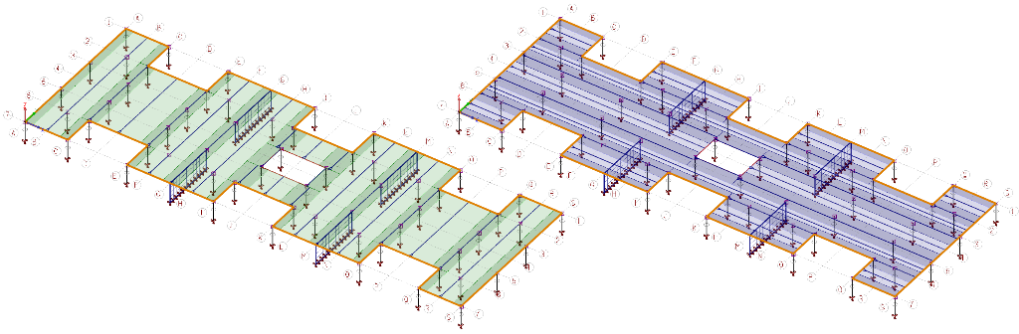
CONCRETE SLAB DESIGN ASSISTANT

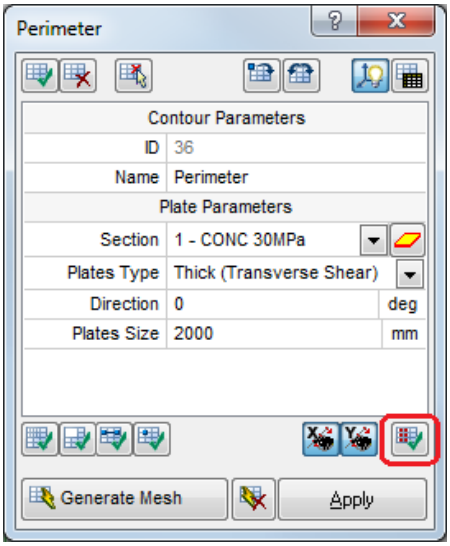
INTRODUCTION

The concrete slab design assistant allows the user to quickly generate the design strips of a concrete slab. The assistant will generate column strips and middle strips that are adapted to the geometries of the bidirectional span of the slab. This assistant is directly linked to the automated mesh generation functionalities, allowing us to use the geometrical elements such as supports, walls and openings for both the finite elements model and the design strips generation



The use of this assistant is done in two steps: the definition of the **column lines** and the generation of the **design strips**. Both of these steps have the option to be automated in order to facilitate the design of a reinforced concrete slab.

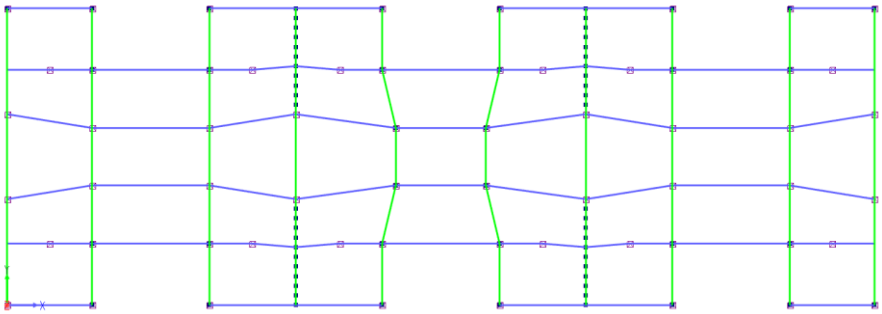
You can access the assistant by selecting the **edit slab design strips** button . It is also possible to access these functionalities in the **edit** menu, selecting the sub-menu **reinforcement**, selection **edit slab design strips** and selection to slab mesh contour perimeter.



FUNCTIONALITIES

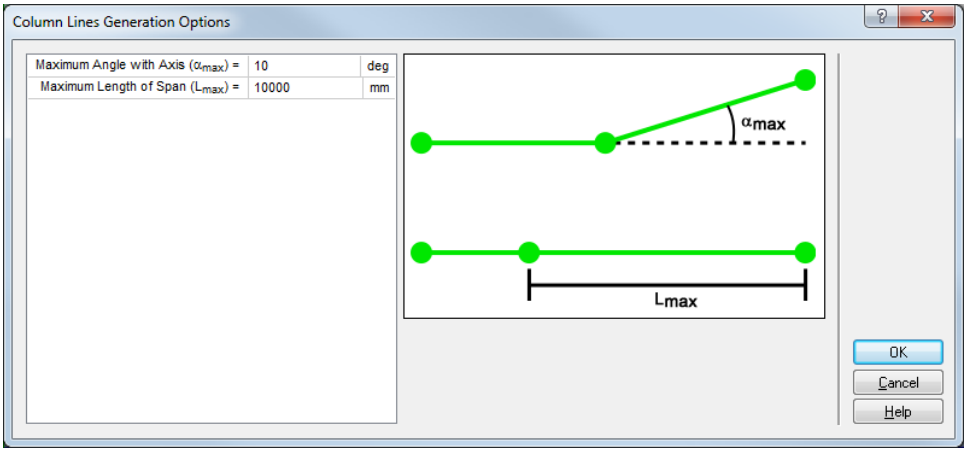
Column line

A column line is used as a guideline for the column strip location. They can be placed on the supports along the two principal axis of the slab. The column lines are also used to automatically define the bidirectional span in the slab. Therefore, they will be the base upon which the automated design strip generation is based. The column lines are used to determine the overall geometry of the bidirectional bay in the slab.

