

Tutorial

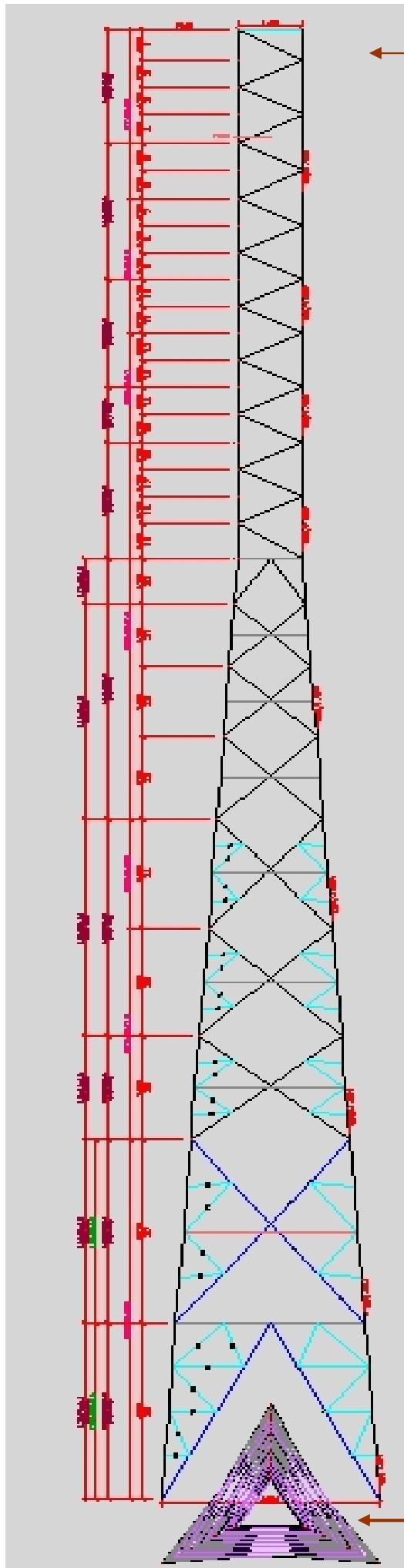
Verification of an existing tower

This document focuses mainly on the advantages of using SmLoader.

This is not a complete user manual but merely a general guide to ease the use of the software.

It is also advised to read the document User Guide (found on the Support page of the site). This document contains useful information leading to a better understanding of all the options throughout the SmLoader.

Below we shall accompany the process used to generate the parameters for an existing structure of which we have a linear drawing and we need to submit the same for verification using XVerauto.



General View of the Tower.

The sketch shows an existing 41 meter high tower for which the client has requested to verify if it will support a certain number of additional antennas.

In order to simplify the explanations, we have chosen a rather simple model having all parameters indicated on the sketch.

The dimensions on this sketch are not readable as we want to view the entire tower on one page. However, below, at page 6, we shall look in detail at the different parts of the structure. It will then be possible to read all the necessary information on the drawing.

This drawing will be used to supply all the data required by the SmLoader software to generate the data files to be processed by XVerauto for verification / validation of the structure.

The existing antennas - not shown on the drawing – are:

At 40 meters

3 SMSC Amps, wind exposed area 1.16 m^2 weighing 87 kg.
 3 SMSC Amps, wind exposed area 1.16 m^2 weighing 87 kg.
 2 solid Dishes of 0.60 m diameter each weighing 32 kg.

At 39 meters

3 SMSC Amps, wind exposed area 1.16 m^2 weighing 87 kg.
 3 SMSC Amps, wind exposed area 1.16 m^2 weighing 87 kg.
 1 Yagi YL4-300, wind exposed area 1.70 m^2 weighing 66 kg.

1 $\varnothing 1.80 \text{ m}$ Dish at 7.20 m, direction 9° , weighing 160 kg
 1 $\varnothing 1.80 \text{ m}$ Dish at 4.20 m, direction 9° , weighing 160 kg

The Lines are all standard.

We can assume two $\varnothing 100\text{mm}$ cables for each 1.80m dish, two $\varnothing 13\text{mm}$ for the 0.60m dish and one $\varnothing 22\text{mm}$ for each UHF antenna.

The client would like to add :

At 37 meters

1 $\varnothing 1.40\text{m}$ Dish, direction 122° , weighing 120 kg
 1 $\varnothing 1.40\text{m}$ Dish, direction 232° , weighing 120 kg

