



Student Steel Bridge Competition

2021 Compete from Campus Guidelines



**Smarter.
Stronger.
Steel.**

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SSBC Compete from Campus

In lieu of in-person events, AISC offers a Compete from Campus option provided it is safe to do so given any restrictions put in place by a team's school. Teams that participate in a Compete from Campus Regional Event will be eligible to qualify for the National Finals which will also be in a Compete from Campus format. Wild card eligibility rules will still apply. Visit aisc.org/ssbccompetefromcampus for resources and updates as they are made available.

Questions & Clarifications

Sean Faron
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- General SSBC Questions
- Pre-registration
- Compete from Campus Judge Sourcing Assistance

John Parucki
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- Compete from Campus Guide Clarifications and Setup

University Programs
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- Technical Difficulties for Compete from Campus Submissions

Questions and clarifications regarding the SSBC rules will still be handled through the normal clarifications process and can be submitted to the Rules Committee through this [form](#).

Virtual Regional Event

All schools in each region will compete against each other virtually. The number of schools eligible to be invited to the National Finals will follow the [Rule 4.4.2](#). Schools must submit their entries to AISC by April 1.

Virtual National Finals

Schools must submit their entries to AISC by May 10.

PLANNING

In order to mimic the conditions of an in-person Regional Event, all parts of the competition should be completed on the same day. The sequence of events should occur in the following order:

1. Construction
2. Aesthetics
3. Loading*
4. Weighing

*If your team cannot perform construction and loading in the same location due to facilities limitations, the bridge may be moved after Aesthetics to the loading area. Force shall not be applied to the bridge except as necessary to move it. For example, leaning or sitting on the bridge is not allowed between the completion of construction and the end of the Compete from Campus events.

Due to the nature of the Compete from Campus version of the competition, some rules have been adjusted to ensure as much consistency as possible between the teams taking part in the Compete from Campus competition.

APPROVAL FROM SCHOOL

When planning for the Compete from Campus program, teams should ensure that they have received all necessary permission from their school through their faculty advisor to participate in this type of activity. A plan for usage of facilities and personnel as well as policy compliance for safety and health may be needed.

SAFETY

In order to keep participants and judges safe, carefully consider the materials used for decking, safety supports, and load. AISC recommends that teams review construction and loading plans and material purchase lists, with their faculty advisor, campus head judge, lab or facilities manager, and any other relevant parties.

MATERIAL AND EQUIPMENT

Teams are responsible for obtaining any material and equipment needed to participate in the Compete from Campus program. Schools may wish to request assistance from local AISC member fabricators through a [local fabricator partnership](#).

DECKING

Decking should be applied to the bridge to hold the load according to [Rule 12.2](#). Preferred decking is steel bar grating identified as W-19-4 (1" x 1/8"). The dimensions of a unit of grating are approximately 3'-6" x 3'-0" x 1" and the weight is approximately fifty pounds. If the preferred material, bar grating, is not available, an alternate object for decking that is the same width and has adequate capacity may be used. Suggested alternatives include the following:

- 1/4" steel plate
- Plywood - 2 layers 3/4" thick APA RATED SHEATHING (48/24), STRUCTURAL I, OR STURD-I-FLOOR (24 oc)

For lighter weight decking material, additional load should be added to the decking so that the initial load is at least 50 pounds, which is the weight of bar grating.

SAFETY SUPPORTS

Place safety supports under the decking according to [Rule 12.3](#). Alternatives to jack stands used at regional and national competitions are given in [Rule 12.3](#) and include the following:

- Nested stacks of plastic buckets
- Timbers
- Sand bags
- Masonry units



Stacked plastic buckets can be used as safety supports under decking.

LOAD

Any 50 pound and 75 pound load can be used for the lateral load test described in Rule 11.4. Alternatively, the lateral load can be applied by a team member using a spring scale that clearly shows that 50 pounds are being applied laterally to the bridge.

Load used for testing vertical deflection of the bridge shall meet the recommendations in [Rule 12.4](#). Alternatives to steel angles are given in the Rules.

