MESILLA VALLEY TRANSPORTATION SOLUTIONS CERTIFIED
Fuel Economy Experts

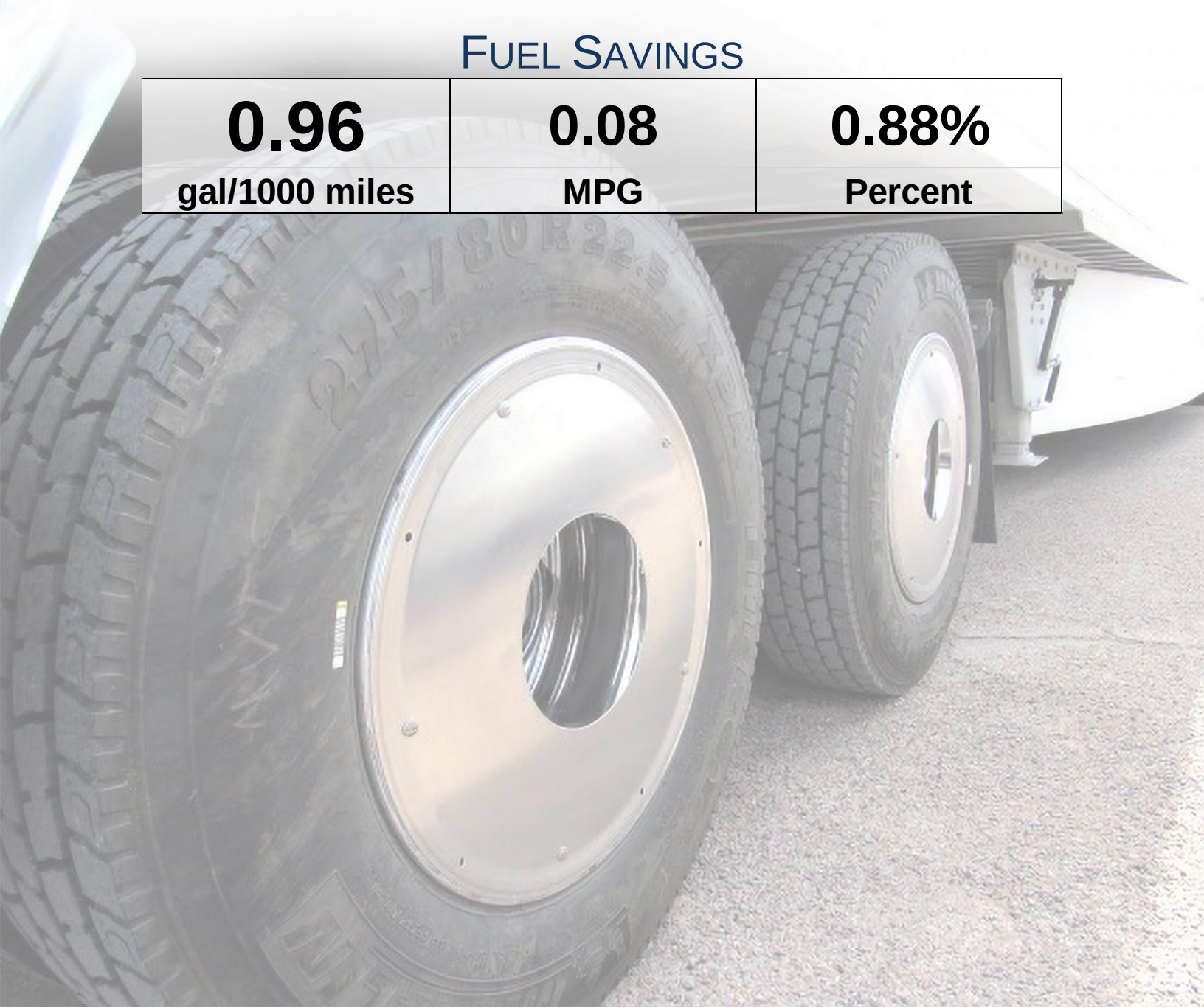
TEST REPORT

MVT SOLUTIONS CERTIFIED™ FUEL ECONOMY TEST
MARCH 11, 2021

ALCOA AERODYNAMIC DRIVE WHEEL COVERS

FUEL SAVINGS

0.96	0.08	0.88%
gal/1000 miles	MPG	Percent



1.0: INTRODUCTION

Mesilla Valley Transportation Solutions (MVTS) certifies the fuel savings from this product are as described in this report. **Note:** this report was designed for carriers and providing information relevant to their needs. Therefore, the format varies from traditional fuel economy and technical reports. The report Summary provides the reader a quick synopsis of the product's fuel savings. Following the Summary is the body of the report and further details on the subjects. This fuel economy test was performed using MVTS proprietary fuel economy test methods. These test methods were developed from race car engineering and advanced vehicle test methods, which the Mesilla Valley Transportation (fleet) has relied on since 2012 to identify substantial fuel savings. The MVTS methods provide highly accurate and reliable answers on real-world fuel savings in comparison to other test methods, which enables carriers to make the best decisions for their company.

Contact MVTS with any questions regarding the product or test. As part of an MVTS Certified™ test, MVTS supports product inquiries, which we encourage carriers to utilize.

Note: blue text indicates a link to the topic. Click to follow. Alt + ← returns the reader to the initial location.

2.0: TEST SUMMARY

MVT Solutions tested the Alcoa Aerodynamic Drive Wheel Covers on the Test Vehicle's Drive Axles (2) only. Fuel savings were **0.96 gal/1000 miles (0.88%)**. These wheel covers are made from aluminum and fasten into the Drive wheel through the outer lip of the Alcoa wheel. Testing was conducted on a modern Class-8 truck with a 53' van trailer and dual wheel package utilizing Alcoa aluminum wheels. Results are shown in Table 1.

Table 1: Fuel Economy Test Results

Product	Fuel Economy Improvement		
	Gal/1000 miles	MPG	Percent
Alcoa Aerodynamic Drive Wheel Covers	**0.96**	0.08	0.88%

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3.0: TEST PROCEDURE

The two (2) vehicles ran simultaneously at 65 mph on the 9-mile circle track near Pecos, Texas. The vehicles were 1-minute apart, avoiding any aerodynamic influence on either vehicle during testing. The vehicles were termed “Compare Vehicle” and “Test Vehicle”. The Compare Vehicle remained unchanged throughout testing; it was used solely for comparison. The Test Vehicle had modifications made during the test (*i.e.* Alcoa Brand Drive wheel covers installed).

