

# Tech Wars 2019

**Niagara County  
Community College**

**Competition Category: Structure - Bridge Competition**

**Level of Competition:** High School

**Event Coordinator:** Evan DeWald (edewald@opschools.org)

**Objective of Competition:** Design a bridge to hold 500lbs. The lightest bridge to hold 500lbs will be awarded first place.

**Rules of Competition:**

**RED text is updated rules for 2018-2019**

•Efficiency= load/ weight of structure

•DO NOT design a bridge to hold an enormous amount of weight. 500 lbs. will be the maximum load applied to the bridge

•Students design and build a 60" bridge to span 56". The bridge will be made from 3/8" square or smaller pine or spruce. The bridge will be tested to failure by placing Olympic style weight plates on the center of the span, supported by a center post for safety.

**TEAMS MUST WEAR SAFETY GLASSES when testing their bridge.**

Rules of the competition:

1.Unlimited number of entries per school (Please e-mail coordinator the number of entries at least one week in advance of the competition.

2.Bridge must be built entirely of 3/8" square or smaller pine or spruce. **NO Wood and/or metal pins may be used at joints. This will be enforced so measure accurately.**

**3.Glue must be a yellow or white carpenter's wood glue.** Glue may be used only at joints. Coating of bridge members will result in disqualification. Sloppy gluing will be penalized for each joint.

**4.Bridge must be 60" long (do not exceed 60")**

**5.Total bridge height (including substructure) must be between 4" and 18" (\*Rule updated 9/19/18)**

6.Bridge may be a through truss, deck truss, arch or a combination.

1.Through trusses must have a clear "roadway" at between 6" and 10"wide and between 6" and 10" high.

**2.A 6" x 6" block must be able to pass clearly through the roadway without any obstructions (failure to do so will result in disqualification)**

3.Substructure may extend no farther than 4" below the top surface of the abutments.

**7. Bridge must have a minimum 2” diameter hole for the safety pipe and slider.** The safety pipe must pass vertically through the center of the span without touching the bridge. The slider will be assembled with necessary shims as the bridge is placed on the testing structure.

8. The weight transfer device will rest on a 5” square shim block. Your bridge must support the 5” square shim to be tested.

9. The bridge must rest entirely on the abutments. No part of the bridge may touch the bottom of the testing structure or hang over the abutments.

**10. NO PINS OR NAILS OR MECHANICAL FASTENERS OF ANY KIND**

11. The roadbed will be a truss/space frame. NO plywood or solid surface permitted. Weight will be applied to the roadbed via the weight transfer device, not the top of the trusses.

12. The distance between the top surface of the abutment and the plane or area that is considered the “road bed” of the bridge must be between 0”- 1” (i.e. imagine a car driving across the top of the abutment and approaching the bridge’s top plane or “road bed”; the bump to be driven up onto the bridge must be 1” or less)

13. NO LAMINATION IS PERMITTED. **No Exceptions-**

**A. Must have a minimum 1/16” gap between bridge members (i.e. parallel running bridge members must have a 1/16” or greater gap between them)**

