Trailer Consultation

TrailerWIN - CraneWIN -FrameWIN

The Guided Example

RD

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TrailerWIN – CraneWIN – FrameWIN

Guided example

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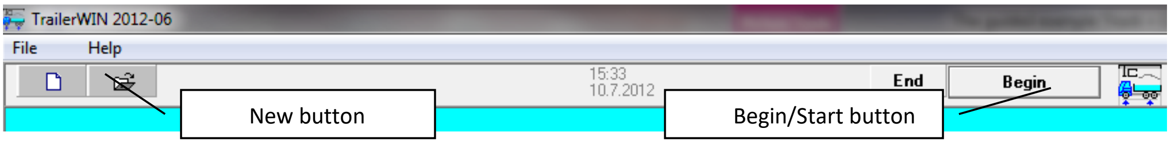
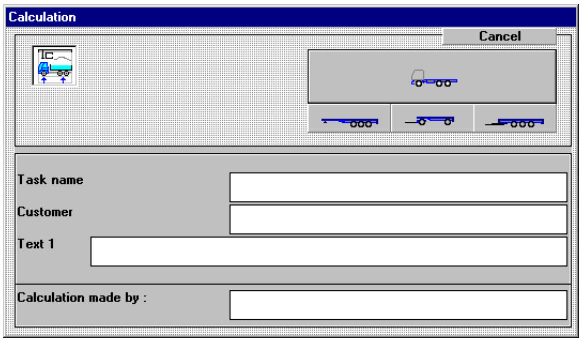
Truck and Crane Calculation with TrailerWIN, CraneWIN and FrameWIN:

We will step thru a calculation in TrailerWIN – CraneWIN – FrameWIN where we use a crane and additional stabilizers. This example is only for learning use of program and should not be used as a model for assembling cranes to chassis.

TrailerWIN, Starting the Calculation

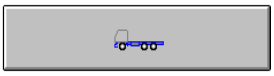
To start calculating a new vehicle. Click the Begin button or New button.



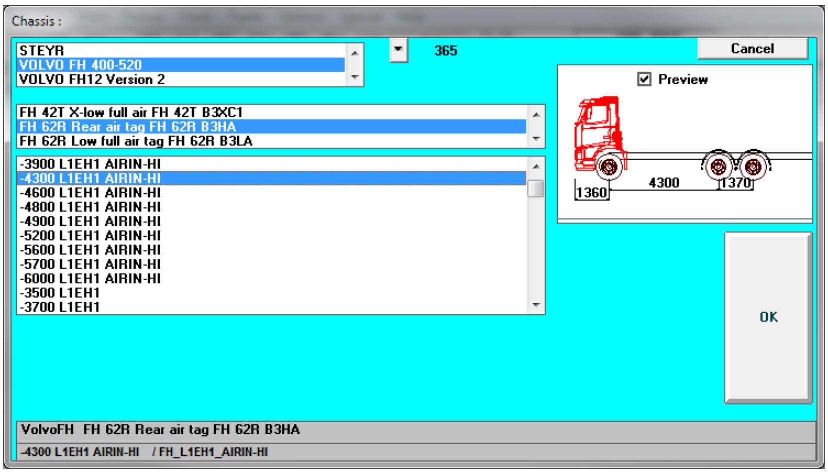


To easily find this calculation later, type in the task name and customer name in the window that pops up.

Then click on the Truck button to begin choosing the truck.



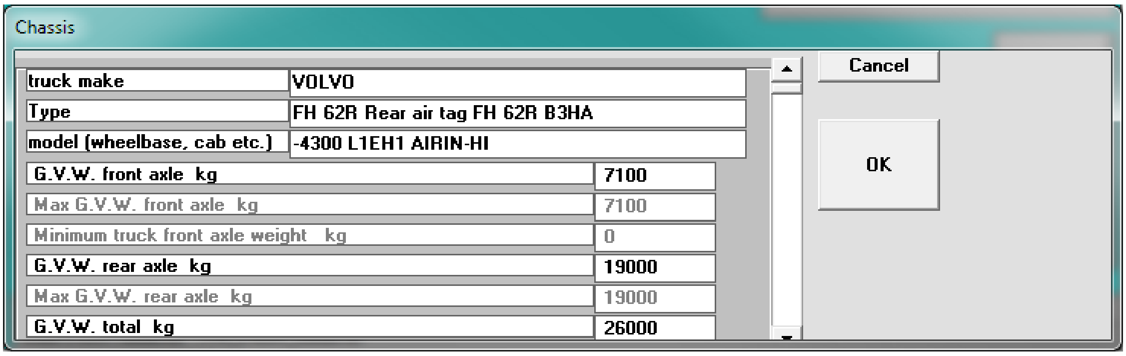
Choosing Chassis



From Chassis Window you can choose the chassis fabricate -> model series -> wheelbase and finally cab.

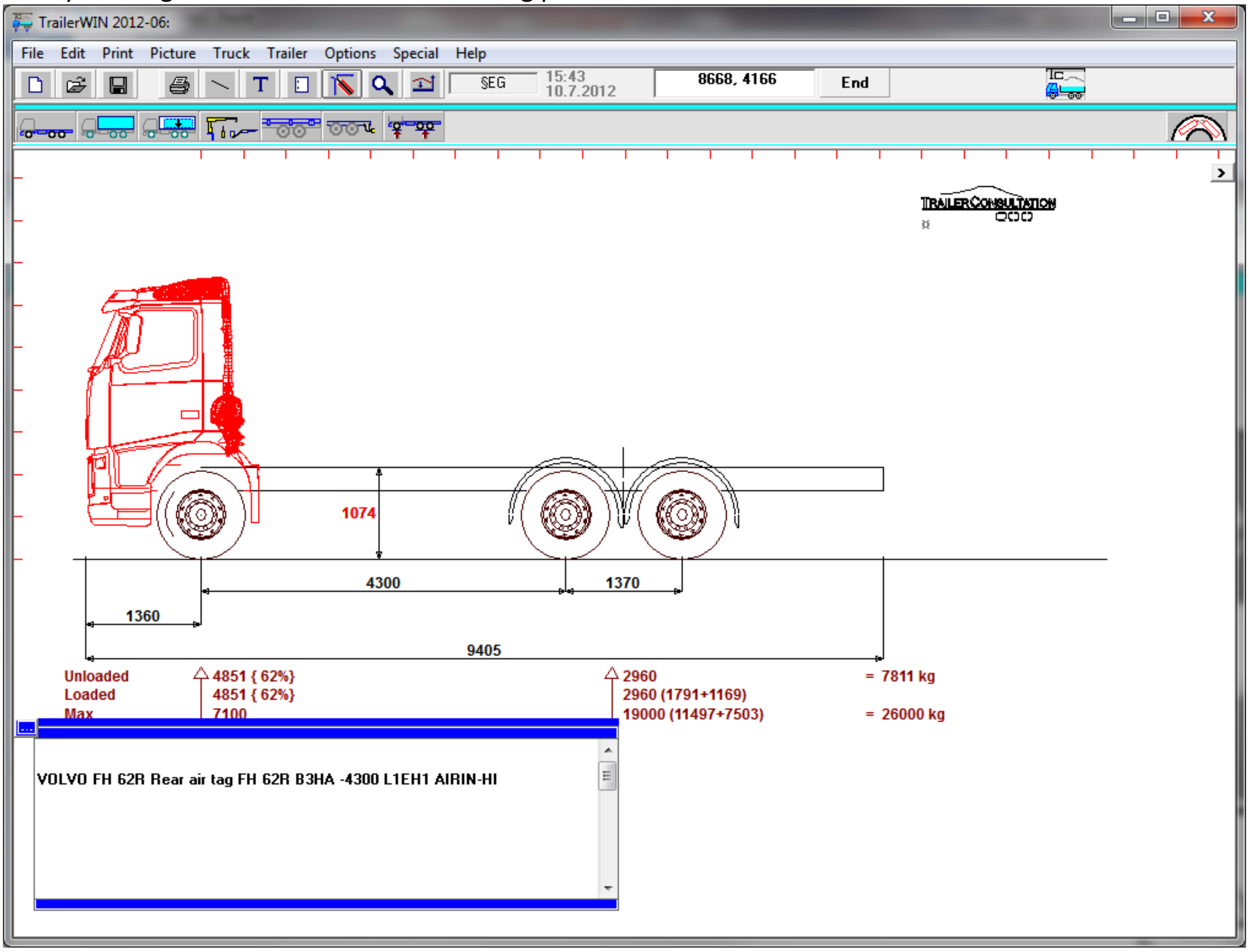
In this example we choose: **VOLVO**
FH 62R Rear air tag FH 62R B3HA
4300 L2EH2 AIRIN-HI

In Chassis data window you can check and change chassis weights and dimensions.



When you are ready, click **OK**.

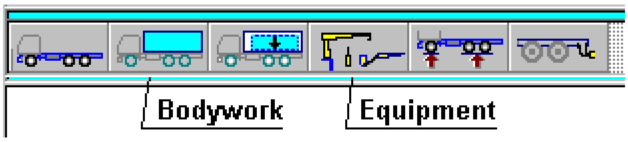
Now you will get the chosen chassis in the big picture.



TrailerWIN – CraneWIN – FrameWIN
Guided example

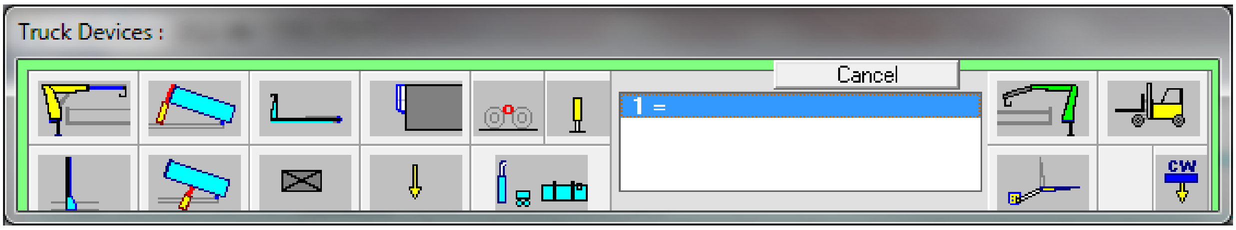
Choosing Crane:

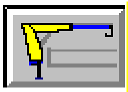
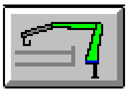
To have a crane behind the cab do as follows
Click on the **Equipment** button.



In the following equipment window you will see the crane button (yellow crane) on the left side.
The other crane button (green crane) on the right side is for rear-mounted crane.

Buttons for choosing the device type:
(Please check the TrailerWIN manual for more information regarding equipments.)

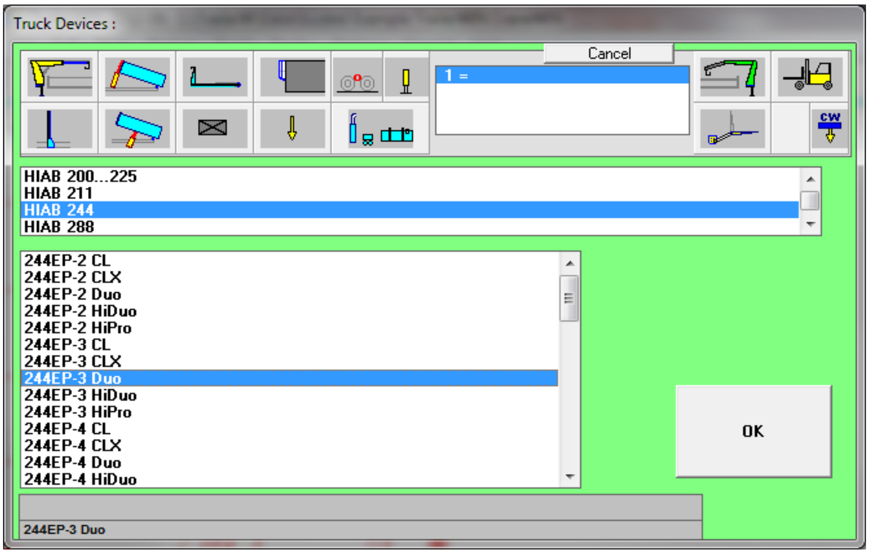


 Crane (front of the body)  Crane (rear of the body)

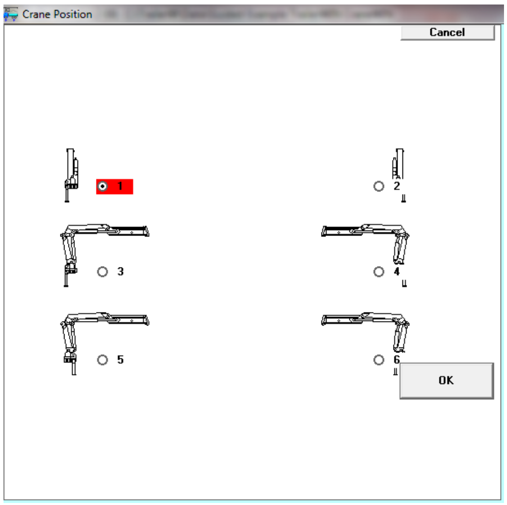
Click the yellow crane on the left side.

Now you can choose the crane model, in this example we choose Hiab 244, and then the model **244EP-3 Duo.**

Click **OK**.



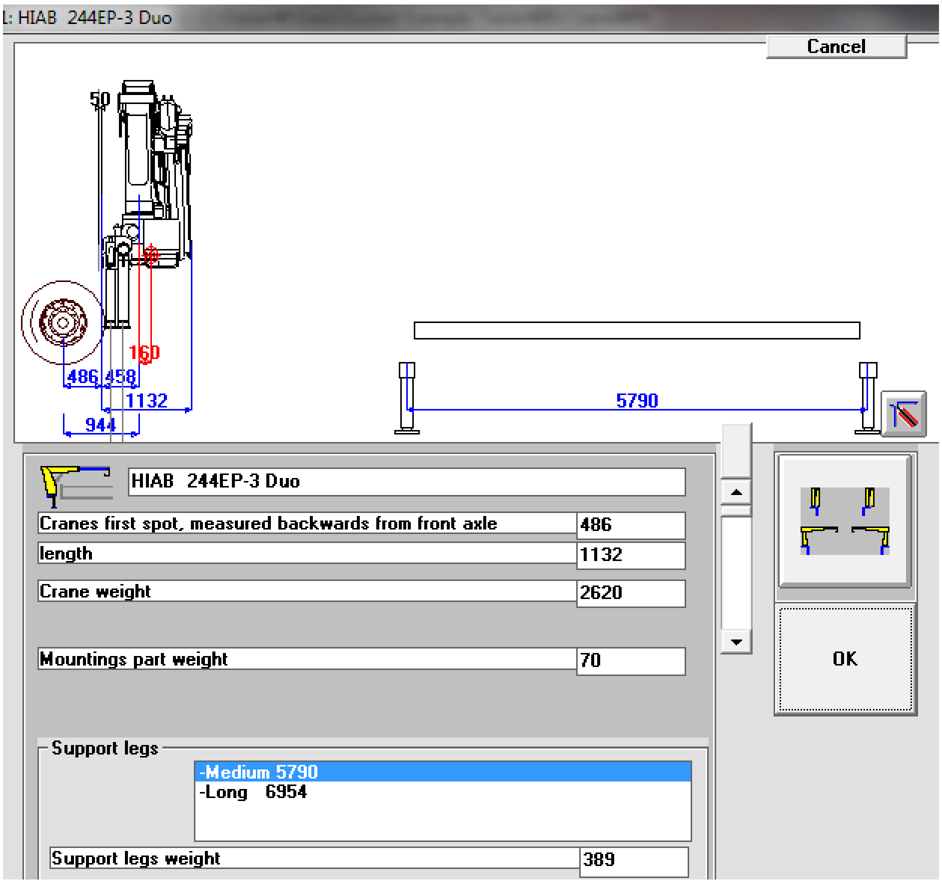
On the following screen You can choose the crane position: folded or unfolded during transport. You also choose the position of stabilizer legs for the crane. Note that choosing different positions will affect also the weight calculation because COG is taken into account from the position of boom.



