



Evacuation Preparation Equipment for Infant in a Flood Disaster a Case Study in Baleendah, Bandung Regency

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Abstract

Bandung Regency is one of the areas located on the banks of the Citarum River. Therefore, it risks flooding, especially in the rainy season. One of the flood disaster victims is an infant. When a flood occurs, infants rely on help from adults to survive. Currently, there is no special equipment to support the pre-evacuation and evacuation of the infant during the flood. Based on the abovementioned concerns, a means for evacuation is required so infants can avoid the flood and ease the evacuation. The method used in this research is Human Centered Design through three stages: inspiration, ideation, and implementation. The result of this research is the design of an infant evacuation preparation facility with the concept of a baby crib. This crib functions as a means of safe evacuation of infants. In addition, this crib can also be used in daily activities such as bathing and putting the baby to sleep. Storage and distribution processes can be carried out more efficiently and save space using a modular system.

Keywords: Flood, Infant, Baby crib, Evacuation facilities

INTRODUCTION

There are various types of natural disasters, one of which is floods. Flood disasters could generally be understood as a relatively high flow of water that exceeds the plains line and is no longer accommodated by the volume of rivers or waterways, causing it to spill over and inundate plains inhabited by humans (Nuraeni. 2012). Flood disaster is a phenomenon that often occurs in Indonesia. West Java Province is one of the provinces with the highest disaster risk in Indonesia (BNPB. 2013). In urban local fencing occurs at the time of the season rain, the scale of the flood that occurred was quite large and cannot be controlled dominantly. This matter requires coping strategies comprehensive and multi-stakeholder (Sebastian. 2008). There are various causes of flood disasters, floods can occur due to high rain intensity and rain that lasts for days. Soil erosion or poor waste handling is one of the causes of water from rivers and canals overflowing and flooding the surrounding areas (IDEP. 2005).

One of the areas in West Java that often experiences flooding is Bandung Regency, which is because the Citarum River drains the Bandung Regency area. Bandung Regency is a plateau in the form of a basin where the Citarum River, as the central basin, becomes the mouth for tributaries from the north, south, and east (Pemerintah Kabupaten Bandung. 2020).

Geographical conditions coupled with the existence of the Citarum River Basin or Daerah Aliran Sungai (DAS) have caused the level of vulnerability to natural disasters in Bandung Regency to be quite high (Akbar. 2018). That causes residents who live in Bandung Regency to be at risk of flooding when the rainy season arrives and the water discharge in the Citarum River increases (Bainus. 2020). In addition, the water catchment area around the tributary area of the Citarum River has now changed its function as a building so that when the water overflows, it will enter residents' housing around the riverbanks. Various kinds of threats are faced, such as flood currents, water depth or level, objects carried by currents, the appearance of venomous animals, electric shocks, collisions, and polluted water, which carry diseases that cause health problems. Apart from the danger during a flood, several diseases need to be watched, including dengue fever, leptospirosis, ARI, diarrhea, and hypothermia (Lemonick. 2011).

Almost every year, the inhabitants of the riverbank areas are prepared to face the danger of flooding, so the community has adapted to floods (Nurwulandari. 2021). As an area that is frequently flooded, residents of Baleendah District have made several anticipations to deal with flooding, including increasing the height of the floor, adding a mezzanine, having a rented house as a temporary residence, and building a house into 2 floors. In addition, several RTs, accommodations for evacuation in the form of *jukung* boats. However, boats are only owned in some RT, so evacuating residents takes time with dependence on waiting for other residents to use boats.

From this threat, there are vulnerable groups to floods, one of which is infants (Kurniasih. 2017). This is because infant is in a condition where they are unable to make decisions and still need help in all their activities and have immune systems that are still vulnerable (Noor. 2009). When a flood disaster occurs, the evacuation process for people who have infants will save and evacuate the infant first. If the flood comes suddenly, the parents will immediately evacuate the infant to a safe location using makeshift equipment to protect the infant from flooding, such as a baby tub and bucket. The infant will be in an uncomfortable place as it is.

Based on the priority level of interest translated through Design Requirements and Objectives (DRO), there are 4 aspects to answer needs related to equipment used for infant, including safety, accessibility, operations, and durability (Nopsa. 2017). Safety factor with attention to security and safety by established regulatory standards (Handayani. 2019). Accessibility by accommodating the

needs of parents to be close to the infant, watching the infant, and accommodating activities related to the infant's care process. Operational through a system mechanism that is easy for users to operate. Durability factor with products that can be used and utilized for a long time and meet infant's needs.

