Official 2017 rulebook

Changes included:

- A-Frame Bridges
- Slope measurement
- Aesthetics & Originality of the Design

Rulebook - 2017

Competition Information	
Mailing Information	Troitsky Bridge Building CompetitionConcordia University1455 de Maisonneuve West, Suite H-838Montreal, Quebec H3G 1M8
E-mail	comps@ecaconcordia.ca troitsky@ecaconcordia.ca
Website	www.troitsky.ecaconcordia.ca

1. Eligibility

Registered full-time engineering students (undergraduate), in universities, colleges or CEGEP.

1a. Registration Procedure

For all registrations, **your registration will NOT be finalized until your payment is received by our server or your cheque is received.** When your registration is finalized you will appear in the list of participating teams.

An official document from your university that clearly indicates that you are an engineering undergraduate student must be sent one month before the competition.

Accepted official documents include TRANSCRIPTS or signed documentation. STUDENT IDs WILL NOT BE ACCEPTED.

1b. Materials Permitted for Bridge Construction

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

- Wooden Popsicle sticks (~11.5cm long, ~1cm wide, ~0.2cm thick)
- White all-purpose glue or equivalent substitute.

Examples: Lepage or Elmer's white glue are acceptable. No epoxy, carpenter's glue, cyanoacralyte or other glue may be used.

- Wooden Toothpicks (non-colored)
- Dental floss
    - IMPORTANT NOTICE: STRING is not an acceptable replacement of **FLOSS**.
    - The floss may be waxed OR unwaxed

TEAMS USING UNAPPROVED MATERIALS WILL BE DISQUALIFIED.

1c. Design Parameters

Maximum and minimum bridge dimensions as well as further specifications must follow these guidelines to avoid disqualification (please see figure below).

2. General Constraints

- Sections of the bridge are to be built in advance, and to be assembled within a four (4) hour period in the day of the competition.

FURTHER WORK DONE OUTSIDE THE FOUR HOUR ASSEMBLY PERIOD WILL DISQUALIFY THE BRIDGE.

- Each pre-fabricated component must fit in a box of dimensions 500 x 400 x 350 mm. No part may protrude from the box. The pieces will be tested to fit dimensional constraints one at a time. A penalty will be awarded for any piece that does not meet the dimensional acquirements. No exceptions will be made.

- No power tools are allowed for assembly on the day of the event. However, manual tools are permitted.

- Any outside help from a non-participant is strictly prohibited during the four hour portion of the bridge building competition.

Penalty: Disqualification

- NO REPAIR IS PERMITTED AFTER THE FOUR HOUR BRIDGE BUILDING PERIOD.

Penalty: Disqualification

During the four-hour portion of the bridge building competition:

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**

Forbidden Tools

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

3. Dimensional Constraints

Specifications

The span under the bridge must be clear.

Penalty: Disqualification

Tolerance*:* If the clear span is between 950 mm and 999 mm that will result in a penalty of 5 points.

The minimum unsupported span must allow a 1000mm long by 150mm high box to pass freely underneath the bridge.

***Penalty**: –5 points for failure of the box to clear the structure.*

A-Frame Bridges will NOT be accepted. Since they cannot be tested to their full-potential.

Penalty: Disqualification

***Tolerance**: None*

The maximum unsupported span length cannot exceed 1200mm.

***Penalty**: –5 points for length over 1200mm.*

The maximum length of the entire bridge must not exceed 1350mm.

***Penalty**: –5 points for length over 1350mm.*

The maximum height of the bridge (from the ground to the tallest point) must not exceed 600mm.

***Penalty**: –5 points for height over 600mm.*

The maximum width of the bridge at any point must be no more than 350mm, so it can fit into the testing apparatus.

***Penalty**: –5 points for length over 350mm plus lost competitive points.*

The minimum operating width of the bridge deck must be 150mm.

