



7th Grade Cohort



Dive In!



Get Ready to be Blown Away (or Not)?! Hurricane-Proof Building Designs



In the aftermath of hurricane Ian, one thing is clear: as a city, we need to do better to prepare for the potentially devastating effects of future hurricanes. This is precisely why I've called you all here today. As the brightest engineers and architects in the area, I'm asking you to DIVE IN! Let's design and build aesthetically beautiful, cyclone-proof buildings to limit or prevent loss of life and property in the future!

--Mayor Dickens



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Tasks!

In teams, discuss current knowledge of challenge-relevant concepts (Engineering Design Process • Aerodynamics • Drag • Gravity • surface area • ETC.)

A. Guided by knowledge gained and using **ONLY** the materials provided, **sketch** your team's home design. Be sure to include labels for any necessary explanations. Team sketches **MUST** be submitted for approval prior to building. **Final sketches should be made to scale.**

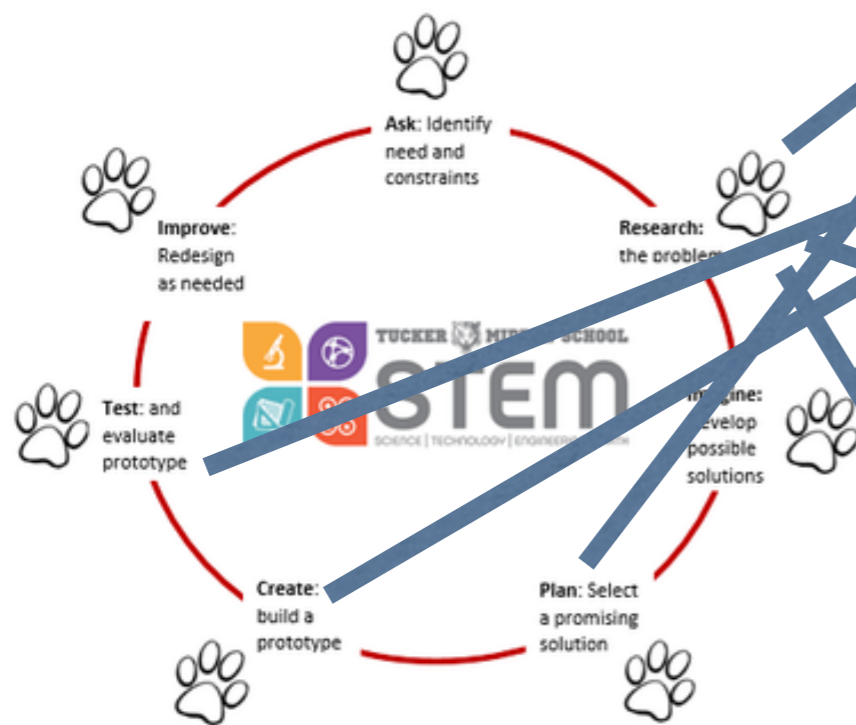
B. Time to **Build!** Remember, design is an **iterative** process. One idea often builds on another. It will most likely take multiple sketches and builds to produce a successful final product. That's OKAY...this process is when we learn the most!

C. Fortunately for us, Georgia's geographic location and relatively short coastline protects us from the full wrath of hurricanes....but we're not completely immune to their damage. Unfortunately for everyone, the ever-warming climate will result in increased risk for Georgians in the future....and that's ALL Georgians, not just the human ones. **Create an innovative 3-5-minute visual presentation that highlights our hurricanic past with a focus on the effect on non-human organisms, populations, communities, and ecosystems.**

D. The United States has had some bad hurricanes over the years. None of them, however, compare to the devastation caused by The Great Bhola Cyclone. **Create an engaging, creative, innovative report on the GBC, with a laser focus on social, geographic, and economic factors that contributed to the devastation.**

E. Prepare a brief (3 minutes or less) **presentation** to the Atlanta City Council, **explaining the STEM** behind YOUR home design. Why should Atlanta implement your design innovations in affordable housing developments moving forward!?

