AUTODESK **UNIVERSITY** 2014

Fusion 360: Simulation for Designer (S4D) and Calculators

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CD7012 Simulation technology for designers is a powerful design tool for a wide community of designers. Now you can make the right design decisions, improve your product functionality, and decrease weight without time-consuming setup, model simplifications, and hard-to-interpret results. In this class you will discover how easily you can improve your design with a 1-Click Solution. No extensive experience or specialized education or training is needed for our Simulation software tools. In addition, I will demonstrate a Bolted Connection for Fusion 360 that will help you to quickly generate right models. This software is powered by known and industry-proven Inventor Design Accelerators technology.

Learning Objectives

At the end of this class, you will be able to:

1. Understand the concept of Simulation for Designer
2. Setup Simulation and verify how your design works
3. Fix breakages and make your design functional
4. Optimize your design – minimize volume/cost while keeping function
5. Create Bolted Connection in seconds rather than minutes

About the Speaker

Vaclav Prchlik is a software development manager for Simulation for Designer software and for Calculators for the Fusion 360 3D CAD design app. Vaclav has been working for Autodesk, Inc., for 10 years, leading the team that is implementing easy-to-use structural analysis, drop test, and mechanical engineering generators and calculators. Before joining Autodesk, he was research and development manager in a small software company that focused on knowledge-driven CAD. Vaclav has a master's degree in industrial engineering and management from University of West Bohemia, and he has a PhD in mechanical engineering.

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1. Concept of Simulation for Designer (S4D)

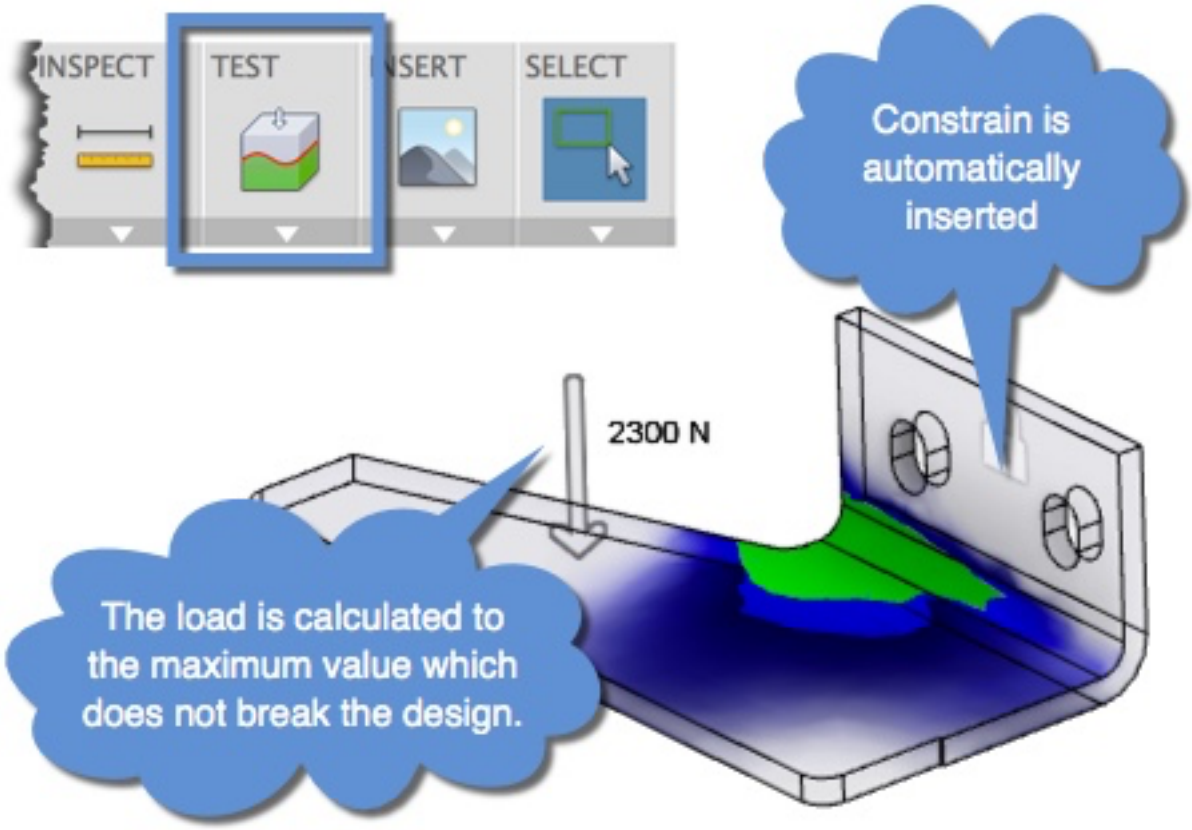
Every designer wants to do the right design that would work. Common questions are:

- Is it likely to break?
- Where are critical areas of my model?
- Can I remove material?

Designers want answers but do not want to be Simulation experts.

