

## NEBRASKA STATE CONTEST RULES

### I. Purpose

The purpose of the Bridge Building contest is to design and build the most efficient bridge that will support an applied load over a given span using given material. Bridges must be built by the competing individual prior to coming to the *SkillsUSA Nebraska Leadership & Skills Conference*. The Bridge Building contest will test to determine the efficiency of the design, not the maximum load carried. Bridges may be disqualified if they do not meet all the identified criteria below.

### II. Clothing Requirements

SkillsUSA or appropriate conference attire. School names should not appear on any clothing.

### III. Eligibility

Any *SkillsUSA Nebraska* member who qualifies for *SkillsUSA Nebraska Leadership & Skills Conference* is eligible to participate. Participants are not required to be present during the testing. However, local advisors may require attendance.

### IV. Bridge Construction and Materials

The bridge must be constructed entirely of wood. Any kind of wood may be used, but it must be 3/16" X 3/16" or less in cross-section.

The bridge must be bonded together with commercially available glue. Any type may be used.

Maximum bridge weight may NOT exceed 100 grams. The official weight of the bridge will be determined by the conference scale.

#### **Not Allowed:**

- Particle board
- Gussets – Any triangular structure that completely fills the corner will be considered a gusset. To be considered a structural member (not a gusset), daylight must exist between the two beams constructing the corner.
- Laminated wood – Layers of wood glued together to form the structural members (sticks/timbers), even if the total cross section is less than 3/16" x 3/16".
- Thread, string, or other materials used to wrap joints is not permitted.
- The bridge may not be coated with any type of material.
- Splines or dowels are not permitted.
- Tension members, if used, must be constructed of wood.

### **V. Scope of The Contest**

The bridge dimensions must be in accordance with the following regulations:

1. **Span Length** – The bridge must be long enough to support itself on the test platforms. The bridge must be able to span a gap of *300mm*. The bridge may not exceed a maximum length of *350mm*.
2. **Width** – The bridge must have a minimum inside width of *50mm*. Any wood pieces added (outriggers) to the bridge only to satisfy dimensional constraints will not be allowed.
3. **Roadbed** – The bridge must contain a “roadbed” with a minimum inside width of **50mm** and a minimum length **305mm**.
  - a. The top of the roadbed is NOT to be a solid surface.
  - b. The roadbed must rest on the test platforms and be long enough to continuously support the bridge while deflecting under load testing.
  - c. The maximum thickness of the roadbed may NOT exceed  $3/8$ ” thick.
  - d. Any part of the structure below the roadbed is to be considered the substructure.
4. **Substructure** – The bridge may have a substructure. The substructure may have a maximum length of *270mm* and can be no more than *75mm* below the top surface of the roadbed.

Except for the roadbed and substructure, there are no other height limitations.
5. The unloaded bridge must be symmetrical from side to side and left to right. (Top to bottom does not matter.)
6. The bridge does not have to have sides or a top.
7. The 50mm X 50mm support block must be supported by the roadbed. The loading rod must be allowed to pass through the roadbed and substructure.
8. A 3-view (front, top, and side) scale drawing with dimensions must accompany the bridge at time of contest.
9. The best efficiency rating (not the max load supported) will be used to determine the winner. The efficiency is max load divided by mass of bridge.

