

“A Review on: Amphibious House”

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Abstract – It is well known that “FLOODS ARE ACTS OF GOD, BUT FLOOD LOSSES ARE LARGELY ACTS OF MAN.”

We are all living in the 21st century and are on the edge of rapidly increasing population. The population on Earth has increased from 1 billion to 7 billion in the previous 3 centuries and is still on the verge of increasing with no signs of reducing by any means.

The increasing number of population leads to their shelter and there shelter causes and affects the environment in indefinite number of ways. A house can cost someone in some bucks, but it costs the environment of Mother Nature more than any other resources. Having knowledge of all these the human being has got no plans to stop, But in the end it all comes back in some or the other ways. Nature always treats you in response, the same way you do. Harms to nature costs Flood, Earthquakes, Hurricanes, tsunamis and other geological natural disasters. The First thing that gets destroyed in these disasters are Habitats. Yes, be it Human or other species the habitat of a human being lies around homes, and these are the first target by the disasters. The Indian Continental alone has spent a total of 3.9 B dollars in the 65 yrs. of its independence, only when the skies cursed. It is a basic need to encounter the problem of losses due to floods, and as said in the phrase the flood losses are largely and solely the act of man itself.

Key Words: Floods, Amphibious House, Buoyancy, Levity, Flood Proof, Architecture, Flood Mitigation, Retro Fitting, Ferrocement, Hybrid Structure, Polystyrene, Styrofoam

1. INTRODUCTION

Amphibious, it is an adjective which means something that can live on land as well as water. The word was derived from modern Latin word amphibium and Greek word amphibian which transformed as Amphibious over the course of time.

The concept of amphibious house is to encounter the issue of losses due to floods. Floods are the natural disasters which cannot be controlled. Due to increased population Human being started reaching out more and more area for the need of shelter, which involved acts like reducing catchment area of rivers and using it to construct more houses, Deforestation which causes global warming and which results somehow into Natural disasters.

An Amphibious House is a House which helps you encounter the problem of Floods and the losses causing due to floods to Houses. These houses ideally rest on ground under normal conditions, But at the time of flood, when the water encounters with the Houses at its risk factor levels it rises with the rising level of water. The Concept of house is based on Buoyant Force. Buoyancy is the force that causes an object to float on water or any other liquid. It exerts from the liquid while the object is partly or fully immersed in liquid and causes the object to float on water.

The Amphibious house is a solution that obeys the laws of Physics and Fluid Dynamics to tackle extreme flooding in low cost to avoid the losses due to floods. It also focuses on keeping the amenities and functionalities of the house while you are afloat, and does not require an individual to migrate from the location of flood prone area.

The First successful attempt to build the Amphibious House was made by Baca Architects on the river Thames.

2. LITERATURE REVIEW

[1] Amphibious House, a Novel Practice as Flood Mitigation Strategy in South- East Asia May 2012

- a. **Methodology:** This paper presents the vulnerability of flooding in terms of exposing population and assets is increased dramatically over these decades. There are different strategies to prevent or mitigate the flood destructions in urban areas. Fighting and protection against flood vulnerability is one of the most important afford of human species.
- b. **Findings and Application:** The concept of the new design for amphibious house was developed including the slab, concrete pontoons, and pit system. The slab was designed based on normal loading by dry season and contrast of water loading and weights during floating time in wet season. The detailed design is not considered in this paper.
- c. **Remark (Future Scope and Conclusion):** In this paper they have concluded that in Malaysia amphibious house with concrete pontoon is the most appropriate. Pre-cast concrete pontoons, which are filled by expanded polystyrene blocks (EPS) are one of the approaches towards economic

and time saving strategy. These pontoons provide buoyancy for the whole system.

[2] Thriving with water: Developments in amphibious architecture in North America Elizabeth English¹, a, Natasha Klink¹ and Scott Turner¹ August 2015:

- a. **Methodology:** From this paper we concluded that traditional flood-mitigation strategies that attempt to control the flow of water only increase the likelihood of catastrophic consequences in the long run, when failure inevitably occurs after years of complacency and development behind flood barriers. Sequences when eventual failure occurs. Current popular approaches to flood risk reduction promote the control of flooding by erecting barriers that may provide some measure of protection for the time being.
- b. **Findings and Application:** A buoyant foundation is a particular type of amphibious foundation, specifically designed to be retrofitted to an existing house that is already slightly elevated off the ground and supported on short piers. It allows a house to remain close to the ground and retain its original appearance under normal circumstances, but to rise with the water and float on its surface when flooding occurs, then settle back into its original position as the water recedes.
- c. **Remark (Future Scope and Conclusion):** Amphibious construction, though not a new concept, has been growing in popularity over the past decade. The implementation of buoyant foundations as both retrofit and new construction could provide benefit to communities at high risk of chronic flooding.

