El Camino College
Computer Aided Design & Drafting

2023 MINIATURE BRIDGE BUILDING COMPETITION

GENERAL

The goal of this competition is to design, build, and test through interactive teamwork, resulting in a miniature bridge that will be judged for its load carrying capacity and efficiency.

TEAMS

All teams must consist of 3 or 4 students.

MATERIALS

Bridges will be 3D printed.

- Maximum part size is 5 X 7 X 1 inches.
- Layer thickness is .3 mm.
- Infill density may be adjusted from 10 – 95%.
- A maximum of 100 grams of PLA may be used (as calculated by the MakerBot software).

Each team will provided one (1) kit of building materials as follows:

- Wood glue.
- Clamps to hold parts together while the glue drys.
- Two (2) craft knives.
- One (1) *Matchbox* or *Hotwheels* type **'Test Car'**.

CONSTRUCTION PLANS and DRAWINGS

Construction Plans and Drawings must be developed by the students. Drawings should be computer generated by programs such as AutoCAD. It is suggested that copies are provided for all team members.

1. Include the following general information on each plan sheet, typically in the lower right corner: a) team name, b) date and c) plan sheet no.

2. ***At a minimum,*** include the following views, labeling each view and showing the required dimensions:

a) **elevation or side view** showing the overall length is 12" minimum and the distance between supports is 11"

b) **end or section view** showing the roadbed width is a minimum 2.5" wide x 2.5" high clear opening, the roadbed is no more than 10mm above the testing table and an overall height dimension.

c) **top or bottom view** showing the center hole for the 1" dia. eyebolt and the overall length and width dimensioned.

CONSTRUCTION SPECIFICATIONS

All bridges must be constructed **using only the materials provided** in the kit and the adhesives provided by the student team.

All bridges must be constructed entirely by the student teams.

Only registered team members are permitted at the building tables during construction.

All bridges must span a clear opening of eleven (11) inches. Remember, the bridge will need to be longer than 11 inches to bear on the testing table. The amount of additional length is up to the discretion of the student team.

Don't forget the 1 inch diameter hole in the middle of the bottom of the bridge.

All bridges must have a **minimum 2.5-inch-wide roadbed** upon which the *Matchbox* or *Hotwheels* toy car can pass completely across the bridge.

The roadbed must be 10mm or less above the testing table. **The** bridge may **NOT** be coated with any material such as paint, tape, stain, varnish or adhesive.

All excess glue must be removed from surfaces that are not bonded together.

Pay special attention the joints between parts. The wood glue is not very strong. Joints may be interlocking.

BRIDGE TESTING PROCEDURE

1. **Check Station -** Student teams will be directed to carry their bridges to the Check Station, where they will be checked according to the following criteria:

    - Each bridge will be measured for specification compliance.
    - Each bridge will be weighed and recorded for determination of design efficiency.
    - Each bridge will be checked for drivability.

6. **Load Testing** Each student team will then be directed to take their bridge to one of the Loading Tables on the Main Stage. At this time, students should put on their protective wear. All loading and measuring apparatus will be provided by the Summit County Engineer's office. The loading will proceed as follows:

    - A 2" x 4" load plate and 1" diameter eyebolt will be attached to the mid-point of the bridge.
    - Weight will be loaded into a five-gallon bucket, which will then be hung from the eyebolt.
    - The student team will proceed to add additional weight to the bucket.
    - The weight carried by the bridge must be monitored.
    - The student team will continue adding weight until the point at which the bridge experiences failure. The final weight carried at that point will be entered into the efficiency calculation.

7. **Post Failure Analysis** After the bridge failure, the student team will analyze the remaining structure to determine its mode of failure and provide important information and reflective insight regarding their bridge design and construction efforts.

BRIDGE SCORING

1. **Weight Supported**

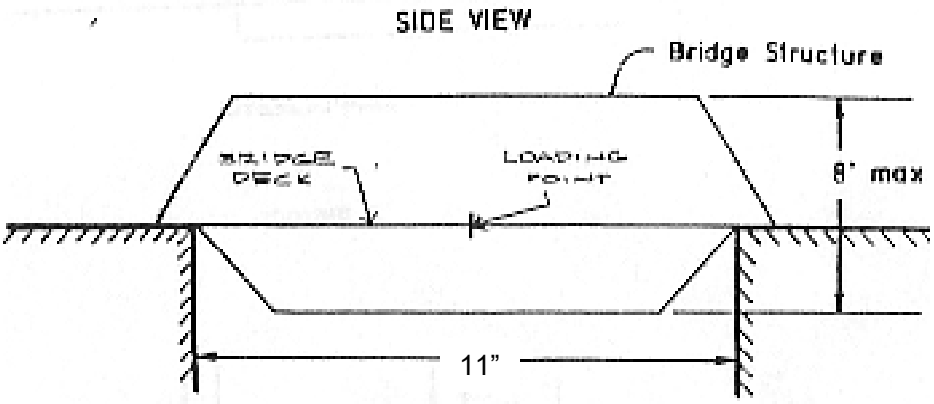
2. **Structural Efficiency -** The Structural Efficiency of each bridge will be determined by the following formula:

$$SE = [W_{SUPPORTED} / W_{BRIDGE}]$$

3. **Bridge Drawing**

Bridge Dimensions:

1. Bridges may have a total height of no more than 8 inches.



2. Bridges may be **no more** than 18 inches and **no less** than 12 inches long.
3. Bridges may have a maximum width of **no more** than 6 inches.
4. Bridges need 1" diameter access in the center for the application of load.