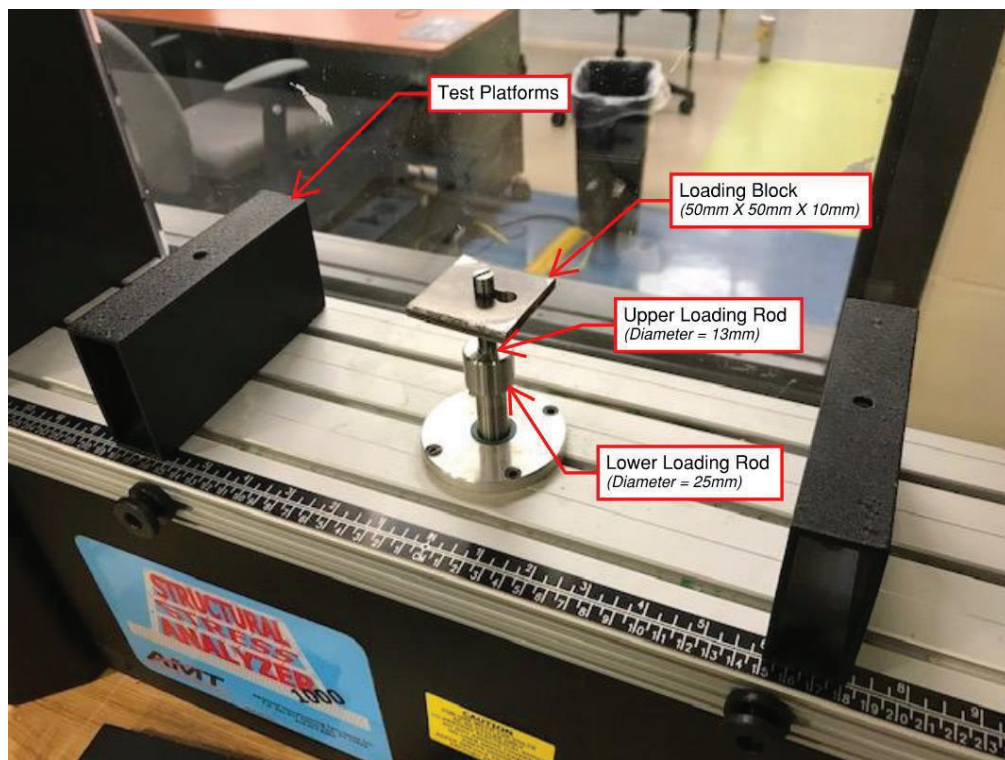
### **VI. Testing**

1. Bridges must be checked in prior to the designated start time identified in the official program. After the start time, and once testing has begun, no additional entries will be accepted.
2. Bridges will remain in the possession of the judges until they are released at the end of the testing.
3. The construction requirements, dimensions, and materials will be checked prior to testing. Bridges which do not meet all requirements may be disqualified.
4. The bridge construction must fit properly within the test machine and accommodate the load plate and loading rod. Bridges which do not meet these requirements cannot be tested and will be disqualified.

