DOCKETED	
Docket Number:	20-TIRE-01
Project Title:	Tire Efficiency Order Instituting Information Proceeding
TN #:	249031
Document Title:	Summary of Tire Testing for California's Replacement Tire Efficiency Program, per Assembly Bill 844 January 2023, Revised
Description:	*** This document supersedes TN 248631 ***
Filer:	Sebastian Serrato
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	3/2/2023 2:39:45 PM
Docketed Date:	3/2/2023

SMITHERS
INNOVATE WITH CONFIDENCE

Revision History

Row Number	Document Number	Revision Date	Revision Description
1	F49432BS	3/1/23	Corrected load and speed index of a single tire within tire group #84 within the Appendix 1.
2	F49432BS	3/1/23	Added missing tire group #11 in the basic statistics of the Appendix 3.

Summary of Tire Testing for California's Replacement Tire Efficiency Program, per Assembly Bill 844 January 2023

Smithers File No. F49432BSR

Prepared for:

California Energy Commission

Funded by:

Pacific Gas and Electric

March 1, 2023

Reference: F49432BS-01VAU

Bradley Sellers
Consultant
Technical Consulting
Smithers MSE

Bruce Lambillotte
Senior Project Manager
Technical Consulting
Smithers MSE

Joshua Guilliams
Vice President
Technical Consulting
Smithers MSE

1.0 Subject

Smithers File F49432BS-01VAU, addressing the statement of work regarding Assembly Bill 844.

2.0 Objective

The objective was to assist the Pacific Gas and Electric Company ("PG&E"), in consultation with the California Energy Commission ("CEC"), in understanding a California focused tire population in regards to both rolling resistance and wet traction.

3.0 Background

Under the authority granted by Assembly Bill 844 (Nation, 2003), the California Energy Commission is mandated to adopt and implement a statewide Replacement Tire Efficiency Program for replacement tires for passenger cars and light-duty trucks, to ensure that replacement tires sold in California are at least as energy efficient as the tires sold as original equipment on the vehicles.[1]

Through the Clean Transportation Program, the California Energy Commission has sought to facilitate collaboration and information exchange with industry stakeholders including tire manufacturers, retail tire businesses, tire test labs, consumer information organizations, environmental interest groups, air districts, electric utilities, and government agencies, expressly for the Commission to fulfill its statutory mandate under AB 844. [2]

Smithers MSE Inc. was contracted to provide rolling resistance testing, tire technology consultations and project management to the Pacific Gas and Electric Company, in consultation with the California Energy Commission regarding the Replacement Tire Efficiency Program.

The Pacific Gas and Electric Company, in consultation with the California Energy Commission, purchased a variety of passenger car and light truck tires and submitted them to Smithers MSE for testing, and assistance in studying any correlations between rolling resistance and other tire characteristics

3.0 Background (continued)

Smithers MSE work herein documented in this report encompasses:

- Tire identifications: including sizes, manufacturers, design names, SKU (stock keeping unit) labels, and stamping information.
- Measurements including tire weights and tread depths.
- Test Results
  Four (4) tires each of 149 unique tire SKUs were submitted for testing. Three (3) tires per SKU (total 447 tires) were tested for rolling resistance and one (1) tire per SKU (total 149 tires) were tested for wet traction.
  - Rolling resistance: ISO 28580(2018) “Passenger Car, Truck and Bus Tyre Rolling Resistance Measurement Method — Single Point Test and Correlation of Measurement Results.” Testing was conducted by Smithers MSE, Inc. Photographs of the test may be found in Appendix Section 5.
  - Tire wet grip test: ISO 23671(2021) “Passenger Car Tyres - Method for Measuring Relative Wet Grip Performance - Loaded New Tyres” (Trailer method).
- Efforts to identify correlations between rolling resistance, wet traction and a number of other tire parameters.

Note, definitions of terminology and test specifications may be found in Appendix Section 6.

It should be further noted that in addressing rolling resistance data, “lower” is directionally desirable. In addressing wet traction, a “higher” wet grip index is directionally desirable.

4.0 Procedures

4.1 Rolling Resistance Test Protocol

Test Protocol	ISO 28580:2018 “Passenger Car, Truck and Bus Tyre Rolling Resistance Measurement Method — Single Point Test and Correlation of Measurement Results.”
Laboratory Certification	ISO 17025
Number Tires Tested	Three (3) per SKU
Number SKUs Tested	149
Description	ISO 28580:2018 specifies methods for measuring rolling resistance, under controlled laboratory conditions, for new pneumatic tires designed primarily for use on passenger cars, trucks and buses. Measurement of tires using this method enables comparisons to be made between the rolling resistance of new test tires when they are free-rolling straight ahead, in a position perpendicular to the drum outer surface, and in steady-state conditions.
Test Drum	• Smithers tested to this protocol using a dynamometer with a cylindrical drum of 1.7m diameter. Per ISO 28580, the equation located in section 9.3 was utilized as a correlation adjustment of the rolling resistance coefficient from the test drum of 1.7m diameter to a dynamometer drum diameter of 2.0m. • 80 grit surface paper was used as permitted by ISO 28580.
Test Preparation	• All tires were mounted and tested on aluminum wheels. Wheel widths were determined by ISO 4000-1 for passenger and ISO 4209-1 for truck/bus. • Tires were inflated to the required cold pressure and the appropriate load was applied per the Table 2 of ISO 28580. • 80km/h speed was used for testing • Tires were allowed to thermally condition in the test environment for a minimum of 3hrs for passenger and 6hrs for truck/bus. • Ambient temperature was maintained between 70°-80°F. Test data was corrected to a standard of 77°F using the correction equation per ISO 28580
Warm-up	• Once the tire was mounted on the dynamometer, a warm-up was performed per Table 3 of ISO 28580.
Testing	• See ISO 28580:2018
Documentation	• Forces were recorded at the machine spindle and used to calculate the rolling resistance force, which is then divided by the test load and multiplied by 1000 to calculate the rolling resistance coefficient.

4.2 Wet Traction Test Protocol*

Test Protocol	ISO 23671:2021 “Passenger Car Tyres - Method for Measuring Relative Wet Grip Performance - Loaded New Tyres” (Trailer method)
Number Tires Tested	One (1) per SKU
Number SKUs Tested	149
Description	ISO 23671:2021 specifies the method for measuring relative wet grip braking performance index to a reference under loaded conditions for new tires for use on passenger cars on a wet-paved surface.
Test Preparation	• Test surface utilized was asphalt per ISO 23671. • External watering of asphalt surface • Ambient test temperature was between 5°C and 35°C.
Testing	• Cold inflation test pressure was 180kPa for standard load tires and 220kPa for extra load tires • Speed at the start of braking was 65±2km/h • Test load was 75±5% of load capacity based upon tire load index
Documentation	• Dynamic tire braking force was recorded in real time and was divided by the dynamic vertical load in real time to calculate the dynamic tire braking force coefficient in real time. The peak braking force coefficient was determined and used to calculate the wet grip index as compared to the reference tire peak braking force.

*Testing was outsourced by Smithers.

4.3 Tire SKU Selections for Program

Tire SKUs were chosen by the California Energy Commission. Smithers MSE was advised that the selections were made with consideration to the sizes and types of tires typically used on a variety of the highest volume types of vehicles in current California usage with respect to vehicle manufacturing year and brand. The decisions were based upon vehicle licensure information.

These vehicles included:

Model Year	Manufacturer	Vehicle Design
2022	Chevrolet	Tahoe
2022	Toyota	Tacoma
2022	Chevrolet	Silverado
2022	Honda	Odyssey
2022	Tesla	Model Y
2022	Tesla	Model 3
2022	Toyota	Mirai
2022	Nissan	Leaf
2022	Ford	F-150 Lightning All-Electric Truck
2022	Ford	Explorer
2022	Toyota	Corolla
2022	Honda	Civic
2022	Chevrolet	Bolt EV
2019	VOLKSWAGEN	JETTA
2019	HONDA	CR-V
2019	CHEVROLET	BOLT EV
2018	JEEP	WRANGLER UNLIMITED
2018	CHEVROLET	SILVERADO 1500
2018	TOYOTA	RAV4
2018	TESLA	MODEL X
2018	TESLA	MODEL 3
2018	FORD	F-150
2018	HONDA	CIVIC
2018	TOYOTA	CAMRY
2018	HONDA	ACCORD
2017	TOYOTA	TACOMA
2017	TOYOTA	SIENNA
2017	SUBARU	OUTBACK
2017	FORD	EXPLORER
2016	TOYOTA	COROLLA
2015	KIA	OPTIMA

4.3 Tire SKU Selections for Program (continued)

Model Year	Manufacturer	Vehicle Design
2015	HONDA	ACCORD
2014	HONDA	CR-V
2014	HONDA	ACCORD
2013	HYUNDAI	ELANTRA
2013	HONDA	CIVIC
2013	MERCEDES-BENZ	C-CLASS
2011	BMW	3 SERIES
2007	HONDA	ODYSSEY
2007	TOYOTA	CAMRY
2006	TOYOTA	TACOMA
2006	TOYOTA	SIENNA
2004	CHEVROLET	SILVERADO 1500
2001	FORD	F-150

SKU selections encompassing original equipment, replacement and efficient category tires were pursued with possible fitment on these vehicles. Tire purchases were conducted in California between April 13th and June 9th of 2022.

4.4 Correlation Studies

Attempts were made to individually correlate rolling resistance results to a number of other tire characteristics. Quantitative correlations include linear correlation analyses with trend lines and with trend line r-squared values identified. Subjective correlations include general comparisons of data without quantitative analyses.

Quantitative Correlation

- wet traction — tested
- price — actual price
- UTQG treadwear rating — tire stamping
- tread depth — measured
- tire weight — measured
- aspect ratio — tire stamping
- diameter at bead — tire stamping
- tire section width — tire stamping

Subjective Correlation

- tire market category — Smithers-assigned; manufacturer/retailer websites
- tire usage category — CEC-assigned; differentiate OE vs. Replacement vs. Efficient
- manufacturer tier — Smithers MSE/Market Data Book
- UTQG traction rating — tire stamping
- UTQG temperature rating — tire stamping
- load index — tire stamping
- speed rating — tire stamping
- run flat — tire stamping and manufacturer/retailer websites

Definitions of these tire characteristics may be found in Appendix Section 6.

The following subsections define the variable in question.

4.4.1 Quantitative Correlation: Wet Traction

Results as tested by ISO 23671:2021

4.4.2 Quantitative Correlation: Price

Actual price paid per tire, excluding sales tax and shipping. Tires were purchased between April 13th and June 9th of 2022

4.4.3 Quantitative Correlation: UTQG Treadwear Rating

Uniform Tire Quality Grading (UTQG) Treadwear Rating as identified by tire stamping on sidewall; example UTQG rating: 560 A B; 560 is treadwear rating. The rating is a numeric index of how well a tire wears in comparison to a reference tire.

4.4.4 Quantitative Correlation: Tread Depth

Tread depth was measured from tread surface to bottom of groove with a digital tread depth gauge. Depths were documented in millimeters.

4.4.5 Quantitative Correlation: Tire Weight (measured)

Tire weights were determined using a calibrated, digital Belfour Model PS8070 (Serial: 1508CRS870545) scale, with measurements documented to the nearest 0.1 lbs.

4.4.6 Quantitative Correlation: Aspect Ratio

Identified by tire size stamping on sidewall; example: 265/75R17: 75 aspect ratio. Aspect ratio = height: width ratio of a section of the tire expressed as a percentage.

4.4.7 Quantitative Correlation: Diameter at Bead

Identified by tire stamping on sidewall; example: 265/75R17: 17 inch wheel diameter at bead ledge

4.4.8 Quantitative Correlation: Tire Section Width

Identified by tire size stamping on sidewall; example: 265/75R17: 265mm tire section width.

4.4.9 Subjective Correlation: Tire Market Category

Subjectively assigned by Smithers to each SKU, based upon manufacturer's website, retailers' marketing websites, price and tread pattern. No tire performance data was used for category assignments

4.4.10 Subjective Correlation: Tire Usage Category

Subjectively assigned by California Energy Commission to each SKU to differentiate OE vs. Replacement vs Efficient. No tire performance data was used for category assignments.

4.4.11 Subjective Correlation: Tire Manufacturer Tier

Tire Manufacturer Tier categories were subjectively assigned by Smithers, based upon manufacturers' global tire sales, as published in Tire Business, February 15, 2021, 32nd Annual Market Data Book.

Tier 1 (Top 4)*	1. Michelin Group 2. Bridgestone Corp. 3. Goodyear Tire & Rubber Co. 4. Continental A.G.
Tier 2 (Next 7)*	5. Sumitomo Rubber Industries Ltd. 6. Pirelli & C. S.p.A. 7. Hankook Tire & Technology Co. Ltd. 8. Yokohama Rubber Co. Ltd. 9. Cheng Shin Rubber (Maxxis Intl.) 10. Zhongce Rubber Group Co. Ltd. 11. Giti Tire Pte. Ltd.
Tier 3 (Others)*	All remaining tire manufacturers

4.4.12 Subjective Correlation: UTQG Traction Rating

Identified by tire stamping. The Traction rating is based on the coefficient of friction of a locked (skidding) tire in a straight line on a wet surface. The traction grades from highest to lowest are AA, A, B and C, and they represent the tire's ability to stop on wet pavement as measured under controlled conditions on specified government test surfaces of asphalt and concrete. A tire marked C may have poor traction performance. The traction grade is based on braking (straight ahead) traction tests and does not include cornering (turning) traction.

NHTSA reported in YR2020 that of current tires:15% are rated "AA", 77% are rated "A", 7% are rated "B" and only four (4) lines of tires are rated "C"

4.4.13 Subjective Correlation: UTQG Temperature Rating

Identified by tire stamping. Sustained high temperature can cause the material of the tire to degenerate and reduce tire life, and excessive temperature can lead to sudden tire failure. The grade C corresponds to a level of performance which all passenger car tires must meet under the Federal Motor Vehicle Safety Standard. Grades A and B represent higher levels of performance on the laboratory test wheel than the minimum required by law. Temperature grades are established for tires that are properly inflated and not overloaded.

Temperature Grades	Speeds in mph
A	Over 115
B	Between 100 to 115
C	Between 85 to 100

NHTSA reported in YR2020 that of current tires: 62% are rated "A", 34% are rated "B" and 4% are rated "C".

4.4.14 Subjective Correlation: Tire Load Index

The load index of a tire is a number that correlates to the maximum safe carrying capacity of the tire when inflated to its maximum pressure, as labeled on the sidewall. Information to ascertain the vehicle load-carrying requirements may be found on the vehicle placard.

Maximum Load Carrying Capacity per Tire					
Load Index	Kg	Pound (lb)	Load Index	Kg	Pound (lb)
71	345	761	99	775	1709
72	355	783	100	800	1764
73	365	805	101	825	1819
74	375	827	102	850	1874
75	387	853	103	875	1929
76	400	882	104	900	1984
77	412	908	105	925	2039
78	425	937	106	950	2094
79	437	963	107	975	2150
80	450	992	108	1000	2205
81	462	1019	109	1030	2271
82	475	1047	110	1060	2337
83	487	1074	111	1090	2403
84	500	1102	112	1120	2469
85	515	1135	113	1150	2535
86	530	1168	114	1180	2601
87	545	1202	115	1215	2679
88	560	1235	116	1250	2756
89	580	1279	117	1285	2833
90	600	1323	118	1320	2910
91	615	1356	119	1360	2998
92	630	1389	120	1400	3086
93	650	1433	121	1450	3197
94	670	1477	122	1500	3307
95	690	1521	123	1550	3417
96	710	1565	124	1600	3527
97	730	1609	125	1650	3638
98	750	1653			

Typical commuter car plus light truck load indices tend to range from about 70 to 124, and this range encompasses the tire population studied herein. Light truck tires have two load indexes labeled on the sidewall of the tire, unlike passenger tires, which only have one. This reflects the possible light truck tire use on vehicles with dual rear wheels.

4.4.15 Subjective Correlation: Tire Speed Rating

The speed rating of a tire is the letter designation representing the speed capability: the designed maximum speed that the tire can sustain over time.

Speed Symbol	(mph)	(kph)	Open Ended Speed Category
Q	99	160	
S	112	180	
T	118	190	
U	124	200	
H	130	210	
V	149	240	
W	169	270	Z
Y	186	300	Z
(Y)	Above 186	Above 300	Z

Light truck speed indices frequently fall within the range of Q – S. Speed indices representing passenger vehicle tires commonly fall within the range of S – Y.

4.4.16 Subjective Correlation: Run Flat Tire Construction

A type of pneumatic tire constructed of special materials, supports, and configurations that allow it to travel for a limited distance and speed after experiencing a loss of most or all inflation pressure.

5.0 Results

Quantitative correlations have been studied using rolling resistance plots where each plotted point depicts the mean value of the three (3) tires tested per set (SKU), and traction charts that depict the results of the one (1) tire tested per set.
Best-fit linear trendlines have been created using Excel to identify R^2 values for each correlation studied. R^2 is an indicator of "goodness of fit" of the linear trendline by measuring the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive. Slopes of the trendlines may be interpreted as follows:

1. A trend line with a positive slope indicates a positive correlation between the variables.
2. A trend line with a negative slope indicates a negative correlation between the two variables.

The steepness of the slope of a trendlines represents the sensitivity of the dependent variable (frequently rolling resistance or traction responses plotted along the Y-axis) to changes in the independent variable (plotted along X-axis).

For example, a trendline with a relatively high R^2 value and a steep positive slope suggests a correlation with a reasonable linear fit to the actual data results, a positive correlation between the dependent and independent variables and a strong sensitivity in the dependent variable to changes in the independent variable.

Table 5A: Rolling Resistance R-Squared Values

	Tire Market Categories							Tire Usage Categories		
	All Terrain	Economy **	Fuel Efficient	Highway	Touring	UHP	EV*	OE	Replacement	Efficient
Price	0.224	0.024	0.034	0.138	0.105	0.000	-	0.008	0.055	0.304
UTQG Treadwear	0.230	0.528	0.660	0.067	0.103	0.116	-	0.033	0.002	0.407
Tread Depth	0.125	0.018	0.742	0.041	0.203	0.001	-	0.432	0.023	0.106
Tire Weight	0.006	0.000	0.244	0.039	0.002	0.016	-	0.078	0.000	0.040
Aspect Ratio	0.178	0.030	0.197	0.007	0.011	0.090	-	0.003	0.001	0.320
Bead Diameter	0.434	0.020	0.047	0.434	0.078	0.076	-	0.008	0.047	0.014
Section Width	0.069	0.074	0.208	0.101	0.056	0.014	-	0.006	0.031	0.003

5.0 Results

Table 5B: Wet Traction Index R-Squared Values

	Tire Market Categories							Tire Usage Categories		
	All Terrain	Economy **	Fuel Efficient	Highway	Touring	UHP	EV*	OE	Replace ment	Efficient
Price	0.212	0.052	0.148	0.051	0.049	0.005	-	0.012	0.011	0.247
UTQG Treadwear	0.012	0.304	0.404	0.007	0.000	0.051	-	0.107	0.000	0.001
Tread Depth	0.080	0.183	0.002	0.082	0.127	0.012	-	0.198	0.132	0.105
Tire Weight	0.170	0.024	0.083	0.012	0.035	0.064	-	0.013	0.158	0.004
Aspect Ratio	0.049	0.170	0.003	0.001	0.071	0.004	-	0.096	0.152	0.033
Bead Diameter	0.091	0.004	0.004	0.194	0.005	0.090	-	0.007	0.002	0.020
Section Width	0.051	0.057	0.095	0.002	0.007	0.100	-	0.001	0.073	0.003

Table 5C: Tire Category Groups: Number of SKU's

	Tire Market Categories							Tire Usage Categories		
	All Terrain	Economy **	Fuel Efficient	Highway	Touring	UHP	EV*	OE	Replace ment	Efficient
Tire Group SKUs	15	11	8	36	51	25	3	14	129	6
Total SKUs	149							149		

Note: Total tire population was 149 SKUs.
*Too few tire SKUs tested to evaluate correlations.
**Economy refers to purchase cost and not economy of operation. Economy of operation falls into "Fuel Efficient" category.

5.0 Results (continued)

Additionally, subjective correlations of some other variables with respect to rolling resistance and wet traction index in the following areas were examined.

- tire category
- manufacturer tier
- UTQG traction rating
- UTQG temperature rating
- load index
- speed rating
- run flat

Individual rolling resistance and wet grip index results may be found in Section #1 of the Appendix.

The complete set of quantitative and qualitative correlation study plots may be found in Section #2 of the Appendix.

The descriptive statistics representing the rolling resistance data of the tire groups (by SKU) may be found in Section #3 of the Appendix.

A multiple linear correlation study of rolling resistance results (total population) correlated with candidate quantifiable tire characteristics may be found in Appendix Section #4.

5.1 Rolling Resistance Coefficient vs Wet Grip Index

Rolling Resistance vs Wet Grip Index: Market Categories (See Charts 5.1A and 5.1B)

An examination of the rolling resistance correlation studies with tire market categories directionally indicated an inverse correlation: wet grip increased with declining rolling resistance. This trend may be counterintuitive, however the correlations tended to be weak, as exhibited by R^2 values that tended to be low. The ultra-high performance (UHP) tire data exhibited no trend between rolling resistance and wet grip.

Rolling Resistance vs Wet Grip Index: OE vs Replacement vs Efficient Usage Categories (See Chart 5.1C)

Rolling resistance correlation studies with tire usage categories (OE vs replacement vs Efficient) again generally indicated an inverse correlation: wet grip increased with declining rolling resistance for the replacement and efficient tires. However, the OE tires varied oppositely: wet grip declined with declining rolling resistance.

5.1 Rolling Resistance Coefficient vs Wet Grip Index (continued)

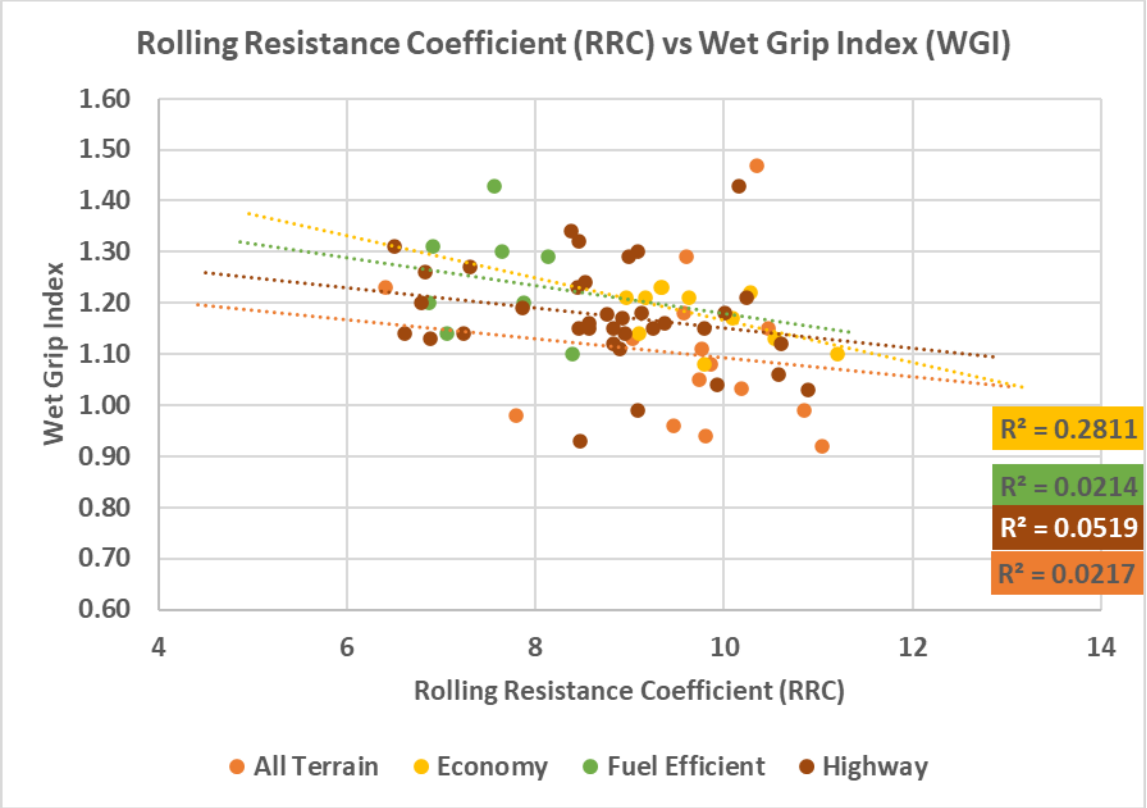


Chart 5.1A

- Tire wet grip index test protocol: ISO 23671:2021
- Tire rolling resistance test protocol: ISO 28580:2018
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.

5.1 Rolling Resistance Coefficient vs Wet Grip Index (continued)

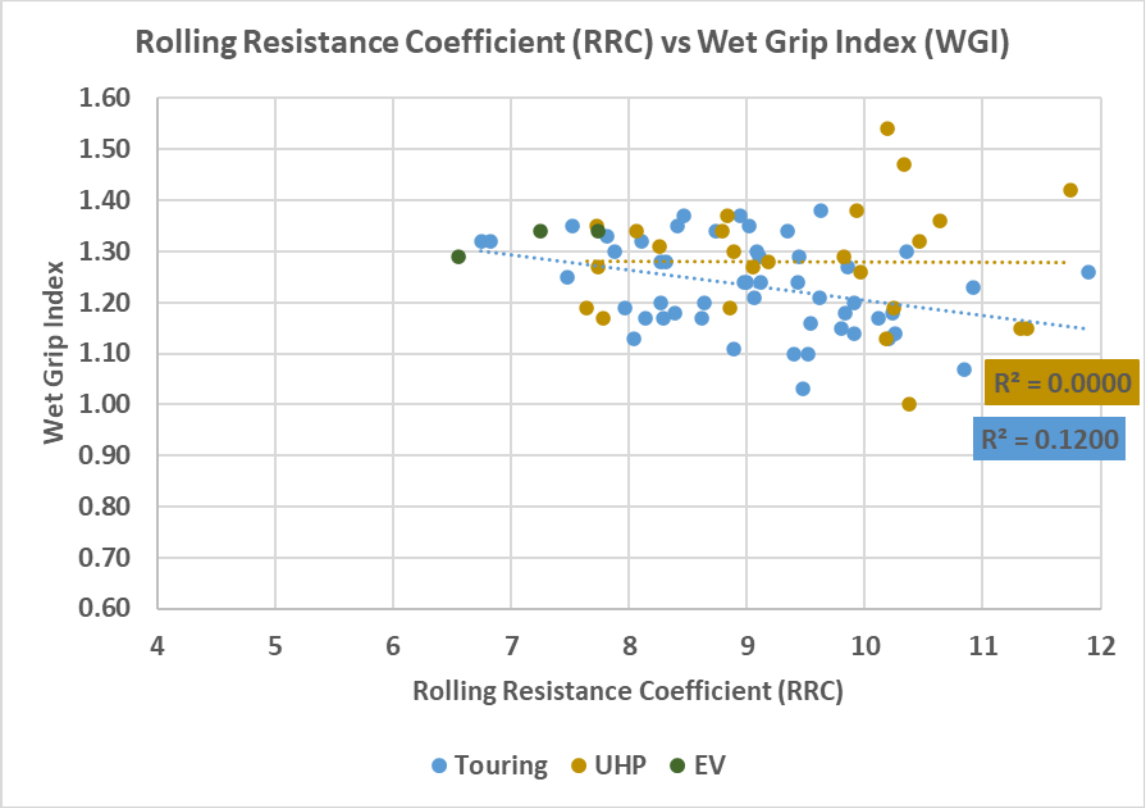


Chart 5.1B

- Tire wet grip index test protocol: ISO 23671:2021
- Tire rolling resistance test protocol: ISO 28580:2018
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.

5.1 Rolling Resistance Coefficient vs Wet Grip Index (continued)

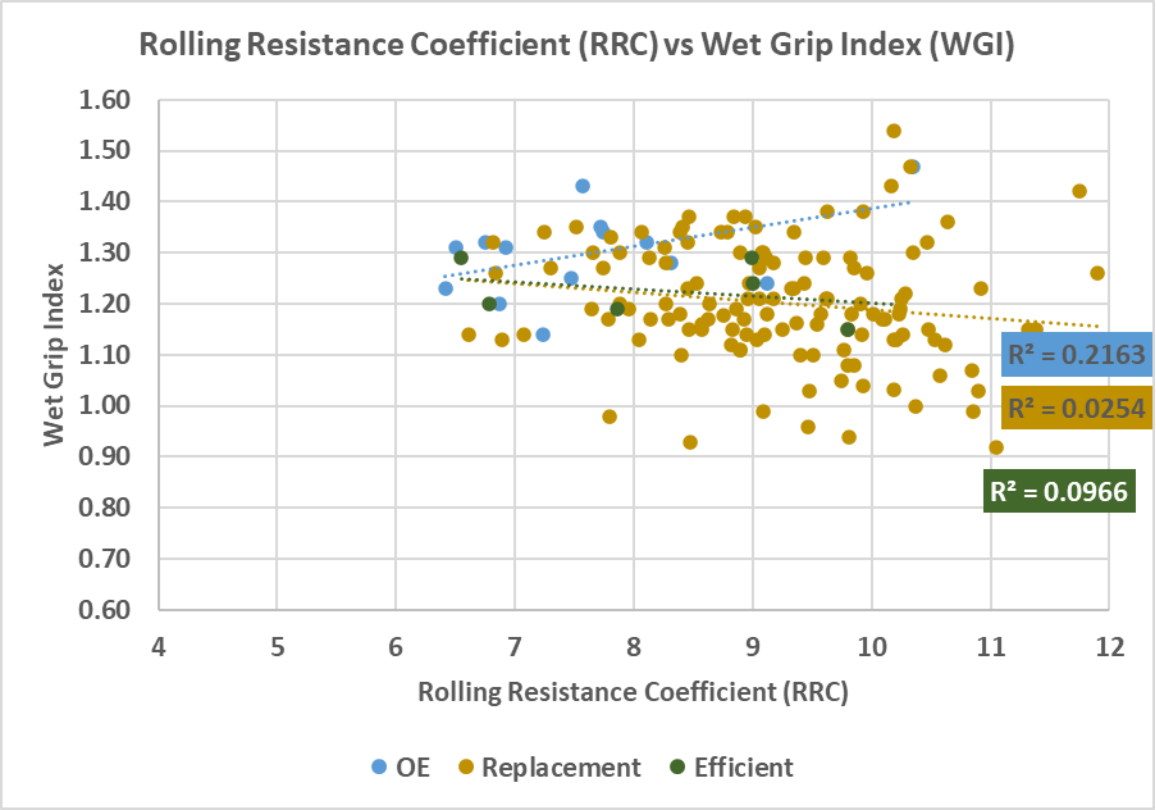


Chart 5.1C

- Tire wet grip index test protocol: ISO 23671:2021
- Tire rolling resistance test protocol: ISO 28580:2018
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.

5.2 Quantitative Correlation to Price

Price vs. Rolling Resistance: Market Categories (See Charts 5.2A and 5.2B)
Rolling resistance data suggested a negative correlation with actual purchase fee: cost generally tended to directionally increase for lower rolling resistance tires, regardless of tire market category, but with the exception of UHP (ultra-high performance tires; no correlation). Most correlations tended to range from negligible to weak as based upon R^2 values.

Price vs. Rolling Resistance: OE vs Replacement vs Efficient Usage Categories (See Chart 5.2C)
Again, rolling resistance data suggested a weak negative correlation: cost generally tended to increase for lower rolling resistance tires. The highest R^2 value of 0.304 represented the Efficient tire usage category.

Price vs. Wet Grip Index: Market Categories (See Charts 5.2D and 5.2E)
Wet grip index data was directionally inconsistent and, correlations tended to range from negligible to very weak.

Price vs. Wet Grip Index: OE vs Replacement vs Efficient Usage Categories (See Chart 5.2F)
The Efficient tire usage category exhibited a weak correlation at $R^2 = 0.247$. No correlations were noted between price and wet grip index for the OE and Replacement usage categories.

5.2 Quantitative Correlation to Price (continued)

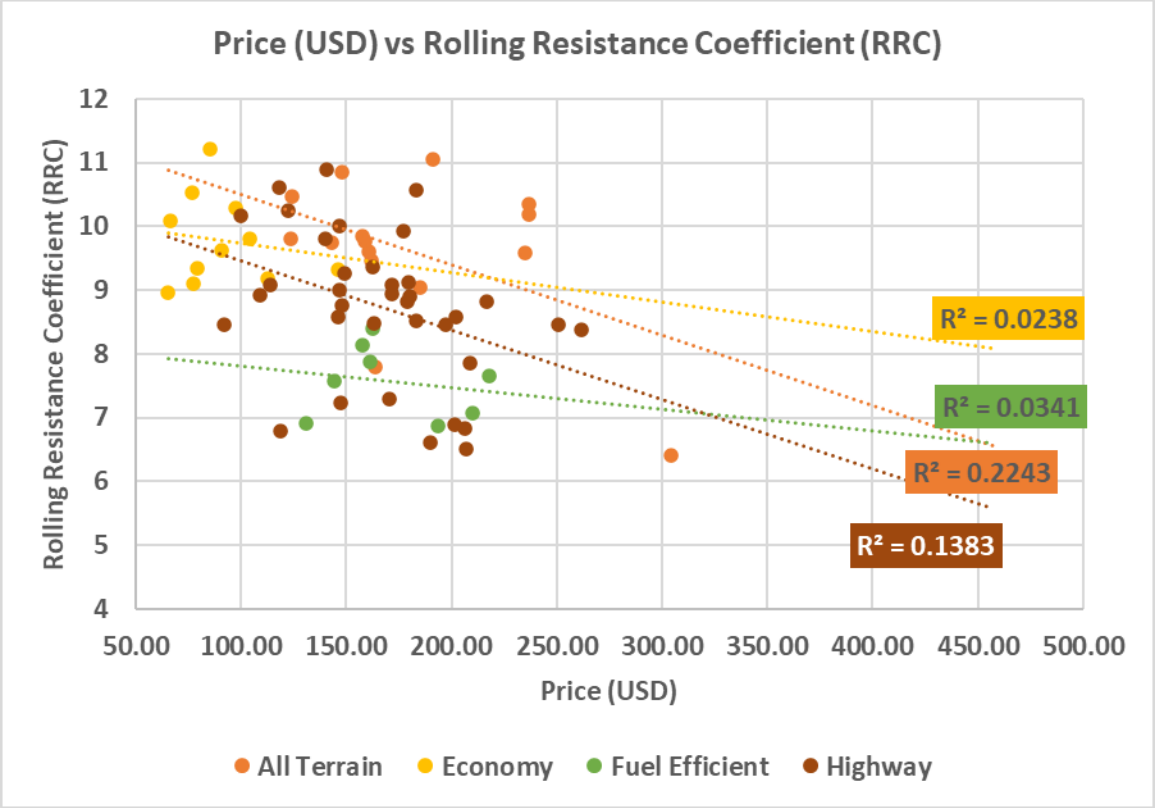


Chart 5.2A

- Price (USD) represents actual per tire purchase price
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.
- Each plotted point represents the mean value of three (3) tires tested.
- Tire rolling resistance test protocol: ISO 28580:2018

5.2 Quantitative Correlation to Price (continued)

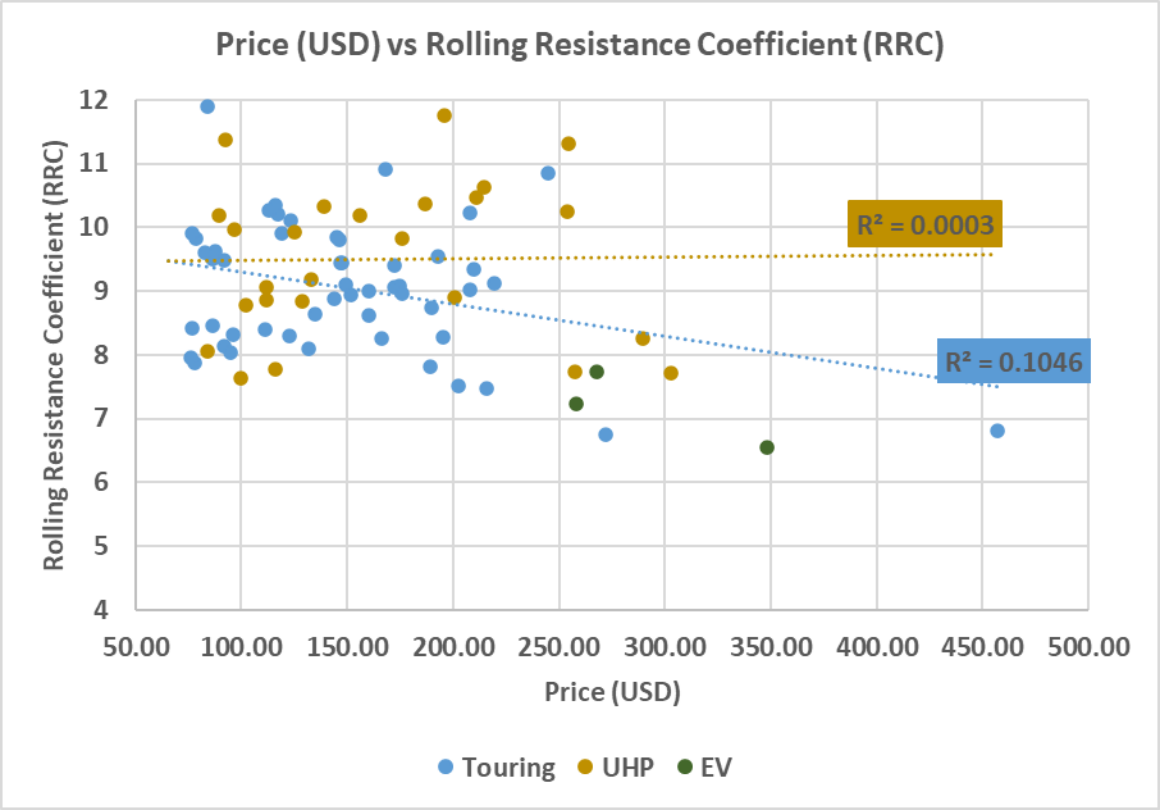


Chart 5.2B

- Price (USD) represents actual per tire purchase price
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.
- Each plotted point represents the mean value of three (3) tires tested.
- Tire rolling resistance test protocol: ISO 28580:2018

5.2 Quantitative Correlation to Price (continued)

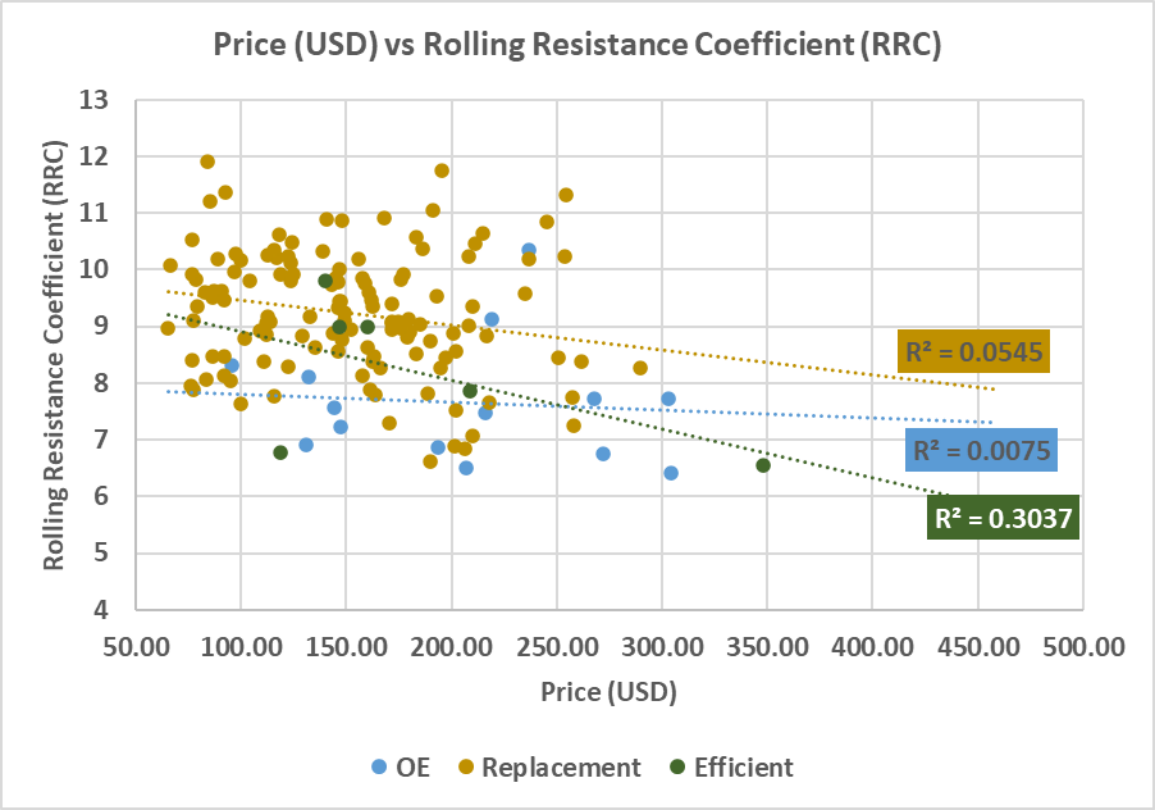


Chart 5.2C

- Price (USD) represents actual per tire purchase price
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.
- Each plotted point represents the mean value of three (3) tires tested.
- Tire rolling resistance test protocol: ISO 28580:2018

5.2 Quantitative Correlation to Price (continued)

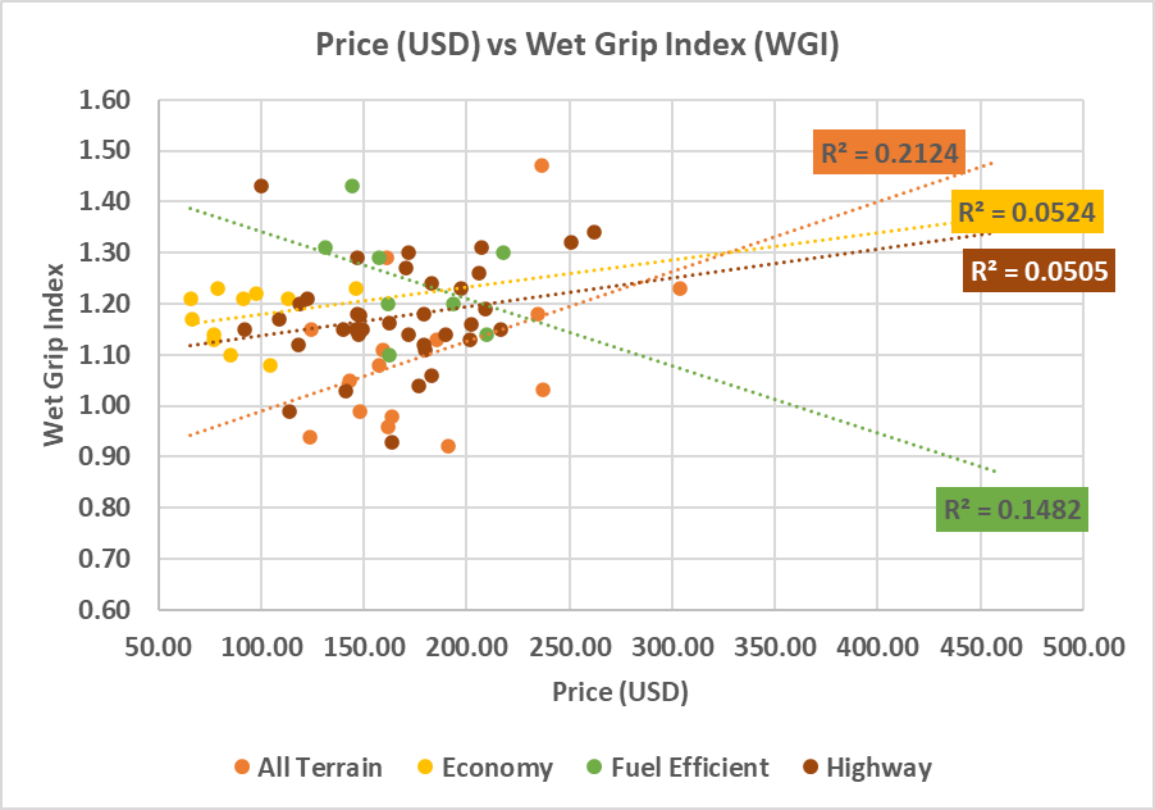


Chart 5.2D

- Price (USD) represents actual per tire purchase price
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.
- Each plotted point represents the value of one (1) tire tested.
- Tire wet grip index test protocol: ISO 23671:2021

