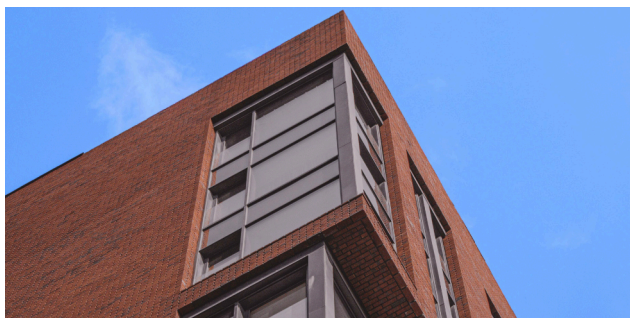


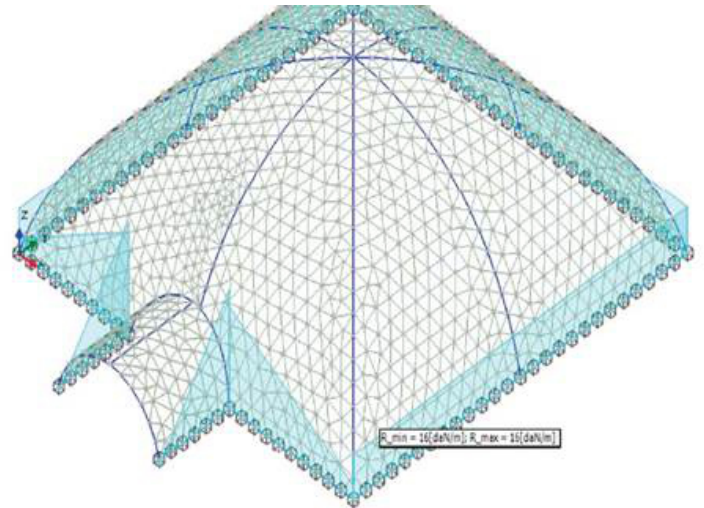
What's New in 3Muri 16.1.0.0

Within a calculation framework that remains reliable and compliant with current standards, Version 16.1.0.0 of 3Muri Project introduces a new model visualisation mode, integrates the CAM® reinforcement system directly into the model, and introduces a new modelling tool to represent the real discontinuities of existing buildings; in addition, 3Muri Vaults extends the constraint options for vaults.

The new features in this release are intended for engineers working on complex masonry buildings, historic aggregates and strengthening interventions, with the aim of improving modelling and model readability, analysis accuracy, and the ability to represent construction reality.

1. New "Element Plan" view

In the Structure environment of 3Muri Project, the wireframe plan can be replaced, when preferred, with a representation that reflects the model's actual geometry: the piers of the current storey (and, for the roof level, those of the storey below as well) are drawn as solid objects, with their actual thickness.



The new pier display mode is enabled by selecting the "Element Plan" checkbox in the display filter dialog, with the option to choose between the current storey and the storey below the roof.

