Tall building configuration effects on their response to earthquake loading

Mohammed S. Al-Ansari

(Civil and Architectural Engineering Department, Qatar University, Doha 2713, Qatar)

Abstract: This paper studies and analyzes the response and behavior of regular and irregular building structures in earthquake zones. The non-linear dynamic response of tall buildings structures were obtained using five simulated models, which were subjected to UBC code dynamic and static equivalent earthquake loads. The maximum response of the structural models were computed and analyzed in order to verify the effects of building configuration on drift results. Drift results agreed with codes recommendations regarding building configuration and showed that regular buildings performance in resisting earthquake forces is better than that of irregular buildings.

Key words: drift; configuration; response; earthquake loads

1. Introduction

The response of tall building to earthquake loading depends on its configuration. Building configuration can be defined as building size and shape in a 3D form and recently there has been increased emphasis on the importance of a building's configuration Fig. 1. Both shape and structural system work together to make the structure image distinctive or attractive and early decisions concerning size, shape, arrangement, and location of major building elements can have a significant effect on the building's performance. Size and shape of the building establishes its mass that is the major determinant of the total inertial forces in the building[1].

Improper architectural -structural configuration is one of the greatest causes of damage to buildings because each of these choices of shapes and structure has significant effects on the response of the building to earthquake loading. Interaction between architect and structural engineer is required as a designer must realize that a building's configuration will determine were seismic damage will occur because earthquake forces will be concentrated in the areas of poor aspect and detailing causing maximum damage.

Architects play a key role in determining the form and function of buildings and balancing many conflicting factors. For this reason, the architect may have a more significant effect on the building's earthquake performance than the structural engineer may, and both share the earthquake resistance building's design responsibility but structural engineer is held liable for building's safety, stability and design quality[2-6].

Structure response as a building drift (roof displacement) is the key parameter in performance-based seismic design rather than force or strength that is used in conventional code design approaches because performance is characterized by the level of damage and damage is related to building displacement. This paper studies and analyzes the response of buildings with different configuration and material in earthquake zones. The building response to UBC static equivalent and dynamic earthquake loads was computed, documented, and analyzed using simulated computer models[7].

2. Out line of the numerical work

Mohammed S. Al-Ansari, male, Ph.D., associate professor; research fields: structure analysis and design, earthquake engineering. E-mail: malansari@qu.edu.qa.