Test Report

MESILLA VALLEY TRANSPORTATION SOLUTIONS
CERTIFIED
Fuel Economy Experts

MVT SOLUTIONS CERTIFIED™ FUEL ECONOMY TEST

December 2021

Alcoa Aero Steer Covers on Alcoa ULT39 Aluminum Wheels

Fuel Savings

0.39	0.04	0.37%
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 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 test.

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

2.0: TEST SUMMARY

MVTS performed fuel economy testing on Alcoa Aero Steer Covers installed on Alcoa ULT39 Aluminum wheels. The **Alcoa Aero Steer Covers on ULT39 wheels showed a fuel savings of 0.39 gal/1000 miles (0.37%).** It should be noted, for the reader's peace of mind, that MVTS conducted previous testing on Alcoa's Aero Steer Covers and found similar fuel savings values of 0.24 gal/1000 miles (Test 1), 0.46 gal/1000 miles (Test 2), which averaged 0.35 gal/1000 miles. Therefore, the results listed above of 0.39 gal/1000 miles were confirmed in multiple MVTS fuel economy tests.

Testing was conducted on a 9-mile test track at 65 miles per hour and with a Gross Vehicle Weight (GVW) of approximately 45,200 lbs. Vehicles were modern Class-8 Sleeper Cabs with 53-ft dry van trailers. Test results can be found below in Table 1.

Table 1: Fuel Economy Test Results

Product	Fuel Economy Improvement		
	Gal/1000 miles	MPG	Percent
Alcoa Aero Steer Covers on ULT39 Wheels	**0.39**	0.04	0.37%

Contents

1.0: Introduction 1
2.0: Test Summary 1
3.0: Test Procedure 4
3.1: Test Vehicles 4
3.2: Wheel Changes, Tire Installs and Pressure Testing Procedure 7
3.3: Run 4: Baseline 8
3.4: Run 6: Aero Steer Cover 9
4.0: Vehicle Fuel Economy Test Equipment 10
5.0: Test Results 11
5.1: Units of Measurement 13
5.2: Weather Conditions Summary 13
5.3: Measurement Accuracy 14
6.0: Conclusion 15
7.0: Appendix 16
7.1: Test Vehicle Details 16
7.2: Compare Vehicle Details 18
7.3: Test Route 20
7.4: Weather Conditions 21
7.5: Product Details 22
7.6: Test Personnel (On-Site) 22
7.6a: MVT Solutions 22
7.6b: MVT Solutions Drivers & Technicians 22
7.6c: Howmet Aerospace Technologies (Alcoa) 22
7.7: MVT Solutions Contact Info 22

Figures

Figure 1: Test Vehicle (A), Compare Vehicle (B) 5
Figure 2: Test Vehicle and Trailer 5
Figure 3: Trailer Gap (Test and Compare Vehicles) 6
Figure 4: Test Vehicle in Baseline Configuration with Alcoa ULT39 Wheels 8
Figure 5: ULT39 Steer Wheel (Right Side) 8
Figure 6: Test Vehicle with Alcoa Aero Steer Cover (Left Side) 9
Figure 7: Alcoa Aero Steer Cover (Right Side) 9
Figure 8: Aerodynamic Sensors 10
Figure 9: Data Acquisition System 10
Figure 10: Fuel Flow Meter 10
Figure 11: Tire Temp. Sensor 10
Figure 12: Test Results (gal/1000 miles) 11
Figure 13: Test Results (%) 12
Figure 14: Aero Steer Covers on ULT39 Wheels Bell Curve 14
Figure 15: Truck and Trailer Info, Test Vehicle 16
Figure 16: Wheel and Tire Info, Test Vehicle 17
Figure 17: Truck and Trailer Info, Compare Vehicle 18
Figure 18: Wheel and Tire Info, Compare Vehicle 19
Figure 19: Pecos Test Track 20

Tables

Table 1: Fuel Economy Test Results 1
Table 2: Test Run Sequence 7
Table 3: Test Results with Accuracy 11
Table 4: Weather Data, December 2, 2021 21

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 Aero Steer Covers installed). More details on the testing procedure can be found in Section 3.2.

