Atir Software Development LTD

STRAP - Reinforced Concrete Column Design (solid section)

Step by step

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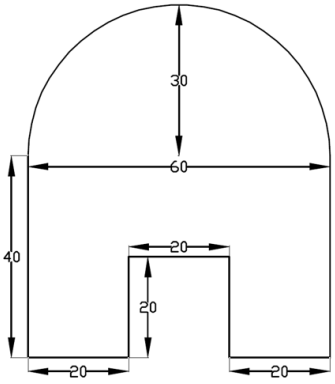
1. Abstract

This example demonstrates how to design a column with an arbitrary cross-section defined by the user. The model is a simple one-member column, loaded with an axial load and moment; the column has the following cross-section:



The example shows how to -

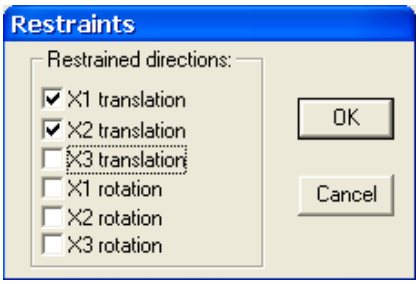
- create the section in the CROSEC section generator.
- copy the section to STRAP.
- arrange the column reinforcement temple (corner bars and groups) in the concrete design module.

The section will be imported into the program from a DXF file. Please download the file from the following link - Section.dxf

2. Geometry Definition

- click the new model icon.
- select Space Frame and click user defined.
- rotate the model to the X1-X3 plane:
  - click the Dynamic rotate icon.
  - click the *X-1 X-3 plane* button.
  - click *end*.
- click Nodes in the side menu and define the following two nodes:
  - X1=0 ; X2=0 ; X3=0
  - X1=0 ; X2=0 ; X3=5
- click Beams and define a beam connecting the two nodes.

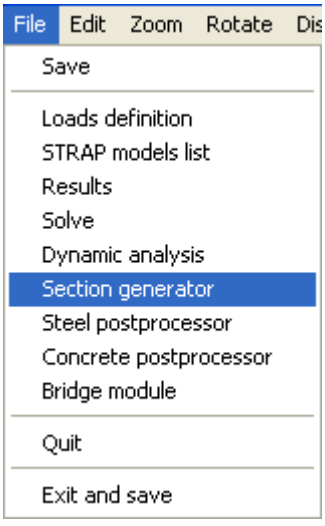
- click Restraints and define the following supports at the two nodes:
  - Bottom node: Fixed
  - Top node: restrain the node against horizontal movement and allow vertical deflection: select Other and –



The defined geometry is displayed as:

The section is defined in the CROSEC section generator program:

- select *File* in the menu bar and *Section generator* in the menu:



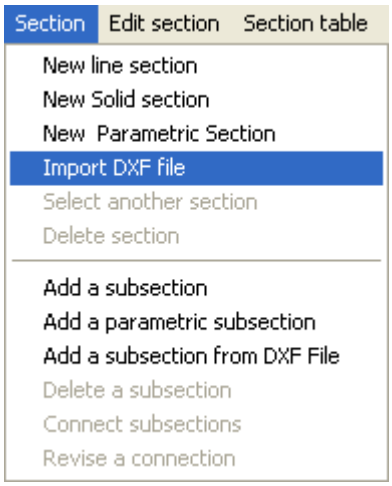
There are three ways to define a section in CROSEC:

- define the lines.
- select a standard section from the library.
- import a DXF format file. This option will be used.

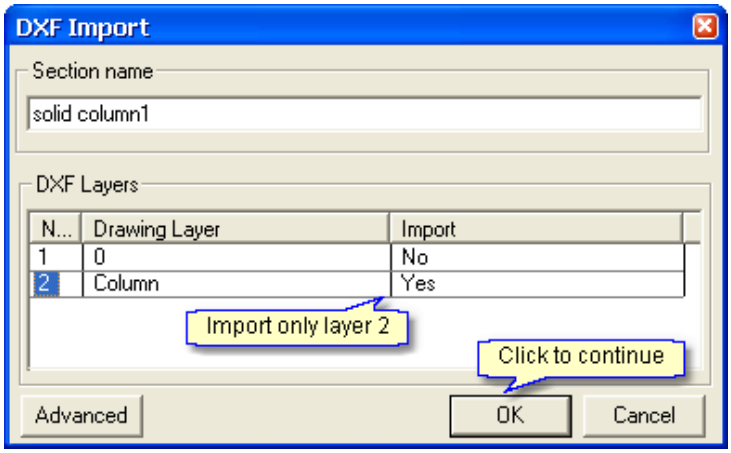
We will use the third option.

