

## Testing and Data Analysis

### *Hill Climbing*



**Figure 69:** *Hill Climbing*

In the hill climbing test, a stop watch was used to time how fast the car climbed up a hill of known grade and length. The main pack voltage was kept at a constant 72V in both trials. The grade was 6.8% and the length of the hill was 143ft, as shown by the calculations in the appendix. In the 1st trial, the field pack was applied, enabling the car to climb the hill in an average time of 8.75 seconds. In the 2nd trial, the field pack was removed and the car was retested and the results showed that the car could not even make it up the hill. The results of this test show that the car is able to climb hills after adding a charge to the field coil as shown by figure 69. More tests were done by checking the ability of the car to move from a dead start at an incline, and the testing showed that the

car was able to climb inclines with various grades as shown by table 9. The client's requirement was for the car to climb a hill for 30 seconds at a speed of 20 mph, after testing it was seen that the car is able to climb any hill at a speed higher than 20 mph as shown by table 10.

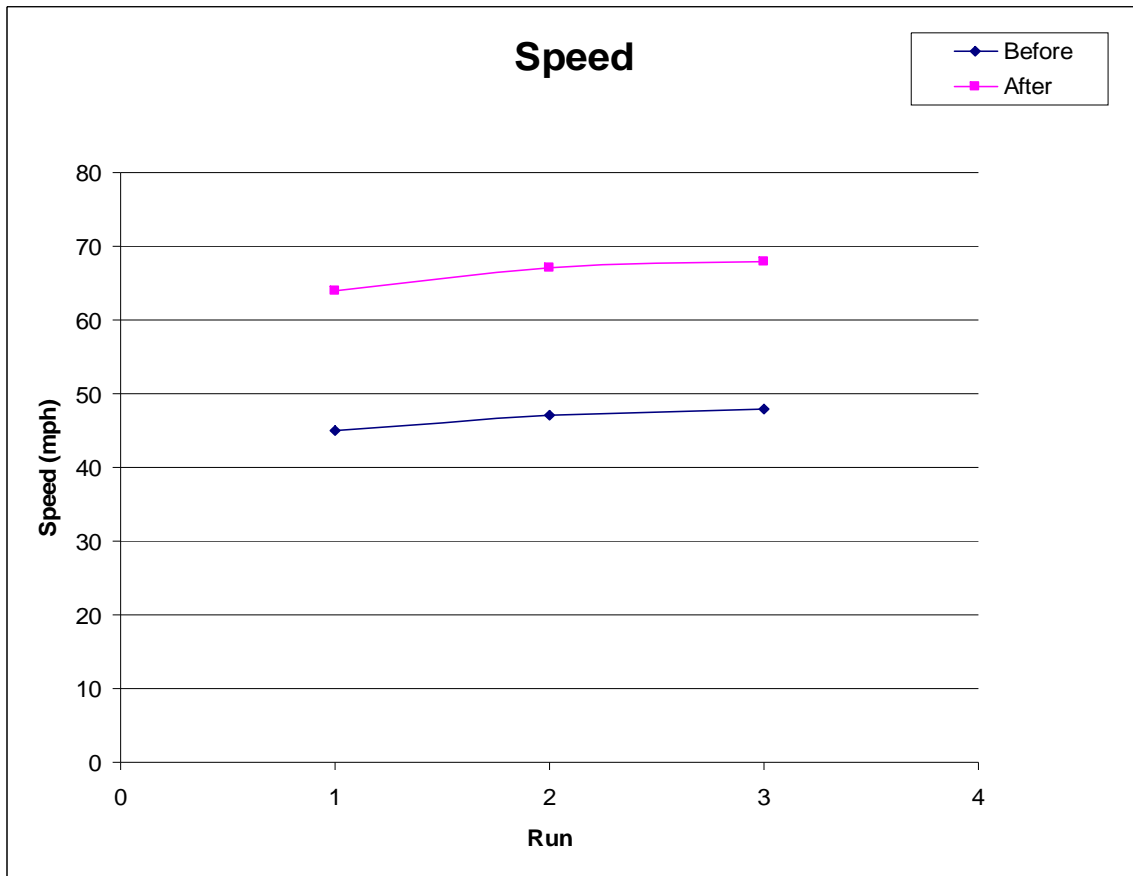
Table 9: *Hill Climbing*

Hill Climbing			
Ruin	Grade	Without Field Pack	Using Field Pack (s)
1	6.8	No	Yes
2	5	No	Yes
3	4.3	No	Yes
4	3	No	Yes

Table 10: *Hill Climbing*

Hill Climbing				
Ruin	Grade	time (s)	Without Field Pack	With Field Pack (s)
1	6.8	30	No	Yes
2	5	34	No	Yes
3	4.3	30	No	Yes
4	3	50	No	Yes

## Speed



**Figure 70:** *Speed*

The results of the speed test are in figure 70. The car was taken to its top speed three separate times with and without the field pack. The first trial was done with 2 people in the car while the second and third trials were done with 1 person in the car. The results showed an overall increase in top speed when using the new concept. Without using the field pack, the average top speed was around 47mph. When the field pack was applied, the average top speed increased to 68 mph. The raw data is shown in table 11. The client's requirement was to increase the speed to approximately 70 mph, as seen by testing the top speed obtained was 68 mph. The car is able to go 70 mph but it was

advised that the terminals could melt at such a high speed and as a result the team decided that 68mph is the top speed attained by testing.