The test procedure may appear similar to the SAE J1321 method traditionally used in the trucking industry; however, the MVTS methods are a much more advanced and precise form of on-road and track testing. The vehicles are equipped with sensors and data recording systems that collect data on fuel consumption, aerodynamics, rolling resistance, driver behavior and many other variables that affect fuel consumption. The data is analyzed using MVTS proprietary methods, which provide very accurate answers on fuel savings. Additionally, the test results can be scientifically translated to a carrier’s real-world daily operations and long-term savings, which is a feature unique to these methods. Overall, the MVTS test methods are a much more advanced and reliable tool for predicting fuel savings than the trucking industry has used previously.

3.1: TEST VEHICLES

Test vehicles were 2019 International LT 625’s with Cummins X15 15-Liter engines and Eaton Endurant 12-speed AMT transmissions. Van trailers were used during testing. The Test vehicle utilized a Hyundai Translead and the Compare vehicle used a Utility 4000D-X. Gross Vehicle Weight (GVW) was approximately 45,000 lbs. Both trucks were equipped with Ex-Guard grill guards, which were previously tested and showed no negative influence on fuel consumption. The Compare vehicle remained unchanged throughout all tests. The Test vehicle configuration was changed between test runs. Trucks and trailers used dual tires. Tire pressures were set at 110 psi in the morning, prior to incurring any affect of daytime heat. Vehicle info can be found in the Appendix.

Vehicles were thoroughly inspected and received regular maintenance prior to testing. It should also be noted, for the reader’s peace of mind, Mesilla Valley Transportation (MVT) and MVT Solutions are 100% confident in the reliable condition of the test vehicles. MVT fleet uses the same vehicle data and test procedures for their own internal purchase decisions.

Figure 1: Test and Compare Vehicles (Left and Right)

Figure 2: Test Vehicle

3.1a: RUN 1: BASELINE WITH STANDARD ALCOA WHEELS

Run 1 was a Baseline run that the Drive wheel cover test was compared to. Run 1 also included the Alcoa Aero Steers on Alcoa ULT36 Aluminum wheels, which will be discussed in greater detail in the Results section (Figure 1 through Figure 4).

