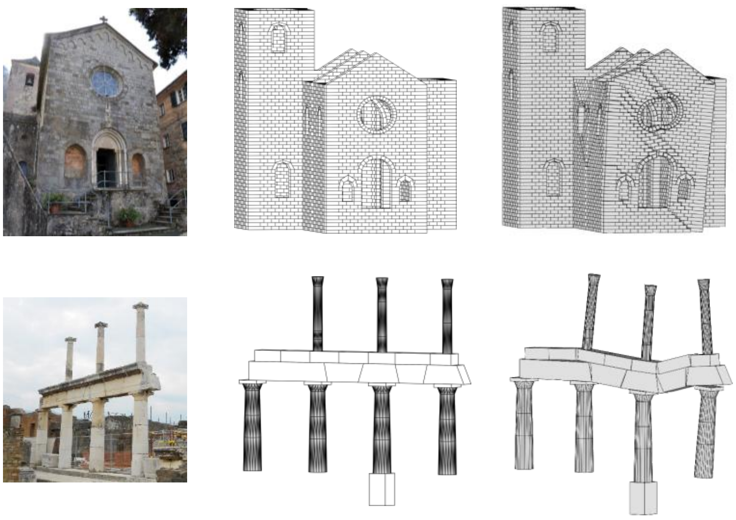
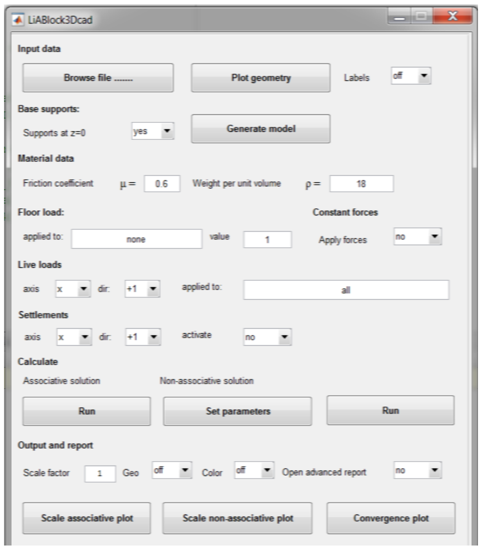
LiABlock_3D

A MATLAB® based Tool for 3D Rigid Block Limit Analysis of Historic Masonry Structures

Version 1.0.0: November 2018





INSTALLATION GUIDE AND USER MANUAL

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Introduction

About LiABlock_3D

LiABlock_3D is a rapid computational tool for limit analysis of masonry structures subjected to point live loads, seismic induced lateral loads and moving supports (Cascini et al., 2018).

Structures are represented as 3D assemblages of rigid blocks interacting at no-tension, frictional contact interfaces. Further details on the adopted contact models, failure conditions and formulations for limit analysis can be found in (Portioli et al., 2014, 2015; Portioli and Cascini, 2016).

LiABlock_3D is built as a standalone executable application from an original MATLAB® program which provides as outputs the computed collapse load and the plot of the corresponding failure mechanism. The Mosek© optimization software is used to solve the mathematical programming problems underlying the limit analysis formulation (www.mosek.com).

LiABlock_3D is created with MATLAB® Compiler™ using the MATLAB® Runtime, which enables royalty-free deployment to users who do not need MATLAB®.

The LiABlock_3D version 1.0 can only be used for research in academic institutions or educational purposes. The software and documentation are provided "as is" and without any warranty of any kind.

The present User Manual includes the instructions to run the Tutorial_1 only. Other functionality, which are included in the LiAblock_3D version 1.0, are not described in the text and will be included in further releases of the User Manual.

Installation

Supported platform

Windows 64 bit x86.

Prerequisites for Deployment

Download and install the Windows 64-bit version of the MOSEK Version 8.0.0.81 from the MOSEK Web site by navigating to https://www.mosek.com/downloads/list/8/.

MOSEK provides faculty, students or staff at degree-granting academic institutions a free academic license. The free academic license can only be used for research in academic institutions or educational purposes.

Academic licences can be requested at https://www.mosek.com/products/academic-licenses/. The license file mosek.lic should be saved to: C:\users\<userid>\mosek\, where <userid> is the User ID on the computer. Use the 'Test license system' utility which is available in 'Mosek Optimization Tools' from the Start Menu to verify that the license is checked out correctly. For further details visit: www.mosek.com .

Set up instructions

To install LiABlock_3D on a computer running Windows 7 Operating system or newer: right-click on "LiABlock_3D.exe" and select Run as administrator; follow the instructions in the installation wizard, using default options for installation folders.

If the MATLAB® Runtime is not installed, the User will be requested to download the Windows 64-bit version of the MATLAB® Runtime from the MathWorks Website.

For more information about the MATLAB® Runtime and the MATLAB® Runtime installer, see Package and Distribute in the MATLAB® Compiler documentation in the MathWorks Documentation Center (www.mathworks.com).

Once the software has been installed, the Liablock_3D input folder must be created by the user in **C:** , under the name "**LiABlock_3D_User_Input**".

Getting started

In this section, a first tutorial is presented dealing with a masonry barrel vault subject to self-weight loading (dead load) and to varying point vertical loads (live loads). The model is made of 81 blocks and 608 contacts (Fig. 1). Input files are spreadsheets in the .xls or .xlsx format that must be saved by the User in the input folder *C:\LiABlock_3D_User_Input*.

Input files can be generated using *different CAD tools or MATLAB® scripts for parametric analysis*. Guidance on how to build the input file from *Autodesk AutoCAD* is provided in Annex I.

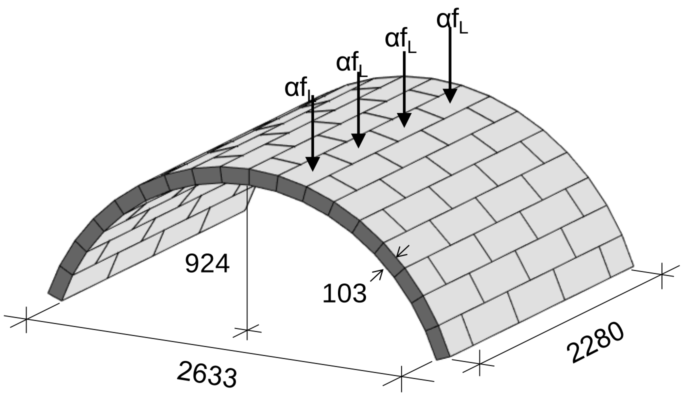


FIGURE 1. Tutorial_1: barrel vault dimensions (mm) and loading conditions.

To start the tutorial, save the file *"Tutorial_1.xls"* in the input folder "C:\LiABlock_3D_User_Input". Open LiABlock_3D pointing to *"All Apps"* on the Start menu and clicking LiABlock_3D or right click on the LiABlock_3D shortcut icon on your desktop. Select Run as administrator. After few seconds, the LiABlock_3D command window appears together with the MS-DOS prompt (Fig. 2c) where control messages are displayed as the analysis starts and proceeds.

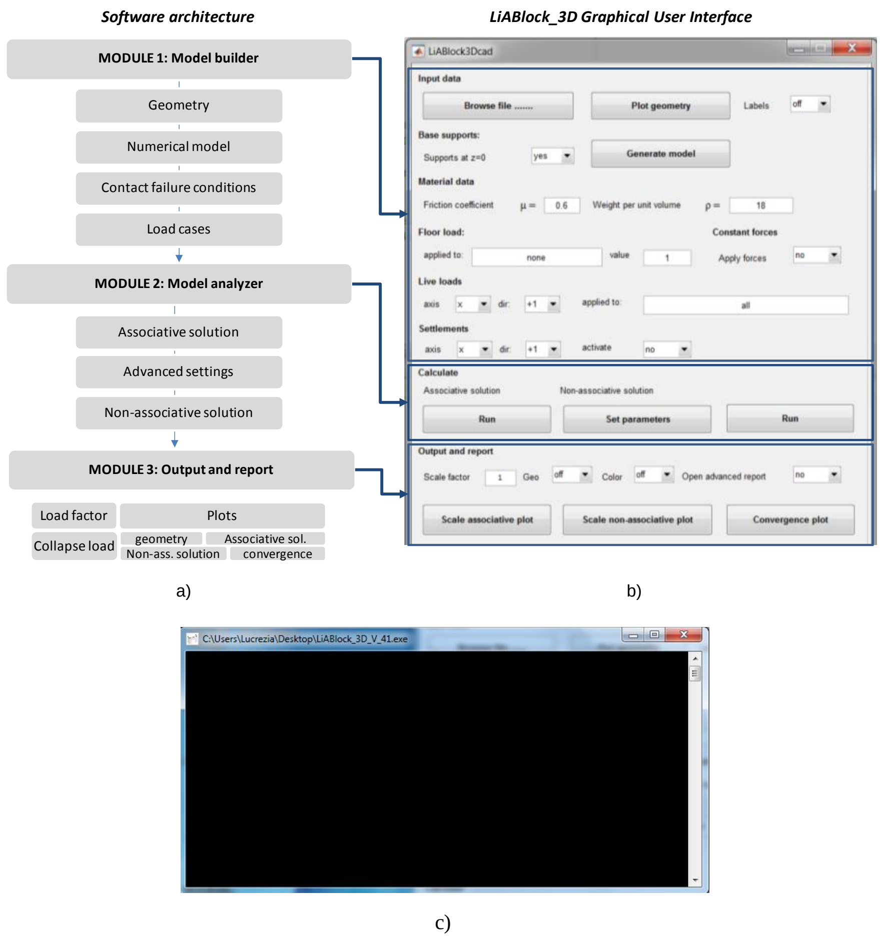


FIGURE 2. LiABlock_3D: a) Software modules; b) The command window interface; c) the MS-DOS prompt

WARNING: LiABlock_3D works in series. As such it is necessary to proceed step by step as specified in the followings without skipping intermediate steps.

Model builder

Input data

Press the ***'Browse file'*** button. The input folder *C:\LiABlock_3D_User_Input* opens. Select the input file "*Tutorial_1.xls*" and press open.

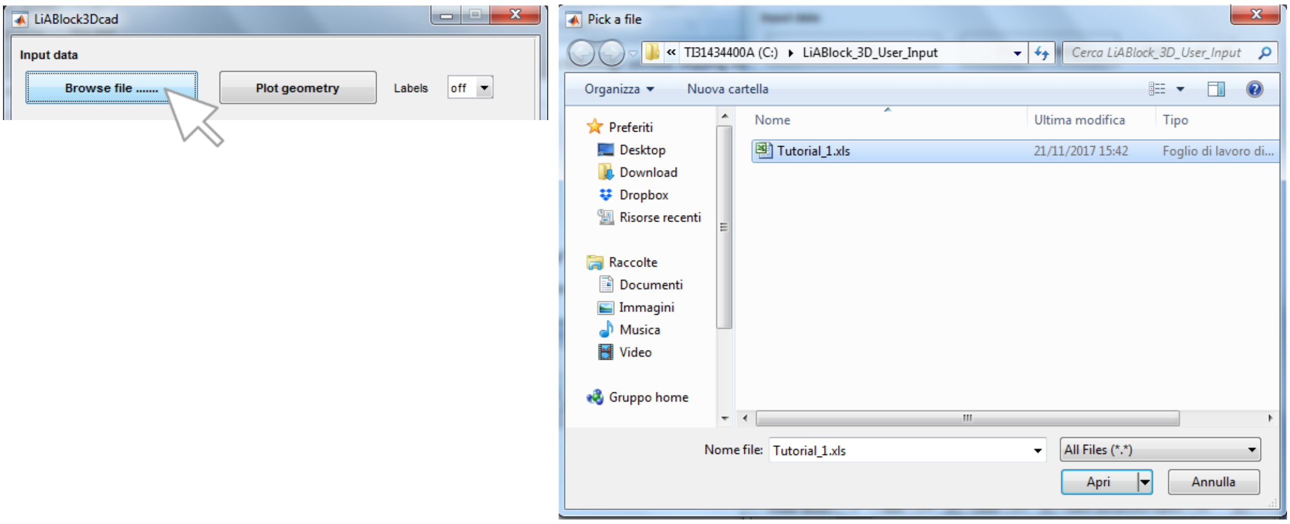


FIGURE 3. Module Builder: loading the file C:\LiABlock_3D_User_Input\Example_1.xls from the command windows.

The MS-DOS prompt displays the message `'Licence check, expiration date status: ok'`

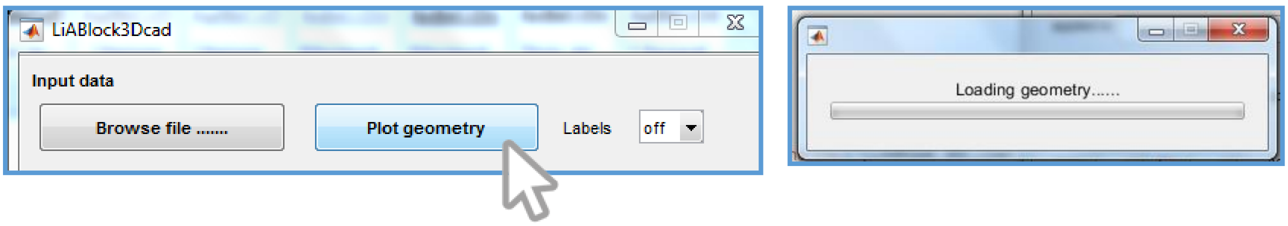
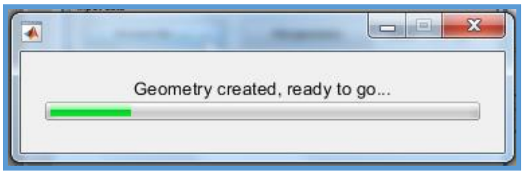


FIGURE 4. Module Builder: plotting Geometry

Click the ***"Plot geometry"*** button to display the 3D geometry model of Tutorial 1. A wait bar opens with the message *"Loading geometry"* and the message `'filename=Tutorial_1.xls'` displays in the prompt.

