MESILLA VALLEY TRANSPORTATION SOLUTIONS CERTIFIED
Fuel Economy Experts

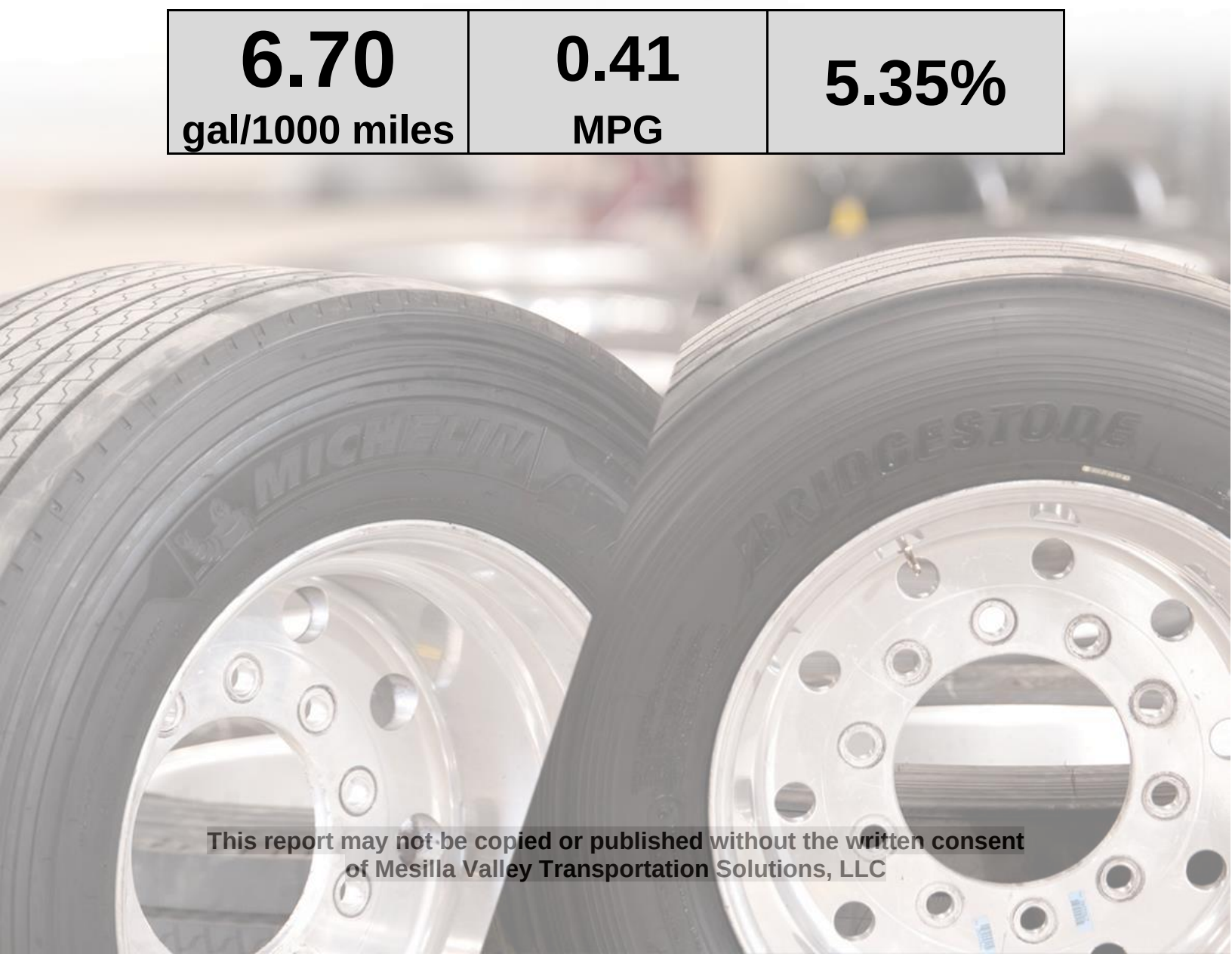
TEST REPORT

MVT SOLUTIONS CERTIFIED™ FUEL ECONOMY TEST

MARCH 2020

MICHELIN X ONE WIDE BASED SINGLE TIRES

6.70	0.41	5.35%
gal/1000 miles	MPG	



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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 and Bridgestone Greatec. Tire were tested as a full vehicle set, including eight (8) WBS and two (2) Steer tires of each respective brand. The **Michelin X One tire package saved 6.70 gal/1000 miles (5.35%) compared to the Bridgestone Greatec package.** Testing was conducted on a 9-mile test track at 65 miles per hour and a Gross Vehicle Weight (GVW) of 72,000 lbs. Tires were EPA SmartWay approved and considered the most 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 full vehicle sets as shown in Table 2 below.

Table 1: Results Summary

	Fuel Economy Improvement		
	Gal/1000 miles	MPG	Percent
Michelin X Ones vs. Bridgestone Greatec	**6.70**	0.41	5.35%

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**
Steer	LRG X Line Energy Z	275/80R22.5
Drive	LRL X One Line Energy D	445/50R22.5
Trailer	LRL X One Line Energy T	445/50R22.5
Bridgestone		
	Model	**Size**
Steer	LRG R284 Ecopia	295/75R22.5
Drive	LRL Greatec M835A Ecopia	445/50R22.5
Trailer	LRL Greatec R197 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 sourcing, purchasing, mounting, break-in miles, and testing. MVT Solutions is an unbiased, independent third-party testing organization.

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.

Contents

1.0: Introduction 1
2.0: Test Summary 1
3.0: Procedure 6
3.1: Tires Tested 6
3.2: Tire sourcing & Mounting 11
3.3: Tire Break-in 12
3.3a: Break-in Route 14
3.4: Test Run Tire Preparation 16
3.5: Fuel Economy Test Procedure 17
3.6: Test Vehicles 17
3.7: Vehicle Fuel Economy Test Equipment 18
4.0: Test Results 20
4.1: Units of Measurement 24
4.2: Weather Conditions Summary 24
4.3: Measurement Accuracy 25
5.0: Savings Calculations 26
5.1: Fuel Savings Calculations 26
5.1a: Financial Savings Calculations 26
5.2: Technology Payback and Return-On-Investment 27
5.3: Technology Profit 28
5.4: Fuel Savings for Different GVW 28
6.0: Conclusion 29
Appendix 30
6.1: Test Vehicle Details 30
6.2: Compare Vehicle Details 31
6.3: Test Route 32
6.4: Tire Details and Pressures 33
6.4a: Run 1: Bridgestone 33
6.4b: Run 2: Michelin 35
6.5: Weather Conditions 37
6.6: Product Details 39
6.7: Test Personnel 39
6.7a: MVT Solutions 39
6.7b: Drivers 39

