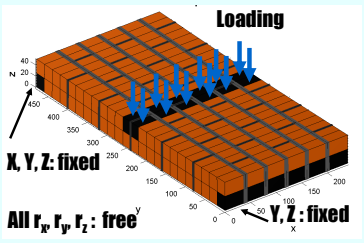
ENSIONAL APPLIED ELEMENT METHOD FOR MASONRY STRUCTU
組積造構造物に対する３次元応用要素法

Out of Plane Behavior

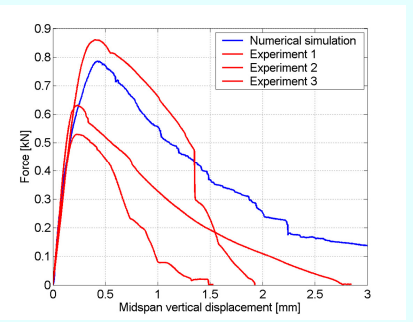
The 3D-AEM model was verified using the experimental data. The non-retrofitted and retrofitted wallette dimension used is 480x240x50mm³ and consist of 6 rows of 6 bricks each.

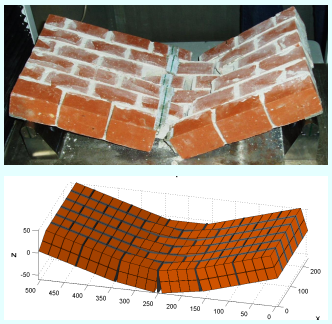
	E [kN/mm²]	G [kN/mm²]	σ_{cr} [kN/mm²]	σ_{cr} [kN/mm²]	μ	β	1/Cmt [kN/mm²]
Mortar	0.5	0.25	0.16e-3	0.22e-3	0.6	0.9	1/30
Brick	15	7.5	NA	NA	NA	NA	NA

Material properties used for the model

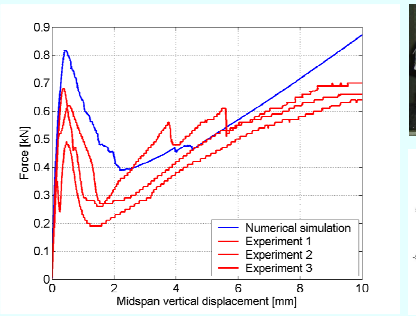


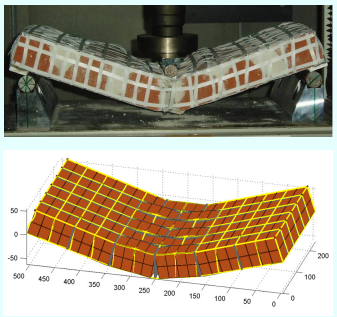
Figures below show the comparison of the numerical and experimental results for non-retrofitted and retrofitted wallettes. It can be seen that in both cases, the numerical model can accurately capture the force-deformation relationships. The good agreement between experimental result and numerical simulation of the crack patterns and deformed shapes can also be observed.





Non-retrofitted Masonry

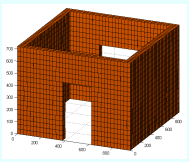




PP Mesh-Retrofitted Masonry

Eigenvector Analysis of the Scaled Masonry Structure

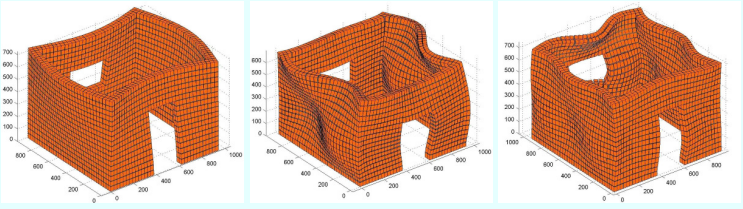
Experimental model



Numerical model

Masonry properties used for analysis
Compressive Strength = 21.8 MPa
Shear Strength = 0.075 MPa
Bond Strength = 0.055 MPa

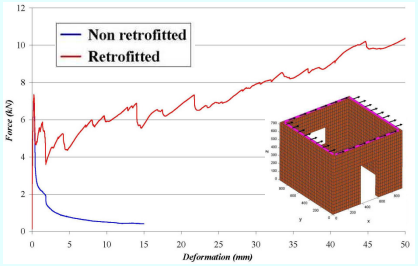
The good agreement between experimental result and numerical simulation can be obtained in both mode shape and natural frequency in the first mode.

