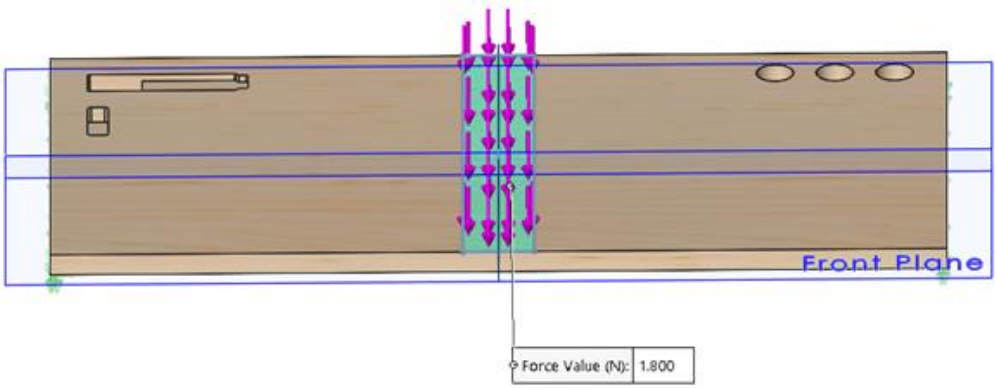
SIMULATION

Using simulation software, we will assure that our FREE desk is strong enough to withstand the possible loads it will have to endure, both in the bench and desk position. The simulation tests will be performed using SolidWorks and the loads will be predetermined by the team. The right properties were found using different sources online.

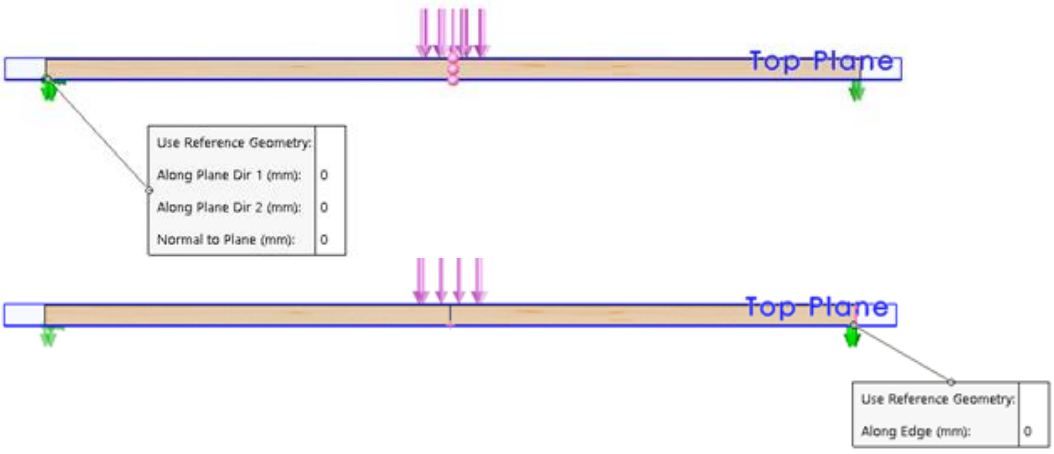
The different lifting mechanisms can carry certain loads, these are tested professionally by the companies who produce them. We did an additional test on the table top to make sure it could withstand the pressure of the user sitting on it. We set the weight of one person at 90 kilograms and used a safety factor of 2, which results in a load of 180 kg (which is approximately 1800N).