JUDGING

PREPARATION

Appoint one to three judges by February 1. These may be professors, local engineers, steel fabricators, or others familiar with the competition rules. The judges can be affiliated with the team's school but cannot be a member of the SSBC team. Appoint one of the judges as the campus Head Judge who will sign the certification attesting that all rules were followed to the best of their knowledge. The team's faculty advisor may serve as a judge only if all other options have been exhausted.

Assistance from AISC

If a team is struggling to find a local volunteer to serve as campus Head Judge, AISC will assist them. To request assistance from AISC, teams should email Sean Faron (faron@aisc.org) by January 15. Once requested, AISC will post the team's request and captain's contact information to aisc.org/ssbc. We will notify local AISC members to contact the team captain.

Commitment

The Head Judge position is expected to require the following time commitment:

- Review of rules and guidelines (~2 hours)
- Pre-competition planning with team (~2 hours)
- AISC-hosted online training session for judges (1 hour)
- On campus competition facilitation (~5 hours)

Training

Judges will be asked to attend an online training session hosted by AISC in early February prior to the competition.

DOCUMENTATION

The official judging form for the Compete from Campus competition should be completed by the campus Head Judge. This form can be obtained at the AISC website and will be released by February 1. In addition to documentation of construction and loading, the form will also contain a space for the contact information for the judge(s) as well as an honor code certification statement to be signed by the team captain and campus Head Judge.

CONSTRUCTION

Construction will take place in the same manner that it would for an in-person Regional Event and is based upon the regulations specified in Section 10 of the Rules. Bridge members, tools, nuts, and bolts are staged for construction and inspected by the judges (see [Section 8](#) and [Sub-Sections 10.2.3, 10.2.4, 10.2.5, and 10.6](#) for details). Timed construction will be observed by the judges and should be recorded on video. Judges inspect the assembled bridge per [Section 9](#) of the Rules and allow for corrections as described in [Section 9.4](#) of the Rules.

PREPARATION

A relatively flat open space is required for construction with minimum dimensions of 49 feet by 15 feet. This space can be indoors or outdoors with no specific restriction on the type of flooring. However, be aware that some types of floors have the potential to be damaged during the bridge construction process.

Mark out the construction site on the floor or ground. The 2021 [Host Guide](#) contains instructions on how to mark the site with tape. Use the Site Plan for Virtual Participation found at the end of this document. The transportation zone for this construction site has been shortened to 10'-0" for all teams Competing from Campus to maintain consistency and to facilitate finding a facility that can fit the site. The campus judge(s) shall verify site plan markings prior to starting the event.

PERFORMANCE

Construction will be evaluated in the same manner as it would during an in-person Regional Event. The judge(s) shall complete all pre-construction checks to ensure that bridge members, tools, nuts, and bolts are compliant with the rules prior to the start of construction (see [Section 8](#) and [Sub-Sections 10.2.3, 10.2.4, 10.2.5, and 10.6](#) for details). The judges will commence timed construction, watch for violations of safe construction practices, assess penalties associated with accidents and maintain the official construction time ([Section 10](#)). After timed construction, structural specifications ([Section 9](#)) will be checked by the judge(s).

Measuring tapes, rules, levels, and handmade templates should be used to check for dimensional requirements to the best of the judge'(s) abilities. Templates can be made out of any fairly rigid material such as a stiff cardboard, if needed.

DOCUMENTATION

A wide frame video that captures the whole construction site shall be taken from the start of timed construction to the completion of inspection of the bridge.

The campus Head Judge should complete the appropriate sections of the judging form.

AESTHETICS

Aesthetics will be judged based on the bridge's appearance and the poster describing the design of the bridge. The poster must meet all of the requirements specified in [Section 6.2.1.2](#) of the Rules but will be submitted electronically. The bridge's appearance will be judged based on a series of photos taken by a team member immediately after completion of the construction event so as to capture the bridge in its as-built state. The bridge's appearance will be judged on the basis of [Rule 6.2.1.1](#). Judging for Aesthetics will be completed by a panel of regional judges after all teams have submitted their competition packages so that the same set of judges can evaluate all of the bridges in the region.

