

## Pre-Construction

1. The judges should use the wood box for member check to determine if each member meets the requirement of the Rules.

The member should fit complete in the box.



Figure 1a. Wood box for member check.

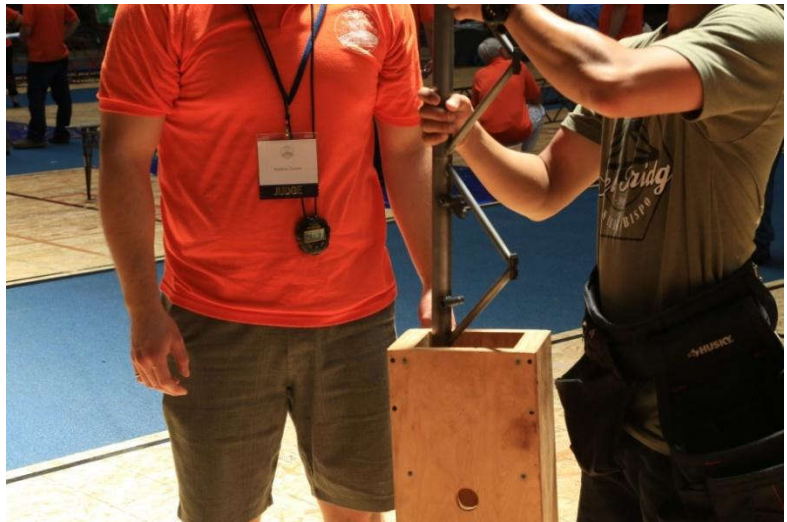


Figure 1b. Judge has competitor perform member check.

2. Use the magnet to determine material compliance with the Rules.

## Post-Construction

1. The judge should use the plywood template for ground clearance to determine if the bridge complies with Rules.

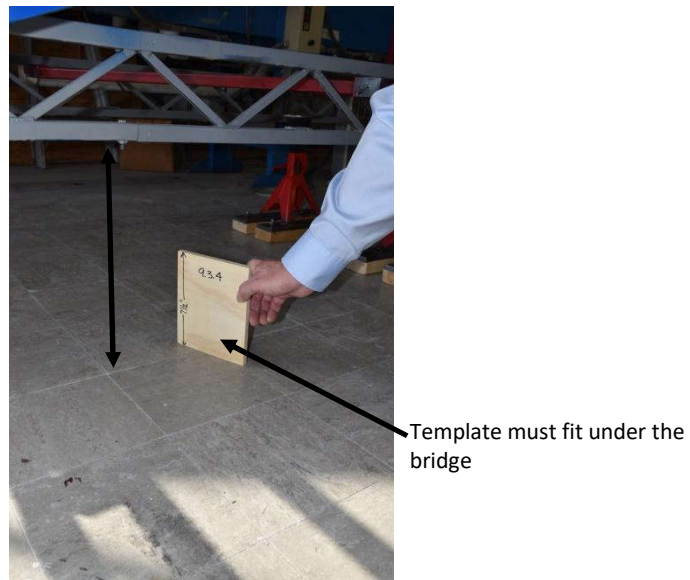


Figure 1. Plywood template for ground clearance.

