

A SHORT REVIEW ON URBAN VULNERABILITY DUE TO SEISMIC ACTIVITY**SUBHAJIT BANDOPADHYAY**

Department of Meteorology, Faculty of Environmental Engineering and Spatial Management, Poznan University of Life Sciences; Poznan, Poland

ABSTRACT

Increasing vulnerability of the global cities due to natural calamities is a prime concern nowadays for scientists, decision, and policymakers. Nowadays cities are the prime hub assembling a huge number of populations. Any kind of small hazard or disaster resulted with great loss of lives with damage and destruction. So the vulnerability of the cities is gradually increasing day by day with the increasing rate of natural hazards. In this short review, we have discussed a few selected literatures based on the urban vulnerability analysis with some methodological framework or implementing new techniques of assessment with particular focus on seismic activity. After describing the short of the study we try to showcase the gaps in the research. Furthermore, we broadly discuss the fundamental advantages of research and how to bridge those gaps in a larger perspective.

KEYWORDS: Urban vulnerability, Seismic activity, Earthquake, Natural hazards, GIS

Urban vulnerability due to Seismic activity such as earthquakes is a function of the displacement of tectonic plate systems. The vulnerability describes the degree to which socioeconomic systems and physical assets in urban areas are either susceptible or resilient to the impact of such natural hazard. Over the past two decades, the vulnerability has come to represent an essential concept in hazards research and in the development of mitigation strategies at the local, national, and international levels.

Assessing urban vulnerability to natural hazards such as earthquakes can be regarded as an ill-structured problem (i.e. a problem for which there is no

unique, identifiable, objectively optimal solution). A review of the literature indicates a number of contrasting definitions of what vulnerability means, as well as numerous conflicting perspectives on what should or should not be included within the broad assessment of vulnerability in cities. Several researches is going on related to urban seismic assessment and urban vulnerability that have been proposed to address the various ways by which society becomes familiar subject to hazard impacts. The objective of this small review is to provide a clear detailed study of urban seismic assessment and also find out the research advantages. Also, try to find the main research gaps and bridging the researchgaps

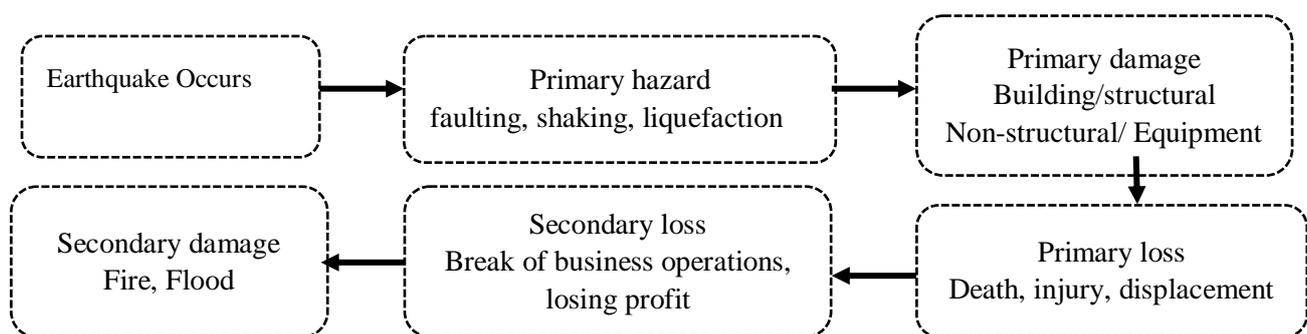


Fig. 1 A flow chart describing the incident to loss with the entire range of vulnerability

MAJOR RESEARCH AREAS OF URBAN SEISMIC ASSESSMENT

The urban risk assessment moves towards a common, cost-effective approach for specifying

where and how many people are vulnerable to natural hazards and identifying high-risk infrastructure. During the day by day many scientific research works are going on in this field. There are many advantages of the researches if we

properly implemented the research outcomes. Few selected research's presented here:

Damage Scenarios Simulation for Seismic Risk Assessment in Urban Zones (Barbat, A. H., Moya, F. Y., & Canas, J., 1996)

This study mainly developed a methodology for simulating seismic damage of unreinforced masonry buildings for seismic risk assessment of urban areas. The simulation process required the generation of thousands of hypothetical buildings, the analysis of their seismic behaviour and probabilistic studies of the computed results. As an example, probable damage scenarios were developed for an urban zone.