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. Trailers were 53-foot Hyundai Dry Vans. Gross Vehicle Weight (GVW) was approximately 45,200 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 for the duration of testing. The Test Vehicle configuration was changed between test runs. Trucks and trailers used dual tires. Tire pressures were initially set at 100 psi (cold) in the morning, prior to incurring any effect of daytime heat. Vehicle configuration information 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 and MVT relies on the same test results for their purchase decisions.

Figure 1: Test Vehicle (A), Compare Vehicle (B)

Figure 2: Test Vehicle and Trailer

Figure 3: Trailer Gap (Test and Compare Vehicles)

Test runs were conducted in the order as shown in Table 2. **Note:** other test runs occurred prior to Run 4 and between Run 4 and Run 6 that were not included in this test.

Table 2: Test Run Sequence

Run	Test Name/Description	Start	End
4	Baseline	4:49 PM	7:01 PM
6	Aero Steer Cover on ULT39 Wheels	9:30 PM	11:09 PM

3.2: Wheel Changes, Tire Installs and Pressure Testing Procedure

The purpose of this test was to determine the fuel savings of Alcoa's Aero Steer Covers on Alcoa ULT39 Aluminum wheels. The ULT39 wheels were installed on the Test Vehicle prior to the start of this test (Run 4).

To ensure consistent tire pressures, tires were inflated to 100 psi cold after being installed on the ULT39 wheels. For Run 4 only, the vehicles were driven 5 laps (45 miles) on the track as a warmup to allow tire pressures and temperatures to stabilize. After 5 laps, both vehicles were stopped and tire pressures were checked, recorded, and adjusted accordingly to 110 psi warm. These steps were taken to reduce the effect of tire pressures on the fuel economy result. Following the warmup, 11 additional laps were completed and data from those laps were analyzed and provided baseline results for Run 4.

3.3: RUN 4: BASELINE

Testing began with the Test Vehicle in the Baseline configuration. This configuration consisted of Alcoa ULT39 wheels in all positions, without Aero Steer Covers installed on the Steer wheels (Figure 4). Tire pressures were managed by the procedure described in Section 3.2.

Figure 4: Test Vehicle in Baseline Configuration with Alcoa ULT39 Wheels

Figure 5: ULT39 Steer Wheel (Right Side)

3.4: Run 6: Aero Steer Cover

Run 6 consisted of installing the Alcoa Aero Steer Covers on the Alcoa ULT39 Steer wheels from Run 4. The Compare Vehicle remained unchanged. **Note:** The silver and black Aero Steer Covers in the images below are the same wheel cover, different by color only.

Figure 6: Test Vehicle with Alcoa Aero Steer Cover (Left Side)

Figure 7: Alcoa Aero Steer Cover (Right Side)

4.0: 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)

Figure 8: Aerodynamic Sensors

Figure 9: Data Acquisition System

Figure 10: Fuel Flow Meter

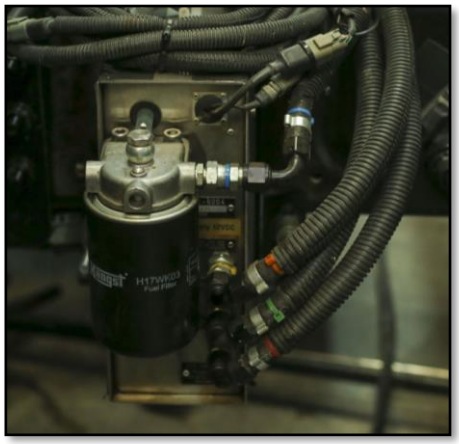


Figure 11: Tire Temp. Sensor

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

5.0: TEST RESULTS

Comparing Run 4 and Run 6 showed the Alcoa Aero Steer Covers on Alcoa ULT39 Aluminum wheels saved 0.39 gal/1000 miles (0.37%).

