

Evaluation of using Green Roofs in Outrigger Braced Structures containing Additional Isolated Upper Floors

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Abstract

Current research is carried out on outrigger braced steel structures with “Green Roof”, illustrating the effect of using Seismic Base Isolation System under the top stories. For this purpose, three dimensional models of outrigger braced structures, 20~60 stories high, are modeled using finite element method and designed according to various soil specifications and spectral accelerations, based on ASCE 7-10 code. All models are supposed to contain Green roofs, which are one of the main principals of modern Sustainable Architecture and is dealt with consumed energy, appearance and the accommodation. On the next stage, the designed models are equipped with base isolation system under the top stories to perform a soft story on the top of the whole structure, demonstrating a Tuned Mass Damper passive control system (TMD) there. After tuning the frequency and the damping ratio for this secondary systems, Time History analysis is carried out on both preliminary and secondary systems due to accelerograms recorded on above mentioned site specifications. Finally, by studying the lateral base shear force of all preliminary and secondary models for all mentioned records, the effects of using base isolation system on the top of outrigger braced structures with Green Roofs are discussed.

Key words: Green Roof, Sustainable Architecture, Outrigger Braced Structures
Seismic Base Isolation, Tuned Mass Damper

1. Introduction

The aseismic behaviour analysis and accurate design of structures for severe earthquakes are mainly carried out using Nonlinear Time history Analysis method (NTHA) according to previous experience of earthquakes which illustrates that many types of structures behave nonlinearly during a severe earthquake. Due to the complexity and time taking behaviour of mentioned method, the structures are usually designed for much lower lateral forces than those demanded by aseismic design codes in elastic range. The seismic linear force for structural design purposes is achieved from a linear earthquake spectra. In outrigger braced structures a central core, composed of braced frames or shear walls is included as shown in Figure 1. When the structure is subjected to lateral loads, the planar