If you have not downloaded the DXF file as explained at the beginning of this example, please do so now.

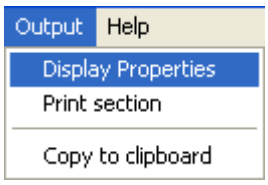
- select *File* in the menu bar and *Import DXF file* in the menu (or click  in the icon bar):

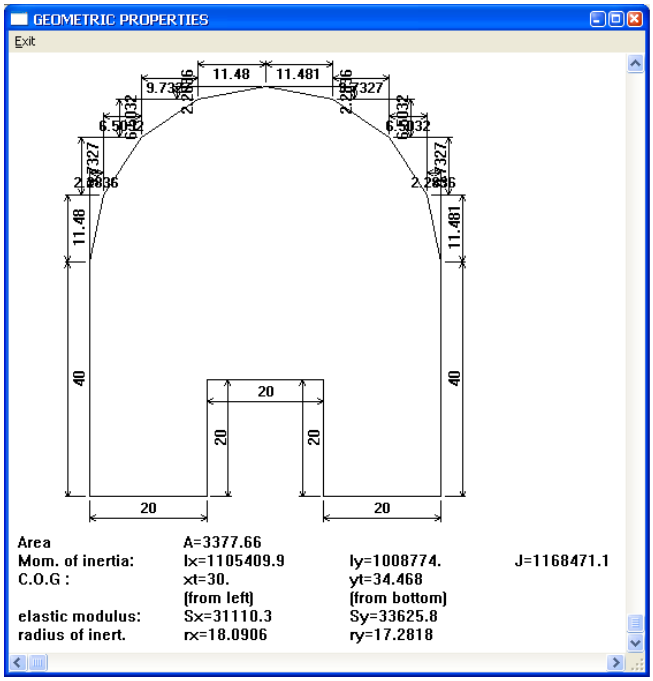


- select the DXF file (in the folder where you saved the file) and click *open*.
- Select the layers to import:

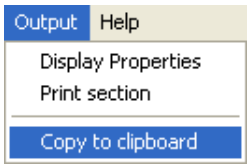


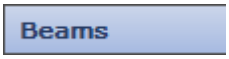
- to display the section properties, select *output* and *display properties* -





- copy the section to the computer's "clipboard". Select *output* and *Copy to clipboard*.



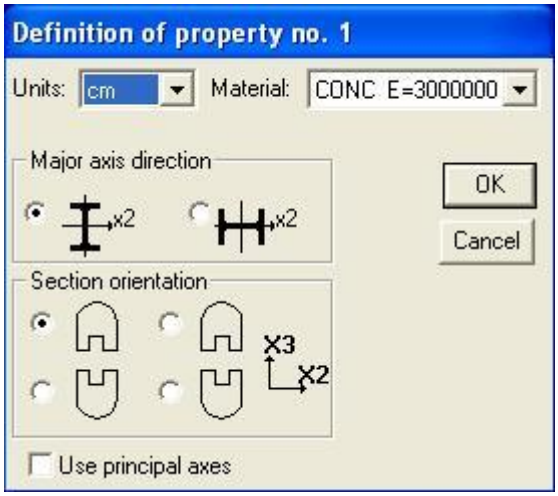
- select *File* in the menu bar and *Exit* in the menu
- click 

and then select 

in the side menu.
- click and highlight the first row in the table ("- Not used -") and click *define/revise*.
- select the *paste* button 

.

- check the section orientation and material:



- click  to display the rendered drawing:

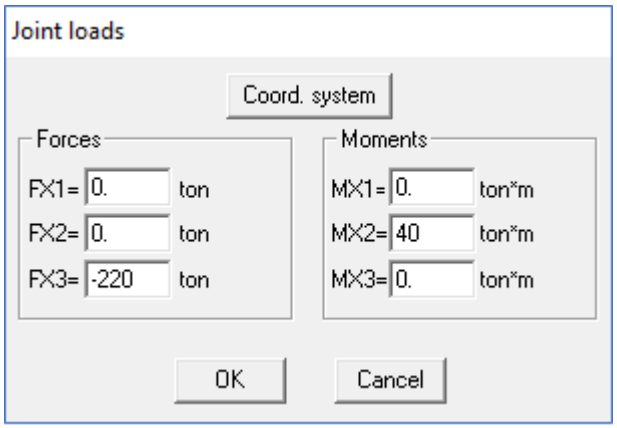
3. Loads Definition

Define dead and live service loads in separate load cases:

- click Loads at the top of the screen.

