MESILLA VALLEY TRANSPORTATION SOLUTIONS
CERTIFIED
Fuel Economy Experts

Test Report

MVT SOLUTIONS CERTIFIED™ FUEL ECONOMY TEST

June 2021

Eco Flaps without Skirts

(28-ft Double Trailers)

2.14	0.18	1.94%
gal/1000 miles	MPG	

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

Eco Flaps were tested on modern Class-8 single axle day cab (SADC) tractors with double 28-ft dry van trailers without skirts. Eco Flaps (aerodynamic mud flaps) resulted in a fuel savings of **2.14 gal/1000 miles (1.94%)**. Eco Flaps were newly designed and incorporated variable spacing between the louvres, whereas the original design Eco Flaps had equal spacing between louvres. These were installed on a total of eight (8) positions, which included a set on one (1) drive axle, one (1) dolly axle, and two (2) trailer axles. Tractor, dolly, and trailers utilized dual tires.

Testing was conducted on a 9-mile test track at 65 miles per hour and a Gross Vehicle Weight (GVW) of approximately 39,160 lbs. Results are shown below in Table 1.

Table 1: Fuel Economy Test Results

Product	Fuel Economy Improvement		
	Gal/1000 miles	MPG	Percent
Eco Flaps	2.14	0.18	1.94%

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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.* Eco Flaps 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 2018 and 2021 International LT single axle day cabs with Cummins X15 15-Liter engines. Trailers were 28-ft double dry vans. Gross Vehicle Weight (GVW) was approximately 39,160 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 (*i.e.* Eco Flaps installed). Trucks and trailers used dual tires. Tire pressures were set at 110 psi in the morning, prior to incurring any effect of daytime heat. Vehicle info can be found in the Appendix.

Mud flaps were 24-in wide x 24-in length on the tractor (dual tires), trailer mud flaps on the first trailer were 24-in wide x 30-in length, dolly mud flaps were 24-in wide x 30-in length, and trailer mud flaps on the second trailer were 24-in wide by 24-in length.

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. **Note:** MVT fleet does not operate 28-ft dry van trailers; however, the same detail went into each test and MVTS Elite Fleets consider the same test results for their decisions.

Figure 1: Test Vehicle where Eco Flap Technologies were Installed

Figure 2: Compare Vehicle (No changes)

Test runs were conducted in the order as shown in Table 2. **Note:** other test runs were conducted before the Eco Flaps Baseline and Test run which did not apply to this report and were therefore not included.

Table 2: Test Runs

Run	Test Name/Description	Start	End
3	Baseline	3:19 AM	4:58 AM
4	Eco Flaps	5:23 AM	7:02 AM

3.2: Run 3: Baseline (Solid Mud Flaps)

During the Baseline run (Run 3) the test vehicle was equipped with solid mud flaps and no aerodynamic devices. See also Figure 1.

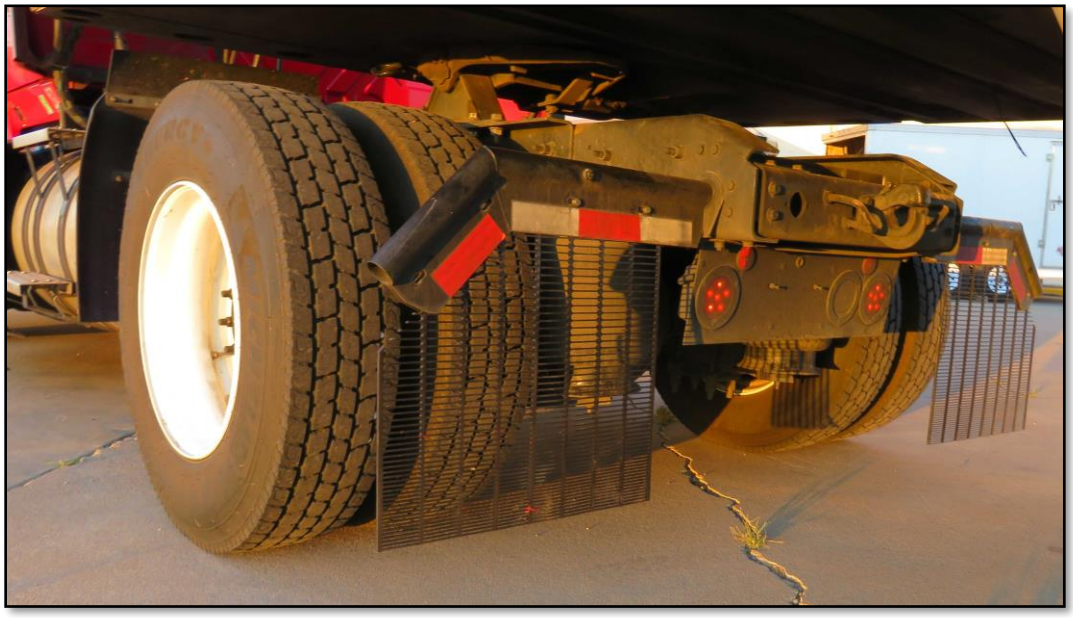
Figure 3: Baseline Truck and Trailer (Solid Mud Flaps)

