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"Earthquake Resistance Building in Kashmir India"

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Abstract - *Earthquakes constitute one of the greatest hazards of life and property on the earth. Due to suddenness of their occurrence, they are least understood and most dreaded. The earthquake resistant construction is considered to be very important to mitigate their effects. This paper presents the brief essentials of earthquake resistant construction and a few techniques to improve the resistance of building and building materials to earthquake forces, economically.*

***Key Words*:** Five band structure, Prop roots, Traditional way of earthquake resistance buildings in Kashmir, Base isolation or Dampers, timber frame with infill masonry construction.

1. INTRODUCTION

An earthquake is the vibration, sometimes violent to the earth's surface that follows a release of energy in the earth's crust. This energy can be generated by a sudden dislocation of segments of the crust, by a volcanic eruption or even by a manmade explosion. The dislocation of the crust causes most destructive earthquakes. The crust may first bend and then the stresses exceed the strength of rocks, they break. In the process of breaking, vibrations called seismic waves are generated. These waves travel outward from the source of the earthquake along the surface and through the earth at varying speeds depending on the material through which they move. These waves can cause disasters on the earth's surface.

No structure on the planet can be constructed 100% earthquake proof; only its resistance to earthquake can be increased. Treatment is required to be given depending on the zone in which the particular site is located. Earthquake occurred in the recent past have raised various issues and have forced us to think about the disaster management. It has become essential to think right from planning stage to completion stage of a structure to avoid failure or to minimize the loss of property. Not only this, once the earthquake has occurred and disaster has taken place; how to use the debris to construct economical houses using this waste material without affecting their structural stability.

1.1 Effect of an Earthquake on the Reinforced Concrete Structures:

At present, the reinforced concrete structures are very common in India. An RC structure is made up of horizontal parameters like beams and slabs; along with the horizontal parameters, it also includes the vertical parameters like the columns and walls. The foundation supports the RC structure and the RC frame is nothing but the RC columns with the joining beams, it takes part in the opposing the forces of the earthquake. The forces generated during the earthquake moves in a downward direction like from the slabs to the beams, from the beams to the columns and also to the walls and finally to the foundation, from the foundation they are scattered or spread along the ground. The major elements of the reinforced concrete structure are as follows:

- Floor slabs
- Masonry walls
- The hierarchy of the strength which explains about the materials that need to be more stronger.

1.2 Seismic Design Philosophy:

The intensity of the earthquake and its vibration can be mild, moderate and very strong. The minor or mild vibrations occur very often, the moderate vibrations happen occasionally and the strong vibrations occur seldom. Therefore, the philosophy of the seismic design lies in the following parameters:

- Earthquake resistant building
- Earthquake design philosophy

2. Brief Literature survey:

How Earthquake Resistant Construction is different?

Since the magnitude of a future earthquake and shaking intensity expected at a particular site cannot be estimated with a reasonable accuracy, the seismic forces are difficult to quantify for the purposes of design. Further, the actual forces that can be generated in the structure during an earthquake are very large and designing the structure to respond elastically against these forces make it too expensive.

Therefore, in the earthquake resistant design post yield inelastic behavior is usually relied upon to dissipate the input seismic energy. Thus, the design forces of earthquakes may be only a fraction of maximum (probable) forces generated if the structure is to remain elastic during the earthquake. For instance, the design seismic for buildings may at times be as low as one tenths of the maximum elastic seismic force. Thus, the earthquake resistant construction and design does not aim to achieve a structure that will not get damaged in a strong earthquake having low probability of occurrence; it aims to have a structure that will perform appropriately and without collapse in the event of such a shaking.

Ductility is the capacity of the structure to undergo deformation beyond yield without loosing much of its load carrying capacity. Higher is the ductility of the structure; more is the reduction possible in its design seismic force over what one gets for linear elastic response. Ensuring ductility in a structure is a major concern in a seismic construction.