After few seconds, the wait bar updates in *"Geometry created, ready to go.."* and a MATLAB figure named "Model geometry" with the interactive plot of the model geometry automatically appears.



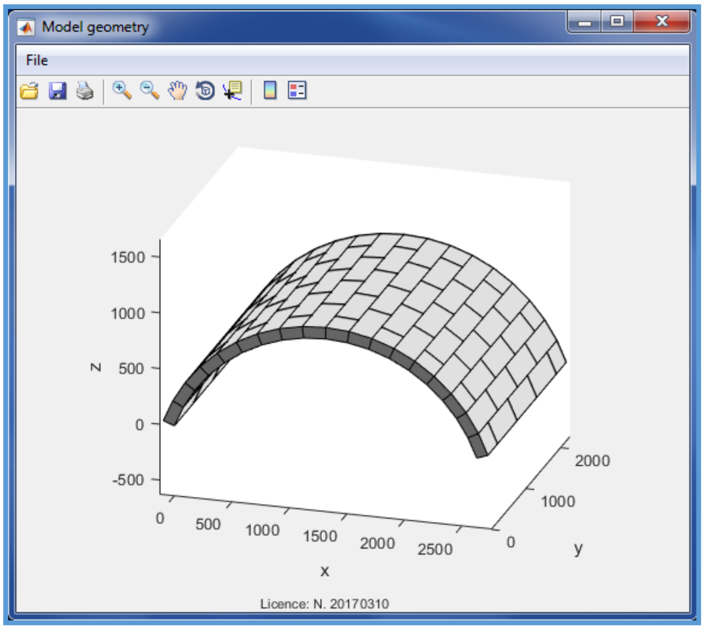


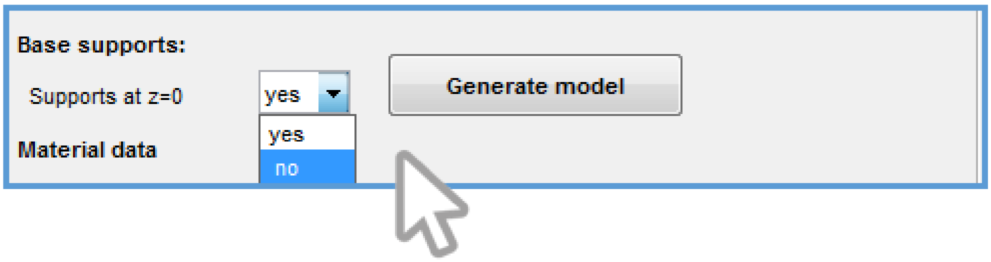
FIGURE 5. Module Builder: Plot of the Geometry of Tutorial 1

To display the number of each block, select ***yes*** in popup menu ***Labels*** and press ***"Plot geometry"*** once again.

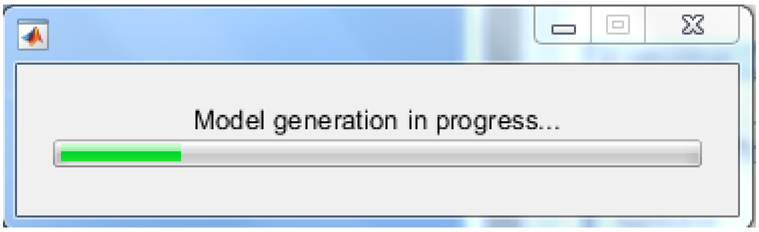
WARNING: do not close the wait bar until the analysis is in progress, otherwise an error message appears in the prompt!

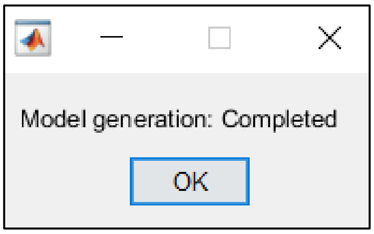
Support condition

To complete the creation of the numerical model, the base support condition must be specified in the pop-up menu ***"Supports at z=0".*** Considering that the support blocks of the vault are sloped, select "no" and click the ***"Generate model"*** button to proceed.



The wait bar displays the message *"Model generation in progress"*.

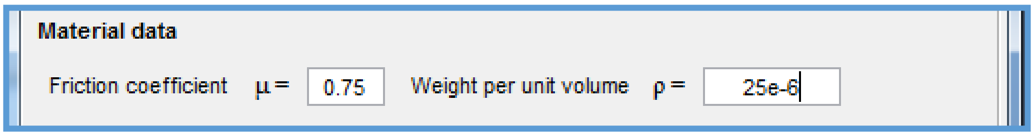




After few seconds, an information box appears. Press ok to go on.

Material data

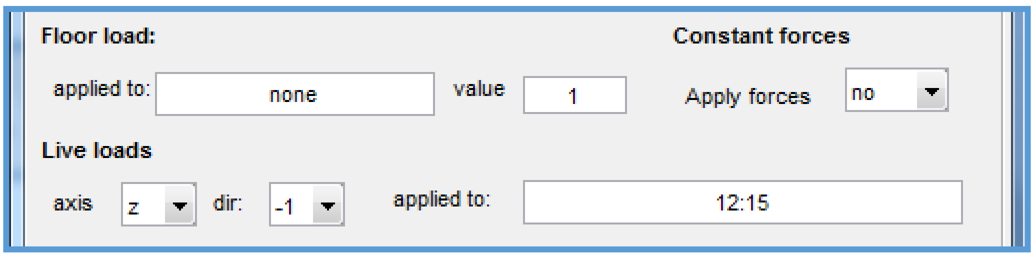
In the material data section, type 0.75 in the friction coefficient white box and 25e-6 in the ρ white box, which correspond to a masonry with a unit weight of 25e-6 N/mm^3.



Loading condition

The vault is loaded with the self-weight, which is applied by default, and with four vertical downward forces applied to the blocks n. 12, 13, 14, 15. No other forces (floor loads or tie loads) are considered.

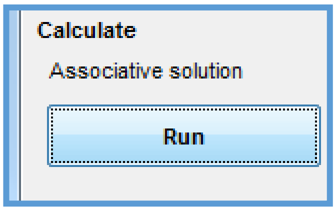
Type *none* in the floor load white box if different and select *no* from the constant forces popup menu. As for live loads select the *z* axis and the negative direction in the *axis* and *dir* popup menu respectively and type *12:15* or *12,13,14,15* in the *applied to* white box



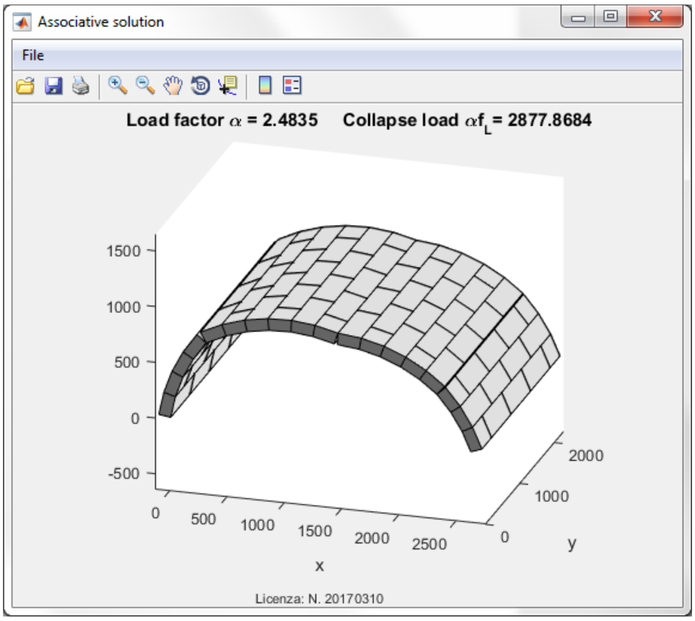
Model solver

Associative solution

Press the ***Run button*** to calculate the associative solution. The wait bar displays the message *"Analysis in progress"*.

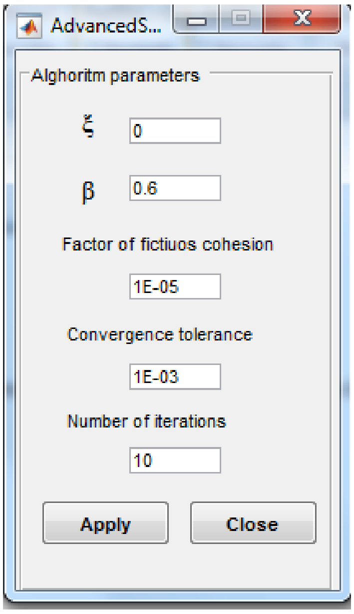


After few second, the wait bar displays the message *"Associative solution found, plotting results..."* and the Associative solution MATLAB figure opens reporting the load factor and the collapse load (collapse load units consistent with ρ, that is Newton for Tutorial 1).



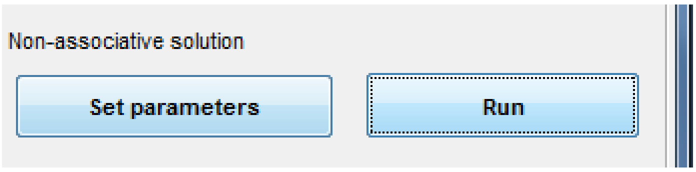
Non-associative solution

To run the non-associative solution, set the advanced parameters first clicking on the button **Set parameters**. A new window named "Advanced Settings" opens.



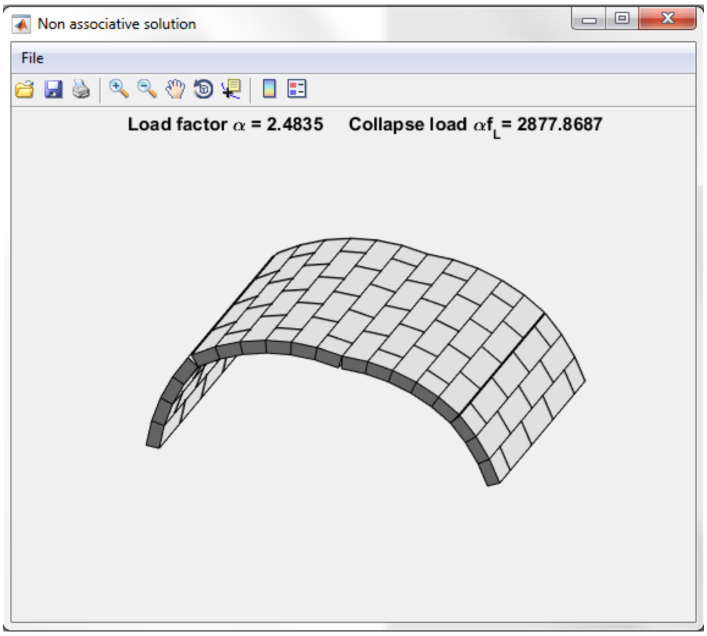
Confirm the default parameters pushing ***Apply***, then close the windows pushing the ***Close*** button.

You are now ready to run the non-associative solution. Press ***Run***, the wait bar displays the message *"Analysis in progress"*.



After few second, the wait bar displays the message *"Non-associative solution found, plotting results..."* and the non-associative solution MATLAB figure opens.

The analysis is now completed!

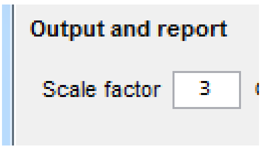


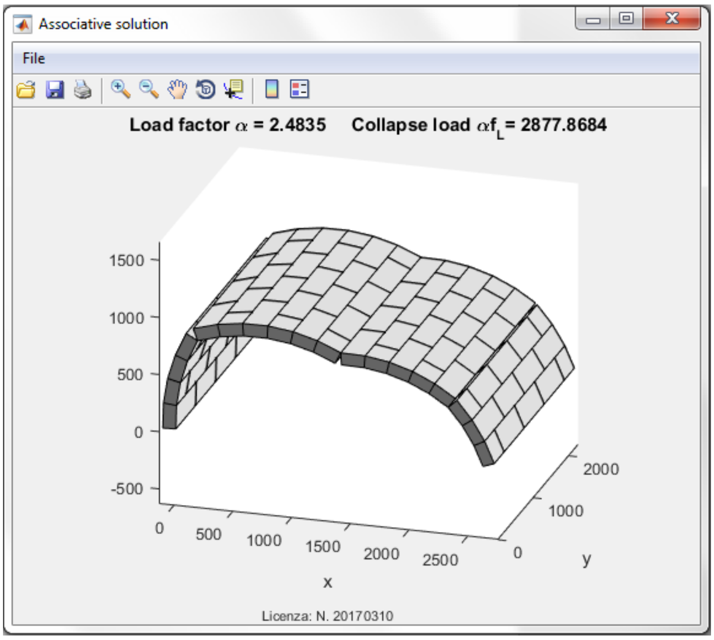
LiABlock_3D TIP: if you want to perform a new analysis, e.g. with different friction coefficient or different loading conditions, you don't need to generate the model once again, which can be time consuming for large models! Just remember to run the associative solution first, otherwise your changes are not taken into account by the solver module!

Output and report

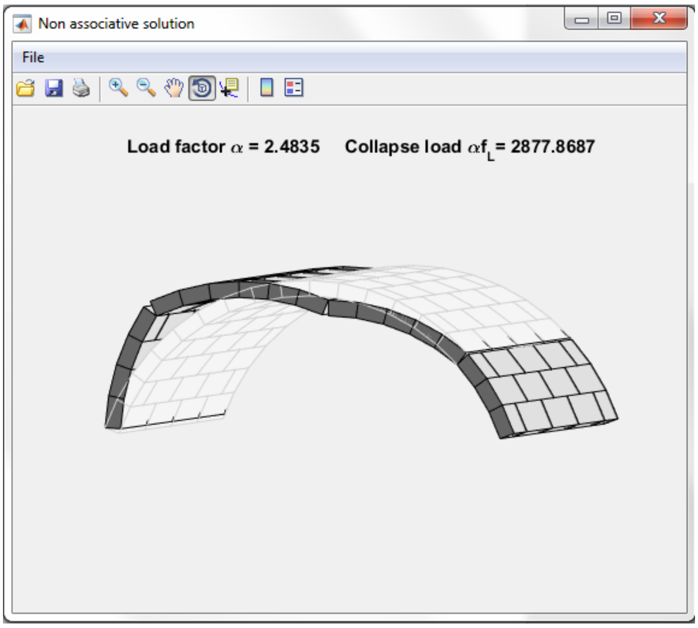
Plot utilities

To magnify the collapse mechanism either in the associative or in the non-associative solution, type a scale factor in the white box and press the scale associative or non-associative plot button.

