

Seismic Rehabilitation of Santa Monica Place Mall Based on ASCE 41

Farzad Tasbihgoo, PhD, PE, Project Engineer, Englekirk Partners,
farzad.tasbihgoo@englekirk.com

Cheng-Ming Lin, PhD, SE, Senior Structural Engineer, Department of State Architects,
lincm64@yahoo.com

Lawrence Ho, SE, Principal, Englekirk Partners,
lawrence.ho@englekirk.com

This paper presents the seismic design and remodeling of Santa Monica Place mall and its seismic strengthening following the guidelines of ASCE 41-06. The original building was designed as a closed roof mall based on the 1976 Uniform Building Code. The existing mall is about 245ft wide in N-S direction and 672ft long in E-W direction, with about 550,00 sqft of leasing space. The remodeled mall is designed to be an open roof mall with about 548,000 sqft of leasing space and same plan dimensions as existing mall. The existing mall is a steel framed structure supporting 2-levels of concrete slab on metal deck floors and roof, along with a seismic joint separating the mall in N-S direction in the middle. The existing lateral load resisting system consists of inverted V-type braced frames (chevron braced frame) in the N-S direction and CMU shear walls in the E-W direction.

A nonlinear two-dimensional push-over analysis with p-delta is conducted on representative braced frames to demonstrate nonlinear behavior of Chevron braced frames based on ASCE 41-06. It is found that plastic rotation of the beam, where two braces intersect, at target displacement is less than the limits defined by ASCE 41-06. It was found that the existing braced frames have a lateral load carrying capacity that is greater than the demand according to the 1976 UBC and ASCE 41-06. The lateral load capacity of every braced frame is also greater than the demands from the proposed new structure. To improve the seismic performance of the inverted V-type Braced Frames, the beam in each frame that is intersected with the braces was strengthened. The strengthening scheme ensures that the expected post-buckling lateral load capacity exceeds the lateral shear demand from ASCE 41-06. Figure 1 shows a graphical comparison of the original braced frame shear capacity, retrofitted braced frame shear capacity, and the base shear demands based on ASCE 41-06.

The mall is scheduled to open in March of 2010.

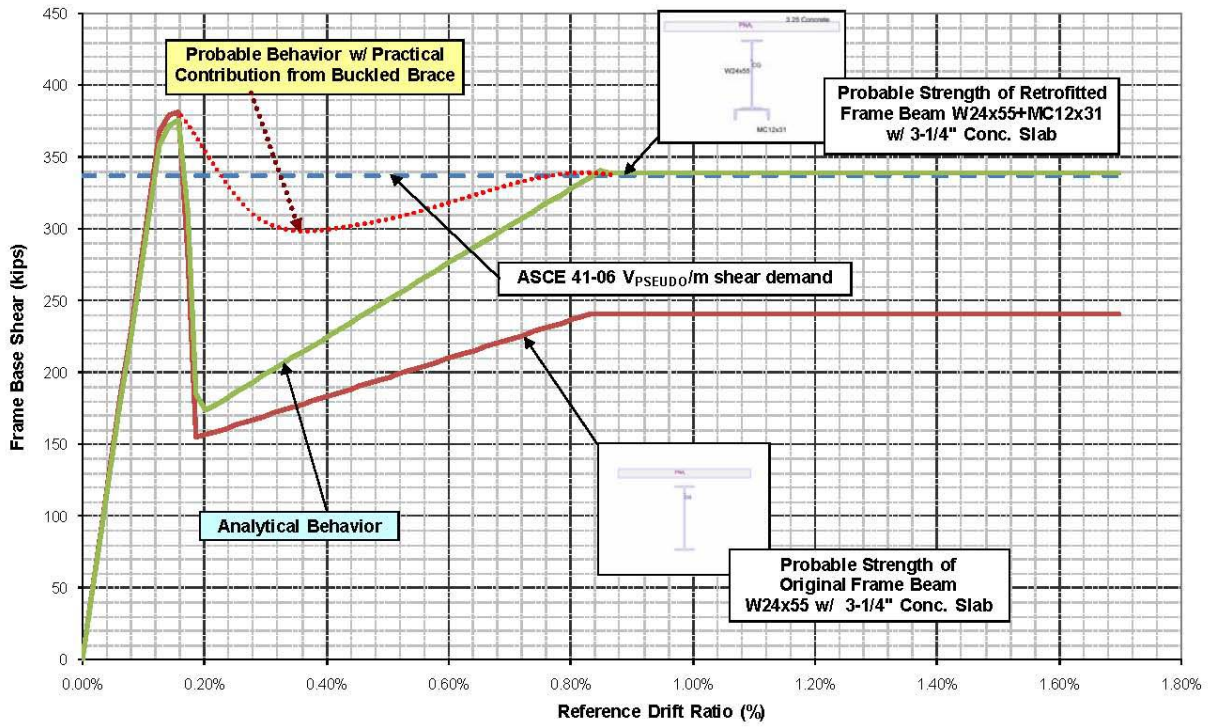


Figure 1: Shear capacity comparison of an existing CBF frame with a retrofitted frame and base shear demand based on ASCE 41-06.