

Title of Thesis: **SEISMIC RISK ASSESSMENT OF AN URBAN SETTLEMENT**

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Abstract

The objective of the present research work is to identify a suitable risk assessment methodology and to conduct a seismic risk assessment of an unplanned (Informal) and a planned (Formal) settlement and to compare the results thus obtained for the two types of settlements.

The seismic risk assessment study carried out in the present research work comprise of seismic hazard analysis, exposure analysis, vulnerability analysis and estimation of social and economic losses. The social losses are estimated in terms of number of injuries and fatalities and direct economic losses are estimated in terms of building repair costs and loss of contents. The estimation of indirect economic losses that occurs due to business interruptions, loss of production capacity and losses in terms of disruption of lifelines and critical facilities including medical and emergency services are not included in the present research work.

Two case study areas have been selected from Delhi, one of these being an unplanned (Informal) settlement (Case Study Area I) and another, planned (Formal) settlement (Case Study Area II) and risk assessment has been carried out for both of these case study areas in order to identify and distinguish the seismic risk parameters.

The seismic risk assessment has been conducted by identification and quantification of the three basic inputs: Building inventory & population of the settlement, Vulnerability assessment method and seismic hazard.

The building inventory was generated by digitizing the acquired satellite images and preparing a map of the case study areas using Arc GIS and ERDAS Imagine software. A comprehensive sample field survey of the unplanned (Informal) settlement was conducted by using a detailed questionnaire to obtain the details of building inventory and socio economic

profile of the population. The information obtained from the satellite images was corroborated through this field survey. The data of building inventory and exposed population for the planned (Formal) settlement was obtained from secondary sources thereby reducing the cost incurred and time spent on data acquisition.

In the present research work, an analytical vulnerability assessment method based on capacity spectrum and an empirical vulnerability assessment method based on intensity scales (MSK, EMS-98 and PSI scales) were employed to estimate the seismic risk of the two settlements.

A common loss model, based on HAZUS methodology corresponding to the various damage states, was adopted for both analytical and empirical vulnerability assessment method to facilitate an easier comparison of the vulnerability assessment methods. The social losses, in terms of number of injuries and fatalities, and direct economic losses, in terms of building repair costs and loss of contents, were determined using analytical and empirical vulnerability assessment methods. The results were then analyzed and compared.

Social losses in terms of injuries and fatalities in terms of per thousand population, per thousand square meter of floor area and per hectare of gross area for the two case study areas were compared by both analytical and empirical methods and were found to be higher in case study area I as compared with case study area II.

Similarly direct economic losses were compared in terms of percentage of damaged areas in various grades of damage; it was found that the percentage of damaged area in grade 4 and grade 5 was higher in case study area I as compared with case study area II.

The risk assessment carried out in the present thesis gives the estimate of social and direct economic losses and hence can form the basis of a detailed and comprehensive disaster mitigation strategy for Delhi. As the comparison of risk assessment clearly establishes that the unplanned or informal settlements are more vulnerable, suitable pre and post disaster management activities can be planned specially for these settlements.