

Webinar on Mainstreaming Indigenous Construction Practices for Earthquake Safety in Himachal Pradesh (17th November, 2020; 11:30 AM to 1:00 PM)

Brief Report



Jointly Organized by:

**National Institute of Disaster Management
(Ministry of Home Affairs, Govt. of India) and
Himachal Pradesh State Disaster Management Authority, (Govt. of
Himachal Pradesh)**

Report Prepared by:

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1. Introduction to the Programme and Context Setting

➤ Speaker: Dr. Amir Ali Khan, Faculty at NIDM

The seismic vulnerability of Himachal Pradesh is primarily attributed to the formation of the Himalayas, some 50-60 million years ago due to the collision of the Indian with the Eurasian Plate. The Vulnerability Atlas of India has classified the entire State of Himachal Pradesh as falling in either Very High Risk (Zone V) or High-Risk Zone (Zone IV). More than 90 percent of the districts Kangra, Mandi and Hamirpur are in Zone V, while the entire distribution of Sirmour and Kinnaur falls in Zone IV. The Kangra earthquake of the year 1905 was one of the most severe earthquakes witnessed in the Indian subcontinent, where almost 20,000 lives were lost.

Traditionally, our ancestors have evolved the wisdom regarding the damaging effects of earthquakes and how these can be mitigated, and the measures can be adopted with respect to construction practices. Knowledge systems have passed from generations, that were aimed for developing resilience for disasters. Over the years, we have not been able to sustain these knowledge systems and skills. All over the world, wherever disasters have frequented, the local populace has come up with local mythical stories, the story of Shesh Nag and Nandi (Lord Shiva's bull) being the two most popular examples from the Indian context. These stories showcase that the damaging impact of hazards have been factored in from times immemorial.



The rationale for organizing this webinar was to find ways and means to re-establish our links with our past heritage and popularize our traditional construction practices. The need is to systematically sensitize, build awareness and local capacities on these aspects.

2. Technical Session 1: Local indigenous construction practices in Himachal Pradesh

- **Speaker: Dr. S.K. Negi, Principal Scientist-Central Building Research Institute (CBRI)-Roorkee**

Dr. Negi commenced his presentation by providing a brief background about his Institution, CBRI-Roorkee which a state-of-the-art institution, with unique R&D competencies, constituted way back in the year 1947 for generating, building, and cultivating building science and technology in the service of the nation. Thereafter he spoke about the human settlement planning in hilly areas, which is a challenging aspect given the fragile ecosystem of the hills and the increasing population pressures. Other challenges for settlement in hilly areas include problems of appropriate site selection, soil erosion issues, lack of basic facilities, high cost of transportation, low per capita income, migration of educated people from hills to plain urban areas to name a few.

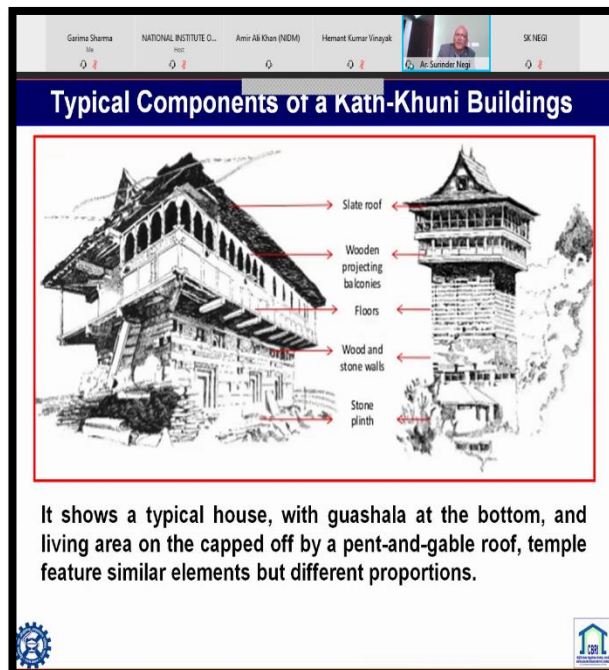
He stressed on the importance of sustainable development in the hills, with the clear cut objectives of conserving the rich natural and cultural heritage, ensuring sustainable economic, institutional and social development for the locals, and promoting tourism is a way that leaves minimal negative impact of the nature. He spoke about Climate Conscious Architecture and how the vernacular architecture has stood the test of time and has features that make such buildings energy efficient.

