

In this sample lab report, annotation will appear in a comment. The lab report itself will be in black. A version of this report without annotation is also available so you can see what a typical report would look like.

The first page in any lab report is the **cover page**. This page has two major purposes. First, it gives the report a professional look. Second, it identifies who should get the grade, and in the event that the report is dropped, who should receive the report for grading and comment.

Note that the competition labs have team lab reports, so in this case both partners are listed together. It's usually good form to put the names in alphabetical order by last name.

Note that lab reports are always **double spaced**, allowing the person reviewing your work to have room to write comments.

**Note that lab reports should have a professional font, no lists, a proper footer and labels for all graphs and images.**

Lab 500: Stock Car Racer

EG1003 Section A2

Richard Petty and Sarah Fisher

Dates of Experiment: January 15, 2007 through April 1, 2007

Date due: April 6, 2007

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Sec. A2 Lab 500

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## Abstract

The objective of this lab was to build a stock car racer capable of competing in the Daytona 500 and DirecTV 500. A second objective was to win the competition between the EG1003 teams entered in these races by achieving the highest Car Competition. The car was successfully entered in both races, and the team achieved second place in the EG1003 competition. The car was run into the wall at Martinsville by another driver, causing it to finish in a much lower position than if it had been able to race at full speed, hurting the car's Car Competition Ratio. The NASCAR car specification, with its emphasis on safety, helped the car remain competitive until the end of both races.

## Introduction

Since the lab was a competition, the winning team was the one with the highest Car Competition. The Car Competition Ratio is:

$$1. \text{ CCR} = \frac{400000 \times (86 - \text{DaytonaPlace} - \text{MartinsvillePlace})}{\text{Cost}}$$

In this ratio, Daytona Place is the position of the car in the finishing order of the Daytona 500. Under the formula, the worse the car finished, the lower the ratio, and the lower the car would finish in the EG1003 competition. The same is true for the Martinsville Place term. Therefore, the car would have to finish well in both races to minimize the ratio. With the cost of the car in the denominator, the car also had to be designed to be as inexpensive as possible.

Since the Daytona 500 is a high speed race on a long track, the car had to be aerodynamically efficient. However, since the Martinsville track is short and narrow, the car had to be very maneuverable as well.

**Comment [EG1]:** The **Abstract** gives an overall, high-level view of the lab report. It is the portion of a lab report that a reader can scan and get a good idea of what the rest of the report should contain.

**It must contain:**

- The objective of the lab
- The results of the lab
- The significance of the results

**Comment [EG2]:** The **Introduction** gives the background information necessary for the reader to understand the report.

**It should contain:**

- Relevant formulas, scientific theories, etc.

It is one of the longest sections of the report and you may paraphrase the manual. However, the work **must** be in your own words. Outside sources are allowed but **must** be cited.

**Comment [EG3]:** Describes the important design considerations a car should have to win with the highest possible ratio, as requested in the "Your Assignment" section of the report.

The NASCAR specifications are extremely specific on the car's design, with safety being paramount. Much of the car consisted of high strength tubing and guard rails to protect the driver. The car must also have the same overall shape as the comparable model being sold commercially so that a casual spectator will recognize it. However, the only parts of the car that must be in common with the commercial version are the hood and the trunk lid, leaving considerable flexibility in how to design the rest of the body. From some Web sites of NASCAR racing teams, it was clear that most of the non-structural body should be made of fiberglass to minimize weight.

**Comment [EG4]:** Describes the factors considered in designing the car & background information used as requested in the "Your Assignment" section of the website.

The rules for this competition required the car to fit within the design constraints given for a Nextel Cup racing car under NASCAR rules. If the car would be disqualified by NASCAR, then it will be disqualified by the EG department. Additionally, all materials bought, whether used or not, must be considered in the final cost of the car. Finally, the car must qualify for each race.

**Comment [EG5]:** Describes the rules of the competition as requested in the "Your Assignment" section of the lab manual.

## Procedure

A 2006 Chevrolet Monte Carlo, 200 feet of steel tubing, a dual electronic ignition, 400 pounds of fiberglass, a Simpson racing seat with five point safety belts, a 400 horsepower turbocharged, supercharged engine, a fuel cell to replace the stock gas tank, small tubing to connect the fuel cell to the engine, 40 sets of racing tires, cargo netting to replace the driver window, and three electrical switches were used to build the vehicle. The switches were used to replace the key ignition, start the car, and provide an "Emergency Power Off" capability required by NASCAR rules. NASCAR rules also required having a complete professional race crew at the races, plus professional technicians supervising the construction of the car, so an additional labor cost was incurred as part of our materials.

**Comment [EG6]:** The Procedure section consists of two parts.

The first paragraph is where you describe the materials used and it **must be in sentences. Lists and bullet points are not acceptable.** Additionally, you should only list materials you have used.

The second paragraph is where you will describe the steps you took to complete the report. It **should not** be a copy-and-paste of the manual, it **must be in your own words.**

First, The NASCAR rules were reviewed and an initial design was determined. The Chevrolet Monte Carlo is allowed as a candidate model under NASCAR rules, and is readily available. Next, sponsorship from Sid's Hardware was obtained, making it possible to procure all the parts. Next, a 2006 Monte Carlo was obtained. The entire body was removed, leaving only the chassis, engine and drive train. The engine was also removed and replaced by a 400 horsepower super turbocharged engine. Next, a fiberglass body and dashboard were constructed to match the body of the commercial Monte Carlo, with some aerodynamic refinements allowed under NASCAR rules. Next, steel tubing was cut and welded to form the cage that acted as the passenger compartment, the attachment points for the new fiberglass body, and the attachment points for the driver safety equipment. The driver's safety seat was attached to the tubing. The five point seat belt system was attached to the driver seat and the steel tubing. Next, the fiberglass body was lowered onto the steel tubing and attached. The stock hood and trunk lid were attached to the fiberglass, and a fiberglass spoiler was constructed to NASCAR specifications and attached to the fiberglass body. Next, the first set of racing tires was installed and the car was painted and decals provided by Sid's Hardware were applied.

After the car was built, Richard Petty was selected to be the car driver, and the car was entered in the Daytona 500 and passed qualifications tests. After qualifying, the car was raced in the Daytona 500. After the race, some damage from the race was repaired. Next, the car was entered in the DirecTV 500 and passed qualification tests. After qualifying, the car was raced in the DirecTV 500. Finally, the total cost for the car was calculated, and from the finish results of the two races the Car Competition Ratio was calculated.

## Data/Observations

**Comment [EG7]:** The **Data and Observations** section is where you discuss what you saw and how you measured it. In this section, you should not explain what you did with that information.

There should **not** be any data calculations being completed in this section.

Any and all tables and photos taken should be included in this section.

The first time the car was tested was on an abandoned runway at Floyd Bennett Field, now part of the Gateway National Park. The car had much greater acceleration than the equivalent car sold in dealer showrooms. Since the car had no speedometer, the maximum speed was estimated to be about 140 miles per hour.

The car was packed up in a trailer and taken to Daytona. The car was tested on the actual track that would be used for the race, and a speed gun was used to determine the top speed of the car. A top speed of 160 miles per hour was recorded.

The car had to pass qualification tests for conformity to NASCAR rules, and be among the fastest 43 cars during qualification trials. The car had the tenth fastest time during qualification trails with a speed of 195 miles per hour, putting it on the outside of the fifth row of the starting grid for the race itself. During qualification, a top speed of 200 miles per hour was recorded.

The car finished eighth in the race, which was much higher than expected. Some damage to the car was sustained when another car slid into the race car. This damage was repaired with no major problems, and the car was taken to Martinsville.

Once again, the car had to pass qualification and be among the fastest 43 cars. This time the car placed in 24<sup>th</sup> place, putting it on the outside of the twelfth row of the starting grid.

The car finished 28<sup>th</sup> in the race, largely because the Number 20 car hit the car and pushed it into the wall. The Sid's Hardware decals were observed by that driver. The Number 20 car is sponsored by Home Depot. The damage to the car was extensive, and the time needed for repairs caused the car to finish much lower in the standings than if the car had not been damaged.

After the DirecTV 500 race, the car was shipped back to Brooklyn in the trailer, and the final cost was calculated.

The following is the cost breakdown:

Item	Unit Cost	Unit of Measure	Quantity	Total Cost
2006 "Stock" Monte Carlo	\$25,000	Each	1	\$25,000
Steel tubing	\$20	Foot	200	\$4,000
Ignition	\$2,000	Each	1	\$2,000
Fiberglass	\$20	Pound	400	\$8,000
Seat and safety belts	\$5,000	Each	1	\$5,000
Engine	\$8,000	Each	1	\$8,000
Fuel cell	\$200	Each	1	\$200
Fuel tubing	\$5	Foot	15	\$75
Tires	\$500	Set	40	\$20,000
Cargo netting	\$10	Square foot	10	\$100
Switches	\$5	Each	3	\$15
Labor	\$200	Hour	840	\$168,000
			<b>Grand Total</b>	<b>\$240,390</b>

**Comment [EG8]:** In this table, there are always five columns: the item, the cost of an individual item, the "Unit of Measure", i.e. how much you can buy at a time (note the tires are sold by the set), the quantity you bought, and the total cost, which is the unit cost multiplied by the quantity.

The Grand total is the sum of the total costs. It is always in the bottom right corner.

Note: that text is typically left adjusted in the columns, and numbers are always right adjusted.

The results of the EG1003 competition are shown in the following table:

Team	Daytona Place	Martinsville Place	Cost	CCR	Position
Elmer and Bugs	35	41	150654	26.5509	3
Micky and Minnie	Didn't qualify	30	240390	DQ	4
Richard and Sarah	8	28	240390	83.1981	1
Jim and Lenny	7	10	395062	69.8625	2

**Comment [EG9]:** You should always include the official competition Excel sheet as provided by your Lab TAs on the EG Website under "Lab Documents".

### Discussion/Conclusions

Using the data shown in the Data and Observations section, the competition ratio was calculated to be:

$$CCR = \frac{400000 \times (86 - \text{DaytonaPlace} - \text{MartinsvillePlace})}{\text{Cost}} = \frac{400000 \times (86 - 8 - 28)}{240390} = 83.1981$$

**Comment [EG10]:** In the Discussion/Conclusions section, you will show any and all calculations completed on the data as well as discussing the conclusions you have drawn.

- You should always show:
- Calculations
  - Overall results of the lab
  - Come to conclusions about how things went
  - Discuss how you could improve (even if you think it went perfectly)
  - Avoid generalities like "this lab was a success"

**Comment [EG11]:** Shows/States the competition ratio of the design as requested in the "Your Assignment" section of the manual.

Overall, the car came in first place in the EG1003 competition, primarily because of its excellent finish at Daytona. The pit crew at Martinsville was also extremely adept at fixing the car quickly and getting it back on the track without losing too many places. The costs of several other cars were also significantly higher than our car, causing the CCR of the other cars to be lower.

The car could be improved by making it quicker to have body parts repaired or replaced, saving time on repairs and minimizing time lost. A second improvement would be to add light weight titanium allow bumper guards at the front and back of the car to defend the car from accidents.

**Comment [EG12]:** Discusses design improvements as requested in the "Your Assignment" section of the manual. **This is a *must* for all labs.**