

3S Trailer Suspension

Meeting # 11

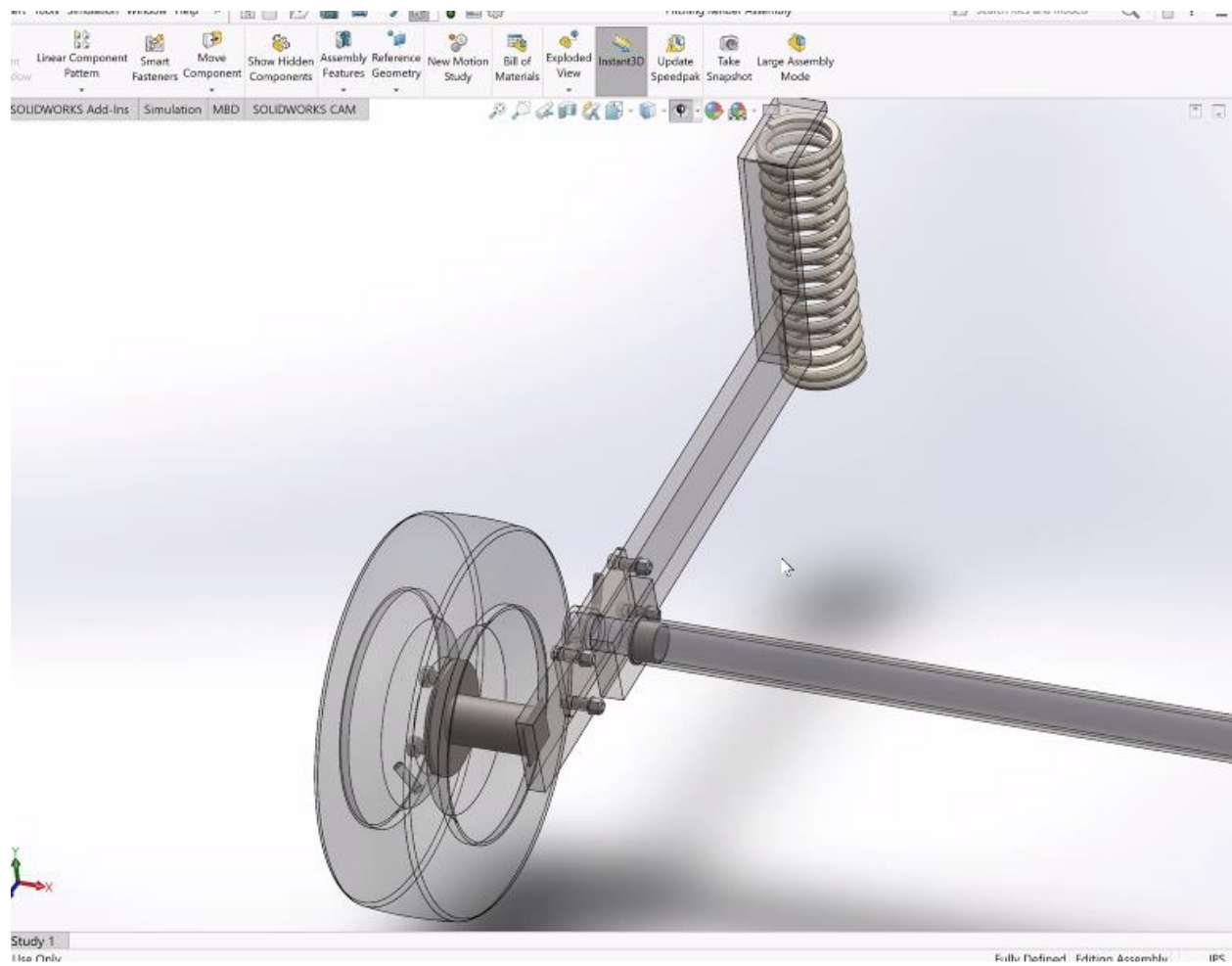
Start Date & Time: Monday. 7/6/2020, 1:30pm

