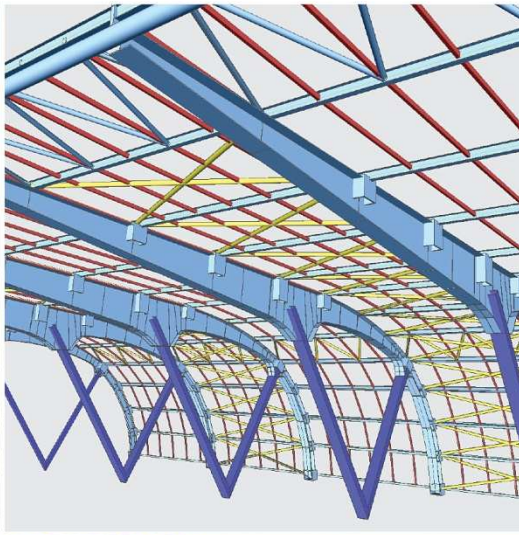
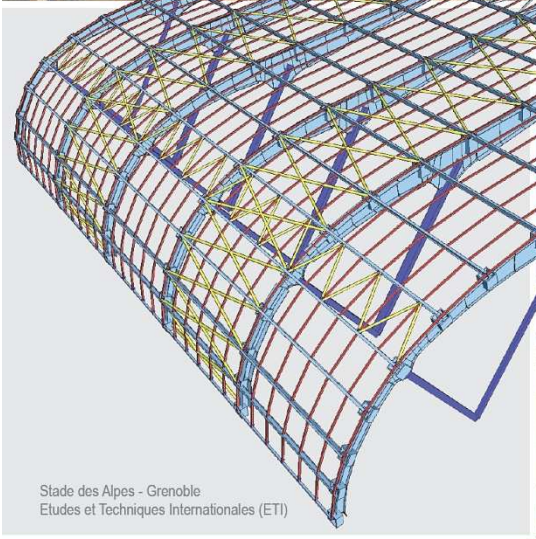
NEMETSCHEK Scia





Stade des Alpes - Grenoble
Etudes et Techniques Internationales (ETI)

Tutorial

Parametric input

Scia Engineer

Table of Contents

General Information

Welcome

Welcome to the Scia Engineer Tutorial Shell. Scia Engineer is a design program under Windows with a broad application field: from checking simple frames to the advanced design of complex projects in steel, concrete, timber,...

The program treats the calculation of 2D/3D frameworks, profile check and check of connections for steel structures included. Besides frames, it is also possible to dimension plate structures, inclusive of advanced concrete calculations.

The complete process of calculation and design has been integrated in one program: input of the geometry, input of the calculation model (loads, supports, ...), linear and non-linear calculation, output of results, member check and optimization according to various codes, generating the calculation note, …

Scia Engineer is available in three different editions:

License version

The license version of Scia Engineer is secured with a 'dongle', a code lock, which you apply to the parallel or USB gate of your computer or a softwarematic license on your network.

Scia Engineer is modular and consists of various modules. The user chooses from the available modules and composes a custom design program, perfectly tuned to his needs.

In the general product overview of Scia Engineer you will find an overview of the different modules that are available.

Demo version

If the program doesn't find a protection, it will automatically start the demo version. The properties of the demo version are:

All projects can be inserted;

The calculation is restricted to projects with 25 elements, 3 plates/shells and two load cases;

The output contains a watermark "Unlicensed software";

The projects that are stored in the demo version cannot be opened in a license version.

Student version

The student version has the same possibilities as the license version for all modules. This version is also secured by a 'dongle' or a softwarematic protection.

The output contains a watermark "Student version".

Projects that are stored in the student version cannot be opened in the license version.

Scia Engineer Support

You can contact the Scia Engineer support service

By e-mail

Send an e-mail to support@Scia.be with a description of the problem and the concerning *.esa file, and mention the number of the version you are currently working with.

By telephone

From Belgium : +32 13 350310

From the Netherlands : +31 26 3201230

Via the Scia Support website

http://www.Scia-online.com/en/online-support.html

Website

Link to Tutorials

http://www.Scia-online.com > Support & Downloads > Free Downloads > input e-mail address > Scia Engineer > Scia Engineer Manuals & Tutorials

Link to eLearning

http://www.Scia-online.com > Support & Downloads > eLearning

Link to Demo version

http://www.Scia-online.com > Support & Downloads > Secured Downloads > input username and password > Service Packs > Scia Engineer > Setup – Scia Engineer

Start writing on an odd page.

End each chapter using Insert > Section break – next page and type the new chapter name to the odd-page heading. Keep separate headings for each section.

Project management

Save, Save as, Close and open

Before entering the construction, we first discuss how to save a project, how to open an existing project and how to close a project. When running a project of this Tutorial, the project can be saved at any time. That way you can leave the program at any time and resume the project from there afterwards.

Saving a project

Click on  in the toolbar.

If a project has not yet been saved, the dialog box **Save as** appears. Click on the arrow in the list **Save** to choose the drive you want to save your project in. Select the file in which you want to put the project and click on **[Open**]. Select the subfolders. Enter the file name in **File name** and click on **[Save]** to save the project.

If you press  twice, the project is automatically stored with the same name. If you choose **File > Save as** in the main menu, you can enter a new/other drive, folder and name for the project file.

Closing a project

To close a project, choose **File > Close** in the main menu.

A dialog box appears asking if you want to save the project. Depending on your choice, the project is saved and the active dialog is closed.

Opening a project

Click on  to open an existing project.

A list with projects appears. Select the desired project and click [**OK]** (or double-click on the project to open it).

Introduction

Example of this Tutorial can be designed with the **Licensed** or **Student** versions.

Before you proceed, you must be familiar with your operating system: for instance working with dialogues, menu bars, toolbars, status bars, handling the mouse, etc. Basic knowledge of input and editing of the structure in Scia Engineer is needed too. You should know how to input beams and slabs, loads and usage of the property window in Scia Engineer.

This Tutorial describes the procedure how to parameterize Scia Engineer projects and make parametric user blocks usable directly in Scia Engineer or in Scia ODA user-environment.

First, we will explain how to parameterize continuous beam including loads and how to use this parametric user block. Second sample project is focused to a structure including slabs.

Parametric project templates

The program Scia Engineer is based on templates. It defines more types of templates:

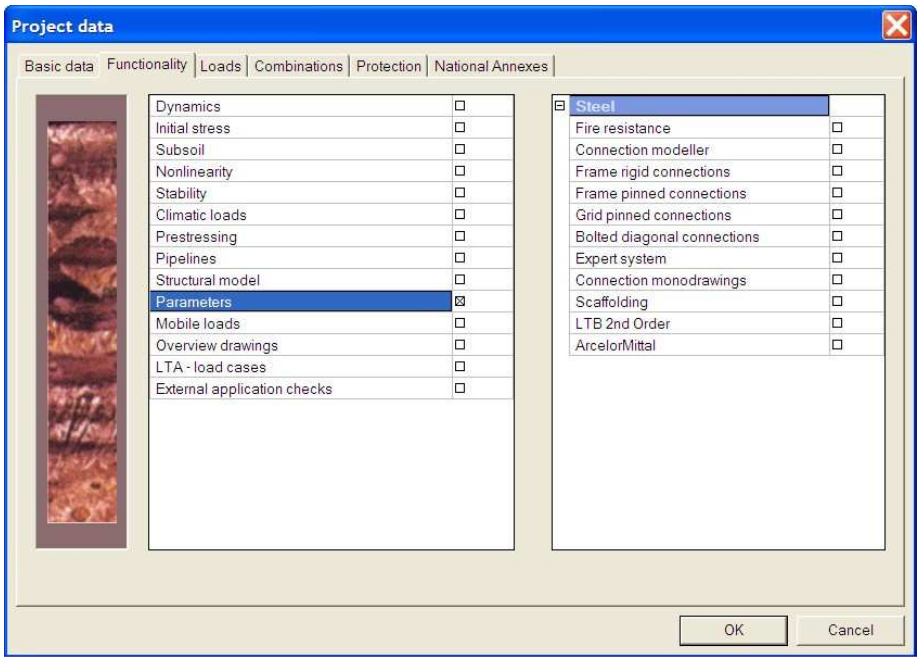
- **document templates:** a list of tables and pictures included to the document
- **document table templates:** for each type of the table in the document can be defined
- one or more templates for further usage in other documents and projects,
- **document page style templates**
- **print templates**
- **project templates:** whole project including settings of design codes,
- **parametric project templates:** enhancement of standard project templates by parameters.

