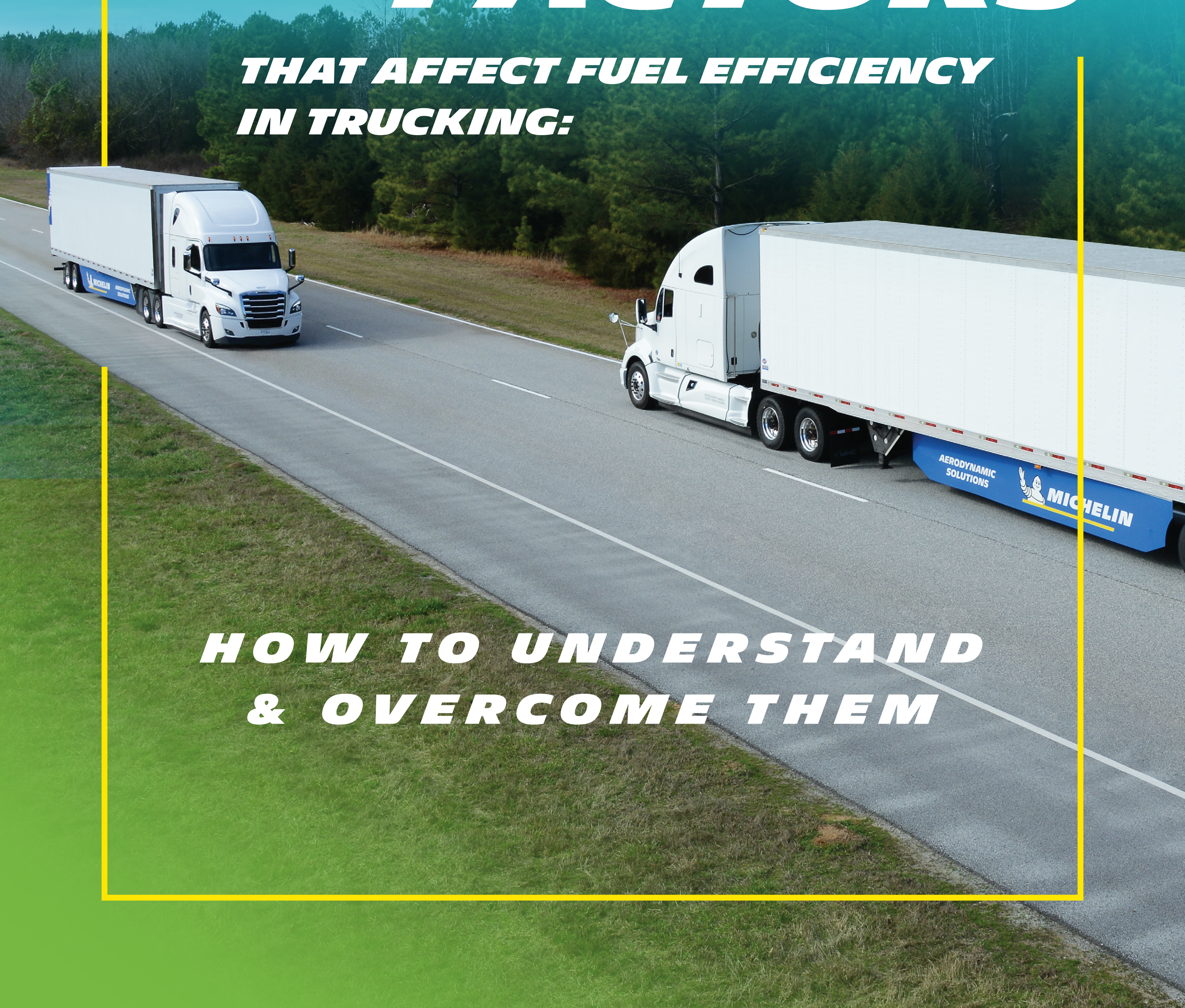
MICHELIN

THE 3 MAIN FACTORS THAT AFFECT FUEL EFFICIENCY IN TRUCKING:

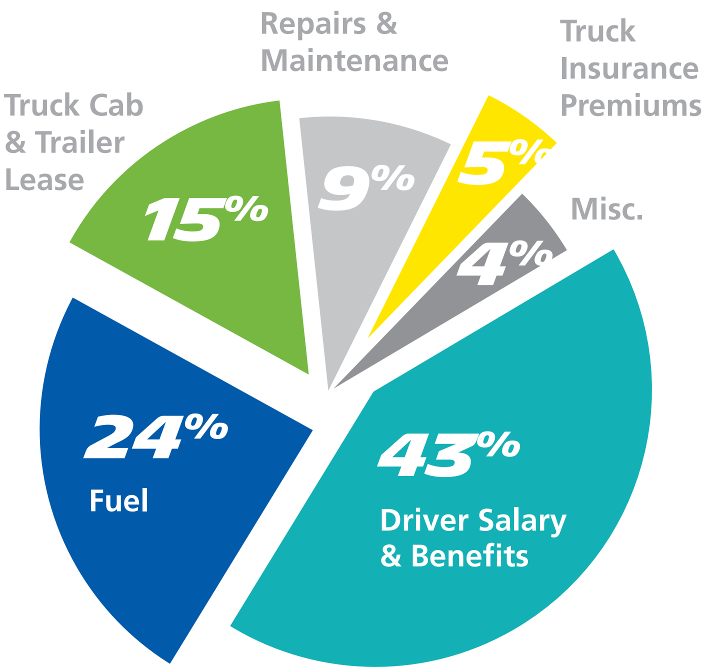
HOW TO UNDERSTAND & OVERCOME THEM



IT'S NO SECRET THAT, BEHIND DRIVER SALARIES AND BENEFITS, FUEL IS THE LARGEST COST ASSOCIATED WITH OPERATING A TRACTOR TRAILER.[1]

A tractor trailer running 90,000 miles per year at 6.5 mpg uses roughly 14,000 gallons of diesel fuel annually. The latest Short-Term Energy Outlook by the U.S. Department of Energy projects that the retail cost of on-highway diesel, including tax, will average $3.09 per gallon in 2020.[2]

This means that a commercial truck can easily consume more than $43,260 of diesel fuel per year, representing about 24% of the total vehicle annual operating cost. (The #1 vehicle expense outside of driver salary and benefits.)



Cost-Per-Mile (CPM) for LTL carriers continues to increase as well, according to the American Transportation Research Institute.[1] From 2017 to 2018, fuel CPM increased by 17.7% for carriers, from 36.8 cents per mile to 43.3 cents per mile.

In a marketplace where fuel will always be a volatile and likely escalating budgetary item, understanding the three main vehicle factors that affect fuel economy can help fleets and owner-operators better manage their largest annual operating expense.

THE TOP 3 FACTORS THAT AFFECT FUEL EFFICIENCY

1 AERODYNAMIC DRAG

2 TIRE ROLLING RESISTANCE

3 MECHANICAL LOSSES

Other factors can impact fuel economy, of course, particularly driver habits. Factors such as weight, gradient, climate and weather generally fall outside of the realm of fleet control. However, driver influence can be significant, and fleets can utilize driver training to improve in this area. Other vehicle technologies, such as predictive cruise control, may also help reduce these impacts.

1. AERODYNAMIC DRAG

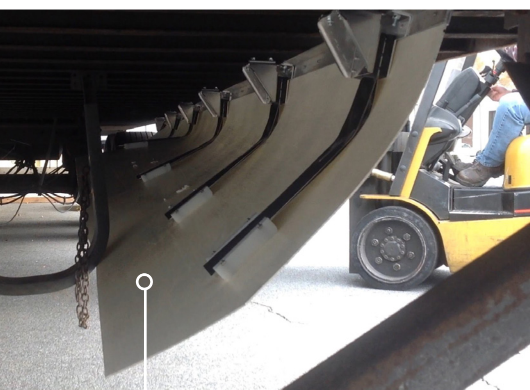
Above 55 mph, aerodynamics dominates the fuel efficiency discussion.

Aerodynamic drag—the air moving out of the way so a truck can move forward—uses upwards of 50% of each gallon of diesel fuel, according to the National Highway Traffic Safety Administration.[3] Smoothly directing flow around the front and sides while reducing turbulence at the back are the two basic ways to improve truck aerodynamics.

There are three areas on a tractor-trailer where aerodynamic drag is the greatest: the front of the tractor, the chassis, and the low pressure pocket behind the doors.

Fleets have put a lot of effort over the years into optimizing the aerodynamics of heavy trucks by installing add-on devices such as side skirts, tails and roof fairings. These accessories often come from varying manufacturers, with some requiring driver activation.

Michelin North America offers a SmartWay® verified, CARB-compliant, aerodynamic trailer solution called MICHELIN® Energy Guard. This easy-to-use, fuel-efficient solution consists of a resilient trailer skirt, trailer-end fairings, a wake reducer and aerodynamic mud flaps.



