

## **BEHAVIOR OF UNREINFORCED AND REINFORCED BRICK INFILL WALL DURING EARTHQUAKES IN NORTH AND NORTH EAST INDIA USING APPLIED ELEMENT METHOD**

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### **ABSTRACT**

In the current year 2020-21, most part of India including North and NE India is recorded with around 100 earthquakes ranging from Magnitude 4 to 6. NE India is the sixth most seismically active zone in the world and falls in Zone 5 in Seismic zonation map of India. People's life and the property are at stake when an earthquake with high magnitude strikes such a region. Infrastructure plays an essential role in the safety of people residing in these areas. In present time new constructions in this region are mostly, RC Structures with Brick infills. Thus, it is necessary to evaluate Brick infill Seismic Performance in RC Structure and eventually devise countermeasures to reduce the casualties during earthquakes. In this study Numerical Analysis is performed, to understand the behavior of Brick infill in RC Frame before and after strengthening during the earthquake. As a strengthening measure, the response of the wall using Horizontal and Vertical Reinforcement is studied. It is found that a reinforced brick infill wall is capable of giving good strength during an earthquake. This numerical study is performed using Applied Element Method, which helps to simulate Brick infill behavior from initial stage of loading till collapse stage and it does not require presumption of crack location, and it is from discrete elements family. Unreinforced masonry wall shows a maximum response to the seismic loading with maximum visible cracks on the wall. The response of the wall gets reduced with provision of reinforcement in the horizontal and vertical direction.

**KEYWORDS:** Brick Infill, RC Structure, Applied Element Method, Seismic Performance, Horizontal and Vertical Reinforcement, Strengthening Measures, Cracks, Response

### **INTRODUCTION**

Past earthquakes witness severe damage to life and property. Scientist and Researchers in Asian countries are extensively working on this area [1]. As per census 2011, India is having around 649, 481 villages. Past earthquakes in India like Koyana (1967), Kilara (1963), Jabalpur (1997), Bhuj (2001) and the recent earthquake in neighboring country Nepal on 25<sup>th</sup> April 2015 witness massive loss of the property and life due to damage and collapse of brick masonry infill buildings.

From past earthquakes, Brick masonry failure can be categorized in four main types:

- i) Vertical cracks at wall junctions or failure at connection,
- ii) Shear cracks or 45<sup>o</sup> bi-directional cracks in wall panels,
- iii) Cracks due to in Plane Movement,
- iv) Out of Plane (flexure) Failure of Wall leading to collapse.

#### **1. Past Research on Understanding the Behavior of RC Brick Infill Buildings**

Analytical and experimental studies were carried out in the past. Past research work focusing on analytical methods is given below.

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