World Academy of Science, Engineering and Technology
International Journal of Civil and Environmental Engineering
Vol:11, No:06, 2017

Influence of Local Soil Conditions on Optimal Load Factors for Seismic Design of Buildings

Authors : Miguel A. Orellana, Sonia E. Ruiz, Juan Bojórquez

Abstract : Optimal load factors (dead, live and seismic) used for the design of buildings may be different, depending of the seismic ground motion characteristics to which they are subjected, which are closely related to the type of soil conditions where the structures are located. The influence of the type of soil on those load factors, is analyzed in the present study. A methodology that is useful for establishing optimal load factors that minimize the cost over the life cycle of the structure is employed; and as a restriction, it is established that the probability of structural failure must be less than or equal to a prescribed value. The life-cycle cost model used here includes different types of costs. The optimization methodology is applied to two groups of reinforced concrete buildings. One set (consisting on 4-, 7-, and 10-story buildings) is located on firm ground (with a dominant period Ts=0.5 s) and the other (consisting on 6-, 12-, and 16-story buildings) on soft soil (Ts=1.5 s) of Mexico City. Each group of buildings is designed using different combinations of load factors. The statistics of the maximums inter-story drifts (associated with the structural capacity) are found by means of incremental dynamic analyses. The buildings located on firm zone are analyzed under the action of 10 strong seismic records, and those on soft zone, under 13 strong ground motions. All the motions correspond to seismic subduction events with magnitudes M=6.9. Then, the structural damage and the expected total costs, corresponding to each group of buildings, are estimated. It is concluded that the optimal load factors combination is different for the design of buildings located on firm ground than that for buildings located on soft soil.

Keywords : life-cycle cost, optimal load factors, reinforced concrete buildings, total costs, type of soil
Conference Title : ICSDEE 2017 : International Conference on Structural Dynamics and Earthquake Engineering
Conference Location : New York, United States
Conference Dates : June 04-05, 2017

Open Science Index, Civil and Environmental Engineering Vol:11, No:06, 2017 publications.waset.org/abstracts/59781.pdf