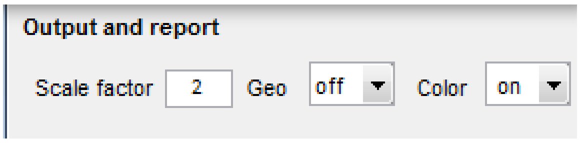


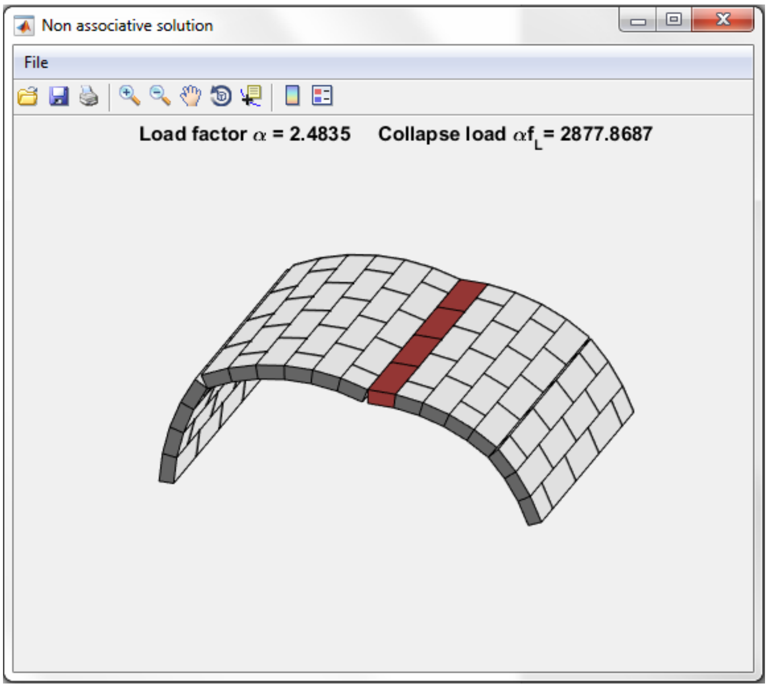


To plot the undeformed geometry in the collapse mechanism plot, select ***yes*** in the Geo pop up menu.



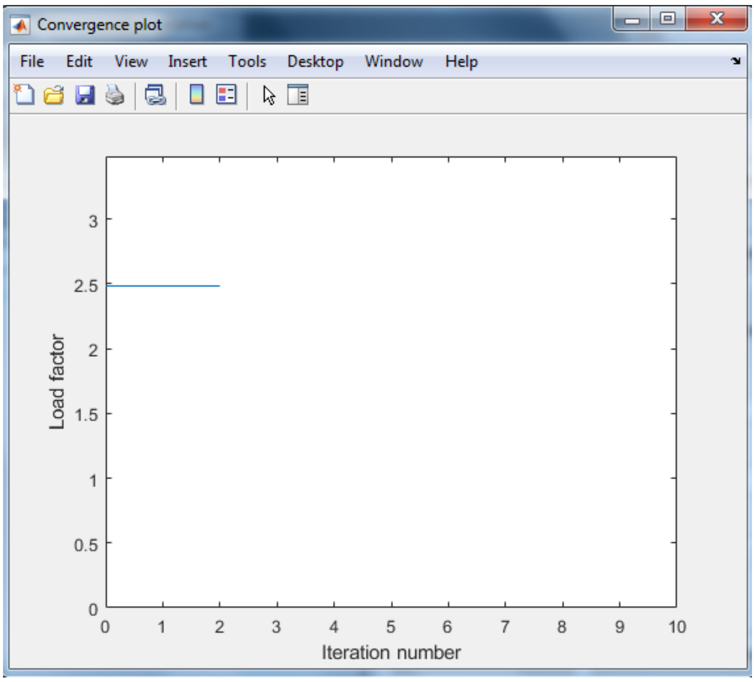
Activating color "on", the block where the live loads are applied on are coloured in red.





Convergence checks

Press the ***Convergence plot*** button to see the convergence plot



References

Cascini, L., Gagliardo, R., Portioli, F., 2018. LiABlock_3D: A Software Tool for Collapse Mechanism Analysis of Historic Masonry Structures. Int. J. Archit. Herit. https://doi.org/10.1080/15583058.2018.1509155

Portioli, F., Cascini, L., 2016. Assessment of masonry structures subjected to foundation settlements using rigid block limit analysis. Eng. Struct. 113. https://doi.org/10.1016/j.engstruct.2016.02.002

Portioli, F., Casapulla, C., Cascini, L., 2015. An efficient solution procedure for crushing failure in 3D limit analysis of masonry block structures with non-associative frictional joints. Int. J. Solids Struct. 69–70. https://doi.org/10.1016/j.ijsolstr.2015.05.025

Portioli, F., Casapulla, C., Gilbert, M., Cascini, L., 2014. Limit analysis of 3D masonry block structures with non-associative frictional joints using cone programming. Comput. Struct. 143, 108–121. https://doi.org/10.1016/j.compstruc.2014.07.010

Contacts

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Annex I

How to build the LiABlock_3D input file from a 3D model in Autodesk AutoCAD.

For a given 3D model, the first action is to recognize the block typologies that compose the structure. A block "type" is characterised by its shape (i.e. rectangular, trapezoidal, etc.) and by its *potential* contact interfaces.

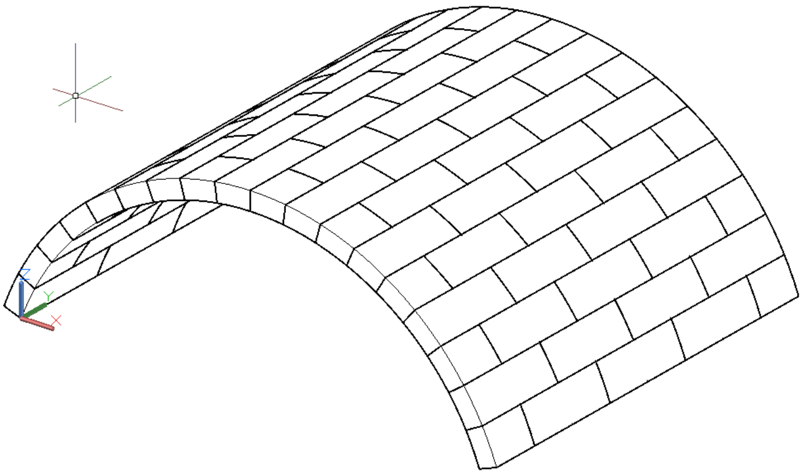


Figure A1. The 3D geometry of the vault in the Model Space

The vault of Tutorial 1 (Fig. A1) is composed by assembling two voussoir elements of 103 mm width and length of 570 and 285 mm respectively. In this case study, it is assumed that contacts are active along the bed joints planes (the blue and red ones in Fig. A2). Contacts among the blocks in the x-z planes are supposed to be inactive. As such two block types shall be defined to build the LiABlock_3D CAD model.

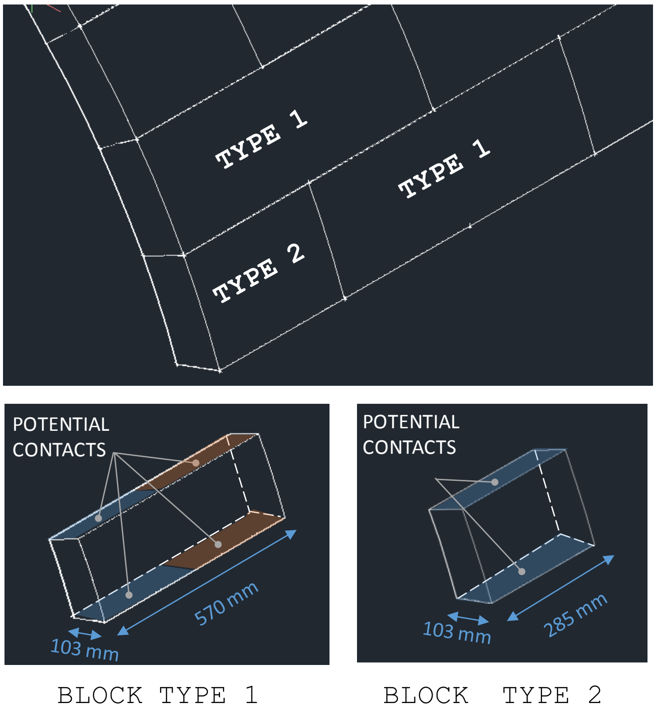
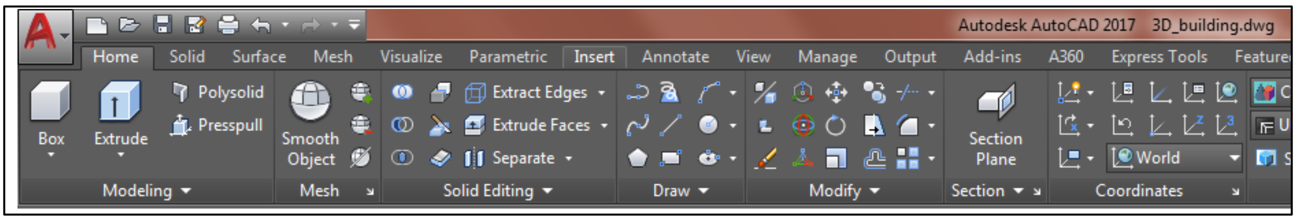


Figure A2. Block types and contact interfaces for Tutorial 1.

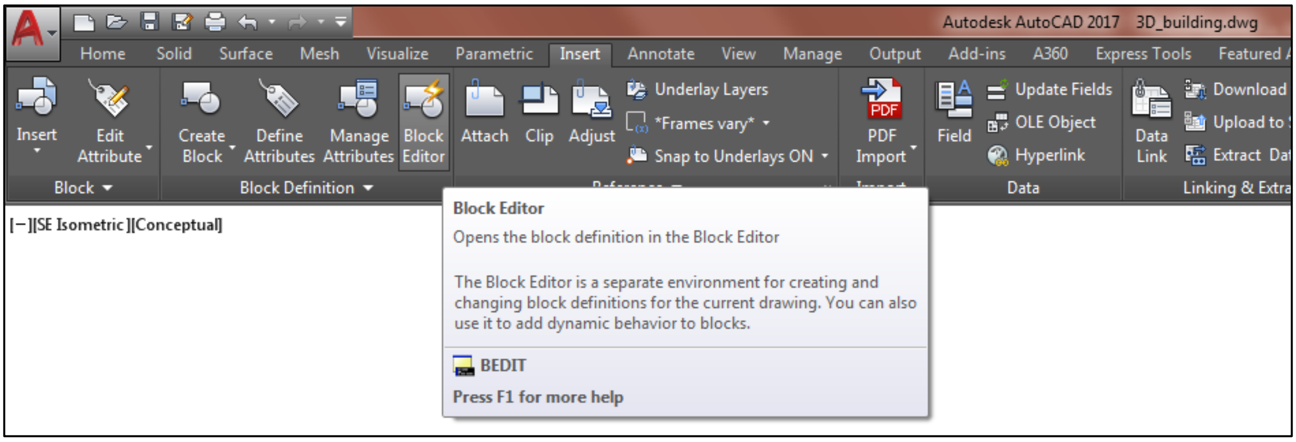
Block types are modelled as Autodesk CAD blocks with attributes. The information required for each block type are the Cartesian coordinates of the vertexes of the polyhedron, which define the geometry, its centroid and the coordinates of vertexes associated to each contact interface.

In the CAD block editor, object 'points' are used to represent the above-mentioned points and position attributes are assigned to them. Additional attributes are attached to the block types to store the block volume and the labels of contact interface.

