Test Report

Michelin
X One Line
Energy D2 Tire

MESILLA VALLEY TRANSPORTATION SOLUTIONS
CERTIFIED
Fuel Economy Experts

MVT SOLUTIONS CERTIFIED™ FUEL ECONOMY TEST

November 2021

Michelin X One Line Energy D2 vs. Bridgestone Greatec M835A Ecopia (Drives Only)

7.26	0.53	5.99%
gal/1000 miles	MPG	Percent

1.0: INTRODUCTION

Mesilla Valley Transportation Solutions ("MVTS" or "MVT Solutions") certifies the fuel savings 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 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

The purpose of this test was to quantify differences in fuel economy of two (2) long-haul, fuel efficient Wide Based Single (WBS) tires; Michelin X One Line Energy D2 (LED2) and Bridgestone Greatec M835A Ecopia. **The Michelin X One Line Energy D2 tire (drives only) saved 7.26 gal/1000 miles (5.99%) compared to the Bridgestone M835A.** Testing was conducted on a 9-mile test track at 65 miles per hour and a Gross Vehicle Weight (GVW) of 78,000 lbs. Tires were EPA SmartWay approved and considered a fuel-efficient offering from both brands in the WBS category. Tires had 500 miles break-in using the same vehicle and load as was used for the fuel economy test. Tests were conducted as drives only as shown in Table 2 below.

Table 1: Results Summary

Product	Fuel Economy Improvement		
	Gal/1000 miles	MPG	Percent
Michelin LED2 vs. Bridgestone M835A	7.26	0.53	5.99%

Savings calculations compared the Michelin X One Line Energy D2 tire (drives only) to the Bridgestone M835A (drives only) and showed that in 125,000 miles, the Michelin X One Line Energy D2 tire (drives only) would save 907.5 gallons of fuel resulting in $2,317[1] per year in savings. Using a total product cost difference of $200 per four (4) tires, the ROI would be 1.0 month and the profits would be $2,117 per tractor annually. **Note:** product costs are for example only, contact Michelin for pricing pertaining to your fleet.

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

Note: This report was not created to discredit Bridgestone tires in any way. It was created to show the potential fuel savings that can exist between tire brands – even top brands that are fuel-efficient, long-haul, SmartWay approved tires such as those tested. Currently, most fleets do not factor fuel savings in tire cost-per-mile (CPM) decisions or view tires as a fuel-saving opportunity since quantifying the differences in fuel savings has been difficult.

Table 2: Tire Test Sets

Michelin		
	Model	**Size**
Drive	LRL X One Line Energy D2	445/50R22.5
Bridgestone		
	Model	**Size**
Drive	LRL Greatec M835A Ecopia	445/50R22.5

Tests were conducted on behalf of Michelin Tires North America; however, all work was conducted independently by MVT Solutions, including tire mounting, break-in miles, and testing. Bridgestone tires were purchased by MVTS; however, the X One Line Energy D2 tires were provided by Michelin since the test was conducted prior to those tires being available on the market.

Note: GVW versus fuel savings; fuel savings from tires are dependent on axle weight and will increase as GVW increases. This report includes a guide on how to calculate savings for a fleet's specific GVW along with cost savings. These can be found in the Savings Calculations section.

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3.0: PROCEDURE

Fuel economy testing of tires varies to other technologies since tire performance changes over time, both long term and short term. During a fuel economy test, fuel economy can change due to tire temperature and pressure. Many extra steps were taken during these tire tests to ensure accuracy and consistency including tire preparation, tire pressure management and monitoring.

3.1: TIRES TESTED

All tires were acquired in new condition for this test and received 500 break-in miles prior to testing. Drive tires were 445/50 R22.5 as shown in Table 3. All tires were SmartWay approved, and each brand's fuel-efficient offerings in the WBS category. Therefore, tires tested are considered direct and fair competitors.

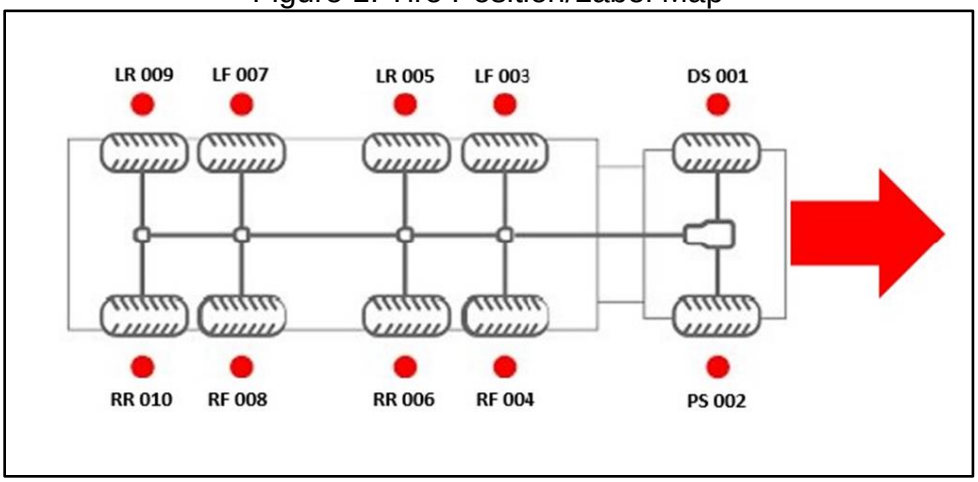
Table 3: Test Tire Info

Michelin					
	Model	Size	Rev/Mile	Tread Depth (32nds)	Load Rating
Drive	LRL X One Line Energy D2	445/50R22.5	517	20	L
Bridgestone					
	Model	Size	Rev/Mile	Tread Depth (32nds)	Load Rating
Drive	LRL Greatec M835A Ecopia	445/50R22.5	524	23	L

All tires were tested on the same truck and trailer, termed the 'Test' vehicle (Veh. B). A second vehicle, the 'Compare' vehicle, remained unchanged throughout testing and is denoted as 'Veh. A: Compare Vehicle' in the table above. The Test and Compare vehicles will be discussed in more detail in the sections below.