Test results with accuracy are shown below in Table 3. Bar graphs are shown in gal/1000 miles (Figure 12) and percent fuel (Figure 13).

Table 3: Test Results with Accuracy

Product	Fuel Economy Improvement		
	Gal/1000 miles	MPG	Percent
Alcoa Aero Steer Covers on ULT39 Wheels	**0.39**	0.04	0.37%
Accuracy	**+/- 0.40**	+/- 0.04	+/- 0.39%

Figure 12: Test Results (gal/1000 miles)

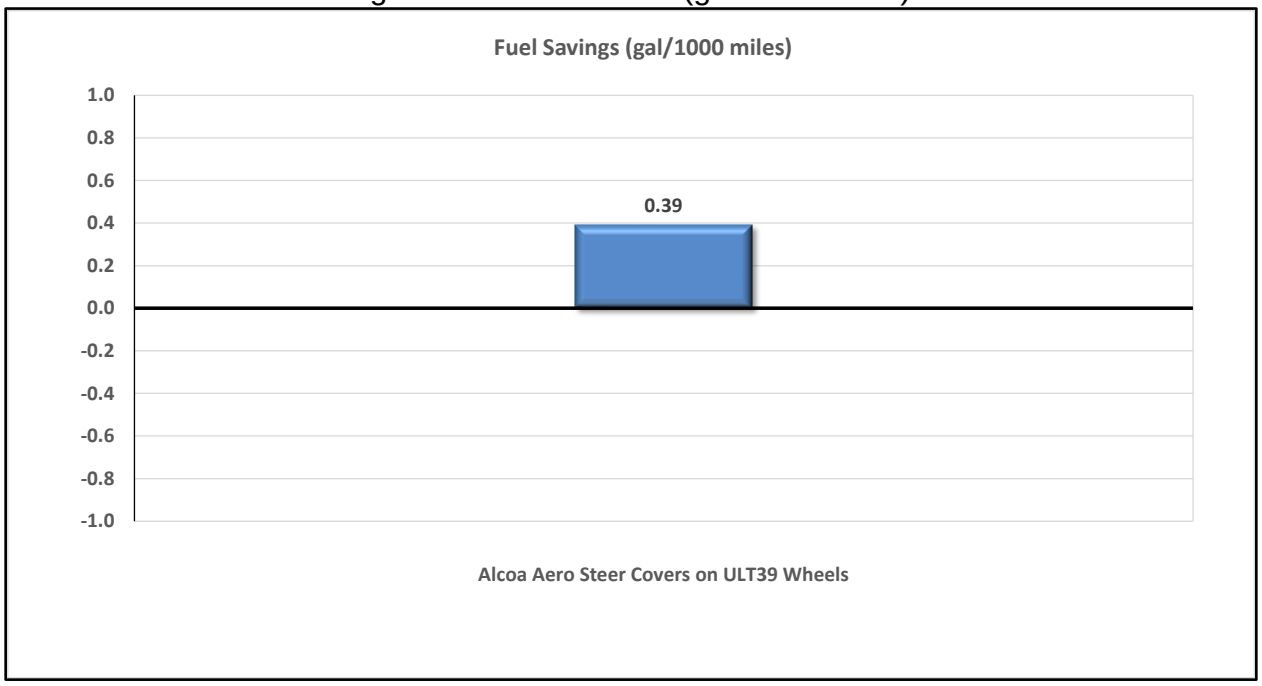
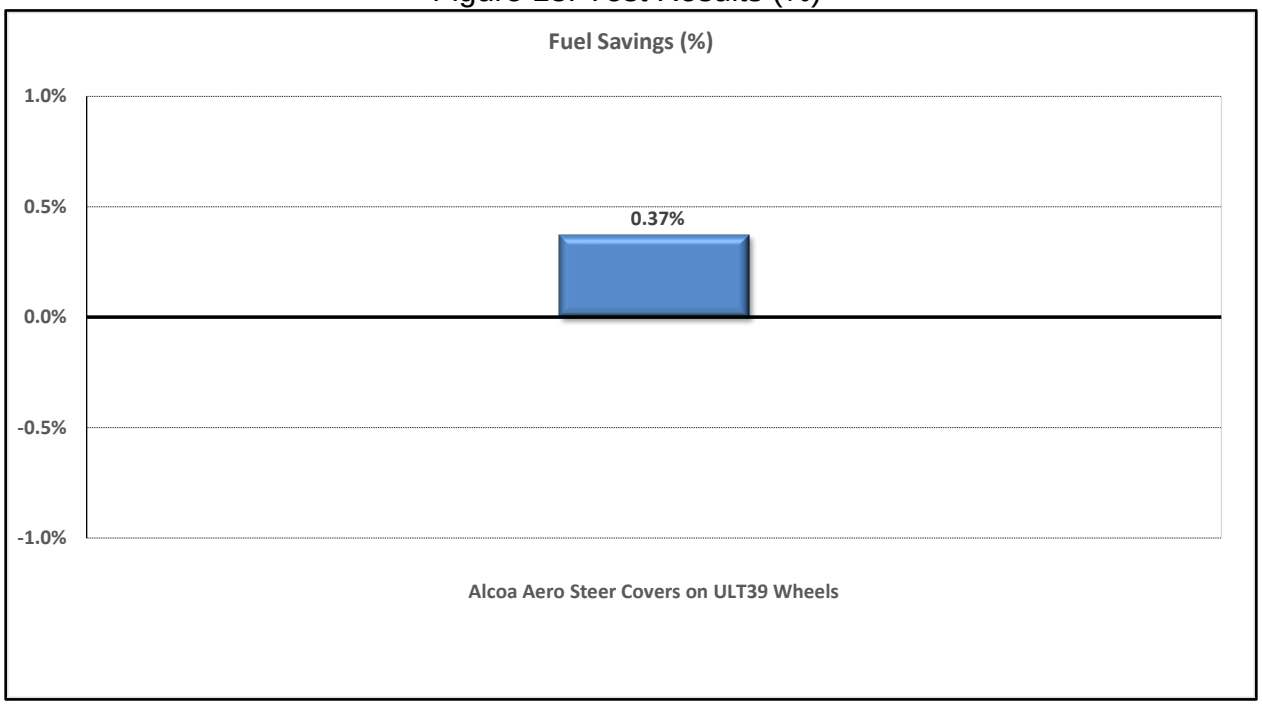


