

Exercise code: DP-2
Exercise type: Group Design, Build and Test Project
Exercise title: Paper structure

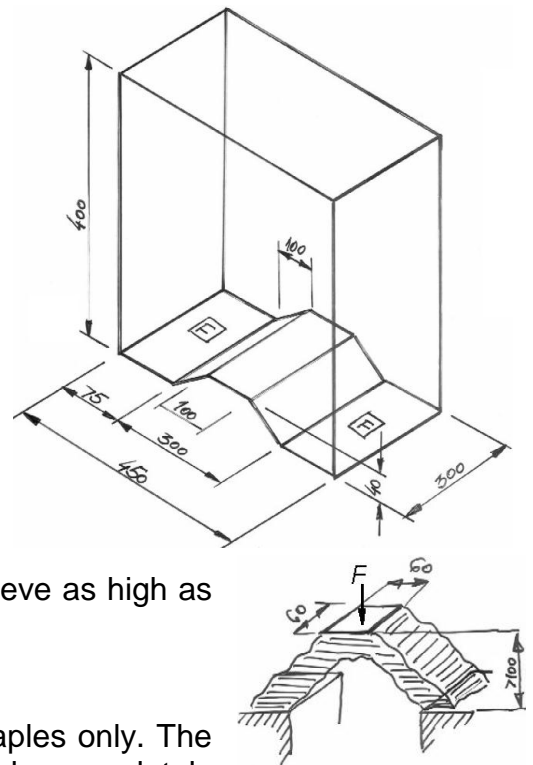
Exercise Assignment:

Task (Objective):

Design, build and test a paper structure to span a gap of 300 mm, which can carry a concentrated load at its middle span on the platform. The goal is to achieve as high as possible load/weight ratio.

Specification:

The structure is to be made of drawing paper and staples only. The structure must bridge over the gap 300 mm long and be completely contained in the volume shown in the figure. Feet of the structure must be completely contained within the areas \square . Load area of the structure must be at least 60x60 mm and must not be less than 100 mm higher than the level of areas \square . Dimensions of the volume within which the structure must be contained are given in the following figure.



WHAT and HOW to do:

- 1. Form a group of 4 members** (same as for the previous exercise). Conduct all phases of the design process (1 – 10) and refer to each of these in the report. This is group design, build and test exercise. All group members should contribute to the project equally in all, calculations, drawings and building of the structure. Specify 3-4 criteria with the aim to design as light system as possible that carries as much as possible load.
- 2. Alternative solutions:**
In the brainstorming phase of the design process outline at least 3 alternative solutions. For each of these make free body diagrams and find the critical (the most loaded) member of the structure. Estimate the load that the structure can take. Estimate the amount of the paper required and the overall weight of the structure. Use that to select the final solution
- 3. Optimisation of the final solution:**
Try to optimise selected solution by rearranging member positions or strengthening a critical members and joints. Sketch the final design in sufficient details such that another person could construct the structure from your design. The details should show, in particular, the design of joints, difficult construction details and approximate position of staples.
- 4. Building and testing:**
When the design report for the exercise is approved proceed with building your structure. Build it exactly as designed. Use of staples is limited. Staples and stapler will be provided. You should bring the paper.

Exercise tips: This is a three week group exercise (weeks 8, 9 and 10). It is worth 20 marks of which:

*Project report - 12 marks; *Structure testing - 5 marks; *Oral presentation - 3 marks

The exercise is competitive. The winning group with the structure of the best load/weight ratio gets 20 marks extra. Preliminary project report has to be submitted to your tutor in tutorial session of week 9. It will be checked and returned to a group in week 10. The building of the structure can begin only when the project is approved. Designs that are not approved will not be eligible for testing. The testing and the oral presentation will be performed ONLY during the tutorial session in week 11. Each group has 10 minutes for testing and the presentation. There will be no alternative date for testing. The report should be written on as many A3 drawing papers as necessary and should contain alternative solutions, calculations and the drawing of the final model. Each group member should contribute equally to the project in all areas: calculations, drawings and report. On the front page list the names of all group members. Indicate the contribution of each individual member by writing his/her initials next to each item for which that member was responsible. Fill in all relevant data in the title block. **Hand in finished report to U/G Mechanical & Aeronautical office, C108, in week 11** (check the deadline on the web).