Requirements for parametric templates

If the user wants to create parametric templates or user blocks then he or she has to buy module **ESA.11 Parametric Modelling.**

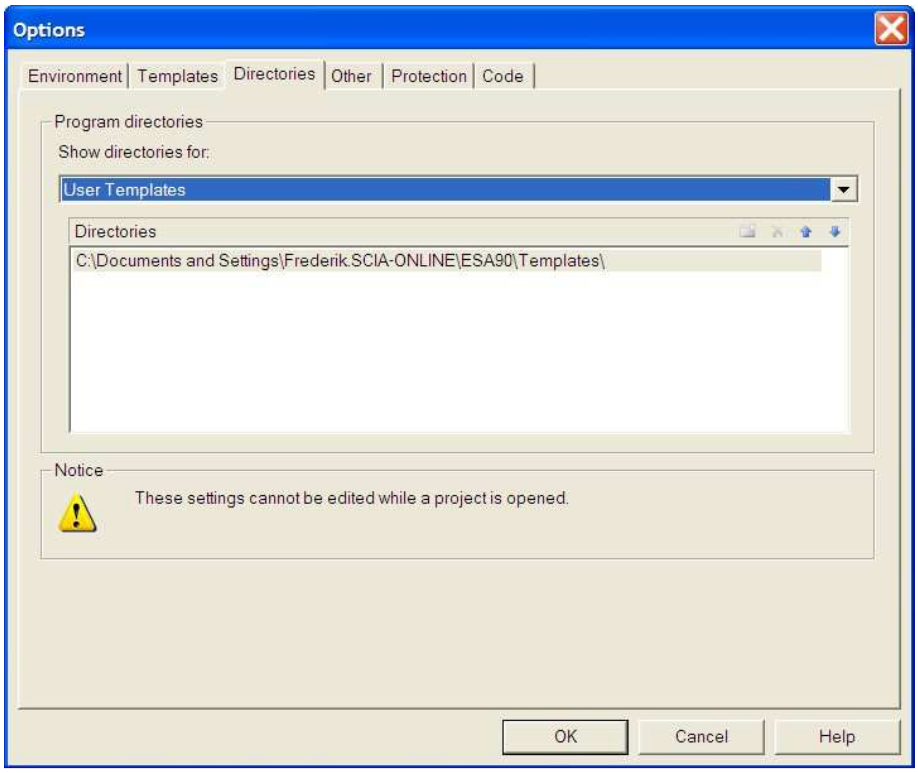
Then there will be an item called "**Parameters"** in the Project data dialogue on the tab Functionality. This functionality must be switched on if we want to parameterize the structure.

It is possible to load the non-parametric structure (standard Scia Engineer project) and add parameters later.



Storage place of project templates

All user defined project templates are stored in special folders. They can define one or more folders on local or network hard-drives. It allows sharing of project templates among more users in a company.



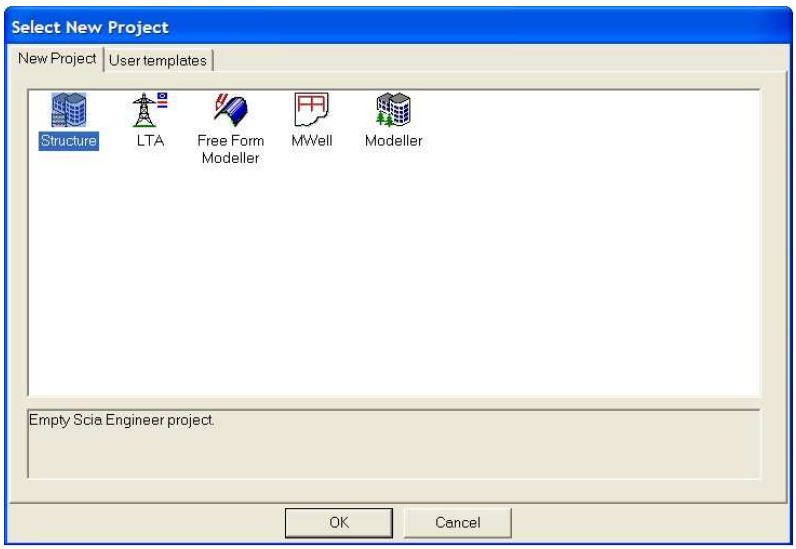
Using of project templates

Standard and parametric project templates can be used in Scia Engineer or in Scia ODA user environment:

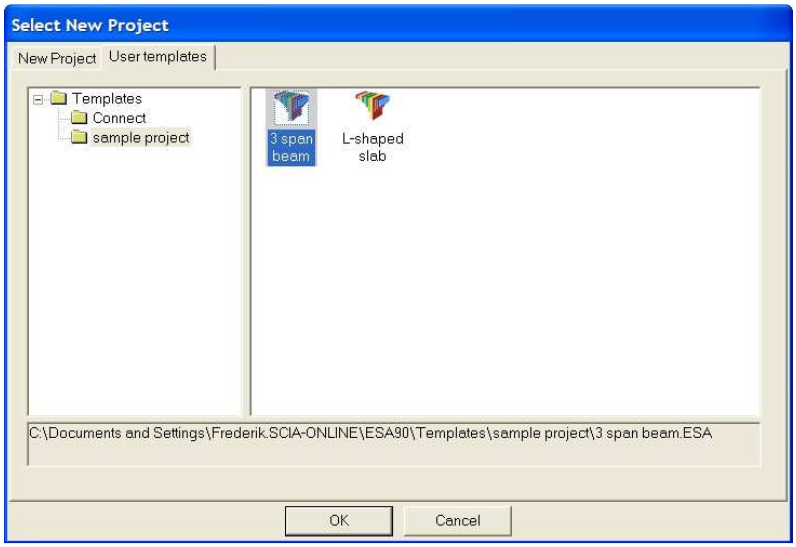
- Scia Engineer allows to input, edit and analyze structures created on basis of the template.
- Scia ODA user environment is designed for inputting of parametric project templates and analyzing those templates. It means that general editing of a model is not allowed. On the other hand templates designed for Scia ODA must define document and/or pictures in the picture gallery.

This tutorial is focused on Scia Engineer.

1. Run Scia Engineer
2. Select New project from Scia Engineer File menu, the standard New project dialogue is displayed



3. If some project templates are stored in corresponding folder(s) the User templates tab appears. Switch to this tab.
4. Select folder Sample Projects



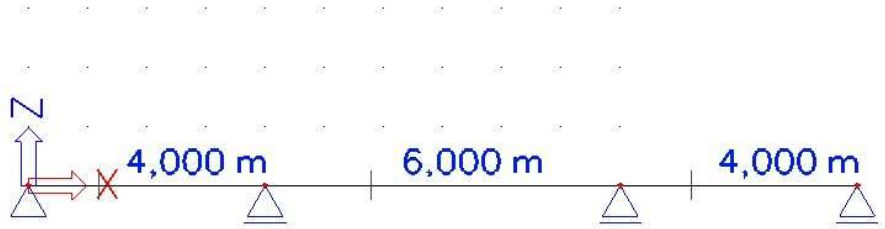
5. Select a template and press button <**OK**>
6. Template dialogue with parameters is displayed
7. Fill in parameters and press button <**OK**>
8. A standard project based on the selected template is created. The user can edit the project by the **Template dialogue** (in the **Main menu**) or by standard Scia Engineer functions.

Example #1: 3-span beam

The goal of this sample project is to create a project template for parametric input of a three span concrete beam loaded by self weight and standard permanent load. The project template can be use for easy input of parameterized structure directly in Scia Engineer or in Scia ODA user environment.

Definition of the structure

1. Create a simple 3 span concrete beam by standard Scia Engineer functions in a **Frame XY**. For parametric input, it is much easier to place the first node in the origin of coordinate system. For the purpose of this Tutorial, the material quality and cross-section used are not important. The geometry is shown in the picture below.

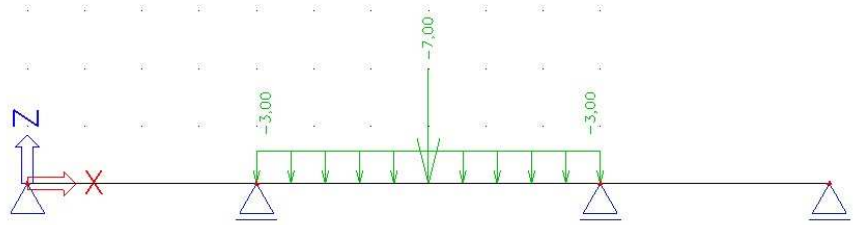


2. The next step is to define loads in 3 load cases:

- LC 1: self weight – all beams are automatically loaded by self weight
- LC 2: permanent, standard load: line and point load on 1st and 3rd spans. The line load has a value of -4kN/m. The point loads have a value of -7kN and are placed relatively on the outside beams respectively on 30% and 70%.
- LC 3: permanent, standard load: line and point load on 2nd span. The line load has a value of -3kN/m. The point load has value of -7kN and is placed in the middle of the middle beam.