Tires were installed in the same positions for the break-in miles and fuel economy tests, as labelled in the figure below.

Figure 1: Tire Position/Label Map



Note: Tire images shown may include footprints and/or dirt. It was decided not to clean the tires with any water or chemicals prior to testing. Footprints were caused by MVTS technicians walking on the tires while checking pressures and dirt was contracted during break-in miles as the vehicle was parked in a secure dirt yard during break-in mile operations.

Figure 2: Run 1 Michelin Drive (Position 003 & 005)

Figure 3: Run 2 Bridgestone Drive (Position 003 & 005)

3.2: TIRE SOURCING & MOUNTING

Bridgestone and Michelin tires were purchased through regular supply chains, which were sourced independently by MVT Solutions through Border Tire in Las Cruces, NM. An exception was the Michelin X One Line Energy D2 tires, which were provided by Michelin due to the test occurring prior to the tire being available on the market.

All tires were mounted in the MVT shop on aluminum wheels prior to break-in and remained mounted until testing was completed. Drives and Trailer tires were not balanced, due to that being common practice in the industry whereas the Steer tires were balanced since that is also common practice.

Table 4: Wheels and Balancing

Position	Wheels	Balanced?
Steer	Aluminum	Yes
Drive	Aluminum	No
Trailer	Aluminum	No

3.3: TIRE BREAK-IN

All tires received a break-in distance of 512.6 miles in the weeks prior to testing. A distance of 500 miles was chosen due to industry standard expectations for tire consistency[2] and break-in. All tires had break-in miles using the same truck, trailer, driver, route, and load to ensure consistency.

All tires were inflated to 100 psi cold pressure during break-in. Each set remained in the MVT shop overnight prior to conducting break-in miles the following day. After installation, tire pressures were again verified to be at 100 psi. All tires were labelled to their position on the vehicle to ensure consistency when reinstalled during the actual fuel economy test.

3.3a: BREAK-IN ROUTE

Break-in miles followed a route from Las Cruces, NM to Albuquerque, NM. This included a variety of terrain types, which allowed the tires to heat cycle. The numbers below correlate with those found in the route map of Figure 4.

1. Start of route: MVT shop, 3530 W. Picacho Ave., Las Cruces, NM
2. To Loves Truck stop, 8993 Robert Larson Blvd, Las Cruces, NM (**6.3 miles**)
3. To Route 66 Casino Hotel, 14500 Central Ave SW, Albuquerque, NM (**250 miles**)
4. Stop for 30 minutes to allow tires to cool
5. To Loves Truck stop, 8993 Robert Larson Blvd, Las Cruces, NM (**250 miles**)
6. Return to 3530 W. Picacho Ave., Las Cruces, NM (**6.3 miles**)
7. Total Distance **512.6 miles**

[2] J1321 Revised FEB2012 Page 13 of 50 4.2.2 Vehicle Type and Configuration

Figure 4: Break-in Route

Data was collected during the break-in process using MVT Solutions data acquisition system and included:

- Road temperature
- Left-front Drive tire temperature
- GPS speed, position, direction, time
- Fuel consumption by flow meter

3.4: TEST RUN TIRE PREPARATION

For the fuel economy test, all test tires were placed beside the shop at the test track and laid flat on the ground overnight. Tire pressures were set to 105.0 psi cold the night prior to testing. Although the test pressure would be 100.0 psi cold for the test, a higher pressure was used to ensure air would not be added prior to testing since the tires would cool overnight and pressures would decrease.

At 6am of the test day, all tire pressures were set to 100.0 psi. This time was chosen to ensure complete darkness and no sunlight effect on any tires. This included the tires mounted on the Compare vehicle, which remained on that vehicle and parked outside overnight.

Each vehicle had a its own corresponding digital tire pressure gauge, which remained with that vehicle throughout the test.

Tire pressures were not adjusted after 6am the morning of the test runs, they were only checked to verify and record pressure values.

Tires on Vehicle A, the Compare vehicle, were not changed during testing. Vehicle B, the Test vehicle, had its tires changed for the corresponding test.

3.5: Fuel Economy Test Procedure

Testing was conducted in Pecos, Texas on the 9-mile test track. Test speed was 65 mph. Wheel revolution counts were changed in accordance with the Drive tire revolutions per mile for the Bridgestone and Michelin tires tested.

The test procedure was as follows:

A) Complete four (4) warm-up laps to allow tire pressures and temperatures to stabilize
B) Stop on test track to record tire pressures
C) Complete 12 laps (108 miles) –where data was used for test results except for lap 5 due to acceleration
D) End test run. Record tire pressures (16 total laps)

Table 5: Warm-up and Test Laps

Lap #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Check Pressures	Warm-up Laps				Stop. Check Pressures. Accelerate.	Test Laps											End Test. Pit. Check Pressures.