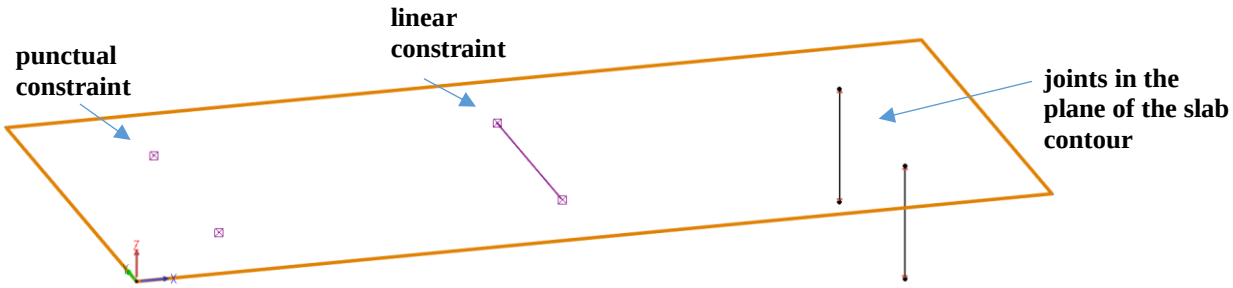


Automated column line generation

The automated column line function allows you to automatically detect the column lines in both axis of the slab. Some parameters are also adjustable to facilitate the column line generation in more complex models. The **maximum angle with axis** and the **maximum length of span** for each support can be adjusted for the column lines automatically detected.



In order to allow the automated generation of the column line, supports of the slab need to be specified for the model. Three types of supports can be detected: the **punctual constraint** and the **linear constraint** and any joints in the plane of the slab contour. The first two types of support can be placed into the model directly from the **mesh contour perimeter** menu. The **punctual constraint** can be used to represent the location of a column and a **linear constraint** can be used to represent a bearing wall. During the automated generation, linear constraints are detected as a punctual support at both end of the wall segment. Once supports are specified in the model, the **automated column line generation** will connect the supports of the model in lines following the orientation of the axis of the perimeter mesh contour of the slab.



Column line edition tool

Several functionalities allow the user to easily modify any column strip within the assistant. It is possible to delete, select or create a column line along X or Y. Also, specific commands allow you to extend a column line to the side of the slab, add or delete a point to a column line and to split a column line at one point.

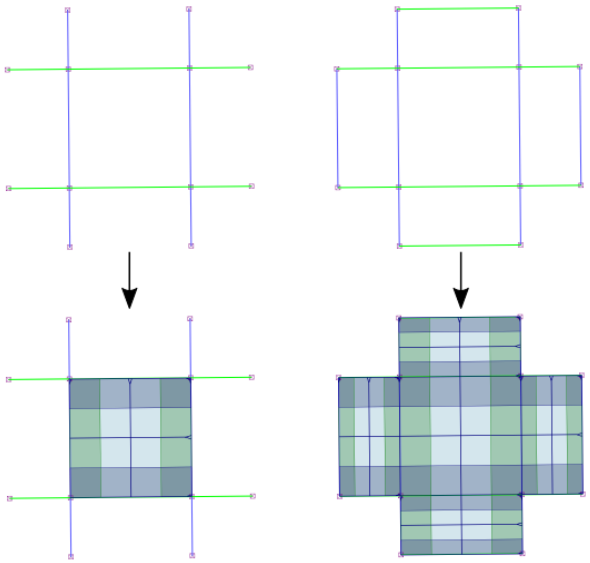
Display parameter

Display parameter allows activating and deactivating the display of the design strip and column lines.

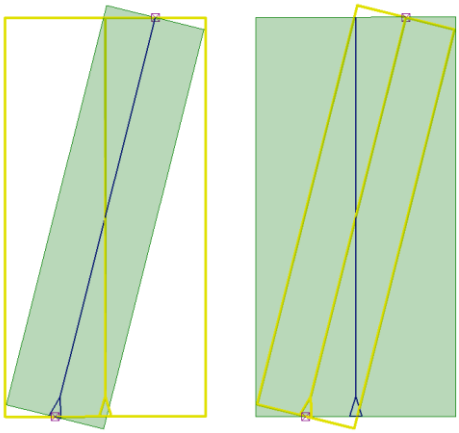
Automated generation of the design strip

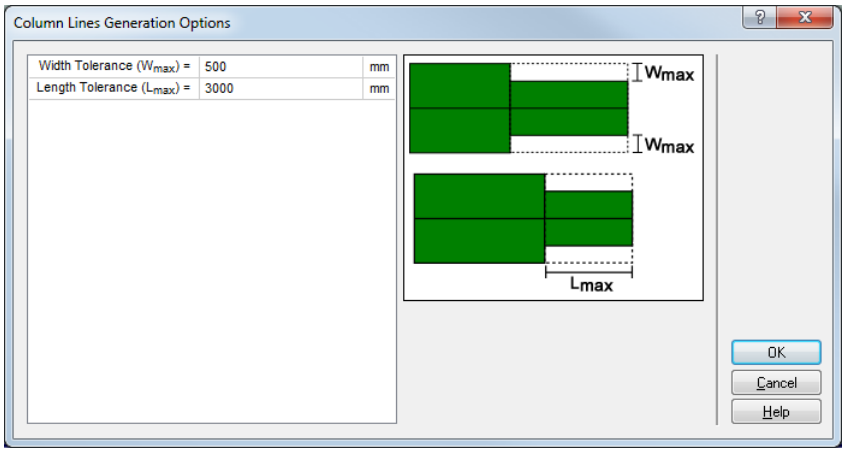
Once all the column lines are defined into the model, it is possible to use the automated generation of the design strip. This command will automatically generate integration lines representing the design strip adapted to the geometry of column lines for the slab. Further information on the use of integration lines is available in the technical document on this topic. (LINK)

The column lines are used to determine the overall geometry of the bidirectional bay in the slab. These bays are detected by having a rectangular shaped bay closed between two X horizontal column lines and two Y vertical column lines. It is possible to have multiple supports present along one span. The four sides of a bay need to be indicated with a column line in order to allow the proper detection of a bidirectional bay.



