WOOD AND STONE HOUSES : AN ITK TO DISASTER MANAGEMENT

R. P. Singh[1] & Amberish Tiwari[2]

ABSTRACT

Indigenous Technological Knowledges (ITKs) are wealth of our country. Wood and stone houses are prevalent as *monuments of the traditional knowledge of the people in the Garhwal region. Our ancestors were experienced about earth-quake disasters and had developed the techniques for house construction for their survival. It is most comfortable to the local environment. In the present study, identification of house structures resistant to earth quake and its ingredients faith and usefulness of the traditional houses and rationale with the prevalent knowledge were the objectives. Quik method for ITK data, survey through interview schedule of randomly selected respondents and observation techniques were used as the methodology of research. Six worst affected villages (three from each district of Uttarkashi and Chamoli) were selected. Both districts were received earthquakes recently in 1991 and 1999. There were three types of house structures identified namely status house, stone house and slate house. Five respondents having traditional houses and another five giving new-cemented houses were selected from each identified villages. In the mean time, the NGO's and social workers were con-tacted, who has contributed in the area and their perceptions were recorded. The study reveals that the traditional houses were most preferred but not built due to unavailability of local materials, wood and masonry, urbanization impact, etc. The Technology is sound and still useful for the people which mitigate the disaster problems but it is on the verge of extinction.*

Key Words: Indigenous Technological Knowledges, Earthquake Disasters, Environmen

INTRODUCTION

Indigenous Technological knowledge in the Himalayan region is the intergenerational wisdom of local inhabitants to perform their livelihood operations in a most eco-friendly manner. Wood and stone houses are available in the Uttaranchal and it is most comfortable to the local environment vis a vis to the earthquake. A project entitled 'Collection Documentation and Validation of ITK- Wood and Stone Houses' was implemented in Uttaranchal under Mission Mode of ICAR wef. June, 2001 - December, 2003. In the present study, out of four objectives one was taken in care to identify the types of house structures, which are known to earthquake resistant. Quik method and survey through interview schedule of randomly selected respondents are the methodologies for the research.. To observe the resistance of house to earthquake, six worst affected villages (three from each district) were selected in Districts Uttarkashi and Chamoli of Uttaranchal. Both Districts were received earthquakes recently in 1991 and 1999. NGO's and social workers were contacted who has contributed in the area and their perceptions were recorded. It was found that the traditional houses are most preferred but not being built due to unavailability of local materials and wood. The lack of trained masonry also hinders the work. Impact of urbanization enforces to adopt new type of houses. Although, the technology is sound and still useful to the people but it is on the verge of extinction.

Damage Through Exarthquake :

Uttarkashi is a border district of India situated between 300° 22'' N and 750° 5i E. It's boundary touches the China border in North, Distt. Chamoli in East, Himanchal Pradesh and Dehradun in West and Tehri and Chamoli in South. Gangotri, the origin of holy Ganga river is in the district. As per census (2001), the area of the district Uttarkashi is 8016 km2 having population 2,94,179 with population density of 37 persons/km2. Its literacy is 66.58 per cent, where the male literacy is 84.52 per cent. The Uttarkashi earthquake was a moderate sized disaster. The scale of damage was more due to faulty housing technology than that of intensity of the earthquake. The districts: Uttarkashi, Tehri and Chamoli were affected by earthquake, but highest intensity was recorded in Uttarkashi district. A total of 14,544 families in Uttarkashi were rendered homeless due to complete collapse of their houses and 21,200 houses were partially damaged. This resulted in a total of 6653 death and around 6,000 injuries. The quake affected around 1.6 lakh inhabitants directly or indirectly i.e. 70 per cent of the total population in Uttarkashi. Children were the most vulnerable group accounting for 40-45 per cent of the total deaths.

Chamoli is also a national border district of India. Its boundary is covered North by China, south by Almora

1. Asstt. Prof. Agril.Ext.& PI of the project, KVK Lohaghat, Champawat (UC)
2. Asstt. Prof. Agril. Engg, Hill Campus, Ranichauri, Tehri Garhwal (U.C.)

and Bageswar district, east by district Pithoragarh and west by Rudraprayag and Uttarkashi of Uttaranchal. As per the census of 2001, district Chamoli is inhabited with the population of 3,69,198 and it's population density is 48 person per km2. It comprises with six tehsils and nine blocks having 1569 villages. Its literacy percentage is 76.23. An earthquake having intensity of 6.6-reitchor scale has been received in 1999. The epicenter of the earthquake was on the lower part of Gopeswar village.