6.7c: Michelin 39
6.8: MVT Solutions Contact Info 39

Figures

Figure 1: Tire Position/Label Map 7
Figure 2: Michelin Steer (Position 1) 8
Figure 3: Michelin Drive (Position 4 & 6) 8
Figure 4: Michelin Trailer (Position 11 & 13) 9
Figure 5: Bridgestone Steer (Position 1) 9
Figure 6: Bridgestone Drive (Position 6) 10
Figure 7: Bridgestone Trailer (Position 7 & 9) 10
Figure 8: Test and Break-in Ballast (72,000 lbs. GWV) 12
Figure 9: Tire Change at MVT Shop for Break-in Miles 13
Figure 10: Break-in Route 14
Figure 11: Test Vehicle Leaving MVT Shop for Break-in Miles 15
Figure 12: MVTS employee checking tire pressure 16
Figure 13: Test Vehicles 18
Figure 14: Test Trailers 18
Figure 15: Aerodynamic Sensors 19
Figure 16: Data Acquisition System 19
Figure 17: Fuel Flow Meter 19
Figure 18: Tire Temp. Sensor 19
Figure 19: Michelin X Ones vs. Bridgestone Greatec Fuel Consumption Bell Curve 25
Figure 20: Vehicle Info, Modified Vehicle 30
Figure 21: Vehicle Info, Compare Vehicle 31
Figure 22: Pecos Test Track 32
Figure 23: Run 1 Tire Details (Veh. A) 33
Figure 24: Run 1 Tire Details (Veh. B) 34
Figure 25: Run 2 Tire Details (Veh. A) 35
Figure 26: Run 2 Tire Details (Veh. B) 36

Tables

Table 1: Results Summary 1
Table 2: Tire Test Sets 2
Table 3: Test Tire Info 6
Table 4: Wheels and Balancing 11
Table 5: Warm-up and Test Laps 17
Table 6: Fuel Economy Improvement Summary 20
Table 7: Bridgestone Test Tire Pressures Comparison (Compare – Test Vehicle) 21
Table 8: Bridgestone Tire Test Pressure Growth 22
Table 9: Michelin Test Tire Pressures Comparison (Compare – Test Vehicle) 22
Table 10: Michelin Tire Test Pressure Growth 23
Table 11: Test Run Times 37
Table 12: Weather Data, Mar. 11 38

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 purchased new for this test and received 500 break-in miles prior to testing. All Drive and Trailer tires were the same size at 445/50 R22.5. Steer tires were 295/75 R22.5 for Bridgestone and Michelin Steers were 275/80 R22.5.

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

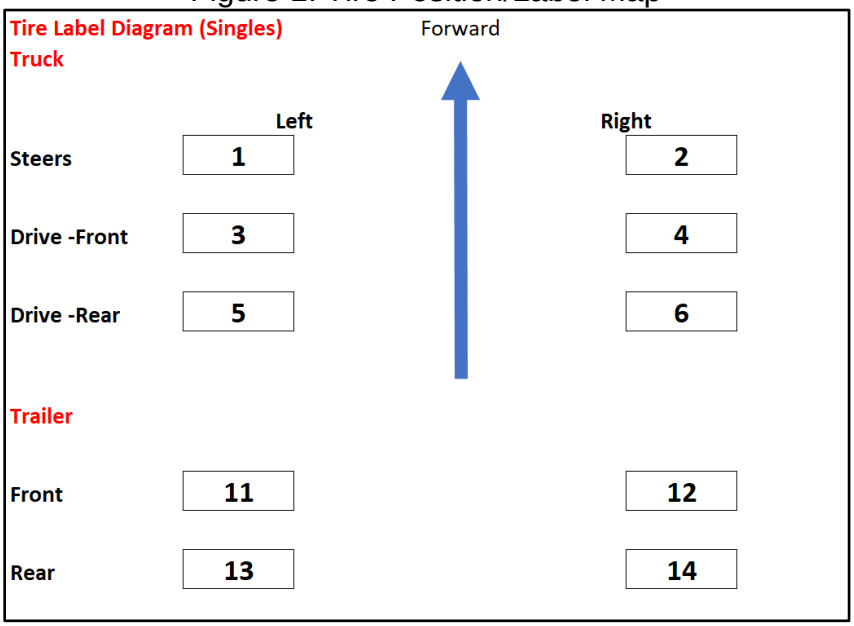
Michelin				
	Model	**Size**	**Rev/Mile**	**Tread Depth (32nds)**
Steer	LRG X Line Energy Z	275/80R22.5		19
Drive	LRL X One Line Energy D	445/50R22.5	517	24
Trailer	LRL X One Line Energy T	445/50R22.5		13
Bridgestone				
	Model	**Size**	**Rev/Mile**	**Tread Depth (32nds)**
Steer	LRG R284 Ecopia	295/75R22.5		18
Drive	LRL Greatec M835A Ecopia	445/50R22.5	524	23
Trailer	LRL Greatec R197 Ecopia	445/50R22.5		11
Veh. B: Compare Vehicle: Michelin Duals				
	Model	**Size**	**Rev/Mile**	**Tread Depth (32nds)**
Steer	LRG X Line Energy Z	275/80R22.5		19
Drive	LRG XDA Energy + (duals)	275/80R22.5	512	22
Trailer	LRG X Line Energy T (duals)	275/80R22.5		12

All tires were tested on the same truck and trailer, termed the 'Test' vehicle (Veh. A). A second vehicle, the 'Compare' vehicle, remained unchanged throughout testing and is denoted as 'Veh. B: Compare Vehicle' in the table above. The Compare vehicle utilized a Michelin dual tire package, which was spec on the MVT vehicles used for testing at the time (MVT has a mixture of dual and WBS). This included X Line Energy Z steers, XDA Energy + drive tires and X Line Energy T trailer tires. Using fuel efficient dual tires on the Compare vehicle during a WBS test did not impede the test validity in any way, as the tire pressure comparison will show. Results will also show there was a significant difference

in the WBS brands, which negates any challenge that could be raised about the difference in duals versus WBS for this test. 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: Michelin Steer (Position 1)

Figure 3: Michelin Drive (Position 4 & 6)

Figure 4: Michelin Trailer (Position 11 & 13)

Figure 5: Bridgestone Steer (Position 1)

Figure 6: Bridgestone Drive (Position 6)

Figure 7: Bridgestone Trailer (Position 7 & 9)

3.2: TIRE SOURCING & MOUNTING

All test tires were purchased through regular supply chains, which were sourced independently by MVT Solutions through Border Tire in Las Cruces, NM. This ensured tire manufacturers were not involved in sourcing or supply of the tires.