2. The judge should use the plywood template for passageway to determine if the bridge complies with Rules.

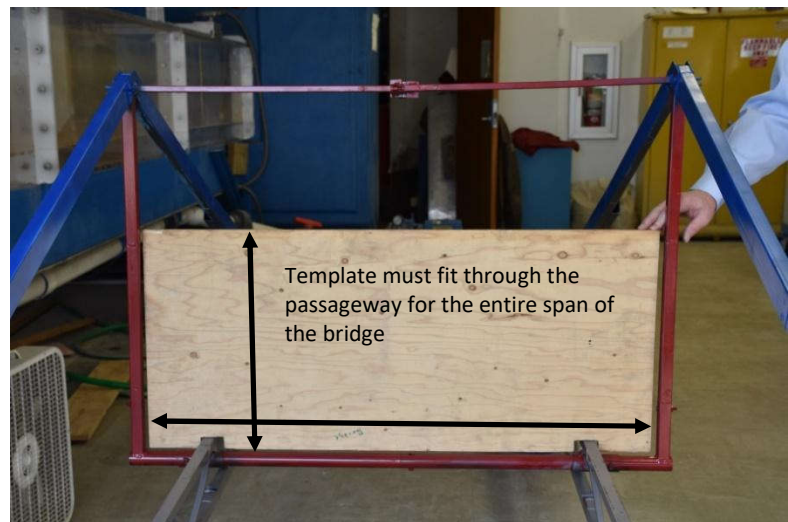


Figure 2. Plywood template for ground clearance.

3. The judges should complete post construction checks including verification of other dimensional requirements using provided equipment such as tape measures and steel bars.

## Lateral Load Test

1. The judge may allow the competitors to preload the bridge. Place grating (no tabs) on the bridge at the location along the span indicated by the Rules and the Lateral Load Test Plan of the Competition Rules.

Set three angles (75 lbs. total) over the stringer indicated in the Lateral Load Test Plan of the Competition Rules. Center the stack of angles on the grating.

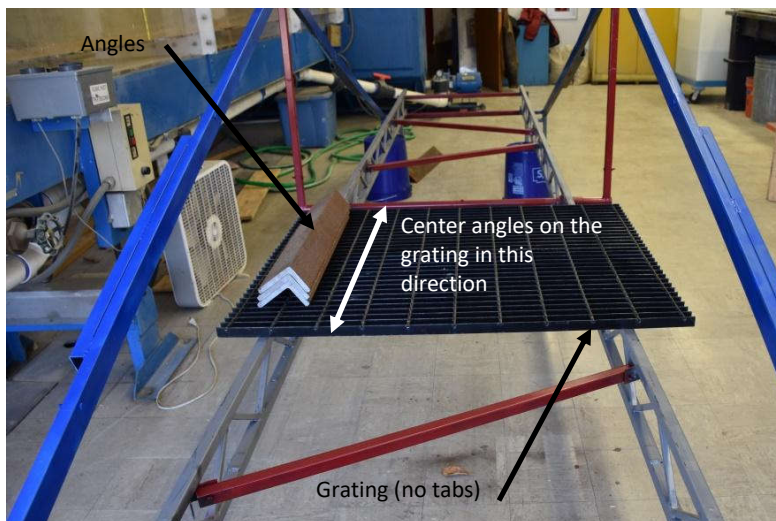


Figure 1. Lateral load test preload.

2. The judge should attach the laser plumb-bob to the bridge stringer at the location labeled as “sway point” in the Lateral Load Test Plan of the Competition Rules.

The bottom of the laser plumb-bob should be positioned about one to two inches above the floor surface. Loop any extra chain length around the stringer and attach the hooked end so that the plumb-bob is securely positioned at the appropriate height.



Figure 2a. Laser plumb-bob.



Figure 2b. Chain secured.



3. The judge should set up the lateral load stand. The final setup before loading is shown here.

Position the lateral load stand so that rope runs perpendicular to the bridge stringer. The rope should run parallel to the floor. See Step 5 for how to adjust stand height. The rope should be taught before loading begins.