METHODOLOGY

The study was exploratory type of research. Information was generated from the villagers. To obtain the data, the Quik method, non-participant observation and interview schedule methods were applied. Six worst affected villages of two districts namely Uttarkashi and Chamoli were selected purposely for the study. Ganeshpur, Didsari and Dharali from Uttarkashi and Gopeswar, Papariyana and Gangole from Chamoli district were the surveyed villages, which were nearer to roadside and having rural environment. In total 60 respondents were selected for interview from surveyed villages. From every village, there were ten villagers selected in total in which five were having traditional houses and five were of new cement houses. The investigator filled the interview schedule and data were tabulated and analyzed on moderate scale.

A. Rabindra and Salil Das expressed 'the housing patterns vary widely across the villages (Economic and polities weekly April, 1993). Altitude, nearness to main roads, income classes, access to forests are some of the important determinant'. Keeping in view the following parameters were taken in consideration. Age, caste, education, income, land, cosmopolite ness and family size were the independent variables along with comfortableness of house, durability of houses, safety at the time of earthquake, reasons for building the traditional houses and reasons for security in traditional houses etc. were dependent variables.

For the Quik method, the data were generated on temperature difference, life of houses, sanitation, air availability, light availability, material availability, social acceptance, cost, comfort ness and safety. The Quik method was operated in all villages through participatory approach and matrix ranking technique were applied.

Quik Method–In the groups, there were men and women both were participated almost equally. Over all scores are being presented in the table (1). In the Quik method survey, there were 128 persons took part comprising 75 males and 53 females from all the villages.

Table 1. Village Wise Number of Male And Female Participated

Name of villages	Male	Female	Total
Didsari	12	10	22
Ganeshpur	10	6	16
Dharali	10	8	18
Gangole	18	12	30
Papriyana	8	10	18
Gopeswar	17	7	24
Total	**75**	**53**	**128**

The villagers were identified ten factors i.e. Temperature variation, Life of house, Sanitation, Air availability, Light availability, Safety at quake, Material availability, Social acceptability, and Cost and given weightage for their acceptance of houses through group discussions.

The total scores given to the old houses were 3138 and 2862 for new houses out of 6000. The total score clearly shows the dominance in acceptance of old house construction technique over the new house construction technique. But the difference of total scores obtained from respective villages is not static because the nearness of the road, city and availability of natural materials were the factors in adoption of technologies (Table 2).

Table 2. Village Wises Score For New and Old Technique Houses

Name of villages	Score for new houses	Score for old houses	Total score
Didsari	495	505	1000
Ganeshpur	507	493	1000
Dharali	390	610	1000
Gangole	480	520	1000
Papriyana	470	530	1000
Gopeswar	460	540	1000
Total	**2802**	**3198**	**6000**
Average	**467**	**533**	**1000**

Perception of Safety at The Time of Earthquake

An interview schedule was served to generate data from the randomly selected respondents from the selected villages. The area comes under severe seismic zone IV and the quakes occur in every two to eight years. The past earthquakes are given experience by huge human, animal and commodity losses. Majority of respondents (86.66%) felt that the traditional houses are better and resistant to earthquake followed by new houses (13.34%). In Table (3) most of the villagers among the respondents were concern towards on safety point because they had lost their relatives.

Table 3. Perceived Safer at the Time of Earth Quack between Houses N=60

Name of Village	Old	New
Didsari	9	1
Ganeshpur	9	1
Dharali	10	-
Gangole	8	2
Papriyana	7	3
Gopeswar	9	1
Total	52	8

Perceived Reasons For Less/Not Damage in The Traditional Type of Houses After Receiving Earthquake

Traditional type of houses was less damaged/not damaged after receiving several earthquakes. But it is also true that many houses have been damaged during the earthquake and there were mixed type of houses in which, cements and bolder of stones were used. These houses were not built with proper traditional techniques. Although the respondents were listed their following opinions for less/not damage in the traditional type of houses (Table 4).

Table 4. Perceived Reasons for Minimum Damage in the Traditional House Due to Earthquake.

