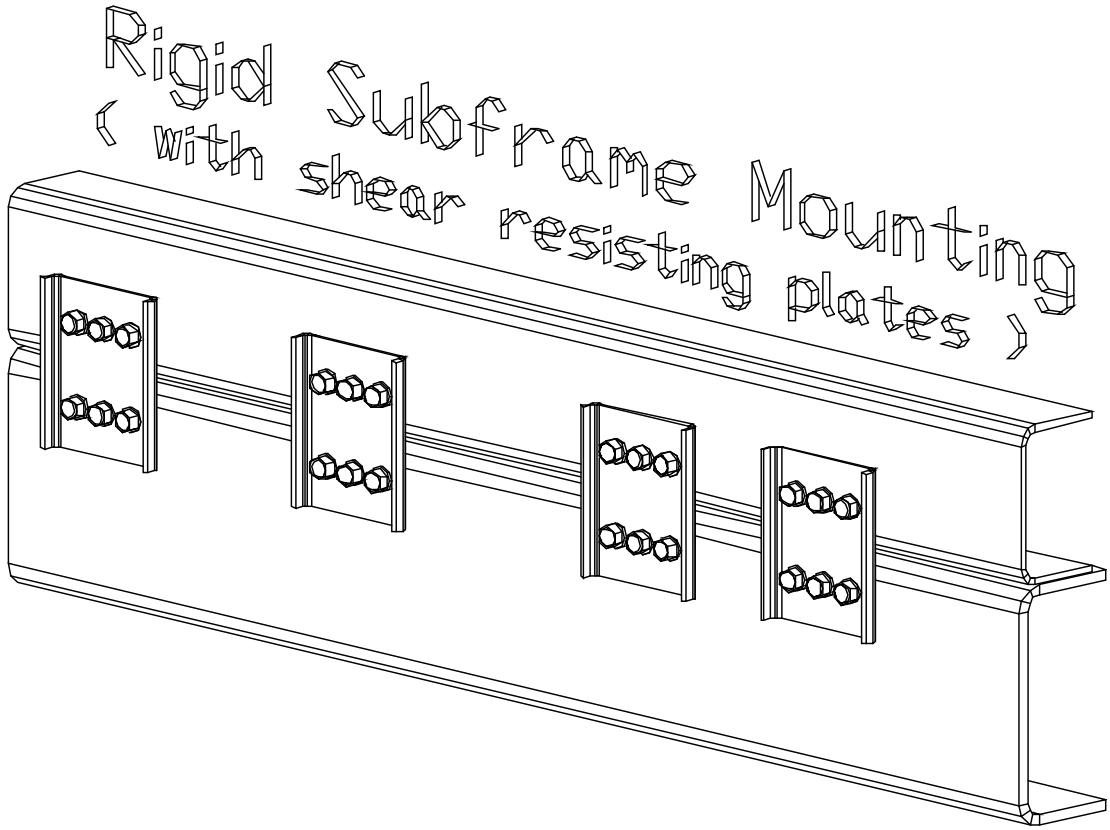
$$\sigma_{F1} = \frac{M\ e_{F1}}{I_C} \qquad on\ chassis\ frame\ lower\ \ fibers$$

$$\sigma_{F2} = \frac{M\ e_{F2}}{I_C} \qquad on\ chassis\ frame\ upper\ \ fibers$$