Figure 3: Baseline Drive Wheels (Front View)

Figure 4: Baseline Drive Wheels (Rear View)

3.1b: RUN 4: ALCOA AERODYNAMIC DRIVE WHEEL COVERS

Runs 2 and 3 were for separate testing purposes. Run 4 was the Alcoa Aerodynamic Drive Wheel Cover test and consisted of installing that technology on the Drive axles of the test vehicle (Figure 5). The covers are constructed of aluminum, a material in which Alcoa is known for its expertise. The covers mount to the wheels via a ring-type assembly, which mounts to the outer lip of the Alcoa wheel (Figure 7). The covers are fastened to the ring assembly using five (5) quarter turn fasteners (Figure 5). The covers include a void center section, which can be utilized to view wheel nuts as required.

Figure 5: Alcoa Aerodynamic Drive Wheel Covers (1 of 2)

Figure 6: Alcoa Aerodynamic Drive Wheel Covers (2 of 2)

Figure 7: Installation Ring Assembly

3.2: VEHICLE FUEL ECONOMY TEST EQUIPMENT

MVT Solutions fuel economy testing utilizes a data acquisition system and sensors specifically for this testing. This style of testing is derived from race car engineering where reliable sensor data is critical to understanding vehicle modifications.

MVTS test sensors include:

- Data acquisition system (records sensor data)
- Fuel flow meter (accurate to 0.2%)
- Fuel temperature sensor
- Tire temperature sensor (infrared, mounted on left-front drive tire)
- Ground/road temperature sensor (infrared, mounted ahead of left-front drive tire)
- Wind speed air pressure sensor (truck hood)
- Wind direction sensor (truck hood)
- Ambient air temperature sensor (truck hood)
- Ambient air pressure sensor (truck cab)
- High Precision GPS (latitude, longitude, altitude, time)

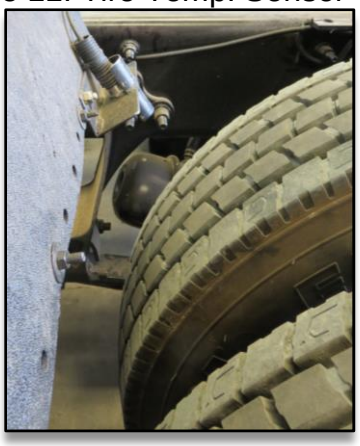
Click this link to see a video of MVTS sensors and testing: How We Test

Figure 8: Aerodynamic Sensors

Figure 9: Data Acquisition System

Figure 10: Fuel Flow Meter

Figure 11: Tire Temp. Sensor



4.0: TEST RESULTS

The Alcoa Aerodynamic Drive Wheel Covers showed a **fuel savings of 0.96 gal/1000 miles (0.88%)**. Testing was conducted with Alcoa Aero Steer Covers and ULT36 Aluminum wheels installed on the Steer axle[1]; however, it is the opinion of MVT Solutions that the Steer wheel covers are not required to obtain the fuel savings of the Aerodynamic Drive Wheel Covers on the Drive axles. This opinion derives from additional testing MVTS conducted on the same day using various iterations of Alcoa wheel cover designs. These tests allowed MVTS to determine the influence of the Steer covers on other axles and MVTS is confident the Aerodynamic Drive Wheel Covers fuel savings are independent of the Aero Steer Covers. However, it is also the opinion of MVT Solutions that the savings of the Steers and Drives are additive.

Table 2: Test Runs

Run	Test Name/Description	Start	End
1	Baseline	8:00 AM	9:39 AM
4	Alcoa Aerodynamic Drive Wheel Covers	1:59 PM	3:38 PM

Table 3: Test Results with Accuracy

Product	Fuel Economy Improvement		
	Gal/1000 miles	MPG	Percent
Alcoa Aerodynamic Drive Wheel Covers	**0.96**	0.08	0.88%
Accuracy	**+/- 0.40**	+/- 0.03	+/- 0.37%

[1]The fuel savings of the Aero Steer Covers on ULT36 Aluminum wheels were 0.35 gal/1000 miles (0.31%). The Aero Steer Cover report can be found at www.m-v-t-s.com.

