Nonlinear Masonry Wall Verification Report

BSYIGMACAD v1.3.6 benchmark evidence package documenting comparison against extracted published reference cases.

Reference Case

JD4 masonry shear wall under 0.30 MPa initial compression

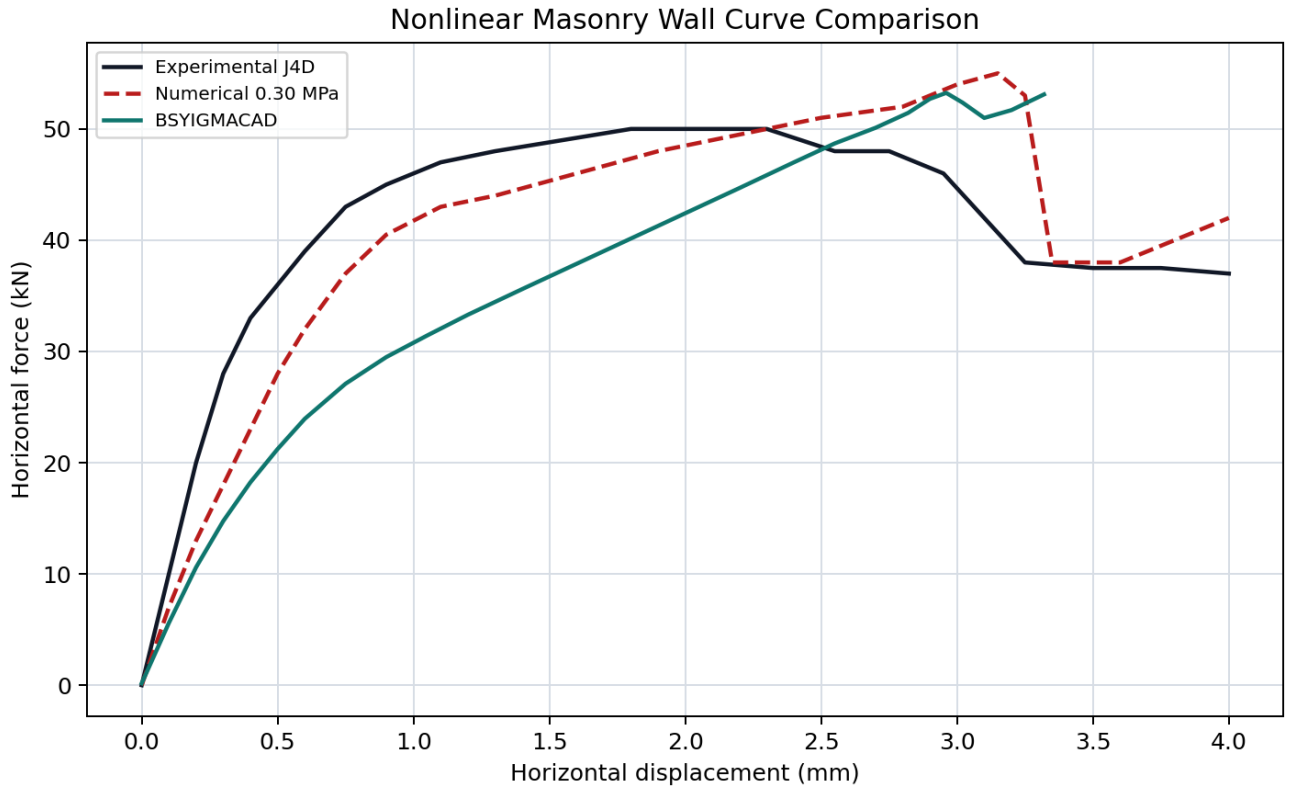
Abdulla, K. F., Cunningham, L. S., and Gillie, M. (2017). Simulating masonry wall behaviour using a simplified micro-model approach. Engineering Structures, 151, 349-365. DOI: 10.1016/j.engstruct.2017.08.021.

Result Summary

Default workflow output is compared against extracted JD4 load-displacement and failure-pattern evidence.

Metric	Value	Unit
BSYIGMACAD peak	53.242	kN
BSYIGMACAD peak displacement/strain	2.960	mm
Reference experimental peak	50.000	kN
Reference numerical peak	55.000	kN
Peak error vs experimental	6.48	%
Peak error vs reference numerical	-3.20	%
RMSE vs experimental key points	11.862	kN
RMSE vs reference numerical key points	8.054	kN

Curve Comparison



Visual Evidence

Reference excerpt

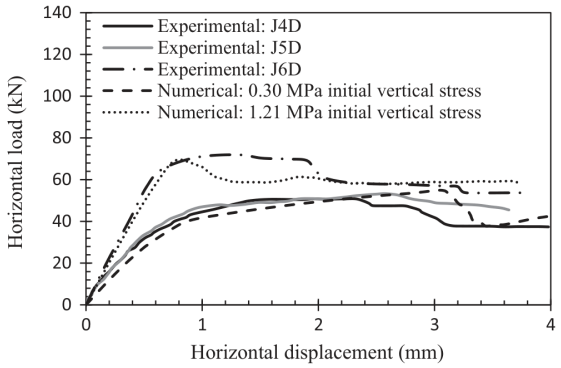
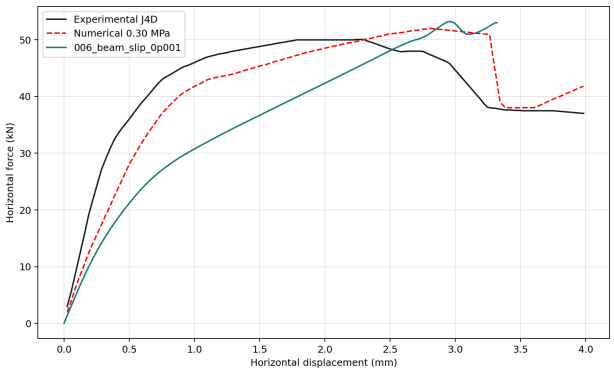


Fig. 13. Comparison between experimental and numerical results.

