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# Stage House, A Strategy for Coping with Tidal Flooding in Semarang

Etty E. Listiati\*, Tyas Susanti\*, IM Tri Hesti Mulyani\*, and Widija Suseno\*\*

\* Faculty of Architecture and Design, \*\* Faculty of Engineering  
Soegijapranata Catholic University, Semarang

DOI: 10.29322/IJSRP.8.11.2018.p8387  
<http://dx.doi.org/10.29322/IJSRP.8.11.2018.p8387>

**Abstract-** Rising sea levels and land subsidence in Semarang has caused some areas in Semarang, especially the areas close to the sea, has experienced tidal flood. The tidal flood become worse when it rains because the volume of water is raising. One of the area which experience tidal flood is RW IV, in Kemijen, East of Semarang

The solution which can be done by the community is lifting the ground and raising the level of the house's floor. This effort need a lot of money, and it has to be done every 5 (five years) to anticipate the tidal flood. Some residents with low economic ability have difficulty to raise the floor because of the financial factor. As a result, the low income family have to face the environmental problem and they have to stay with the water when the tidal flood come.

One of the solution is to build a "stage house". With stage house, water cannot reach the floor and does not disturb the activities of the family member. The proposed stage house model is 1.5 meters above ground level / road surface.

This research is a follow-up research (2nd year research) where the design of stage house as the result of the first research, is applied. The application of the design is done in RW IV. In the development of this adaptif house for tidal flood, the community approach has been used as a major approach. Community participation can be seen from the initial process of identifying problems to the final step which is building the stage house.

With the model of this stage house is expected to give a solution for tidal flood in Semarang.

**Keywords-** Semarang, Stage house, Tidal flood.

## I. INTRODUCTION

Tide always happened in Kemijen, especially when it rained. A very high tide occurred in 2006. Almost the entire area of Kemijen was inundated by the tide. However, at present (in 2018), most of Kemijen area have been spared from tidal flood due to the pumps at River Banger. However, the area of RW IV still frequently had the tide due to poor drainage. With the tidal flood, it disrupted the people's activities of residents, so, until recently, some residents are still doing the construction by raising the level of the house's floors to avoid tidal flood. When a tide happened, it was very troublesome for the residents and disrupted their daily activities with inundated feet. Therefore, in order to have their daily activities, when a tidal flood occurred, a stage house was proposed for the flood-stricken area. Stage house is a building where the floor level is raised from the ground or water.

In this research, the model of stage house was proposed with the height of 1.5 meters above ground level. The heights of the house floors were calculated against the height of the tide and the land subsidence that occurred in the area; about 5.75 cm - 13.5 cm [1]. The proposed construction of stage house was intended to avoid the landfilling when elevating/ raising the level of the house's floors, which was usually done by the residents to avoid tidal flood. As a result, landfilling will cause new problems because the tide water will move to other lower areas or bare land. By using the shape of stage house, the water under the floor of the houses still flows as usual, and environmental ecosystem is not disturbed.



**Figure 1: a/left ) A house with raised floor level (Mr. Mahdi's house), b/right) a house without the raising of floor level (Mr. Bambang Susilo's house)**

## II. METHODOLOGY

This research was an applied research. Based on the observations made in the field, the problems faced by the community of Kemijen had been identified. The problem of tide has been the problem faced to present. The results of this study are expected to be able to overcome the tide problems related to their homes.

Applied research, according to Maryati, is a research that provides practical and useful solutions [3]. Applied research focuses on the application of the research results in daily activities rather than the development of theories or ideas. The main characteristic is that the impact can be felt directly and implemented in real conditions.

To obtain the data, the first step was making field observations along with an understanding through library study related to the environmental problems in Kemijen area. In the observation, interview method was also conducted using key resource person. The results of observation, interview, and library study were the first step of making hydraulic stagehouse.

2 The design of stage house was made by taking into account the environmental conditions in Kemijen area and the economic capabilities of the Kemijen community affected by tide. The finished design was then socialized to the public. Then, the next step was to apply the design to the selected locations. The site determination was also considered together with the community so that its implementation was not misplaced. In its application, community participation was the main element through mutual cooperation mechanism.

