INTRODUCTION

Currently, the building code designs for collapse prevention. While the code provides adequate life safety for residential structures, the seismic damages to a home can be overwhelming for home owners.

Homes may be rendered uninhabitable due to seismic damages and residual displacements. Repairs may not be an option; therefore, households are displaced. By implementing the light frame unibody system, these factors can be significantly reduced.

Research Purpose

More studies are needed to assess which type and brand of construction adhesive has better performance and cost effectiveness to be implemented in unibody system.

- Evaluate the bonding properties of six different construction adhesives
- Find the stiffness and shear strength of six different construction adhesives

LIGHT FRAME UNIBODY BACKGROUND

The light frame unibody system incorporates the architectural features with the exterior walls to help resist lateral loading due to wind or earthquake loads. Adhesive is utilized in combination with mechanical fasteners to achieve the unibody system in an inexpensive manner.

Benefits

- Adhesive + mechanical fasteners increases strength and stiffness
- Period of the home is decreased reducing the displacement and damage

LIGHT FRAME UNIBODY PREVIOUS & CURRENT TESTING

The overall project is a four phase project.

1. The first phase consisted of 4 shear walls, which was conducted at Stanford University.
2. The second phase consisted of full scale shear walls, which was conducted at California State University Sacramento.
3. The third phase is currently ongoing, where four quasi static full scale room test are being conducted at UC Berkeley Richmond Field Station.
4. The final phase is a shake table test of a full scale home, which will be conducted in San Diego.

Adhesive Testing

A simple push-through test was designed to investigate the properties of the adhesive.

Setup Description

- Epoxy was used for the connection that was not being considered to prevent any type of failure
- A small actuator was used to conduct the push through
- A yolk was attached by drilling screws to the displacing 2x4

Test Setup

- Push Through Test
- Area of Adhesive Applied

RESULTS

Experimental Test

The test results produced a force versus displacement graph representing the six adhesives tested.

- The two failure modes consisted of the failure of the paper backing of the gypsum and the failure in the gypsum itself.

CONCLUSION

Crucial data was lost with the damaged specimens and due to insufficient and inconsistent data selecting a "best" adhesive is difficult without further testing.

- Two potential best adhesives being Liquid Nails Heavy Duty, and Loctite PL 375 VOC Heavy Duty Construction Adhesive.
- The common failure mode is in the paper backing of the drywall and not the adhesive.
- Further testing must be completed to finalize the decision of the best product and recommendations for future testing.
- Using a mold of the specimen to help create identical specimens
- Using a more efficient attachment method to attach the displacing 2x4 to eliminate the damage which was caused by the drilling procedure
- Edges making contact with the base of test area and the wheels of the instrument should be flat

The models and test values can be applied to designing the properties of a shear wall if a certain adhesive is implemented in the construction; however, more testing must be completed to achieve higher accurate results.

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