Vulnerability to earthquake hazards through spatial multi-criteria analysis of urban area (Rashed, T., & Weeks, J., 2003)

This paper reports on the findings from a project in which a GIS methodology has been developed to assess urban vulnerability through a spatial analytical procedure. First, they highlight the deficiencies of current GIS approaches to urban vulnerability analysis and discuss the ill-structured nature of the vulnerability problem.

Urban earthquake risk worldwide (Davidson, R., Villacis, C., Cardona, C., & Tucker, B., 2000)

This work was undertaken by the Secretariat of the International Decade for Natural Disaster Reduction and Geo-hazards International. The study aims to: (1) develop a systematic comparative assessment of the magnitude, causes, and ways to manage earthquake risk in cities worldwide, (2) identify cities around the world that are facing similar earthquake risk challenges and foster partnerships among them, and (3) provide a forum in which cities can share their earthquake and earthquake risk management experiences using a consistent, systematic framework for discussion.

Urban seismic risk assessment from a holistic perspective(Carreño, M. L., Cardona, O. D., &Barbat, A. H., 2012)

This article presents a methodology which evaluates the seismic risk from a holistic perspective, which means, it takes into account the expected physical damage and also the conditions related to social fragility and lack of resilience, which favor the second order effects when a hazard event strikes an urban centre. This seeks to obtain results which are useful in the decision making the process for risk reduction. The proposed method for urban seismic risk evaluation uses the fuzzy sets theory in order to handle qualitative concepts and variables involved in the assessment, the

physical risk level, and aggravation level, related to the social fragility and the lack of resilience, are evaluated and finally, a total risk level is determinate.

Urban Risk reduction : An Asian Perspective (Shaw, R., Srinivas, H., & Sharma, A., 2009)

Cities and the urban areas are becoming the settlement of choice majority to the people. It's causes many global environmental problems which directly invites some unwanted disasters. So the urban risk areas are now emerging. It's clear that the basic urban risks are invited by the human beings. Urban lifestyles are also directly indirectly impacted on environmental degradation towards natural hazards focused on Asian cities.

GIS-based urban seismic risk assessment using risk (Sinha, R., Aditya, K. S. P., & Gupta, A., 2008)

In this paper, a newly developed GIS-based system for seismic risk assessment, namely RISK.iitb, has been described. RISK.iitb quantifies this system considers the requirements of the disaster management community, and results can be easily understood by the various stakeholders while maintaining scientific rigor. An example analysis has been performed for the Mumbai municipal region to illustrate the uses of risk.

ADVANTAGES

Quantification and sustainable management is needed in order to assess the loss properly and speedy recovery from the situation. Many reports recommend that local community awareness and capacity building is highly effective in this regard to reduce the risk at that point of time. According to Jim Yong Kim, former president of the World Bank, even as climate change increases the risk of natural disaster, cities can be made increasingly safe, as long as public policy makers and researches are carefully prepared.

The Urban Risk Assessment (URA) presents a flexible approach that project and city managers can use to identify feasible measures to assess a city's risk. The methodology focuses on three reinforcing pillars that collectively contribute to the understanding of urban risk: a hazard impact assessment, an institutional assessment, and a socioeconomic assessment.

Recognizing the immense disaster risks faced by urban centres. UNDP has implemented several urban risk management projects with a clear focus on local impacts and try to find out the proper solution of the problems.

National societies have been always present in urban areas. By the research programmes, they can promote the capacity building and resilience power building actions more effectively.

Newly growing geo-information based research on urban areas are very strong to find out the proper seismic hazard causes & measure structural vulnerability, and exposure and loss estimation.