5.2 Quantitative Correlation to Price (continued)

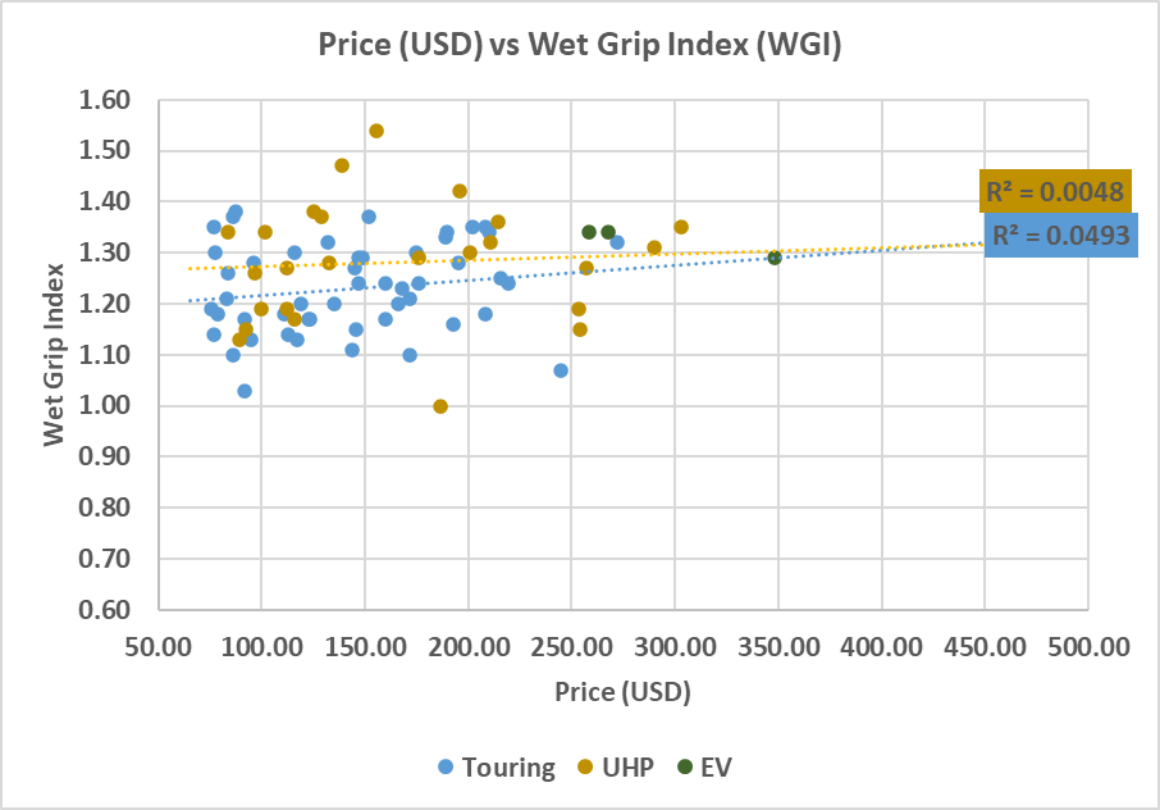


Chart 5.2E

- Price (USD) represents actual per tire purchase price
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.
- Each plotted point represents the value of one (1) tire tested.
- Tire wet grip index test protocol: ISO 23671:2021

5.2 Quantitative Correlation to Price (continued)

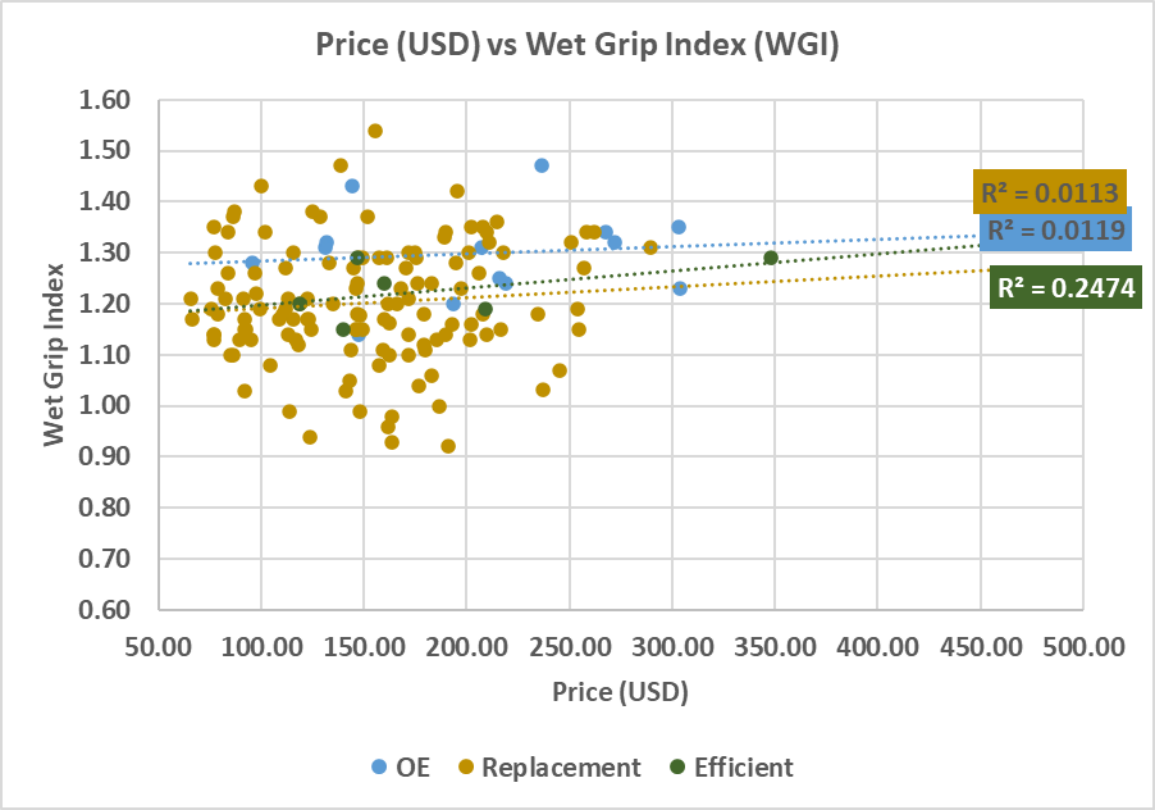


Chart 5.2F

- Price (USD) represents actual per tire purchase price
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.
- Each plotted point represents the value of one (1) tire tested.
- Tire wet grip index test protocol: ISO 23671:2021

5.3 Quantitative Correlation to UTQG Treadwear

UTQG Treadwear Rating vs. Rolling Resistance: Market Categories (See Charts 5.3A and 5.3B)
Rolling resistances, as based upon the Market Categories RRC data, did exhibit correlations for Economy and Fuel Efficient tires. In both cases, rolling resistance directionally increased with increasing UTQG Treadwear Rating (used as an indicator of tread life). The R^2 of the Economy tires was 0.528 and indicated a moderate correlation between rolling resistance and treadwear. The relatively higher slope of the trendline suggested a higher RR sensitivity to increasing treadwear rating.

The correlation between rolling resistance and treadwear for the Fuel Efficient tires was stronger, as indicated by a higher R^2 value of approximately 0.660. However, the RR sensitivity to increasing treadwear rating was less that that indicated by the Economy tires (less steep trendline).

Correlations between UTQG Treadwear Ratings and rolling resistances for the remaining categories were weak with low R^2 values.

UTQG Treadwear Rating vs. Rolling Resistance: OE vs Replacement vs Efficient Usage Categories (See Chart 5.3C)
The rolling resistance data, when examined from a usage category perspective of OE vs Replacement vs Efficient tires, exhibited trendlines with low correlation coefficients for the OE and Replacement categories. The Efficient category trendline had a higher R^2 value of 0.407; with higher treadwear rating correlated to higher rolling resistance. The Efficient category also exhibited greater sensitivity of the trendline slope with increasing wear rating as compared to the OE and Replacement categories.

UTQG Treadwear Rating vs. Wet Grip Index: Market Categories (See Charts 5.3D and 5.3E)
Tire wet grip indices, as based upon the Market Categories RRC data, exhibited trendlines with R^2 = .404 for the Fuel Efficient category, and R^2 = .304 for Economy category tires. In both cases, the correlations directionally indicated declining wet grip indices with increasing UTQG Treadwear Ratings. Remaining correlations were weak with inconsistent directionality.

UTQG Treadwear Rating vs. Wet Grip Index: OE vs Replacement vs Efficient Usage Categories (See Chart 5.3F)
Analyses of the tire wet grip indices correlated with UTQG Treadwear Ratings was inconclusive due to low R^2 values.

5.3 Quantitative Correlation to UTQG Treadwear (continued)

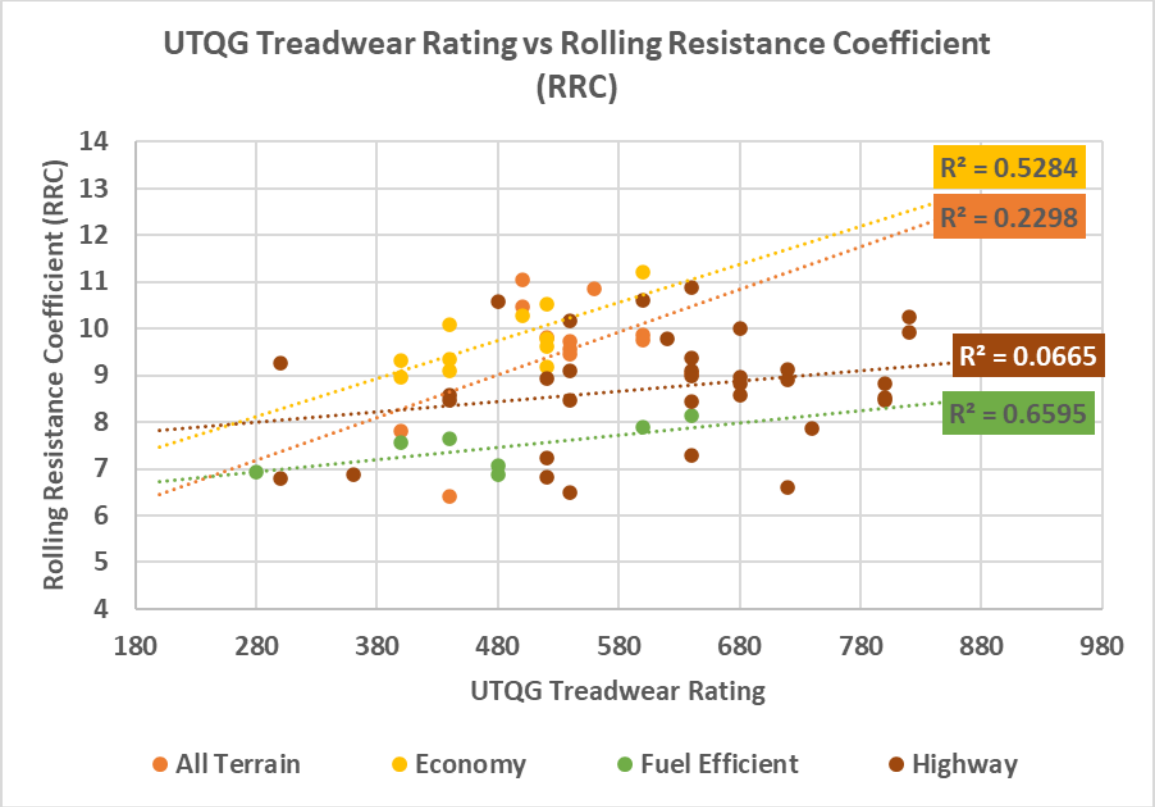


Chart 5.3A

- Uniform Tire Quality Grading (UTQG) Treadwear Rating as identified by tire stamping on sidewall; example UTQG rating: 560 A B; 560 is treadwear rating. The rating is a numeric index of how well a tire wears in comparison to a reference tire.
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.
- Each plotted point represents the mean value of three (3) tires tested.
- Tire rolling resistance test protocol: ISO 28580:2018

5.3 Quantitative Correlation to UTQG Treadwear (continued)

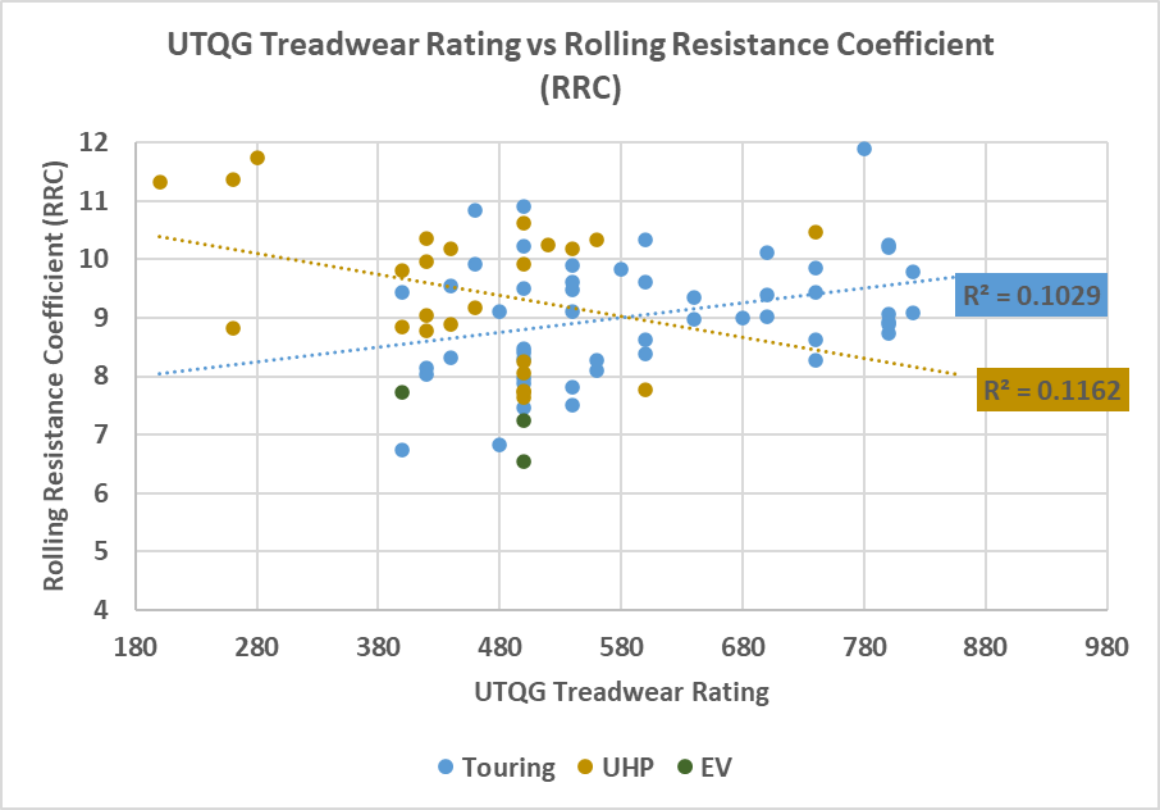


Chart 5.3B

- Uniform Tire Quality Grading (UTQG) Treadwear Rating as identified by tire stamping on sidewall; example UTQG rating: 560 A B; 560 is treadwear rating. The rating is a numeric index of how well a tire wears in comparison to a reference tire.
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.
- Each plotted point represents the mean value of three (3) tires tested.
- Tire rolling resistance test protocol: ISO 28580:2018

5.3 Quantitative Correlation to UTQG Treadwear (continued)

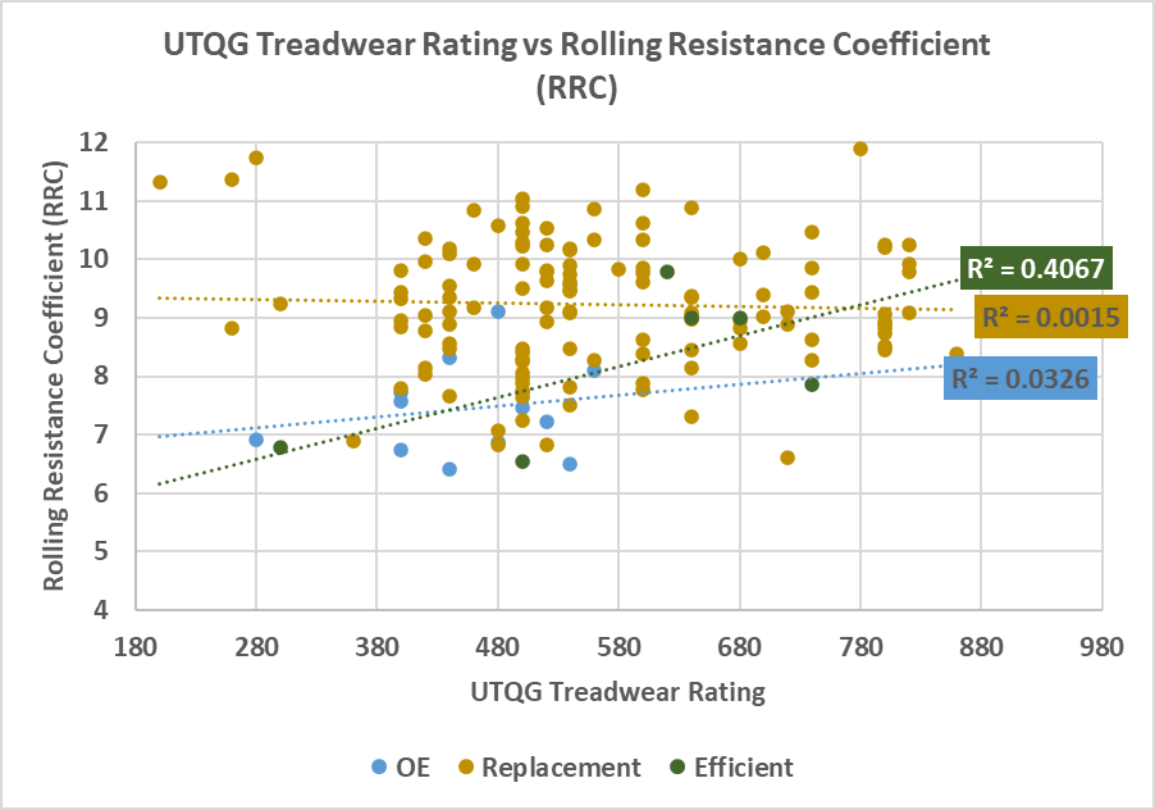


Chart 5.3C

- Uniform Tire Quality Grading (UTQG) Treadwear Rating as identified by tire stamping on sidewall; example UTQG rating: 560 A B; 560 is treadwear rating. The rating is a numeric index of how well a tire wears in comparison to a reference tire.
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.
- Each plotted point represents the mean value of three (3) tires tested.
- Tire rolling resistance test protocol: ISO 28580:2018

5.3 Quantitative Correlation to UTQG Treadwear (continued)

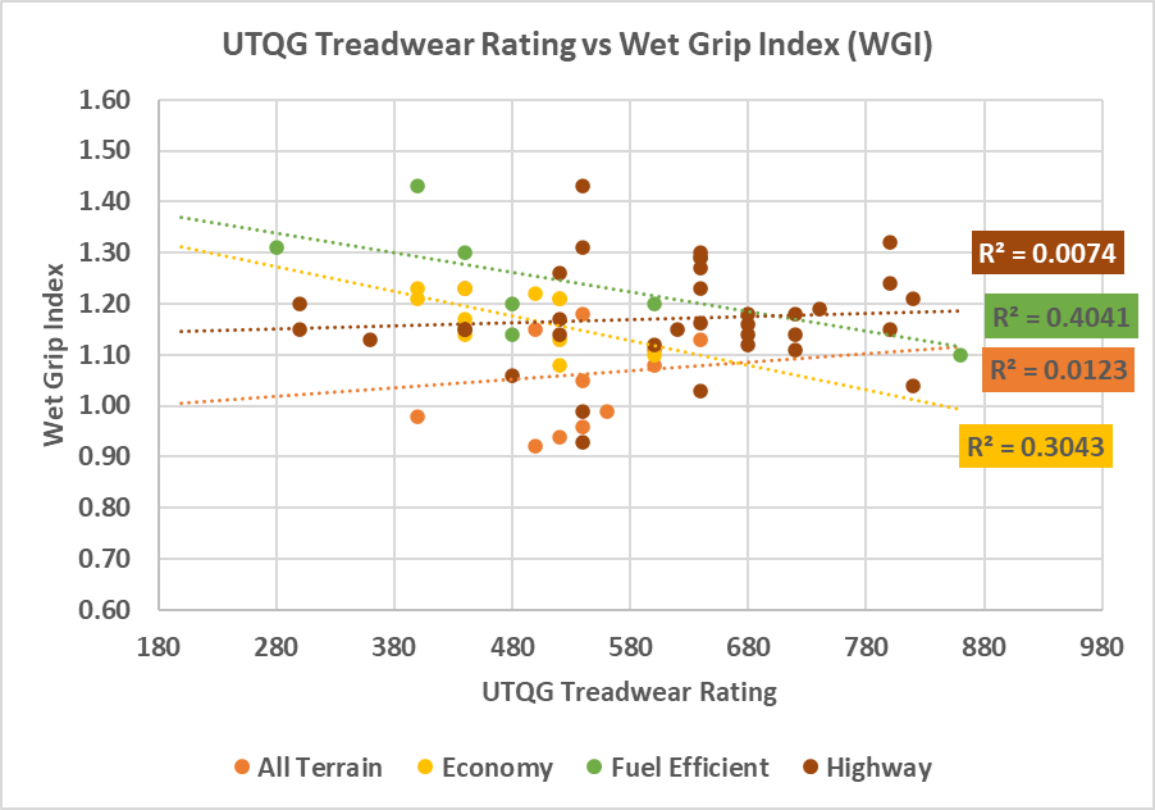


Chart 5.3D

- Uniform Tire Quality Grading (UTQG) Treadwear Rating as identified by tire stamping on sidewall; example UTQG rating: 560 A B; 560 is treadwear rating. The rating is a numeric index of how well a tire wears in comparison to a reference tire.
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.
- Each plotted point represents one (1) tire tested.
- Tire wet grip index test protocol: ISO 23671:2021

5.3 Quantitative Correlation to UTQG Treadwear (continued)

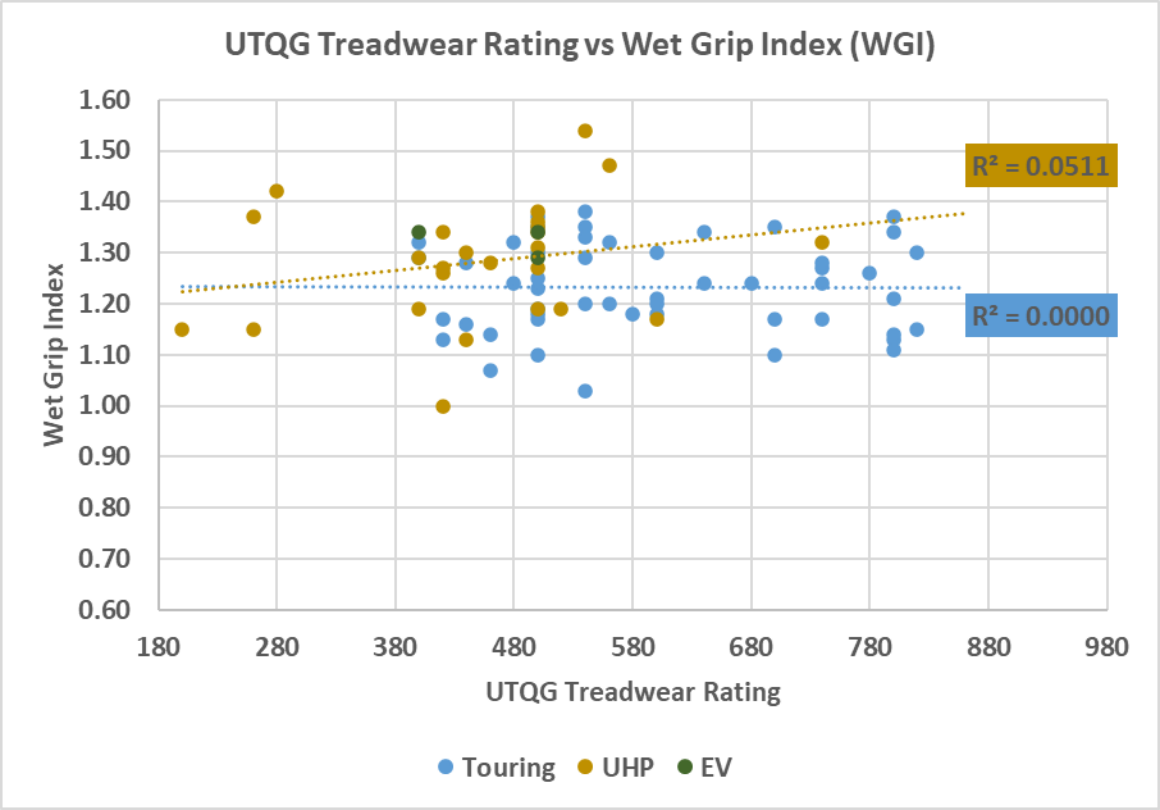


Chart 5.3E

- Uniform Tire Quality Grading (UTQG) Treadwear Rating as identified by tire stamping on sidewall; example UTQG rating: 560 A B; 560 is treadwear rating. The rating is a numeric index of how well a tire wears in comparison to a reference tire.
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.
- Each plotted point represents one (1) tire tested.
- Tire wet grip index test protocol: ISO 23671:2021

5.3 Quantitative Correlation to UTQG Treadwear (continued)

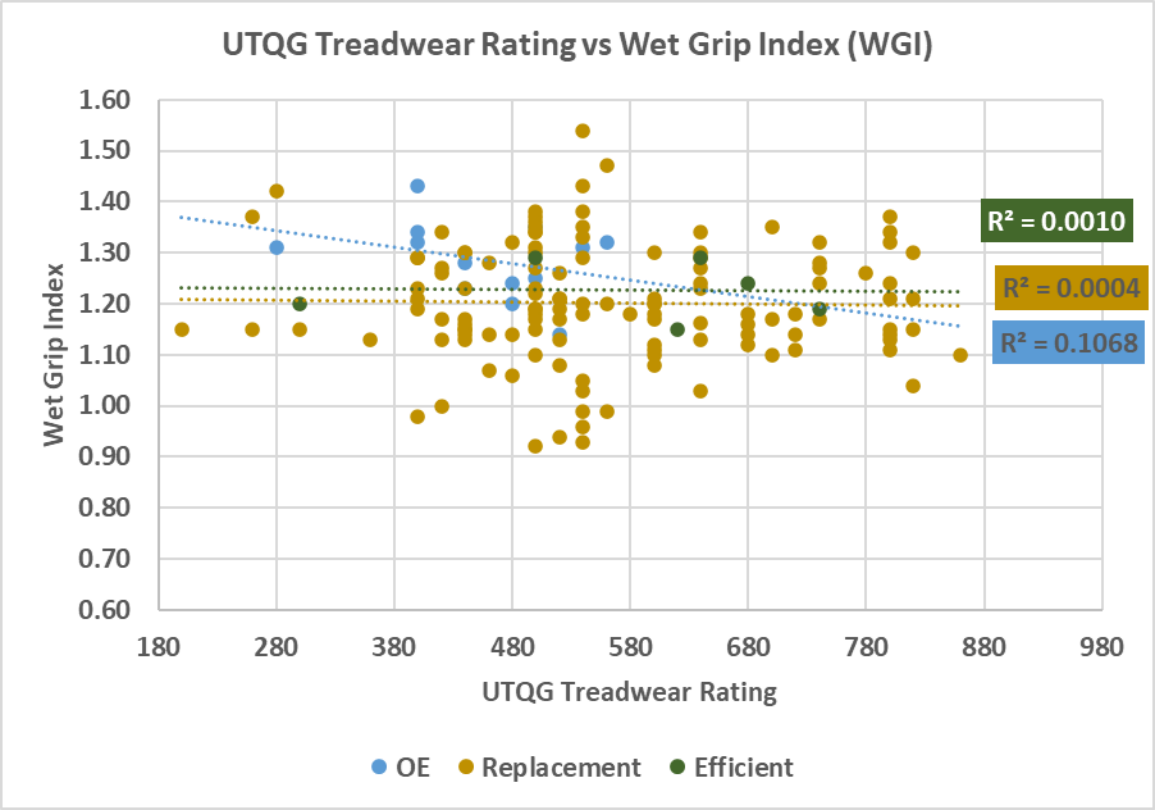


Chart 5.3F

- Uniform Tire Quality Grading (UTQG) Treadwear Rating as identified by tire stamping on sidewall; example UTQG rating: 560 A B; 560 is treadwear rating. The rating is a numeric index of how well a tire wears in comparison to a reference tire.
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.
- Each plotted point represents one (1) tire tested.
- Tire wet grip index test protocol: ISO 23671:2021

5.4 Quantitative Correlation to Tread Depth

Tread Depth vs Rolling Resistance: Market Categories (See Charts 5.4A and 5.4B)
Rolling resistance results generally indicated a positive correlation with measured tread depth: rolling resistance increased with increasing tread depth, for tire market categories. Most correlations tended to range from negligible to weak, with the exception of the Fuel Efficient category, which exhibited an R^2 of 0.742. The Fuel Efficient category trendline also exhibited a relatively steeper slope the other categories, suggesting a higher RRC sensitivity to increasing tread depth.

Tread Depth vs Rolling Resistance: OE vs Replacement vs Efficient Categories (See Chart 5.4C)
Rolling resistance results tended to indicate a positive correlation with tread depth: rolling resistance increased with increasing tread depth, for the usage categories of OE vs Replacement vs Efficient. The highest R^2 was exhibited by the OE group at 0.432.

Tread Depth vs. Wet Grip Index: Market Categories (See Charts 5.4D and 5.4E)
Wet grip index test results did not correlate well with tread depth and were not directionally consistent. The correlations with tread depth tended to exhibit very low R^2 values. Data tended to generally cluster around the 8 mm tread depth for non-light truck categories.

Tread Depth vs Wet Grip Index: OE vs Replacement vs Efficient Usage Categories (See Chart 5.4F)
Wet grip index test results did not correlate well with tread depth and were not directionally consistent.

5.4 Quantitative Correlation to Tread Depth (continued)

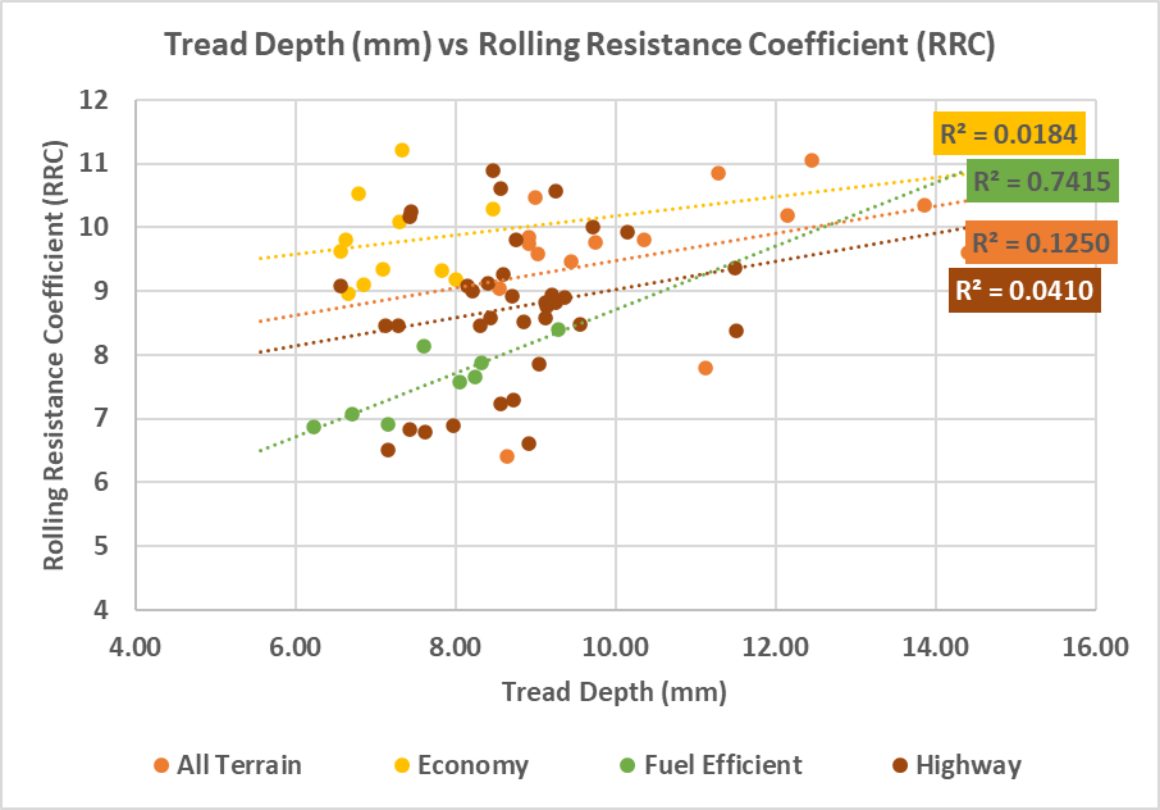


Chart 5.4A

- Tread depth measured in millimeters with a tread depth gauge: measured to groove bottom.
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.
- Each plotted point represents the mean value of three (3) tires tested.
- Tire rolling resistance test protocol: ISO 28580:2018

5.4 Quantitative Correlation to Tread Depth (continued)

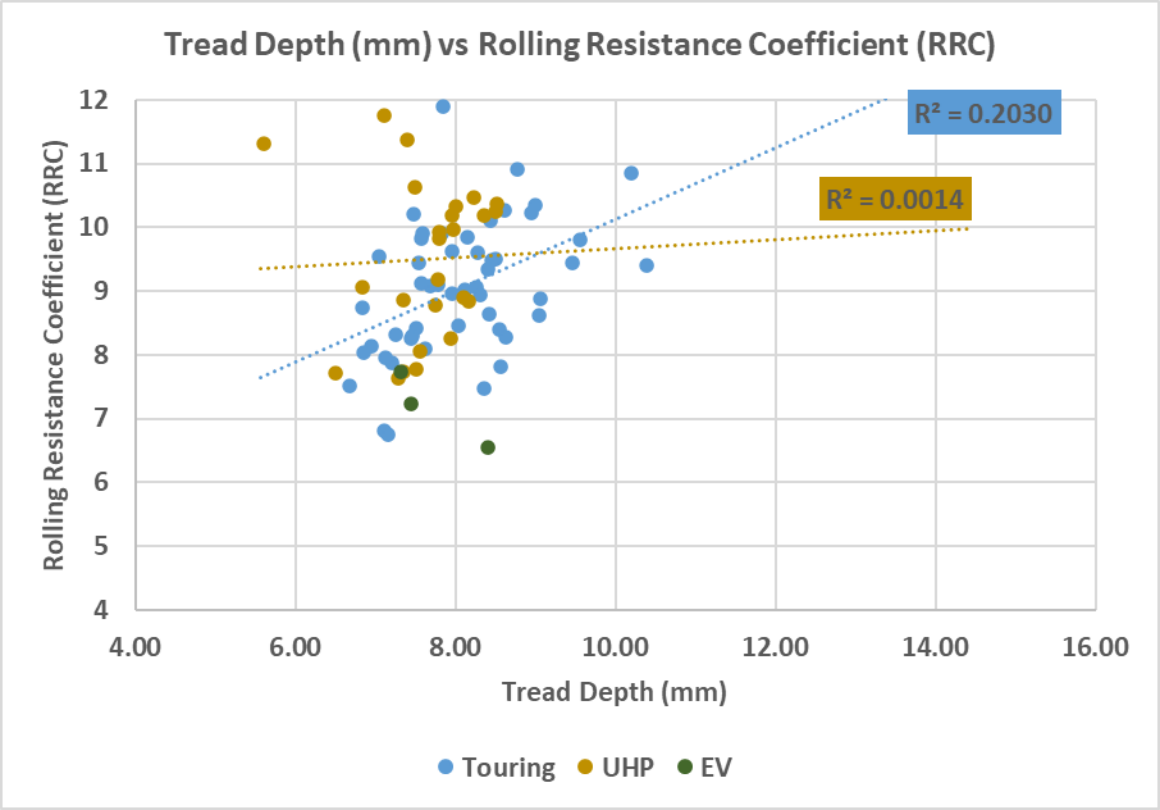


Chart 5.4B

- Tread depth measured in millimeters with a tread depth gauge: measured to groove bottom.
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.
- Each plotted point represents the mean value of three (3) tires tested.
- Tire rolling resistance test protocol: ISO 28580:2018

5.4 Quantitative Correlation to Tread Depth (continued)

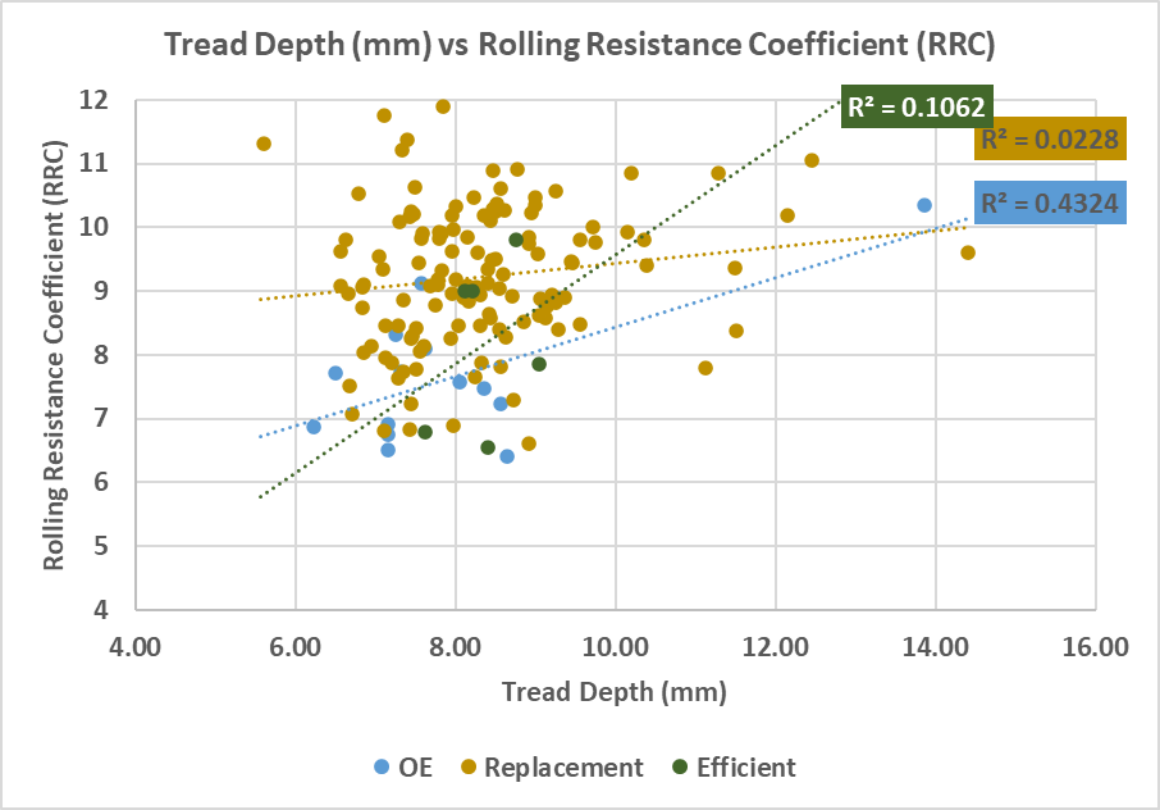


Chart 5.4C

- Tread depth measured in millimeters with a tread depth gauge: measured to groove bottom.
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.
- Each plotted point represents the mean value of three (3) tires tested.
- Tire rolling resistance test protocol: ISO 28580:2018

5.4 Quantitative Correlation to Tread Depth (continued)

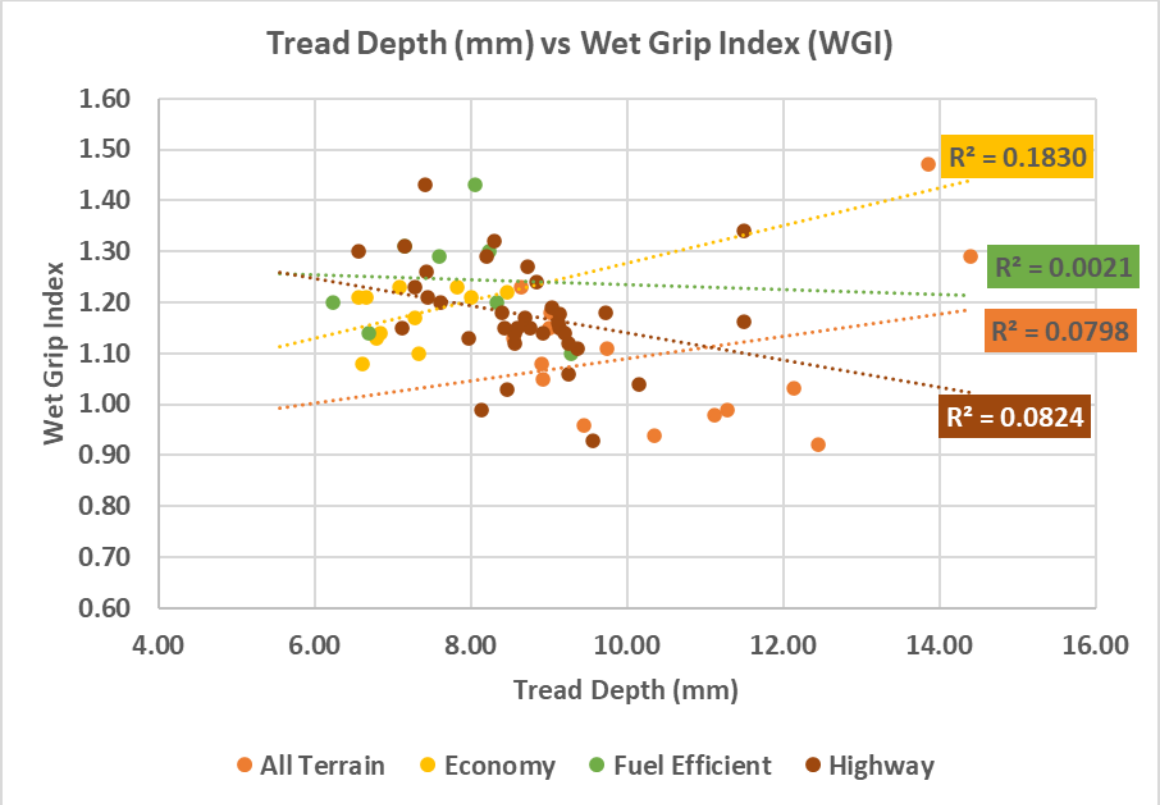


Chart 5.4D

- Tread depth measured in millimeters with a tread depth gauge: measured to groove bottom.
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.
- Each plotted point represents one (1) tire tested.
- Wet grip index test protocol: ISO 23671:2021

5.4 Quantitative Correlation to Tread Depth (continued)

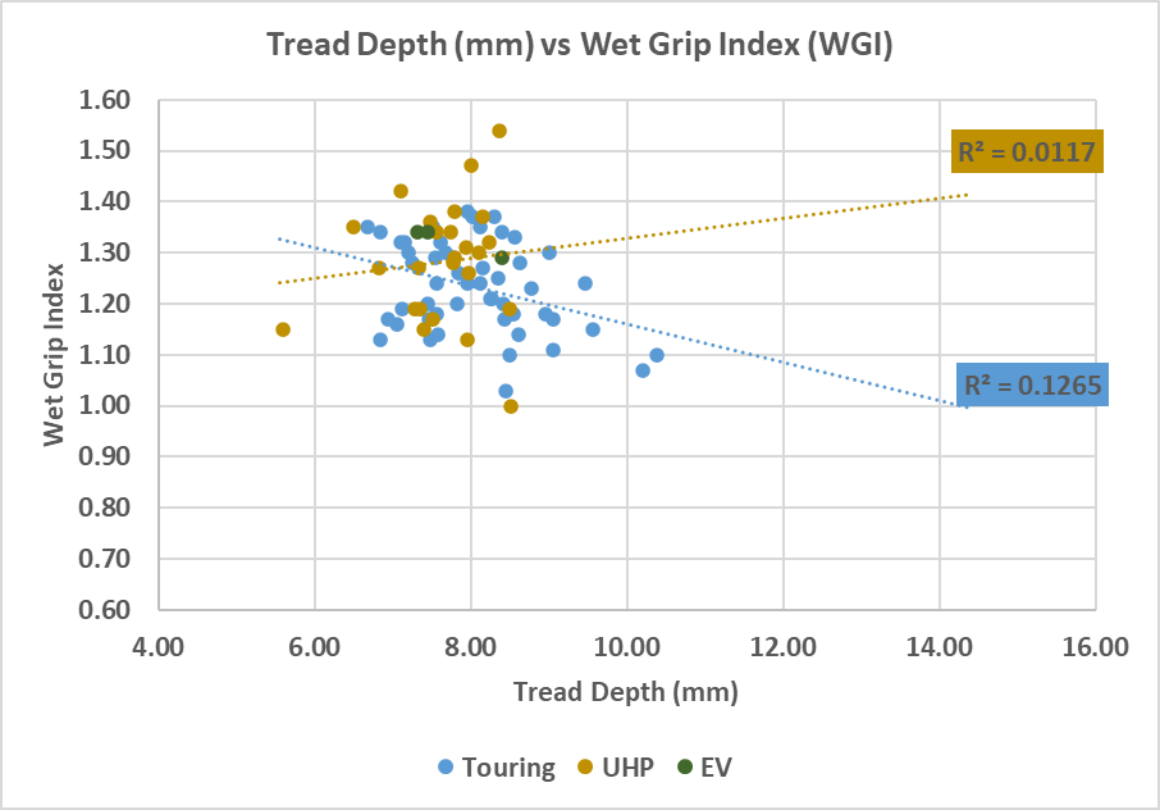


Chart 5.4E

- Tread depth measured in millimeters with a tread depth gauge: measured to groove bottom.
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.
- Each plotted point represents one (1) tire tested.
- Wet grip index test protocol: ISO 23671:2021

5.4 Quantitative Correlation to Tread Depth (continued)

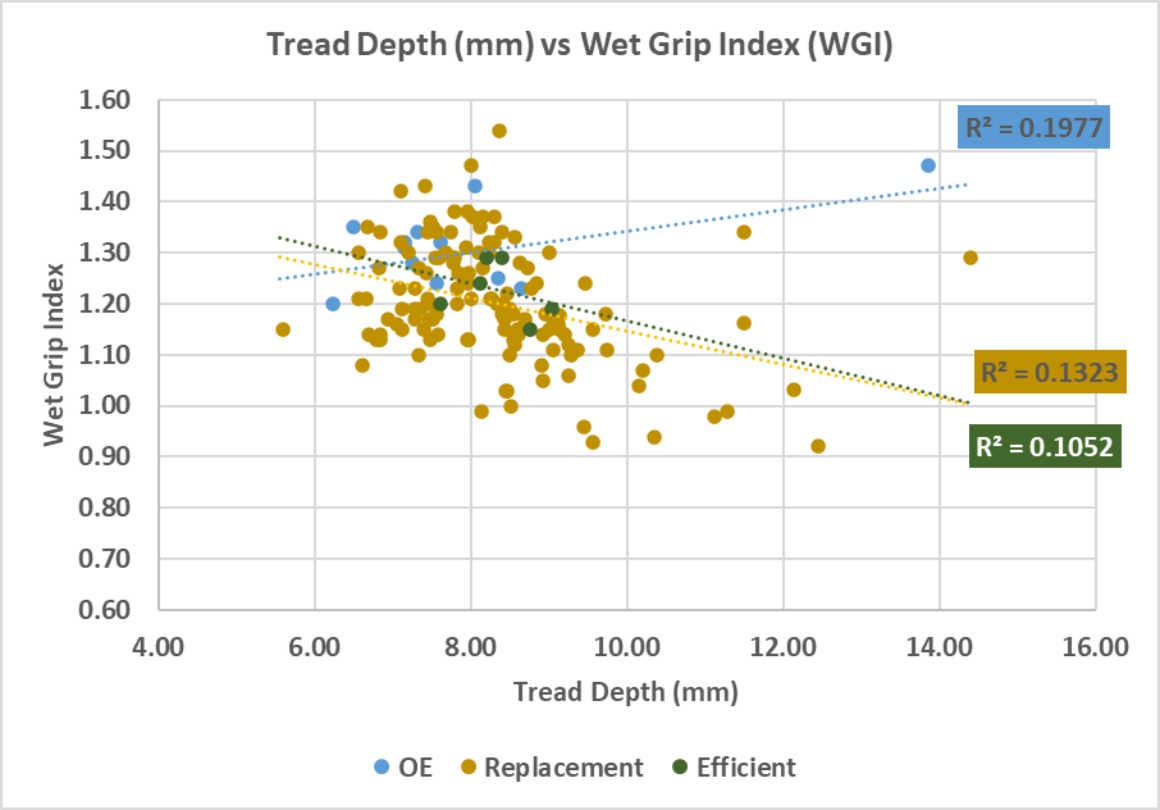


Chart 5.4F

- Tread depth measured in millimeters with a tread depth gauge: measured to groove bottom.
- R^2 measures the proportion of variation in the dependent variable that can be attributed to the independent variable. The R-squared value R^2 is always between 0 and 1 inclusive.
- Each plotted point represents one (1) tire tested.
- Wet grip index test protocol: ISO 23671:2021

5.5 Quantitative Correlation to Tire Weight

Tire Weight vs Rolling Resistance: Market Categories (See Charts 5.5A and 5.5B)
Rolling resistance results for Efficient Tires hinted (R^2= 0.244) at a weak, but positive correlation with tire weight: rolling resistance increased with increasing tire weight. Analyses of the remaining market categories of tires were inconclusive, with very low R^2 values from the linear correlation analyses.

