BUILD A BRIDGE

Today's engineering design challenge: Create a bridge to cross over a local river. The objective is to design and construct a sturdy, stable bridge that can support the weight of vehicle traffic. The bridge will be a scale model and span 12 inches (12-inch gap between tables is required). Bridges will be tested by suspending weight from the center of the bridge. The client has a set budget, and it is the team's responsibility to remain below the budget during construction. If two bridges can support the same amount of weight, the budget — or cost-savings — will be used as a tie-breaker.

MATERIALS

- Popsicle sticks
- Super glue or hot glue gun (and glue)
  Note: Consider age and responsibility of class before using super glue.
- Weight
  Note: Recommend using washers, sandwich bags of sand, etc. Bridges could hold up to 20 pounds.
- Graph paper
- Duct, masking or scotch tape
- Pipe cleaners
- Tongue depressors
- Card stock

Item	Cost
Popsicle stick	$10
Tongue depressor	$15
Duct tape	$10/foot
Masking tape	$7/foot
Scotch tape	$5/foot
Card stock	$20/sheet
Craft glue	$75/bottle
Super glue	$100/bottle
Pipe cleaners	$5

METHOD

1. Each team of four has a $500 budget.
2. Brainstorm ideas and sketch bridge designs on graph paper, conceptualizing several ideas to choose from.
3. Once a design has been chosen, "purchase" supplies and organize a workspace. Do not "buy" the materials until a design is drawn on paper.
4. Construct the bridge!
   Note: Unused materials will be given a 50% return if the material is in good condition.
5. Test the bridge by hanging a basket (or bag) from the middle of the bridge, adding one weight at a time. Load each bridge until failure.
6. Share results and reflections on the project. (What designs worked? What designs failed? How does cost of materials impact your decision to use them?)

TAKE IT BACK TO CLASS

- Cost scaling — Different materials cost different amounts, and each material has different strengths. When making decisions, consider the strength requirement versus how much it will cost. Making the right decisions will impact the overall strength of a structure.
- Forces — Different areas of the bridge experience forces in different ways. The bottom of the bridge was stretched (tension) and the top of the bridge is compressed (compression). Some items are better in tension or compression. For example, a pipe cleaner can be pulled (tension), and it will remain in its shape, but if very little compression is applied, it bends. Concrete, on the other hand, is the opposite. It can withstand greater compression than it can tension.
- Schedule — Some decisions are based on schedule. When engineers design, they consider how much time they have to build, in addition to strength and budget. Did time have any influence on the design? Was a redesign requested or necessary? How would the design change if engineers (or students) only had half as long?
- West Point Bridge Designer — West Point Bridge Designer is free bridge design software that allows students to build bridges using trusses. Design and materials can be adjusted before running the simulation to see if the bridge can support a truck.
  Find it here: *http://bridgedesigner.org/download/*

SOURCE

https://tryengineering.org/teacher/popsicle-bridge/

NOTES

BURNS McDONNELL