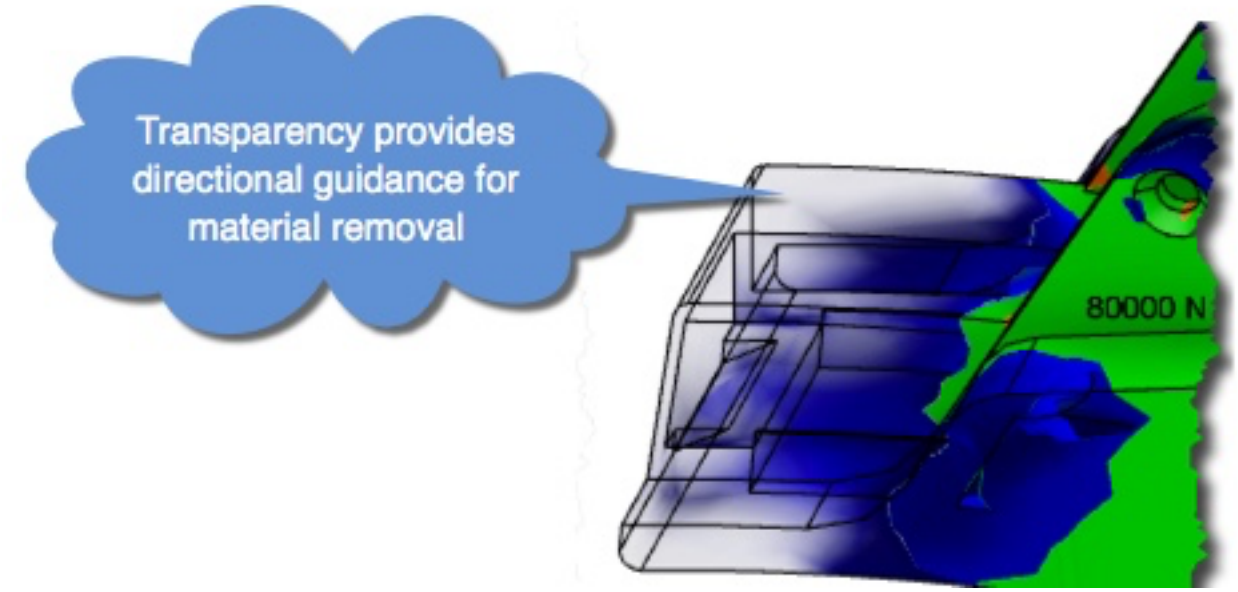
Start with Results

1-Click command immediately provides simulation feedback. After any design change the results are updated automatically.



Directional Guidance

Transparency indicates areas which don't carry any substantial load. Green color informs about optimally used material. Red color indicates a breakage.



Effortless

No need for complex preparation and simplification of model. Setup is simple and results are self-explanatory.

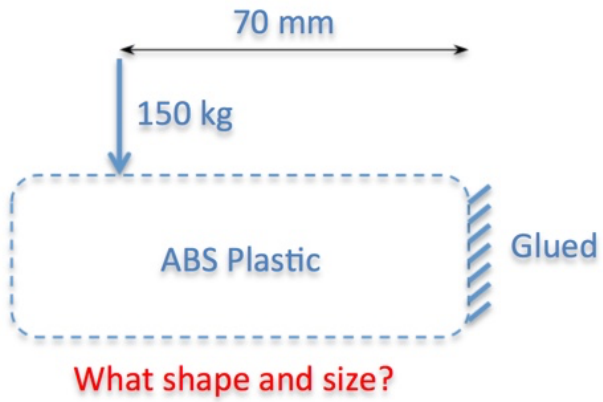
Native Part of Fusion 360

Seamlessly integrated to the design workflows. Simulation results are ready when needed.

2. Simulation Setup and verification of design

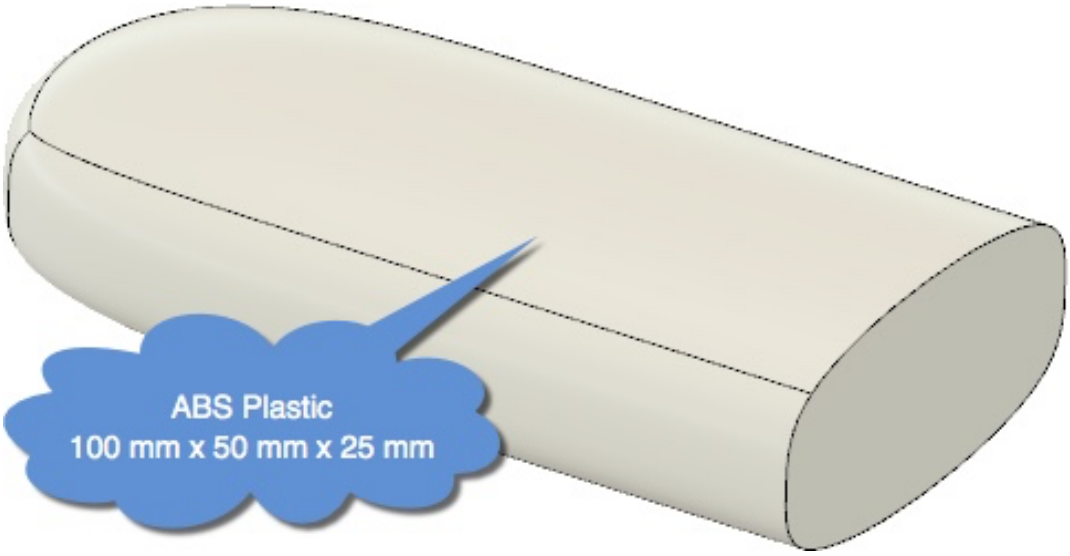
Goal

Design a simple holder from ABS plastic that would keep 150 kg. Production method: 3D print.