180kgf = 180 × 9.80665 N = 1765.197 N

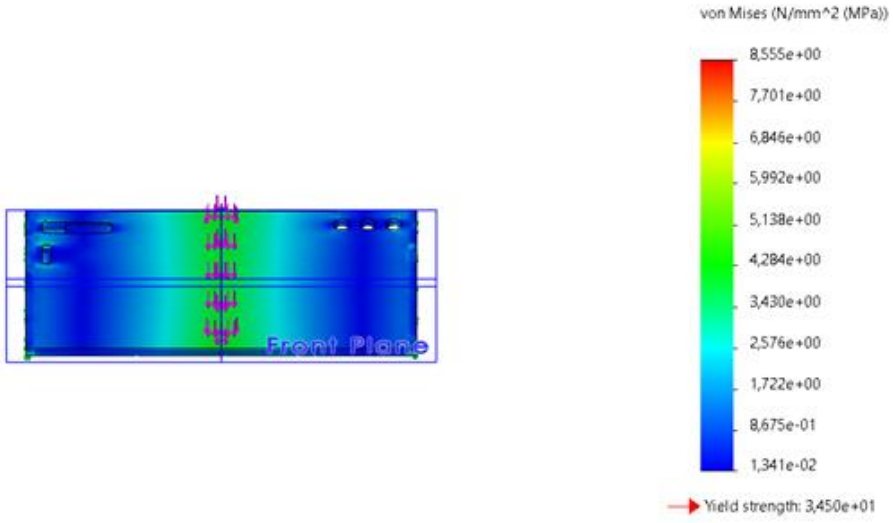
By using this safety factor, we can be sure that our desk can withstand this load even if the user is standing on it. We have put the load in the middle of the table, the most vulnerable part.

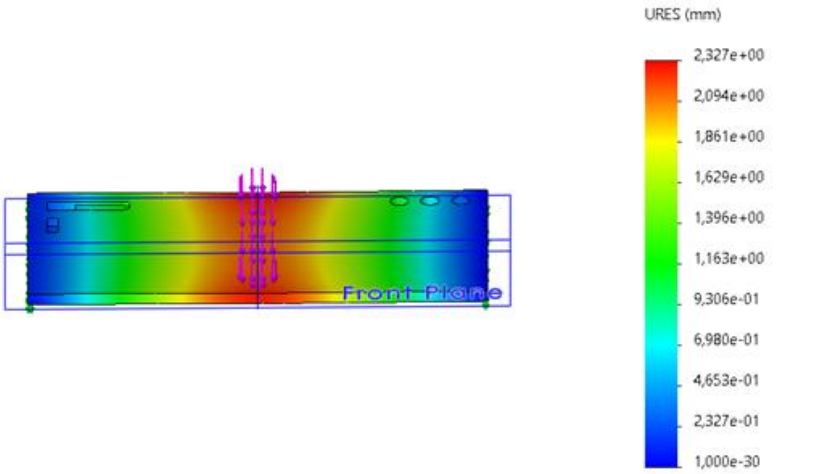


The next two figures illustrate how we handled the fixtures to simulate the lifting mechanism and boxes underneath. The left side is prevented from moving in the x-, y- and z-direction. The right side is only prevented from moving vertically.

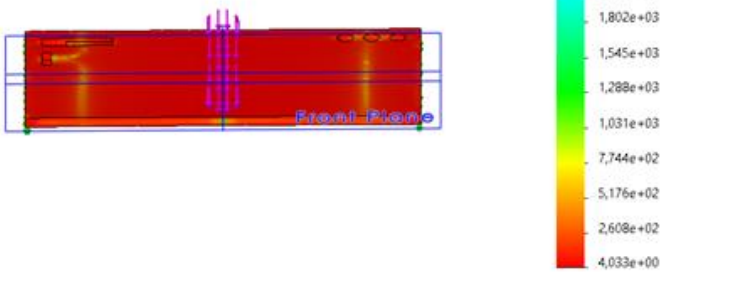


The results of this simulation are illustrated in the following figures; they shows us the stress plot, the displacement and the factor of safety.