LC2:

LC3:



Definition of parameters

We can continue by defining the required parameters. The **Parameter Menu** can be accessed by clicking on **Main Menu → Tools → Parameters** in **Tree window**.

Geometry:

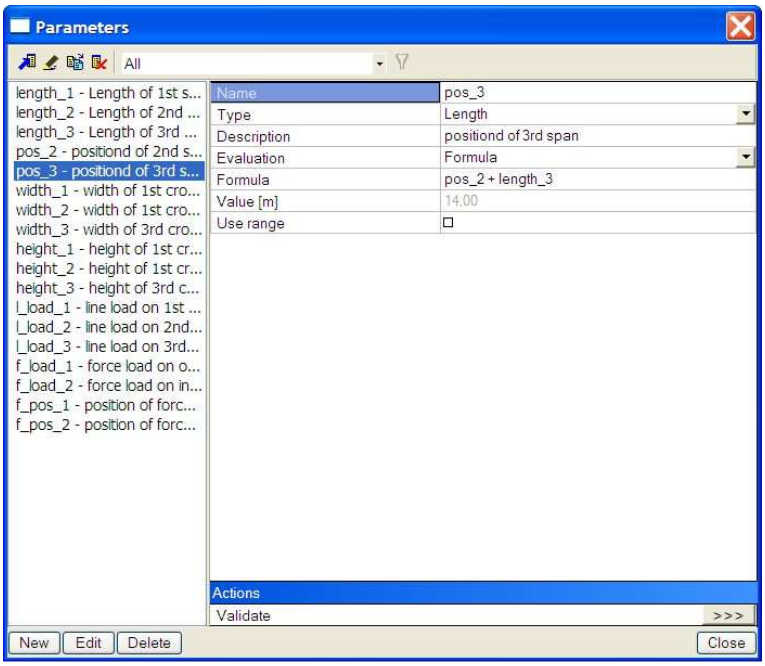
Name	Type	Description	Evaluation	Formula	Value
length_1	length	Length of 1st span	value		4 m
length_2	length	Length of 2nd span	value		6 m
length_3	length	Length of 3rd span	value		4 m
pos_2	length	position of 2nd span	formula	length_1+length_2	
pos_3	length	position of 3rd span	formula	pos_2+length_3	

Cross-section:

Name	Type	Description	Evaluation	Value
width_1	css length	width of 1st cross-section	value	500 mm
width_2	css length	width of 2nd cross-section	value	500 mm
width_3	css length	width of 3rd cross-section	value	500 mm
heigth_1	height	height of 1st cross-section	value	500 mm
height_2	height	height of 1st cross-section	value	500 mm
height_3	height	height of 1st cross-section	value	500 mm

Loads:

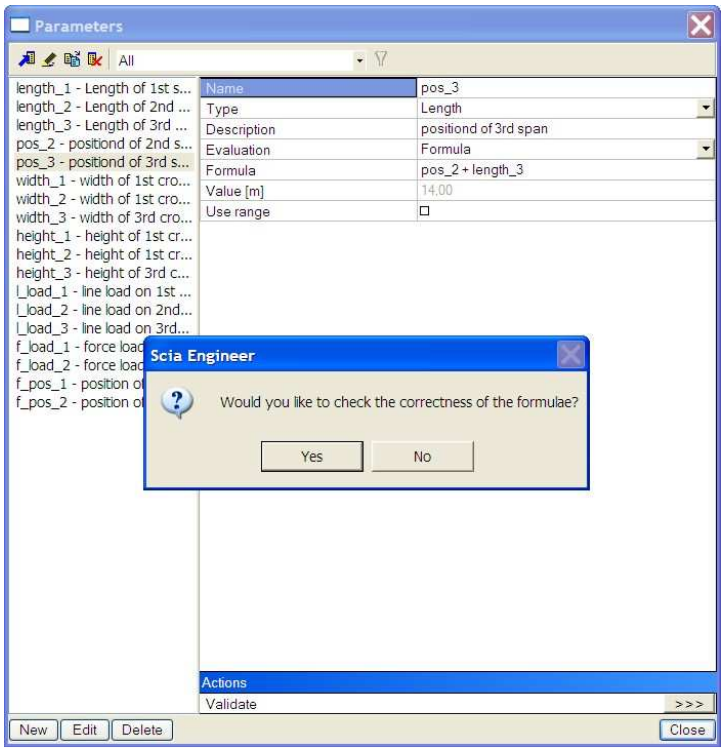
Name	Type	Description	Evaluation	Value
l_load_1	line load	line load on 1st span	value	-4 kN/m
l_load_2	line load	line load on 2nd span	value	-3 kN/m
l_load_3	line load	line load on 3rd span	value	-4 kN/m
f_load_1	force	force load on outer beam	value	-7 kN
f_load_2	force	force load on inner beam	value	-7 kN
f_pos_1	relative	position of force on outer beams	value	0.3
f_pos_2	relative	position of force on inner beam	value	0.5



Note: Formula type parameters are calculated from other parameters and are for internal use (they are not usable in parametric input dialog). For example in this case formulas are used for definition of end node position of second and third beams.

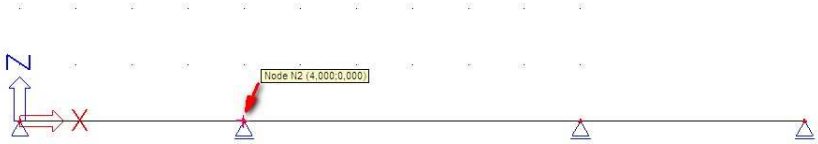
After defining all necessary parameters, click <**CLOSE**>.

Scia Engineer now checks the correctness of the use formulas. Click <**YES**>.



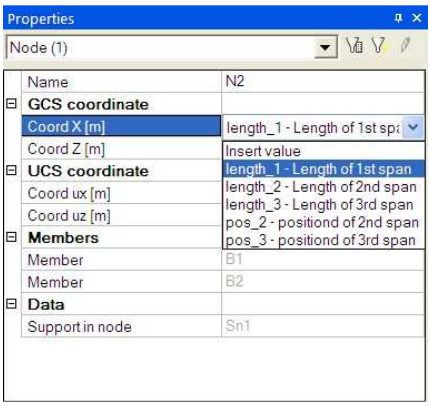
Assigning parameters to the structure

1. Select the end node of the first span



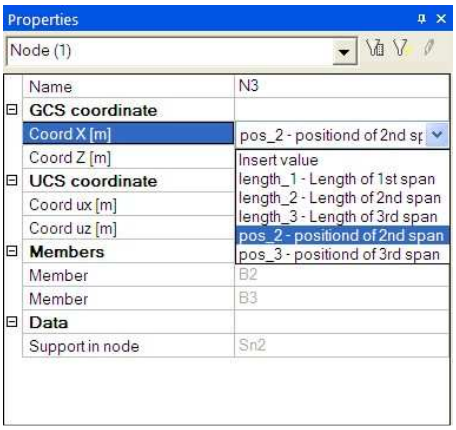
2. Select item **GCS coordinates > Coord X [m]** in the **Property window**. If appropriate parameters are defined then the edit box is replaced by a combo box. This means, you can now input not only a real value, but also a defined parameter.

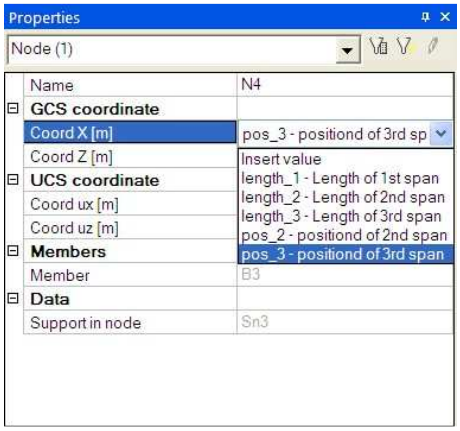
3. Change the value to "**length_1**" parameter (using the little down-arrow button).



