

Optimization of Length of Replaceable Link Beam in Eccentrically Braced Frame Based on the Level of Life Safety

Abstract

The most important aspect during an earthquake is protecting human life, an aspect prioritized through certain pre anticipate measures as well as methods of damage reduction. The force-oriented design method cannot adequately predict and control the seismic behavior of a structure because: 1) its applications are limited to the linear range and, 2) it adjusts and controls the performance level of a structure based on the importance factor alone. Designing structures based on their seismic performance levels can be a proper alternative. In this method, deformation and rotation of structural elements resulting from earthquake influence the design. Moreover, this method can, to a certain extent, predict the behavior of structural elements and intentionally strengthen, brace, or weaken certain parts of the structure such as the coupling beam in an eccentrically braced frame (EBF). The behavior of the coupling (connecting) beam (i.e., the deformable member or mechanical fuse) directly affects the frame, and, ultimately, the overall structural performance. Coupling beam length influences the performance as well as nonlinear deformation or plastic rotation of the beam (in some earthquakes, a maximum plastic rotation of 0.08 radians has been observed). A replaceable coupling beam is a type of coupling beam with high plastic rotation capacity which can separate itself from other members of the EBF. This study aims to examine and recommend the best replaceable beam in terms of seismic performance and life safety as well as to offer ways for better implementation of long coupling beams. In the design process, the coupling beam was designed first with the remaining EBF members designed later based on this beam. Performances of three coupling beams with different lengths were examined up to the life safety performance level. The static pushover analysis was conducted using SAP2000.

Keywords: Replaceable coupling beam, Mechanical fuse, Plastic rotation, Life safety performance level