RESEARCH GAPS

It is true that the research related to urban seismic risk assessment are very well advanced and it more or less gives the true direction of safety and security towards a stable urban life. .But again some problems are still working towards a risky future. Here we try to find out some research gaps related to this issue.

(i) We have to give importance to socio-economic factors in our research and must find out the basic problems at the grass hood level. We need to erase it from its root.

(ii) If we properly find out our socio-economic weakness than we can also exactly estimate the damages. Need more emphasis in this field.

(iii) So many researches are already done and many more advance type research's are still going on. But expect few of them no research and the outcomes from the researches are properly implemented in the practical ground.

(iv) Research on earthquake early working systems in urban areas are very much needed. It's not possible strongly but we can reduce the quantity of the damage by early warning.

(v) Many time we identified the lack of integration of urban planning and risk reduction strategies, first, the marginal position of both fields within international aid organizations, and second, an incompatibility between the respective professional disciplines. This gap must be dismissed for the sake of the common people.

(vi) Need more research for coastal urban belts due to its sensitivity towards coastal calamities.

(vii) The community based seismic risk assessment and related research must be needed in more numbers.

(viii) Micro-level, city and Town level research on seismic disaster management plans should give more importance.

(ix) A comparative analysis approach based research, as well as the short research, in current

adaptation approaches, and generates core issues and key questions must be included.

(x) Qualitative research must be carried out in both the household and institutional levels to analyse the needs, capacities, and perspectives of them.

CONCLUTIONS

A clearer understanding of the gaps between what already done and what we have to do with proper approaches firstly find out. But first, we have to find out the basic problems then try to solve it. According to me, we must take care of some real ground problems before doing a successful research.

(i) Need proper governance and proper implementation of research outcomes.

(ii) Need more education towards hazard and disaster to the local people.

(iii) Involvement of more motivated students to do work in the ground and also try to aware local people about disaster management.

(iv) More local people participation and aware them about disasters and also learn them how to cope up with the disasters.

(v) Community-based learning programme related to urban issues needed.

(vi) Capacity building programmes can carry out throughout the country at the micro levels.

(vii) Need more financial support to researchers.

(viii) Institutional awareness also needed.

The proposed concept underlines the need for a paradigm shift to move from the dominant focus on the adjustment of physical structures towards the improvement of planning tools and governance processes. It addresses, in particular, the necessity to link different temporal and spatial scales in adaptation strategies, to acknowledge and to mediate between different types of knowledge (expert and local knowledge), and to achieve improved integration of different types of measures, tools and norm systems (in particular between formal and informal approaches).

ACKNOWLEDGEMENT

The author is heartily grateful to anonymous reviewers and editors for considering the manuscript.

REFERENCES

- Barbat, A. H., Moya, F. Y., & Canas, J., 1996. Damage scenarios simulation for seismic risk assessment in urban zones. *Earthquake spectra*, **12(3)**:371-394.
- Carreño, M. L., Cardona, O. D., & Barbat, A. H., 2012. New methodology for urban seismic risk assessment from a holistic perspective. *Bulletin of earthquake engineering*, **10(2)**:547-565.
- Davidson, R., Villacis, C., Cardona, C., & Tucker, B., 2000. 'A project to study urban earthquake risk worldwide. In Proc., 12th World Conf. on Earthquake Engrg.
- Rashed, T., & Weeks, J., 2003. Assessing vulnerability to earthquake hazards through spatial multicriteria analysis of urban areas. *International Journal of Geographical Information Science*, **17(6)**:547-576.
- Shaw, R., Srinivas, H., & Sharma, A., (2009). *Urban risk reduction: An Asian perspective (Vol. 1)*. Emerald Group Publishing.
- Sinha, R., Aditya, K. S. P., & Gupta, A. (2008). GIS-based urban seismic risk assessment using RISK.iitb. *ISSET Journal of Earthquake Technology*, **45(3-4)**: 41-63.