DOCUMENTATION

Submit a PDF file of your poster.

Submit the following photos of your bridge with your competition package. The photos must be taken immediately after the completion of the construction event.

- North, south, east, and west elevations
- Overhead photo
- One of each connection type

LOADING

Since accuracy and availability of measurement equipment cannot be guaranteed across all teams, the lateral load and vertical load tests will be a pass/fail event for the Compete from Campus competition. Passing the lateral load and vertical load test is required in order to be considered for awards beyond aesthetics and to be eligible to compete in the National Finals.

Safety is the main priority during load testing. Safety precautions provided in [Section 11.1 and 11.2](#) of the Rules shall be followed for all load testing. The judge(s) have ultimate authority to stop load testing if it is deemed unsafe for any reason. If the testing is deemed unsafe, the bridge will only be eligible for the Aesthetics award and will be deemed to have failed the load test event.

PREPARATION

A relatively flat surface with dimensions larger than the bridge is required for load testing. Due to the potential for damage to the floor as a result of bridge failure or dropping of any weights, it is suggested that plywood or other protective material be used to cover the floor in the area where load testing will occur. Steel plates of the same thickness can be used under the four footings of the bridge to provide a rigid bearing surface.

The lateral load test can be conducted using any system that can apply a 50 lb horizontal load. The application of the horizontal load can be accomplished through the use of a pulley system allowing the 50 lb load to hang vertically (see the 2021 [Host Guide](#) for the device used for Regional Events) or through a spring scale that is attached to the top of the stringer and pulled horizontally to maintain 50 lbs of force. A plumb bob will be required to ensure that the sway does not exceed 1 in.

The vertical load can be applied using any materials that will fit in a stable manner on the decking of the bridge such that a load of 1,500 lbs can be added to one bridge deck and 1,000 lbs can be added to the other bridge deck. Possible materials used for loading may include but are not limited to steel angles, sand bags, and concrete blocks.

All Compete from Campus teams will apply load at locations corresponding to the same die roll. For Regional Events, N=2. A distinct die roll will be announced for the National Finals.

Use the [Vertical Load Test Plan for Compete from Campus Competition](#) for details in regards to where bridge decking should be placed and vertical deflection checked.

Note that safety supports shall be positioned so that no portion of the load will drop more than approximately four inches if the bridge collapses. The safety supports should support the bridge decks in multiple locations so that in the event of the bridge collapsing, the potential for the weight sliding off of the decking is limited.

PERFORMANCE

Lateral and vertical loading will follow the same procedures provided in [Section 11](#) of the Rules with the exception that deflection and lateral sway measurements will not be explicitly taken, but checked to make sure they do not exceed the maximum specified values (1 inch and 3 inches, respectively).

The lateral load test shall follow the procedure outlined in [Section 11.4](#) of the Rules. The use of a plumb bob attached to the location where the lateral load is being applied and centered on a 2 inch diameter circle taped to the floor prior to the application of the load will provide a straightforward means of determining whether the 1 inch maximum sway requirement is met.

The vertical load test shall follow the procedure outlined in [Section 11.5](#) of the Rules. The sequence in which the load is applied is specified in [Section 11.5.3](#) of the Rules. This loading sequence shall be followed as closely as possible at the discretion of the judge. Prior to loading, a means of indicating that the bridge has deflected 3 inches at either vertical deflection measurement location shall be put into place. This measurement system may be accomplished with a sturdy wood block whose surface sits 3 inches below the deck or even a horizontal ribbon that is placed 3 inches below the stringer so as to minimize the need to make a physical measurement near the bridge while it is under load. The bridge passes the vertical load test if the deflection does not exceed 3 inches when loaded to 2,500 lbs and collapse of the bridge does not occur during unloading. Loading shall be stopped immediately if the deflection exceeds 3 inches, a decking unit or some of the load falls off the bridge, or the bridge collapses or a dangerous collapse is imminent in the opinion of the judge. If loading is stopped for any of these reasons, then the bridge is deemed to have failed the vertical load test. Deflections causing (i) the bridge to touch safety supports or the floor, (ii) rupture of a member, weld, or bolt, (iii) slip in an interlocking connection, (iv) buckling, and/or (v) excessive side sway are all conditions that will prompt the judge to declare

the bridge unsafe and loading will be stopped. Lateral sway will be not explicitly measured although the judge may cite excessive side sway as a reason to stop loading.