## III. RESULT AND DISCUSSION

### A. Location of Stage House Buildings

In this study, the stage house was made 1.5 meters higher from the road level to anticipate the presence of tidal flood and the land subsidence in Kemijen Village. The height of the road was taken as the estimation point (standard) for the height of the floor level of the stage houses, considering the road in the neighborhood was always raised to counterbalance the tidal flood.

With the stage house, it is expected that the residents can still move as usual because their feet were not wet because of the water. The stage house in this study was built to the home yard of Mrs. Hanifah (Mr. Heri) which was still often exposed to tide (the puddle of tide was found) at RW IV (Rukun Warga IV). The home yard of Mrs. Hanifa still had the vacant land with 6,9 meters x 7,5 meters, which was always inundated with water. The stage house built was positioned adjacent/ coinciding with the old/ original house building so that it can be interconnected later.



**Figure 2 : Mrs. Hanifah's house (a) front view (b) the yard inside the house**

Mrs. Hanifah's house was one of the houses which was not raised. The house floor was lower than the street.



**Figure 3 : The location of the stage house to be built in the yard inside Mrs. Hanifah's house.**

Mrs. Hanifah's house (the old/ original building) was always exposed to tidal floods since the floor of the house building was still lower than the street level. In addition, the house was located near a pond, so it affected the groundwater level. The condition made the research team try to make Mrs. Hanifah's house in such a way so that they had a space avoided from puddles. For this kind of environment, the appropriate type of house is a stage house. Stage house does not create the problem of eco system because there is no land filled [2]

The presence of the stage house of 1.5 meters higher from the ground level was useful as the empty space under the floor could be used for other activities, such as sitting around while chatting and relaxing. It can be done when there is no tidal flood.



An empty space under the stage house

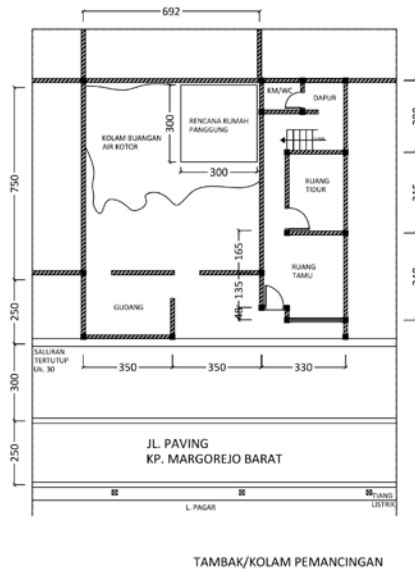
**Figure 4: An empty space under the stage house**

Given the home yard was flooded quite widely, it is expected that the house can be developed later. Hence, the stage house was built adjacent to the old building.

### B. Dimension of Stage House Building

The stage house made with the dimension of 3 x 3 square meters is a roofed room and given a covering wall and doors. The space can be used for the regular activities (rest, sleep, sitting) of the occupants (more than one). The size of 3x3 square meters was taken based on the module of the average house size in RW IV of Kemijen Village (9 x 13 square meters).

The stage house that had been made (completed in June 2018) has been used by the residents as a place to rest/ sleep and other activities by family members. Basically they are very happy because they have a dry place and not inundated.



**Figure 5: The sketch of Mrs. Hanifah's house and the position of the stage house that would be built over the inundation of tidal water**

### C. The Use of Tidal Water for Bamboo Preservation

The stage house was made of bamboo. Bamboo was selected as the main building material because it is light and easy to find. As a building material, bamboo can last long when preserved in advance. It was also applied on the stage houses made/ built. The bamboo used as a construction material was *petung* bamboo. For the pillar, the bamboo used had the diameter of 15 centimeters. The bamboos were preserved before they were used for the buildings. The preservation was done by soaking. Given that the environment, including Mrs. Hanafi's yard, had a puddle of tidal water, the bamboo soaking was done in the location as well so that the implementation was relatively easy and close for the transport.