# SkillsUSA Nebraska

## Bridge Building

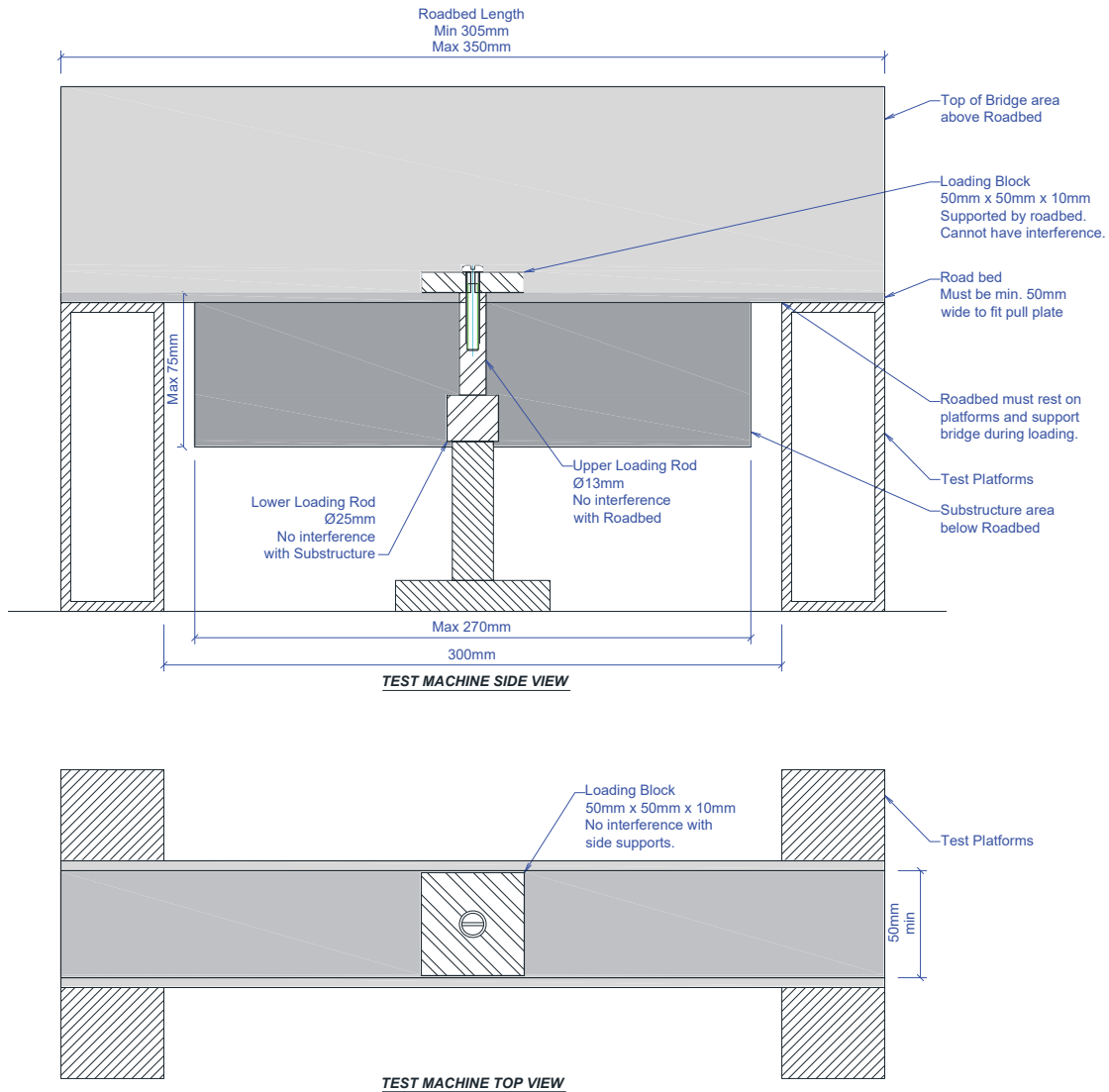
- a. Make certain the roadbed can support and allow the  $50\text{mm} \times 50\text{mm} \times 10\text{mm}$  Loading Block to fit.
  - b. The Upper Load Rod, which has a diameter of  $13\text{mm}$ , attaches to the pull plate and must pass through the center of the roadbed. The Lower Load Rod has a diameter of  $25\text{mm}$  which must be allowed to pass through any substructure.
  - c. Refer to the test machine picture and diagram below for further information.
5. The mass of the bridge will be weighed prior to testing.
  6. The bridge is loaded (tested) by the Loading Rod pulling down on the Loading Block. The Loading Block is a metal pull plate setting flat in the center of the roadbed. Bridges will be tested until failure or when the limits of the test machine have been reached. Failure is defined as the inability of the bridge to carry additional load (Maximum Load).
  7. No portion of the roadbed can be allowed to deflect more than  $20\text{mm}$  below the top of the test platforms, while at maximum load.



Test Machine Picture

# SkillsUSA Nebraska

## Bridge Building



### VII. Scoring

1. Efficiency Rating is calculated by the following:

$$\text{Efficiency Rating} = \frac{\text{max. load supported by bridge [lbs]} \times 454}{\text{mass of bridge [grams]}}$$

- a. The mass of the bridge (in grams) is recorded prior to testing.
  - b. The Maximum Load [lbs] is determined by load testing.
2. Drawings are scored from zero to 20 points.
  3. Total Score = Efficiency Rating + Drawing Score
  4. In the event of a tie, the lightest bridge will be the winner.
  5. Example scorecard calculation:

Contestant Number	Deflection (20mm MAX)	Max Load	x 454 =	Weight of Bridge (100gm max)	Efficiency Rating = gm/lbs x weight	Plus Drawings (Up to 20 points)	Total Points
	[mm]	[lbs]	[gm/lbs]	[grams]			
Example	21	43	19522	49	398.41	17	415