TRITON ROBOTICS

# Shock Support Bracket Analysis

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## Abstract

This analysis is to determine if the shock support bracket is able to withstand the drop test of the infantry. When faced with a force of 49.5 Newtons, it will not yield.

## Calculations

The current Infantry robot uses a suspension system to absorb the force of the impact during the drop test. This calculation will assume that the force applied to the shock absorbers is also translated to the shock support brackets since they are connected together.

### Constants

| | |
|---|---|
| Expected Weight of Infantry in RMUL 2021 | 20 kg |
| Height of Drop Test | 0.2 m |

Drag force will be ignored for this calculation.

The potential energy of the Infantry robot at the max height of the drop test is 39.2 Joules, using the equation $P = mgh$.

Assuming that all this potential energy gets directly converted to kinetic energy, the speed of the robot at the ground is 1.98 meters per second, using the conservation of energy and the equation $mgh = \frac{1}{2}mv^2$.

If the robot is going at 1.98 meters per second and collides into the ground at a complete stop, the magnitude of the change in momentum or impulse is 39.6 Newton-seconds using the equation $J = \Delta p = \left|0 - mv_o\right|$.

The force of the collision can be found by assuming a duration of 0.1 seconds and constant force using $J = F\Delta t$. This gives us a force of 396 Newtons.

Since there are eight shock support brackets, the total force will be distributed across all eight brackets, leaving each bracket to face 49.5 Newtons of force.