Figure 13: Test Results (%)



5.1: 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.

5.2: WEATHER CONDITIONS SUMMARY

Ambient temperature during testing ranged from 54°F to 80°F with winds ranging from 0-7 mph. Weather data was acquired from a local Weather Underground weather station and complete data can be found in the Appendix.

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.

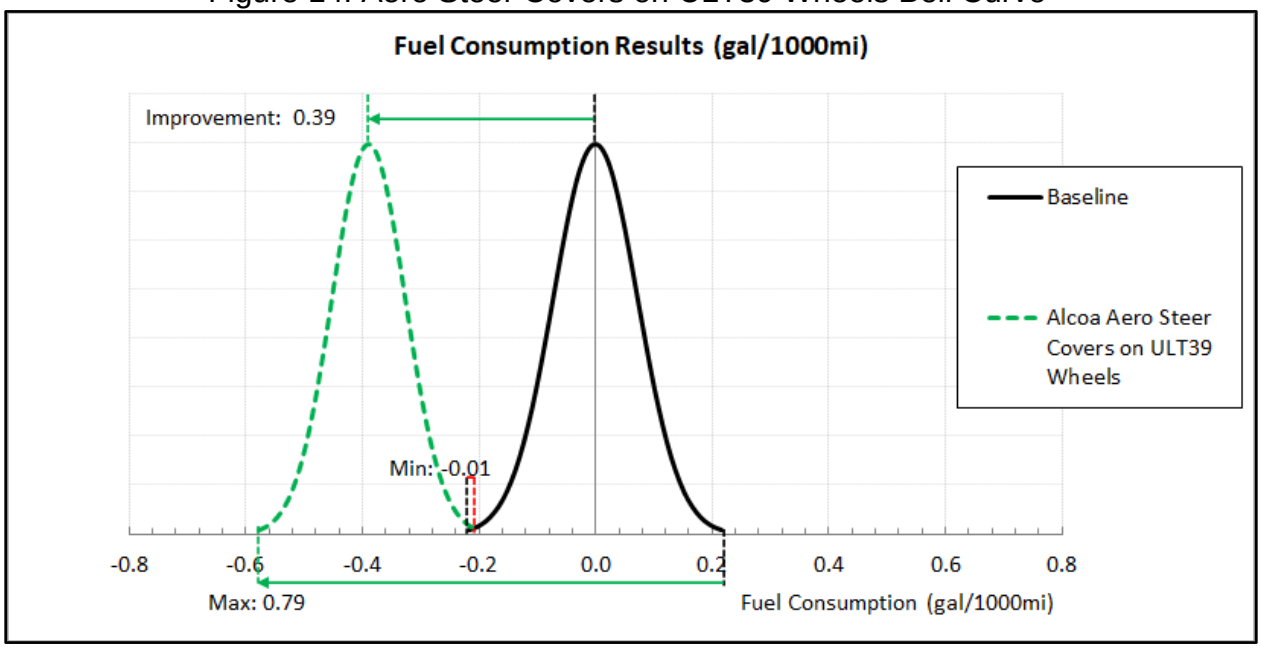
5.3: MEASUREMENT ACCURACY

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 illustrates the statistical bell curves of the Alcoa Aero Steer Covers installed on Alcoa ULT39 Aluminum wheels. The graph shows two very distinct curves, indicating a confident difference in fuel economy. The arrow pointing to the left illustrates less fuel used with the Aero Steer Covers (*i.e*. fuel savings). The distance between the peaks of the bell curves is the test result average, which was 0.39 gal/1000 miles. Minimum and maximum values were calculated as the test result plus or minus the accuracy values (0.39 +/- 0.4), which were -0.01 and 0.79 gal/1000 miles.

Figure 14: Aero Steer Covers on ULT39 Wheels Bell Curve



6.0: CONCLUSION

MVTS conducted fuel economy testing on Alcoa Aero Steer Covers installed on Alcoa ULT39 Aluminum wheels and found a fuel savings of 0.39 gal/1000 miles (0.37%). These test results were similarly found in previous MVTS tests of 0.24 gal/1000 miles and 0.46 gal/1000 miles, which averaged 0.35 gal/1000 miles.

Testing included steps to provide consistency. Tire pressures during Run 4 (Baseline) were checked after a 5-lap warmup and adjusted accordingly to maintain 110 psi warm. This reduced the effect of varying tire pressures stemming from tire temperature changes during test runs. The Alcoa Aero Steer Covers on Alcoa ULT39 Aluminum wheels proved to be a valid fuel saving technology.

MVTS would further advise fleets that the Alcoa Aero cover is a unique design, developed from extensive Computational Fluid Dynamics (CFD) analysis by Alcoa. Comparable fuel savings should not be expected from other steer wheel cover products, regardless of whether they appear similar in design.

For questions or inquiries please contact MVTS.

