EXAMPLE 2-009
Inelastic Response of Stone-Concrete Bearing Walls Subjected to Lateral Loads

1. EXAMPLE DESCRIPTION

Figure 1 shows a stone in-filled RC frame wall that is subjected to a lateral load. Geometry, dimensions, reinforcement details and loading setup are shown in Figs. 1.a and 1.b. The ELS model of the wall is shown in Fig.1.c.

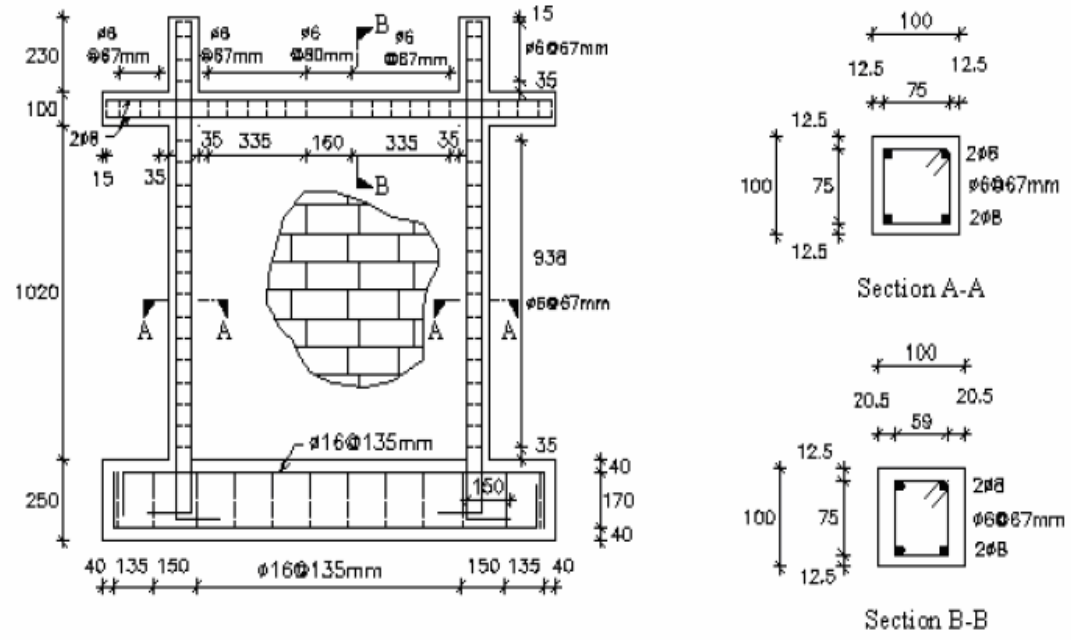

Fig. 1.a Problem geometry

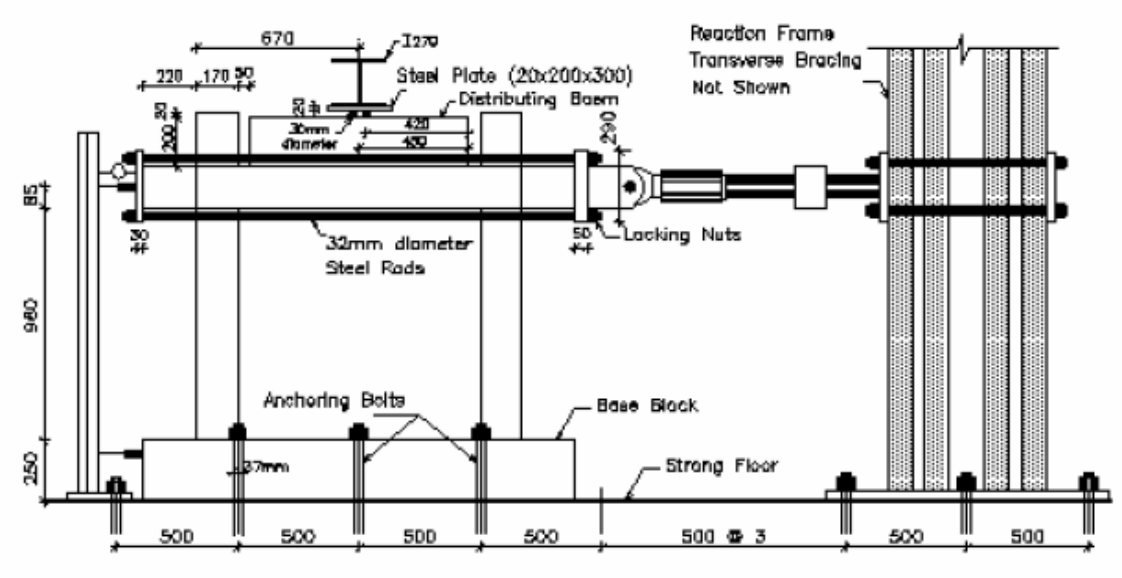

Fig. 1.b Loading set up [Ref. 1]

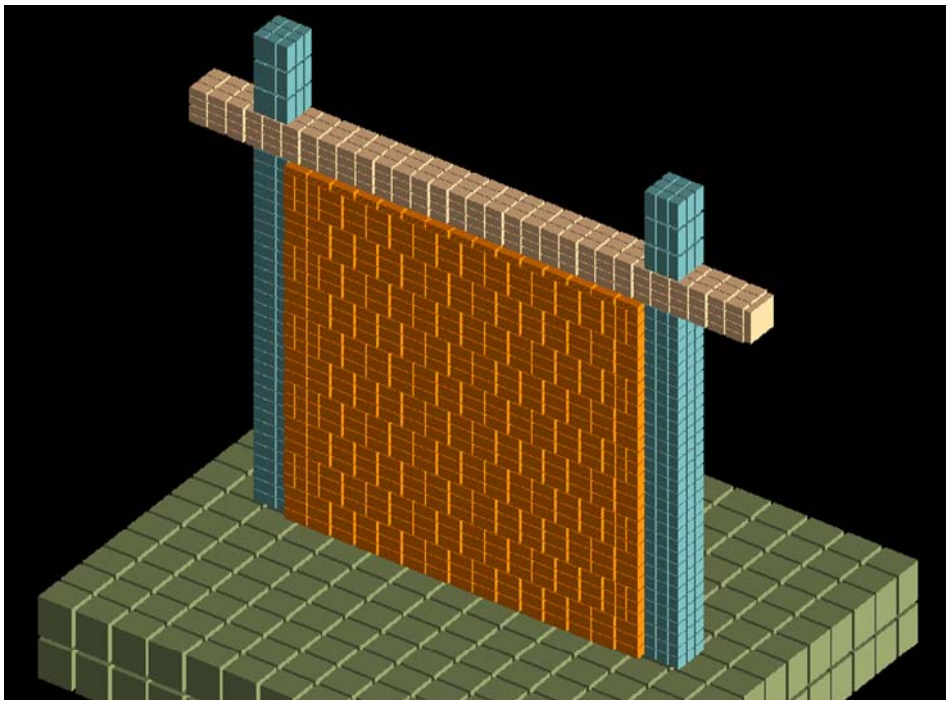

Fig. 1.c ELS mesh

2. MATERIAL PROPERTIES

The compressive strength of the concrete is 3.75 ksi (0.0273 kN/mm^2) while the yield stress and ultimate stress of the main reinforcement are 53.48 ksi (0.37 kN/mm^2) and 80.76 ksi (0.56 kN/mm^2), respectively. The yield stress and ultimate stress of the stirrups are 46.08 and 57.17 ksi (0.32 and 0.39 kN/mm^2), respectively. The compressive stress of the natural stone is 117.92 ksi (0.82 kN/mm^2).

The applied element method follows a discrete crack approach in which the material is represented by a group of springs located at the surfaces of the element. The springs represent the axial and shear behavior of the material. For more details about constitutive models of the constituent materials refer to the ELS® technical manual.

3. RESULTS

Figure 2 illustrates the analytical load-deflection results compared to the experimental ones. As can be obviously seen, the results are in a good agreement with the experiments. The behavior is well predicted in the elastic stage, post cracking stage, and in the post-yielding stage. In other words, the overall response could be successfully predicted using ELS.

