

An Assessment of Physical Vulnerability to Earthquake in an Urban Village of Delhi

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ABSTRACT

Urban villages have a haphazard unplanned development that makes them prone to risks of an earthquake. This research focuses on the case study of the risks of an earthquake to an urban village in the city of Delhi, India. It was found by visual observation of buildings and infrastructure along with an unstructured interview with some households to assess the physical vulnerability to an earthquake.

Keywords: Disaster management, Earthquake hazard, Urban Village

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1. Introduction

An earthquake is a sudden disturbance and the movement of the earth caused by the seismic waves passing through the rocks under the ground. Major earthquakes have been responsible for numerous deaths and damage to property in areas where dense population live in structurally weak buildings.

The National Capital Territory of Delhi, situated between 28°24'-28°52' N Latitude and 76°50'-77°20' E Longitude is classified under the severe category (Zone IV) risk zone for earthquakes by the Bureau of Indian Standards (ET Online, 2018). The urban population of Delhi which was 7137 persons per sq. km in 1951 increased to 14584 persons per sq. km in 2011 (Census of India, 2011). As the population grew in the city and with the process of development, the acquisition of agricultural land took place as was proposed in the Delhi Development Authority Master Plan 1961. In the process what remained was the 'abadi', or the habitable area and these came to be known as urban villages that were exempt from the following of many legal requirements (Kumar and Bhaduri, 2018)

2. The Study Area

In Delhi, ShahpurJat is one of the historical agricultural villages which later transformed from the 1960s to an urban village dominated by fashion shops and textile production, however it suffers from unplanned development including narrow roads, congested places, etc. that pose extreme risks in the case of occurrence of a natural disaster. (Sehnan, 2019). ShahpurJat historically lay within the medieval city of Siri Fort and housed predominantly the community of PanwarJats. (Roychowdhury, 2019)

3. Review of Literature

Kumar and Bhaduri.(2018). Studied the disaster risk in three urban villages of Delhi- Seelampur, Ghazipur, and Maujpur. These urban villages are characterized by a high growth rate, high density of population, unplanned buildings, and infrastructure shortage and therefore increasing the risk of disaster in the event of an earthquake.

Shukla et al.(2007). Highlight the importance of the Delhi fold Belt and the Delhi-Sargodha ridge in the context of the seismic hazard of Delhi. They state that the potential seismic hazard in the area is attributed to the Himalayan thrust system and the active fault system of the Delhi Fold Belt.

4. Purpose of the Study

- (i) To assess the physical characteristics of the urban built environment which make them vulnerable to earthquakes.

5. Research Methodology

This research focuses on the case study on the area of Shahpur Jat to assess its physical vulnerability to an earthquake in Delhi. This is done by visual observation of the overall physical structure of buildings and infrastructure in the area to assess the physical vulnerability. Physical vulnerability is the possible vulnerability of damage to particular physical structures such as a building.(Meslem and Lang, 2017)

Besides, an unstructured interview of residents is used to gain insights into their perceptions towards the risks of an earthquake, precautions taken (if any), and potential responses in the case of such an extreme event. For this 100 local households were interviewed in different locations within the Shahpur Jat area.

6. Findings

The large entry road becomes narrower down towards the interior portions into a maze of closely spaced buildings. The main roads are congested with both traffic as well as people with a lack of sidewalks and most buildings have an entrance directly on the road. With the use of Google Earth, the area approximately measures 0.26 square km with few large open areas in the form of parks clustered in the fringes. The vulnerability of the whole area, especially of the buildings towards the interiors, increases significantly due to the congestion. To study the physical vulnerability of buildings to earthquakes 100 buildings were randomly selected. As stated by the majority of residents surveyed, buildings were not constructed following the building codes and norms.

In 30% of the buildings, the number of floors was not in proportion to its horizontal foundation and thus the building appears disproportionately tall structure. Such a building will not stand sturdy in case of an earthquake. In buildings where there was no designated parking area, vehicles were parked alongside the narrow roads, further congesting the area and blocking the easy movement of people away from the buildings in case of an earthquake.

In the DDA flats too many modifications like the construction of extra room on the terrace, extended balconies were made and this impacts the structural stability of the building. On many of the upper floors, the balcony has been extended resulting in sunlight hardly reaching the ground level making the narrow roads dark and dingy. The residents also mentioned that most buildings were more than 20-30 years old (70%) and most of them lacked regular maintenance of the structure.

It was observed that 75% of the houses had very narrow staircases in which only one-two persons can climb at a time. The DDA flats had a medium width staircase and only 2% of the buildings had a wide staircase. Besides 80% of the houses had unstable fixtures like window air conditioners, the exhaust of split AC, pots lined on the balcony wall. These flower pots can fall during earthquake tremors and cause serious injury to people.

7. Conclusion

Shahpur Jat is at extreme risk in case an earthquake occurs in Delhi. Hence, there is an urgent need to increase community awareness of the risks posed and measures that may be taken to prepare for such an extreme event. This may be true for many other places too and further research can expand on this case to help furnish information to policymakers, planners, etc., and provide various

recommendations and suggestions. A proper effort in advance to prepare for the risks of such an event can help mitigate the effects of such a natural disaster.

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