The width of the column strip is calculated as the quarter of the shorter of the two spans of a bi-directional bay. In the case where a bay is not perfectly symmetrical, the shortest side of the bay will be considered. If one of the column strips is not completely parallel with the reinforcement axis of the slab, its width will be adjusted to the absolute width on both sides of the strip, as illustrated below. The more inclined the strip will be, the wider it will be adjusted. The middle strip is the space available between two column strips, hence the user only has to manage the width of the two surrounding column strips.



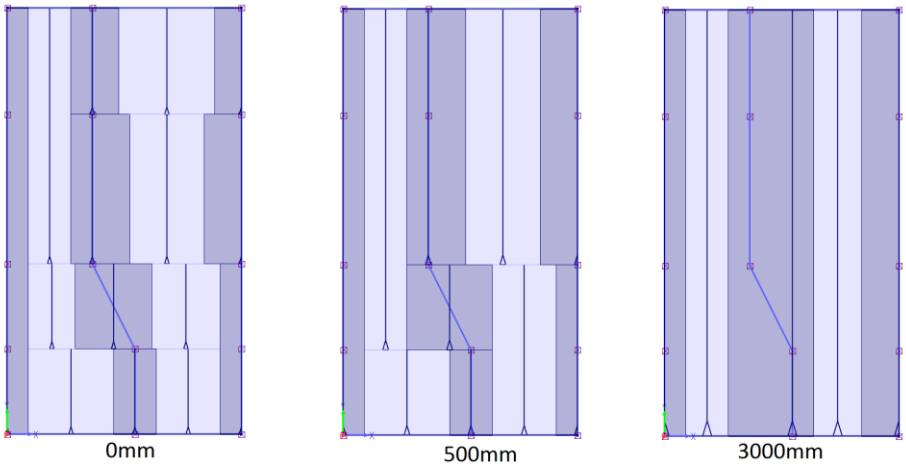


The uniformization of the strip width allows the user to generate more uniform strip widths along a succession of similar span. The width of the column strip is uniformized if the width of the adjacent strips is below the **uniformization width tolerance**; this operation is made on both sides of the column strips independently. The figure below shows the results of the same automated generation of the design strip with different **uniformization width tolerance** value.

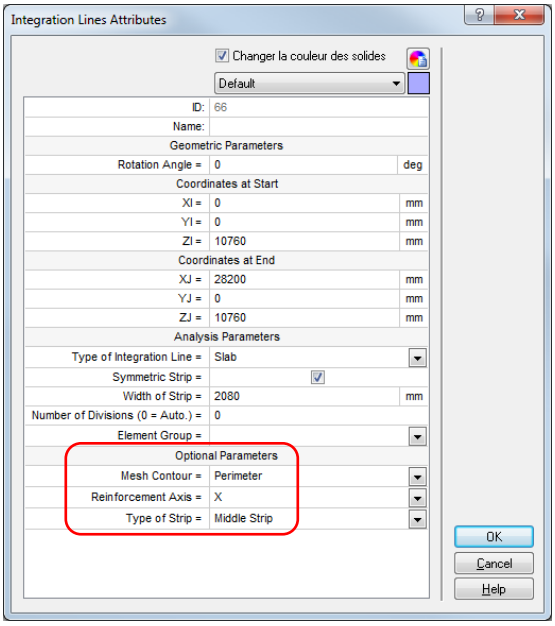
At 0 mm, only the strips with the same width are uniformized.

At the default value of 500mm, the generation provides strips with moderate uniformization.

At 3000 mm, the central strips get completely uniformized as one wide strip, causing the middle strip on both sides to be thinner. In the same way, the strip width would be uniformized if an adjacent strip as a length less than the **minimal uniformization strip length.**

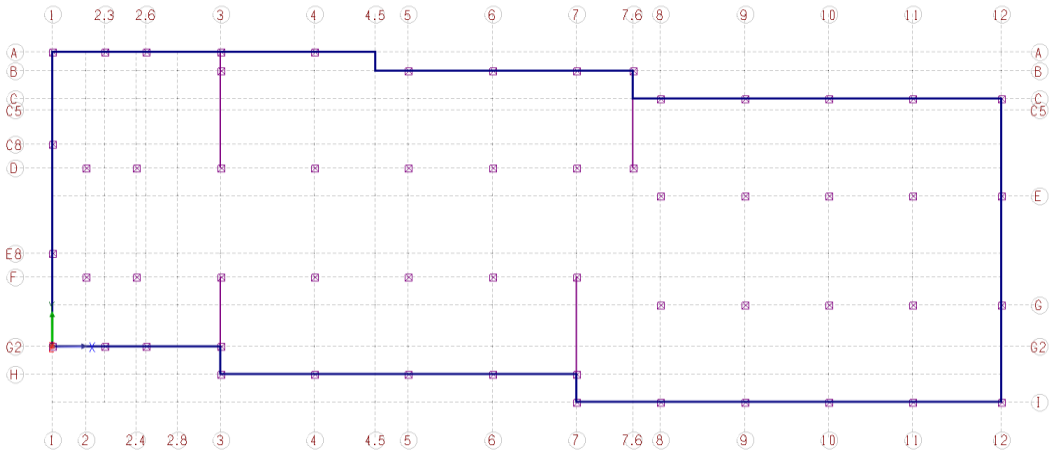


Each design strip is defined as an integration line allowing to precisely monitor the design moments and sheer provided by the finite element model. In addition to all the geometrical properties of each integration line, the bottom part of each Integration line attributes menu shows the different information associated to its design strip parameters.

