Building on Stilts – The Only Way to Go?

Reflection on design approaches in flood prone areas

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1 Introduction

On the 31 of August 2014 a major downfall hit Malmö which caused severe flooding. The heavy rain also resulted in a new Swedish record regarding the level of rain in a 24 hour time lapse; the latest comparison reaches back to the 1960s (SMHI, 2014). There is little doubt that these kinds of consequences can't be overlooked; it is obvious that flooding no longer is a local, isolated concern but a global one affecting at first all countries with coastal areas. It is a threat that is highly relevant in the field of architecture and planning thus this paper will further explore this perspective.

In many parts of the world flooding is already happening to a larger extent and with a higher frequency than in Sweden. According to the study "Future Flood Losses in Major Coastal Cities" (Hallegatte, et al., 2013) an increase in flooding exposure in coastal cities can be seen due to climate change, population increase and subsidence. The latter is a metrological phenomenon where the air is slowly sinking and causing a rise of the air temperature (SMHI, 2013). In the book "Extreme Architecture – Building for Challenging Environments" (2009) the

author Ruth Slavid discusses that some larger flooding disasters have become an eye-opener. One example mentioned is the hurricane Katrina in the US with its subsequent flooding leading to the start-up of the project “Make it Right” – a project where architects were invited to present ideas on how to provide housing taking into consideration the flooding hazard as well as the local perspective. According to Slavid many of the presented designs suggested building on stilts.

In my opinion this example illustrates a quite representative way of looking upon flood prone design. Is building on stilts however always the best solution? Should the approach be the same in for instance the Philippines and in Sweden? And what can be learnt from the historical way of dealing with the problem? The aim with this paper is consequently to investigate what design alternatives can be found and consider how they can be implemented in different situations.

Flooding in the Philippines. Photo: AP Photo

2 Literature Review

In order to zoom in to the different design solutions one first has to zoom out and discuss some background perspectives. This chapter is therefore divided into shorter paragraphs dealing with different angles to structure the line of thought.

Vulnerability

One could question why new settlements occur at all in flood prone areas; wouldn't it be better to stay away from building on the exposed land in the first place? It would be the safest way, and this is the approach in many developed countries (Roaf, et al., 2009). One reason could however be that flooding may actually be profitable in terms of good land for agriculture (Liuke, 2015). Furthermore, it is likely to believe that many people, especially in poor countries, simply don't have the "luxury" of choosing where to settle down. Liuke (2015) further states that our settlements around the world increase our vulnerability. This is an interesting reflection; not only is the threat of flooding rising but so is our susceptibility to it. It is safe to say that disaster risk management is highly relevant.

A past perspective

In "Adapting Buildings and Cities for Climate Change*"* (Roaf, et al., 2009) it is discussed that people historically measured risks by using the knowledge from similar past situations. What differs in modern age is that the future climate will vary a lot in comparison to the climate today thus it is further argued that if we are to use predicting climate models a *scenario strategy* must be implemented.

In the Netherlands, a country which has dealt with the problem of water and reclaiming land for centuries, this kind of scenario strategy is done by The Royal Netherlands Meteorological Institute (Kazmierczak & Carter, 2010). The country has a large amount of its land below sea level and since 1953, when major flooding occurred causing the death of thousands of people, the Netherlands changed its protection approach by applying the strategy of *living* with the water rather than fighting it. This has resulted in projects where accommodation and water are not seen as "enemies" but coexist thanks to the design solution (Slavid, 2009).

Design approaches

How is the abovementioned example executed? There are obviously different ways to do it but one of the ideas is, as mentioned above, the *house on stilts*. One vernacular building type illustrating this strategy is the nipa hut from the Philippines; this traditional, rural Filipino home was most commonly raised on stilts to protect the dwellers from floods. The materials used were chosen to keep the house cool due to the tropical climate and owing to the elevation the air could move (Fazzi, 2005) The architecture also allowed for easy rebuilding or repairing of the structure (Gardner, n.d.). This original building type is however not very present in today's urban architecture:

"Like an endangered species, these wood and stone houses are vanishing toward certain extinction." (Gardner, n.d.)

Building on stilts in Bacoor City, Philippines. Photo: Elin Karud, 2015

A more controversial approach is the *floating house* which can be done in numerous ways. One project that is worthwhile to highlight is the Yacumama Lodge in Peru. Situated in a humid and wet area this thatch house is made from the local timber ironwood. Due to the high density of the material the house sits on a raft made by local balsa in order to prevent it from sinking. Using traditional technique the house was built by students of architecture in only eight days (Slavid, 2009).

A Dutch project in the town Maasbommel is related to the floating house type, namely the *amphibious house* – a house constructed on dry land but that will float in the event of a flood. This is possible owing to the house's attachment to hulls allowing the house elevate 4 meters along steel piles. It is basically the same principle as for boats. What can also be mentioned is that this kind of house was in addition designed to withstand the power of the water and the movements created accordingly (Slavid, 2009).

Floating house in the Netherlands. Photo: Peter Minemma

3 Discussion

It is evident that there are more design solutions than simply raising a building on stilts. There are many different ways but the abovementioned approaches give an idea of the range of strategies.

In February 2015 I travelled to the Philippines on a field trip with the Lund University master's course "Urban Shelter". The course focuses on housing in the Philippines and the three week visit to the capital Metro Manila gave us an insight through study visits and interviews with dwellers and professionals. When arriving I was expecting to see many buildings on stilts due to the country's exposure to flooding and to what I had learnt about the architectural approach of the problem. I was however surprised to see this was not the case; some buildings were elevated but the vast majority of the houses were built on solid ground. This perception was further consolidated when I was doing the research for this paper; it turned out to be easier to find examples and case studies of other flooding approaches than the pillar method, not only regarding the Philippines but in general. This is why I asked myself is building on stilts is the only way to go. The method has obvious advantages since you elevate the dwellers from the flood level but there are some downsides that might explain the moderate use of the method.

