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Pushover Analysis on Applying Viscous Dampers in Retrofitting Process of SDH TV Building

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Abstract

In recent decades, usage of the viscous dampers on retrofitting various infrastructures was considered. Using this kind of energy absorption provide the conditions for clean retrofitting with minimal damage in retrofitting process. According to the construction of viscous dampers in Iran and taken to the experimental analysis, this type of dampers in structural retrofitting process as a case study was used. Nonlinear static analysis or pushover analysis is appropriate State for retrofitting design therefore, this analysis was used. In this regards, sap 2000 software for nonlinear static analysis was applied. The analysis in the using or not using of damper has been done separately. The results show that in case of using damper, plastic hinges of the structures remain in life safety domain but in case of not using damper, plastic hinges reach to collapse border and after that debacle to complete rupture. Mann-Whitney statistic test between created strain in elements with damper and without damper indicates that it is quite significant difference between the information. Layout applied dampers in this project has been based on not create plastic joints that this issue needs to try and error and repeating the calculations to bring the proper results. With regard to the results achieved, retrofitting with viscous dampers was evaluated as ideal methods of retrofitting.

Keywords: Pushover analysis, Viscous damper, Life safety, Retrofitting

1. INTRODUCTION

General earthquake-resistant design (EQ-RD) philosophy, which is widely accepted throughout the world, states that structures be designed to resist low-intensity earthquakes with no damage (structural and non-structural), medium-intensity earthquakes with repairable levels of non-structural and structural damage, and high-intensity earthquakes with significant damage to both structural and non-structural elements without overall or partial collapse in order to avoid loss of life. Even though the above EQ-RD philosophy has been targeted to achieve in earthquake engineering society, only the life safety and collapse prevention in the above general philosophy are explicitly prevented in seismic design codes [1]. The recent trend in seismic codes is oriented to a simplified mechanical approach in order to assess buildings seismic performances using procedures which are based on non-linear static analyses and on the Capacity Spectrum Method [2]. This method considers the non-linear behaviour of structures by means of their capacity curve, which can be obtained reducing the pushover analysis result through the definition of a “substitute” [3] s.d.o.f. equivalent system. The seismic demand can be then estimated, in terms of spectral displacement (performance point), intersecting the so called Capacity Spectrum (the Capacity Curve plotted in terms of spectral acceleration and displacement) with the earthquake response spectrum, plotted in AD format (acceleration vs. displacement) and properly reduced to take into account the effects of energy dissipation related to non-linear structural response. This non-linear static approach aims at predicting the maximum horizontal displacement resulting from a dynamic analysis [4].

Although elastic analysis provides a useful overview of the expected dynamic response of a bridge, in general it cannot predict the failure mechanisms or the redistribution of forces that follow plastic hinge development during strong ground shaking [5]. Nonlinear pushover analysis on the other hand, is a widely used analytical tool for the evaluation of the structural behaviour in the inelastic range and the identification of the locations of structural weaknesses as well as of failure mechanisms [6], [7]. Results obtained from the recent studies have enabled, especially in USA, some major changes in seismic design codes for the above-