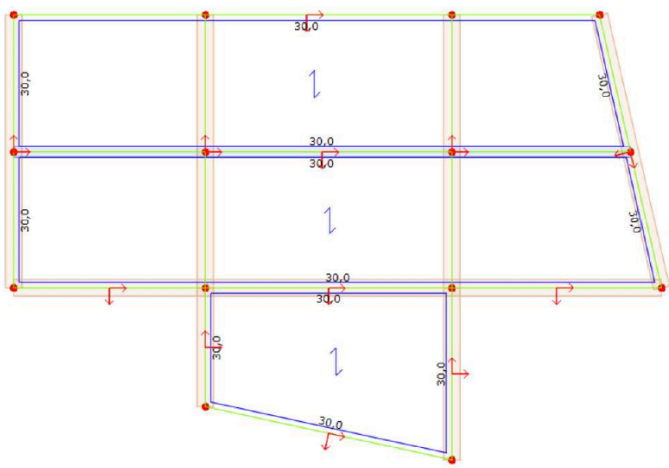


Fig. 1 – Element Plan view of the roof level

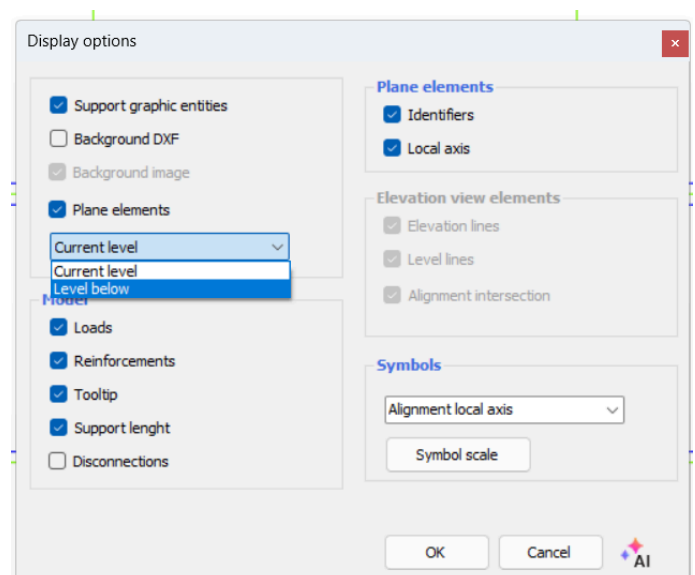


Fig. 2 – Display options dialog: enabling the Element Plan view

The elements remain snap-enabled: they can be snapped to when inserting nodes or openings, and any change to the piers updates the plan immediately. To avoid cluttering the drawing, ID labels and tooltips remain reserved for the classic view.

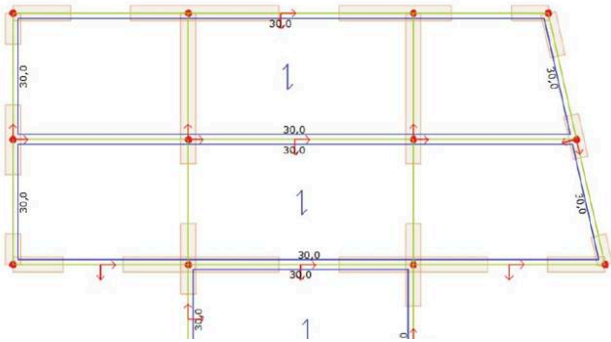


Fig. 3 – Element Plan view of the storey below the roof

In practice

A more direct reading of the masonry geometry, useful for visually checking the model and for communication with the design team; and a measurable productivity gain during editing, due to direct snapping onto solid elements and synchronous updating as the model changes.

2. CAM[®] reinforcement

The CAM[®] system (Cuciture Attive dei Manufatti – active confinement stitching) is a structural reinforcement technology for the strengthening and seismic upgrading of existing masonry buildings. In 3Muri Project it is now possible to apply the three-dimensional grid of pre-tensioned stainless-steel straps on both faces of the wall: the grid induces a state of triaxial pre-compression that compacts the masonry mass, ties the wall leaves together and creates distributed reinforcement, producing the box-like behaviour required for earthquake resistance.

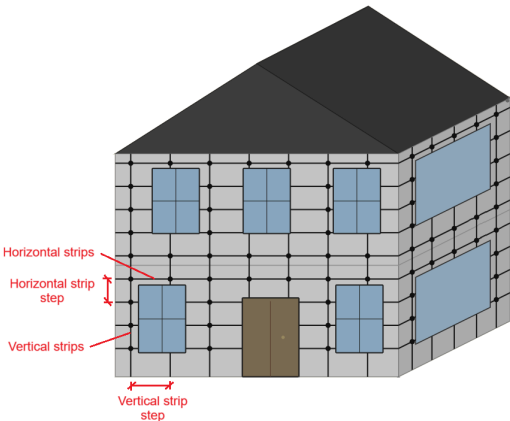


Fig. 4 – Layout of the CAM reinforcement: horizontal and vertical straps, with their respective spacing

How 3Muri Project manages it

Through a dedicated dialog, the engineer can:

- **Select the steel type** from the preloaded options (AISI 301, C1000, Duplex) or define a custom material.
- **Set the spacing, number and dimensions** of the vertical and horizontal straps independently.
- **Copy the parameters** from one direction to the other with a single click on the arrow icons.
- **Define the safety factor** and the drift limit values for combined bending-axial load and shear.

Vertical		Horizontal	
Material	Type 1 - AISI 301 steel	Material	--User defined--
Number of strips per side	1	Number of strips per side	1
Step [cm]	100	Step [cm]	80
bn [mm]	19,00	bn [mm]	19,00
tn [mm]	0,90	tn [mm]	0,90
fyk [N/mm ²]	350,0	fyk [N/mm ²]	500,0

Calculation coefficients	
γn	1,10
Shear drift	0,0080
Bending drift	0,0160

☐ Spandrel: strips for bending resistance
☒ Minimum element width: 30 [cm]

Fig. 5 – table for entering CAM data

The software automatically applies the reinforcement to both faces of the wall and processes the strengthened masonry in a way that is transparent and straightforward for the designer: a structurally effective, code-compliant intervention that can be configured in minutes, directly within the analysis model.

