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RAPID VISUAL SCREENING (RVS) OF SEISMICALLY VULNERABLE R.C.C BUILDINGSIN GUWAHATI CITY

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ABSTRACT

Urban seismic risk in Guwahati is increasing with population growth and the encroachment of vulnerable built-in environment into areas susceptible to seismic hazard. The city lies in zone "V" and is the gateway to seven north-eastern states of India. The earthquake resistance of buildings greatly influences seismic losses. The overwhelming majority of deaths and injuries in earthquakes occur because of the disintegration and collapse of buildings, and much of the economic loss and social disruption caused by earthquakes is also attributable to the failure of buildings and other human-made structures. ARapid Visual Screening(RVS)survey of multi storeyed buildings of Guwahati is carried out to make the general people aware of the faulty constructions in the city and rectify the defects in the existing buildings thus making it safe against earthquake.

Keywords: Construction, Earthquake, Rapid Visual Screening, Seismic Risk.

I. INTRODUCTION

Guwahati being a metropolitan city is a commercial and educational hub of Assam and North-East region of India. There has been a phenomenal increase in population and development program in NorthEast India. This has resulted to increase vulnerability of human population and physical structures to earthquakes. Moreover the constructions of buildings here not as per building codes. The contractors here doesn't give importance to the building codes so as to earn profit by investing less. They use poor quality and less durable materials in buildings. So all these factors are responsible for faulty constructions in the city and as a result making the buildings vulnerable to earthquakes. Guwahati city falls in the highest seismic risk zone (Zone V) in India. Some severe earthquakes have occurred in this region in the past (notably in 1897 and 1950). Until about 1950 or so, the typical construction in the entire northeast region comprised simple single storey 'Assam type' structures which possess good earthquake resistant features. With growing urbanization, RC framed construction has become the standard construction practice in Guwahati during the course of the last five decades. Most of the high-rise constructions in Guwahati have come up only in the past 12 years, and they have not yet been tested for their resistance to a high intensity earthquake.

Based on historical occurences of earthquakes, regions in India are classified into low, moderate, severe and very severe earthquake prone zones. More than half of the country's population live in moderate to very severe zones(refer to the seismic map below).

Guwahati city falls under the seismic zone of Zone V, which is a very severe zone i.e most probable to earthquake. So being in such a high risk zone earthquake resistant design must be adopted to the building construction in this zone.

1.1 Relationship Between Risk , Hazard & Vulnerability

Hazard implies the potential for a natural or human caused events to occur with negative consequences.

Risk means the probability of the loss which may occur from the hazard.

Vulnerability is extent to which the communities strucures services or environment are likely to be damage or disrupted by impart of the hazard.

Relationship :-

Risk = Hazard X Vulnerability.

For example, Loss of life = EarthquakeX Poor construction.

1.2 Objective

To carry out a RVS survey of multi-storeyed buildings in and around Guwahati city, 50 numbers of buildings were surveyed so as to check the vulnerability of the buildings in case of an earthquake. Overall, there are many building units in Guwahati, which are vulnerable, and pose unprecedented risk, if earthquake strikes. The greatest challenge, therefore, is not only to rehabilitate these vulnerable houses so as to reduce considerable loss to human life and property but also to evolve an accepted methodology in Indian context to estimate/quantify the seismic vulnerability of the existing built environment, which will provide a useful information for policy making.

II. CRITERIA TO JUDGE SEISMIC VULNERABILITY OF BUILDING

2.1 Plan of the building.
2.2 Gap between buildings.
2.3 Type of ground storey.
2.4 Cantilever projection.
2.5 Floating columns.
2.6 Cracks developed due to previous earthquake.

2.1 Plan of the Building

The plan of a building varies in shape and size.The shape of the building may be rectangular, square, quadrant, L- shaped, T- shaped, U- shaped,etc. An important figure in building configuration is its regularity and symmetry in horizontal and vertical plane. Plane irregularity is of two types i.e., horizontal layout and vertical layout in geometry. In these irregular shaped buildings, due to the effect of re-entrant corners, the building can be severely damaged or even collapse. Re-entrant corners occurs due to the twisting moment generated around these corners of the buildings, this is due to the unsymmetricity of the lateral seicmic force and the resistance of the building. Therefore the ideal rectangular or square plan which is structurally symmetric, with enough in-plane stiffness in its diaphragm, presents an ideal behaviour because it has the same displacement at every point in the slab. Thus rectangular and square plan buildings are seismically more stronger than the buildings with L-shaped, U- shaped or T- shaped.