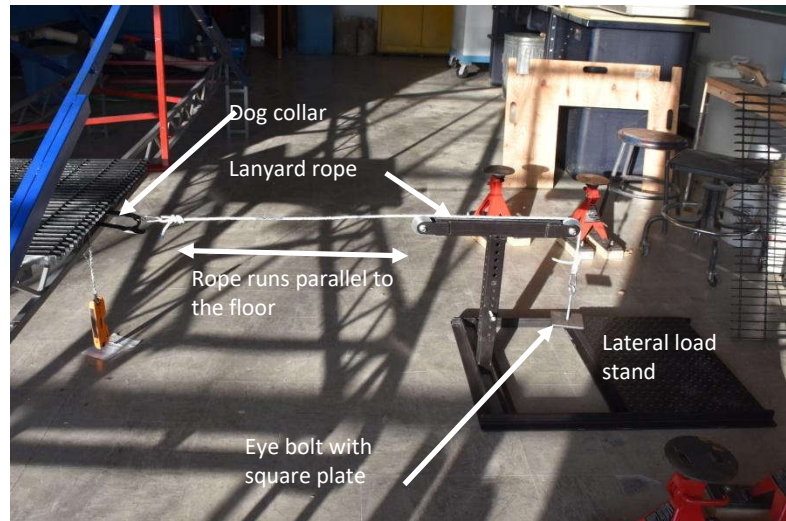


Figure 3. Lateral load stand setup

4. At the bridge end of the rope, connect the carabiner clip to the D-ring of the dog collar. Attach the dog collar to the bridge stringer as close to the laser plumb-bob as possible but at least one grating bar away from the laser plumb-bob so that the two items do not touch. The position of the dog collar and laser plumb-bob should be the same for each bridge.

At the load stand end of the rope, connect the carabiner clip to the eye bolt with small plate.

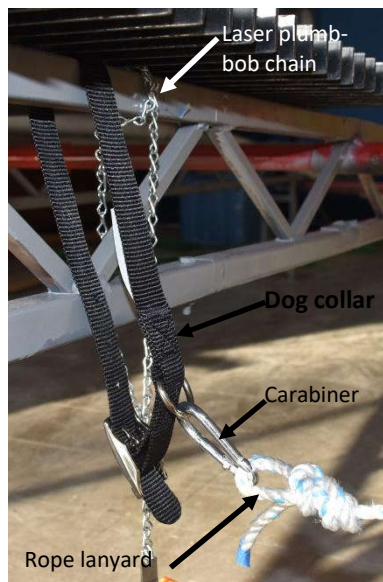


Figure 4a. Rope to bridge.

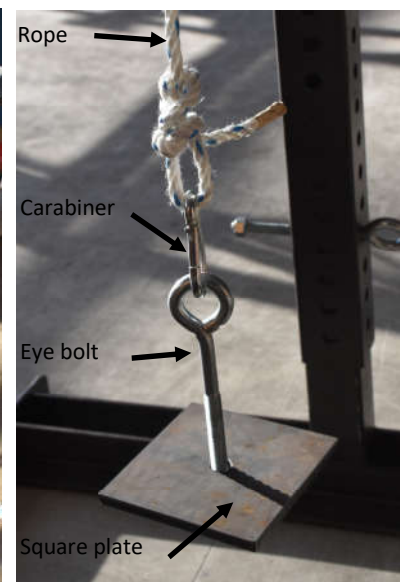


Figure 4b. Rope to eye bolt.

5. The height of the lateral load stand should be adjusted so that the rope is parallel to the floor. To do this, remove the bolt and slide the outer tube sleeve up or down. Reinsert the bolt and secure once the optimal height is found.

Ensure a minimum of two inches between the bottom of the plate and eyebolt and the floor surface.

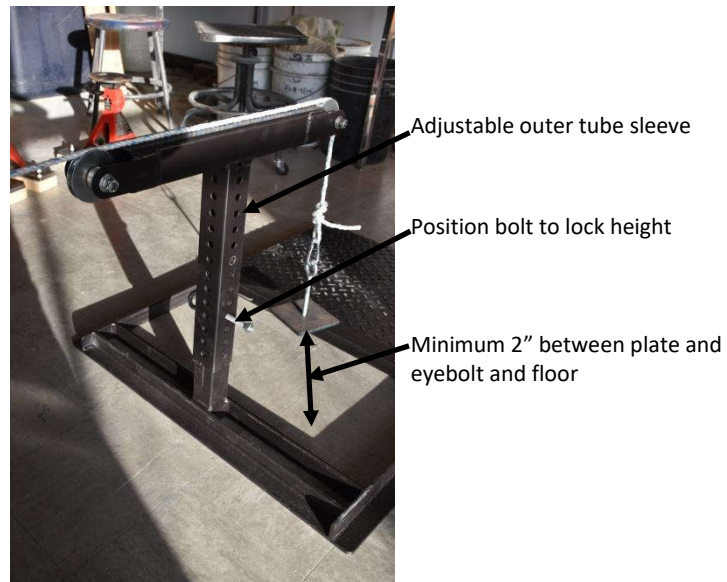


Figure 5. Lateral load stand height.

