



RESEARCH PROJECT

BENDING STRENGTH OF 3-D PRINTED PARTS

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INTRODUCTION

- ▶ Purpose of research,
- ▶ work methods,
- ▶ hypotheses:
 1. The upstanding printed part will withstand the lowest load.
 2. The part printed on its back will withstand the highest load.
 3. The mass of the parts will be equal.
 4. The horizontally printed part will break at a lower force than the back side part.



3-D PRINTING

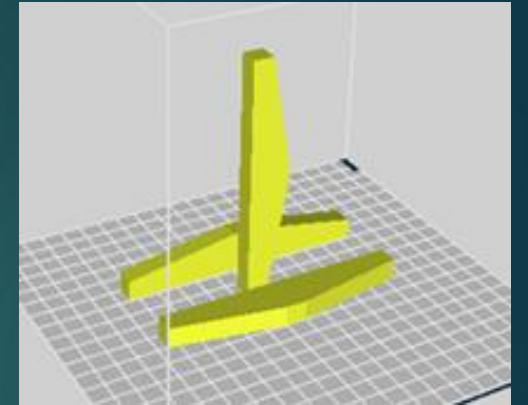
- ▶ Meaning,
- ▶ construction of a 3-D printer,
- ▶ how it works,
- ▶ materials,
- ▶ application in our daily live.



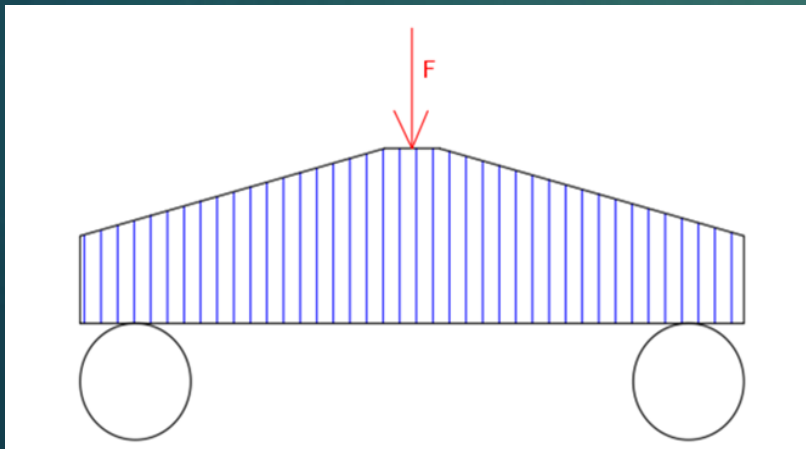
3D printer

THE SHAPE OF INDIVIDUAL PARTS

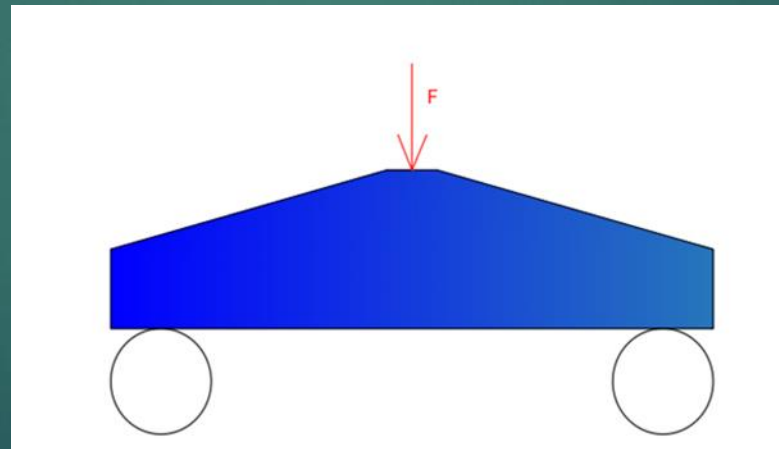
- ▶ Testing of different shapes.
- ▶ Deciding on the experimental shape.
- ▶ Making a printing file.



