

Building Management under Limate Change Condition for Mekong Delta in Vietnam

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ABSTRACT: Recently climate change affect directly to the living condition of all households in Mekong delta of Vietnam. To be aligned with such condition, people are trying to build more building with higher level to maintain all floors above the sea level. However when the tide down their building is not sufficient for such dry condition. In this research the author propose a multi purposes building management to help them solving such problem. Beside that people can approach the clever manner with bad leaving condition in Vietnam.

KEY WORDS: Climate change, building management, tide down

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I. INTRODUCTION

Following the latest decision of Prime minister number 68/QĐ-TTg dated 15/01/2018 [1] regarding to construction planning of Mekong delta until 2030 and vision to 2050 then the construction are restricted to backfill, encourage to develop along the flood drainage. This requirement means that to keep the existing ground level and construction following the climate change and sea level rise. Beside that the construction management by building and non-building are not described in this decision.

In reality, some research to build the building for farmer in this area applied. It is the combination of traditional and modern technology. Architect Vo Trong Nghia and his partner built the S-house type with the cost of one building is 80 million Vietnam Dong with full function that make designer to think about it. It is shown in picture 1.



Figure 1: Low price house proposed by Architect Vo Trong Nghia

However, this is the building derive from reinforced concrete column, roof from coconut leaves bellow and concrete wave roof above, the surrounding wall mainly made of coconut leaves. Main window are closed made of polycarbonate plate can receive the light go thru but now wind can pass. Main door are made of wood and polycarbonate combination. This type of house based on natural condition and based on the nature. This type of building is limited to apply since it only fit the demand of low cost and try to use the local material [3]. If the tide up, this one is not fit at all.

Besides that, some project was built to fit the tide condition but after tide down it is need to clean the room for using it (it is building with more than 2 floors). Then the cost for construction will be higher [4]. On other hand, during the tide up, the building can use one floor above only. If they need to use such kind of equipment, furniture, then they have to move to the next floor [5]. But if so, all the life condition will be messy and uncomfortable.

Need the solution that meet at least the following requirements for this type of building: (1) the leaving condition is not messy; (2) all furniture can be used in the building during the flood is raising; (3) low investment for building in such bad condition since their leaving standard is not so high.

II. THEORY AND BASEMENT

Decision No. 68/QĐ-TTg of the Prime Minister of Vietnam declared that the planning for Mekong delta should follow the trend of the world is sustainable development. Therefore, the construction to be done follow the rule that building shall be built to be aligned with flood stream to avoid the affection to the city. The development direction for rural areas follow the combination between old model and new one to be sustainable with the climate changes [6]. At the deep flooded, the building should be designed with the model of building resting on top of piles. Then the construction shall be done in the manner that resting on pile or column at the ground floor.

On the other hand, according to “Climate change and sea level rise scenarios for Vietnam 2016” [7] shown that some of that may happened in the future. And that may cause the deep flooded in some areas.

III. REALITY

Nowadays, there are some project are built with the following trends:



Figure 2: Two floor type resting on the pile and roofing system



Figure 3: Flooded but Building not rested on the piling system

There is a need to design a building system to meet the above requirement. It should be researched and proposed then apply to building can sustain under the flood condition under climate changes.

IV. SOLUTION TO BE RESEARCHED

Therefore, the uses of piling system applied for Mekong delta areas need to fit the following requirements:

a. Solution No.01: The building should have at least 2 floors with the deep flooded area (2m flooded area and above). Based on that the ground floor to meet the condition to harvest such as rise, corn, sugar cane,...The first floor level and above is the place for their leaving activities.

b. Solution No.02: The building is designed to meet the demand that it will not affect to their normal leaving condition when the tide up. Then it need a movement for their building in such way of moving in vertical direction to move their building up. Thus it should be design with minimum number of column but can stand for such kind of condition regarding to the structure aspect. Therefore the number of column will be workable with four columns. Due to the building will be worked under water condition with high humidity then pile system should be adopted.

