Study on Vibration Isolation Systems for Sensitive Equipment

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Abstract

In major earthquakes there are some buildings which should stand functionally after main shock, like hospitals, relief and fire centers and so on, where sensitive devices should work properly after vibrations even if the structure faces severe damage itself. Consequently, vibration isolation of sensitive equipment has attracted many researchers' interest. Equipment may be divided into two groups, namely floor mounted equipment and on the ground equipment. For the second group, there is a conventional method of analysis which is considering the isolation system with ground records as input. Floor mounted equipment are different since the transferred vibrations and forces through the building is different from ground vibrations. This change in transferred is also dependent upon the building, therefore in this study 4 models of 3, 10, 20, and 40-story buildings are considered as representative for low-rise, mid-rise, and high-rise buildings. Performing nonlinear time history analysis by selecting several ground motion records, floor responses considered as input excitation for the floor mounted equipment and effects of various design parameters on the seismic performance of sensitive equipment due to acceleration is studied.

Keywords: Acceleration Sensitive Equipment, Seismic Performance, Seismic Isolation.

1. INTRODUCTION

Electronic equipment should be protected against motions and vibrations occurring due to earthquakes. On the other side, the seismic isolation technique is not only expected to protect buildings against earthquakes but it should be used to protect equipment against different types of vibrations. As an instance, functionality of specific locations like hospitals, control rooms in refineries or industrial centers, and emergency centers like fire stations, police stations and information centers is of a great importance and vital just after a major shock, moreover this functionality is not only dependent on the buildings, but the equipment in such centers should remain functional after major shocks, however many of these equipment in such locations are vulnerable to severe vibrations, and consequently they should be protected against earthquakes or major shocks.

Equipment located in the buildings can be divided into two categories according to their positioning and locations:

1- Equipment mounted on ground level, even in the building, in which they should be located at the ground floor, or on the ground outside of the building.
2- Equipment which are not included in the first category, i.e. they should be installed on the building floors.

The difference between these types is that in the first group merely the vibration signals importing directly from the ground are of the importance and effects of the equipment inclusive structure is negligible, whilst for the second group, the vibration signals resulting from the ground seismic excitations, experience alterations as a result of being transferred through the equipment inclusive structure and this alterations should be considered in the studies.

In other words, this classification is considered corresponding to the fact that imported seismic excitation to equipment located in floors differs from excitation at the base of the structure by the ground and

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