



TROITSKY BRIDGE COMPETITION

OFFICIAL 2018 RULEBOOK

Concordia University

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1. ELIGIBILITY

Students must be registered in a full-time engineering (undergraduate) program at the university, college or CÉGEP level.

1.1 Registration Procedure

Registration will not be finalized until payment (cheque) is received and processed. For mailing address refer to section 7.

When payment transactions are finalized, the participant will be added to the list of teams.

1.1.1 Documentation

An official document will be required from the university, clearly indicating that the participants are registered as an engineering undergraduate. This document must be received at the latest, one month before the competition.

Accepted official documents include transcripts or signed documentations. Student IDs are not accepted.

1.1.2 Load Prediction Form

The load prediction form will be provided after the payments are received. They need to be filled out and returned with the proof of enrollment.

1.2 Materials Permitted for the Bridge Construction

All bridges competing in the Troitsky Competition must be made entirely from the following materials:

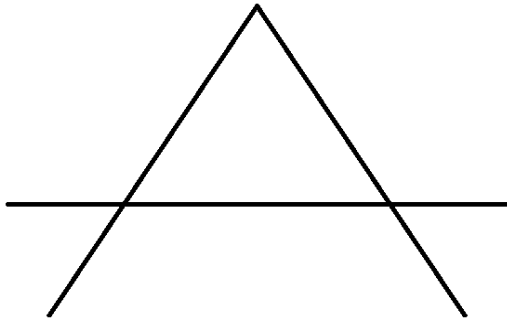
- Wooden Popsicle sticks (~11.5 cm long; ~1 cm wide; ~0.2 cm thick)
- White all-purpose glue or equivalent substitute
 - Lepage or Elmer's white glue are accepted.
 - No epoxy, carpenter's glue, cyanoacrylate or any other glue of this type will be accepted.
- Dental floss
- String is not an acceptable replacement of floss.
- The floss may be waxed or unwaxed.

Teams using any unapproved materials will be disqualified.

1.3 Design Parameters

A-frame bridges will not be accepted.

A-frame bridges also include the following:



A-Frame Bridge



Truncated A-Frame Bridge

1.4 Sportsmanship

Excessive language and intimidation towards the executive committee, staff, volunteers, will not be tolerated.

2. GENERAL CONSTRAINTS

2.1 Assembly

Sections of the bridge are to be built in advance, and to be assembled within a three hour period on the day of the competition.

All pieces of the bridge must be joined into one continuous solid structure. Any pieces not attached to the overall structure will be removed and cannot be used. No exceptions will be made.

Assembly done outside of the three hours will result in an automatic disqualification. No repairs will be accepted after the three hour assembly time. If any repairs are done, this will lead to an immediate disqualification.

2.2 Pre-fabrication

Each pre-fabricated component must fit in a box of dimensions 500x400x350 mm. No part may protrude from the box. The pieces will be tested to fit dimensional constraints one at a time.

A piece that does not fit the dimensional requirements, cannot be used for the design. No exceptions will be permitted.

Make sure the pieces are tested before coming to avoid any unwanted surprises.

2.3 Tools

No power tools are allowed for the assembly on the day of the event. However, manual tools are permitted (i.e. clamps, sandpaper, chisel, etc.)

2.3.1 Permitted Tools

- Hand drills, pin drills.
- Hand saws, razor saws.
- Sanding blocks, sandpaper.
- Clamps, weights.
- Knives: pen-knives, utility knives, hobby knives (X-Acto) or single-edged razor blades
- Other manual tools

2.3.2 Forbidden Tools

- Power drills.
- Electric saws.
- Power sanders.
- Other power tools.



2.4 External Help

No outside help will be accepted. This includes and is not limited to: non-participants, coaches, mentors, parents, friends during the three hour assembly time.

Any outside help will lead to an immediate disqualification.