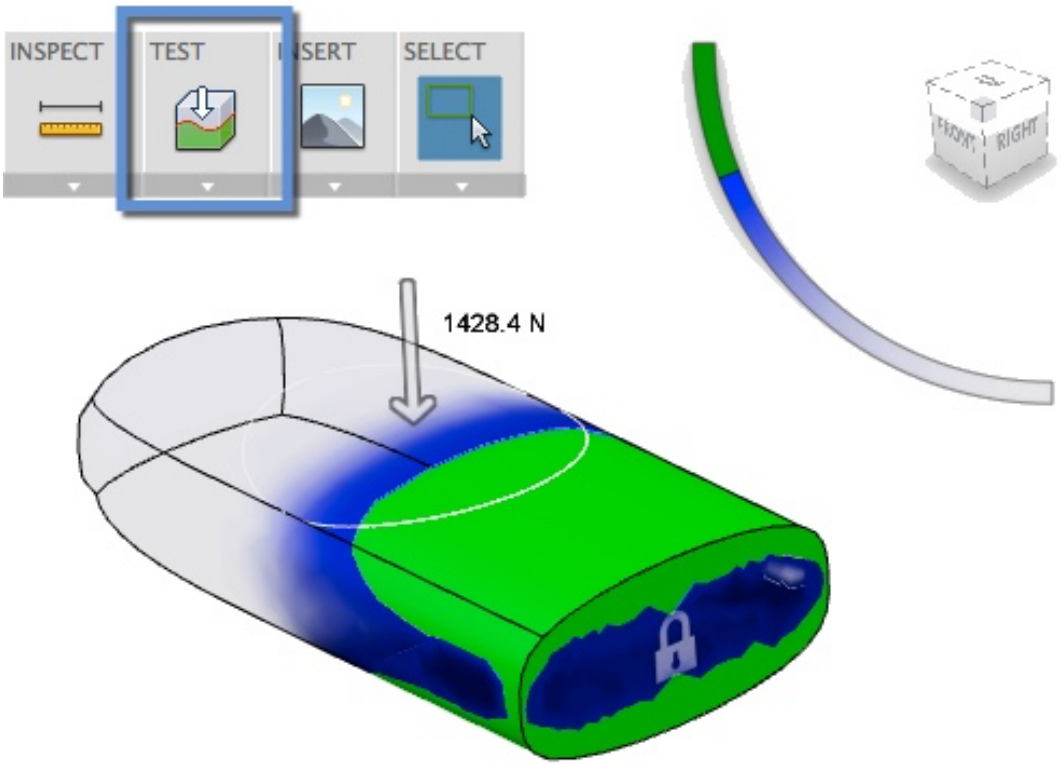
Create a Simple Body

Use the Sculpt environment to design a simple part. Use ABS Plastic as material.

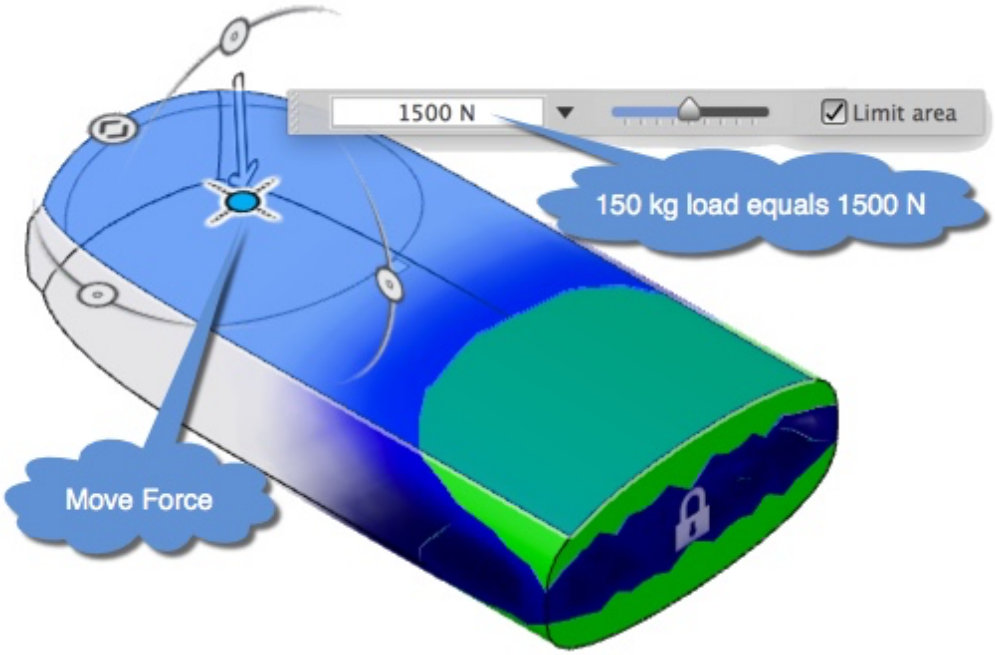


Setup Simulation

1-Click provides an entire simulation setup, and presents the results. A constrain is automatically placed to the planar surface. A load with a natural direction is automatically placed to the topmost surface. The load is scaled to the maximum value that would not break the design.

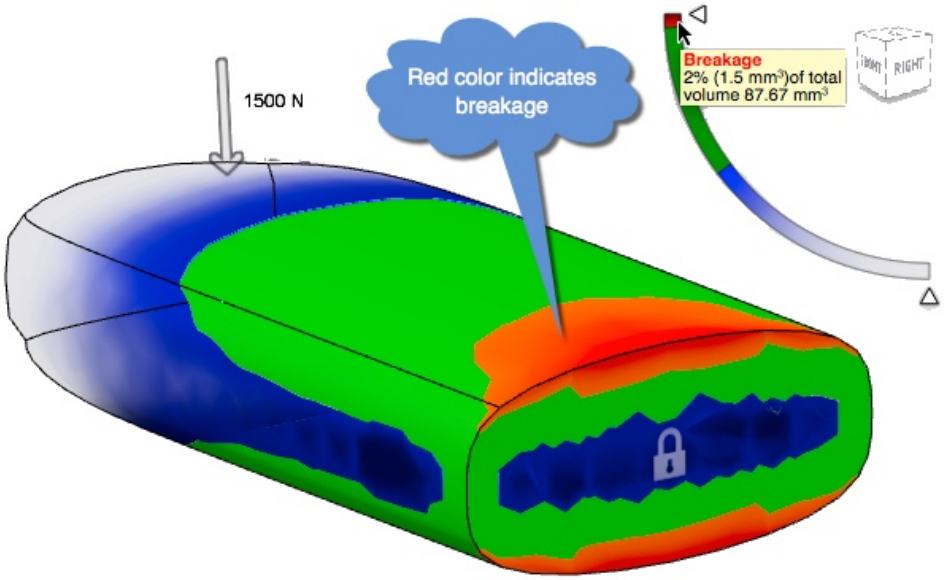


Modify the input by entering 1500 N (equals 150 kg) and move the load.