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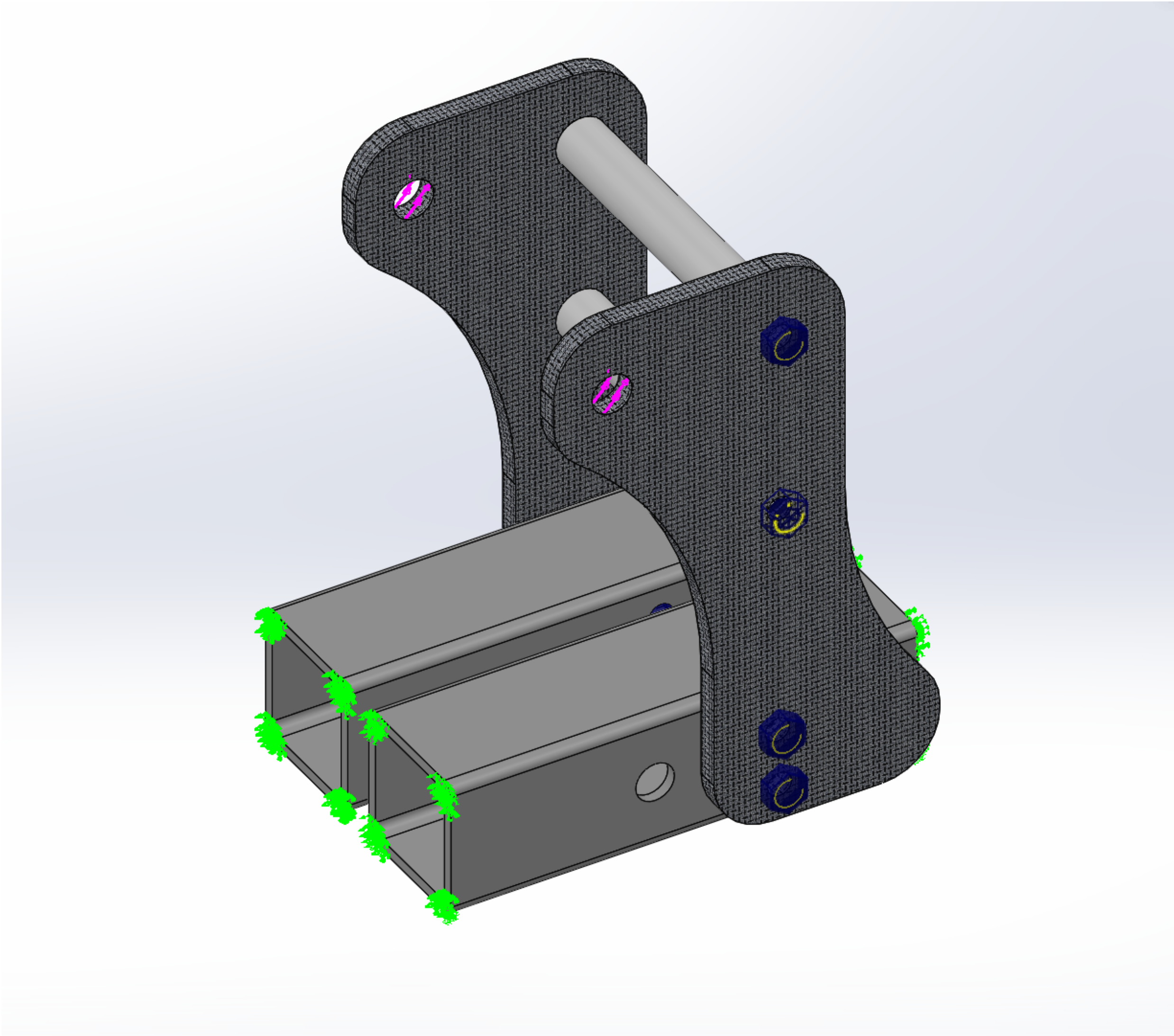
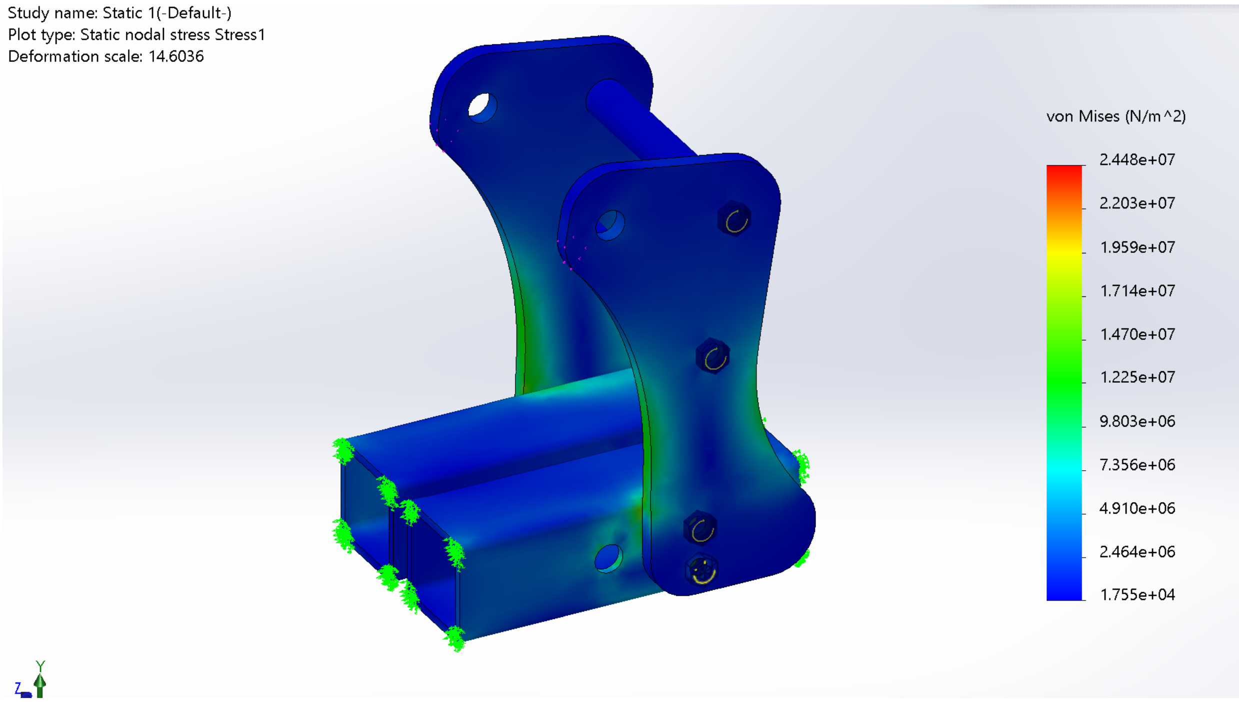
# FEA 1

