# Drafting Behind Big Rigs:  Testing the Myth

## Abstract

*The Mythbusters crew, in season 5 episode 11 entitled "Big Rig Myths," dedicated an entire episode to test "myths" or hypotheses regarding big rig trucks [1].  This report documents the process they used to test the following hypothesis: drafting (driving close) behind a big rig truck can increase fuel economy.  Both small scale and full scale test were performed. The large scale test used a Cascadia big rig followed by a Dodge Magnum.  The speed and fuel efficiency was tested at several following distances, and the results indicate that fuel efficiency can be gained by drafting close behind the truck.  However, this practice is extremely dangerous and not recommended.*

## The Big Rig Drafting Myth: Background and Hypothesis

Many people believe that drafting behind a big rig truck can increase fuel economy, so the MythBusters set out to determine if this is true.  An example theory of drafting comes from NASCAR racing [2].  As a car drives forward, it needs to push through the air in front of it.  The force that this air exerts on the car is called the 'drag'.  Fast cars strive for less drag through aerodynamic designs because less drag means that the car doesn't need to work as hard to move forward.  As a car moves forward, a low pressure zone (an area of a lower concentration of air) forms behind the car.  This can be expected because as the car moves forward, the space that the back of the car occupied just moments before is now empty and creates a vacuum.  This vacuum sucks in some of the air around it, thus creating a low pressure zone.  An example of this can be seen in **Figure 1**.

***Figure 1.*** *A car in a wind tunnel simulates a car driving down the road.  Smoke is blown at high speeds to study the way the air flows over the car.  The low pressure zone can be seen behind the car by noticing that the streams of smoke bend inwards at the back of the car.*

*Source:* http://jarrodhart.files.wordpress.com/2009/05/2005-pagani-zonda-f-s-wind-tunnel-1024x768.jpg

This fact would suggest that if one car is driving right behind the other, the front of the second car could be in the low pressure zone behind the first car.  Hypothetically, this low pressure zone should create less drag for the second car, and therefore less work is required for this car to move forward.  This hypothesis tested is that the low pressure zone created behind a big rig is large enough to reduce the drag of a car behind it by a significant enough amount to effect fuel economy.

## Method and Materials

Before testing this hypothesis in full scale, a small-scale model was first tested. A model truck was placed in a wind tunnel along with a car hooked up to a force gauge positioned behind the truck. The force exerted on the car was measured at different distances behind the truck. The model results showed that as the car was moved closer to the model big rig, the force exerted on the car drastically reduced, thus encouraging a full scale testing. Once taken full scale, a big rig drove at a constant speed while a car travelling at the same speed followed the truck at difference distances. The fuel economy was measured by a computer hooked up to the fuel injection.

Based upon this small-scale test, a full scale test was implemented using the equipment and procedure described below.

### *Equipment*

Once the model results were shown to be conclusive, this myth was tested in full scale. To test this myth full scale, the following were required:

- a Cascadia model big rig manufactured by Freightliner
- a Dodge Magnum
- data acquisition system on laptop hooked up to fuel injection system
- a laser distance measurement sensor
- walkie-talkies for communication between the drivers
- a crazy driver

The Cascadia model big rig made by Freightliner – one of America's leading big rig manufactures – was chosen because it was aerodynamically engineered to be the most fuel efficient big rig in the world. The data acquisition system hooked up to the fuel injection system determines the fuel economy. The method of determining the fuel economy is exactly the same as physically measuring the amount of fuel that goes into engine. A laser distance measurement sensor was used so that the distance between the car and truck can remain as constant as possible. Walkie-talkes were used as quick communication between the team (Grant was driving the car, Kari was a passenger in the big rig, and Tory was watching from the side).

### *Procedure*

Once the model results were conclusive, the team went full scale. They got in contact with Freightliner, a big rig manufacturing company, to use one of their big rigs for the experiment. In order to test the fuel economy, a data acquisition system on a laptop was connected to a car's fuel injection system. The team then got a baseline mpg (miles per gallon) for the car. They spray painted three lines on the road:

1. a starting line,
2. a line ¼ mile ahead of the start, and
3. a finish line ½ mile ahead of the previous.

Grant drove the car from the start line and got up to 55mph before the ¼ mile. The base fuel economy was calculated over the next ½ mile. Once the team had their baseline, numerous runs were made so that Grant could drive the car 55mph at distances of 100 feet, 50 feet, 20 feet, 10 feet, and 2 feet behind the big rig. Grant driving behind the big rig at a distance of 2 feet can be seen in **Figure 2**.

***Figure 2.*** *Grant driving 2 feet behind the big rig at 55 mph.*

*Source: http://www.youtube.com/watch?v=M35KVt5_M8g&feature=related*

## Results

The team recorded the fuel economy of the car and compared it to their baseline control case. Their results are shown in **Table 1**.

***Table 1.*** *Fuel economy results*

| **Full Scale at 55mph** | | |
|---|---|---|
| **Distance behind big rig** | **Miles per gallon** | **Increase from control** |
| Control test | 32.0 | N/A |
| 100 feet | 35.5 | 11% |
| 50 feet | 38.5 | 20% |
| 20 feet | 40.5 | 27% |
| 10 feet | 44.5 | 39% |
| 2 feet | 41.0 | 28% |

## Discussion

With each successive test, Grant followed behind the big rig more closely. As Grant drove the car closer to the big rig, the vehicle's fuel economy increased. The fuel economy decreased, however, on Grant's last run. As the car follows the truck more closely, the drag on the car is significantly reduced, making it more difficult for Grant to maintain a constant distance behind the big rig, causing him to frequently tap the accelerator to try to maintain a 2-foot distance from the truck. This tapping of the accelerator decreased the fuel economy.

## Conclusions

The test clearly shows that drafting behind a big rig can increase fuel economy. Although this idea seems good in theory, in practice it is extremely unsafe. Even if one was drafting a big rig at a distance of 100 feet apart at 55mph (88.5km/h), the driver's reaction time is only a little over 1 second, which would not allow enough time to react to a significant change in speed or direction, and may result in an accident. So although the hypothesis is proven true, the practice is not recommended as any savings in fuel efficiency are heavily outweighed by the risk to personal safety of anyone on the road nearby.

## References


[1] Mythbusters, "Big Rig Myths" Season 5, Episode 11. *YouTube* [online video]. Available: https://www.youtube.com/watch?v=IIRZTffYv18 [accessed: Oct. 5th, 2017]

[2] D. McFadin, "Side drafting: From a specialist's tool to racing commodity," *NBC Sports* [Online], 26 June, 2016. Available: https://nascar.nbcsports.com/2016/06/29/side-drafting-from-a-specialists-tool-to-racing-commodity/ [Accessed: Oct 5th, 2017].