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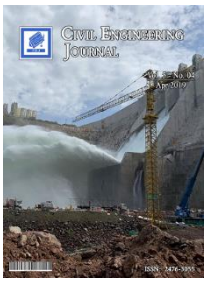

Performance of Concrete MRF at Near-Field Earthquakes Compared to Far-Field Earthquakes

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Abstract

The characteristic of near-field earthquake records has been investigated in the previous studies. However, the effects of the near-field earthquakes on the response of the building structures need to be further investigated. Engineering demand parameters like inter-story drift ratio and floor acceleration can provide a good means for comparing the response of structures to the near-field and the far-field earthquakes. The main objective of this paper was to apply these two parameters to compare the behavior of the concrete Moment Resistant Frame (MRF) subjected to near-field and far-field ground motions. In this study, non-linear numerical simulations were performed on concrete MRF office buildings subjected to two sets of 14 near-field records and 14 far-field records. The analytical models simulated 4-story, 8-story, and 16 story buildings. The obtained results indicated that the near-field effects can increase the inter-story drift ratio and floor acceleration at lower stories of low and mid-rise building subjected to high ground motion intensities.

Keywords: Near-Fault Earthquake; Building Performance; Concrete MRF; Inter-Story Drift Ratio; Floor Acceleration.

1. Introduction

Earthquake events have proven to be destructive to manmade constructions including both buildings and infrastructures [1, 2]. Understating the performance of structures during the seismic events can help to improve the constructions and build more resilient societies.

Previous studies and observations indicated that the building response to near-field and far-field earthquake records have notable differences. Many researchers have tried to apply scientific measures to characterize the effects of near-fault earthquakes on structural response [3-5].

The near-fault earthquake has mainly been investigated from two viewpoints. The first one is the geological aspect of near-fault earthquakes. The studies performed by Cork et al. (2016), Akkar et al. (2018) and Bray and Rodriguez-Marek (2004) concentrated on explaining the physics of near-field earthquakes and can be referred to as examples of the first viewpoint. The emphasis of these studies was to justify the special characteristics of near-fault ground motions including large long period pulse in velocity time history [6-8]. Some other researchers like Somerville (2003) tried to find some rules to predict the properties of near-field earthquake response spectra, considering the geological causes of this phenomenon [9].

The current study is concentrated on the second aspect of the near-field earthquakes which is the special effect of near-field earthquakes on the structural behavior. Most of the previous studies on this subject have compared some

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