Tire Weight vs Rolling Resistance: OE/Replacement/Efficient Tires (See Chart 5.5C)
The analyses of data representing the rolling resistance results of the usage categories of the tire population: OE vs Replacement vs Efficient did not yield relevant correlations with tire weight.

Tire Weight vs. Wet Grip Index: Market Categories (See Charts 5.5D and 5.5E)
Wet grip index data correlations with tire weight exhibited very low R^2 values (negligible correlations).

Tire Weight vs Wet Grip Index: OE/Replacement/Efficient Tires (See Chart 5.5F)
Wet grip index data correlations with tire weights representing usage categories (OE vs replacement vs Efficient) exhibited very low R^2 values (negligible correlations).

Charts may be found in the Appendix.

5.6 Quantitative Correlation to Aspect Ratio

Tire Aspect Ratio vs. Rolling Resistance: Market Categories (See Charts 5.6A and 5.6B)
Rolling resistances, as based upon the Market Categories RRC data, did not exhibit consistent directional trendlines when correlated with aspect ratios. Low R^2 values were noted.

Tire Aspect Ratio vs. Rolling Resistance: OE vs Replacement vs Efficient Usage Categories (See Chart 5.6C)
The rolling resistance data, when examined from a usage category perspective of OE vs Replacement vs Efficient tires exhibited trendlines with low correlation coefficients for the OE and Replacement categories. Although the Efficient category trendline had a higher R^2 value (0.320), it was based upon tires spanning only two aspect ratios.

Tire Aspect Ratio vs. Wet Grip Index: Market Categories (See Charts 5.6D and 5.6E)
Tire wet grip indices, as based upon the Market Categories RRC data, did not exhibit consistent directional trendlines when correlated with aspect ratios.

Tire Aspect Ratio vs. Wet Grip Index: OE vs Replacement vs Efficient Usage Categories (See Chart 5.6F)
Analyses of the tire wet grip indices representing the usage categories of OE vs Replacement vs Efficient tires suggested trendlines indirectly correlated: wet grip declined with increasing aspect ratio. Nevertheless, R^2 values representing the trendlines were weak and trendline slopes were shallow, further suggesting low sensitivity.

Tire Aspect Ratio as identified by tire size stamping on sidewall; example: 265/75R17: 75 aspect ratio. Aspect ratio = height: width ratio of a section of the tire.

Charts may be found in the Appendix.

5.7 Quantitative Correlation to Bead Diameter

Bead Diameter vs. Rolling Resistance: Market Categories (See Charts 5.7A and 5.7B)
Rolling resistances, as based upon RRC data, generally declined with increasing bead diameter, although this was not the case with Efficient tires. R^2 values, and thus the quality of the correlation, were very low for six (6) of the seven (7) market categories. Only the All Terrain tires (light truck SKUs) exhibited a moderate R^2 value: 0.434. In this case, the RRC trendline indicated a decline in rolling resistance with increasing bead diameter.

Bead Diameter vs. Rolling Resistance: OE vs Replacement vs Efficient Usage Categories (See Chart 5.7C)
The rolling resistance data, when examined from a usage category perspective of OE vs Replacement vs Efficient tires did not yield useful correlations, as denoted by low R^2 values. No correlations between bead diameter and rolling resistance were noted.

Bead Diameter vs. Wet Grip Index: Market Categories (See Charts 5.7D and 5.7E)
Wet grip index results were directionally inconsistent and, correlations tended to range from negligible to very weak for much of the data. The higher R^2 value representing the fuel efficient category may have been attributable to the small sample size.

Bead Diameter vs. Wet Grip Index: OE vs Replacement vs Efficient Usage Categories (See Chart 5.7F)
No correlations were noted between bead diameter and wet grip index for the three usage categories studied: OE, Replacement and Efficient tires.

Bead Diameter identified by tire size stamping on sidewall; example: 265/75R17: 17 inch wheel diameter at bead ledge.

Charts may be found in the Appendix.

5.8 Quantitative Correlation to Section Width

Tire Section Width vs. Rolling Resistance: Market Categories (See Charts 5.8A and 5.8B)
Rolling resistances, as based upon the market categories RRC data, did not correlate with tire section widths, with the exception of the Fuel Efficient Tires, with a trendline which exhibited increasing rolling resistance with increasing section width (weak R^2 = 0.208).

Tire Section Width vs. Rolling Resistance: OE vs Replacement vs Efficient Usage Categories (See Chart 5.8C)
The rolling resistance data, when examined from a usage category perspective of OE vs Replacement vs Efficient tires did not yield useful correlations with section widths, as denoted by low R^2 values.

Tire Section Width vs. Wet Grip Index: Market Categories (See Charts 5.8D and 5.8E)
Wet grip index results were directionally inconsistent and linear correlation trendlines exhibited negligible R^2 values. tended to range from negligible to very weak for much of the data.

Tire Section Width vs. Wet Grip Index: OE vs Replacement vs Efficient Usage Categories (See Chart 5.8F)
No correlations were noted between tire section widths and wet grip indices for the three usage categories studied: OE, Replacement and Efficient tires.

Tire Section Width as identified by tire size stamping on sidewall; example: 265/75R17: 265mm tire section width

Charts may be found in the Appendix.

5.9 Subjective Correlation to Tire Market Category

Tire market categories were subjectively assigned by Smithers to each SKU ordered, as based upon manufacturers' marketing websites, examination of tread patterns, and purchase costs ("Economy" category). Assignment of SKUs to the "All Highway" category was based upon tread pattern appearance and lack of emphasis upon the other six (6) categories in the subjective range. The "Economy" category was based upon purchase costs only, with no consideration of usage costs.

Tire Market Category vs Rolling Resistance

Mean rolling resistance coefficients for tires representing the "EV" and "Fuel Efficient" market categories exhibited the lowest rolling resistances. The "Economy" and "All Terrain" tire market categories exhibited the highest rolling resistances, as based upon RRC data.

Tire Market Category vs Wet Grip Index

Wet grip indices generally tended to be inversely related to the rolling resistance results by category. "EV", "UHP" (ultrahigh performance) and "Fuel Efficient" tires exhibited the highest wet grip indices. The "Economy" and "All Terrain" tires exhibited the lowest wet grip indices.

5.9 Subjective Correlation to Tire Market Category (continued)

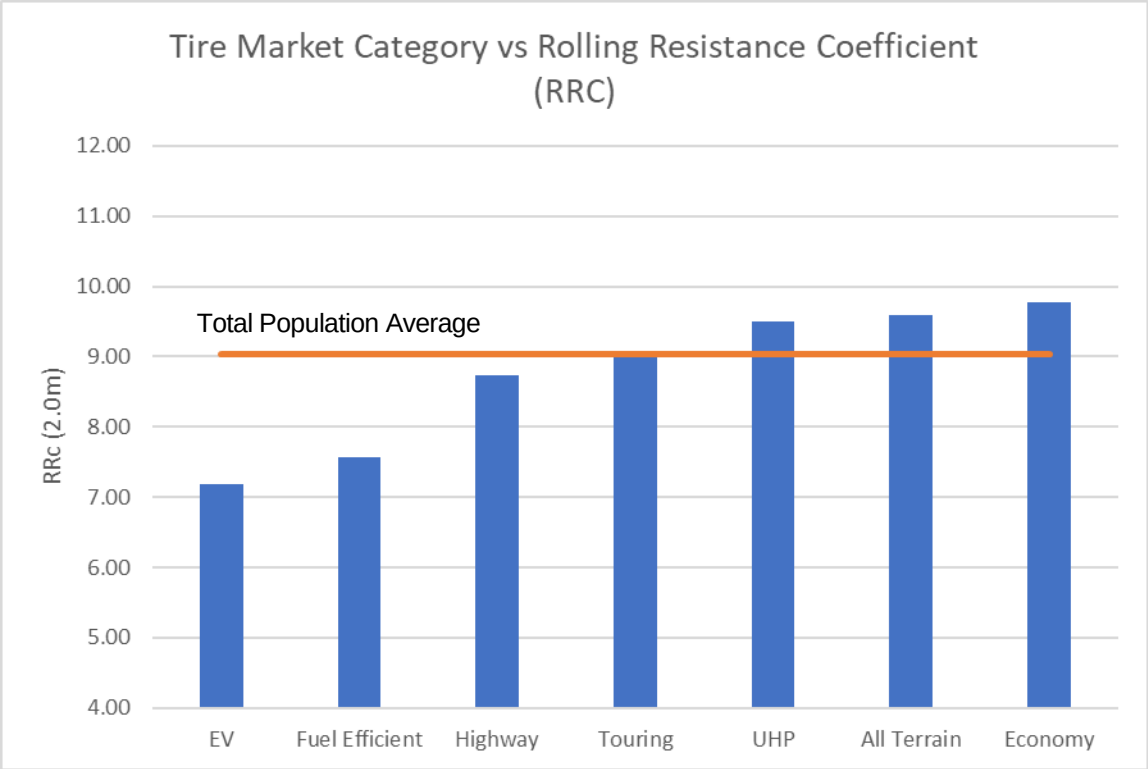


Chart 5.9A

- Tire market categories were subjectively assigned by Smithers, as based upon manufacturers' marketing websites, examination of tread patterns, and purchase costs ("Economy" category).
- Each bar represents the total average of the mean values of SKUs tested within that market category. Three (3) tires were tested per SKU.
- Tire Market categories were rank ordered for this chart.
- Tire rolling resistance test protocol: ISO 28580:2018
- Orange bar represents the average of the total tire population.

5.9 Subjective Correlation to Tire Market Category (continued)

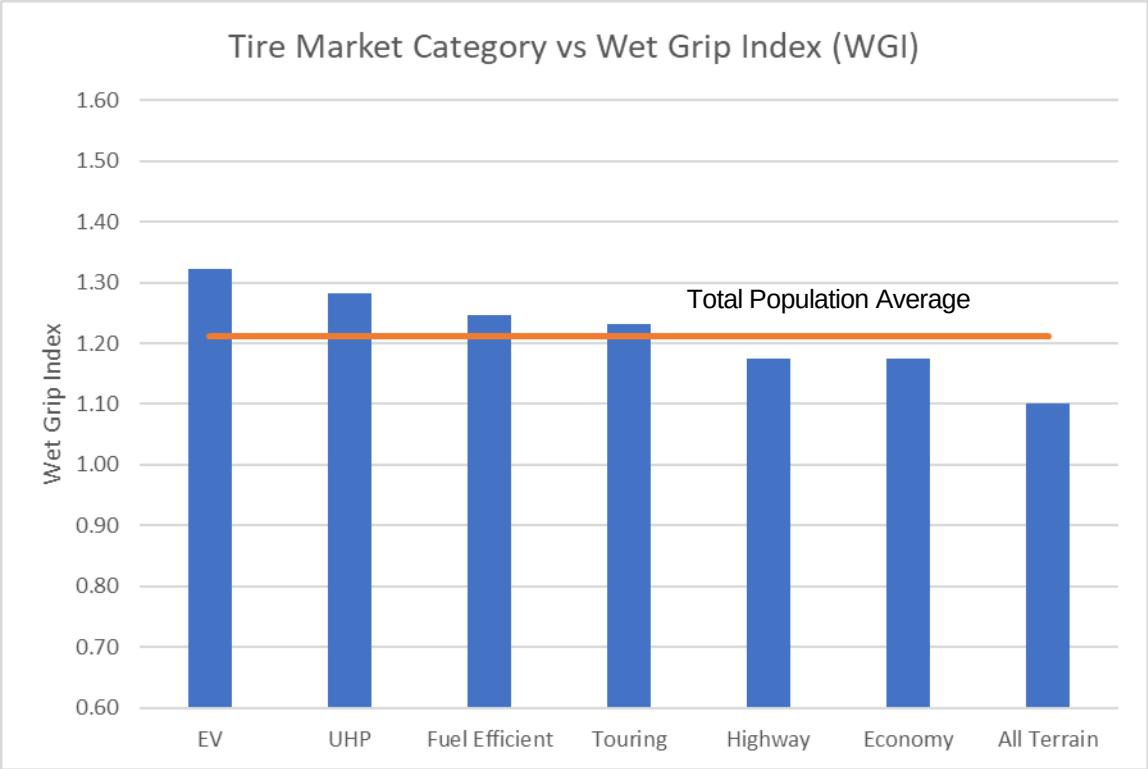


Chart 5.9B

- Tire market categories were subjectively assigned by Smithers, as based upon manufacturers' marketing websites, examination of tread patterns, and purchase costs ("Economy" category).
- Each bar represents the total average of the mean values of SKUs tested within that market category. One (1) tire was tested per SKU.
- Tire Market categories were rank ordered for this chart.
- Tire wet grip index test protocol: ISO 23671:2021
- Orange bar represents the average of the total tire population.

5.10 Subjective Correlation to Manufacturer Tier

Tire Manufacturer Tier categories were subjectively assigned by Smithers, based upon manufacturers' global tire sales, as published in *Tire Business,* February 15, 2021 32nd Annual Market Data Book

- Tier #1: top four (4) tire manufacturers,
- Tier #2: next seven (7) largest tire manufacturers
- Tier #3: all others.

Tire Manufacturer Tier vs Rolling Resistance

Mean rolling resistance coefficients for tires representing the Tier #1 and Tier #2 categories were very similar. The group average Tier 3 rolling resistance was higher.

Tire Manufacturer Tier vs Wet Grip Index

Mean wet grip indices for tires representing the Tier #1 and Tier #2 categories were similar. The group average Tier 3 wet grip index was slightly lower.

5.10 Subjective Correlation to Manufacturer Tier (continued)

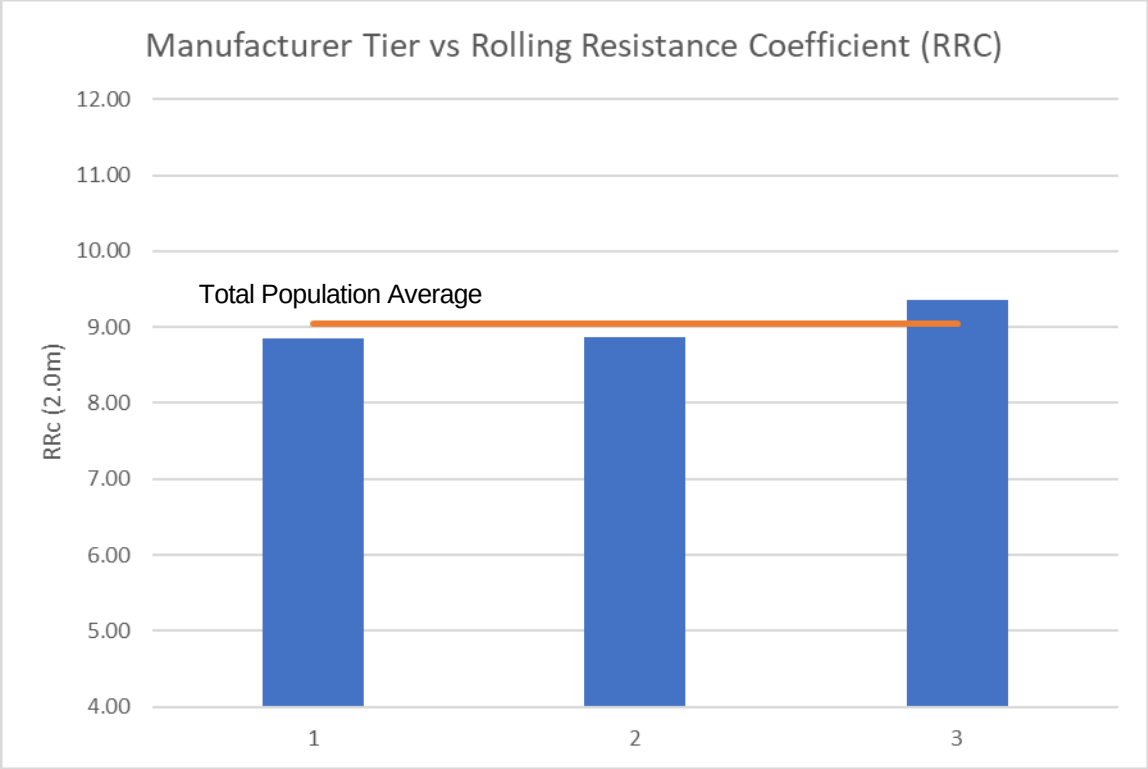


Chart 5.10A

- Tire Manufacturer Tier categories were subjectively assigned by Smithers, based upon manufacturers' global tire sales, as published in
- Tier #1 = top four (4) tire manufacturers, Tier #2 = next largest seven (7) tire manufacturers, and Tier #3 = all others.
- Each bar represents the total average of the mean values of SKUs tested within that Tire Manufacturer Tier. Three (3) tires were tested per SKU.
- Tire rolling resistance test protocol: ISO 28580:2018
- Orange bar represents the average of the total tire population.

5.10 Subjective Correlation to Manufacturer Tier (continued)

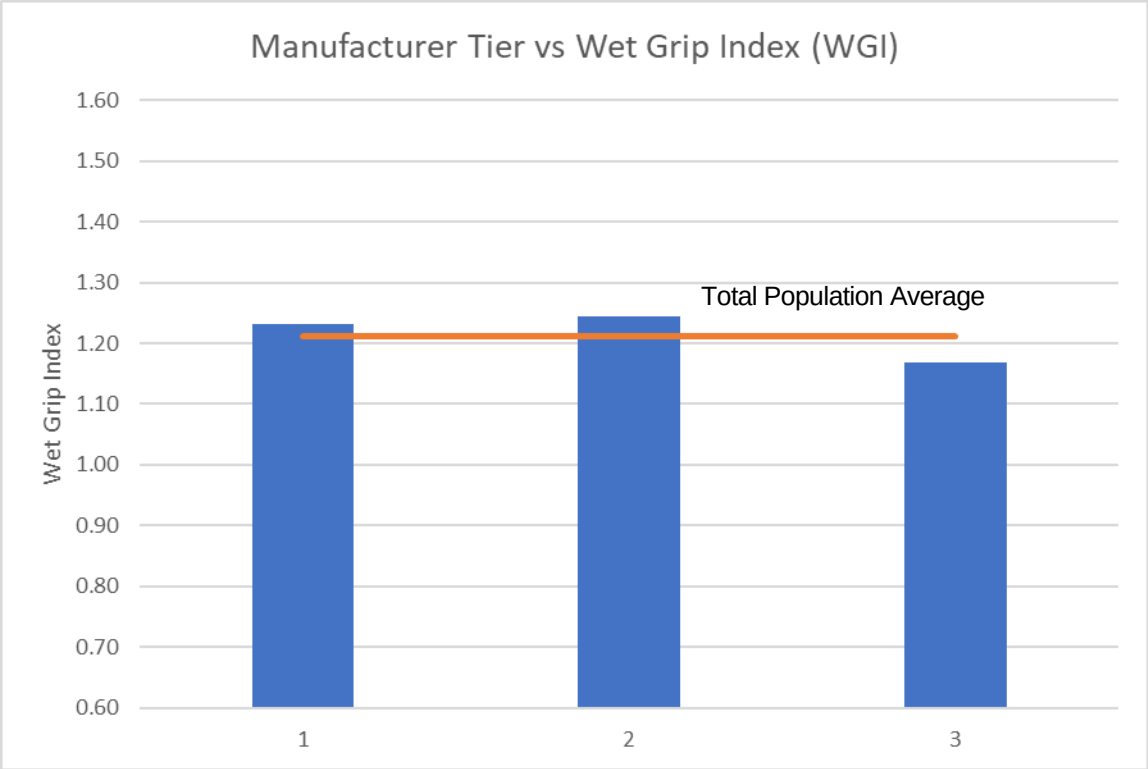


Chart 5.10B

- Tire Manufacturer Tier categories were subjectively assigned by Smithers, based upon manufacturers' global tire sales, as published in *Tire Business* "37th Global Tire Report: 2022 Global Tire Company Rankings"
- Tier #1 = top four (4) tire manufacturers, Tier #2 = next largest seven (7) tire manufacturers, and Tier #3 = all others.
- Each bar represents the total average of the mean values of SKUs tested within that Tire Manufacturer Tier. One (1) tire was tested per SKU.
- Tire wet grip index test protocol: ISO 23671:2021
- Orange bar represents the average of the total tire population.

5.11 Subjective Correlation to UTQG Traction Rating

The UTQG Traction rating is based on the coefficient of friction of a locked (skidding) tire in a straight line on a wet surface. The traction grades from highest to lowest are AA, A, B and C, and they represent the tire's ability to stop on wet pavement as measured under controlled conditions on specified government test surfaces of asphalt and concrete. A tire marked C may have poor traction performance. The traction grade is based on braking (straight ahead) traction tests and does not include cornering (turning) traction.

Traction Grading		
Grades	g-Force (asphalt)	g-Force (concrete)
AA	>0.54	0.38
A	>0.47	0.35
B	>0.38	0.26
C	<0.38	0.26

NHTSA reported in YR2020 that of current tires:

- 15% are rated "AA"
- 77% are rated "A"
- 7% are rated "B"
- Only 4 lines of tires are rated "C"

UTQG Tire Traction Rating vs Rolling Resistance

Mean rolling resistance coefficients for tires representing the rated UTQG traction grades increased with increasing traction grades. Rolling resistance increased by approximately 25% over the span of traction ratings from "B" to "AA".

UTQG Tire Traction Rating vs Wet Grip Index

As expected, wet grip indices from ISO 23671(2021) testing correlated well with UTQG traction ratings.

5.11 Subjective Correlation to UTQG Traction Rating (continued)

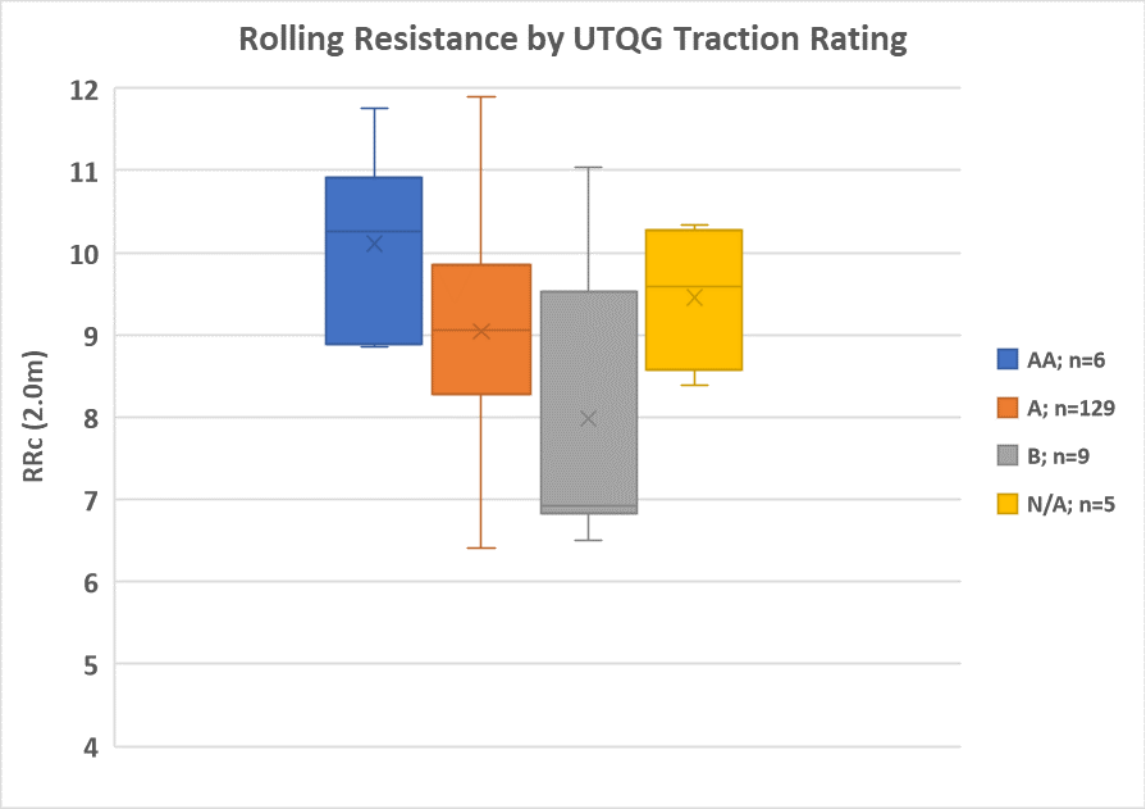


Chart 5.11A

- UTQG TRACTION – AA, A, B and C: The traction grades from highest to lowest are AA, A, B and C and they represent the tire's ability to stop on wet pavement as measured under controlled conditions on specified government test surfaces of asphalt and concrete. A tire marked C may have poor traction performance. The traction grade is based on braking (straight ahead) traction tests and does not include cornering (turning) traction.
- NA = unrated (light truck tires with LT designation).
- Each bar represents the total average of the mean values of SKUs tested within that traction grade designation. Three (3) tires were tested per SKU.
- Tire rolling resistance test protocol: ISO 28580:2018
- Orange bar represents the average of the total tire population.

5.11 Subjective Correlation to UTQG Traction Rating (continued)

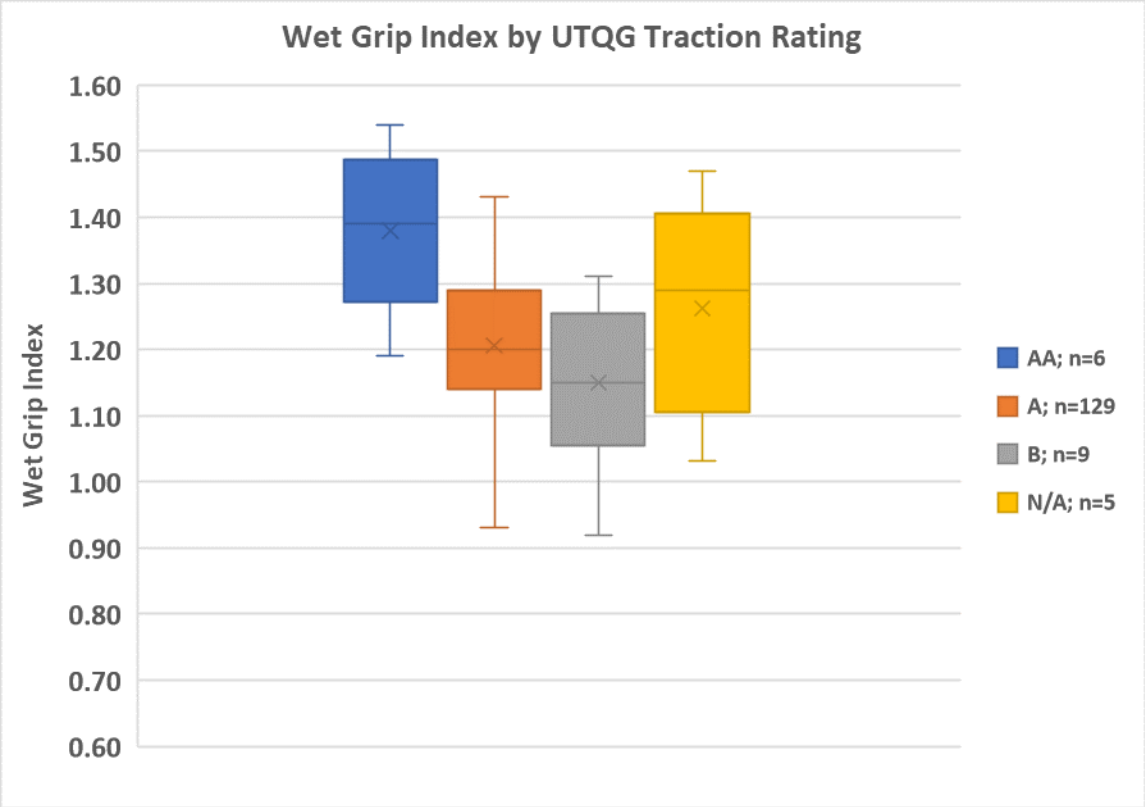


Chart 5.11B

- TRACTION – AA, A, B and C: The traction grades from highest to lowest are AA, A, B and C and they represent the tire's ability to stop on wet pavement as measured under controlled conditions on specified government test surfaces of asphalt and concrete. A tire marked C may have poor traction performance. The traction grade is based on braking (straight ahead) traction tests and does not include cornering (turning) traction.
- NA = unrated (light truck tires with LT designation).
- Each bar represents the total average of the mean value of tire SKUs tested within that temperature rating designation. One (1) tire was tested per SKU.
- Tire wet grip index test protocol: ISO 23671:2021
- Orange bar represents the average of the total tire population.

5.12 Subjective Correlation to UTQG Temperature Rating

TEMPERATURE – A, B and C: The temperature grades are A (the highest), B and C, representing the tire's resistance to the generation of heat and its ability to dissipate heat when tested under controlled conditions on a specified indoor laboratory test wheel. Sustained high temperature can cause the material of the tire to degenerate and reduce tire life, and excessive temperature can lead to sudden tire failure. The grade C corresponds to a level of performance which all passenger car tires must meet under the Federal Motor Vehicle Safety Standard. Grades A and B represent higher levels of performance on the laboratory test wheel than the minimum required by law. Temperature grades are established for tires that are properly inflated and not overloaded.

Temperature Grades	Speeds in mph
A	Over 115
B	Between 100 to 115
C	Between 85 to 100

NHTSA reported in YR2020 that of current tires:

- 62% are rated "A"
- 34% are rated "B"
- 4% are rated "C"

Tire Temperature Rating vs Rolling Resistance

Mean rolling resistance coefficients for tires representing temperature grades A and B were very similar. Mean rolling resistance in terms of RRC for the unrated light truck tires, plotted with the bar: "NA" was about 5% higher than for the "A" and "B" UTQG temperature rated tires.

Tire Temperature Rating vs Wet Grip Index

Wet grip indices were generally higher for the unrated (LT) tires and "A" temperature rated tires, although differences were small in magnitude.

Charts may be found in the Appendix.

5.13 Subjective Correlation to Load Index

The load index of a tire is a number that correlates to the maximum safe carrying capacity of the tire when inflated to its maximum pressure, as labeled on the sidewall. Information to ascertain the vehicle load-carrying requirements may be found on the vehicle placard.

Maximum Load Carrying Capacity per Tire					
Load Index	Kg	Pound (lb)	Load Index	Kg	Pound (lb)
71	345	761	99	775	1709
72	355	783	100	800	1764
73	365	805	101	825	1819
74	375	827	102	850	1874
75	387	853	103	875	1929
76	400	882	104	900	1984
77	412	908	105	925	2039
78	425	937	106	950	2094
79	437	963	107	975	2150
80	450	992	108	1000	2205
81	462	1019	109	1030	2271
82	475	1047	110	1060	2337
83	487	1074	111	1090	2403
84	500	1102	112	1120	2469
85	515	1135	113	1150	2535
86	530	1168	114	1180	2601
87	545	1202	115	1215	2679
88	560	1235	116	1250	2756
89	580	1279	117	1285	2833
90	600	1323	118	1320	2910
91	615	1356	119	1360	2998
92	630	1389	120	1400	3086
93	650	1433	121	1450	3197
94	670	1477	122	1500	3307
95	690	1521	123	1550	3417
96	710	1565	124	1600	3527
97	730	1609	125	1650	3638
98	750	1653			

Typical commuter car plus light truck load indices tend to range from about 70 to 124, and this range encompasses the tire population studied herein. Light truck tires have two load indexes labeled on the sidewall of the tire, unlike passenger tires, which only have one. This reflects the possible light truck tire use on vehicles with dual rear wheels.

Tire Load Index vs Rolling Resistance

Mean rolling resistance coefficients appeared to vary randomly with increasing tire load indices.

5.13 Subjective Correlation to Load Index (continued)

Tire Load Index vs Wet Grip Index
Wet grip indices appeared to vary randomly with increasing tire load indices.

Charts may be found in the Appendix.

5.14 Subjective Correlation to Speed Rating

The speed rating of a tire is the letter designation representing the speed capability: the designed maximum speed that the tire can sustain over time.

Speed Symbol	(mph)	(kph)	Open Ended Speed Category
Q	99	160	
S	112	180	
T	118	190	
U	124	200	
H	130	210	
V	149	240	
W	169	270	Z
Y	186	300	Z
(Y)	Above 186	Above 300	Z

Light truck speed indices frequently fall within the range of Q – S. Speed indices representing passenger vehicle tires commonly fall within the range of S – Y.

Tire Speed Rating vs Rolling Resistance
Mean rolling resistance coefficients for each speed rating were similar for the common speed rating range of T – W ratings for passenger type vehicles. The S speed rated tire category exhibited a lower mean RRC, and the Y speed rated tires (ultra-high performance) exhibited a higher mean RRC. The Q and R speed rated light truck tires typically exhibited higher average RRC rolling resistance levels as compared to the mean RRC representing the speed rating range of T – W ratings for passenger type vehicles.

Tire Speed Rating vs Wet Grip Index
With the exception of the Q-rated light truck tires, wet traction indices generally increased with increasing speed ratings.

Charts may be found in the Appendix

5.15 Subjective Correlation to Run Flat

A smaller segment of the tire market is the run flat tire, which usually appears on luxury or heavy vehicles. Run-flat tires have reinforcement to ensure they can temporarily support the vehicle's weight when the air pressure is lost. However, they are not built to continue driving, as many are rated to go up to 50 miles at 50 mph or less. Basically run-flat tires have a contingency built in that allows a driver to continue on the road if it experiences a puncture, allowing them to get somewhere safely for a replacement.

The most common choice is the self-supporting run flat. This type of run-flat features a reinforced sidewall construction, which has an increased chance of supporting the car in the event of air pressure loss. The sidewall maintains its connection to the rim.

Run-flat vs Rolling Resistance (RRC)
Rolling resistances as based upon RRC values for tires representing the run-flat design category were significantly higher (approximately 17%) than the non run-flat category tires.

Run-flat vs Wet Grip Index
The average wet grip index of the run-flat design category was generally equivalent to the wet grip index representing the non-run-flat tire design category.

Charts may be found in the Appendix

5.16 Efficient Tire Analysis

The client classified specific tires as “Efficient”. Below represents the specified “Efficient” tires tested and the similar non-efficient tires tested for comparison where possible. Similar tires being defined as the same size and similar speed and load indices (like vehicles and applications).

OE Tire: Tires which are specified by the vehicle manufacturer and are fitted on the new vehicle.
Replacement Tire: General aftermarket tires; not vehicle manufacturer specified

Table 5.16A: Efficient vs. Other Usage Categories Rolling Resistance Comparison

Tire Size	Speed Rating	Load Index	Category	RRC (2.0m Drum)
235/55R19	T	105	Efficient	6.55
235/55R19	V	101	OE	6.75
225/65R17	V	102	Efficient	9.00
225/65R17	V	102	Replacement	10.17
225/65R17	H	102	Efficient	8.99
225/65R17	H	102	Efficient	9.80
225/65R17	H	102	Replacement	7.88
225/65R17	H	102	Replacement	8.14
225/65R17	H	102	Replacement	8.39
225/65R17	H	102	Replacement	8.53
225/65R17	H	102	Replacement	8.64
225/65R17	H	102	Replacement	8.74
225/65R17	H	102	Replacement	9.06
225/65R17	H	102	Replacement	9.08
225/65R17	H	102	Replacement	9.85
225/65R17	H	102	Replacement	9.91
225/65R17	H	102	Replacement	10.11
225/65RF17	H	102	Replacement	10.23
225/65R17	H	102	Replacement	10.61

5.16 Efficient Tire Analysis (continued)

Table 5.16A: Efficient vs. Other Usage Categories Rolling Resistance Comparison (continued)

Tire Size	Speed Rating	Load Index	Category	RRC (2.0m Drum)
195/65R15	S	91	Efficient	6.79
195/65R15	S	91	OE	6.92
195/65R15	S	91	OE	8.32

The results varied by tire size:

- 235/55R19: "Efficient" vs "OE" tires exhibited comparable rolling resistance values
- 225/65R17 102V: Standard replacement tire RRC>Efficient tire
- 225/65R17 102H: Comparison of "Efficient" to standard replacement yielded mixed RRC results
- 195/65R15 91S: One OE tire SKU was equivalent to the Efficient tire SKU average. A second OE tire SKU exhibited higher RRC than the Efficient group average.

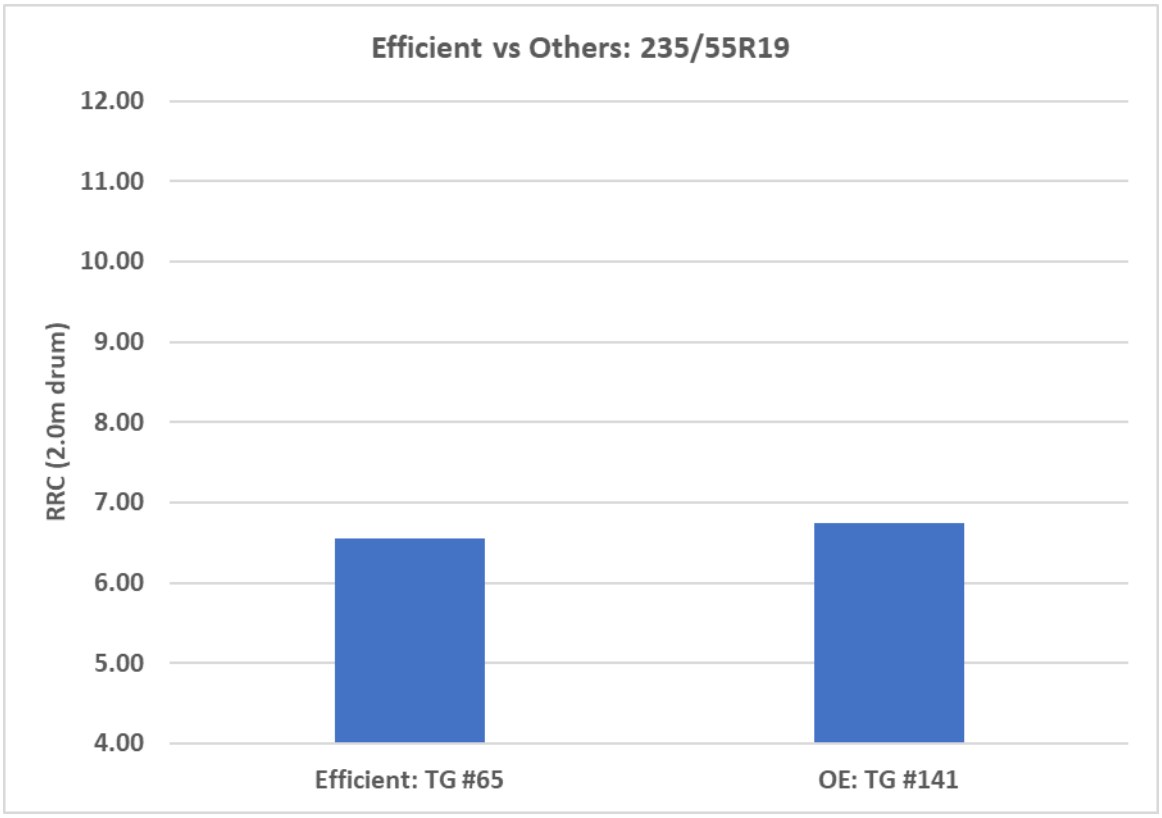


Chart 5.16A

Note: "TG" equals "Tire Group". See Appendix Section 1 for Tire Group details.