2.2 Gap Between Buildings

There should be adequate gaps between two buildings from earthquake considerations to reduce the extent of damages of structures . It leads to the phenomenon of pounding effect, which results due to closed spacing of two adjacent buildings, where the bulidings collide each other and can lead to loss of life and property.

2.3 Type of Ground Storey

It simply means that the ground storey has kept open or closed .As we all know that from earthquake considerations a open grond storey which is also known as soft storey has a more vulnerable to earthquake due to the seismic force. So preventive measures should be taken to enhance the extant of vulnerability by constructing shear walls, & by constructing infill walls in the ground storey.

2.4 Cantilever Projection

The projection of the cantilever should not exceed its permissible value of 1.0 m, because during the shaking of the ground surface the structure should be a chance to fail due to the maximum induced moment at the cantilevering portion.

2.5 Floating Columns

Another defect of column is very common in many multistoreyed buildings in urban areas, which is known as "***floating column***".A column is supposed to be a vertical member starting from foundation level and transferring the load to the ground. The term "*floating column"* is also a vertical element which at its lower level rests on a beam which is a horizontal member. The beams in turn transfer the load to other columns below it.

2.6 Cracks Developed Due to Previous Earthquake

Cracks may be developed in a R.C.C structure due to physical wearing & tearing, weathering effects and mechanical vibrations. So during earthquake vibrations the pervious cracks may cause failure of the building structure easily. Thus previous cracks are more vulnerable to earthquake.

III. RVS ASSESSMENT OF SURVEYED BUILDINGS

RVS on as many as 50 residential units around Guwahati city is carried out based on the mentioned criteria. The table below represents the outcome of the project where 14 buildings out of them were found to be seismically vulnerable on the basis of grade of vulnerability to earthquake. The grades of vulnerability are not as per Indian Standard Codes or any reference books/journals related to seismic hazard. The classification is done based on the study of the project in which the buildings are classified taking into account the number of defects detected in thatparticular building unit. If a building is detected with three or more defects, then grade of vulnerability is Grade III, i.e., more prone to damage during an earthquake, Grade II implies to moderate damage and Grade I signifies minimum or minor damage during earthquake.

Table 3.1: Table Showing the Grades of Vulnerability of Some R.C.C Buildings in Guwahati City

Building No.	Defect	Grade of Vulnerability
1. Khanapara	`Soft storey, Cantilever	Grade II
2. Zoo Road	Soft storey, Cantilever	Grade II
3. Anilnagar	Soft storey, Cracks , Cantilever	Grade III
4. Narengi	Irregular plan, Cantilever ,Gap between buildings	Grade III
5. Beltola	Soft Storey, Cantilever length	Grade II
6. Kharguli	Cracks, Soft storey, Gap between buildings	Grade III
7. Ambari	Soft storey, Cantilever , Floating column	Grade III
8. Pandu	Soft storey ,Plan , Cantilever	Grade II
9. Birubari	Soft storey, Cantilever	Grade II
10. Super Market	Soft storey, Cantilever	Grade II
11. Rehabari	Soft storey, Cantilever	Grade II
12. Hengrabari	Cantilever length	Grade I
13. Sarania	Plan irregularity	Grade I
14. Geeta Nagar	Cantilever, Gap between buildings	Grade II

IV. CONCLUSION

Through this project our main objective is to check over the faulty construction of buildings going on in the city which makes the buildings vulnerable to earthquake and to rectify the defects in that particular building Recently a rising trend is observed in constructing a multi-storeyed building that building codes are not being followed properly which is a practice code for design of the building components such as to providing ductility or special confining reinforcement and thus is a major aspect in case of an earthquake. So we undertook an initiative to create awareness among people regarding these faulty constructions to prevent the risk of vulnerability of the building and its users to earthquake. Thus, we suggest the people to mandatorily consult a structural engineer in case of constructing a new building regarding its plan, design and construction.

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