To reach the house floor of 1.5 meters, the stairs of bamboo were made with the width of 90 centimeters the height of 20 centimeters.



**Figure 6 : The stairs to the stage house made of bamboo**

#### *D. The Construction Execution by Mutual Cooperation (Gotong Royong)*

The implementation of the construction of the stage houses is expected to be carried out by mutual cooperation by the residents due to the togetherness (guyub) of Kemijen residents especially in RW IV. The preservation of bamboos could be done in Kemijen environment which was still inundated (swamp area), and the bamboo work required no special skills. Because the tidal water was not always inundated, in low tide (wet-dry), the bottom of the stage house used galvanized iron or concrete material that was relatively resistant to wet and dry conditions alternately.

The floor of the house was also made of bamboo blades that could be made by the residents, and then the blades were woven.

For the rafter, the bamboo with the diameter of 8 centimeters was used, and for the batten, bamboo blades were used and made by the people in a mutual cooperation.



**Figure 7: The soaking of bamboos in tidal pond**

#### *E. Connection of Stage House with Original House*

At the time of the construction, a communication was attempted with the homeowners in order that the completion could be adjusted to the expectations of the researchers and residents. Then, the directions of doors, windows and stair position were discussed to avoid future problems.

The stage houses were built adjacent to the old/ original houses, allowing the "interconnection between buildings/ spaces". In addition, in the other parts, there were still water puddles used for bamboo soaking.

In the figure below (figure 8), it shows the connection between the original house and the stage house.



**Figure 8:**  
**Front View of Mrs. Hanifah's House Before Stage the House Construction.**  
**Front View of the Stage House from the Street (the front side of Mrs. Hanifah's house).**

#### *F. The Appearance of Stage House Building*

For the appearance/ facade of the whole stage house building made of bamboo, it was finished using brown varnish, which did not change the natural color of the bamboo. This bamboo stage house can be seen from the front side of Mrs. Hanifah's house, so it is quite a contrast with the surrounding houses. Natural impression appears in an area that is friendly to nature in the area dominant with water.

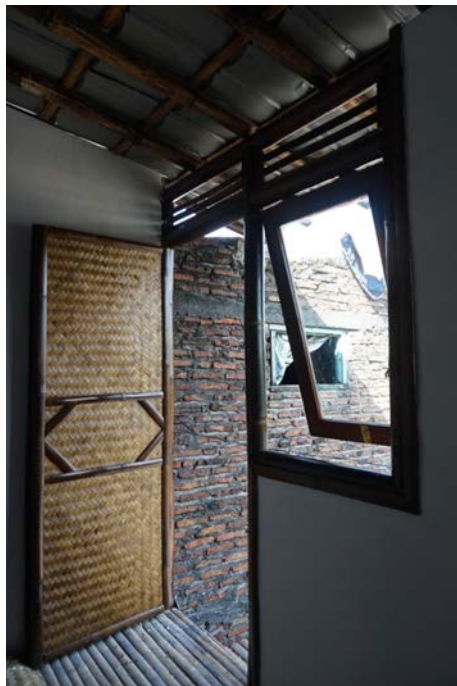


**Figure 9: Outside view of Mrs' Hanifah's stage house looks natural because the building materials are dominant with bamboo.**

For the building blanket, woven bamboo was used on the outside part, so the woven bamboo can be seen on the building facade. For the inner wall, calciboard was used as covering wall. It was used to avoid any disturbance of rats and other insects (when bamboo woven is still used) since the plaited bamboo is vulnerable to be gnawed by rats. However, with a closed calciboard, the wall pores of woven bamboo for circulation are blocked. Therefore, it is necessary to make windows for air circulation and lighting as well as outlook. In the stage building, windows were made on the front side, next to the door. It is adequate for lighting, but it is not adequate for circulation. Therefore, ventilation holes are still required. For this stage house model, the back side is neighbor's wall, so windows cannot be made. The possible solution is cross-ventilation is made on the left-right side wall as the side is still the land of Mrs. Hanifah's house.