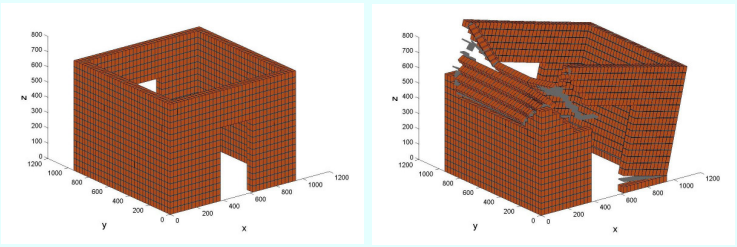


1st Mode **2nd Mode** **3rd Mode**

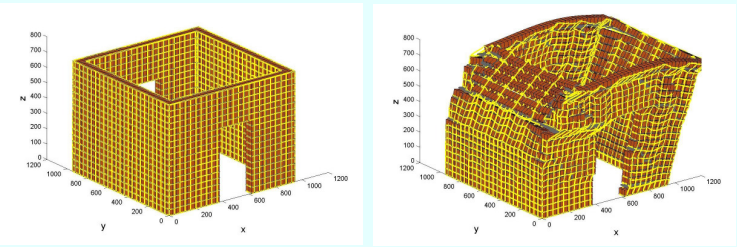
Pushover Loading

Load is applied in order to investigate the PP-band mesh effectiveness in the small-scale masonry house. In the non-retrofitted case, there is only very small residual strength observed after the first crack. In the retrofitted case, larger residual strength after the formation of the cracks was observed. As deformation increases, the retrofitted house can resist higher force than the initial cracking load. Moreover, the failure mode is more ductile compared to the one observed in non-reinforced house model.





Non-retrofitted Masonry

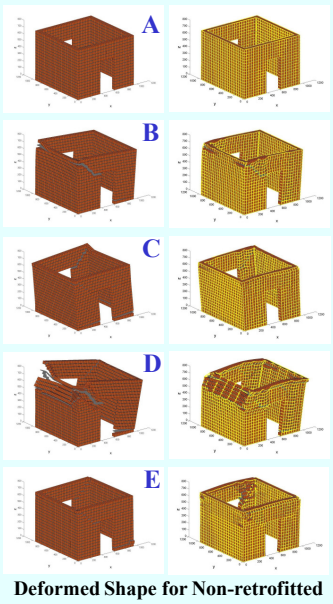


PP Mesh-Retrofitted Masonry

Initial (left) and Deformed Shape (right) of Masonry Model

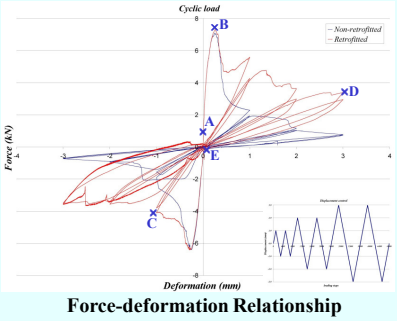
Displacement in the right : 15mm, Illustration scale factor : 20

Cyclic Loading



Deformed Shape for Non-retrofitted and Retrofitted Masonry Model

Numerical model to simulate the cyclic response of masonry was developed by adopting damage model in the AEM. Two cycles for each amplitude of 1mm, 2mm, 3mm as shown in the below figure were applied. Considering the result of numerical modeling, it can be concluded that PP-band meshes can effectively improve the hysteretic behavior of the masonry house.



Force-deformation Relationship under Cyclic Loading

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