



# **HOUSING IN FLOOD PLAIN ZONE - (REGENRATIVE FLOOD RESILIENT STRUCTURE) - KERALA**

**<sup>1</sup>Chandru T**

M.Arch student (Housing Executive)

School of Planning Architecture and Design Excellence (SPADE), Hindustan Institute of Technology and Science, Chennai.

chandrusharma29@gmail.com

**<sup>2</sup>Muthaiah Kathiresan**

Assistant Professor, School of Planning Architecture and Design Excellence (SPADE), Hindustan Institute of Technology and Science, Chennai.

pt.muthaiah@hindustanuniv.ac.in

**<sup>3</sup>Sheeba Chander**

Professor, School of Planning Architecture and Design Excellence (SPADE), Hindustan Institute of Technology and Science, Chennai.

sheebac@hindustanuniv.ac.in

**ABSTRACT**

The Paper aim is to study and understand the process of designing the floating houses in the flood plain zone which is environment friendly. To investigate the resilient features of floating houses and to analyse the possibility of using locally available and recycled materials in floating housing as a new form of resilient living. Resilient aspects of the floating houses can be recapitulate as the buoyant characteristics for natural disasters, to develop a people centred approach to housing community by incorporating different modern materials.

**Keywords:** Floating structures; resilient living; affordability;

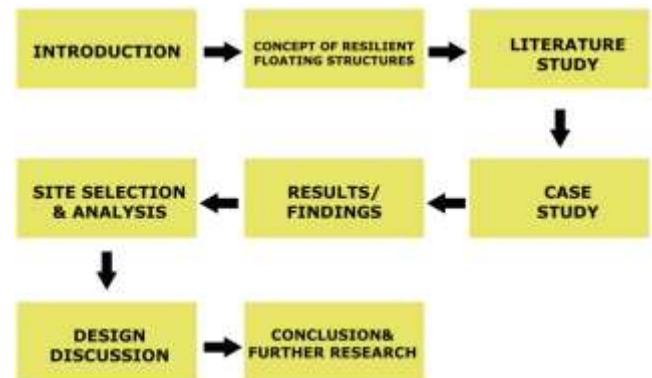


Figure1. Graphical Abstract

**1. INTRODUCTION**

New trends of living indicate people need to live in peaceful spaces while encouraging a safe & good environment and keeping a strong sense of neighborhood community. Therefore new types of flood-related housing need to be provided in order to address both climate conditions and meet the contextual needs of a growing number of people who live in high-risk low-lying and coastal areas.

Considering the resilient features of the floating house at a time of serious climate change requires a new paradigm, and floating/amphibious/floatable structures have the great possibility as a new form of resilient living.

**2. CONCEPT OF RESILIENCE FLOATING STRUCTURES**

Resilience in the built environment is the capacity to adapt the changing situation and to recover functionality and vitality in the face of stress or disturbance. The resilience initiatives have been chosen because of their direct relevance to local needs, affordability, and ability to address multiple challenges facing households. This concept describes an innovative approach towards adaptation compared to the traditional flood resilient infrastructure.

Resiliency is mainly focused on the face of natural calamity. The ability for one to return from a devastating event is critical to one's ability to thrive. Resilience after a natural calamity can be gauged in a range of distinctive ways. It can be measured on a neighborhood level, and on a physical level. Natural calamities are tough to predict, so the potential to put together them is instead limited. (Wikipedia, 2015)

**Aim and Objectives**

The aim of the proposal is to design a flood resilient structures in the river based flood plain zone which is environment friendly.

The objectives of the proposal are as follows:

1. To explore main principles behind floating architecture, and design parameters of floating building.
2. To design modular standardized building and low rise floating structural materials.
3. To provide a people centred approach to housing community by incorporating different modern materilas.
4. To achieve affordable way to achieving to floating structures
5. To explore the critical resilient dimensions which ensure saety and security of the people in the flood plain zone.
6. To study the design and construction technology of existng floating structure as a case study

**3. METHODOLOGY**

The design proposal methods has been three different stages 1.Literature study and case study. 2. Site selection and Site analysis 3. Design of regenerative flood resilient structures. These methods followed under the previous Research paper based on flood resilient structures kerala.

#### 4. LITERATURE STUDY

[1] *A Study on the Floating House for New Resilient Living Author: Changho Moon Article October 2015*: This paper aims to discuss the concept of resilience in floating housing can be summarized as the buoyant characteristics for natural disasters, use of renewable and nearly self sufficient energy systems in locations subject to limited energy sources, the movability, mobility, water recycle system and prefabrication and modular construction. New trends of living indicate people prefer to live in a peaceful and comfortable house while enjoying safe in sustainable way.