Figure 12: Fuel Savings (gal/1000 miles)

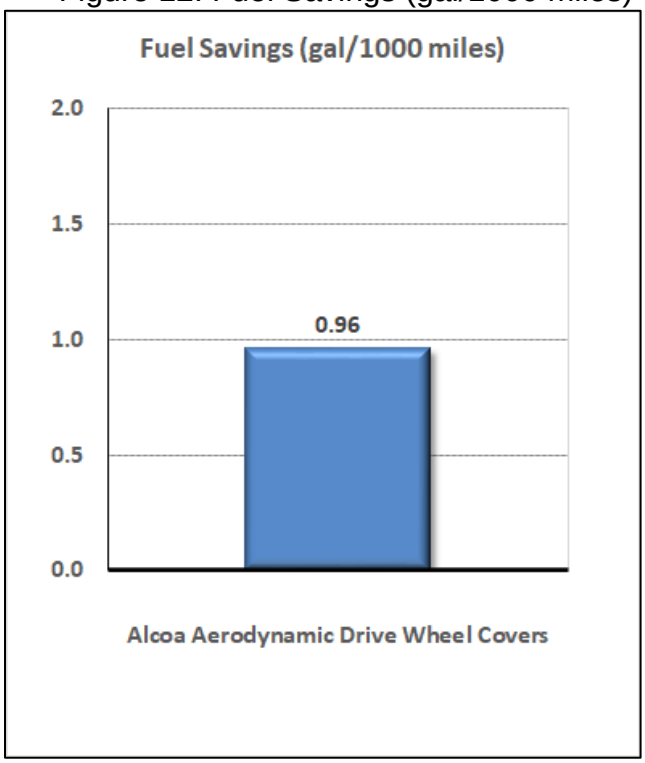
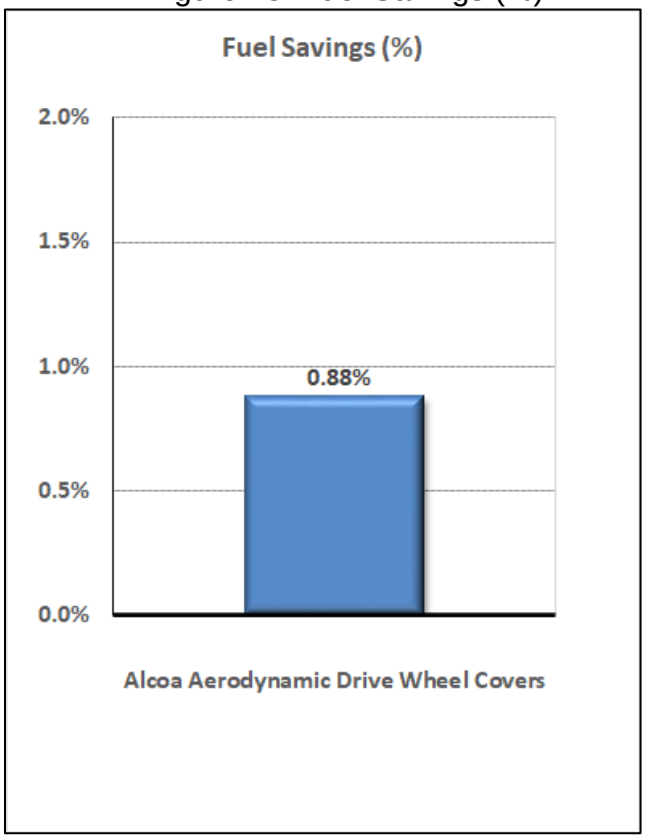


Figure 13: Fuel Savings (%)



4.1: UNITS OF MEASUREMENT

The reader may not be familiar with units of gal/1000 miles (gallons per 1000 miles) since it is not traditionally used in the trucking industry. The following paragraphs briefly explain the reasons for these units and how they help carriers better calculate fuel savings.

Units of gal/1000 miles more reliably calculate fuel savings when compared to other units such as miles-per-gallon (MPG) and percent (%). Those units are prone to error from changing variables such as vehicle baseline fuel economy, load, driver behavior, and duty cycle. For example, gal/1000 miles values are not affected by load for an aerodynamic product. Any empty Class-8 unit at 34,000 lbs. will save the same fuel in gal/1000 miles as one loaded to 80,000 lbs. However, when viewed in percent (%) or MPG the values change with load. This causes a carrier to experience varied results in real-world operation and difficulty predicting the financial benefits of the product unless units of gal/1000 miles are used.