5.16 Efficient Tire Analysis (continued)

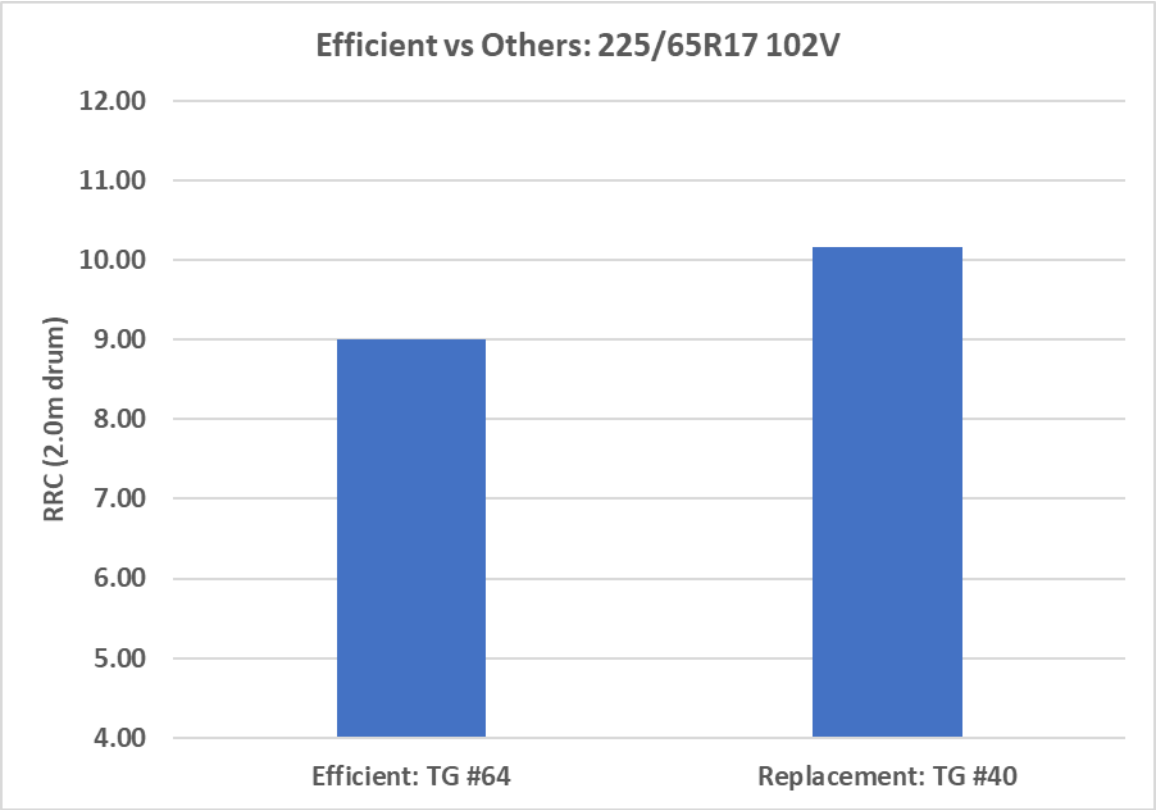


Chart 5.16B

Note: “TG” equals “Tire Group”. See Appendix Section 1 for Tire Group details.

5.16 Efficient Tire Analysis (continued)

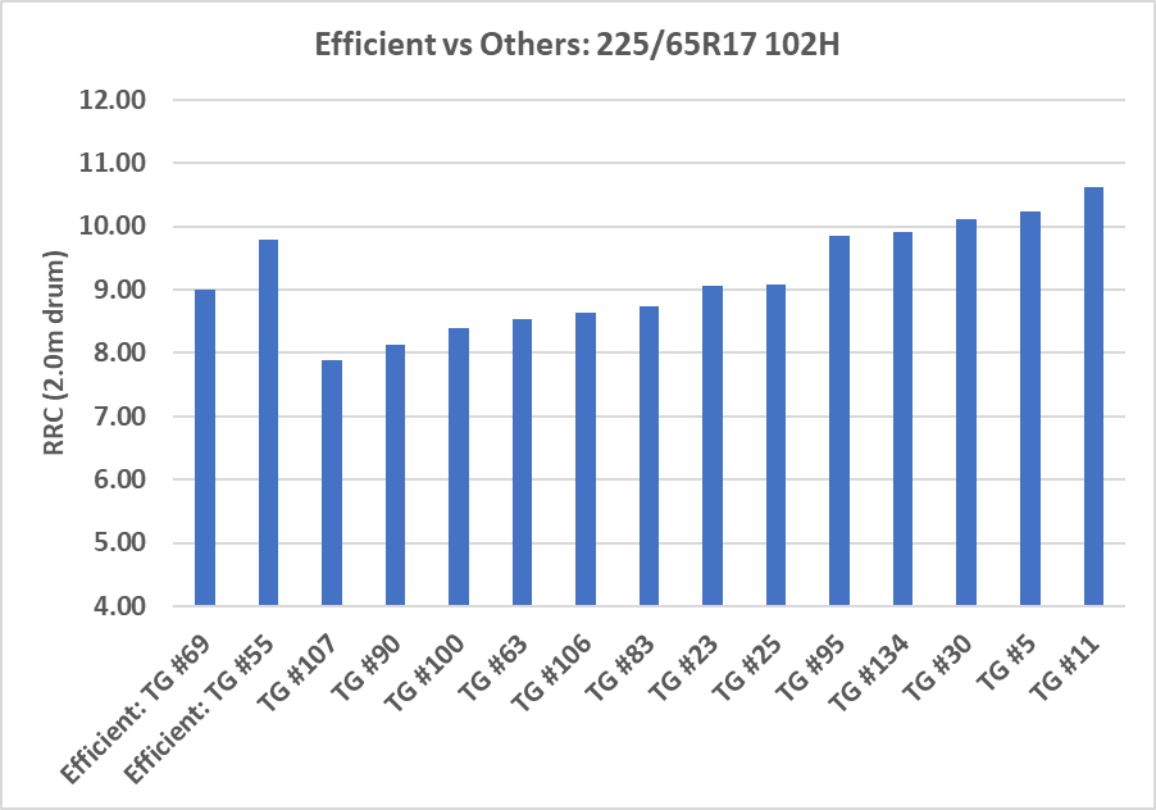


Chart 5.16C

Note: “TG” equals “Tire Group”. See Appendix Section 1 for Tire Group details. “Other Tires” rank ordered in chart.

5.16 Efficient Tire Analysis (continued)

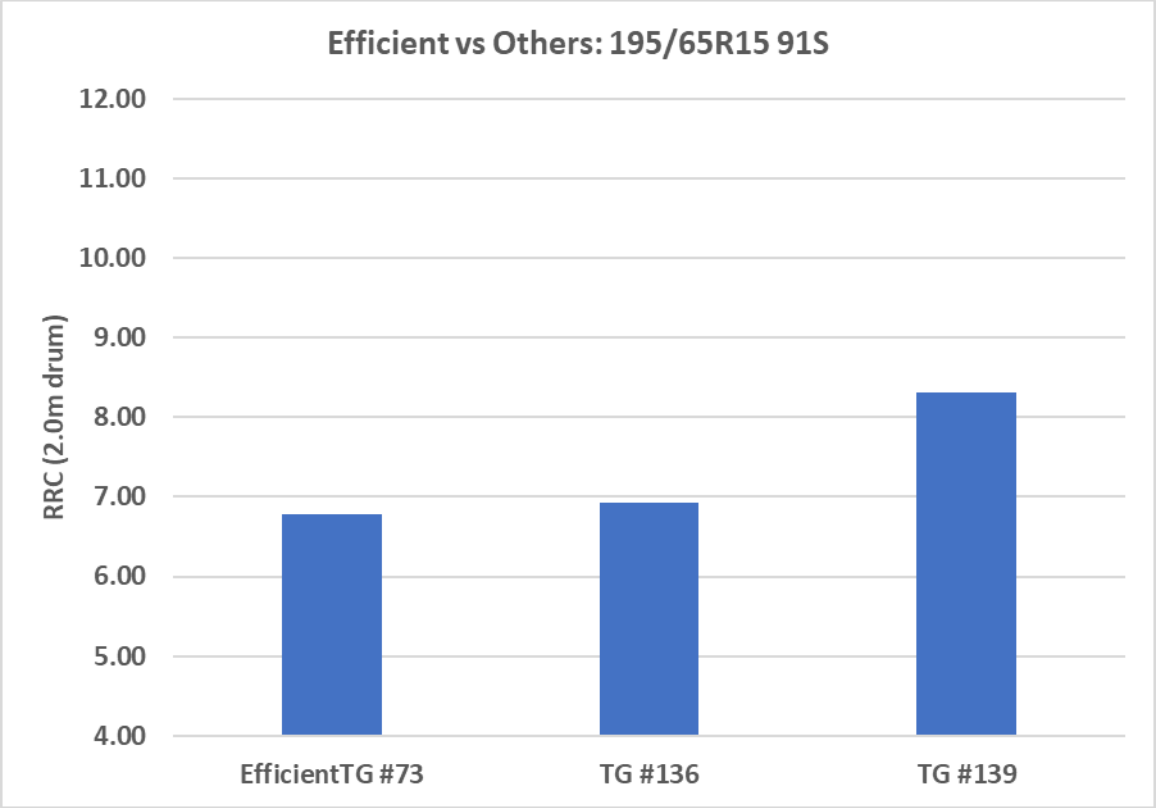


Chart 5.16D

Note: “TG” equals “Tire Group”. See Appendix Section 1 for Tire Group details.

5.17 OE Tire Analysis

Below represents the specified “Replacement” tires tested and the similar “OE”, (original equipment) tires tested for comparison where possible. Similar tires being defined as the same size and similar speed and load indices (like vehicles and applications).

OE Tire: Tires which are specified by the vehicle manufacturer and are fitted on the new vehicle.
Replacement Tire: General aftermarket tires, non-vehicle manufacturer specified

The results varied by tire size:

215/50R17 91H:	“OE” tire SKU exhibited similar RRC to “Replacement” SKU group average rolling resistance values
235/60R18 103H:	“OE” tire SKU average RRC > replacement tires’ RRC averages
205/55R16 89H:	“OE” tire SKU exhibited significantly lower RRC compared to “Replacement” SKU group average
245/75R16 109S/T:	“OE” tire SKU exhibited lower RRC compared to “Replacement” SKU groups averages
215/55R16 93H/V:	The “OE” group average RRC was on par with one of the comparable replacement tires, and significantly lower than a second “Replacement SKU group average
195/65R15 91S/H:	The OE tires tended to exhibit lower RRC values than the majority (two exceptions) of the “Replacement” tires.
235/40R19 96W/V:	The “OE” group average RRC was on par with one of the comparable replacement tires, and lower than a second “Replacement SKU group average

5.17 OE Tire Analysis

Table 5.17A: OE vs. Other Usage Categories Rolling Resistance Comparison

Tire Size	Speed Rating	Load Index	Category	RRC (2.0m Drum)
215/50R17	H	91	OE	6.87
215/50R17	H	91	Replacement	7.07
235/60R18	H	103	OE	9.12
235/60R18	H	103	Replacement	8.47
235/60R18	H	103	Replacement	7.81
205/55R16	H	89	OE	7.57
P205/55R16	H	89	Replacement	11.38
P245/75R16	S	109	OE	7.23
P245/75R16	T	109	Replacement	9.17
P245/75R16	S	109	Replacement	9.25
P245/75R16	T	109	Replacement	9.58
215/55R16	H	93	OE	8.10
215/55R16	H	93	Replacement	8.13
215/55R16	V	93	Replacement	10.18
195/65R15	S	91	OE	6.92
195/65R15	S	91	OE	8.32
195/65R15	S	91	Efficient	6.79
195/65R15	H	91	Replacement	7.96
195/65R15	H	91	Replacement	8.41
195/65R15	H	91	Replacement	8.94
195/65R15	H	91	Replacement	9.61
195/65R15	H	91	Replacement	10.20
195/65R15	H	91	Replacement	10.25
195/65R15	H	91	Replacement	10.26
195/65R15	H	91	Replacement	10.54
235/40R19	W	96	OE	7.74
235/40R19	V	96	Replacement	7.74
235/40R19	V	96	Replacement	9.02

5.17 OE Tire Analysis (continued)

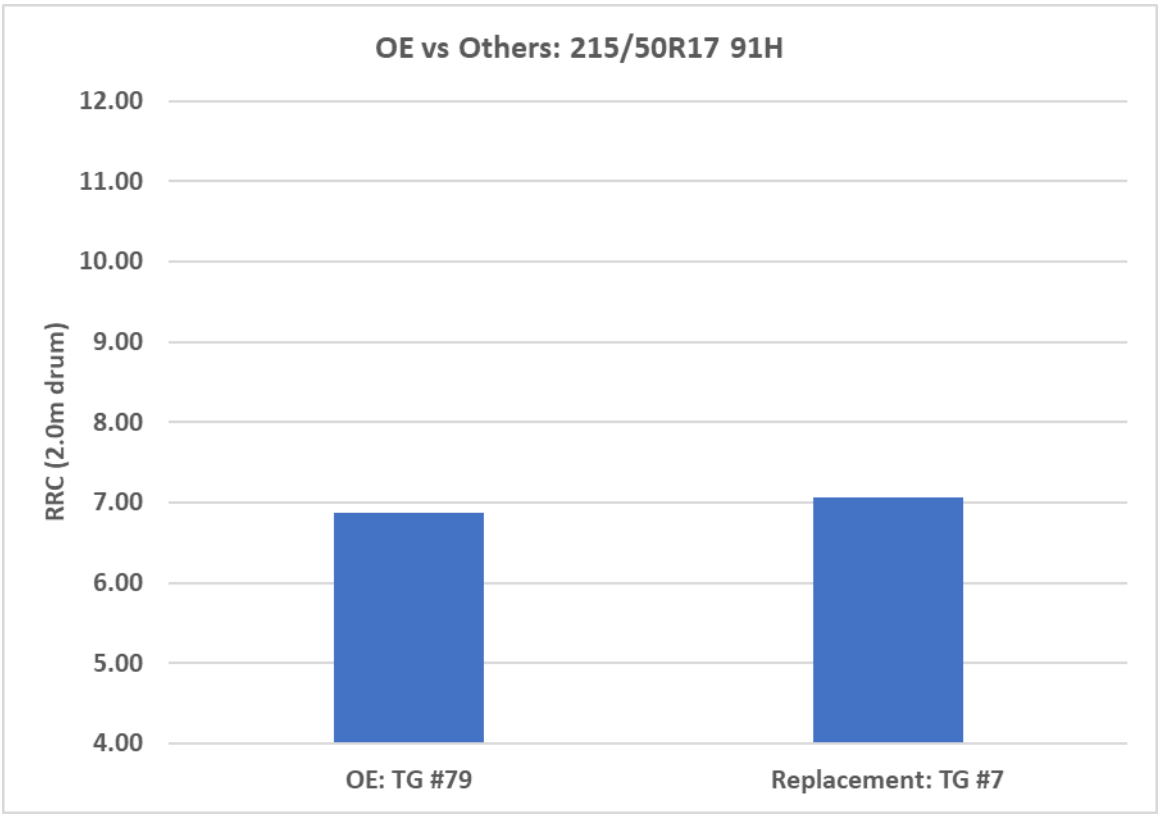


Chart 5.17A

Note: “TG” equals “Tire Group”. See Appendix Section 1 for Tire Group details.

5.17 OE Tire Analysis (continued)

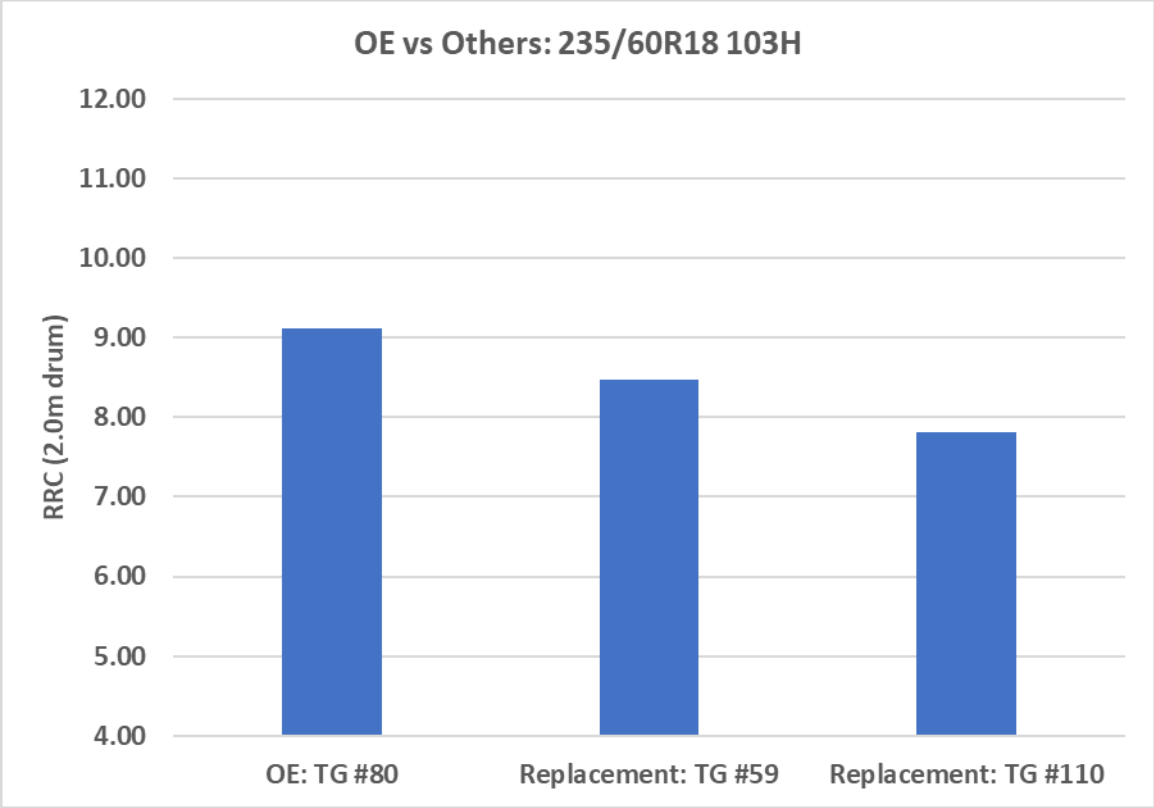


Chart 5.17B

Note: “TG” equals “Tire Group”. See Appendix Section 1 for Tire Group details.

5.17 OE Tire Analysis (continued)

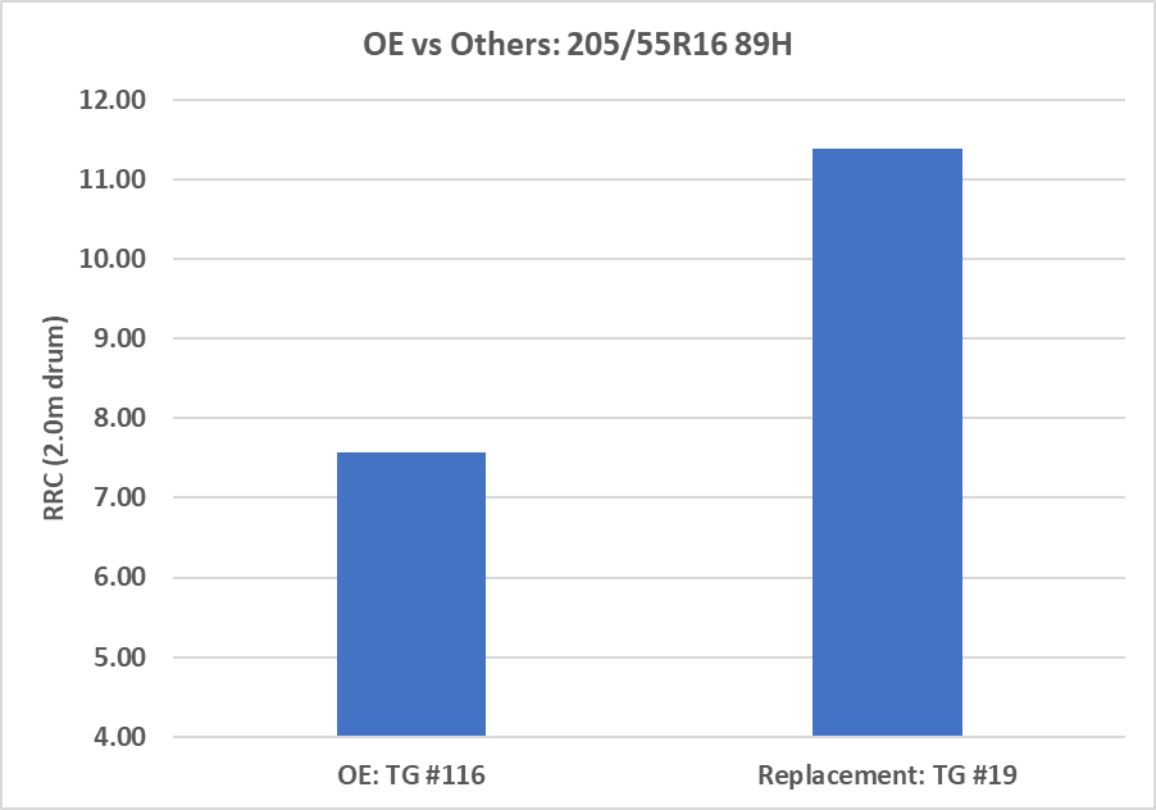


Chart 5.17C

Note: “TG” equals “Tire Group”. See Appendix Section 1 for Tire Group details.

5.17 OE Tire Analysis (continued)

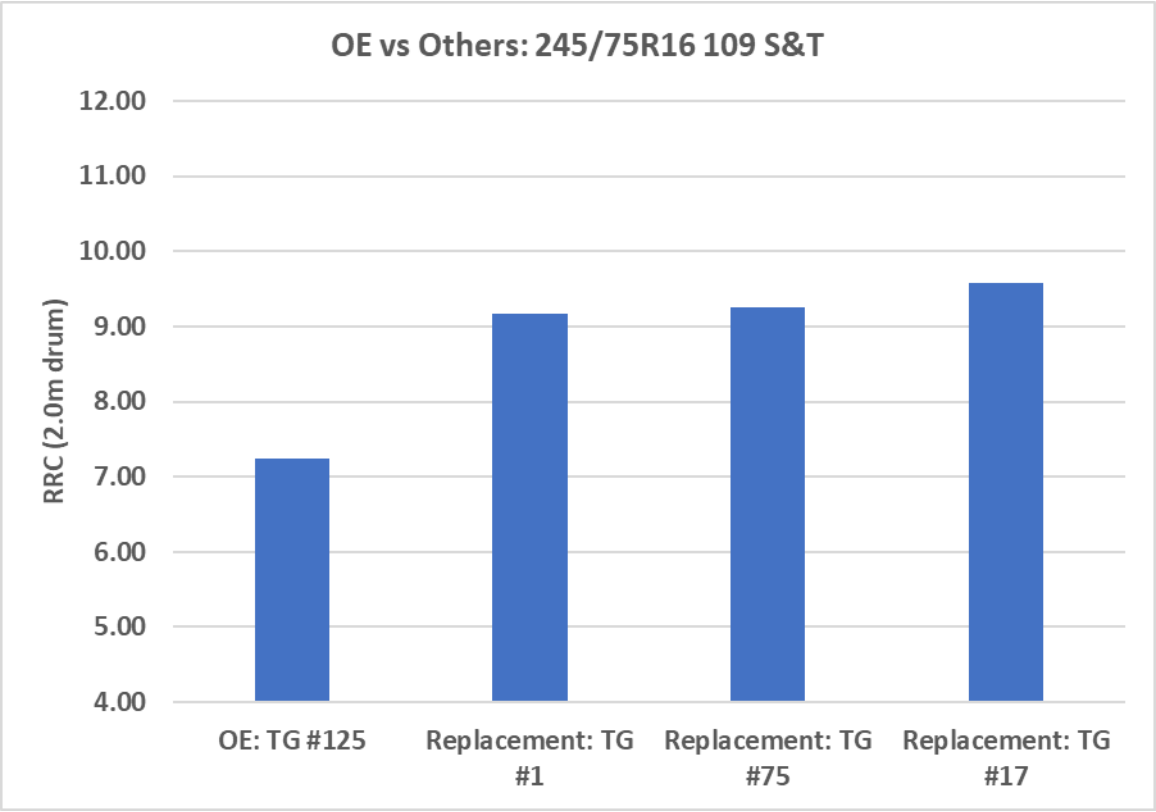


Chart 5.17D

Note: “TG” equals “Tire Group”. See Appendix Section 1 for Tire Group details.

5.17 OE Tire Analysis (continued)

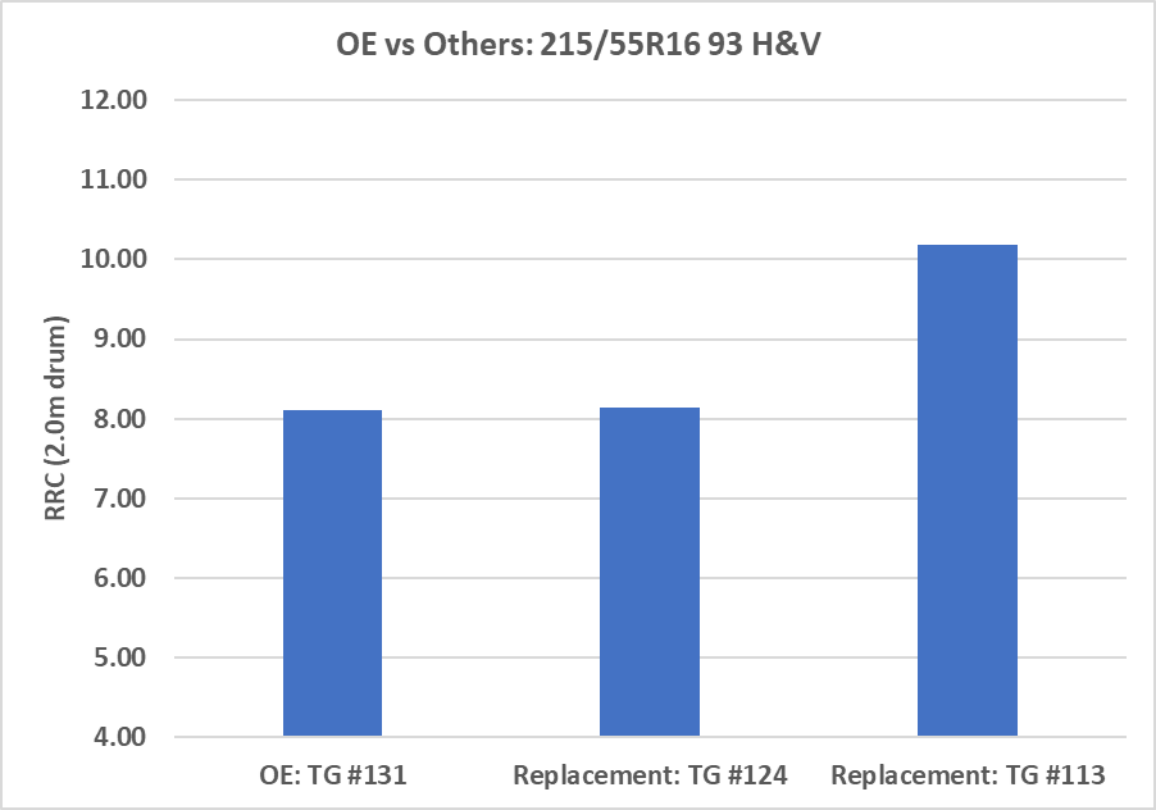


Chart 5.17E

Note: “TG” equals “Tire Group”. See Appendix Section 1 for Tire Group details.

5.17 OE Tire Analysis (continued)

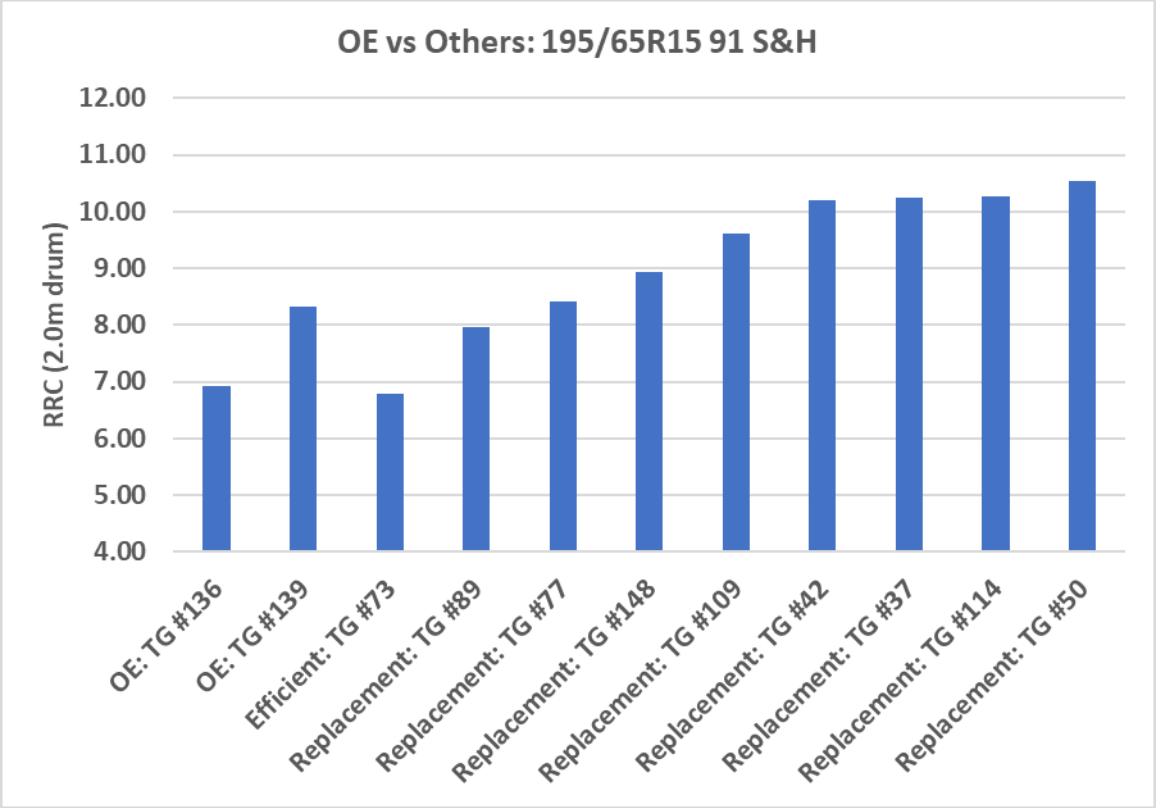


Chart 5.17F

Note: “TG” equals “Tire Group”. See Appendix Section 1 for Tire Group details.

5.17 OE Tire Analysis (continued)

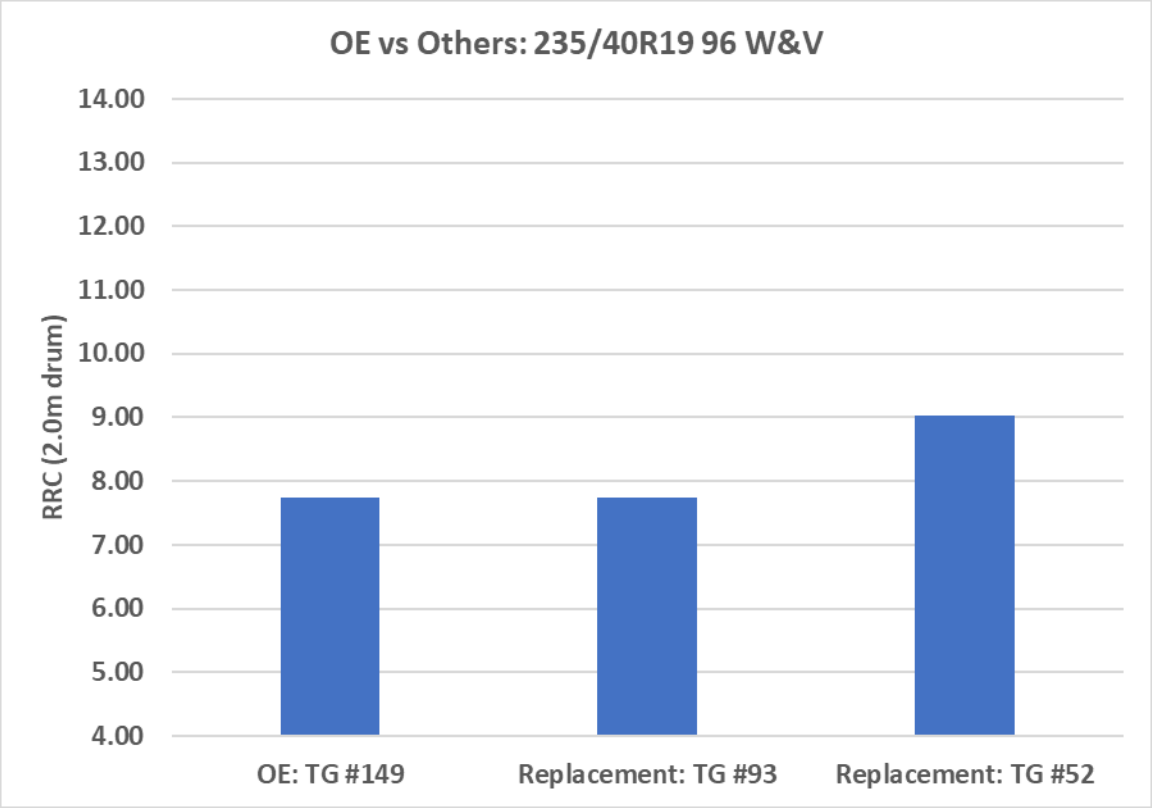


Chart 5.17G

Note: “TG” equals “Tire Group”. See Appendix Section 1 for Tire Group details.

5.18 Tire Group Descriptive Statistics of Rolling Resistance Data

The rolling resistance coefficient (RRC) values from each of the 149 SKU groups were statistically analyzed to characterize each three-tire population. These analyses may be found in the Appendix, Section 3. Mean and median values, standard deviations, confidence intervals and other characterizations of the data may be found in this Section.

5.19 Multiple Linear Correlation Analysis of Rolling Resistance Data

In addition to the numerous univariate correlation analyses studied, a multiple linear regression analysis was conducted using the quantifiable independent variables from the study. Multiple linear regression is a regression model that estimates the relationship between a quantitative dependent variable and two or more independent variables using a straight line. The objective of this effort was to determine if an analysis of the entire rolling resistance data population could achieve a high R^2 correlation coefficient with all or a subset of the variables.

The results may be found in the Appendix, Section 4. The R^2 correlation coefficient was 0.445: not particularly high. Several of the variables exhibited degrees of multicollinearity (correlations between independent variables), which was expected. The following variables accounted for the ability to predict RRC at the R^2 value of 0.445 ($P < 0.05$): load index, sidewall max load, tread depth, tire weight, bead diameter, price, and aspect ratio.

Bradley Sellers Associate Consultant Technical Consulting Smithers MSE	Bruce Lambillotte Senior Project Manager Technical Consulting Smithers MSE	Joshua Guilliams Vice President Technical Consulting Smithers MSE

Appendix

1. Individual Tire Information and Test Data
2. Complete Set Data Charts (Results Section)
3. Tire Group Descriptive Statistics of Rolling Resistance Data
4. Multiple Correlation Analysis of Rolling Resistance Data
5. Photos of ISO 28580 Rolling Resistance Test Setup
6. EU Rolling Resistance Correlation
7. Definitions
8. References

Appendix

1. Individual Tire Information and Test Data

    - Rolling Resistance Data
    - Wet Grip Data
    - Other Tire Group Information

Rolling Resistance Data

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	RR Force (N)	RRC (2.0 meter)	Price ($)
1	2202737	P245/75R16	109	T	7.94	33.0	73.7	9.12	113.01
1	2202738	P245/75R16	109	T	7.94	33.5	74.7	9.24	113.01
1	2202739	P245/75R16	109	T	7.94	33.1	74.1	9.16	113.01
2	2202731	P255/70R17	110	T	10.32	37.9	80.0	9.62	143.42
2	2202732	P255/70R17	110	T	10.32	39.1	82.6	9.93	143.42
2	2202733	P255/70R17	110	T	10.32	38.2	80.5	9.68	143.42
3	2202758	225/65R17	102	T	7.94	27.5	63.6	9.53	145.96
3	2202759	225/65R17	102	T	7.94	27.4	61.8	9.26	145.96
3	2202760	225/65R17	102	T	7.94	27.3	61.3	9.19	145.96
4	2202749	235/75R16	112	S	8.73	37.0	94.6	10.76	124.41
4	2202750	235/75R16	112	S	8.73	35.9	91.8	10.44	124.41
4	2202751	235/75R16	112	S	8.73	36.5	89.7	10.21	124.41
5	2202791	225/65RF17	102	H	8.73	39.6	68.3	10.24	208.05
5	2202792	225/65RF17	102	H	8.73	39.7	67.7	10.15	208.05
5	2202793	225/65RF17	102	H	8.73	39.6	68.7	10.31	208.05
6	2202734	235/45ZR18	98	W	7.14	26.6	57.3	9.75	175.75
6	2202735	235/45ZR18	98	W	7.14	26.2	58.1	9.88	175.75
6	2202736	235/45ZR18	98	W	7.14	26.6	57.9	9.84	175.75
7	2202740	215/50R17	91	H	6.35	22.5	34.8	7.21	210.01
7	2202741	215/50R17	91	H	6.35	22.6	34.3	7.10	210.01
7	2202742	215/50R17	91	H	6.35	22.5	33.3	6.89	210.01
8	2202776	215/55ZR16	93	W	7.94	21.6	52.5	10.30	139.00
8	2202777	215/55ZR16	93	W	7.94	21.6	53.2	10.43	139.00
8	2202778	215/55ZR16	93	W	7.94	21.5	52.3	10.26	139.00
9	2202779	215/60R16	95	V	7.94	22.4	52.1	9.63	86.41
9	2202780	215/60R16	95	V	7.94	22.5	51.1	9.44	86.41
9	2202781	215/60R16	95	V	7.94	22.5	51.3	9.47	86.41
10	2202743	P215/70R16	99	T	7.94	25.6	54.3	8.92	108.92

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	RR Force (N)	RRC (2.0 meter)	Price ($)
10	2202744	P215/70R16	99	T	7.94	25.4	54.8	9.01	108.92
10	2202745	P215/70R16	99	T	7.94	25.7	53.8	8.85	108.92
11	2202746	225/65R17	102	H	8.73	29.1	70.8	10.62	118.28
11	2202747	225/65R17	102	H	8.73	29.6	71.5	10.72	118.28
11	2202748	225/65R17	102	H	8.73	29.4	70.1	10.51	118.28
12	2202761	255/70R17	112	S	8.73	33.2	64.0	7.28	170.53
12	2202762	255/70R17	112	S	8.73	33.1	64.5	7.35	170.53
12	2202763	255/70R17	112	S	8.73	32.1	63.9	7.28	170.53
13	2202752	P275/45R20	106	V	8.73	32.5	77.5	10.39	186.62
13	2202753	P275/45R20	106	V	8.73	32.5	77.1	10.35	186.62
13	2202754	P275/45R20	106	V	8.73	32.4	77.3	10.37	186.62
14	2202764	LT245/75R16	120/116	S	11.91	43.4	108.5	9.31	162.45
14	2202765	LT245/75R16	120/116	S	11.91	44.1	108.9	9.33	162.45
14	2202766	LT245/75R16	120/116	S	11.91	44.0	110.4	9.46	162.45
15	2202797	275/45R20	110	T	9.53	36.6	87.7	10.54	183.15
15	2202798	275/45R20	110	T	9.53	36.5	88.6	10.65	183.15
15	2202799	275/45R20	110	T	9.53	36.7	87.7	10.54	183.15
16	2202794	265/45R20	108	W	8.73	33.1	79.7	10.16	253.80
16	2202795	265/45R20	108	W	8.73	33.1	80.9	10.31	253.80
16	2202796	265/45R20	108	W	8.73	32.9	80.5	10.26	253.80
17	2202788	P245/75R16	109	T	9.53	37.0	77.3	9.57	234.90
17	2202789	P245/75R16	109	T	9.53	36.8	76.7	9.49	234.90
17	2202790	P245/75R16	109	T	9.53	37.1	78.2	9.67	234.90
18	2202782	215/55RF16	93	V	9.53	27.1	55.8	10.95	168.15
18	2202783	215/55RF16	93	V	9.53	27.1	55.4	10.86	168.15
18	2202784	215/55RF16	93	V	9.53	27.2	55.8	10.94	168.15
19	2202773	P205/55R16	89	H	7.94	22.5	51.2	11.25	92.59
19	2202774	P205/55R16	89	H	7.94	22.3	52.2	11.48	92.59
19	2202775	P205/55R16	89	H	7.94	22.4	51.9	11.40	92.59
20	2202755	235/45R18	94	V	7.94	26.2	49.5	9.41	147.24

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	RR Force (N)	RRC (2.0 meter)	Price ($)
20	2202756	235/45R18	94	V	7.94	26.2	50.2	9.54	147.24
20	2202757	235/45R18	94	V	7.94	26.4	49.3	9.37	147.24
21	2202770	215/55R17	94	V	7.14	22.1	40.0	7.60	202.31
21	2202771	215/55R17	94	V	7.14	22.0	39.4	7.49	202.31
21	2202772	215/55R17	94	V	7.14	22.0	39.3	7.47	202.31
22	2202612	205/55R16	91	H	7.94	20.6	49.1	10.16	97.00
22	2202613	205/55R16	91	H	7.94	20.2	48.6	10.07	97.00
22	2202614	205/55R16	91	H	7.94	20.3	46.6	9.65	97.00
23	2202561	225/65R17	102	H	8.73	24.8	60.7	9.11	172.00
23	2202562	225/65R17	102	H	8.73	24.9	59.4	8.90	172.00
23	2202563	225/65R17	102	H	8.73	25.1	61.2	9.17	172.00
24	2202546	205/65R16	95	H	7.94	22.7	53.1	9.81	78.81
24	2202547	205/65R16	95	H	7.94	22.4	53.2	9.84	78.81
24	2202548	205/65R16	95	H	7.94	22.4	53.3	9.85	78.81
25	2202621	225/65R17	102	H	7.94	28.4	60.1	9.01	174.80
25	2202622	225/65R17	102	H	7.94	28.5	60.5	9.07	174.80
25	2202623	225/65R17	102	H	7.94	28.5	61.0	9.15	174.80
26	2202552	215/55R16	97	H	7.94	20.8	49.5	8.65	102.00
26	2202553	215/55R16	97	H	7.94	20.9	50.5	8.81	102.00
26	2202554	215/55R16	97	H	7.94	20.8	51.0	8.90	102.00
27	2202597	215/70R16	100	H	8.73	26.9	56.4	8.98	179.55
27	2202598	215/70R16	100	H	8.73	27.1	57.7	9.19	179.55
27	2202599	215/70R16	100	H	8.73	27.0	57.7	9.19	179.55
28	2202767	245/75R17	112	T	11.11	38.5	68.8	7.83	163.93
28	2202768	245/75R17	112	T	11.11	39.1	68.0	7.74	163.93
28	2202769	245/75R17	112	T	11.11	38.9	68.8	7.84	163.93
29	2202618	265/60R18	110	T	7.14	35.0	56.6	6.81	206.11
29	2202619	265/60R18	110	T	7.14	34.8	56.7	6.81	206.11
29	2202620	265/60R18	110	T	7.14	34.8	57.3	6.89	206.11
30	2202609	225/65R17	102	H	8.73	29.9	67.5	10.12	123.46

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	RR Force (N)	RRC (2.0 meter)	Price ($)
30	2202610	225/65R17	102	H	8.73	29.0	67.8	10.17	123.46
30	2202611	225/65R17	102	H	8.73	29.3	67.0	10.05	123.46
31	2202564	P275/55R20	111	T	9.53	39.6	65.8	7.70	208.96
31	2202565	P275/55R20	111	T	9.53	39.9	67.9	7.94	208.96
31	2202566	P275/55R20	111	T	9.53	40.9	67.9	7.94	208.96
32	2202570	265/70R16	112	T	9.53	37.1	78.0	8.88	216.60
32	2202571	265/70R16	112	T	9.53	37.1	77.0	8.76	216.60
32	2202572	265/70R16	112	T	9.53	37.3	77.7	8.85	216.60
33	2202579	235/75R16	112	T	8.73	34.0	87.3	9.94	157.69
33	2202580	235/75R16	112	T	8.73	33.8	85.2	9.70	157.69
33	2202581	235/75R16	112	T	8.73	33.6	87.2	9.93	157.69
34	2202585	195/65R15	95	V	7.14	16.9	48.6	8.98	65.59
34	2202586	195/65R15	95	V	7.14	17.6	48.7	9.00	65.59
34	2202587	195/65R15	95	V	7.14	17.0	48.2	8.90	65.59
35	2202582	215/60R16	95	V	7.14	21.4	52.8	9.75	91.16
35	2202583	215/60R16	95	V	7.14	20.9	51.3	9.47	91.16
35	2202584	215/60R16	95	V	7.14	21.0	52.3	9.67	91.16
36	2202576	P195/65R15	89	H	7.14	16.5	45.9	10.09	66.47
36	2202577	P195/65R15	89	H	7.14	16.5	45.6	10.03	66.47
36	2202578	P195/65R15	89	H	7.14	16.5	46.2	10.14	66.47
37	2202567	195/65R15	91	H	7.94	19.5	49.5	10.27	122.55
37	2202568	195/65R15	91	H	7.94	19.8	49.7	10.30	122.55
37	2202569	195/65R15	91	H	7.94	19.6	49.1	10.17	122.55
38	2202603	235/65R16	103	H	6.35	27.2	62.2	9.07	171.94
38	2202604	235/65R16	103	H	6.35	27.3	62.5	9.11	171.94
38	2202605	235/65R16	103	H	6.35	27.3	62.3	9.08	171.94
39	2202615	235/45R18	94	Y	7.94	27.2	61.1	11.61	195.66
39	2202616	235/45R18	94	Y	7.94	27.1	61.9	11.78	195.66
39	2202617	235/45R18	94	Y	7.94	27.2	62.3	11.85	195.66
40	2202588	225/65R17	102	V	7.94	27.1	66.4	9.96	99.83