[2] *Amphibious House, a Novel Practice as Flood Mitigation Strategy in South- East Asia May 2012*: This paper discuss the vulnerability of flooding in terms of exploring the population and assets is increased dramatically over these decades. There are different strategies to prevent the flood destructions in urban areas. Protecting and fight against flood vulnerability is one of the most important aspect of human species.

[3] The idea of the new design for amphibious structure was developed by including the pit system, concrete pontoons and slab. The slab was designed based on normal loading by dry condition and it also contrast of water loading and weights during the in floating wet season.

#### 5. CASE STUDY

##### 5.1.1 Maasbommel, Neatherland

Netherland is located on the delta and experience flooding from rivers and from ocean storms addresses the challenge of building in a flood zone in order to adapt to an increasing risk of river flooding. Most settlement communities in maasbommel are protected with dykes, levees and flood gates. Dutch government granted to allowed a construction of “adaptive building techniques” in 15 zones along the river sides, which resulted in “Amphibious structures”

Amphibious structures are built to be situated near water body and are construct to adapt to rising water levels. Floating structures are permanently in the water, while amphibious homes are situated above the water and are designed to float when the water levels rise.

Amphibious homes are commonly used as flexible mooring posts and rest on concrete foundations. If the water level rises during a flood it can easily move upwards and float. The fastenings to the mooring posts restrict the action inducted by the water. The concrete slab is used for amphibious buildings that normally rest in a dry region.



**Figure 2.** Floating and amphibious houses with access road and floating pier. *Source: studio van hesse*

##### 5.1.2 Lift House Dhaka, Bangladesh

The lift (low income flood-proof technology) House is an amphibious housing alternative solution designed for low-income families flood prone communities in Dhaka Bangladesh. LIFT house can be designed with a central courtyard axis with 12 units in each cluster where the lift communities are replacing houses in an existing slum settlement, and to reduce crowding that create an open spaces. The lift house plans integrate the ideas such as narrow pedestrian paths, shared spaces and circulation spaces as retail activity with a large public square. The Lift House responds to the crisis of floods, housing needs of the urban poor and environmental degradation

The LIFT House is a stability between the old and the new, indigenous substances with modern-day technology. Its implementation was fortunate and people living in it are comfortable with the facilities but its effectiveness for the duration of a flood condition was no longer available however it did float or was successful on the test.



**Figure3.** Exterior bamboo treatment of lift house

### 5.1.3 Vietnam Bamboo Houses

The H & P Architects have developed affordable housing in Vietnam for a flood threat zone, by using designing a new type of terrestrial dwelling that floats above the flood. the building is strong enough to stand up to a 1.5meter high flood and currently, the architects are experimenting with the model to see if it can survive a 3m high flood. the flexible structures are positioned to be mass-produced and can be built by using them for around 25 days. it can be produced with a number of modules and the total cost of the housing module is only 2500\$.



**Figure4.** Eight and Six house module

There's an excellent appearance and sense to these structures too. They have included a vertical garden on one façade. Plants, flowers, and vegetables can nestle in bamboo plant holders, out of attaining the water. the interior bamboo works as a multi functional space like a house, medical, community center and educational spaces are all possible options. Each module is anchored to the ground level with four steel rods, with the water or oil drums serving as the basement that the house sits on. When the rains come, the house rises up on its rods, stopping it and washing away.

Therefore, the house can warm people in the most severe conditions and help them in the future, also make contributions to ecological and social development as well as economic stabilization. This will provide conditions for the self-control process and create a connection between vernacular tradition and structures.

## 6. RESILT AND FININGS

### 6.1 Conclusion from Literature studies:

The resilient aspects of floating strucutres at a time of serious climate change and require a new paradigm. Floating/amphibious /floatable homes can provide a viable new shape of resilient residing if suitable resilient elements are utilized in accordance with the circumstances.

The resilience initiatives have been chosen because of their direct relevance to local needs, affordability, and capability to tactile multiple challenges facing households.

### 6.2 Conclusion from Case studies:

The Amphibious housing demonstrates that architecture, and engineering for flood strategies can be mixed to create aesthetical floating homes that allow occupants to revel in the dwelling close to the water safely.

The Netherland and Bangladesh are among the most vulnerable countries, but floods are increasing all over the world. The lift house is a greater example, an experimental resilient structure is possible to combine both vernacular with advanced technological methods and local material resources. This result is a well-adapted design to social, cultural, and economical dimensions and it is a resilient solution to environmental changes

## 7. SITE SELECTION AND ANALYSIS

The site selection based upon the river based major affected flood prone area in the suburban region. The site is located in Kerala , Aluva. This peri-urban location is a bridge to span rural and urban areas.