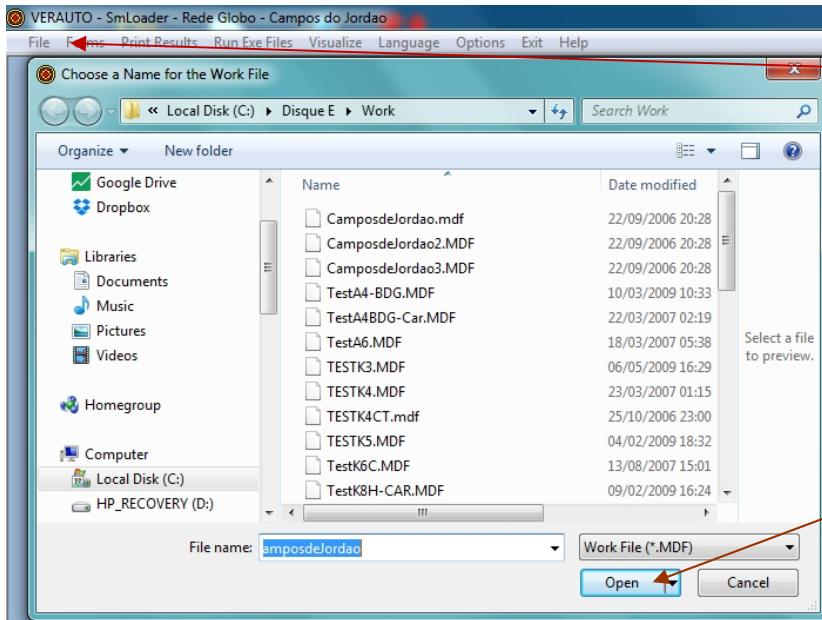
At 35 meters

1 $\varnothing 1.40\text{m}$ Dish, direction 122° , weighing 120 kg
 1 $\varnothing 1.40\text{m}$ Dish, direction 232° , weighing 120 kg

The above antennas will have one 100 mm feed line per antenna.

Vertical projection of the structure – Top View

We start by looking in the computer's library for a tower whose design we know is close to this one.



displayed with the title of the structure.

Then we run SmLoader.exe and click on File.

A drop-down menu opens with :

Open
New
Save As
Exit

The Open option shows the dialog box on the left and we selected the (.MDF) file for the tower at Campos de Jordão which is a 40m high triangular tower.

Click on Open to read the file and save the data on the SmLoader database.

After reading the file, the first dialog is

The title can now be changed by the user to any name for the new structure. This new structure will be created using the base structure we chose in the "File | Open" dialog.

Further on we shall see how this choice will prove to be a real time saver.

Here we see the modified dialog with the title of the new structure and the full name and location of the new data file. Note that the creation date has been modified accordingly.

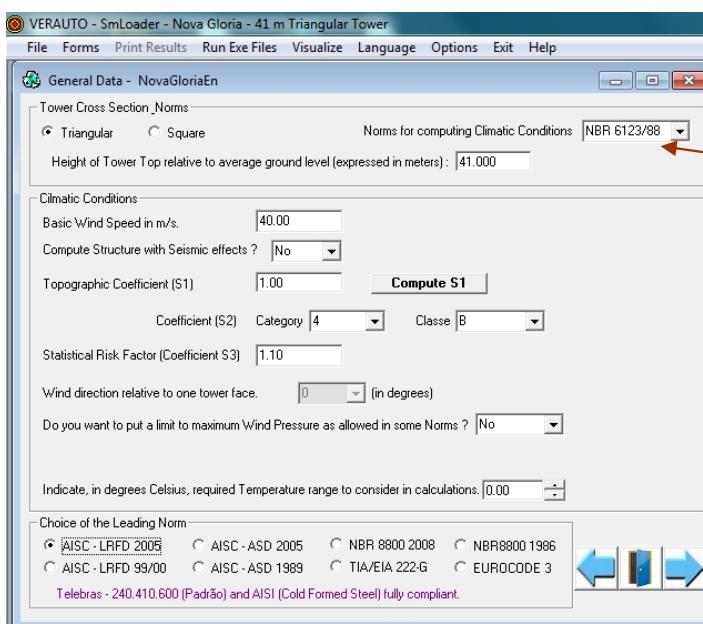
Click on the blue arrow to proceed to the next window.

This new window is discussed in the document « Choose Climatic Conditions » found among the list of tutorials.

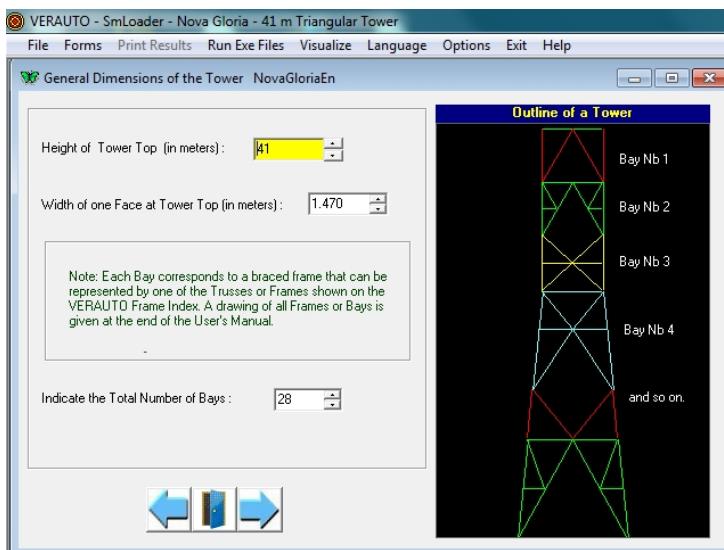
Please note that the selected Climatic Norm is the Brazilian one where the appropriate topographic, statistic, category and class factors specified in the Norm have been selected and informed by the user.

