Performance Based Seismic Retrofitting of Reinforced Concrete Buildings Using Steel Braces and a Link

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Summary

This paper is focused on a proposed seismic retrofitting system (PRS) configured to upgrade the performance of seismically vulnerable reinforced concrete (RC) buildings. The PRS and a conventional retrofitting system using squat infill shear panels (SISPs) are used in an existing school and an office building. Nonlinear time history analyses of the buildings in the original and retrofitted conditions are conducted to assess the efficiency of the PRS. The analyses results revealed that the building retrofitted with the PRS has a more stable lateral force-deformation behavior with enhanced energy dissipation capability than that of the one retrofitted with SISPs. The building retrofitted with the PRS experiences significantly less damage due to more ductile behavior of the system.

Keywords: Seismic retrofitting, reinforced concrete, building, shear link, performance based design

1. Introduction

In many municipal areas around the world, the reinforced concrete (RC) buildings designed and constructed using codes that are now known to provide inadequate safety under seismic forces are potential hazards. Therefore, these structurally deficient buildings should be retrofitted to withstand design level earthquakes in compliance with the modern building design codes. There are many well known seismic retrofitting methods for RC structures. These methods can be classified mainly into two groups as; (i) conventional methods, based on improving the strength, stiffness and ductility of the structure, (ii) innovative response modification methods aimed at alleviating the effect of seismic forces on structures.

Conventional methods include techniques such as adding RC shearwalls or RC infill walls to the structural system and jacketing of RC columns [1].These methods have some technical and practical disadvantages. Strengthening the RC columns by jacketing and/or adding shearwalls results in an increase in the weight of the structure that produce larger earthquake forces.

Innovative response modification methods on the other hand include techniques such as installing seismic isolation devices to the base of the building or hysteretic, frictional or fluid viscous dampers to the structural framing system of the building. Such methods are generally costly to implement [2]. This makes them unsuitable for ordinary buildings. Most applications of response modification methods are therefore found in important government or historical buildings [3].

Consequently, a seismic retrofitting system that combines the advantages of both conventional and modern retrofitting techniques is required. Accordingly, this research study is focused on a proposed steel link-brace retrofitting system configured to upgrade the performance of seismically vulnerable RC buildings by combining the advantages and eliminating most of the disadvantages of conventional and modern response modification retrofitting techniques for RC buildings.

The efficiency of the PRS is studied using two existing buildings; a two stories school building and

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