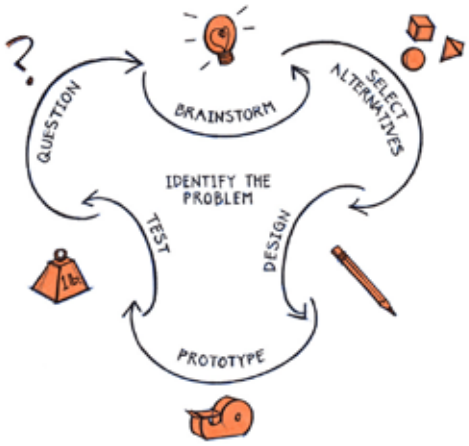
Build:
Lateral Force-Resisting Systems

THAYER SCHOOL OF ENGINEERING AT DARTMOUTH



Design Goal: Design a set of lateral force-resisting systems that you can test to see which is stiffest, most flexible and strongest.

Supplies:

- Cardboard, foamcore, popsicle sticks, K*Nex, etc.
- Paper clips, nuts/bolts
- Glue, hot glue, duct tape
- Scissors, X-Acto knife

Question: : Lateral force-resisting systems are used in structures to resist lateral or horizontal loads, often due to wind or earthquakes. The three main types of lateral force-resisting systems are: moment-resisting frames, braced frames, and shearwalls. Which of these systems is the stiffest, meaning it deflects the least? Which is the most flexible, meaning that it deflects the most? And which is the strongest, meaning it can support the highest load?

Brainstorm: Sketch your ideas for how to construct the three different systems.

Select Alternatives: Will your materials work to create the systems or will you need to find alternates? Maybe you don't have one of the suggested materials (e.g. foamcore) – what can you use instead that fits the need?

Design and Prototype: Design and build a set of lateral force resisting systems:

1. Braced frame (looks like a truss)
2. Moment resisting frame
3. Shear wall

Braced Frame

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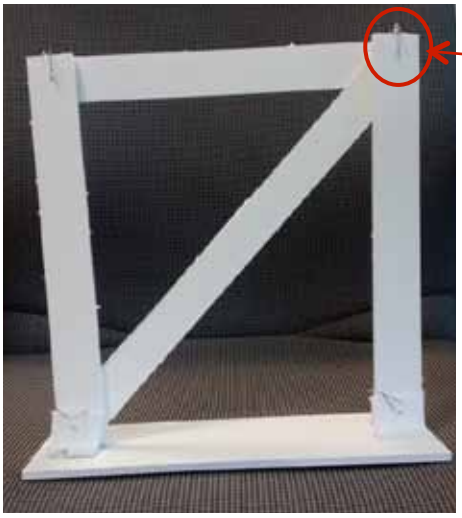
To create a true braced frame the connections should be pinned. I used paper clips in the model below to create pinned connections between pieces of foamcore. You can also use nuts/bolts or just tape or glue the joints.



Pinned connection created using a paper clip.

Moment-Resisting Frame

For a moment-resisting frame the connections will need to be stronger and able to resist a moment. I used hot glue to connect the pieces of the moment-resisting frame but you could also tape the joints or use a different type of glue.

For the shearwall I simply used a panel of foamcore for the wall. I hot-glued the wall to the base, with a scored segment of foamcore for reinforcement. You could also simply use duct tape to connect the wall to a base or a table or other surface.

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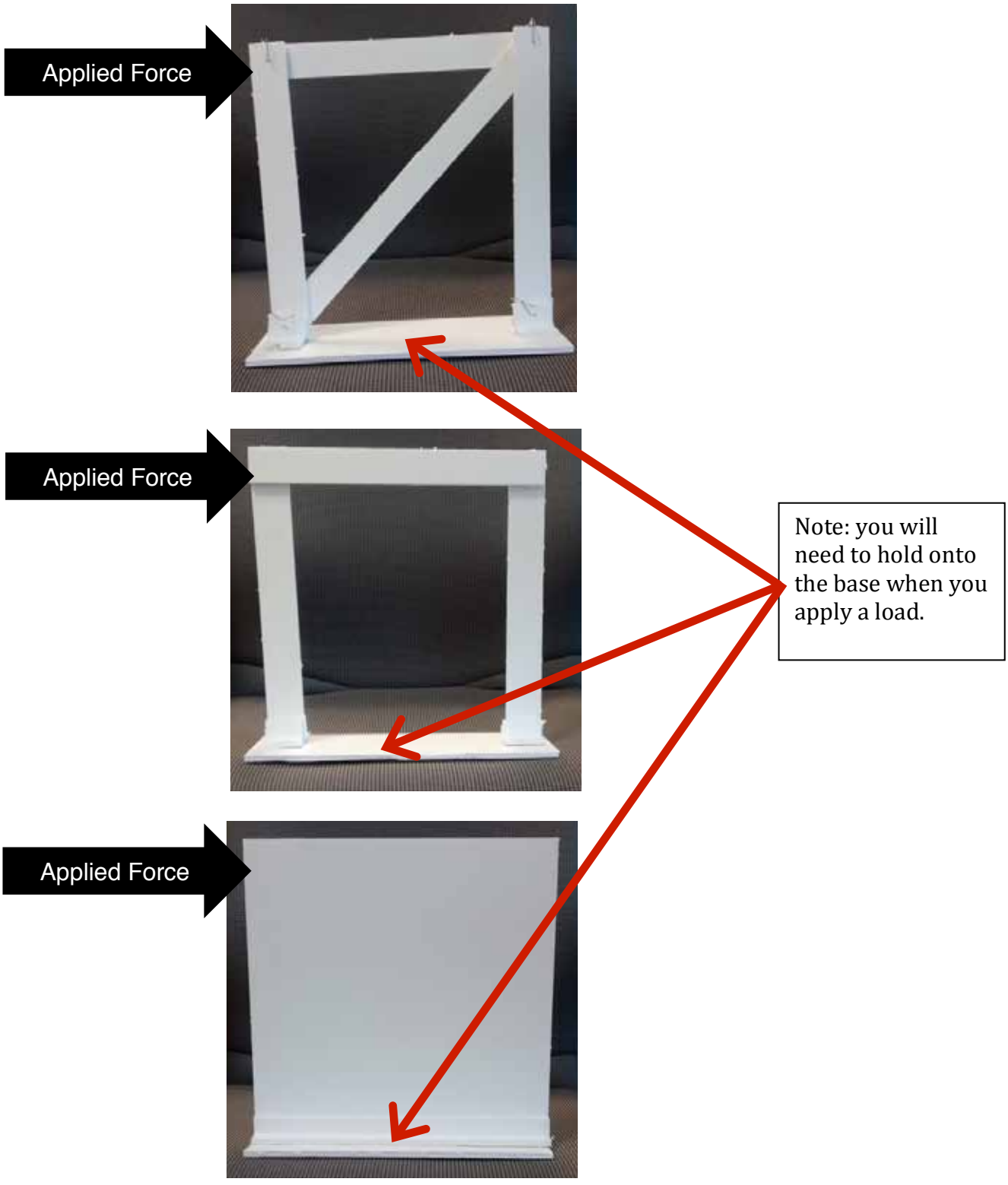
Test and Reflect: Test your models by pushing on them. Which feels the strongest? Weakest? Stiffest (deflects the least)? And most flexible (deflects the most)? Which system used the most material? Which system used the least material? Which was the easiest to build? Which was the most difficult to build?



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