

Bridge-a-Roni

1. **DESCRIPTION:** The objective of this event is to design and build the lightest bridge, constructed only of pasta and glue, with the greatest structural efficiency, capable of supporting a load of up to 10 kg. Each team may bring and enter only one pasta bridge.
2. **ESSENTIAL STANDARDS ALIGNMENT:** Science as Inquiry
3. **TEAM OF UP TO:** 2
4. **MAXIMUM TIME:** 10 min.
5. **TEAMS:** Teams must bring bridge and safety glasses.
6. **EVENT LEADERS:** Will provide all equipment, except for eye protection, needed for testing and scoring. The equipment needed is as follows:
 - a. A testing platform with two elevated flat support surfaces (e.g. blocks of wood) 40.0 cm apart from each other, at least 15 cm wide.
 - b. A square loading block, 5.0 cm long x 5.0 cm wide x 2.0 cm tall (+/- 1 mm) with a hole drilled in the center of the square face. Connected through this hole will be a ¼” eyebolt (with wing nut and washer) connected to a chain. The loading block and chain assembly is placed on the bridge by the team during testing and used to suspend the bucket and sand beneath the bridge.
 - c. An electronic balance or scale that can mass up to 12 kg (the “sand scale”) and one that can mass a bridge up to 400 g to the nearest 1 g (the “bridge scale”). Bridges exceeding the capacity of the bridge scale will be massed on the sand scale instead.
 - d. A plastic tarp to protect floor from sand, if needed.
7. **SAFETY REQUIREMENTS:** Teams must wear safety glasses throughout event.
8. **IMPOUND:** None
9. **CONSTRUCTION:**
 - a. The bridge is to be a single structure constructed of ONLY pasta, multi-purpose glue, and/or hot glue. Multi-purpose glue must be labeled safe and non-toxic (e.g. Elmer’s). Other materials are not allowed, including paint, rubber bands, twist ties, other types of glue, etc.
 - b. The bridge must be free standing and span a **40.0 cm** distance while resting on top of the testing platform.
 - c. The bridge shall not exceed **55.0 cm** in length, **15.0 cm** in width, and not extend below the top of the testing platform when unloaded.
 - d. **The minimum height of the bridge is 10.0 cm;** there is no maximum height on the bridge.
 - e. The bridge must support, at the center of its span, the loading block and chain assembly described in 6.b. The bridge must have an adequately sized opening at its center that allows the bolt and chain to pass through the bridge and hang below the bridge. The loading block assembly must rest freely on the bridge and cannot be rigidly attached to the bridge.
 - f. If the bridge has multiple levels, the team may decide which level to place the loading block on, as long as it remains at the center of the span.



10. **THE COMPETITION:**

- a. Once teams enter the event area to compete, they may not leave the area or receive outside assistance, materials, or communication until they are finished competing. Only contestants and judges will be allowed in the event area while teams are competing. Teams violating this rule will be disqualified.
- b. All bridges must be measured and weighed prior to testing.
- c. Teams must strive to handle the bridge themselves throughout the process of measuring and loading. Event leaders should only handle bridges as a last resort.
- d. Teams must place the bridge on the testing platform themselves so that the ends of the bridge rest on the top surfaces of the testing platform.
- e. Teams will place the loading block on the bridge at the center of its span so the chain hangs freely without touching the testing platform, and connect a 5 gallon bucket to the chain below the testing platform.
- f. The team will be given **3 minutes** to load sand into the bucket once the loading block and bridge are positioned.
- g. Loading must stop when failure of the bridge occurs, when the maximum load of 10 kg is supported, or when the time expires. Failure is defined as the inability of the bridge to support additional load, or something other than the bridge is supporting the load (i.e., the bridge leans and chain touches edge of platform, or sags enough that the bucket touches ground, or part of the bridge sags below the top of the testing platform).
- h. Event leaders will remove sand added after failure occurs. Event leaders will also remove any pasta bits that fall into the sand. The Load Supported at that time will be used to calculate the Structural Efficiency.
- i. The mass of the loading block assembly, bucket, and sand are included in the Load Supported.

11. **SCORING:**

- a. The best structural efficiency (highest number) wins, determined by the following equation:
$$\text{Structural Efficiency} = \text{Load Supported (grams)} \div \text{Mass of Bridge (grams)}$$
- b. Bridges that hold more than 10 kg will be scored using 10 kg (10,000 g) as the maximum Load Supported.
- c. Bridges will be scored in 2 tiers:
Tier 1: Bridges with no violations
Tier 2: Bridges with construction violations
Bridges that cannot be tested for any reason (e.g. cannot accommodate the loading block or team does not have proper eye protection) will be given participation points only.
- d. Ties will be broken in favor of the team with the lighter bridge.

12. **RESOURCES:**

See the Event Resources tab on our website at www.sciencenc.com for instructions, videos and more.