Tips & Tricks:
You can activate editing of Force by double-click.

For load of 150 kg, the current design fails. The red area indicates breakage.



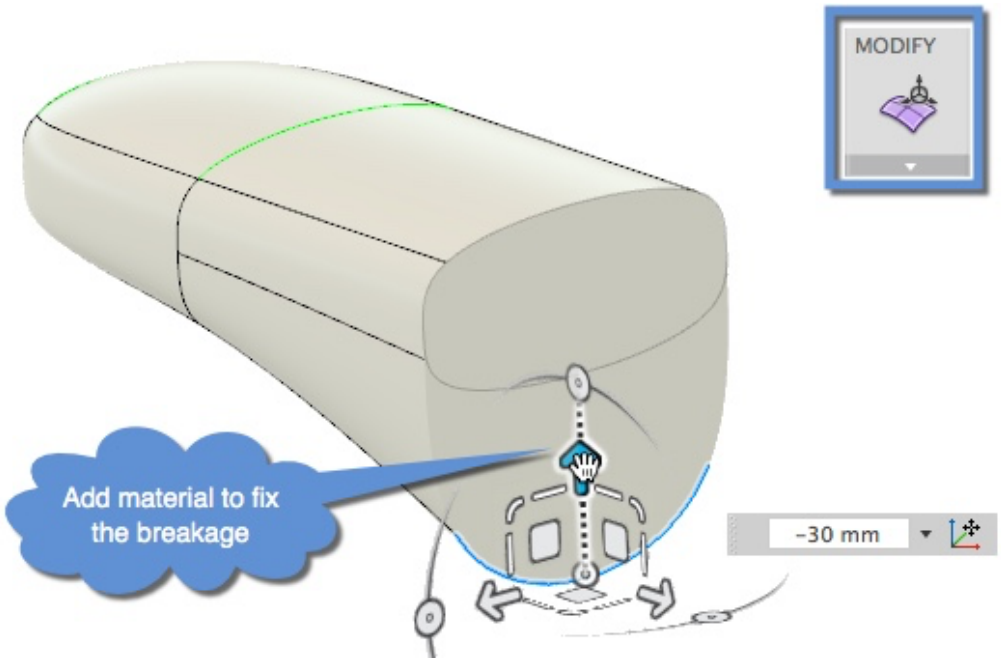
Tips & Tricks:
Clicking on the legend visually isolates the area. Double-click shows the entire spectrum.

3. Fixing Design Breakages

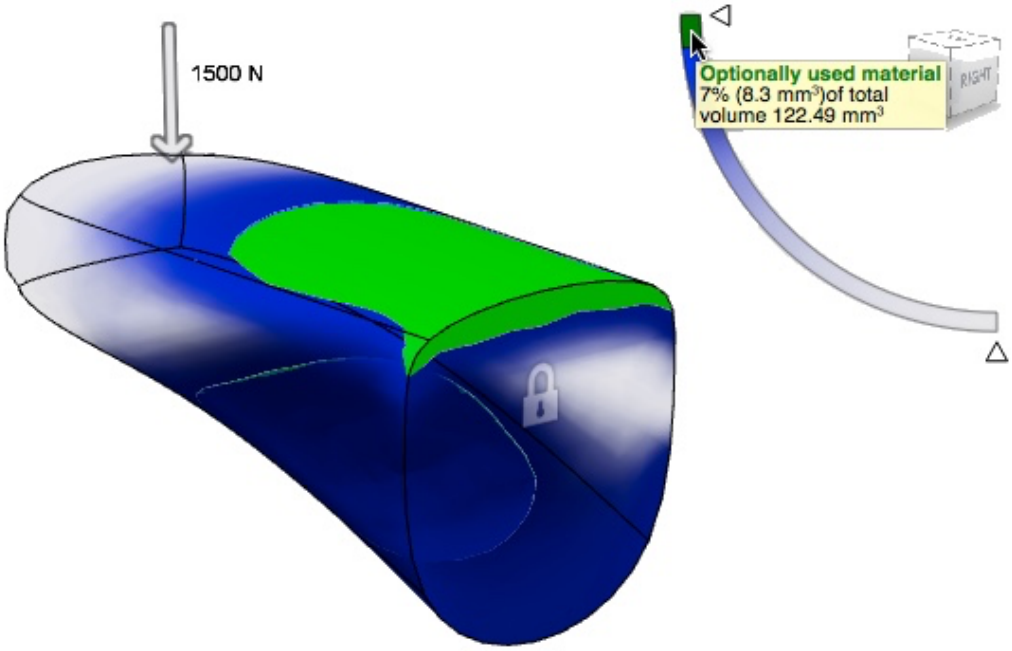
Fusion 360 Simulation for Designer guides you to improve the design. Red areas of the model need to add a material.

Add Material

Return to the Sculpt environment and add material in the critical area.