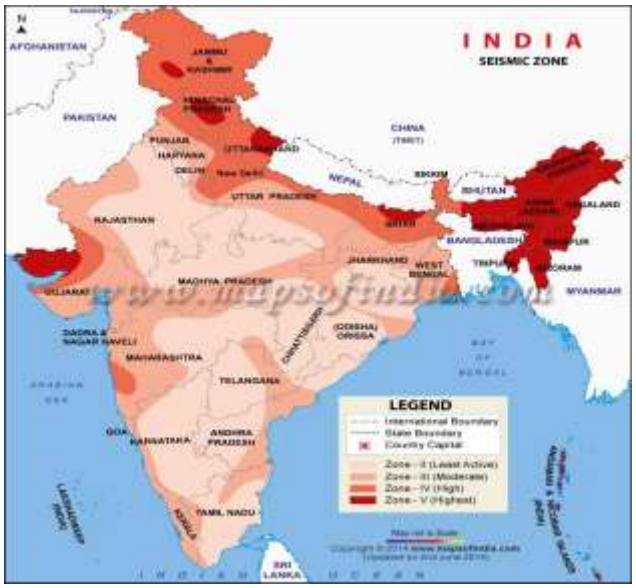

Fig 1: Seismic Zoning Map of India

2.1 Effect of Earthquake in Kashmir:

The state of Jammu & Kashmir is the western most extension of the Himalayan mountain range in India. Here it comprises of the Pir Panjal, Zanskar, Karakoram and Ladakh ranges.

As for the Kashmir is concerned Some part lies in zone IV and zone V.

- Zone - IV: This is considered to be the high seismic zone.

- Zone - V: It is the highest seismic Zone

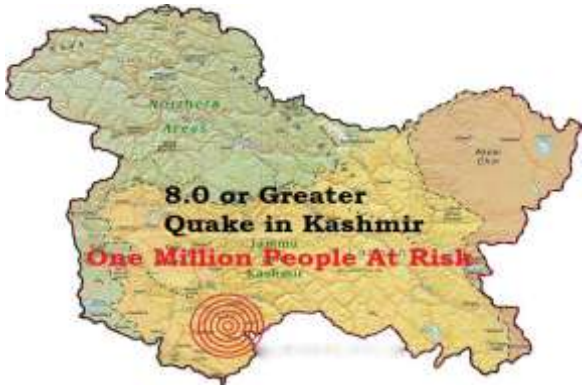

Fig 2: Greater Earthquake in Kashmir

2.2 Major Earthquake in Kashmir:

Acronyms Used:
D=Depth, OT=Origin, Time, Mw=Moment, Magnitude, Ms=Surface, Wave magnitude, Mb=Body,

Wave Magnitude, ML=Local Magnitude.

6 June 1828 –

Srinagar area (Jammu & Kashmir), M 6.0 (TS) 34.08N, 74.833EThis earthquake caused widespread devastation in Srinagar and other parts of the Kashmir Valley. 1,000 people were killed in this earthquake.

30 May 1885 –

NW of Srinagar (Jammu & Kashmir**),** M7.0(TS)34.60N,74.38E This earthquake is one of the deadliest shocks in Kashmir. It was centred just north of the Wular Lake. It jolted the Valley of Kashmir and along with it Srinagar, Baramulla and Sopore. 3,200 people are said to have been killed in this earthquake. There were also unconfirmed reports of fissures in the ground as a result of the quake. The Kashmir area was totally destroyed.

20 November 2002 –

Astore Valley, P.O.K., Mw 6.3 35.345 N, 74.592 E, D=13.0 kms, OT=21:32:27 UTC.
A strong earthquake struck the Astore Valley in the Kashmir Himalayas, on 21 November 2002 at 03:02 AM local time killing 23 people and causing damage to property. It had a magnitude of Mw=6.3.

8 October 2005 –

Kashmir-Pakistan-India border, Mw 7.6 34.432 N, 73.537 E, D=020.0 kms, OT=03:50:40 UTC A major earthquake struck the India-Pakistan border on the morning of 8 October 2005. It had a magnitude of Mw=7.6 and was felt strongly in much of Pakistan, northern India and eastern Afghanistan. The earthquake resulted in more than 80,000 deaths in northern Pakistan and adjoining parts of Jammu & Kashmir, India and is by far one of the deadliest in the sub-continent. At least 10 people also died in other parts of north India and 4 in Afghanistan due to this earthquake. Tremors from the earthquake were felt more than a thousand kilometers away in the Indian states of Gujarat, Madhya Pradesh and Uttar Pradesh.

23 October 2005 –

Kashmir-Kohistan aftershock, Mw 5.3
34.884 N, 73.024 E, D=10.0 kms, OT=04:16:48 UTC A moderate aftershock struck the Kashmir Himalayas on 23 October 2005 at

15:04 UTC. It was felt strongly in Kashmir & the NWFP, causing additional damage to buildings weakened in the 8 October 2005 earthquake. It had a magnitude of Mw=5.3.