Traditional technique of house building is quake resistant.
Stone are used through 'Jor-Tod' technique for wall making.
Wood structure gives support to the stones.
Roofs are made up of slate stone which is light in weight.
The foundation of the house is well stable.
The hinge joint of wooden posts & sleepers frame is well tied and has shock observing capacity.
'Koniya' technique is used in the old and tradition houses at the outer side corners of the house.
The stones are used in the wall after giving a proper shape, which is approximately 6-40"×4" size.
The walls are thick.
The wood has more capacity to bear shocks.
The technically sound houses do not damage in the quake otherwise technically mix type made houses collapse at the time of quake.
Wooden beams are used between walls, which supports the structure.
Thin and flat stones do not displace from the wall.
In the old technique, the treatment of soil, place and foundation are very important. Due to this consideration the house do not damage.
Since old technique takes sufficient time in layer to layer setting so that it is durable.
Now a day, the use of cement in wall preparation facilitates to use the irregular size and shape of stone. It saves both time and labour.

Responses Regarding Damage after Quake–

Majority of the respondents (61.66%) was in favour that there is less damage in the traditional type of houses followed by more damage (38.34%) as shown in table (5). Respondents were included all the damaged houses and not damaged house which were made of stones and woods. They could not differentiate the proper traditional techniques were used are not

Table 5. The Response Regarding Damage After Quake in Old Houses

Village	Old house	
	Less	More
Didsari	1	9
Ganeshpur	7	3
Dharali	10	-
Gangole	6	4
Papriyana	6	4
Gopeswar	7	3
Total	37	23

Although, the respondents have listed their perceived reasons for, less damage/not damage of traditional houses as below in Table (5) A.

Table (5) A- Perceived Reasons For Less Damage In Traditional Type Of Houses

The houses do not damage.
If it damage, the wooden beam gives space for security.
The use of irregular shape of stones in the wall makes damage at the time of quake.
It damages when it becomes old and the wooden beam is rotten. Proper maintenance is not there.
Proper technique is not used therefore, the damage occurs.
Thin and flat stone do not damage.
In case of roof damage it is repairable.
Roofs are light so the damage is less.
The walls with thin and shaped stones are thick/broad.

The respondents omitted their perception for more damage in traditional houses Table (5B).

Table (5 B)-Perceived Reasons For More Damage in Traditional Type of Houses

Wrong technique is used.
Irregular shaped round shaped stones is used with the help of cement in the wall.
Use of big and irregular shaped stone used in the wall with the help of cement.
To minimize the time and labour, the big bolder are being used and becomes the reason for menace.

The old wooden beams breaks after rotting.
Cement use provides facility to make narrow wall.
Roof falls on the sleeping people.

RESULTS & DISCUSCUSSION

The preference of the people is based on characteristics of houses with view to its suitability against cold climate and seismic hazards, although these techniques are very old. There are several limitations being posed to the villagers by the government in view to environmental degradation. The average scores for traditional houses are more (533) followed by scores for new-cemented houses (487) in overall surveyed villages.

Er. A.S. Arya, then Head of Quake Engineering Cell, of the Bureau of Indian Standard (BIS) explains, "Traditionally built timber houses proved to be the most effective at keeping damage at bay". He, further added that "It would incorrect to say that not only materials used in old fashioned houses survive but also the construction techniques determined the amount of damage. Making houses for earthquake prone areas is more about 'software' than 'hardware'.

The scores on temperature variation between inside the house and out side the house, life of the house, safety at quake and comfort ability parameters along with availability of materials made the traditional houses at their most preference. Although, the urbanization factors, light availability, air availability and sanitation were their liking.

There were three types of traditional houses were classified and observed i.e. status houses, slate houses and stone houses and the wall construction materials of each type are different. The safety of human and animal lives is more in traditional wood and stone houses because it does not damage due to good foundation, wide wall, light roof and wooden joints. If any old wooden beam or plank rotten due to seepage of water, it breaks at one point, which make an angle with the ground at the time of damage. This angle provides a support to the rest of structure and provides space to the dwellers at the time of quake damage.

The traditional methods in particular, the stone bolder that have irregular shape must not used. The stones were used in a rectangle and flat shape. The through stones are used in every two feet height, which binds the layer of stones. The 'Koniya' technique provides joints at corners. So the wall does not fall at the time of quake.

CONCLUSION

Indian civilization evolved much knowledge through their experiences and its still appropriate for modern civilization. Wood and Stone houses are typical technology, which is fit for house construction in seismic prone zones and harse climate. There are three technologies namely status house, slate house and stone houses are found useful in this area. All the technologies are having better techniques i.e. foundation making, wall making, joining of wooden frame for house frame, roof making etc. provides a better and cheep methods to build a house. The use of locally available material may be used through a regulatory procedure, which will also protect the environment. This ITK should be taken as a technique for house construction and disaster management.

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