Note that lap 5 was used to accelerate the vehicles to 65 mph and was not part of the test results data. Tire pressure values are shown here and the comparisons are summarized in the Test Results section.

3.6: TEST VEHICLES

Test vehicles were 2019 International LT 625's with Cummins X15 15-Liter engines and Eaton Endurant 12-speed Automated Manual Transmissions (AMT). Trailers were 53' Hyundai dry vans. Gross Vehicle Weight (GVW) was 78,000 lbs. Both trucks were equipped with Ex-Guard grill guards, which were previously tested and showed no influence on fuel economy. The Compare vehicle remained unchanged throughout all tests. The Test vehicle configuration was changed between test runs with the installation of the test tires. 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 5: Test Vehicles

Figure 6: Test Trailers

Table 6 below shows the test run order and times.

Table 6: Test Run Times

Run	Test Name/Description	Start	End
1	Michelin X One LED2 Drives	8:00 AM	10:12 AM
2	Bridgestone Greatec M835A Drives	10:57 AM	1:09 PM

3.7: 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)

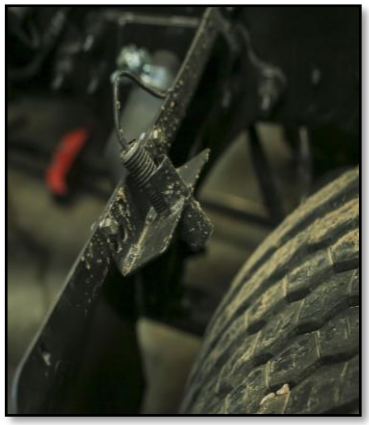
Click this link to see a video of MVTS sensors and testing: How We Test

Figure 7: Aerodynamic Sensors

Figure 8: Data Acquisition System

Figure 9: Fuel Flow Meter

Figure 10: Tire Temp. Sensor



4.0: TEST RESULTS

The **Michelin X One Line Energy D2 tires (drives only) saved 7.26 gal/1000 miles (5.99%)** compared to the Bridgestone Greatec M835A Ecopia at 65 mph and 78,000 lbs. GVW.

Table 7: Fuel Economy Improvement Summary

Product	Fuel Economy Improvement		
	Gal/1000 miles	MPG	Percent
Michelin LED2 vs. Bridgestone M835A	**7.26**	0.53	5.99%
Accuracy	+/- 0.34	+/- 0.02	+/- 0.28%

Tire pressures were monitored closely during the testing. They were checked before the test, after the warm-up laps and at the conclusion of the test. This provided a comparison of the tire pressures on the Compare and Test vehicles. It also provided a comparison of the pressure changes (*i.e.* growth) on the Compare and Test vehicles. This was important to ensure the Test vehicle did not experience significant differences in pressure growth between brand comparisons, which could affect results.

Table 9 shows the average pressure variance of the Greatec M835A Ecopia (Drives only) was 0.5 psi, the minimum was 0.0 psi, and the maximum was 2.5 psi. This is considered consistent and reliable.

Table 8: Bridgestone Test Tire Pressures Comparison (Compare – Test Vehicle)

Average Tire Pressure Comparison				
(Test Vehicle - Compare Vehicle)				
2.0		Steers (psi)		1.5
3.5	0.0	Drives-Front (psi)	0.0	3.8
1.5	0.0	Drives-Rear (psi)	0.0	4.8
1.5	0.0	Trailer-Front (psi)	0.0	3.3
2.3	0.0	Trailer-Rear (psi)	0.0	2.8
1.5		Average Pressure Variance (psi)		
0.0		Minimum Pressure Variance (psi)		
4.8		Maximum Pressure Variance (psi)		

Table 9: Bridgestone Tire Test Pressure Growth

Tire Pressure Growth Comparison				
(End Pressure - Start Pressure) of (Test Vehicle - Compare Vehicle)				
0.0		Steers (psi)		0.0
2.0	0.0	Drives-Front (psi)	0.0	1.5
2.0	0.0	Drives-Rear (psi)	0.0	2.5
0.0	0.0	Trailer-Front (psi)	0.0	0.5
0.5	0.0	Trailer-Rear (psi)	0.0	0.5
0.5		Average Pressure Variance (psi)		
0.0		Minimum Pressure Variance (psi)		
2.5		Maximum Pressure Variance (psi)		

The Michelin X One Line Energy D2 (Drives only) tire pressures were also consistent. Table 10 shows the tire pressure comparison and indicates values similar to the Bridgestone test in terms of average, minimum, and maximum variance. Table 11 shows the pressure growth was also consistent with the other tire test run with an average of 0.0 psi, a minimum of -0.5 psi, and maximum of 0.5 psi.

Table 10: Michelin Test Tire Pressures Comparison (Compare – Test Vehicle)

Average Tire Pressure Comparison				
(Test Vehicle - Compare Vehicle)				
1.8		Steers (psi)		1.3
1.0	0.0	Drives-Front (psi)	0.0	0.8
1.0	0.0	Drives-Rear (psi)	0.0	1.3
1.8	0.0	Trailer-Front (psi)	0.0	2.8
2.0	0.0	Trailer-Rear (psi)	0.0	2.8
0.9		Average Pressure Variance (psi)		
0.0		Minimum Pressure Variance (psi)		
2.8		Maximum Pressure Variance (psi)		

Table 11: Michelin Tire Test Pressure Growth

Tire Pressure Growth Comparison				
(End Pressure - Start Pressure) of (Test Vehicle - Compare Vehicle)				
0.5		Steers (psi)		0.5
0.0	0.0	Drives-Front (psi)	0.0	-0.5
0.0	0.0	Drives-Rear (psi)	0.0	-0.5
0.5	0.0	Trailer-Front (psi)	0.0	0.5
0.0	0.0	Trailer-Rear (psi)	0.0	-0.5
0.0		Average Pressure Variance (psi)		
-0.5		Minimum Pressure Variance (psi)		
0.5		Maximum Pressure Variance (psi)		

Overall, tire pressures and growth were consistent and reliable between the tire test sets. The raw values can be found in the Appendix.