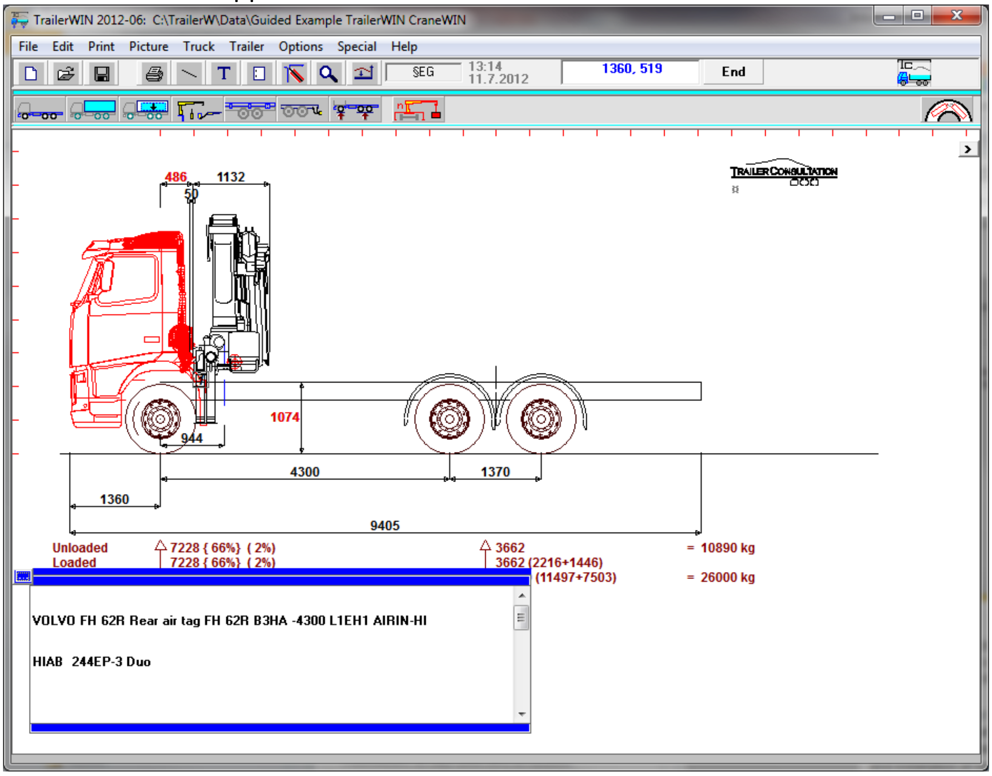
In the following Crane Data Window you can check and edit crane weight and dimension data.

You can also choose stabilizer leg model. You can go back to Crane Position window by clicking the button above ok-button.

Click **Ok**

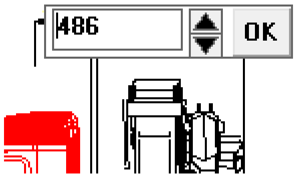


The chosen crane appears on the chassis.



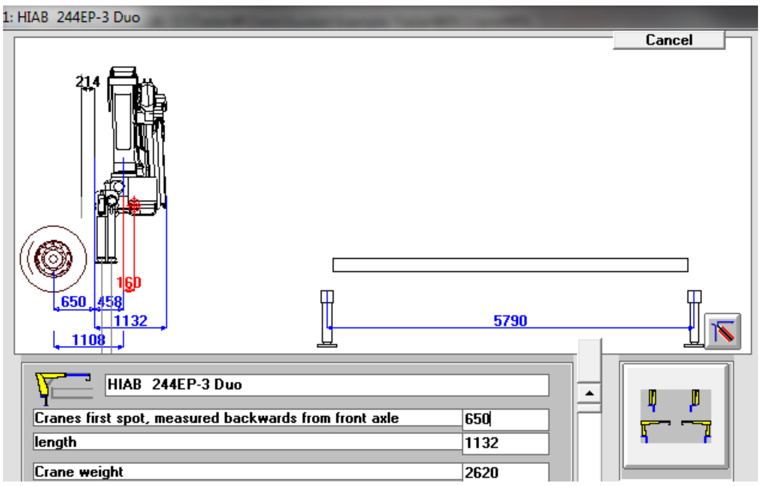
Now we want to move the crane rearwards.

We can do this with 3 different methods.



1. Double-Click the red dimension number at the top of the picture (hot dimension) 486, and type new value 650, and then click OK.

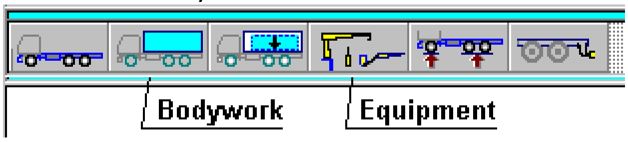
2. Drag the crane with your mouse from the small grey rectangle under the crane. The crane moves to a new place, but be aware that very exact movements are difficult with this method.



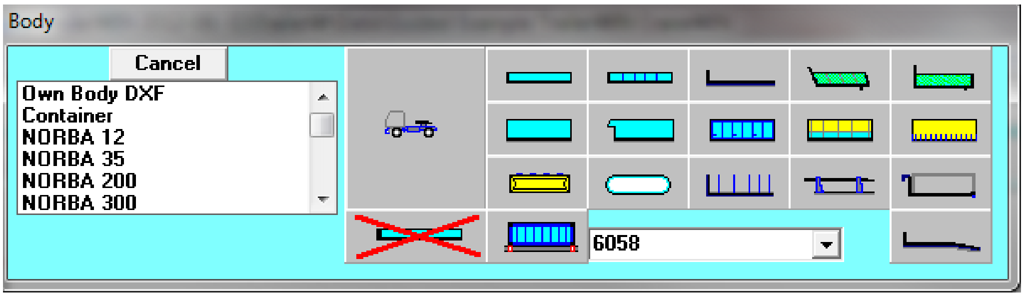
3. Click on the Equipment button, and choose the crane in question from the list. You will now come back to the Crane Data Window.
Type in the new value: **650**

Choosing the Bodywork

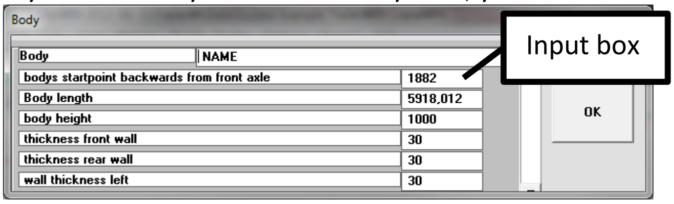
Click on the Bodywork button.

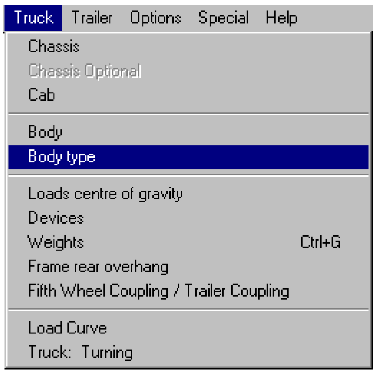


The Bodywork Window opens. Here You can choose standard body types and also get body-drawings from DXF-files on the left scroll-box. (See TrailerWIN manual for more instructions.)



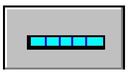
If you've already chosen the bodywork, you will now see the Body data window instead.





To go back to choose the body type, click Menu: **Truck - Body type** and choose the desired body type.

In this example we choose Open Body button



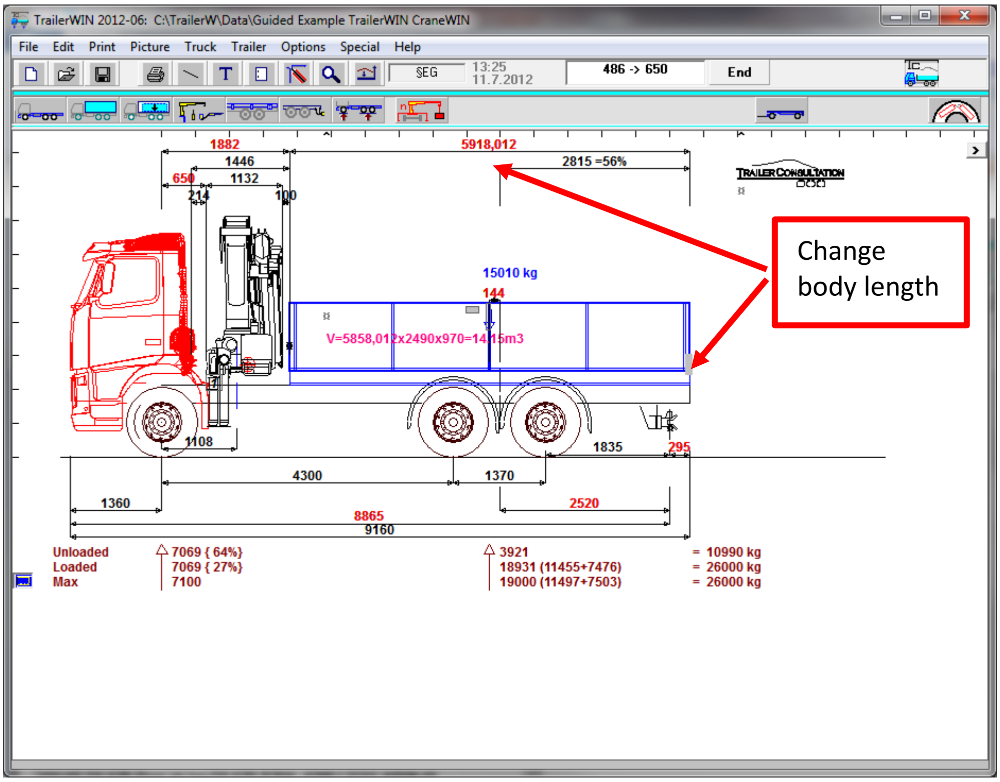
Now the Body data window appears.

The program first calculates the body length to optimize the rear axle weight to near maximum allowed, when the body is evenly loaded.

If you have a specific body length that you'd like to have, you can type this length into the input box.

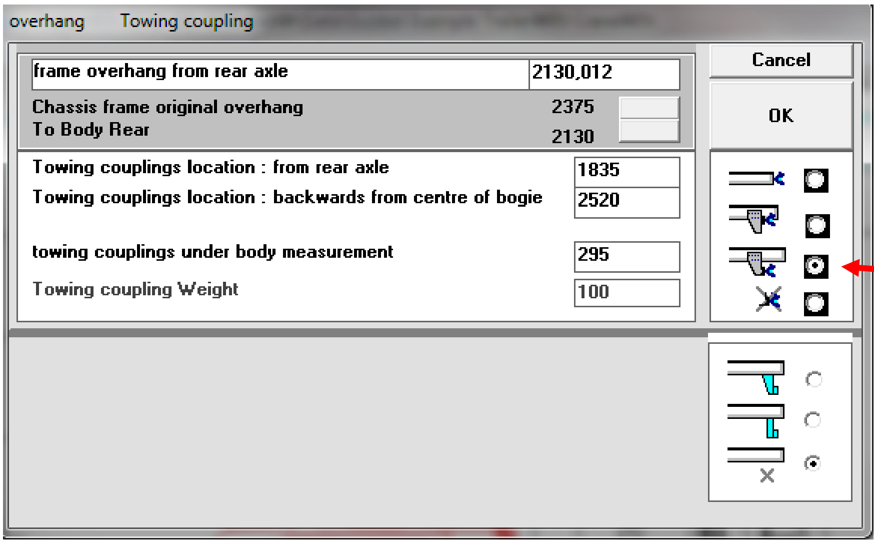
Click **Ok**.

You can also change the body length later directly from picture; double-click the red dimension or drag the small grey rectangle at the end of the body with your mouse.

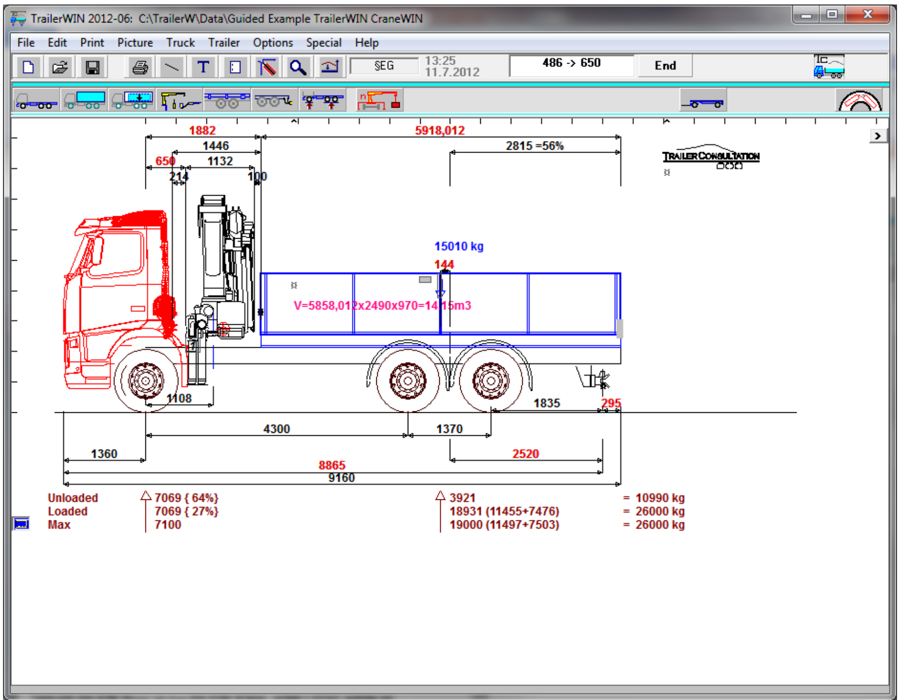


Next You will see the rear overhang Towing coupling window. Here You can modify the rear overhang of the frame. You can also choose different types of trailer couplings and rear bumpers if needed. This window will always appear after You have chosen a body. You can´t add a trailer without first having a trailer coupling on the truck.

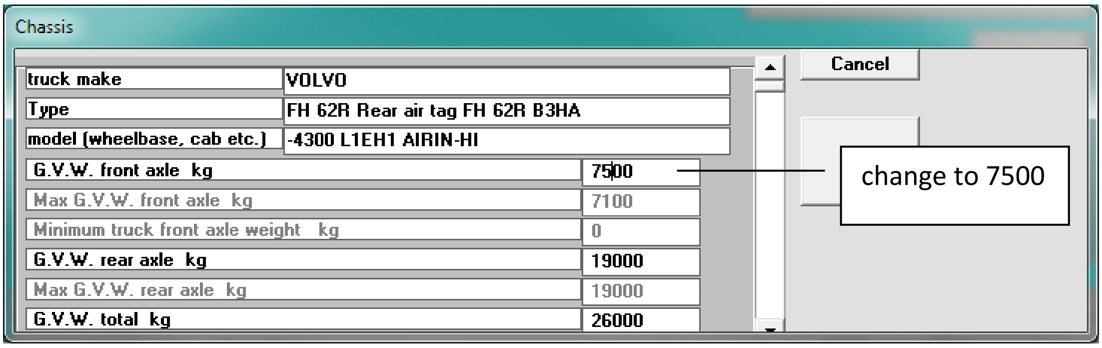
We choose low-mounted trailer coupling and click ok.



Now you see:
The axle weight without load and with load, under the picture.
First row shows axle loads without payload and the second row with payload.
The numbers in brackets "**{64%}**" mean that the front axle takes 64% of the vehicle weight.

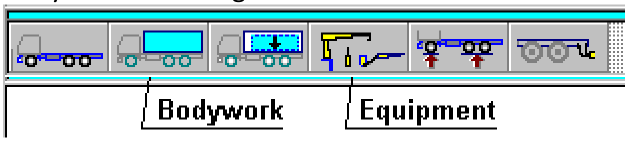


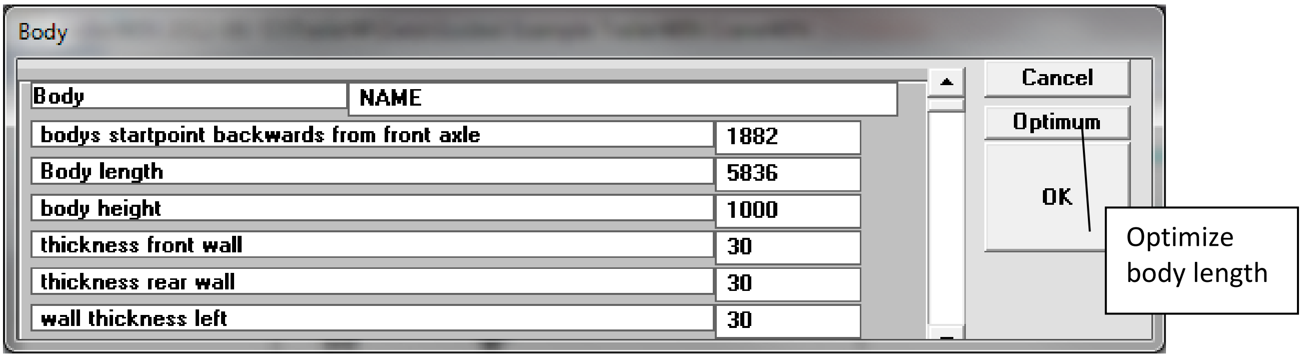
For changing the max. allowed front-axle load, click the chassis button 



Change **G.V.W. front axle** to 7500 kg, we must also change total weight manually if needed. In this case 26000 kg is ok. Click OK button.