ENGINEERING DESIGN PROCESS



The mission of Tucker Middle School STEM is to EXPOSE students to STEM career paths, EQUIP them with skills to be successful in these careers, and ENGAGE students in solving the problems of today.

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Facilitated Rollout Plan

- PBL Launch by CTAE Facilitator with support from 7th Grade STEM Cohort Math and Science teachers, followed by student independent research and discovery in groups.
- Block periods following the launch will vary in terms of type of instruction and range from 12 to 18 student work hours depending on need, but must include some direct instruction as need on relevant topics as follows:
 - **EDP; Hurricane-Proof Housing → Led by CTAE Facilitator**
 - **Surface Area; Fluid Dynamics → Co-Led by Math & Science Cohort Teachers**
 - **Essay Writing & Presentation Prep: Best Practices → Language Arts Cohort Teacher**
 - **Social, geographic, and economic factors that impact disasters → Social Studies Cohort Teacher**

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What will your design look like...and how effective will it be!?

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- Prepare a brief (3 minutes or less) **presentation** to the Atlanta City Council, **explaining the STEM** behind **YOUR** home design. Why should Atlanta implement your design innovations in affordable housing developments moving forward!?



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Criteria & Constraints

- Design must be free-standing
- Design must use 15 “items” provided on the Materials Table.
- Design must include 2 or more “working windows” and 2 or more “working doors.”
- Design must have an overhanging roof.
- Design must be at least 30cm tall and 15 cm wide at top of main frame (under roof).
- 8 work-hours provided.
- See rubric for grading.

Anatomy of a High Wind & Hurricane Resistant Home  deltechomes.com
800.642.2508

All aspects of a Delttec home are ingeniously designed to work as a system, making it the smartest home you can build for high wind areas.



A. SHAPE
Aerodynamic circular building envelope works with nature, not against it.

1. Wind can't build up enough pressure on any side to cause a structural failure.
2. Reinforced clear span roof is at optimum pitch (6/12) for wind deflection and reduced lift.
3. Circular structure transfers environmental loads most efficiently, with a high degree of redundancy providing extra resilience and performance during critical events.

B. ENGINEERING
Creating a building envelope to resist high wind and provide safety to its occupants.

4. Radial truss array in roof and floors work like spokes on a wheel.
5. Potential energy from sustained winds is dispersed throughout the structure instead of building up in a single area.

C. MATERIAL EXCELLENCE
Merging superior materials with a superior design results in a stronger and more durable structure.

6. Machine rated 2400 psi framing lumber used in trusses and walls is twice as strong as typical framing material.
7. Five Ply SIB® plywood sheathing used instead of OSB on exterior walls, roof and floors strengthens the home and prevents flying debris from penetrating the structural envelope of the home.
8. Reinforced windows with impact glass prevent wind and water from entering the home.

D. CONNECTIONS
Emphasis on maintaining continuous load paths and strong connections between the roof, exterior walls, floor systems and foundation.

9. Oversized truss hangers keep roof system anchored to walls.
10. Walls have multiple construction ties to the floor system for structural stability and to transfer shear forces.
11. Continuous metal strapping from roof trusses to foundation helps maintain structural stability.

E. SUSTAINABILITY
Utilizing products and construction techniques that enhance livability in the event of a prolonged power outage.

12. Solar water heater provides uninterrupted hot water.
13. Enhanced insulation maintains a more balanced temperature inside the home.
14. High wind rated reflective metal roofs help reduce radiant heat gain in the home.
15. Passive solar design helps heat and cool the building through appropriate shading and window placement.

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Materials List



**Groups can choose from the available items on the
Get Ready to be Blown Away (or Not)?! Hurricane-Proof Building
Designs! Materials Table. Remember, all materials must be justified,
and no materials will be provided until a sketch is approved!**

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Materials

- 5 Straws
- 5 Rubber Bands
- 20 cm duct tape
- 1 meter of masking tape
- 10 popsicle sticks
 - 1 cup
 - 4 index cards
 - 10 paper clips

**Design can use up to 15
“items” above**

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20%

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20%

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40%

Category 1 → 50%
Category 2 → 70%
Category 3 → 90%
Category 4 → 110%
Category 5 → 120%