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 also more reliable for a fleet's real-world savings due to this unit not being affected by vehicle speed. The fuel savings from tires are nearly the same at 20 mph as they are at 65 mph (*i.e.* savings are nearly linear with speed). Therefore, it is important to use units of gal/1000 miles. To convert from MPG to gal/1000 miles, simply use 1000 divided by MPG (ex. 1000 / 7.15 MPG = 139.9 gal/1000 miles).

4.2: WEATHER CONDITIONS SUMMARY

Ambient temperature during testing ranged from 37°F to 70°F with winds ranging from 0-3 mph. Weather data was acquired from a local Weather Underground weather station and complete weather 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.

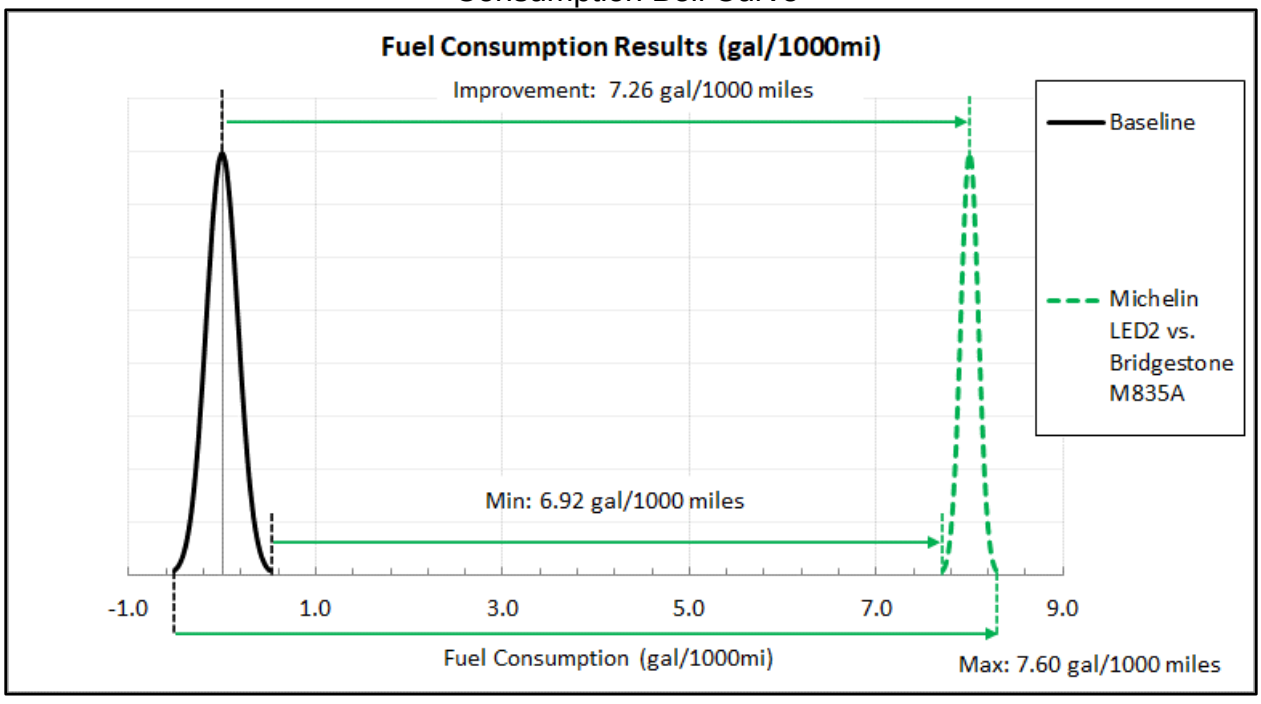
4.3: MEASUREMENT ACCURACY

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 11 below shows the statistical bell curves of the Michelin X One Line Energy D2 tire (drives only) versus Bridgestone M835A test result. The Baseline test (Michelin X One LED2) and the Bridgestone M835A test clearly show two separate bell curves, indicating the test had valid accuracy and the results were reliable. The graph shows the arrow pointing to the right illustrating more fuel used for the Bridgestone tires, meaning the baseline tire (Michelin X One LED2) by comparison, saved fuel. The distance between the peaks of the bell curves is the test result average, which was 7.26 gal/1000 miles. Minimum and maximum values were calculated as the test result plus or minus the accuracy values (7.26 +/- 0.34), which were 7.60 and 6.92 gal/1000 miles.

Figure 11: Michelin X One Line Energy D2 (drives only) vs. Bridgestone M835A 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

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: Michelin X One Line Energy D2 tire (drives only) fuel savings versus Bridgestone M835A (drives only) and 125,000 miles travelled annually:

$$Fuel\ Savings = (7.26\ gal/1000\ miles)x\ \frac{(125{,}000\ miles/year)}{1000} = 908\ gal/year$$

Therefore, the Michelin X One Line Energy D2 tire (drives only) would save 908 gallons of fuel per year for this vehicle travelling 125,000 miles.

