Global Retrofit Techniques-Weakening and Damping via Rocking Columns and Dampers

Hwasung Roh and A. M Reinhorn

University at Buffalo, the State University of New York

ABSTRACT

In yielding structures acceleration response is proportional to structural strength after yielding. Structural strength needs to be controlled in order to protect structural and nonstructural components. The current retrofit methods, such as bracing systems, lead to increase in the strength. Correspondingly, story accelerations are increased, while the displacement demands are decreased. Also the ductility demand is decreased. Damping and strength reduction can control both accelerations and displacement response. This study is only focused to the strength reduction technique defined here as "weakening". The weakening structure can be implemented by allowing the columns or beams to rotate freely at the connections. Rocking columns, the subject of this work, are alternative techniques for structural system. The simplified model of rocking column is proposed and compared with the experiment results conducted at University at Buffalo. The computational techniques for implementing the simplified model of the rocking column in IDARC2D are completed. Furthermore, the story displacement and strength of the global behavior is investigated with the one-third scale model structure.

BACKGROUND

Weakened and Damped structure
- Weakening structures: Reduce of strength response
- Damping structures : Reduce of displacement response

OBJECTIVES

- Development of simplified model of rocking column
- Implementation in computer program
- Verification of the simplified model using the implemented computer program
- Comparison with experiment results

METHODS

Simplified model of rocking column and IDARC2D implementation

RESULTS

Comparison with experiment results
- Column length and depth: 48in. and 7in.
- Yield strength: 5.2ksi
- Yield strain: 0.0037
- Cyclic test : CY-5 & CY-10
- 5 and 10 means the percentage of the applied axial load to the nominal strength

CONCLUSIONS

- The proposed simplified model of rocking column is comparable
- IDARC2D can simulate the rocking column element
- The capacities of global strength and top displacement are decreased depending on the position of rocking columns.
- When the rocking columns are used for the base columns, the total displacement is localized on the top story.
- The proposed method is a maximum. That is matched with the concept of weakening structure

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