### Preload

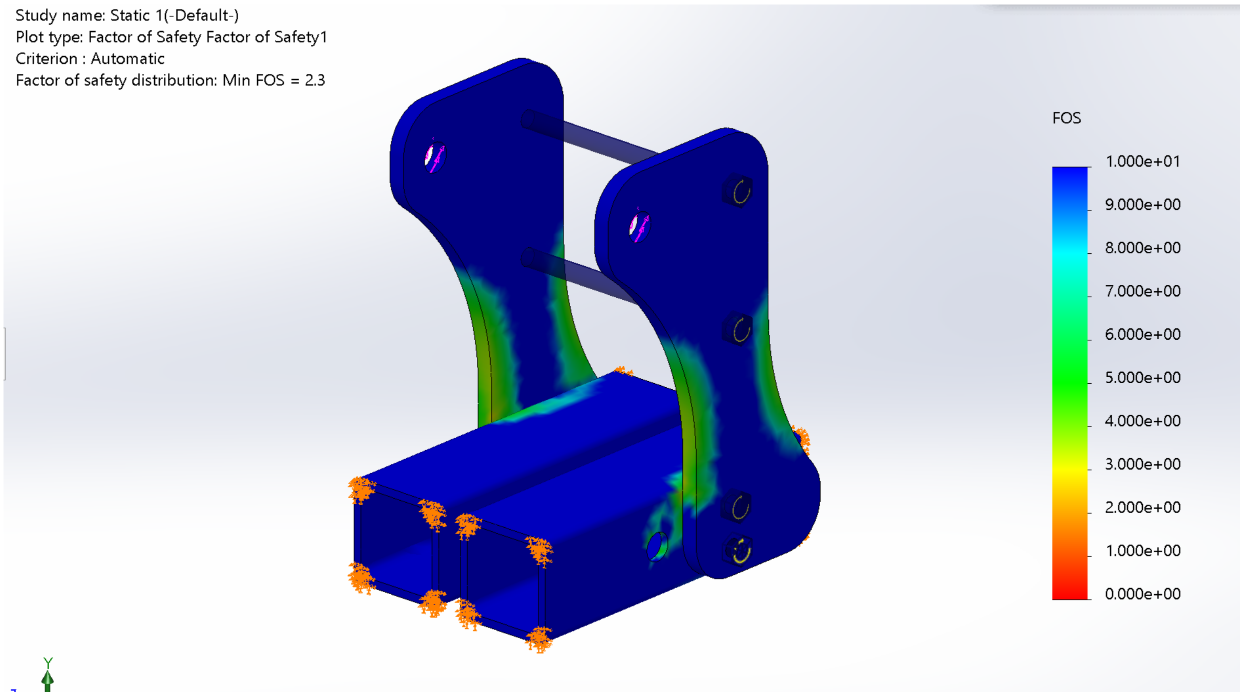
- Using the equation for preload $F_P = Kd$, the preload for a M3 screw is 0.0018 N-m.