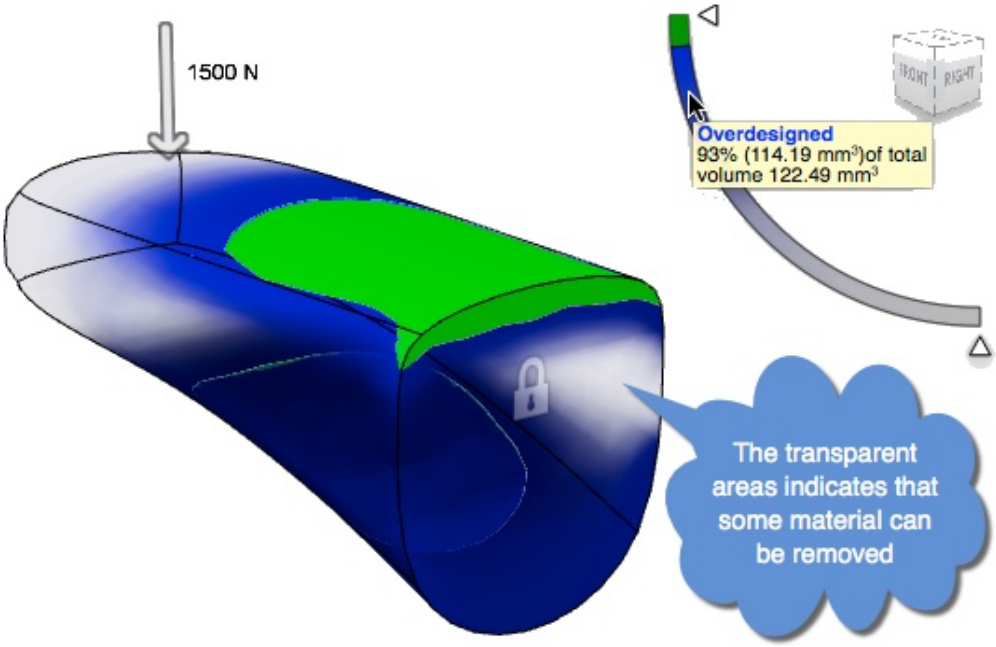
With the modified shape there is no red colored area, which indicates that the design is functional.



Tips & Tricks:
Legend tooltip shows both percentage and absolute volume values.

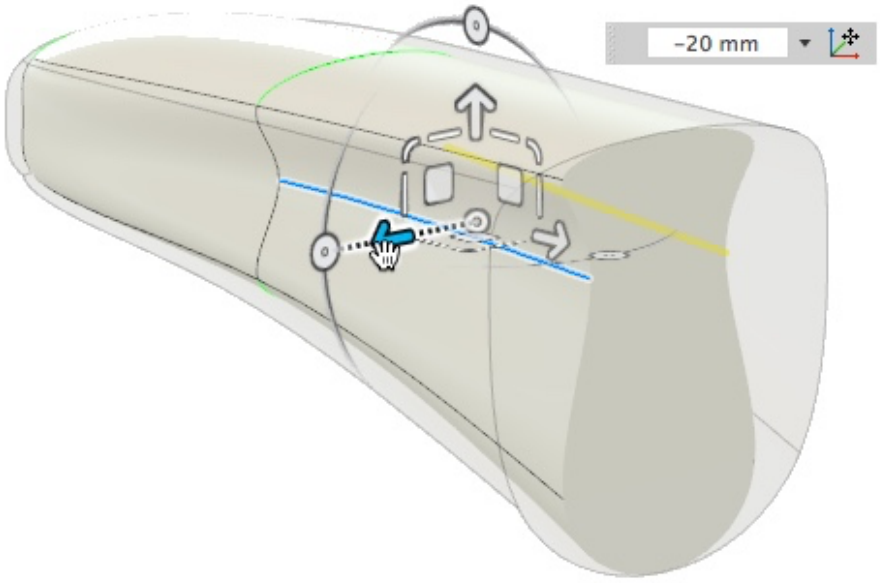
4. Design Optimization

The current design is better – it will not break. But it is not optimal; there are a lot of overdesigned areas. Please note that the total volume is 122 cm^3.

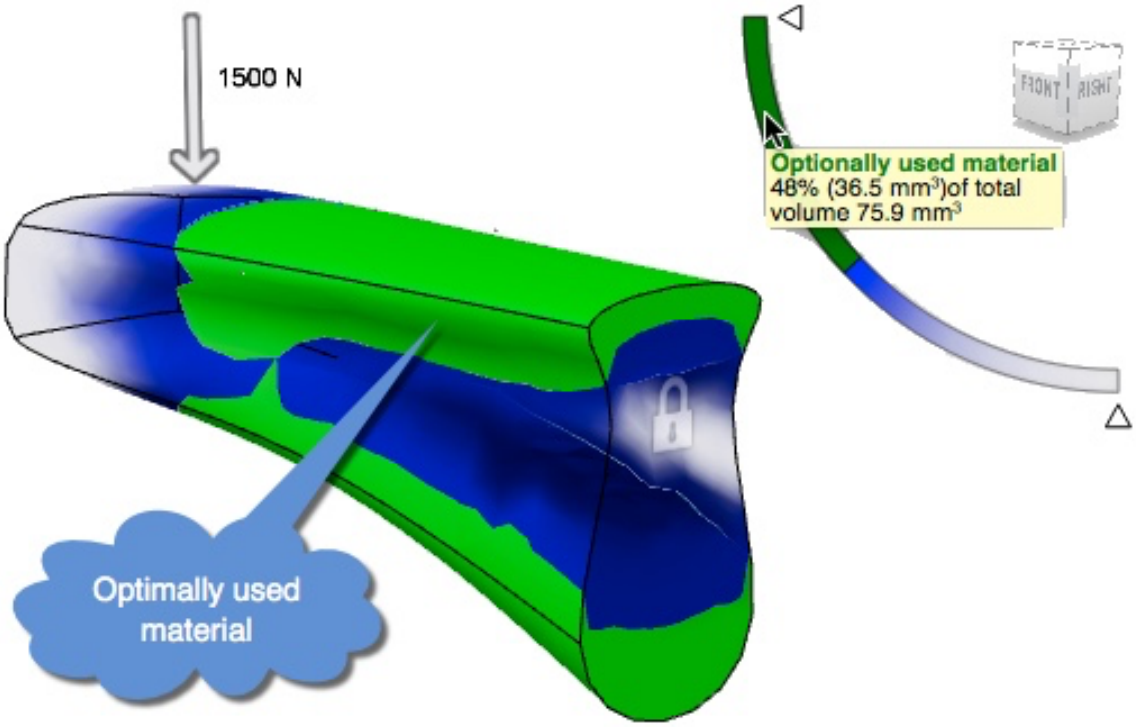


Tips & Tricks:
To analyze more complex parts you may want to use legend grips to select just a subset of results.