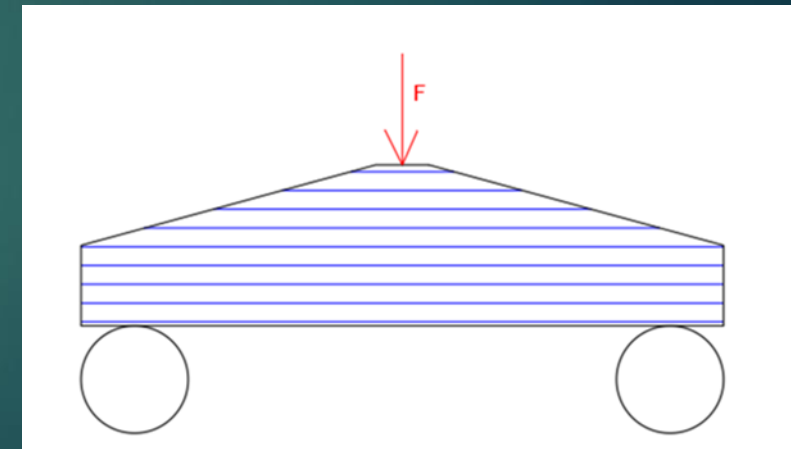
Position of the parts during printing



Upstanding printed part



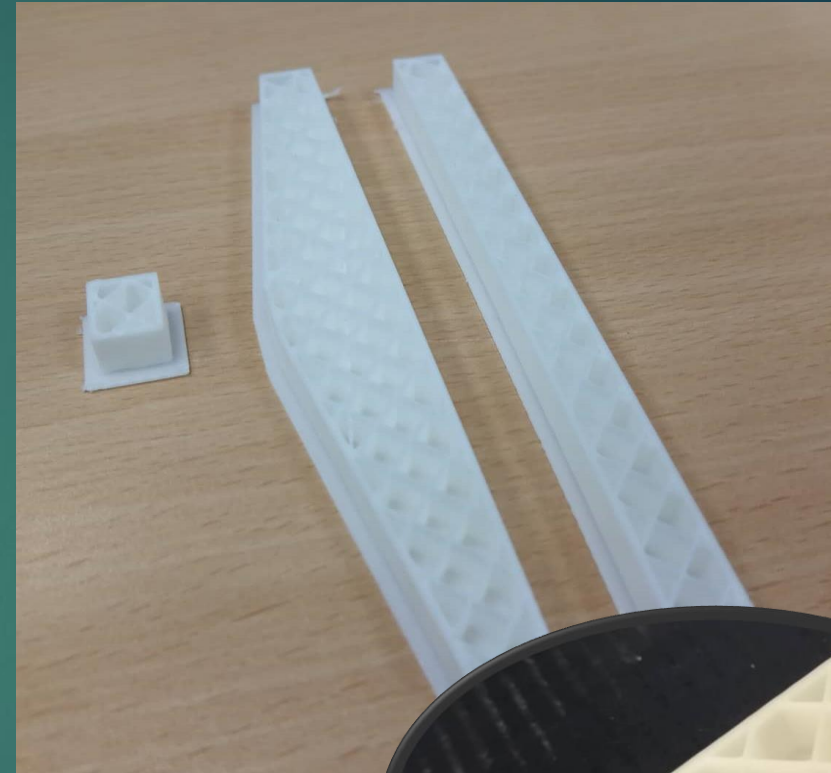
Back printed part



Horizontally printed part

PRINTING OF THE PARTS

- ▶ Preparation for printing.
- ▶ Printing settings:
 1. number of shells
 2. infill percentage
 3. infill pattern
 4. layer thickness
 5. temperature of the nozzle



