BUILDING BRIDGES CHALLENGE

SUMMARY OF ACTIVITY:

Activity Description: Participants will build a bridge that will stand the test of time! They will think about what makes bridges sturdy, and how engineers incorporate those shapes into their designs.

STEAM Skills: Engineering - building, problem solving

Ideal Age Group: All ages

Length: open ended, 25-30

MATERIALS AND SUPPLIES:

• Cardboard (8 ½ x 11)	• Regular Straws (30)
• Paper (2 sheets of 8 ½ x 11)	• Skewers (25)
• Large popsicle sticks (30)	• Optional: Cup and weights

General supplies needed: scissors, tape

TALKING POINTS AND BACKGROUND:

- Who builds bridges?
    - **Engineers:** Someone who designs, builds or maintains engines, public works and structures.
    - Why is it important to build your bridge sturdily? What happens if it isn't built properly? https://www.youtube.com/watch?v=j-zczJXSxnw (Gallopin' Gertie Bridge Collapse)
- Bridges must be built securely and safely, (taking into account the weight it will be under and changing weather) as without a strong base the bridge can collapse.
- How do we make bridges strong? What shape should be used?
    - The triangle: One of the strongest shapes, the triangle is able to hold its shape under immense weight, due to its strong base and two strong supports leading to the point.
        - If you built a bridge with rectangle supports and the weight became too much, the rectangles would collapse on themselves. With triangular supports, the triangles would not collapse!
    - Hexagon: One of the strongest shapes, hexagons often appear in nature due to their design and weight bearing capacities. Where can we find hexagons in nature?

        - Beehives! These shapes can be created with less wax, allowing for a stronger structure with less work for the hive.
        - Hexagons are one of the only shapes that **tesselate** perfectly; fitting in perfectly without gaps or overlapping.
- What are the different types of bridges?
    - **Arch Bridge**: Shaped in a curved arch, the weight of the bridge is distributed evenly along the arch allowing for strong supports. Relies on **abutments** (supports at either end of the bridge).
        - Ex: Pont du Gard Aqueduct
    - **Beam Bridge:** one of the simplest designs, straight across the distance with support coming from abutments on either end.
        - Ex: Iowa River Bridge
    - **Truss Bridge:** Support for this structure comes from the **truss** (an assembly of beams that create a structure)
        - Ex: Jefferson Railroad Bridge
    - **Cantilever Bridge:** Supported by **cantilevers** (long projecting beam secured at only one end).
        - Ex: Forth Bridge
    - **Tied-Arch Bridge:** Similar to arch bridges, the weight of this structure is supported along an arch, above the bridge.
        - Ex: Fort Pitt Bridge
    - **Suspension Bridge:** Uses ropes/cables to support the weight of the bridge from vertical structures.
        - Ex: Golden-Gate Bridge

PROCEDURE:

1. Participants can build this however they would like; allow for free-form building.
2. Have a few different types of bridges already built to demonstrate to participants some of the ideas that they could follow.
3. Remind participants of the shapes that their bridges should be built out of (if they want it to be stable and load-bearing) -> triangles, hexagons, circles.

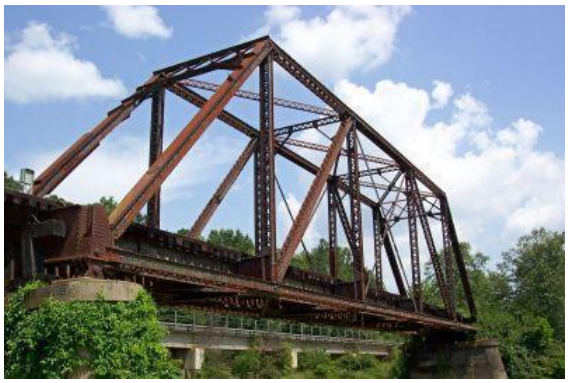
TIPS AND TRICKS:

REFERENCES OR OTHER LINKS:

https://www.youtube.com/watch?v=j-zczJXSxnw

Golden Gate Bridge (Suspension bridge)

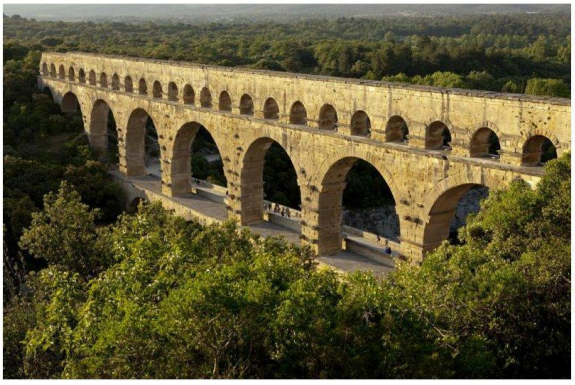
Iowa River Bridge (Beam Bridge)



Jefferson Railroad Bridge (Truss Bridge)

Forth Bridge (Cantilever bridge)

Fort Pitt (Tied arch bridge)



Pont du Gard Aqueduct (Arch Bridge)