4. Change the X co-ordinates of end nodes for the second and third span in the same way (node N3 and N4).

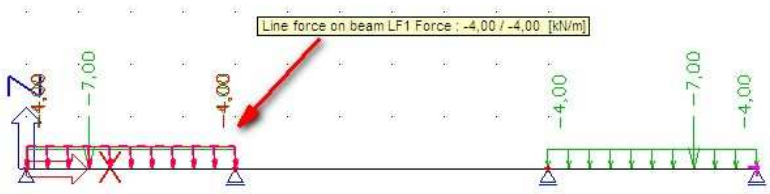
5. Change their values to "pos_2" and "pos_3" respectively.



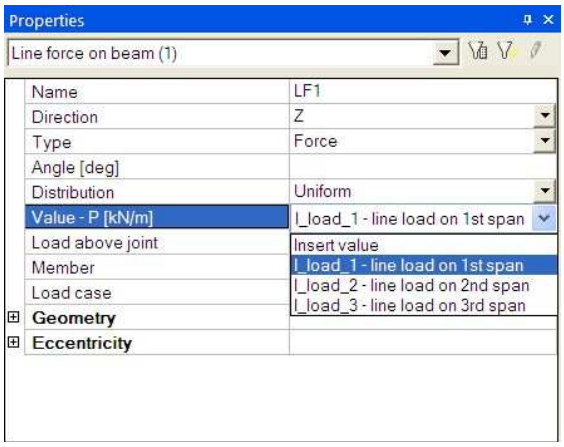


6. The next step is to assign parameters to loads.

   - Adjust the second load case to be displayed in the window.
   - Select the first load and let's focus on the Property window again.



- Change the load value to parameter "l_load_1".



- Adjust value of the forces and other line load one by one similarly.

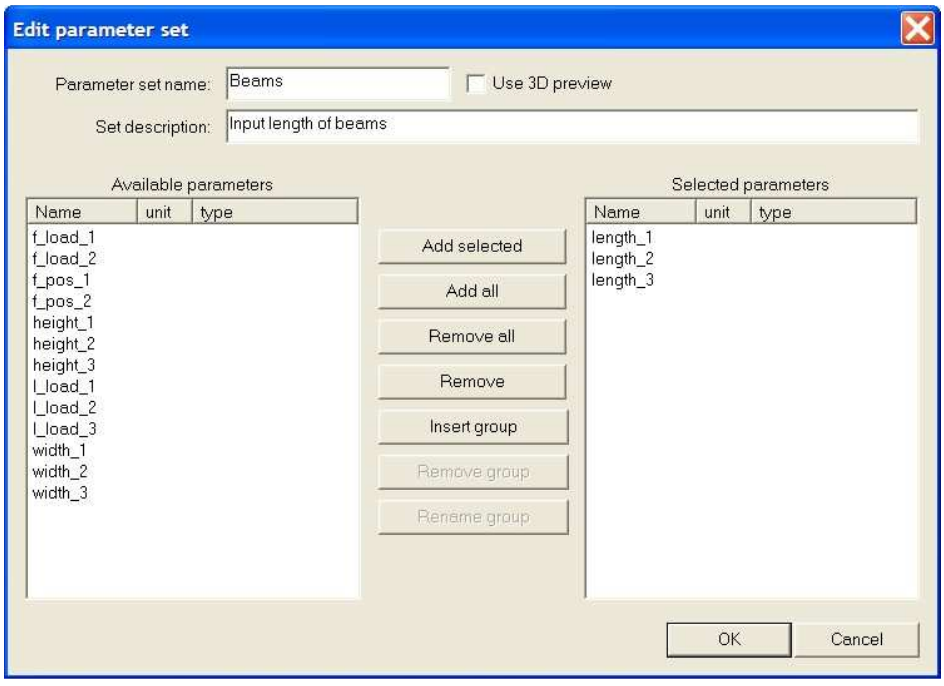
7. Do the same change with the load in the last load case.

Template dialogue

The user can define a template dialogue for easier editing of input parameters. Defined parameters can be arranged to sets (represented by tabs in the dialogue) and to groups (represented by trees).

1. Open the **Parameter template settings** in the **Tools menu**. Let's define three parameter sets according to the pictures below.
2. Select parameters in the **Available parameters** window and move them to the **Selected parameters** window by pressing **Add selected** button.

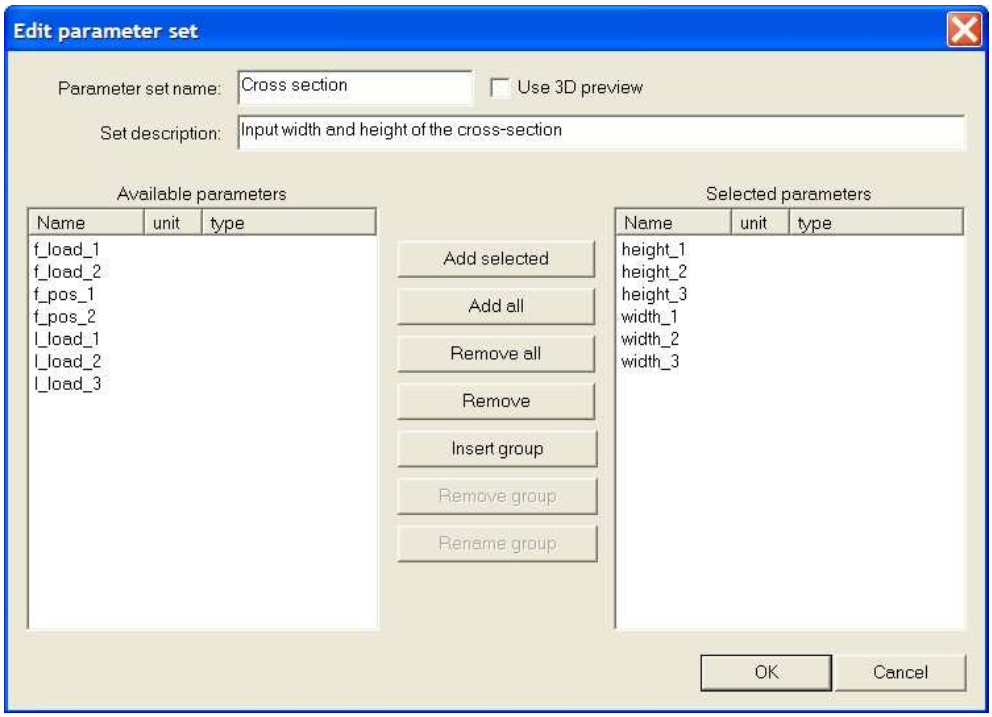
- First tab:



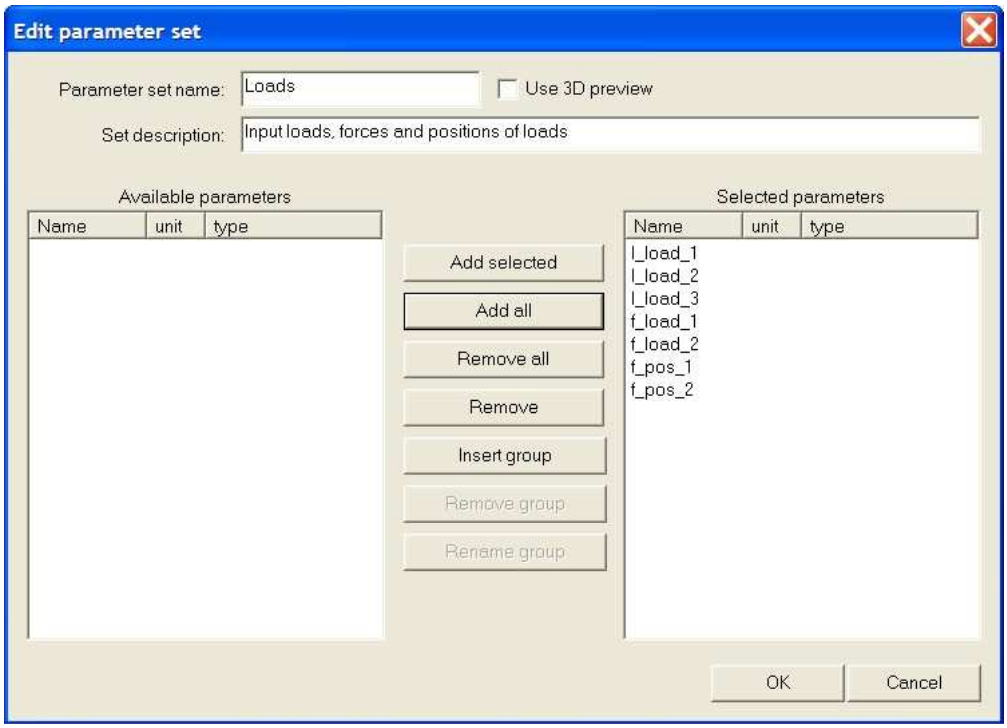
Click <**OK**> to save this set.