7.0: APPENDIX

7.1: TEST VEHICLE DETAILS

Figure 15: Truck and Trailer Info, Test Vehicle

Date	December 2, 2021					
Company	Mesilla Valley Transportation Solutions					
Location	Pecos, Texas					
Test Route	Pecos 9-mile Test Track					
TRUCK ID:	**Veh. A**					
Brand	International					
Date of Manufacture	2019					
Model	LT 625					
Engine	Cummins X15					
VIN	3HSDZAPR4KN562972					
Starting Mileage (miles):	27,026					
Transmission	Eaton Endurant 12-speed AMT					
Rear Gear	2.79 : 1					
Fuel Load	Full					
Fuel Type & Batch	No. 2 Diesel					
Axle Weights (S,D,T) (lbs)	11,260		17,300		16,640	
Total weight	45,200					
TRAILER ID:	**T-1**					
Model	Hyundai Translead					
VIN	3H3C532C6MR248009					
Year	2020					
Type	Dry Van					
Size	53-ft					
Trailer Gap (inches)	35" from cab extender to trailer					
Add-ons	Trailer Skirts					

Figure 16: Wheel and Tire Info, Test Vehicle

		Truck	**Veh. A**		
LF		**Front Axle**			RF
Michelin X Line Energy		Type			Michelin X Line Energy
275/80R22.5		Size			275/80R22.5
16/32		Tread Depth (32nds)			16/32
100		Cold Pressure (psi)			100
ULT39 Aluminum		Wheel Type			ULT39 Aluminum
LF-Outer Drive	LF-Inner Drive	**Drive Axle**		RF-Inner Drive	RF-Outer Drive
Michelin XDA Energy +	Michelin XDA Energy +	Type		Michelin XDA Energy +	Michelin XDA Energy +
275/80R22.5	275/80R22.5	Size		275/80R22.5	275/80R22.5
18/32	18/32	Tread Depth (32nds)		18/32	18/32
100	100	Cold Pressure (psi)		100	100
ULT39 Aluminum	ULT39 Aluminum	Wheel Type		ULT39 Aluminum	ULT39 Aluminum
LR-Outer Drive	LR-Inner Drive	**Drive Axle**		RR-Inner Drive	RR-Outer Drive
Michelin XDA Energy +	Michelin XDA Energy +	Type		Michelin XDA Energy +	Michelin XDA Energy +
275/80R22.5	275/80R22.5	Size		275/80R22.5	275/80R22.5
18/32	18/32	Tread Depth (32nds)		19/32	19/32
100	100	Cold Pressure (psi)		100	100
ULT39 Aluminum	ULT39 Aluminum	Wheel Type		ULT39 Aluminum	ULT39 Aluminum
		Trailer	**T-2**		
LF-Outer Trailer	LF-Inner Trailer	**Tandem Front**		RF-Inner Trailer	RF-Outer Trailer
Bridgestone R123 Ecopia	Bridgestone R123 Ecopia	Type		Bridgestone R123 Ecopia	Bridgestone R123 Ecopia
275/80R22.5	275/80R22.5	Size		275/80R22.5	275/80R22.5
10/32	11/32	Tread Depth (32nds)		10/32	10/32
100	100	Cold Pressure (psi)		100	100
ULT39 Aluminum	ULT39 Aluminum	Wheel Type		ULT39 Aluminum	ULT39 Aluminum
LR-Outer Trailer	LR-Inner Trailer	**Tandem Rear**		RR-Inner Trailer	RR-Outer Trailer
Bridgestone R123 Ecopia	Bridgestone R123 Ecopia	Type		Bridgestone R123 Ecopia	Bridgestone R123 Ecopia
275/80R22.5	275/80R22.5	Size		275/80R22.5	275/80R22.5
10/32	10/32	Tread Depth (32nds)		10/32	10/32
100	100	Cold Pressure (psi)		100	100
ULT39 Aluminum	ULT39 Aluminum	Wheel Type		ULT39 Aluminum	ULT39 Aluminum