Units of gal/1000 miles are the most reliable units of measurement for aerodynamic fuel savings due to their scientific and mathematical relationship to fuel consumption. Further detail is beyond the scope of this report and the reader is encouraged to contact MVT Solutions if more information is desired.

4.2: WEATHER CONDITIONS SUMMARY

Temperatures ranged from 51°F to 77°F. Winds ranged from 0 mph to 16 mph and gust conditions were omitted from the test results based on consistency of test data. It should be noted that the MVTS test methods account for these variables and their effects on fuel savings. Therefore, the range in climate conditions did not impede the test results shown in this report. Complete weather data can be found in the Appendix.

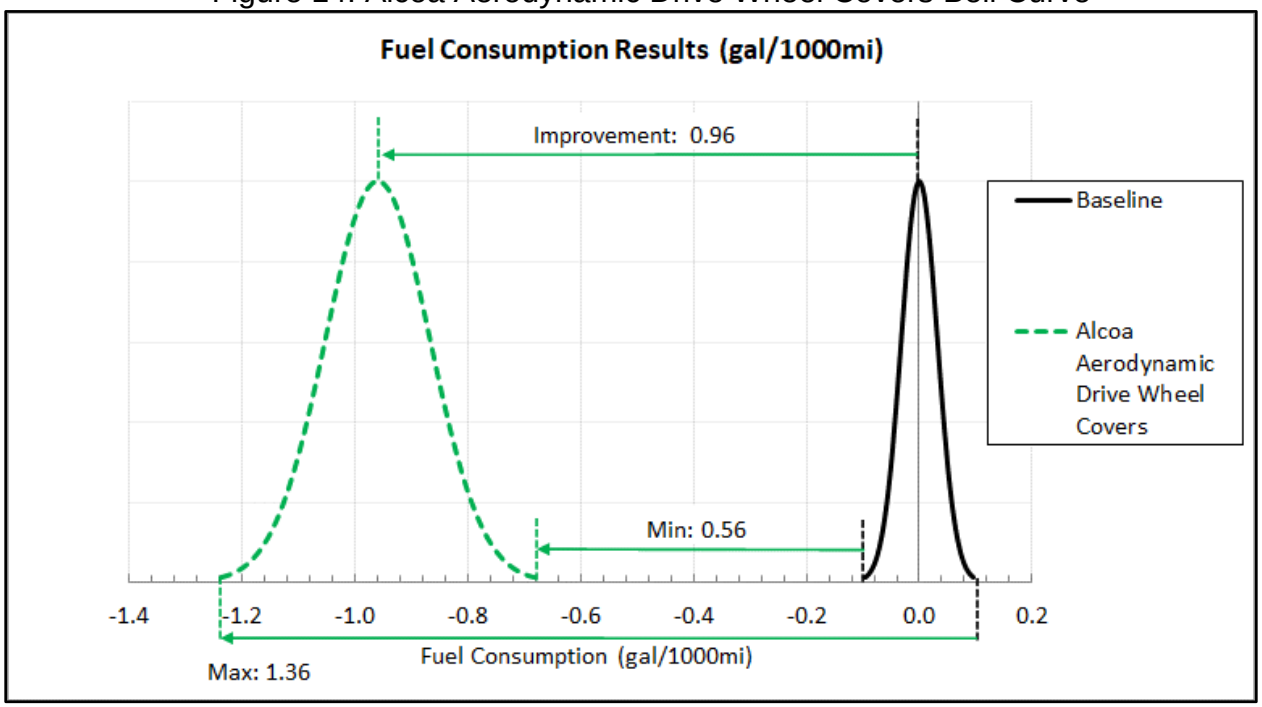
4.3: MEASUREMENT ACCURACY

The accuracy of fuel economy measurements is critical in determining the trustworthiness of test results. Historically, this has been a major difficulty in the trucking industry with fuel economy testing, which has led to confusion and misleading results. The MVTS test methods overcome this issue by achieving better accuracy, which is one of the ways it provides more reliable test results.