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	RR Force (N)	RRC (2.0 meter)	Price ($)
40	2202589	225/65R17	102	V	7.94	27.1	68.4	10.25	99.83
40	2202590	225/65R17	102	V	7.94	27.1	68.6	10.29	99.83
41	2202555	265/45R20	108	Y	8.73	33.1	65.1	8.29	289.74
41	2202556	265/45R20	108	Y	8.73	32.5	64.5	8.22	289.74
41	2202557	265/45R20	108	Y	8.73	32.6	64.9	8.27	289.74
42	2202549	195/65R15	91	H	8.73	18.1	48.9	10.12	117.00
42	2202550	195/65R15	91	H	8.73	18.2	49.1	10.18	117.00
42	2202551	195/65R15	91	H	8.73	18.1	49.8	10.31	117.00
43	2202558	235/45ZR18	98	W	7.94	22.8	44.4	7.54	99.71
43	2202559	235/45ZR18	98	W	7.94	22.8	44.8	7.62	99.71
43	2202560	235/45ZR18	98	W	7.94	22.8	45.7	7.76	99.71
44	2202355	235/45ZR18	98	W	7.14	25.0	52.2	8.87	111.96
44	2202356	235/45ZR18	98	W	7.14	24.6	51.9	8.82	111.96
44	2202357	235/45ZR18	98	W	7.14	25.1	52.3	8.88	111.96
45	2202208	205/55R16	91	V	8.73	17.6	42.1	8.72	128.99
45	2202209	205/55R16	91	V	8.73	17.6	42.5	8.80	128.99
45	2202210	205/55R16	91	V	8.73	17.9	43.3	8.98	128.99
46	2202361	P215/65R16	96	H	7.14	21.9	52.2	9.38	79.16
46	2202362	P215/65R16	96	H	7.14	21.8	52.0	9.33	79.16
46	2202363	P215/65R16	96	H	7.14	21.7	51.9	9.32	79.16
47	2202349	215/70R16	100	H	7.14	23.1	57.4	9.14	77.36
47	2202350	215/70R16	100	H	7.14	22.6	56.4	8.99	77.36
47	2202351	215/70R16	100	H	7.14	23.1	57.1	9.17	77.36
48	2202573	215/65R16	98	T	7.14	26.8	65.1	11.05	85.46
48	2202574	215/65R16	98	T	7.14	27.0	66.0	11.22	85.46
48	2202575	215/65R16	98	T	7.14	27.0	66.7	11.34	85.46
49	2202600	215/70R16	100	T	8.73	26.5	64.4	10.26	97.81
49	2202601	215/70R16	100	T	8.73	26.6	63.9	10.18	97.81
49	2202602	215/70R16	100	T	8.73	26.3	65.4	10.42	97.81
50	2202606	195/65R15	91	H	7.14	19.8	51.2	10.60	76.91

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	RR Force (N)	RRC (2.0 meter)	Price ($)
50	2202607	195/65R15	91	H	7.14	19.7	50.4	10.44	76.91
50	2202608	195/65R15	91	H	7.14	19.3	51.0	10.56	76.91
51	2202594	215/55R17	94	V	7.14	21.9	50.9	9.69	104.46
51	2202595	215/55R17	94	V	7.14	22.3	52.5	9.98	104.46
51	2202596	215/55R17	94	V	7.14	22.2	51.1	9.73	104.46
52	2202591	235/40R19	96	V	8.73	23.7	50.3	9.03	208.04
52	2202592	235/40R19	96	V	8.73	23.8	50.1	8.99	208.04
52	2202593	235/40R19	96	V	8.73	23.4	50.3	9.03	208.04
53	2202543	265/70R16	112	T	10.32	40.9	85.5	9.73	159.00
53	2202544	265/70R16	112	T	10.32	40.8	86.5	9.85	159.00
53	2202545	265/70R16	112	T	10.32	40.4	85.5	9.73	159.00
54	2202483	P235/75R16	106	T	8.73	34.1	79.3	10.65	140.96
54	2202484	P235/75R16	106	T	8.73	32.9	78.2	10.50	140.96
54	2202485	P235/75R16	106	T	8.73	34.4	86.0	11.54	140.96
55	2202229	225/65R17	102	H	8.73	27.7	64.8	9.72	139.99
55	2202230	225/65R17	102	H	8.73	28.0	66.0	9.90	139.99
55	2202231	225/65R17	102	H	8.73	27.7	65.2	9.78	139.99
56	2202214	265/45R20	108	V	7.14	30.0	53.0	6.75	456.96
56	2202215	265/45R20	108	V	7.14	29.7	54.2	6.91	456.96
56	2202216	265/45R20	108	V	7.14	29.3	53.3	6.79	456.96
57	2202217	275/45R20	110	V	7.94	36.4	69.7	8.38	197.00
57	2202218	275/45R20	110	V	7.94	36.2	70.7	8.50	197.00
57	2202219	275/45R20	110	V	7.94	36.3	70.4	8.47	197.00
58	2202352	205/65R16	95	H	7.94	25.5	65.0	12.00	83.96
58	2202353	205/65R16	95	H	7.94	24.4	63.5	11.73	83.96
58	2202354	205/65R16	95	H	7.94	24.8	64.8	11.97	83.96
59	2202367	235/60R18	103	H	7.14	26.5	58.1	8.47	91.97
59	2202368	235/60R18	103	H	7.14	26.3	58.1	8.47	91.97
59	2202369	235/60R18	103	H	7.14	26.5	58.1	8.46	91.97
60	2202358	235/45R18	98	W	8.73	25.1	51.9	8.82	200.96

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	RR Force (N)	RRC (2.0 meter)	Price ($)
60	2202359	235/45R18	98	W	8.73	25.4	52.8	8.96	200.96
60	2202360	235/45R18	98	W	8.73	25.2	52.3	8.89	200.96
61	2202364	255/70R17	112	T	9.53	34.6	77.5	8.82	180.00
61	2202365	255/70R17	112	T	9.53	34.9	78.6	8.95	180.00
61	2202366	255/70R17	112	T	9.53	34.7	78.3	8.91	180.00
62	2202223	LT245/75R16	120/116	S	8.73	40.3	100.2	8.71	147.96
62	2202224	LT245/75R16	120/116	S	8.73	40.9	101.1	8.79	147.96
62	2202225	LT245/75R16	120/116	S	8.73	40.6	100.9	8.77	147.96
63	2202199	225/65R17	102	H	7.94	24.5	57.3	8.60	182.99
63	2202200	225/65R17	102	H	7.94	24.3	56.4	8.45	182.99
63	2202201	225/65R17	102	H	7.94	24.3	56.8	8.52	182.99
64	2202193	225/65R17	102	V	7.94	27.4	59.3	8.89	159.99
64	2202194	225/65R17	102	V	7.94	27.5	60.4	9.05	159.99
64	2202195	225/65R17	102	V	7.94	27.5	60.4	9.05	159.99
65	2202220	235/55R19	105	T	7.94	28.7	47.7	6.57	347.99
65	2202221	235/55R19	105	T	7.94	28.8	47.2	6.50	347.99
65	2202222	235/55R19	105	T	7.94	28.9	47.7	6.57	347.99
66	2202196	LT255/70R17	121/118	S	11.91	48.7	122.7	10.15	236.99
66	2202197	LT255/70R17	121/118	S	11.91	48.5	123.1	10.19	236.99
66	2202198	LT255/70R17	121/118	S	11.91	48.6	123.7	10.23	236.99
67	2202202	215/55R16	97	H	8.73	24.3	55.8	9.74	145.99
67	2202203	215/55R16	97	H	8.73	24.7	56.1	9.80	145.99
67	2202204	215/55R16	97	H	8.73	24.5	56.4	9.85	145.99
68	2202226	205/65R16	95	H	7.94	22.7	51.1	9.45	91.96
68	2202227	205/65R16	95	H	7.94	22.8	51.4	9.49	91.96
68	2202228	205/65R16	95	H	7.94	23.0	51.3	9.48	91.96
69	2202205	225/65R17	102	H	7.94	27.3	59.5	8.93	146.99
69	2202206	225/65R17	102	H	7.94	27.3	59.6	8.94	146.99
69	2202207	225/65R17	102	H	7.94	27.2	60.7	9.11	146.99
70	2202232	265/60R18	110	V	7.94	34.1	71.0	8.53	250.99

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	RR Force (N)	RRC (2.0 meter)	Price ($)
70	2202233	265/60R18	110	V	7.94	34.4	70.1	8.42	250.99
70	2202234	265/60R18	110	V	7.94	34.6	70.0	8.41	250.99
71	2202211	265/60R18	110	H	8.73	34.3	70.8	8.51	145.96
71	2202212	265/60R18	110	H	8.73	34.4	71.8	8.63	145.96
71	2202213	265/60R18	110	H	8.73	34.4	71.4	8.58	145.96
72	2202187	215/60R16	95	V	7.14	21.7	52.9	9.78	76.96
72	2202188	215/60R16	95	V	7.14	22.0	53.1	9.81	76.96
72	2202189	215/60R16	95	V	7.14	21.8	54.9	10.15	76.96
73	2202184	195/65R15	91	S	7.14	16.2	32.5	6.74	118.99
73	2202185	195/65R15	91	S	7.14	16.5	32.7	6.78	118.99
73	2202186	195/65R15	91	S	7.14	16.6	33.1	6.85	118.99
74	2202190	225/60R18	100	H	9.53	30.1	61.9	9.86	176.99
74	2202191	225/60R18	100	H	9.53	29.5	61.0	9.72	176.99
74	2202192	225/60R18	100	H	9.53	29.7	64.0	10.20	176.99
75	2202785	P245/75R16	109	S	8.73	29.7	74.8	9.26	149.31
75	2202786	P245/75R16	109	S	8.73	30.1	74.2	9.18	149.31
75	2202787	P245/75R16	109	S	8.73	29.8	75.3	9.32	149.31
76	2203253	235/45R18	98	W	7.94	27.3	63.1	10.71	214.69
76	2203254	235/45R18	98	W	7.94	27.4	61.8	10.50	214.69
76	2203255	235/45R18	98	W	7.94	27.3	62.9	10.69	214.69
77	2203310	195/65R15	91	H	7.94	18.7	41.3	8.55	76.92
77	2203311	195/65R15	91	H	7.94	18.3	40.0	8.28	76.92
77	2203312	195/65R15	91	H	7.94	18.4	40.5	8.40	76.92
78	2203247	235/45R18	94	W	5.56	24.7	60.2	11.44	254.35
78	2203248	235/45R18	94	W	5.56	24.5	58.6	11.14	254.35
78	2203249	235/45R18	94	W	5.56	24.4	59.8	11.37	254.35
79	2203289	215/50R17	91	H	6.35	19.8	33.4	6.93	193.76
79	2203290	215/50R17	91	H	6.35	20.0	33.5	6.94	193.76
79	2203291	215/50R17	91	H	6.35	19.8	32.5	6.74	193.76
80	2203241	235/60R18	103	H	7.94	29.8	61.8	9.01	219.41

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	RR Force (N)	RRC (2.0 meter)	Price ($)
80	2203242	235/60R18	103	H	7.94	30.2	63.7	9.28	219.41
80	2203243	235/60R18	103	H	7.94	29.8	62.2	9.07	219.41
81	2203280	235/60R18	107	H	7.94	29.0	62.3	8.15	122.51
81	2203281	235/60R18	107	H	7.94	28.9	64.2	8.39	122.51
81	2203282	235/60R18	107	H	7.94	28.9	63.8	8.34	122.51
82	2203307	215/55R16	97	H	7.14	21.2	44.4	7.75	77.74
82	2203308	215/55R16	97	H	7.14	21.3	44.7	7.80	77.74
82	2203309	215/55R16	97	H	7.14	21.4	46.4	8.09	77.74
83	2203244	225/65R17	102	H	7.14	25.7	57.5	8.62	189.99
83	2203245	225/65R17	102	H	7.14	26.1	58.6	8.79	189.99
83	2203246	225/65R17	102	H	7.14	25.8	58.6	8.79	189.99
84	2202948	235/60R18	103	V	8.73	28.5	61.1	8.91	144.00
84	2203262	235/60R18	103	V	8.73	28.8	60.9	8.87	144.00
84	2203263	235/60R18	103	V	8.73	29.1	61.1	8.90	144.00
85	2203271	265/70R16	112	S	12.70	44.6	96.9	11.03	191.00
85	2203272	265/70R16	112	S	12.70	44.3	96.2	10.96	191.00
85	2203273	265/70R16	112	S	12.70	44.7	97.9	11.14	191.00
86	2203265	265/60R18	110	T	9.53	34.0	72.6	8.73	202.34
86	2203266	265/60R18	110	T	9.53	33.8	71.7	8.62	202.34
86	2203267	265/60R18	110	T	9.53	33.8	69.5	8.35	202.34
87	2203268	265/70R16	112	T	8.73	36.9	79.4	9.03	185.22
87	2203269	265/70R16	112	T	8.73	36.8	79.9	9.09	185.22
87	2203270	265/70R16	112	T	8.73	37.0	78.9	8.98	185.22
88	2203313	215/50ZR17	95	W	7.94	21.7	43.8	8.09	83.85
88	2203314	215/50ZR17	95	W	7.94	21.7	43.3	8.00	83.85
88	2203315	215/50ZR17	95	W	7.94	21.7	43.8	8.09	83.85
89	2203292	195/65R15	91	H	7.14	17.0	37.8	7.84	75.99
89	2203293	195/65R15	91	H	7.14	17.2	38.2	7.92	75.99
89	2203294	195/65R15	91	H	7.14	17.1	39.2	8.12	75.99
90	2202902	225/65R17	102	H	7.14	24.9	54.4	8.16	92.00

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	RR Force (N)	RRC (2.0 meter)	Price ($)
90	2202903	225/65R17	102	H	7.14	25.0	54.0	8.09	92.00
90	2202904	225/65R17	102	H	7.14	24.9	54.4	8.16	92.00
91	2202938	265/65R18	110	T	9.53	38.6	79.0	9.49	161.97
91	2202939	265/65R18	110	T	9.53	38.3	78.7	9.47	161.97
91	2202940	265/65R18	110	T	9.53	37.8	78.4	9.42	161.97
92	2202926	235/45ZR18	98	W	7.94	25.0	53.7	9.13	133.00
92	2202927	235/45ZR18	98	W	7.94	24.7	54.2	9.22	133.00
92	2202928	235/45ZR18	98	W	7.94	25.2	54.1	9.19	133.00
93	2202914	235/40R19	96	V	7.94	24.2	43.1	7.74	257.40
93	2202915	235/40R19	96	V	7.94	23.3	43.0	7.72	257.40
93	2202916	235/40R19	96	V	7.94	23.8	43.2	7.76	257.40
94	2203286	235/40ZR19	96	W	7.94	23.2	43.7	7.84	115.86
94	2203287	235/40ZR19	96	W	7.94	23.0	42.2	7.57	115.86
94	2203288	235/40ZR19	96	W	7.94	23.3	44.1	7.93	115.86
95	2203283	225/65R17	102	H	7.94	30.8	65.5	9.83	145.00
95	2203284	225/65R17	102	H	7.94	31.0	66.6	9.99	145.00
95	2203285	225/65R17	102	H	7.94	30.6	65.0	9.75	145.00
96	2203295	265/60R18	110	V	7.94	32.6	76.7	9.22	149.11
96	2203296	265/60R18	110	V	7.94	32.3	75.2	9.04	149.11
96	2203297	265/60R18	110	V	7.94	32.4	75.3	9.05	149.11
97	2203274	235/60R18	103	V	7.94	28.2	57.7	8.40	111.00
97	2203275	235/60R18	103	V	7.94	28.4	57.1	8.37	111.00
97	2203276	235/60R18	103	V	7.94	28.2	57.7	8.40	111.00
98	2203259	LT245/75R16	120/116	Q	14.29	43.3	109.9	9.55	161.00
98	2203260	LT245/75R16	120/116	Q	14.29	43.3	111.0	9.65	161.00
98	2203261	LT245/75R16	120/116	Q	14.29	43.6	110.3	9.59	161.00
99	2202953	245/75R17	112	S	8.73	31.8	58.1	6.62	189.96
99	2202954	245/75R17	112	S	8.73	31.9	57.7	6.57	189.96
99	2202955	245/75R17	112	S	8.73	31.7	58.4	6.65	189.96
100	2202956	225/65R17	102	H	8.73	26.4	56.4	8.46	162.45

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	RR Force (N)	RRC (2.0 meter)	Price ($)
100	2202957	225/65R17	102	H	8.73	26.3	55.9	8.39	162.45
100	2202958	225/65R17	102	H	8.73	26.3	55.5	8.33	162.45
101	2202971	215/70R16	100	H	7.94	27.0	57.6	9.18	113.80
101	2202972	215/70R16	100	H	7.94	27.4	56.9	9.06	113.80
101	2202973	215/70R16	100	H	7.94	27.0	56.6	9.02	113.80
102	2202950	265/60R18	114	T	8.73	38.9	78.6	8.49	163.39
102	2202951	265/60R18	114	T	8.73	38.7	79.2	8.56	163.39
102	2202952	265/60R18	114	T	8.73	38.5	77.4	8.36	163.39
103	2202917	P255/70R17	110	T	9.53	37.9	76.6	9.20	171.99
103	2202918	P255/70R17	110	T	9.53	37.3	79.4	9.55	171.99
103	2202919	P255/70R17	110	T	9.53	37.2	78.5	9.43	171.99
104	2202905	245/75R16	111	R	11.11	36.0	92.7	10.84	148.00
104	2202906	245/75R16	111	R	11.11	35.9	93.8	10.97	148.00
104	2202907	245/75R16	111	R	11.11	35.8	92.0	10.76	148.00
105	2202932	245/60R18	105	V	7.14	30.8	55.5	7.66	217.97
105	2202933	245/60R18	105	V	7.14	31.0	55.5	7.65	217.97
105	2202934	245/60R18	105	V	7.14	31.0	55.5	7.65	217.97
106	2202923	225/65R17	102	H	8.73	25.9	59.2	8.88	135.00
106	2202924	225/65R17	102	H	8.73	25.6	56.8	8.52	135.00
106	2202925	225/65R17	102	H	8.73	25.6	56.8	8.51	135.00
107	2202911	225/65R17	102	H	7.94	24.9	52.4	7.85	161.50
107	2202912	225/65R17	102	H	7.94	25.1	52.6	7.88	161.50
107	2202913	225/65R17	102	H	7.94	25.2	52.8	7.92	161.50
108	2202959	205/60R16	92	V	8.73	22.9	50.8	10.29	116.00
108	2202960	205/60R16	92	V	8.73	22.7	50.3	10.18	116.00
108	2202961	205/60R16	92	V	8.73	23.0	52.3	10.58	116.00
109	2202968	195/65R15	91	H	8.73	18.7	46.5	9.63	83.00
109	2202969	195/65R15	91	H	8.73	19.0	47.2	9.77	83.00
109	2202970	195/65R15	91	H	8.73	18.8	45.6	9.44	83.00
110	2202908	235/60R18	103	H	7.94	29.4	54.3	7.91	189.05

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	RR Force (N)	RRC (2.0 meter)	Price ($)
110	2202909	235/60R18	103	H	7.94	29.0	53.7	7.82	189.05
110	2202910	235/60R18	103	H	7.94	29.2	52.8	7.70	189.05
111	2203301	215/55R17	94	V	9.53	25.5	50.5	9.61	147.00
111	2203302	215/55R17	94	V	9.53	25.2	48.7	9.27	147.00
111	2203303	215/55R17	94	V	9.53	25.2	49.6	9.43	147.00
112	2203277	P255/70R17	110	S	7.94	35.0	57.5	6.91	201.36
112	2203278	P255/70R17	110	S	7.94	35.1	57.7	6.93	201.36
112	2203279	P255/70R17	110	S	7.94	35.5	56.7	6.81	201.36
113	2203256	215/55R16	93	V	7.94	20.9	52.6	10.32	89.26
113	2203257	215/55R16	93	V	7.94	21.0	50.9	9.98	89.26
113	2203258	215/55R16	93	V	7.94	20.9	52.2	10.24	89.26
114	2203304	195/65R15	91	H	8.73	18.2	49.7	10.30	113.04
114	2203305	195/65R15	91	H	8.73	17.7	49.4	10.23	113.04
114	2203306	195/65R15	91	H	8.73	18.3	49.5	10.25	113.04
115	2203298	215/55R17	98	V	7.94	24.5	57.1	9.70	87.36
115	2203299	215/55R17	98	V	7.94	24.3	56.3	9.57	87.36
115	2203300	215/55R17	98	V	7.94	24.5	56.5	9.60	87.36
116	2203250	205/55R16	89	H	7.94	20.2	34.9	7.67	144.36
116	2203251	205/55R16	89	H	7.94	20.2	34.4	7.55	144.36
116	2203252	205/55R16	89	H	7.94	20.0	34.0	7.48	144.36
117	2203316	205/60R16	92	H	7.14	19.6	43.2	8.74	86.54
117	2203317	205/60R16	92	H	7.14	19.5	41.6	8.42	86.54
117	2203318	205/60R16	92	H	7.14	19.3	40.7	8.24	86.54
118	2202929	265/60R18	110	T	8.73	36.7	72.3	8.70	179.00
118	2202930	265/60R18	110	T	8.73	37.1	73.5	8.84	179.00
118	2202931	265/60R18	110	T	8.73	37.0	74.3	8.94	179.00
119	2202965	LT245/75R16	120/116	Q	11.11	44.0	96.7	8.41	261.90
119	2202966	LT245/75R16	120/116	Q	11.11	43.5	95.1	8.27	261.90
119	2202967	LT245/75R16	120/116	Q	11.11	43.7	97.5	8.47	261.90
120	2202962	245/60R18	105	H	8.73	33.7	64.0	8.83	172.00

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	RR Force (N)	RRC (2.0 meter)	Price ($)
120	2202963	245/60R18	105	H	8.73	33.8	64.8	8.93	172.00
120	2202964	245/60R18	105	H	8.73	34.3	65.9	9.09	172.00
121	2202935	225/45ZR17	94	Y	7.94	23.4	53.2	10.11	155.80
121	2202936	225/45ZR17	94	Y	7.94	23.1	53.7	10.22	155.80
121	2202937	225/45ZR17	94	Y	7.94	23.2	53.8	10.24	155.80
122	2202920	235/45R18	98	W	6.35	25.7	42.4	7.20	258.30
122	2202921	235/45R18	98	W	6.35	25.8	42.6	7.24	258.30
122	2202922	235/45R18	98	W	6.35	25.7	42.9	7.29	258.30
123	2202941	215/70R16	110	T	8.73	28.0	63.3	10.08	147.00
123	2202942	215/70R16	110	T	8.73	28.7	61.4	9.78	147.00
123	2202943	215/70R16	110	T	8.73	28.0	63.9	10.18	147.00
124	2202944	215/55R16	93	H	7.94	21.0	41.0	8.05	157.70
124	2202945	215/55R16	93	H	7.94	21.0	41.4	8.12	157.70
124	2202946	215/55R16	93	H	7.94	21.1	42.0	8.24	157.70
125	2203504	P245/75R16	109	S	8.73	31.7	59.8	7.40	147.21
125	2203505	P245/75R16	109	S	8.73	30.9	57.2	7.07	147.21
125	2203506	P245/75R16	109	S	8.73	31.8	58.4	7.23	147.21
126	2203540	265/65R18	114	T	7.94	35.1	59.4	6.42	207.06
126	2203541	265/65R18	114	T	7.94	35.4	61.1	6.61	207.06
126	2203542	265/65R18	114	T	7.94	35.4	60.0	6.48	207.06
127	2203531	235/60R18	107	V	7.94	33.4	68.7	8.98	176.00
127	2203532	235/60R18	107	V	7.94	33.0	68.9	9.01	176.00
127	2203533	235/60R18	107	V	7.94	33.0	68.3	8.92	176.00
128	2203507	235/60R18	107	V	8.73	30.6	63.6	8.32	195.00
128	2203508	235/60R18	107	V	8.73	30.6	62.6	8.19	195.00
128	2203509	235/60R18	107	V	8.73	30.5	63.6	8.32	195.00
129	2203513	255/40R20	101	W	7.14	26.6	49.6	7.66	303.02
129	2203514	255/40R20	101	W	7.14	26.3	50.5	7.80	303.02
129	2203515	255/40R20	101	W	7.14	26.7	49.9	7.72	303.02
130	2203519	235/45ZR18	98	W	7.14	24.6	53.5	9.10	112.06

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	RR Force (N)	RRC (2.0 meter)	Price ($)
130	2203520	235/45ZR18	98	W	7.14	24.4	53.1	9.03	112.06
130	2203521	235/45ZR18	98	W	7.14	24.5	53.2	9.03	112.06
131	2203498	215/55R16	93	H	7.94	21.7	41.9	8.21	132.01
131	2203499	215/55R16	93	H	7.94	21.7	41.2	8.08	132.01
131	2203500	215/55R16	93	H	7.94	21.3	40.9	8.02	132.01
132	2203552	215/70R16	100	T	8.73	26.6	54.3	8.64	160.00
132	2203553	215/70R16	100	T	8.73	26.4	54.0	8.60	160.00
132	2203554	215/70R16	100	T	8.73	26.4	54.1	8.62	160.00
133	2203516	P255/70R16	109	T	10.32	35.0	78.9	9.76	124.00
133	2203517	P255/70R16	109	T	10.32	35.2	78.1	9.66	124.00
133	2203518	P255/70R16	109	T	10.32	35.4	80.8	9.99	124.00
134	2203546	225/65R17	102	H	7.94	26.0	66.8	10.02	119.00
134	2203547	225/65R17	102	H	7.94	26.1	65.7	9.86	119.00
134	2203548	225/65R17	102	H	7.94	26.1	65.7	9.85	119.00
135	2203501	235/60R17	100	T	7.94	26.5	52.3	8.33	166.21
135	2203502	235/60R17	100	T	7.94	26.5	51.4	8.19	166.21
135	2203503	235/60R17	100	T	7.94	26.9	52.0	8.29	166.21
136	2203537	195/65R15	91	S	7.14	17.6	33.4	6.92	131.07
136	2203538	195/65R15	91	S	7.14	17.5	33.4	6.92	131.07
136	2203539	195/65R15	91	S	7.14	17.6	33.4	6.92	131.07
137	2203534	225/45ZR17	94	W	7.94	23.3	52.0	9.88	125.00
137	2203535	225/45ZR17	94	W	7.94	23.3	52.0	9.89	125.00
137	2203536	225/45ZR17	94	W	7.94	24.0	52.6	10.01	125.00
138	2203555	235/45R18	98	Y	8.73	26.0	62.3	10.58	211.00
138	2203556	235/45R18	98	Y	8.73	25.7	61.3	10.42	211.00
138	2203557	235/45R18	98	Y	8.73	25.7	61.2	10.40	211.00
139	2203558	195/65R15	91	S	7.14	18.0	39.8	8.24	95.94
139	2203559	195/65R15	91	S	7.14	17.2	39.1	8.11	95.94
139	2203560	195/65R15	91	S	7.14	17.9	41.5	8.60	95.94
140	2203549	235/60R17	102	T	6.35	23.9	53.5	8.02	95.00

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	RR Force (N)	RRC (2.0 meter)	Price ($)
140	2203550	235/60R17	102	T	6.35	23.9	53.5	8.02	95.00
140	2203551	235/60R17	102	T	6.35	23.8	53.9	8.08	95.00
141	2203543	235/55R19	101	V	7.14	27.5	44.3	6.84	272.16
141	2203544	235/55R19	101	V	7.14	27.4	43.5	6.72	272.16
141	2203545	235/55R19	101	V	7.14	27.3	43.2	6.68	272.16
142	2203525	255/65R18	111	H	8.73	34.4	63.1	7.38	215.99
142	2203526	255/65R18	111	H	8.73	34.6	64.5	7.54	215.99
142	2203527	255/65R18	111	H	8.73	34.6	64.1	7.50	215.99
143	2203522	275/60R20	115	T	8.73	41.1	61.1	6.41	303.99
143	2203523	275/60R20	115	T	8.73	41.1	61.7	6.47	303.99
143	2203524	275/60R20	115	T	8.73	40.9	60.6	6.36	303.99
144	2203528	275/45R20	110	H	10.32	38.9	90.9	10.93	245.10
144	2203529	275/45R20	110	H	10.32	38.7	89.7	10.78	245.10
144	2203530	275/45R20	110	H	10.32	39.3	90.1	10.83	245.10
145	2203510	LT275/65R18	113/100	Q	14.29	49.0	99.7	10.40	236.69
145	2203511	LT275/65R18	113/100	Q	14.29	49.3	98.9	10.31	236.69
145	2203512	LT275/65R18	113/100	Q	14.29	49.3	99.0	10.32	236.69
146	2203771	215/55R17	94	V	7.14	22.3	50.0	9.52	192.99
146	2203772	215/55R17	94	V	7.14	22.4	50.5	9.61	192.99
146	2203773	215/55R17	94	V	7.14	22.0	49.9	9.49	192.99
147	2203780	215/55R17	94	V	8.73	23.2	49.5	9.42	209.99
147	2203781	215/55R17	94	V	8.73	23.2	48.3	9.19	209.99
147	2203782	215/55R17	94	V	8.73	23.4	49.6	9.43	209.99
148	2203777	195/65R15	91	H	7.94	19.0	42.6	8.82	151.98
148	2203778	195/65R15	91	H	7.94	19.2	43.5	9.02	151.98
148	2203779	195/65R15	91	H	7.94	19.1	43.3	8.98	151.98
149	2203774	235/40R19	96	W	7.14	24.4	43.0	7.72	267.86
149	2203775	235/40R19	96	W	7.14	24.1	42.6	7.66	267.86
149	2203776	235/40R19	96	W	7.14	24.6	43.6	7.84	267.86

Wet Traction Index Data

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	Wet Grip	Price ($)
1	wet-1	P245/75R16	109	T	8.00	33.3	1.21	113.01
2	wet-2	P255/70R17	110	T	8.92	38.1	1.05	143.42
3	wet-3	225/65R17	102	T	7.83	27.2	1.23	145.96
4	wet-4	235/75R16	112	S	9.00	36.3	1.15	124.41
5	wet-5	225/65RF17	102	H	8.95	39.5	1.18	208.05
6	wet-6	235/45ZR18	98	W	7.80	26.4	1.29	175.75
7	wet-7	215/50R17	91	H	6.70	22.7	1.14	210.01
8	wet-8	215/55ZR16	93	W	8.00	21.7	1.47	139.00
9	wet-9	215/60R16	95	V	8.50	22.5	1.10	86.41
10	wet-10	P215/70R16	99	T	8.70	25.8	1.17	108.92
11	wet-11	225/65R17	102	H	8.57	29.4	1.12	118.28
12	wet-12	255/70R17	112	S	8.72	34.0	1.27	170.53
13	wet-13	P275/45R20	106	V	8.52	33.0	1.00	186.62
14	wet-14	LT245/75R16	120/116	S	11.49	44.6	1.16	162.45
15	wet-15	275/45R20	110	T	9.25	36.4	1.06	183.15
16	wet-16	265/45R20	108	W	8.50	33.6	1.19	253.80
17	wet-17	P245/75R16	109	T	9.02	37.3	1.18	234.90
18	wet-18	215/55RF16	93	V	8.77	26.9	1.23	168.15
19	wet-19	P205/55R16	89	H	7.40	21.8	1.15	92.59
20	wet-20	235/45R18	94	V	7.55	26.6	1.29	147.24
21	wet-21	215/55R17	94	V	6.68	22.2	1.35	202.31
22	wet-22	205/55R16	91	H	7.98	20.4	1.26	97.00
23	wet-23	225/65R17	102	H	8.26	25.1	1.21	172.00
24	wet-24	205/65R16	95	H	7.57	22.7	1.18	78.81
25	wet-25	225/65R17	102	H	7.68	28.6	1.30	174.80
26	wet-26	215/55R16	97	H	7.75	20.9	1.34	102.00
27	wet-27	215/70R16	100	H	8.41	27.2	1.18	179.55
28	wet-28	245/75R17	112	T	11.13	39.3	0.98	163.93

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	Wet Grip	Price ($)
29	wet-29	265/60R18	110	T	7.43	35.0	1.26	206.11
30	wet-30	225/65R17	102	H	8.43	29.6	1.17	123.46
31	wet-31	P275/55R20	111	T	9.04	39.8	1.19	208.96
32	wet-32	265/70R16	112	T	9.13	37.5	1.15	216.60
33	wet-33	235/75R16	112	T	8.92	33.8	1.08	157.69
34	wet-34	195/65R15	95	V	6.65	17.6	1.21	65.59
35	wet-35	215/60R16	95	V	6.56	21.3	1.21	91.16
36	wet-36	P195/65R15	89	H	7.29	16.5	1.17	66.47
37	wet-37	195/65R15	91	H	7.45	19.8	1.21	122.55
38	wet-38	235/65R16	103	H	6.56	27.3	1.30	171.94
39	wet-39	235/45R18	94	Y	7.11	27.3	1.42	195.66
40	wet-40	225/65R17	102	V	7.42	26.9	1.43	99.83
41	wet-41	265/45R20	108	Y	7.94	33.1	1.31	289.74
42	wet-42	195/65R15	91	H	7.48	18.3	1.13	117.00
43	wet-43	235/45ZR18	98	W	7.28	23.1	1.19	99.71
44	wet-44	235/45ZR18	98	W	7.35	25.1	1.19	111.96
45	wet-45	205/55R16	91	V	8.16	18.0	1.37	128.99
46	wet-46	P215/65R16	96	H	7.09	22.1	1.23	79.16
47	wet-47	215/70R16	100	H	6.85	23.1	1.14	77.36
48	wet-48	215/65R16	98	T	7.33	26.9	1.10	85.46
49	wet-49	215/70R16	100	T	8.47	26.6	1.22	97.81
50	wet-50	195/65R15	91	H	6.79	19.8	1.13	76.91
51	wet-51	215/55R17	94	V	6.62	22.2	1.08	104.46
52	wet-52	235/40R19	96	V	8.12	23.8	1.35	208.04
53	wet-53	265/70R16	112	T	9.75	40.8	1.11	159.00
54	wet-54	P235/75R16	106	T	8.46	34.0	1.03	140.96
55	wet-55	225/65R17	102	H	8.76	28.1	1.15	139.99
56	wet-56	265/45R20	108	V	7.10	29.5	1.32	456.96
57	wet-57	275/45R20	110	V	7.28	36.4	1.23	197.00
58	wet-58	205/65R16	95	H	7.85	24.2	1.26	83.96

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	Wet Grip	Price ($)
59	wet-59	235/60R18	103	H	7.12	26.3	1.15	91.97
60	wet-60	235/45R18	98	W	8.10	25.6	1.30	200.96
61	wet-61	255/70R17	112	T	9.37	35.0	1.11	180.00
62	wet-62	LT245/75R16	120/116	S	9.14	40.6	1.18	147.96
63	wet-63	225/65R17	102	H	8.85	24.5	1.24	182.99
64	wet-64	225/65R17	102	V	8.12	27.6	1.24	159.99
65	wet-65	235/55R19	105	T	8.40	28.9	1.29	347.99
66	wet-66	LT255/70R17	121/118	S	12.14	48.8	1.03	236.99
67	wet-67	215/55R16	97	H	9.56	24.8	1.15	145.99
68	wet-68	205/65R16	95	H	8.45	23.0	1.03	91.96
69	wet-69	225/65R17	102	H	8.21	27.2	1.29	146.99
70	wet-70	265/60R18	110	V	8.30	34.2	1.32	250.99
71	wet-71	265/60R18	110	H	8.43	34.5	1.15	145.96
72	wet-72	215/60R16	95	V	7.58	22.1	1.14	76.96
73	wet-73	195/65R15	91	S	7.62	16.7	1.20	118.99
74	wet-74	225/60R18	100	H	10.15	29.5	1.04	176.99
75	wet-75	P245/75R16	109	S	8.60	30.8	1.15	149.31
76	wet-76	235/45R18	98	W	7.49	27.3	1.36	214.69
77	wet-77	195/65R15	91	H	7.51	18.1	1.35	76.92
78	wet-78	235/45R18	94	W	5.60	24.6	1.15	254.35
79	wet-79	215/50R17	91	H	6.23	20.0	1.20	193.76
80	wet-80	235/60R18	103	H	7.57	30.3	1.24	219.41
81	wet-81	235/60R18	107	H	7.46	29.0	1.17	122.51
82	wet-82	215/55R16	97	H	7.21	21.2	1.30	77.74
83	wet-83	225/65R17	102	H	6.84	25.6	1.34	189.99
84	wet-84	235/60R18	103	V	9.06	29.1	1.11	144.00
85	wet-85	265/70R16	112	S	12.45	44.5	0.92	191.00
86	wet-86	265/60R18	110	T	9.12	34.4	1.16	202.34
87	wet-87	265/70R16	112	T	8.54	37.2	1.13	185.22
88	wet-88	215/50ZR17	95	W	7.56	21.6	1.34	83.85

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	Wet Grip	Price ($)
89	wet-89	195/65R15	91	H	7.13	17.1	1.19	75.99
90	wet-90	225/65R17	102	H	6.94	24.9	1.17	92.00
91	wet-91	265/65R18	110	T	9.45	38.2	0.96	161.97
92	wet-92	235/45ZR18	98	W	7.78	25.1	1.28	133.00
93	wet-93	235/40R19	96	V	7.34	23.7	1.27	257.40
94	wet-94	235/40ZR19	96	W	7.51	22.9	1.17	115.86
95	wet-95	225/65R17	102	H	8.15	30.9	1.27	145.00
96	wet-96	265/60R18	110	V	7.78	32.7	1.29	149.11
97	wet-97	235/60R18	103	V	8.55	27.8	1.18	111.00
98	wet-98	LT245/75R16	120/116	Q	14.40	44.0	1.29	161.00
99	wet-99	245/75R17	112	S	8.92	39.7	1.14	189.96
100	wet-100	225/65R17	102	H	9.29	26.0	1.10	162.45
101	wet-101	215/70R16	100	H	8.14	27.0	0.99	113.80
102	wet-102	265/60R18	114	T	9.56	39.6	0.93	163.39
103	wet-103	P255/70R17	110	T	10.38	37.2	1.10	171.99
104	wet-104	245/75R16	111	R	11.29	36.0	0.99	148.00
105	wet-105	245/60R18	105	V	8.24	30.8	1.30	217.97
106	wet-106	225/65R17	102	H	8.42	26.0	1.20	135.00
107	wet-107	225/65R17	102	H	8.33	25.4	1.20	161.50
108	wet-108	205/60R16	92	V	9.00	22.8	1.30	116.00
109	wet-109	195/65R15	91	H	8.27	19.1	1.21	83.00
110	wet-110	235/60R18	103	H	8.57	29.9	1.33	189.05
111	wet-111	215/55R17	94	V	9.46	25.5	1.24	147.00
112	wet-112	P255/70R17	110	S	7.97	36.0	1.13	201.36
113	wet-113	215/55R16	93	V	7.96	20.9	1.13	89.26
114	wet-114	195/65R15	91	H	8.61	17.7	1.14	113.04
115	wet-115	215/55R17	98	V	7.95	24.2	1.38	87.36
116	wet-116	205/55R16	89	H	8.05	20.2	1.43	144.36
117	wet-117	205/60R16	92	H	8.03	19.4	1.37	86.54
118	wet-118	265/60R18	110	T	9.25	36.2	1.12	179.00

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	Wet Grip	Price ($)
119	wet-119	LT245/75R16	120/116	Q	11.50	44.3	1.34	261.90
120	wet-120	245/60R18	105	H	9.21	33.9	1.14	172.00
121	wet-121	225/45ZR17	94	Y	8.36	23.3	1.54	155.80
122	wet-122	235/45R18	98	W	7.45	25.6	1.34	258.30
123	wet-123	215/70R16	110	T	9.72	28.2	1.18	147.00
124	wet-124	215/55R16	93	H	7.60	20.8	1.29	157.70
125	wet-125	P245/75R16	109	S	8.56	31.3	1.14	147.21
126	wet-126	265/65R18	114	T	7.15	35.5	1.31	207.06
127	wet-127	235/60R18	107	V	7.95	33.1	1.24	176.00
128	wet-128	235/60R18	107	V	8.63	30.8	1.28	195.00
129	wet-129	255/40R20	101	W	6.50	26.8	1.35	303.02
130	wet-130	235/45ZR18	98	W	6.83	24.5	1.27	112.06
131	wet-131	215/55R16	93	H	7.62	21.2	1.32	132.01
132	wet-132	215/70R16	100	T	9.05	26.4	1.17	160.00
133	wet-133	P255/70R16	109	T	10.35	35.1	0.94	124.00
134	wet-134	225/65R17	102	H	7.82	25.8	1.20	119.00
135	wet-135	235/60R17	100	T	7.45	26.4	1.20	166.21
136	wet-136	195/65R15	91	S	7.15	17.7	1.31	131.07
137	wet-137	225/45ZR17	94	W	7.80	23.2	1.38	125.00
138	wet-138	235/45R18	98	Y	8.23	25.8	1.32	211.00
139	wet-139	195/65R15	91	S	7.25	18.2	1.28	95.94
140	wet-140	235/60R17	102	T	6.85	24.5	1.13	95.00
141	wet-141	235/55R19	101	V	7.15	27.6	1.32	272.16
142	wet-142	255/65R18	111	H	8.35	34.3	1.25	215.99
143	wet-143	275/60R20	115	T	8.65	41.4	1.23	303.99
144	wet-144	275/45R20	110	H	10.20	38.8	1.07	245.10
145	wet-145	LT275/65R18	113/100	Q	13.86	48.6	1.47	236.69
146	wet-146	215/55R17	94	V	7.05	22.3	1.16	192.99
147	wet-147	215/55R17	94	V	8.40	23.1	1.34	209.99
148	wet-148	195/65R15	91	H	8.30	19.2	1.37	151.98

Smithers Group ID	Smithers Tire ID	Tire Size	Load Index	Speed Rating	Tread Depth (mm)	Tire Weight (lbs)	Wet Grip	Price ($)
149	wet-149	235/40R19	96	W	7.32	24.6	1.34	267.86

Other Tire Group Information

Smithers Group ID	Tire Size	UTQG Treadwear	UTQG Traction	UTQG Temperature	Tire Market Category	Tire Usage Category	Manufacturer Tier	Run Flat (Y/N)
1	P245/75R16	520	A	B	Economy	Replacement	3	N
2	P255/70R17	540	A	A	All terrain	Replacement	3	N
3	225/65R17	400	A	B	Economy	Replacement	1	N
4	235/75R16	500	A	A	All terrain	Replacement	2	N
5	225/65RF17	500	A	A	Touring	Replacement	1	Y
6	235/45ZR18	400	A	A	UHP	Replacement	1	N
7	215/50R17	480	A	B	Fuel Efficient	Replacement	1	N
8	215/55ZR16	560	AA	A	UHP	Replacement	1	N
9	215/60R16	500	A	A	Touring	Replacement	3	N
10	P215/70R16	520	A	B	Highway	Replacement	3	N
11	225/65R17	600	A	A	Highway	Replacement	3	N
12	255/70R17	640	A	B	Highway	Replacement	1	N
13	P275/45R20	420	A	A	UHP	Replacement	1	N
14	LT245/75R16	640	A	B	Highway	Replacement	1	N
15	275/45R20	480	A	B	Highway	Replacement	3	N
16	265/45R20	520	A	A	UHP	Replacement	2	N
17	P245/75R16	540	A	B	All terrain	Replacement	1	N
18	215/55RF16	500	A	A	Touring	Replacement	1	Y
19	P205/55R16	260	A	A	UHP	Replacement	1	N
20	235/45R18	400	A	A	Touring	Replacement	1	N
21	215/55R17	540	A	A	Touring	Replacement	1	N
22	205/55R16	420	A	A	UHP	Replacement	1	N
23	225/65R17	800	A	A	Touring	Replacement	1	N
24	205/65R16	580	A	B	Touring	Replacement	3	N
25	225/65R17	820	A	B	Touring	Replacement	1	N