Click <**NEW**> to add a second list (see below).

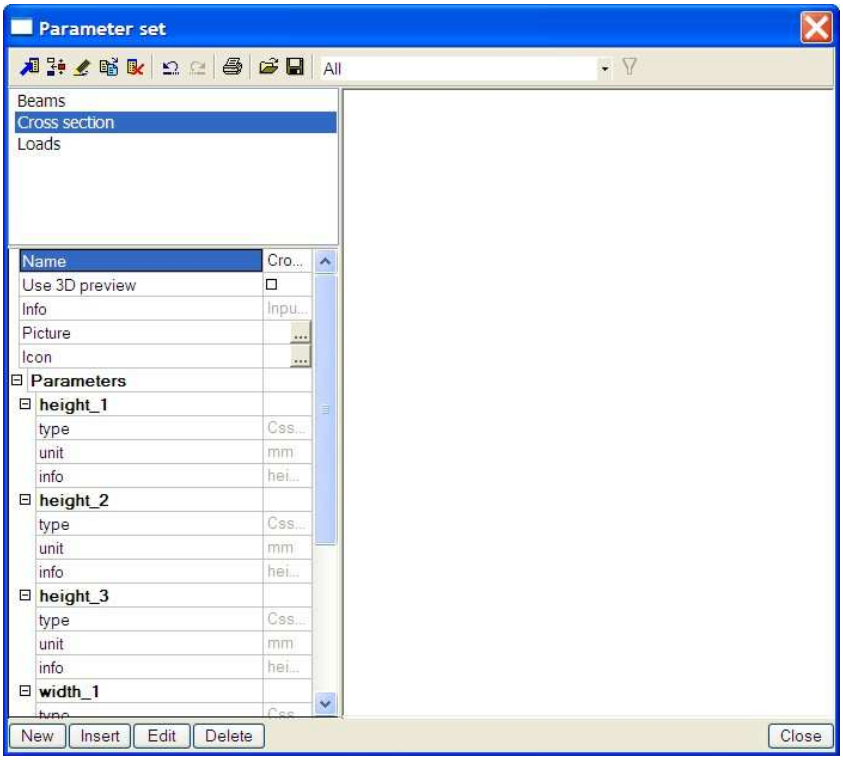
- Second tab:



- Third tab:



3. The **Parameter set** window gives the 3 parameter sets: Beams, Cross section and Loads



4. The next step is to prepare a picture to accompany the first set.
    - Close the manager and adjust
    - Set a standard “View Y” view in the graphical window.
    - Use function **File > Print picture > Save picture to file** to save the drawing into an external BMP file.

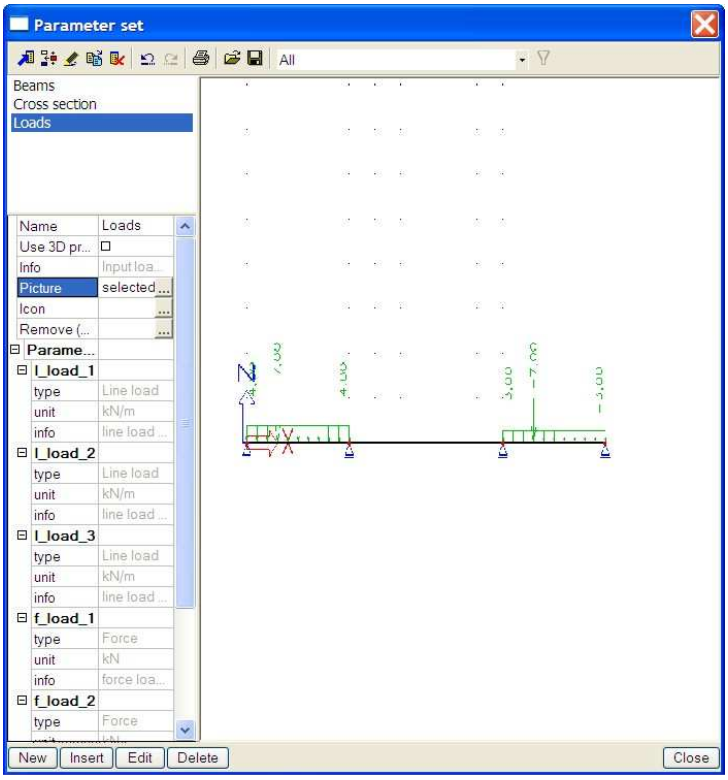
Note: In this case we made just one picture to accompany with all three sets. Character of the structure is rather longitudinal so all three pictures in one will better fit window.

5. Alternatively pictures may be easily composed in Picture gallery *(see User’s guide for further information)*, and/or imported from any external picture editor.

6. Open the **Parameter sets manager** (**Tools > Parameters template settings**) and **edit** the Geometry set (or Loads set or Cross section set).

7. Assign the picture to the tab using button [**Picture**].

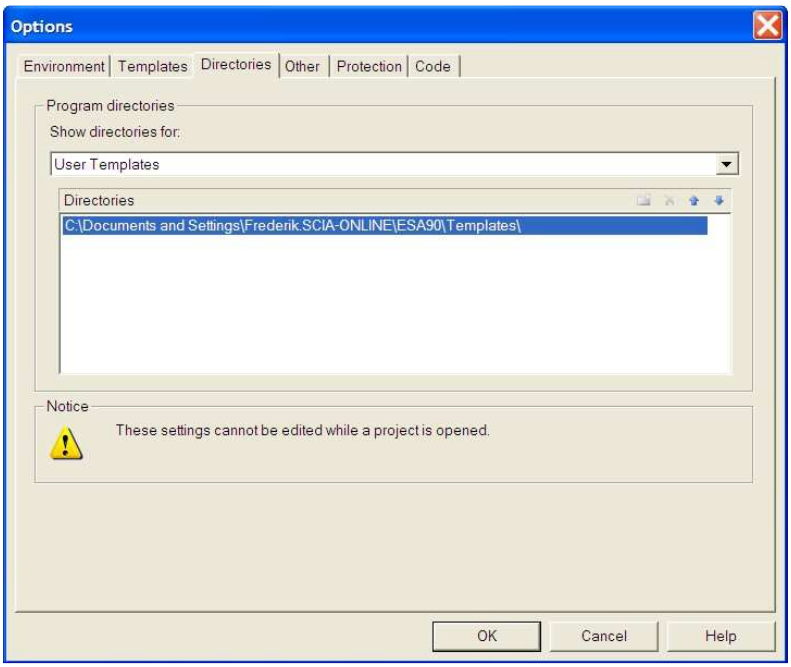
8. At this moment the project is prepared to be saved as parameterized template.



Saving the project as a template

All Scia Engineer projects can be used as templates. When the user wants to use a standard or parameterized project as a template then he has to copy it to a folder which is defined in the **Options** dialogue on the tab **Directories** (**Setup > Options > Directories**):

1. Save the project to standard Engineer file to a standard folder defined for Engineer files



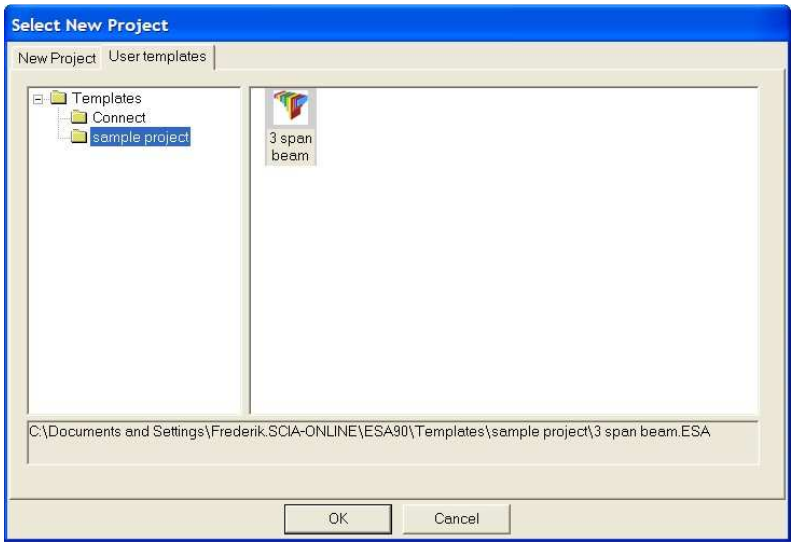
2. Copy the project to the folder defined for **User Templates**.