5.1a: FINANCIAL SAVINGS CALCULATIONS

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[3] /gal. **Note**: MVTS uses average retail fuel prices from the year prior to the test being conducted. Fleets can use the formula below with an alternate fuel price if preferred.

$Savings\ (\$/year) = \left(908\ \frac{gal}{year}\right)\ x\ \left(\frac{\$2.551}{gal}\right) = \$2{,}317\ /year$ in fuel savings

Therefore, the Michelin X One Line Energy D2 tire (drives only) would save $2,317 per year in fuel for the vehicle travelling 125,000 miles.

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

5.2: TECHNOLOGY PAYBACK AND RETURN-ON-INVESTMENT

Buyers of fuel economy technologies are most interested in saving money. For a technology supplier to be successful, their technology must save their potential customers money and many fleets consider the number of months required for the technology to pay for itself as a buying qualification, which is referred to as 'payback' in trucking or sometimes ROI.

$$Payback\ (months) = \frac{(Product\ cost)}{(Savings\ (\$/year))}\ x\ (12\ months/year)$$

Where the 'Product cost' in the case of tires is the difference between the two brands. MVTS advises fleets to ensure they are comparing prices based on fleet size and not retail or a mixture of both.

Example @$200 'Price cost': Using example pricing with the Michelin X One Line Energy D2 tire (drives only) costing $200 more than the Bridgestone M835A (drives only):

$$Payback\ (months) = \frac{(\$200)}{(\$2{,}117\ /year)}\ x\ \left(12\frac{months}{year}\right) = 1.0\ months$$

Therefore, with a $200 per vehicle set difference in pricing, the Michelin X One Line Energy D2 tire (drives only) would pay for itself (i.e. payback or ROI) in 1.0 months. This is extremely fast by comparison to add-on technologies.

Example @$400 'Product cost':

$$Payback\ (months) = \frac{(\$400)}{(\$2{,}317\ /year)}\ x\ \left(12\frac{months}{year}\right) = 2.1\ months$$

Therefore, with a $400 per vehicle set difference in pricing, the Michelin X One Line Energy D2 tire (drives only) would pay for itself (i.e. payback or ROI) in 2.1 months. This is still very fast by comparison to add-on technologies.

Note: payback examples utilize an estimated 125,000 miles of usage for each brand. Tire wear and miles achieved is something the fleet may need to evaluate for themselves.

5.3: TECHNOLOGY PROFIT

Since saving money is the end goal, calculating profit is another important factor. **Note**: these calculations will consider fuel and purchase price only and not maintenance, or tire life. An assumption will be made for this example that both brands have equal tire life.

$$Profit\ (\$) = (Savings) - (Cost)$$

Example @$600 'Product cost': Using annual values from above.

$Profit\ (\$) = (\$2{,}317) - (\$200)$ = $2,117 saved per year, per vehicle.

If this were translated to a 1000-truck fleet, the profits would be $2.117M annual.

Therefore, the Michelin X One Line Energy D2 tire (drives only) could add $2,117 in profit per vehicle with 125,000 miles in travel. For a fleet of 1000 vehicles, this would equate to $2.117M.

Example @$400 'Product cost': Using annual values from above.

$Profit\ (\$) = (\$2{,}317) - (\$400)$ = $1,917 saved per year, per vehicle

If this were translated to a 1000-truck fleet, the profits would be $1.917M annual.

Therefore, the Michelin X One Line Energy D2 tire (drives only) could add $1,917 in profit per vehicle with 125,000 miles in travel. For a fleet of 1000 vehicles, this would equate to $1.917M.

Note: the profit calculations do not account for total cost-per-mile (CPM) that may include tire wear etc. The non-fuel economy related CPM items can be evaluated within the fleet and may vary between fleets.

5.4: FUEL SAVINGS FOR DIFFERENT GVW

A fleet that operates at a Gross Vehicle Weight (GVW) other than the 78,000 lbs. this test was conducted at can still calculate their fuel savings from MVTS test results. Units of gal/1000 miles must be used.

$$Fleet\ Fuel\ Savings = \frac{(Fleet\ GVW)}{(Test\ GVW)}\ x\ (MVTS\ Test\ Result)$$

Example: Fleet GVW = 47,500 lbs., comparing Bridgestone M835A (drives only) to Michelin X One Line Energy D2 tire (drives only):

$$Fleet\ Fuel\ Savings = \frac{(47{,}500)}{(78{,}000)}\ x\ \left(7.26\frac{gal}{1000}miles\right) = \mathbf{4.42}\frac{\boldsymbol{gal}}{\mathbf{1000}}\boldsymbol{miles}$$

Therefore, the fleet with an average GVW of 47,500 lbs. would see savings of 4.42 gal/1000 miles instead of 7.26 gal/1000 miles for the Michelin X One Line Energy D2 tire (drives only) versus the Bridgestone M835A (drives only).

Note: greater accuracy can be achieved by calculating with Drive axle weights instead of full vehicle.

6.0: CONCLUSION

The Michelin X One Line Energy D2 tire (drives only) had a fuel economy advantage over the Bridgestone M835A (drives only) of 7.26 gal/1000 miles (5.99%) with a GVW of 78,000 lbs.

After conducting many tires tests at MVT Solutions, savings of 7.26 gal/1000 miles between brands on drives is not surprising, despite all tires being labelled as fuel efficient SmartWay approved. Tires and rolling resistance contribute significantly to fuel consumption, and therefore provide great opportunity for savings. Tires can also provide an excellent ROI since the fleet is already purchasing tires and therefore fuel savings are acquired with little or no additional cost, as shown in the financial calculations section above.