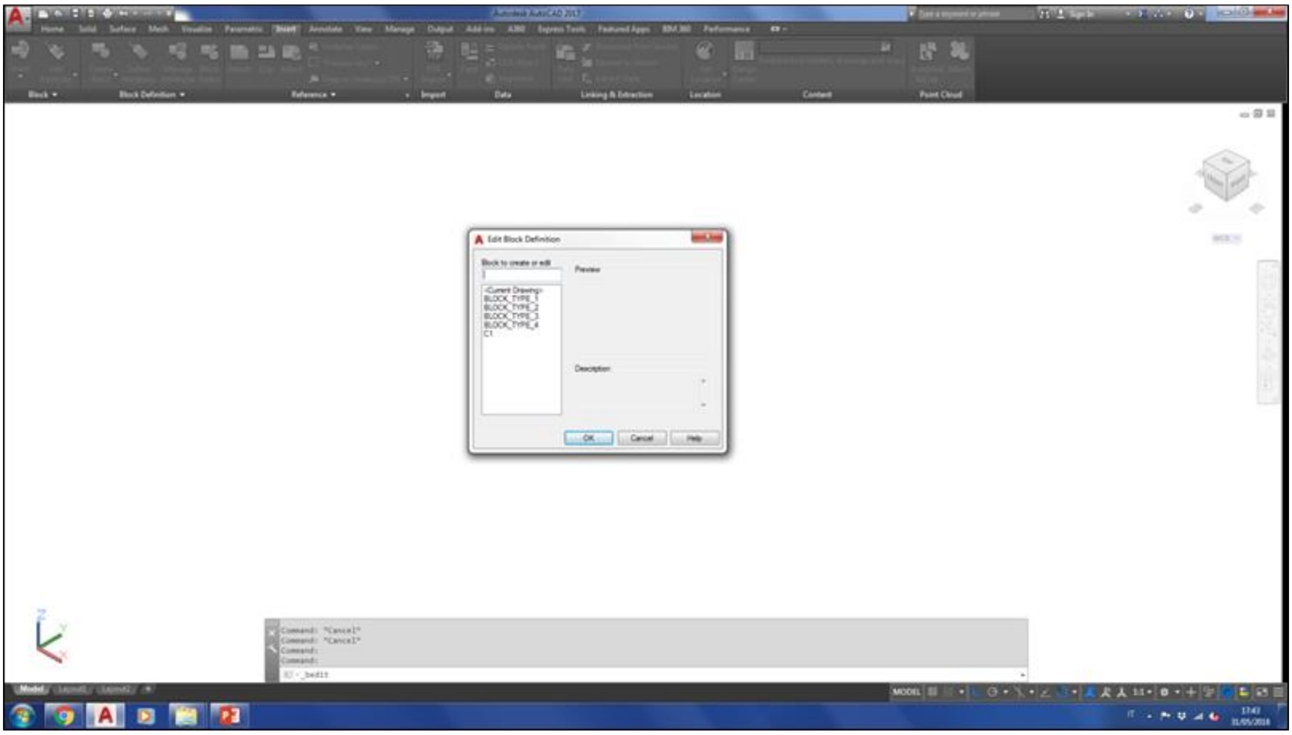
1. From the AutoCAD main menu, select Insert



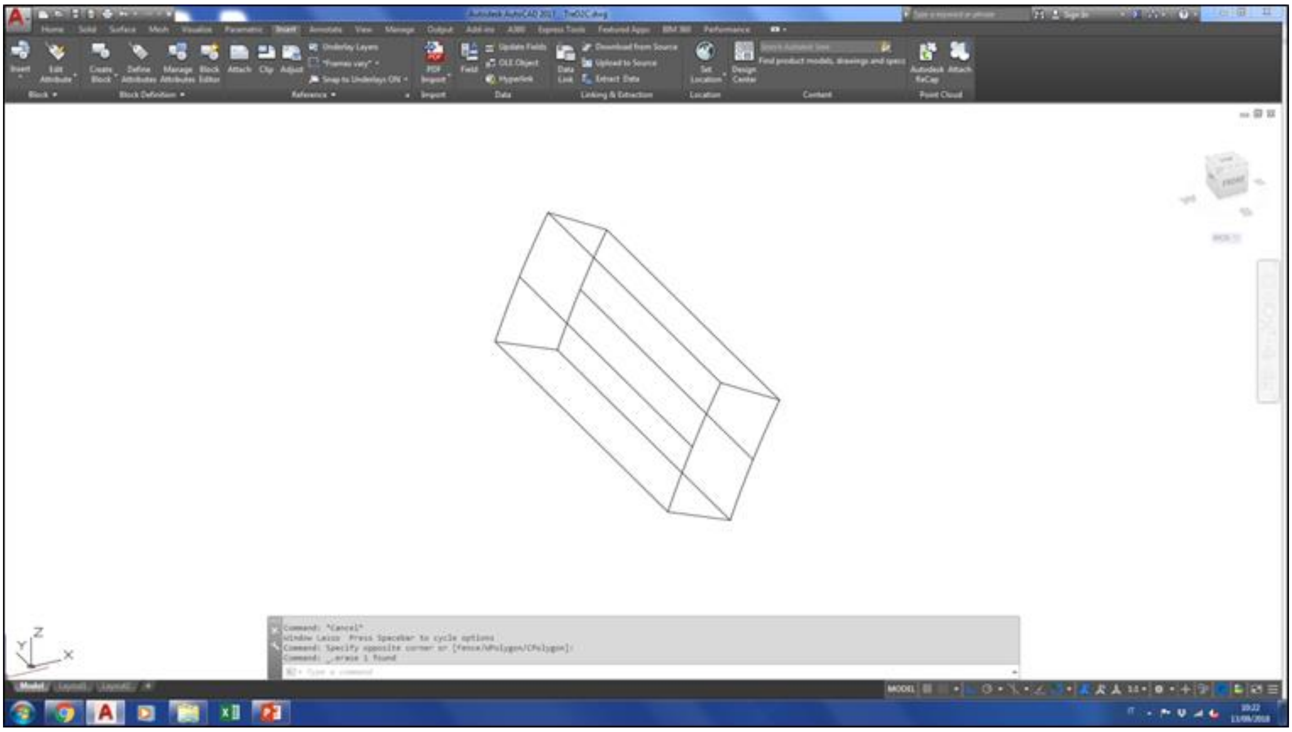
2. Open the Block Editor



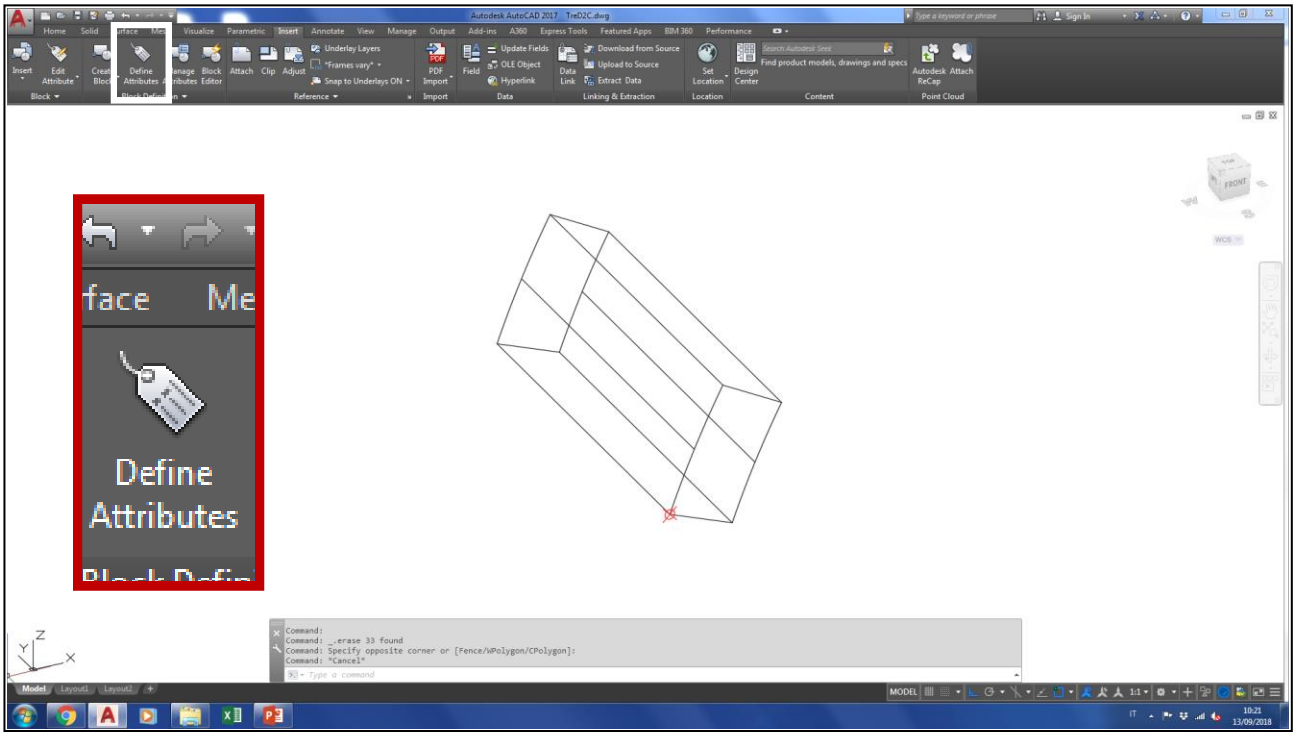
3. Type the name of the block you are going to create, e.g. BLOCK_TYPE_1



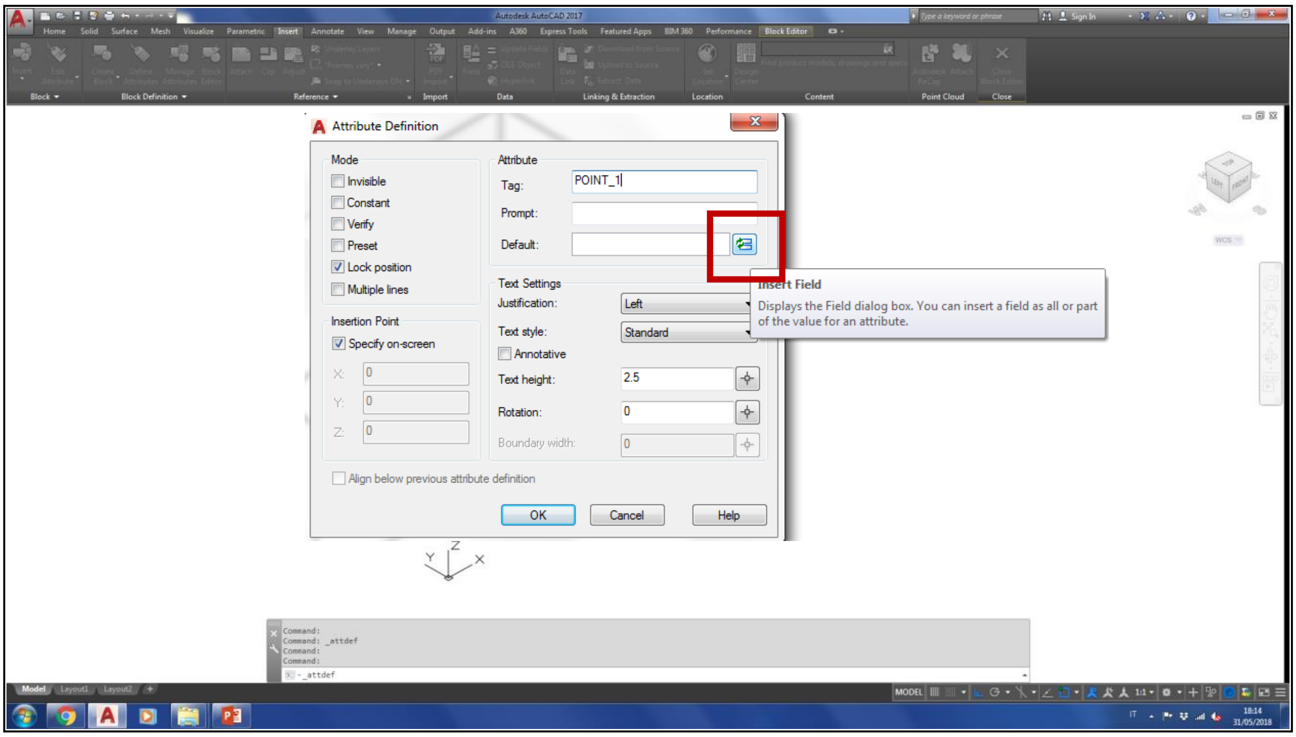
4. Select the first object in the model space that you are going to transform in CAD block, i.e. a single Block Type composing the model.



5. It's time to add POINTS. Insert object 'POINT' for each vertex of the solid and for each contact surface you are going to define. Insert also a POINT at the centroid of the solid. Then create position attributes. Let's start with the first vertex of the voussoir. Click on *Define attributes* .