3.3: RUN 4: TEST RUN WITH ECO FLAPS

Run 4 consisted of installing the newly designed Eco Flaps on the tractor and trailer, which comprised of eight (8) wheel positions including one (1) drive axle, one (1) dolly axle, and two (2) trailer axles. Run 4 was compared to Run 3 to quantify the fuel savings of Eco Flaps on 28-ft double trailers without skirts.

Figure 4: Test Vehicle Configuration (Eco Flaps, Truck and Trailers)

Figure 5: Tractor with Eco Flaps



3.4: 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)

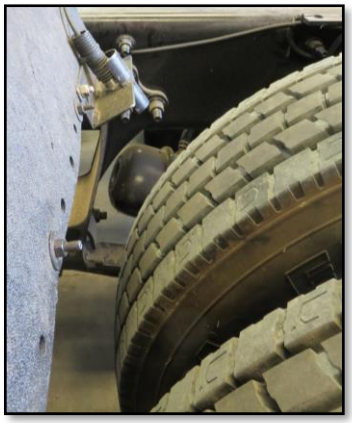
Click this link to see a video of MVTS sensors and testing: How We Test

Figure 6: Aerodynamic Sensors

Figure 7: Data Acquisition System

Figure 8: Fuel Flow Meter

Figure 9: Tire Temp. Sensor



4.0: TEST RESULTS

Newly designed Eco Flaps (aerodynamic mud flaps) resulted in a fuel savings of **2.14 gal/1000 miles (1.94%)** on 28-ft double trailers without skirts. Table 3 shows the test results and accuracy.

Table 3: Test Results with Accuracy

Product	Fuel Economy Improvement		
	Gal/1000 miles	MPG	Percent
Eco Flaps	**2.14**	0.18	1.94%
Accuracy	**+/- 0.32**	+/- 0.03	+/- 0.29%

Test results are shown graphically in gal/1000 miles below in Figure 10 and as a percent in Figure 11.

Figure 10: Fuel Savings (gal/1000 miles)