Currently, no evacuation facilities are available that can be used as a means of special evacuation preparation for infants as first aid facilities in the event of a flood. Therefore, we need an evacuation facility for infants specifically for flood disaster conditions that can be used as evacuation preparation. The design process aims to find a design for infant evacuation facilities when a flood occurs by considering human, service, and environmental aspects by fulfilling 3 stages of the incident: pre-disaster, emergency response, and post-disaster.

METHOD

In designing evacuation facilities, the research process used is qualitative with the Human Centered Design method. Human-Centered Design (HCD) is an approach to developing products that focus on humans or users. Designers carry out the process of designing products or services according to human needs, habits, and capabilities (IDEO. 2015). In the process, the HCD method begins with understanding people first and knowing what their needs are through a process of observation. The design process uses the Human Centered Design method through three stages: inspiration, ideation, and implementation.

A. Inspiration

Several processes were carried out during the inspiration stage, including secondary research, observation, and expert interviews. The secondary research process is the collection of literature data related to field conditions, flood disasters, and assistive devices. After obtaining the data, the analysis includes a comparative analysis of existing products. Then, expert interviews were conducted with 10 informants and BNPB members involved in dealing with floods in the Baleendah District, Bandung Regency. In addition to conducting interviews, observations were made when the researchers were in Baleendah District, then confirmed the data obtained during field observations through expert interviews. After receiving interview and field data, the next step is to process the data by analyzing interviews and field observations. The last process in the inspiration stage is to carry out an evacuation simulation test in water using models and infant.

B. Ideation

At this stage, the process of filtering various ideas is carried out to produce a simple prototype. Several processes are carried out at this stage, starting from creating a framework, namely determining the mood board for product design. Next, analyze the Business Model Canvas as a thinking process based on social and service aspects. Before designing a product, an idea is carried out through a visual concept through a storyline in the form of a storyboard. A storyboard is a narrative delivery related to distributing the product's use. The last process in the ideation stage is the rapid prototype, which is the process of visualizing the inspiration and ideation stages that have been carried out. The rapid prototype resulted in four alternative flood evacuation product designs.

C. Implementation

The implementation phase focuses on testing and evaluation. At this stage, it goes through several processes, including prototype trials of the four alternative designs that have been made and prototypes using 3d printing with a scale of 1: 6 to determine the design's advantages and disadvantages. Then carry out an analysis of the four alternative designs. After the design analysis, a get feedback process is carried out. In this process, data collection is carried out related to input on

the designed designs. Interviews were conducted, and questionnaires were distributed to prospective users to obtain feedback on the designs that had been designed. After getting input on the design, an evaluation process is carried out to get the final design. The evaluation process is carried out to add to and improve the results of the analysis of alternative designs based on expert input.

FINDINGS AND DISCUSSION

The product design for infant evacuation facilities during a flood occurs through inspiration, ideation, and implementation. Based on the analysis that has been carried out, the product for infant evacuation facilities for flood disasters is in the form of a crib. This product has the main function of an evacuation facility. Still, apart from being an evacuation product, this crib has other functions that can be used as an everyday product, such as baby bathing facilities and baby sleeping crib. This crib can be used by infant aged 0 to 6 months, and this is because the activities of infants aged 0-6 months are sleeping, bathing, playing, eating, drinking, and breastfeeding.

Baby Crib

The crib has dimensions of length, width, and height 86 x 53 x 81.4 cm with a weight of 1325 grams for the crib and 544 grams for the legs. Using polypropylene plastic material, silicone synthetic rubber, and memory foam with a maximum capacity of 73.7 liters. This crib has several parts:

- A top cover (gauze cover and transparent cover)
- A baby cribs
- A memory foam mattress
- A kangaroo blankets
- Crib legs

The baby crib has a handle, hook, cleat hook, handgrip, bevel baby crib, reflector, and fender ring. At the bottom, it is designed to be anti-slip. On the mattress using memory foam, which is combined with a kangaroo blanket, on the right and left sides, there is a zipper or zipper. Products can be stacked in up to three cribs. Product maintenance can be done when converting the product into an infant bath facility. In the process of bathing the infant, it functions to clean and maintain the cleanliness of the crib. This process is to determine whether there is a leak from the crib. It can also be used as a baby sleeping crib for daily use. If the baby crib is not used, it can be stored in a more compact form. Figure 1 shows the image of baby crib for evacuation in various position.