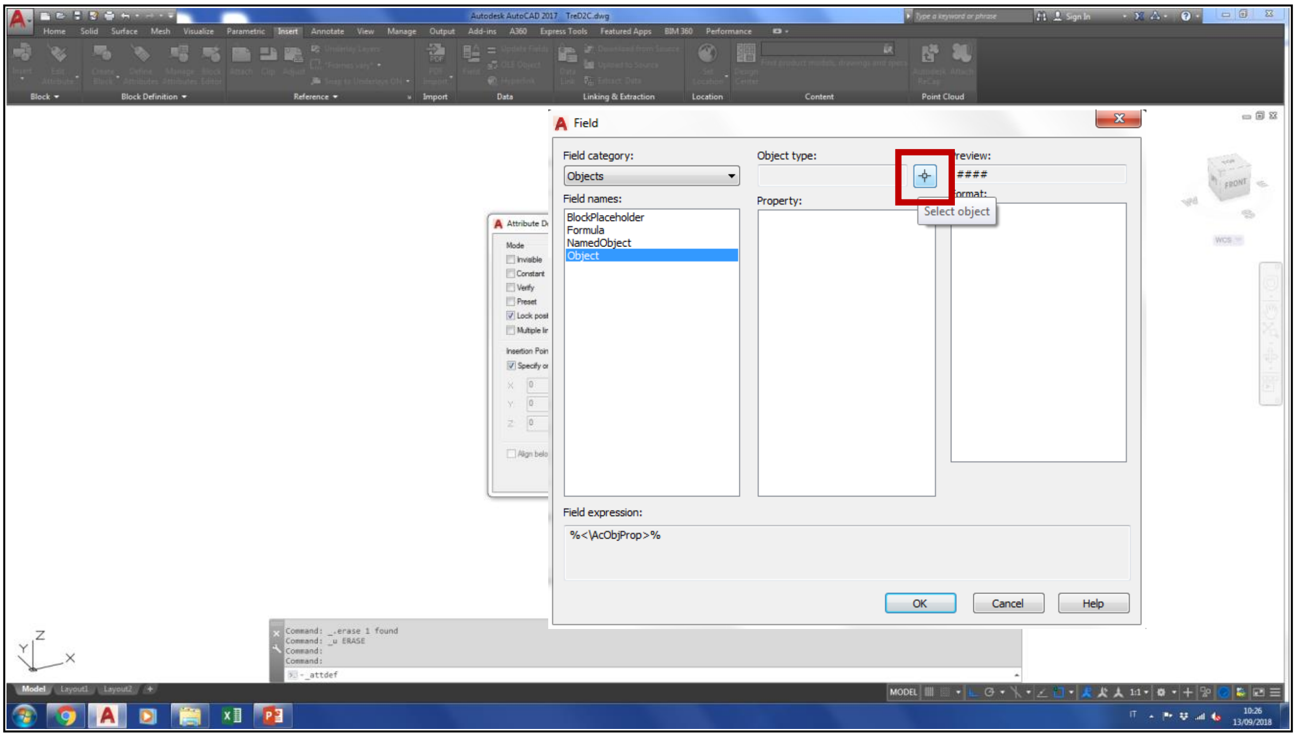


5.1. To attach a tag to point 1, type POINT_1 in the field Tag and click on *Default* option.

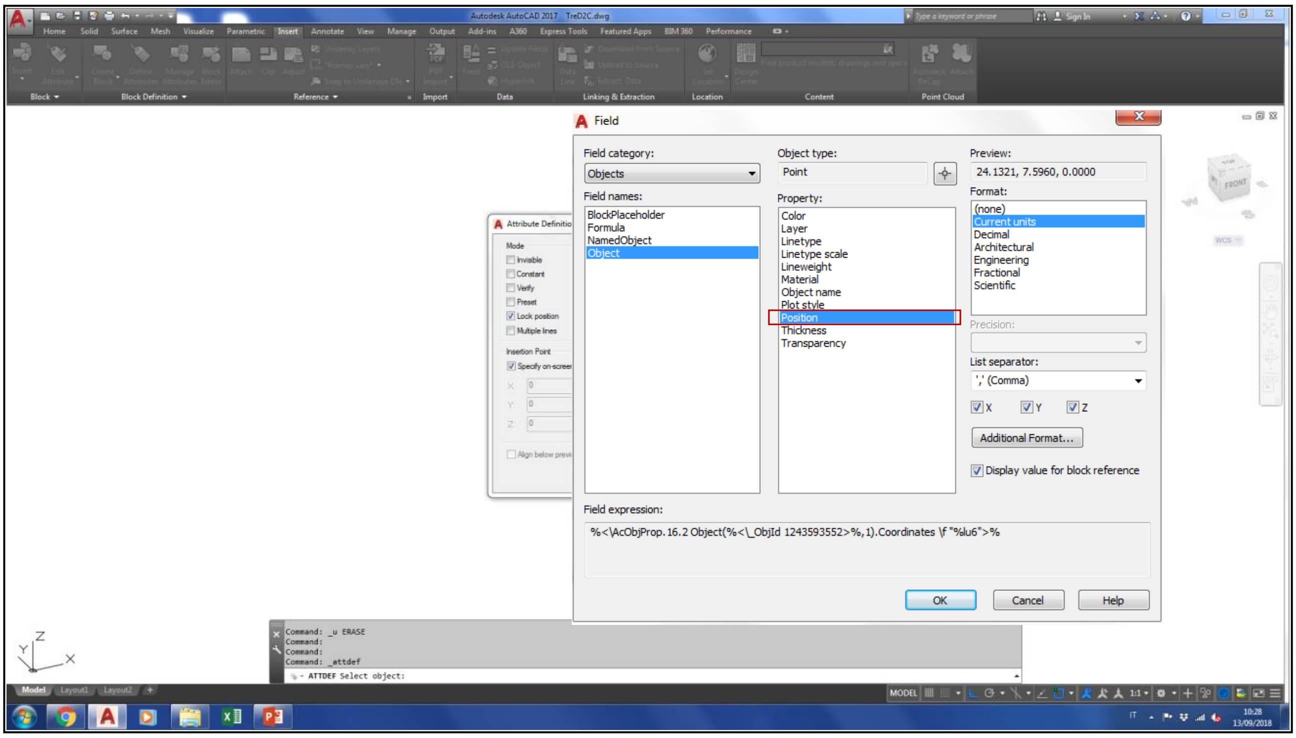


WARNING: Use the following tags: POINT_1, POINT_2,... POINT_8 for the primary vertexes of the voussoirs, POINT_9,...POINT_12 for the additional points that define the contact surfaces, C for the centroid of the voussoir.

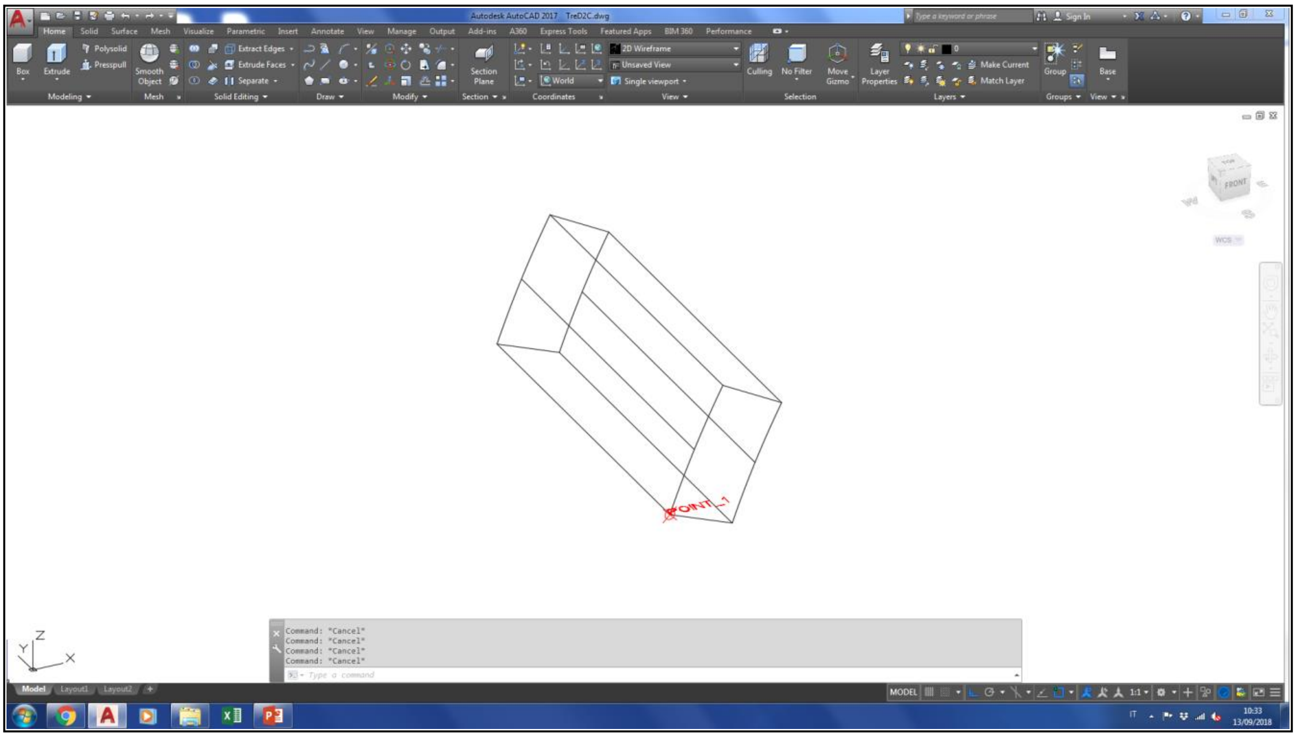
5.2. Click on *Object Type*, select the first vertex of the vouissoir for which the attribute is under definition.



5.3. Click on *Position*, select *Current unit* on the right, press ok

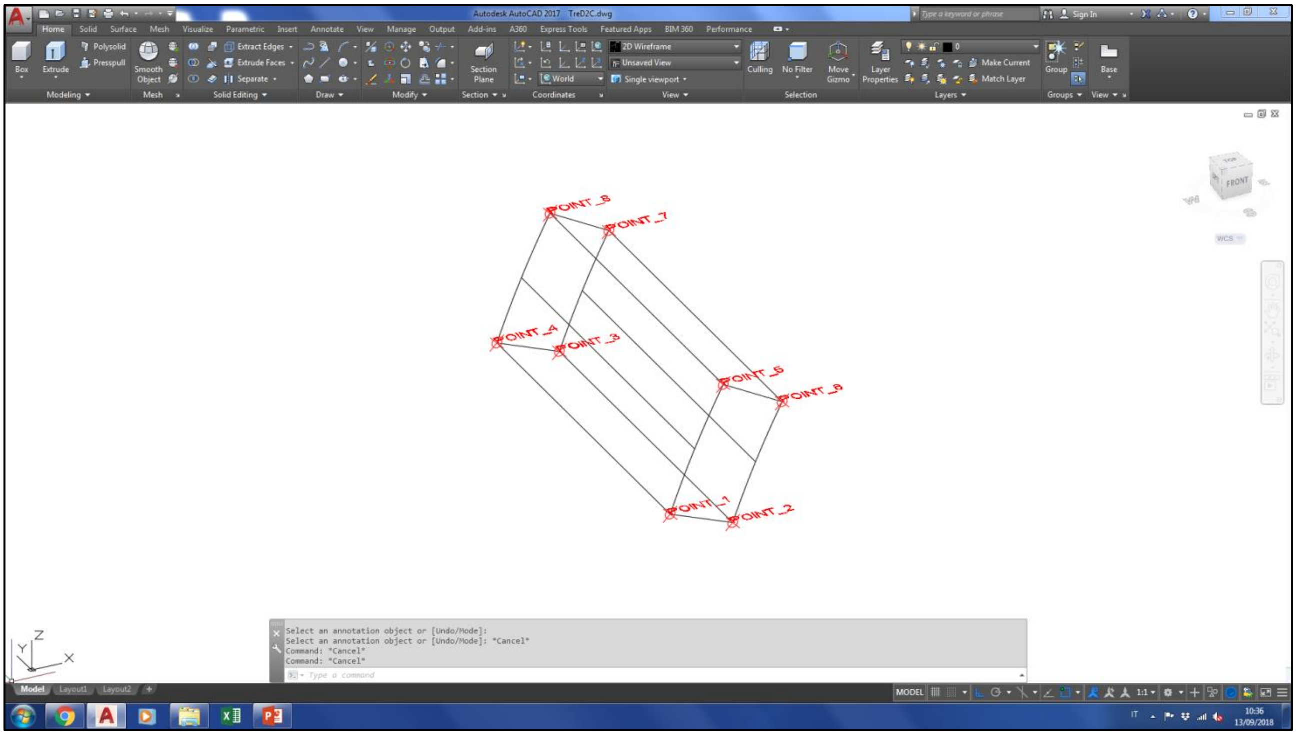


Now the attribute of the first vertex is created. For a better visualization, put the label close to the vertex. Now you will see the vertex 1 with the tag POINT_1 in the block editor space.



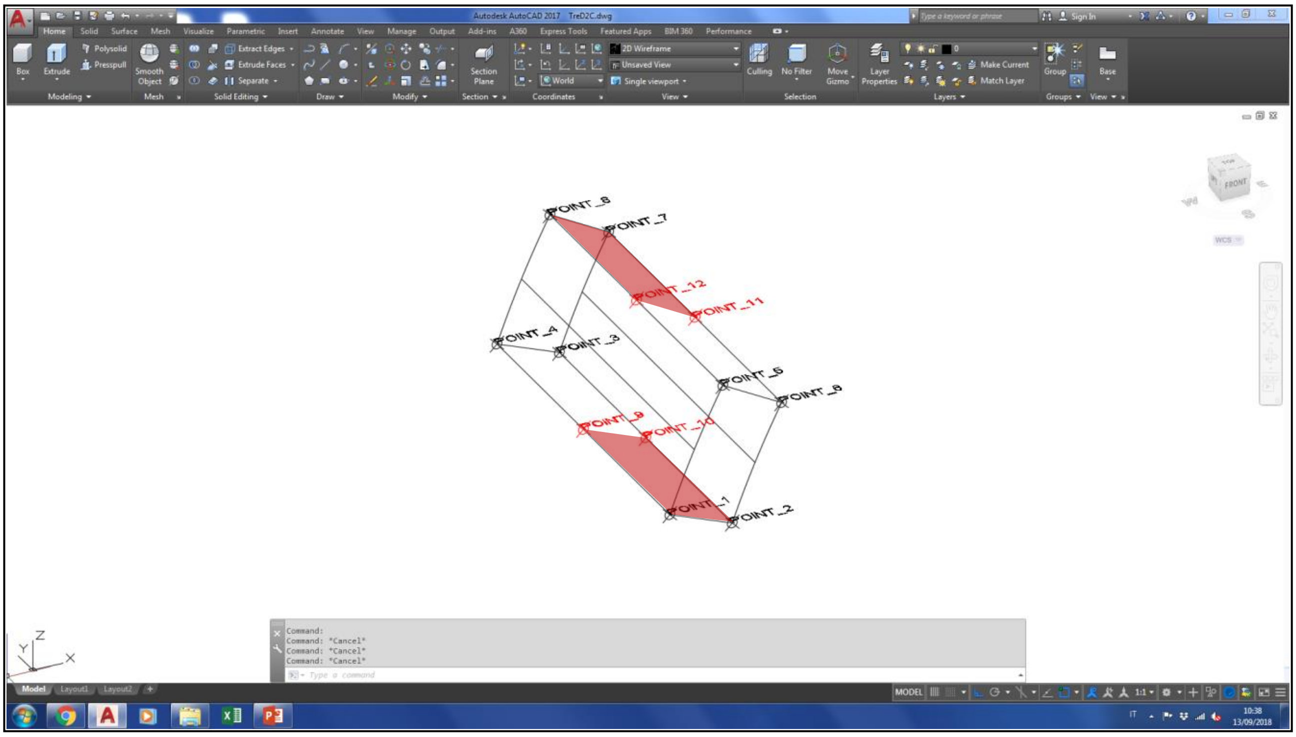
LiABlock_3D TIP: you can adjust the POINT visualization mode. Type pdsize in the command bar to modify the dimension of points on the screen and pdmodeto select the symbol you may prefer to display points. Current view corresponds to pdmode=35.