Accuracy for all the tests was calculated using a 95% confidence interval, a common standard for testing measurement. 95% confidence interval indicates that if the test were repeated 100 times, values would fall within the range in 95 out of the 100 tests (*i.e.* the reader would be 95% confident the value would be within that range).

Figure 14 below shows the statistical bell curves of the Alcoa Aerodynamic Drive Wheel Covers (Run 1 vs. 4). The two runs clearly show two separated bell curves, indicating the test had valid accuracy and results were reliable. The graph shows the arrow pointing to the left, indicating less fuel used (*i.e.* fuel saved). The distance between the peaks of the bell curves is the test result average, which was a fuel savings of **0.96 gal/1000 miles (0.88%)**. Minimum and maximum values were calculated as the test result plus or minus the accuracy values (0.96 +/- 0.40), which were 1.36 and 0.56 gal/1000 miles.

Figure 14: Alcoa Aerodynamic Drive Wheel Covers Bell Curve



5.0: CONCLUSION

MVTS fuel economy tests were conducted on Alcoa Aerodynamic Drive Wheel Covers installed on the tractor Drive axles.

Fuel savings were **0.96 gal/1000 miles (0.88%).** Accuracy of the test was decent at +/- 0.40 gal/1000 miles.

Wheel covers have been proven as an aerodynamic fuel-saving device in the trucking industry; however, MVTS warns that not all wheel covers save equally. In fact, some wheel covers do not result any fuel savings. Alcoa has clearly conducted research and development to create a design that does in fact save fuel.

The test values shown can be used to estimate a carrier's savings in real-world operations. More precision can be obtained by using a carrier's vehicle and duty cycle information. Contact MVT Solutions for assistance or more information.

6.0: APPENDIX

6.1: 'TEST' VEHICLE DETAILS

Figure 15: 'Test' Vehicle Details

Date	March 11, 2021					
Company	Mesilla Valley Transportation Solutions					
Location	Pecos, Texas					
Test Route	Pecos 9-mile Test Track					
TRUCK ID:	**Veh. B**					
Brand	International					
Year	2019					
Model	LT 625					
Engine	Cummins X15					
VIN	3HSDZAPR3KN562087					
Mileage (miles):	11,683					
Transmission	Eaton Endurant 12-speed AMT					
Rear Gear	2.79 : 1					
Fuel Load	Full					
Fuel Type & Batch	No. 2 Diesel					
Axle Weights	11,400		17,340		17,020	
Total weight	45,760					
Photo/Video/Audio folder name:						
TRAILER ID:	**T-2**					
Model	Hyundai Translead					
VIN	3H3V532C6LR282006					
Year	2019					
Model	Dry Van					
Size	53-ft					
Trailer Gap (inches)	35" from cab extender to trailer					
Add-ons	GreenWing skirts					

Figure 16: 'Test' Vehicle Tire Info

			Truck	**Veh. B**		
LF:			**Front Axle Tires**			RF: Same
Michelin X Line Energy			Type			Michelin X Line Energy
275/80R22.5			Size			275/80R22.5
18/32			Tread Depth (32nds)			18/32
110			Pressure (psi)			110
LF-Outer Drive:	LF-Inner Drive:		**Drive Axle Tires**		RF-Inner Drive:	RF-Outer Drive
Michelin X Line XDA Energy +	Michelin X Line XDA Energy +		Type		Michelin X Line XDA Energy +	Michelin X Line XDA Energy +
275/80R22.5	275/80R22.5		Size		275/80R22.5	275/80R22.5
22/32	23/32		Tread Depth (32nds)		23/32	23/32
110	110		Pressure (psi)		110	110
LR-Outer Drive:	LR-Inner Drive:		**Drive Axle Tires**		RR-Inner Drive:	RR-Outer Drive
Michelin X Line XDA Energy +	Michelin X Line XDA Energy +		Type		Michelin X Line XDA Energy +	Michelin X Line XDA Energy +
275/80R22.5	275/80R22.5		Size		275/80R22.5	275/80R22.5
23/32	21/32		Tread Depth (32nds)		23/32	23/32
110	110		Pressure (psi)		110	110
			Trailer	**T-2**		
LF-Outer Trailer:	LF-Inner Trailer:		**Tandem Front**		RF-Inner Trailer	RF-Outer Trailer
Bridgetone R123	Michelin X Line Energy +		Type		Michelin X Line Energy +	Bridgetone R123
295/75R22.5	275/80R22.5		Size		275/80R22.5	275/80R22.5
10/32	12/32		Tread Depth (32nds)		14/32	14/32
110	110		Pressure (psi)		110	110
LR-Outer Trailer:	LR-Inner Trailer:		**Tandem Rear**		RR-Inner Trailer	RR-Outer Trailer
Bridgetone R123	Michelin X Line Energy +		Type		Michelin X Line Energy +	Bridgetone R123
295/75R22.5	275/80R22.5		Size		275/80R22.5	275/80R22.5
10/32	12/32		Tread Depth (32nds)		14/32	14/32
110	110		Pressure (psi)		110	110

