Team Philippines’s Shelter For Displaced Families

Section 025

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Prototype #2
Mission Statement, Concept Refinement, and Re-Design Ideas:
Team Philippines is a non-profit organization. We are based in the Philippines and was created by group of young individuals who saw there was a need for the reconnecting of families. Our employees and our volunteers have been working nonstop to reunite families after they have been displaced due to a natural disaster. We believe that one major step to doing this is first giving these displaced people a roof over their worried and traumatized heads. This roof will not replace what they lost but will give them a good start to reconstructing their lives in the aftermath. Our design for these home a pretty simple and basic. This means it can be easily and quickly constructed. This will give the people one less thing to worry about while they reassembly everything.

We have a few problems with our first prototype. Mainly, it was with the roof. In the first prototype, the roof wasn’t connected to the walls and when we did our crush test, it was the first to fail. We all decided that this was what we were going to change. So our second prototype is a lot like our first prototype but we changed the design of the roof. Our second design does not have a roof with two sides. We decide to make our roof a flat plane that is slanted downwards toward the front door. And because we had so much extra space, we gave the families extra closet space.

We suggest that other teams take the individual brainstorm process extremely. We all had different ideas and concepts and because we took this section of the project seriously we were able to create of first prototype. For example, one member had an idea to add windows all around the house to save money on lighting the house and ventilating the house. While another member came up with the idea to create have a slanted roof so it would be easy to catch runoff water so that the family could use it for something important. Ideas like these were how we were able to come up with this design. The only hard part was finding a way to incorporate all the ideas in the house, so we have so we had to pick and choose which ideas would be the most beneficial to the displaced families.

Our dream prototype would include all the ideas we had and would cost no more than five dollars to construct. We would have solar panels on the roof for clean energy. We would have it made of some kind of carbon based materials so it would be flexible while also being durably. We make the house much more comfortable by adding the restroom and washing/dying machines inside the house. We would want to add more furniture. We would also want it to have all the personal items the families had in their homes before it was destroyed. Of course, this would be unreasonable due to the fact that this is just a temporary home.
Consideration of Human Needs and Consideration of Overall System:
In our design project we covered all human needs[2] from the base of pyramid to the top. First, we started from basic needs like water, food and sleep. Since we selected a tropical environment[3] to build shelter, we came up with the idea of collecting rainwater that is going to fall on the rooftops. We designed a slanted roof that has drains on the edge to collect the water and we added filters inside the drains to clear the dust from the water. Eventually, we decided to have pipelines to transfer the water to the faucet located in the common area and we included a reservoir to store extra water. Considering their need for sleep we decided to give six beds to each shelter and our charity will be responsible for providing food to displaced people. Regarding security and safety needs, we designed three separate rooms that have two beds in each of them for people to have privacy. To maintain the security we put locks to the outside doors of the shelters. Considering their social needs, we created a common area inside the shelter for people to socialize and build friendships. As we moved toward to their self-esteem and self-actualization needs, we imagined a system that people can fulfill the feeling of accomplishment by being awarded for their contribution to their community. In other words, everybody will be assigned to a job such as nursing, cleaning, teaching or cooking in order to sustain a social cooperation within the community. As a result, displaced people will obtain a continuity of their society through the incentives that will be provided by our charity.

As we were designing our first prototype, we researched for materials that have been used in Philippines to build shelters. From our research, we decided to use coco lumber and amakan fabric for the structure of the shelter because of their wide availability also; those materials were quick and easy to construct in few hours. Besides the materials, we also designed the shelters in a square shape to save space and fit more shelters into our area. We planned to set the houses in a field as large as a regular football field[1], which is 110 meters (150 yards) long and 60 meters (65 yards) wide. From our calculations, we found that we can fit 120 houses and 30 public restrooms into the area with 80 cm space between the houses. Therefore, we accommodated the needs of the secondary customer by using low-cost materials, a design that can be built easily and installed right next to each other without sacrificing any space.
Test Summary #1 and #2 & Cost Analysis

Test Summary #1

<table>
<thead>
<tr>
<th>Safety</th>
<th>We will use strong materials for the outside of the shelter</th>
<th>If the outside material is stronger than the inside</th>
<th>Foam board</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Cost</td>
<td>We will calculate the cost of building the shelter</td>
<td>If the model is under five dollars</td>
<td>Papers calculator</td>
</tr>
<tr>
<td>Durability</td>
<td>Crush Test</td>
<td>If it remains undamaged under the weight of 8 books</td>
<td>Books Crush test setup</td>
</tr>
<tr>
<td>Privacy</td>
<td>If the walls separate rooms from each other</td>
<td>If we can assign separate spaces to people (no more than two to a room)</td>
<td>Cardboard model walls</td>
</tr>
<tr>
<td>Low Energy</td>
<td>Cut out windows and see where light can reach to cut down on lighting costs</td>
<td>If all areas are illuminated by outside light</td>
<td>Phone flashlight</td>
</tr>
<tr>
<td>Waterproof</td>
<td>We will pour water over the house to see if there are leaks</td>
<td>If no water enters the shelter it passes</td>
<td>12 oz water</td>
</tr>
</tbody>
</table>

Prototype #1

Our safety, low cost, and privacy tests were all very successful on our initial prototype (see table 1). The floor plan and design met expectations and remained relatively unchanged. The durability test went fairly well for the floor and wall structures. The roof, however, caved in under a low amount of pressure due to poor construction, as well as the fact that the roof was
supported by itself in the center and nothing else. In our water proof test, the walls and roof held out water just fine, but the flooring had soaked through. After water ran off the roof, it settled right on the side of the house and just seeped into the bottom. Our low energy test also passed for the main internal area, but the private rooms were not getting as much light.