Border Tire mounted and balanced all Steer tires. Drive and Trailer tires were mounted in the MVT shop with a single technician. 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

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

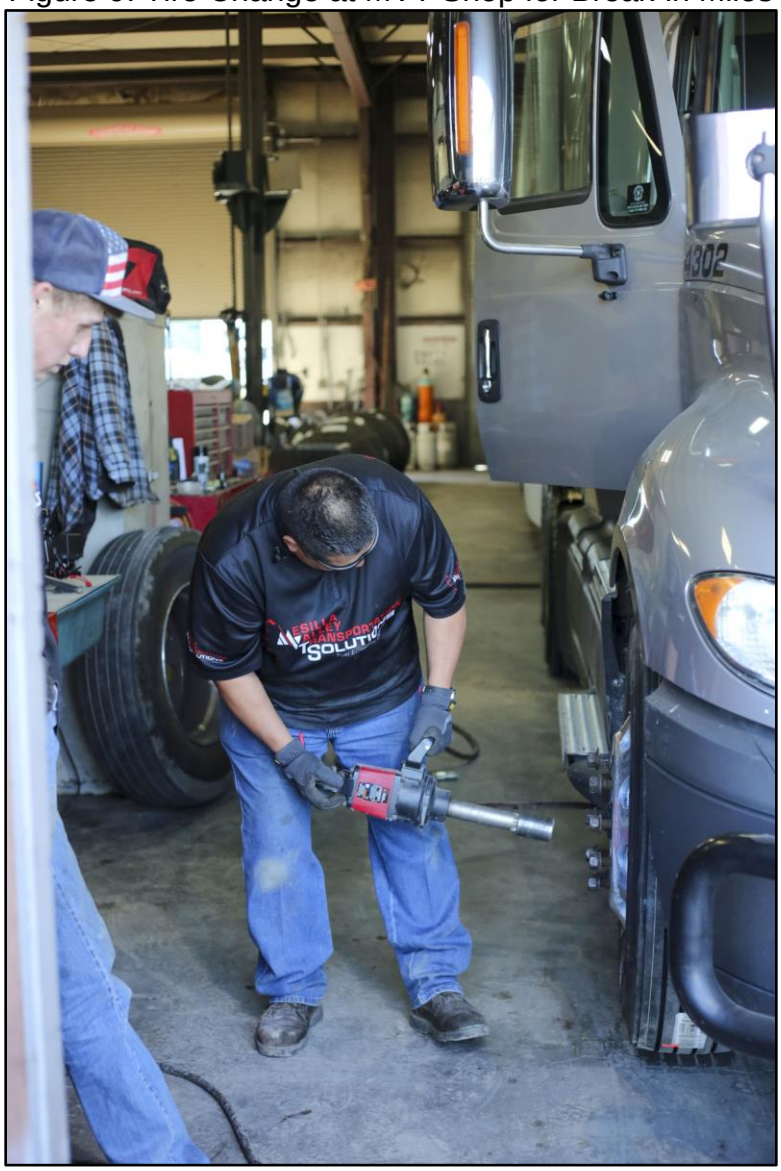
3.3: TIRE BREAK-IN

All tires received a break-in distance of 500.3 miles in the weeks prior to testing. A distance of 500 miles was chosen due to industry standard expectations for tire consistency[1] and break-in. All tires had break-in miles using the same truck, trailer, driver, route, and load to ensure consistency.

Figure 8: Test and Break-in Ballast (72,000 lbs. GWV)

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

Figure 9: Tire Change at MVT Shop for Break-in Miles



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.

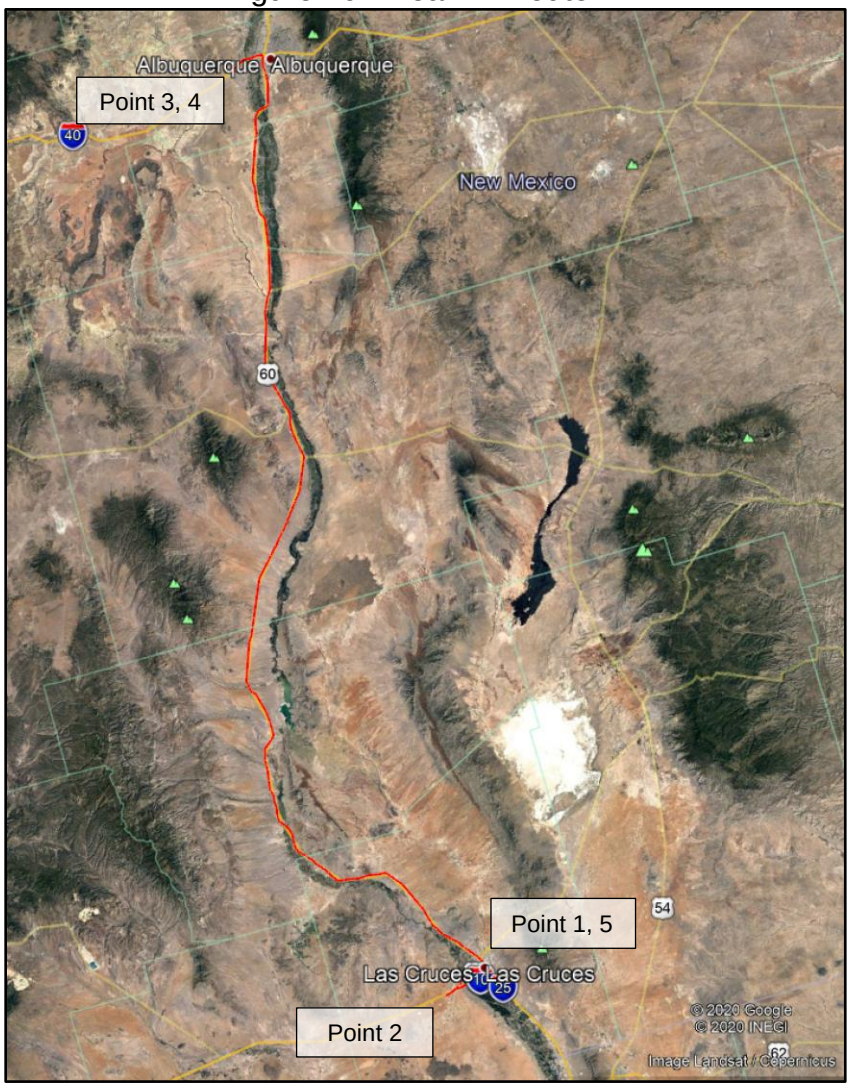
3.3a: BREAK-IN ROUTE

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 10.

