Experimental and Analytical Investigation of a New Pure Bending Yielding Damper for Concentrically Braced Frames

Hassan Zibasokhan

hassan.zibasokhan@cv.iut.ac.ir

Date of submission: May 19, 2019

Department of civil engineering

Isfahan University of Technology, Isfahan 84156-83111, Iran

Farhad Behnamfar, Assoc. Prof.[*] (farhad@cc.iut.ac.ir)
Mojtaba Azhari, Prof.[**]
Mohammad Navid Moghim, Assist. Prof.[***]

Abstract

In this dissertation, a new yielding damper device is introduced for seismic protection of concentrically braced structures. The device is fabricated by a set of transverse plates inserted in the middle of a diagonal brace. The special configuration of the new device transforms the axial force of a concentric brace to pure bending in the damper plates. Experimental results of specimens of the proposed damper device show a stable hysteretic behavior of the brace and similar behavior in tension and compression. The behavior of the proposed damper is investigated numerically using the finite element method in the ABAQUS software. Comparing the numerical results of the FEM with the experimental ones, a good agreement is observable in hysteresis behavior of the proposed damper. A parametric study has been conducted as well. Effect of variations in geometrical properties of the damper plate including thickness, side part length, middle part length, width, and number of plate, on hysteretic behavior of the pure bending device are investigated numerically. In the following of this manuscript, the analytical behavior of the proposed damper is studied. The principles of strength of materials are used to derive equations for load-displacement curve of the proposed device. An analytical model is also developed and verified to predict the cyclic behavior of the pure bending damper device.

Key Words

Pure bending yielding damper (PBYD),Damper device, Diagonal braced frame, Steel plate, Cyclic behavior, Experimental study, Energy dissipation, Finite element method, Analytical model.

---

[*] Department of Civil Engineering, Isfahan University of Technology (Supervisor)
[**] Department of Civil Engineering, Isfahan University of Technology (Advisor)
[***] Department Graduate Program Coordinator