6.2: COMPARE TRUCK/TRAILER VEHICLE DETAILS

Figure 17: 'Compare' Vehicle Details

Date	March 11, 2021					
Company	Mesilla Valley Transportation Solutions					
Location	Pecos, Texas					
Test Route	Pecos 9-mile Test Track					
TRUCK ID:	**Veh. A**					
Brand	International					
Year	2019					
Model	LT 625					
Engine	Cummins X15					
VIN	3HSDZAPR4KN562972					
Mileage (miles):	11,660					
Transmission	Eaton Endurant 12-speed AMT					
Rear Gear	2.79 : 1					
Fuel Load	Full					
Fuel Type & Batch	No. 2 Diesel					
Axle Weights	11,400		17,340		17,020	
Total weight	45,760					
Photo/Video/Audio folder name:						
TRAILER ID:	**5578046**					
Model	Utility 4000D-X					
VIN	1UYVS2533N3557846					
Year	2021					
Model	Dry Van					
Size	53-ft					
Trailer Gap (inches)	35-inches from cab extender to trailer					
Add-ons	Utility USS-120A-4 skirts					
	Utility Aero Tail (UAT)					

Figure 18: 'Compare' Vehicle Tire Info

			Truck	**Veh. A**		
LF:			**Front Axle Tires**			RF: Same
Michelin X Line Energy			Type			Michelin X Line Energy
275/80R22.5			Size			275/80R22.5
18/32			Tread Depth (32nds)			18/32
110			Pressure (psi)			110
LF-Outer Drive:	LF-Inner Drive:		**Drive Axle Tires**		RF-Inner Drive:	RF-Outer Drive
Michelin X Line XDA Energy +	Michelin X Line XDA Energy +		Type		Michelin X Line XDA Energy +	Michelin X Line XDA Energy +
275/80R22.5	275/80R22.5		Size		275/80R22.5	275/80R22.5
22/32	21/32		Tread Depth (32nds)		22/32	21/32
110	110		Pressure (psi)		110	110
LR-Outer Drive:	LR-Inner Drive:		**Drive Axle Tires**		RR-Inner Drive:	RR-Outer Drive
Michelin X Line XDA Energy +	Michelin X Line XDA Energy +		Type		Michelin X Line XDA Energy +	Michelin X Line XDA Energy +
275/80R22.5	275/80R22.5		Size		275/80R22.5	275/80R22.5
21/32	22/32		Tread Depth (32nds)		21/32	21/32
110	110		Pressure (psi)		110	110
			Trailer	**5578046**		
LF-Outer Trailer:	LF-Inner Trailer:		**Tandem Front**		RF-Inner Trailer	RF-Outer Trailer
General HT	General HT		Type		General HT	General HT
295/75R22.5	295/75R22.5		Size		295/75R22.5	295/75R22.5
13/32	13/32		Tread Depth (32nds)		13/32	13/32
110	110		Pressure (psi)		110	110
LR-Outer Trailer:	LR-Inner Trailer:		**Tandem Rear**		RR-Inner Trailer	RR-Outer Trailer
General HT	General HT		Type		General HT	General HT
295/75R22.5	295/75R22.5		Size		295/75R22.5	295/75R22.5
13/32	13/32		Tread Depth (32nds)		13/32	13/32
110	110		Pressure (psi)		110	110

6.3: TEST ROUTE

Pecos, Texas 9-mile circle track (Figure 19). Counter-clockwise direction, middle lane (of 3).