3. Restart Scia Engineer
4. Alternatively it is possible to save the file directly to the folder defined for **User Templates**.

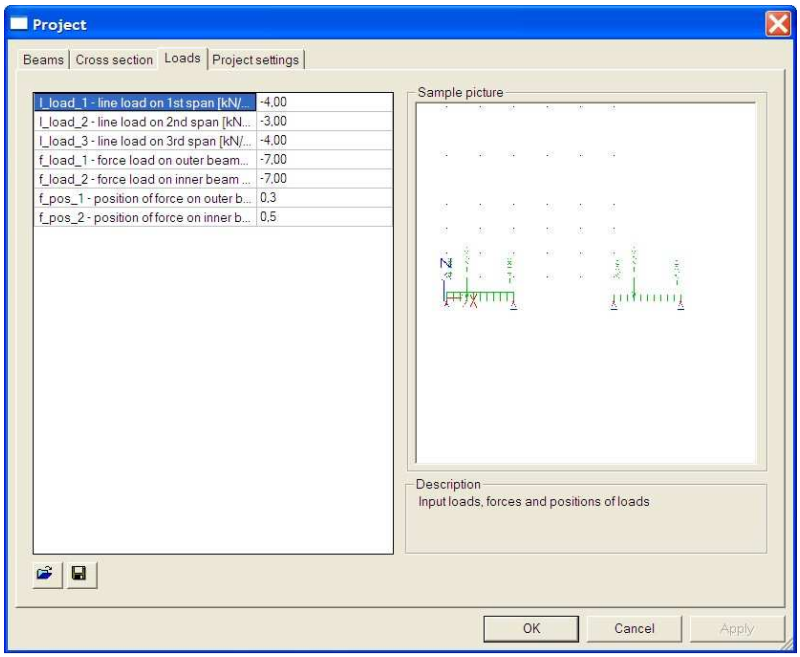
Creating of a new project based on the parametric Project template

Using of parametric templates is very easy.

1. Open a new project:
    - Call function **File > New**,
    - select a tab **User templates**,



    - select a project,
    - press OK button.
2. Go through individual tabs and fill in the parameters



Once the parameters have been defined (notice that only few numbers had to be inserted), the project is opened and a new 3-span continuous beam is automatically created in front of you.

The project template can pre-define also document, pictures in the picture gallery and in the paper space gallery and default values for design on members.

Editing of a parametric project

If the template dialogue for the parametric project is created then a user can edit parameters by it. It means that all parameters are kept in the project and they are not replaced by actual values. This feature brings possibility to edit parameters by the template dialogue anytime.

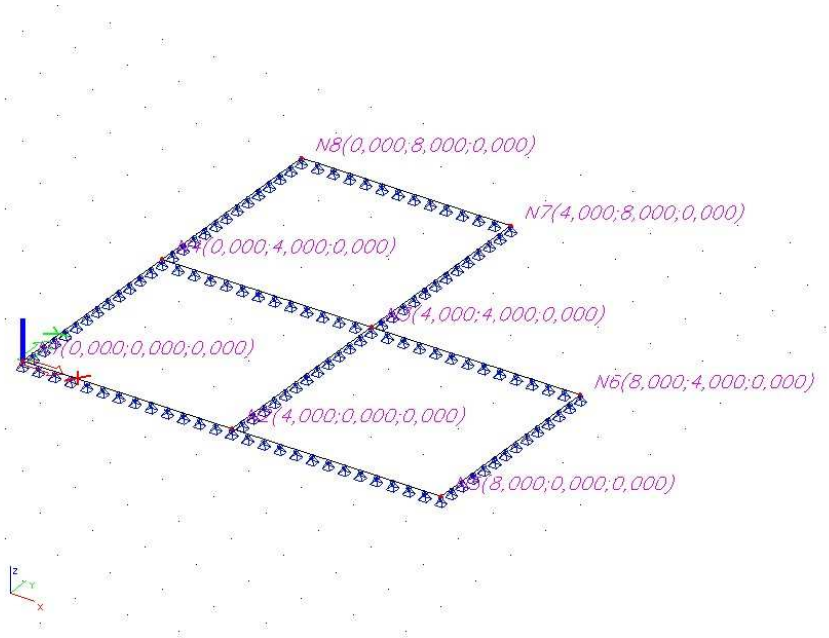
Example #2: L-shaped slab

The goal of this sample project is to create project template for parametric input of L-shaped slab. The slab is loaded by self weight and surface load. Also the surface load is parameterized.

Storing, opening and editing of the parametric template is the same as in the 1st example.

Definition of the structure

1. Create a simple L shaped slab. Coordinates of the nodal points are shown in the picture below.

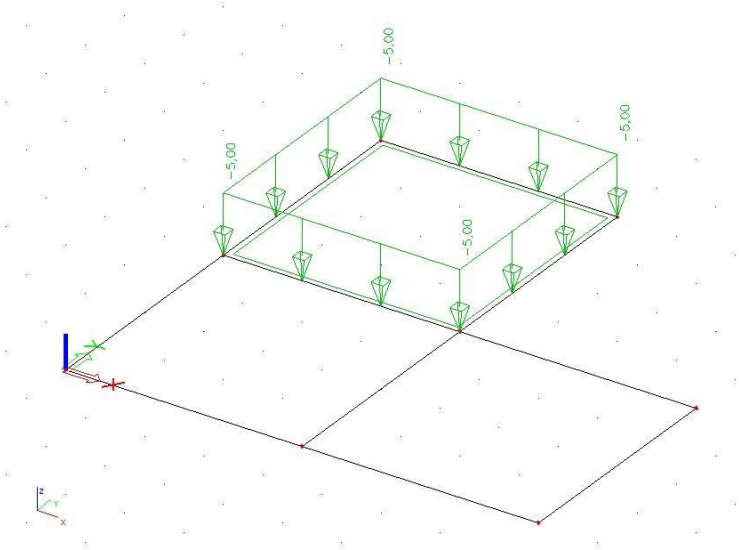


Note: As in the previous example we place the first node to the origin of coordinate system.

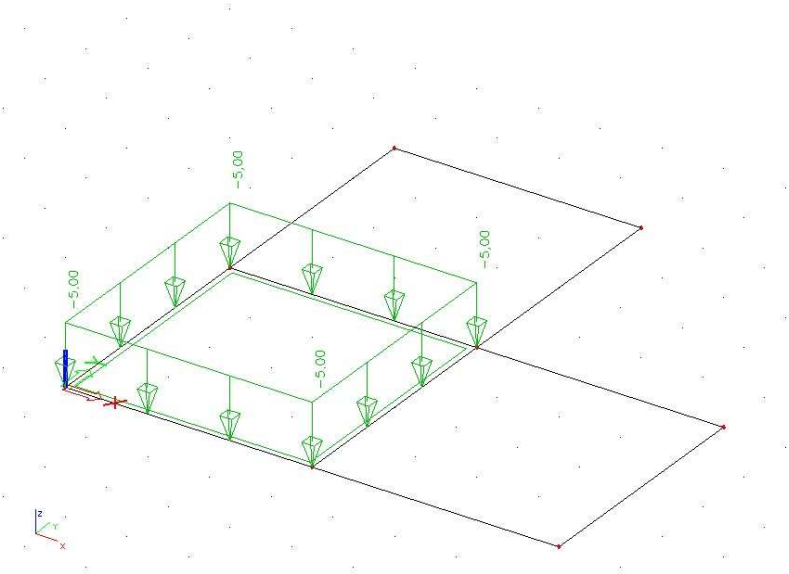
2. Define loads in 4 load cases:

- LC 1: self weight
- LC 2: variable, standard
- LC 3: variable, standard
- LC 4: variable, standard