Smithers Group ID	Tire Size	UTQG Treadwear	UTQG Traction	UTQG Temperature	Tire Market Category	Tire Usage Category	Manufacturer Tier	Run Flat (Y/N)
26	215/55R16	420	A	A	UHP	Replacement	1	N
27	215/70R16	720	A	A	Highway	Replacement	1	N
28	245/75R17	400	B	B	All terrain	Replacement	1	N
29	265/60R18	520	A	B	Highway	Replacement	1	N
30	225/65R17	700	A	A	Touring	Replacement	3	N
31	P275/55R20	740	A	B	Highway	Efficient	1	N
32	265/70R16	800	A	A	Highway	Replacement	1	N
33	235/75R16	600	A	B	All terrain	Replacement	2	N
34	195/65R15	400	A	A	economy	Replacement	3	N
35	215/60R16	520	A	A	economy	Replacement	3	N
36	P195/65R15	440	A	A	economy	Replacement	3	N
37	195/65R15	820	A	B	highway	Replacement	1	N
38	235/65R16	640	A	A	highway	Replacement	1	N
39	235/45R18	280	AA	A	UHP	Replacement	1	N
40	225/65R17	540	A	A	highway	Replacement	3	N
41	265/45R20	500	A	A	UHP	Replacement	2	N
42	195/65R15	800	A	A	Touring	Replacement	1	N
43	235/45ZR18	500	A	A	UHP	Replacement	3	N
44	235/45ZR18	400	AA	A	UHP	Replacement	3	N
45	205/55R16	260	A	A	UHP	Replacement	2	N
46	P215/65R16	440	A	A	economy	Replacement	3	N
47	215/70R16	440	A	A	economy	Replacement	3	N
48	215/65R16	600	A	A	economy	Replacement	3	N
49	215/70R16	500	A	B	economy	Replacement	3	N
50	195/65R15	520	A	A	economy	Replacement	3	N
51	215/55R17	520	A	A	economy	Replacement	3	N
52	235/40R19	700	A	A	Touring	Replacement	1	N
53	265/70R16	600	A	B	All terrain	Replacement	3	N
54	P235/75R16	640	A	A	highway	Replacement	3	N
55	225/65R17	620	B	A	highway	Efficient	3	N
56	265/45R20	480	A	A	Touring	Replacement	1	N

Smithers Group ID	Tire Size	UTQG Treadwear	UTQG Traction	UTQG Temperature	Tire Market Category	Tire Usage Category	Manufacturer Tier	Run Flat (Y/N)
57	275/45R20	640	A	A	highway	Replacement	3	N
58	205/65R16	780	A	B	Touring	Replacement	3	N
59	235/60R18	440	A	A	highway	Replacement	3	N
60	235/45R18	440	AA	A	UHP	Replacement	2	N
61	255/70R17	720	A	A	highway	Replacement	3	N
62	LT245/75R16	NA	NA	NA	highway	Replacement	3	N
63	225/65R17	800	A	A	highway	Replacement	1	N
64	225/65R17	680	A	A	Touring	Efficient	3	N
65	235/55R19	500	A	A	EV	Efficient	2	N
66	LT255/70R17	NA	NA	NA	All terrain	Replacement	1	N
67	215/55R16	820	A	B	Touring	Replacement	1	N
68	205/65R16	540	A	A	Touring	Replacement	3	N
69	225/65R17	640	A	A	highway	Efficient	2	N
70	265/60R18	800	A	A	highway	Replacement	1	N
71	265/60R18	440	A	A	highway	Replacement	3	N
72	215/60R16	460	A	A	Touring	Replacement	3	N
73	195/65R15	300	B	B	highway	Efficient	3	N
74	225/60R18	820	A	B	highway	Replacement	1	N
75	P245/75R16	300	B	B	Highway	Replacement	1	N
76	235/45R18	500	AA	A	UHP	Replacement	1	N
77	195/65R15	500	A	A	Touring	Replacement	3	N
78	235/45R18	200	A	A	UHP	Replacement	1	N
79	215/50R17	480	B	B	Fuel Efficient	OE	1	N
80	235/60R18	480	A	A	Touring	OE	1	N
81	235/60R18	500	A	A	Touring	Replacement	3	N
82	215/55R16	500	A	A	Touring	Replacement	3	N
83	225/65R17	800	A	A	Touring	Replacement	1	N
84	235/60R18	800	A	B	Touring	Replacement	1	N
85	265/70R16	500	B	B	All Terrain	Replacement	1	N
86	265/60R18	680	A	B	Highway	Replacement	1	N
87	265/70R16	640	A	B	All Terrain	Replacement	1	N

Smithers Group ID	Tire Size	UTQG Treadwear	UTQG Traction	UTQG Temperature	Tire Market Category	Tire Usage Category	Manufacturer Tier	Run Flat (Y/N)
88	215/50ZR17	500	A	A	UHP	Replacement	3	N
89	195/65R15	500	A	A	Touring	Replacement	2	N
90	225/65R17	420	A	B	Touring	Replacement	1	N
91	265/65R18	540	A	B	All Terrain	Replacement	3	N
92	235/45ZR18	460	A	A	UHP	Replacement	3	N
93	235/40R19	500	A	A	UHP	Replacement	2	N
94	235/40ZR19	600	A	A	UHP	Replacement	3	N
95	225/65R17	740	A	A	Touring	Replacement	2	N
96	265/60R18	540	A	A	Touring	Replacement	3	N
97	235/60R18	600	A	A	Touring	Replacement	1	N
98	LT245/75R16	NA	NA	NA	All Terrain	Replacement	1	N
99	245/75R17	720	A	A	Highway	Replacement	1	N
100	225/65R17	860	A	A	Fuel Efficient	Replacement	2	N
101	215/70R16	540	A	A	Highway	Replacement	3	N
102	265/60R18	540	A	B	Highway	Replacement	3	N
103	P255/70R17	700	A	B	Touring	Replacement	2	N
104	245/75R16	560	A	B	All Terrain	Replacement	3	N
105	245/60R18	440	A	A	Fuel Efficient	Replacement	1	N
106	225/65R17	600	A	B	Touring	Replacement	3	N
107	225/65R17	600	A	A	Fuel Efficient	Replacement	1	N
108	205/60R16	600	A	A	Touring	Replacement	2	N
109	195/65R15	600	A	B	Touring	Replacement	3	N
110	235/60R18	540	A	A	Touring	Replacement	2	N
111	215/55R17	740	A	A	Touring	Replacement	2	N
112	P255/70R17	360	B	B	Highway	Replacement	1	N
113	215/55R16	440	A	A	UHP	Replacement	3	N
114	195/65R15	800	A	A	Touring	Replacement	1	N
115	215/55R17	540	A	A	Touring	Replacement	3	N
116	205/55R16	400	A	A	Fuel Efficient	OE	1	N
117	205/60R16	500	A	A	Touring	Replacement	3	N
118	265/60R18	680	A	B	Highway	Replacement	2	N

Smithers Group ID	Tire Size	UTQG Treadwear	UTQG Traction	UTQG Temperature	Tire Market Category	Tire Usage Category	Manufacturer Tier	Run Flat (Y/N)
119	LT245/75R16	NA	NA	NA	Highway	Replacement	2	N
120	245/60R18	680	A	B	Highway	Replacement	2	N
121	225/45ZR17	540	AA	A	UHP	Replacement	1	N
122	235/45R18	500	A	A	EV	Replacement	1	N
123	215/70R16	680	A	B	Highway	Replacement	2	N
124	215/55R16	640	A	A	Fuel Efficient	Replacement	1	N
125	P245/75R16	520	A	B	Highway	OE	1	N
126	265/65R18	540	B	B	Highway	OE	1	N
127	235/60R18	640	A	A	Touring	Replacement	2	N
128	235/60R18	740	A	A	Touring	Replacement	2	N
129	255/40R20	500	A	A	UHP	OE	1	N
130	235/45ZR18	420	A	A	UHP	Replacement	3	N
131	215/55R16	560	A	A	Touring	OE	1	N
132	215/70R16	740	A	A	Touring	Replacement	2	N
133	P255/70R16	520	A	B	All Terrain	Replacement	3	N
134	225/65R17	540	A	A	Touring	Replacement	3	N
135	235/60R17	560	A	A	Touring	Replacement	1	N
136	195/65R15	280	B	A	Fuel Efficient	OE	2	N
137	225/45ZR17	500	A	A	UHP	Replacement	2	N
138	235/45R18	740	A	A	UHP	Replacement	2	N
139	195/65R15	440	A	A	Touring	OE	2	N
140	235/60R17	420	A	B	Touring	Replacement	1	N
141	235/55R19	400	A	A	Touring	OE	1	N
142	255/65R18	500	A	A	Touring	OE	2	N
143	275/60R20	440	A	A	All Terrain	OE	2	N
144	275/45R20	460	A	A	Touring	Replacement	2	N
145	LT275/65R18	NA	NA	NA	All Terrain	OE	1	N
146	215/55R17	440	A	A	Touring	Replacement	3	N
147	215/55R17	640	A	A	Touring	Replacement	2	N
148	195/65R15	800	A	A	Touring	Replacement	2	N
149	235/40R19	400	A	A	EV	OE	1	N

