Course: ENG ME 360

Assignment: Skateboard FEA

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Goal of this exercise:

The goal of this project is to create a 3 D model of a skateboard deck and apply

Structural Analysis.

Constraints:

Design constraints include following parameters:

- 180lb is applied to the skateboard (weight of an adult)

- US shoe size 12

- Safety factor of 3

- Vertical span of the stressed skateboard cannot exceed 0.375 in (9,525 mm)

Design:

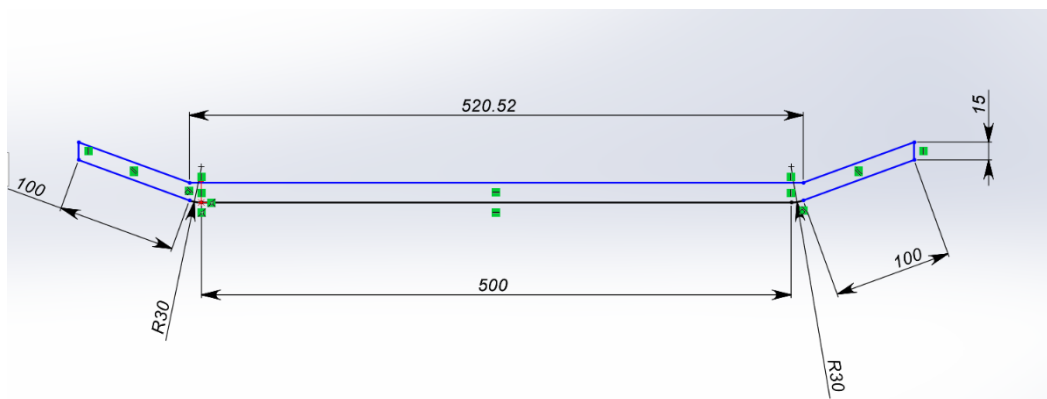Below Figure 1 illustrates the dimensions of the skateboard model.

Figure 1: Side view of the skateboard design.

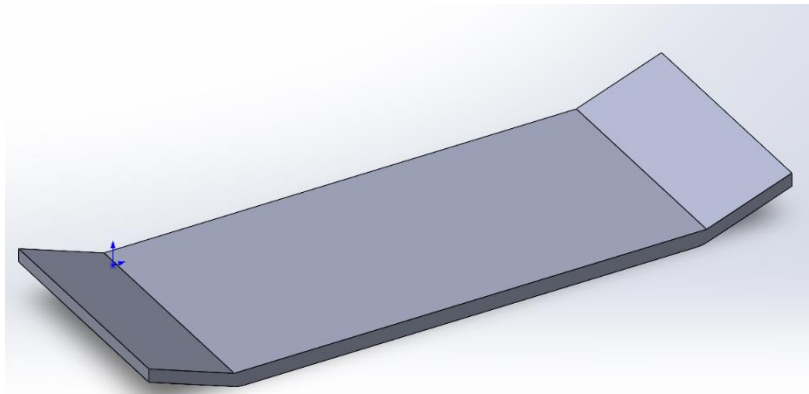On the next page Figures 2,3,4 illustrate the design of the skateboard steps
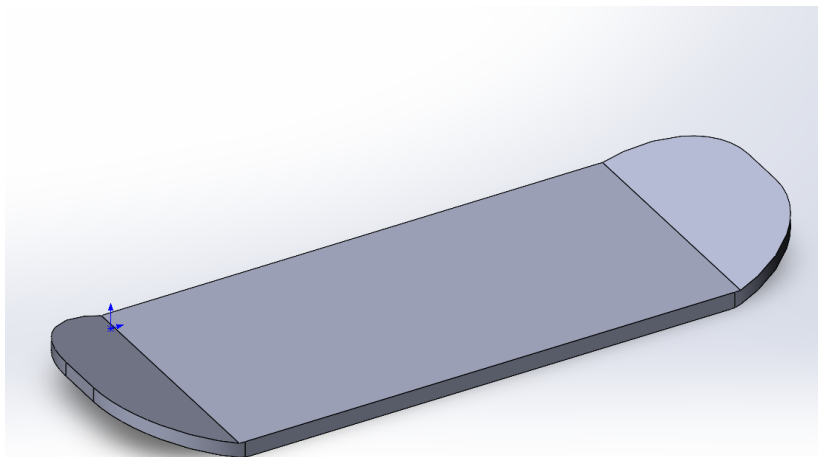
Figure 2: Major extrude.
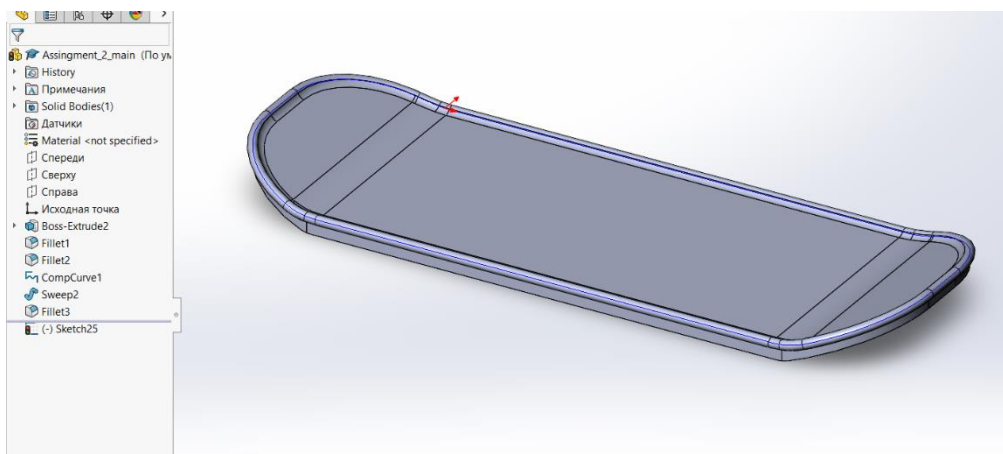

Figure 3: Rounding extrude.

Figure 4: Adding minor features.

Model of the deck used in subsequent analyses:

FEA analysis parameters are represented in the model in the following way:

User weight will be equally distributed inside the two sketches (of footprints) on the top surface of the skate. Illustrated in figure 5. (12 US size)

Supports: will be distributed as 2 squares (the metal attachments of the wheels). Illustrated in figure 6.
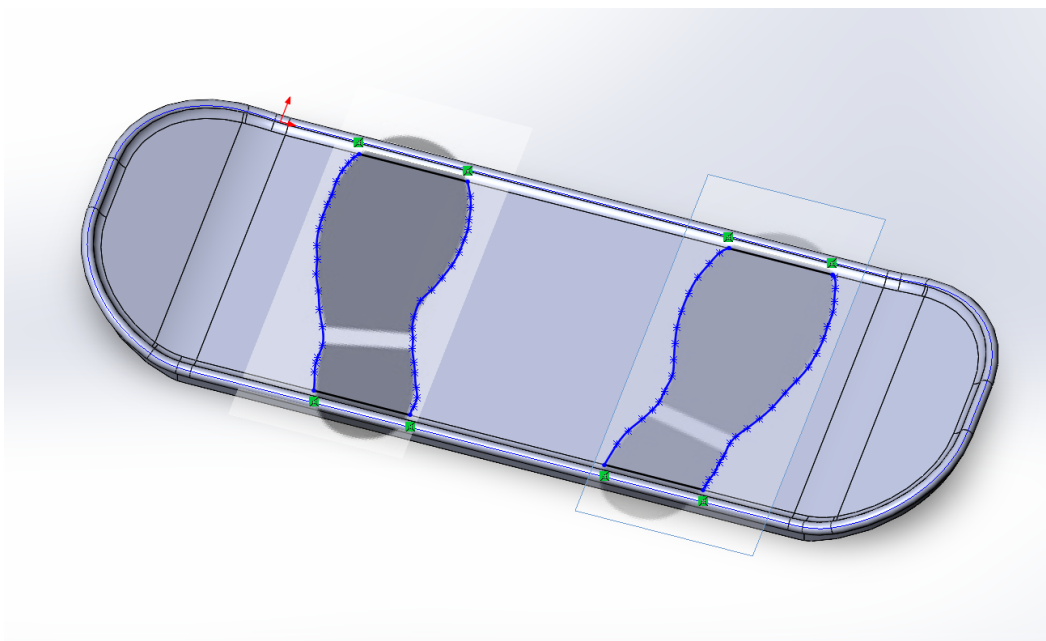

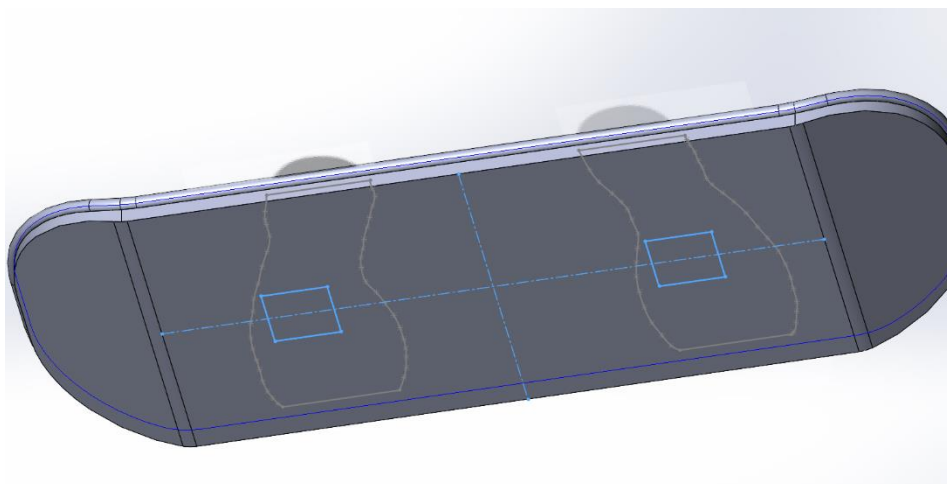*Figure 5: Footprints. Where load is going to be applied*

Figure 6: Supports

Material selection process:

We are going to chose 3 materials for this design: (Skateboards are usually made from wood thus all 3 materials are going to be woods. Woods are low weight and relatively high yield strength). Solidworks Did not have built in values for materials below, so data was taken from MatWeb website. (Tensile Strength at Break, Modulus of Elasticity)

Materials:

- Balsa wood

- Oak wood
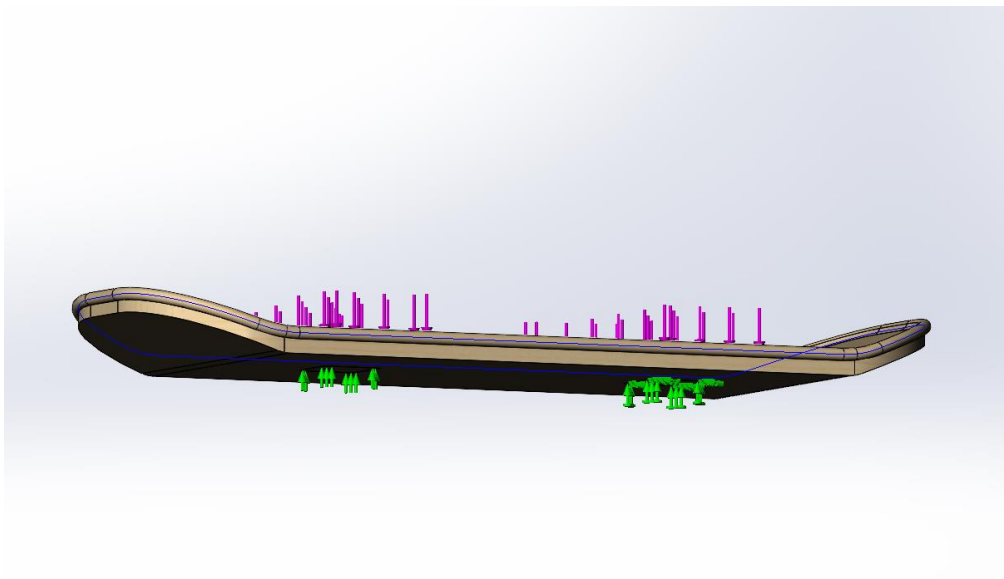
- Pine wood

FEA:

Figure 7: illustrates all the setup of forces and supports.

For each material, a simulation of structural analysis was run. Results illustrated in figures (8-10)
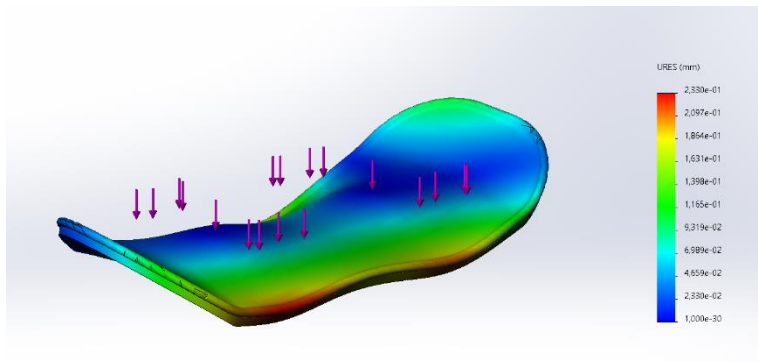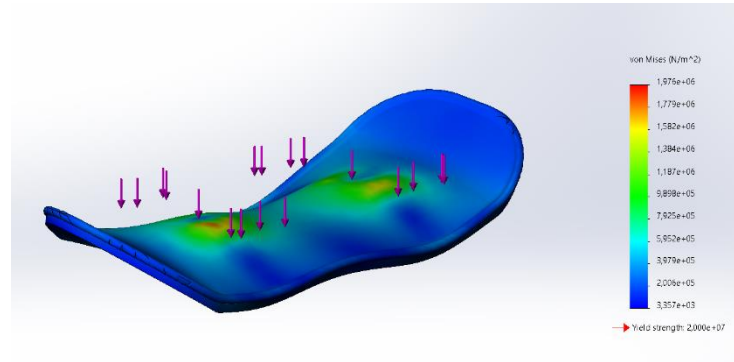
Balsa wood:

Figure 8: Displacement

Figure 9: Stress

Maximum displacement: 2.33 mm

Oak wood:
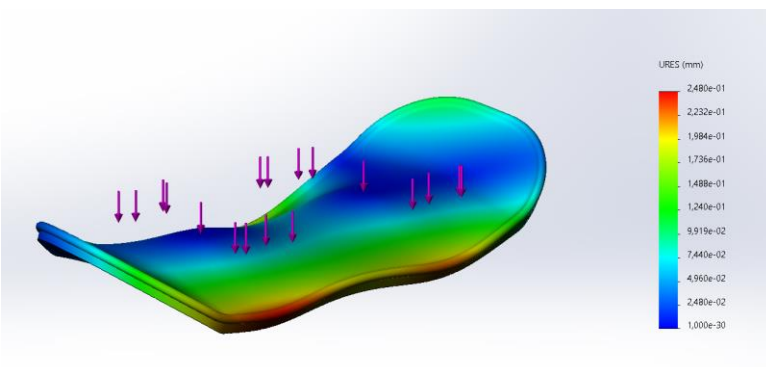
Figure 10: Displacement

Figure 11: Stress

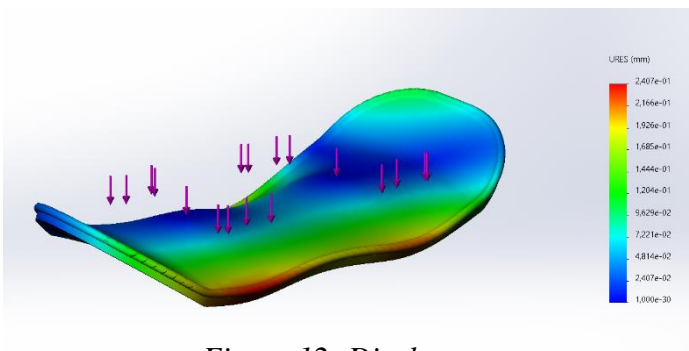Maximum displacement: 2.48 mm
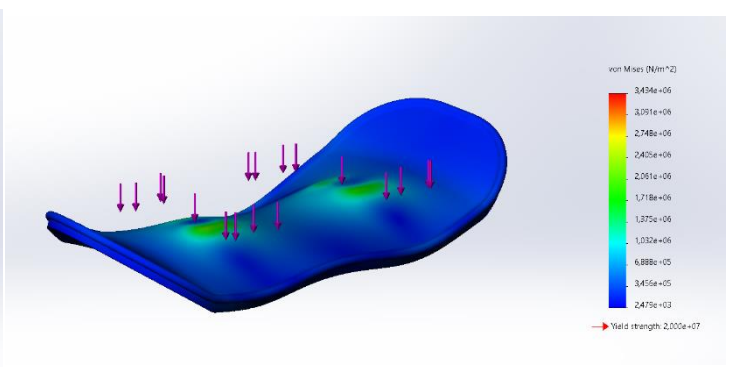
Pine wood:

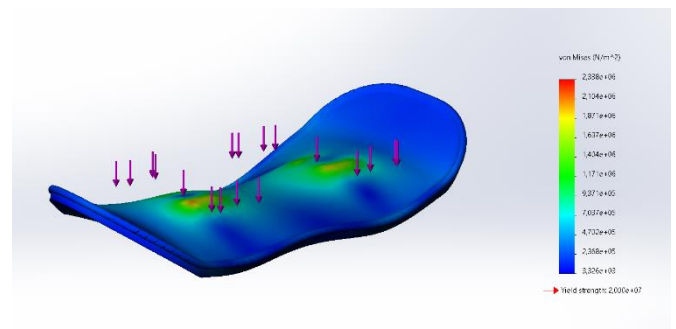*Figure 12: Displacement*

Figure 14: Stress

Maximum displacement: 2.41 mm

Design optimization:

Quality of our skateboard depends on how much it bends and weighs. To minimize the weight of the deck and have good quality we would run the simulation many times using different 3-D shapes, materials, loads, fixtures. If we have done it enough times, we would be able to find optimal best solution of the skate board deck.

Conclusion and future work:

Although the work in this assignment was executed very vaguely (many approximations), not real model (Skateboards are usually made from layers of different materials and in different shape than we did), this exercise illustrates how many important engineering values could be found using FEA simulations. Real life analysis would use similar procedure but more constraints and analysis work.