***Penalty**: –5 points for deck width under 150mm.*

The maximum height of the span (the deck or platform) must not exceed 450 mm from the ground.

***Penalty**:* –5 points for deck height over 450mm.

A smooth continuous bridge deck for vehicular traffic must be provided along the entire span of the bridge. It must run the entire length of the bridge. The continuous deck must be constructed entirely of wood (i.e. no solid glue decks).

***Penalty**:* –25 points for a nonconforming deck.

The slope of the deck must not exceed 6% (height difference of 3cm over 50cm span). The slope will be measured from one point:

- The center of the bridge

***Penalty**:* –5 points for deck slope over 6%.

The load will be applied on the deck of the bridge. A clear opening of at least 100mm by 100mm must be maintained above the center of the bridge deck so that loading jack may be applied at the center point of the deck.

No external anchorage of the piers is permitted.

***Penalty**:* –15 points for anchoring pier. The bridges rest on a flat smooth steel surface in the Crusher.

The maximum bridge weight is limited to 6.0kg and the minimum weight is 1.0kg.

***Penalty**:*

-1 point for 6.01 - 6.99

-2 points for 7.00-7.99

-3 points for 8.00 - 8.99

-4 points for 9.00 -9.99

-5 points for anything over 10.00

The bridge is considered to have failed once the maximum deflection of 50mm is reached or, any member fails and the carried load at that point will become its ultimate load.

IF ANY OF THESE CONSTRAINTS ARE NOT MET, POINT DEDUCTIONS OR DISQUALIFICATION 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. Evaluation for Troitsky 2015

10 pts. Aesthetics & Originality of the Design (A&O)

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

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

5 pts. Booth Design and Team Spirit (BDP)

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. The point distribution will be as follows:

- Up to 2.5 points for the Q&A
- Up to 2.5 points for the booth design and team spirit

25 pts. Ultimate Load Carrying Capacity (Fu)

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.

25 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 failed when:

a. The vertical deflection at the mid span exceeds 50mm, or

b. Any member or joint fails, as previously defined.

10 pts. Predicted Ultimate Load Carrying Capacity

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

$$E = | (Fu) - (Fu,p) | / Fu$$

Where,

Fu = Ultimate load attained in competition in kgf

Fu,p = Predicted Ultimate Load in kgf25 points will be awarded to the team with the lowest error, and zero point to the team with the highest error, and all others will be awarded points based on linear interpolation between these two extremes.

Dead Weight (m): The dead weight is measured and recorded in grams after final assembly and drying time. One-gram precision is used for the structural efficiency calculations.

35 pts. Structural Efficiency (ns)

The structural efficiency will be calculated by the following equation:

$$ns = Fu / m$$

Where,

Fu = Ultimate load attained in competition

m = Dead weight of bridge as measured at competition

25 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 load supported means zero points.

5 pts. Predicted Mode of Failure (FM)

The team will predict the mode of failure (deflection or member/joint failure) prior to testing. Correct prediction will result in 10 points, incorrect zero.

10 pts. 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 & design behind their bridge during the presentation that will last three minutes. The ranking on ten (10) of this part of the competition is based on the grading criteria mentioned below.

There will be access to a computer with internet. However, it is the responsibility of the students to know if the correct software is installed on the computer. Note that you may e-mail the organizers to know if the software will be available. However, here is what the judges will be looking for in your bridge:

- Originality
- Good knowledge of Engineering Principles behind the design
- Time constraint (Penalty of one (1) point for every fifteen (15) seconds over. Being under the time limit is ACCEPTABLE.)
- Good public speaking
- & Attire

Summary of Evalution

Summary of Evaluation	**Worth**
Aesthetics & Originality of the Design	**10%**
Booth Design and Team Spirit	**5%**
Ultimate Load Carrying Capacity	**25%**
Predicted Ultimate Load Carrying Capacity	**10%**
Structural Efficiency	**35%**
Predicted Mode of Failure	**5%**
Presentation	**10 %**