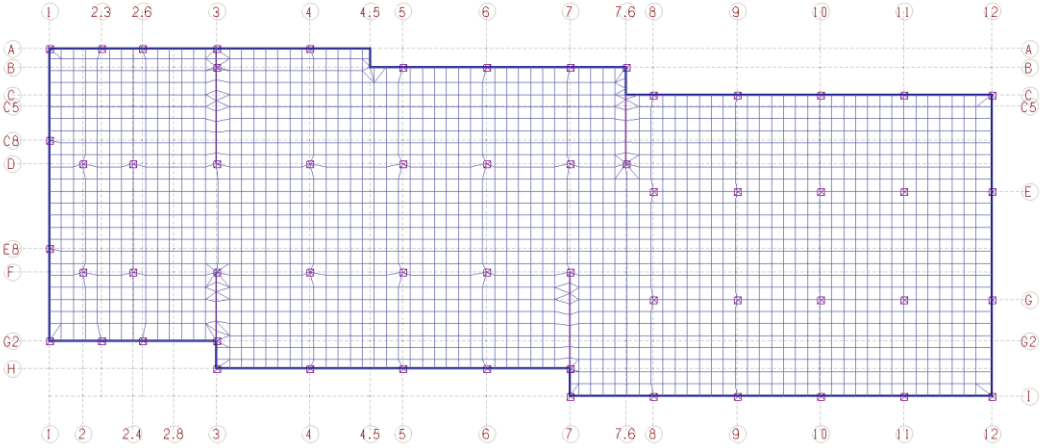


EXAMPLE OF PROJECT COMPLETED WITH THE SLAB DESIGN ASSISTANT: PROJECT 1

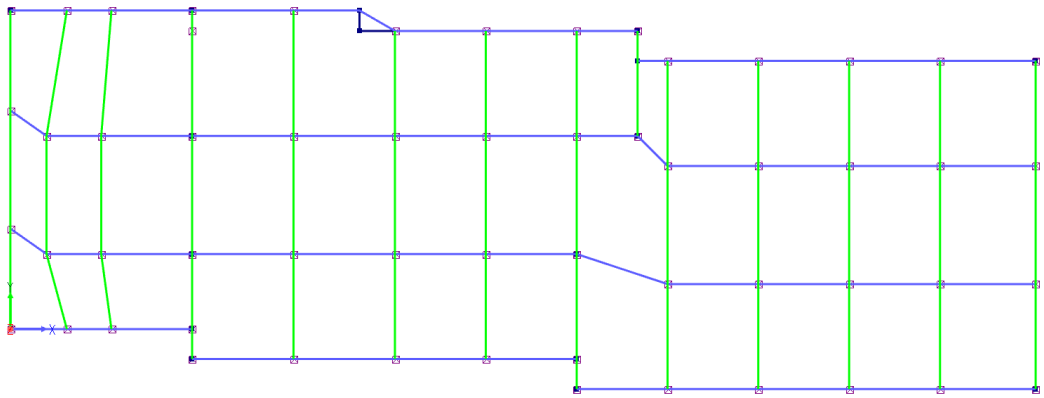
Mesh contour plan



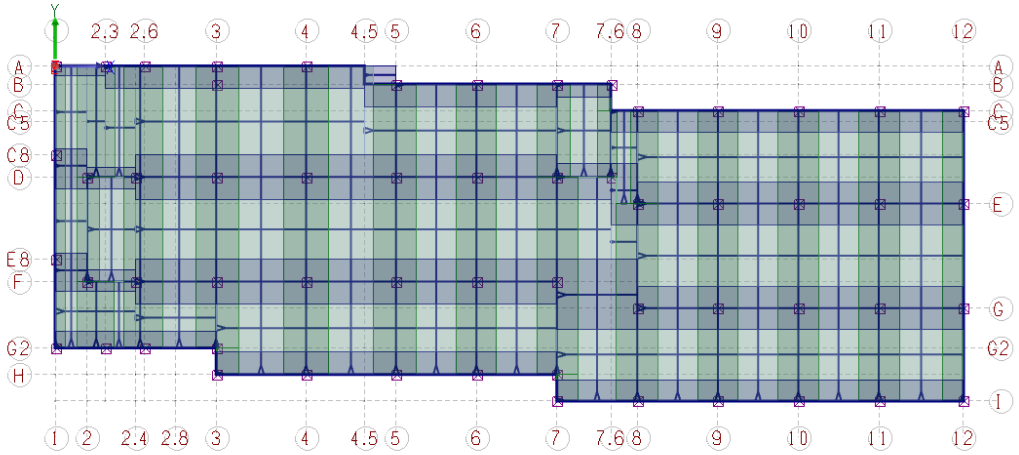
Finite element mesh



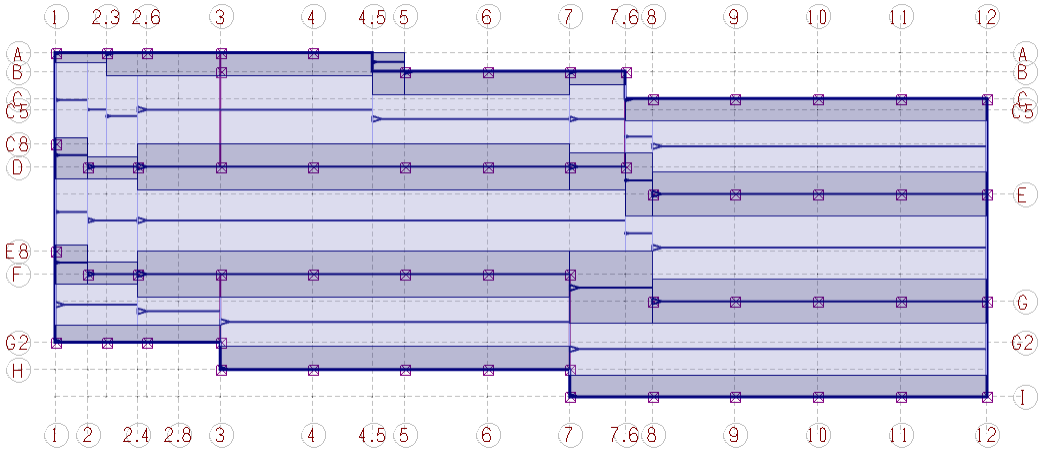
Column lines