Remove Material

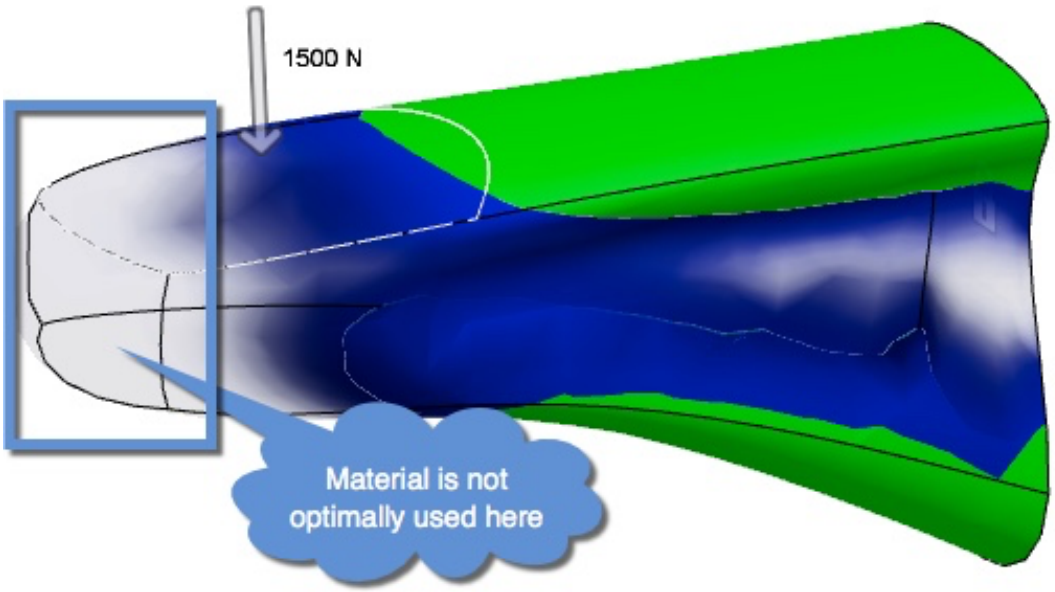


As a result, the modified design is better. The percentage of optimally used material is higher and the volume decreased from 122 cm^3 to 76 cm^3.

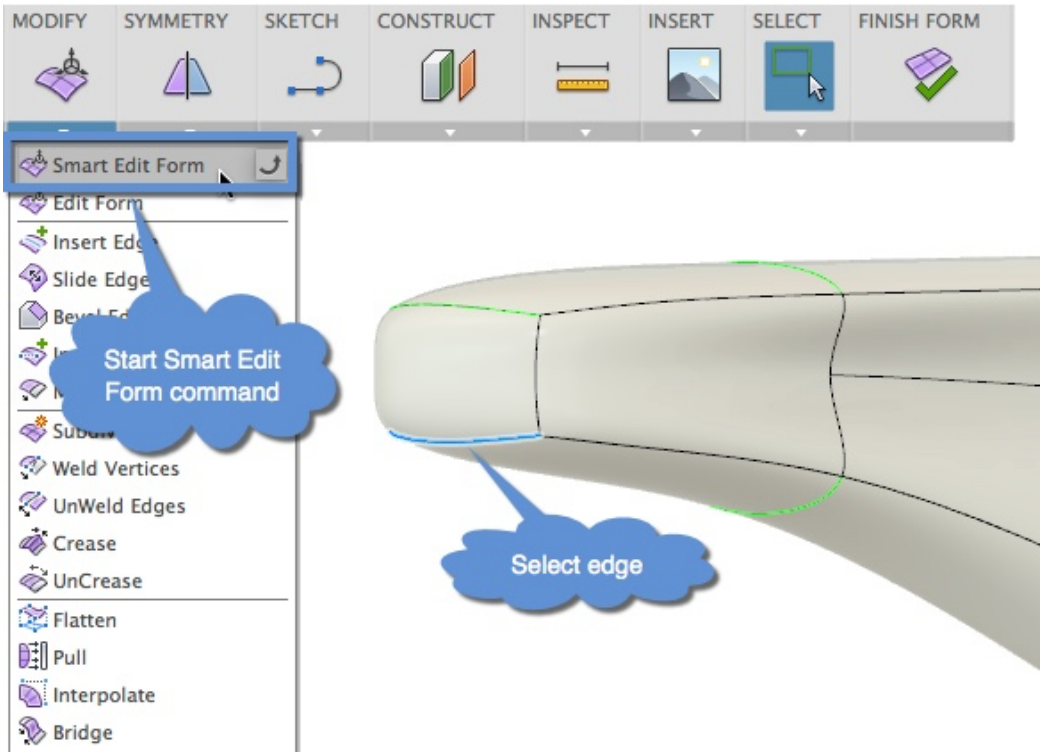


Smart Automatic Material Removal

There are still areas for improvement in the front of the holder.