Tires were tested in new condition, apart from a 500-mile break-in period. Therefore, the difference in fuel consumption tested will be the highest value in the life of the tire unless irregular wear were to occur. As tire tread depths decrease with miles driven, the difference in fuel consumption can also be expected to decrease. To quantify this decrease would require further testing as the tires wear, which was out of the scope of this test due to time, cost, and complexity. The Mesilla Valley Transportation fleet uses 'new condition' tire test values to make decisions on tires and fuel economy. Although the values will lessen over the life of the tires, the new condition test results provide a fast and consistent opportunity to quantify the differences in tires. In most cases, this filters the poor performing tires and narrows decision choices to one or two options.

Savings calculations compared the Michelin X One Line Energy D2 tire (drives only) to the Bridgestone M835A (drives only). Calculations showed that in 125,000 miles, the Michelin X One Line Energy D2 tire (drives only) would save 908 gallons of fuel at 78,000 GVW in comparison to the Bridgestone M835A (drives only). Using the 2020 average retail cost of diesel fuel of $2.551/gal, this equated to $2,317 per year in fuel savings. Using an example cost difference whereby the Michelin X One Line Energy D2 tire (drives only) were $200 more than the Bridgestone M835A for a set of four (4), the ROI (or Payback) was 1.0 month. Using a difference of $400 produced a Payback of 2.1 months. Using an assumption that both tire sets reached 125,000 miles tire life, the profit would be $2,117 with the $200 difference and $1,917 with the $400 difference. For a 1000-truck fleet, this equated to $2.117 Million and $1.917 Million per 125,000 miles for the $200 and $400 cost differences, respectively.

Fuel savings from an example GVW of 47,500 lbs. for the Michelin X One Line Energy D2 tire (drives only) compared to Bridgestone M835A (drives only) would be 4.42 gal/1000 miles instead of 7.26 gal/1000 miles, which occurred at 78,000 lbs. GVW.

7.0: APPENDIX

7.1: TEST VEHICLE DETAILS

Note: tire details for each test run can be found in the Tire Details and Pressures section.

Figure 12: Vehicle Info, Modified Vehicle

Date	November 30, 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):	25,198					
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)	11,280		33,400		33,460	
Total weight	78,140					
Photo/Video/Audio folder name:						
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					

7.2: COMPARE VEHICLE DETAILS

Figure 13: Vehicle Info, Compare Vehicle

Date	November 30, 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					
Mileage (miles):	25,324					
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)	11,400		33,180		33,560	
Total weight	78,140					
Photo/Video/Audio folder name:						
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					

7.3: TEST ROUTE

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

Figure 14: Pecos Test Track

7.4: TIRE DETAILS AND PRESSURES

Note: tire pressure values shown below were used to calculate the Pressure Comparison and Pressure Growth tables in the Test Results section.

7.4a: RUN 1: MICHELIN (DRIVES ONLY)

Figure 15: Run 1 Tire Details (Veh. B)

Veh. B: Michelin LED2 WBS Test Vehicle

		Truck	**B**	
LF:	**Wheel**	**Front Axle Tires**	**Wheel**	RF: Same
Michelin X Line Energy Z		Type		Michelin X Line Energy Z
275/80R22.5		Size		275/80R22.5
19	Aluminum	Tread Depth (32nds)	Aluminum	19
113.0		Pressure (psi) Start		112.5
117.5		Pressure (psi) End		117.0
115.3		**Pressure (psi) Avg.**		**114.8**
LF-Outer Drive:		**Drive Axle Tires**		RF-Outer Drive
Michelin X One Line Energy D2		Type		Michelin X One Line Energy D2
445/50R22.5		Size		445/50R22.5
20	Aluminum	Tread Depth (32nds)	Aluminum	20
114.5		Pressure (psi) Start		114.0
121.0		Pressure (psi) End		119.5
117.8		**Pressure (psi) Avg.**		**116.8**
LR-Outer Drive:		**Drive Axle Tires**		RR-Outer Drive
Michelin X One Line Energy D2		Type		Michelin X One Line Energy D2
445/50R22.5		Size		445/50R22.5
20	Aluminum	Tread Depth (32nds)	Aluminum	20
114.5		Pressure (psi) Start		115.0
121.5		Pressure (psi) End		121.0
118.0		**Pressure (psi) Avg.**		**118.0**
		Trailer		
LF-Outer Trailer:		**Tandem Front**		RF-Outer Trailer
X One Line Energy T2 Retread		Type		X One Line Energy T2 Retread
445/50R22.5		Size		445/50R22.5
14	Aluminum	Tread Depth (32nds)	Aluminum	14
115.0		Pressure (psi) Start		117.0
121.0		Pressure (psi) End		123.5
118.0		**Pressure (psi) Avg.**		**120.3**
LR-Outer Trailer:		**Tandem Rear**		RR-Outer Trailer
X One Line Energy T2 Retread		Type		X One Line Energy T2 Retread
445/50R22.5		Size		445/50R22.5
14	Aluminum	Tread Depth (32nds)	Aluminum	14
115.5		Pressure (psi) Start		116.5
121.5		Pressure (psi) End		123.0
118.5		**Pressure (psi) Avg.**		**119.8**

Figure 16: Run 1 Tire Details (Veh. A)

