COMPARATIVE STUDY ON SEISMIC ANALYSIS OF BUILDINGS FOR DIFFERENT CODE OF PRACTICES COMMONLY USED IN SRI LANKA

K.P.N. Prasanna

(118624N)

Degree of Master of Engineering in Structural Engineering Design

Department of Civil Engineering

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other university or institute of higher learning and to the best of my knowledge and believe it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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ABSTRACT

Earthquake threat has been identified by many countries and analysis and design against seismic effects have therefore become almost a basic part of their structural design process. Sri Lanka has also identified the importance of designing buildings against seismic actions, specially due to recent incidents, which took place in and around the Island. However, Sri Lanka does not have its own code of practice for designing against seismic actions. Also there are not many established guidelines available in the country for this purpose. As a result, when it is required to analyze and design buildings against seismic actions, the engineers and scientists in the country face difficulties, basically with which codes and guidelines to follow. It is obvious that all of those codes are not equally suitable for conditions in Sri Lanka and also will not give out similar results.

The aim of this research is to check the performance level that a building can achieve when analyzed according to different codes of practice, which are commonly used in Sri Lanka in seismic analysis. In this context, three codes of practice were considered, taking into account their applicability over the others in Sri Lankan context, namely the Australian code (AS1170.4-2007), the Indian code (IS 1893 (Part 1):2002) and the Euro code (BS EN-1998-1:2004). The recommendations provided in the research, conducted by the University of Moratuwa, Sri Lanka, aimed at providing guidance on suitable analysis procedures for buildings in Sri Lanka, based on the euro code were also inco-operated in the analysis.

First, the seismic analysis procedures outlined in those codes with respect to both static and dynamic analysis were discussed in detail. Then, the analysis procedures introduced in the respective codes of practice were compared and contrasted, considering how they handle the major effects, characteristics of the structures and geotechnical considerations etc.

In order to demonstrate the analysis procedures and to make a comparison on results, three high-rise buildings, having floors between 10 to 20 were selected and analyzed according to the guidelines provided in the three selected codes of practice respectively. In this case, all the structures were analyzed for three different soil conditions, which could be found in Sri Lanka. The computer software "ETABS" has been used for finite element modeling of all the structures. Response Spectrum Analysis (RSA) was used in all the dynamic analysis purposes. Equivalent static analysis was also carried out as per requirements, established in particular codes of practice.

According to the results obtained in the analysis, it has been found that, irrespective of the code of practice, which has been used in the analysis, the structures have achieved Immediate Occupancy Level (IOL)in all twenty seven cases, according to FEMA356 standards. It was also found that the Indian code has given the highest drift values in many occasions while the Euro code also has given very close or sometimes similar drift values. In contrast, the Australian code has generally resulted lowest drift values. Further, it has also been identified that the Euro code has given the highest design base shear forces in all eighteen occasions. On the other hand, the Indian code has given lowest design base shear force in many occasions. The Australian code has also shown the lowest design base shear forces in few occasions.

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