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Research Paper

Flood Resilient Houses-For Flood Prone Kashmir

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Abstract:*A natural disaster is a major adverse event resulting from natural processes of the Earth and floods being the most frequent type. The overflow of water causes the floods and submerges the land that is usually dry. Floods in Kashmir are usually caused by not so heavy rainfall and subsequently the overflowing of Jhelum and its various other tributaries. Theunpresented floods of September 2014 tell a tale of human misery and economic breakdown of the erstwhile state. It destroyed everything that came in its way like residential houses, schools, colleges, hospitals. Thousands of people were rendered homeless. Chances of another flood of the same or even greater intensity in the coming years cannot be ruled out and as such an alternative method of preventing such disaster in near future needs to be analyzed.*
In this report, concept of flood resilient houses has been discussed with area of concern being Kashmir. Flood resilient houses involves the construction of safe, economical, eco-friendly structures that can withstand the harsh flood conditions.
Key Words:*Flood, Flood Resilient, Amphibious house, Floating House, dock.*

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1. INTRODUCTION

Jammu and Kashmir has had a long history of flooding. Floods in the state are linked to the Jhelum River and it has history of crossing the danger mark and thereby inundating the 'Valley'. Starting first week of September 2014, the state had seen an unprecedented amount of rainfall, resulting in its worst floods since 1959. While the scale of devastation caused by these floods is nothing short of massive, with over 477 people having lost their lives so far, the Valley, along with the Jammu region has, over the time witnessed floods occurring at regular intervals

Jammu & Kashmir experienced the worst floods in the past 60 years during first week of September 2014 due to unprecedented and intense rains. The Jhelum River and its tributaries were in spate and caused havoc and huge damage various districts of Kashmir Valley. The September 2014 Kashmir floods caused widespread damage in the valley of Kashmir, particularly in the city of Srinagar, and had a significant socioeconomic impact. Around 175,000 residential houses were damaged in the valley. Recent studies focusing on the flood–hazard that the Jhelum river poses, have shown that a flood event with a return period of five or more years is likely to cause overflowing in the river. As such, policy decisions regarding flood safety are rather important.80% of the surveyed houses were submerged to more than half of their heights and nearly 20% were found to be completely collapsed. Houses with mud mortar, and timber as the material for beams, slabs and plinth were the found to be most damaged, while houses with cement mortar having a damp proof course and reinforced cement concrete beams and slabs were found to have performed well. It is emphasized that structural design in Kashmir has to account for seismic forces as well, and that any guideline thereof needs to take into account both hazards–floods as well as earthquakes.

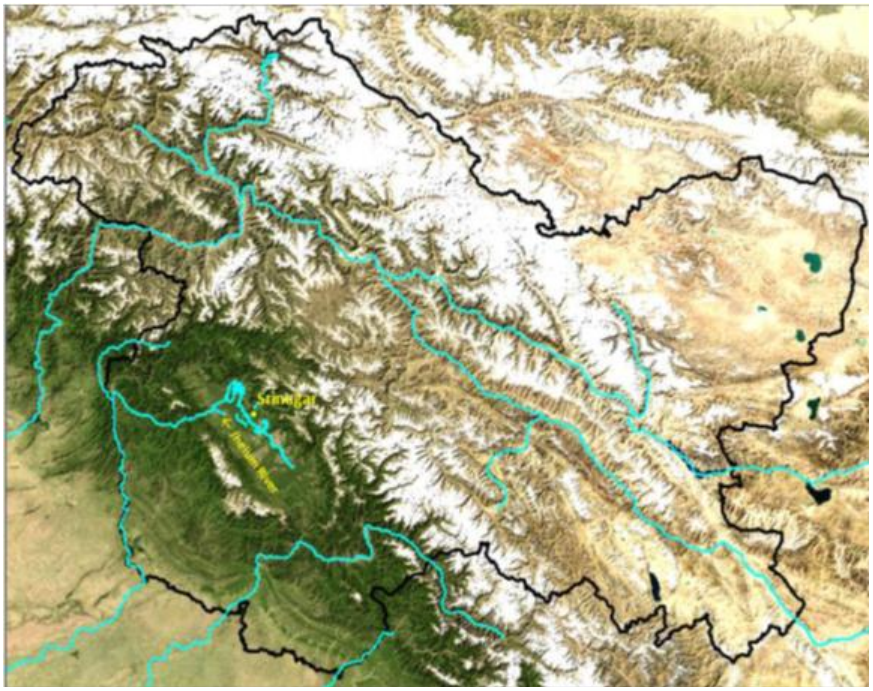


Figure 1: Jammu & Kashmir with stream network

2. NEED FOR FLOOD RESILIENT BUILDINGS

The time-tested vernacular architecture or 'Kashmiri-type' buildings are unable to perform due to intensified calamities brought by climate change, fast depleting indigenous materials, change in user expectation and sporadic intervention of popular modern material and technology. As such need arises for construction of structures which can withstand the effects of multiple hazards of the Valley.