DOCUMENTATION

Submit a video that captures the lateral and vertical load test.

The campus Head Judge will record on the judging form whether the bridge has passed or failed the lateral and vertical load tests. No specific deflection measurements are required to be recorded.

WEIGHT

Bridges are weighed immediately after the load test event. All bridges shall be weighed, including those that fail one of the load tests.

PERFORMANCE

Weigh the bridge. The use of four scales, with one placed under each footing, provides the optimal means for measuring the total weight of the bridge. The weight at each footing shall be recorded. If it is impractical to weigh the entire bridge at one time, its individual parts may be weighed and summed to obtain the total weight of the bridge.

DOCUMENTATION

Enter the weight of the bridge on the judging form.

SCORING

For the Compete from Campus Competition, the competition categories of aesthetics, construction speed, and lightness will be applied as stated in [Section 6](#) of the Rules. The categories of stiffness and cost estimation will not be considered. The construction economy category will be modified through the removal of the load test penalties term in the construction cost equation and the structural efficiency category will be modified by removing the aggregate deflection and load test penalties terms in the structural cost equation as shown below:

Construction cost, C_c^* :

$$C_c^* = \text{Construction time (minutes)} \times \text{number of builders (persons)} \\ \times 70,000 (\$/\text{person-minute}) + (\text{Total time} - \text{Construction time}) \\ \times 240,000 (\$/\text{minute})$$

Structural cost, C_s^* :

If *measured weight* does not exceed 175 pounds,

$$C_s^* = (\text{Total weight} - \text{Measured weight}) (\text{pounds}) \times 5,000 (\$/\text{pound})$$

If *measured weight* exceeds 175 pounds but does not exceed 300 pounds,

$$C_s^* = (\text{Measured weight} - 175) (\text{pounds}) \times 8,000 (\$/\text{pound}) \\ + (\text{Total weight} - \text{Measured weight}) (\text{pounds}) \times 5,000 (\$/\text{pound})$$

If *measured weight* exceeds 300 pounds,

$$C_s^* = (\text{Measured weight} - 237.5) (\text{pounds}) \times 16,000 (\$/\text{pound}) \\ + (\text{Total weight} - \text{Measured weight}) (\text{pounds}) \times 5,000 (\$/\text{pound})$$

The overall performance rating of a bridge is the sum of construction cost and structural cost.

The bridge achieving the lowest value of this total wins the overall competition.

HONOR CODE

PERFORMANCE

The team certifies that the rules were followed to the best of the judges' and team's knowledge, and all observed violations were recorded on the judging forms.

DOCUMENTATION

The campus Head Judge and Team Captain should sign the certification statement included in the judging form.

RECORDS

Submit your records to AISC through this [link](#).

Record a video to document the construction and load testing portions of the competition. Be sure to record your video in landscape mode for a full view of the construction site. Post the video on YouTube or another platform that can be accessed by AISC. In order to keep the video private, you may change the viewing setting to unlisted so that only those with the URL can view it. Submit the URL.

Submit a PDF scan of the judging form completed by the campus Head Judge.