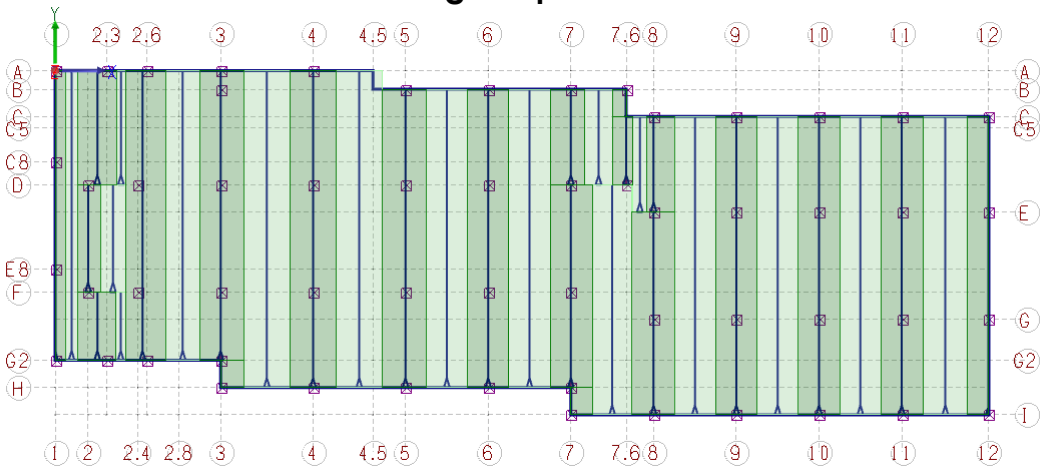
Design strips X and Y



Design strips X axis

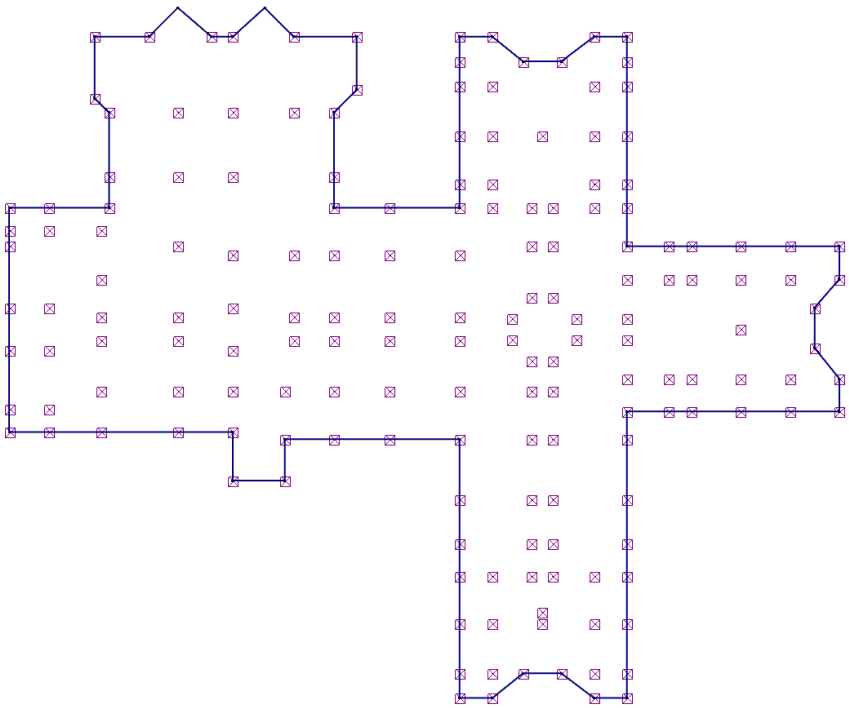


Design strips Y axis

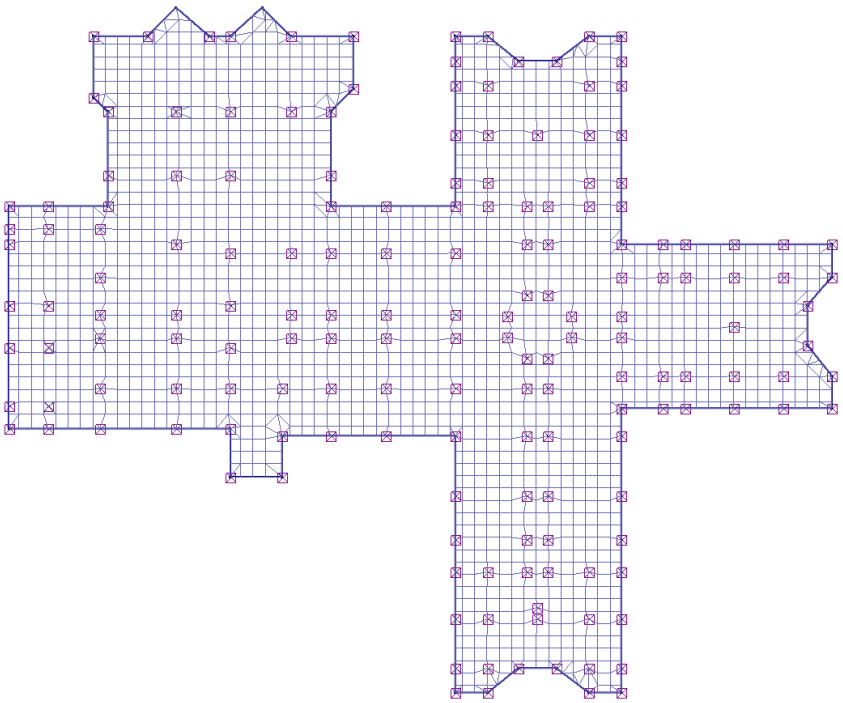


EXAMPLE OF PROJECTS COMPLETED WITH THE SLAB DESIGN ASSISTANT: PROJECT 2

