SmartWay®
U.S. Environmental Protection Agency

Track Testing for SmartWay Verification

What is track testing?

Track testing is a method for measuring fuel economy performance with full-scale vehicles and technologies in controlled conditions. For the EPA SmartWay Program, a modified version of the Society of Automotive Engineers (SAE) J1321 Track Test procedure is used to assess the fuel savings of certain aerodynamic trailer technologies. These protocols use closed tracks that can accommodate tractor-trailers at highway speeds.

Example of a track used for testing large trucks, courtesy of Pecos Research and Testing Center (PRTC)

During SmartWay track testing, two or more comparable class 8 tractor-trailers follow the same driving profile at constant highway speed (65 mph) cruise conditions. Trucks must be appropriately spaced to avoid impacting each other's aerodynamic performance. To begin testing, all trucks perform a "baseline" run without any aerodynamic technologies. Then, they conduct "test" runs where one truck remains unmodified as a "control" and one or more of the remaining "test" trucks are equipped with aerodynamic technologies. Each truck is equipped with a portable fuel tank so fuel consumption can be directly measured by weighing the tanks after each run. Fuel savings is quantified by the relative change in fuel used by the "test" truck(s) (with aerodynamic devices) compared to the unmodified "control" truck (no devices). By comparing fuel saved by the "test" truck(s) to any fuel use changes in the "control" truck (operating at the same time on the same track under similar conditions), this method reduces certain weather and track-related variables.

What kind of measurements can I expect from track testing?

This test method directly measures fuel consumption instead of assessing an aerodynamic drag coefficient. The difference in fuel use between "baseline" and "test" segments for the control and test truck(s) determines the percent fuel saved by the device. Additionally, the statistical uncertainty is computed to indicate whether projected fuel savings can be attributed to the aerodynamic technologies or the degree of variability in the measurement.

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How is the 2014 updated SmartWay track testing procedures different from what was done prior to 2014?

Similar to industry truck test procedure updates, the 2014 SmartWay track test includes a number of updates. Prior to 2014, SmartWay verification track testing was based on industry methods commonly referred to as Society of Automotive Engineers (SAE) J1321 procedures adopted in 1986. For the new 2014 SmartWay track test, EPA updated the protocol to incorporate the more recent (2012) version of the SAE J1321 procedure, overlaid with new SmartWay testing enhancements, such as tractor-trailer set-up specifications.

These new enhancements will improve truck comparisons by limiting some sources of variability. One main addition is to require more than one complete track test in order to achieve SmartWay verification. This is an industry recommended practice and will give fleets additional confidence that the aerodynamic technology(s) verified with this procedure will perform comparably in similar conditions on the road.

How does the track testing results compare to that of other tests?

Each test method for SmartWay verification has advantages and disadvantages relative to the others. Below are some considerations:

Track tests use real tractor-trailers so the complexities of an operating truck are built-in. This is also the only SmartWay test that directly measures fuel savings without using a factor to convert aerodynamic drag improvement to a projected fuel savings. However, operating full-sized trucks in an outdoor environment adds variability. This makes it important to limit factors that could increase variability (e.g., weather, engine response) by adhering rigorously to the test method and closely monitoring and documenting testing conditions.

Coastdown tests use real tractor-trailers and limit engine and drivetrain influences by disengaging them – to more directly isolate and measure air resistance. To minimize the variability resulting from external factors (e.g., changes in road grade, weather, vehicle set-up), it's important to follow the protocol conditions closely and to thoroughly monitor and document testing.

Wind tunnel tests provide excellent repeatability due to the greater control of the environmental factors. Test facilities can also apply simulated side winds to evaluate how an aerodynamic device may perform in on-road conditions. Because changes can be made to the trailer (or tractor) body relatively quickly, scale wind tunnels are often used for design work. However, it is critical to represent the tractor-trailer and device with as much realism and fidelity to detail as possible, in order to produce results that represent real-world performance. For some aerodynamic devices, it may not be possible to scale the representation down enough to fit onto a small truck model.

Computational fluid dynamics (CFD) tools provide excellent repeatability by simulating on-road wind conditions (like the wind tunnel) and generate animated visual simulations of air flow and wind interactions around a truck. These animated visualizations can illustrate how a device works to reduce air resistance, instead of simply calculating a projected fuel savings. CFD tools can be limited in the amount of tractor-trailer and environmental complexity that can be represented in the computer model, so it is important to understand the limitations of what is and is not included in a CFD computer simulation.

In general, all these methods produce results that simulate highway cruise conditions and must be appropriately interpreted when applying to a fleet's unique driving profile. The testing organization and/or SmartWay can help fleets understand how their on-road fuel savings may differ.

For more information: www.epa.gov/smartway/forpartners/technology.htm or Tech_Center@epa.gov.