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 66 Casino, Route 66 Casino Hotel, 14500 Central Ave SW, Rio Puerco, Albuquerque, NM 87121 (**250 miles**)
4. Stop for 30 minutes to allow tires cool
5. Return to 3530 W. Picacho Ave., Las Cruces, NM (**244 miles**)
6. Total Distance **500.3 miles**

Upon completion of the break-in miles, the truck and trailer were parked overnight in the MVT yard. In the morning, the break-in process was repeated for the next set of tires.

Figure 10: Break-in Route



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

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

Figure 11: Test Vehicle Leaving MVT Shop for Break-in Miles

3.4: Test Run Tire Preparation

For the fuel economy test, all test tires were placed in the shop at the test track and laid flat on the floor 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 set the night before testing to ensure air would not be added prior to testing since the tires would cool overnight and pressures would decrease.

At 5am of the test day, all tire pressures were set to 100.0 psi. This time was chosen to ensure complete darkness and no sunlight affect on any tires. This included the tires mounted on the Compare vehicle, which remained on that vehicle and parked outside of the shop overnight.

Each vehicle had a its own corresponding digital tire pressure gauge, which remained with that vehicle throughout the test. These gauges were brand new and accurate to 0.5 psi.

Figure 12: MVTS employee checking tire pressure

Tire pressures were not adjusted after 5am the morning of the test runs, they were only checked to verify and record pressure values.

Tires on Vehicle B, the Compare vehicle with dual tires, were not changed during testing. Vehicle A, the Test vehicle, had its tires changed for each 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 each tire set tested.

The test procedure was as follows:

A) Complete five (5) 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 is used for test results
D) End test run. Record tire pressures (18 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	17	18	
Check Pressures	Warm-up Laps					Stop. Check Pressure. Accelerate.	Test Laps 1-12												End Test. Pit. Check Pressures.

Note that lap 6 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 2015 International LT's with Cummins ISX 15-Liter engines and Eaton 10-Speed Automated Manual Transmissions (AMT). Trailers were 53' Hyundai dry vans. Gross Vehicle Weight (GVW) was 72,000 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. The Compare vehicle used dual tires, whereas the Test vehicle used Wide Based Single (WBS) tires since they were the tested product. 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 piece 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 13: Test Vehicles

Figure 14: Test Trailers

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 15: Aerodynamic Sensors

Figure 16: Data Acquisition System

Figure 17: Fuel Flow Meter

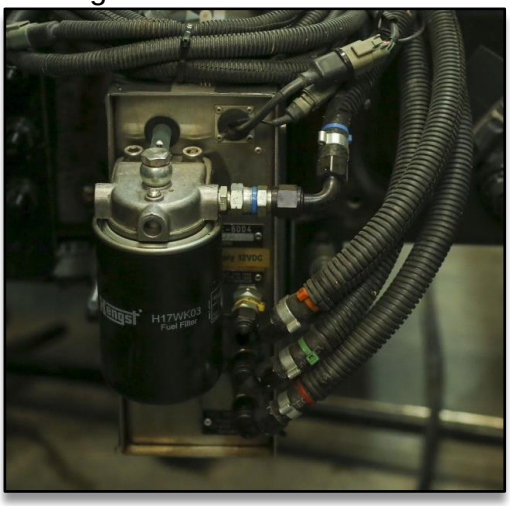
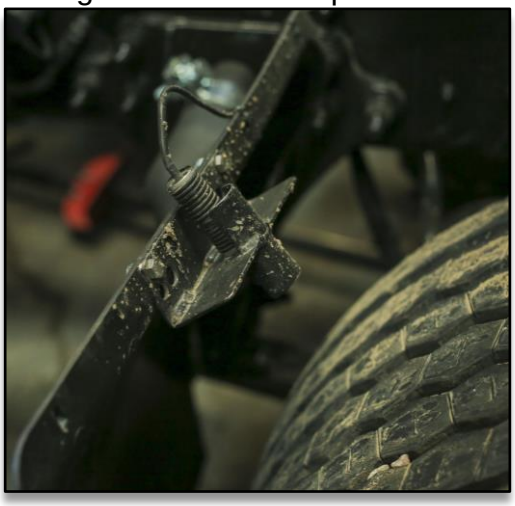


Figure 18: Tire Temp. Sensor



4.0: TEST RESULTS

Compared to the Michelin X One tire package, the Bridgestone Greatec packages used 6.70 gal/1000 miles (5.35%) more fuel at 65 mph and 72,000 lbs. GVW.

The reader should be aware that since Steer tires were part of each tire package, they would have an impact on the overall fuel economy results. However, the impact of Steer tires is generally small compared to the Drive and Trailer axles due mainly to the lower load on the Steer axle. Secondly, the test was conducted as a complete brand package (*i.e.* all wheel positions) since fleets spec their equipment in that manner. Overall, the affect of the Steer tires was considered minimal and the focus of the test and results was placed on the WBS tires of the Drive and Trailer axles.

Table 6: Fuel Economy Improvement Summary

	Fuel Economy Improvement		
	Gal/1000 miles	MPG	Percent
Michelin X Ones vs. Bridgestone Greatec	**6.70**	0.41	5.35%
Accuracy	**+/-0.49**	+/-0.03	+/-0.39

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 8 shows the average pressure variance was -1.6 psi, the minimum was -2.5 psi, and the maximum was -0.5 psi. This is considered consistent and reliable.

