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Seismic Capacity Assessment of Existing RC Building by Using Pushover Analysis

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Abstract

The infrastructure, existing in Sudan, is mostly not structured or designed to resist seismic forces accordingly. The study investigated the seismic damage of a 5 storey existing reinforced concrete building in Khartoum, Sudan. Three performance levels were considered in the study, which included immediate occupancy, life safety, and collapse prevention. The gravity push was carried out using force control method and lateral push with displacement control, using SAP2000. Pushover analysis produces push curve, consisting of capacity spectrum, demand spectrum, and performance point. It showed the performance level of building components along with maximum base shear carrying capacity. It has been observed that demand curve intersected the capacity curve between the points B and C at the X direction that is life safety level; and between the points B and C at the Y direction that is life safety and collapse prevention level. Therefore, some building elements are needed to be strengthened.

Keywords: Pushover Analysis; Demand Curve; Capacity Curve; Plastic Hinge; SAP2000; Performance Point; Sudan.

1. Introduction

Sudan has different tectonic and geological formations. Currently, the infrastructure existing in Sudan is mostly not structured or designed to resist seismic forces. Limited work has been conducted, concerning seismic hazard assessment [1]. Up till now, there is no seismic design code in Sudan. The most common type of existing buildings in Sudan is the reinforced concrete (RC) building. Most of these buildings were built in last 50 years and designed to face gravity loads. They were designed in accordance to British Standard Code (BSI) (BS 8110, 1997). These buildings are currently in use for offices and shops and have a reinforced concrete frame structural system. Therefore, the study aimed to examine the safety assessment of existing multistory building. For this purpose, a pushover analysis was carried out.

Capacity curve, which is a load-deformation plot, is the output of pushover analysis. As, pushover analysis is a non-linear static analysis; the load-deformation curve can be obtained from SAP2000. This software was used to perform non-linear static pushover analysis. The SAP2000 static pushover analysis capabilities, which are fully integrated into the program, allowed quick and easy implementation of pushover procedures. These have been prescribed in ATC-40 [2] and FEMA 273 [3] documents for two and three-dimensional buildings. SAP2000 recommends P-M-M hinges for columns and M3 hinges for beams and described in FEMA [3].

Sudan is not free from earthquakes as it has experienced many earthquakes during the recent history [1, 4]. Moreover, a great attention is received by the evaluation of seismic performance of the existing buildings in Sudan. In Sudan, it is a common practice not to consider the effects of earthquake in the building designing [4]. Therefore, the study has contributed to examine the seismic damage of 5 storey existing reinforced concrete building, which was designed

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