2.3 Problem formulation:

Remedial Measures to Reduce the Losses due to the Earthquakes:

The necessary remedial measures that aid in reducing the losses occurred to the earthquake are as follows:

- Planning of the building
- The band's provision
- The joints of beam column
- The foundation
- The domes
- The staircases
- The masonry building
- The arches

2.4 Significance of proposed research work:

- I have used wooden struts in Brick work so that it can easily the seismic load or other loads and can distribute loads in Fsine0 Fcos0.
- As in Kashmir Traditional Construction is being used so it becomes more economical to use wooden bracing or struts in masonry work.
- Then I have discussed about band structure which must be implemented in new construction because our Kashmir lies in highly Dangerous Seismic zones.
- In my area North Kashmir Sopore, it lies in zone IV I have made a 3BHK Residential house with 5 band Structure.
- Then I have discussed about dampers and made a simple project and done a test. I have used spring as dampers in foundation shown in figure.
- There is a lack of awareness in the earthquake disaster mitigations. Avoiding non-engineered structures with unskilled labour even in unimportant temporary constructions can help a great way.
- Statewide awareness programmes have to be conducted by fully exploiting the advancement in the information technology.

2.5 Objective:

Earthquakes constitute one of the greatest hazards of life and property on the earth. Due to suddenness of their occurrence, they are least understood and most dreaded. However, as the recent earthquakes have shown, the performance of normal structures during past Indian earthquakes has been less satisfactory. This is mainly due to the lack of awareness amongst most practicing engineers of the special provisions that need to be followed in earthquake resistant design and thereafter in construction earthquake resistant construction is considered to be very important to mitigate their effects. This paper presents the brief essentials of earthquake resistant construction in Kashmir division and a few techniques to improve the resistance of building and building materials to earthquake forces, economically.

3. Methodology/ Planning of work:

Traditional way of earthquake resistance buildings in Kashmir:

- IDEA GENERATION:

PROP ROOTS: Prop roots are also called as pillar roots e.g. Banyan, Maize, and etc. Prop roots support the plant from areas higher up. They are still molar to pillars in a building. Stilt roots develop obliquely to the stem, are non-hydroscopic, and support the plant similar to ropes on a tent

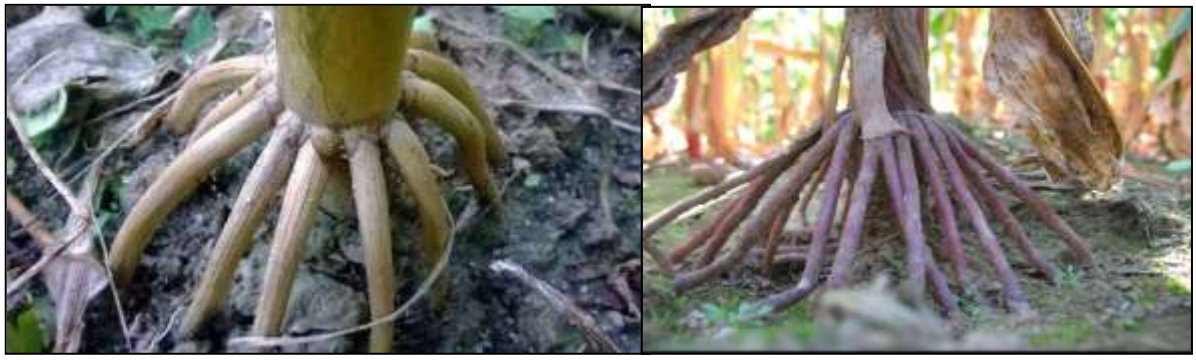

Fig 3: Prop Roots

3.1 Five band structure of Residential houses in Kashmir:

- Raft Beam
- Foundation Beam
- Plinth Beam
- Lintel Beam
- Roof Beam

Over View of Timber-laced masonry bearing wall construction:

