Malaysian Refugee Shelter

[INSERT CREATIVE NAME HERE]

Group 5

EDSGN 100  Section 22

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Dr. Ritter

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1. **Mission Statement:**
   To provide shelter for Malaysian refugees displaced by flooding. The shelter must be cost effective, durable, sustainable, and meet basic human needs. We seek serve flood refugees directly or through charitable organizations.

2. **Context and Need Development:**
   
   a. **Background Research**

   We chose flooding in Malaysia because we wanted to help an otherwise struggling country that largely receives little support from outside countries in refugee crises to live a stable and permanent lifestyle. Flooding is a serious issue that affects many people in Malaysia. For example, a storm in December, 2014 displaced 247,104 people (1). Sixty percent of the economic issues caused by natural disasters are the results of the flooding that are caused by excessive rainfall and illegal logging (2). The logging causes general deforestation and increases runoff in the event of a flood (3).

   Malaysia was freed from British Rule in 1957. They have a constitutional monarchy where there is a king, and the prime minister are the heads of the government (4). Roughly twenty-five percent of the population is rural (2), and the multiple cultures in the area include Malay culture, a Chinese culture, an Indian culture, and an Eurasian culture. There is a distinction between Malay and non-Malay cultures; however, they are trying to unify a national Malaysian culture (5).

   Malaysia is both a peninsula and an island nation. It also contains rainforests and “high coastal plains with high interior mountains” (6). The weather experienced there is tropical with heavy and frequent rainstorms. They have monsoons from October to February. Available resources in Malaysia are tin, timber, petroleum, natural gas, copper, iron ore, and bauxite (6).

   In Malaysia, lives often get disrupted by flooding causing them to move out of their homes. Therefore, there are many cases of displacement in this country. People in these situations can often times get depressed and can fall into a “state of shock.” To try to deal with this, Mercy Malaysia helps conduct health assessments and they also distribute hygiene packs.

   In general at least ninety-three percent of Malaysians have access to water and sanitation facilities, but water borne illness is still a common problem during the wet season floods (7). Rural electrification is improving and is currently at 93 percent overall, but some areas of eastern Malaysia are still around 77 percent (11).

   Mercy Malaysia is an organization that provides emergency assistance to vulnerable communities (8). While Mercy Malaysia focuses on helping the people directly, the relief workers of this nongovernment organization main concern is the standing water within the villages because it is an easy way to spread diseases. They are also handing out devices for water purifying and information on water safety to try to prevent the spread of diseases through the
water caused by the flooding. On top of all of the health concerns that come with the floods in Malaysia, the children’s education gets affected too. They have tried to transform undamaged schools into evacuation centers which has disrupted the students’ learning (9).

Malaysia has a Department of Irrigation and Drainage. This department has a sector devoted to flood management. In 1972, an official committee was established to provide relief for those affected by the floods at district, state, and national levels. This committee is called the Natural Disaster Relief Committee. They focus on trying to control flood damage by creating new infrastructures such as the Stormwater Management and the Road Tunnel Project. The purpose of this specific project is to divert flood water during flooding into an underground tunnel that directs the water to another river (10).

b. Secondary Market:

Our primary market is the refugees while our secondary market would include a charity that would provide shelters. The charity we chose is the Malaysian Red Crescent. It is a smaller section of the Red Cross and the Red Crescent Movement. This chapter operates in Malaysia. The Malaysian Red Crescent has approximately 300,000 volunteers. Their most recent active location is medical treatment at Kg. Aur Duri and Dusun Nyiur. Some volunteers went to Malaysia to treat the sick and disabled. The charity’s typical response is to send volunteers to places of need with supplies that are essential for survival. A shelter designed for this charity should be easy to assemble and disassemble, hold multiple people, and be durable to protect against the elements. Interested individuals can participate with this charity by donating food, clothes, and/or medical supplies, donate blood, and volunteering to build homes, to educate, or to medically assist (12).

c. Overview of Needs:

Table 1: Customer Needs

<table>
<thead>
<tr>
<th>Needs</th>
<th>Primary Wants</th>
<th>Secondary Wants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost efficient</td>
<td>Assembled without tools</td>
<td>Transferable to a business</td>
</tr>
<tr>
<td>Easily repaired</td>
<td>Insulated</td>
<td>Flood resistant (floats)</td>
</tr>
<tr>
<td>Houses six people</td>
<td>Durable (ten years)</td>
<td>Electricity</td>
</tr>
<tr>
<td>Rooms and Windows</td>
<td>Lockable</td>
<td>Kitchen</td>
</tr>
<tr>
<td>Floor</td>
<td>Furniture (beds)</td>
<td>Indoor bathroom</td>
</tr>
</tbody>
</table>

All of the above needs appeared in our prototype. Some of the primary wants were also present including durability, lockable, and assembly without tools. None of the secondary wants appeared in our prototype considering they would have drastically increase the cost.
3. Concept Generation Summary:
   a. Target Specifications