**Figure5.** Aluva flood map 2018 August

**Aluva Climate Change:** Aluva is undergoing dramatic changes in its urban fabric. Climate change is a reality and its impacts have already manifested in Aluva through recent flooding events.

The site analysis has been based on flood imapcts and others criteria (1) Location and river based settlement (2) Flood water flow in every year (3) Existing housing conditions (4) Flood Hazard maps (5) Climate Change (6) Connectivity between Aluva and Uliyanoor. (7) Intensity of water flow (8) Major effected nodes and Junctions (9) Figure ground mapping (10) Activity Mapping (10) Road hierarchy (11) Land use mapping (12) Existing Living patten. These parameters are using site study and analysing the past present and future of aluva.

Based on the study aim is to maximize the opportunities to make Aluva - Uliyanoor a better place to live by improving the quality of life for all.

## 8. DISCUSSION

The design proposal was developed by following the results and guidelines obtained from the studies mentioned above. After applying the short-term measures of the action plan, the master plan proposes urban, landscape, and housing interventions that will help the community to survive during the flood crisis.

The action plan strategically is planned to bring the community together by enhancing the public space and providing cool and shaded areas where the community can gather together. These spaces include public squares and sports playgrounds, pedestrian shaded paths along the residential area and pedestrian paths along the roads. This master plan is at the same time scalable to other household communities and allows interconnectivity systems and infrastructures between them.

**EXISTING DWELLING UNITS:** The units with least structural damaged are retained with provisions made for reducing losses in the next flood crises.

**CREATING BUFFER ZONE AND PLANTATION:** For Preventing soil erosion during water surge

**NEW DWELLING UNITS:** Design a resilient house for developing areas and replacing the most affected houses.

**MODULAR HOUSING UNITS:** Design a amphibious structures adding a resilient half of the house and upgrading the open space used to design the modular houses and for future consideration.

**RIVER EDGE:** Tetrapods are designed in such a way that dissipate the pressure of incoming waves by making the water glide round instead of toward them and can continue to be steady even under the most extreme climate conditions. A wide variety of tetrapods organized collectively shape an interlocking in the Periyar river edges.

Integrated with interior and exterior environment is good community gathering spaces. Closed Corners creates a strong sense of spatial enclosure.

Courtyard used for multi purpose activity playing games, cowshead, utility purpose, functional gathering space, etc Space relation between inside and outside connect with street corridors.(1)Shared Function (2) Shared Courtyard(3) Shared Structure (4) Shared Facade

## 9. CONCLUSION AND FUTURE RESEARCH

The Design proposals are supported by a complementing strategy for the Periyar River basin to steer future development and decision-making to support local efforts in the long term. This regenerative neighborhood housing module is a flexible scale with respect to the context of Aluva. Living on the water in flood situations can also reduce the negative effects of heat, and may improve the quality of life in Uliyanoor.

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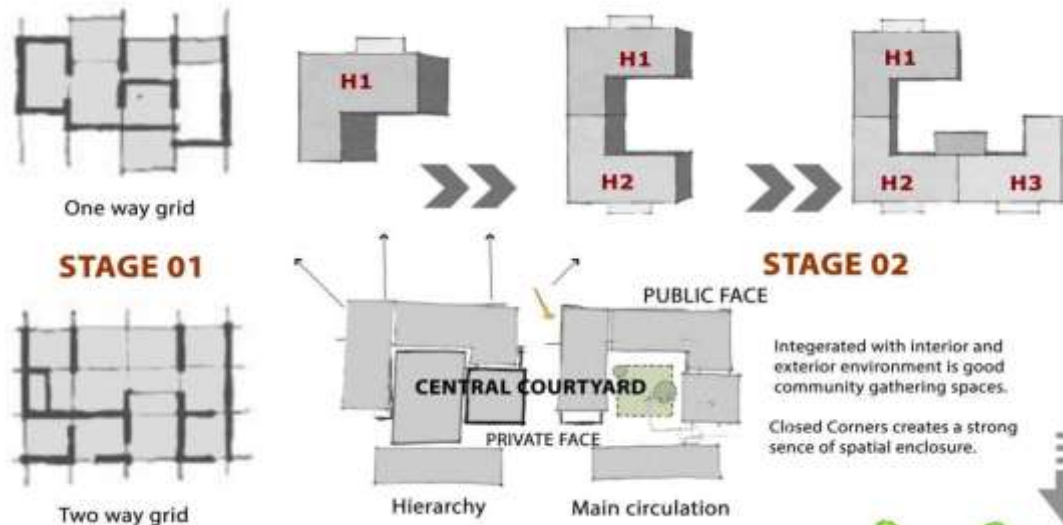