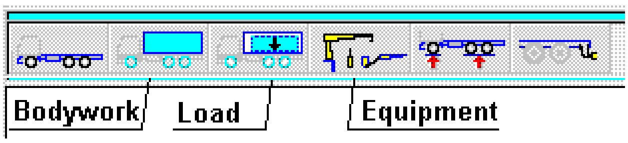
If we now want to see, what the optimum body length with these weights is, we click the Bodywork button again.



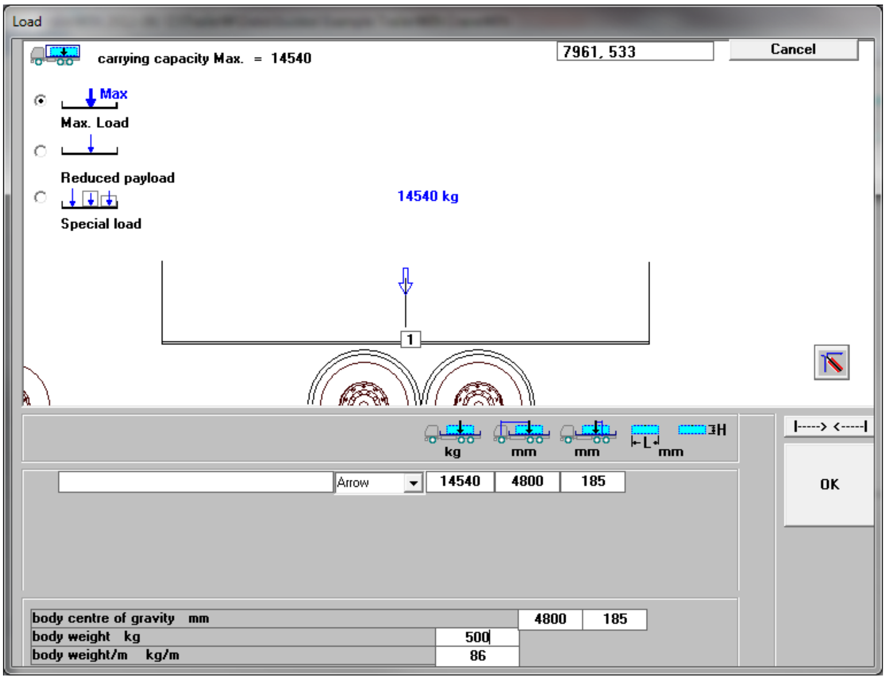


In bodywork window, click the **Optimum** button
You will see that the body length changes.

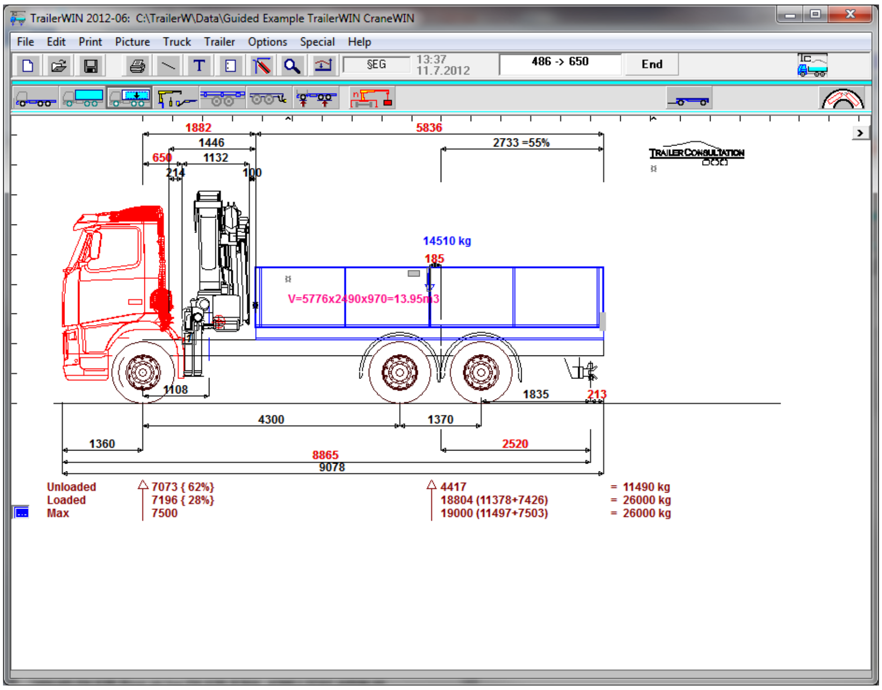
Body weight (body own weight) can be given in Body data window as kg/m or in the Load data window as total body weight or kg/m.



Click the Load button on the toolbar.

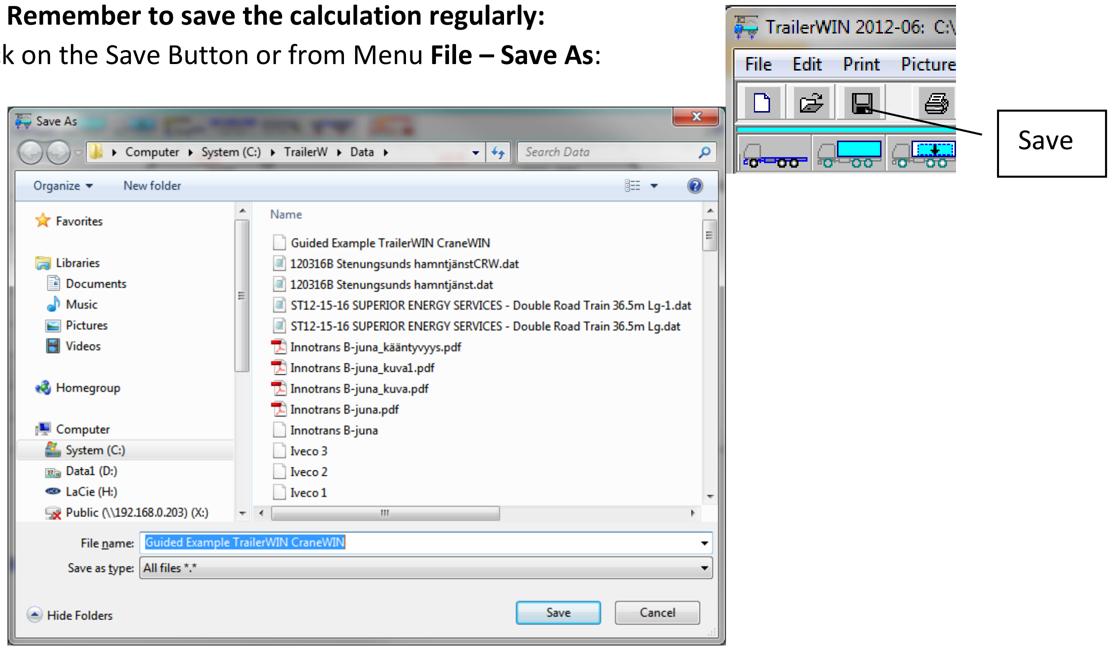


We change **load spaces own weight kg** to value 500 kg.
Then click OK.



Now you have succesfully built up the truck in TrailerWIN.

! ! Remember to save the calculation regularly:
Click on the Save Button or from Menu **File – Save As**:

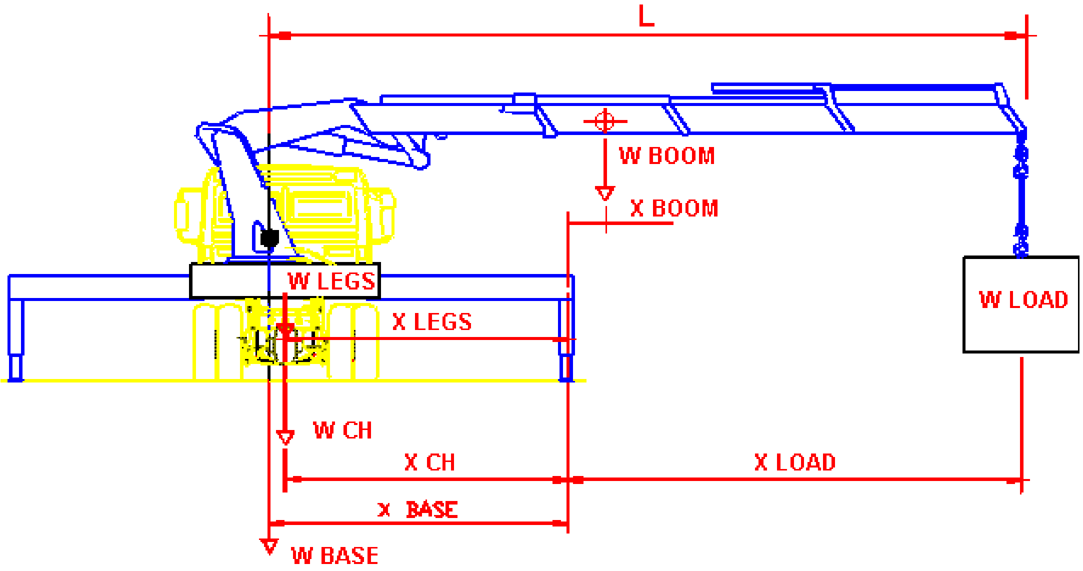


Use a logical name. It helps you to find this calculation later.

You have several options to save drawings and print out the calculation. For more details, please check TrailerWIN manual.

CraneWIN

Principle of stability calculation in CraneWIN

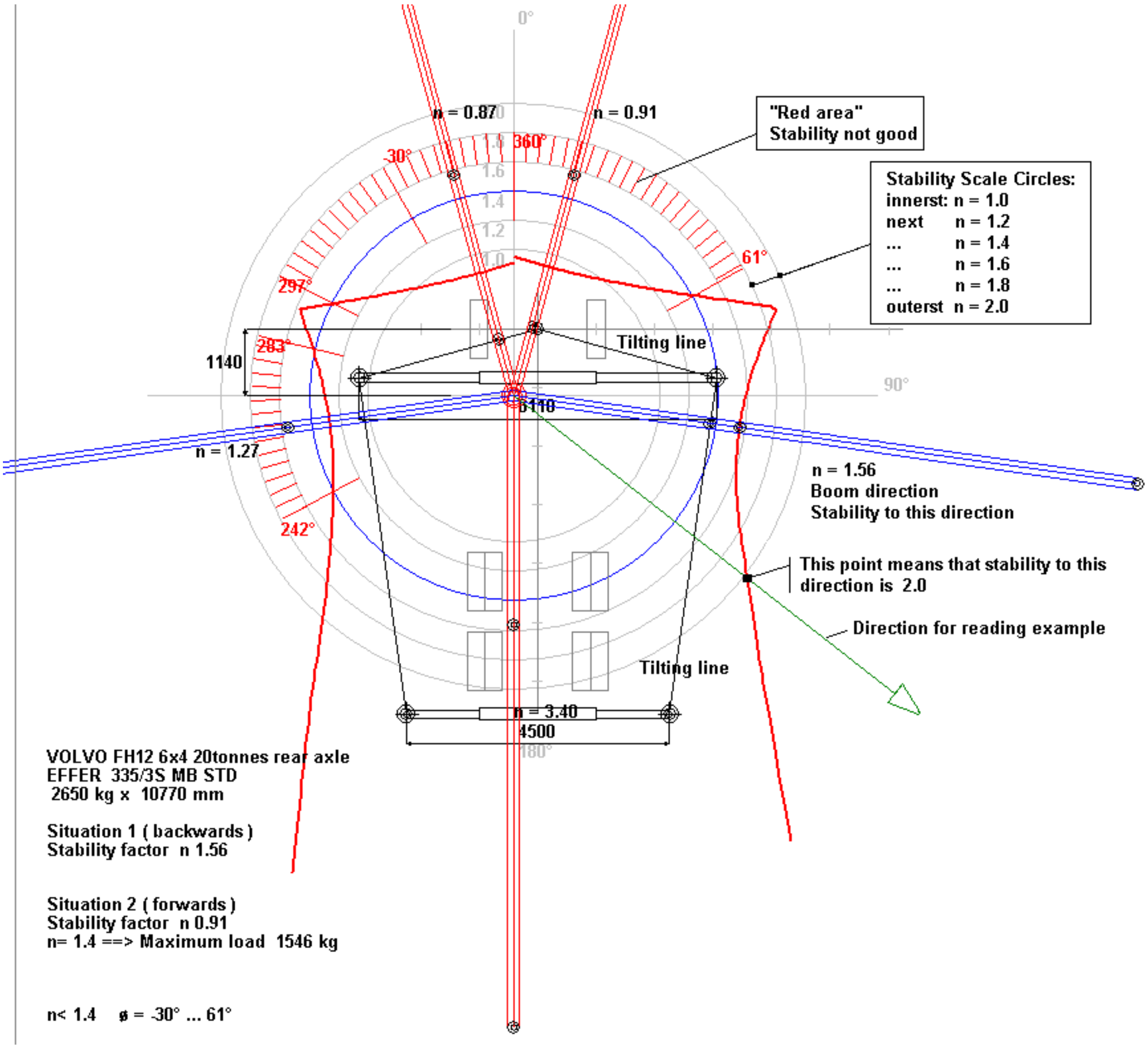


CRANES STABILITY CALCULATION (Measures from tilting line)

Chassis weight Front axle	WchFront x xChFront	= xxx
Chassis weight Rear axle	WchRear x xChRear	= xxx
Weight of support legs	WLegs x xLegs	= xxx
Weight of base	Wbase x xBase	= xxx
Stabilizing moment		Sum = xxxx
Weight of boom	WBoom x xBoom	= xxx
Load * Max outreach	Wload x xLoad	= xxx
Tilting moment		Sum = xxxxx

Stability factor n Stabilizing moment / Tilting moment = n

Reading the stability diagram:



The circle diagram shows stability in all directions. Truck front is upwards in the picture.

Imagine the boom in the picture to this direction, for which you want to read stability. The point where the boom direction line crosses the red stability curve, shows the stability.

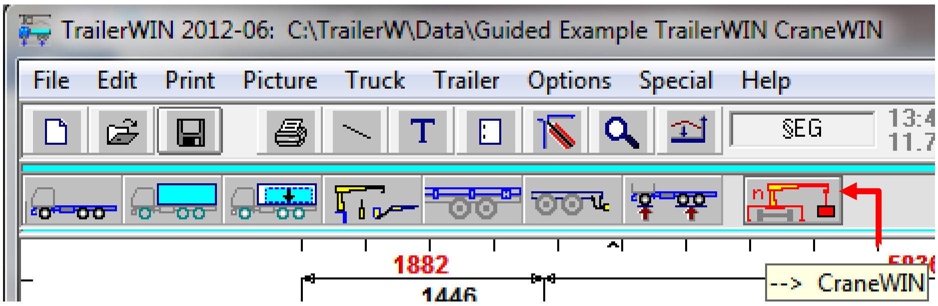
If this point is for example on scale circle 2.0, the stability is 2.0 to this direction (see example point on the picture).

Note that You can also see the tilting line in the diagram. It is shown as black lines between stabilizers and to the middle of the front axle.

Later we will see how we can modify the tilting line on front axle.