The screenshot shows a presentation slide titled "Problems of Hill Settlements". At the top, there is a header bar with the names of participants: Garima Sharma, NATIONAL INSTITUTE O..., Amir Ali Khan (NIRM), Hemant Kumar Vinayak, and SK NEGI. Below the title, there is a list of problems:

- Difficulty of getting suitable site and orientation on the hill slopes.
- **Problems of soil erosion and land slides.**
- Tradition construction technology is affected due non avail wood .
- **High cost involved in the site and infrastructure developmen**
- Lack of basic services like road, health facilities, water electricity and sanitation etc.
- **Difficulty in transport of the building materials like ceme brick etc.**
- Inadequate planning and inefficient utilization of the built-up
- **Poorly protected walling against erosion by rains and flooding.**
- Low per capita income due to major population is based in agriculture and its allied activities .
- **Migration of education people from Hills to Plain urban areas.**

Below the text, there are two photographs: one showing a hillside with buildings and another showing a mountain landscape. There are also logos for CBRI and a gear icon.

Dr. Negi discussed in detail about indigenous construction practices which constitute of dwellings and structures that have responded to the topography and local climate of the region. These age-old structures were developed by local artisans with the help of locally available materials. The factors that generally influence any built form includes topography, climate, meteorological events, locally available materials, lifestyle of the people and local customs and traditions. In Himachal Pradesh, as around 64% of land area is covered with forests, hence most of the traditional constructions involved use of wood. Other materials used included stones and slates.



The participants were informed that in traditional hilly settlements (Kath-Kuni Buildings), temple was at the heart of a settlement and was usually sighted at the highest spot. The surrounding areas of temples were mainly used as sites for cultural and religious gatherings, and for housing. Settlements were contoured, south facing, and well in sync with the 'colours of nature' that appeared to grow organically out of the folds of the landscape. He briefly described the major construction techniques of HP. These include: (i) Kaath-Kuni (found in districts Kinnaur, Kullu, Mandi and parts of Shimla and Solan), (ii) Dhajji-Dewari (prominent is districts Shimla, Kangra and Chamba), (iii) Mud Construction (evident in Lahaul & Spiti and Kinnaur) and (iv) Dry Construction (observed in Kangra and Kinnaur). These construction types were generally two to three storey high, the lower floor was for cattle, while the upper floors were used for residing purpose, storage and kitchen.

The basic structure for housing and temples was almost the same, barring differences in the roofing and platforms. Temples were mostly constructed on a raised platform. Thereafter, Dr. Negi described the alternate wall courses, which involved laying two wooden wall beams, longitudinally parallel to each other with a gap in between. The space between the two membranes was filled with rubble stone and edge secured with kadil (wooden nail) which provided necessary resilience to the structure. He also highlighted the importance of the corner stone, which protected the building from various weathering effects. Space in the walls was used judiciously to form in-built cupboards.



Thereafter, Dr. Negi described the design parameters for indigenous constructions, which were collated based on a study conducted by CBRI-Roorkee in the entire Himalayan belt of our country. These parameters include socio-cultural aspects-living habits of the local people, affordability, climatic conditions, materials and construction techniques, safety, maintenance and overall aesthetic features. He further summarized the strategies for construction in hilly regions. Some of the essential aspects which need to be considered are:

- (i) Appropriate site selection
- (ii) Socio-economic and cultural patterns of life
- (iii) Simplicity and symmetry in design
- (iv) Grouping together of all the wet components
- (v) When using mud mortar for wall construction, building height should be limited to just one storey
- (vi) Non engineered stone masonry should be limited to two storeys
- (vii) Large openings should be avoided
- (viii) Staircases should be well connected
- (ix) Appropriate positioning horizontal bands and shear walls
- (x) Jointing details at roof level
- (xi) Energy efficiency

Dr. Negi concluded his presentation by stating that a scientific approach needs to be adopted for appropriate construction technology based on a detailed analysis of the available options and overall cost analysis. He urged the State government to conduct awareness and skill development programmes for the engineers, architects and diploma holders of the State, as awareness generation about traditional construction practices and the National Building Codes and local bye-laws are a major issue that needs to be addressed.

