

# SAMPE Benelux

## Additive Manufacturing Contest for engineering students



# INVITATION

**SAMPE Benelux has the great pleasure to announce the 2020-2021 Additive Manufacturing Contest: an exercise in design of a rigid vertical structure (column or tower) that will be tested in compression to failure!**

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 now takes the initiative to start an additive manufacturing competition. Teams of Benelux engineering students are invited to join the competition and show their design skills. We look forward to kick off this competition in the Benelux!

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 vertical structure that will be tested to failure in compression. Students will learn and expand their abilities in additive manufacturing and engineering design: starting from a concept, design calculations and structural optimisation, the students work towards a digital model that is printed by a SAMPE partner and finally tested in compression.

Prizes will be awarded based on the design that meets in the most optimal way the imposed deflection, strength and dimensional targets. The contest competition (live, in virtual format or both live and virtual) will take place on the 31st of March 2021 at Saxion Hogeschool in Enschede, the Netherlands.

### IMPORTANT DATES

**Deadline for registrations:** Tuesday, 17th of November 2020

**Preliminary design:** Friday, 18th of December 2020

**Final design:** Friday, 12th of February 2021

**Additive Manufacturing Contest:** Wednesday, 31st of March 2021

### 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 test the structure made by additive manufacturing. Teams consist of 1 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. A SAMPE partner, Vivero Solutions, will print the structures and bring them to the test location on 31st of March where the teams can inspect and clean-up the printed parts and possibly assemble their parts together. The teams will also present their design choices during the contest.

### TECHNICAL RULES

#### General information

- Students will design a rigid vertical structure (column or tower) that will be tested to failure between the platens of a typical compression load frame.
- Compression load will be limited to 25kN to protect the load frame.
- The material will be Onyx One polymer from Markforged, compatible with Markforged Desktop printers.

- Entries may be assembled from multiple printed parts. Only printed parts may be used in the assembly and no adhesives will be allowed to assist assembly.
- Parts to be printed need to fit within the printer dimensions of a Markforged Desktop printer.
- Support material may be used to create the part. Any trapped support material will be considered part of the structure and thus included in the weight.
- Basic hand tools (hobby knives, files and sand paper) will be available for finishing and fitting work during the test day.

#### Printing

- Students will submit an STL file and desired printing orientation of their design for printing via e-mail.
- STL files will be checked for quality and prepared for printing by the committee. Printing parameters are intended to be consistent across all contestants and will only be adjusted if approved by the committee.
- All entries will be printed by the committee prior to the show.
- Post-processing and assembly may be done until test time.
- Standard entries will be printed with no more than 3 shells and will have 100% infill.
- The standard layer height is 100µm and maximum 200µm.
- Each entry must be printed in one single print envelope. That is, each entry (including all pieces) must be able to fit within a 320 x 132 x 154 mm box for printing.

#### Structural test

- Students will design a rigid vertical structure that will be compression tested to failure.
- The column must have at least a 2:1 aspect ratio: height must be at least twice the width and depth.
- The column must fit on a 13-cm diameter platen and not be taller than 750 mm. No part of the structure may extend outside of this cylinder.
- The column may not deflect more than 20% of its original height. If it does, the peak load will be determined up to the 20% deflection point. Columns must be a minimum of 50 mm tall and hold a minimum of 0.5 kN to be considered for awards.

#### Scoring

The columns will be ranked according to the score below and will be based on the normalised weight, height and load during testing. For the ranking, higher values of the score are better. The normalisation is based on the minimum and maximum values of all competitors.

$$Score = -3W + 4H + 2P$$

With:

$$W = \text{Normalised weight} = \frac{(W_{\text{column}} - \text{Min}(W_{\text{competitors}}))}{(\text{Max}(W_{\text{competitors}}) - \text{Min}(W_{\text{competitors}}))}$$

$$H = \text{Normalised height} = \frac{(H_{\text{column}} - \text{Min}(H_{\text{competitors}}))}{(\text{Max}(H_{\text{competitors}}) - \text{Min}(H_{\text{competitors}}))}$$

$$P = \text{Normalised load} = \frac{(P_{\text{column}} - \text{Min}(P_{\text{competitors}}))}{(\text{Max}(P_{\text{competitors}}) - \text{Min}(P_{\text{competitors}}))}$$



#### AWARDS

Awards will be granted to the bridges with the highest score, 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.

#### REGISTRATION TO THE CONTEST

Send an e-mail to [additivemanufacturing@sampe-benelux.org](mailto:additivemanufacturing@sampe-benelux.org) providing the following information (by 17 th of November at the latest):

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

#### AGENDA OF THE TEST DAY

During the testing day, the printed models will be prepared for testing, the teams will present their designs and potentially assist during the structural testing (if the situation allows for live presence). The jury will determine the winners at the end of the contest.

#### CONTACT

For more information and your team's application, please contact our organisation committee at: [additivemanufacturing@sampe-benelux.org](mailto:additivemanufacturing@sampe-benelux.org).

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