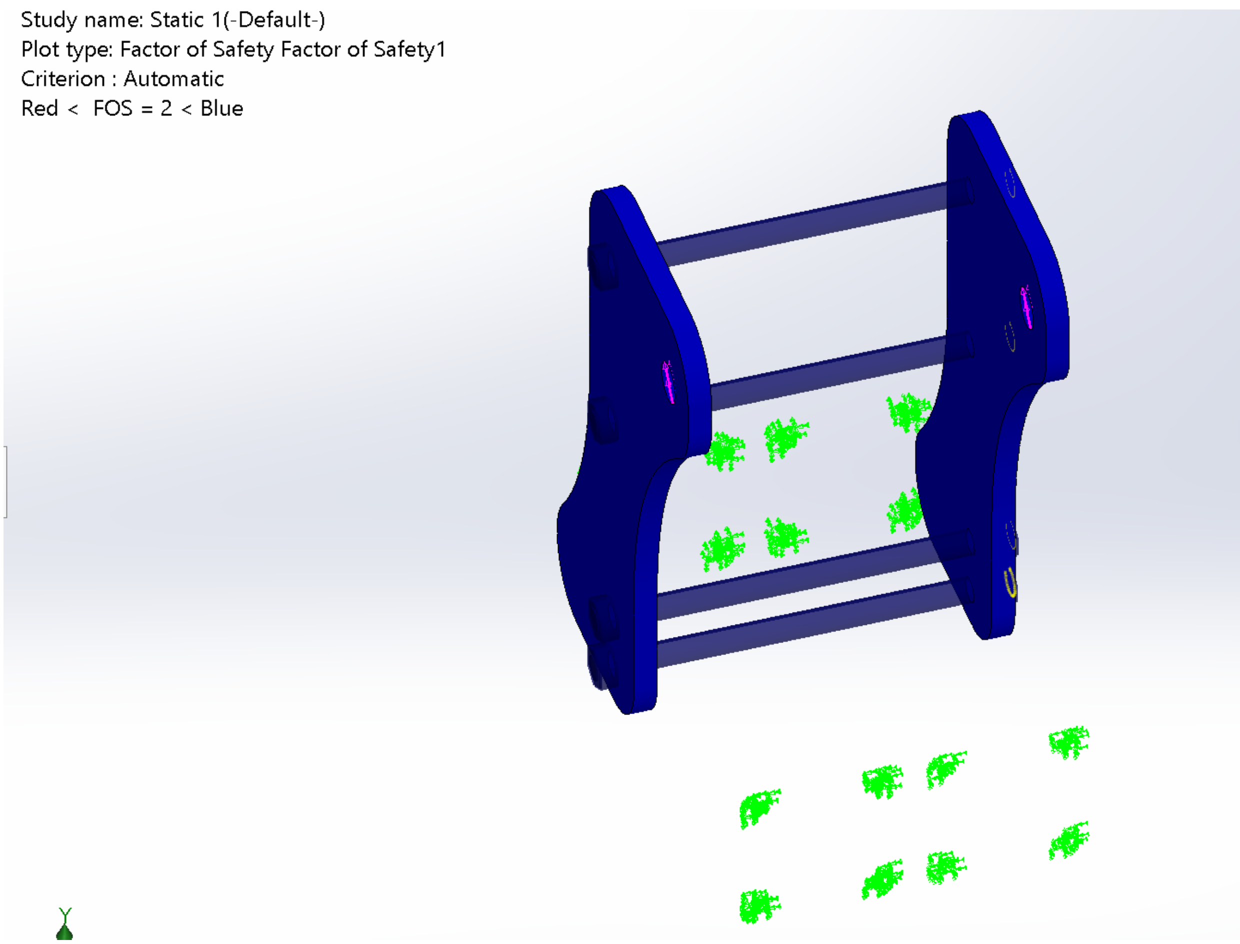


- Fixtures were added to both ends of the square tubing since it is connected to the chassis. This assumes that the chassis will act as a rigid body.
- The direction of the force is the direction that the suspension system will act upon the shock support brackets.
- For the square tubing, I used aluminum 6061. For the bracket, I used medium-high impact acrylic. For the spacer, I used ABS.
- A default mesh is used and the analysis will be run only once because this analysis acts as a simple check for whether or not it will work.




- The shock support bracket deforms as expected




- The bracket should be able to withstand the drop test.

## References


https://roymech.org/Useful_Tables/Screws/Preloading.html
https://www.trfastenings.com/products/knowledgebase/stainless-steel-fasteners/pre-load-and-tightening-torques-coarse-metric-threads