**PROBLEM STATEMENT**

Which factor or factors show significant effect on the rate of carbon dioxide emissions from vehicles with various engine sizes?

**VARIABLES**

Three factors had been identified in our model to have affected the rate of carbon dioxide emissions from vehicles with various engine sizes. These are speed limit, traffic lights, and traffic congestion. Throughout the trials, we kept the number of crossings or intersections constant at 2 while we changed the values of speed limit and number of cars using sliders, to observe the effect of each identified factor on the rate of carbon dioxide emissions of the four vehicles. We also changed the traffic lights (from red to green and vice versa) with a switch and a slider to control the switching of lights according to the number of ticks per cycle.

**HYPOTHESIS**

We believed that traffic lights and traffic congestion would show the most significant effect on the rate of carbon dioxide emissions; every time the cars would stop when traffic light is red, increased carbon dioxide would be emitted for every second that the cars are waiting for their turn to move forward. In addition, more cars mean more carbon dioxide emissions that would increase the presence of this greenhouse gas in the atmosphere.

**CO2 EMISSION BY CARS**

You see it every time that smoke billows from your car's exhaust pipe, so there's no denying that vehicles are major contributors to air pollution. Air pollution refers to the presence of foreign substances in the air that don’t belong there, or excessive amounts of certain impurities that wouldn't harm us otherwise. When cars burn gasoline, they emit pollutants. Gasoline fumes escape into the air even when we pump gasoline into our fuel tanks.

There are four major pollutants that come from cars:

1. A car emits carbon monoxide when the carbon in fuel doesn't burn completely.

2. A car's exhaust emits hydrocarbons, a toxic compound of hydrogen and carbon.

3. When fuel burns, nitrogen and oxygen react with each other and form nitrogen oxides (NOx).

4. Particulate matter -- small particles of foreign substances -- in the air contribute to atmospheric haze and can damage people’s lungs.

Pollutants from cars contribute to various types of air pollution. When hydrocarbons and NOx combine in sunlight, they produce ozone. High in the atmosphere, ozone protects us from the sun’s ultraviolet rays. When holes in the atmosphere's ozone layer allows ozone to come closer to Earth, it contributes to smog and causes respiratory problems.

**BACKGROUND RESEARCH**

Studies show that the major sources of carbon dioxide emissions in the United States are electricity and transportation (see Figure 1). In 2012, about 38% of the total U.S. carbon dioxide emissions came from the combustion of fossil fuels, specifically coal, to generate electricity; this is the largest source of carbon dioxide emissions in the nation. The second largest source of carbon dioxide gas comes from transportation through the combustion of fossil fuels like gasoline and diesel. This accounts for about 32% of the total emissions.

Between the years 1990 to 2012 (see Figure 2 on the next page), carbon dioxide emissions in the United States increased by about 5%. Several factors have been studied to be the sources of this increase. Some of these sources are increased population and economic growth, fluctuating energy prices, development of new technologies, and changing seasonal temperatures. Emissions from transportation contributed to about a 5% increase as well. It has been noted that as the level of carbon dioxide in the atmosphere increases, the greenhouse effect has also increased. This means that the dominant factor of the warming of the Earth is the increased emission of carbon dioxide in the atmosphere.