3. Technical Session 2: Building Earthquake Resilience through Indigenous Construction Practices in Himachal Pradesh

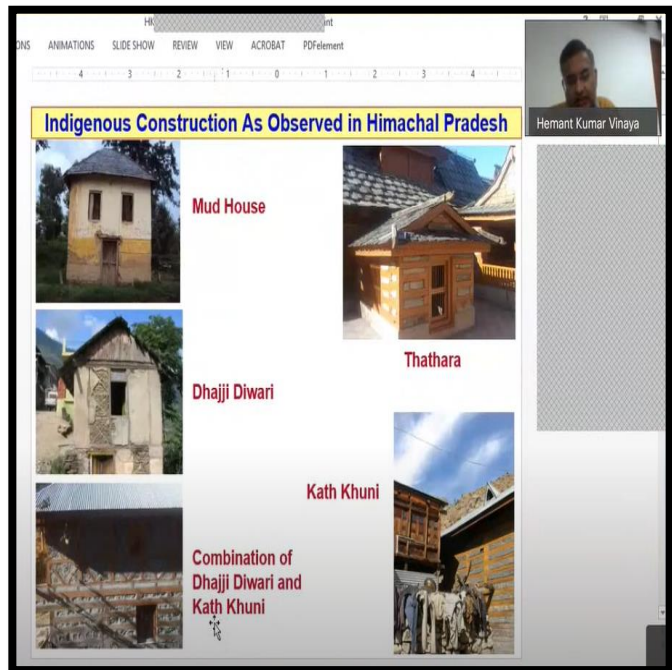
- **Speaker: Dr. Hemant Kumar Vinayak, Associate Professor, Entrepreneurship Development and Industrial Coordination, National Institute of Technical Teacher Training & Research (NITTR), Chandigarh.**

Dr. Vinayak commenced his presentation by showcasing images of traditional constructions observed in HP, namely: Mud Houses, Dhajji Dewari, Kaath Kunni, Thatara, and combination of Dhajji Dewari and Kaath Kunni. All these typologies have been documented in the Study carried out by NDMA with the agency of five IITs in the year 2011. An important aspect is that all buildings parts need to be tied together, so that they behave as a uniform entity. Furthermore, he

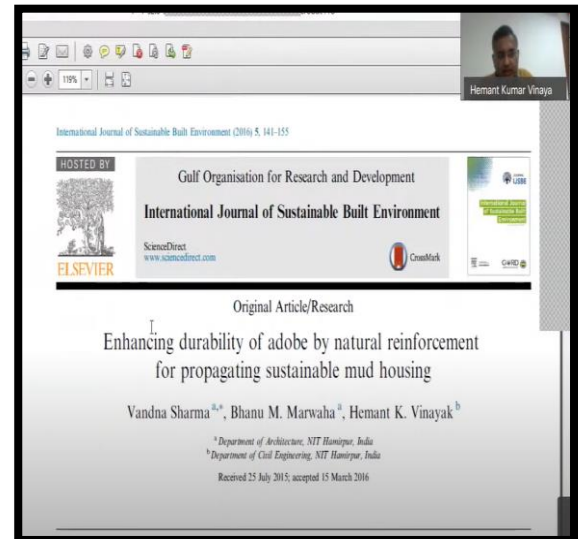
shared the image of a mud house, showing the traditional wisdom of the ancestors, where the height of the walls was less than 8 feet and the length was less than 10 feet. However, with the passage of time elements of new constructions have been incorporated in traditional structures in an unscientific manner.

He gave a pertinent example, whereby even if people need to purchase a cloth item that is priced at Rs. 500/- a lot of survey is undertaken by people. However, for construction of houses where an investment of lakhs and lifetime savings are concerned, people hardly consult any experts, and leave the matter to the discretion of the local masons. Thereafter he discussed good features of earthquake resistant constructions, such as low walls, good bond in walls, use of foundation and plinth, intersection of walls at right angle to ensure there are no bevel corners, openings are at least 1.2 meters away from corners, buttress in long walls and so on.

He mentioned that the main difficulty is in the acceptability of design of traditional constructions. These are mainly to do with the maintenance of buildings, limitation in size and execution which is carried out without major calculations. Therefore, indigenous construction practices are largely a subject of academic concern.