[3] A Study on the Floating House for New Resilient Living Author: Changho Moon Article October 2015:

- a. **Methodology:** This paper aims to discuss the concept of resilience in floating housing Resilient features of the floating house can be summarized as the buoyant characteristics for natural disasters, the easy employment & potential use of renewable and nearly self-sufficient energy systems in locations subject to limited energy sources, the movability, mobility, long life, water recycle system, prefabrication and modular construction with the potential for reduced environmental impact.
- b. **Findings and Application:** New trends of living indicate people prefer to live in a peaceful and comfortable house while enjoying safe & natural atmosphere and keeping a strong sense of community.
- c. **Remark (Future Scope and Conclusion):** To investigate the resilient features of floating houses

& to review the possibility of floating housing as a new form of resilient living, and to suggest some reference ideas for the planning and design of floating housing projects.

[4] Review Paper on Ferrocement in Construction May 2017 Author: Gursewak Dass, Mohit Talwar:

- a. **Methodology:** It had been concluded from this study how ferrocement is better than conventional types RCC, PCC etc. and perform good against lateral displacement, fire resistant etc. economically without required any skilled worker. Ferrocement is a composite material used to form thin section, it is composed of a mortar, and reinforcement include light steel fabrics and meshes.
- b. **Findings and Application:** Ferrocement is a good material. Ferrocement is economical in nature and having a good performance against lateral load.
- c. **Remark (Future Scope and Conclusion):** when we compare Ferrocement with RCC (Reinforced Cement Concrete) it perform better against crack, because wire meshes that were used in Ferrocement will cover the macro part of Ferro cement structure and avoid cracking. Pre-cast ferrocement structure are in light weight as compared with RCC and sometime pre stressed concrete structure, considerably reduce the cost hence ferrocement is most appropriate in pre-cast industry.

[5] Floating Concrete by Using Expanded Polystyrene Beads Mayank Patel, Rishabh Yadav, Jayvirsinh Parmar, Nishani Salvi Abhijitsinh Parmar:

- a. **Methodology:** EPS or expanded polystyrene is a rigid cellular plastic originally invented in Germany in 1950. It has been used in packaging solutions since 1958. It is 98% air but the rest is made from tiny, spherical EPS beads - themselves made only of carbon and hydrogen. Nowadays enormous amount of waste polystyrene is produced in the world. This will ultimately cause pollution and is detrimental to the ecosystem. Rapid and relatively simple construction. Economical in terms of transportation as well as reduction in man power.
- b. **Findings and Application:** Concrete is produced by mixing binding materials and inert materials with water. Thus, water and its quality (and also its quantity) plays an important role in determining the quality of concrete, ultimately.
- c. **Remark (Future Scope and Conclusion):** Polystyrene is a versatile plastic used to make a wide variety of consumer products. As a hard, solid plastic, it is often used in products that require clarity, such as food packaging and laboratory ware.

3. OBJECTIVE

The objective of Amphibious House is to eradicate the flood problem with a permanent solution to first level of houses and infrastructures. Also the solution must be affordable and having a suitable and bearable technique by all means. So that it may not harm any System or Environment and everyone out there be able to have the benefit of it.

4. THE ARCHITECTURE

The main Architecture of the house is the main component of the house. A buoyant architecture beneath the house displaces the house vertically. The Amphibious house is a flood mitigation strategy which works in synchrony with the region's weather cycles and levels of flooding.

The design also includes site selection, structure of house, Type of soil, availability of local material resources, availability of labor and etc.

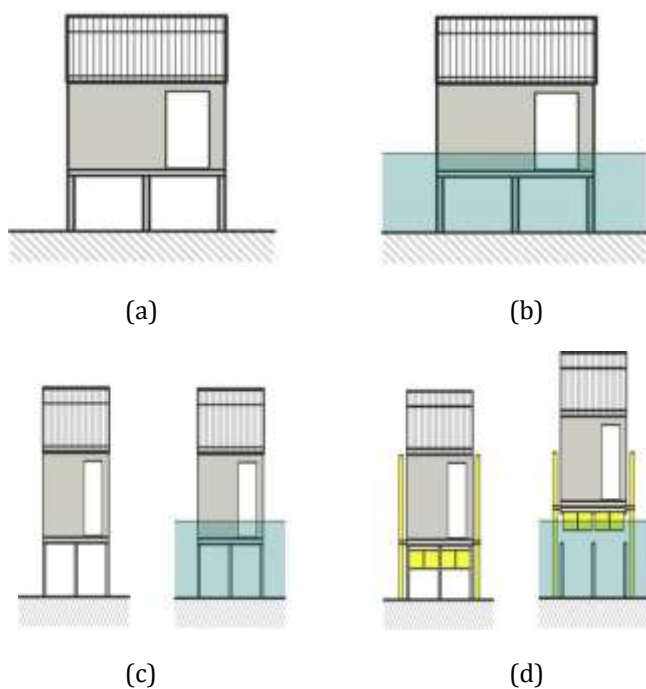


Fig - 1: (a) Ideal Stage, (b) Flood water starts rising-1,

(c) House starts leaving its ideal stage to elevating stage,

(d) The final stage after lifting of amphibious house

The Above Fig-1 represents the Reference Architecture or Base working of an amphibious house.

