CHAPTER 8

8. Summary and Conclusions

8.1 Summary and Conclusions

Monotonic and cyclic performance of structurally insulated panel (SIPS) shear walls was the focus of this study. A summary of the pertinent research conducted on timber shear walls was presented. Monotonic loading and the sequential phased displacement cyclic loading schemes were used to test 23, 8 ft by 8 ft shear walls of 4 different configurations. The monotonic and cyclic performance of the SIPS shear walls was compared. Monotonic and cyclic performance of the SIPS shear walls were also compared to modern light-framed wood construction.

The following observations and conclusions were drawn from the SIPS shear wall tests.

- Vertical connecting elements between the panels and on the ends of the panels are so strong and stiff that the performance of the SIPS shear walls is governed by the connection to the bottom plate.
- The bottom plate connections of the walls are critical to the capacity of the SIPS shear walls. The primary mode of failure for the SIPS shear walls was at the bottom plate unless tie-down anchors were introduced to move the mechanism of failure away from the bottom of the wall.
- Stiffness, capacity, and energy dissipation ability of a SIPS shear wall can be greatly increased with the addition of tie-down anchors.
- Tie-down anchors help SIPS shear walls act more in a racking fashion, as shear walls are assumed to act, rather than rigid bodies as SIPS shear walls without anchors behave.

- Results obtained for capacity, stiffness, and ductility of the SIPS shear walls tested under ASTM E564 monotonic tests are equivalent to the results obtained from testing walls under a straight one-directional ramp test.
- Results obtained for capacity for monotonic tests are equivalent to the capacity obtained from the initial cycle envelope curve determined for the cyclic sequential phased displacement tests.
- No appreciable difference exists in the values of elastic stiffness obtained from monotonic and sequential phased displacement tests.
- The overall behavior of the SIPS shear walls under monotonic loading is similar to the behavior of the walls under the sequential phased displacement loading.
- The SIPS shear wall with the tie-down anchors is the only configuration of wall tested which has values of capacity that are equivalent to light-framed construction.
- The SIPS shear walls exhibited higher stiffness, lower ductility, lower energy dissipation ability, and lower equivalent viscous elastic damping ratios than light-framed construction. These conclusions, along with the fact that the SIPS shear walls are only equivalent in capacity and not significantly greater, would lead to the conclusion that the SIPS shear walls are not as effective as light-framed construction shear walls in high seismic zones.

8.2 Future Research

To the author's knowledge, this is the first investigation into the cyclic performance of structurally insulated panel shear walls. Additional research is needed to study the seismic performance of SIPS shear walls. Effects of other types of fasteners such as nails, staples, and wood screws need to be studied further. Load tables need to be generated for monotonic and cyclic or dynamic tests with these other types of fasteners and spacings to help designers effectively use SIPS as shear walls. Also, the effects of the adhesive on the strength, stiffness, and ductility of the system needs to be investigated. The effects of vertical gravity loads should also be tested for SIPS shear walls without tie-down anchors to see if a higher level of performance is achieved in

practice than this study. As has been done with light-framed shear walls, long SIPS walls with openings should be investigated.

Further research is needed in the area of timber shear walls in general as well as SIPS shear walls, to determine how values of stiffness, ductility, energy dissipation, and equivalent viscous damping can be effectively used by designers to design the safest structures in high seismic zones. These values can be used to compare different lateral load resisting systems and should be considered by designers, but not enough data exists to allow engineers use these values effectively. In order to maximum seismic safety, more than the capacity of a system needs to be considered.