Checking stability with CraneWIN

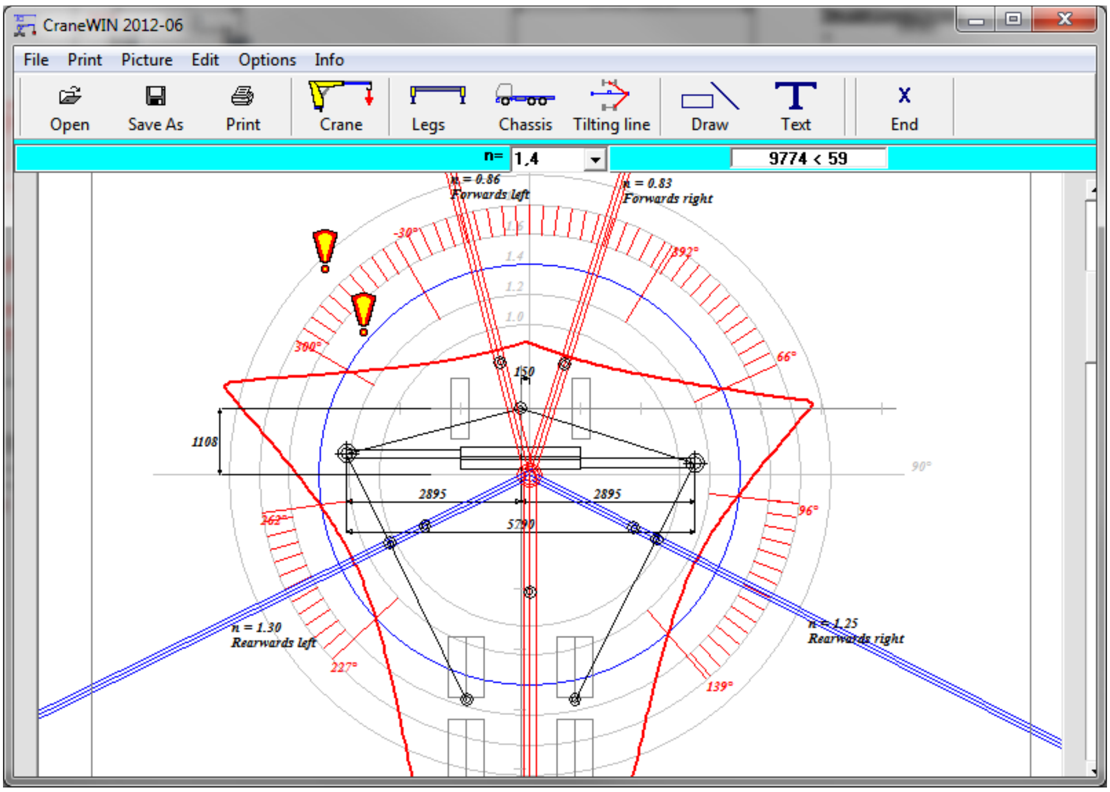
Now you can check the Crane Stability.
We get to the CraneWIN Program by clicking on the → CraneWIN button or by choosing Menu **Special - CraneWIN**.



CraneWIN will now start and all data will automatically be transferred from TrailerWIN to CraneWIN.

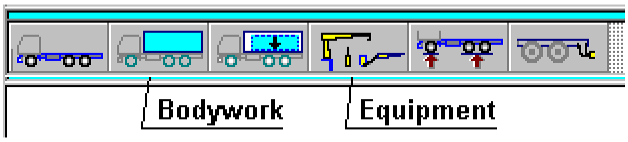
Note that modifications made in CraneWIN will not be copied back to TrailerWIN :

Stability chart of Guided example

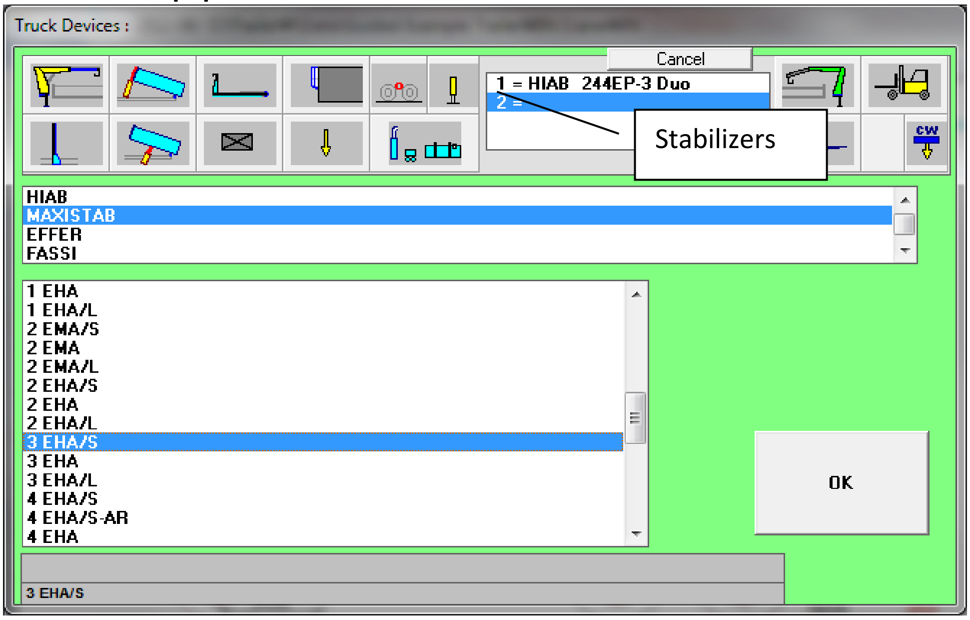


This diagram shows, that the stability is very bad and additional stabilizer legs are absolutely needed.

Click on the **End**-button to go back to the TrailerWIN picture and add stabilizers.

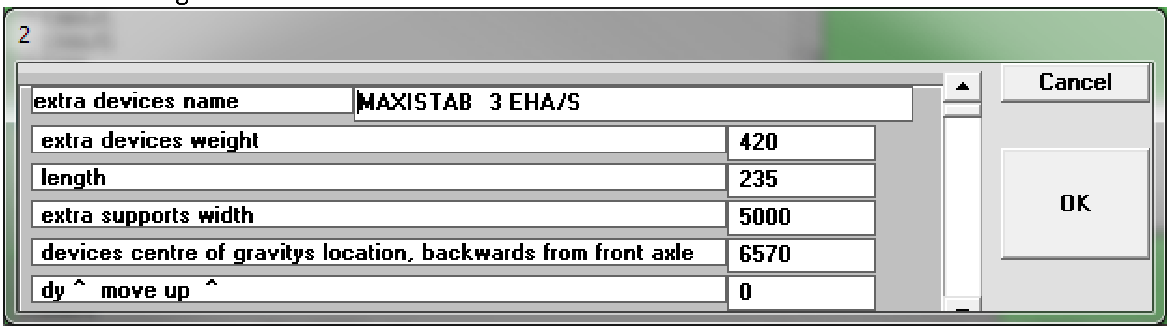


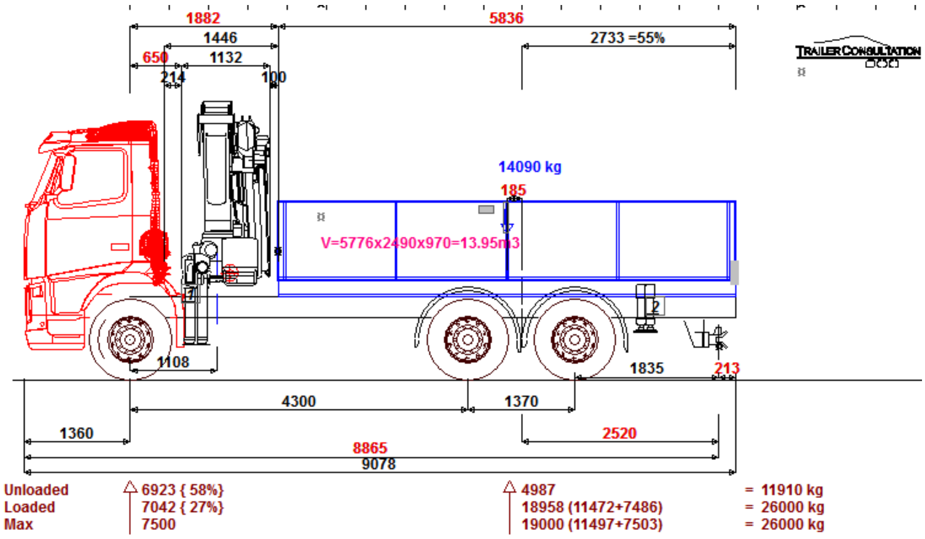
Click on the **equipment** button.



Choose Stabilizer legs-button and You will then see a list of Manufacturers of Stabilizers.
We click on **Maxistab** and choose model **3 EHA/S**.

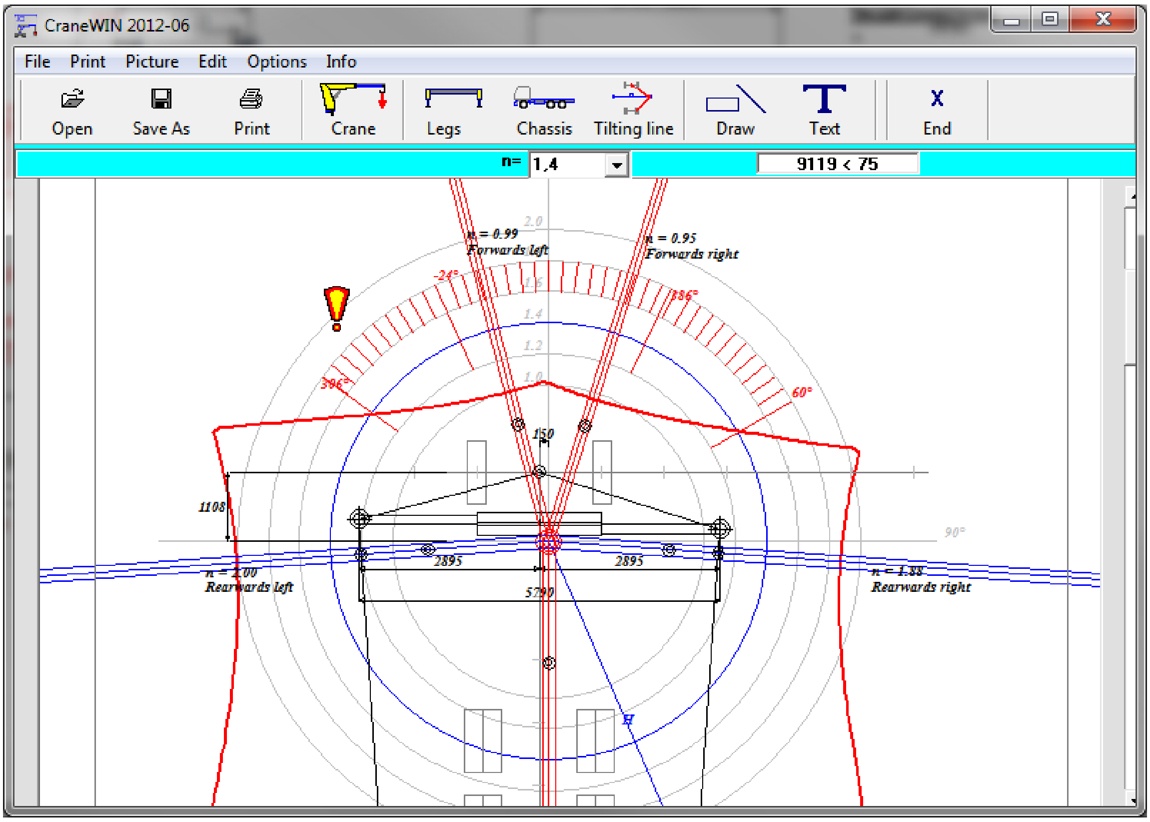
In the following window You can check and edit data for the stabilizer.





The chosen stabilizers are now added to the picture and it is now possible to test the stability again:

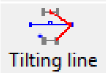
Click on the "CraneWIN" button again.

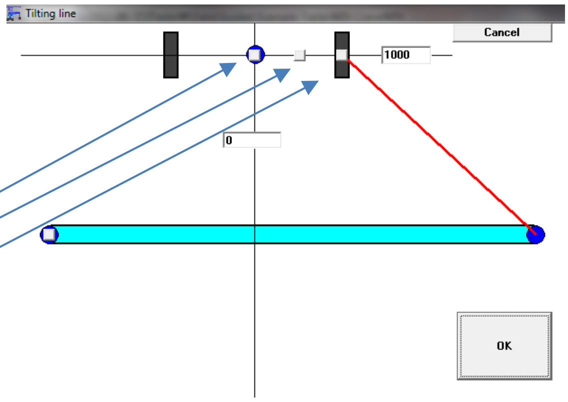


Now we can see that the stability is much better, but there are still problems to the front.

Modifications in CraneWIN

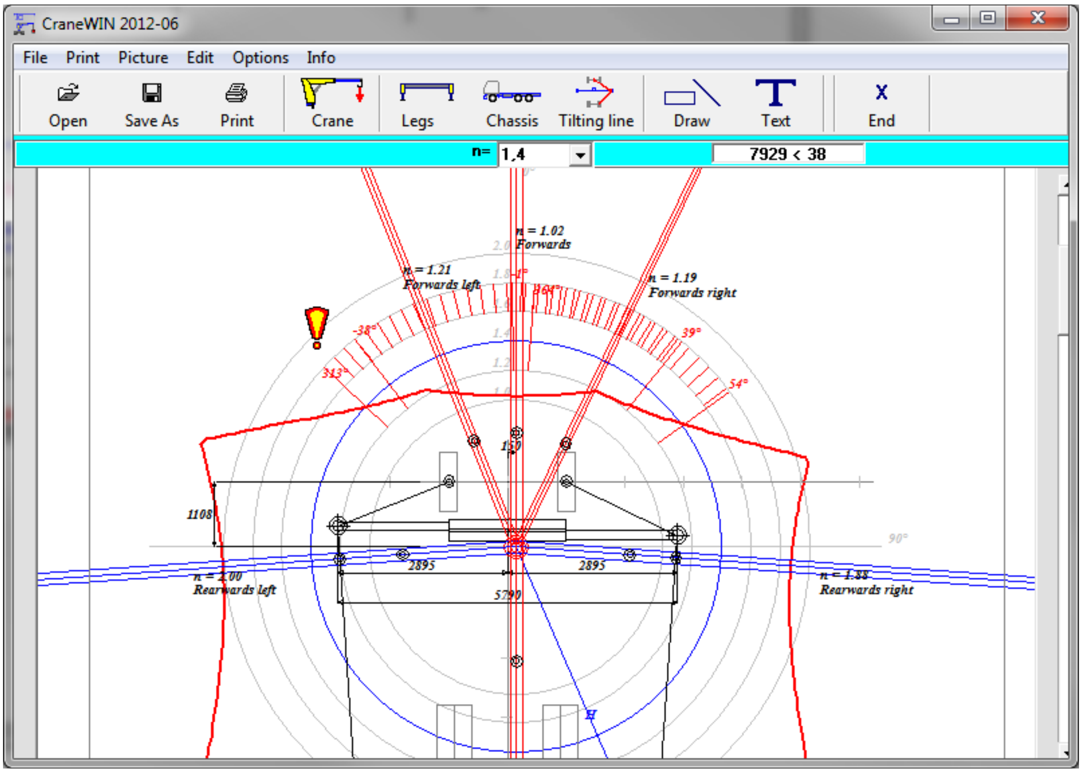
As we can see from the picture, the Tilting line goes to the middle of the front-axle. If we want to see how much it affects to set the Tilting line to the middle of the front wheels, we can click on the **Tilting Line**- button.





Here we can choose 3 different positions for the tilting line; in the middle of front axle (no stabilizing effect sideways), between wheel and midpoint or in the position of wheel. Note that we can also give own values in the textboxes.

Choose the "best" option:
in the middle of the wheel.



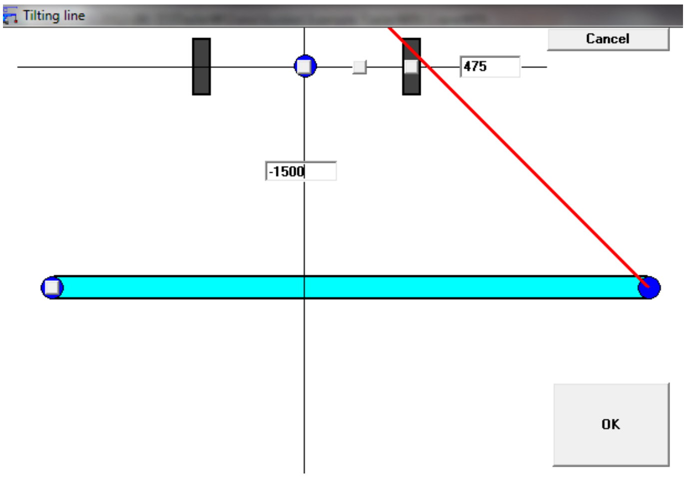
Now we can see that the stability still isn't good enough and we will need front stabilizers too.

We can check the stability with front stabilizers in CraneWIN by giving own measurements to the Tilting line. However then the weight of front stabilizers would not be in the TrailerWIN weight calculation.