6. The judge should turn on the laser plumb-bob and position a paper target on the floor so that the laser points to the center of the target. Secure the target to the floor surface with tape.



Figure 6. Paper target start position.

7. To prevent slip at the foundation during the lateral load test, competitors may provide lateral restraint at the base of the structure at the floor level per the Rules.

Competitors may use a foot at each support or an object such as an angle.

Do not apply restraint above the floor level. Do not push down on the bridge.



Figure 7a. Acceptable restraint.



Figure 7b. Acceptable restraint.

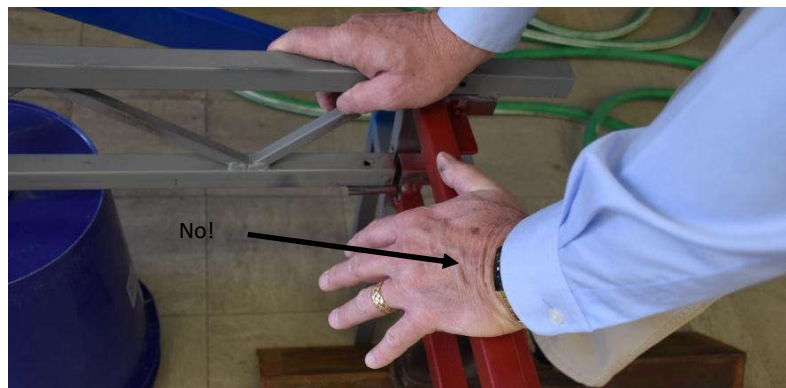


Figure 7c. Unacceptable restraint.

8. A competitor **must stand on the lateral load stand** to prevent slip. The competitor should load the pulley with the two slotted steel plates.

Note: Did you spot the rule violation shown in this photo? The participant should be wearing work boots.



Figure 8. Load applied to lateral load stand.

9. Once the load sequence is complete, the judge should check the location of the laser on the paper target.

If the laser falls outside of the circle, the bridge fails the lateral load test per the Rules.

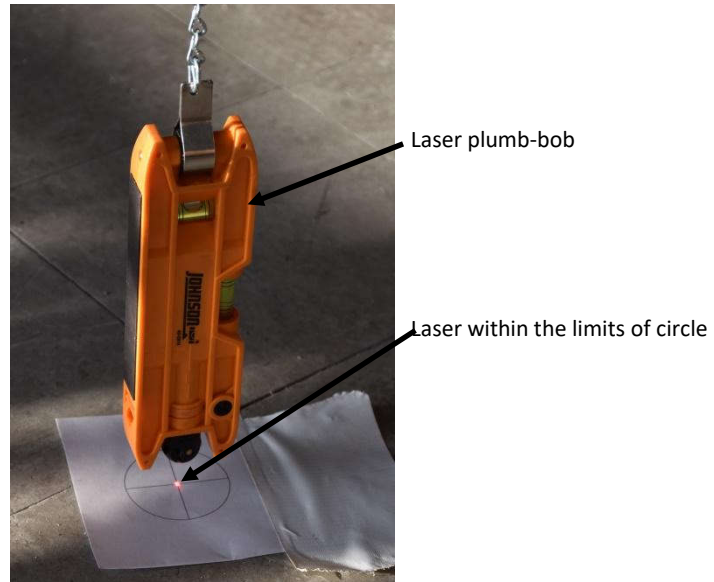


Figure 9. Laser on paper target.

10. Unload the bridge. Once the slotted plates are removed from the pulley, the competitor may step off from the stand. Disconnect the rope from bridge and remove preload grating and angles.



## Vertical Load Test

1. Figure 1 shows a bridge under vertical load.

To begin setup, the bridge should be positioned over the steel bearing plates.