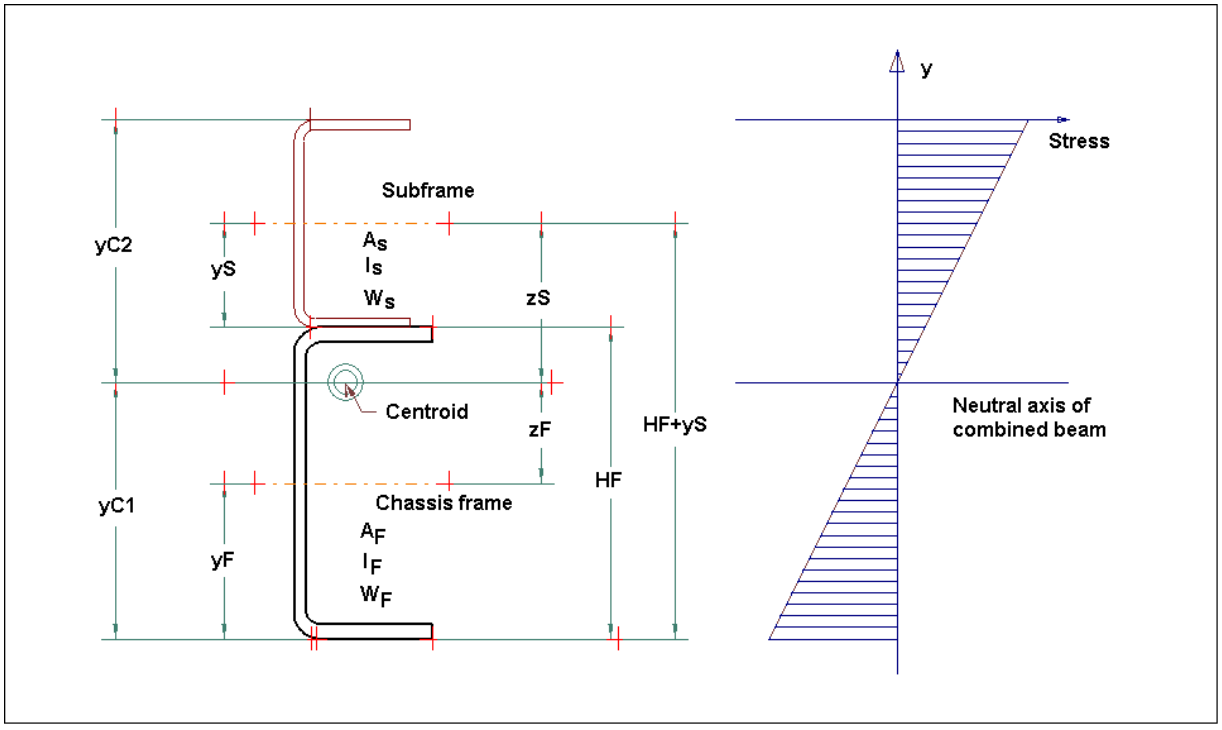
$$\sigma_{S1} = \frac{M\ e_{S1}}{I_C} \qquad on\ subframe\ lower\ \ fibers$$

$$\sigma_{S2} = \frac{M\ e_{S2}}{I_C} \qquad on\ subframe\ upper\ \ fibers$$

Rigid mounting : subframe mounted with shear resisting plates



With a rigid mounting the calculation of I_x and W_x for a combined beam turns out to be more complicated :
At first we have to calculate the centroid (Center of gravity) y_C for the combined cross-section.
With dimension y_C we calculate z_F and z_S and then the second moment of combined cross-section I_C and the section modulus for the combined cross-section W_C.



$$y_C = \frac{A_F\ y_F\ +\ A_S\ (H_F\ +y_S\ )}{A_F + A_S}$$

$$z_F = y_C - y_F$$

$$z_S = H_F + y_S - y_C$$

$$I_C = (\ I_F + A_F\ {z_F}^2\ ) + (I_S + A_S\ {z_S}^2\ )$$

$$W_C = \frac{I_C}{e_C} \qquad e_C = \max(y_{C1}\ ,\ y_{c2}\ )$$

Maximum normal stresses **σ** with bending moment ***M*** at a combined beam cross-section with rigid mounting are :

$$\sigma_F = \frac{M\ y_{C1}}{I_C} \qquad on\ \ frame\ \ lower\ \ fibers$$

$$\sigma_S = \frac{M\ y_{C2}}{I_C} \qquad on\ subframe\ \ upper\ \ fibers$$

In both cases :

The normal stress distribution in figures:
Young's modulus ***E*** for chassis frame material = Young's modulus ***E*** for subframe material.
With all steel qualities ***E*** ≈ 210 000 N/mm^2

Safety factor can be calculated:

$$n = \frac{R_e}{\sigma} \qquad R_e = Yield\ \ point \qquad ;\ for\ material\ Fe52,\ R_e = 350\ N\ /\ mm^2$$

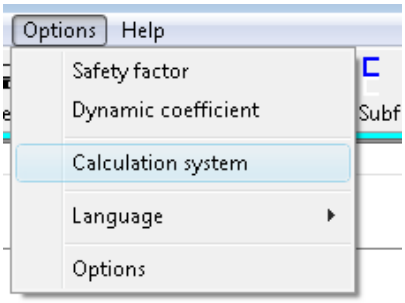
$$\sigma = calculated\ \ \ stress$$

Bending Moment *M*
In ***FrameWIN*** *software by Trailer Consultation* the bending moment ***M*** is the lifting moment of the crane multiplied by dynamic coefficient υ (default υ = 1.3).

CALCULATION WITH NEW STANDARD EN12999

Subframe safety factor can now be made by two different systems, Basic FrameWIN System or EN12999/EN13001. The main difference from the Basic FrameWIN System is that it uses different safety-factors for crane-weight and the load. The new standard also takes notice of differencies in operation methods. On a crane with automatic speed control the forces on sudden rising/stopping will be much lower than on cranes with On/Off-type valve. FrameWIN now gives you the possibility to choose calculation method.

