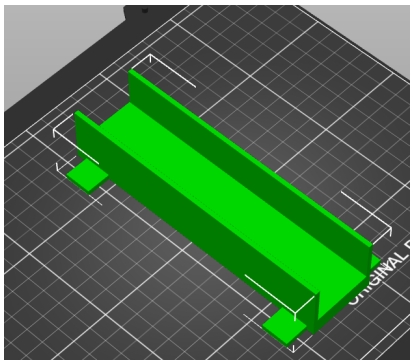
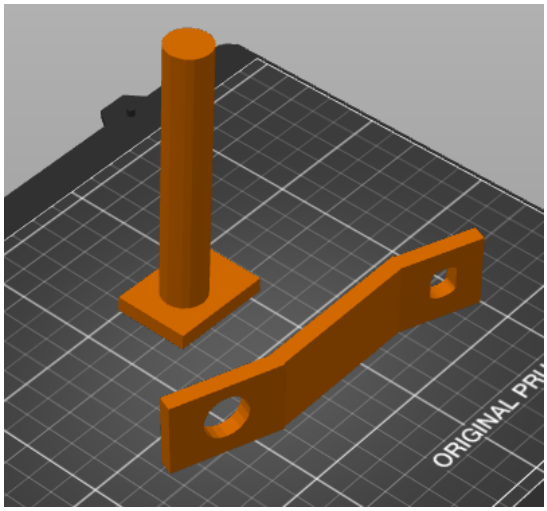
Parts and Sizes

Wingnut 4x - .55cm (diameter)
Big Phillips head 2x - .5 cm (diameter) - 3.1 cm (length)
Nut 2x - .65 cm (diameter)
Small Phillips 4x - .3cm (diameter) - 2.45 cm (length)
Plastic Washer 2x - .55cm(diameter) - .65cm(length)
Flat Phillips 2x - 8x1.5 inch
Metal Washers 2x- .5 cm(diameter)
Sheet Metal Screws 12x - 8x1 inch

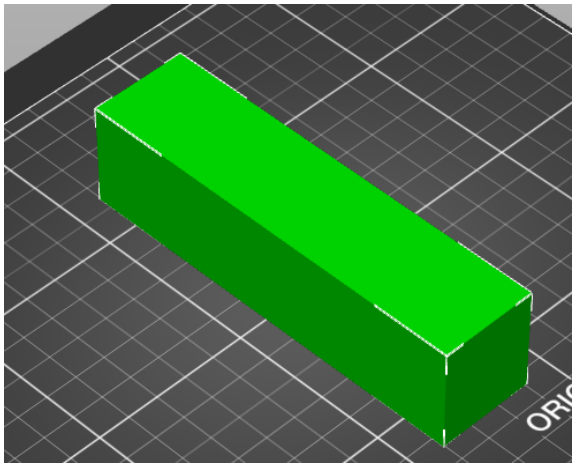
3D printed Rails 6x -



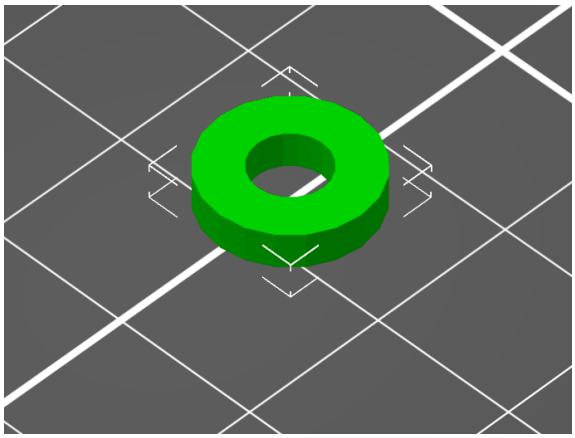
3D printed Handle Set 1x-



3D printed Brick 1x -

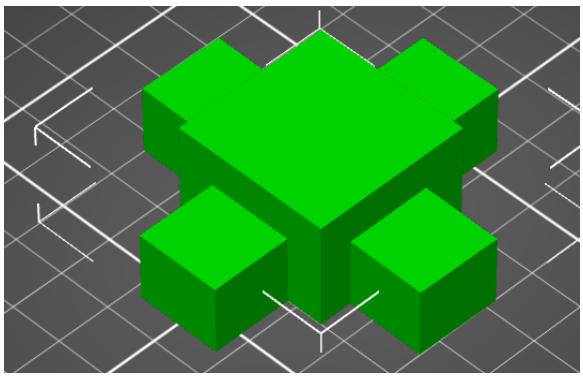


3D printed Washers 2x -



3D printed Clamps 2x -

3D printed “Feet” 4x-



Pulling Winch 1x -

Abrasion Proof Rope 1x - about 3 Feet

VL53L1X Laser Distance Sensor 1x -

3D printed Laser Distance Sensor Case 1x -

3D printed I2C Case 1x -

Instructions:

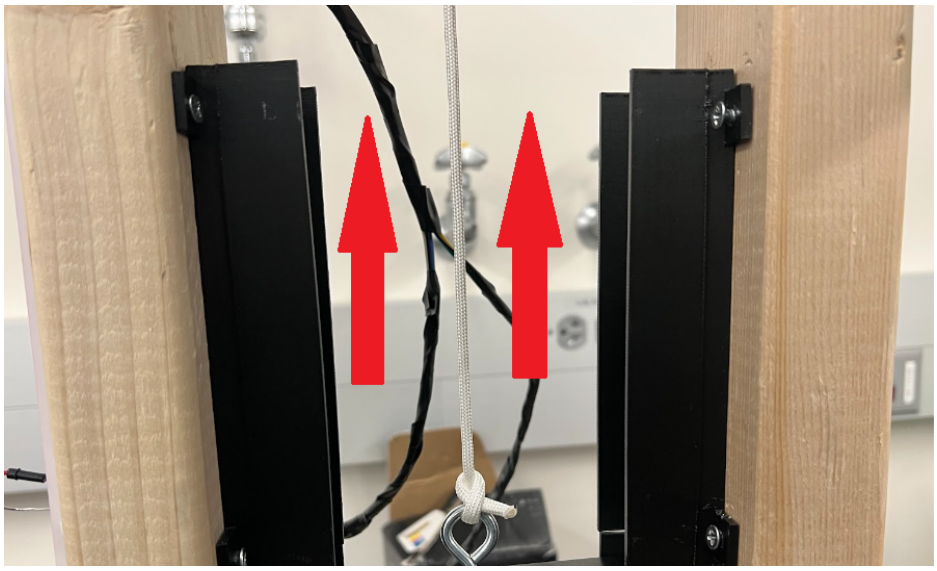
Tensiometer:

1. **Make sure that the bottom wooden block (red mark) meets the top of the bottom left 3D printed rail**
    a. **The rail measures up to 15 cm, measure to make sure that the bottom of the wooden block measures up to that same distance**

2. **Add material to the 3D printed clamps.**
    a. **Unscrew the small phillips with the size, 0.3cm (diameter) - 2.45 cm (length) and the**
    b. **Place the material with a width of 0.02m into the clamps.**
    c. **Make sure that the material is uniformly distributed in both clamps**

3. **Load up ArduSpreadSheet software to start testing**
    a. **See *Software Instructions - Ardunio***

4. **Once the software is ready to start testing, start to pull on the 3D printed crank on the pulley winch so that the rope starts to pull**
    a. **Uniformly pull the crank (keep at the same speed during each trial)**
        i. **Not doing this will cause the data to be skewed**



5. **Keep on pulling the crank until the material breaks**
    a. **The material should break in the middle**
6. **Transfer Stress-Strain Data from ArduSpreadSheet to Matlab App**
    a. **See *Software Instructions - Matlab App***
7. **The Matlab App will show the final Stress-Strain Curve graph that comes from the information which you experimentally found**
    a. **See *Software Instructions - Matlab App***

Software Instructions

Arduino Instructions:

Arduino Instructions:
Initial Setup:
-Download Arduino through installer, make sure installation is stored in the Documents folder(C:\Users\UserName).
-Store the Arduspreadsheet folder in the tool folder within the Arduino folder(C:\Users\UserName\Documents).
-Store library files in the libraries folder within the Arduino folder(C:\Users\UserName\Documents).

Instructions for Use:

1. **Open the Arduino Application(should be a shortcut on the desktop)**
2. **Navigate to the "tools" tab and select Arduspreadsheet, if Arduspreadsheet is not seen refer to "Initial Setup"**
3. **On the Arduspreadsheet tab, at the bottom there is a drop down menu for choosing sperators. Choose the comma separator.**
4. **At this point the sensors are reading data, in the upper right of the Arduspreadsheet there should be a "Clear " button, click this button before you begin stretching a material.**
5. **When the material breaks click the "Stop" button in the lower right corner of Arduspreadsheet.**
6. **Now we are going to make a .csv file, After you have stopped your data there should be an "Append" button in the upper left corner, press this button**

and a prompt for where you want to save and name your .csv file will show up. Navigate to the Desktop and save your file there.

7. **To start a new test press the "start" button in the lower right corner of the Arduspreadsheet and repeat from step 4.**

MatLab App

1. **On the Matlab App, press the button “Get Data” to select the data.**
2. **The thickness and width of the material is entered to calculate stress.**
3. **From the data, the Stress and Strain plot is graphed.**
4. **The Ultimate Tensile Strength is given and two points from the linear section are used to calculate Young's modulus.**

5. **The “Reset” button can be pressed to get new data.**