The drag coefficients for computing the wind load on the structure, according to the chosen Norm, are provided in the software. The same applies to all other variables specified by the selected Norm and no action is required from the operator to provide them.

Here the specifications of the client do not expect a temperature range but the use of the AISC LRFD 2005 Norm for verification of stability.



Let us now proceed to the next window by clicking on the right arrow at the bottom of this one. All Data will be automatically saved to the data Base.

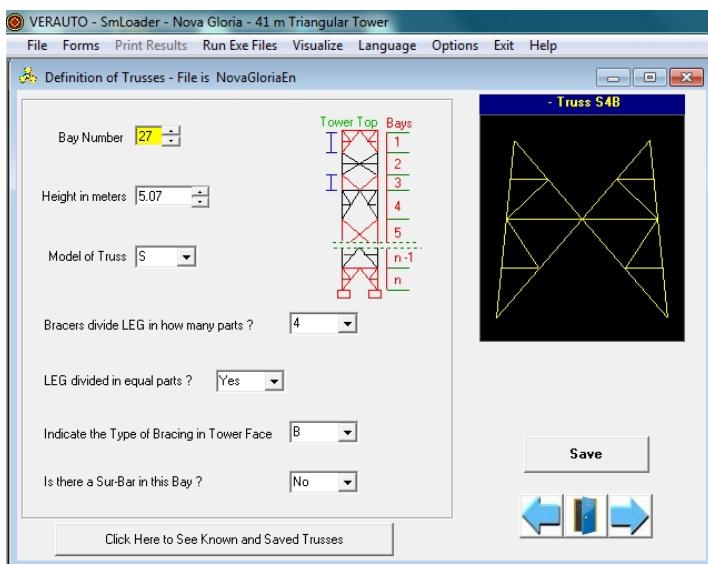


Here we will specify the general dimensions of the structure including the number of bays. (28)

The height of the Top of the Tower is not the height of the tower if the latter is on an elevated base like a building.

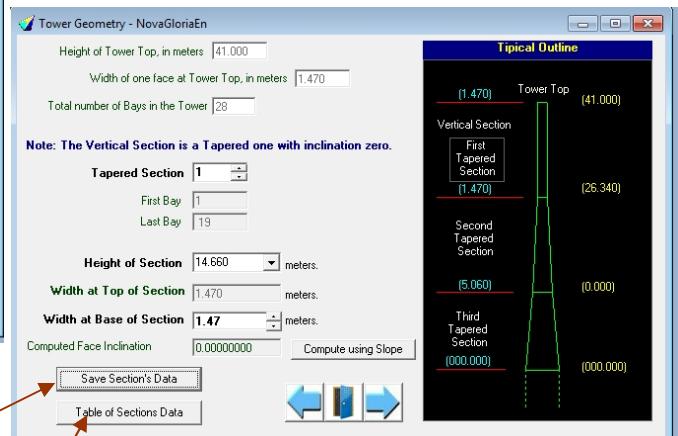
The line drawing of the profile of the tower is shown to remind the user that the bays are numbered from the top down and also indicate what is meant by the term "Bay" in SmLoader.

Let us move to the next window using the right arrow. The left one will move back to the previous window.

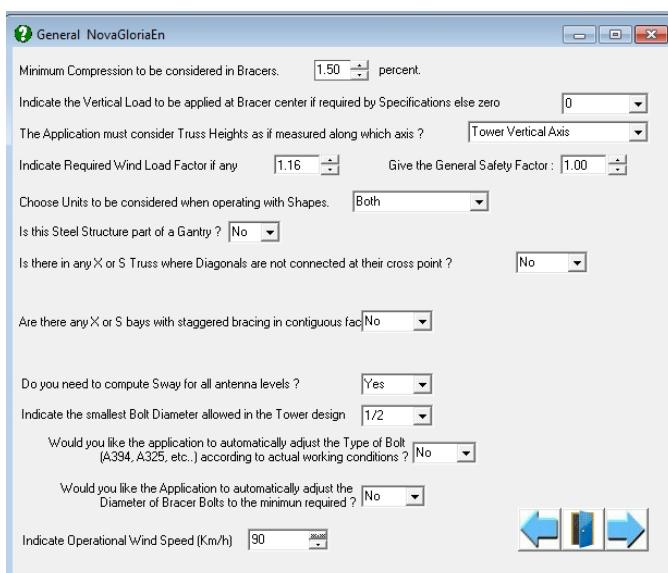


The window on the left is discussed in detail on the tutorial **Change or Modify Bays** found on the Support page of the website.