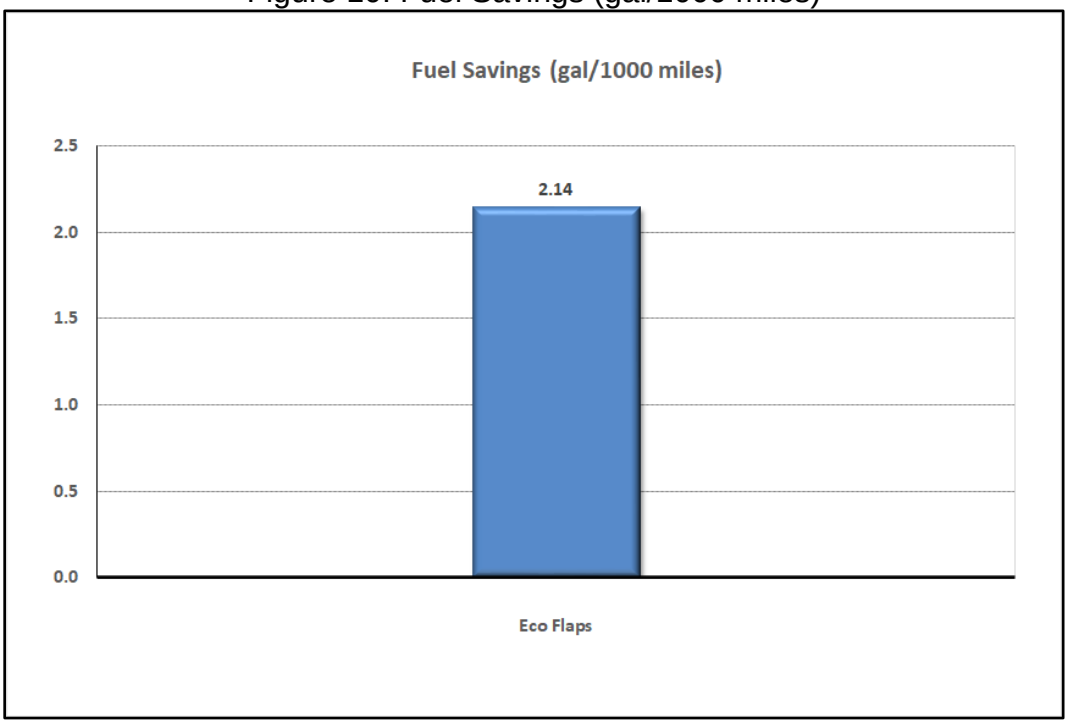


Figure 11: Fuel Savings (%)

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 calculates 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 gal/1000 miles in fuel as one loaded to 80,000 lbs. However, when viewed in percent (%) of MPG the values will 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 its 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 needed.

4.2: WEATHER CONDITIONS SUMMARY

Temperatures ranged from 67°F to 73°F. Winds were reported from 3-7 mph by a local Weather Underground weather station. 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.

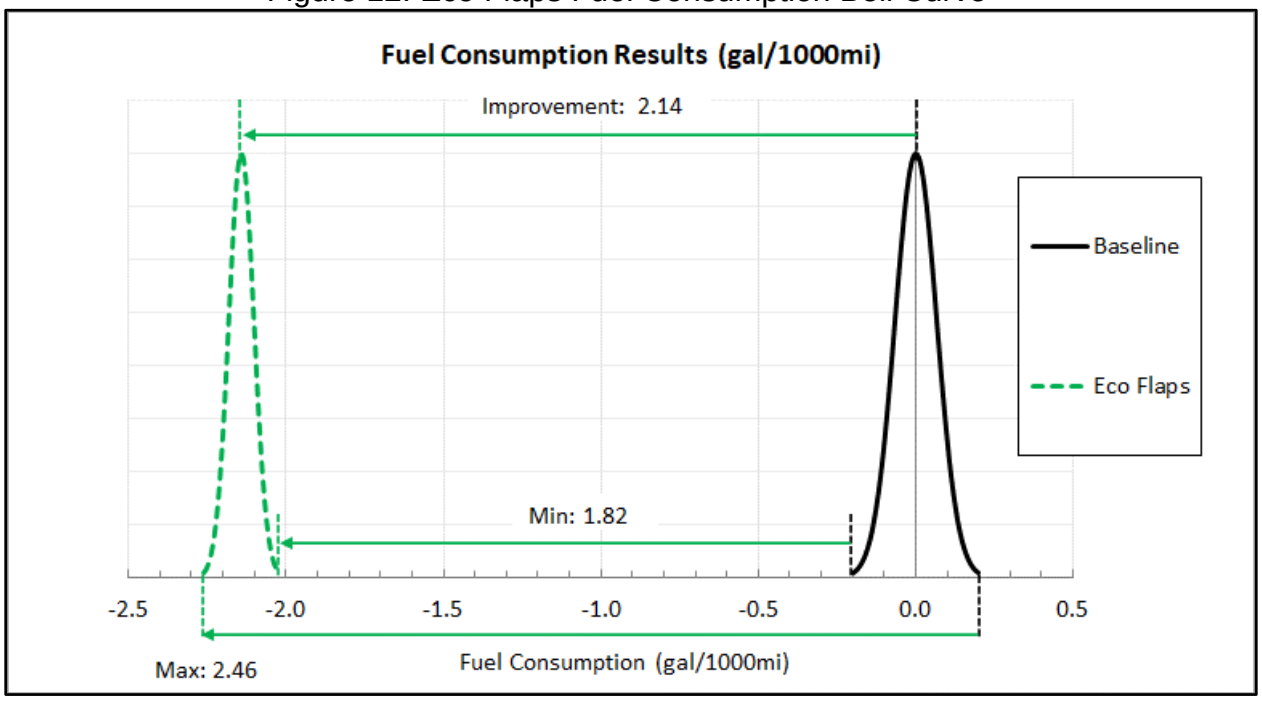
4.3: MEASUREMENT ACCURACY

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 12 below shows the statistical bell curves of Eco Flaps on 28-ft double trailers without skirts. The Baseline run and Eco Flaps run clearly show two separate bell curves, indicating the test had valid accuracy and results were reliable. The graph shows the arrow pointing to the left, illustrating less fuel used (*i.e.* fuel savings). The distance between the peaks of the bell curves is the test result average, which was a fuel savings of 2.14 gal/1000 miles. Minimum and maximum values were calculated as the test result plus or minus the accuracy values (2.14 +/- 0.32), which were 2.46 and 1.82 gal/1000 miles, respectively.