Table 7: Bridgestone Test Tire Pressures Comparison (Compare – Test Vehicle)

Average Tire Pressure Comparison				
(Compare Vehicle - Test Vehicle)				
-3.0		Steers (psi)		-3.8
-6.3		Drives-Front (psi)		-7.5
-7.5		Drives-Rear (psi)		-7.8
-4.1		Trailer-Front (psi)		-7.5
-6.5		Trailer-Rear (psi)		-7.5
-6.1		Average Pressure Variance (psi)		
-7.8		Minimum Pressure Variance (psi)		
-3.0		Maximum Pressure Variance (psi)		

Table 8: Bridgestone Tire Test Pressure Growth

Tire Pressure Growth Comparison				
(End Pressure - Start Pressure) of (Compare Vehicle - Test Vehicle)				
-1.0		Steers (psi)		-0.5
-1.0		Drives-Front (psi)		-2.5
-2.0		Drives-Rear (psi)		-2.5
-2.0		Trailer-Front (psi)		-1.0
-1.5		Trailer-Rear (psi)		-1.5
-1.6		Average Pressure Variance (psi)		
-2.5		Minimum Pressure Variance (psi)		
-0.5		Maximum Pressure Variance (psi)		

Similar to the previous tire tests, the Michelin X One tire pressures were also consistent. Table 9 shows the tire pressure comparison and indicates values similar to the Bridgestone test in terms of average, minimum, and maximum variance. Table 10 shows the pressure growth was also consistent with the other tire tests with an average of -1.0 psi, a minimum of -2.0 psi, and maximum of 0.0 psi.

Table 9: Michelin Test Tire Pressures Comparison (Compare – Test Vehicle)

Average Tire Pressure Comparison				
(Compare Vehicle - Test Vehicle)				
-2.5		Steers (psi)		-2.5
-4.1		Drives-Front (psi)		-5.1
-4.0		Drives-Rear (psi)		-4.9
-5.1		Trailer-Front (psi)		-5.8
-3.9		Trailer-Rear (psi)		-4.5
-4.2		Average Pressure Variance (psi)		
-5.8		Minimum Pressure Variance (psi)		
-2.5		Maximum Pressure Variance (psi)		

Table 10: Michelin Tire Test Pressure Growth

Tire Pressure Growth Comparison				
(End Pressure - Start Pressure) of (Compare Vehicle - Test Vehicle)				
0.0		Steers (psi)		0.0
-0.5		Drives-Front (psi)		-1.5
0.0		Drives-Rear (psi)		-1.5
-2.0		Trailer-Front (psi)		-1.5
-1.5		Trailer-Rear (psi)		-1.5
-1.0		Average Pressure Variance (psi)		
-2.0		Minimum Pressure Variance (psi)		
0.0		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) or percent (%). Those units are prone to error from changing variables such as vehicle baseline fuel economy, load, driver behavior, and duty cycle. For example, a vehicle achieving 9 MPG with a highly aerodynamic configuration will save the same gal/1000 miles as a vehicle achieving 6 MPG. However, the percent fuel savings will be different since that is based on the baseline fuel economy and the 6 MPG vehicle will use more fuel, which will make the percent savings value lower.

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

Temperatures ranged from 68.0°F to 83.0°F. Winds ranged from 0 mph to 12 mph. 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.

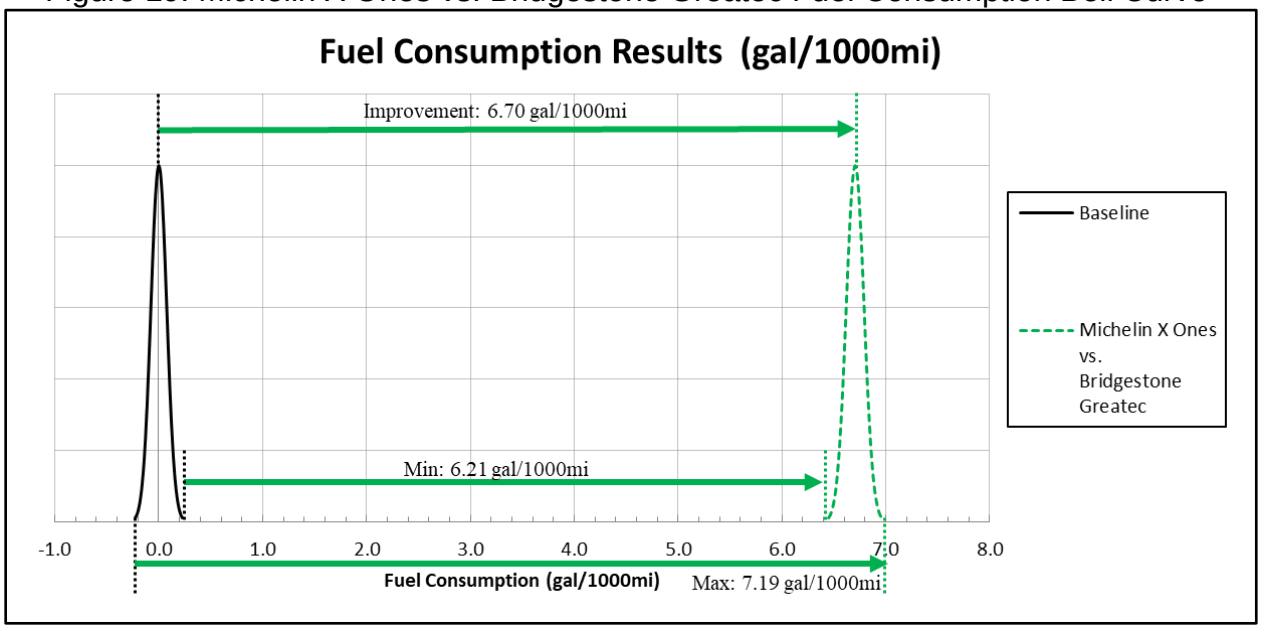
4.3: MEASUREMENT ACCURACY

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 19 below shows the statistical bell curves of the Michelin X Ones versus Bridgestone Greatec test result. The Baseline test (Michelin X Ones) and the Bridgestone Greatec 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 Ones) by comparison, saved fuel. The distance between the peaks of the bell curves is the test result average, which was 6.70 gal/1000 miles. Minimum and maximum values were calculated as the test result plus or minus the accuracy values (6.70 +/- 0.49), which were 7.19 and 6.21 gal/1000 miles.

Figure 19: Michelin X Ones vs. Bridgestone Greatec 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 WBS package fuel savings versus Bridgestone WBS package and 125,000 miles travelled annually:

$$Fuel\ Savings = (6.70\ gal/1000\ miles)x\frac{(125{,}000\ miles/year)}{1000} = 837.50\ gal/year$$

Therefore, the Michelin X One package would save 837.50 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 2019, $3.056[2] /gal

$Savings\ (\$/year) = \left(837.50\frac{gal}{year}\right)\ x\ \left(\frac{\$3.056}{gal}\right) = \$2{,}559.40\ /year$ in fuel savings

Therefore, the Michelin X One package would save $2,559.40 per year in fuel for the vehicle travelling 125,000 miles.