BSYIGMACAD output



Reference excerpt

the un-cracked regions and occurrence of high compressive stresses and crushing of the wall at its toe.

4.2. Response of masonry under out-of-plane loading

The focus of this validation study is the on-plan C-shaped masonry wall tested by Griffith and Vaculik [31] under out of plane loading, see Fig. 16. The main portion of the wall forming the web was 4 m long and 2.5 m high, the return walls which formed the flanges were 0.45 m long and 2.5 m high, in all cases the wall was 110 mm thick. The wall was built with 10-hole cored

the web and a reaction frame. The recorded forces in the reaction frame were then divided by the surface area of the web to determine the applied pressure. The response of the wall was presented as a relationship between the applied pressure and out of plane displacement at the centre of the inner surface of the main web.

The material properties required for defining the numerical model were obtained from the original experimental data. Where properties were not reported in the experiments, these were obtained either by calculation or assumptions based on relevant data available in the literature detailed as follows. Poisson's ratio was set as 0.15, similar to the previous validation study as reported in [28]. The mortar elastic modulus (E_m) was calculated based on the given values of brick units (E_b) and masonry (E_{mp}) elastic

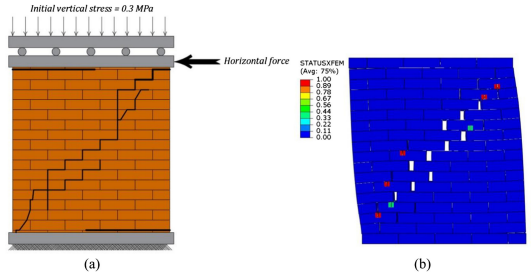
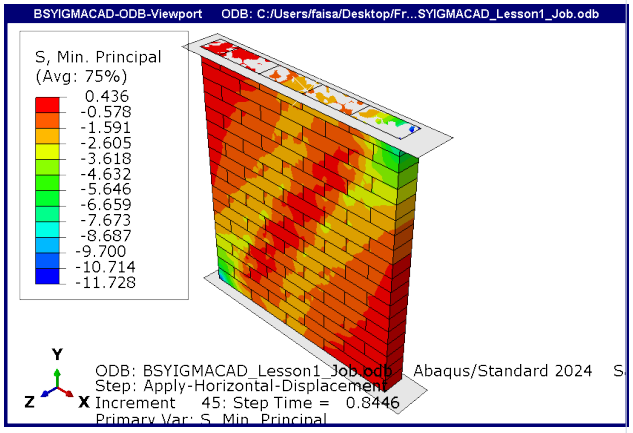


Fig. 14. Comparison of failure modes: (a) experimental failure patterns; (b) numerical failure patterns (scale factor = 20).

BSYIGMACAD output



Reference excerpt

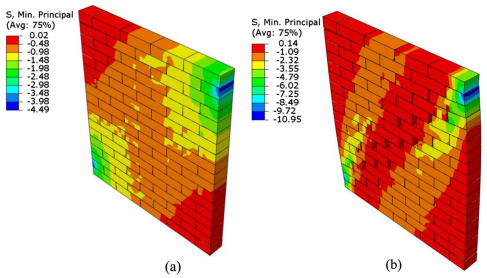
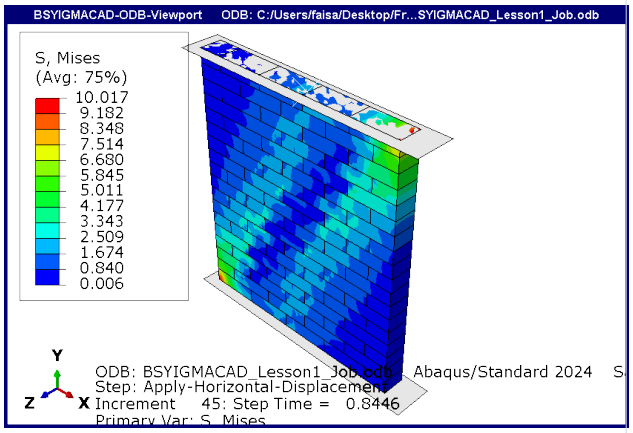


Fig. 15. Crack pattern and minimum principal stress distribution (N/mm²) in the wall with the initial vertical compression stress of 0.3 N/mm²: (a) at 1 mm horizontal displacement at top; (b) at 4 mm horizontal displacement at top (scale factor = 20).

BSYIGMACAD output



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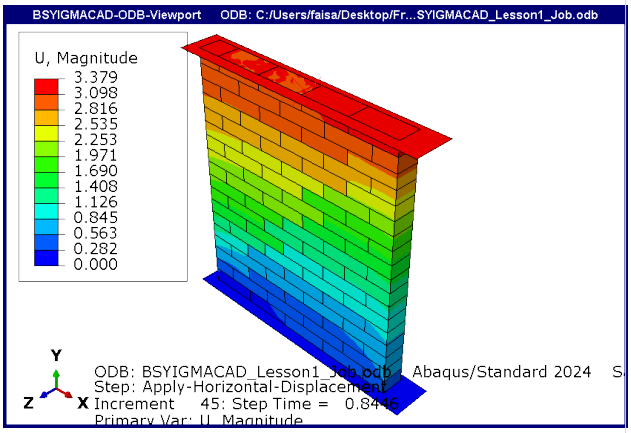

BSYIGMACAD output