MEASUREMENT

► Testing procedure



Measuring weight

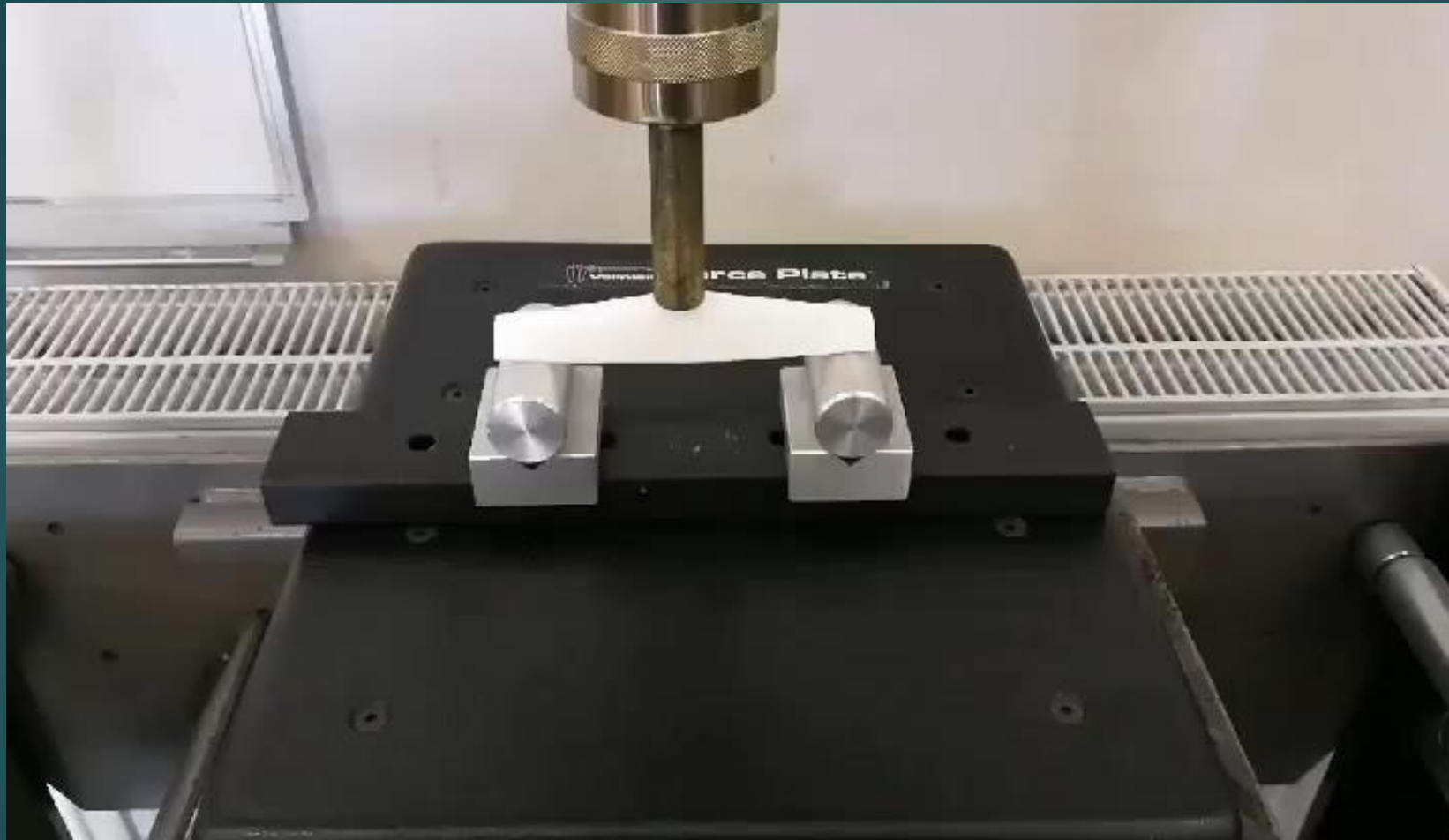


Measuring force



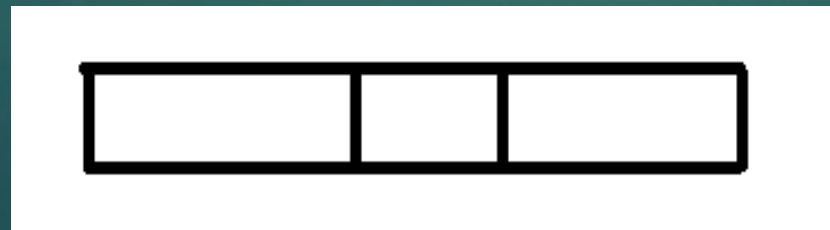
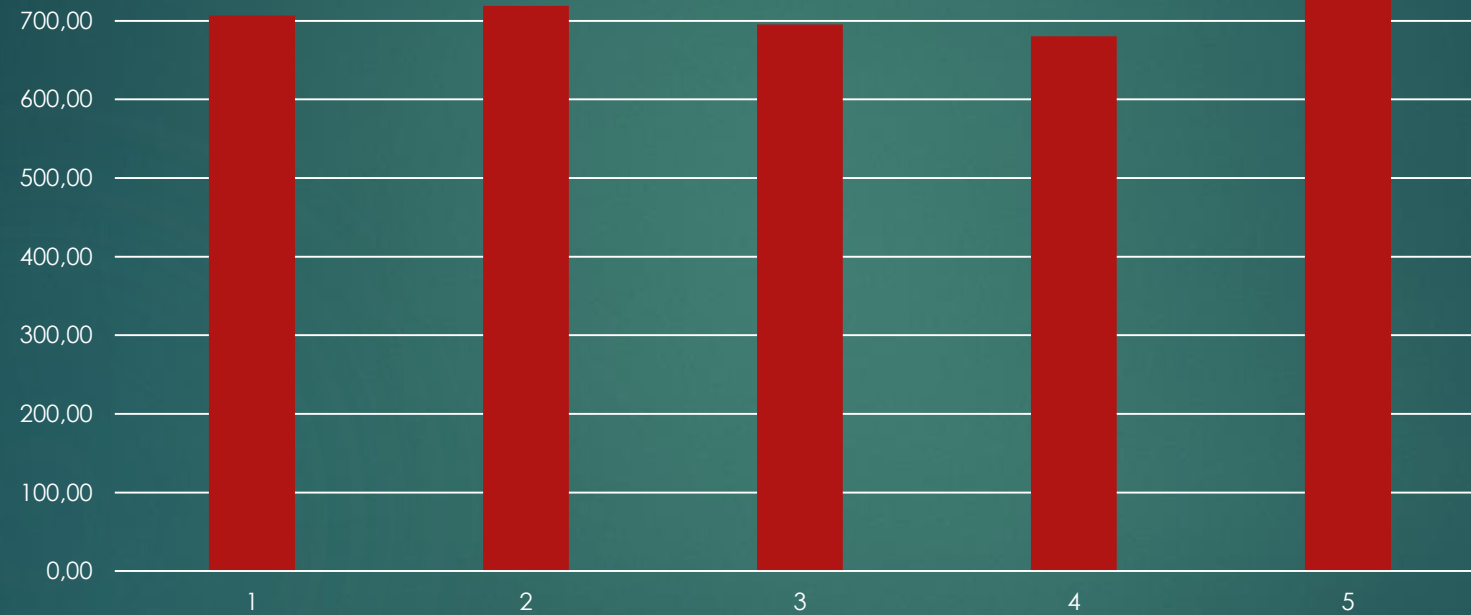
Equipment for measuring forces