Figure 12: Eco Flaps Fuel Consumption Bell Curve



5.0: SAVINGS CALCULATIONS

Below is a brief outline of how to use the test results to calculate savings. For more detail or assistance contact MVT Solutions.

5.1: FUEL SAVINGS CALCULATIONS (ECO FLAPS (28-FT DOUBLE TRAILERS))

Fuel savings resulting from this test can be calculated as follows:

$$Fuel\ Savings\ (gal/year) = (Test\ result)\ x\ \frac{(Thousands\ of\ miles\ travelled\ per\ year)}{1000}$$

Test result must be in units of gal/1000 miles (*i.e.* not percent or MPG)

Example: Eco Flaps fuel savings of 2.14 gal/1000 miles and 125,000 miles travelled annually:

$$Fuel\ Savings = (2.14\ gal/1000\ miles)x\ \frac{(125{,}000\ miles/year)}{1000} = 268\ gal/year$$

Therefore, Eco Flaps on 28-ft doubles would save 268 gallons of fuel per year for this vehicle travelling 125,000 miles.

5.2: FINANCIAL SAVINGS CALCULATIONS (ECO FLAPS (28-FT DOUBLE TRAILERS))

Financial calculations can be made by multiplying the fuel saved by the fuel price:

$$Savings\ (\$/year) = (Fuel\ Savings)\ x\ (Price\ of\ fuel)$$

Example: Using the example above and U.S. average retail price of diesel fuel in 2020, $2.551[1] /gal.

$Savings\ (\$/year) = \left(268\ \frac{gal}{year}\right)\ x\ \left(\frac{\$2.551}{gal}\right) = \$683\ /year$ in fuel savings

Therefore, Eco Flaps would save $683 per year in fuel for the vehicle travelling 125,000 miles.

[1] Source: https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2DXL0_PTE_NUS_DPG&f=W

6.0: CONCLUSION

MVTS Certified™ testing proved the fuel savings of the newly designed Eco Flaps on 28-ft double trailers without skirts, with answers that were clear and precise.

Eco Flaps on the truck and 28-ft double trailers without skirts resulted in a fuel savings of **2.14 gal/1000 miles (1.94%)**.

Overall, the fuel savings of the Eco Flaps was impressive and would interest any fleet. Obtaining 2.14 gal/1000 miles simply from changing mud flaps is an easy opportunity for any fleet since vehicles already utilize mud flaps.

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.

7.0: APPENDIX

7.1: COMPARE TRUCK/TRAILER VEHICLE DETAILS

Figure 13: Vehicle Info, Compare Vehicle

Date	June 15, 2021						
Company	Saia LTL						
Location	Pecos, Texas						
Test Route	Pecos 9-mile Test Track						
TRUCK ID:	**Veh. A, 224092**						
Brand	International						
Date of Manufacture	02/2021						
Model	LT Day Cab SA						
Engine	Cummins X15						
VIN	3HSDYAPN9NN154620						
Mileage (miles):	2,321						
Transmission	N/A						
Rear Gear	N/A						
Fuel Load	Full						
Fuel Type & Batch	No. 2 Diesel						
Axle Weights	10,200	11440	7,980	9540			
Total weight	39,160						
Photo/Video/Audio folder name:							
TRAILER ID:	**A, 292259**						
Model	Wabash						
VIN	1JJV281D9KL133512						
Date of Manufacture	07/2018						
Model	Dry Van, TRA REM VAN DVDBHPC						
Size	28-ft						
Tractor to Trailer Gap	27 inches						
Add-ons	Michelin Energy Guard skirts						
28-ft double trailer configuration							
TRAILER ID:	**292776**						
Model	Hyundai						
VIN	3H3V281C7LT403197						
Date of Manufacture	02/2021						
Model	VC2280141-FJPRW						
Size	28-ft						
Trailer to Trailer Gap	48 inches						
Add-ons	Michelin Energy Guard skirts						
28-ft double trailer configuration							