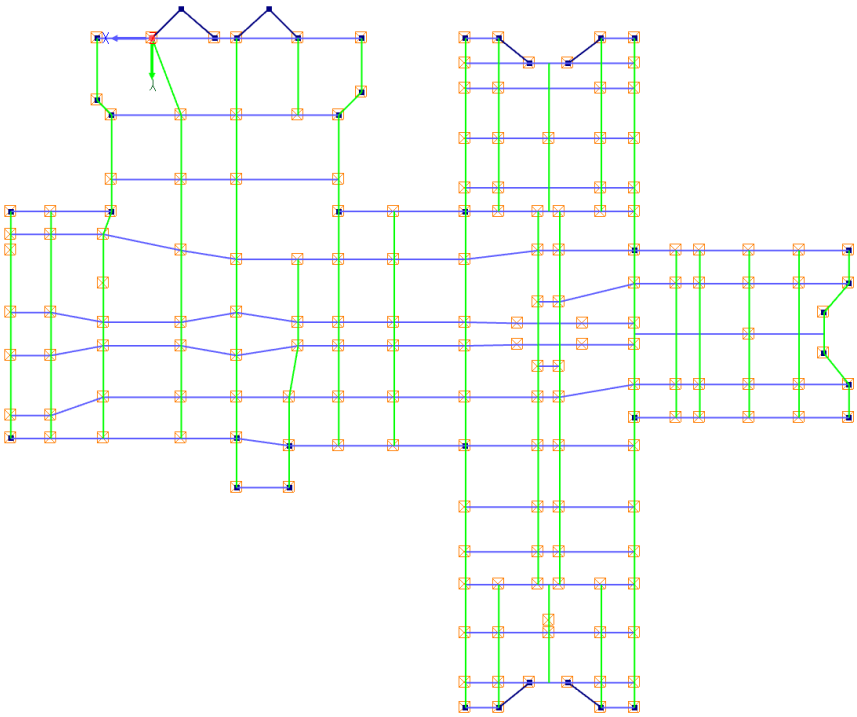
Mesh contour plan



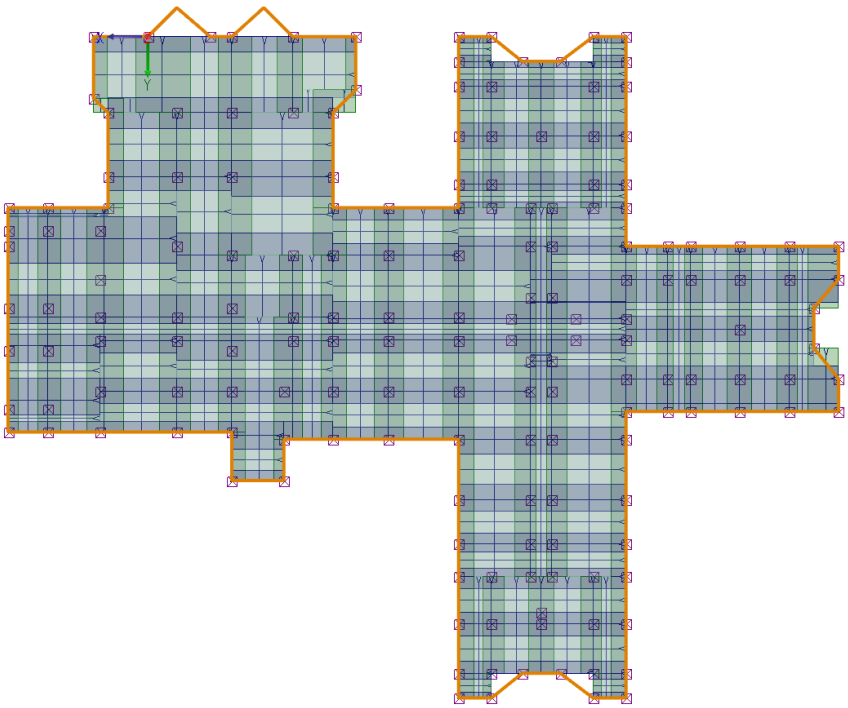
Finite element mesh



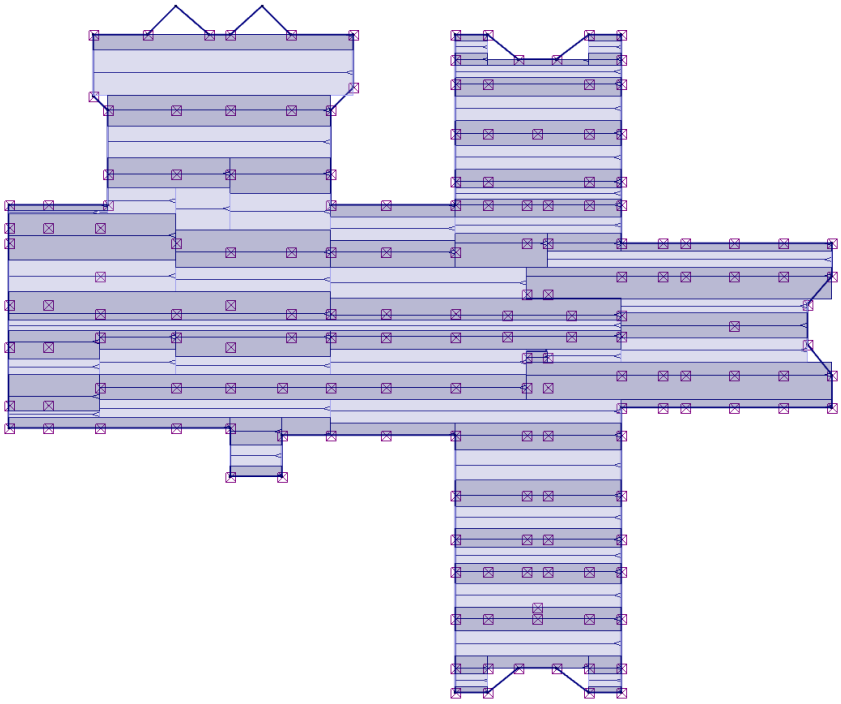
Column lines



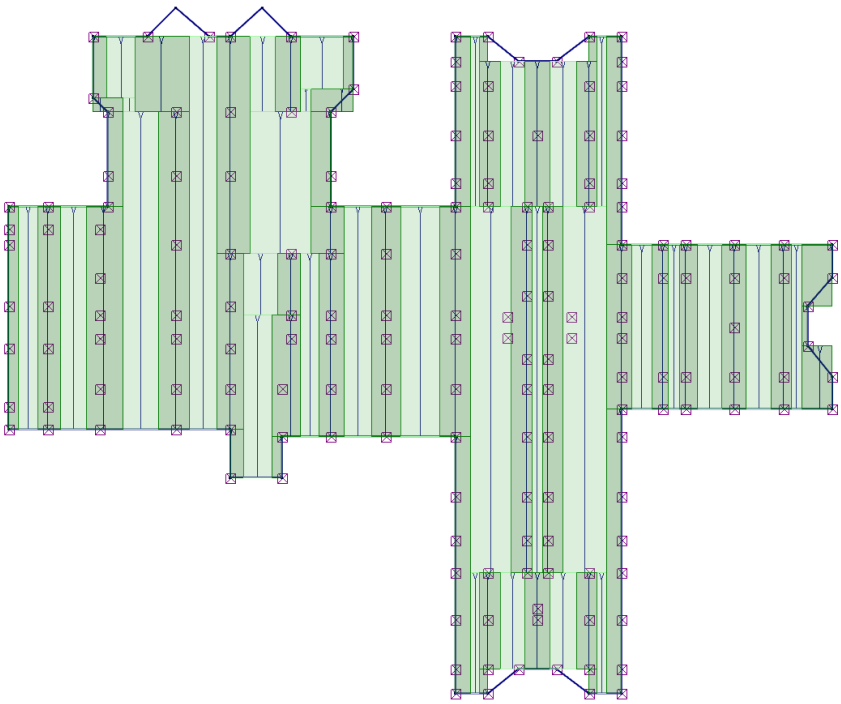
Design strips X and Y



Design strips X axis

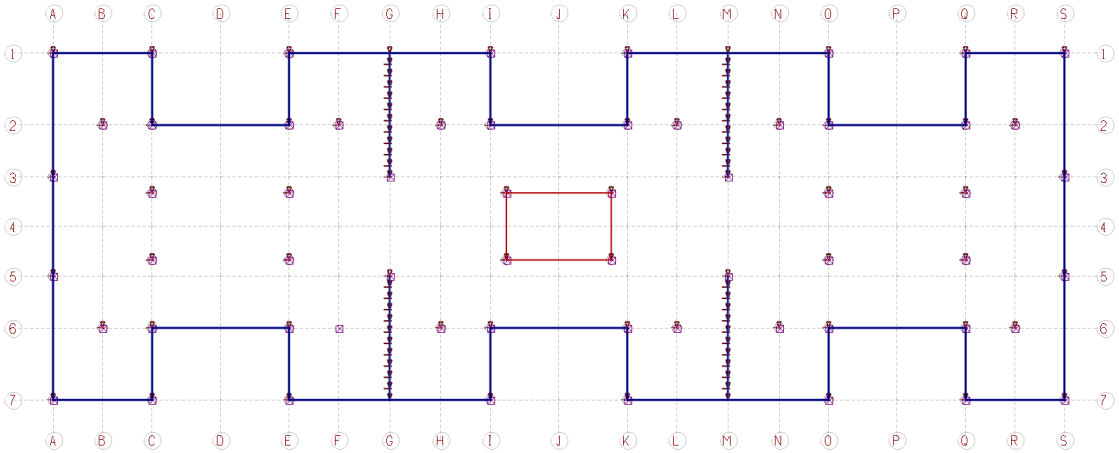


