

Reprinted from **Real Answers**

What consumes fuel?

Special Edition Four

real QUESTIONS
real ANSWERS

BRIDGESTONE

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What consumes fuel?

Every bit of energy produced or used by a truck comes from the fuel in the tank. Even what you use from the batteries has to be replenished by the alternator. That's basic science.

The heat of the engine, the headlights, the air conditioning, the instrument lights, the truck's motion, even the sound of the truck roaring by, are the result of converting diesel fuel into energy.

Some things influence fuel consumption more than others. We'll take them in order, starting with some of the largest.

SPEED: the biggest factor

Moving a big truck down the road requires the engine, drive train and tires to push against several different resistances.

AIR RESISTANCE
(aerodynamics)

TIRE ROLLING RESISTANCE

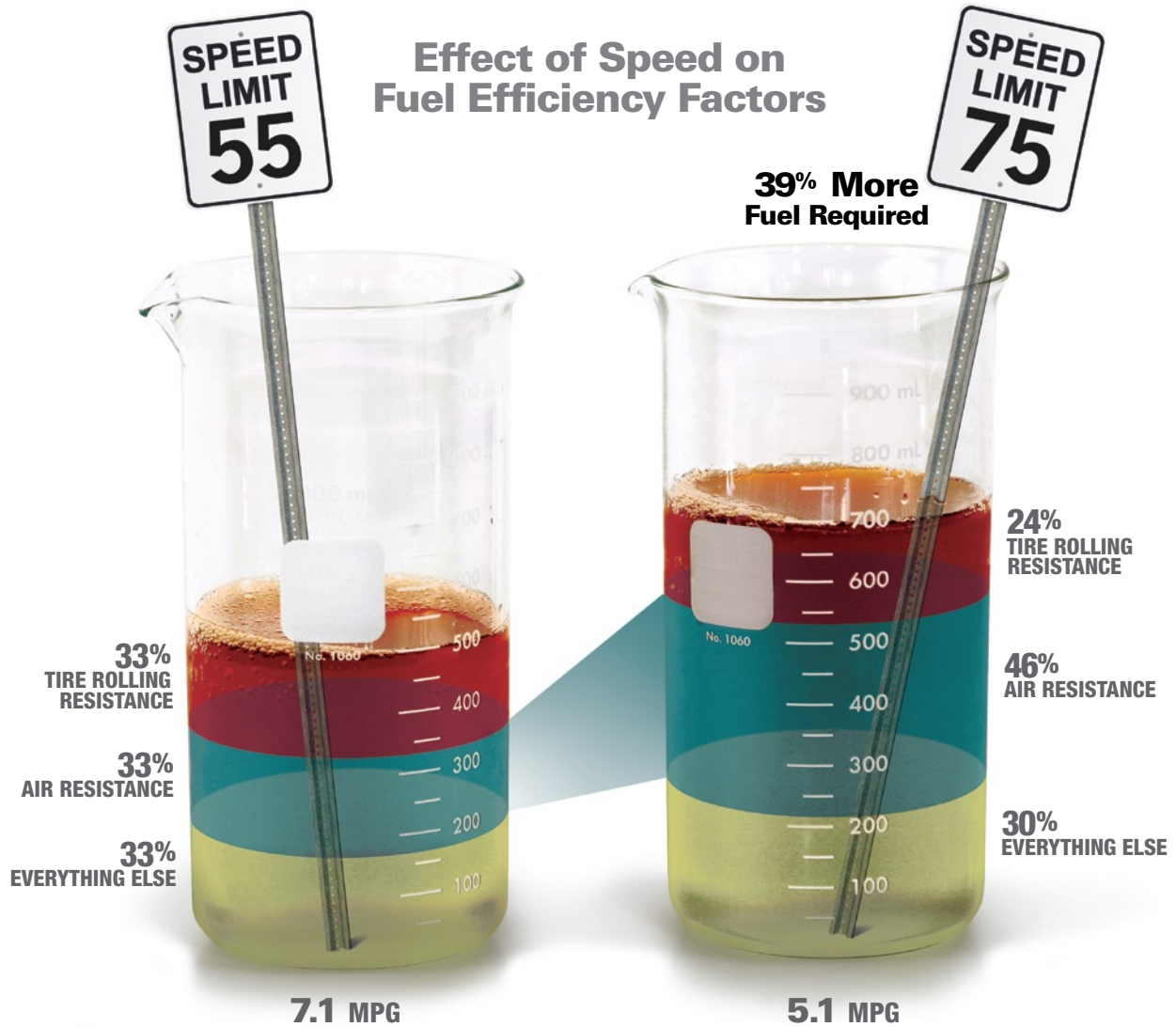
Air resistance

Air resistance is practically nonexistent at very low speeds, but increases rapidly with speed, becoming a major contributor to fuel consumption. In fact, once speeds exceed about 45 mph, air resistance is *more* important than tire rolling resistance.