We will therefore proceed to the next window by clicking the right arrow.

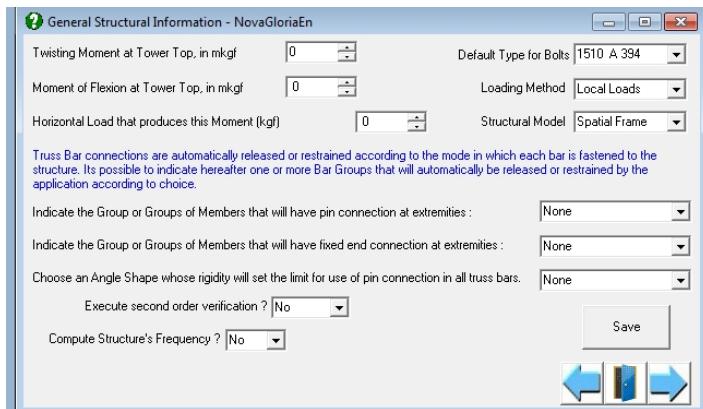


We use this dialog to define the slopes of the faces of the structure. We only need to provide the module's height and base width. The software automatically calculates the slopes. A button is provided to display a table with the widths and slopes for each bay of the structure – thus making it easy to check the data for the whole structure.



On the window at left, you will specify the safety coefficients, the system of units for specifying profiles, several choices for presentation of the results and the operational wind speed. Moving the cursor over the different input boxes brings up tips giving an indication of the data to be supplied.

Other information concerning the lattice modules or bays may be given to instruct the application on what to do, for example, on the state of diagonals in specific X frames, the axis on which the vertical dimensions will be specified and even the weight that must be supported by horizontal bracers during maintenance of the structure.



This new window offers the choice for the calculation method (Spatial Frame suggested) then indicate the current type of bolts, the loads acting over the top of the structure with their influence thereon, the type of connection (free or restrained) at the extremities of several members and even the choice to compute or not the frequency of the structure.

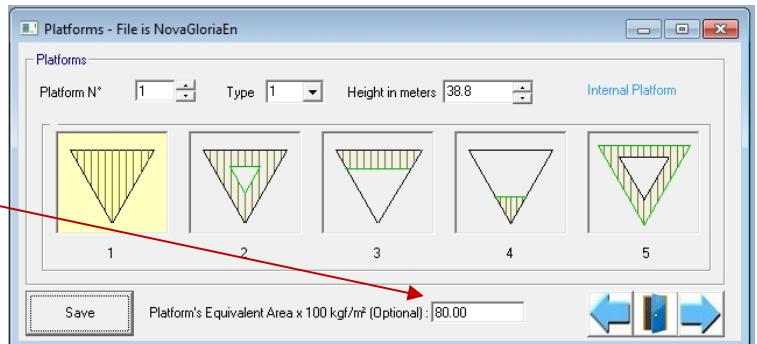
Two loading methods are available (local or distributed loads). The application will automatically adjust the calculations to the requested method.

A click on the blue arrow takes us to the next window relative to Platforms.

Here the selection is done helped by sketches and one may indicate the equivalent area of the platform or let the software compute it.

Moving to the next Window, always using our blue arrows, we reach the specification for Ladders and Platforms. (just below)

Here we have the choice to use the diagrams to help find out the average wind exposed area of ladder and lines.

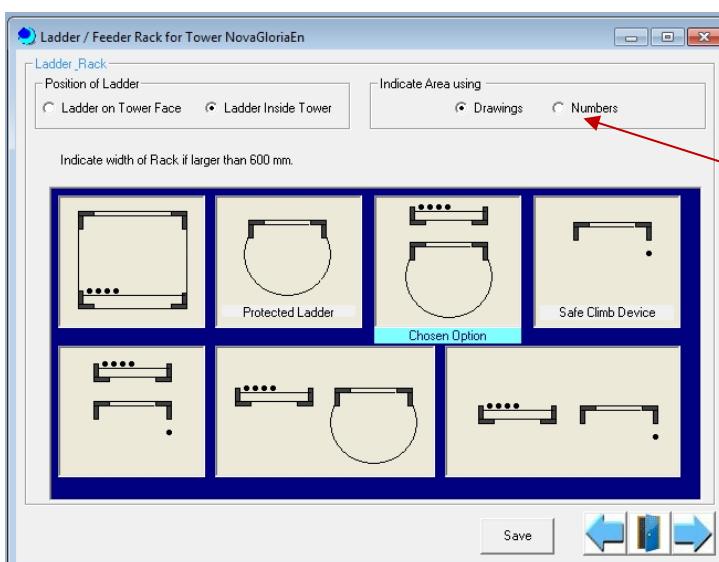


The number of lines, wave guide or coaxial cables, will be specified in the Antenna dialog window. In this window we will just inform their position with respect to the main ladder.