Flood resilient buildings can be defined as structures having the ability to 'bounce-back' and cope up with flood damages. `

Some common ways that are implemented around the world in constructing the Flood Resilient Buildings are:

Rising the Elevation: The elevation of living area is raised above the base flood elevation (B.F.E)

Building the Lower Levels Water Tight: The walls and openings of the base levels are sealed to prevent the water from penetrating inside.

Wet Flood Proofing: It involves the controlled and safe passage of flood water through the lower levels of the house.

Floating House: Floating houses are constructed on water in a way that the load of the structure is equal or less than the uplift force of the water. The house is provided with some anchor system for stopping the house to dislocate. This type of floating house is free to move in both the directions i.e., in vertical direction as well as in horizontal direction. In J&K, houseboats, as accommodation for tourists, are common on the backwaters of Dal Lake.

Figure 2: Kashmir's Houseboat

Amphibious Houses: Amphibious structures are unlike floating units such as houseboats. These houses usually sit on the ground like any ordinary house but when inundated, rise up to a predefined height and sink back to their original position after the water recedes. Movement is defined by the help of vertical guiding poles Here the main working principle is that a lightweight superstructure sits on a buoyant base similar to a ship's hull which is watertight, lightweight and strong.

3. SOME WORKING EXAMPLES

Experiments with Flood Resilient houses are common in countries with flooding problem, though not in India. Some examples are

- **The Buoyant Foundation Project (BFP)** –

A research project by Dr. Elizabeth English in 2006 for retrofitting Louisiana 'shotgun' houses of 700 sq. ft. area with EPS blocks.

- **Make it Right FLOAT House**:

Funded by renounced actor Brad Pitt, the house was designed to be affordable and able to withstand flooding, floating as water levels rise.

- **Maasbommel's Amphibious Home, Netherlands** are fastened to flexible mooring posts and rest on concrete foundations

- **Floating House at Lake Huron, Canada** is a timber framed structure built on a steel deck resting on a steel pontoon. Thanks to its pontoon base, the house adapts to the changing water levels of the lake, which rise and fall throughout the year.

- **LIFT House by Prosun Roy, Bangladesh:**

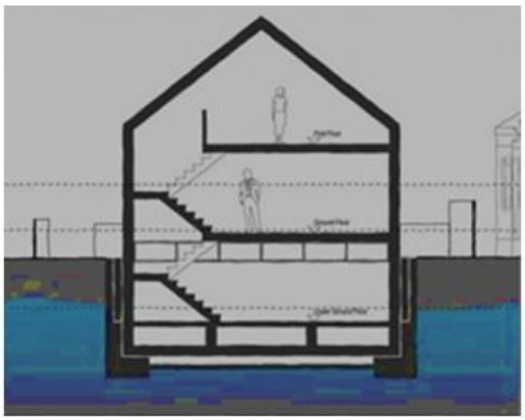
The LIFT House is an amphibious housing solution for flood prone communities. It is an innovative house that floats up with rising floodwater and returns to ground as the flood recedes. It had empty plastic water bottles tied in a bamboo cage to raise a lightweight bamboo building by few centimeters. But the durability of the base is questionable.

- **Makoko Floating School, Lagos, Nigeria**: Makoko Floating School, Lagos, Nigeria had a modular base of sealed plastic barrels united together with wooden bars. Module can be connected to form a bigger base to support a bamboo superstructure. But the structure collapsed when one anchoring chain gave up and the structure toppled to collide with adjacent buildings and logs.

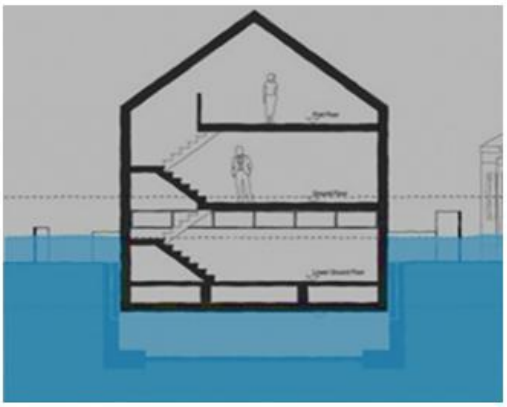
Figure 3: Working State

Figure 4: Collapsed State

• **Britain's First Amphibious Homes:** Faced with building on a site prone to unpredictable flooding, the architects set about creating a design that could mitigate the risk of interior flooding. As floodwaters fill the fixed "dock" beneath the three-bedroom home, the water levels push the buoyant house upwards. To ensure that the home doesn't float away, the structure is attached to four guideposts that extend upwards and allow for a 2.5-meter-high floodwater clearance.



Normal Condition



Flood Condition

4. CONCLUSION

The valley of Kashmir is exposed to multiple hazards of seismicity and flooding to a critical extent. The advanced construction technologies are yet to penetrate among the overwhelming population living below the poverty line. It's hard to imagine a future where these Flood Resilient Houses don't have a significant role to play.

"*The water gets to do what the water wants to do. It's not a confrontation with Mother Nature—it's an acceptance of Mother Nature*." - Elizabeth English. As such there's a dire need for extensive research in the field of Flood Resilient Houses.

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