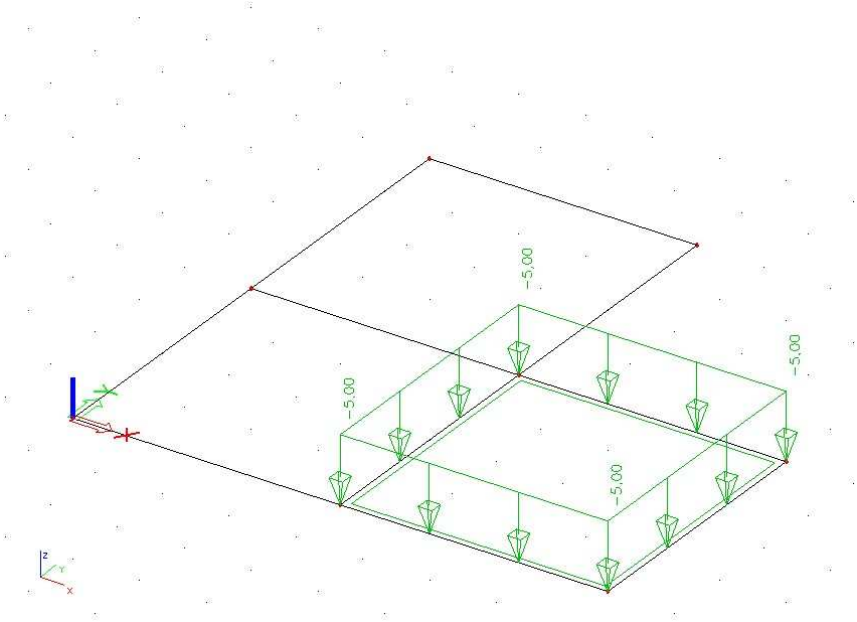
LC 2:



LC 3:



LC 4:



Definition of parameters

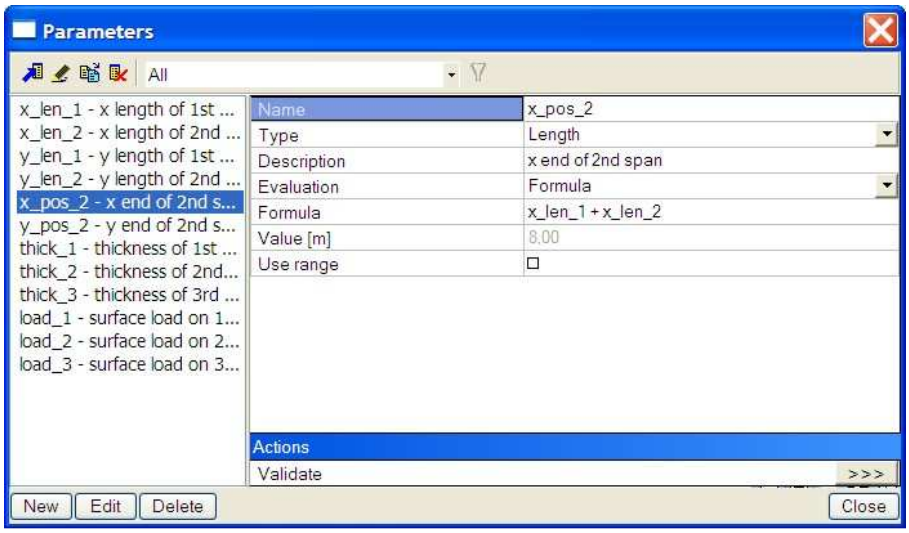
Define parameters: use function **Tools -> Parameters** in the **Main menu:**

Geometry parameters:

Name	Type	Description	Evaluation	Formula	Value
x_len_1	length	X Length of 1st span	value		4 m
x_len_2	length	X Length of 2nd span	value		4 m
y_len_1	length	Y Length of 1st span	value		4 m
y_len_2	length	Y Length of 2nd span	value		4 m
x_pos_2	length	X end position of 2nd span	formula	x_len_1 + x_len_2	
y_pos_2	length	Y end position of 2nd span	formula	y_len_1 + y_len_2	
thick_1	css length	thickness of 1st slab	value		200 mm
thick_2	css length	thickness of 2nd slab	value		200 mm
thick_3	css length	thickness of 3rd slab	value		200 mm

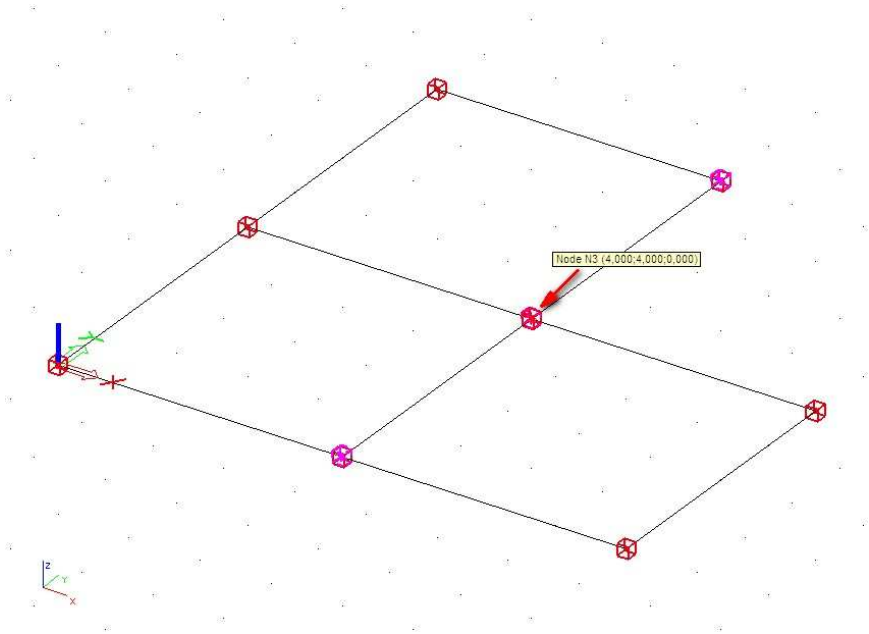
Loads:

Name	Type	Description	Evaluation	Formula	Value
load_1	surface load	surface load on 1st slab	value		-5 kN/m²
load_2	surface load	surface load on 2nd slab	value		-5 kN/m²
load_3	surface load	surface load on 3rd slab	value		-5 kN/m²

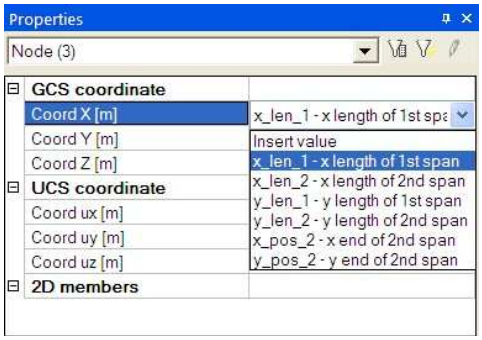


Assigning parameters to the structure

1. Select nodes which have the same X coordinates



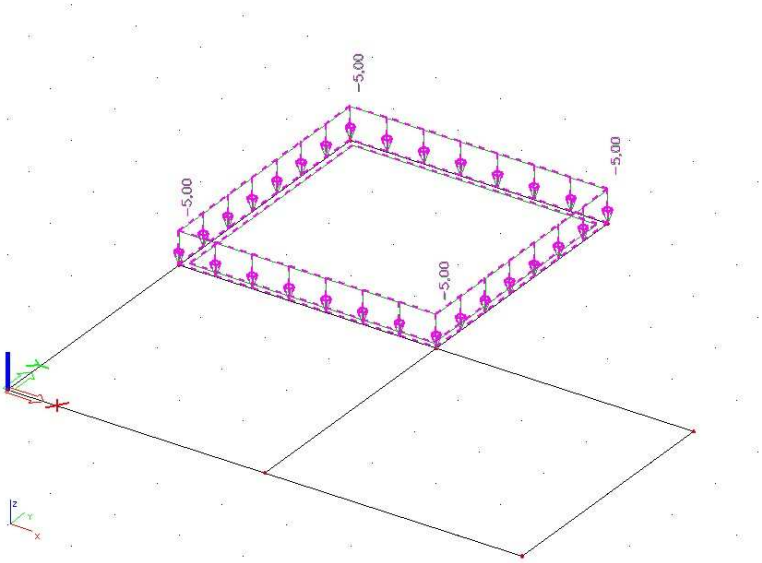
2. Select item **GCS coordinates > Coord X [m]** and change its content to **x_len_1**, in the **Property window** (using the little down-arrow button)