There is an option to specify the load values by linear meter corresponding to the vertical ladder and racks..

Always using our blue arrow, the next window will come up with the scheme to inform about the vertical members also known as LEG MEMBERS.

That window is fully discussed in the tutorial page “Specify Structural Members” found at the Support page of the verauto-tower-design.com website.



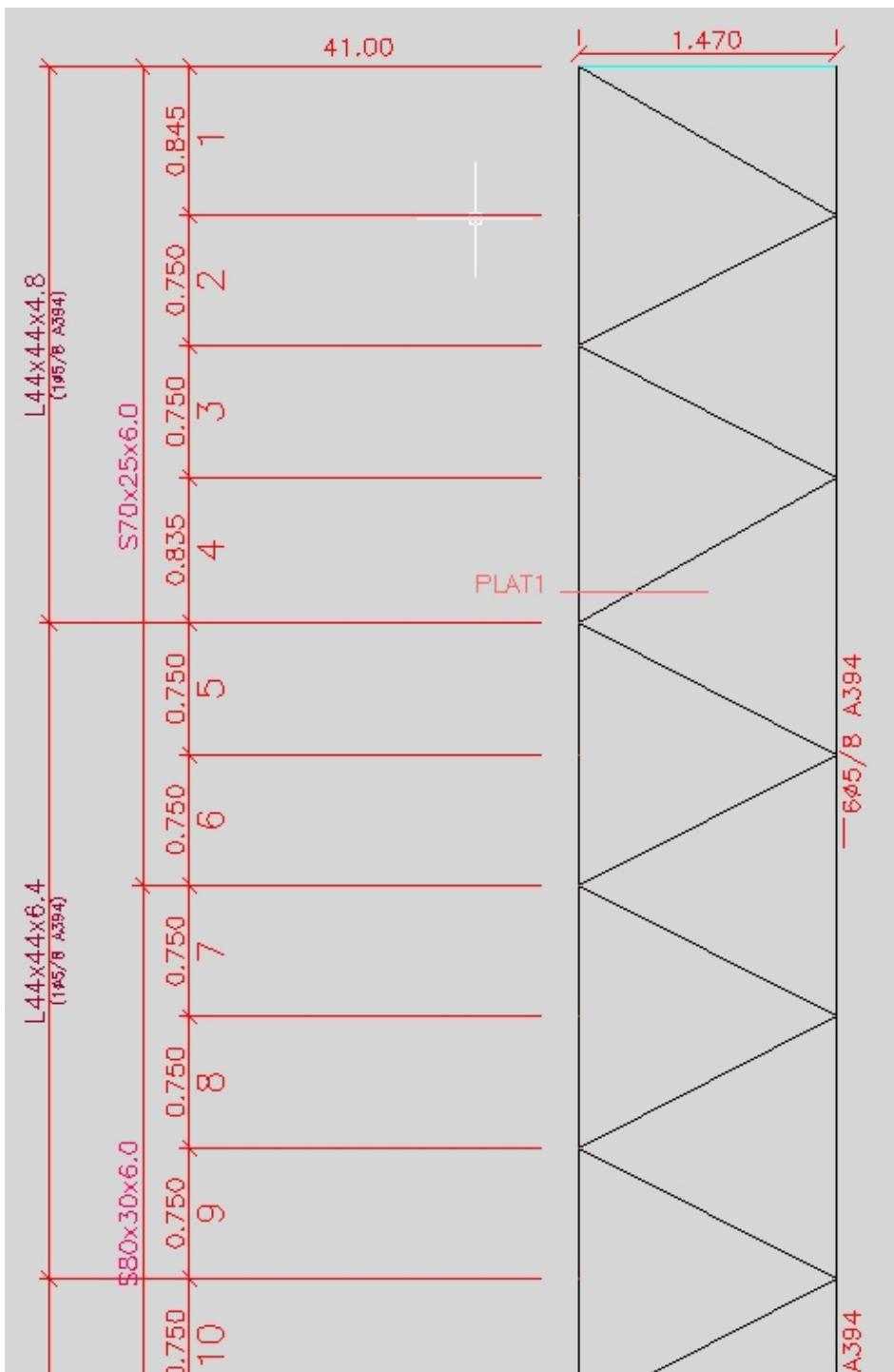
The next dialog windows address the specifications for the other elements of the structure such as diagonals or bracers. They are very similar to the one for the vertical members described above.

Finally we find the windows for definition of antennas also detailed in the tutorial, under “Specify Antennas and Lines”, on the Support page of the verauto-tower-design.com website.

Please note that at any time, within SmLoader, it is easy to obtain help on the currently selected item by pressing the F1 key. This action opens a popup window with a good amount of explanation on the current operation.

ANNEX TO THE MAIN DOCUMENT

A. Details for the example of a tower to be verified (page 2)



Here we have the upper part of the 41 meter Tower to be verified.

It's an existing tower to which are attached a certain number of antennas as indicated at page 2, General View of the Tower.