Appendix

2. Data Charts from Results Section

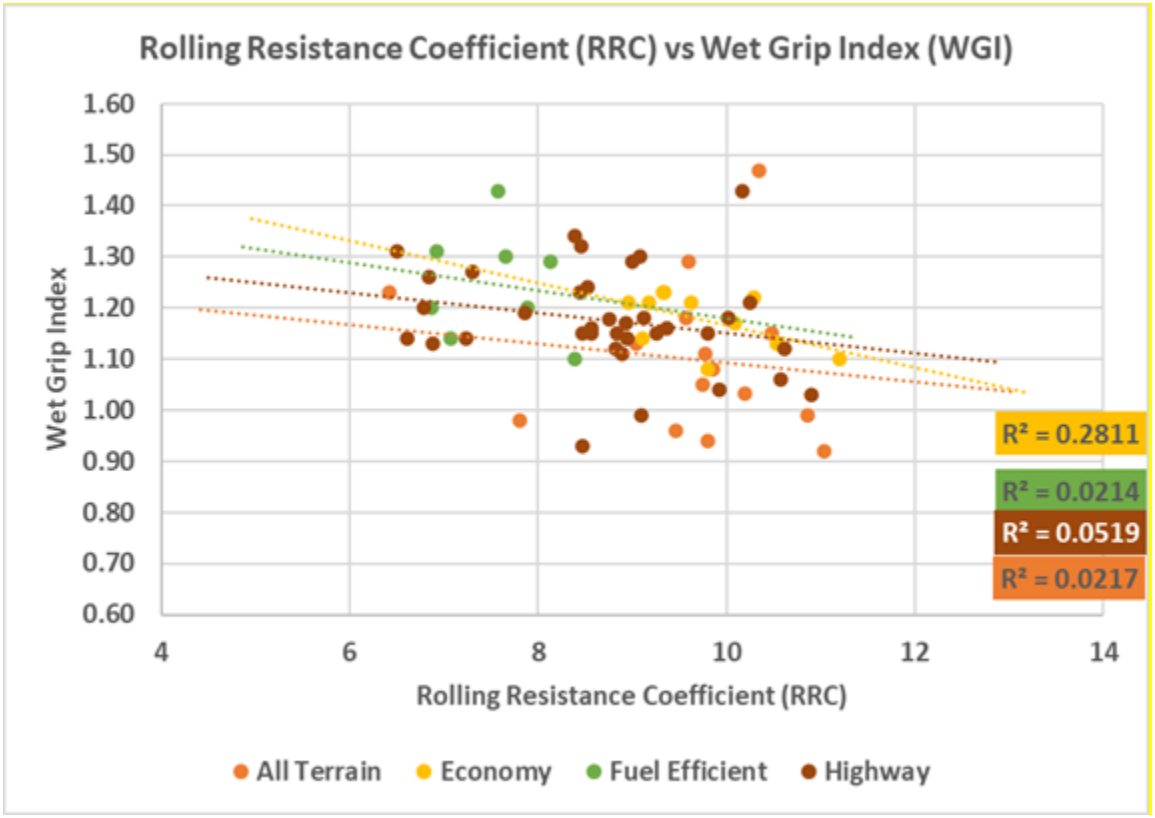


Chart 5.1A

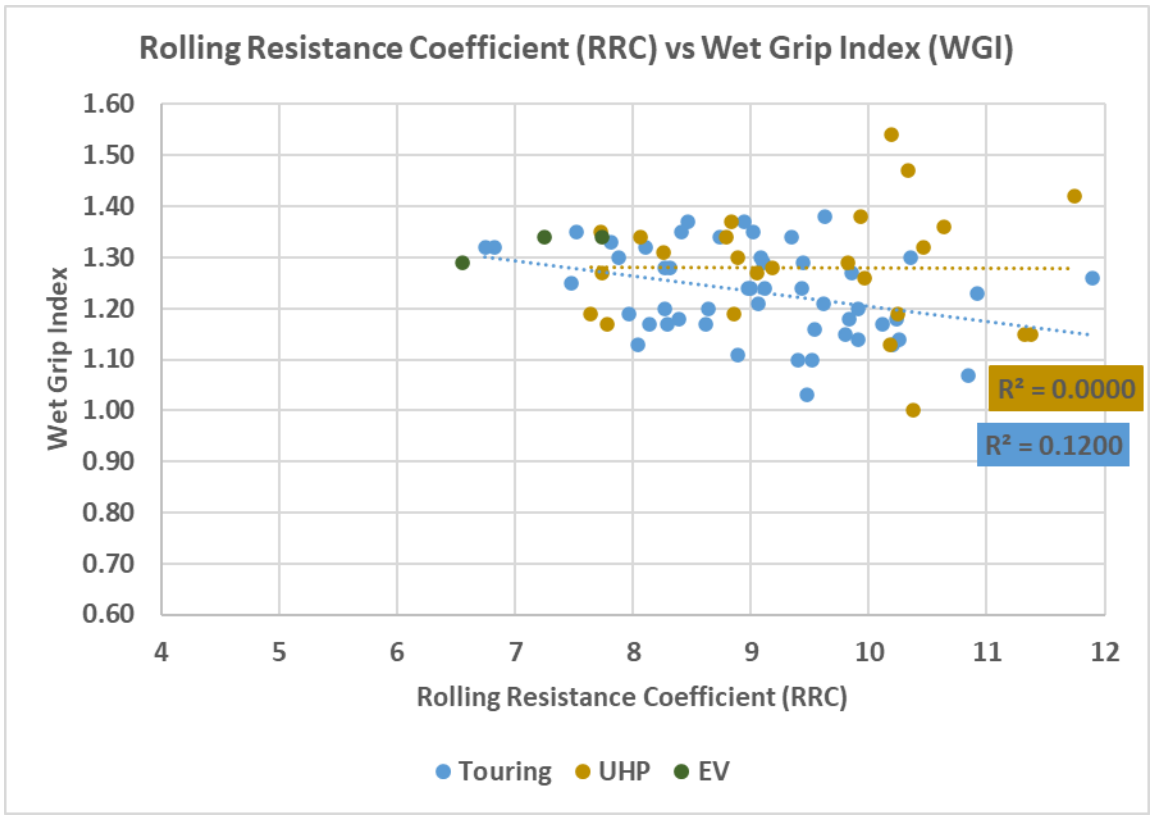


Chart 5.1B

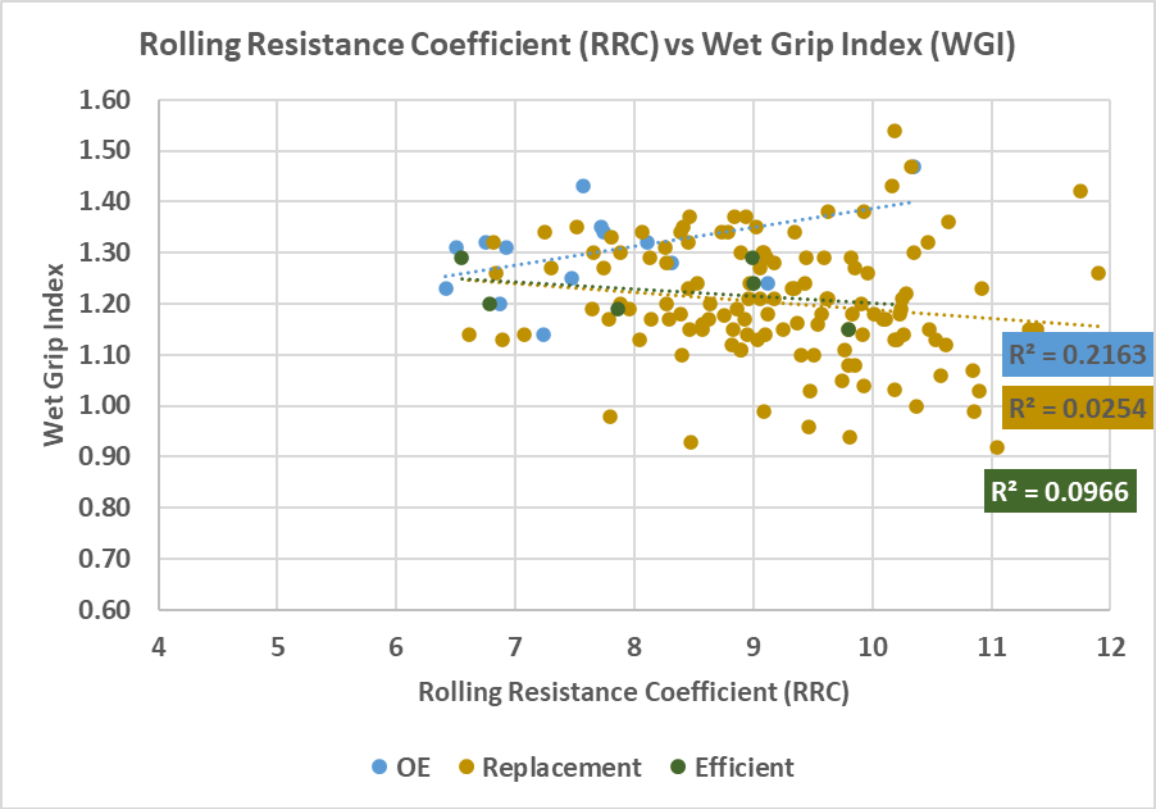


Chart 5.1C

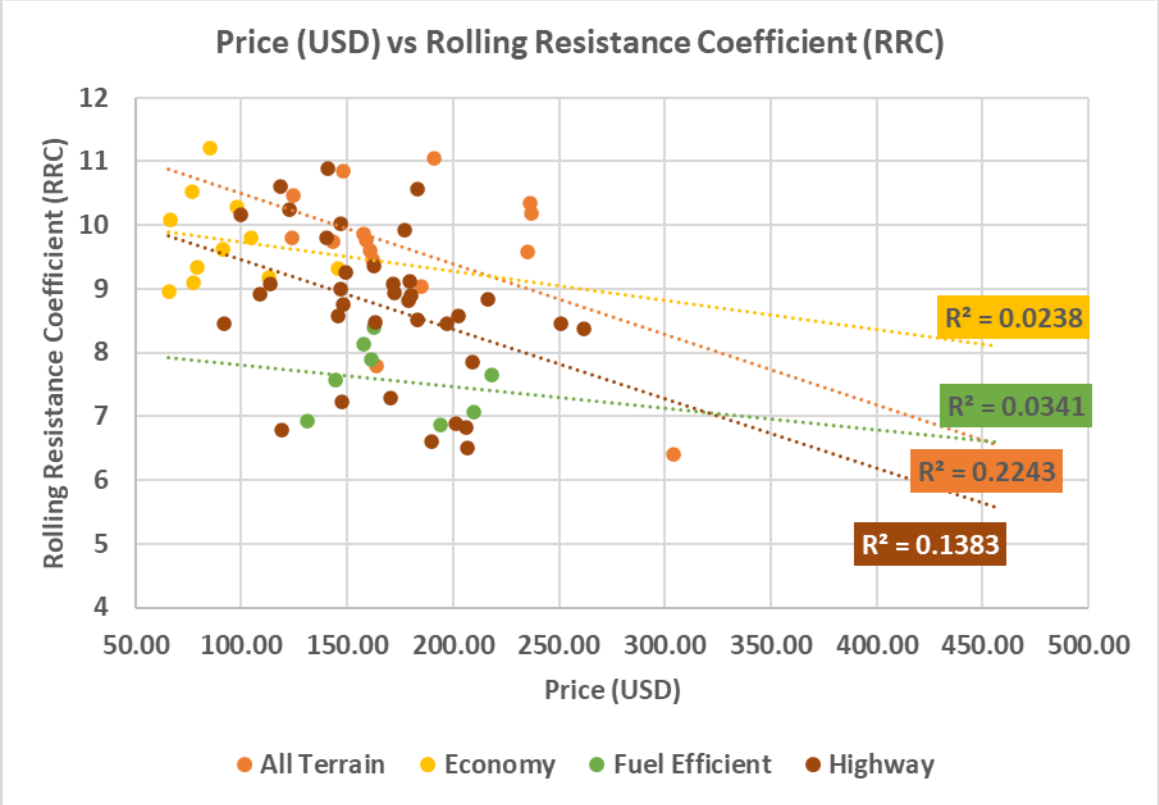


Chart 5.2A

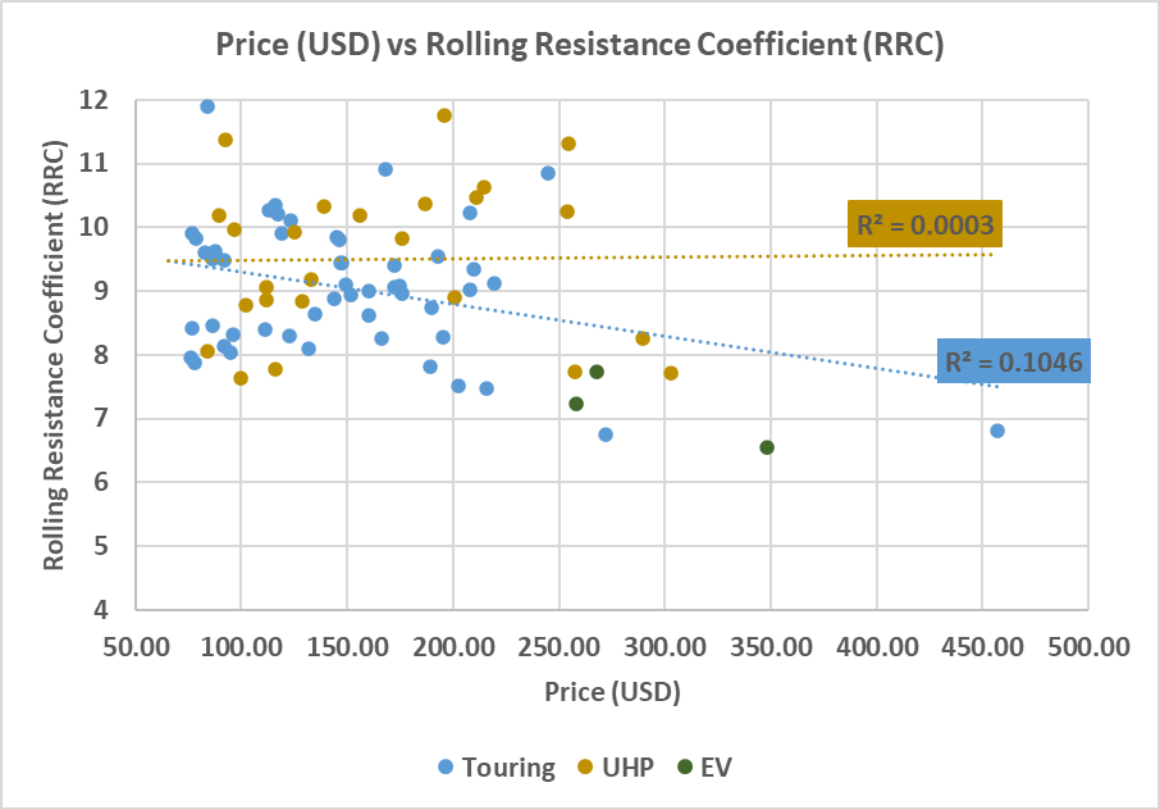


Chart 5.2B

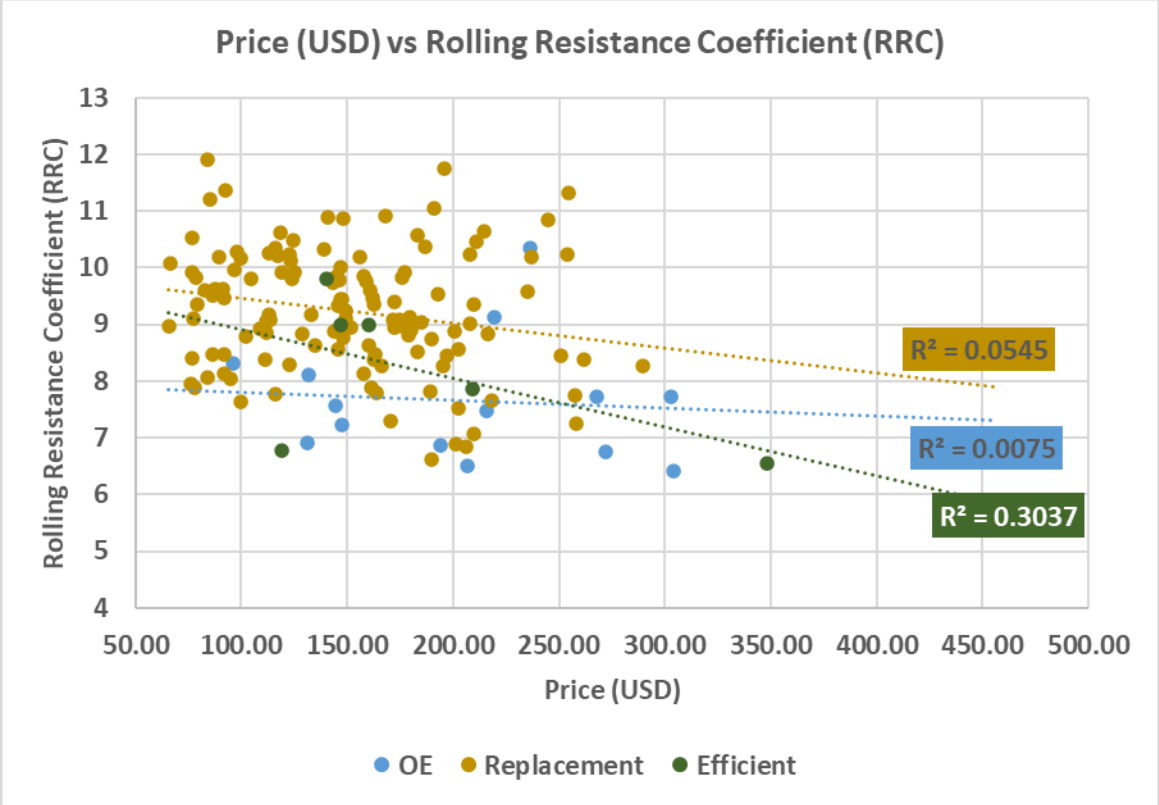


Chart 5.2C

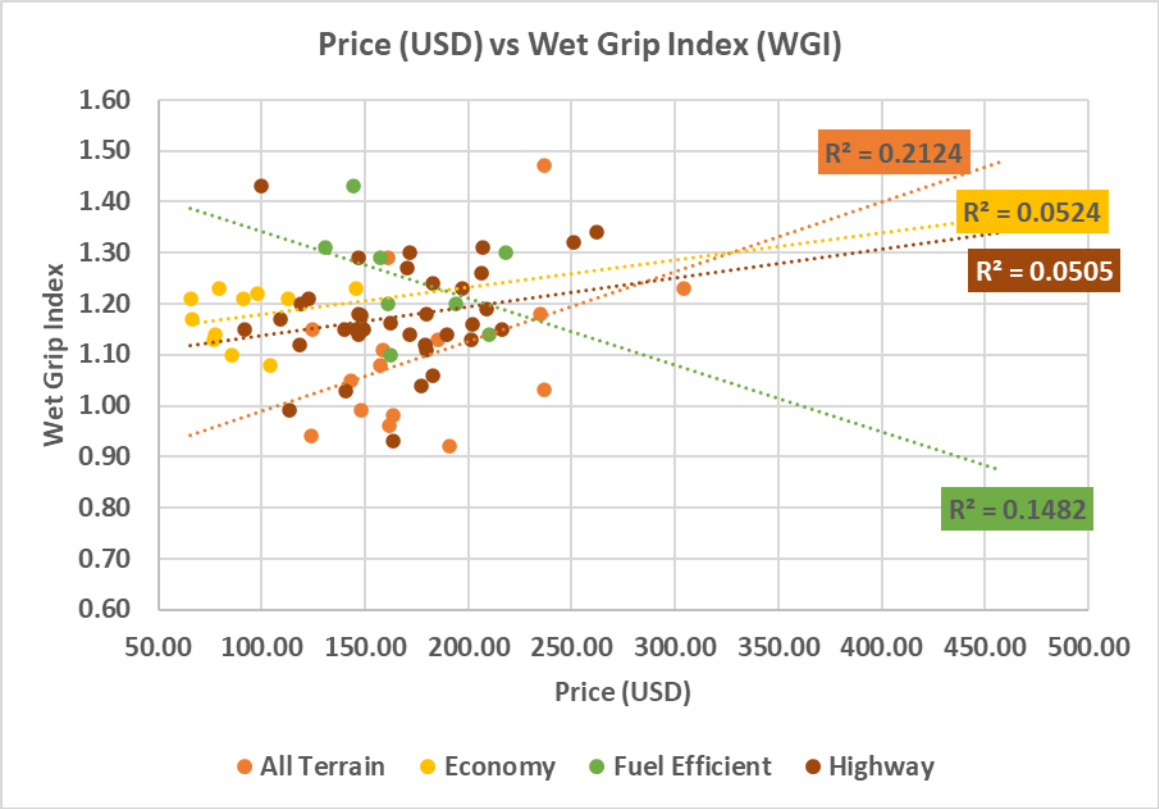


Chart 5.2D

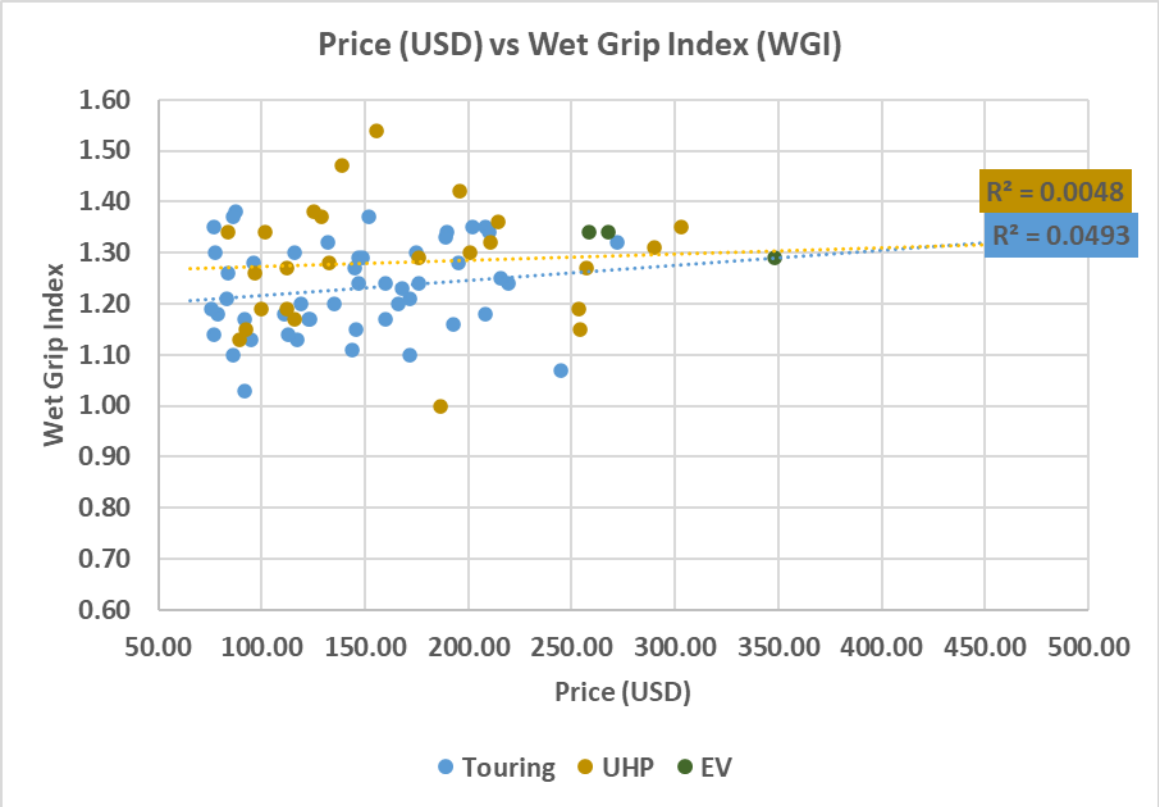


Chart 5.2E

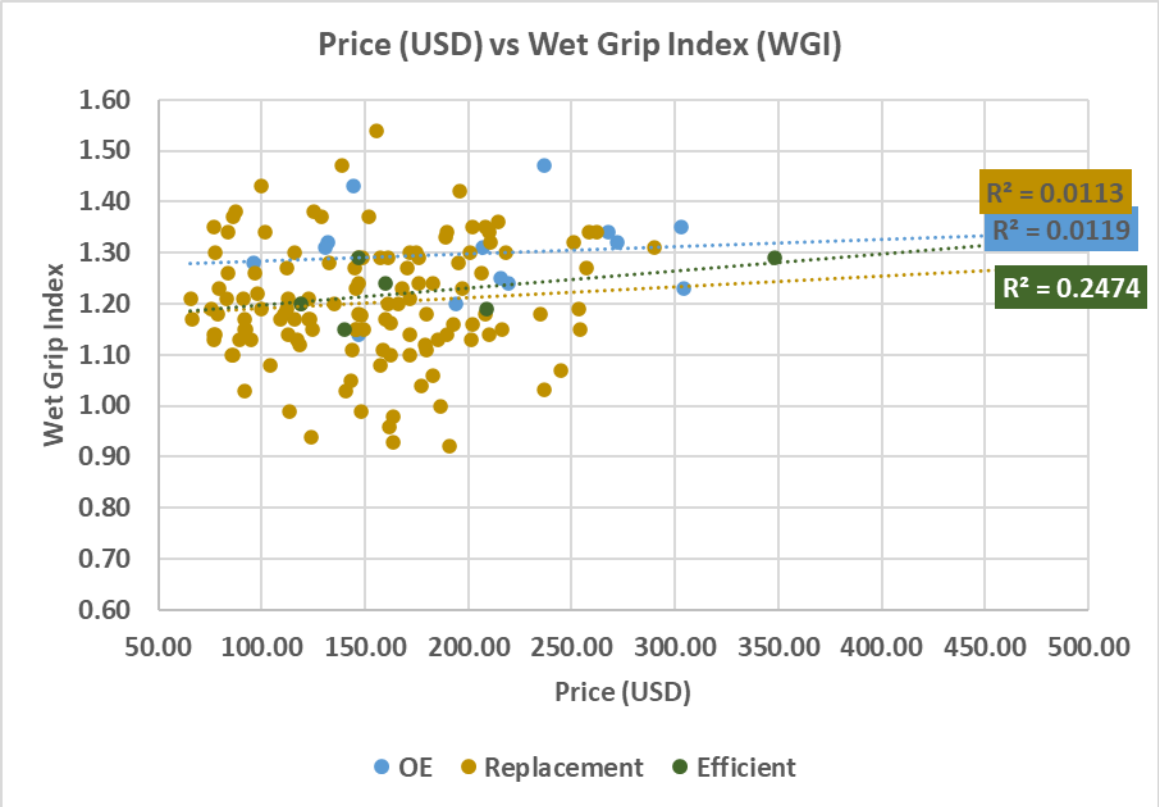


Chart 5.2F

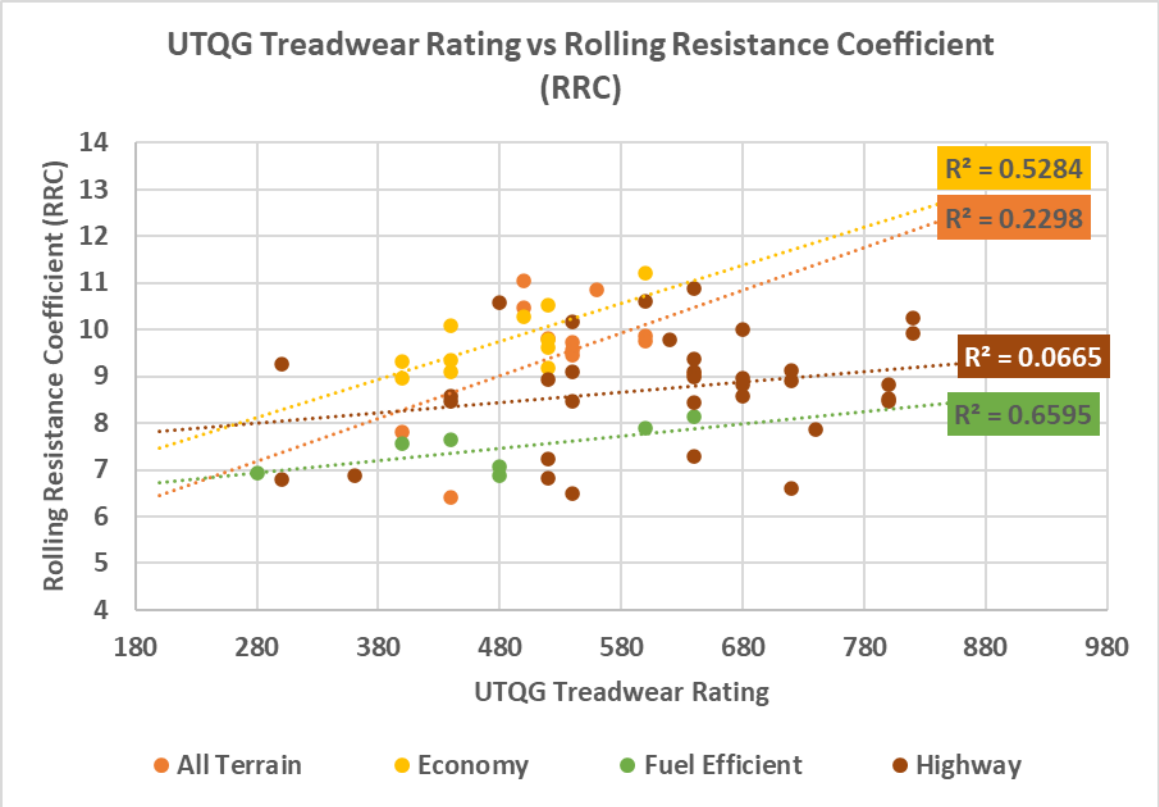


Chart 5.3A

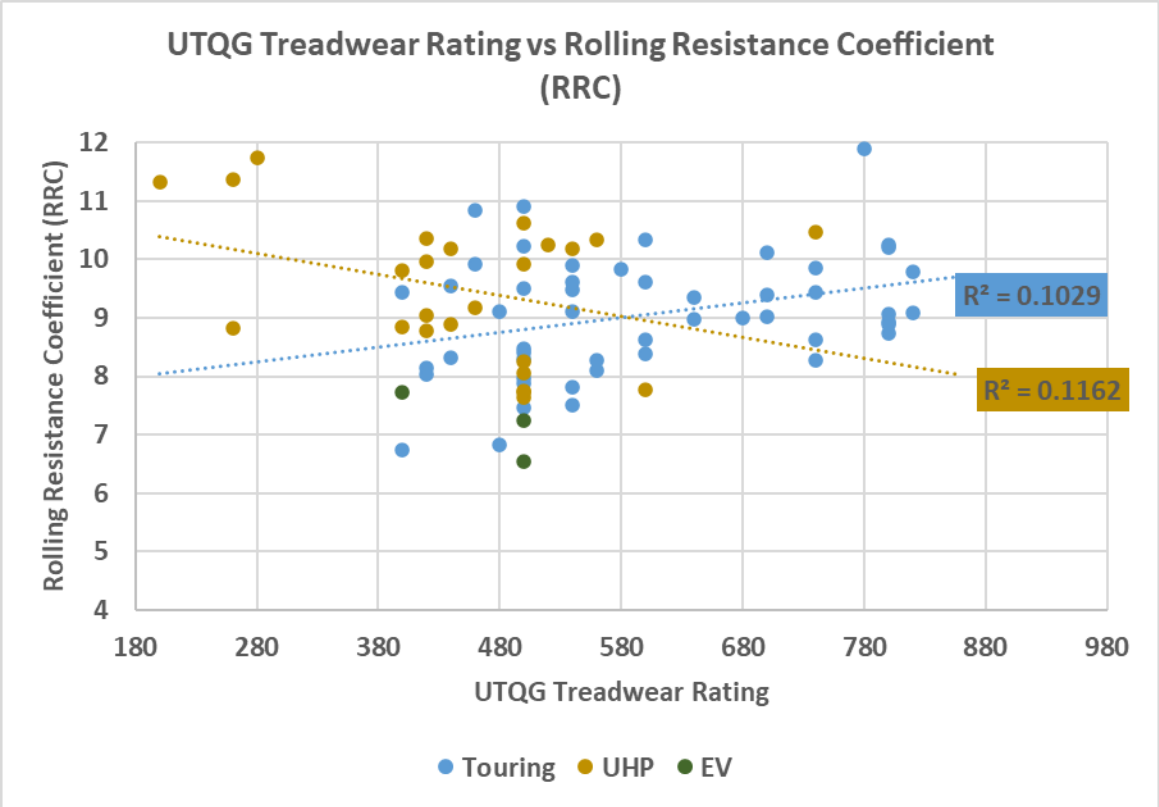


Chart 5.3B

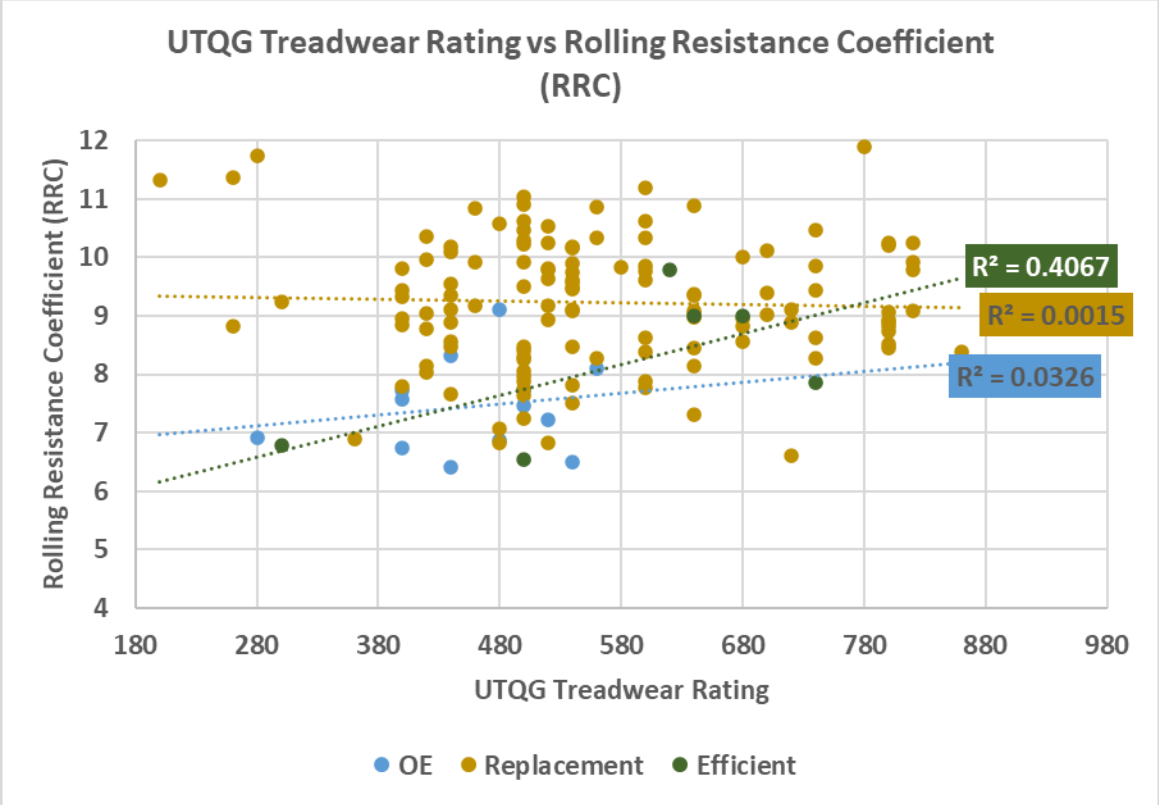


Chart 5.3C

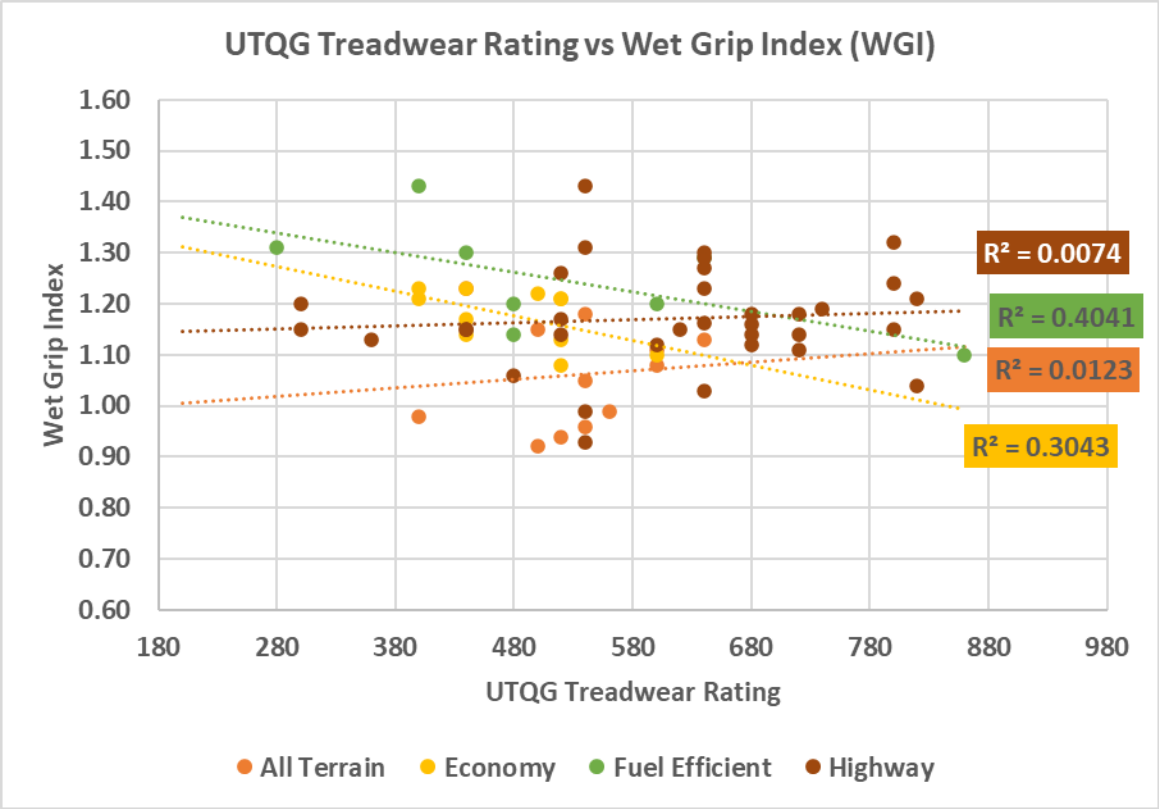


Chart 5.3D

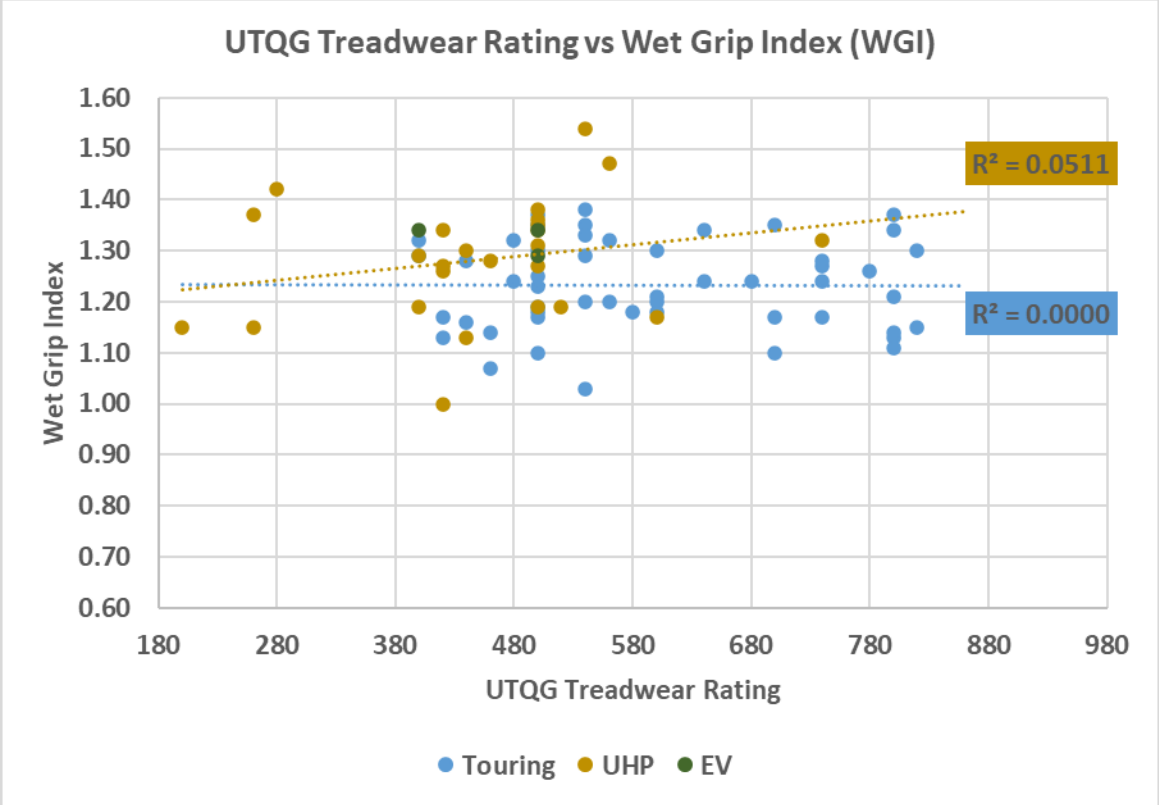


Chart 5.3E

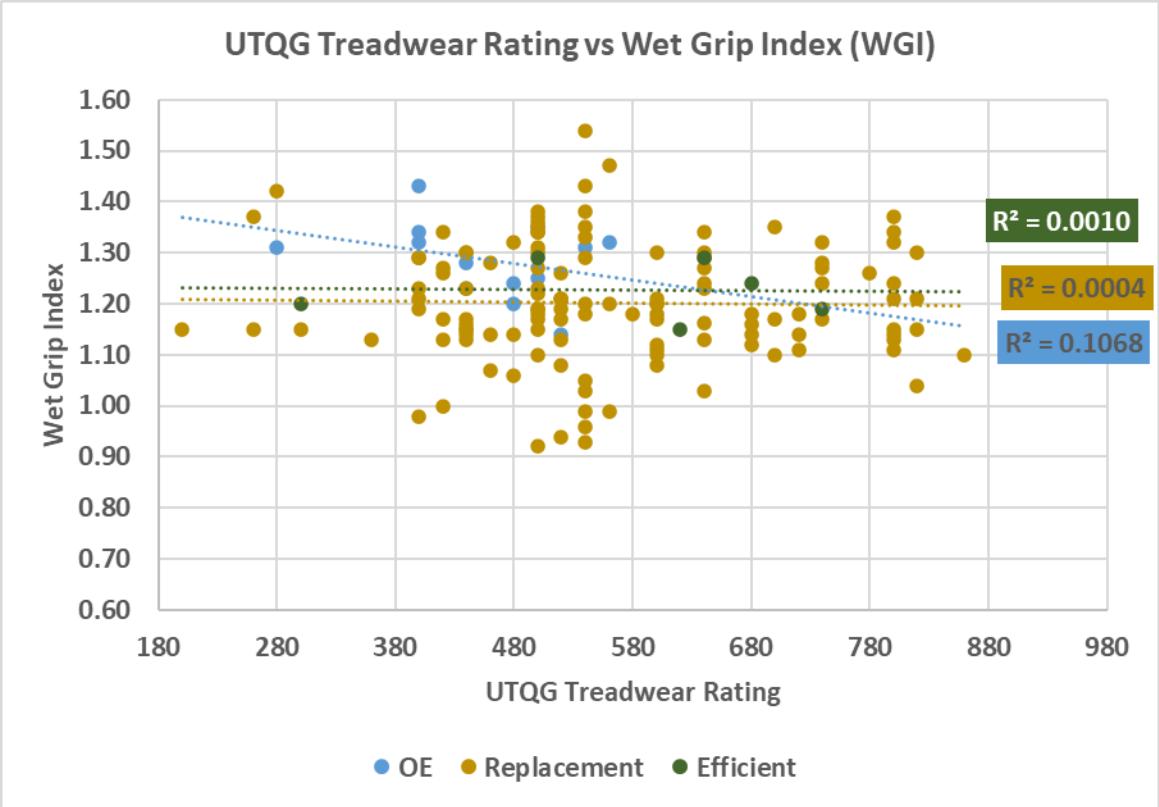


Chart 5.3F

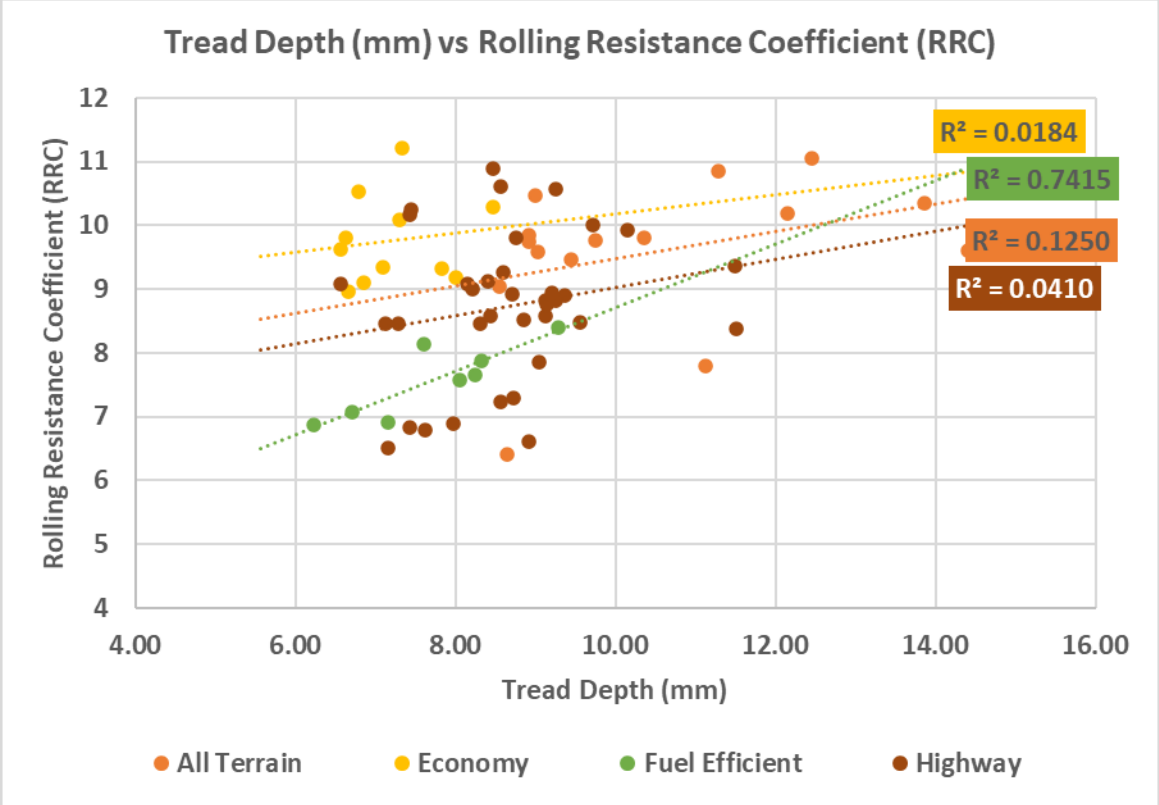


Chart 5.4A

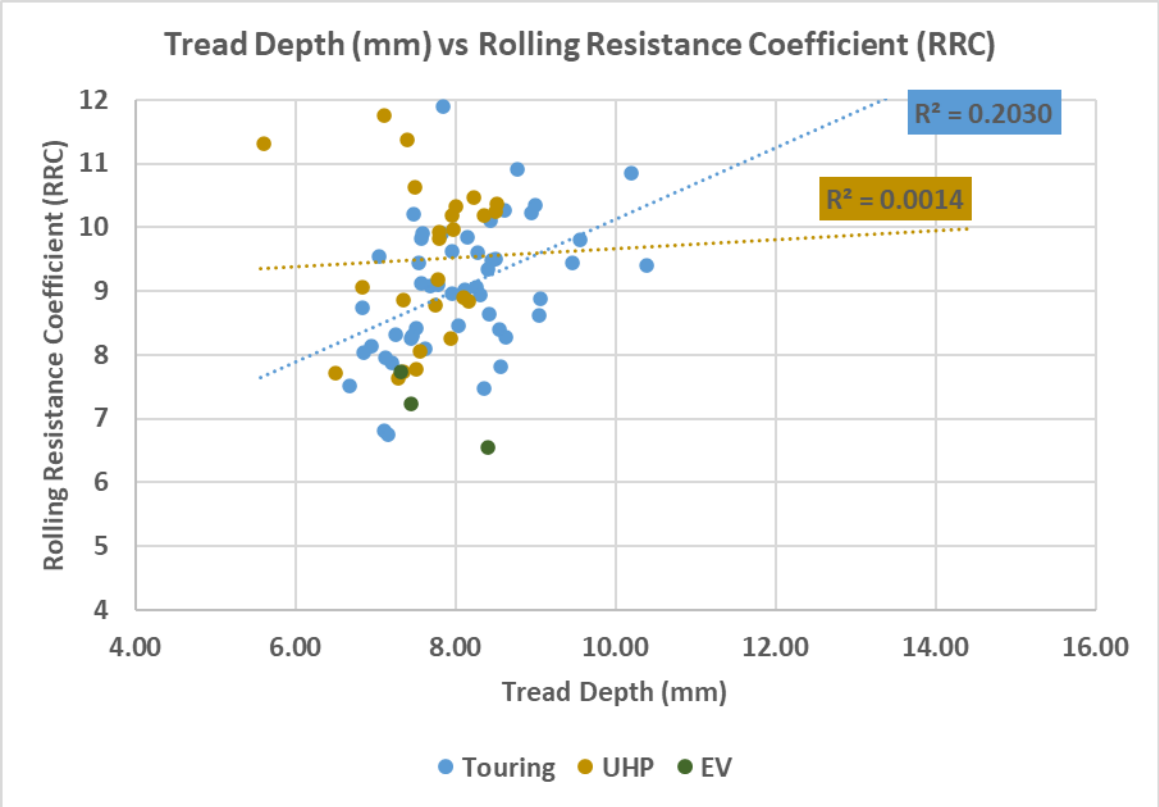


Chart 5.4B

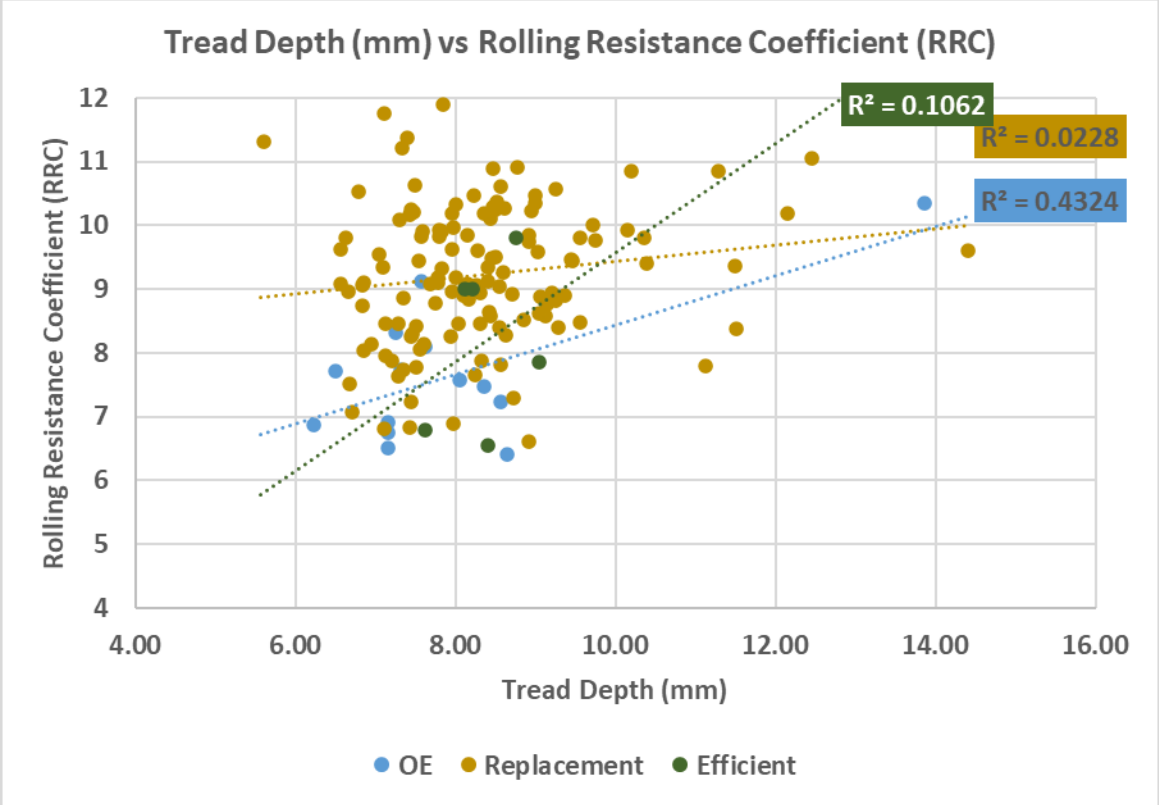


Chart 5.4C

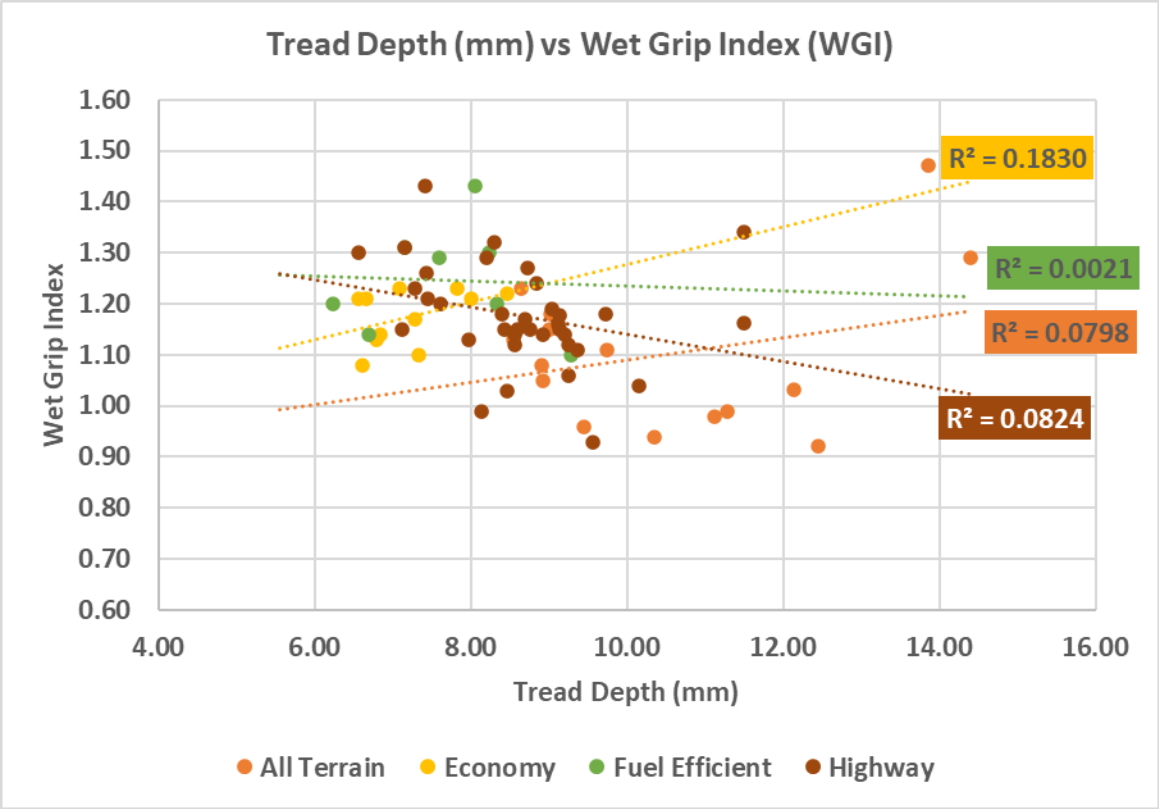


Chart 5.4D

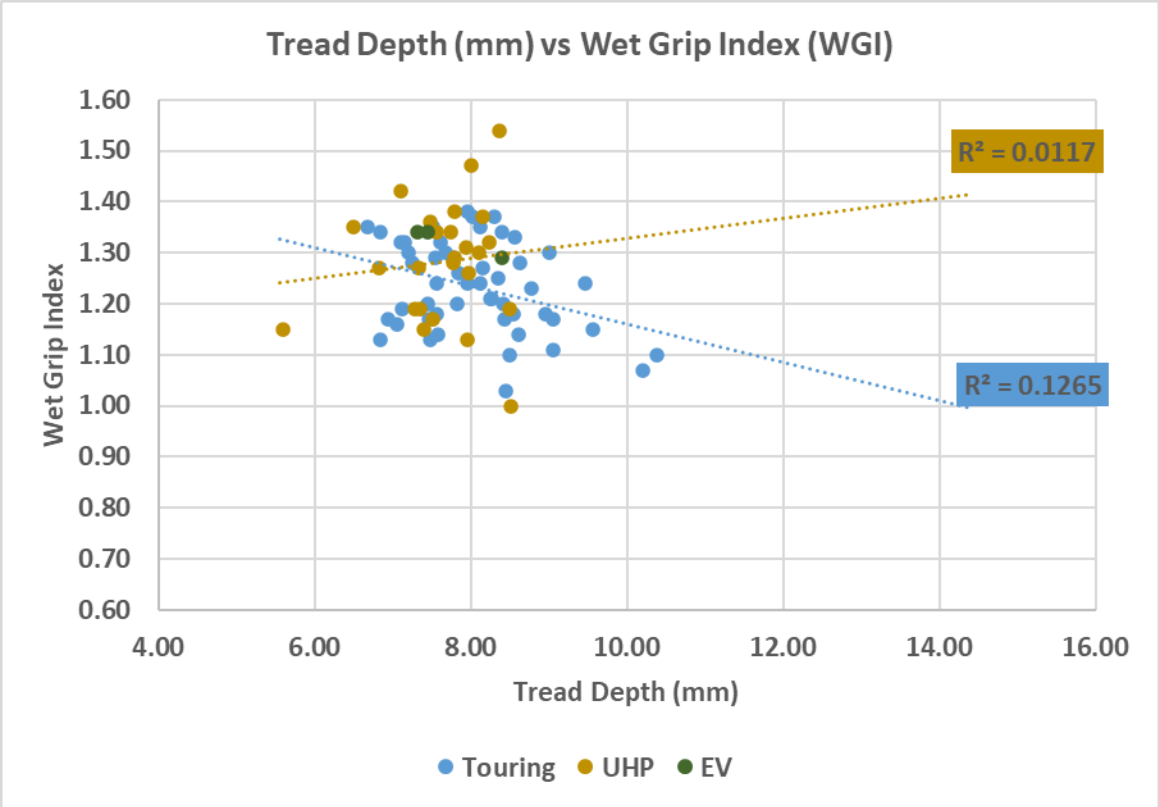


Chart 5.4E

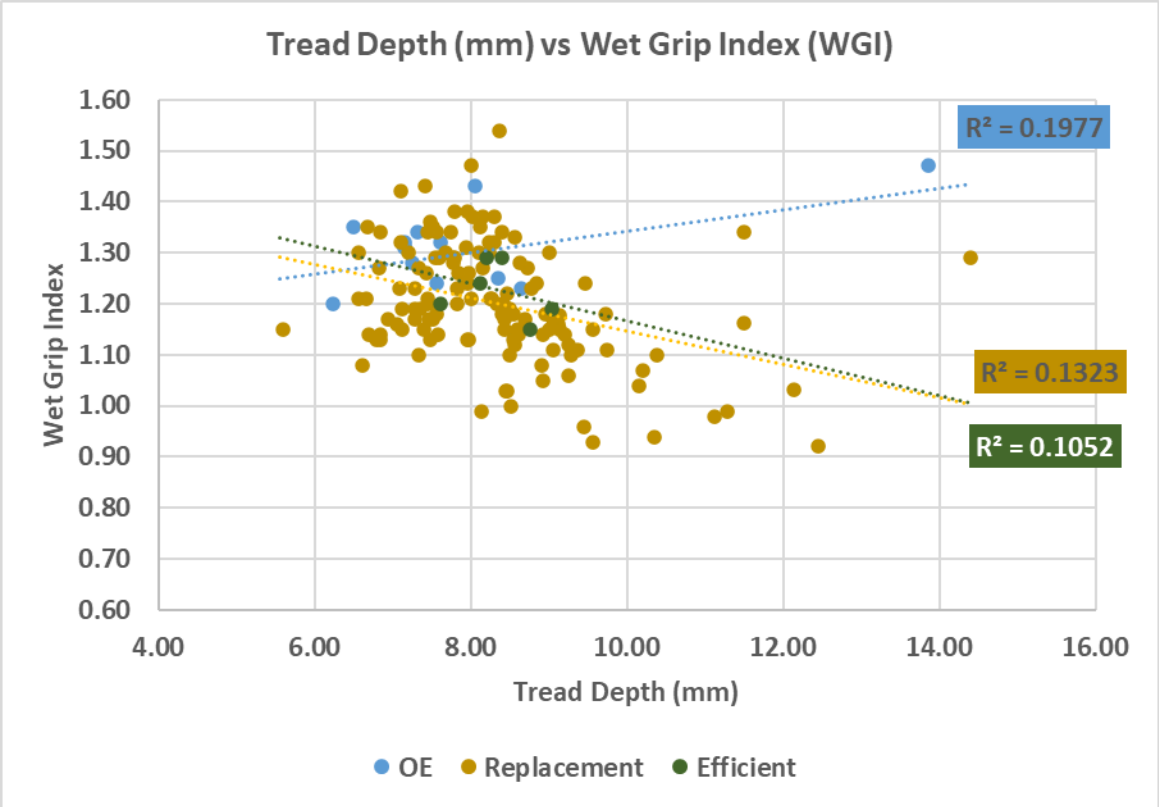