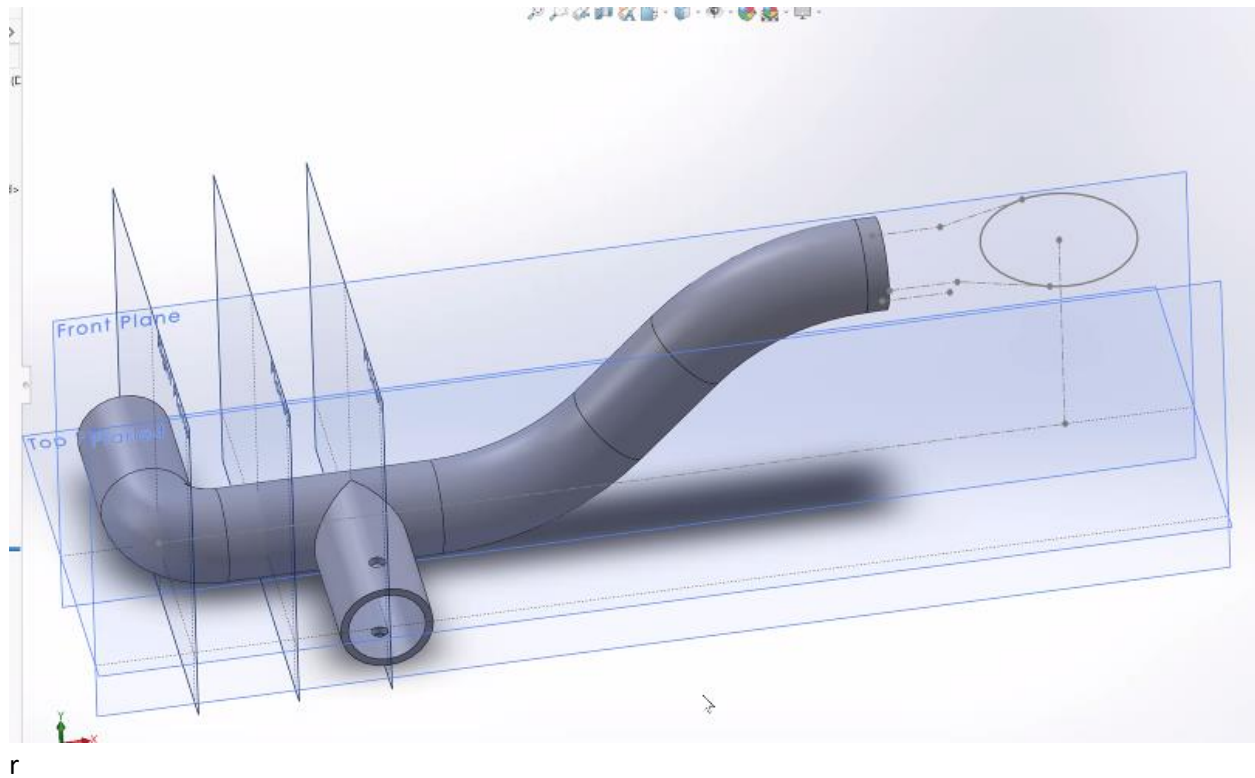
Members Present: Caitlin, Robert

End Time: 2:45pm

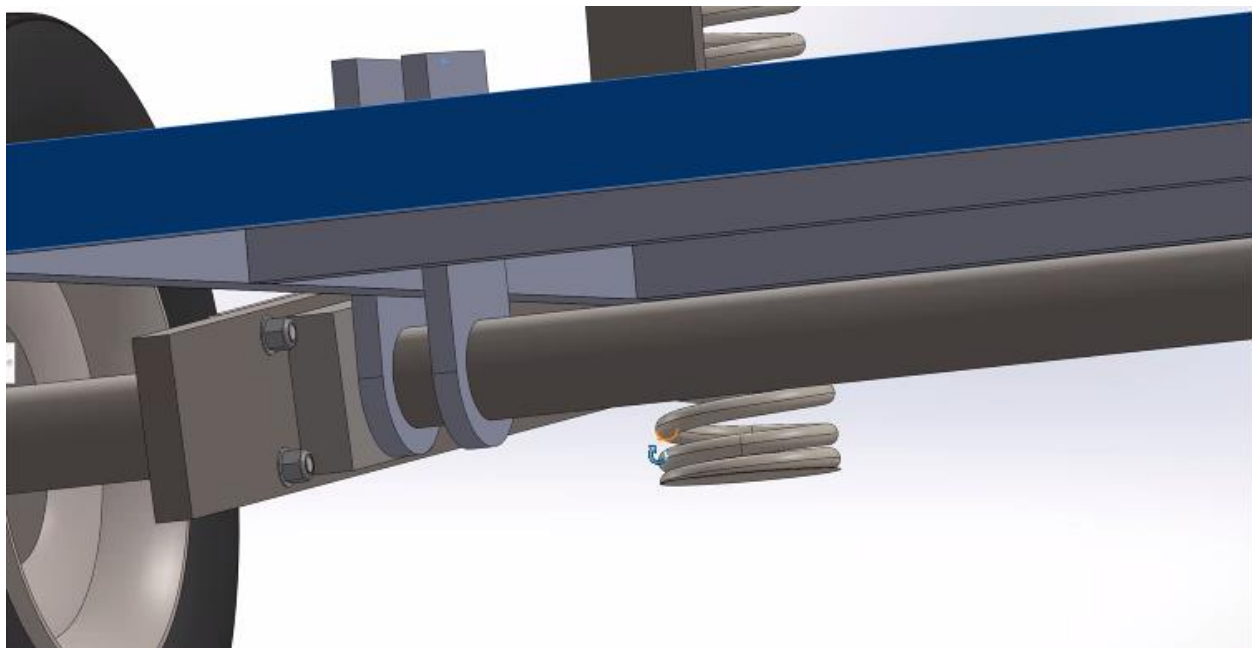
Last Meeting:

- Sleeve bearing is press fit into cover pipe
- Inner axle - inside diameter of sleeve bearing
- Flange is not welded to anything
- Must add that feature - not on it currently - weld on
- Make it big enough and thick enough
- Not actual washer - made piece
- That piece is left over from previous project - actual prototype don't need it in our actual design
- That piece mates to the flange bearing - still worthwhile to have
- Make sure it doesn't rub against the frame
- Must use a flange bearing
- Pick correct lever ratio selecting spring





- Could cut the top off and reuse it in a different part
- Move the axle up as close to the bottom of the frame as possible



- Revised and Swenson likes this way more

- No rubbing will be happening
- Tubing that covers the axle doesn't need to be the whole way over just for the mounting
- Would save a bunch of material!

| Scale | Base | Height | Spring | Tongue |
|-------|--------|--------|--------|--------|
| 1:1 | 4 ft | 8 ft | 12 in | 40 in |
| 1:2 | 2 ft | 4 ft | 6 in | 20 in |
| 1:4 | 1 ft | 2 ft | 3 in | 10 in |
| 1:8 | .5 ft | 1 ft | 1.5 in | 5 in |
| 1:16 | .25 ft | .5 ft | .75 in | 2.5 in |

- 4X6 - 0.75 - 9inchs long on the bed – 13in
- **1:8 scale is chosen**
- Spring will be the same
- Find grounded ends - so it's easier to capture
- Didn't want too big or too small
- Wheels and tires - what size are they starting from because they have a scale
- From the budget we have found a 1:10 scale
- Smaller the tire - doesn't cover up the axle or anything
- Our design is still not good enough we need to rework the design
- Wants lever ratio changed!

