

## Three Stories Masonry Wall Capacity and Behavior Second Progress Report

by Fernando S. Fonseca, Ph.D., S.E. and Ernesto Fortes, Jeff Buxton, David Ochoa, and Kyle Chavez, Graduate Students

### Summary

Lateral load testing has been performed on four wall specimens (walls 4, 5, 6, and 7) with plans to test three more specimens in the near future. The testing was conducted to determine the shear strength and failure mode of the walls.

### Construction

Construction of each wall began with casting a reinforced concrete footing measuring approximately 305 mm × 1219 mm x 4064 mm as shown in Figure 1.



Figure 1 - Reinforced concrete footing

The specimens are half-scale and the designs represent a three-story shear wall. Wall 4 has windows in the center of the wall as shown in Figure 2. Walls 5 and 6 have doors but wall 5 has a masonry beam above the doors while wall 6 has a reinforcement concrete T-beam.



Figure 2- walls tested

Researchers made a slight change on the design of the walls (from the previous walls) in an attempt to improve their behavior. A bond beam, as shown in Figure 3, has been added on the fifth course of every wall.



Figure 3 - Bond Beam at the fifth course

### Wall Testing

Walls were tested using a custom reaction/testing frame that allows the MTS actuator to push and pull the walls cyclically at increasing loads and/or displacements as shown in Figure 4. The walls were instrumented with LVDTs, string pots, and strain gauges as shown

in Figure 5. After each push or pull, cracks were documented to track their development and propagation as shown in Figure 6.



Figure 4 - : Reaction/Testing Frame



Figure 5 - Instrumentation



Figure 6 – Crack Pattern

### Failure Modes

All walls experienced a shear failure. Wall 4 (with windows) failed in the third story as shown in Figure 7. Wall 5 (with doors and a masonry beam above the doors) also failed in the third story as shown in Figure 8. Wall 6 (with doors and a reinforcement concrete T-beam above the doors) failed in the third story as well as shown in Figure 9. Wall 7 (with windows) in the first story as shown in Figure 10.

Load-Displacement Relationships Figure 11 to Figure 14 shows the load-displacement relationship, as measured at the top of the wall, for walls 4, 5, 6, 7, respectively.