Figure 19: Pecos Test Track

6.4: WEATHER CONDITIONS

Weather during testing had moderate temperatures and winds. Weather data was acquired from a local Weather Underground weather station. Source shown below.

The reader should be aware that MVTS methods include instantaneous and constant weather data acquisition on each vehicle, and this testing has minimal dependency on external weather data collection. MVTS test data accounts for changes in wind, temperature, and other pertinent variables instantaneously. Note, darkened rows pertain to test times.

Table 4: Weather Data, March 11

Time	Temperature	Dew Point	Humidity	Wind	Wind Speed	Wind Gust	Pressure	Precip.	Condition
1:15 AM	58 F	49 F	71%	NNW	5 mph	0 mph	27.20 in	0.0 in	Fair
2:15 AM	56 F	48 F	75%	NW	5 mph	0 mph	27.21 in	0.0 in	Fair
3:15 AM	56 F	49 F	78%	N	5 mph	0 mph	27.21 in	0.0 in	Fair
4:15 AM	55 F	50 F	83%	N	3 mph	0 mph	27.23 in	0.0 in	Fair
5:15 AM	53 F	48 F	83%	CALM	0 mph	0 mph	27.23 in	0.0 in	Fair
6:15 AM	52 F	48 F	86%	CALM	0 mph	0 mph	27.24 in	0.0 in	Fair
7:15 AM	50 F	47 F	87%	CALM	0 mph	0 mph	27.25 in	0.0 in	Fair
8:15 AM	51 F	48 F	87%	SSE	7 mph	10 mph	27.26 in	0.0 in	Fair
9:15 AM	52 F	47 F	84%	SSW	5 mph	0 mph	27.30 in	0.0 in	Fair
10:15 AM	58 F	49 F	71%	CALM	0 mph	0 mph	27.32 in	0.0 in	Fair
11:15 AM	63 F	46 F	54%	CALM	0 mph	0 mph	27.32 in	0.0 in	Fair
12:15 PM	67 F	47 F	50%	NNE	3 mph	0 mph	27.32 in	0.0 in	Fair
1:35 PM	0 F	0 F	0%	0	0 mph	0 mph	0.00 in	0.0 in	Fair
2:15 PM	75 F	48 F	38%	E	14 mph	0 mph	27.26 in	0.0 in	Fair
3:15 PM	77 F	51 F	40%	E	14 mph	18 mph	27.23 in	0.0 in	Fair
4:15 PM	76 F	52 F	43%	E	16 mph	22 mph	27.20 in	0.0 in	Fair
5:15 PM	73 F	53 F	50%	E	15 mph	0 mph	27.19 in	0.0 in	Fair
6:15 PM	68 F	55 F	62%	E	15 mph	0 mph	27.19 in	0.0 in	Fair
7:15 PM	67 F	55 F	64%	ENE	12 mph	0 mph	27.21 in	0.0 in	Fair
8:15 PM	66 F	55 F	66%	E	10 mph	0 mph	27.24 in	0.0 in	Fair
9:15 PM	66 F	55 F	68%	E	13 mph	0 mph	27.24 in	0.0 in	Fair
10:15 PM	66 F	56 F	69%	E	17 mph	0 mph	27.25 in	0.0 in	Fair
11:15 PM	65 F	55 F	72%	ESE	14 mph	0 mph	27.26 in	0.0 in	Fair
11:55 PM	64 F	54 F	69%	ESE	10 mph	0 mph	27.26 in	0.0 in	Fair

Source: https://www.wunderground.com/history/daily/us/tx/pecos/KPEQ/date/2021-3-11

6.5: PRODUCT DETAILS

- Alcoa Aero Steer Covers on Alcoa ULT36 Aluminum wheels
- Alcoa Aerodynamic Drive Wheel Covers

6.6: TEST PERSONNEL

6.6a: MVT SOLUTIONS

- Daryl Bear, Lead Engineer & COO
- Jacob Schwartz, Test Engineer

6.6b: DRIVERS

- Carlos Aragon
- Jack Burchell
- Allan Dahringer
- Seth Knight

6.6c: HOWMET AEROSPACE TECHNOLOGIES (ALCOA)

- Douglas Mason, Ph. D, Global Technical Manager, Global Accessories Manager

6.7: MVT SOLUTIONS CONTACT INFO

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