We will do a quick check to see how this works:

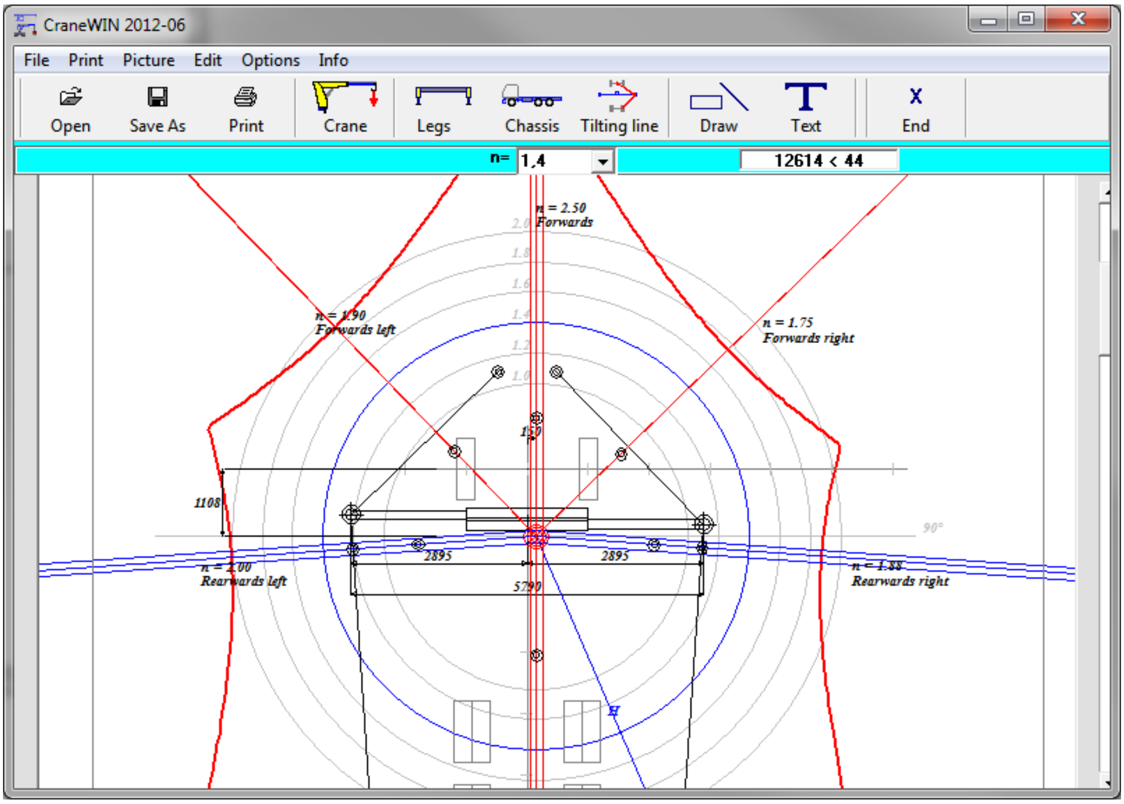
Click on the “Tilting line” -button

Fill in the value **475** for width (950/2) and **-1500** for longitudal direction because we want to check the stability when we have a stability point in front of front axle. Then click “OK”.



Be aware that by doing it this way, we’re not taking into account the stabilizing effect of the front stabilizers, this method is only for checking purposes.

Note also that the measurement shown in TrailerWIN is to the first point of stabilizer leg, not the middle of the stabilizer leg.

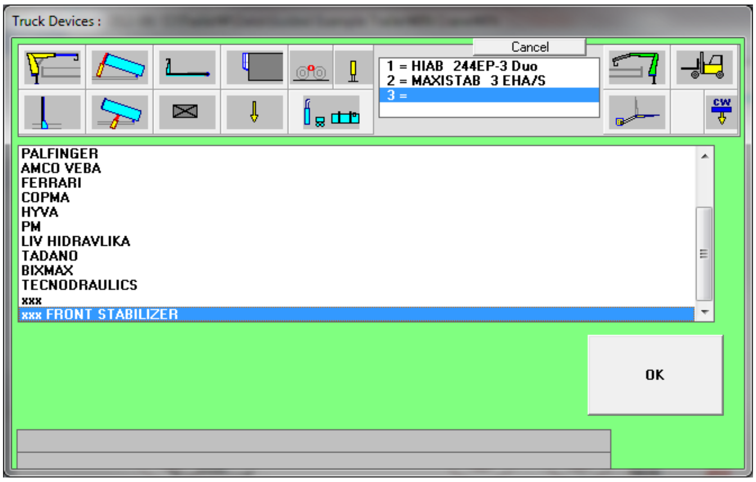


As we can see the stability is very good but the weights of the front stabilizers are not taken into account here.

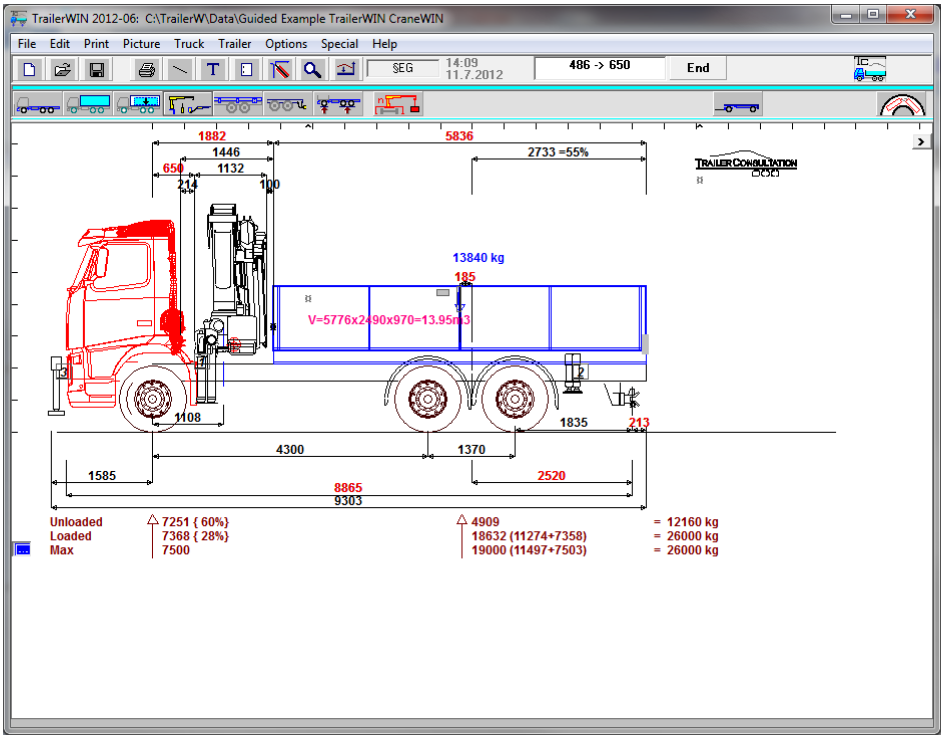
To do this correctly we add the front stabilizers in TrailerWIN.

Go back to TrailerWIN and choose the Equipment button again. Then choose stabilizer and scroll down the list to the end.

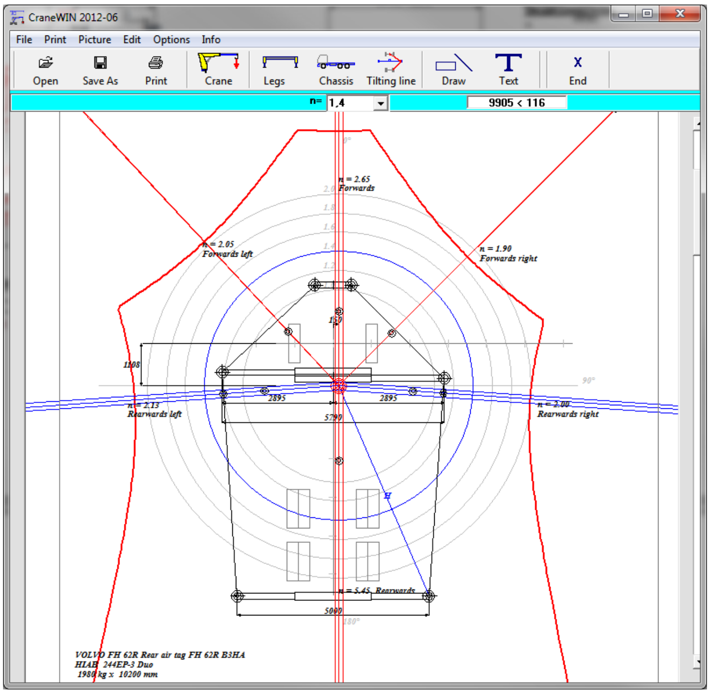
Choose Front Stabilizers and make necessary modifications to the data. Click **ok**.



Now we can see the front stabilizers in the TrailerWIN picture and they are also added into the weight calculation. This way the weight of the front stabilizers will also be in the stability calculation.



Go back to CraneWIN and check the stability once again.



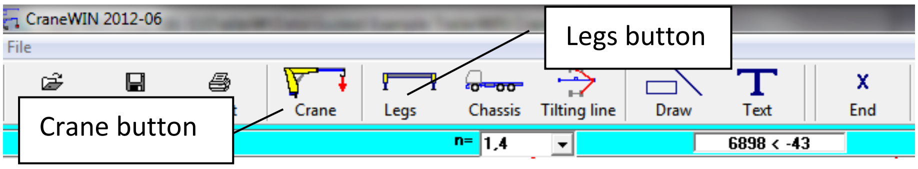
Now we can see that the stability is very good in all directions. Now we also have the weight of the front stabilizers in the calculation. They do not affect the stability forwards because they are in the tilting line but to other directions their weight will be taken into account in the calculation.

```
    ----------------------------------------------------------------------
-------------
    Forwards
                                               kg x     m =       kgm
    ----------------------------------------------------------------------
-------------
    Chassis weight  Front axle                  4576 x   1.510 =    6910
    Chassis weight  Rear axle                   4181 x   6.351 =
26554
    Weight of support legs                       459 x   2.343 =
1075
    Weight of extra support legs                 420 x   8.080 =
3394
    Front Stabilizers                            250 x   0.000 =     0
```

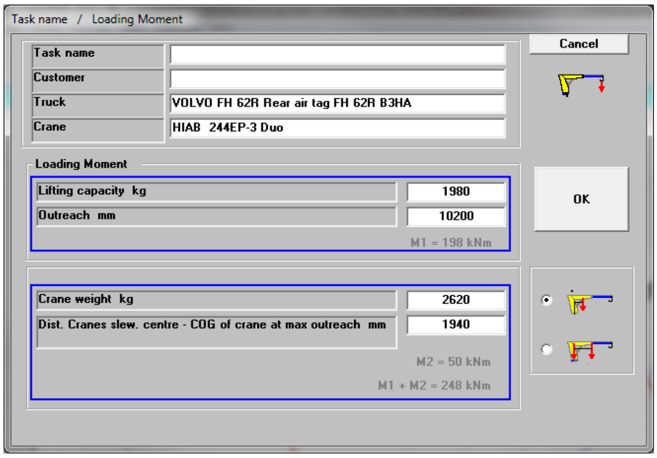

Changes to Crane and stabilizers in CraneWIN

It's possible to check and change crane and stabilizer data in CraneWIN; e.g. change load, outreach, stabilizer width etc. Note that if you change something in CraneWIN, it does not have any influence to the TrailerWIN calculation.

To change the Crane load, outreach etc, click on the Crane button.

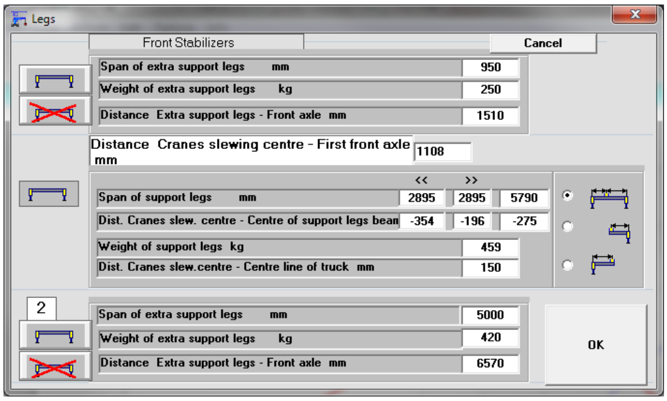


Here You can make changes to Lifting capacity, outreach, weights and COG-point of the crane.



For changing Stabilizer legs data click on the **Legs**-button.

Here You can make modifications to all support leg data.

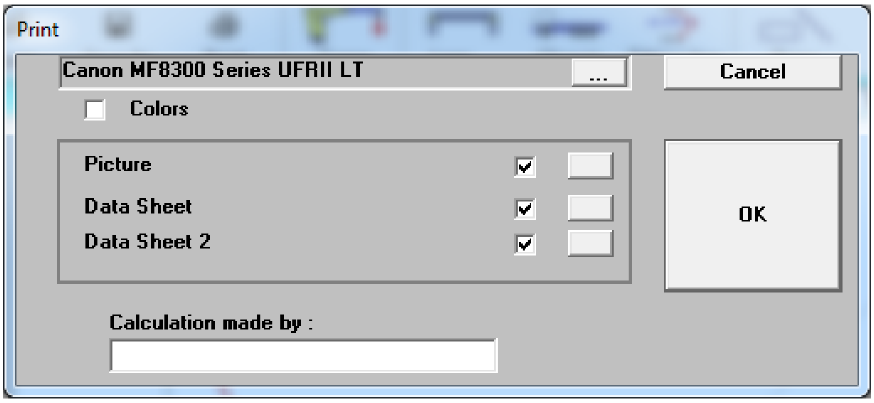


Note that these changes will not be saved back into TrailerWIN, You must save this CraneWIN calculation separately to a CraneWIN file.

Printing in CraneWIN

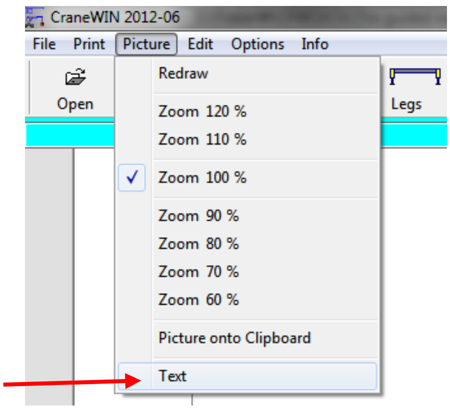
When you have finished the calculation you can print out the stability chart and stability calculation.

To do this, choose print from Menu.



You can choose to print all pages or select a part of the calculation.

You can preview the text-page before printing by selecting **Picture-Text** from the menu.



This is the same information that will be printed out on printer.

On the next page you can see a part of the text as a print out. You can see that all calculations are presented here to help checking the calculation.