Figure 3 shows the calculated principal strain contours obtained from analysis.

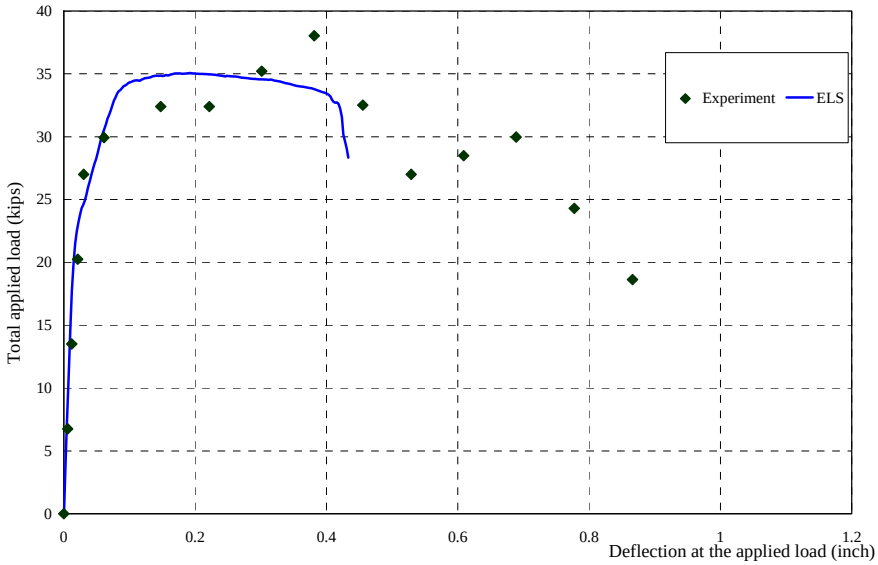

Fig. 1 Load-deflection predicted by ELS in a comparison to the experimental results

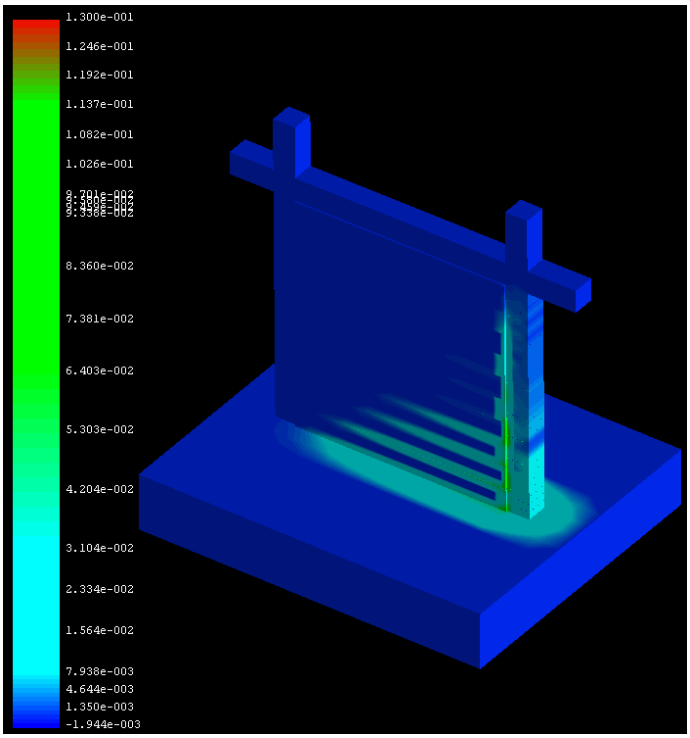

Fig. 2 Calculated principal strain contours (in 1_Dir) at applied load -34.12 kips (at output frame 153).

4. CONCLUSIONS

Based on the analytical and experimental results, it can be concluded that the ELS can successfully analyze and predict a close-to-reality behavior of stone in-filled frame structures in the elastic, post-cracking and post-yielding stages.

5. REFERENCES

1- H. S. Al-Nimry, N. S. Armouti and A. S. Najmi, Royal Scientific Society, Amman, Jordan Department of Civil Engineering, University of Jordan , Amman, Jordan.
2- Technical Manual of Extreme Loading for Structures.