VIDEO



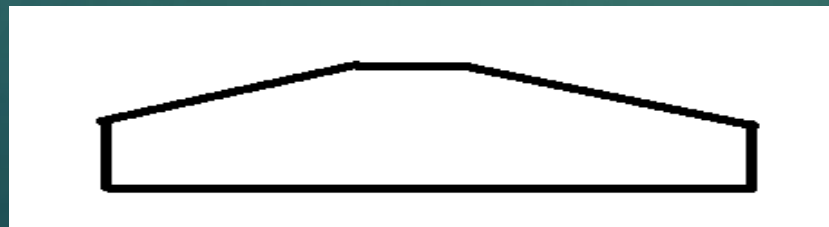
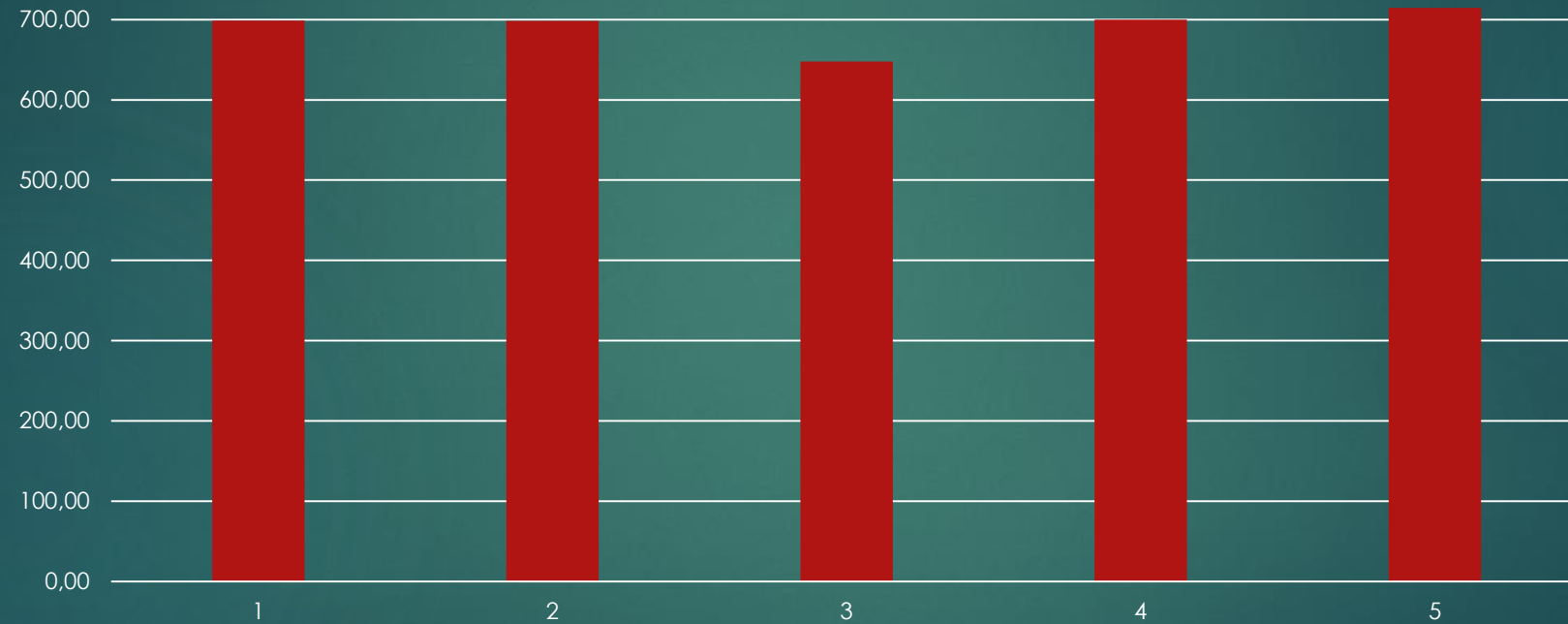
RESULTS