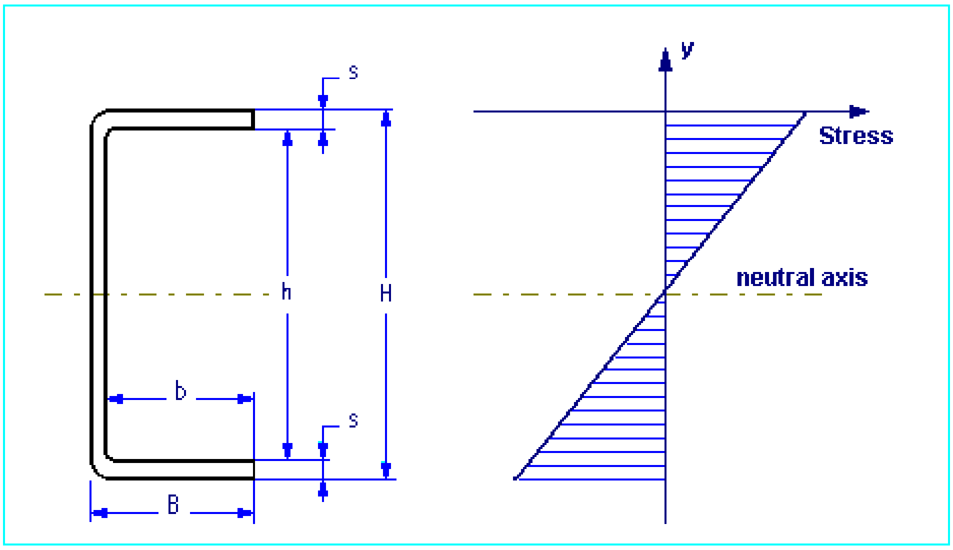
```
---------------------------------------------------------------------------------
Distance  Cranes slewing centre - First front axle   mm    1108
Crane weight                                        kg    2620
Dist. Cranes slew. centre - COG of crane at max outreach
                                                   mm    1940
Outreach                                            mm    10200
Lifting capacity                                   kg    1980
Chassis weight  Front axle                          kg    4576
Chassis weight  Rear axle                           kg    4181
Dist. Cranes slew.centre - Centre line of truck     mm    150
Dist. Cranes slew. centre - Centre of support legs beam
                                                   mm  < = -354
                                                                 > = -196
Span of support legs                                mm    5790
Weight of support legs                              kg    459
Distance  Extra support legs - Front axle           mm    6570
Span of extra support legs                          mm    5000
Weight of extra support legs                        kg    420
Front Stabilizers         :
Distance  Extra support legs - Front axle           mm    -1510
Span of extra support legs                          mm    950
Weight of extra support legs                        kg    250
Distance  Front axle - Rear axle support point      mm    4841
Track front axle                                    mm    2000
Track  Rear axle                                    mm    1800

---------------------------------------------------------------------------------
CRANES STABILITY CALCULATION   (Measures from tilting line)
---------------------------------------------------------------------------------
---------------------------------------------------------------------------------
Rearwards right
                                                   kg x     m =       kgm
---------------------------------------------------------------------------------
Chassis weight  Front axle                         4576 x   2.951 =    13506
Chassis weight  Rear axle                          4181 x   2.614 =    10931
Weight of support legs                              459 x   2.893 =    1328
Weight of extra support legs                        420 x   2.494 =    1047
Front Stabilizers                                  250 x   3.057 =    764
Crane weight                                       2620 x   0.785 =    2056
---------------------------------------------------------------------------------
Stabilizing moment                                          Sum = 29632
---------------------------------------------------------------------------------
Load * Max outreach                                 1980 x   7.475 =    14801
---------------------------------------------------------------------------------
Tilting moment                                              Sum = 14801
---------------------------------------------------------------------------------
Stability factor  n                                29632 / 14801 =  2.00
---------------------------------------------------------------------------------
Maximum load   1980 kg
---------------------------------------------------------------------------------


---------------------------------------------------------------------------------
---------------------------------------------------------------------------------
Forwards right
                                                   kg x     m =       kgm
---------------------------------------------------------------------------------
Chassis weight  Front axle                         4576 x   1.403 =    6422
Chassis weight  Rear axle                          4181 x   4.825 =    20173
Weight of support legs                              459 x   1.992 =    914
Weight of extra support legs                        420 x   6.047 =    2540
Front Stabilizers                                  250 x   0.336 =    84
Crane weight                                       2620 x   0.140 =    368
---------------------------------------------------------------------------------
```

SUBFRAME CALCULATION IN FRAMEWIN THEORY

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:

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

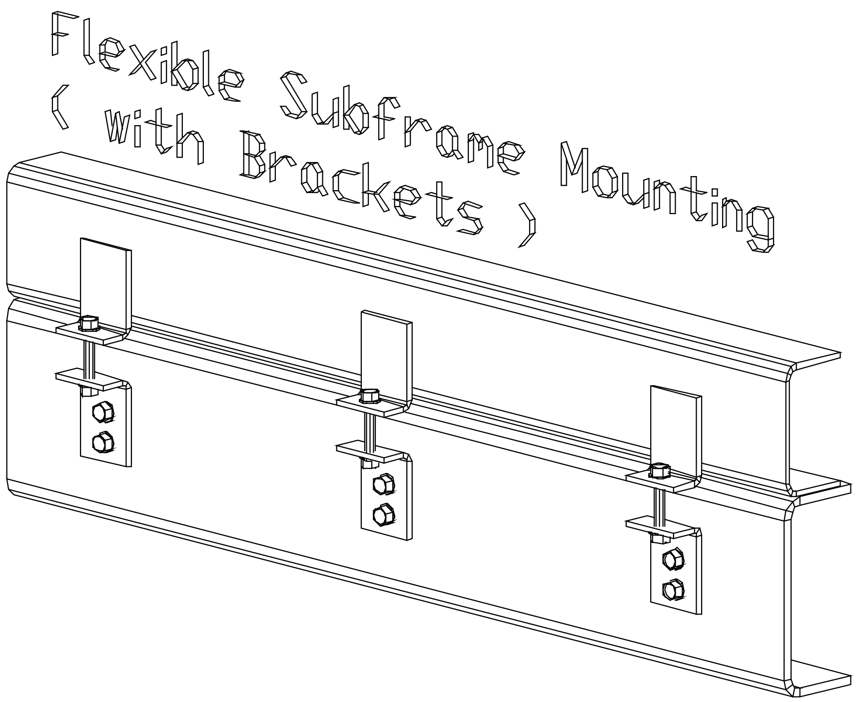
$$W_x = \frac{I_x}{H/2} = \frac{I_x\,2}{H}$$

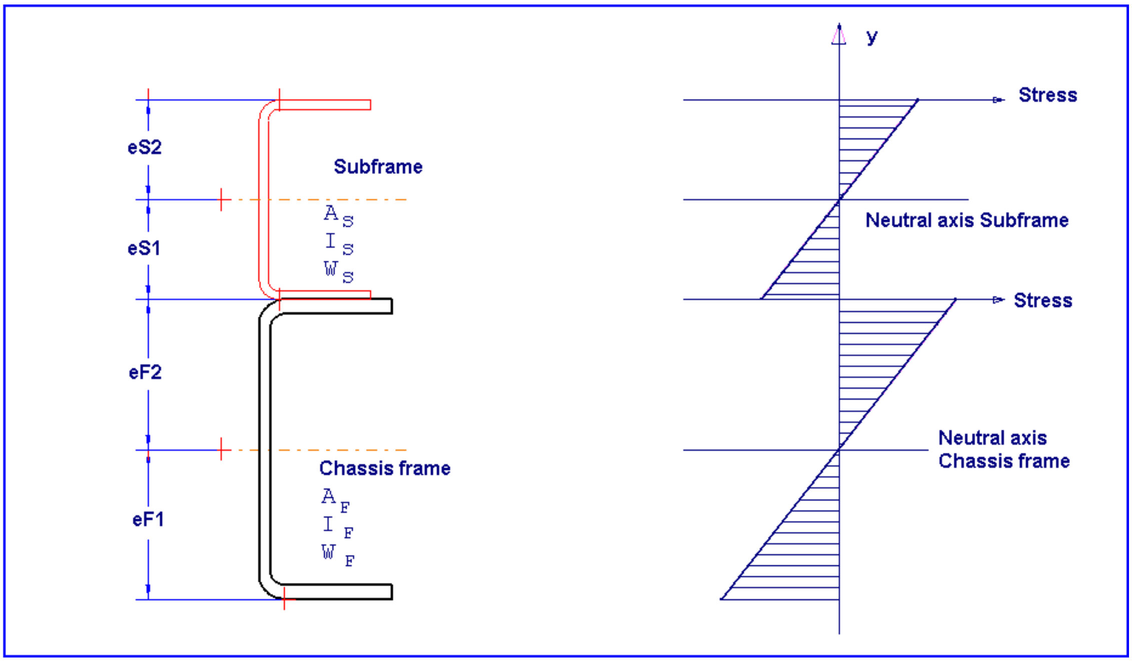
COMBINED BEAM : Chassis Frame + Subframe

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:

$$I_C = I_F + I_S$$

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

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

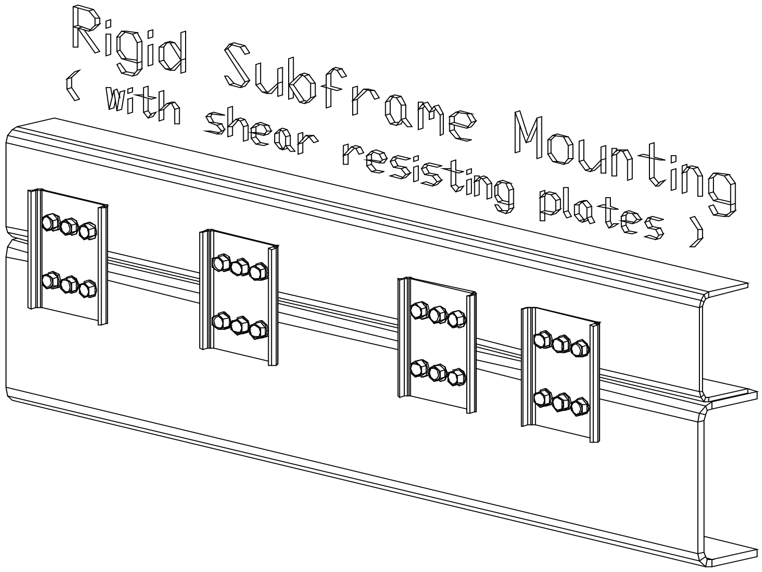
$$\sigma_{F1} = \frac{M\ e_{F1}}{I_C} \qquad \text{on chassis frame lower fibers}$$

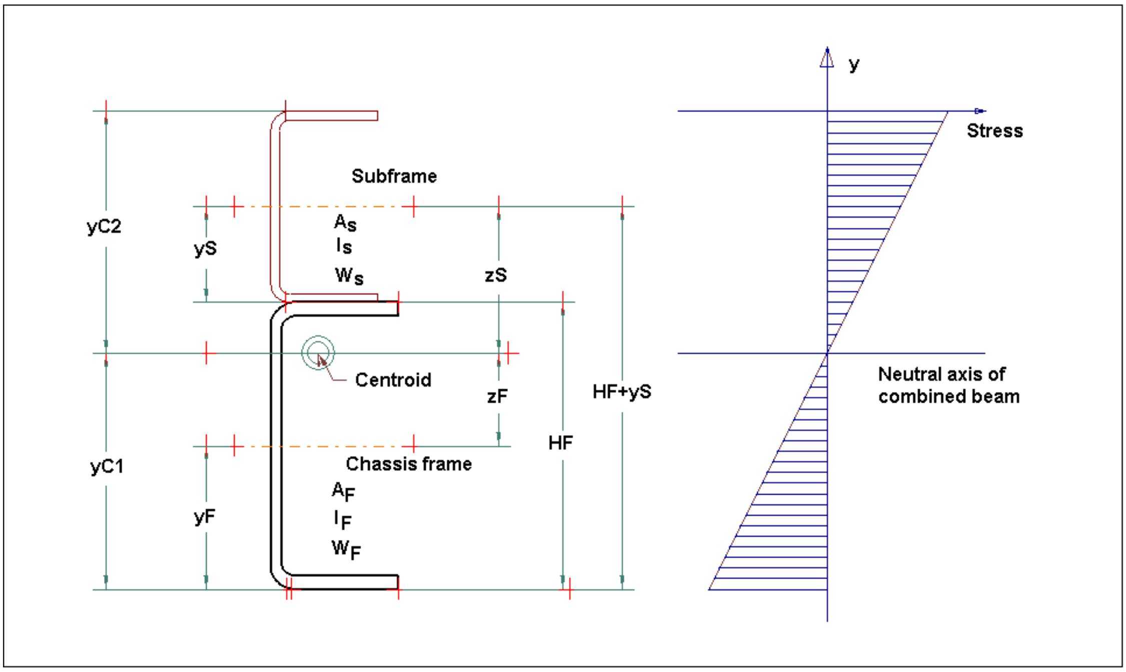
$$\sigma_{F2} = \frac{M\ e_{F2}}{I_C} \qquad \text{on chassis frame upper fibers}$$

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

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

Rigid mounting : subframe mounted with shear resisting plates





With a rigid mounting the calculation of $\boldsymbol{I_x}$ and $\boldsymbol{W_x}$ for a combined beam turns out to be more complicated :

At first we have to calculate the centroid (Center of gravity) $\boldsymbol{y_C}$ for the combined cross-section. With dimension $\boldsymbol{y_C}$ we calculate $\boldsymbol{z_F}$ and $\boldsymbol{z_S}$ and then the second moment of combined cross-section $\boldsymbol{I_C}$ and the section modulus for the combined cross-section $\boldsymbol{W_C}$.

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

$$z_F = y_C - y_F$$

$$z_S = H_F + y_S - y_C$$

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

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

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:

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

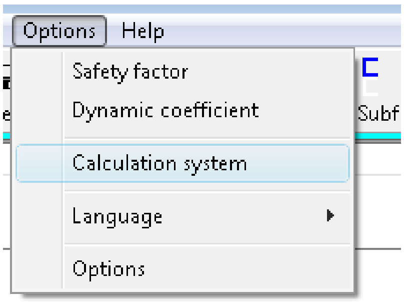
$$\sigma = calculated \quad stress$$

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 the calculation method.

Choosing new calculation system EN12999 in FrameWIN



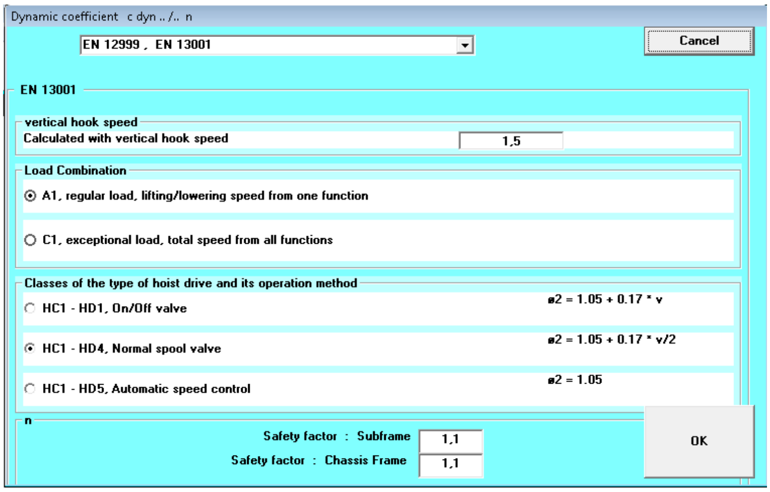
In FrameWIN You can choose calculation system for dynamic forces. By choosing Options->Calculation system or by clicking on Dynamic coefficient-button on menu.

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

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

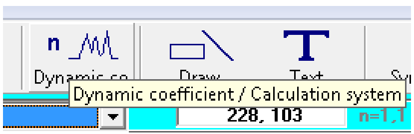
The calculation is made for mobile cranes, Hoist Class 1 (HC1).

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

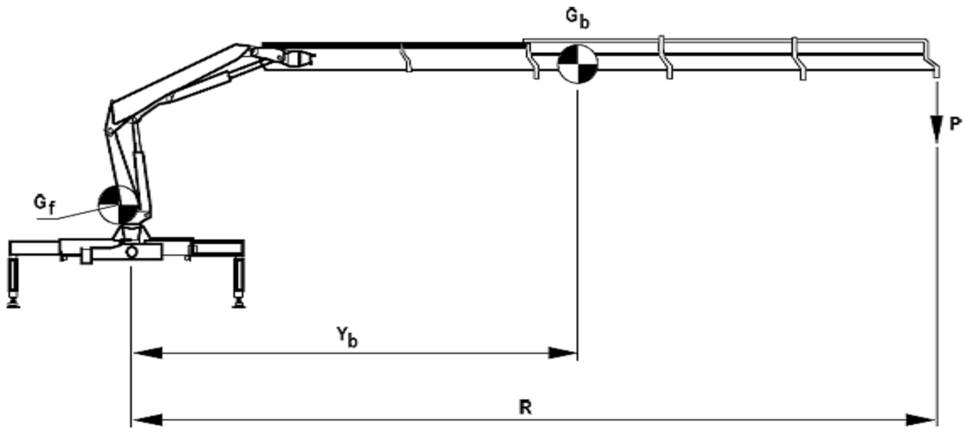


About calculation system EN12999/EN13001

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 flexible mounted cranes. (HC2 is for rigidly mounted cranes)
From options window You can make the 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

$$\frac{(\gamma_{p1}\,\Phi_2\,P\,R\;+\;\gamma_{p2}\,\Phi_1\,G_b\,Y_b)}{W}\,g = \frac{\sigma a}{\gamma_m}$$

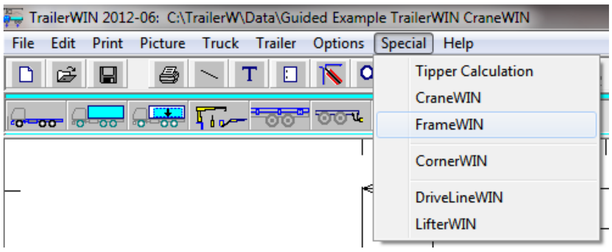
Symbols and coefficients

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

FrameWIN Subframe calculation for Guided Example

Now when we have done the Stability calculation we can build up a Subframe with FrameWIN.

