

SEISMIC BEHAVIOR OF REINFORCED CONCRETE FRAMES RETROFITTED BY PRESTRESSED STEEL STRIPS

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Keywords: Prestressed, Steel Strip, Seismic Behavior, Retrofit, Pushover Analysis

ABSTRACT

Failure of RC columns under a combination of axial compressional load and seismic moments could result in the collapse of RC frames during severe earthquakes. This paper presents a new technique for retrofitting RC columns by wrapping them with pre-stressed steel strips. Previous experimental studies have proved this technique to be effective and promising. A previously introduced stress-strain model is used to obtain moment-curvature diagrams for retrofitted columns using a nonlinear analysis. Subsequently, these diagrams were employed in nonlinear pushover analyses to study the seismic performance of retrofitted RC frames as compared with the normal frames. The results indicate that this retrofitting approach enhances the seismic performance markedly by increasing the ductility of the columns, and hence, reducing the level of damage. In particular, this retrofitting technique replaced the undesirable failure of the columns by the rather more desirable failure of beams.

INTRODUCTION

In buildings that are designed according to specifications of former codes, or do not comply with the current codes, it is possible that deficiencies like inadequate transverse reinforcement and poor reinforcement detailing may lead to undesirable phenomena such as shear failure and axial failure of columns by occurrence of earthquakes. Hence, upgrading of these building, especially their columns is important. Various approaches to retrofitting of RC buildings has been introduced thus far and used like shear walls, wrapping of columns by FRP sheets, jacketing, etc. Each of these methods has its own advantages and disadvantages. One of the most important criteria in the implementation of these methods is their cost-effectiveness.

One of common methods of retrofitting in seismic regions is actively or passively wrapping of columns. This method increases ductility and rotation capacity of columns and as a result, increases overall ductility of buildings.

Wrapping of columns with pre-stressed steel strips is a new technique that is economic and can be easily implemented. This technique was invented at the Sheffield University by Frangou and Pilakoutas (1995). Commercially available strapping tensioners and sealers make it easy to post-tension the strip and fix the strip ends in the seals. The strips can be tensioned about 30% of their yield stress. Hence, an effective