Breaking forces on the parts printed back side [N]



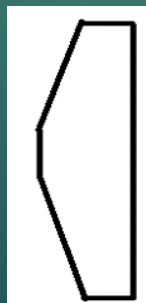
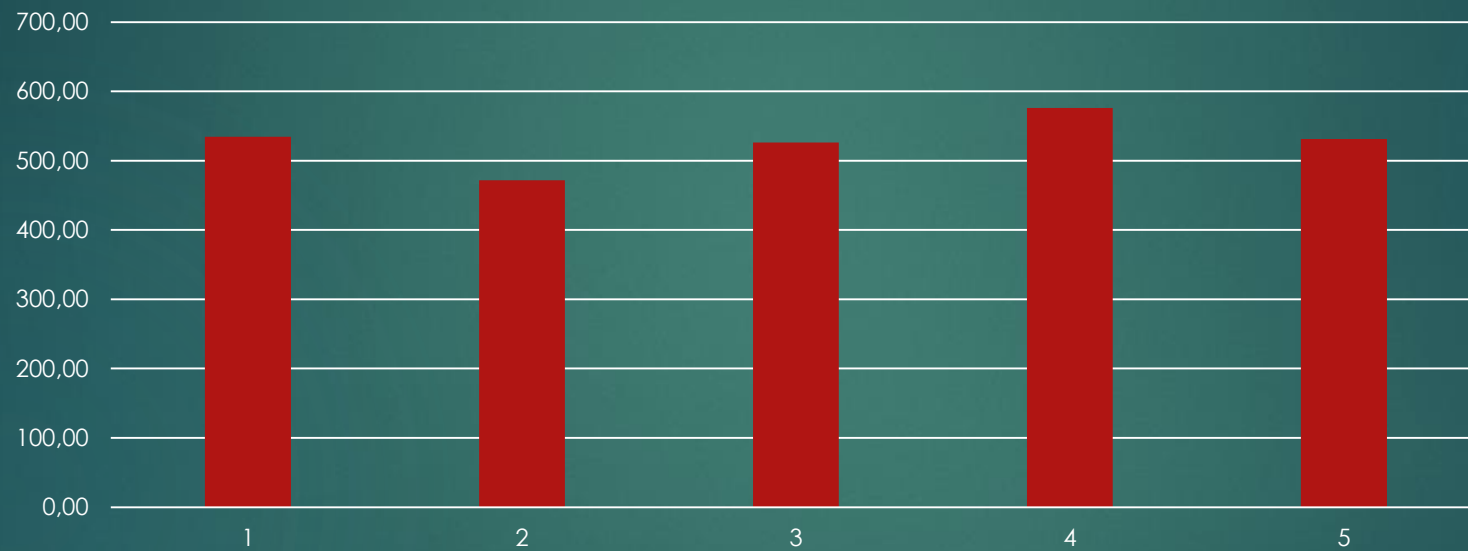
RESULTS

Breaking forces on the parts printed horizontally. [N]