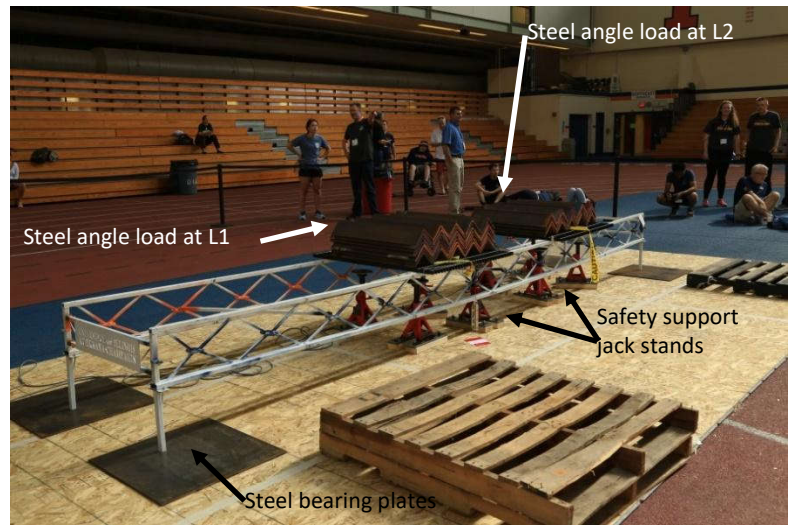


Figure 1. Bridge at vertical load station.

2. The judge should position four jack stands beneath the bridge in each of the two load areas where decking is shown in the Vertical Load Test Plan as indicated in the Competition Rules.

There should be a total of eight jack stands.



Figure 2. Jack stands under bridge at load location.



3. The judge should lay the 2x4 (2" x 4" x 3'-6" wood piece) across the tops of the two bridge stringers.

Place the 4" block on the jack stand. Raise the height of the jack stand until the top of the 4" block touches the 2x4 and set the jack stand height. Note: there may be about  $\frac{1}{2}$ " between the block and the 2x4.

Do this for each of the eight jack stands.

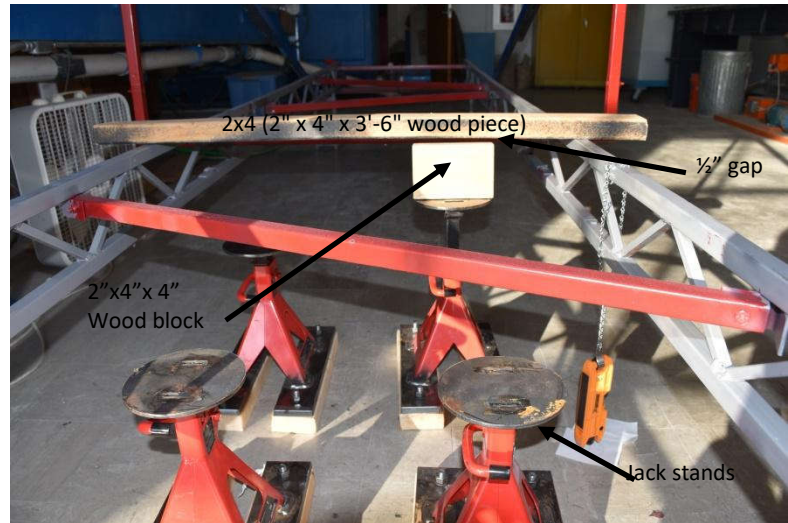


Figure 3. Jack stand height adjustment.

4. Judges should direct the competitors to place the grating (with tabs) on top of the bridge stringers in the two load locations along the span of the bridge.



Figure 4. Grating in position.

5. Judges should direct the competitors to position the grating so that the tabs face upward and the bars span from stringer to stringer.

Position the grating at locations L1 and L2 determined by the Rules and the Vertical Load Test Plan and Elevation of the Competition Rules.



Figure 5. Orientation of grating.

6. If necessary, reposition jack stands so that they sit directly beneath the grating.

Do not place the jack stands under any obstructions such as horizontal bracing running between stringers.