New calculation system EN12999 in FrameWIN



In FrameWIN You can choose calculation system for dynamic forces. By choosing Options->Calculation system or by clicking on Dynamic coefficient-button on menu.

When choosin EN12999, EN13001 You will have to choose following settings:

- Vertikal hook Speed
- Load Combination A1/C1
- HD class of Hoist Drive. HD1/HD4/HD5.
- Safety factors for Frame and Subframe. Recommendation by standard is: $\gamma_m = 1.1$

The calculation is made for mobile cranes, Hoist Class 1 (HC1).

You will also get the settings and formulas on the outprint.

About calculation system EN12999/EN13001

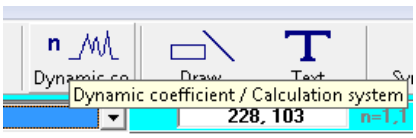
Here is a short description of the new standard EN12999. For more information, please refer to the standards EN12999, EN13001.

FrameWIN makes calculation by Hoist Class 1 (HC1) which is the Hoist Class for mobile- and flexibile mounted cranes. (HC2 is for rigidly mounted cranes)

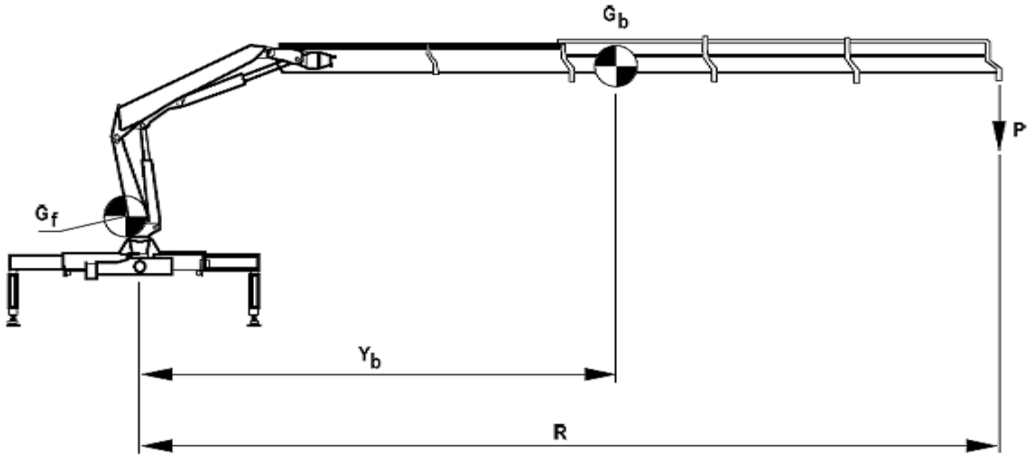
From options window You can make following selections for Hoist Drive Class:

- HD1 for cranes with On/Off –type valves regulating lifting and lowering
- HD4 for cranes with normal spool valve operated by user.

HD5 for cranes with automatic speed control



Formulas and symbols



Formula for calculating stresses and safety factor

$$\frac{(\gamma_{p1}\phi_2 P R + \gamma_{p2}\phi_1 G_b Y_b)}{W} g = \frac{\sigma a}{\gamma_m}$$

Symbols and coefficients

G_f = Crane own weight without boom system
G_b = Boom system weight (or total crane weight)
Y_b = Center of gravity for boom system (or crane)
P = Payload
R = Center of gravity for payload
V_h = Rising/lowering hook speed used for calculating Φ_1, Φ_2
V_{hmax} = Maximum hook speed
γ_{p1} = Partial safety factor for payload
For Load combination A1 safety factor γ_{p1} = 1.22
For Load combination C1 safety factor γ_{p1} = 1.1
γ_{p2} = Partial safety factor for crane weight
For Load combination A1 safety factor γ_{p2} = 1.34
For Load combination C1 safety factor γ_{p2} = 1.1
Φ_1 = Crane weight factor for dynamic effects when rising/lowering suddenly stops
Φ_1 = 1.1 or max Φ_2
Φ_2 = Payload factor for dynamic effects when rising/lowering suddenly stops.
Φ_2 =1.05 + 0.17 V_h
For Load Combination A1 :
V_h = V_{hmax} for Hoist Drive Class 1 (HD1)
V_h =0.5 V_{hmax} for Hoist Drive Class 4 (HD4)
V_h =0 for Hoist Drive Class 5 (HD5)
For Load Combination C1:
V_h = V_{hmax} for Hoist Drive Classes 1 and 4 (HD1 / HD4)
V_h =0.5 V_{hmax} for Hoist Drive Class 5 (HD5)
W = Bending moment
g = 9.81 Nm (=1 kg)
σa = Calculated stress
γ_m = Safety factor
γ_m >= 1.1