3. DIMENSIONAL CONSTRAINTS

3.1 Lengths

3.1.1 Span Length

- The clear span must be between 1000 and 1200 mm.
- If the clear span is greater than 1200 mm, a penalty of 5 points will be awarded.
- If the clear span is between 950 and 999 mm, a penalty of 5 points will be awarded.
- If the clear span is less than 950 mm, the bridge will be automatically disqualified.

3.1.2 Total Length

- The maximum length of the bridge cannot exceed 1350 mm. Any bridge exceeding this length will be awarded a penalty of 5 points.
- Note: The length will be measure from the farthest extruding points.
- Exceeding this length may also result in the bridge not fitting in the hydraulic press. See section 4.2.

3.2 Heights

3.2.1 Bridge Height

- The maximum height of the bridge cannot exceed 600 mm. Any bridge exceeding this height will be awarded a penalty of 5 points.

3.2.2 Deck Height

- The maximum height of the ground to the surface of the bridge deck must not exceed 450 mm. Any bridge exceeding this height will be awarded a penalty of 5 points.

3.3 Widths

3.3.1 Bridge Width

- The maximum width of the bridge must not exceed 350 mm. A bridge exceeding this width will be awarded a penalty of 5 points.

3.3.2 Deck Width

- The minimum width of the deck must be greater than 150 mm. Any deck not meeting this width will be awarded a penalty of 5 points.

3.4 Slope

The slope of the deck must not exceed 3%.

The slope will be measured from the highest to the lowest visible point of the deck and the horizontal distance between them. Using the heights from 3.2. Any bridge exceeding the 3% slope will be awarded a penalty of 5 points.

3.5 Anchorage

No external anchorage of the piers is permitted. Any bridges that are externally anchored will be automatically disqualified.

3.6 Deck

3.6.1 Smoothness

The deck must be visibly smooth. Any visible lumps from glue, or bumps from uplifting popsicle sticks will result in the deck not being considered smooth. It is not advised to use dental floss on the surface of the deck, as exposed dental floss will cause the deck to not be considered smooth. A non-smooth deck will be awarded a penalty of 10 points.

3.6.2 Continuous

The deck must be continuous. It is important to acknowledge that this bridge is made for vehicular traffic. If the deck is made of multiple pieces, all pieces must be connected so that there is a smooth connection and no visible gaps, dips, or raises. Any bridge deck that is not continuous will be awarded a penalty of 20 points.

3.6.3 Entry and Exit Points

The deck must have clear defined entry and exit points for vehicular traffic. Any bridge that does not have clear entry/exit will be automatically disqualified.

3.6.4 Deck Design

Any deck that is strictly made of glue will be automatically disqualified.

3.6.5 Warping

Any deck that is visibly warped (not flat) will be awarded a 5 point penalty.

3.7 Clear Span Test

The minimum unsupported span must allow a 1000 mm long by 150 mm high box to pass freely underneath the bridge. Any nonconforming bridge will be awarded a penalty of 5 points.

3.8 Mass

The weight of the bridge must fall between the ranges of 1.00 to 6.00 kg.

Starting at 6.01 kg every 250 g (0.25 kg) extra will be awarded a penalty of 1 point.

- 6.01 to 6.25 kg: -1 point total
- 6.26 to 6.50 kg: -2 points total
- 6.51 to 6.75 kg: -3 points total
- 6.76 to 7.00 kg: -4 points total
- 7.01 to 7.25 kg: -5 points total
- 7.26 to 7.50 kg: -6 points total
- 7.51 to 7.75 kg: -7 points total
- 7.76 to 8.00 kg: -8 points total
- ...

3.9 Disclaimer

If any of these constraints are not met, point deductions may be imposed at the sole discretion of the executive committee. These rules are intended to be complete but the discretion of the committee is reserved at all times.



4. CRUSHING

4.1 Clear Opening

A clear opening of at least 100 by 100 mm must be located above the center of the bridge so that the loading jack may be applied at the center point of the deck. Any bridge without this opening will not be crushed and will be automatically disqualified.