After we tested our first prototype, we made a few changes. First we changed the roof structure from a triangular structure that leaned on itself, to a sloped roof that distributes weight onto the wall supports. This structure also gives more control over the flow of rainwater, as all water on the roof will flow in one direction. The structure was also raised the house using stilts like traditional structure in the Philippines[6]. This prevents water from seeping in through the floorboards and compromising the integrity of the rest of the structure. This makes the structure more waterproof and durable. Lastly, windows were added to each individual room, excluding the closets, to allow daylight to be used as a light source and cut down on energy costs. These windows can also be shut.

With prototype 1 the cardboard model cost about $3.25 to make. The full final model cost approximately $825 full sized and made with proper materials. As far as upkeep goes, the only areas that could use replacements are the windows. In the worst case scenario, in which all windows break at once, the repair would only be $15. The material we chose for the walling is amakan, and coco wood for the supports. These materials were chosen as they are local to the Philippines and have been used in many refugee camps in the past. The flooring would have to be a bit sturdier, as the structure is raised off the ground, so it is planned to be made of oriented strand board.

- Estimated cost using cardboard $3.25
- Estimated cost using desired materials $825
- Possible upkeep cost $15
- Using local amakan weaves and coco wood due to low material cost and simplicity to acquire [4]

**Context and Customer Need Development & Concept Generation Summary**

Most of our ideas for the development of our shelter were gathered from the Internet and based on historical events that occurred in the Philippines. We searched past shelters constructed in the Philippines after disasters occurred and examined their physical structure to get ideas for the architecture of our shelter. Furthermore, we researched the climate of the Philippines to select appropriate products for our location [3]. The Philippines was found to be a relatively warm country hence we suggested that only a fan and a couple windows were necessary for the internal conditions of the shelter. Additionally, we decided to make the washing machines, bathrooms and refrigerators commutable by placing them outside of the shelter. This would be appropriate considering that the weather isn’t cold and unbearable to reach to these commodities. Lastly, a
dryer was found to be unnecessary and expensive and a replacement for this was clothing lines that are inexpensive.

The secondary customer selected is the United Nations Children’s Fund (UNICEF), which is a non-profitable charity agency. Its present duties are to protect children as well as to aid developing countries and those affected by natural and manmade disasters. After the Typhoon, Yolanda, the UNICEF staff delivered critical aid to the people affected by the storm. They worked alongside with the Philippine government and humanitarian organizations to help provide clean water to nearly a million people, to reunite lost children with their families and to deliver emergency health kits to clinics [5].

From our sketches, my group and I selected 6 shelters shown below, which we considered to be the best. In our concept-scoring matrix also shown below, under criteria were our customer needs and target specifications for prototype one. In order of most important, they include our shelter being waterproof, durable, safe, low cost and low energy. We weighed out these criteria and gave them a percentage. Waterproof was considered to be the most important because acknowledging that the Philippines is prone to Typhoons, it was essential for this to be the main priority of the shelter. Furthermore, we rated how well each of our selected shelters fit these criteria out of 5 which 5 being the highest and calculated their weighted score by multiplying its rating by the weight of the respective criteria.

### Concept Scoring Matrix

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Shelter #1</th>
<th>Shelter #2</th>
<th>Shelter #3</th>
<th>Shelter #4</th>
<th>Shelter #5</th>
<th>Shelter #6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td>W</td>
<td>R</td>
<td>WS</td>
<td>R</td>
<td>WS</td>
<td>R</td>
</tr>
<tr>
<td>Low Cost</td>
<td>15%</td>
<td>5</td>
<td>.75</td>
<td>1</td>
<td>.15</td>
<td>3</td>
</tr>
<tr>
<td>Durability</td>
<td>20%</td>
<td>3</td>
<td>.6</td>
<td>5</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Privacy</td>
<td>12%</td>
<td>3</td>
<td>.36</td>
<td>5</td>
<td>.6</td>
<td>1</td>
</tr>
<tr>
<td>Low Energy</td>
<td>13%</td>
<td>5</td>
<td>.65</td>
<td>1</td>
<td>.13</td>
<td>5</td>
</tr>
<tr>
<td>Water proof</td>
<td>25%</td>
<td>5</td>
<td>1.25</td>
<td>5</td>
<td>1.25</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>24</td>
<td>4.06</td>
<td>2.0</td>
<td>3.98</td>
<td>2.0</td>
</tr>
<tr>
<td>Weight</td>
<td>W</td>
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<tr>
<td>Weighted Score</td>
<td>WS</td>
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</tr>
</tbody>
</table>

Shelter 1 and 2

Shelter 3 and 4

Shelter 5

Shelter 6