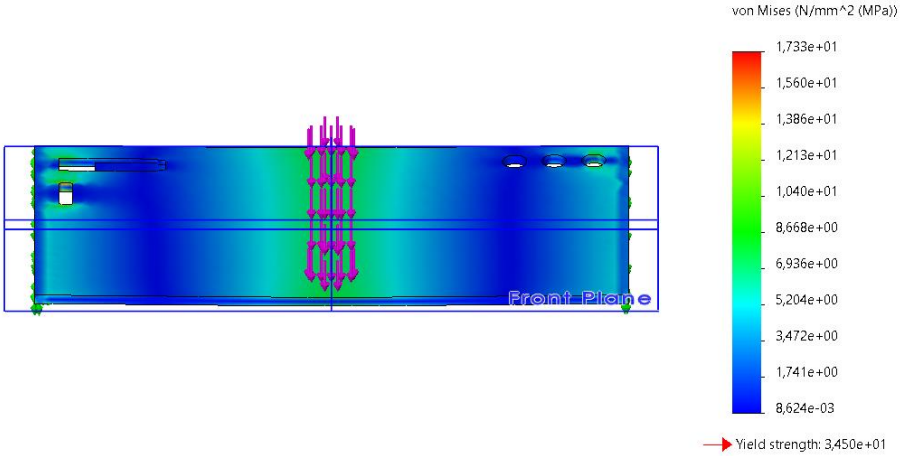


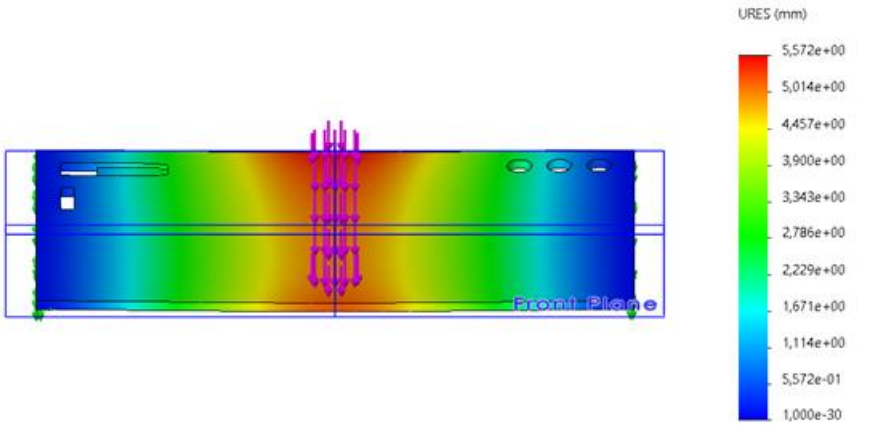


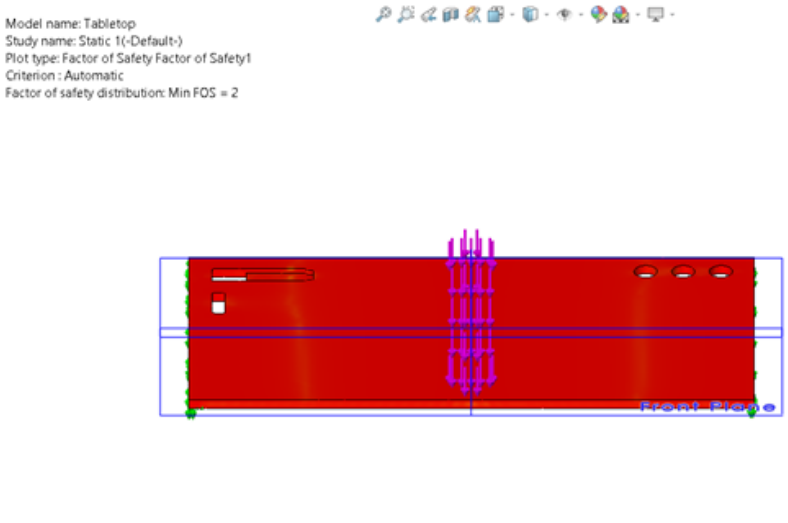
Model name: Tabletop
Study name: Static 1(-Default-)
Plot type: Factor of Safety Factor of Safety1
Criterion : Automatic
Factor of safety distribution: Min FOS = 4



We can see the maximum displacement, while using double the weight of the user, is 2.3 mm. This is acceptable, given that we're working with a worst-case scenario. What's really important is the factor of safety that has been calculated by SolidWorks. . This should minimally be 2 but as you can see in the figures above, it's actually 4. This means our table can withstand this pressure and we can even make our table top lighter. The table top is now 3 mm thick, we'll change this into 2 mm and run the tests again. By eliminating that extra cm, our desk is now as thick as the boxes. Illustrated in the next figures are the results of these tests.







The maximum displacement is now 5 mmm, which is too much. The safety factor is now just a little bit less than 2, namely 1,991. The desk would still be strong enough to carry the weight of one person, given that the safety still has a value of about 2. The displacement is higher than it should be though.

We have decided to only eliminate 5 mm of the desktop, resulting in a thickness of 2.5 mm. This results in a factor of safety of 3.5, which is more than enough. The maximum displacement now has a value of 3.4 mm. These final results are illustrated in the following figures.