5.4. Repeat for each vertex of the solid element.

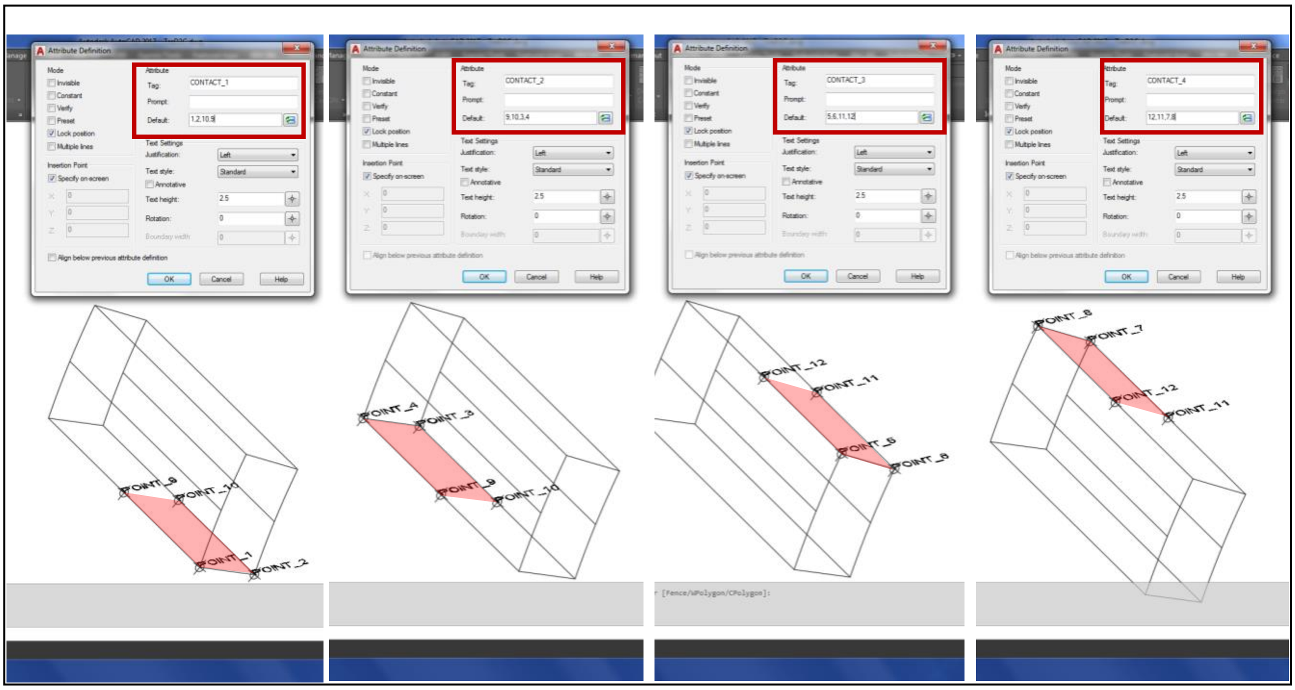


WARNING: For a correct representation of the solid model in LiABlock_3D, the points must be ordered following a consistent extrusion rule. For example, with reference to the previous Figure, LiABlock_3D will create a rigid block extruding the surface with vertices POINT_1, POINT_2, POINT_3, POINT_4 to surface with vertices POINT_5, POINT_6, POINT_7, POINT_8. Points can be ordered following a clockwise or counterclockwise rule.

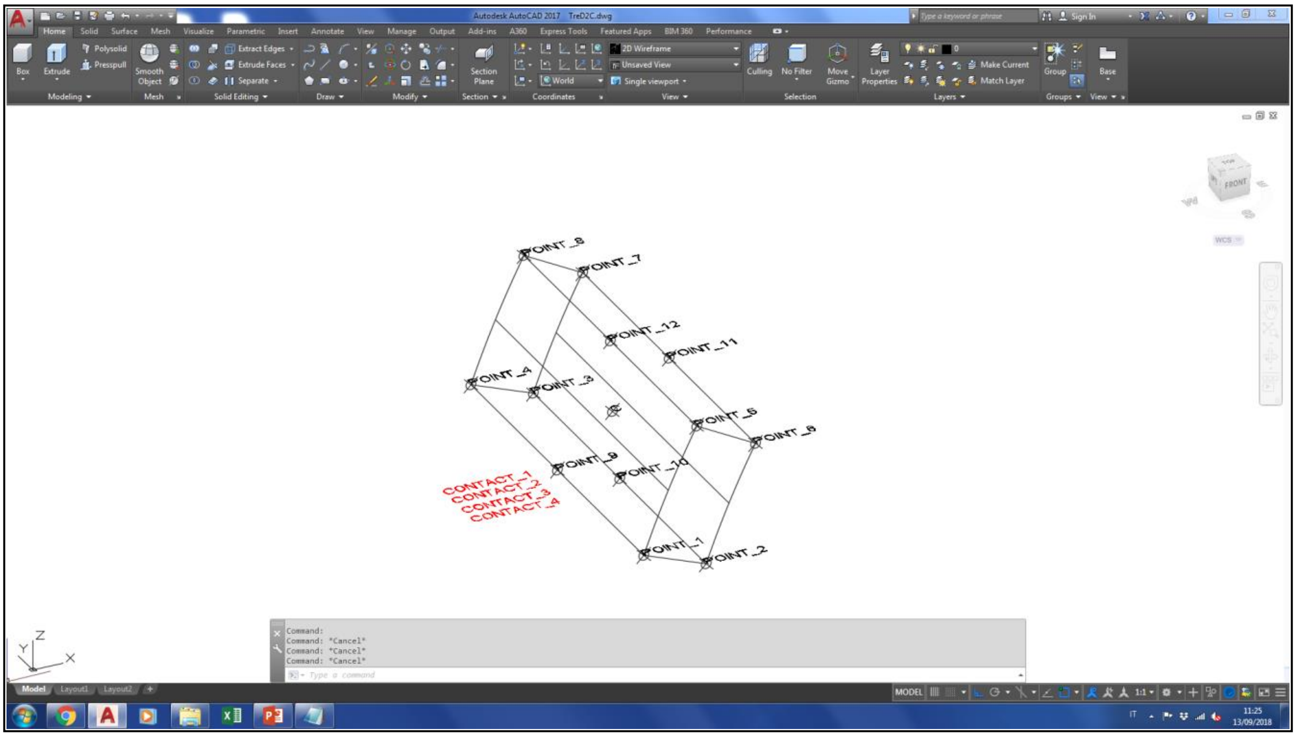
5.5. Repeat the procedure to add internal nodes for the definition of contact interfaces (POINT_9 to POINT_12). These points can be generated in any order.



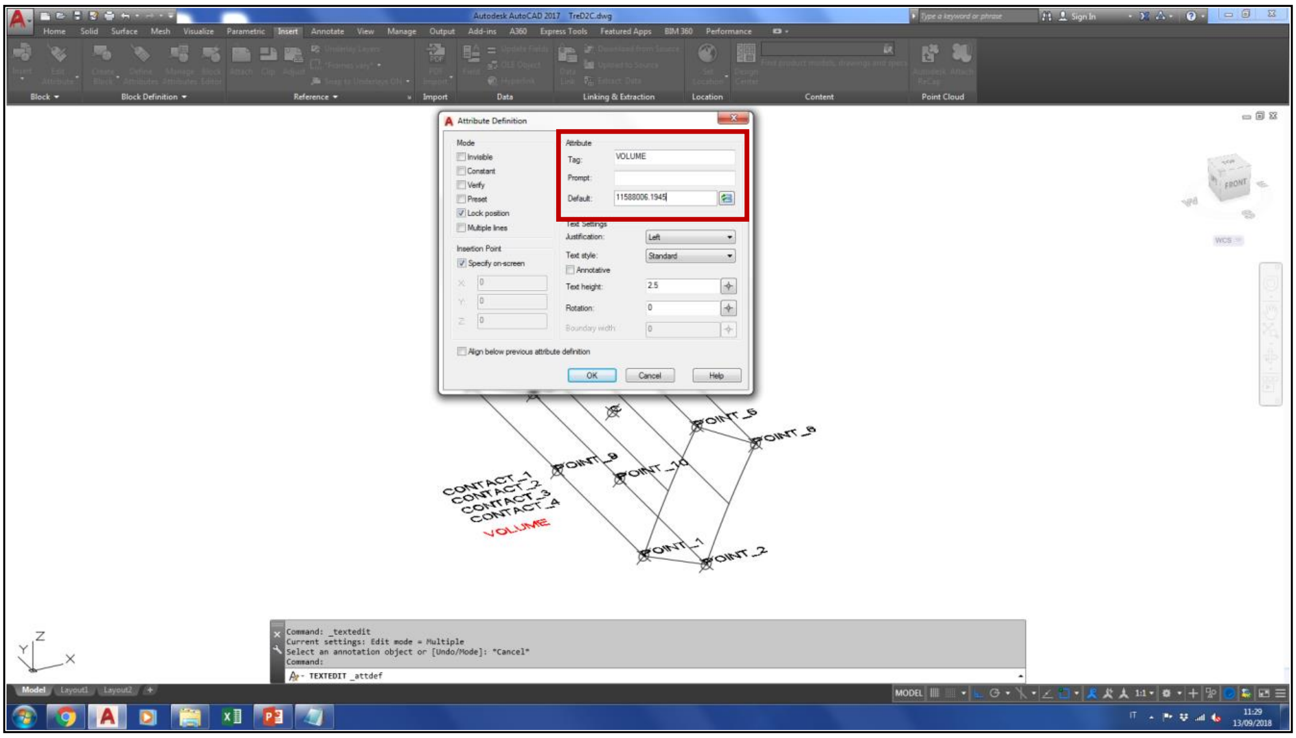
6. Now create static labels to store the number of points which define the contact surfaces. Click on Define Attributes once again. Type CONTACT_1 as tag of the first contact surface. Type the number of the point that define the surface in the Default field separated by comma. Repeat for each surface.



6.1. Repeat the procedure to add the centroid of the block, use the label 'C' as Tag.

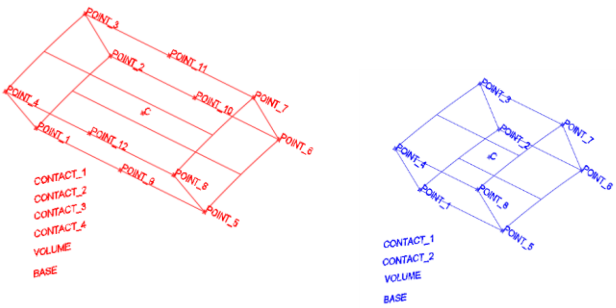


7. Create an attribute to store the information about the volume of the block. Repeat the step 6 to create the VOLUME.

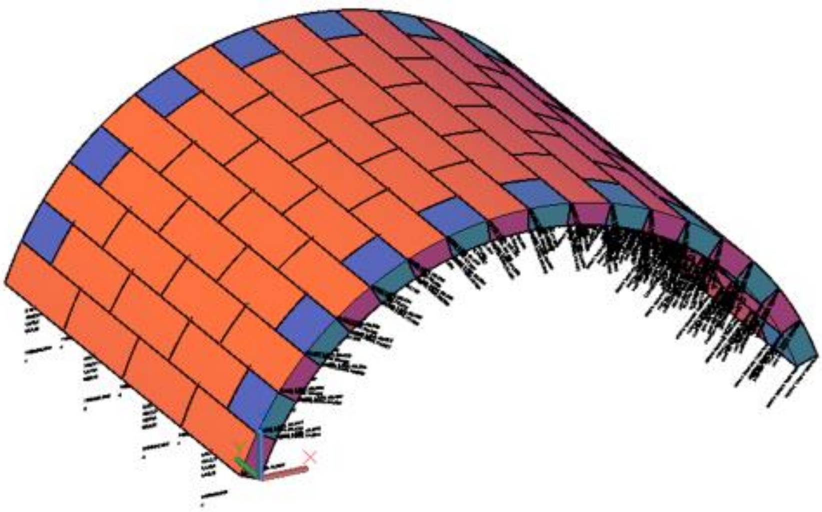


LiABlock_3D TIP: for complex block geometry, you can type MASSPROP in the Autocad Command line to get information about the solid volume and the Cartesian coordinates of the centroid referred to the UCS active at the time of the query.

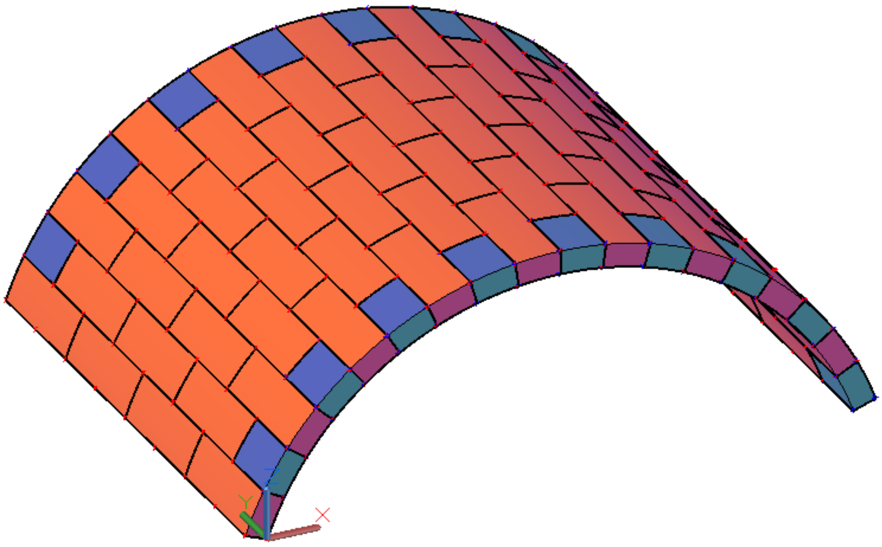
8. The Block_Type_1 is now created. Repeat step 1-7 to create the Block_type_2.