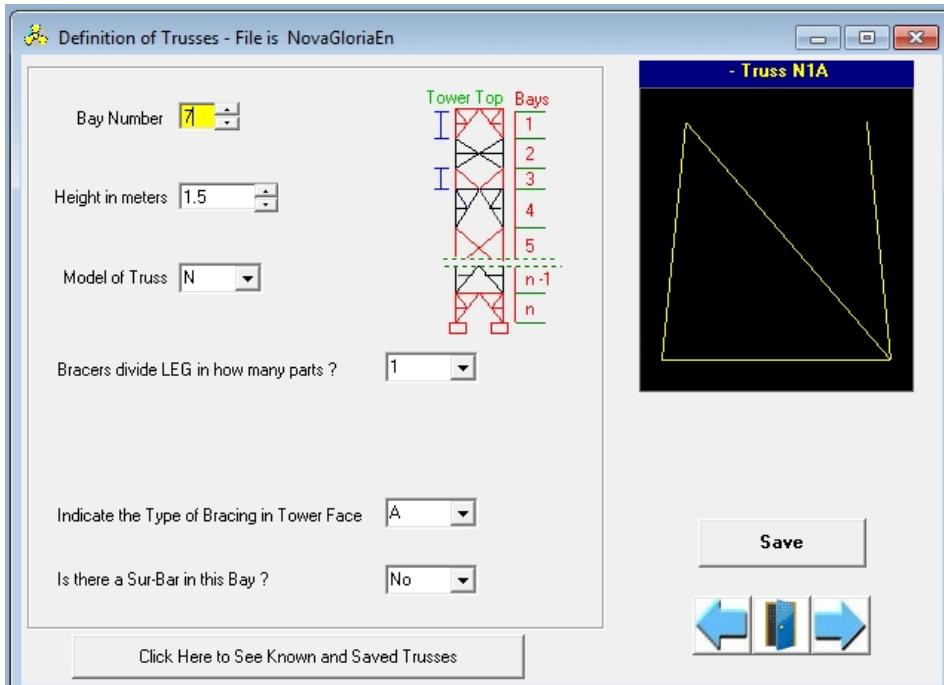
We can observe, on the left, that the leg members are:

- for the first section of 6 bays, a standard angle brought to 60° that we use to call S (from its US name Schifflerized) having the following dimensions 70 x 25 x 6 mm. (70 = side (or leg) of the angle, 25 = heel and 6 represents leg's thickness).

- The diagonals are standard equal leg angles of 44 x 4.8 mm, down to bay 4 and 44 x 6.4 mm after. They are attached to leg members by means of a 5/8" A394 steel bolt.

All this information will be supplied to SmLoader using first the window "Definition of Trusses" (shown hereunder) then the Leg Members and Diagonals will be detailed in the respective windows indicated as "Leg Members", then "Diagonal" and so on.

B. Example for modification of bay lattice



On the left, we can see the bay dialog where the bay at level 7 of the tower used to start with (see Page 3) is defined as a type "N" of height 1.5m. We must therefore correct it to adjust to our tower in the line drawing above which consists of two bays at levels 7 and 8 of type W and height 0.75 m.

Referring to the drawing of the tower we wish to verify (see page 1), we note that bays similar to bay 7 are repeated up to bay number 19.

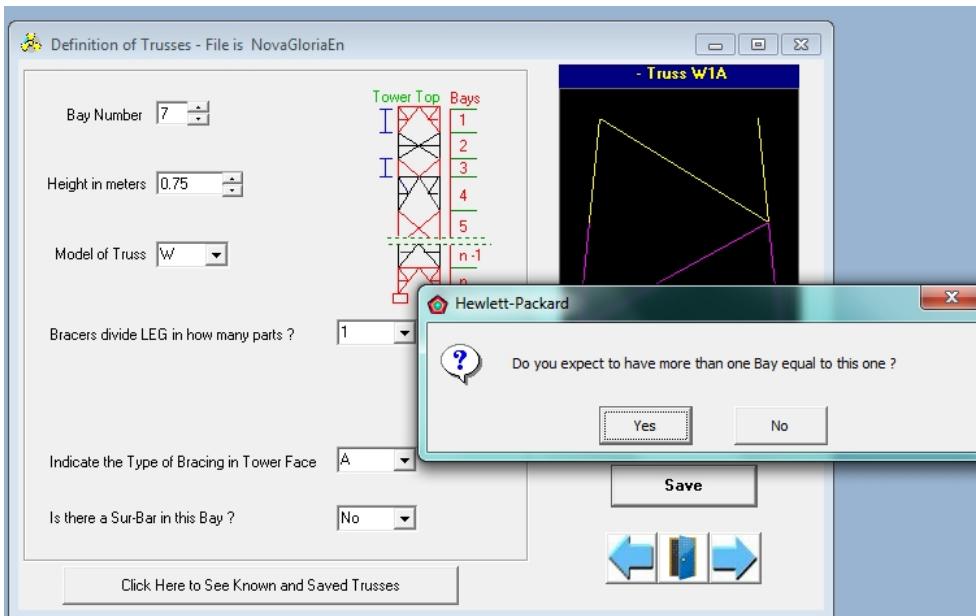
Thus we have modified bay number 7 by specifying the height of 0.75m and the model W1A, without Sur-Bar.