Figure 14: Tire Info, Compare Vehicle

		Truck	Veh. A, 224092		
LF:		Front Axle Tires			RF: Same
Bridgestone R284		Type			Bridgestone R284
295/75R22.5		Size			295/75R22.5
17/32		Tread Depth (inches)			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
19/32	19/32	Tread Depth (inches)		19/32	19/32
110	110	Pressure (psi)		110	110
		Trailer	A, 292259		
LR-Outer Trailer:	LR-Inner Trailer:	Tandem Rear		RR-Inner Trailer	RR-Outer Trailer
Continental Eco Plus HS3	Continental Eco Plus HS3	Type		Breidgestone R123	Breidgestone R123
295/75R22.5	295/75R22.5	Size		295/75R22.5	295/75R22.5
9/32	8/32	Tread Depth (inches)		9/32	11/32
110	110	Pressure (psi)		110	110
		Trailer	292776		
LF-Outer Trailer:	LF-Inner Trailer:	Tandem Front		RF-Inner Trailer	RF-Outer Trailer
Breidgestone R123	Breidgestone R123	Type		Breidgestone R123	Continental HDR2
295/75R22.5	295/75R22.5	Size		295/75R22.5	295/75R22.5
11/32	11/32	Tread Depth (inches)		10/32	10/32
110	110	Pressure (psi)		110	110
LR-Outer Trailer:	LR-Inner Trailer:	Tandem Rear		RR-Inner Trailer	RR-Outer Trailer
Bridgestone R197	Bridgestone R197	Type		Bridgestone R197	Bridgestone R197
295/75R22.5	295/75R22.5	Size		295/75R22.5	295/75R22.5
7/32	6/32	Tread Depth (inches)		9/32	8/32
110	110	Pressure (psi)		110	110

7.2: TEST TRUCK/TRAILER VEHICLE DETAILS

Figure 15: Vehicle Info, Test Vehicle

Date	June 15, 2021						
Company	Saia LTL						
Location	Pecos, Texas						
Test Route	Pecos 9-mile Test Track						
TRUCK ID:	**Veh. B, 204534**						
Brand	International						
Date of Manufacture	12/2018						
Model	LT Day Cab SA						
Engine	Cummins X15						
VIN	3HSDYAPN7LN806843						
Mileage (miles):	284,576						
Transmission	N/A						
Rear Gear	N/A						
Fuel Load	Full						
Fuel Type & Batch	No. 2 Diesel						
Axle Weights	10,200	11440	7,980	9540			
Total weight	39,160						
Photo/Video/Audio folder name:							
TRAILER ID:	**B, 292250**						
Model	Wabash						
VIN	1JJV281D8KL133503						
Date of Manufacture	07/2018						
Model	Dry Van, TRA REM VAN DVDBHPC						
Size	28-ft						
Tractor to Trailer Gap	27 inches						
Add-ons	Eco Flaps						
28-ft double trailer configuration							
TRAILER ID:	**290720**						
Model	Great Dane						
VIN	1GRAP5612HK269054						
Date of Manufacture	01/2016						
Model	CCP-3311-02028						
Size	28-ft						
Trailer to Trailer Gap	48 inches						
Add-ons	Eco Flaps						
28-ft double trailer configuration							

Figure 16: Tire Info, Test Vehicle

			Truck	Veh. B, 204534		
LF:			Front Axle Tires			RF: Same
Bridgestone R284			Type			Bridgestone R284
295/75R22.5			Size			295/75R22.5
17/32			Tread Depth (inches)			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
19/32	19/32		Tread Depth (inches)		19/32	19/32
110	110		Pressure (psi)		110	110
			Trailer	B, 292250		
LR-Outer Trailer:	LR-Inner Trailer:		Tandem Rear		RR-Inner Trailer	RR-Outer Trailer
Bridgestone R123	Bridgestone R123		Type		Bridgestone R123	Bridgestone R123
295/75R22.5	295/75R22.5		Size		295/75R22.5	295/75R22.5
9/32	8/32		Tread Depth (inches)		9/32	11/32
110	110		Pressure (psi)		110	110
			Trailer	290720		
LF-Outer Trailer:	LF-Inner Trailer:		Tandem Front		RF-Inner Trailer	RF-Outer Trailer
Continental EcoPlus HT3	Continental EcoPlus HT3		Type		Continental EcoPlus HT3	Continental HDR2
295/75R22.5	295/75R22.5		Size		295/75R22.5	295/75R22.5
9/32	8/32		Tread Depth (inches)		10/32	10/32
110	110		Pressure (psi)		110	110
LR-Outer Trailer:	LR-Inner Trailer:		Tandem Rear		RR-Inner Trailer	RR-Outer Trailer
Bridgestone R197	Bridgestone R197		Type		Bridgestone R283	Bridgestone R283
295/75R22.5	295/75R22.5		Size		295/75R22.5	295/75R22.5
7/32	6/32		Tread Depth (inches)		9/32	8/32
110	110		Pressure (psi)		110	110

