Parametric study of concrete base isolated building in the near field earthquakes

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Abstract

Recently the experience of recent near source earthquakes such as Northridge, Kobe and Tabas earthquakes have shown that the structures are more vulnerable in the near source earthquakes. This has also shown in many studies. The main reason for that is due to a strong and long period velocity pulse which generates in the near-field (NF) earthquakes. Base isolation systems are one of the methods for reducing the damage and vulnerable in the near source earthquakes, seismic isolation system increase period of vibration which reduce seismic force and the amount of energy transferred into the structure. In this paper, a parametric study has been carried out to study the behavior of based isolated concrete buildings in the near source earthquakes. One base isolated concrete building with 6 stories is considered. The behavior of selected structure has been studied using nonlinear dynamic analysis under three near and three far field (FF) earthquake recorders. A parametric study of various value of stiffness for the base isolation has been studied as well. The results have shown that the responses of building in the NF are very much than FF earthquakes, and the use of base isolation system reduces the base shear and story acceleration of building in NF in contrast FF, but displacement increased. Also the parametric study on the stiffness of base isolation showed that, decreasing stiffness of isolator's causes the base shear and story acceleration reduced, but this subject for story displacements is not valid.

Keywords: Base isolation, Near-source earthquakes, Seismic behavior, Concrete buildings

1. INTRODUCTION

Occurrence of large earthquakes close to cities in Iran and very countries is unavoidable. After the occurrence earthquake of 1966, in parkfield, California research about near-field (NF) started. The importance of the NF earthquakes characteristic has been noted by several researchers, Naeim.F, Bertero and Chopra are researcher worked about NF [1]. The resulting ground motions will subject structures in the NF region to large, rapid displacement pulses which are not considered in design codes [1]. NF earthquakes cause more damage than FF earthquakes, because NF earthquakes have included large amplitude, long period, and pulse in velocity records. This character can be produce large displacement in the buildings [2]. The NF zone is typically assumed to be within a distance of about 20-60 km from a ruptured fault, of course several defines of NF from researcher presented and have not one unite define. Very structures in worlds constructed with base isolation systems; the words first base isolated structure in the United States is university of southern California hospital constructed [3].

With attention to the subject about NF said in above section, the use of resisting systems for buildings against NF earthquakes is inevitable. Presented one of the methods for protection of buildings from damage of NF earthquakes is use of base isolation techniques. The main objective of base isolation system is to separate the structure from the ground, in the result the lowers of effect of ground motion transmitted to the structure. Base isolation systems with lengthening the fundamental period of structure, reduces the acceleration and the seismic forces induced in structure. However, the displacements increase. The buildings isolated by lead rubber bearing (LRB) implement very well during the 1994 Northridge and 1995 Kobe earthquakes respondent the suitability of LRB as a base isolator [4]. The most types of base isolator in buildings used are several types, such as Laminated Rubber Bearing, High Damping Rubber Bearing, Lead Rubber Bearing and Friction Pendulum Bearing [5].

In recent years a series of new studies have been carried out on base isolated buildings under NF. A research was carried out by Jangid-R.S. in [6] seismic response of the multi-story buildings isolated by the