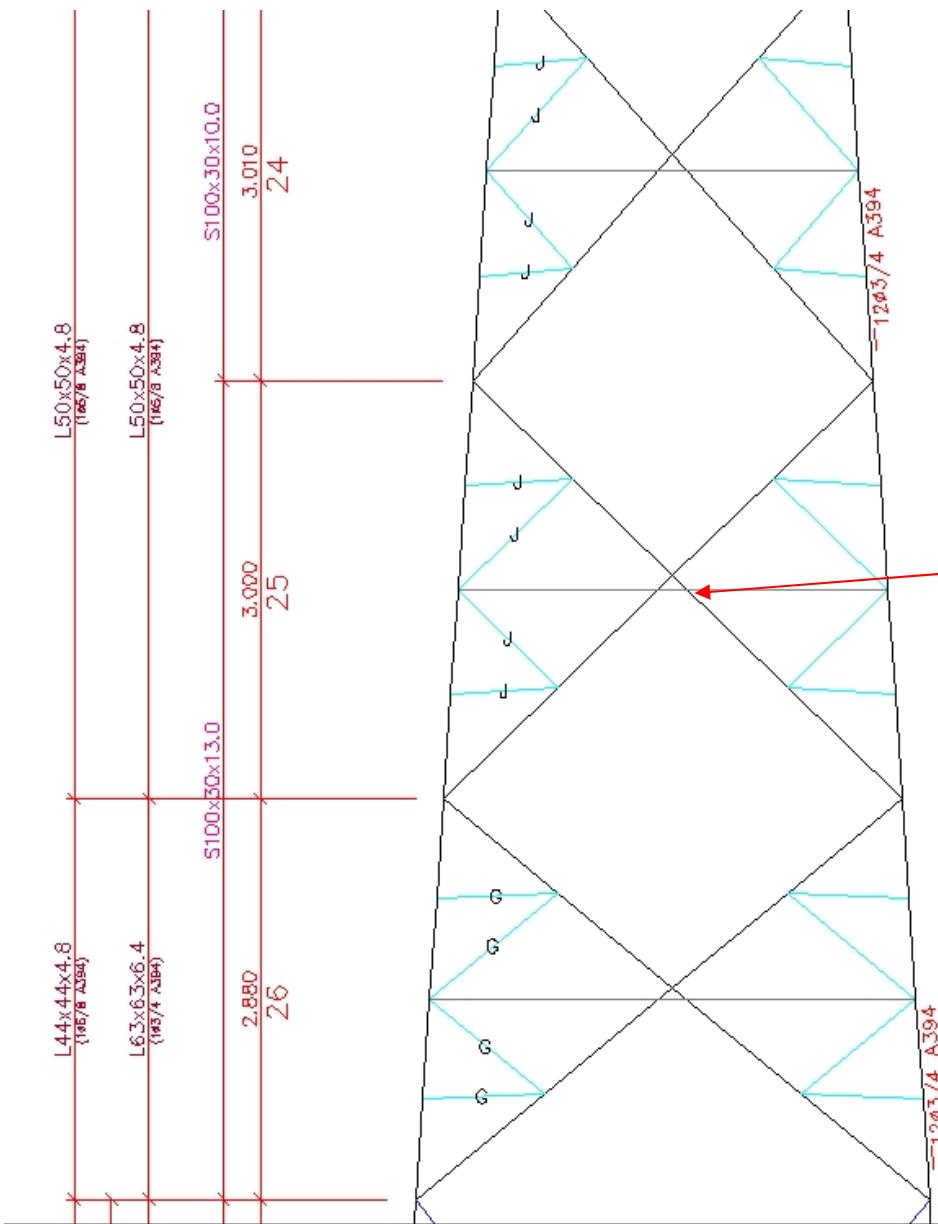
When saving this bay, the user is given the possibility to specify if there are other bays identical to the one being saved. We therefore click on Yes and specify bay 19 as the last bay similar to bay 7.

In this case, the software will save the same bay model for bays 8 to 19 and will display bay 20 to continue defining bays.

The same procedure will be used to describe the other bays of the tower we are verifying.

Let us look more closely at bays 24, 25 and 26 which have a specificity which can be interesting to observe. (see below)





These bays are of model "S", which means that the crossbars (Bracers) divide the Leg Member in equal parts. This generally results in a reduction of the free (unsupported) length of the Leg Member.

However, the horizontal bar, which goes through the intersection of the diagonals in the "X" model, will usually pass slightly below that point in the model "S".