Buildings on solid ground, Philippines. Photo: Elin Karud, 2015

Lack of street life

In the guide "Climate Change Toolkit: Designing for Flood Risk" by the Royal Institute for British Architects, RIBA, (2009) it is for instance discussed that a effort such as a building on stilts or columns, is seldom integrated with the rest of the architecture which causes problems in the function of the neighbourhood and street scene (RIBA, 2009). Additionally it is argued that the empty space in between the stilts tend to result in a lack of surveillance and no feeling of ownership which can cause problems with security (RIBA, 2009). The latter argument accords with my personal impression of the pillar method; I appreciate the lively spaces you can create a few metres up by for instance linking with small bridges or terraces but I have similarly struggled to see the potential of the space beneath since it is often perceived as a rather dark and unfriendly zone.

RIBA further discusses the possibility of using the space as a parking area or garage but quickly dismisses the solution since it creates a dull street level and also because it is difficult to create equal accessibility for everyone with this solution (RIBA, 2009). One should be aware of that with pillars you might handle the threat of flooding but end up with new problems instead. Using this design method would consequently need a well thought-out strategy for designing the space so that it works as a humane environment.

Space as parking. Photo: Barmysot, 2009

Waterborne architecture

The advancement of waterborne architecture throughout the world can be explained by it being a solution for dealing with the future problems of population growth and sea level rise due to climate change. The floating building could for instance create an alternative construction site as a complement to the shortage of buildable land because of the growing population. Other advantages are the mobility of the building and the possibility of using renewable source water - the surrounding water could be used for both heating and cooling over the year (Stopp & Strangfeld, 2010). There are however some problems linked to floating architecture since the surrounding boundaries differ a lot from those on dry land. Stopp and Strangfeld (2010) state that aspects that you need to pay regard to include for instance the chemical problems such as salt and pH-levels which are linked to the use of materials and the physical problems such as the force of waves, interaction with nature and waste management. Even security measures are mentioned which I find relevant; having children playing on a floating house requires an insight in the threat of water as well as designing safe footbridges.

Inform and instruct

The abovementioned design strategies illustrate two problems faced with the flooding resilience; the social aspect of a building typology and the more technical issues. In addition to these an important aspect in the discussion is also the individual resilience; how do we translate the built strategies into action when the disaster strikes? In my opinion one could create a floodable building that might work on paper but as long as the dwellers are not aware of how to use it the design would be ineffective. The conceived flooding features would be important and therefore you would need to inform the dwellers on how to best arrange their living according to the principles; maybe by having an introduction when moving in and handing out a set of instructions. On a community level this could further be developed on a larger scale with informative workshops and similar.

4 Urban Shelter Design

To tackle the problem with flooding I suggest that one should start with a "toolbox" – a set of design guidelines and strategies since shifting circumstances require different approaches regarding buildings. The RIBA design guide describes the flooding phenomenon in terms of these categories: source of flooding, pathway i.e. the route and receptor – the "victim" of the disaster (RIBA, 2009).

As can be seen from the sections above it is not evident which typology is the best solution and I have consequently merged the theories into a simplified checklist to start with in order to get an overview for each unique case. I have translated the RIBA categories into "6 Water Ws", an example could look like this:

	Low risk	Medium risk	High risk
Why	Rainfall	Groundwater	River
Where		Buildings	Streets
Who	Infrastructure		People
When		Occasionally	Every year
What		Pillar house	Second floor escape
Way	Evacuate	Stay	Move up

Table: Elin Karud

The outcome of my research for this paper is that in terms of design strategy I have found it very useful to deal with the flooding issue by dividing it into levels of risk and to consider the typologies on these terms. The idea derives from RIBA who also suggests a zoning-strategy.

Regarding the design there are different detail aspects to consider for each case. For the second floor escape house the strategy is based on that water is allowed to enter the building and that the design is adapted to this. Tools to use here are for instance to put electrical sockets above the flood level, to have a well dimensioned floor to use as storage space for emergency equipment and to put wall hooks above the flood line and use them for hanging up valuable belongings (RIBA,

2009). The toolbox for building on stilts includes a good design below the exposed ground floor and the safety issue of elevating a building. Finally, for the waterborne houses it should be important to consider resistant materials.

5 The Role of Architects

In “Housing and Urbanisation” (2000) the author, planner and architect Charles Correa states that the role of architects in general is to influence good planning since architects are often able to see connections between problems. Correa means that this is due to the fact of a frequent involvement in numerous assignments. I fully agree with this statement and this means that architects have a responsibility as professionals to express their knowledge.

Being able to see the whole picture one has to be able to identify risks; this has to be done by for instance politicians, engineers, planners and architects since the public relies on the trust of authorities. Regarding flooding this could mean that if there is not a satisfying relationship the public doesn’t perceive the flooding risk and consequently settle down in a flood prone area (Slovich, 2000 referred in Crichtron, 2012). Not only does each profession need to have insight in the flooding threat but in order to get a functioning solution an interdisciplinary approach is crucial. Below a descriptive summary is presented:

“The buildings we will live in, in 20 or 50 years’ time, will be, by and large, those we occupy or are building today and so our choices, today, must be based on such descriptions of a probable future, because they are the best chance we have of designing buildings that go some way, at least, towards being the most appropriate long-term solutions in a rapidly changing world.” (Roaf, et al., 2009)

In conclusion, regardless if you are a politician, engineer, planner, architect or dweller it is my belief that the solution to a good flooding design is spelled e d u c a t i o n.

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