A design procedure for the seismic protection of infilled frames by dissipative braces

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Summary

Existing reinforced concrete frame buildings with non-ductile detailing suffered severe damage and caused loss of life during earthquakes. Different rehabilitation systems have been developed to upgrade the seismic performance of this kind of structures. The research discussed in this paper, carried out under the partial financial support of "convenzione Dipartimento di Protezione Civile-Consorzio RELUIS, signed 11/07/2005 (repertorio n. 540), research line 2, deals with the seismic protection of frame structures, in particular for the application presented buckling restrained steel braces (BRB) have been selected. A displacement-based procedure to design dissipative bracing for the seismic protection of frame structures is proposed and some applications are discussed. A two-fold performance objective is considered to protect the structure against the collapse and the non-structural damage by limiting global displacements and interstorey drifts. As an example, some r.c. frame buildings, designed according to the non-seismic Italian Code, have been analyzed also considering the infills and retrofitted with BRB via the proposed procedure. In order to assess the effectiveness of the proposed rehabilitation design procedure non linear static and dynamic time-history analyses have been performed. Concluding the necessity of performing dynamic analysis, instead of non linear static analysis, on structures with dissipative bracing systems has been discussed.

Keywords: structural response, infilled r.c. frame, seismic protection, dissipative braces

1. Introduction

Buildings not designed according to seismic codes present structural deficiencies and might suffer damage and collapse when subjected to seismic action; in this case rehabilitation aims to guarantee life safety of people. Buildings designed according to modern seismic concepts can usually resist even to strong seismic action thus preventing collapse but, at the same time, accepting some damages in structural and non structural components. In this case it might be reasonable to reduce structural vulnerability. Common retrofitting aims to enhance structural strength (reducing ductility demand) or dissipation and ductility (reducing drift and allowing plastic deformations).

In the last decade a very diffuse retrofitting system uses buckling restrained dissipative steel braces (BRB) that offer some unquestionable advantages: openings adaptive, irrelevant weight increase, easy installation and minimum interference to buildings use, strength increase controlled, relevant

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