DEVELOPMENT OF A FIDELITY STRUCTURAL MODEL BASED ON A SHAKE TABLE TEST FOR AN INNOVATIVE SEISMIC RESISTING SYSTEM

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INTRODUCTION.

The proposed research project is to produce a fidelity three-dimensional (3D) structural model based on a shake table test (Fig. 1), which will be used to demonstrate performances of an innovative seismic resisting system for reducing damages to building structures under earthquakes.

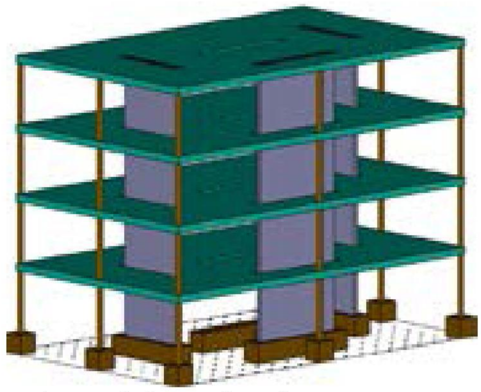

Fig. 1. Schematic of test structure.

METHODOLOGY.

The model development will be performed by calibrating a 3D model of the shake table test structure through detailed comparison of the structural seismic responses obtained from analytical simulations using the 3D model and those observed in the shake table test. Nonlinear dynamic analysis will be used for the model development. Open sourced earthquake engineering finite element software, OpenSees, and commercial general purpose finite element software, ANSYS, will be utilized as the analysis tools.

RESULTS AND DISCUSSION.

The new seismic resisting system uses floor seismic isolation method which is one of emerging techniques in earthquake engineering. The floor isolation system has been proposed to reduce the structure seismic response by isolating single or multiple stories [1] or by segmenting the building into independent regions [2]. Alternatively, the isolating effect is introduced between primary (vertical) elements of lateral force resisting system (LFRS) and floor slabs through ductile anchorage connectors. The ductile anchorage connector consists of emerging materials and devices widely used in earthquake engineering. An innovative way to configure these devices is to combine them into the floor anchorage isolation system to reduce the structural seismic demands without significant relative displacements between the floor slab and the LFRS: energy dissipating devices serve as ductile connectors for structural seismic demand reduction, self-centering devices as elastic restoring elements for minimizing structural residual displacements and bumper devices serve as stoppers to prevent excessive relative displacements between the floor slab and the wall.

CONCLUSIONS.

This proposed research project will not only advance the knowledge for the nonlinear structural dynamic modeling in applying to the new seismic resisting system but also develop a fidelity model to permit accurately examining the new system performances under various structural design parameters. Using this fidelity model, analytical parametric studies will be performed in future research to develop designs and configurations of the new seismic resisting system applicable to structures in seismic regions including Almaty of Kazakhstan.

REFERENCES.

1. Villaverde R., Aguirre M., Hamilton C. (2005). Aseismic roof isolation system built with steel oval elements: exploratory study. Earthquake Spectra, 21(1): 225-241.
2. Pan T.C., Ling S.F., Cui W. (1995). Seismic response of segmental buildings. Earthquake Engineering and Structural Dynamics, 24: 1039-1048.