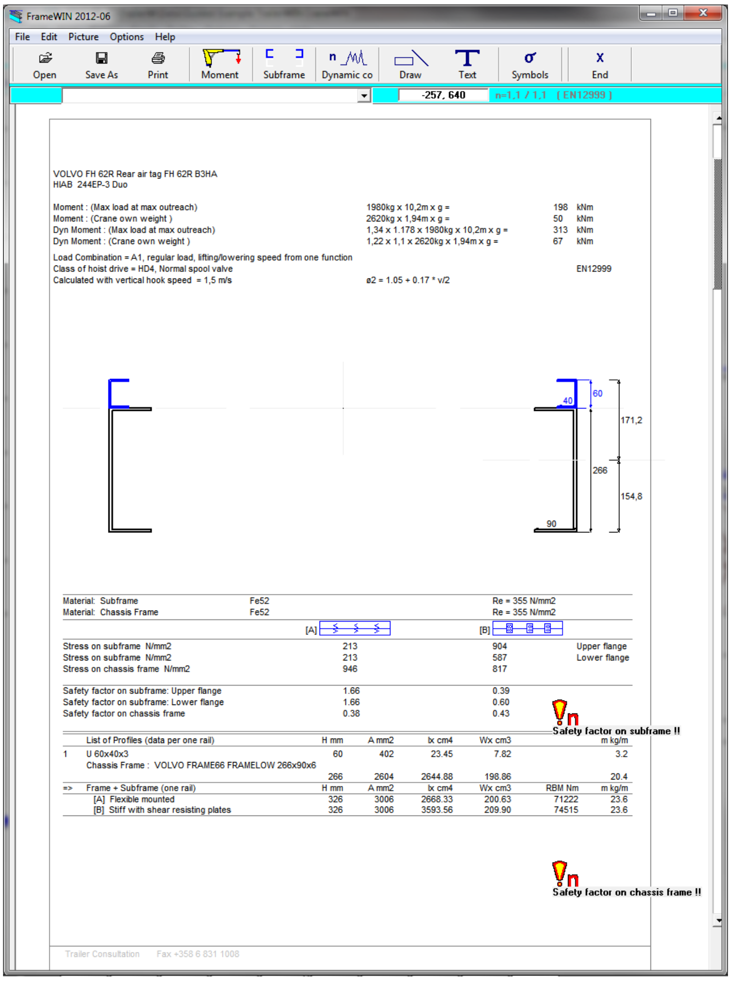
From TrailerWIN click on Menu **Special – FrameWIN**



When FrameWIN starts You will see a picture with Truck Frame and a small beam as Subframe:

The calculation is based on the Crane capacity selected in TrailerWIN.

First thing is to make correct selection for the Truck Chassis Frame. Program does not know which Frame is on the chassis and it chooses only first selection from the manufacturers list.



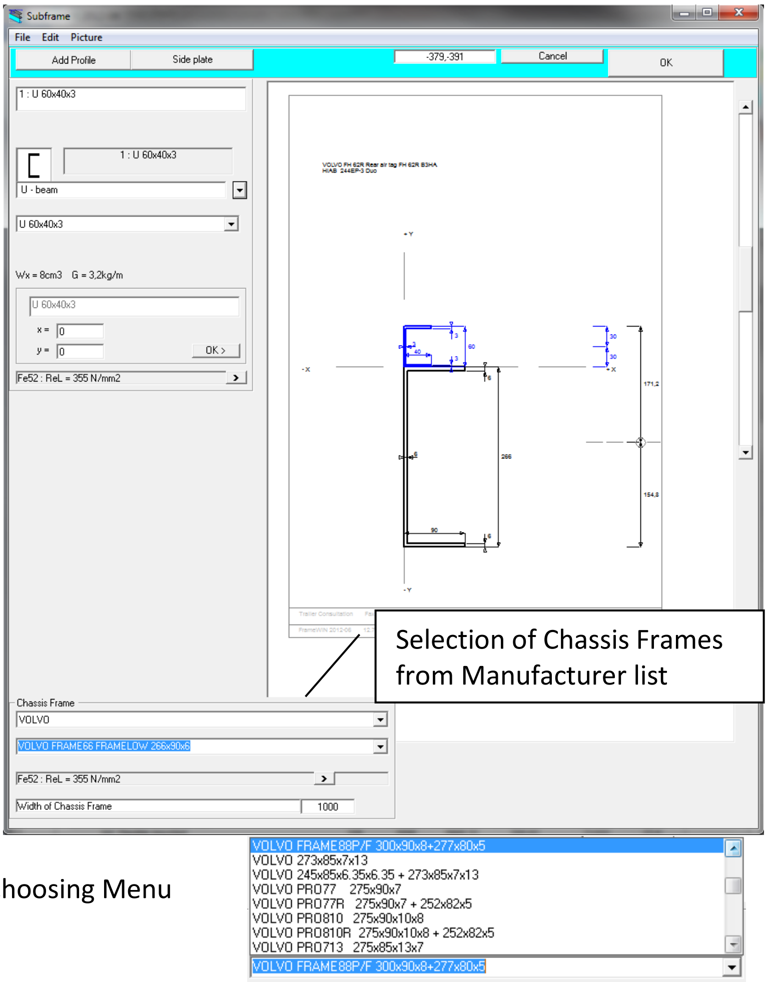
Click in Menu: **Edit – Chassis Frame**

In the lower left corner You see 2 listboxes, one for Manufacturer and second list for models.

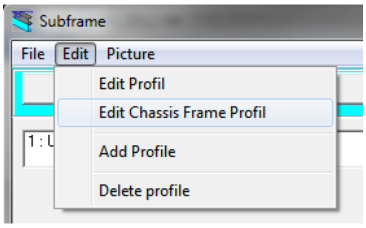
These lists are not complete and other options might be available.

In this window the measurement between the subframe-beams can also be edited.

In this window select frame **Volvo FRAME88P/F 300x90x8+277x80x5**

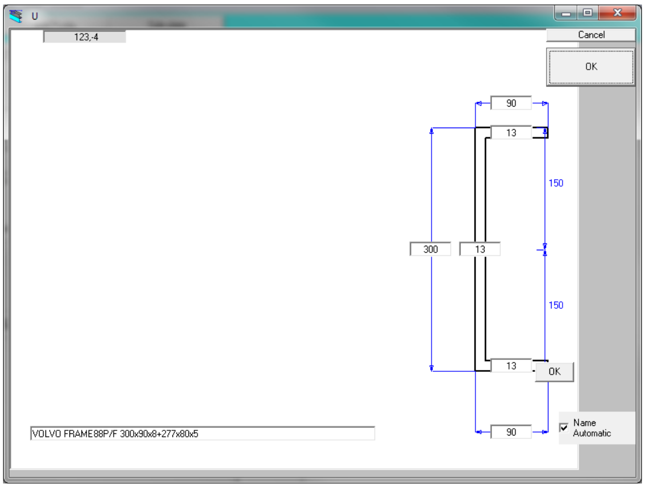


The profiles can also be edited by choosing Menu **Edit – Edit Chassis Frame Profil**



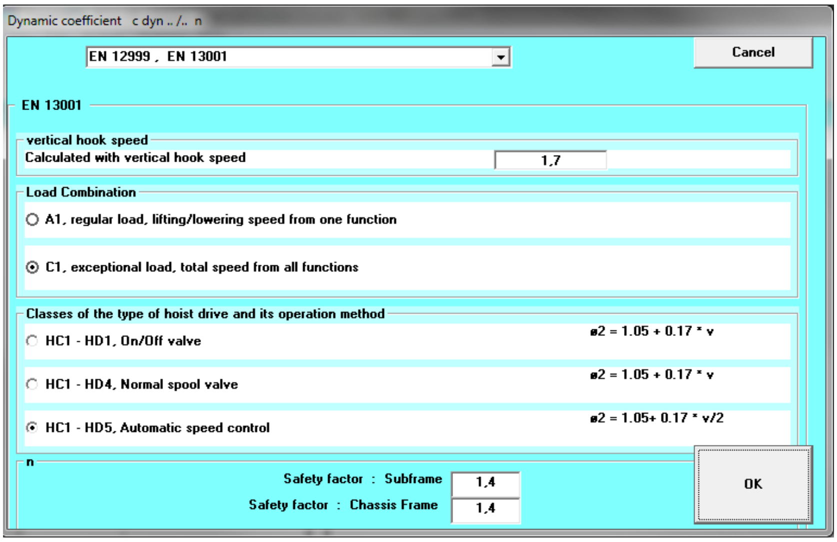
The measures of the profile can then be edited in a graphics view of the Frame profile:

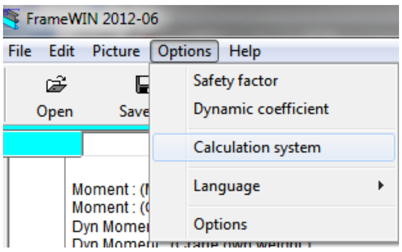
The subframe profiles can be edited the same way by first selecting one of the added profiles and choosing menu **Edit- Edit Profile.**



Now we go to Calculation Method and choose EN12999, EN 13001 Calculation system.

Click on Menu **Options – Calculation System**

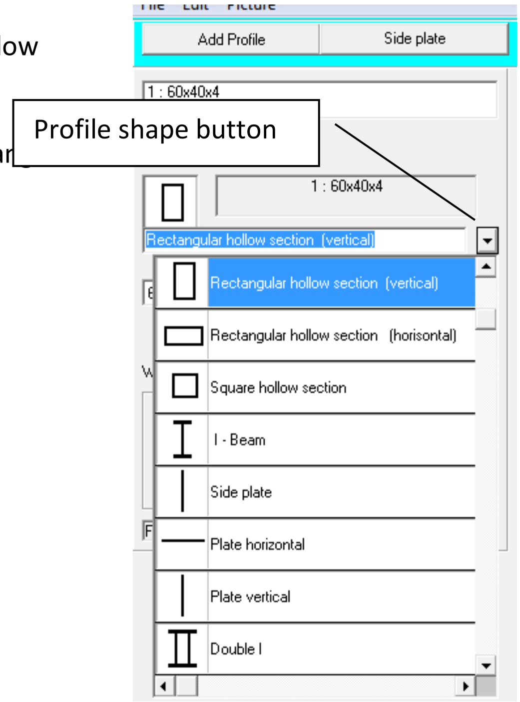




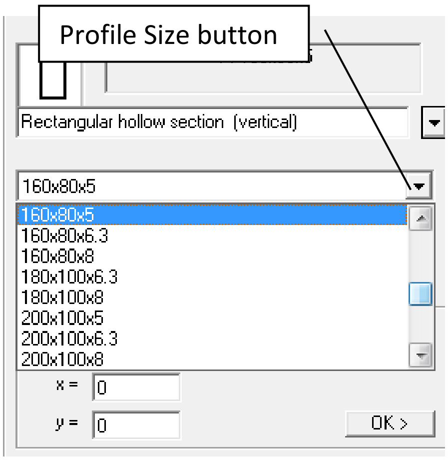
The window will then show data used for calculating Dynamic forces of the crane.
In this case we will choose **C1** for Load Combination- Exceptional load and **HC1-HD5** Automatic Speed Control. The vertical hook speed we change to **1.7** and the safety Factor to **1.4.**
Click **Ok.**

Next we will change the option for Subframe to a hollow section beam:

Click on the Profile shape-button and select the Rectan hollow section (Vertical).



Choose profile 160x80x5 from profile Size list.

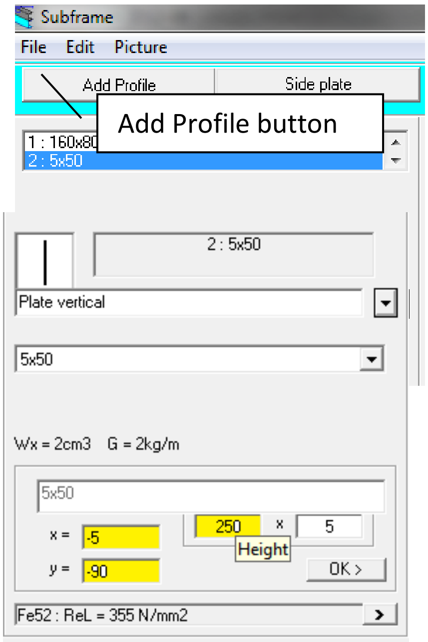


Click **Ok** and go back to main-window.

We go on adding a vertical plate between the Chassis frame and Subframe

Choose **Add Profile – Plate Vertical**
Modify the x-placement to -5 so it will go outside the Chassis Frame and Subframe.

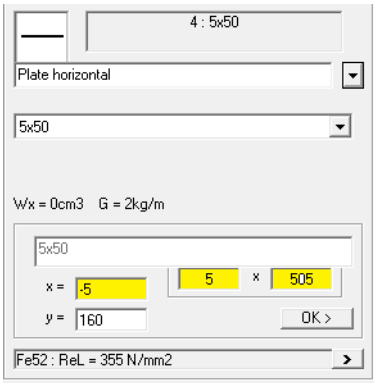
Modify the height of the plate to 250 and move the plate so it will reach the top of the subframe by changing the y measure to -90.



We can now see that on Flexible mounting the safety factor on Chassis Frame is 1.27 but if we use a Fixed mounting we can reach a safety factor of 1.81.

Material: Subframe	Fe52	Re = 355 N/mm2	
Material: Chassis Frame	Fe52	Re = 355 N/mm2	
	[A]	[B]	
Stress on subframe N/mm2	178	196	Upper flange
Stress on subframe N/mm2	286	17	Lower flange
Stress on chassis frame N/mm2	279	197	
Safety factor on subframe: Upper flange	1.99	1.81	
Safety factor on subframe: Lower flange	1.24	20.37	
Safety factor on chassis frame	1.27	1.81	

We continue adding more profiles. We now add a horizontal plate on top of subframe that fills up the gap between the frame-beams.



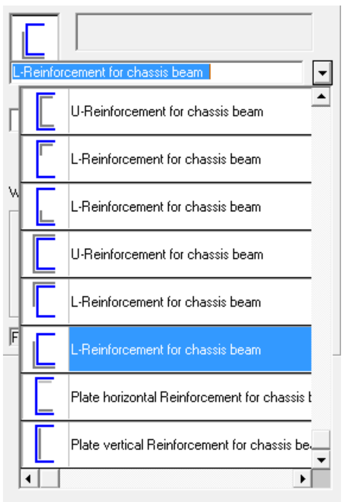
Click on **Subframe button** or Menu **Edit-Subframe**

Then click **Add Profile** –button

Choose Plate horizontal plate

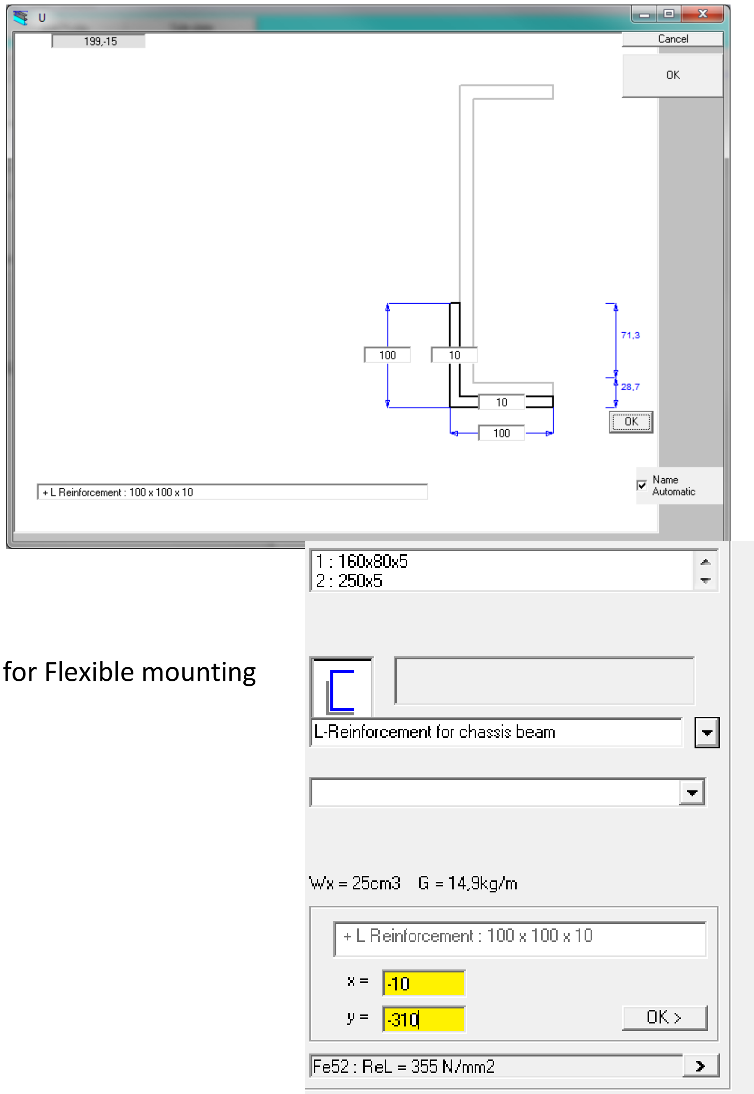
Modify the measures, width to **500** and placement of the sideplate in x-direction to **-5**
Here we must notice that the width of the horizontal plate has to be set to **MIDPOINT OF TRUCK**
.