Veh. A: Michelin WBS Compare Vehicle				
		Truck	A	
LF:	Wheel	Front Axle Tires	Wheel	RF: Same
Michelin X Line Energy Z	Aluminum	Type	Aluminum	Michelin X Line Energy Z
275/80R22.5		Size		275/80R22.5
16		Tread Depth (32nds)		16
111.5		Pressure (psi) Start		111.5
115.5		Pressure (psi) End		115.5
113.5		**Pressure (psi) Avg.**		**113.5**
LF-Outer Drive:	Steel	Drive Axle Tires	Steel	RF-Outer Drive
Michelin X One Line Grip D		Type		Michelin X One Line Grip D
445/50R22.5		Size		445/50R22.5
27		Tread Depth (32nds)		27
113.5		Pressure (psi) Start		113.0
120.0		Pressure (psi) End		119.0
116.8		**Pressure (psi) Avg.**		**116.0**
LR-Outer Drive:	Steel	Drive Axle Tires	Steel	RR-Outer Drive
Michelin X One Line Grip D		Type		Michelin X One Line Grip D
445/50R22.5		Size		445/50R22.5
27		Tread Depth (32nds)		27
113.5		Pressure (psi) Start		113.5
120.5		Pressure (psi) End		120.0
117.0		**Pressure (psi) Avg.**		**116.8**
		Trailer		
LF-Outer Trailer:	Steel	Tandem Front	Steel	RF-Outer Trailer
X One Line Energy T2		Type		X One Line Energy T2
445/50R22.5		Size		445/50R22.5
12		Tread Depth (32nds)		12
113.5		Pressure (psi) Start		114.5
119.0		Pressure (psi) End		120.5
116.3		**Pressure (psi) Avg.**		**117.5**
LR-Outer Trailer:	Steel	Tandem Rear	Steel	RR-Outer Trailer
X One Line Energy T2		Type		X One Line Energy T2
445/50R22.5		Size		445/50R22.5
12		Tread Depth (32nds)		12
113.5		Pressure (psi) Start		113.5
119.5		Pressure (psi) End		120.5
116.5		**Pressure (psi) Avg.**		**117.0**

7.4b: RUN 2: BRIDGESTONE (DRIVES ONLY)

Figure 17: Run 2 Tire Details (Veh. B)

Veh. B: Bridgestone WBS Drives Test Vehicle				
		Truck	B	
LF:	Wheel	Front Axle Tires	Wheel	RF: Same
Michelin X Line Energy Z	Aluminum	Type	Aluminum	Michelin X Line Energy Z
275/80R22.5		Size		275/80R22.5
19		Tread Depth (32nds)		19
117.5		Pressure (psi) Start		117.5
119.0		Pressure (psi) End		118.5
118.3		**Pressure (psi) Avg.**		**118.0**
LF-Outer Drive:		**Drive Axle Tires**		RF-Outer Drive
Bridgestone Greatec M835A Ecopia	Aluminum	Type	Aluminum	Bridgestone Greatec M835A Ecopia
445/50R22.5		Size		445/50R22.5
23		Tread Depth (32nds)		23
122.5		Pressure (psi) Start		123.0
125.5		Pressure (psi) End		126.0
124.0		**Pressure (psi) Avg.**		**124.5**
LR-Outer Drive:		**Drive Axle Tires**		RR-Outer Drive
Bridgestone Greatec M835A Ecopia	Aluminum	Type	Aluminum	Bridgestone Greatec M835A Ecopia
445/50R22.5		Size		445/50R22.5
23		Tread Depth (32nds)		23
120.5		Pressure (psi) Start		123.5
124.0		Pressure (psi) End		127.0
122.3		**Pressure (psi) Avg.**		**125.3**
		Trailer		
LF-Outer Trailer:		**Tandem Front**		RF-Outer Trailer
X One Line Energy T2 Retread	Aluminum	Type	Aluminum	X One Line Energy T2 Retread
445/50R22.5		Size		445/50R22.5
14		Tread Depth (32nds)		14
121.0		Pressure (psi) Start		123.5
122.5		Pressure (psi) End		125.0
121.8		**Pressure (psi) Avg.**		**124.3**
LR-Outer Trailer:		**Tandem Rear**		RR-Outer Trailer
X One Line Energy T2 Retread	Aluminum	Type	Aluminum	X One Line Energy T2 Retread
445/50R22.5		Size		445/50R22.5
14		Tread Depth (32nds)		14
121.5		Pressure (psi) Start		123.0
123.5		Pressure (psi) End		124.5
122.5		**Pressure (psi) Avg.**		**123.8**

Figure 18: Run 2 Tire Details (Veh. A)

