SparkLab, Sciencentre

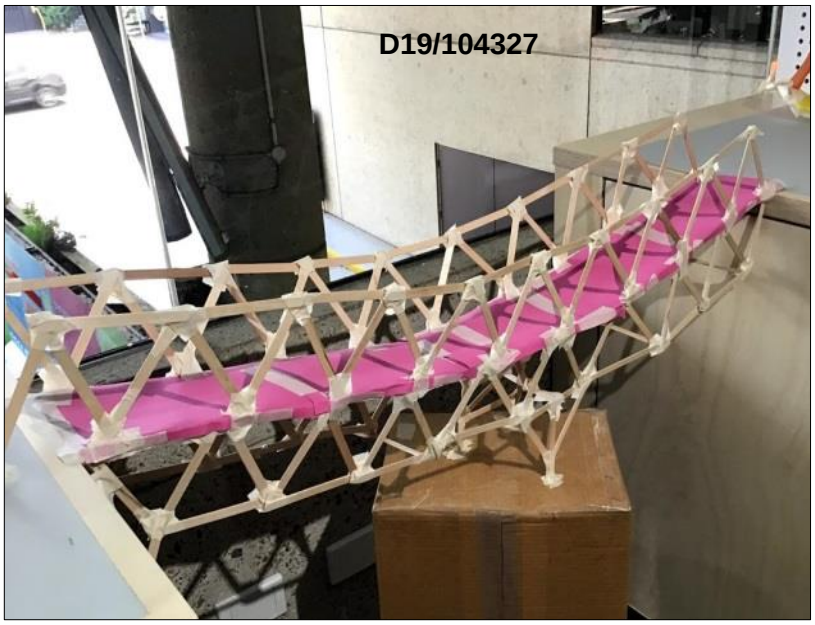
Maker Space: *Can you cross it?*

The Challenge

How strong can you make a bridge of paper and paddle pop sticks?
Build a structure to connect two parts of a cardboard box landscape together.
Add weights to your bridge to test its strength. How much weight can your design carry?

Learning Outcomes

- Explore and understand materials and their properties to build and strengthen a structure.
- Understand how different shapes can be used to increase the strength of a structure such as a bridge.
- Develop skills in creating 3D structures out of flat pieces of paper.
- Develop design skills by following a design process to develop and improve upon ideas.
- Appreciate the importance of structural design and engineering in everyday life, with particular relevance to the types of buildings and structures they regularly frequent and use (schools, home, the office, sports stadia, cultural institutions)
- Increase participant's understanding and confidence of the testing and design process; observing areas of the design that need improvement, posing a new design solution, making a change and observing the impact of that change.
- Enjoy testing designs by adding testing weights and pushing designs to their limits.
- Be inspired by early success and build upon initial designs.
- Feel and recognise success in implementing creative solutions to real world challenges. Apply this approach in their everyday life.
- Express enjoyment in engaging in the challenge and sharing ideas and understandings.



Equipment
- Scissors.
- Rulers.
- Cardboard boxes of similar height
- Weights for testing (Any objects with known weights would be suitable)

Design Materials
- Paper
- Paddle pop sticks
- Masking Tape

Optional materials
- Additional cardboard boxes of different shapes and sizes
- Household furniture
- Toy cars or objects that move across landscapes

Set-up steps
1. Place two or more cardboard boxes on a flat surface, at least 35cm apart.
2. Secure the boxes with tape so they cannot fall over.
3. Design a structure that can span the gap between the two boxes.

Design process

This activity follows a design process. Below are some questions that will help at each stage of the process.

Think of some solutions

- How wide is the gap that you need to cross?
- What materials do you think you could use?
- What ideas do you have for a design?
- What are some real world examples that you have seen before?
- What ideas do you have for a design?

Make a prototype

- What materials will you use as structure? Do the materials for the surface of the bridge need to be different?
- What shapes make the strongest structures?
- What elements have you incorporated into your design?
- What part of your design are you finding tricky to build?

Test it out

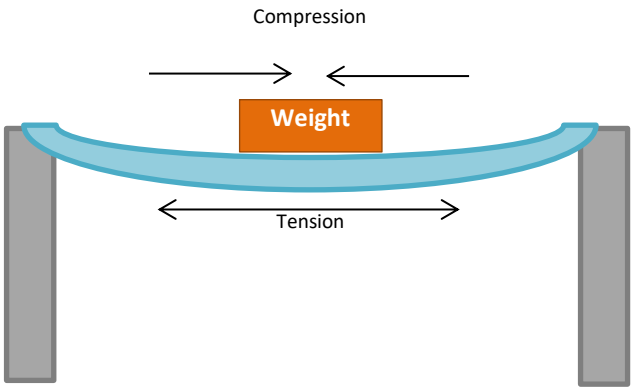
- Test out your design. For an added challenge add weight to see how strong your structure is.
- What did you observe during testing?
- What did you notice about the way your materials behaved when testing your design?
- What part of your design worked really well?

Improve your design

- How could you improve on your design?
- What ideas could you incorporate from someone else's design? Talk to a friend or search online.
- What changes can you make to make your design stronger?
- If you started again, what would you do differently? What would you do the same? Create a record of your design to guide future projects.

Background Information

Bridges are designed to carry a lot of weight and to withstand forces of tension (stretching) and compression (squashing) when a weight is placed upon them. A flat structure may not be very strong on its own, but some shapes can help to strengthen a design.



Triangles are very strong shapes – you cannot squash a triangle! When a compression force is applied to one side of a triangle, the force is spread evenly across all three sides. You see lots of triangles in bridges and other structures – truss bridges use lots of triangles to spread the force across a wider area.

Cylinders are also very strong structures. A force applied to the top of a cylinder is evenly dispersed throughout the whole shape. You can see lots of columns in building structures.

. **Key Search Terms**: Forces acting on bridges: Shape strength design.