Figure 6a. Correct position.



Figure 6b. Incorrect position.

7. Judges may allow competitors to preload the bridge at locations L1 and L2 per the Rules.

Position the angles so that the outer angles touch the grating tabs. The inner angles should touch the outer angles

Angles should be oriented in the same direction (for example, long leg of angles all facing north.)

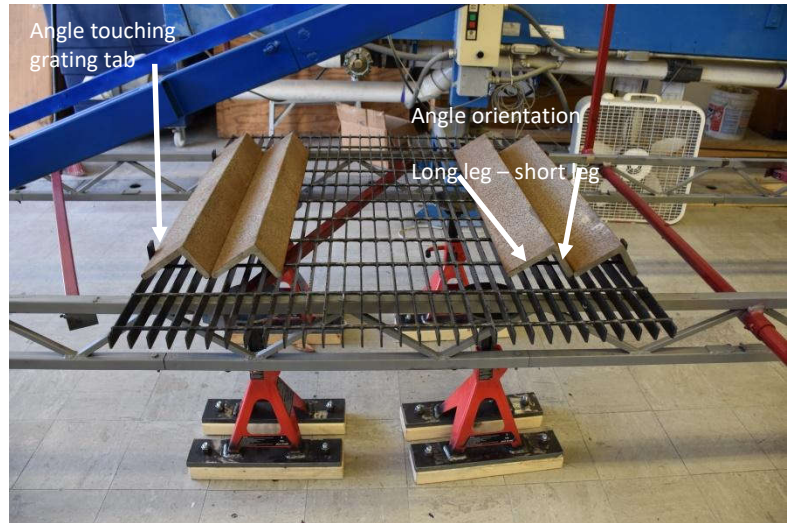


Figure 7. Position of vertical preload.

8. The judge should use the C-clamp to ensure that the bottom of the decking touches the top of the stringer per the Rules. The C-clamp should be removed when no longer needed.



Figure 8a. C-clamp



Figure 8b. C-clamp



9. The judge should attach the laser plumb-bob to the bridge stringer at the location indicated in the Vertical Load Test Plan. Use the 2"x4"x 4" wood block as a spacer in order to set the height of the laser bob.



Figure 9. Laser plumb-bob position.

10. Turn on the laser plumb-bob and position a paper target on the floor so that the laser points to the center of the target. Secure the target to the floor surface with tape.



Figure 10. Paper target start position.

11. Locate the two vertical deflection measurement devices. Each device consists of three parts:

- (1) plate with hook
- (2) caliper stand
- (3) protective cover

Set the display unit to decimal inches.

Place the gage under the bridge.

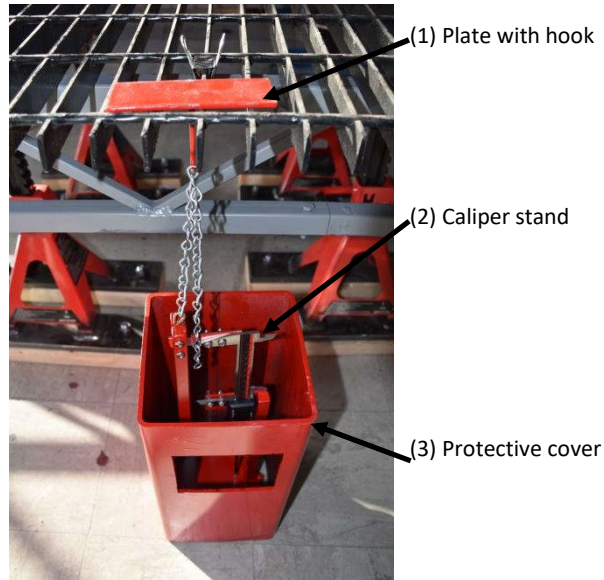


Figure 11. Vertical deflection measurement device.

12. The bar weights attached to the chain and upper jaw should be vertical.

Place the steel protective sleeve over the gage with the display showing. Not shown here for clarity.

Press the 'zero' button.