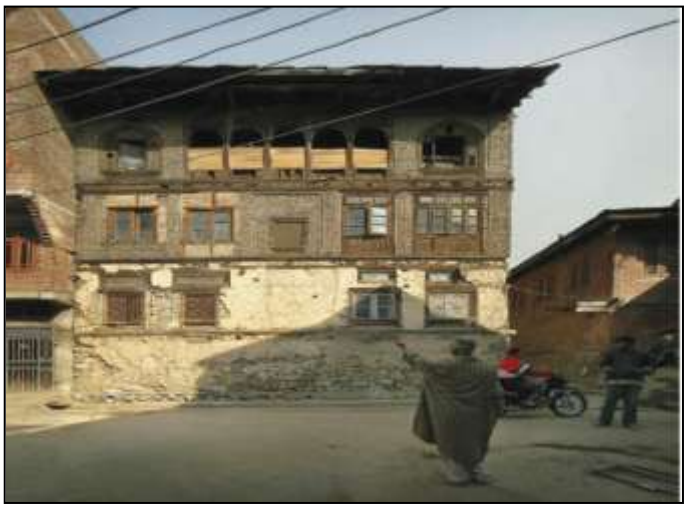

Fig 4 : Showing Taq construction in Srinagar (Symmetrical layout of windows is characteristic of taq and hence this name) (Source: 'Randolph Lagenbach book-Do not tear it down).

Over View of timber frame with infill masonry construction

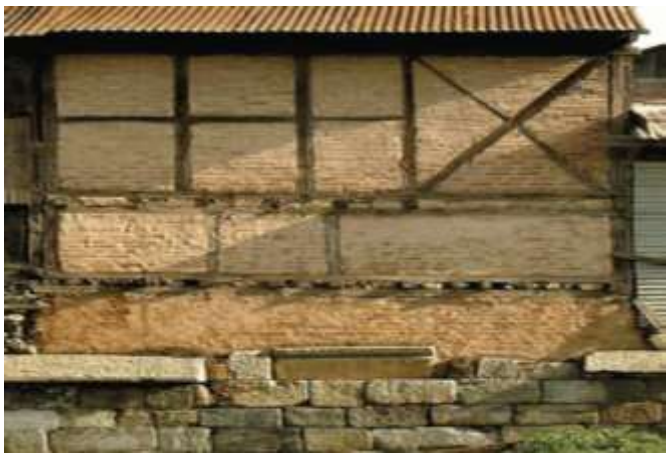

Fig 5: Showing elevation of Dhajji-Dewari Construction in Down-Town Srinagar (Source: 'Randolph Lagenbach book-Do not tear it down').

3.2 Base isolation or Dampers of residential building in Kashmir:

Base isolation is a state-of-the-art method in which the structure (superstructure) is separated from the base (foundation or substructure) by introducing a suspension system between the base and the main structure Base isolation, also known as seismic base isolation or base isolation system, is one of the most popular means of protecting a structure against earthquake forces.

Fig 6: Model of Base Isolation with Spring as its base

Buildings with rigid layout (box like structure) with strong joints between different components are generally earthquake proof because rigid buildings react as a single unit to earthquake forces.

As base Isolation is old idea but were never used in Kashmir. Now as for my research is concerned, I want to implement it in my area for that I have made a Project to demonstrate how actually Base Isolation works during Earthquake. I have used Spring as a Base Isolator.

3.3 Proposed Place of work:

I have worked in my area north Kashmir Sopore Kashmir. Generally, they were using traditional way of construction. First I more focus on framed structure, ductility, and reinforcement.

I. Initially I design commercial Building with full structural details. It was G+1.

- Site Location: On the Edge of River Jhelum Sopore Kashmir.
- Load Carried By Each Column: 92 tons
- Total shops: 22 Shops
- Column size: 9”x14”
- Footing: isolated foundation