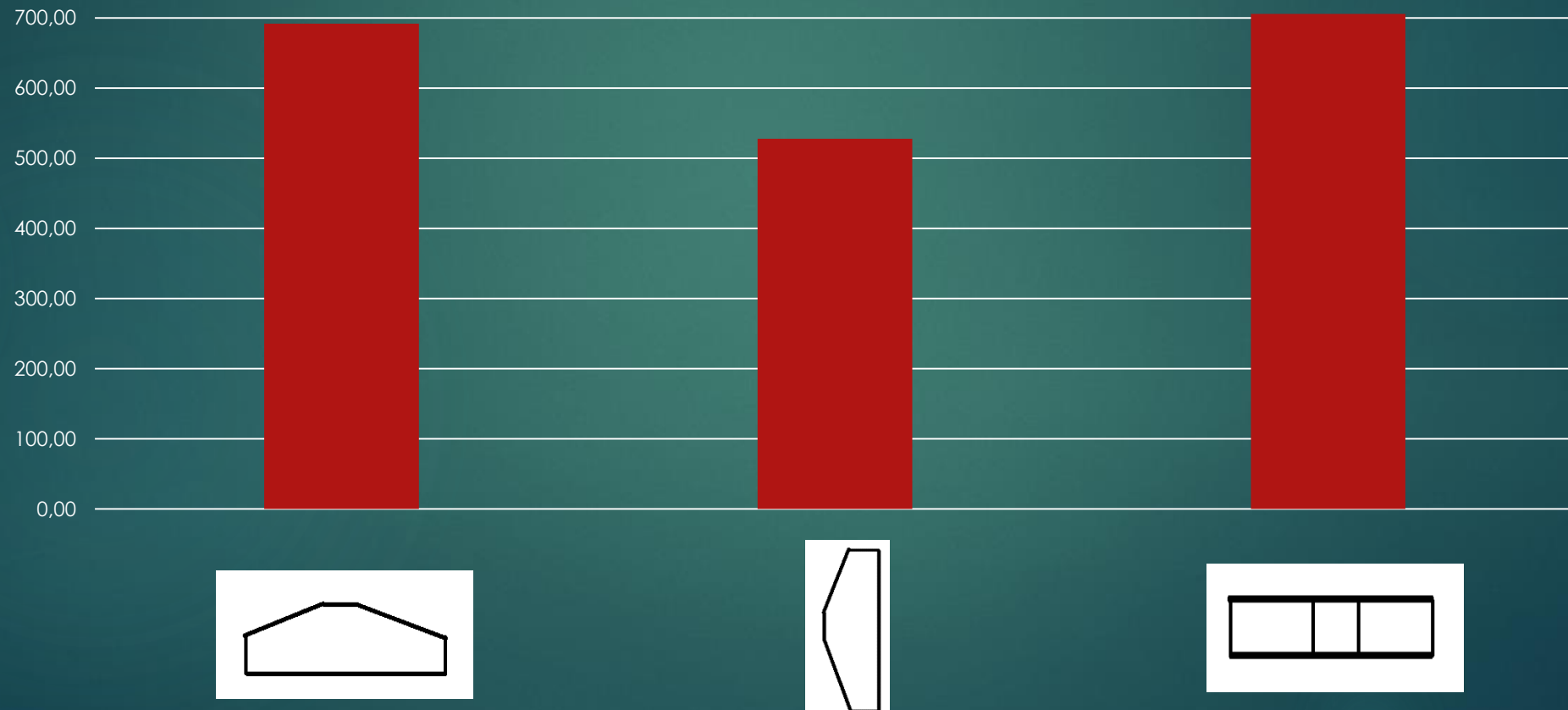
RESULTS

Breaking forces on the upstanding printed parts. [N]



RESULTS

Comparison of average breaking forces based on different positions of printing.[N]



HYPOTHESES ANALYSIS

1. The upstanding printed part will withstand the lowest load. The hypothesis was proven because the lowest breaking forces were achieved with the upstanding printed parts.
2. The part printed on its back will withstand the highest load. The hypothesis was proven because the highest breaking forces were achieved with the parts printed back side.
3. The mass of the parts will be equal. The hypothesis was proven because the deviation in the measured mass was very small.
4. The horizontally printed parts will break at a lower force than the back side printed one. The hypothesis was not proven because **the difference** between these two types of parts was only 2 percent. We expected a bigger difference.

CONCLUSION



► Findings:

1. It is important in which position the parts are during printing.
2. With the right position we can achieve better resistance against forces.

► Suggestions for further experiments:

1. Testing different printing materials
2. Experimenting with different percentage of infill according to the best load / weight ratio.
3. Experimenting with different patterns of infill according to the best load / weight ratio
4. Experimenting with numbers of shells according to the best load / weight ratio.