Air resistance is a major part of fuel consumption, and that is why truck manufacturers work so hard to improve the aerodynamics of their equipment.

Tire rolling resistance

Tire rolling resistance is the amount of drag created by the tires as the vehicle runs down the highway. Anybody who has rolled a truck tire across the shop knows it takes *some* effort. But try to do it at 55 miles per hour with several thousand pounds of load on it!



Increasing speed from 55 to 75 mph can increase fuel consumption by 39 percent, while cutting the effectiveness of fuel-efficient tires by 27 percent.

It takes energy to deform the tire, energy that comes from fuel. Some of it comes back when the tire returns to its un-flexed shape, but some is lost as heat.

Part of rolling resistance comes from the flexing and un-flexing of the tire as it rolls into and out of contact with the pavement.

Even though rolling resistance doesn't increase as fast as air resistance with an increase in speed, rolling resistance is present – and a major factor – at much lower speeds.

Just as with air resistance, the actual amount of rolling resistance is influenced by many factors, including load, speed, inflation pressure, tread pattern, amount of tread wear and tire design and construction.

The relative importance of rolling resistance

Because tire rolling resistance is not the only factor involved, an improvement in rolling resistance doesn't produce an equal improvement in fuel economy.

In the real world, if only 10 percent of your revenue comes from hauling groceries, a 10 percent increase in your grocery volume will *not* produce a 10 percent increase in your overall revenue. (In fact, in that example, you'd get about 10 percent of 10 percent – or about a one-percent improvement.) In most cases, as we'll see, it takes about a three- or four-percent change in rolling resistance to produce a one-percent change in fuel economy.

Speed & travel time

Bridgestone research shows that speed is the largest single factor affecting fuel economy. In tests, vehicles went from about 5.1 miles per gallon at 75 mph to about 7.1 miles per gallon at 55 mph.



5.1 MPG



6.0 MPG



7.1 MPG

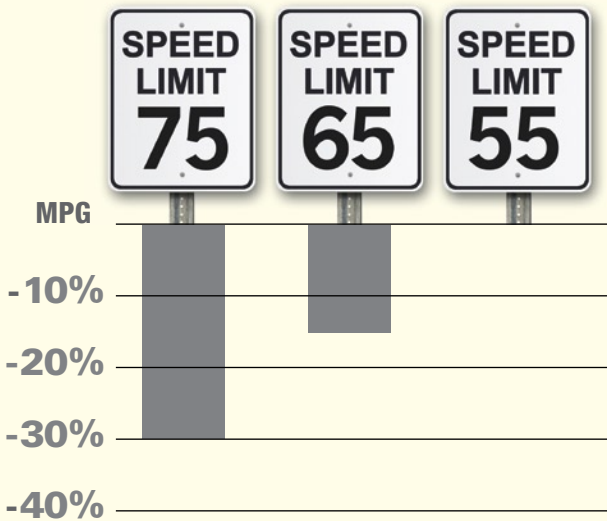
Fuel Economy at Different Speeds

Some measured changes in miles per gallon at different speeds.

Fuel Economy & Travel Time at Different Speeds

SPEED	MILES PER GALLON	INCREASE IN MILES PER GALLON	PERCENT FUEL SAVED	TIME FOR 500 MILES OF TRAVEL	INCREASE IN TRAVEL TIME
75	5.1	—	—	6 hr. 40 min.	—
65	6.0	18%	15%	7 hr. 42 min.	15.5%
55	7.1	39%	28.2%	9 hr. 5 min.	36.2%

The Effect of Speed on Fuel Economy



Each MPH over 55 = -1.6% MPG

A change from 75 mph to 65 mph is almost practical. At 75 mph, test vehicles achieved about 5.1 mpg. At 65, the figure was 6.0 mpg. That's about an 18 percent improvement in miles per gallon, for a cost of about 15.5 percent in extra travel time. The amount of fuel saved is about 15 percent.

Dropping back to 55 mph produces a larger improvement in fuel economy, but a larger cost in time. If you can still meet delivery schedules and your drivers have enough available hours of service to do it, cutting speed can be an effective way to save fuel.

Bridgestone tests indicate for every 1 mph you increase speed (between 55 mph and 75 mph), you cut your miles per gallon by about 1.6 percent.

