

SAE BAJA 2015

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Introduction

The SAE Baja competition is a student design competition that tests a student's ability to design, engineer, build, test, promote, and compete with a vehicle within the limits set by the rules.

The goal is to create a single passenger off-road vehicle while maintaining leading performance in speed, handling, ride, and ruggedness.

Frame Design

The frame and roll cage must be able to protect the driver in the event of a crash during the competition without the material yielding. The team went through eight frame revisions until deciding on the final design. The final frame design for is shown below in Figure 1. The frame includes a roll cage that complies to the rules set forth by the competition. The frame is constructed of round 1.250"x0.065" 4130N chromoly steel to optimize the strength and weight of the frame. The overall weight of the bare frame is 92 pounds.

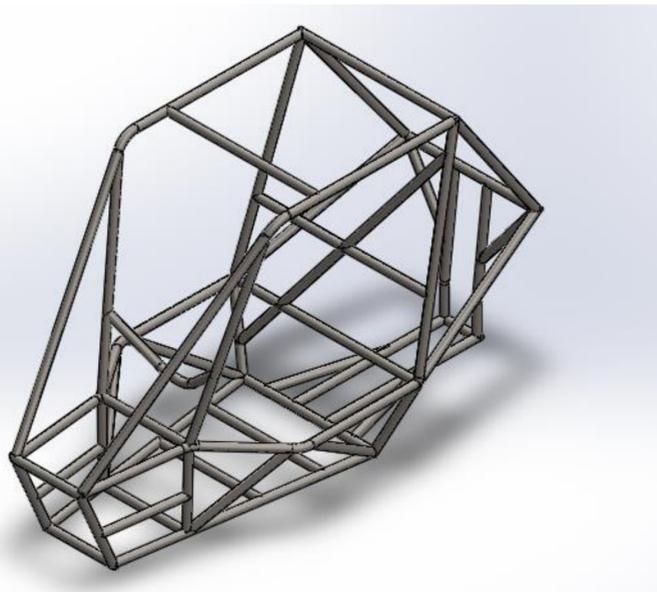


Figure 1: Frame Design in SolidWorks

Frame Analysis

Analysis was performed on the frame for the event of an 8G front and rear impact, a 2G side impact, and a 10ft fall onto the frame. Analysis was performed in SolidWorks and the results can be seen in Table 1.

Impact Scenario	Factor of Safety
8G Front	1.27
8G Rear	2.50
2G Side	2.87
10ft Fall	2.66

Table 2: Suspension Factor of Safety

Suspension Design

The front suspension design uses A-Arms to allow for more travel as well as greater strength than a wishbone system. The rear suspension utilizes a semi-trailing arm design. This gives a significant weight reduction over previous years and allows for more travel. The suspension can be seen on the full vehicle assembly below in Figure 2. Both the front and the rear suspension are dampened by FOX coil over shocks.

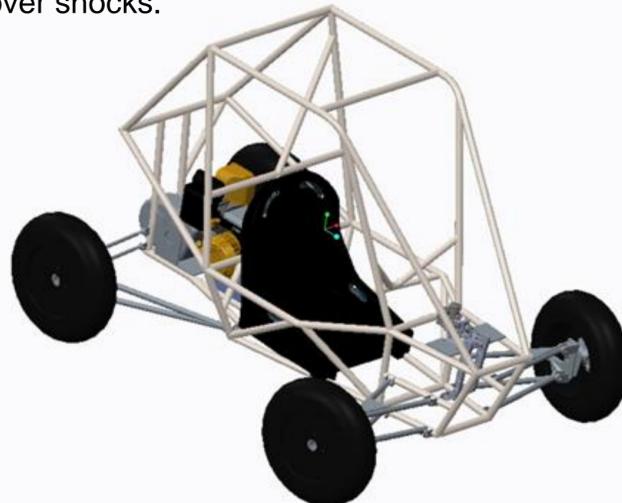


Figure 2: Full Vehicle Design

Suspension Analysis

Both the front and rear suspension systems were analyzed using ANSYS. The suspension components were analyzed under a 2G dynamic load, to simulate landing at the end of a jump. The results are displayed in Table 2.

Impact Scenario	Factor of Safety
Front Suspension	2.3
Rear Suspension	2.3

Table 2: Suspension Factor of Safety

Powertrain

The powertrain system transmits power from the engine to the wheels. The engine used, to comply with the SAE rules, is an unmodified Briggs & Stratton 10 hp OHV Intek engine. The next component used in the powertrain system is a continuously variable transmission from CVT tech. This allows a quicker transmission of power from the engine to the differential using a weighted pulleys and a connecting belt. The final component of the powertrain system is an E-Z-GO TXT golf cart differential with a final drive ratio of 13.32:1. Another benefit of this differential is that it enables the car with a reverse gear for better maneuverability.

Full Assembly

The SAE Baja 2015 car has been fully manufactured and tested. The full manufactured assembly can be seen in Figure 3 below.



Figure 3: Final Assembly

Conclusion

This year's team has designed, engineered, built, and tested a vehicle that will maintain driver safety while performing to the highest of its abilities while still maintaining the rules and regulations set by the SAE competition.

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