Design strips Y axis

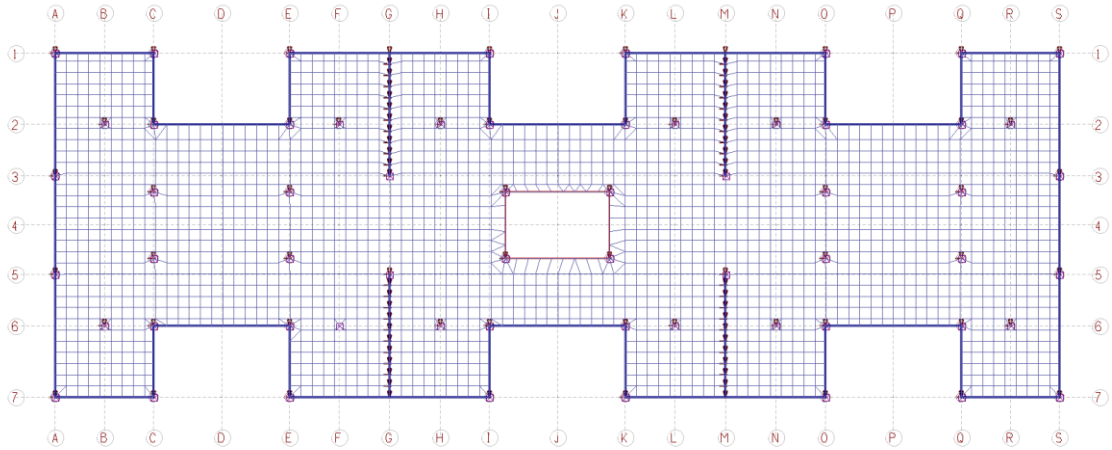


EXAMPLE OF PROJECT COMPLETED WITH THE SLAB DESIGN ASSISTANT: PROJECT 3

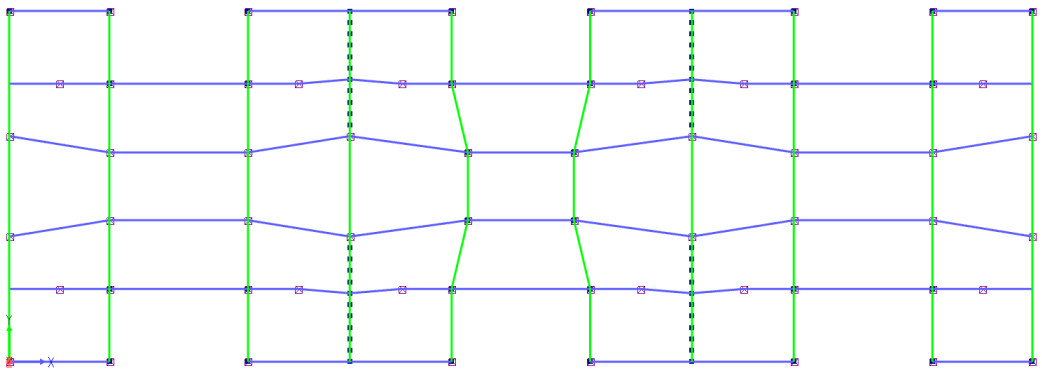
Mesh contour plan



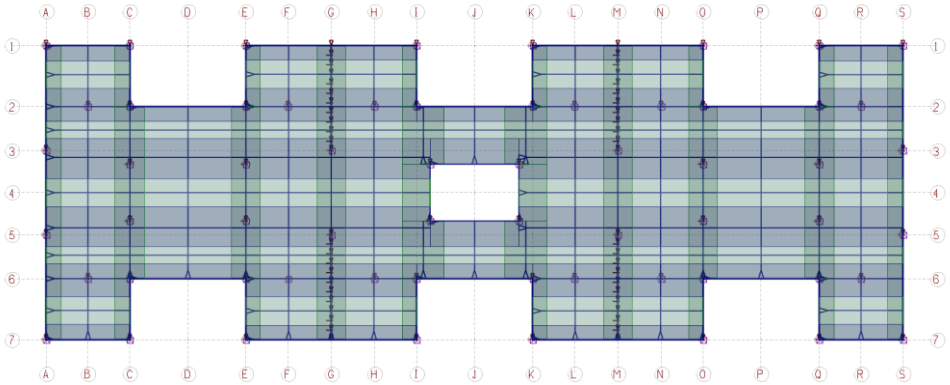
Finite element mesh



