COLLAPSE CAPACITY ASSESSMENT OFREGULAR TALL BUILDINGS UNDER PULSE LIKE NEAR FIELD GROUND MOTIONS

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ABSTRACT

Structural response to near fault ground motions has received significant attention in recent years. Such ground motions are different from ordinary ones and are characterized by a large, long period, velocity pulse caused by the forward directivity. These velocity pulses could potentially impose sever demands on structures and increase their risk of seismic collapse. The situation could even be worse for tall buildings with fundamental periods close to the period of the velocity pulses, and requires special consideration in design process. Besides, Prediction of seismic-induced collapse potential of structures has been among the main concerns in Performance Based Earthquake Engineering (PBEE). The results could be used as an important measure in designing new structures, or evaluating the seismic performance of existing ones. Not surprisingly, much effort has been made in accurate prediction of collapse capacity of structures due to its importance in estimation of the human and monetary losses during and after an earthquake episode.Collapse assesment of structure under near fault directivity excitation shows a higher value than expcted by the code which is 1% in 50 years but in the the case of the farfield suites the resualt are almost consistent with thedesign collpase level defined by the code.

INTRODUCTION

In this paper the collapse capacity of regular tall buildings under near-field ground motions with directivity effect will be investigated. A number of building models with different number of stories is considered. Using a sufficient number of near field ground motions suggested by Baker (2007), from PEER NGA database, the effect of near fault ground motion on the models is evaluated. In order to recognize the strong pulse in velocity time history, all the pulse like ground motion in database have been rotated to the fault normal direction. Seismic collapse risk of each archetype building is evaluated using incremental dynamic analysis (IDA)Vamvatsikos D, Cornell C.Allin (2002). Also, the procedure is repeated for the far field earthquake excitation to compare the effect of near field and far field earthquake excitation on collapse capacity of tall buildings. The far-field database is based on the FEMA P695 ground motion set. This work is a part of a comprehensive research on collapse capacity of irregular tall buildings subjected to near-field ground motions.The hypothetical site of the buildings is located in down town Los Angeles, California, USA with the longitude = -118.25 and latitude= 34.05 that is near to several known faults.
In order to evaluate the collapse risk of the structures, this study utilizes the λc which is then used to calculate the probability of collapse of the buildings in 50 years. It then will be possible to estmiate the collapse potential of buildings that fulfil the ASCE7-10 target desgin collapse level which is 1% in the50 years. Seismic hazard curves and collapse fragility curves of buildings are two main component to compute the λc.