Define joint loads at the top of the column:

- click New load in the side menu and enter a title.
- click Joint load in the lower side menu and Define in the upper side menu, then define the following axial load and moment:



- click End load case.
- click Solve to solve the model.

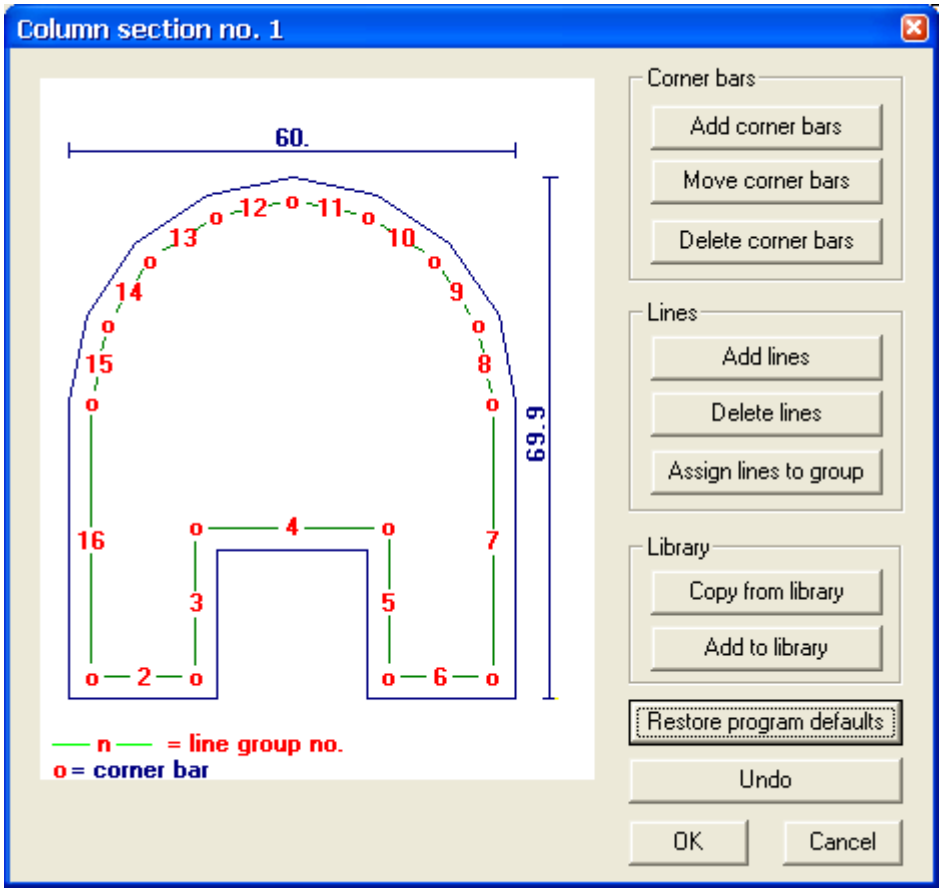
4. Reinforced Concrete Design

- click the Concrete tab
- click Columns
- click Define
- click Defaults and specify X3 as the 'Height axis". The program will automatically create columns for all members parallel to this axis.
  - specify various design parameters - design code, concrete type, reinforcement grade, cover, etc.

To arrange the reinforcement template for the solid section:

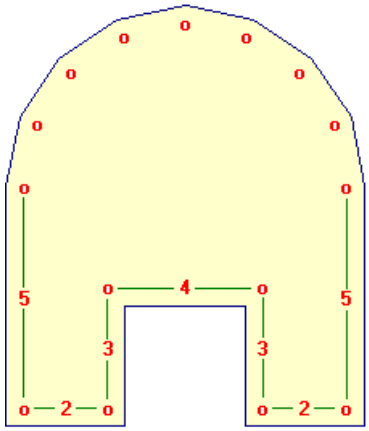
- click Properties
- click *Edit STRAP solid section*.

