ABSTRACT

Earthquakes are the most destructive hazards due to their sudden onset nature and the colossal magnitude of the loss of life they bring in. Their occurrence in urban areas triggers a chain of failures depending upon the spatial configuration of the place surrounding the impact. Hence, understanding the vulnerability in the context of the spatial organization of an urban area and the people residing in it is crucial to comprehend the comprehensive outcome of an earthquake.

The spatial organization or the Built Environment (BE) is a direct outcome of the adopted planning practices, and hence urban planning becomes a valuable instrument in managing disaster risk. However, the urban planning theories have not been sufficiently explored in relevance to disaster research. Although the elements of the BE (buildings, roads, infrastructure, etc.) are individually extensive research domains, the literature stops short of comprehensively analyzing vulnerability arising out of systemic dependencies between them.

To this end, this study seeks to propose a simple approach to identify a vulnerable neighborhood within the city by addressing the contextuality of the BE and the population inhabiting it. At the mid-scale level of intervention, a systemic framework that considers the interaction between five elements: buildings, accessibility, layout, density, and land use, is proposed to evaluate the Built Environment Vulnerability (BEV). Similarly, 13 indicators developed based on census variables are used to assess the residing population's Social Vulnerability (SV).

The proposed methodological framework was implemented in nine wards of Siliguri Municipal Corporation, India, a city in a 'high damage risk' seismic zone. The Rapid Visual Screening procedure combined with collapse analysis and road closure analysis highlights that the vulnerability of individual elements is not a standalone problem but has cascading effects on the other elements. A visual depiction of vulnerability arising out of an interaction between the built environment elements in the form of isolated streets is presented. Further, the study finds BEV and SV to have a significant association between them, and one seemed to indicate the other. Hence, a qualitative Total Seismic Vulnerability Index is proposed to understand the association between the two dimensions and compare two wards on equal footings.

Keywords

Earthquake; Built Environment Vulnerability; Social Vulnerability; Rapid Visual Screening; Road Closures