In practice

A reinforcement that can be configured in minutes, without leaving the analysis model or relying on external spreadsheets: a technically sound intervention that also serves as a strong point when presenting proposals to clients.

3. Connection element

In the structural modelling of masonry walls, the actual condition is often complex: walls built in different periods, pre-existing cracks, adjacent buildings that come into contact during an earthquake. The connection element is designed to model these conditions: technically, it is a two-node spring element with axial stiffness only, with mechanical behaviour that can differ in tension and in compression, both in stiffness and in strength.

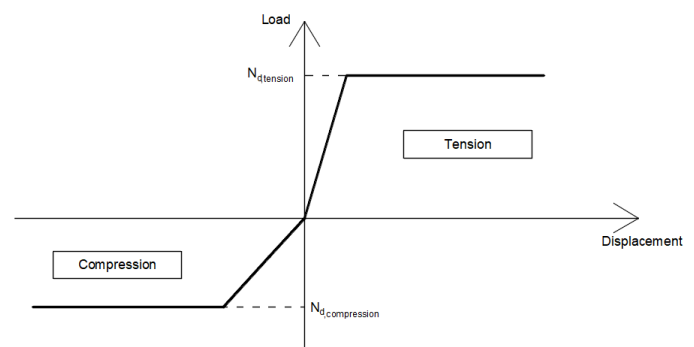


Fig. 6 – Behaviour law of the connection element: stiffness and strength differentiated in tension and compression

What can be modelled

- **Seismic pounding** between adjacent structural units in an urban aggregate.
- **Lack of masonry interlocking** between adjoining walls built in different periods or with different materials.
- **Cracks** that interrupt or limit structural continuity.
- **"Slack" tie-rods** with no pre-tensioning, which engage only once the nodes move apart beyond a given threshold.
- **Euler buckling** in compressed steel bracing members.
- **Discontinuous ("floating") walls** distributing their load onto the elements of the storey below.
- **Disconnection between walls** to eliminate an unwanted flange effect.

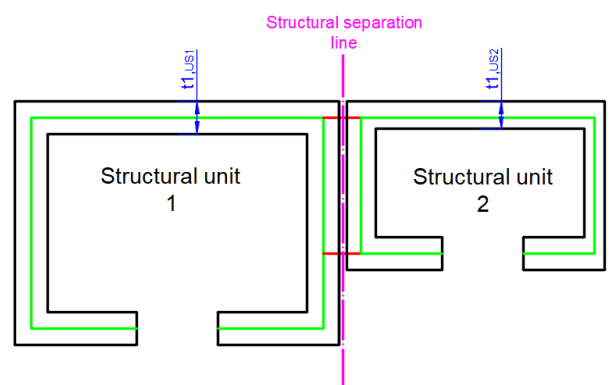


Fig. 7 – Connection element at the junction between two adjacent structural units

The input dialog controls finite or infinite stiffness (independently for tension and compression), finite or infinite strength, activation distance, pre-tensioning for pre-stressed tie-rods, and initial gap for struts. In a building aggregate, the stiffness of the connection can be calibrated using the actual physical formula (elastic modulus, wall thickness, storey height), without forced approximations; in the pushover analysis, 3Muri Project displays the compression or tension state of the element at every step.

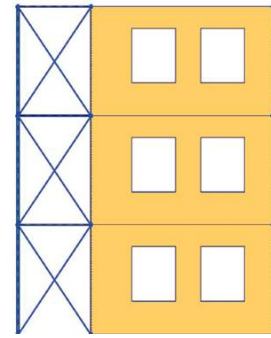


Fig. 7 - Connection element used to model a compressed steel bracing member

In practice

A single finite element covers a wide range of scenarios, from seismic pounding between adjacent buildings to floating walls, from slack tie-rods to steel bracing, and allows every physical discontinuity of the building, within an aggregate, to be represented in a simple and efficient way.

4. 3Muri Vaults: local-system constraints and distributed linear reactions

Local-system constraints with finite flexibility

Traditional modelling required constraints to be defined solely with respect to the building's global coordinate system. The new release introduces orientation in local systems and finite flexibility, with three options for the local X-axis:

- **Coincident with the global X-axis:** maintains standard compatibility inherited from previous versions.
- **Parallel to the application edge:** essential for constraints applied to groups of lines (e.g. the springing lines of a vault): the local axis rotates and automatically adapts to the geometric direction of the line.
- **Generic angle relative to the global X-axis:** a custom value from 0° to 359°, to precisely capture the irregularities typical of listed historic buildings.

