

SAMPE Benelux composite bridge building competition for engineering students



INVITATION

Dear composite material enthusiast,

The SAMPE Benelux Chapter has the great pleasure to announce the 2018-2019 Bridge Building Contest: an exercise in design, manufacturing and testing of a scaled bridge model in composites!

SAMPE Benelux is a networking organisation of 170 professionals and students in advanced materials, very active in composite materials. Promoting technical excellence by exchanging know how is one of SAMPE's key objectives. To create a dialogue and network with tomorrow's engineers, SAMPE Benelux organises its second bridge building contest, with use of composite materials, to be run amongst teams of Benelux engineering students. This event is very popular in other SAMPE chapters for +20 years. After a successful event last year, we look forward to the new, creative designs of 2018-2019.

The contest duration is five months and could be performed within a course or project framework. Students will have to use their knowledge and creativity to design a bridge. Students will learn and expand their abilities in composite manufacturing and engineering design: starting from a concept, design calculations and material selection, they will eventually go to bridge manufacturing and testing of the bridge element.

Prizes will be awarded based on the design that meets in the most optimal way the imposed deflection, strength, cost and weight targets, with extra incentives to use bio-based materials. The contest competition will take place on the 28th of March 2019 at University of Gent in Belgium.

IMPORTANT DATES

Deadline for inscriptions: Friday, 19th of October 2018

Preliminary design of bridge (including material choice):
Friday, 7th of December 2018

Final design of bridge: Friday, 26th of February 2019

Bridge Building Contest: Thursday, 28th of March 2019

PARTICIPANTS

If you are a Bachelor, Master or PhD student in Belgium, The Netherlands or Luxembourg, you can apply to this contest. Students participating in the contest will have to establish teams. Each team will design and manufacture a bridge model. Teams consist of 3 to 5 students. Bachelor, Master and PhD students can cooperate and get together in one team. You apply for the competition with names of the team, students, coach and affiliation. Each registered team will submit its preliminary design together with the desired sample materials by 7th of December, its final design on the 26th of February and arrive to the challenge with its manufactured bridge on 28th of March at the test location. The teams will also bring a presentation to the contest detailing the material selection, manufacturing process and design.

TECHNICAL RULES

Materials

A limited set of materials is available for all teams. It includes the following elements:

- Glass fibre UD and weave
- Carbon fibre UD and weave
- Flax fibre UD and biax non-crimp fabric
- Basalt fibre UD and biax non-crimp fabric
- Epoxy and bio-epoxy
- Structural foams: PMI foam, PP honeycomb, cork and balsa core
- Paste adhesive

The materials set is sponsored by different material suppliers. The complete list of materials to be considered will be made available upon subscription. The use of other materials for the bridge is not allowed. Teams are free to use additional auxiliary materials or tools during manufacturing (like consumables). A wide range of process and material combinations are therefore available to build the final bridge.

Weight

The mass of the bridge shall not exceed 1.2 kg. Competitors that exceed this limit will have the chance to remove material from the bridge until the target is met.

Dimensions

Design a load carrying structure with a maximum width of 130 mm. The distance between the supports is 585 mm. The maximum length of the structure is 610 mm. The height shall not be larger than 200 mm. The structural design can be chosen freely within these dimensions.

Loading

The structure will be loaded statically using a three-point bending test (see Figure 1). At mid-span the loading force will be applied to the deck surface of the bridge. The bridge will be simply supported at the support points. Please consider the design at the load introduction points carefully. The geometry of the support and loading points will be provided upon subscription.

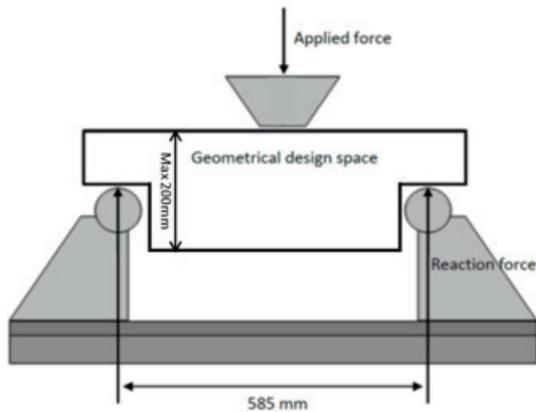


Figure 1. Schematic of three-point bending test

Other aspects

Not only the mechanical aspects will be considered, but also the amount of bio-material in the bridge, the weight, the costs, and the amount of waste material during production. Material costs are fictitiously charged. The manufacturing technique is in principle free to choose. You should however consider that the structure must be manufactured with the available materials. Acceptable methods of fabrication include wet layup and vacuum infusion.

Scoring

The structure is evaluated by the design factor D, which should be kept as small as possible. The factor comprises four criteria:

1. The maximum compression load P_{max} [N] where failure occurs. The design load is 25.000N. The minimum failure load should be at least 5000 [N].
2. The displacement d in mm at 3000 [N].
3. The material costs for production of the bridge C_{bridge} minus 0.9 times the costs of the bio-materials in the bridge (C_{bio}) [€].
4. The structural mass of the bridge M_{bridge} [kg].

$$D = \sqrt{\frac{25000N}{P_{max}}} \times \left(1 + \frac{d_{3000N}}{10mm}\right) \times (C_{bridge\ prod} - 0.9 * C_{bio}) \times M_{bridge}$$



An estimation of the failure force and the displacement of the structure must be given in the design phase of the structure. The structure of each group will be tested up to failure (max. 30.000[N]).

AWARDS

Awards will be granted to the bridges with the lowest D-factor, meeting all the requirements listed above. Weight will also be given to the design justifications entered and the presentation given by the team prior to testing. Five jury members chosen by SAMPE and the competition sponsors will evaluate the work of all the teams and will appoint the winners. The winners will receive 400 €. A series of other prizes will be awarded depending on received sponsorship. A one year SAMPE student membership is offered to all participants that show up at the test event.

APPLICATION

Send an e-mail to yaela@yaelacomposites.nl providing the following information (by 19th of October at the latest):

- Team name
- Team members
- Team point of contact e-mail
- Team coach name
- Team coach email
- Affiliation

AGENDA OF THE BRIDGE BUILDING TEST DAY

During the testing day, all teams will present and test their bridges in the hall of the laboratory. The jury will then determine the winners of the contest. Also a guided lab tour will be given.

CONTACT

For more information and your team's application, please contact:

Yaéla Borrenbergs (yaela@yaelacomposites.nl)

Composites Manufacturing Engineer & Board Member SAMPE Benelux

Take a look here if you want to get an impression on last year's bridge building contest:

sampe-benelux.org/blog/sampe-benelux-bridge-building-contest-2017

SAMPE Benelux thanks the material sponsors of the SAMPE Benelux students event:

