I am writing the following paper to find the most efficient speed to operate a transportation truck to maximize profits for a company. With the given variables we will be able to find the best operating speed and we will graph the results to show you the rate change of different speeds. We will be evaluating the cost of operation at a rate of 50 miles per hour and at a rate of 65 miles per hour.

 A truck is driving 260 miles over flat terrain at 50 miles per hour and gets seven miles per gallon with fuel costs at $3.50 per gallon. For each mile per hour increase in speed, the truck loses a tenth of a mile per gallon in its mileage. The drivers get paid $27.50 per hour and the cost of running the truck is $11.33 per hour. What constant speed (between 50 and the speed limit of 65 miles per hour) should the truck drive to minimize the total cost of the trip? (Department)

 To find this answer we must begin with finding out how long the trip will take. We are going to start with the time it takes to make the trip at 50 miles per hour. To find this we will use the equation:

$\frac{260 miles}{50 mph}=5.2hrs$.

 Now that we know how long the trip took we need to figure out how much it will cost to pay the driver and operate the truck for the given amount of time by multiplying the time it takes to make the trip by the drivers hourly rate and the hourly rate to operate the truck.

$$5.2\left(27.50+11.33\right)=201.92$$

 To continue figuring the cost of the trip we now need to figure out what the fuel costs will be for the 260 mile trip.

$$\frac{260miles}{7mpg}=37\frac{1}{7}gallon of fuel$$

$$37\frac{1}{7}gallons of fuel X \$3.50per gallon=\$130.00$$

 Now we will add the operating costs and the fuel costs to get the total cost of the trip.

$$201.92+130.00=\$331.92$$

The total cost of the trip at 50 miles per hour is $331.92.

 Next using the same procedures along with factoring in the change in miles per gallon we will figure out the cost of the trip while going 65 miles per hour.

Time of the trip: $\frac{260miles}{65mph}=4 miles per gallon$

Driver and truck costs: 4(27.50+11.33)=$155.32

Mileage: 7-(15 X 0.1)= 5.5mpg

Fuel required: $\frac{260miles}{5.5mpg}=47\frac{3}{11}gallons$

Fuel cost: 47 3/11 X $3.50= $165.45

Total cost to make the trip at 65 miles per hour is $320.77.

 Now that we know what the cost of the trip is at 50 miles per hour and 65 miles per hour it gives us points that we can put on a graph to help us be able to figure out what speed would be the most efficient to operate the truck at. In order to do this we will need to find a formula to be able to find this point. The following is the formula that will need to be followed to be able to find the minimum value of the graph. We will let *x* be the most efficient speed and C(*x*) will be the cost at the minimum value.

$$C\left(x\right)=\left(\frac{260}{x}\right)\left(38.83\right)+\left(\frac{260}{7-\left(0.1\right)\left(x-50\right)}\right)(3.50)$$

 To check your formula insert 50 and 65 in for *x* and see if you come up with the same cost as previously computed. After verifying your formula replace *x* with different speeds to give yourself some points to plot on the graph to determine the most efficient speed.

 As the graph shows, the best speed to travel would be between 61 and 62 miles per hour. This formula works as long as the truck is consistently on flat ground. Logically this would not work in the real world due to the fact there isn’t a place that is this flat for such a long period. Any kind of incline, decline, or rough road will change the results of this formula.