Figure 1: Conceptual evolution

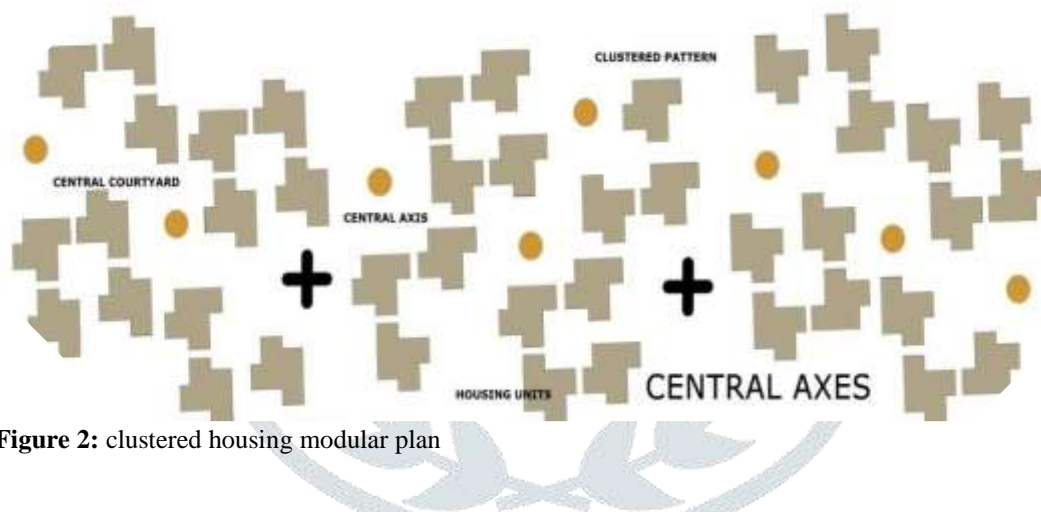


Figure 2: clustered housing modular plan



Figure 3: typical modular houses grond floor plan



Figure 4: typical modular combined houses grond floor plan



Figure 5: ground floor clustered plan



Figure 6: detailed view of sing clustered house



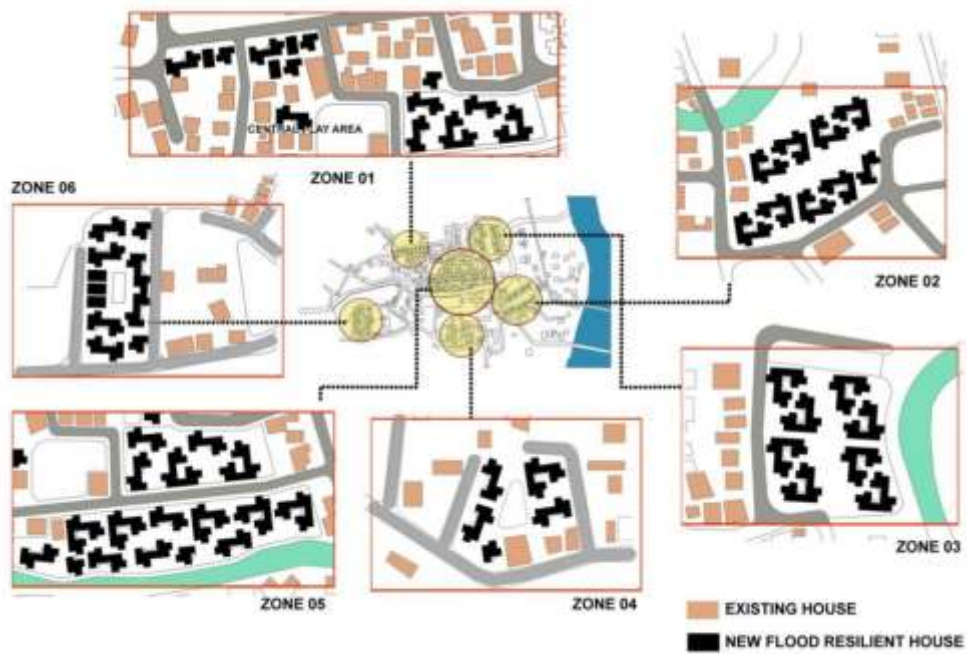


Figure 7: resilient modular houses zoning and plan



Figure 8: sectional skyline for Aluva and Uliyanoor



Figure 9: river edge housing view of uliyanoor