Pull the chain to open the caliper so that it can measure the maximum deflection allowed by competition rules plus a minimum of 0.5 inches.

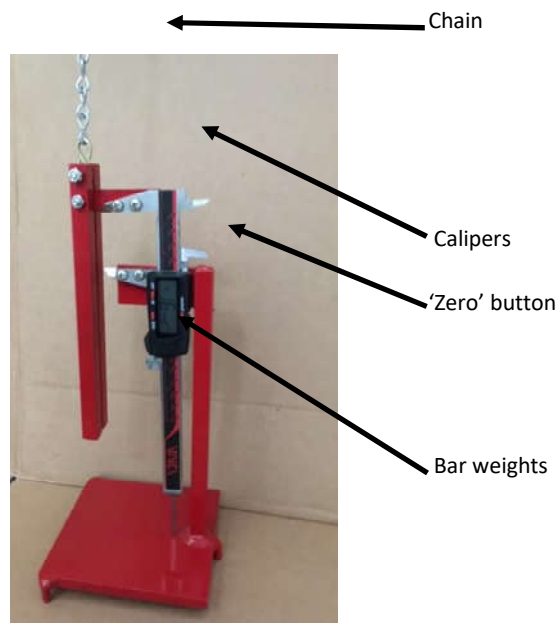


Figure 12. Caliper stand.

13. Use the provided hook to connect the chain to the decking at the location specified by the Rules.

Move the gage and sleeve so that the chain is vertical. It should not have kinks.

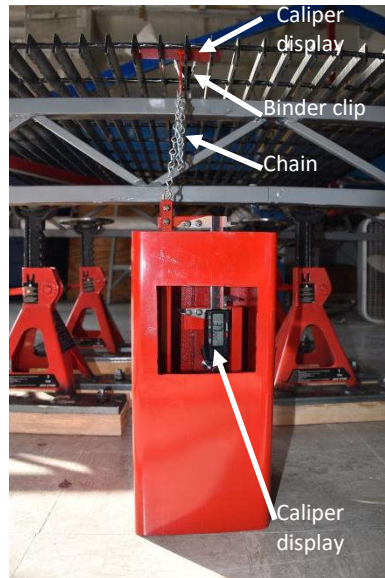


Figure 13a. Device setup.

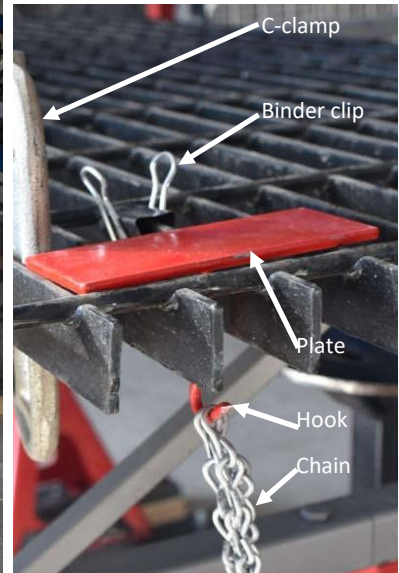


Figure 13b. Chain to hook.

14. Initial values should be recorded rather than using the 'zero' button.

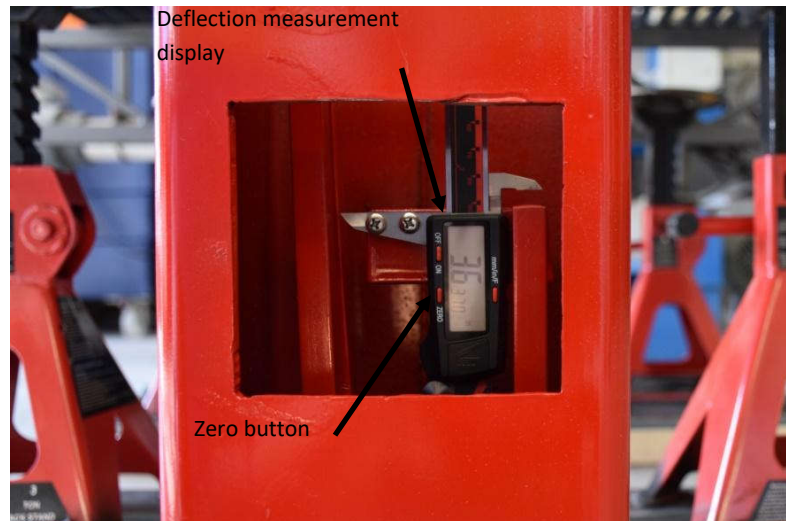


Figure 14. Record initial values.