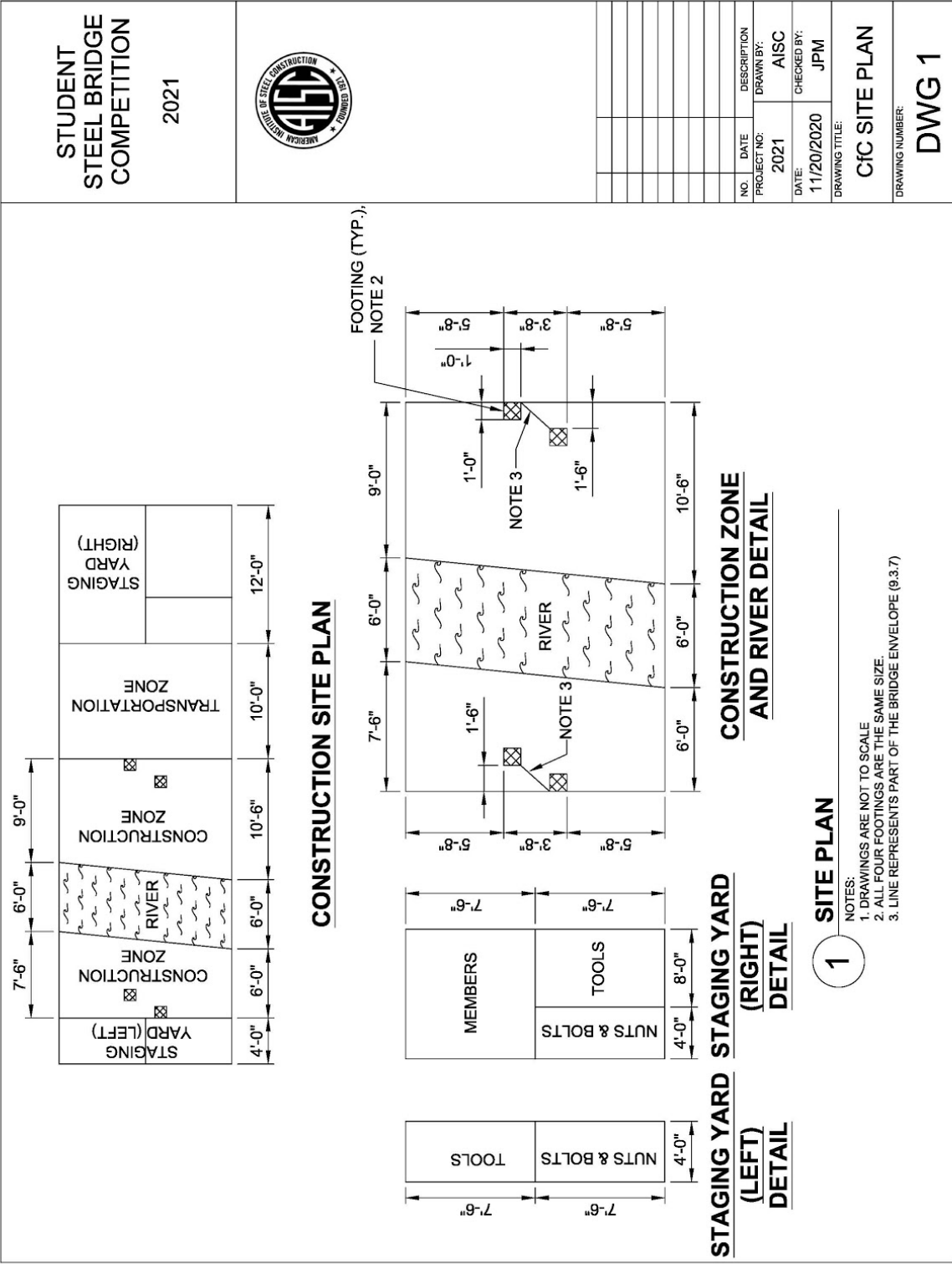
Records to Submit

Your submission to AISC should include:

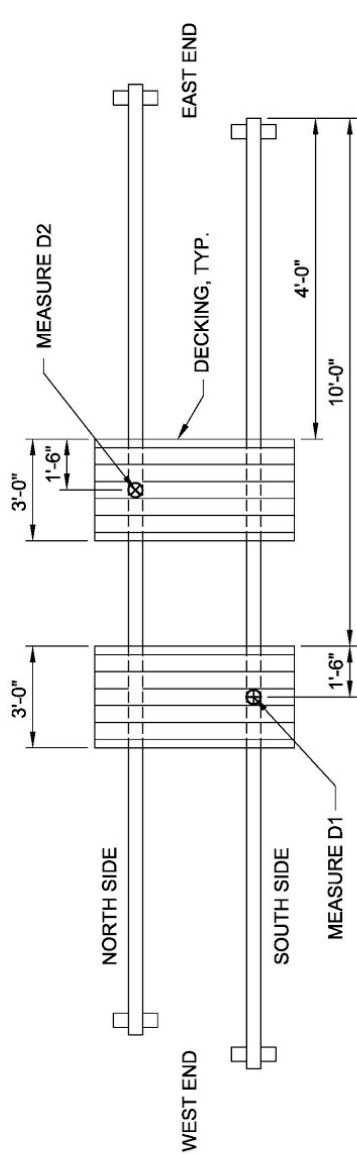
- ☐ Video URLs of the competition:
 - ☐ Construction (*landscape required*)
 - ☐ Lateral load test
 - ☐ Vertical load test
- ☐ Judging Form (PDF Scan)
 - ☐ Construction
 - ☐ Loading
 - ☐ Weight
 - ☐ PDF scan of the certification statement signed by the Head Judge and Team Captain
 - ☐ Name(s) and contact information for the judge(s)
- ☐ Aesthetics Poster (PDF)
- ☐ Aesthetics Bridge Photographs (JPEG/ PNG)
 - ☐ North, south, east, and west elevations
 - ☐ Overhead photo
 - ☐ One of each connection type

APPENDIX

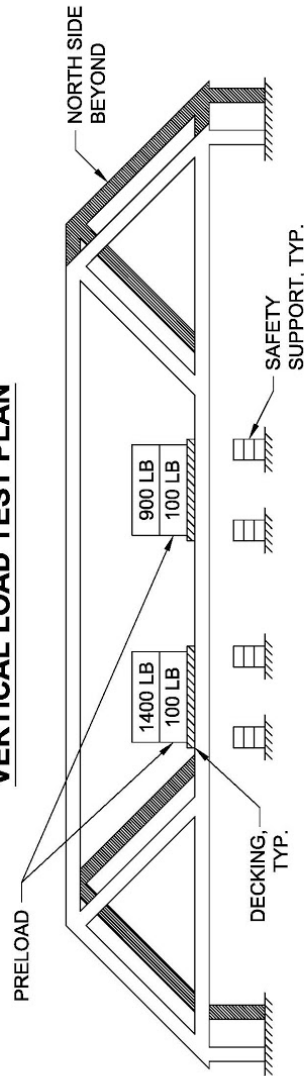
1. Site Plan Diagram
2. Vertical Load Test Plan and Elevation Diagram



2021

[illegible]

VERTICAL LOAD TEST PLAN



VERTICAL LOAD TEST ELEVATION

VERTICAL LOAD TEST PLAN AND ELEVATION

NOTES:

1. DRAWINGS ARE NOT TO SCALE
2. DECKING LOCATIONS ARE MEASURED FROM THE EAST END OF THE SOUTH SIDE STRINGER.
3. SAFETY SUPPORTS ARE REQUIRED UNDER BOTH DECKING UNITS AT ALL TIMES.
4. THE 100 LB PRELOAD IS PLACED FIRST, FOLLOWED BY INITIALIZATION OR INITIAL READINGS OF DEFLECTION AND SWAY MEASURING DEVICES.
5. THE PRELOAD REMAINS IN PLACE, AND 1400 LB OF LOAD IS PLACED ON THE DECKING UNIT LOCATED AT "1.1", FOLLOWED BY 900 LB OF LOAD ON THE DECKING UNIT LOCATED AT "1.2".
6. LOCATIONS OF DEFLECTION AND SWAY MEASUREMENTS ARE SPECIFIC TO THE NORTH AND SOUTH SIDES (11.5.1-3)
7. DEFLECTIONS LOCATIONS D1 AND D2 SHOULD NOT EXCEED 3 IN..
8. STOP LOADING IF ANY DEFLECTION EXCEEDS 3 IN. OR SWAY APPEARS TO BE UNSAFE