   Table 2: Target Specifications

<table>
<thead>
<tr>
<th>User Need (low cost)</th>
<th>Specifications (e.g., Less than 10 dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average cost for minor repairs</td>
<td>Less than 20 dollars</td>
</tr>
<tr>
<td>Average time for minor repairs</td>
<td>Under 2 hours</td>
</tr>
<tr>
<td>Enough square footage</td>
<td>To house 6 people (30’ x 24’)</td>
</tr>
<tr>
<td>Can have up to</td>
<td>3 rooms, 3 windows</td>
</tr>
<tr>
<td>Durability lasts</td>
<td>Up to 10 years</td>
</tr>
<tr>
<td>Privacy</td>
<td>1 latch on door, padlock not included</td>
</tr>
<tr>
<td>Window Latches</td>
<td>1 per window and shutters</td>
</tr>
<tr>
<td>Assembled with</td>
<td>0 tools, hands only</td>
</tr>
<tr>
<td>Average cost to buy</td>
<td>Less than 250 dollars</td>
</tr>
</tbody>
</table>

   The specific target specifications of prototype one included: a square base, a triangle roof, flooring, a latch lock, curtains (for wall dividers), and windows with shutters. All of these specs allow the customer to have security or relative privacy. Both of these are very important in the final design.

   b. Images of our sketches

   ![Sketches of some of our more promising ideas](image)

   Figure 1: Sketches of some of our more promising ideas
After a group discussion it was decided that stilts on our shelter would be infeasible and not practical. They would decrease stability and increase complications in construction.

c. Scoring Matrix:

Table 3: Scoring Matrix

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weight</th>
<th>Rating</th>
<th>Weighted Score</th>
<th>Rating</th>
<th>Weighted Score</th>
<th>Rating</th>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Cost to buy</td>
<td>25%</td>
<td>1</td>
<td>0.25</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Houses 6 People</td>
<td>30%</td>
<td>2</td>
<td>0.6</td>
<td>4</td>
<td>1.2</td>
<td>4</td>
<td>1.2</td>
</tr>
<tr>
<td>Zero Tools</td>
<td>20%</td>
<td>1</td>
<td>0.2</td>
<td>4</td>
<td>0.8</td>
<td>3</td>
<td>0.6</td>
</tr>
<tr>
<td>Rooms and windows</td>
<td>15%</td>
<td>2</td>
<td>0.3</td>
<td>5</td>
<td>0.75</td>
<td>5</td>
<td>0.75</td>
</tr>
<tr>
<td>Durability (10 years)</td>
<td>7%</td>
<td>2</td>
<td>0.14</td>
<td>4</td>
<td>0.28</td>
<td>3</td>
<td>0.21</td>
</tr>
<tr>
<td>Privacy (latch)</td>
<td>3%</td>
<td>5</td>
<td>0.15</td>
<td>5</td>
<td>0.15</td>
<td>5</td>
<td>0.15</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>5</td>
<td><strong>1.64</strong></td>
<td>5</td>
<td><strong>4.18</strong></td>
<td>5</td>
<td><strong>3.91</strong></td>
</tr>
</tbody>
</table>
**Concept Decision:** We determined that housing six people, cost efficiency, and easy construction were the most important design factors of our shelter. Three less important categories included that privacy, durability, and rooms/windows. From there we discussed the roofs and stilts. These features created three different products as shown above. We determined that the stilts were not a practical idea. We agreed that a triangle roof would be the strongest. This resulted in the ideal shelter having no stilts and a triangle roof.

4. **Test Report Summary for Prototype 1:**

*Table 4: Prototype Tests*

<table>
<thead>
<tr>
<th>User Need / Feature /</th>
<th>Describe Test</th>
<th>What is “pass”?</th>
<th>Materials / tools needed</th>
<th>Pass/Fail?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pour Water</td>
<td>Pour a jug of water on house</td>
<td>Does not fall apart</td>
<td>Water, sample roof</td>
<td>PASS</td>
</tr>
<tr>
<td>2. Throw down</td>
<td>Throw the prototype down the stairs</td>
<td>Does not completely break</td>
<td>Stairs</td>
<td>PASS</td>
</tr>
<tr>
<td>3. Fit 6 people</td>
<td>Put little figurines in the house</td>
<td>6 figurines fix comfortably</td>
<td>Figurines</td>
<td>PASS</td>
</tr>
<tr>
<td>4. Draft test</td>
<td>To see if we can feel a draft in the shelter if wind is blowing</td>
<td>No draft</td>
<td>Fan</td>
<td>PASS</td>
</tr>
<tr>
<td>5. Resistant against wind</td>
<td>Use fan to blow against prototype</td>
<td>Prototype does not fall</td>
<td>Fan</td>
<td>FAIL: didn’t survive high winds, needs to be grounded</td>
</tr>
<tr>
<td>6. Roof doesn’t collapse</td>
<td>Put weight on roof to test its durability</td>
<td>Can hold at least 15 pounds</td>
<td>Weights</td>
<td>PASS: approx. 120 pounds</td>
</tr>
</tbody>
</table>