4.2 Hydraulic Press Constraint

Any bridge that does not fit longitudinally (a bridge cannot be placed diagonally) in the hydraulic press will not be crushed and will be automatically disqualified.

5. EVALUATION

5.1 Aesthetics and Originality of the Design

To be assessed by the judges (faculty and professionals) based on four criteria, each worth 2.5 points for a maximum of 10 points:

- Symmetry of the bridge.
- Visible excess glue.
- Quality of the cuts.
- General appearance.

5.2 Presentation

The presentation, which will take place the day of the building, will give a chance for the participants to show the judges and your peers the ingenuity of their bridge. The presentation will judge the students' ability of selling their bridge. The participants must effectively explain the engineering and design behind their bridge during the presentation that will last three minutes. The ranking on ten of this part of the competition is based on the grading criteria mentioned below. Here is what the judges will be looking for in your bridge:

- Originality.
- Good knowledge of engineering principles behind the design.
- Good public speaking.
- Time constraint: 3 minutes
 - Penalty of 1 point for every fifteen seconds over. Being under the time limit is acceptable.

There will be access to a computer with internet and power point. However, it is the responsibility of the students to know if the correct software is installed on the computer. Note that you may email the organizers to know if the software will be available.

A maximum of 10 points will be awarded for the presentation of the bridge design.

5.3 Q&A and Team Spirit

To be assessed by the judges. A portion of these marks will be awarded for the ability to answer questions from the judges during the Q&A period after the presentation. Team costumes are encouraged but not required.

- Up to 2.5 points for the Q&A.
- Up to 2.5 points for the team spirit.

A maximum of 5 points can be earned for this section.

5.4 Ultimate Load Carrying Capacity

The ultimate load capacity of the bridge will be evaluated at the point of failure by a point load at mid-span, distributed by a 100mm by 200mm plate, applied to the deck.

30 points will be awarded to the team with largest ultimate load capacity, and the remaining teams will be awarded points based on their bridge's ultimate load capacity as a percentage of the previously stated largest ultimate load capacity.

The bridge is considered to have failed when:

- a. Deflection (The vertical deflection at the mid span exceeds 50mm)
- b. Shear (including joint failure)
- c. Instability

5.5 Structural Efficiency

The structural efficiency (ns) will be calculated by the following equation:

$$ns = \frac{F_u}{m}$$

Where:

- F_u : Ultimate load attained in the competition
- m = Dead weight of bridge as measure at the competition

35 points will be awarded to the team with the highest score in this category, and all others will be awarded points based on their structural efficiency as a fraction of the highest score. Less than 1 kgf (kilogram force) load supported means zero points.

5.6 Predicted Ultimate Load Carrying Capacity

The error in prediction of the ultimate carrying capacity will be calculated by the following equation:

$$E = \left| \frac{F_u - F_{u,p}}{F_u} \right|$$

Where:

- F_u : Ultimate load attained in the competition, kgf
- $F_{u,p}$: Predicted ultimate load in kgf

7.5 points will be awarded to the team of the lowest error, and zero points to the team with the highest error, and all others will be awarded points based on linear interpolation between these two extremes.

5.7 Predicted Mode of Failure

The team will predict the mode of failure (deflection, shear, or instability) prior to testing. Correct prediction will result in 2.5 points being awarded.

An incorrect prediction will result in no points (0 points) being awarded.

5.8 Summary of Evaluation

Summary of Evaluation	Weight
Aesthetics and Originality of the Design	10%
Presentation	10%
Q&A and Team Spirit	5%
Ultimate Load Carrying Capacity	30%
Structural Efficiency	35%
Predicted Ultimate Load Carrying Capacity	7.5%
Predicted Mode of Failure	2.5%



6. CONTACT INFORMATION

6.1 Mailing Information

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6.2 Personal Contacts

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