MID NIGHT 1 2 3 4 5 6 7 8 9 10 11

1. OFF DUTY

2. SLEEPER BERTH

3. DRIVING

Running at higher speeds:

Loss of tire fuel efficiency

With all tires, fuel economy decreases when speed increases. But with fuel-efficient tires, some 45 percent of the fuel efficiency of the tire may be lost when a tire runs at 75 mph instead of 55 mph.

In fact, with non-fuel-efficient tires, mpg drops only about 30 percent when speed increases from 55 to 75 mph, suggesting that fuel-efficient tires suffer *more* loss at higher speeds than do non-fuel-efficient types.

At higher speeds, overall vehicle aerodynamics become a much larger factor, reducing the contribution of tires to the fuel economy picture. You might say that a fuel-efficient tire has “more to lose” at higher speeds than a non-fuel-efficient tire.


Increased engine wear

And tires aren't the only thing that suffers. Engine manufacturers estimate maintenance costs may be as much as 10-15 percent higher at 75 mph than at 55 mph. Engine durability could also drop 10-15 percent.

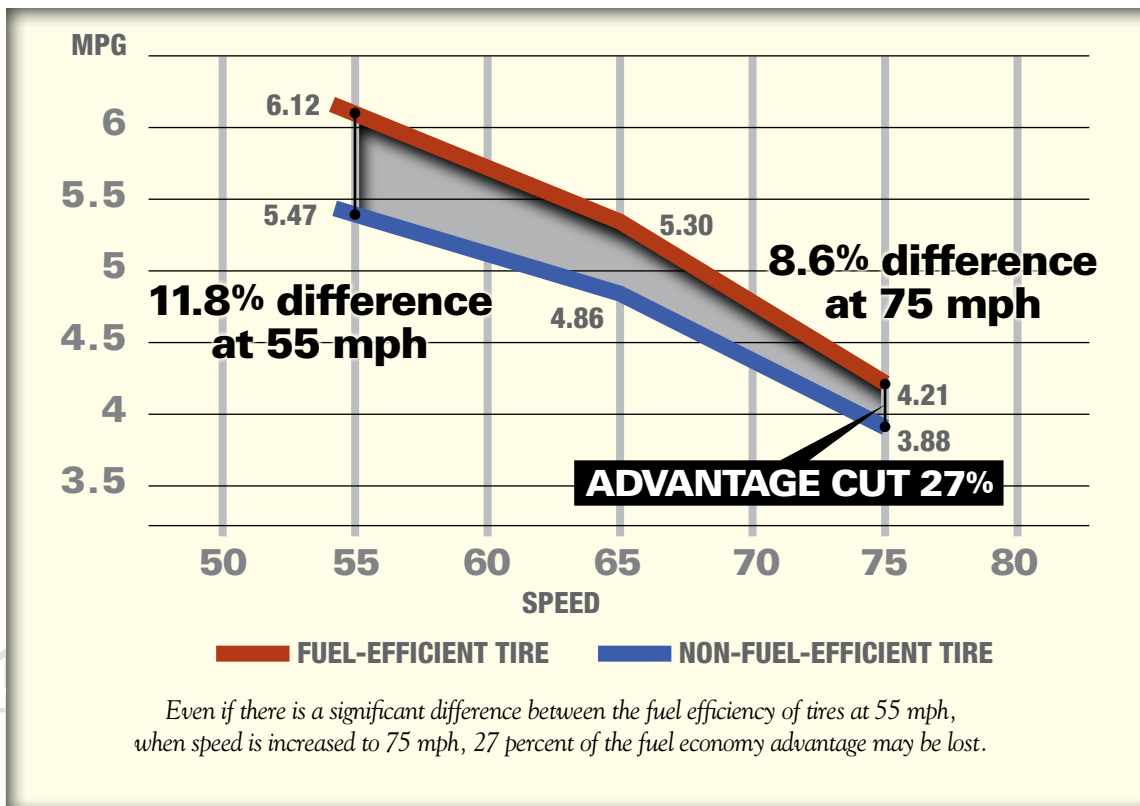
Shorter tire life

Finally, treads wear faster at higher speeds. Tests show removal mileages may be cut 10-30 percent. Uneven tire wear is more likely because of changes in footprint shape. Tires run hotter, which can reduce casing life and retreadability. And, impact damage is often more severe at higher speeds.

Although some of these things may seem to have little to do with fuel economy, they can have a lot to do with increased tire operating costs.

As we said earlier, a fuel efficiency component that costs more than it saves is not a good bargain. 

Effect of Speed on Tire Fuel Efficiency



TOTAL HOURS

10.00

2.00
15

8.00