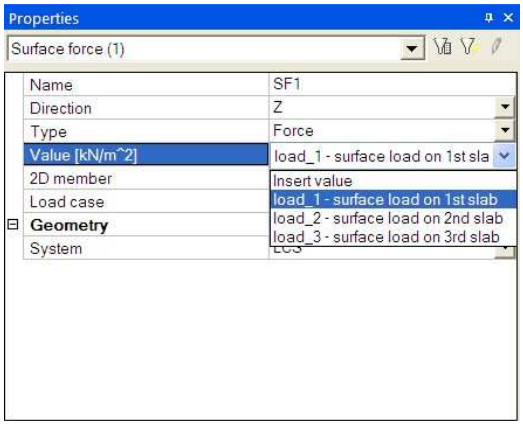


3. Change the X co-ordinates of nodes on the right side of the picture for coordinate **x_pos2**

4. Do the same changes for Y direction and use parameters **y_len_1** and **y_pos2**

5. Adjust the second load case to be displayed in the window. Select the surface load and change the load value to parameter **load_1**





6. Make the same changes with the load in the next load cases

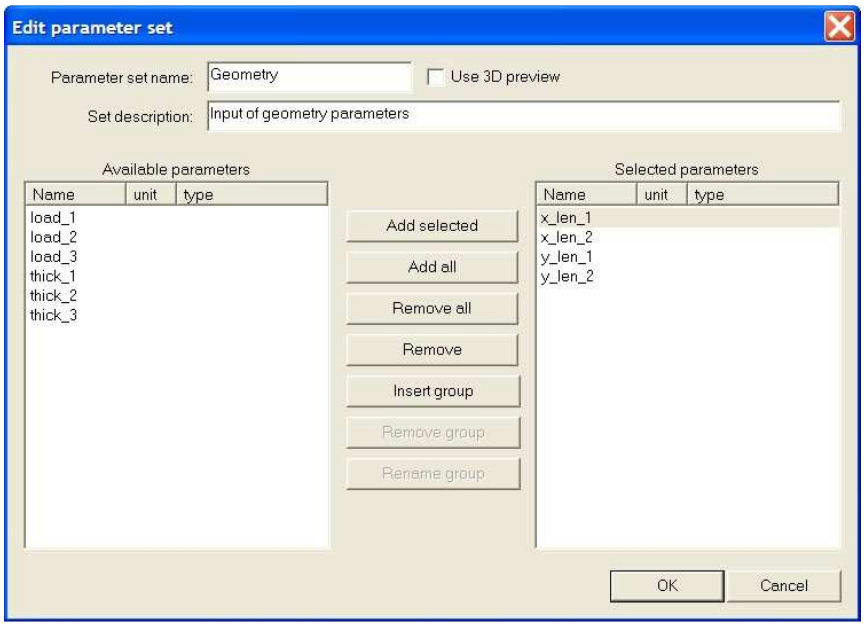
Template dialogue

The user can define a template dialogue for easier editing of input parameters. Defined parameters can be arranged to sets (represented by tabs in the dialogue) and to groups (represented by trees).

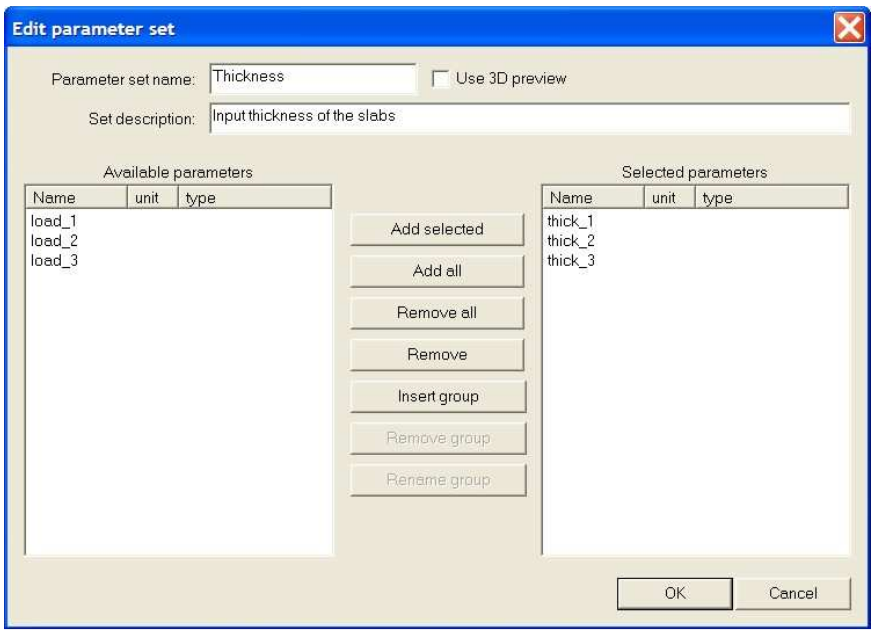
1. Open the Parameter set manager (**Main menu > Tools > Parameters template settings**). Let's define three parameter sets according to the pictures below.

2. Select parameters in the **Available parameters** window and move them to the **Selected parameters** window by pressing the **Add selected** button.

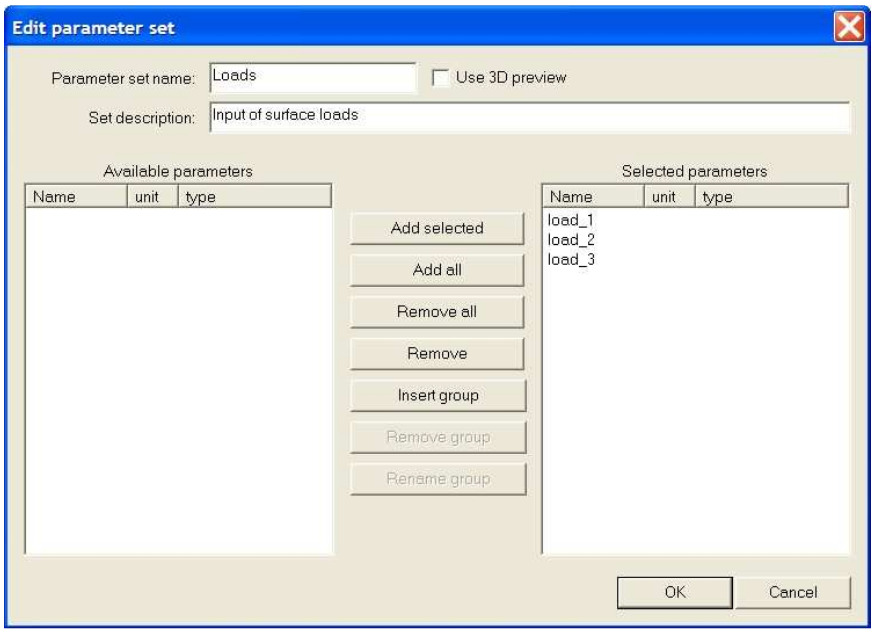
- First set:



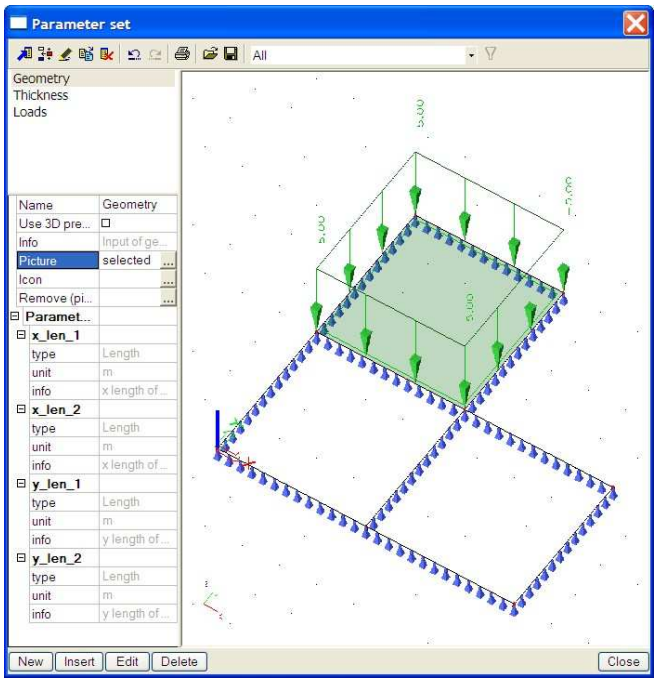
- Second set:



- Third set:



3. The next step is to prepare a picture to accompany the first set.
    - Close the **Parameter template settings**
    - Set a standard AXO view in the graphical window
    - Use function **File > Print picture > Save picture to file** to save the drawing into an external BMP file
    - Alternatively pictures can be easily composed in Picture gallery *(see User's guide for further information)*, and/or imported from any external picture editor.
4. Open the Parameter template settings
5. Select the Geometry
6. Assign the picture to the tab using button [**Picture**]
7.



At this moment the project is prepared to be saved as parameterized template