Derive from those above two solution, it need to solve the problem accordingly.

In solution No.01 the first floor level shall be higher than 3m to make sure that the building is not flooded (the data from the recent report, the tide level is about 2m in comparison with ground level). However, to make sure that building should be stable and food are not flooded. It need to research in the manner to keep them dry and store in right way. And in the Mekong delta, the most popular transportation means and storage way are boat, ship or vessel. Then, the mechanical way is to build more boat to store the agricultural product such as rice, corn, potato, manioc,...In case of tide up, people need to draw the boat out of their house only, then they need to cover the food accordingly. The rest thing is to arrange them in a good way and right dimension for all type of agriculture product. We propose the boat with rectangular type, vertical wall then the arrangement will be better for all types of product. The height of wall boat dependent on type of material and to be calculated based on Archimedes' principle.

The magnitude of Archimedes' force is as following formula:

$$F=d.V=D.g.V. \quad (1)$$

While:

g: Gravity acceleration.

D: Liquid specific weight. This case it is water.

V: Volume solid occupation.

Nowadays, the farmer used to store their farming product in very small amount to avoid risk. The rest they will sell off to cut cost of storage and maintenance. Thus, they care only on some type of product such as rice [8]. Therefore to follow the Solution #1, the building to be design in such way that the ground floor height should be more than 3.5m to leave above the flood level. The column system should be designed to follow standard in this case is piling type. It can be made of concrete or steel that can resist the corrosion. The first floor can be design to fit the main demand for user such as bedroom, leaving room, kitchen,...At the ground floor, the supporting system can be used 4 main columns. The column spacing and span dependent on owner requirement but most of the case it shall be about 4m wide by 8m length as shown in figure 4 and figure 5.

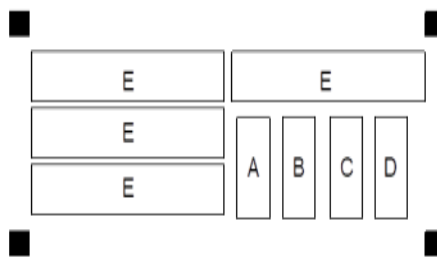


Figure 4: Ground floor layout plan (Solution #1)

(in which A,B,C,D: Location for farmer equipment, transportation means,...; and E: Location for boat (storage of agricultural products))

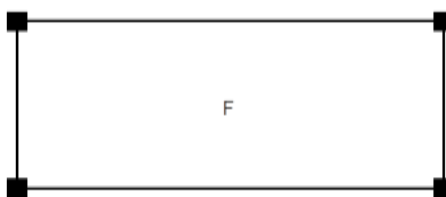


Figure 5: First floor layout plan (solution #1)

(in which F: for household layout plan)

For the Solution #2, it can be divided to two categories that using the theory that the first floor should be rested on one system that can be floated vertically. In this case the leaving activities will not be affected during the flood coming at any time. The solution 2a using gear system to move the building to higher level. However, this solution has some limitation. In this case we need to predict the highest level of flood so that we can design the column/pile to move inside along the column (refer to figure 7). The piling system inside the pile may affected by the weather condition. Then it need to maintenance timely.

For the solution 2a, the column system need to use round section then the movement will be better. Based on this solution, the building can be more than one floor if needed. In practice, the building at the rural areas, the cost of it is the most important to them since their leaving standard is not so high. To keep building floating along with tide level, it need to design the first floor resting on top of beam system that need to be strong enough to withstand the dead load at least. Then this system will be shifted along the column height. Figure 6 shown the column layout plan and shape of columns. Figure 7 shown the movement theory between pile and inside pile to move the building up and down.



Figure 6: Column layout plan for ground floor (Solution 2a)

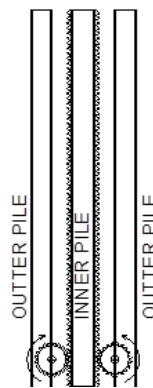


Figure 7: Theory for the movement of pile inside the pile and the gear system to move building up/down

Therefore this solution need to have a hydraulic jack to lift the building up and down thru the pile and gear. To make all the column up/down together we need to calculate the moment support for them to make all go the same speed. Beside that the maintenance is also required.