[2] 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 @$600 'Price cost': Using example pricing with the Michelin WBS package costing $600 more than the Bridgestone WBS package:

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

$$Payback\ (months) = \frac{(\$600)}{(\$2{,}559.40\ /year)}\ x\ \left(12\frac{months}{year}\right) = 2.8\ months$$

Therefore, with a $600 per vehicle set difference in pricing, the Michelin X One tire package would pay for itself (i.e. payback or ROI) in 2.8 months. This is extremely fast by comparison to add-on technologies.

Example @$1000 'Product cost':

$$Payback\ (months) = \frac{(\$1000)}{(\$2{,}559.40\ /year)}\ x\ \left(12\frac{months}{year}\right) = 4.7\ months$$

Therefore, with a $1000 per vehicle set difference in pricing, the Michelin X One tire package would pay for itself (i.e. payback or ROI) in 4.7 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.

$Profit\ (\$) = (\$2{,}559.40) - (\$600)$ = $1,959.40 saved per year, per vehicle.

If this were translated to a 1000-truck fleet, the profits would be $1.96M annual.

Therefore, the Michelin X One package could add $1,959.40 in profit per vehicle with 125,000 miles in travel. For a fleet of 1000 vehicles, this would equate to $1.96M.

Example @$1000 'Product cost': Using annual values from above.

$Profit\ (\$) = (\$2{,}559.40) - (\$1000)$ = $1,559.40 saved per year, per vehicle

If this were translated to a 1000-truck fleet, the profits would be $1.56M annual.

Therefore, the Michelin X One package could add $1,559.40 in profit per vehicle with 125,000 miles in travel. For a fleet of 1000 vehicles, this would equate to $1.56M.

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 72,000 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 to Michelin WBS

$$Fleet\ Fuel\ Savings = \frac{(47{,}500)}{(72{,}000)}\ x\ \left(6.70\frac{gal}{1000}miles\right) = \mathbf{4.42}\frac{\boldsymbol{gal}}{\mathbf{1000}}\boldsymbol{miles}$$

Therefore, the fleet with an average GVW of 47,500 lbs. would see savings of 4.42 gal/1000 miles instead of 6.70 gal/1000 miles for the Michelin X One package versus the Bridgestone Greatec package.

Note: there can be some variation based on individual axle weights. Calculating based on each axle type (Steer, Drive, Trailer) is ideal; however, would require tests conducted for each axle type individually, which was not done for this test.

6.0: CONCLUSION

The Michelin X One package had a fuel economy advantage over the Bridgestone Greatec package of 6.70 gal/1000 miles (5.35%). These values also include the Steer tires of the respective brands, which were not tested independently due to the Steer tires having minor impact on fuel economy due to smaller relative axle loads and the tendency of most fleets utilizing a single brand of tire in all wheel positions.

After conducting many tires tests at MVT Solutions, savings of 6.70 gal/1000 miles between brands 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.

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 Ones package to the Bridgestone Greatec package. Calculations showed that in 125,000 miles, the Michelin X One package would save 837.50 gallons of fuel at 72,000 GVW in comparison to the Bridgestone Greatec package. Using the 2019 average retail cost of diesel fuel of $3.056/gal, this equated to $2,559.40 per year in fuel savings. Using an example cost difference whereby the Michelin package was $600 more than the Bridgestone Greatec package, the ROI (or Payback) was 2.8 months. Using a difference of $1000 produced a Payback of 4.7 months. Using an assumption that both tires sets reached 125,000 miles tire life, the profit would be $1,959.40 with the $600 difference and $1,559.40 with the $1000 difference. For a 1000-truck fleet, this equated to $1.959 Million and $1.559 Million per 125,000 miles for the $600 and $1000 cost differences, respectively.

Fuel savings from an example GVW of 47,500 lbs. for the Michelin X One compared to Bridgestone Greatec would be 4.42 gal/1000 miles instead of 6.70 gal/1000 miles, which occurred at 72,000 lbs. GVW.

APPENDIX

6.1: TEST VEHICLE DETAILS

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

Figure 20: Vehicle Info, Modified Vehicle

Date	March 11, 2020					
Company	Mesilla Valley Transportation					
Location	Pecos, Texas					
Test Route	Pecos 9-mile Test Track					
TRUCK ID:	4302					
Brand	International					
Year	2015					
Model	LT					
Engine	Cummins X15					
VIN	3HSDJAPRXFN556641					
Mileage (miles):	650,767					
Transmission	Eaton 10-Speed					
Rear Gear	2.64					
Fuel Load	Full at start					
Fuel Type & Batch	No. 2 Diesel					
Axle Weights	12,040		29,880		30,120	
Total weight	72,040					
No aero.						
Photo/Video/Audio folder name:						
TRAILER ID:	7543					
Model	Hyundai Composite XT					
VIN	3H3V532C0LT401199					
Year	2019					
Size	53' Dry Van					
Trailer Gap (inches)						
Add-ons	Greenwing skirts.					

6.2: COMPARE VEHICLE DETAILS

Figure 21: Vehicle Info, Compare Vehicle

Date	March 11, 2020					
Company	Mesilla Valley Transportation					
Location	Pecos, Texas					
Test Route	Pecos 9-mile Test Track					
TRUCK ID:	**4303**					
Brand	International					
Year	2015					
Model	LT					
Engine	Cummins X15					
VIN	3HSDJAPR4FN726119					
Mileage (miles):	541,682					
Transmission	Eaton 10-Speed					
Rear Gear	2.64					
Fuel Load	Full at start					
Fuel Type & Batch	No. 2 Diesel					
Axle Weights	12,020		30,040		29,940	
Total weight	72,000					
No aero.						
Photo/Video/Audio folder name:						
TRAILER ID:	**7423**					
Model	Hyundai Composite XT					
VIN	3H3V532C7LT401104					
Year	2019					
Size	53' Dry Van					
Trailer Gap (inches)						
Add-ons	Greenwing skirts.					