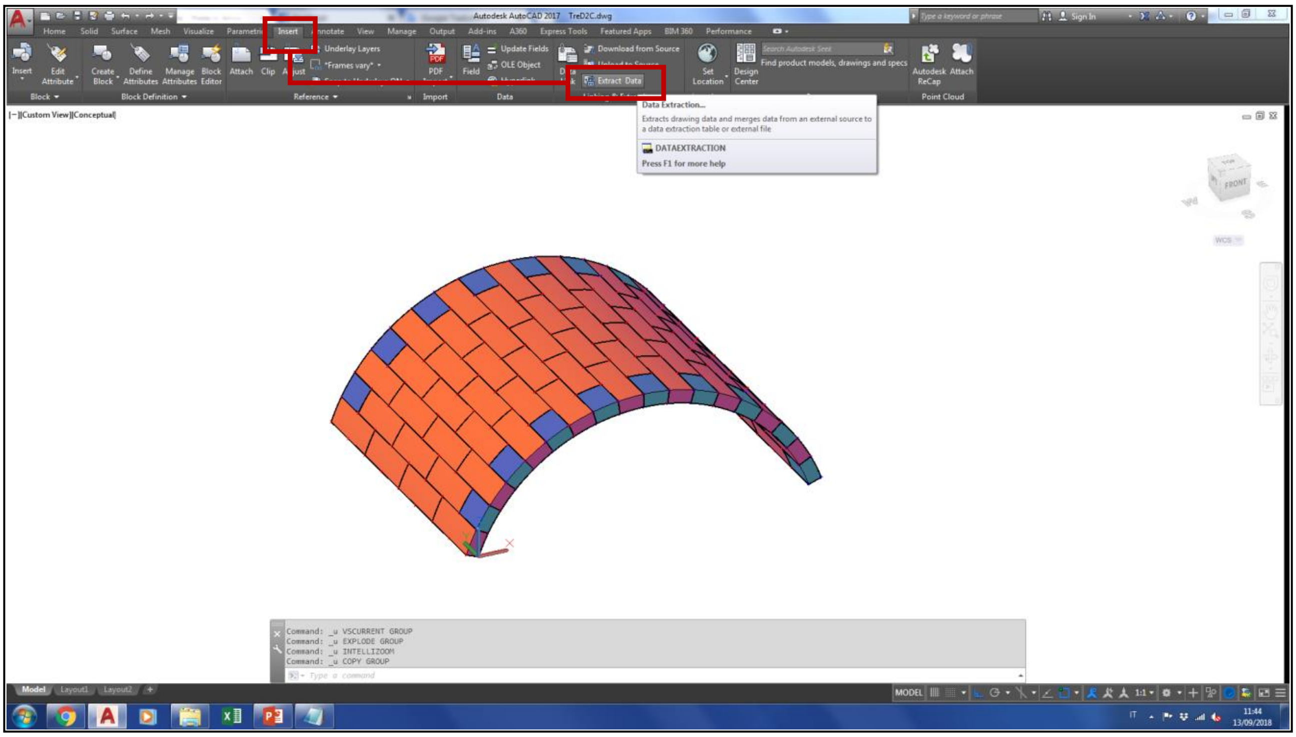
9. Once the block types have been created, return in the model space and build the LiABlock_3D input CAD model by assembling the Block types previously created.

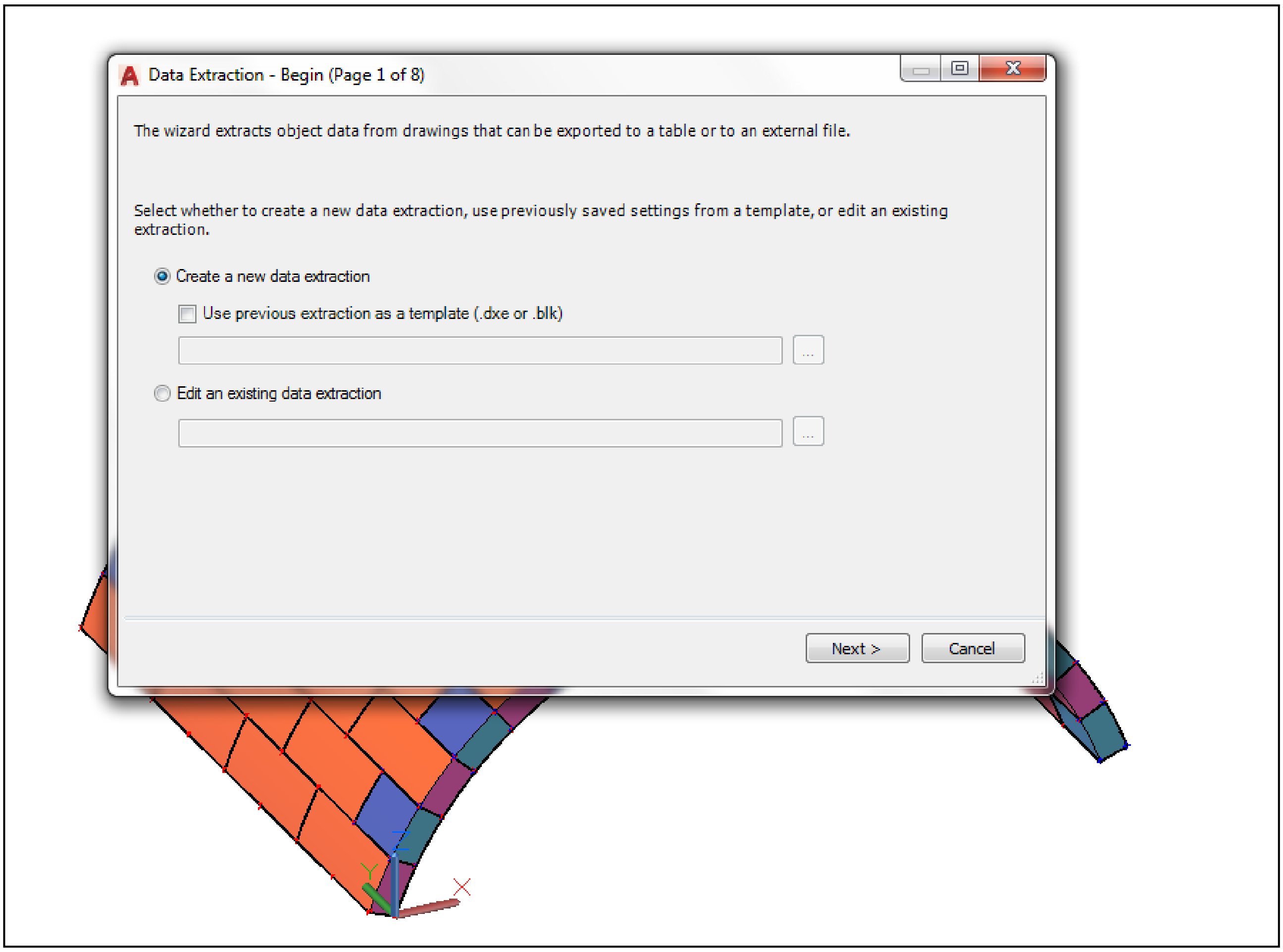


Type ATTDISP in the Command line and digit OFF to hide the label of attributes in the Model space.

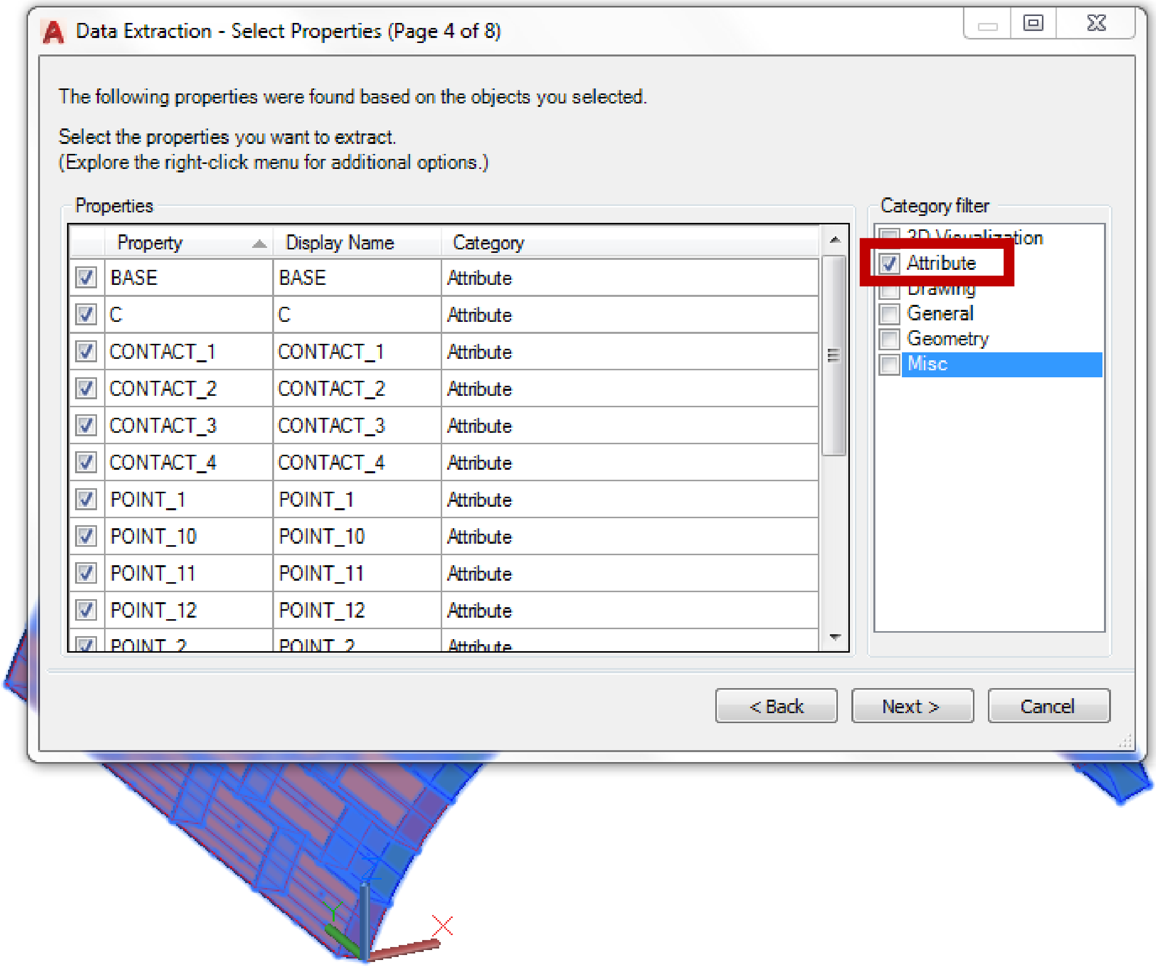


10. To create the .xls LiABlock_3D input file, launch the Autocad Data Extraction Wizard and follow the instructions.

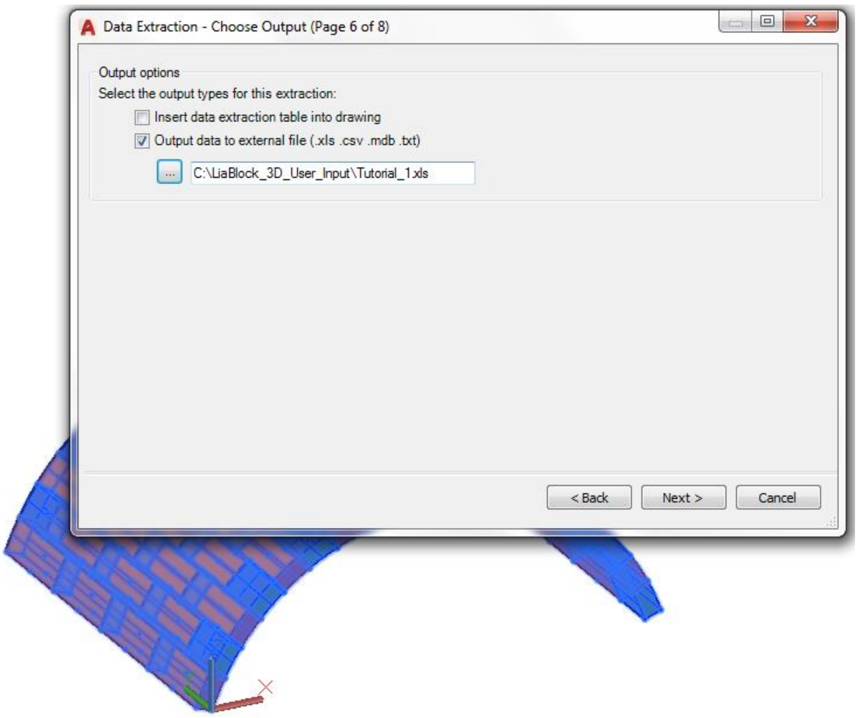




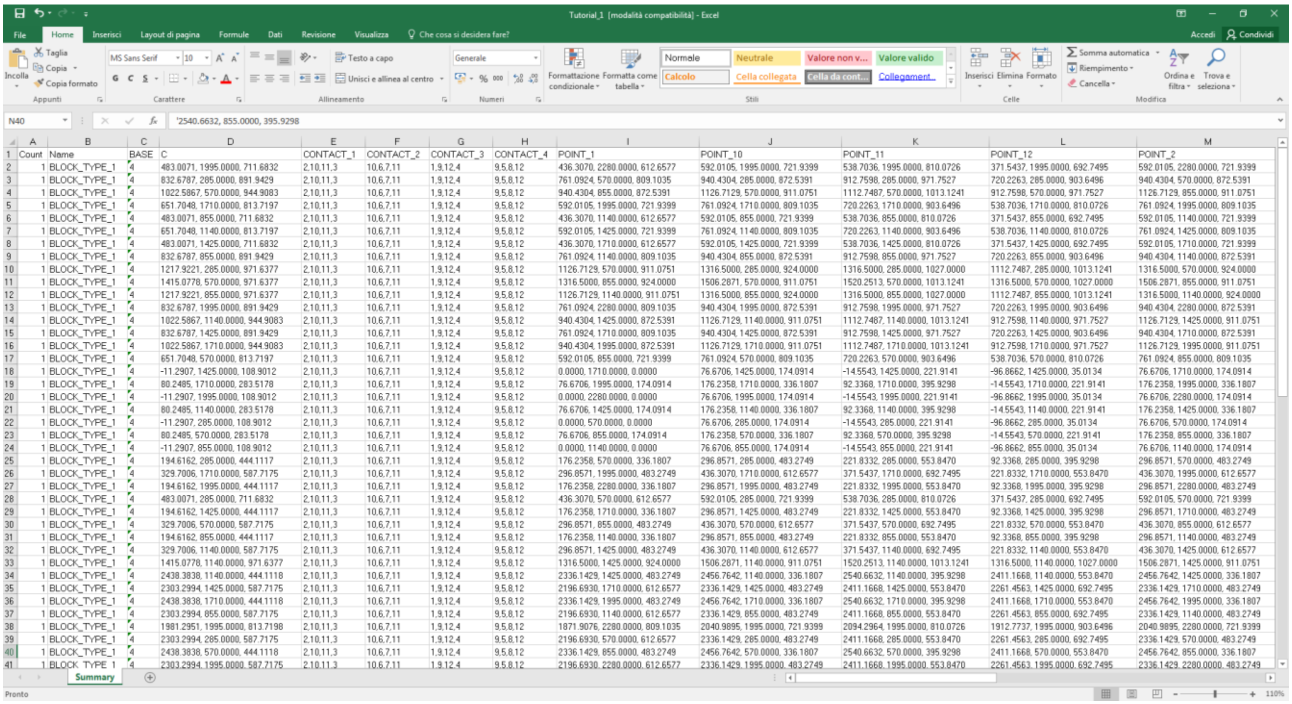
11. On page 4 of the Data Extraction wizard, activate the Attribute Category filter only