Now when we reinforced to top of the subframe we will get more force on lower part of the subframe. Instead of reinforcing the lower flange of subframe we can choose to reinforce the Truck frame on the bottom instead by inserting a L-reinforcement outside lower part of Truck frame.



Choose **Add profile - L-Reinforcement for Chassis beam.**

Next window shows the profile of the reinforcement. Here we modify the reinforcement to add more strength to the lower part of frame by modifying the measures as follows:

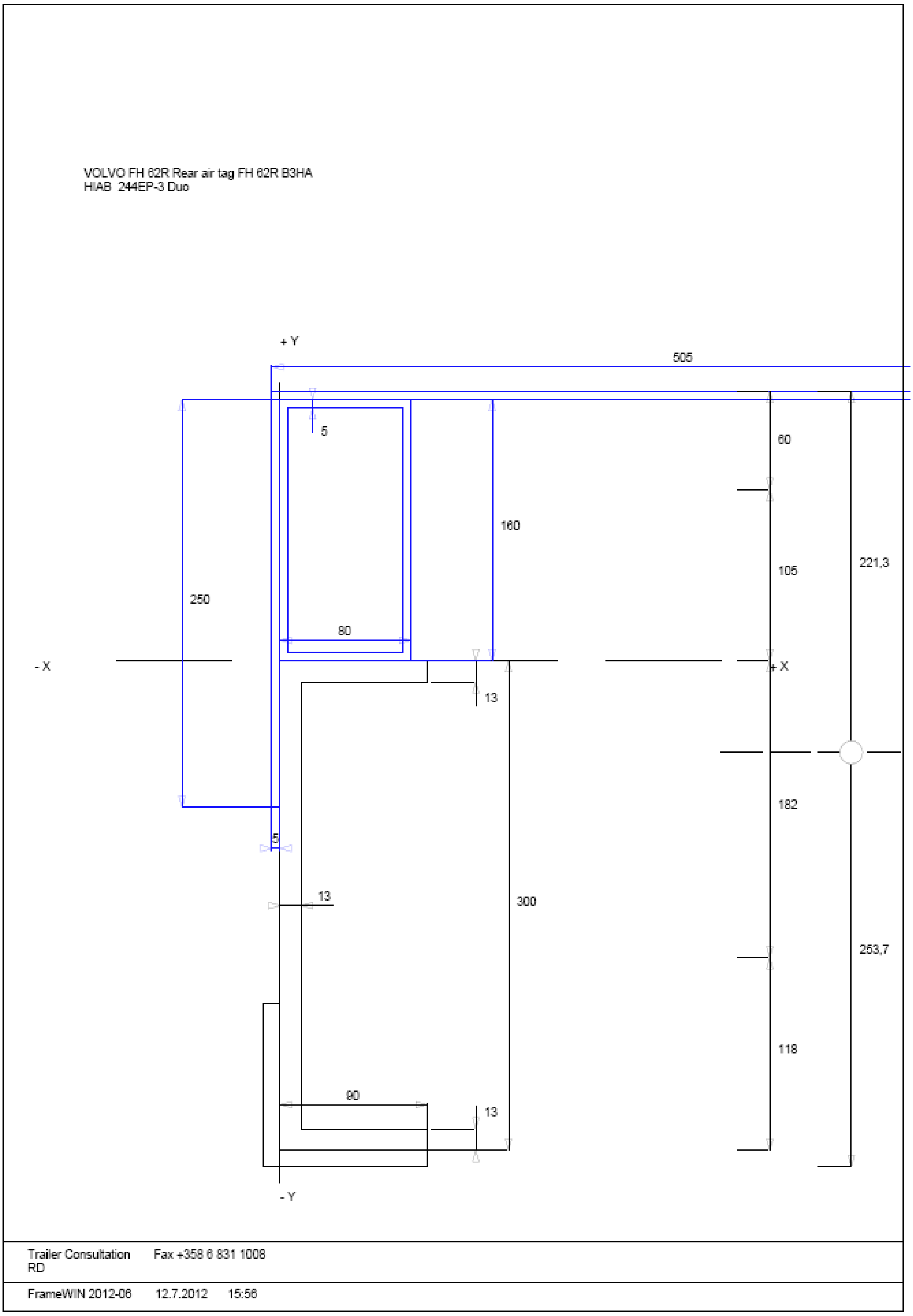


Now we must change the x- and y-measures to get the reinforcement to outside of Chassis frame. Change x-measure to **-10** and y-measure to **-310.**

Click the small **Ok-button.**

Now we have a good safety factor for Flexible mounting also.

When Printing You will get two pages. First page a detailed drawing of the Subframe:

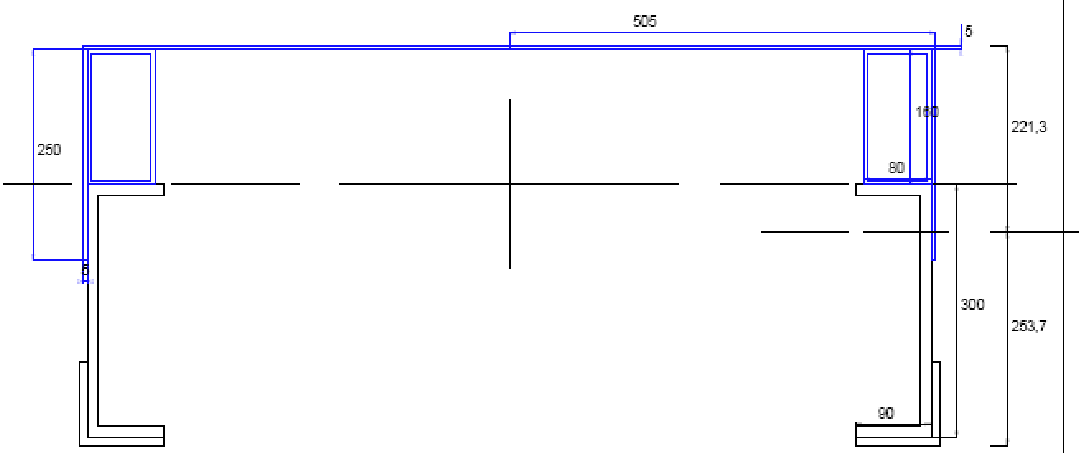


On the other page You will get details about the calculation as seen on screen:

VOLVO FH 62R Rear air tag FH 62R B3HA
HIAB 244EP-3 Duo

Moment : (Max load at max outreach)	1980kg x 10,2m x g =	198	kNm
Moment : (Crane own weight)	2620kg x 1,94m x g =	50	kNm
Dyn Moment : (Max load at max outreach)	1,1 x 1.194 x 1980kg x 10,2m x g =	260	kNm
Dyn Moment : (Crane own weight)	1,1 x 1,1 x 2620kg x 1,94m x g =	60	kNm

Load Combination = C1, exceptional load, total speed from all functions
Class of hoist drive = HD5, Automatic speed control EN12999
Calculated with vertical hook speed = 1,7 m/s ø2 = 1.05 + 0.17 * v/2



Material: Subframe	Fe52	Re = 355 N/mm2	
Material: Chassis Frame	Fe52	Re = 355 N/mm2	
	[A]	[B]	
Stress on subframe N/mm2	76	87	Upper flange
Stress on subframe N/mm2	246	13	Lower flange
Stress on chassis frame N/mm2	189	100	
Safety factor on subframe: Upper flange	4.69	4.09	
Safety factor on subframe: Lower flange	1.44	26.87	
Safety factor on chassis frame	1.88	3.57	

	List of Profiles (data per one rail)	H mm	A mm2	Ix cm4	Wx cm3		m kg/m
1	160x80x5	160	2300	761.92	95.24		18.1
2	250x5	250	1250	651.04	52.08		9.8
4	5x505	5	2525	0.53	2.10		19.8
=>	Subframe Profiles together	255	6075	3004.56	154.06		47.7
	Chassis Frame : VOLVO FRAME88P/F 300x90x8+277x80x5						
		300	5902	7050.39	470.03		46.3
5	+ L Reinforcement : 100 x 100 x 10	100	1900	180.00	25.24		14.9
=>	Chassis Frame total	310	7802	9708.85	505.72		61.2
=>	Frame + Subframe (one rail)	H mm	A mm2	Ix cm4	Wx cm3	RBM Nm	m kg/m
	[A] Flexible mounted	475	13877	12713.41	651.87	231413	108.9
	[B] Stiff with shear resisting plates	475	13877	40848.63	1610.33	571666	108.9

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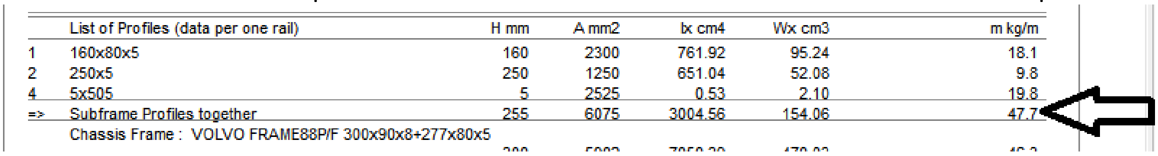
Adding the subframe in TrailerWIN calculation

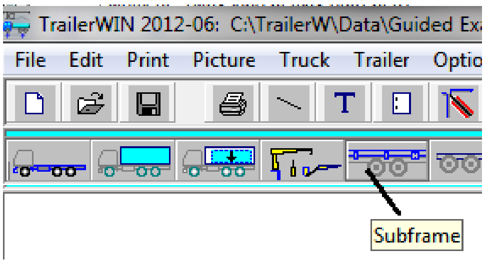
Now when we have built up the subframe we can read the mass of the subframe in Outprint:



	List of Profiles (data per one rail)	H mm	A mm2	Ix cm4	Wx cm3	m kg/m
1	160x80x5	160	2300	761.92	95.24	18.1
2	250x5	250	1250	651.04	52.08	9.8
4	5x505	5	2525	0.53	2.10	19.8
=>	Subframe Profiles together	255	6075	3004.56	154.06	47.7
	Chassis Frame : VOLVO FRAME88P/F 300x90x8+277x80x5					

This calculation is purely based on the kg/m mass of different beams and gives You only rough weight data. In this case the subframe mass is calculated as 47.7 kg/m. We will use a value of 50 kg/m in TrailerWIN.

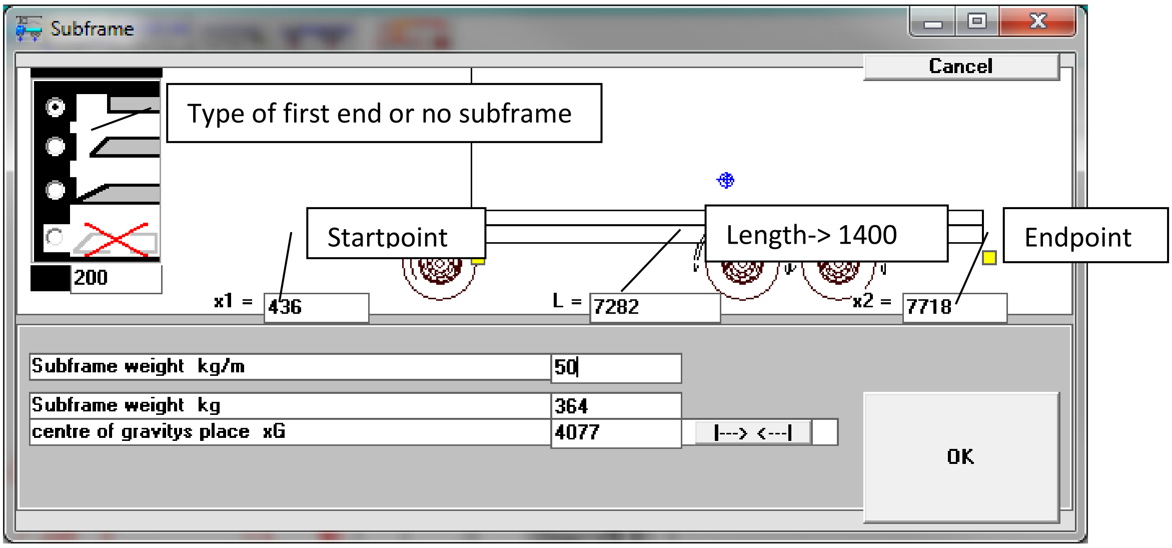
Go back to the TrailerWIN calculation and select **Subframe** button:



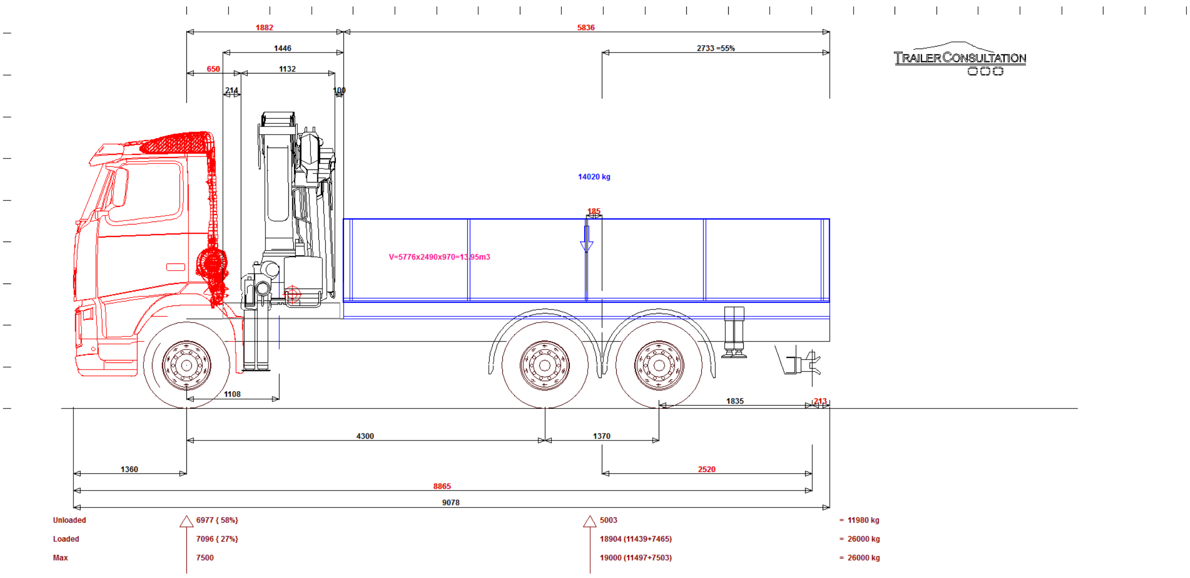
In this window You can now make selections for Subframe. First we choose the type of front-end by choosing the radio-buttons:

Then we can use our value for weight of subframe in kg/m or we can use a total Subframe weight in the next textbox.
Then we can change start- and endpoint of subframe by entering x1- and x2-values or by giving a length (L). You can also use mouse and drag the yellow boxes to modify length.

Here we use the first option and modify the length of the subframe to **1400**mm in the box "L=".



The Subframe is now shown as a gray rectangle below the crane in the big picture:



On the text-page we can also verify that all equipments are listed in the weight calculation:

	x CoG	Fa	Ra	Total
+ Chassis weight		4776	2960	7736
+ number of persons 1 x 75 kg	0	75	0	75
+ body weight 86 kg/m	4800	4	496	500
+ Subframe weight 50 kg/m	1136	54	16	70
1 HIAB 244EP-3 Duo	1268	2273	806	3079
2 MAXISTAB 3 EHA/S	6570	-150	570	420
3 __ 950	-1510	328	-78	250
+ Towing coupling	7505	-55	155	100
= weights unloaded :		7305	4925	12230
+ carrying capacity	4800	117	13653	13770
= Weights loaded :		7421	18579	26000
:: Gross Vehicle Weight		7500	19000	26000

This Guided example is only for learning use of the programs and shall not be used as a good practice of assembling Crane to a chassis. The subframe profile is only for practicing program use and must not be used as a model for good design of subframe.

For more information please use the Manuals in PDF-format in TrailerWIN/Manual-directory.