7.3: TEST ROUTE

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

Figure 17: Pecos Test Track

7.4: WEATHER CONDITIONS

Weather during testing was fair with winds from 3-7 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, June 17, 2021

Time	Temperature	Dew Point	Humidity	Wind	Wind Speed	Wind Gust	Pressure	Precip.	Condition
12:15 AM	80 °F	48 °F	33%	ESE	7 mph	0 mph	27.35 in	0.0 in	Fair
1:15 AM	78 °F	52 °F	40%	SE	7 mph	0 mph	27.35 in	0.0 in	Fair
2:15 AM	77 °F	54 °F	44%	SE	5 mph	0 mph	27.36 in	0.0 in	Fair
3:15 AM	73 °F	53 °F	49%	SE	6 mph	0 mph	27.35 in	0.0 in	Fair
4:15 AM	73 °F	54 °F	52%	SE	7 mph	0 mph	27.34 in	0.0 in	Fair
5:15 AM	70 °F	53 °F	55%	ESE	5 mph	0 mph	27.34 in	0.0 in	Fair
6:15 AM	69 °F	54 °F	58%	E	3 mph	0 mph	27.35 in	0.0 in	Fair
7:15 AM	67 °F	54 °F	62%	E	3 mph	0 mph	27.36 in	0.0 in	Fair
8:15 AM	72 °F	55 °F	56%	ESE	5 mph	0 mph	27.36 in	0.0 in	Fair
9:15 AM	78 °F	56 °F	47%	E	6 mph	0 mph	27.37 in	0.0 in	Fair
10:15 AM	84 °F	55 °F	36%	ESE	3 mph	0 mph	27.37 in	0.0 in	Fair
11:15 AM	88 °F	48 °F	25%	ESE	9 mph	0 mph	27.36 in	0.0 in	Fair
12:15 PM	91 °F	45 °F	20%	ESE	8 mph	0 mph	27.36 in	0.0 in	Fair
1:15 PM	94 °F	44 °F	18%	ESE	14 mph	17 mph	27.33 in	0.0 in	Fair
2:15 PM	96 °F	42 °F	15%	E	9 mph	18 mph	27.31 in	0.0 in	Fair
3:15 PM	97 °F	39 °F	13%	SE	13 mph	18 mph	27.29 in	0.0 in	Fair
4:15 PM	98 °F	38 °F	12%	SE	8 mph	17 mph	27.27 in	0.0 in	Fair
5:15 PM	97 °F	39 °F	14%	SE	8 mph	22 mph	27.26 in	0.0 in	Fair
6:15 PM	97 °F	41 °F	15%	E	14 mph	0 mph	27.25 in	0.0 in	Fair
7:15 PM	96 °F	42 °F	15%	ESE	15 mph	0 mph	27.24 in	0.0 in	Fair
8:15 PM	93 °F	44 °F	18%	E	18 mph	22 mph	27.24 in	0.0 in	Fair
9:15 PM	89 °F	46 °F	22%	ESE	18 mph	0 mph	27.25 in	0.0 in	Fair
10:15 PM	86 °F	49 °F	27%	ESE	15 mph	0 mph	27.26 in	0.0 in	Fair
11:15 PM	84 °F	48 °F	28%	ESE	14 mph	0 mph	27.29 in	0.0 in	Fair

Source: https://www.wunderground.com/history/daily/us/tx/pecos/KPEQ/date/2021-6-17

7.5: PRODUCT DETAILS
- Eco Flaps

7.6: TEST PERSONNEL

7.6a: MVT SOLUTIONS
- Daryl Bear, Lead Engineer & COO
- Jacob Schwartz, Test Engineer
- Jonathan Ruppert, Test Engineer

7.6b: DRIVERS
- Allan Dahringer
- Carlos Aragon
- Jack Burchell
- Seth Knight

7.6c: ECO FLAPS
- Asa Hazelwood, President

7.7: MVT SOLUTIONS CONTACT INFO

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