6.3: TEST ROUTE

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

Figure 22: Pecos Test Track

6.4: TIRE DETAILS AND PRESSURES

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

6.4a: RUN 1: BRIDGESTONE

Figure 23: Run 1 Tire Details (Veh. A)

Veh. A: Bridgestone WBS (All Positions)

			Truck	4302			
LF:	Bridgestone WBS		Front Axle Tires			Bridgestone WBS	RF: Same
Bridgestone R284 Ecopia			Type				Bridgestone R284 Ecopia
295/75R22.5			Size				295/75R22.5
18/32			Tread Depth (32nds)				18/32
116.5			Pressure (psi) Start				118.0
118.5			Pressure (psi) End				119.0
117.5			**Pressure (psi) Avg.**				**118.5**
LF-Outer Drive:		Bridgestone WBS	**Drive Axle Tires**	Bridgestone WBS			RF-Outer Drive
Bridgestone Greatec M835A Ecopia			Type				Bridgestone Greatec M835A Ecopia
445/50R22			Size				445/50R22
24/32			Tread Depth (32nds)				24/32
118.0			Pressure (psi) Start				120.0
120.0			Pressure (psi) End				122.5
119.0			**Pressure (psi) Avg.**				**121.3**
LR-Outer Drive:		Bridgestone WBS	**Drive Axle Tires**	Bridgestone WBS			RR-Outer Drive
Bridgestone Greatec M835A Ecopia			Type				Bridgestone Greatec M835A Ecopia
445/50R22			Size				445/50R22
24/32			Tread Depth (32nds)				24/32
119.5			Pressure (psi) Start				120.5
122.5			Pressure (psi) End				123.5
121.0			**Pressure (psi) Avg.**				**122.0**
			Trailer	7543			
LF-Outer Trailer:		Bridgestone WBS	**Tandem Front**	Bridgestone WBS			RF-Outer Trailer
Bridgestone Greatec R197 Ecopia			Type				Bridgestone Greatec R197 Ecopia
445/50R22.5			Size				445/50R22.5
12/32			Tread Depth (32nds)				12/32
115.0			Pressure (psi) Start				119.5
117.5			Pressure (psi) End				121.0
116.3			**Pressure (psi) Avg.**				**120.3**
LR-Outer Trailer:		Bridgestone WBS	**Tandem Rear**	Bridgestone WBS			RR-Outer Trailer
Bridgestone Greatec R197 Ecopia			Type				Bridgestone Greatec R197 Ecopia
445/50R22.5			Size				445/50R22.5
12/32			Tread Depth (32nds)				12/32
118.5			Pressure (psi) Start				120.0
121			Pressure (psi) End				122.0
119.8			**Pressure (psi) Avg.**				**121.0**

Figure 24: Run 1 Tire Details (Veh. B)

Veh. B (Compare)

			Truck	4303		
LF:			Front Axle Tires			RF: Same
Michelin X Line Energy Z			Type			Michelin X Line Energy Z
275/80R22.5			Size			275/80R22.5
19/32			Tread Depth (32nds)			19/32
114.0			Pressure (psi) Start			114.5
115.0			Pressure (psi) End			115.0
114.5			**Pressure (psi) Avg.**			**114.8**
LF-Outer Drive:	LF-Inner Drive:		**Drive Axle Tires**		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
22/32	22/32		Tread Depth (32nds)		22/32	22/32
111.5	113.0		Pressure (psi) Start		113.0	114.0
112.5	114.0		Pressure (psi) End		114.0	114.0
112.0	**113.5**		**Pressure (psi) Avg.**		**113.5**	**114.0**
LR-Outer Drive:	LR-Inner Drive:		**Drive Axle Tires**		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
22/32	22/32		Tread Depth (32nds)		22/32	22/32
112.0	114.0		Pressure (psi) Start		114.5	113.5
113.0	115.0		Pressure (psi) End		115.0	114.0
112.5	**114.5**		**Pressure (psi) Avg.**		**114.8**	**113.8**
			Trailer	7423		
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
12/32	12/32		Tread Depth (32nds)		12/32	12/32
111.5	112.0		Pressure (psi) Start		112.5	112.5
112.0	113.0		Pressure (psi) End		113.0	113.0
111.8	**112.5**		**Pressure (psi) Avg.**		**112.8**	**112.8**
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
12/32	12/32		Tread Depth (32nds)		12/32	12/32
111.0	114.5		Pressure (psi) Start		113.0	113.5
112.0	115.5		Pressure (psi) End		113.5	114.0
111.5	**115.0**		**Pressure (psi) Avg.**		**113.3**	**113.8**

6.4b: Run 2: Michelin

Figure 25: Run 2 Tire Details (Veh. A)

Veh. A: Michelin WBS (All Positions)							
			Truck	4302			
LF:	Michelin WBS		Front Axle Tires			Michelin WBS	RF: Same
Michelin X Line Energy Z			Type				Michelin X Line Energy Z
275/80R22.5			Size				275/80R22.5
19/32			Tread Depth (32nds)				19/32
116.5			Pressure (psi) Start				117.0
115.5			Pressure (psi) End				115.5
116.0			**Pressure (psi) Avg.**				**116.3**
LF-Outer Drive:		Michelin WBS	**Drive Axle Tires**	Michelin WBS			RF-Outer Drive
Michelin XOne Line Energy D			Type				Michelin XOne Line Energy D
275/80R22.5			Size				275/80R22.5
24/32			Tread Depth (32nds)				24/32
116.0			Pressure (psi) Start				117.5
115.5			Pressure (psi) End				117.5
115.8			**Pressure (psi) Avg.**				**117.5**
LR-Outer Drive:			**Drive Axle Tires**				RR-Outer Drive
Michelin XOne Line Energy D			Type				Michelin XOne Line Energy D
275/80R22.5			Size				275/80R22.5
24/32			Tread Depth (32nds)				24/32
117.0			Pressure (psi) Start				118
116			Pressure (psi) End				118
116.5			**Pressure (psi) Avg.**				**118.0**
			Trailer	7543			
LF-Outer Trailer:		Michelin WBS	**Tandem Front**	Michelin WBS			RF-Outer Trailer
Michelin XOne Line Energy T			Type				Michelin XOne Line Energy T
275/80R22.5			Size				275/80R22.5
13/32			Tread Depth (32nds)				13/32
116.0			Pressure (psi) Start				117.0
116			Pressure (psi) End				117.0
116.0			**Pressure (psi) Avg.**				**117.0**
LR-Outer Trailer:			**Tandem Rear**				RR-Outer Trailer
Michelin XOne Line Energy T			Type				Michelin XOne Line Energy T
275/80R22.5			Size				275/80R22.5
13/32			Tread Depth (32nds)				13/32
116.0			Pressure (psi) Start				116.5
116			Pressure (psi) End				116.5
116.0			**Pressure (psi) Avg.**				**116.5**

Figure 26: Run 2 Tire Details (Veh. B)

Veh. B (Compare)

