Design For Disaster Relief

Engineering Notebook

(Student Name Here)

(Group Name Here)

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science FRIDAY EDUCATE

Problem:

“Recent severe storms have cause massive flooding across our region. Thousands of families have been evacuated from their neighborhoods and many homes have been destroyed. With no way to predict how long these residents will be out of their homes, there is an urgent need for emergency shelters.

Currently, displaced residents are living in tents, community centers, or with friends and family and are in dire need of housing. We have secured several acres of land in a safe location and are looking for designers to help build homes so these residents can regroup as a community away from the flood zone.”

- Katie Brown
  Communications Director
  Flood Zone Fabricators

Step 1: Empathize

WHO are the people you are helping?

- What age?
- Are they single people? Families? Are there pets?

What are their needs?

- Will they need multiple rooms?
- Do the users have special needs for their home like a ramp, porch, or multiple doors?
- How are they feeling now?

Use the space below to describe the needs of this community.

Step 2: Define

WHAT is the problem you are trying to solve?

Design Constraints	Define your challenge: What additional needs did you identify above that you want to focus on in your design?
● Able to fold and pack flat for easy transport. ● Made of 2 manilla folders, using folds to make structure strong enough to hold 1kg without breaking. ● Assembled in under 5 minutes with just tape. ● Be $\geq$ 2 cm above ground. ● Have ventilation that opens to take advantage of breezes and closes if rains continue. ● Use at least one triangle or column for strength. ● Have 100cm^2 of floor space to fit a family of 4.	

Step 2, Continued:

WHAT is the problem you are trying to solve?

What additional needs did you identify above that you want to focus on in your design?	What will define a successful prototype?

Step 3: Generate Ideas

Look around you. What shapes do you see used for strength in buildings, bridges, towers, or products? Sketch some shapes that you think add strength and support to the design. **NOTE:** You can either sketch them on the printout version of this, take a picture of your sketch and upload them here using your electronic device, or create a digital sketch you can upload here.	**Idea Number 1**	**Idea Number 2**
	Idea Number 3	**Idea Number 4**

Try Out Different Shapes:

Using three index cards and tape, try to fold an index card so that it can hold a book off the table. Experiment with different shapes, heights, and folding patterns, folding each card differently until you find a design that successfully holds a book off the table without crushing the index card.

Include a sketch or digital image of your design.	*Observe your designs and those of your classmates. Which ones were successful at supporting the weight of the book and why?*
Did it work?	

Experiment With Triangles:

Shape	Triangle
Try rolling a new index card into triangles. Test its strength in different directions by loading it with books. **What do you notice?**	
How could you incorporate cylinders into the design of your structure?	

Experiment With Cylinders:

Shape	Cylinders
Try rolling a new index card into a cylinder. Test its strength in different directions by loading it with books. **What do you notice?**	
How could you incorporate cylinders into the design of your structure?	

Design: How Will You Build An Emergency Shelter?

Make a drawing of your final design below. Be sure to annotate on your design to answer the questions on the following page.
NOTE: You can either sketch them on the printout version of this, take a picture of your sketch and upload them here using your electronic device, or create a digital sketch you can upload here.

How Will You Build An Emergency Shelter? Continued

What will your final structure look like?	What are the steps to fold it?	How will it pack flat?	What design elements will give it strength?

Step 4: Prototype Your Shelter

Using your annotated drawing, construct your prototype using the following materials:

- 2 (used) manilla folders
- 50cm masking tape
- Scissors
- 1kg weight
- Ruler

You can include a digital picture of your completed prototype here.

Step 5: Evaluate Your Prototype

Design Constraint	Document Results For Your Prototype
Can be folded and packed flat for easy transport.	What are the dimensions of your prototype when fully assembled? When packed flat?
Uses folds to make two manilla folders into a structure strong enough to hold 1kg without breaking.	How much mass can your structure hold before collapsing?

Step 5, Continued:

Can be assembled in under 5 minutes using only tape.	How much time did you need to assemble your prototype?
Floor is >2 cm off the ground.	How far off the ground is the floor of your structure?
Has ventilation that opens to take advantage of breezes and closes if rains continue.	Draw your system for opening and closing windows or doors.

Step 5, Continued:

Has 100cm^2 of floor space.	Calculate the square footage of your prototype.
Uses at least one triangle or cylinder for strength.	What shapes did you choose to use for strength and where did you place them?
Your group's design constraints:	What design constraints did your group choose to add and how did you integrate them into your design?

Step 6: Reflection

Describe the design elements that worked well in your prototype. What are you proud of?	
Discuss the problems with your prototype, and how you might solve them.	

Step 6: Continued

Describe three design elements from other shelters made by other groups that worked well and why.	1) 2) 3)
As a class, analyze elements from several designs to come up with a new solution that is even better. Work together to create and build a design using the best elements from the structures you tested.	