In some cases, the horizontal bar is built of two halves that are bolted to the diagonals cross point. However this case is not frequent.

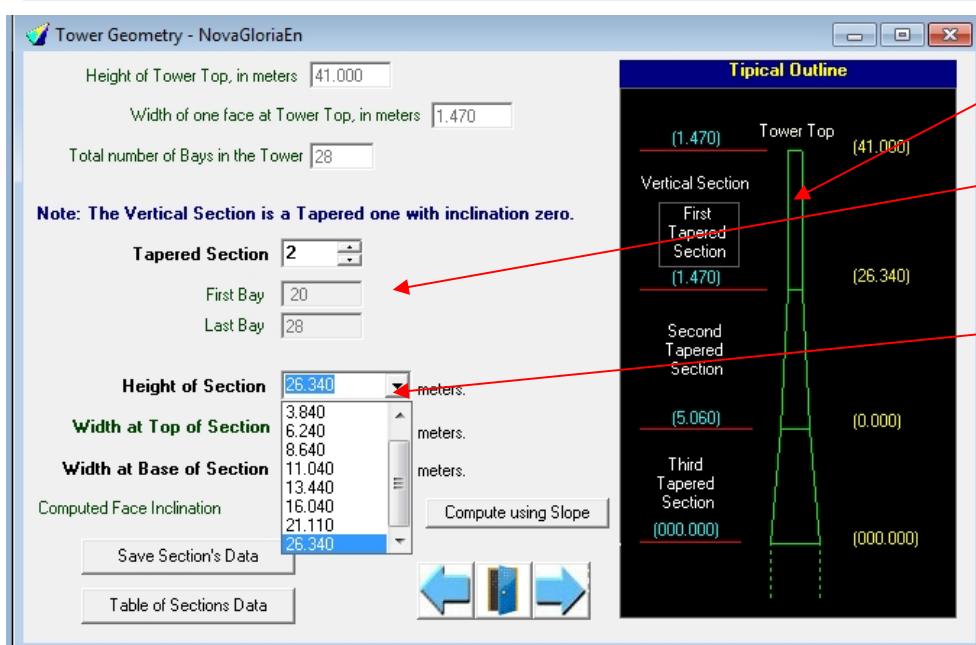
Let us now move to another dialog window, where we shall define the slope of the tower faces.

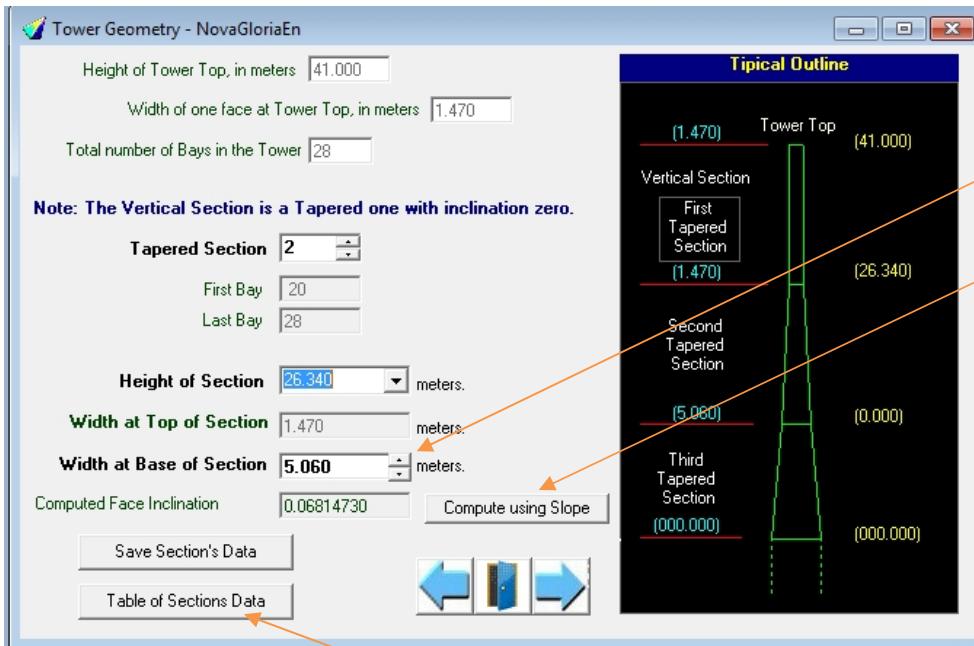
Here we see that the first section has vertical faces.

The second section starts at bay 20 and ends at bay 28 as shown on the left.

When we click on the drop down arrow for the section height, the dropdown menu will list numbers that are an integral multiple of the height of the bays.

Here we chose the last entry in the list, taking us to the tower base.





sometimes useful: You can see a table of the slopes and widths of each Bay.

Next, to calculate the slope of the section, we have entered the width of the tower base.

We could also have defined the slope and let the software calculate the width of the base.

Both alternatives are allowed. The software does the calculation for you.

This window has another gadget that is