As seen in Figure 3, our shelter is capable of resisting water and directing runoff away from the shelter. In Figure 4, our shelter was capable of holding 75 pounds of paper and only failed when 120 pounds (Emily) was put on the shelter demonstrating its durability. Another durability test as seen in Figure 5, showcased its ability to withstand impacts.
5. Concept Refinement Summary
   a. Prototype Two

   Our second design is similar to our first design because it performed well in our initial testing. Our original prototype was made efficiently but excluded many minor details, such as windows. In our final virtual prototype we added windows with shutters, and a lock. Overall we believe that the second round of testing will be
similar to the results of our first prototype except it will contain additional comforts for our customer.

![Figure 4: Sketch of Final Prototype](image)

6. Test Report Summary for Prototype 2
   a. Final Prototype

   Although our final prototype does not have many differences from the original, it will meet more of our customer needs. In the first model we did not include any windows or shutters which would mean that there would be no airflow within our shelter. The only problem is that complications may arise with the draft test considering imperfections of the construction. The inclusions of the locks will increase privacy for the customer which is one of their primary needs.

![Figure 5: Final Prototype with open shutters and doors](image)
7. Cost Analysis

a. Estimated Costs

The estimated cost for both of the prototype based off of the costs in class is $1.30. We used 5.18 square feet of cardboard at a cost of 25 cents per square foot.

b. Expected Price of Final Product

The prototype was made from cardboard to a 1 to 15 scale of the final product. The final product will be made of plastic lumber that runs at a cost of $5 per square foot (13). This gives us an expected cost of $388 per shelter. However, plastic lumber made from recycled materials is an option that could reduce our cost. Bulk production is also predicted to reduce this costs.

c. Estimated Total Cost

In ten years, we predict that the total cost for one of our shelters for a family is $688. This allows for $300 worth of repairs and other costs.

d. Materials

The entire shelter is to be made of plastic lumber with the exception of the locks themselves which will be metal. We intend for everything else, the walls, door, shutters, roof, and hooks to be made from the plastic lumber.
8. Consideration of Human Needs

a. Human Needs

We covered the base of the human pyramid by providing shelter for refugees and gradually moved up. The next aspect of the pyramid is safety which we covered in our shelter by providing a durable structure with security and a certain level of privacy. We included latches on the windows and a lock on the door for privacy within the home. To preserve the family dynamic in the hierarchy of needs our shelter can be placed into a community like layout. The home is also capable of housing more than one family or up to six people.

b. Specific Components

We incorporated windows on our shelter in order to create light and ventilation. We have locks on the door in the form of a latch and hook in order to provide a sense of security. We also had shutters on the windows to give privacy to those inside.

9. Consideration for Overall System

a. Design Decisions

The shelter requires no tools for construction which eases setup. Considering it does not need tools, it would not require much time. Also we chose to make our shelter out of plastic, this would be an easy material to transport which is an important aspect when building a community for displaced people. This is a material that is easy to come across which would also make the construction process easier.

b. Scale

The size of one shelter is 24 feet by 30 feet. This is a relatively small size for a home that can house around six people. By keeping the size of our shelter small without getting rid of the people’s privacy we are able to fit many of these shelters into a plot of land increasing the size of the communities.

c. Efficiency of Space

As far as the overall space of the homes together, we would be able to fit approximately 135 homes per square mile. If we were to house six people per house,
the community could accommodate 810 displaced people.

d. Accommodations of Community Needs

Whereas we are efficient with our space, the community would have to be in a gridlock system. That does not create a sense of community, even though the structure is efficient. We accommodate the Malaysian Red Crescent by providing homes for those who have lost their permanent homes.

10. Re-Design Ideas/Thoughts

a. Dream Design

Our dream design includes all of the features listed in Table 1 under “Needs”, “Primary Wants” and more accessories like curtains and furniture. This would help us to better serve our customers by providing a higher standard of living. If the shelter resembles a typical home, the refugees will feel more comfortable in their new environment.

b. Future Plans

In the event a future group take up this project, we would suggest implementing the suggestions for our dream design in section 10a. We are well aware of the cost constraints at this point but a future group may be able to minimize this. Additionally, a future team may want to consider prototyping in full scale as to truly test the product for durability and reliability.

11. Conclusion

Overall, [INSERT CREATIVE NAME HERE], believe in helping the refugees affected by Malaysian floods by providing them with cost efficient, durable and sustainable housing unit during emergency situations. Families affected by these situations are forced from their own homes and must find shelter inland. Based on our design work this semester, we were able to research, design, build and successfully test a 1:15 scale prototype that provides a viable solution to our customer’s problem. We then went back through the iterative design process to further improve our design and found relatively few areas for improvement. Therefore, we are very satisfied with the shelter and hope the people of Malaysia are too.
Works Cited