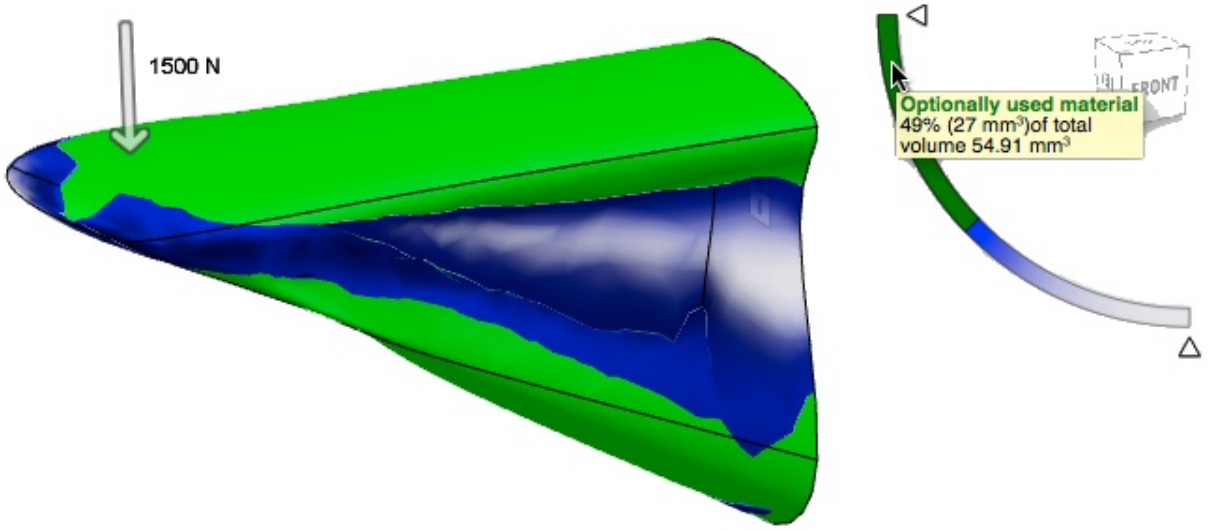


Smart Edit Form command offers automatic optimization of your model based on selected Edge(s)/Face(s). It moves it as far as possible to not to cause the model breakage.



Tips & Tricks:
You can select multiple Edges and/or Faces.

Smart Edit Form command decreased volume from 76cm^3 to 55cm^3.

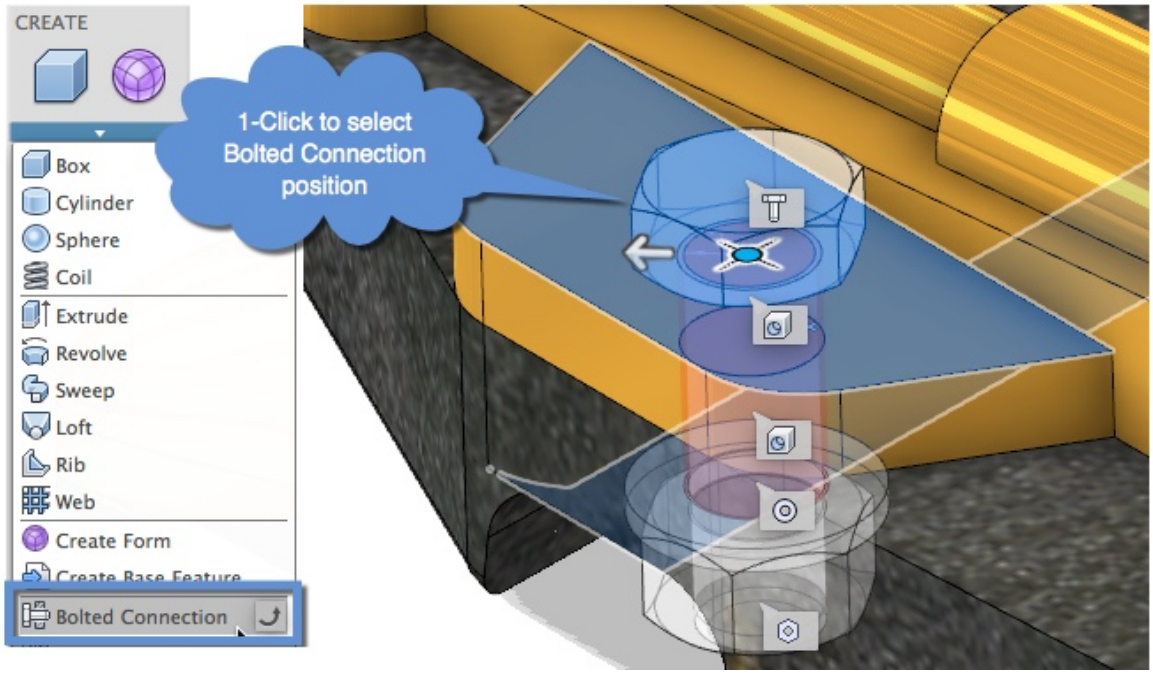


5. Bolted Connection

Modeling Bolted Connection is one of the most common time consuming tasks. Now you can be more productive with Fusion 360. Learn how to make bolted connection in seconds rather than minutes.

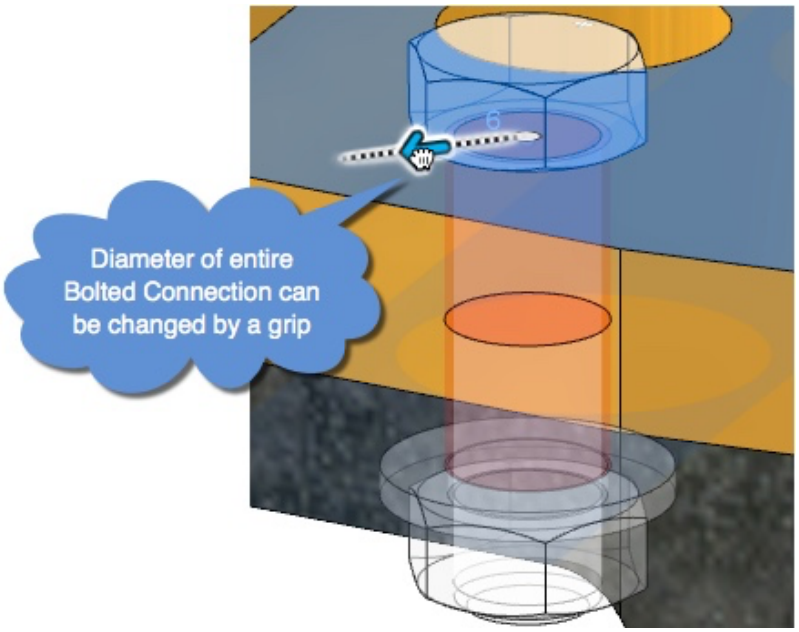
1-Click Creation

The entire Bolted Connection can be created using a 1-Click modeling command. It analyzes the selected surface to find the opposite surface for a washer and a nut. Minimal bolt length is automatically adjusted according to material thickness and washer and nut height.