Table 11: *Raw Data Runs*

Speed		
Run	w/o FP (mph)	w/ FP(mph)
1	45	64
2	47	67
3	48	68
Average	46.7	66.3

## Range

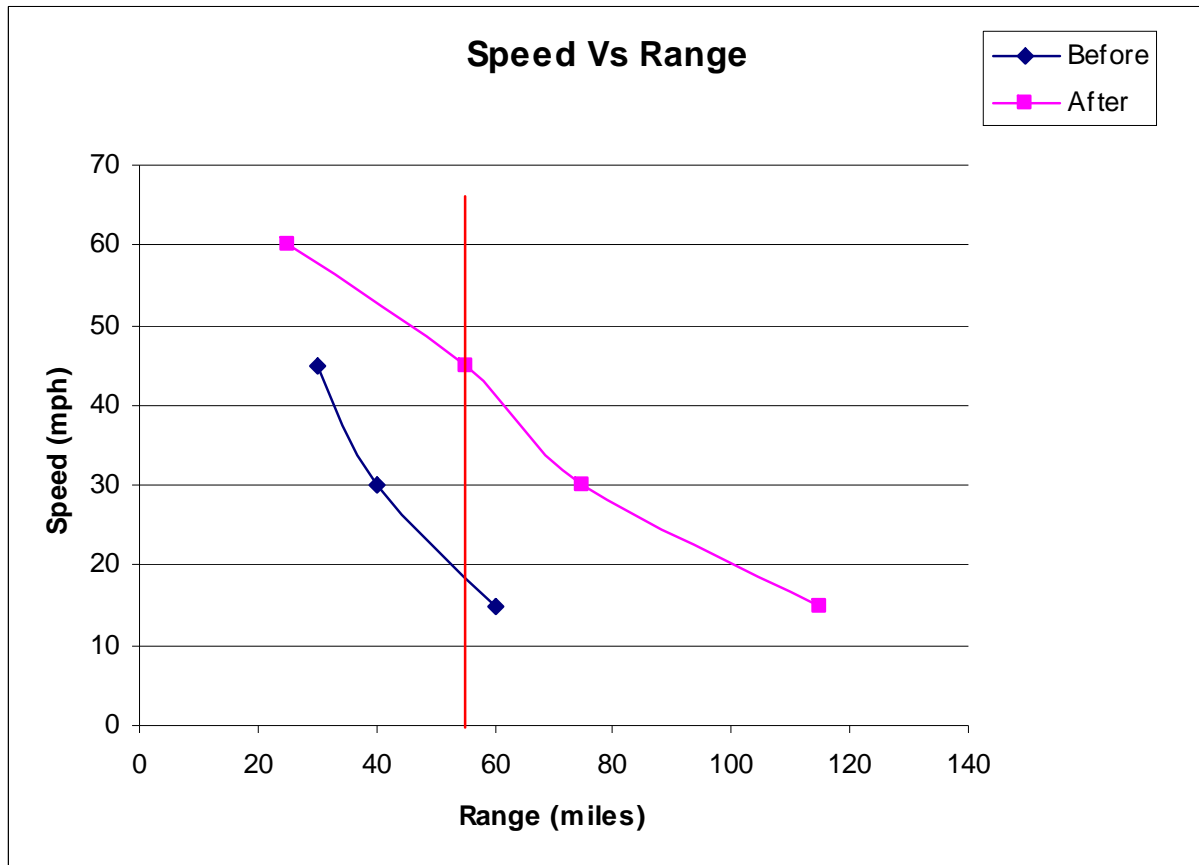


Figure 71: *Range*

Range is a measurement of speed; the faster the car is driven the lesser distance the car will travel before running out of charge. The range test was conducted by driving at a constant speed while taking into account the distance traveled and the amount of charge lost from the Curtis gauge. After that, the ratio was taken between the distance traveled and the charge lost from the gauge as shown in the appendix under range calculations. Table 12 shows the raw data. It was concluded that at an average speed of

45mph the car's range is 55 miles compared to 30 miles range before implementing the new concept as shown by figure 71.

Table 12: *Raw Data Runs*

Range		
Speed(mph)	Range before (miles)	Range after (miles)
15	60	115
30	40	75
45	30	55
60		25

### ***Weight Distribution***

The distribution of weight in the vehicle will only affect the traction on the tires not the overall performance with speed, torque, and range. We conducted an experiment to prove this theory; the experiment was done by putting one group member who weighs 190 lbs, which is approximately the weight of 3 trojans batteries, was placed on the hood of the vehicle to simulate adding 3 batteries in the hood compartment of the vehicle. Two group members were placed inside the vehicle to simulate the weights of the vehicle occupants during daily travel. The test was conducted in the same fashion as the torque experiment, the only difference, after the group member who was placed on the hood was relocated inside of the vehicle to simulate all batteries placed in the rear. Trails showed that the car traveled up the hill at the same rate in either orientation (batteries in front compartment or rear of car).