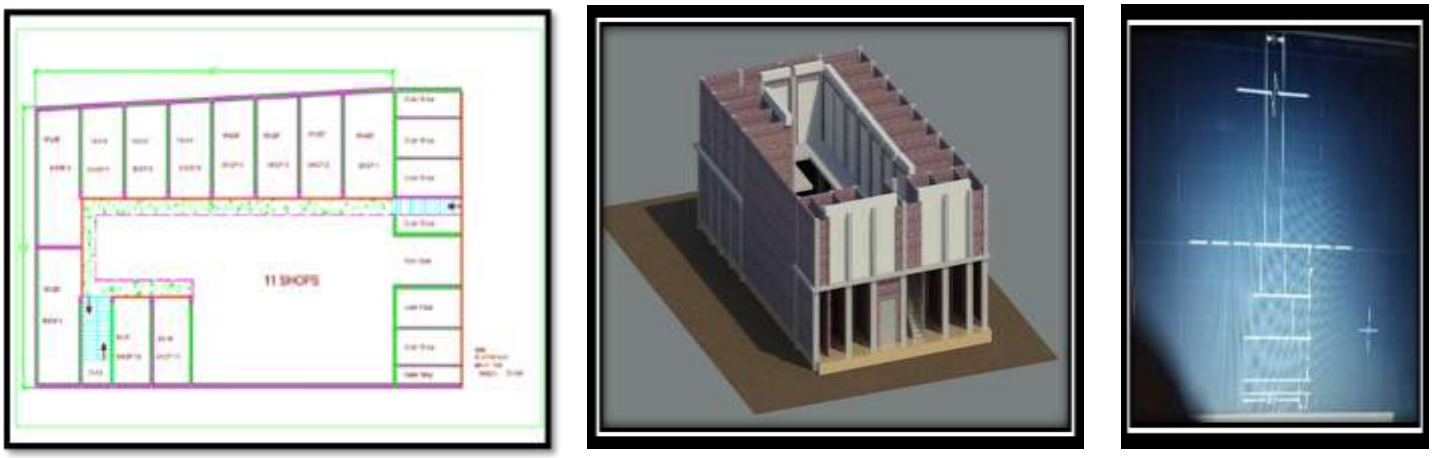

Fig 7 Fig shows Plan, Section and 3D of proposed site.

2. Then I design a Residential House 3BHK.

Site Location: Now-Hamam Sopore.

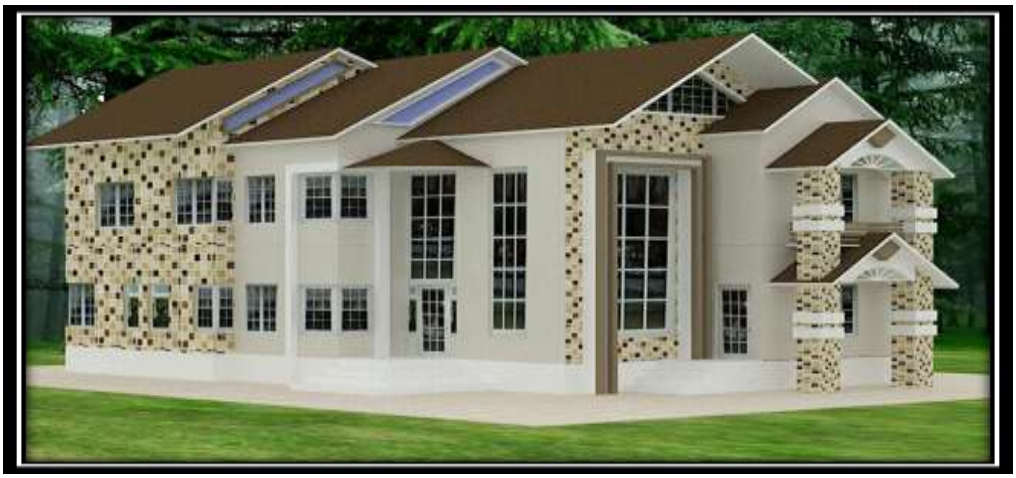

Fig 8 Fig shows proposed site during work and its 3D plan.

4. DISCUSSION AND CONCLUSION:

Traditional knowledge and qualities should not be lost but find a new and modern interpretation. For the houses that will be new, the traditional houses can be the key of many solutions. The realiability of earthquake resistant building is influenced by the quality of construction, quality of building materials and fit in structural engineering. Despite the proven track record of good seismic performance found in traditional forms of dwelling construction in Kashmir, such construction is now rarely undertaken. Replacement of traditional construction forms has been dictated both by market forces and cultural changes where reinforced

concrete buildings had collapsed in earthquakes. The resident of the earthquake damaged city had begun to construct a home in concrete before the earthquake.

Recommendations:

- There is a lack of awareness in the earthquake disaster mitigations. Avoiding non-engineered structures with unskilled labour even in unimportant temporary constructions can help a great way.
- Statewide awareness programmes have to be conducted by fully exploiting the advancement in the information technology.
- Urgent steps are required to be taken to make the codal provisions regarding earthquake resistant construction undebatable.
- The builders and constructors should adopt the codal provisions in all the future construction, as prevention is better than cure. On the light of avoiding the risk, this may not be an impossible task as earthquake resistant measures in building involves only 2%-6% additional cost depending on the type of building.
- Using construction techniques like SIMCON and RHCBM can not only mitigate earthquake effects but also are cost effective.

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