12. On page 6, select Output data on eternal file and save the extraction in the LiABlock_3D input folder.



13. You are now able to open the .xls input file! Open LiABlock_3D and enjoy your analysis!



	Count	Name	BASE	C	CONTACT_1	CONTACT_2	CONTACT_3	CONTACT_4	POINT_1	POINT_10	POINT_11	POINT_12	POINT_2
2	1	BLOCK_TYPE_1	4	483.0071, 1995.0000, 711.6832	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	436.3070, 2280.0000, 612.6577	592.0105, 1995.0000, 721.9399	538.7036, 1995.0000, 810.0726	371.5437, 1995.0000, 692.7495	592.0105, 2280.0000, 721.9399
3	1	BLOCK_TYPE_1	4	832.6787, 285.0000, 891.9429	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	761.0924, 570.0000, 809.1035	940.4304, 285.0000, 872.5391	912.7598, 285.0000, 971.7527	720.2263, 285.0000, 903.6496	940.4304, 570.0000, 872.5391
4	1	BLOCK_TYPE_1	4	1022.5867, 570.0000, 944.9083	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	940.4304, 855.0000, 872.5391	1126.7129, 570.0000, 911.0751	1112.7487, 570.0000, 1013.1241	912.7598, 570.0000, 971.7527	1126.7129, 855.0000, 911.0751
5	1	BLOCK_TYPE_1	4	651.7048, 1710.0000, 813.7197	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	592.0105, 1995.0000, 721.9399	761.0924, 1710.0000, 809.1035	720.2263, 1710.0000, 903.6496	538.7036, 1710.0000, 810.0726	761.0924, 1995.0000, 809.1035
6	1	BLOCK_TYPE_1	4	483.0071, 855.0000, 711.6832	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	436.3070, 1140.0000, 612.6577	592.0105, 855.0000, 721.9399	538.7036, 855.0000, 810.0726	371.5437, 855.0000, 692.7495	592.0105, 1140.0000, 721.9399
7	1	BLOCK_TYPE_1	4	651.7048, 1140.0000, 813.7197	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	592.0105, 1425.0000, 721.9399	761.0924, 1140.0000, 809.1035	720.2263, 1140.0000, 903.6496	538.7036, 1140.0000, 810.0726	761.0924, 1425.0000, 809.1035
8	1	BLOCK_TYPE_1	4	483.0071, 1425.0000, 711.6832	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	436.3070, 1710.0000, 612.6577	592.0105, 1425.0000, 721.9399	538.7036, 1425.0000, 810.0726	371.5437, 1425.0000, 692.7495	592.0105, 1710.0000, 721.9399
9	1	BLOCK_TYPE_1	4	832.6787, 855.0000, 891.9429	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	761.0924, 1140.0000, 809.1035	940.4304, 855.0000, 872.5391	912.7598, 855.0000, 971.7527	720.2263, 855.0000, 903.6496	940.4304, 1140.0000, 872.5391
10	1	BLOCK_TYPE_1	4	1217.9221, 285.0000, 971.6377	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	1126.7129, 570.0000, 911.0751	1316.5000, 285.0000, 924.0000	1316.5000, 285.0000, 1027.0000	1112.7487, 285.0000, 1013.1241	1316.5000, 570.0000, 924.0000
11	1	BLOCK_TYPE_1	4	1415.0778, 570.0000, 971.6377	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	1316.5000, 855.0000, 924.0000	1506.2871, 570.0000, 911.0751	1520.2513, 570.0000, 1013.1241	1316.5000, 570.0000, 1027.0000	1506.2871, 855.0000, 911.0751
12	1	BLOCK_TYPE_1	4	1217.9221, 855.0000, 971.6377	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	1126.7129, 1140.0000, 911.0751	1316.5000, 855.0000, 924.0000	1316.5000, 855.0000, 1027.0000	1112.7487, 855.0000, 1013.1241	1316.5000, 1140.0000, 924.0000
13	1	BLOCK_TYPE_1	4	832.6787, 1995.0000, 891.9429	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	761.0924, 2280.0000, 809.1035	940.4304, 1995.0000, 872.5391	912.7598, 1995.0000, 971.7527	720.2263, 1995.0000, 903.6496	940.4304, 2280.0000, 872.5391
14	1	BLOCK_TYPE_1	4	1022.5867, 1140.0000, 944.9083	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	940.4304, 1425.0000, 872.5391	1126.7129, 1140.0000, 911.0751	1112.7487, 1140.0000, 1013.1241	912.7598, 1140.0000, 971.7527	1126.7129, 1425.0000, 911.0751
15	1	BLOCK_TYPE_1	4	832.6787, 1425.0000, 891.9429	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	761.0924, 1710.0000, 809.1035	940.4304, 1425.0000, 872.5391	912.7598, 1425.0000, 971.7527	720.2263, 1425.0000, 903.6496	940.4304, 1710.0000, 872.5391
16	1	BLOCK_TYPE_1	4	1022.5867, 1710.0000, 944.9083	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	940.4304, 1995.0000, 872.5391	1126.7129, 1710.0000, 911.0751	1112.7487, 1710.0000, 1013.1241	912.7598, 1710.0000, 971.7527	1126.7129, 1995.0000, 911.0751
17	1	BLOCK_TYPE_1	4	651.7048, 570.0000, 813.7197	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	592.0105, 855.0000, 721.9399	761.0924, 570.0000, 809.1035	720.2263, 570.0000, 903.6496	538.7036, 570.0000, 810.0726	761.0924, 855.0000, 809.1035
18	1	BLOCK_TYPE_1	4	-11.2907, 1425.0000, 108.9012	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	0.0000, 1710.0000, 0.0000	76.6706, 1425.0000, 174.0914	-14.5543, 1425.0000, 221.9141	-96.8662, 1425.0000, 35.0134	76.6706, 1710.0000, 174.0914
19	1	BLOCK_TYPE_1	4	80.2485, 1710.0000, 283.5178	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	76.6706, 1995.0000, 174.0914	176.2358, 1710.0000, 336.1807	92.3368, 1710.0000, 395.9298	-14.5543, 1710.0000, 221.9141	176.2358, 1995.0000, 336.1807
20	1	BLOCK_TYPE_1	4	-11.2907, 1995.0000, 108.9012	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	0.0000, 2280.0000, 0.0000	76.6706, 1995.0000, 174.0914	-14.5543, 1995.0000, 221.9141	-96.8662, 1995.0000, 35.0134	76.6706, 2280.0000, 174.0914
21	1	BLOCK_TYPE_1	4	80.2485, 1140.0000, 283.5178	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	76.6706, 1425.0000, 174.0914	176.2358, 1140.0000, 336.1807	92.3368, 1140.0000, 395.9298	-14.5543, 1140.0000, 221.9141	176.2358, 1425.0000, 336.1807
22	1	BLOCK_TYPE_1	4	-11.2907, 285.0000, 108.9012	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	0.0000, 570.0000, 0.0000	76.6706, 285.0000, 174.0914	-14.5543, 285.0000, 221.9141	-96.8662, 285.0000, 35.0134	76.6706, 570.0000, 174.0914
23	1	BLOCK_TYPE_1	4	80.2485, 570.0000, 283.5178	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	76.6706, 855.0000, 174.0914	176.2358, 570.0000, 336.1807	92.3368, 570.0000, 395.9298	-14.5543, 570.0000, 221.9141	176.2358, 855.0000, 336.1807
24	1	BLOCK_TYPE_1	4	-11.2907, 855.0000, 108.9012	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	0.0000, 1140.0000, 0.0000	76.6706, 855.0000, 174.0914	-14.5543, 855.0000, 221.9141	-96.8662, 855.0000, 35.0134	76.6706, 1140.0000, 174.0914
25	1	BLOCK_TYPE_1	4	194.6162, 285.0000, 444.1117	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	176.2358, 570.0000, 336.1807	296.8571, 285.0000, 483.2749	221.8332, 285.0000, 553.8470	92.3368, 285.0000, 395.9298	296.8571, 570.0000, 483.2749
26	1	BLOCK_TYPE_1	4	329.7006, 1710.0000, 587.7175	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	296.8571, 1995.0000, 483.2749	436.3070, 1710.0000, 612.6577	371.5437, 1710.0000, 692.7495	221.8332, 1710.0000, 553.8470	436.3070, 1995.0000, 612.6577
27	1	BLOCK_TYPE_1	4	194.6162, 1995.0000, 444.1117	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	176.2358, 2280.0000, 336.1807	296.8571, 1995.0000, 483.2749	221.8332, 1995.0000, 553.8470	92.3368, 1995.0000, 395.9298	296.8571, 2280.0000, 483.2749
28	1	BLOCK_TYPE_1	4	483.0071, 285.0000, 711.6832	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	436.3070, 570.0000, 612.6577	592.0105, 285.0000, 721.9399	538.7036, 285.0000, 810.0726	371.5437, 285.0000, 692.7495	592.0105, 570.0000, 721.9399
29	1	BLOCK_TYPE_1	4	194.6162, 1425.0000, 444.1117	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	176.2358, 1710.0000, 336.1807	296.8571, 1425.0000, 483.2749	221.8332, 1425.0000, 553.8470	92.3368, 1425.0000, 395.9298	296.8571, 1710.0000, 483.2749
30	1	BLOCK_TYPE_1	4	329.7006, 570.0000, 587.7175	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	296.8571, 855.0000, 483.2749	436.3070, 570.0000, 612.6577	371.5437, 570.0000, 692.7495	221.8332, 570.0000, 553.8470	436.3070, 855.0000, 612.6577
31	1	BLOCK_TYPE_1	4	194.6162, 855.0000, 444.1117	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	176.2358, 1140.0000, 336.1807	296.8571, 855.0000, 483.2749	221.8332, 855.0000, 553.8470	92.3368, 855.0000, 395.9298	296.8571, 1140.0000, 483.2749
32	1	BLOCK_TYPE_1	4	329.7006, 1140.0000, 587.7175	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	296.8571, 1425.0000, 483.2749	436.3070, 1140.0000, 612.6577	371.5437, 1140.0000, 692.7495	221.8332, 1140.0000, 553.8470	436.3070, 1425.0000, 612.6577
33	1	BLOCK_TYPE_1	4	1415.0778, 1140.0000, 971.6377	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	1316.5000, 1425.0000, 924.0000	1506.2871, 1140.0000, 911.0751	1520.2513, 1140.0000, 1013.1241	1316.5000, 1140.0000, 1027.0000	1506.2871, 1425.0000, 911.0751
34	1	BLOCK_TYPE_1	4	2438.3838, 1140.0000, 444.1118	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	2336.1429, 1425.0000, 483.2749	2456.7642, 1140.0000, 336.1807	2540.6632, 1140.0000, 395.9298	2411.1668, 1140.0000, 553.8470	2456.7642, 1425.0000, 336.1807
35	1	BLOCK_TYPE_1	4	2303.2994, 1425.0000, 587.7175	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	2196.6930, 1710.0000, 612.6577	2336.1429, 1425.0000, 483.2749	2411.1668, 1425.0000, 553.8470	2261.4563, 1425.0000, 692.7495	2336.1429, 1710.0000, 483.2749
36	1	BLOCK_TYPE_1	4	2438.3838, 1710.0000, 444.1118	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	2336.1429, 1995.0000, 483.2749	2456.7642, 1710.0000, 336.1807	2540.6632, 1710.0000, 395.9298	2411.1668, 1710.0000, 553.8470	2456.7642, 1995.0000, 336.1807
37	1	BLOCK_TYPE_1	4	2303.2994, 855.0000, 587.7175	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	2196.6930, 1140.0000, 612.6577	2336.1429, 855.0000, 483.2749	2411.1668, 855.0000, 553.8470	2261.4563, 855.0000, 692.7495	2336.1429, 1140.0000, 483.2749
38	1	BLOCK_TYPE_1	4	1981.2951, 1995.0000, 813.7198	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	1871.9076, 2280.0000, 809.1035	2040.9895, 1995.0000, 721.9399	2094.2964, 1995.0000, 810.0726	1912.7737, 1995.0000, 903.6496	2040.9895, 2280.0000, 721.9399
39	1	BLOCK_TYPE_1	4	2303.2994, 285.0000, 587.7175	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	2196.6930, 570.0000, 612.6577	2336.1429, 285.0000, 483.2749	2411.1668, 285.0000, 553.8470	2261.4563, 285.0000, 692.7495	2336.1429, 570.0000, 483.2749
40	1	BLOCK_TYPE_1	4	2438.3838, 570.0000, 444.1118	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	2336.1429, 855.0000, 483.2749	2456.7642, 570.0000, 336.1807	2540.6632, 570.0000, 395.9298	2411.1668, 570.0000, 553.8470	2456.7642, 855.0000, 336.1807
41	1	BLOCK_TYPE_1	4	2303.2994, 1995.0000, 587.7175	2,10,11,3	10,6,7,11	1,9,12,4	9,5,8,12	2196.6930, 2280.0000, 612.6577	2336.1429, 1995.0000, 483.2749	2411.1668, 1995.0000, 553.8470	2261.4563, 1995.0000, 692.7495	2336.1429, 2280.0000, 483.2749