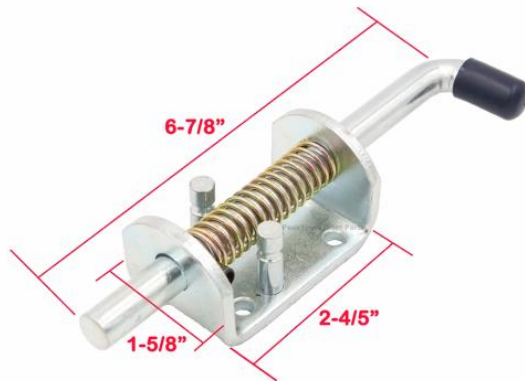
Today's Objectives:

- Discuss finite element findings
- Final budget ready to go
- Show Code written for lever ratio

Notes:

- Stuff has been deleted from the student folders
- Hard to find the folders and solid works models

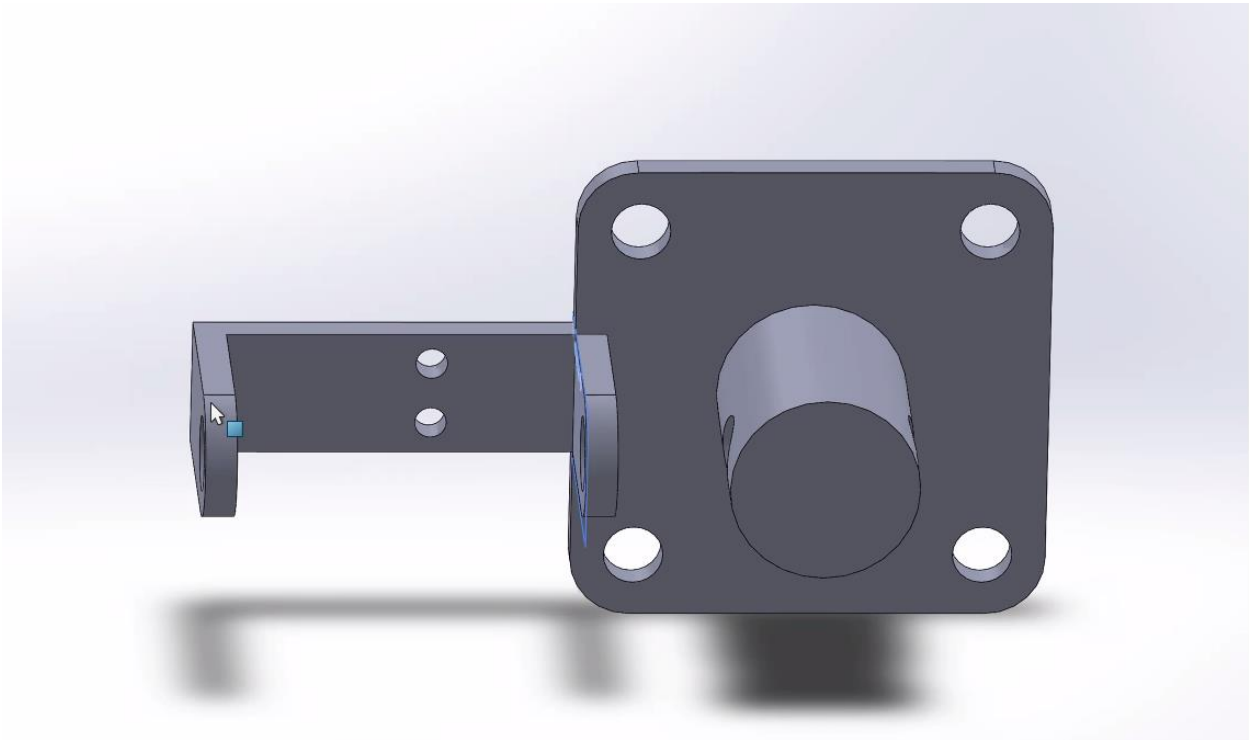
\$6.99



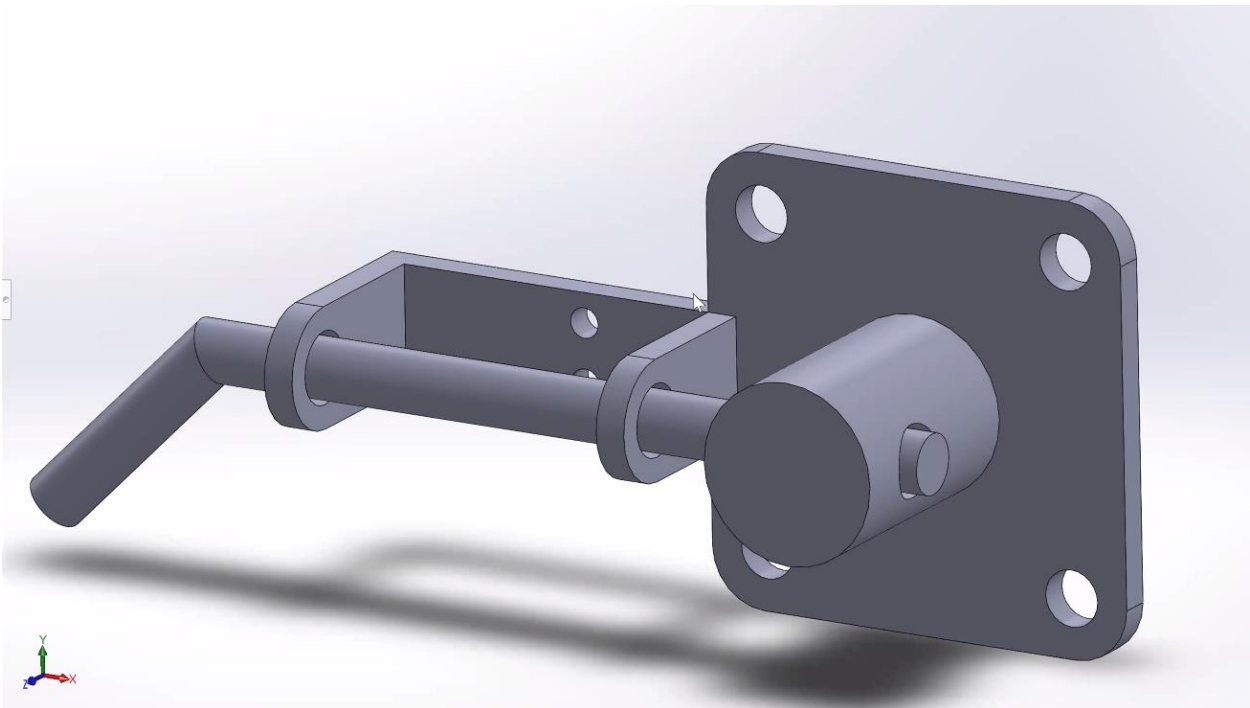
Copyright © PeakTow Trailer Parts



- Don't lose the pin while switching the suspension systems
- Spring will lock into place when - so you can do it by yourself easier
- Based off a Flanged set screw bearing

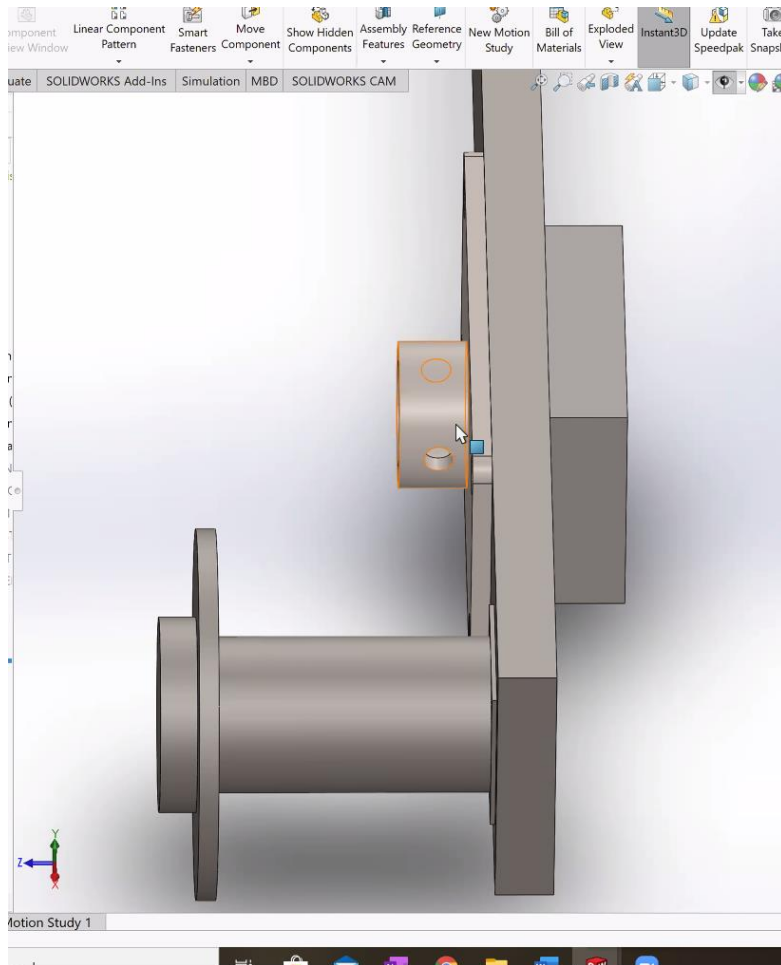


- Pin would slide through from the side

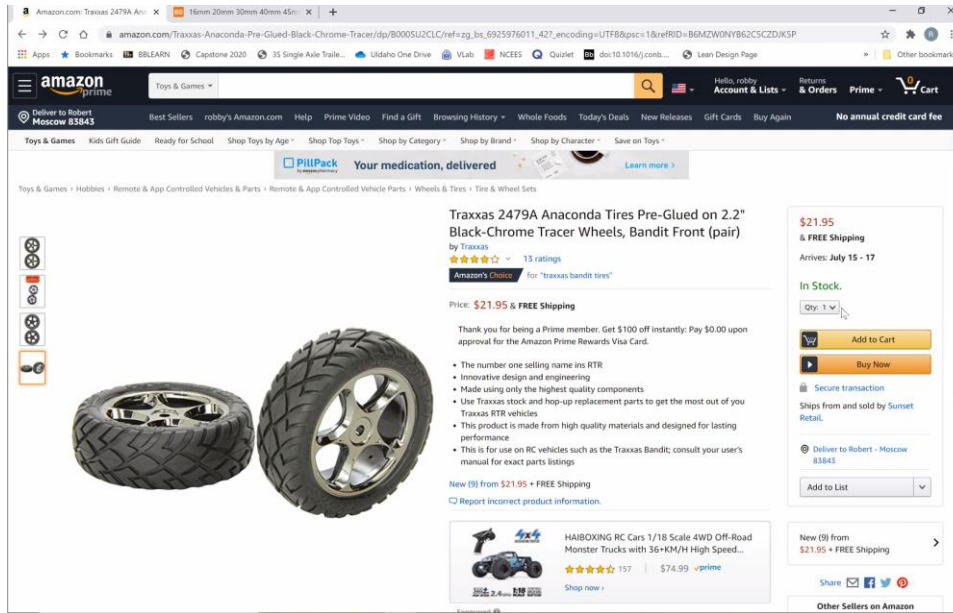


- Independent to dependent pin suspension
- Metal on metal will be fine for the time being for this
- Could put a gasket - to keep things cleaner

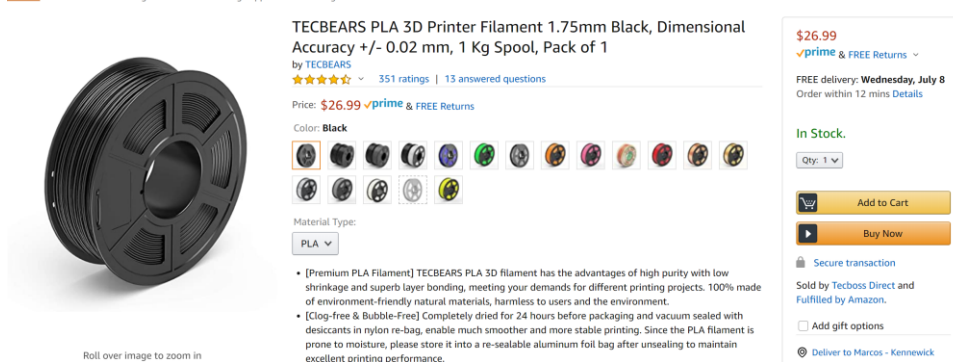
- Press fit flanged bearing go into the rocker arm so that the axle is pressed fit into and attached to rocker arm with 4 bolts - no bearings in this piece
- To keep the axle in place - press fit inside the rocker arm
- Taken out if axle is damaged etc.
- It's not always spinning around just a little bit of movement- put a rubber spacer to compress tightly - it moves but it doesn't have metal on metal
- Makes it impossible for someone to mess up the holes with the axle
- Do we need the spacer? If so, what could be better?
- Leaving whole axle covered - easier to mount - only 2 bearings instead of 4
- Hot oil flanged bearings - no revolutions happening it's only going back and forth
- Minimum width for trailer - restraint



- Have the bolt go all the way through the spacer - have bearing completely sealed in
- Adds strength!
- Easy to laser cut the lever arm - bend - stronger and quicker
- Found smaller wheels



- Picked out a black filament!
- Emailed max to ask



- Lever ratio MATLAB code


```

Lever_Ratio_Spring_Rate_Calculator_3S_Trailer.m
5  %% tire deflection = 1 in
6  %% spring rate (VARIABLE) = 112 lb/in
7  %% spring deflection = lever ratio
8  %% lever_length = 29.25 in
9  %% max_lever ratio = 4.5 -> don't want spring to compress more than half of free length
10
11 F_max_load = 2000; %% lb
12 %% lever_ratio = 23/6.25 -> current design choice for 2000 lb configuration
13 lever_ratio = 23/6.25;
14     fprintf('Lever Ratio= %f \n',lever_ratio);
15 deflection_spring = lever_ratio; %% to comply with desired 1 in deflection at tire
16 F_spring_static = (F_max_load/2)/lever_ratio;
17 spring_rate = 123; %% lb/in -> Change this to test spring performance
18     fprintf('Spring Rate= %f lb/in \n',spring_rate);
19 spring_preload = 0.75*spring_rate;
20
21
22 %% F.S. = 2
23 F_spring2 = (2/2)*F_max_load/lever_ratio; %% Max spring load
24     fprintf('Spring load= %f lb \n',F_spring2);
25 Rate_spring2 = (F_spring2-F_spring_static)/deflection_spring; %% lb/in - Minimum required spring stiffness -> CONCERNE
deflection_tire2'
26     fprintf('a) Minimum desired spring stiffness= %f lb/in \n',Rate_spring2);
27 deflection_spring2_max = (F_spring2-spring_preload)/spring_rate;
28 Rate_spring2_max = (F_spring2-F_spring_static)/deflection_spring2_max;
29     fprintf('b) Minimum actual spring stiffness = %f lb/in \n',Rate_spring2_max);
30 deflection_tire2 = deflection_spring2_max/lever_ratio; %% Design goal to keep near 1 in
31     fprintf('Tire deflection at max load = %f in \n',deflection_tire2);
32
33 %% F.S. = 3
34 % F_spring3 = (3/2)*F_max_load/lever_ratio %% Max spring load (FS=3)
35 % Rate_spring3 = (F_spring3-F_spring_static)/deflection_spring
36 % deflection_spring3_max = (F_spring3-spring_preload)/spring_rate;
37 % deflection_tire3 = deflection_spring3_max/lever_ratio
38
39
40 %% For parametric study INCOMPLETE, feel free to edit
41 % for
42 %     lever = linspace(2.5,5,100);
43 %     spring = linspace(75,175,100);
44 %     %% lever = ((2000/lever)-0.75*spring)/spring;
45 %     %%force = (2000/lever)-F_spring_static)/lever;
46 % end
47

```

- Budget is now official and will be shown to Swenson during tomorrow's meeting

For Next Time:

- Choose 3 lever ratio options
- Choose Springs
- Choose bearings

Comments/Concerns/Reflections from Today:

- 2 team members were not able to make it to this meeting today

Next Meeting Time & Date: **Tuesday, 7/07/2020 @ 9:30pm**