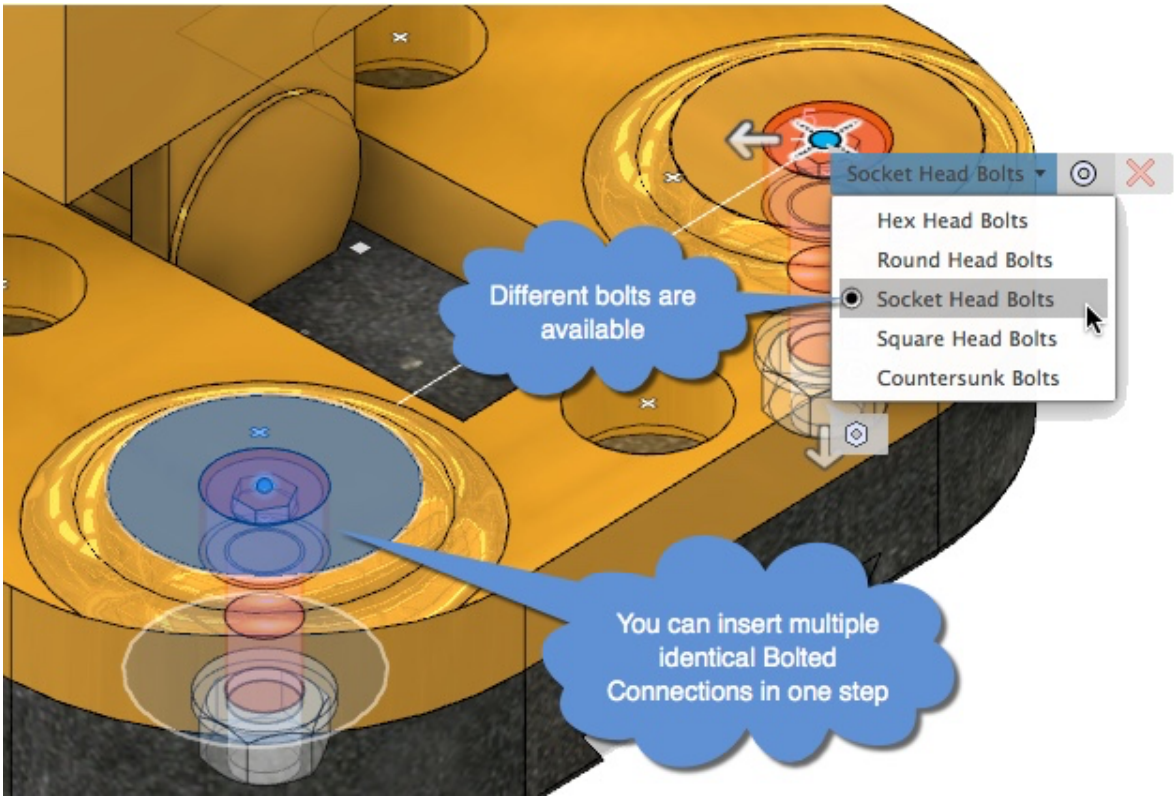
Diameter change

Insert another bolted connection. As you hover over faces, bolted connection preview is generated, including dynamic calculation of bolt length. Diameter can be easily changed by a grip. Change of the bolt diameter will automatically find the correct washers, nut and holes.



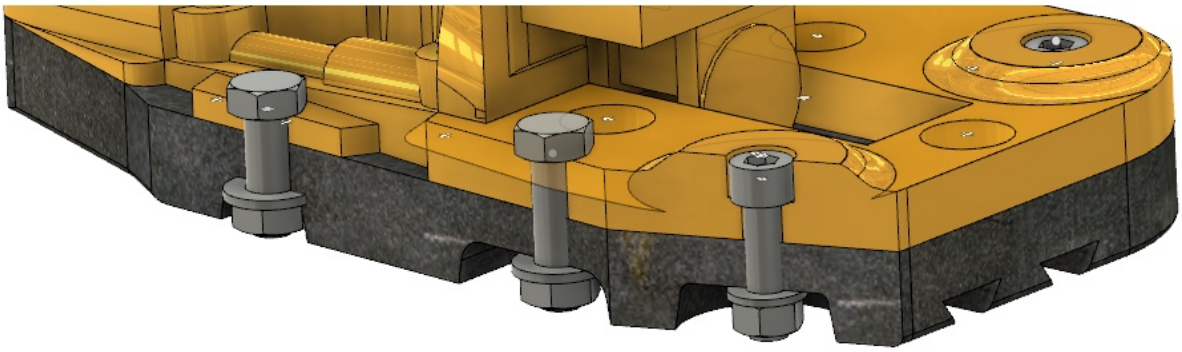
Topology change

You can change the type of Bolt, Washer and Nut. Standard clearance holes are available.



Results

Bolted connections are created in seconds rather then minutes.



In addition, you can easily modify the bolted connection later (add/change/remove any fastener, modify diameter, etc.)