- The program displays the default reinforcement arrangement:
  - a "corner bar" at every perimeter corner
  - a reinforcement line between every pair of adjacent corner bars:



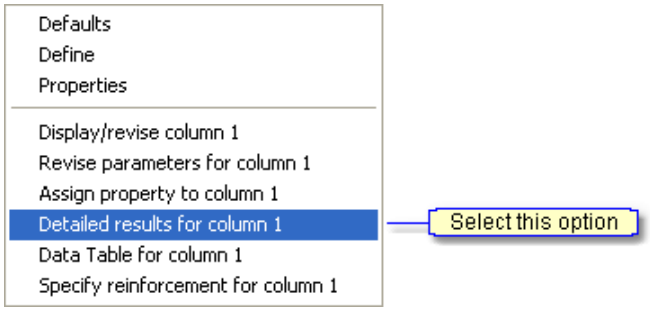
- The following changes will be made:
  - lines 8 to 15 will be deleted as the corner bars along the arc are sufficient.
  - the following symmetric line pairs will be specified as identical: 7-16, 3-5 and 2-6.
- click *Delete lines*: highlight line 8 and click the mouse. Repeat for line 9 to 15
- click *Assign lines to group*:click on line 7 and then on line 16; line 16 is renumbered "7".Repeat for lines 3-5 and 2-6.

When completed the section should appear as:

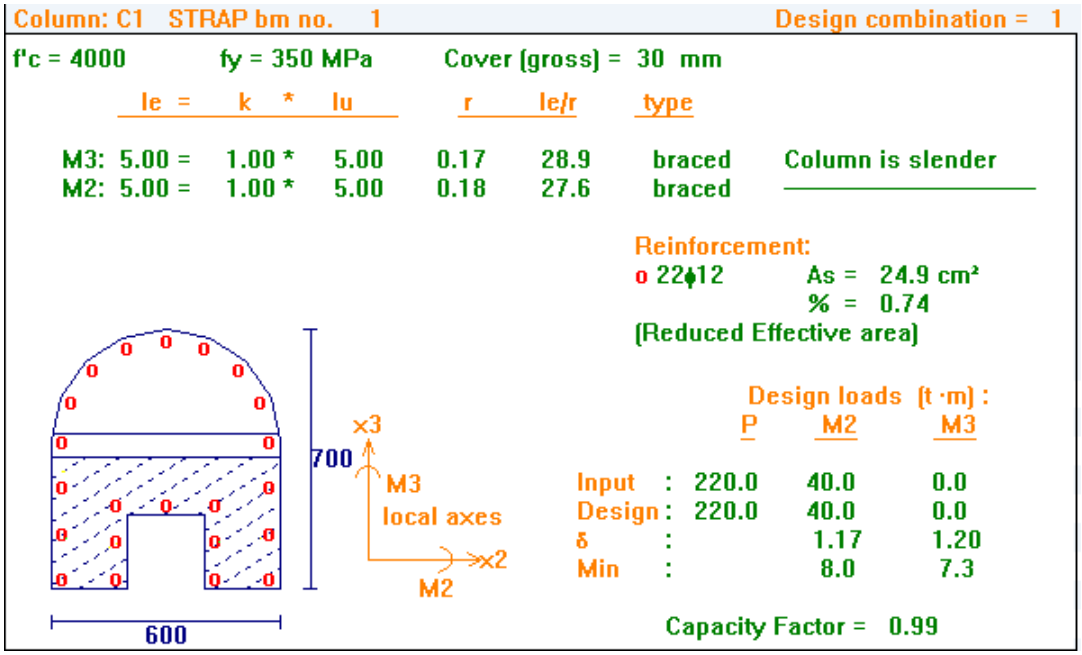


- click *OK*.
- click *End*.
- click 

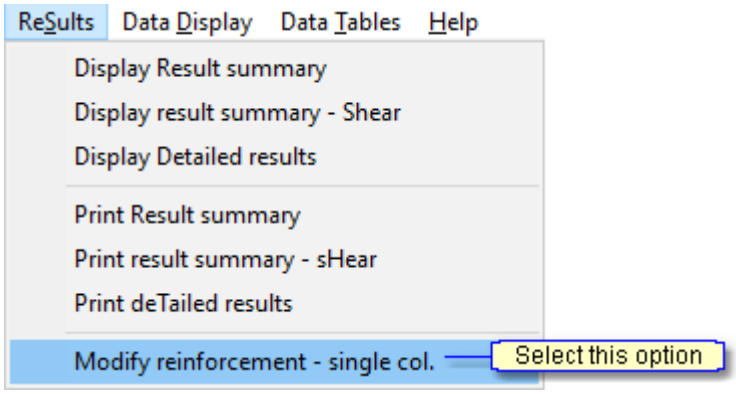
in the side menu; the column result summary is displayed.
- to display the detailed results, right-click on the column:



- select ◉ Design combination only. The detailed results are displayed -



- Finally, you may modify the diameter of quantity of bars in any reinforcement group:



- select the column. The program displays the following screen: