



**CALIFORNIA STATE SCIENCE FAIR  
2016 PROJECT SUMMARY**

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<b>Project Title</b> <b>Effects of Added Weight and Tire Material on Climbing and Sliding Friction</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The objective of this experiment was to show what kind of tires work best with different amounts of weight. If weight increases, then traction will increase no matter what tire material is tested. As long as weight is increasing, the tire material being used should not matter because of the equation <math>F = \mu W</math>, where F is the force being exerted by the wheel, W is the weight, and <math>\mu</math> is the traction coefficient or tire material.</p> <p><b>Methods/Materials</b> The robot was built over the months of Nov. and Dec. 13 different weights were chosen. 0,1,2,3,4,5,6,7,8,9,10,15,and 20 lbs. Only added weight was tested. The 3 different tire materials were plastic, rubber,and a spray-on rubber. In the sliding tests, the robot was left to go down the ramp of 30° with different tires and weights on its own. In the climbing tests,current was applied to the motors to see how far it would go in 1 second with different weights and tires. The speed was recorded for each test in in/s with 3 trials for each combination of tire materials and weights.There were 234 tests total.</p> <p><b>Results</b> For the sliding friction test with plastic wheels, speed decreased gradually, which showed traction was increasing. For the plastic wheel climbing friction tests the vehicle did not climb the ramp at all. The rubber wheel sliding tests were similar(did not slide down at all)except for the 20 pound tests,in which the weight overcame the lock. For the rubber wheel climbing tests, the vehicle traveled slow at first, then increased to 19 in/s where it then plateaued. For the sliding friction tests when the robot had rubber-spray coated wheels,it gradually slowed down as more weight was added. Finally,for the rubber-spray climbing tests,the robot's speed spiked and dropped sporadically.</p> <p><b>Conclusions/Discussion</b> The original hypothesis was that increasing weight increased traction no matter what material was used. This was true for most of the tests. However, according to the climbing plastic test and the sliding rubber test,the experimental setup was slightly flawed.(The rubber did not slide downhill and the plastic could not drive up the ramp)Thus traction may actually have been increasing,but humans could not see it since nothing moved.That means is that there are three tests supporting the hypothesis,two tests that do not support the hypothesis,and one in which the data is invalid,which overall supports the hypothesis because 3/5 of the experiments support it.</p>	
<b>Summary Statement</b> This project shows how the amount of weight and difference in tire materials effect the amount of friction and traction something has.	
<b>Help Received</b> We borrowed the robot materials and the testing surface from the robotics club. Other than that, everything was done ourselves.	