7.2: COMPARE VEHICLE DETAILS

Figure 17: Truck and Trailer Info, Compare Vehicle

Date	December 2, 2021					
Company	Mesilla Valley Transportation Solutions					
Location	Pecos, Texas					
Test Route	Pecos 9-mile Test Track					
TRUCK ID:	**Veh. B**					
Brand	International					
Date of Manufacture	2019					
Model	LT 625					
Engine	Cummins X15					
VIN	3HSDZAPR3KN562087					
Mileage (miles):	26,915					
Transmission	Eaton Endurant 12-speed AMT					
Rear Gear	2.79 : 1					
Fuel Load	Full					
Fuel Type & Batch	No. 2 Diesel					
Axle Weights (S,D,T) (lbs)	11,260		17,300		16,640	
Total weight	45,200					
TRAILER ID:	**T-2**					
Model	Hyundai Translead					
VIN	3H3V532C6LR282006					
Year	2019					
Type	Dry Van					
Size	53-ft					
Trailer Gap (inches)	35" from cab extender to trailer					
Add-ons	Trailer Skirts					

Figure 18: Wheel and Tire Info, Compare Vehicle

			Truck	Veh. B		
LF			**Front Axle**			RF
Michelin X Line Energy			Type			Michelin X Line Energy
275/80R22.5			Size			275/80R22.5
18/32			Tread Depth (32nds)			18/32
100			Cold Pressure (psi)			100
Steel			Wheel Type			Steel
LF-Outer Drive	LF-Inner Drive		**Drive Axle**		RF-Inner Drive	RF-Outer Drive
Michelin XDA Energy +	Michelin XDA Energy +		Type		Michelin XDA Energy +	Michelin XDA Energy +
275/80R22.5	275/80R22.5		Size		275/80R22.5	275/80R22.5
17/32	18/32		Tread Depth (32nds)		18/32	17/32
100	100		Cold Pressure (psi)		100	100
Steel	Steel		Wheel Type		Steel	Steel
LR-Outer Drive	LR-Inner Drive		**Drive Axle**		RR-Inner Drive	RR-Outer Drive
Michelin XDA Energy +	Michelin XDA Energy +		Type		Michelin XDA Energy +	Michelin XDA Energy +
275/80R22.5	275/80R22.5		Size		275/80R22.5	275/80R22.5
17/32	18/32		Tread Depth (32nds)		19/32	17/32
100	100		Cold Pressure (psi)		100	100
Steel	Steel		Wheel Type		Steel	Steel
			Trailer	T-2		
LF-Outer Trailer	LF-Inner Trailer		**Tandem Front**		RF-Inner Trailer	RF-Outer Trailer
Michelin X Line Energy T	Michelin X Line Energy T		Type		Michelin X Line Energy T	Michelin X Line Energy T
275/80R22.5	275/80R22.5		Size		275/80R22.5	275/80R22.5
11/32	11/32		Tread Depth (32nds)		11/32	11/32
100	100		Cold Pressure (psi)		100	100
Steel	Steel		Wheel Type		Steel	Steel
LR-Outer Trailer	LR-Inner Trailer		**Tandem Rear**		RR-Inner Trailer	RR-Outer Trailer
Michelin X Line Energy T	Michelin X Line Energy T		Type		Michelin X Line Energy T	Michelin X Line Energy T
275/80R22.5	275/80R22.5		Size		275/80R22.5	275/80R22.5
11/32	11/32		Tread Depth (32nds)		11/32	11/32
100	100		Cold Pressure (psi)		100	100
Steel	Steel		Wheel Type		Steel	Steel

7.3: TEST ROUTE

Pecos, Texas 9-mile circle track. Clockwise direction, middle lane (of 3).