Figure 1. Baby crib for evacuation in various positions.

Operational

a. Product Assembling Process

The operation of this product is assembling components by assembling crib legs by adjusting the color of the pin connection with the hole. The process of assembling a baby crib is enough to place the grip of the baby crib in the grip hole on the foot of the crib and put a memory foam mat in the baby crib. On the side on the transparent side of the crib, the installation is inserted from the top

side and attached using sealant in two directions.

b. Bathing Infant

Process when this product is used for bathing a baby, all that needs is to open the top cover of the crib and remove the infant mattress. The crib can be separated from the upper crib with the legs. Next, an adult can pour water into the crib to bathe the baby. After bathing the infant, the crib will be used again as a bed crib. All that needs to be done is to dispose of the remaining bathing water by tilting the crib, then rinsing it with clean water, dry the inner surface of the crib then reinstall the baby mat. Figure 2 shows the dimension of the product design while figure 3 shows the components and parts of the baby crib.

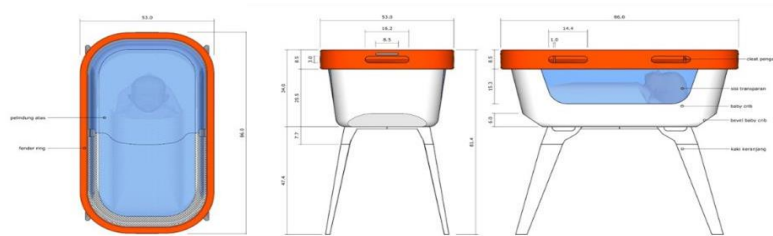


Figure 2. Dimensions of the product design

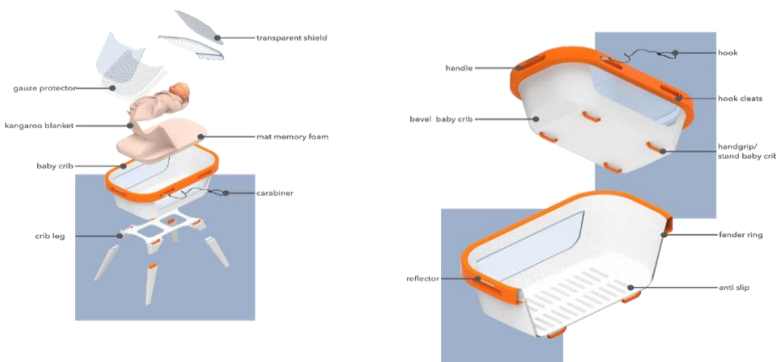


Figure 3. Components and parts of a baby crib for evacuation

c. Putting Infant to Sleep

A crib will be used as an infant bed to put the infant to sleep by placing the infant on a mattress. Next, cover the infant with a kangaroo blanket attached to the mattress, then close the zipper on the right and left sides of the blanket. To prevent the infant from being bitten by mosquitoes, you can complete the crib using the top protector with a transparent cover.

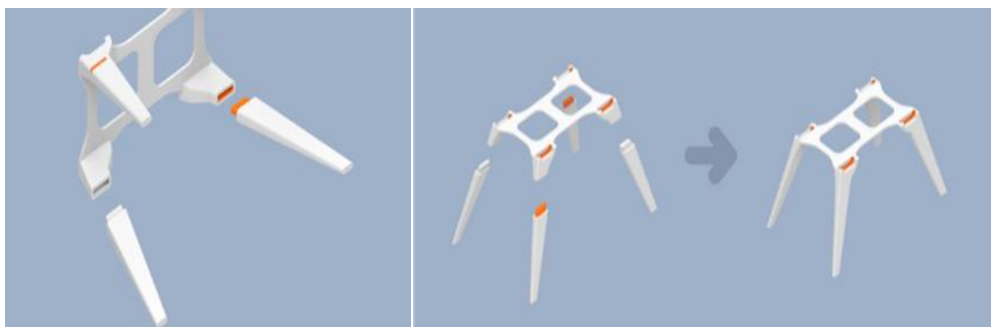


Figure 4. The process of assembling the crib components by matching the color of the pin connections.