		Truck	4303		
LF:		Front Axle Tires			RF: Same
Michelin X Line Energy Z		Type			Michelin X Line Energy Z
275/80R22.5		Size			275/80R22.5
19/32		Tread Depth (32nds)			19/32
114.0		Pressure (psi) Start			114.5
113.0		Pressure (psi) End			113.0
113.5		**Pressure (psi) Avg.**			**113.8**
LF-Outer Drive:	LF-Inner Drive:	**Drive Axle Tires**		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
22/32	22/32	Tread Depth (32nds)		22/32	22/32
111.5	113.0	Pressure (psi) Start		113.0	113.5
110.5	111.5	Pressure (psi) End		111.0	112.0
111.0	**112.3**	**Pressure (psi) Avg.**		**112.0**	**112.8**
LR-Outer Drive:	LR-Inner Drive:	**Drive Axle Tires**		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
22/32	22/32	Tread Depth (32nds)		22/32	22/32
112.0	114.0	Pressure (psi) Start		114.0	113.5
111.0	113.0	Pressure (psi) End		113.0	112.0
111.5	**113.5**	**Pressure (psi) Avg.**		**113.5**	**112.8**
		Trailer	7423		
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
12/32	12/32	Tread Depth (32nds)		12/32	12/32
111.5	112.0	Pressure (psi) Start		112.0	112.0
109.5	110.5	Pressure (psi) End		110.5	110.5
110.5	**111.3**	**Pressure (psi) Avg.**		**111.3**	**111.3**
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
12/32	12/32	Tread Depth (32nds)		12/32	12/32
111.0	114.5	Pressure (psi) Start		112.5	113.0
109.5	113.5	Pressure (psi) End		111.0	111.5
110.3	**114.0**	**Pressure (psi) Avg.**		**111.8**	**112.3**

6.5: WEATHER CONDITIONS

Weather during testing was relatively warm with light 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 11: Test Run Times

	Begin	End
Bridgestone WBS	11:44 A.M.	2:24 P.M.
Michelin WBS	6:37 P.M.	9:18 P.M.

Table 12: Weather Data, Mar. 11

Time	Temperature	Dew Point	Humidity	Wind	Wind Speed	Wind Gust	Pressure	Precip.	Condition
12:53 AM	63 F	58 F	84 %	SSW	10 mph	0 mph	27.17 in	0.0 in	Fair
1:53 AM	62 F	57 F	84 %	SSW	7 mph	0 mph	27.16 in	0.0 in	Fair
2:53 AM	60 F	57 F	90 %	SW	6 mph	0 mph	27.15 in	0.0 in	Fair
3:53 AM	60 F	57 F	90 %	S	7 mph	0 mph	27.13 in	0.0 in	Fair
4:53 AM	58 F	56 F	93 %	WNW	5 mph	0 mph	27.12 in	0.0 in	Fair
5:00 AM	56 F	54 F	93 %	NW	5 mph	0 mph	27.12 in	0.0 in	Fog
5:15 AM	58 F	55 F	90 %	SW	7 mph	0 mph	27.12 in	0.0 in	Fog
5:24 AM	59 F	57 F	93 %	SW	8 mph	0 mph	27.12 in	0.0 in	Fair
5:53 AM	60 F	57 F	90 %	SW	8 mph	0 mph	27.12 in	0.0 in	Fair
6:11 AM	60 F	58 F	93 %	SW	8 mph	0 mph	27.13 in	0.0 in	Partly Cloudy
6:19 AM	60 F	58 F	93 %	SW	10 mph	0 mph	27.12 in	0.0 in	Fog
6:53 AM	60 F	59 F	96 %	SSW	9 mph	0 mph	27.13 in	0.0 in	Fog
7:25 AM	60 F	59 F	96 %	SSW	7 mph	0 mph	27.13 in	0.0 in	Fog
7:51 AM	61 F	59 F	94 %	SW	5 mph	0 mph	27.13 in	0.0 in	Fog
7:53 AM	60 F	59 F	96 %	SW	5 mph	0 mph	27.13 in	0.0 in	Fog
8:53 AM	60 F	59 F	96 %	SW	7 mph	0 mph	27.13 in	0.0 in	Fog
9:51 AM	61 F	59 F	94 %	WSW	6 mph	0 mph	27.14 in	0.0 in	Fog
9:53 AM	61 F	59 F	93 %	W	5 mph	0 mph	27.15 in	0.0 in	Fog
10:53 AM	63 F	60 F	90 %	W	5 mph	0 mph	27.14 in	0.0 in	Partly Cloudy
11:15 AM	64 F	60 F	87 %	W	5 mph	0 mph	27.15 in	0.0 in	Fair
11:53 AM	68 F	60 F	76 %	SSW	3 mph	0 mph	27.15 in	0.0 in	Fair
12:53 PM	75 F	53 F	46 %		0 mph	0 mph	27.13 in	0.0 in	Fair
1:53 PM	76 F	48 F	37 %	CALM	0 mph	0 mph	27.10 in	0.0 in	Fair
2:53 PM	80 F	46 F	30 %	W	5 mph	0 mph	27.06 in	0.0 in	Fair
3:53 PM	81 F	48 F	31 %	W	7 mph	0 mph	27.01 in	0.0 in	Fair
4:53 PM	81 F	46 F	29 %	S	9 mph	0 mph	26.99 in	0.0 in	Fair
5:53 PM	83 F	45 F	26 %	SW	12 mph	0 mph	26.97 in	0.0 in	Fair
6:53 PM	81 F	45 F	28 %	SW	12 mph	0 mph	26.97 in	0.0 in	Fair
7:53 PM	78 F	46 F	32 %	SSW	8 mph	0 mph	26.98 in	0.0 in	Fair
8:53 PM	73 F	48 F	41 %	S	9 mph	0 mph	26.98 in	0.0 in	Fair
9:53 PM	71 F	48 F	44 %	S	7 mph	0 mph	26.97 in	0.0 in	Fair
10:53 PM	70 F	48 F	46 %	SSW	9 mph	0 mph	26.98 in	0.0 in	Fair
11:53 PM	67 F	51 F	57 %	SW	7 mph	0 mph	26.99 in	0.0 in	Fair

Source: https://www.wunderground.com/history/daily/us/tx/midland/KMAF/date/2020-3-11

6.6: 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

6.7: TEST PERSONNEL

6.7a: MVT SOLUTIONS

- Daryl Bear, Lead Engineer & COO
- Drew Cassidy, Test Engineer

6.7b: DRIVERS

- Allan Dahringer
- Andrew Burnett
- Carlos Aragon
- Jack Burchell

6.7c: MICHELIN

- Bill Walmsley (Project Lead)

6.8: MVT SOLUTIONS CONTACT INFO

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