**Figure 10 : the stage house's floor;preserved bamboo blades were used**



**Figure 11 : a)Window for lighting b) Wall cover of calciboard; rafter and batten of preserved bamboo**

The presence of inner walls made of calciboard is expected to be painted with a color that suits the taste of the occupants,so it is more comfortable to live in. The shape of the roof is lasenar with the roof angle of 16 degrees. The shape was chosen in order that the implementation and construction of the stage house is quite easy and efficient. The houses has no ceiling so that the cost of building and construction is lower. However, in the absence of ceiling,it makes the inner space rather hot during the day because there is no air space between the roof and the room. For roofing materials (metal roof),it is made of metal and asphalt that causes solar thermal radiation propagate into the house/ space. The roof materials were chosen because it is relatively light and reasonably priced.

#### *G. Model of Public Participation*

Public participation is interpreted as a process of community involvement in various activities. The process can be undertaken for the sake of development by harmonizing their abilities without sacrificing their interests [4]. In the application of hydraulic stage house design,it was implemented using public participation approach. The form of the participation can be seen from the selection of locations where the stage house would be placed. The determination of location was not done unilaterally but through the agreement made in RT's (Rukun Tetangga) meeting. RT (Rukun Tetangga) is the smallest organization and the closest in having direct contact with the community, and within the scope of the RT, the people usually communicated with each other and interacted intensively through various activities, such as social gathering and other activities. At the RT level, the guyub (mutual assistance) is highly apparent especially in the area of Kemijen.

In addition, community participation is also seen in the construction of stage houses. The community work together to provide food and drink for the workers who built the house on stage. In the process of development, inputs from the community such as RT



chairman and homeowner always accommodated and accommodated by the research team so that the form and application of the stage house in accordance with the needs of its users.

#### 6. CONCLUSION

The shape of the stage house can solve the problem of designating a house in tidal flooded area because the house is not inundated with tidal water. The height determination of the stage house can be based on the average data of the existing tidal flood. However, for tidal regions with land subsidence, such as Kemijen area, it is necessary to also consider the height of the stage house in relation to the average annual land subsidence.

Bamboo stage house building can be durable when the bamboo used is previously preserved. Preservation can be done by soaking in tidal water that inundates the environment.

To save the cost of the house construction of the stage house, bamboo was used as the main material and carried out in a mutual cooperation. The poor condition of the community of Kemijen economically makes the construction of stage house for the residents more suitable for the people. In addition, the mutual cooperation of the people/ community participation in Kemijen area is very good.

#### ACKNOWLEDGEMENT

Thanks to the Directorate of Research and Community Service, the Directorate General for Research and Development of the Ministry of Research, Technology and Higher Education who had funded the research for PTUPT Scheme.

We also thank to Mrs.Hanifah family and the Head of Village, staffs, and residents of Kemijen Village who were very helpful to the research team in searching the data as well as applying the design.

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#### AUTHORS

**First Author** – Etty Endang Listiati, Lecturer on landscape Architecture and Behaviour Architecture, , Faculty of Architecture and Design, Soegijapranata Catholic University, email: [etty@unika.ac.id](mailto:etty@unika.ac.id)

**Second Author**- B.Tyas Susanti, Lecturer on Antropology, Faculty of Architecture and Design, Soegijapranata Catholic University , email: [santi@unika.ac.id](mailto:santi@unika.ac.id)

**Third Author**- IM.Tri Hesti Mulyani, Lecturer on Ecological Architecture, Dept of Architecture, Faculty of Architecture and Design, Soegijapranata Catholic University, email: [mulyani@unika.ac.id](mailto:mulyani@unika.ac.id).

**Fourth Author**- Widija Suseno, Lecturer on Civil Engineering, Faculty of Engineering, Soegijapranata Catholic University, email: [widija@unika.ac.id](mailto:widija@unika.ac.id)

**Correspondence Author** – B.Tyas Susanti, [santi@unika.ac.id](mailto:santi@unika.ac.id), contact number +62 813 262 79547



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