Figure 5. Components and parts of a baby crib for evacuation



Figure 6. The process of cleaning the baby crib before it is used again to put the infant to sleep.

d. Evacuation Process

When evacuating, ensure the infant is on a mat and the kangaroo blanket covers the infant's body. Attach the top protector and the glass guard to avoid splashing rainwater and flooding. Attach the straps to the cleat hooks. Lift the infant bassinet and make sure the legs of the crib are released. In the evacuation process involving only one person, all that needs to be done is to hold the front and back sides of the bassinet or the bottom of the bassinet. When the evacuation process involves two people, have the side of the bassinet or the bottom of the bassinet. When a flood occurs, the fender ring keeps the infant evacuation crib balanced, but adult users remain vigilant to ensure that flood water does not get into the baby crib.



Figure 7. The process of using a baby crib as a means of

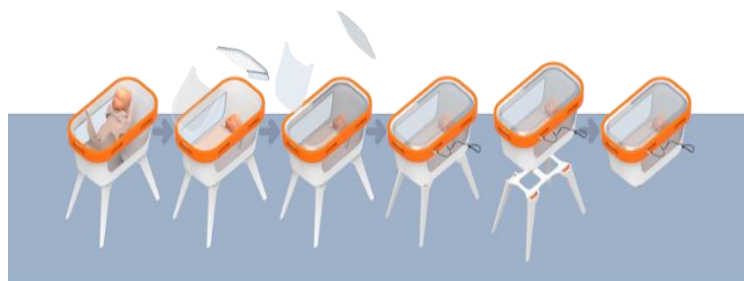


Figure 8. The process of evacuating infant when a flood occurs.



Figure 9. The process of evacuating infant when a flood occurs with the help of one or two people.

Storage and Distribution Process

When the baby is grown up and the baby crib is not used again, it can be stored neatly. The system used in the process of storage efficiency and saving space is using a modular system. The modular system's function is to facilitate storing and distributing baby cribs to the public. The storage efficiency process is finished by putting all the components into the baby crib basket. When baby cribs are in large quantities, they can be arranged by stacking them in multiples of 3 for efficient distribution and storage.

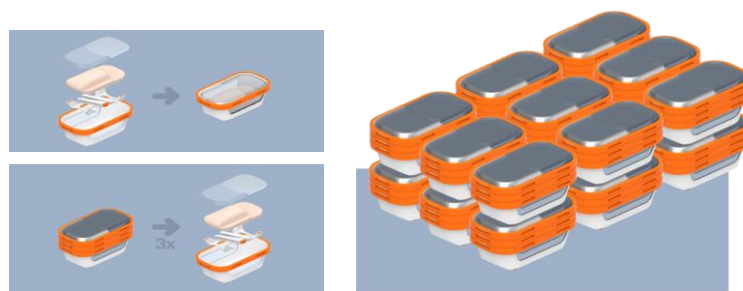


Figure 10. Configuration of a baby crib in compact form

CONCLUSION

Based on this research, it is known that the condition of the people of Baleendah District, Bandung Regency, still has limitations in the evacuation process when a flood occurs, especially in the evacuation of infants aged 0-6 months. This research seeks to solve problems related to threats faced during evacuating infants and preparing before a disaster occurs because the case of Baleendah Sub-District is an area that experiences seasonal flooding. Unlike the previous safety products, this product is an infant bassinet that is designed according to regulations set by the government by considering the safety of users, namely infants. This product can also accommodate parents to supervise infants and volunteer teams in evacuation from disaster locations to other locations. Safer or transfer to a rescue boat in hard-to-reach areas. Apart from being a means of evacuating infants during a flood, this basket has another function: bathing infants and sleeping facilities for infants. So that if a sudden flood occurs, the adult can use the crib immediately.

This research shows that pre-disaster infant evacuation preparation facilities have a role that is more than a supporting tool in securing disaster management efforts. However, evacuation preparation facilities can support the process of finding, reaching, securing, and transferring infants during a flood. Increasing the function of this evacuation preparation facility can add value to the evacuation product, functionally, and experience for the rescue team, parents, and infants. The process of improving functions can be carried out based on safety, accessibility, operational, and

durability aspects by considering the stages of disaster management, starting from the pre-disaster, emergency response, and post-flood disaster stages.

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