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Investigation of Seismic Performance of High-rise Reinforced Concrete Frames Using TADAS Metallic Yielding Dampers

A. Seyed Kazemi*

Assistant Professor, Department of Civil Engineering, Ayatollah Amoli Branch, Islamic Azad University, Amol, Iran.

e-mail: a.seyedkazemi@iauamol.ac.ir

E. Asghari Karimi

Department of Civil Engineering, Ayatollah Amoli Branch, Islamic Azad University, Amol, Iran.

e-mail: I_asghari@yahoo.com

M. Esmaeilnia Amiri

Assistant Professor, Department of Civil Engineering, Ayatollah Amoli Branch, Islamic Azad University, Amol, Iran.

e-mail: m.e.amiri@iauamol.ac.ir

Past seismic experience shows that many existing mid to high-rise reinforced concrete (RC) moment frame structures require seismic evaluation and possibly retrofitting. In this study, TADAS metallic yielding dampers were used for seismic retrofitting of reinforced concrete moment frames. For this purpose, three high-rise reinforced concrete frames of 12, 15 and 20 stories were designed using the old version of the Iranian seismic code and concrete regulations. Control of structures showed the need for seismic improvement in these structural models. Therefore, to satisfy the basic and enhanced performance objectives, metallic dampers were added to the structures and were designed using performance-based plastic design method. Validation was performed by selecting a valid experimental model and simulating the experiment with an accurate behavioral model of the TADAS damper in OpenSees software. Then, by performing nonlinear dynamic and static analyzes, the seismic behavior of the retrofitted structures was evaluated at two performance levels of life safety (LS) and collapse prevention (CP). The results show that TADAS metallic yielding dampers can increase the strength and lateral stiffness of RC frames by 30 to 60% with the least number of bracing bays. Also, in addition to uniformizing the distribution of maximum inter-story drift over the height, it reduces drift by more than 60%. Moreover, due to the improvement of structures, the ratio of plastic rotation angle (θ/θ_y) in the critical beam and column of the frames for different earthquake hazard levels is reduced by about 70%.

Keywords: Reinforced Concrete Frame, Nonlinear Analysis, Performance Levels, Seismic Retrofitting, Metallic Yielding Damper.

* Corresponding author
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