Figure 19: Pecos Test Track

7.4: WEATHER CONDITIONS

Weather during testing was fair with winds ranging from 0-7 mph. 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, December 2, 2021

Time	Temperature	Dew Point	Humidity	Wind	Wind Speed	Wind Gust	Pressure	Precip.	Condition
12:15 AM	47 °F	29 °F	49 %	W	6 mph	0 mph	27.45 in	0.0 in	Fair
1:15 AM	49 °F	30 °F	48 %	CALM	0 mph	0 mph	27.44 in	0.0 in	Fair
2:15 AM	46 °F	28 °F	49 %	NW	5 mph	0 mph	27.43 in	0.0 in	Fair
3:15 AM	47 °F	29 °F	51 %	CALM	0 mph	0 mph	27.43 in	0.0 in	Fair
4:15 AM	44 °F	28 °F	54 %	NW	3 mph	0 mph	27.42 in	0.0 in	Fair
5:15 AM	43 °F	28 °F	55 %	CALM	0 mph	0 mph	27.42 in	0.0 in	Fair
6:15 AM	41 °F	27 °F	57 %	CALM	0 mph	0 mph	27.44 in	0.0 in	Fair
7:15 AM	41 °F	27 °F	58 %	NW	7 mph	0 mph	27.45 in	0.0 in	Fair
8:15 AM	46 °F	32 °F	58 %	NW	9 mph	0 mph	27.46 in	0.0 in	Fair
9:15 AM	51 °F	32 °F	47 %	NW	7 mph	0 mph	27.47 in	0.0 in	Fair
10:15 AM	56 °F	32 °F	40 %	NW	8 mph	0 mph	27.48 in	0.0 in	Fair
11:15 AM	62 °F	32 °F	32 %	N	3 mph	0 mph	27.47 in	0.0 in	Fair
12:15 PM	67 °F	33 °F	28 %	N	3 mph	0 mph	27.44 in	0.0 in	Fair
1:15 PM	71 °F	34 °F	26 %	CALM	0 mph	0 mph	27.40 in	0.0 in	Fair
2:15 PM	75 °F	37 °F	25 %	CALM	0 mph	0 mph	27.36 in	0.0 in	Fair
3:15 PM	79 °F	38 °F	23 %	SE	5 mph	0 mph	27.34 in	0.0 in	Fair
4:15 PM	80 °F	40 °F	24 %	E	3 mph	0 mph	27.34 in	0.0 in	Fair
5:15 PM	79 °F	39 °F	24 %	E	5 mph	0 mph	27.33 in	0.0 in	Fair
6:15 PM	71 °F	38 °F	30 %	E	5 mph	0 mph	27.33 in	0.0 in	Fair
7:15 PM	66 °F	37 °F	34 %	ESE	3 mph	0 mph	27.34 in	0.0 in	Fair
8:15 PM	64 °F	38 °F	37 %	E	5 mph	0 mph	27.35 in	0.0 in	Fair
9:15 PM	57 °F	36 °F	45 %	SW	7 mph	0 mph	27.36 in	0.0 in	Fair
10:15 PM	55 °F	35 °F	46 %	W	3 mph	0 mph	27.36 in	0.0 in	Fair
11:15 PM	54 °F	35 °F	49 %	CALM	0 mph	0 mph	27.36 in	0.0 in	Fair
11:55 PM	53 °F	34 °F	48 %	W	7 mph	0 mph	27.36 in	0.0 in	Fair

Source: https://www.wunderground.com/history/daily/us/tx/pecos/KPEQ/date/2021-12-2

7.5: PRODUCT DETAILS

- Alcoa Aero Steer Covers on ULT39 Wheels

7.6: TEST PERSONNEL (ON-SITE)

7.6a: MVT SOLUTIONS

- Daryl Bear, Lead Engineer & COO
- Jacob Schwartz, Test Engineer
- Jonathan Ruppert, Test Engineer
- Amber Schwartz, BSc.
- Garrett Patton, Technician

7.6b: MVT SOLUTIONS DRIVERS & TECHNICIANS

- Allan Dahringer, Director of Maintenance, MVT fleet
- Ron Knowles
- Carlos Aragon
- Jack Burchell

7.6c: HOWMET AEROSPACE TECHNOLOGIES (ALCOA)

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

7.7: MVT SOLUTIONS CONTACT INFO

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