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Post-Earthquake Analysis, Retrofit, and Future Performance of the Centinela Building

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Abstract

In April 2016, a M_w 7.8 earthquake struck the coast of Ecuador, causing major destruction in the cities located near the epicenter. Most of the residential buildings did not collapse but they experienced substantial damage of the non-structural components and some structural elements. The design for life safety and collapse prevention criteria were satisfied; however, the damage level prohibited their subsequent occupancy. As a result, all social activities of the affected cities cannot normalize until this infrastructure is reconstructed. In this paper, the Centinela building, a structure affected by the earthquake, is investigated to determine the damage level and retrofit alternatives. In addition, a risk assessment is conducted to predict the response of the building during future events, considering both the structural and non-structural components. In the future, these types of assessments may serve as a decision-making tool for government agencies and owners.

Keywords: Ecuador; Muisne earthquake; Bahia de Caraquez; seismic performance; seismic retrofit; risk assessment; non-structural element damage

1 Introduction

On the evening of Abril 16th, 2016 (18:58:37 local time), a M_W 7.8 earthquake struck the west coast of northern Ecuador due to shallow thrust faulting on or near the plate boundary between the Nazca and Pacific plates [1]. The earthquake caused substantial infrastructure damage in the regions close to the epicenter. This paper presents the analyses of one of the many structures affected by the event. The Centinela building is in the city of Bahia de Caraquez, which is located at approximately 125km southwest from the epicenter (Fig. 1). This is an 8-story residential building, categorized as special reinforced concrete moment frame with unreinforced masonry (URM) infill walls, which consists of brick and/or hollow concrete blocks (HCB).

As in most of the structures located in the region close to the epicenter, this building experienced significant non-structural component damage during the earthquake. As shown in the following sections, post-seismic evaluations are performed using both local [2] and international [3] standards to understand the behavior of the structure during this seismic event and to develop retrofit techniques that mitigate the damage in future earthquakes. The results of these evaluations are used to conduct a vulnerability analysis to predict the expected performance of this structure and

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