Dr. Vinayak shared an example from a PhD thesis of Dr. Vandana Sharma, that he had guided on “Enhancing availability of adobe by natural reinforcement for propagating sustainable mud houses”. The PhD scholar had prepared samples of bricks using various natural fibres, and these were tested for strength and set of recommendations and conclusions of the study emerged. However, there is a need to converge the research outcomes with policies and plans of the State.



He then brought in another facet of limited documentation of indigenous construction practices in the guidelines laid out by the Department of Town & Country Planning (TCP) and the Developmental Plans (example shared of Sundernagar). When these documents are searched with respect to indigenous construction practices, merely a paragraph or two are found, and a few photographs are shown. This is a huge gap, as anyone who is desirous of undertaking such construction will not find any support or guidance from these few lines. On the other hand, there is so much of literature and scientific tests to guide the modern construction practices.

Dr. Vinayak highlighted the roles which various government departments need to play, especially for promoting and safeguarding the indigenous knowledge and construction practices. For instance, the Himachal Pradesh State Disaster Management Authority and the Department of TCP should look at the disaster resistant aspects of traditional constructions. The Department of Language, Art and Culture and Tourism should ensure that indigenous constructions are widely represented and showcased as part of our rich cultural heritage through various touristic activities. The Department of Rural Development should ensure that there is compliance in the construction regime beyond the municipal boundaries. The Forest Department can work towards policies to ensure that the requisite supply of timber can be provided.

He specifically stressed the need to regulate the constructions that are taking place in rural areas. Another critical factor that he highlighted was that of codes, namely IS 13827 -Improving Earthquake Resistance of Earthen Buildings-Guidelines and IS 13828:1993- Improving Earthquake Resistance of low strength in Masonry Buildings-Guidelines. These codes are hardly discussed or referred to, but these must be adhered to especially when taking up mud constructions, which offer far more thermal comfort, in comparison to RCC or masonry structures. He also talked about the Pradhan Mantri

Awaas Yojana (PMAY), and the series of documents titled 'Pahal' which were released which demonstrated houses that are most appropriate to the local contexts, across the country. However, the implementation of this programme has not been upto the mark, as showcased by him with the set of images.



Thereafter he discussed a recent revolutionary step taken up the Government of Maharashtra. On 1st October, 2020 the Department of PWD, Govt of Maharashtra released their Schedule of Rate which approves the usage of bamboo in construction of houses. This is extremely relevant for construction in rural areas., and other States should also follow this, including HP to promote the usage of locally available materials. In case of traditional construction typologies of Himachal Pradesh, wood is used intensively which makes it more prone to the hazard of fires.

He summed his presentation, by highlighting that the two Schemes launched by the HPSDMA, namely, 'Scheme for Creation of Taskforce of Youth Volunteers' can be utilized to raise awareness on issues of earthquake resistant housing technologies, preventive measures which can be taken and overall awareness about usage of ISI mark. Under the HPSDMA's Scheme for 'Training of Masons, Carpenters and Bar Binders on Hazard Resistant Construction' focus should be improve the quality of workmanship of local masons.

The following set of recommendations emerged from the deliberations during the webinar. These are as follows:

4. Recommendations & Way Forward

- **Inputs by: Dr. S.K. Negi, Dr. Hemant Kumar Vinayak and Dr. Amir Ali Khan)**
- (i) The Government of Himachal Pradesh needs to develop its own document, detailing the indigenous construction typologies of the State and clear guidelines for executing and implementing such designs.
- (ii) The local masons and artisans should be mapped, and strategies should be worked out to ensure that their profession is lucrative. Appropriate stress needs to be given to their capacity enhancement.

- (iii) The Electricity Departments may take up IEC activities to prevent fires due to electrical short-circuiting.
- (iv) For wooden houses, flame proof paints should be mandatorily recommended.
- (v) Guidelines of regulation and monitoring of construction in rural areas need to be developed.
- (vi) The Departments of Tourism and Language Art and Culture need to work in tandem to popularize indigenous constructions from the tourism perspective. This can also be popularized among youth as an entrepreneurial venture that they can take up.
- (vii) There is critical need for sensitization and awareness of the key stakeholder departments as well as the local community. Capacity building initiatives such as workshops and online training programmes need to be organized rigorously for key stakeholders from various Departments of GoHP.
- (viii) The GoHP should involve local artists and folk theatre groups to popularize messages regarding undertaking safe construction practices, adopting indigenous construction practices, fire safety and basic do's and don'ts for various hazards.