14. Common woodworking joinery such as dado, lap, half lap, mortise-and-tenon are permitted.

15. NO GUSSET PLATES may be used.

**Bridge Testing:**

**1. Bridges will be scored on a strength-to-weight ratio. (highest score wins)**

**Efficiency= Load (lbs.) / Mass of Structure**

**2. 500 lbs of weight will be supplied.**

3. For a weight to be counted, the bridge must support it for 3 seconds.

**4. Bridge must hold a minimum of 200 lbs. to be scored.**

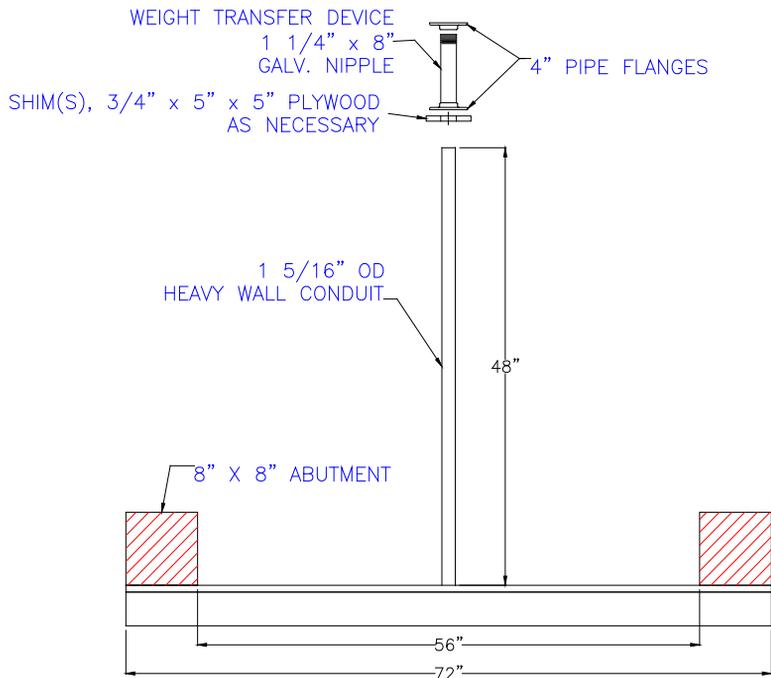
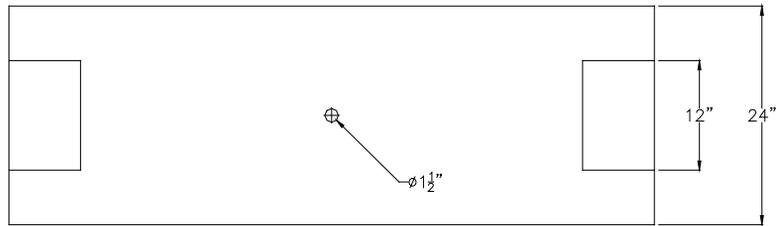
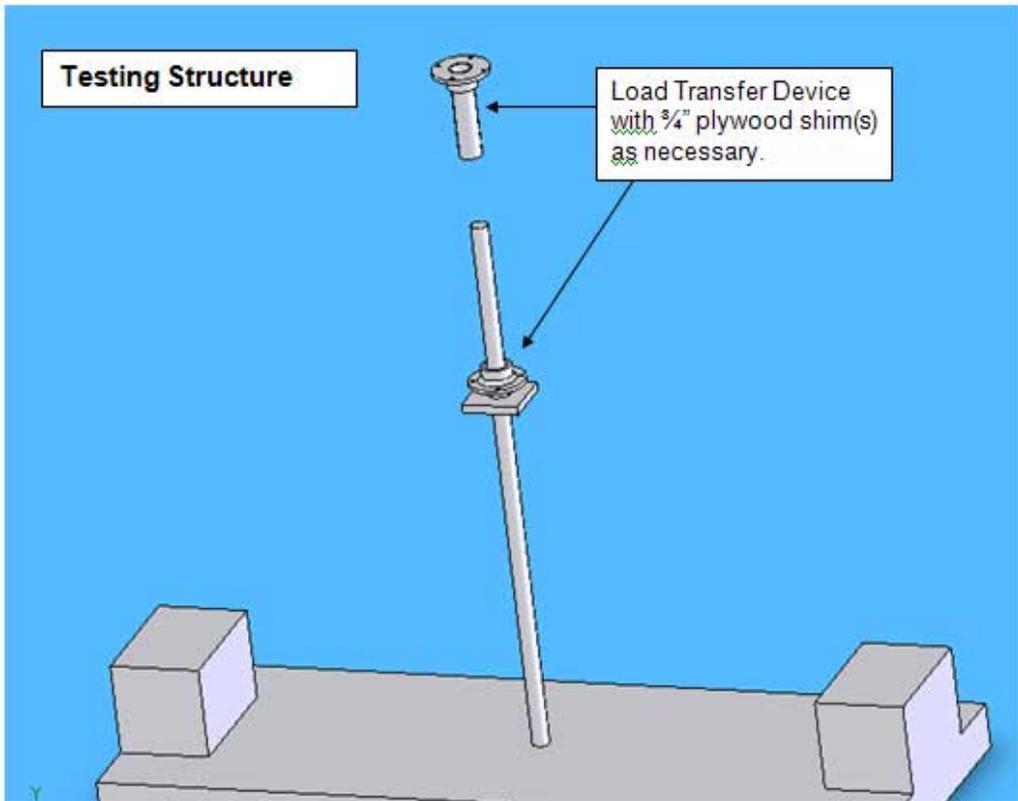
**5. All bridges will be inspected carefully for adherence to the rules. Bridges that do not meet minimum specifications WILL BE DISQUALIFIED!**

6. Students will place their own weights, but may ask for assistance if they choose.

**7. Students will have 10 minutes to stack weights. Once the 10 minute time limit has been reached or the weights reach the top of the safety pole, the weight will be recorded and the structure testing will stop.**

8. Sportsmanship is as important as engineering; judges will be the sole determiner of poor sportsmanship. Teams found to be exercising poor sportsmanship will be disqualified from the event.

9. The load transfer device is designed to transfer the load to the roadbed\*. See #11 under “Rules of Competition”



## **Bridge testing, continued:**

The load transfer device is intended to put the load onto the roadbed of the bridge for a more realistic test of the bridges design.

All bridges will be tested with at least one (1)  $\frac{3}{4}$ " x 5" x 5" plywood shim under the load transfer device, therefore all bridges need to have members in the center of the span to support the 5" x 5" shim.

More shims will be added if necessary for the load transfer device to clear the upper side of the bridge.