15. The competitors can commence load placement starting at L1.

Stack angles in layers. Layer one should have angle legs faced down. Layer two should have angle legs faced up in a nested position. Alternate each layer.

When stacking, a short offset of about  $\frac{1}{2}$ " to 1" may be used to facilitate safe and easy stacking and unstacking.

Do not stack angles using a large offset. Do not stack angles with the offset in one direction only.

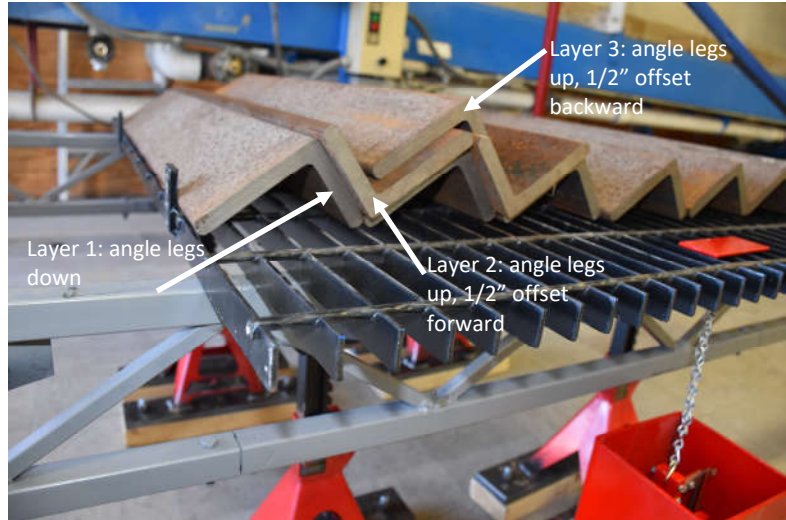


Figure 15a. Proper stacking of loading angles.

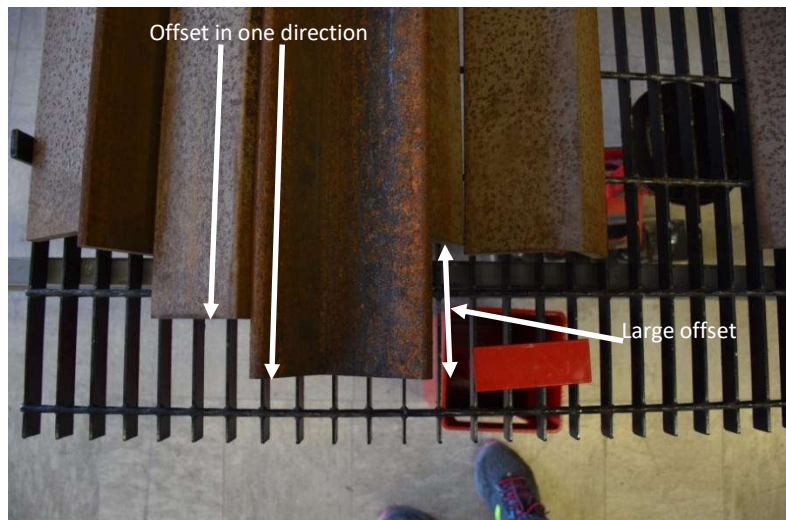


Figure 15b. Improper stacking of loading angles.

16. Loading should be accomplished in a safe, smooth, and continuous manner. Judges should monitor the sway and deflection measurements per the Rules. The judge should record the deflection readings at the end of the load stage and allow the team captain to verify them.

Competitors should then remove all loading angles.