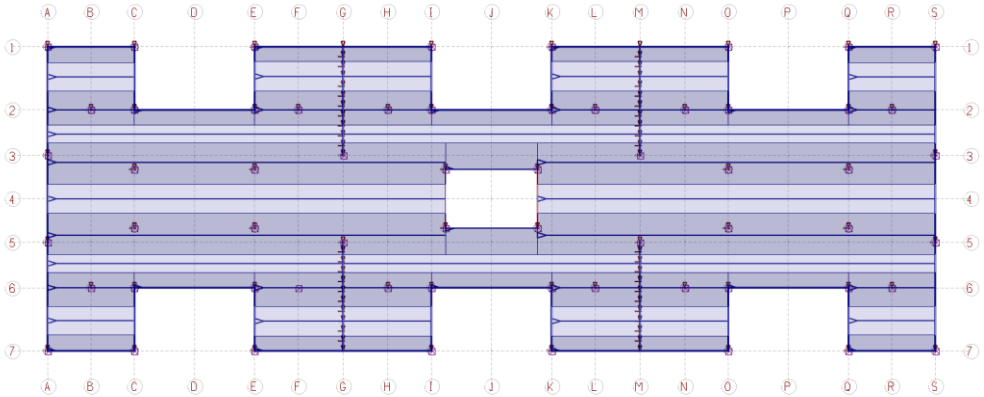
Column lines



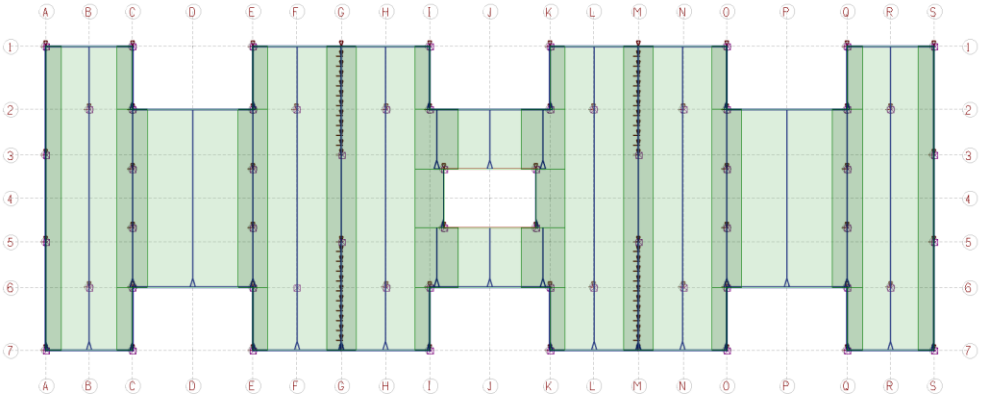
Design strips X and Y



Design strips X axis



Design strips Y axis



FOR MORE INFORMATION:
SAFI QUALITY SOFTWARE INC.
STRUCTURAL ENGINEERING TECHNOLOGIES
P. 418.654.9454
EMAIL: INFO@SAFI.COM
WEB: WWW.SAFI.COM