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ANALYSIS AND DESIGN OF A NEW FRICTIONAL DEVICE WITH BRAKE LININGS DAMPERS (BLD) AND THEIR APPLICATION IN BUILDINGS

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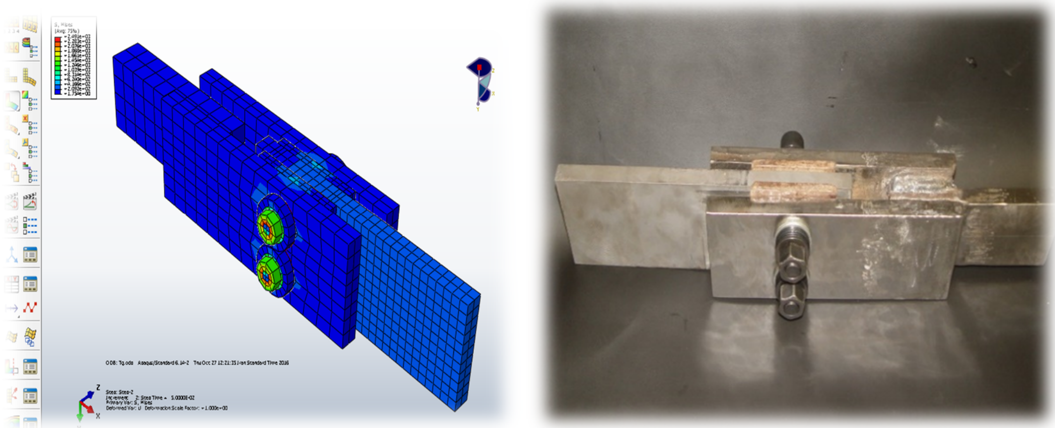
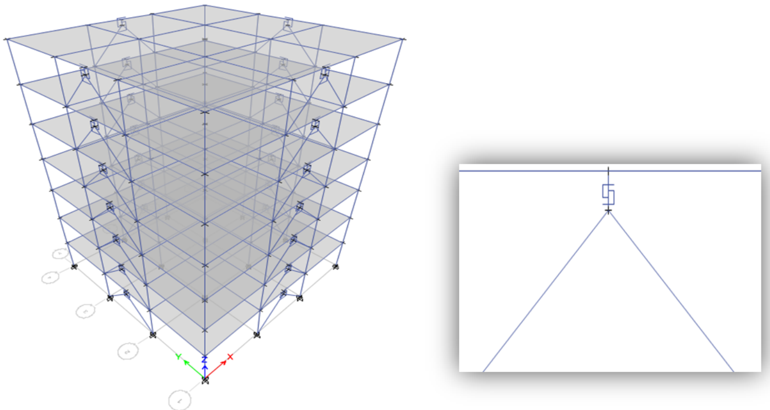
Nowadays, in seismic countries, it is recommended to use a variety of energy dissipating tools devices to dissipate seismic energy during earthquakes. Based on experimental investigations on BLD at IIEES, in this paper the dynamics properties of the recently-proposed damper has been explained. The mechanism of operation of BLD, according to studies, is that by generating friction and heat, a high percentage of the seismic input energy is dissipated. In order to evaluate the damper and its advantages compared to other alternatives, as well as to evaluate the structures equipped with it, some typical structures were designed using the Iranian codes 360, 524 seismic Standard No. 2800. At first, appropriate model was constructed for BLDs based on the experimental results and the theory of Coulomb's dry friction and. The ABAQUS software was used to model, and calibrate the experimental model, so that important factors such as sinusoidal load and the degree of folding of the screws and the coefficient of friction of the lining in the damper can be considered exactly. The 3D 8-node continuum element with reduce integration has been used to model the BLD in ABAQUS, and the pre-stress loads in the bolts were applied using the Bolt Load module of the software. The hysteresis response and force capacity of BLDs regarding the performed numerical and experimental studies have been compared.



(a) (b)

Figure 1. (a) Experimental specimen for BLD, (b) Numerical model for BLD in ABAQUS.

In the second phase of this investigation, designing and modeling of a sample structure that equipped with BLD has presented. The 3-, 5-, and 7-story buildings representing typical mid-rise steel buildings, were designed in ETABS. Accordingly, the requirements of the ASCE / SEI 7-10 International Standard has been adopted to design the above-mentioned structures with BLDs. The moment-resisting frame should be designed to resist 75% of the total base shear. To design the dampers, as it is known, the stiffness of the classes in a structure should be optimally selected to prevent the creation of a weak class that is recommended in all international regulations and 2800 Standards of Iran. Thus, it is possible to determine the difficulty of the classes by using the threshold force of the dampers and referring to the 524 Iranian code, and considering the optimal and suitable displacement with maximum displacement of the regulations for the building floors. Then, using non-linear static analyses the response-modification factor of the structure was evaluated adopting one of the methods prescribed in ATC-19, i.e. Miranda and Bertero relationship. Also, the response-modification factors of the proposed structures compared with that of the conventional structure without a damper. The obtained results have shown that the changes in the resistive-anodizing coefficients and the shape-shapedness with respect to the analysis of structures with and without the damper increase, also with the increase in the height of the resistance coefficient and the coefficient of structural formation increases. But in general, the damper increases 11% the response modification factor in nonlinear static analysis. Also, by comparing the damping of structures with and without BLD dampers, according to the 524 Iranian code, the increase of the mean structural equivalent damping is increased from 5% to 18.2%.



(a) (b)

Figure 2. (a) 3D view modeled on E-tabs V16, (b) win eleman on E-tabs V16.

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