Figure 7 – Failure of Wall 4



Figure 8 – Failure of Wall 5



Figure 9 – Failure of Wall 6



Figure 10 – Failure of all 7

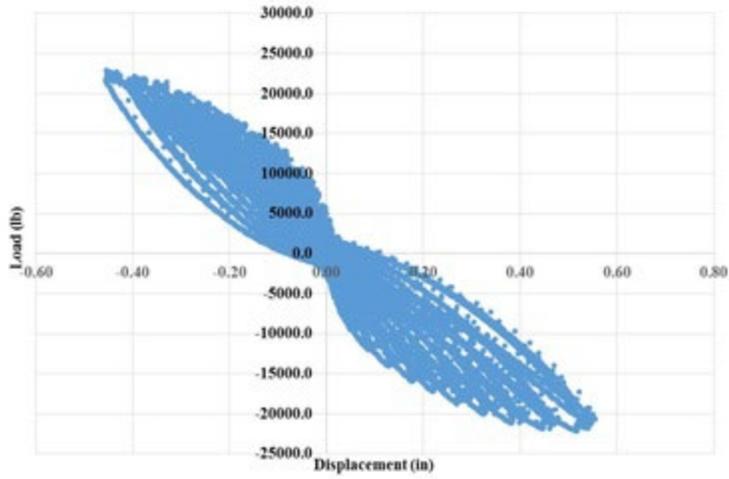


Figure 11 - Load-Displacement Relationship for the Wall 4

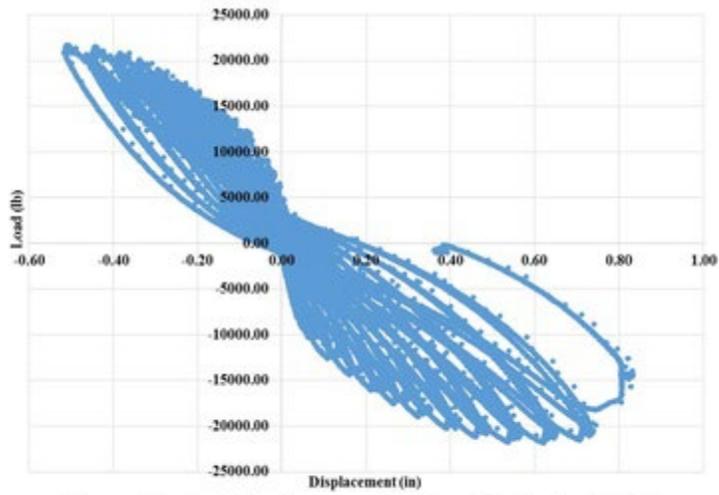


Figure 12 - Load-Displacement Relationship for the Wall 5

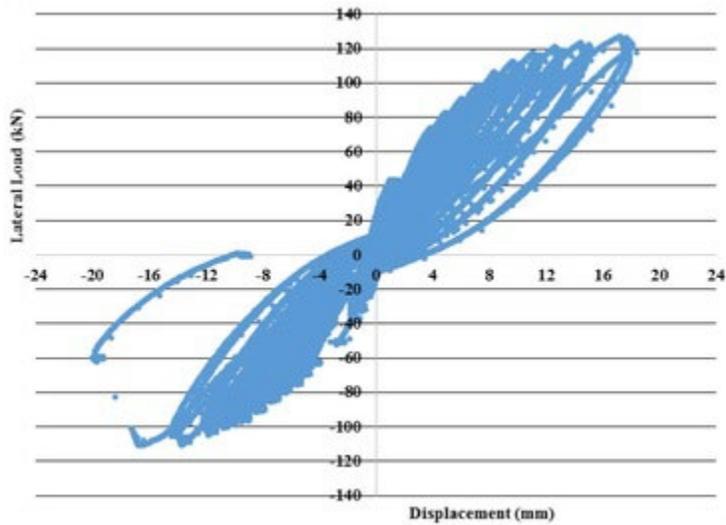


Figure 13 - Load-Displacement Relationship for the Wall 6

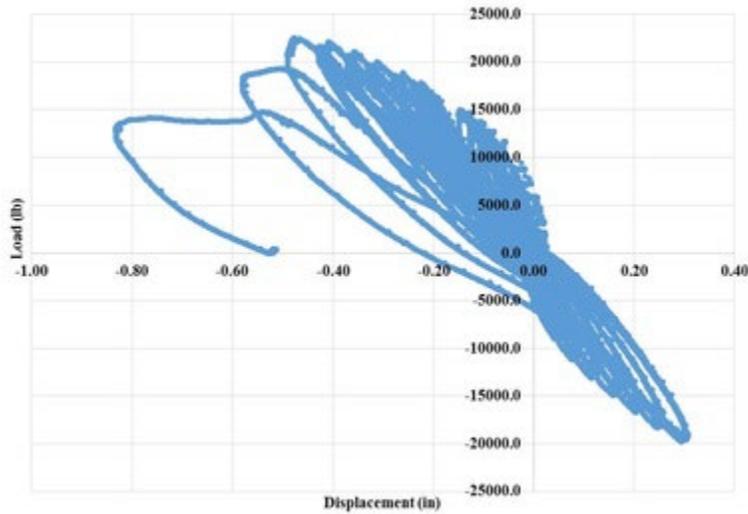


Figure 14 - Load-Displacement Relationship for the Wall 7

### Future Work

Three more walls will be constructed and tested. Wall 8 is being prepared to be tested in the 3rd week of January. Wall 9 is completed and will be tested in the last week of January. Wall 10 is almost completed and will be tested in the second week of February.