In the Fig-1,

(a) Stage describes the Ideal stage of the structure where no signs of flood is present.

(b) In this stage the flood occurs and the process of amphibious house initiates

(c) In this 3rd stage of the system of Amphibious House, the rise of house starts along with the flood water

(d) This is final stage after the complete elevation of the amphibious house, where the house is rises by the necessary elevation of the flood water

5. METHODOLOGY

The house uses technology from marine and bridge construction as well as conventional building to create an elegant solution to flooding that is also attractive and complimentary to the setting. The flotation attributes, including the guide-posts, slide-gear and flexible services are expressed in the architecture as is the industrial weather screen skin. The triple height glazed facade allows views of the river from all floors. The northern elevation provides a simple complement to neighboring houses.

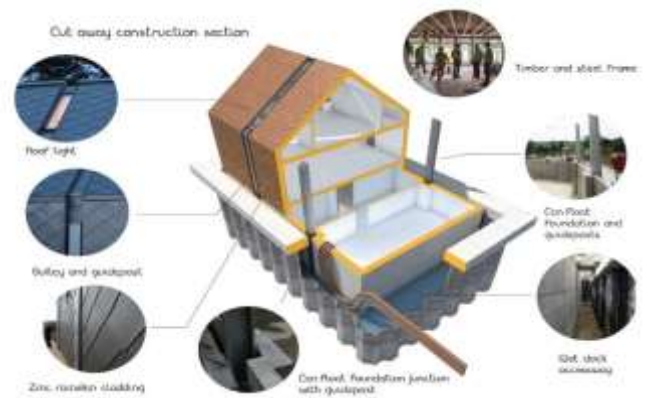


Fig - 2: Cut away construction section - Amphibious House

In the Fig - 2 above, The Cut away construction Section of the amphibious house describes the components which are,

Roof light, Gully and guidepost, Zinc rainskin cladding, Junction of foundation with guidepost, Wet clock access way, Foundation and guideposts and Timber with steel frames.



Fig - 3: Plan of the amphibious house



Fig - 4: Construction of amphibious house



Fig - 5: Construction of amphibious house

The above Fig - 4 and Fig - 5 indicate the construction in process of the Amphibious House.

In Fig - 4 we can see the elevation heights attainable by the house, the engineers on field are taking care of the plan to be designed and implemented as structured.

6. CONCLUSION & FUTURE SCOPE

The Amphibious house demonstrates that architecture, engineering and flood strategies can be holistically combined to create beautiful buildings that allow occupants to enjoy living near water safely.

The future scope of Amphibious House involves increasing the number of storey of the infrastructure, also making the necessary arrangements for the parking management of vehicles that are being used by individuals. For now the concept has been deployed for the house and some infrastructures at limitations, but we look forward to deploy it to large scale infrastructures like Warehouses, Multi-storey Buildings, Hospitals, Industrial enterprises.

The concept can also be elongated into green house that can be having electricity while staying afloat, also being able to use other essential requirements.

Also the material used for the construction of the building of architecture can be more lightweight. So that the load balancing becomes easy.

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REFERENCES

- [1] English E., "Amphibious Foundations and the buoyant foundation project: Innovative Strategies for Flood-resilient Housing," a paper presented at the Road Map Towards a Flood Resilient Urban Environment International Conference on Urban Flood Management, 25-27 November 2009, Paris, France.
- [2] Sandhya K. (Reg. no.313012251023) April 2016, "Amphibious Architecture in India," Da Vinci School of Design and Architecture, Karapakkam, Chennai.
- [3] Elisabeth English, Natasha Klink and Scott Turner, "Thriving with water: Developments in Amphibious Architecture in North America," School of Architecture, University of Waterloo, Canada, FLOOD risk 2016- 3rd European Conferences on Flood Risk Management, E3S Web of Conferences.
- [4] ICAADE 2015, First International Conference on Amphibious Architecture, Design and Engineering, Bangkok, Thailand, 26-29 August 2015. <http://icaade2015.wixsite.com/icaade-2015>
- [5] Buoyant Foundation Project, Inc. www.buoyantfoundation.org
- [6] Mohamad Ibrahim Mohamad, Mohammad Ali Nekooie, Zuhilmi Bin Ismail and Roohollah Taherkhani, "Amphibious Urbanization as a Sustainable Flood Mitigation Strategy in South-East Asia," Advanced Materials Research, Vols. 622-623, pp. 1696-1700, 2013.
- [7] Case study of 'The Thames Amphibious House'. www.construction21.org