Veh. A: Michelin WBS Compare Vehicle

		Truck	**A**	
LF:	**Wheel**	**Front Axle Tires**	**Wheel**	RF: Same
Michelin X Line Energy Z		Type		Michelin X Line Energy Z
275/80R22.5		Size		275/80R22.5
16	Aluminum	Tread Depth (32nds)	Aluminum	16
115.5		Pressure (psi) Start		116.0
117.0		Pressure (psi) End		117.0
116.3		**Pressure (psi) Avg.**		**116.5**
LF-Outer Drive:		**Drive Axle Tires**		RF-Outer Drive
Michelin X One Line Grip D		Type		Michelin X One Line Grip D
445/50R22.5		Size		445/50R22.5
27	Steel	Tread Depth (32nds)	Steel	27
120.0		Pressure (psi) Start		120.0
121.0		Pressure (psi) End		121.5
120.5		**Pressure (psi) Avg.**		**120.8**
LR-Outer Drive:		**Drive Axle Tires**		RR-Outer Drive
Michelin X One Line Grip D		Type		Michelin X One Line Grip D
445/50R22.5		Size		445/50R22.5
27	Steel	Tread Depth (32nds)	Steel	27
120.0		Pressure (psi) Start		120.0
121.5		Pressure (psi) End		121.0
120.8		**Pressure (psi) Avg.**		**120.5**
		Trailer		
LF-Outer Trailer:		**Tandem Front**		RF-Outer Trailer
X One Line Energy T2		Type		X One Line Energy T2
445/50R22.5		Size		445/50R22.5
12	Steel	Tread Depth (32nds)	Steel	12
119.5		Pressure (psi) Start		120.5
121.0		Pressure (psi) End		121.5
120.3		**Pressure (psi) Avg.**		**121.0**
LR-Outer Trailer:		**Tandem Rear**		RR-Outer Trailer
X One Line Energy T2		Type		X One Line Energy T2
445/50R22.5		Size		445/50R22.5
12	Steel	Tread Depth (32nds)	Steel	12
119.5		Pressure (psi) Start		120.5
121.0		Pressure (psi) End		121.5
120.3		**Pressure (psi) Avg.**		**121.0**

7.5: WEATHER CONDITIONS

Weather during testing was fair with low wind. Weather data was acquired from a local Weather Underground weather station. Source shown below table.

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 12: Weather Data, December 1, 2021

Time	Temperature	Dew Point	Humidity	Wind	Wind Speed	Wind Gust	Pressure	Precip.	Condition
7:15 AM	37 °F	27 °F	66 %	CALM	0 mph	0 mph	27.45 in	0.0 in	Fair
7:35 AM	37 °F	27 °F	65 %	CALM	0 mph	0 mph	27.46 in	0.0 in	Fair
7:55 AM	37 °F	27 °F	66 %	CALM	0 mph	0 mph	27.46 in	0.0 in	Fair
8:15 AM	38 °F	27 °F	65 %	ESE	3 mph	0 mph	27.46 in	0.0 in	Fair
8:35 AM	42 °F	29 °F	59 %	CALM	0 mph	0 mph	27.47 in	0.0 in	Fair
8:55 AM	45 °F	29 °F	55 %	CALM	0 mph	0 mph	27.47 in	0.0 in	Fair
9:15 AM	48 °F	31 °F	50 %	CALM	0 mph	0 mph	27.48 in	0.0 in	Fair
9:35 AM	51 °F	31 °F	46 %	CALM	0 mph	0 mph	27.48 in	0.0 in	Fair
9:55 AM	53 °F	31 °F	43 %	S	3 mph	0 mph	27.49 in	0.0 in	Fair
10:15 AM	56 °F	32 °F	39 %	CALM	0 mph	0 mph	27.49 in	0.0 in	Fair
10:35 AM	58 °F	32 °F	37 %	CALM	0 mph	0 mph	27.48 in	0.0 in	Fair
10:55 AM	60 °F	32 °F	35 %	CALM	0 mph	0 mph	27.48 in	0.0 in	Fair
11:15 AM	61 °F	32 °F	33 %	CALM	0 mph	0 mph	27.48 in	0.0 in	Fair
11:35 AM	64 °F	32 °F	30 %	CALM	0 mph	0 mph	27.47 in	0.0 in	Fair
11:55 AM	65 °F	32 °F	29 %	CALM	0 mph	0 mph	27.46 in	0.0 in	Fair
12:15 PM	67 °F	33 °F	28 %	CALM	0 mph	0 mph	27.45 in	0.0 in	Fair
12:35 PM	69 °F	32 °F	26 %	SSE	3 mph	0 mph	27.45 in	0.0 in	Fair
12:55 PM	69 °F	33 °F	26 %	CALM	0 mph	0 mph	27.44 in	0.0 in	Fair
1:15 PM	70 °F	33 °F	26 %	CALM	0 mph	0 mph	27.43 in	0.0 in	Fair
1:35 PM	71 °F	34 °F	26 %	CALM	0 mph	0 mph	27.42 in	0.0 in	Fair
1:55 PM	72 °F	34 °F	25 %	CALM	0 mph	0 mph	27.42 in	0.0 in	Fair

Source: https://www.wunderground.com/history/daily/us/tx/pecos/KPEQ/date/2021-12-1

7.6: PRODUCT DETAILS

- Michelin Tires North America
  One Parkway South, Greenville, SC 29615 USA
  www.michelintruck.com

- Bridgestone Commercial
  200 4th Ave S, Nashville, TN 37201
  www.commercial.bridgestone.com

7.7: TEST PERSONNEL

7.7a: MVT SOLUTIONS

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

7.7b: DRIVERS

- Allan Dahringer
- Ron Knowles
- Carlos Aragon
- Jack Burchell

7.7c: MICHELIN

- Bill Walmsley, Product Category Manager: Line Haul & Coach Tires
  Business Line - Long Distance Transportation
- Jim Garrett, AMN B2B Product Marketing
  Long Distance Transportation (LB4)

7.8: MVT SOLUTIONS CONTACT INFO

Daryl Bear, Lead Engineer & COO
Daryl.Bear@m-v-t-s.com
317-603-9325

Jacob Schwartz, Test Engineer
Jacob.Schwartz@m-v-t-s.com
575-288-3342

Jonathan Ruppert, Test Engineer
Jonathan.Ruppert@m-v-t-s.com
575-405-5015