For each of the 5 degrees of freedom (Ux, Uy, Uz, Rot X, Rot Y), the designer selects a Free, Rigid or Elastic constraint behaviour.

Setting the elastic constraint unlocks the input of a numerical stiffness value, with units of measurement that adapt dynamically to the type of group (points or lines).

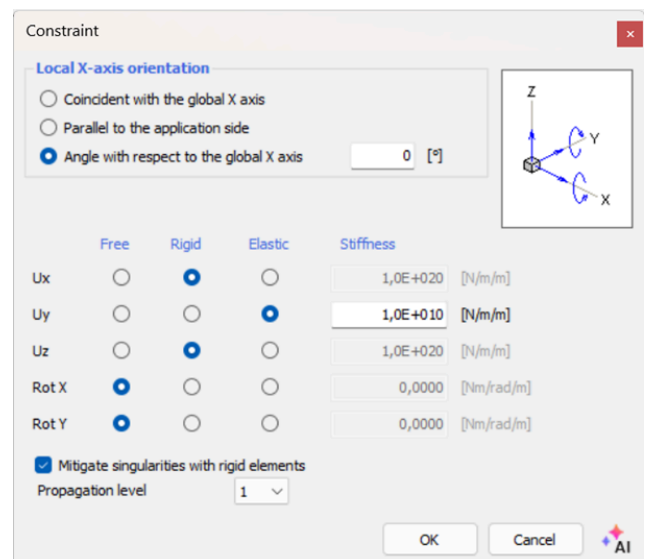


Fig. 8 - Constraint dialog: local X-axis orientation and stiffness values for the 5 degrees of freedom

Display of distributed linear constraint reactions

Where the display of support reactions was previously limited to single vector arrows per node, 3Muri Vaults now instantly plots the continuous diagram of forces distributed per unit length, making it possible to assess directly the action transmitted from the vaults to the perimeter walls below.

- **Rlin V — Vertical Linear Reactions:** the diagram of distributed vertical loads transmitted to the base walls, plotted on the local plane containing the vault springing line.
- **Rlin H — Horizontal Linear Reactions:** the pattern of distributed horizontal thrusts, projected in plan orthogonally to the direction of the constrained edge.

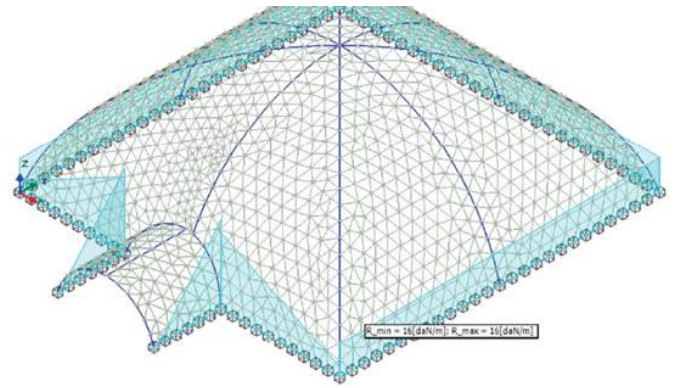


Fig. 9 - Linear constraint reactions R_V for a pavilion vault

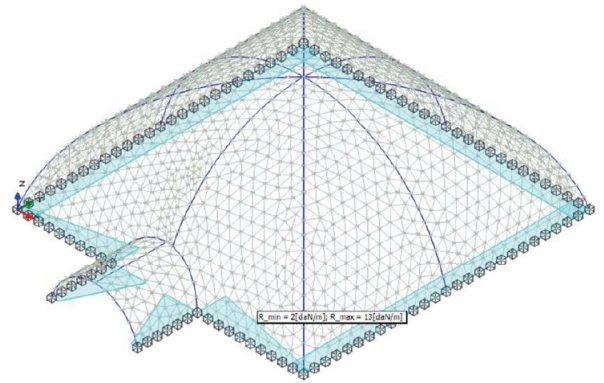


Fig. 10 - Linear constraint reactions R_H for a pavilion vault

In practice

The more complex and irregular the vault model (listed historic buildings, composite geometries), the more the ability to orient constraints in the local system and to read reactions as continuous diagrams, rather than isolated arrows, affects the quality of the analysis and the verification of the base walls.