Solution 2b shown in figure 8 and figure 9 based on the floating water force. For this case, it will be cheaper and fit with most of the case for the water level rise. However, the number of float needs for each building should be calculated based on the total weight of that one. One thing need to consider that the float also need to be check timely to make sure it will work when the tide come.

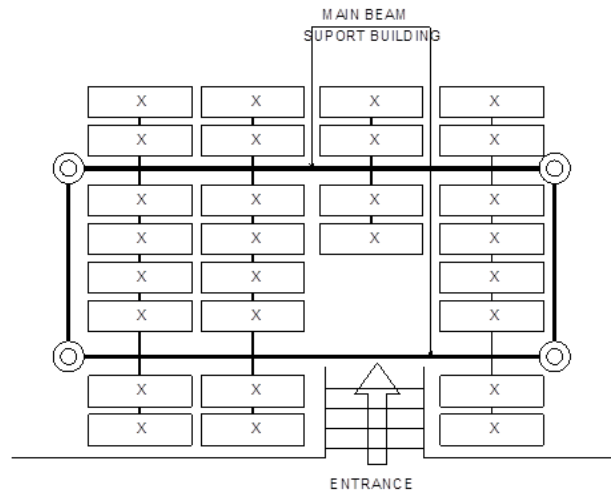


Figure 8: Ground floor layout plan (solution 2b)

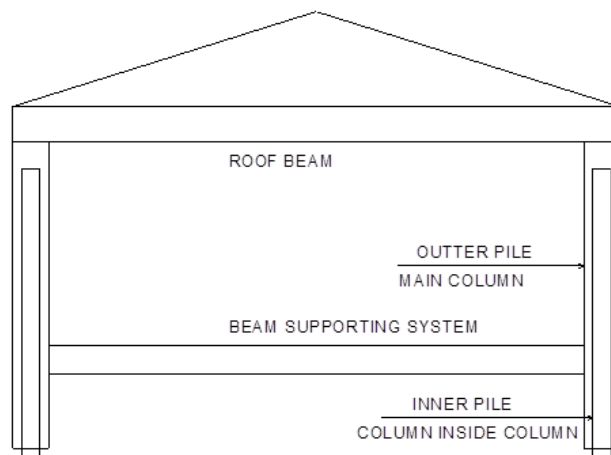


Figure 9: Cross section (solution 2b)

Beside the structure solution we can propose more non-structure solution to meet when the flood raise up. It is to train people to understand about this mater. It is to support them all the knowledge about the flood one is not only in bad side but also in good side. Such as flood can bring many alluvium for their crop. That make their crop over their expectation. This will help them to treat the flood season to be a friendly way and adapt the bad condition. They will not consider as a mystery nature.

V. CONCLUSION AND PROPOSAL

In summary, with the flood coming to the rural area due to weather change make the farmer life become more difficulty and not easy to manage. Building management is the mater to control and need to provide appropriate solutions. It is not only one solution alone but also a combination one. With the flood area was stipulated in decision of prime minister number 68/QĐ-TTg dated 15/01/2018 [1] regarding to the planning for Mekong delta area to the year 2030 and the vision to the year 2050 then the area #1: the height of inundated in average from 2m and above then the solution #1 or solution #2 is acceptable. However, we need to have an accurate forecast the level of inundated so that we can design the building with better result.

For the area 2 to area 4 the height of inundated is 2m maximum then the solution 2 is not sufficient for their leaving condition. It need a higher investment then it may not work for them due to high cost of investment and normal operation. Thus the solution #1 in this case show that it will make them fit the demand and economic side. The solution #1 will help them saving cost and keep people leaving in good condition. It will follow the trend of worldwide development for the sake of sustainable environmental development under climate change.

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