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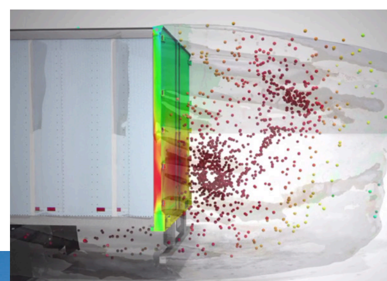

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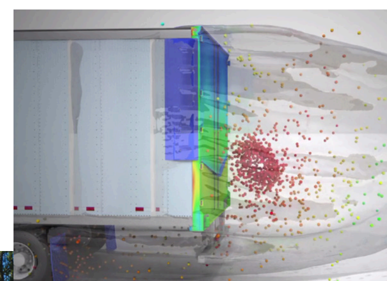


MICHELIN® ENERGY GUARD

INNOVATIVE WAKE REDUCER

AERODYNAMIC MUD FLAPS

DRAG-REDUCING TRAILER-END FAIRINGS

RESILIENT TRAILER SKIRT

PATENT-PENDING BRACKET AND SLIDER DESIGN

MICHELIN® Energy Guard is an integrated solution, with each piece engineered to complement the others so that they work together seamlessly to deliver proven fuel savings. Features of the components include:

Resilient trailer skirt with a patent-pending bracket design that keeps the skirt rigid until it strikes an obstacle. If the skirt strikes an obstacle, the bracket will toggle and allow the skirt to easily flex both inward and outward.

Trailer-end fairings that manage airflow around the rear of the trailer to reduce drag.

Wake reducer to lessen the drag of the turbulent air behind the trailer. The trailer-end fairings and wake reducer are constantly functioning, with zero moving parts and no driver intervention.

Aerodynamic mud flaps that are patent-pending and designed to reduce vehicle drag and redirect road spray.

Lightweight, yet durable, the Energy Guard system saves 10 gallons every 1,000 miles, which is about 7.4% fuel savings at 65 mph for an average fleet.[3]

1,000 GALLONS SAVED PER 100,000 MILES

$3,000 FUEL SAVINGS ANNUALLY

$$

Estimated fuel savings are $3,000 annually ($3.00/gallon x 100,000 trailer miles)[4] and estimated gallons saved is 1,000 per 100,000 miles.

FOR MORE INFORMATION, visit www.michelintruck.com/services-and-programs/aerodynamic-solutions/.

2. TIRE ROLLING RESISTANCE

SURPRISING TO MOST PEOPLE IS THAT TIRE ROLLING RESISTANCE EATS UP APPROXIMATELY 30–33% OF EACH FUEL GALLON.

Rolling resistance dominates energy consumption at speeds between 35 mph–55 mph. The average operating speed of trucks is typically below 55 mph in major urban areas, due to traffic impact and congestion, according to the U.S. Department of Energy.

Rolling resistance is the amount of energy lost (in the form of heat) due to the compression of the rubber in the tire as it rotates and interacts with the road while carrying the vehicle and its load.

Tires are made of viscoelastic rubber compounds, which means that once materials have been distorted, they only regain their original shape after a certain period of time. The energy it takes to distort tires is never fully restored. Some of it dissipates in the form of heat, and this heat loss is the rolling resistance.

Under the weight of a load, a truck's tires are distorted with every rotation of the wheel. The constant flexing and compression put tires to the test. The independent flexing of the tire sidewall creates a tread contact area with the ground that allows significantly less distortion to take place where the rubber meets the rough road surface, so to speak. Small or large, these distortions are essential for comfort, grip and traction. But in return, they cause rolling resistance.

ROLLING RESISTANCE BY AXLE (ON A 6X4 TRACTOR)

Axles contribute differently to rolling resistance because they carry a different distribution of the vehicle weight. Rolling resistance contribution by axle on a 6x4 tractor is the following:

STEER AXLE: 16%

DRIVE AXLE: 42%

TRAILER AXLE: 42%

Different parts of the tire vary in their contribution to the total rolling resistance of the tire. The tread interacts with the road surface and impacts the energy required to rotate the tire through the tread contact area while under load. The sidewall and bead areas help manage the energy consumed by the flexing of the tire sidewall under load and through rotation. There are four basic attributes of tire design that impact rolling resistance:

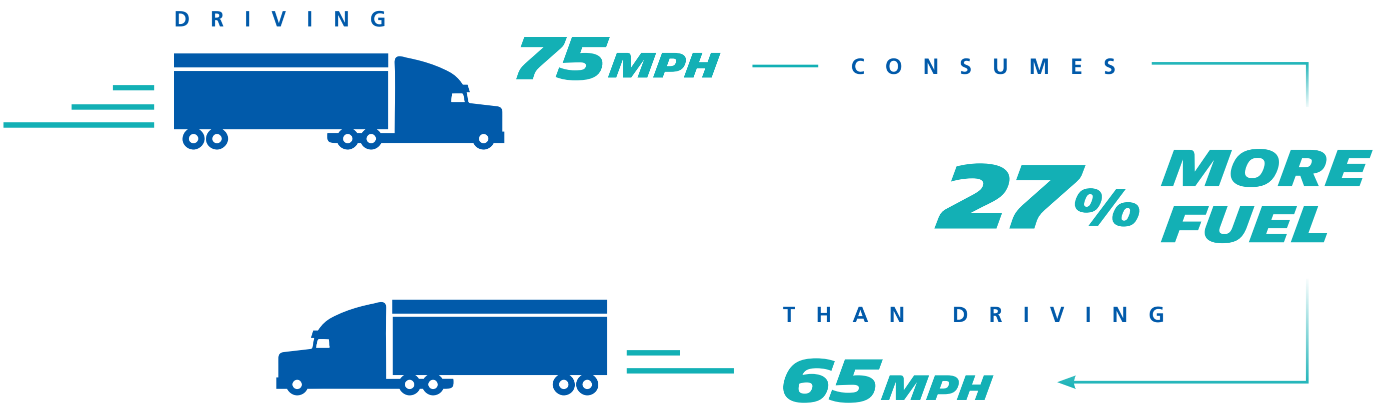
As a general rule, deeper tread tires resist rolling more than shallow tread tires. For example, comparing the rolling resistance of the same tire carrying the same load at 30/32nds tread depth to a worn version at 4/32nds tread depth, the rolling resistance improves from between 30–50% depending on the tire.

This is why fleets can see an increase in fuel consumption when replacing worn tires with new—ones even fuel-efficient new tires. As the tire wears to lower tread depths its rolling resistance improves, which improves the vehicle's fuel efficiency.

The compound, or rubber recipe, used to build a specific tire also affects rolling resistance. Varying chemistries and molecular makeup in rubber compounds produce different properties. Rolling resistance and fuel costs increase when a tire's compound loses more of the energy generated as it compresses when making contact with the road.

3. MECHANICAL LOSSES

Mechanical losses from engine capacity, vehicle configuration and accessories eat up about 15% of each fuel gallon, according to the North American Council for Freight Efficiency. A first step to reducing fuel consumption from mechanical losses is reducing speed. A truck traveling at 75 mph consumes 27% more fuel than one going 65 mph, according to American Trucking Association figures, so limiting truck speed to 65 mph would save 2.8 billion gallons of diesel fuel over a decade.



65MPH = 2.8 BILLION GALLONS

OF DIESEL FUEL SAVED OVER A DECADE

Idling is another fuel guzzler. Nondiscretionary idling brought about by highway congestion and discretionary idling that enables air conditioning or heat during rest periods consume an estimated 1.1 billion gallons of diesel fuel every year, ATA studies show.

New technologies designed to reduce idling, such as automatic engine shutdown and start-up systems, are now available. For example, a driver can set an automated system to start or stop based on a scheduled time period or when outside temperatures reach specific degrees. Auxiliary power units also can be installed to run air conditioning, heat, lights, onboard equipment and appliances.

Truck stop electrification is another technology designed to provide truck driver services such as heating, air conditioning or power for appliances, without the need for engine idling.

To optimize fuel efficiency, it is critical to understand the main contributing factors within your fleet: mechanical losses, tire rolling resistance and aerodynamic drag. To see how you can help reduce your fleet's fuel expenses—whether it's through improved rolling resistance, innovative tire technology or an aerodynamic solution—contact:

Name
Title
Email

[1] "An Analysis of the Operational Costs of Trucking" 2019, prepared by the American Transportation Research Institute, November 2019
[2] https://www.eia.gov/petroleum/gasdiesel/
[3] "Factors and Considerations for Establishing a Fuel Efficiency Regulatory Program for Commercial Medium- and Heavy-Duty Vehicles" U.S. Department of Transportation | National Highway Traffic Safety Administration
[4] Estimated fuel savings based on commissioned, third-party simulation (CFD) and SAE J1321 track testing when compared to trailer with no aerodynamic devices.