Pop-up Science Centre

SPAGHETTI BRIDGE CONSTRUCTION CHALLENGE

Bridges will be tested at the Gold Coast Schools Pop-up Science Centre
August 23, 12pm, Robina Community Centre

Divisions:  P-3 | 4-6 | 7-9 | 10-12

What to do:

- Construct a bridge solely of pasta and glue.
- The object is to construct a bridge that will carry the heaviest load while still meeting specifications. (see page 2)
- Any solid, round, commercial pasta (e.g. spaghetti, spaghettini or vermicelli) may be used as long as its initial diameter is not greater than 3 mm.
- Only liquid glues (including hot melt glue) may be used as a bonding material.
- Bridges must span a gorge measured from vertical contact to vertical contact. The horizontal surface of the gorge on each side is used for support. (Nb. The span of the gorge is 400mm. Therefore the bridge must be greater than 400mm or it will not fit)
- Bridges are to be no longer than 500mm (therefore allowing for 50mm support on each side of the gorge)
- The vertical edge of the gorge may not be used (no thrust support from side banks permitted).
- All bridges have to be able to support their own weight when spanning the gorge.
- The maximum vertical depth of the bridge, from the highest point in its structure to the lowest, cannot exceed 250mm.
- The bottom of the bridge should not extend more than 100mm below the level of the vertical supports.

Important!! A block of wood (50mm x 50mm x 100mm long), representing a car, must be able to pass unobstructed from end to end across the bridge along the top surface of the road deck.
• This block of wood will be positioned in the centre of the bridge and will support the weight load as it is added.
• Bridges will be loaded until they fail. Each bridge will be loaded by a person from the group that built the bridge.
• A minimum of a 5 second waiting period is required between load applications.
• The final official load is the last load that the bridge withstood for a period of 5 seconds prior to destruction.
• Timing is provided by the official timekeeper.

**What makes a winning entry?**

• Successfully spans a 400mm gorge and meets set specifications (see below)
• The bridge is free standing,
• The bridge weighs 400g or less,
• The winner is the legal bridge with the highest official load before structural failure.
• The bridge that supports the greatest load for 5 seconds.
• In the event of a tie the lightest bridge will be declared the winner.
• The bridge is made of spaghetti and glue only.

**Construction Specifications**

<table>
<thead>
<tr>
<th>Spaghetti Bridge Specifications</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gorge width</strong></td>
<td>400 mm</td>
</tr>
<tr>
<td><strong>Maximum bridge length</strong></td>
<td>500mm</td>
</tr>
<tr>
<td><strong>Maximum bridge height</strong></td>
<td>250mm</td>
</tr>
<tr>
<td><strong>Minimum bridge width</strong></td>
<td>50mm</td>
</tr>
<tr>
<td><strong>Maximum Weight</strong></td>
<td>400 grams</td>
</tr>
</tbody>
</table>

*Please note that bridges will be tested until destruction. Please indicate on your entry if you do not wish your bridge to be included in the strength component of this competition.*

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Griffith University Science Outreach Program

Queensland Government
**Construction Tips**

1. Design your bridge on a sheet of graph paper first.

2. Hot glue tends to cook and melt the ends of the spaghetti, so use just enough to hold pieces together.

3. Try to keep your design simple, using multiples of triangles. Make use of trusses to make your bridge stronger. Trusses are triangle-shaped support beams that attach point-side down to the roadbed of the bridge on either side. Attach the trusses to each other with glue. Trusses distribute the forces of the weight you will add to the bridge.

4. An inverted triangle is more stable than a triangle with the apex on top.

5. Create the roadbed. You can do this by gluing several layers of spaghetti to each other to make a thick, flat roadbed. Or, you may want to leave the strands unglued in some layers so they will naturally move and help redistribute the weight. (Remember, a block of wood, 50mm x 50mm x 100mm long, must be able to pass unobstructed from end to end across the bridge along the top surface of the road deck).

6. Attach the trusses to each side of the roadbed and to the trusses on the other side. The finished bridge will have a roadbed on the bottom with trusses rising above on both sides, like walls and a roof.

7. The bearing points are the points where the bridge is supported at the ends by the edge of the gorge. This area should be flat and smooth. If the bearing point is not flat, the bridge may twist and break.

8. Try to make the spaghetti connections strong but flexible. If the connections are too rigid, when the bridge starts to deflect, the joints will twist and rotate and put added bending force into the spaghetti. Spaghetti is not very strong in bending! In fact, if the ends of the spaghetti are cooked and weakened at the joints, then the bending forces from the joint twisting will break the spaghetti very quickly.

9. Weigh your bridge. Rather than set the bridge itself on the scale, set it on something stable like a box and weigh both. Subtract the weight of the box.