Chart 5.4F

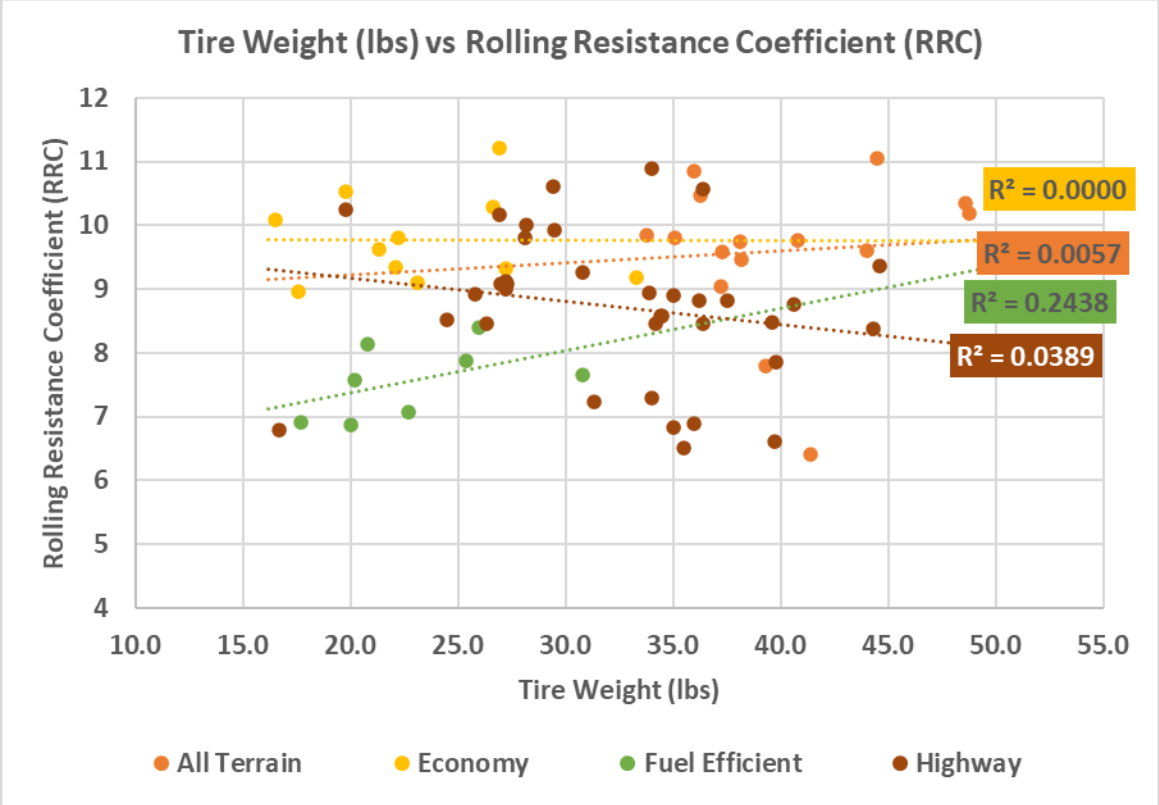


Chart 5.5A

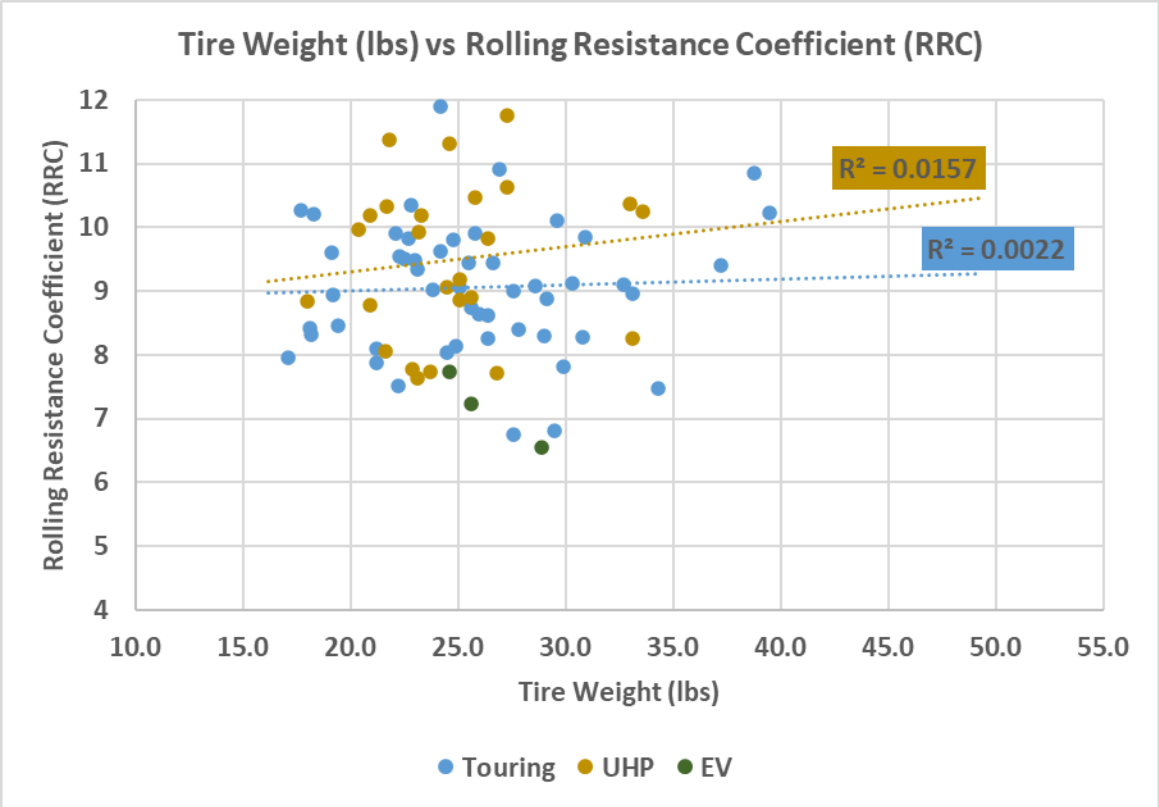


Chart 5.5B

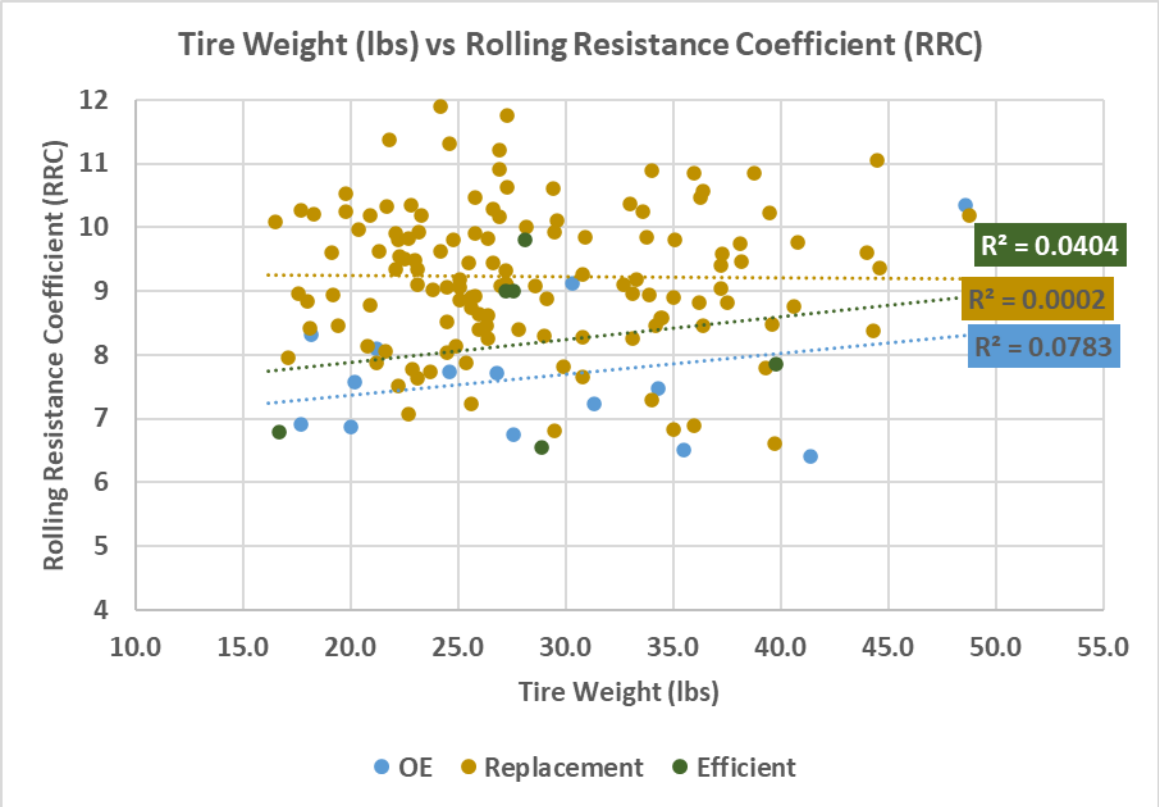


Chart 5.5C

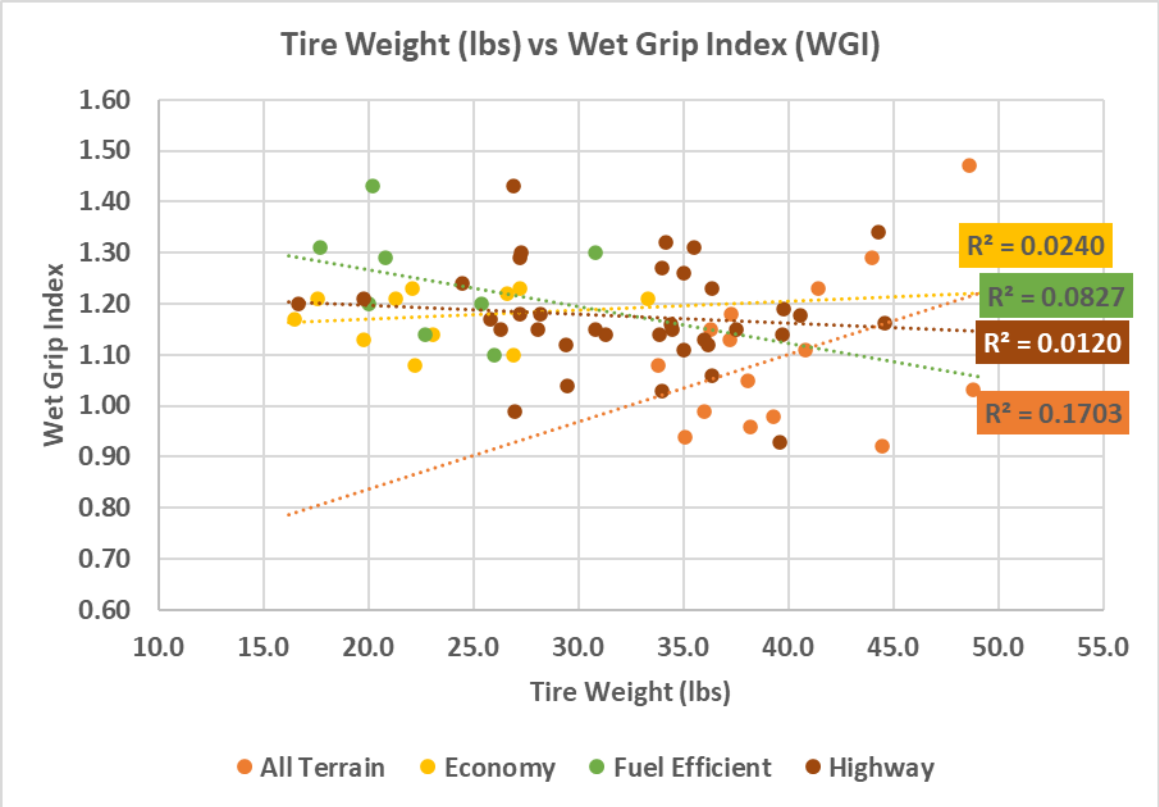


Chart 5.5D

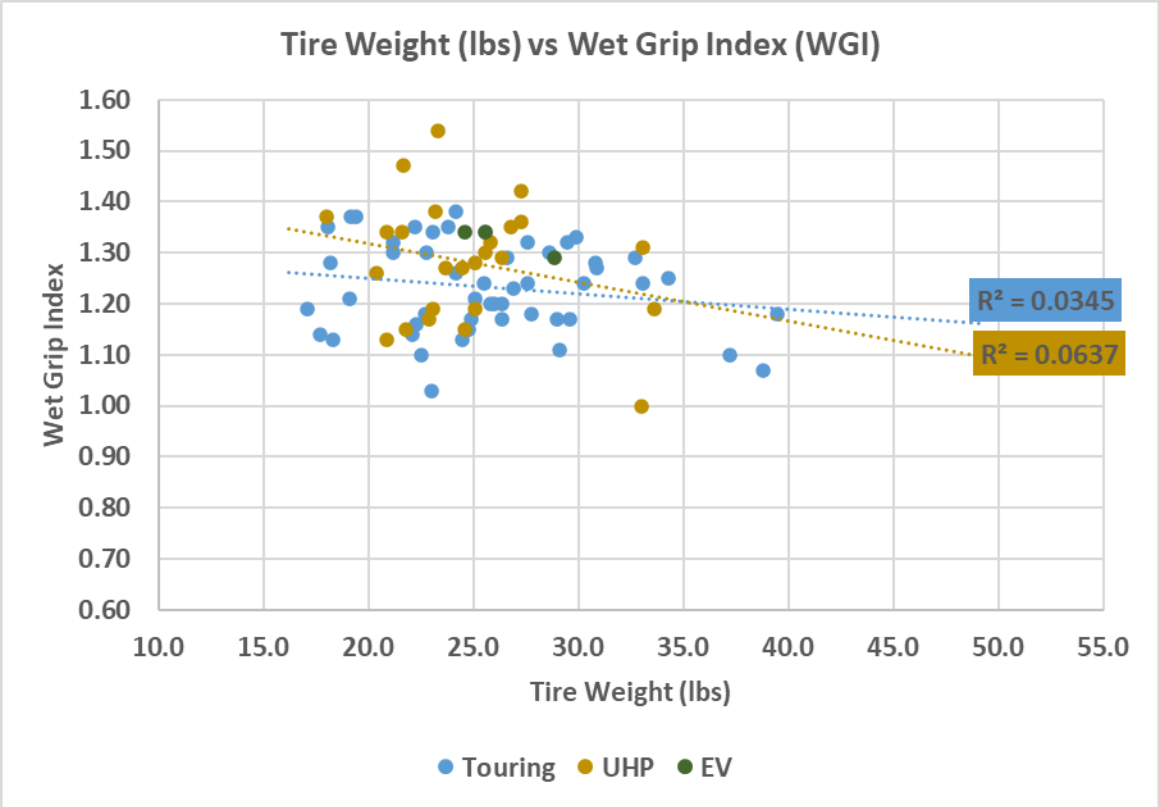


Chart 5.5E

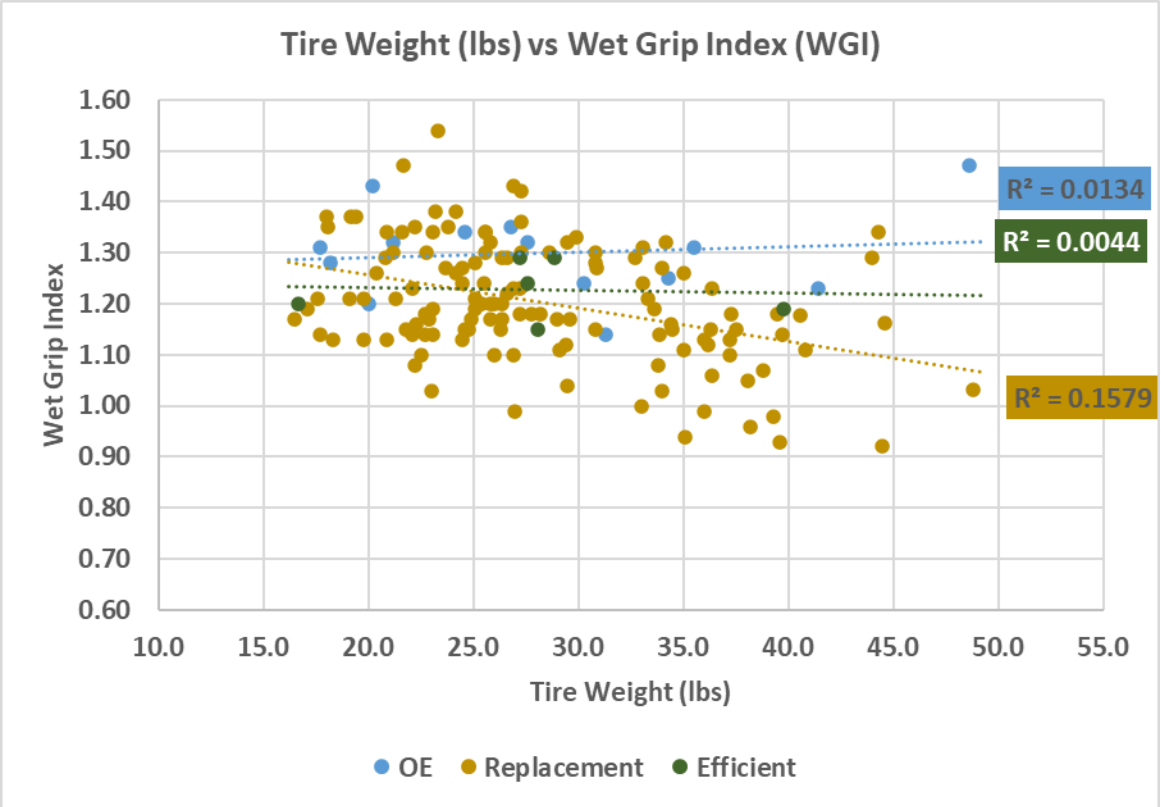


Chart 5.5F

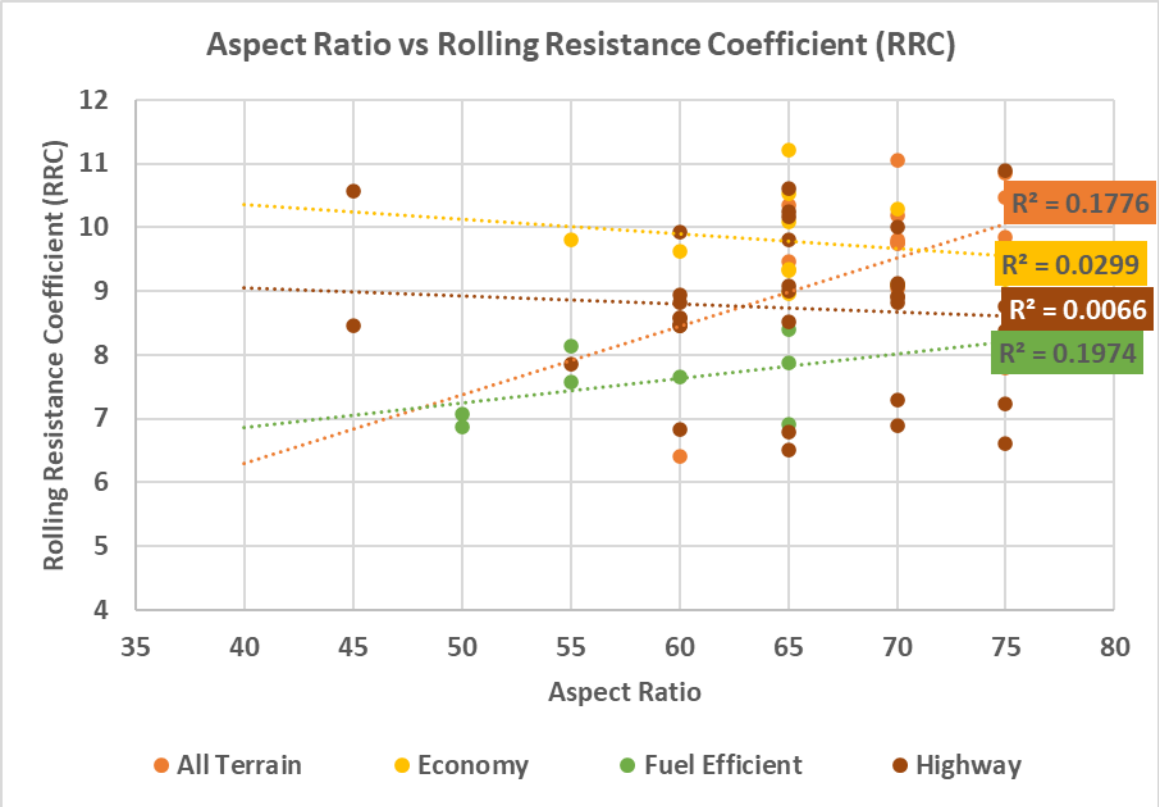


Chart 5.6A

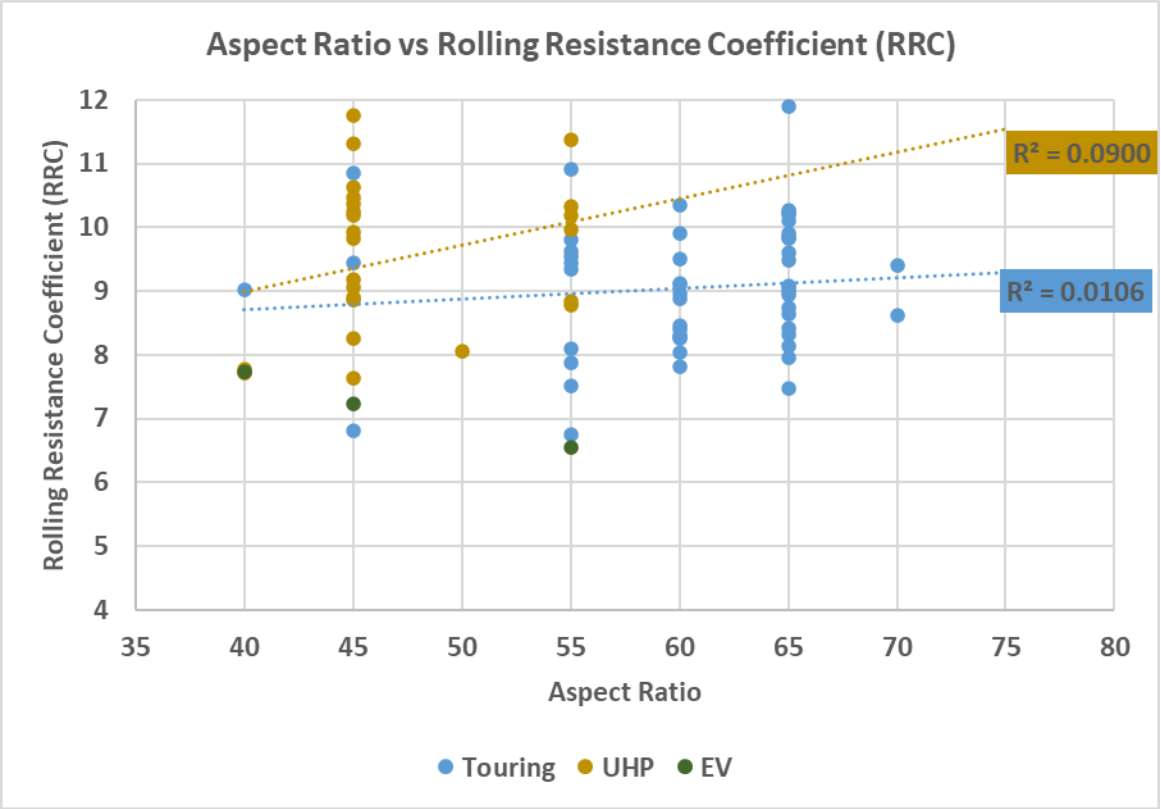


Chart 5.6B

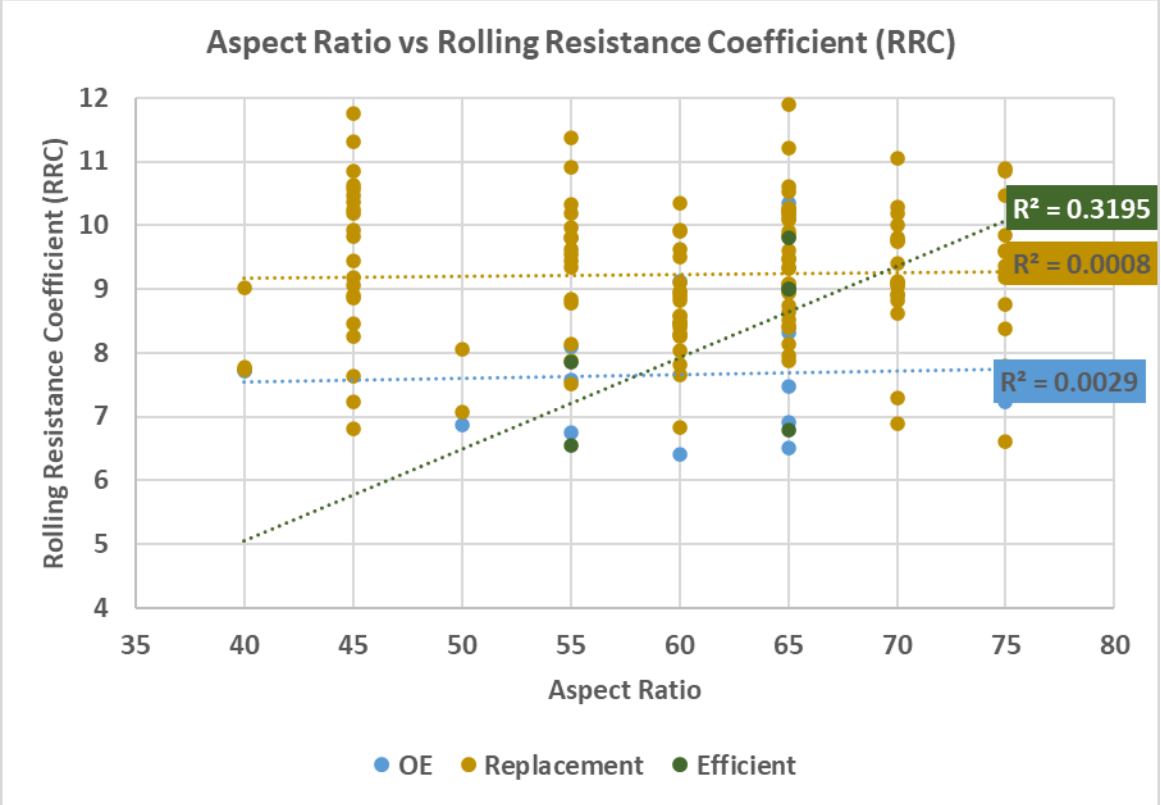


Chart 5.6C

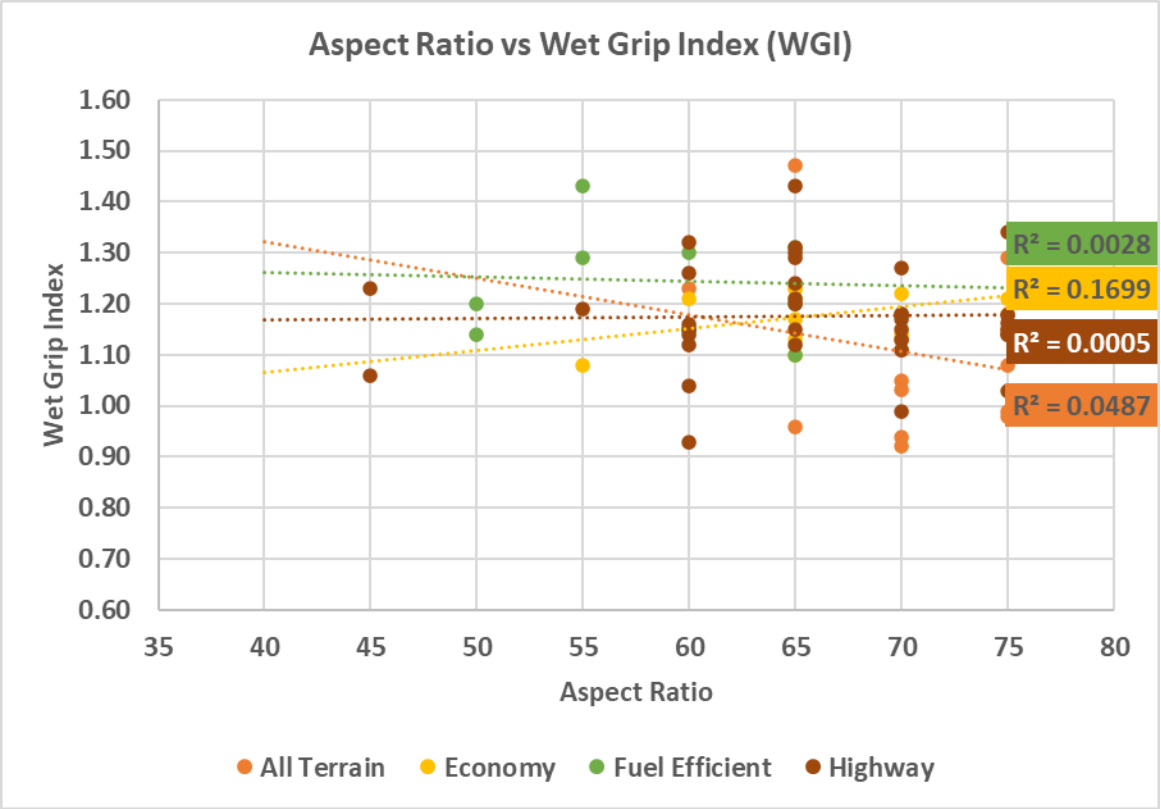


Chart 5.6D

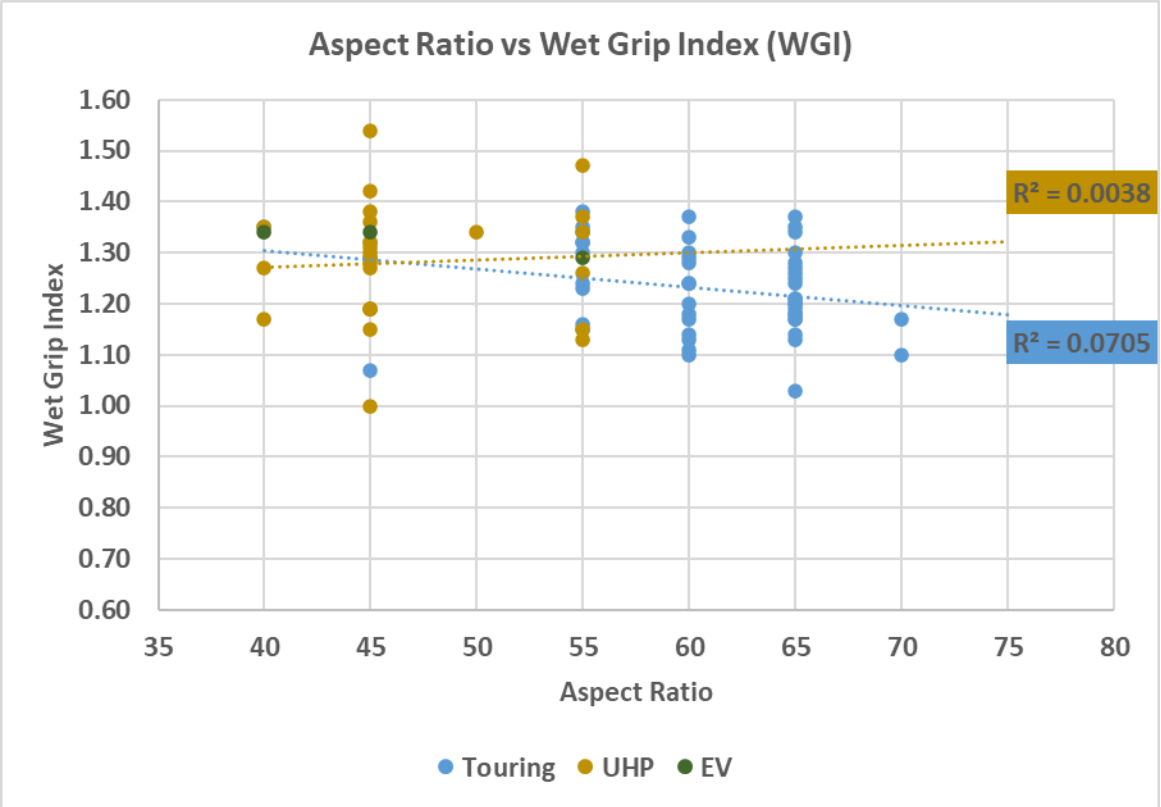


Chart 5.6E

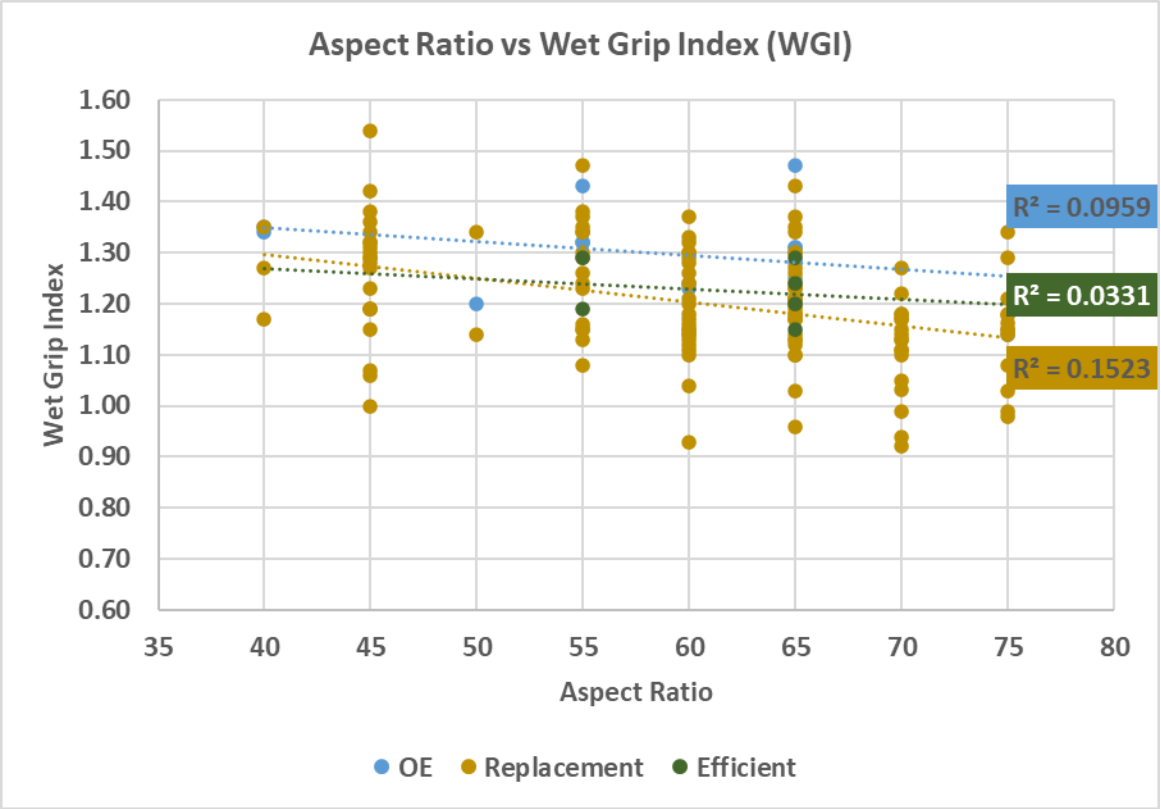


Chart 5.6F

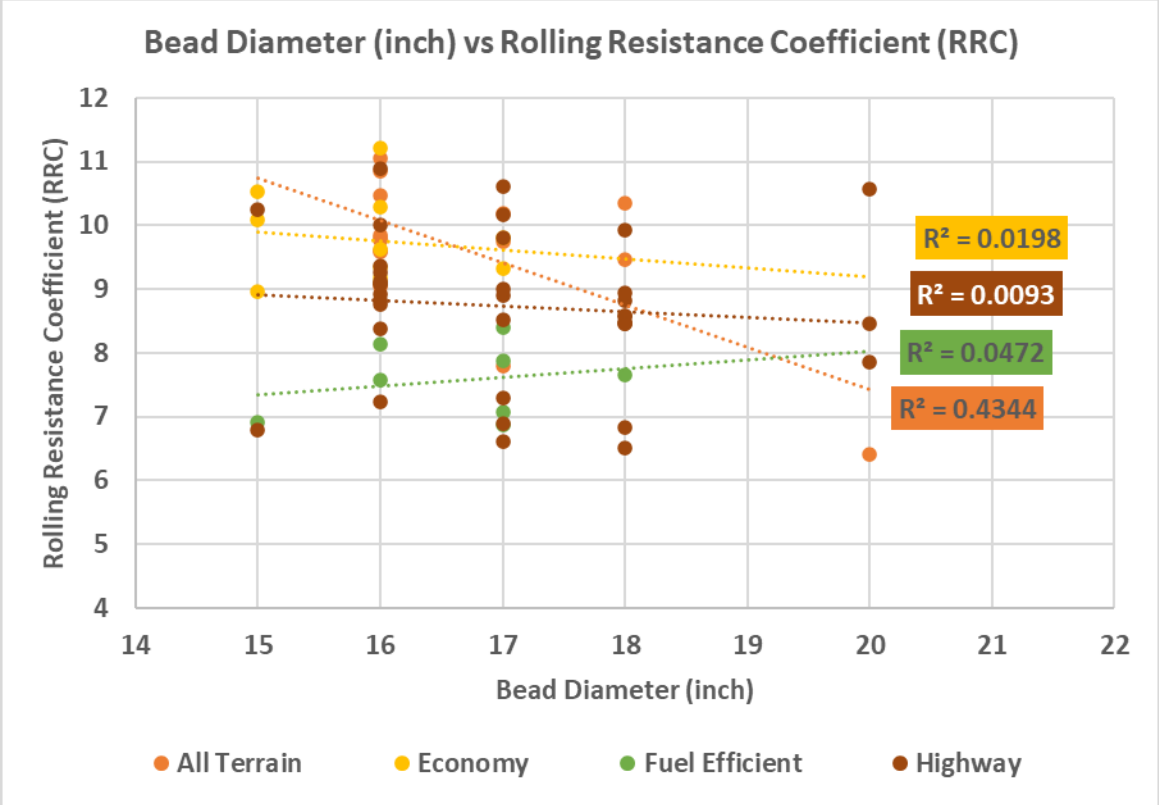


Chart 5.7A

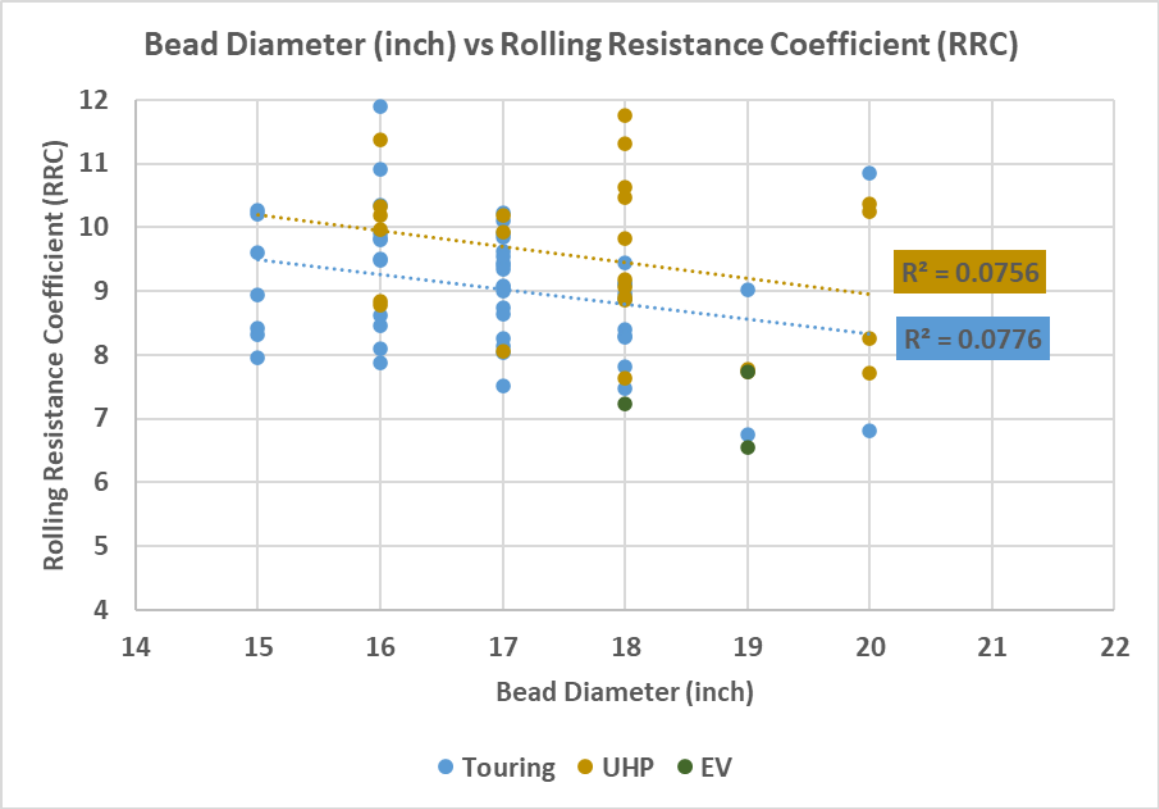


Chart 5.7B

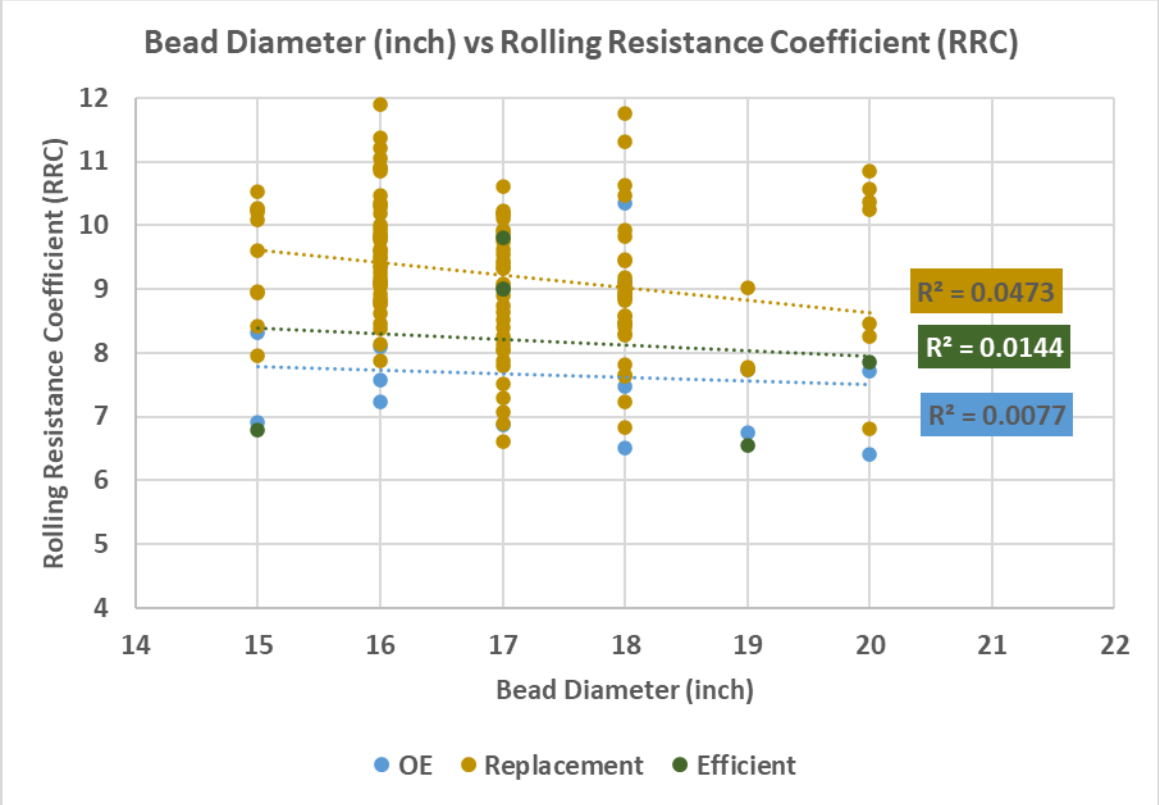


Chart 5.7C

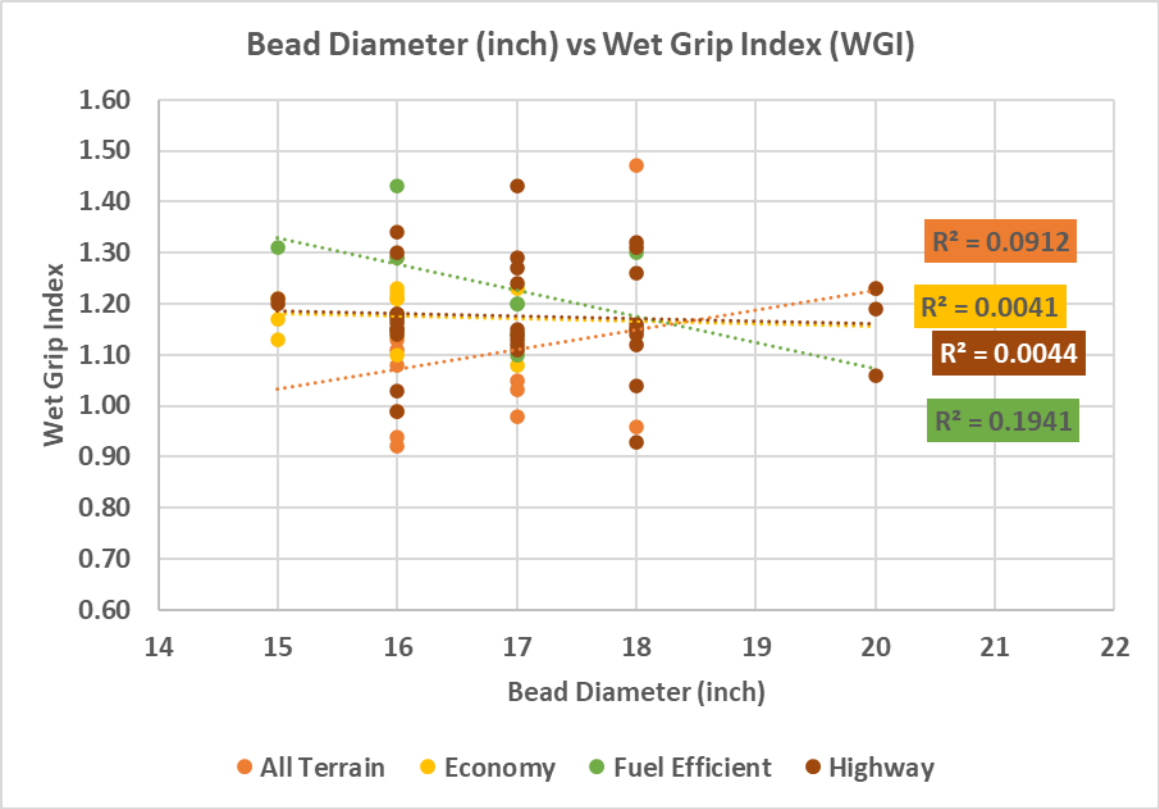


Chart 5.7D

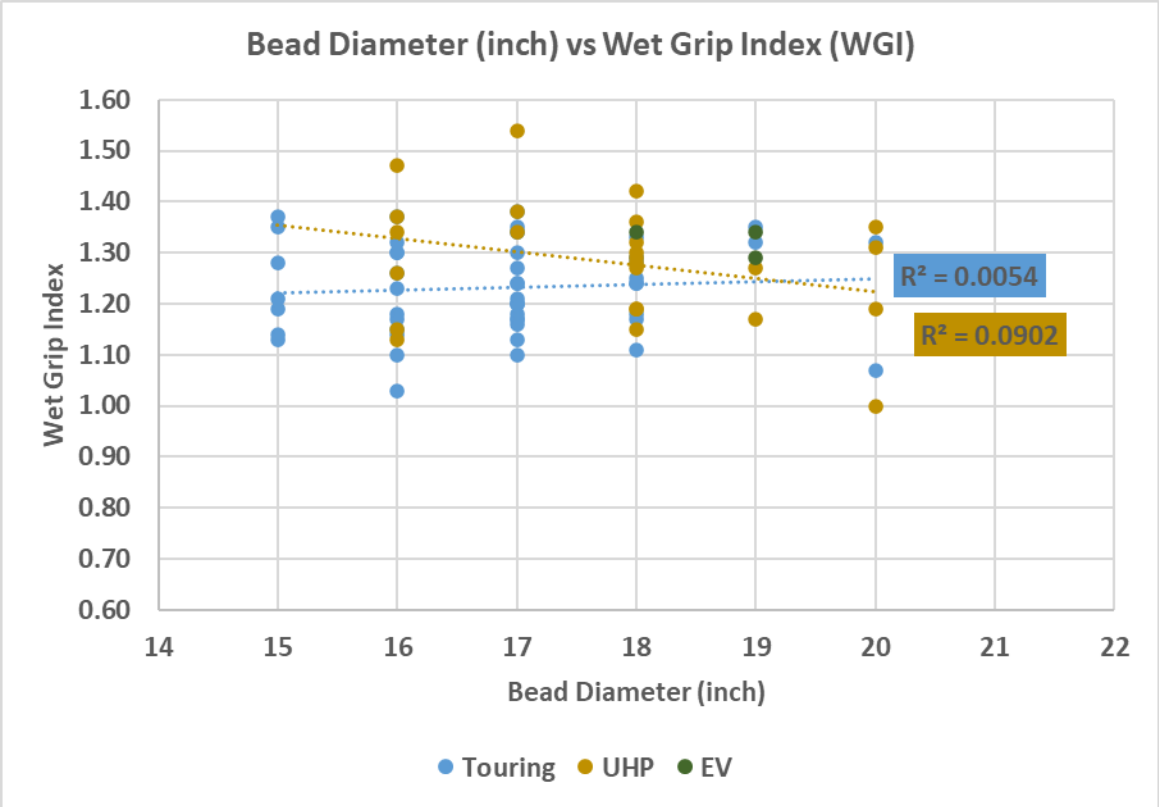


Chart 5.7E

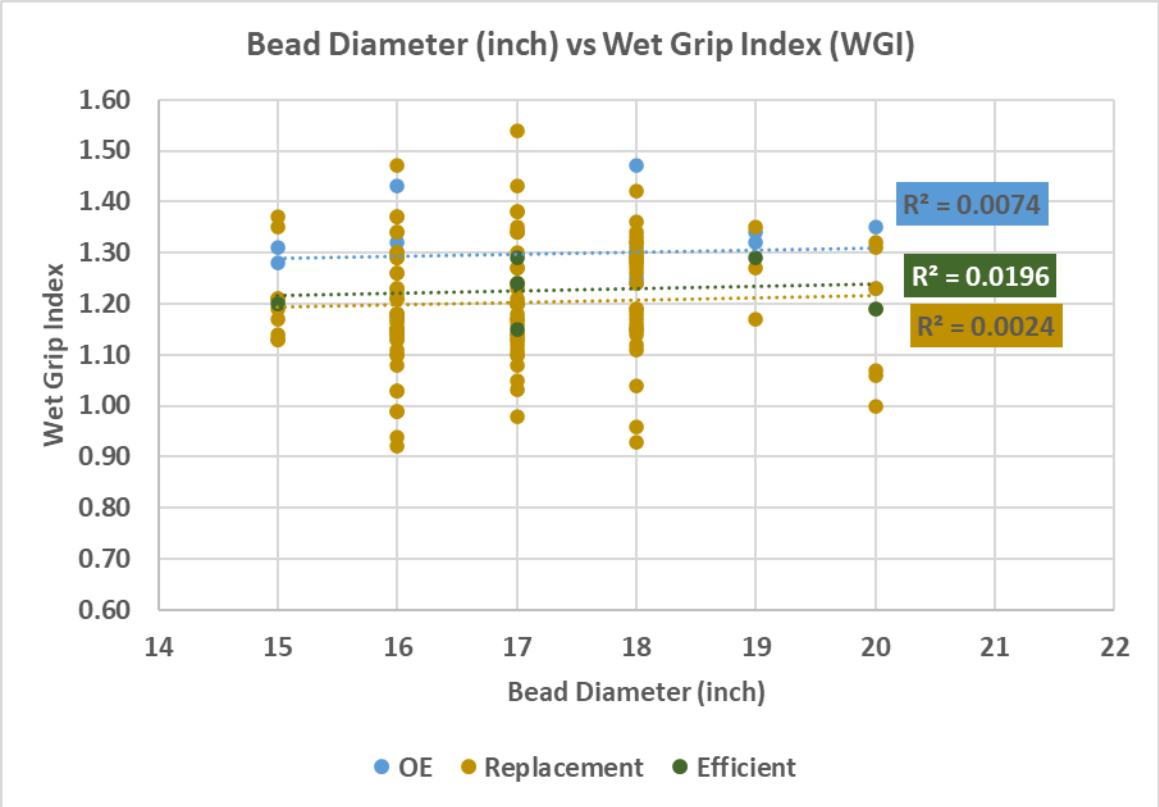


Chart 5.7F

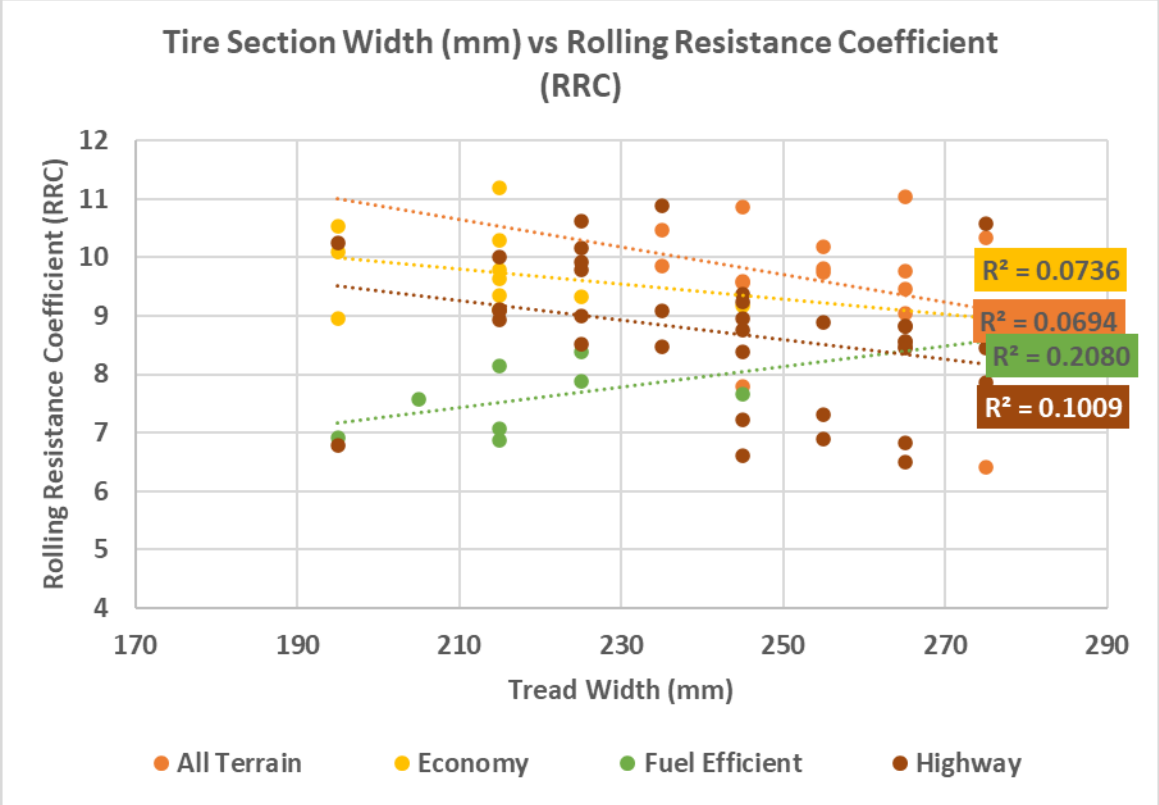


Chart 5.8A

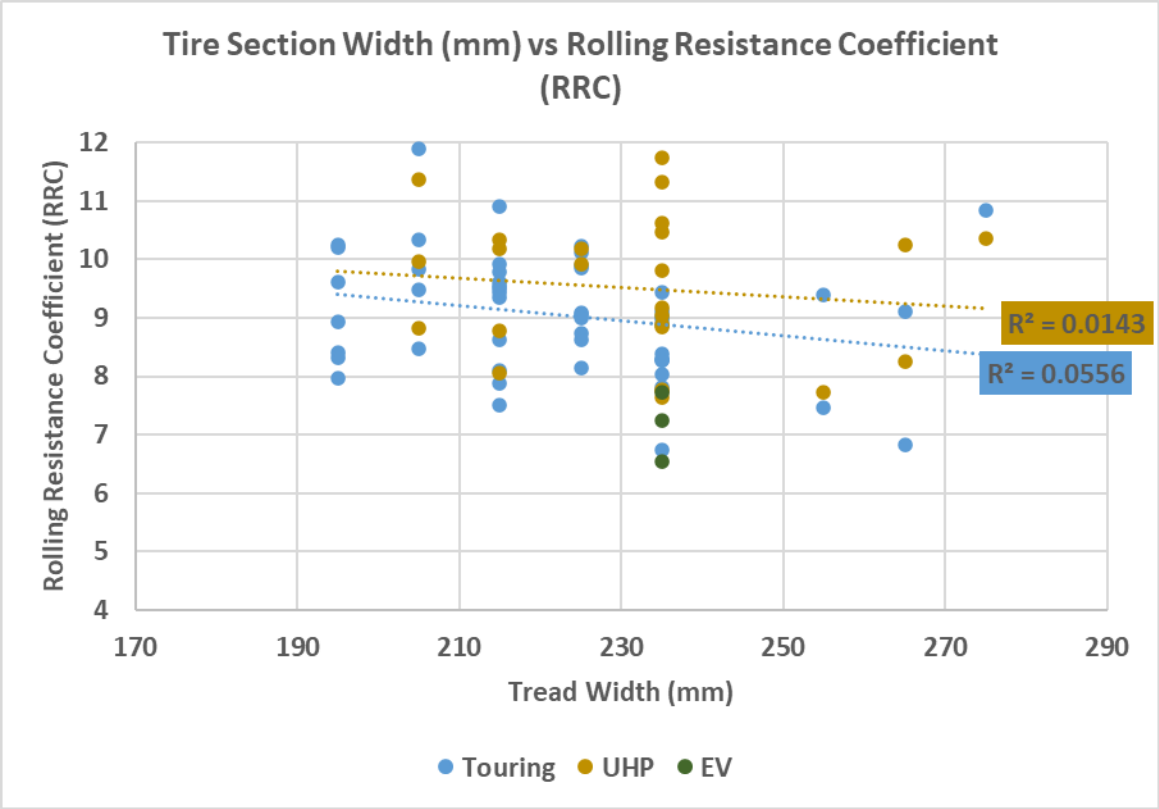


Chart 5.8B

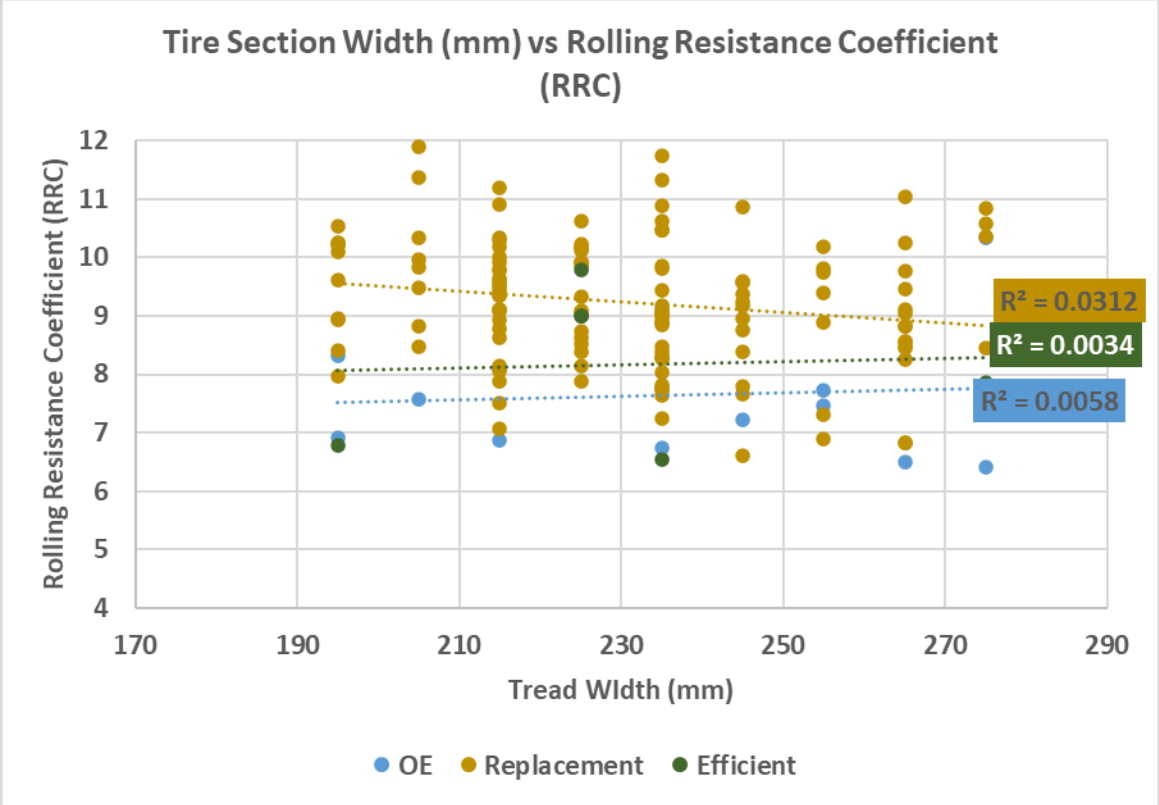


Chart 5.8C

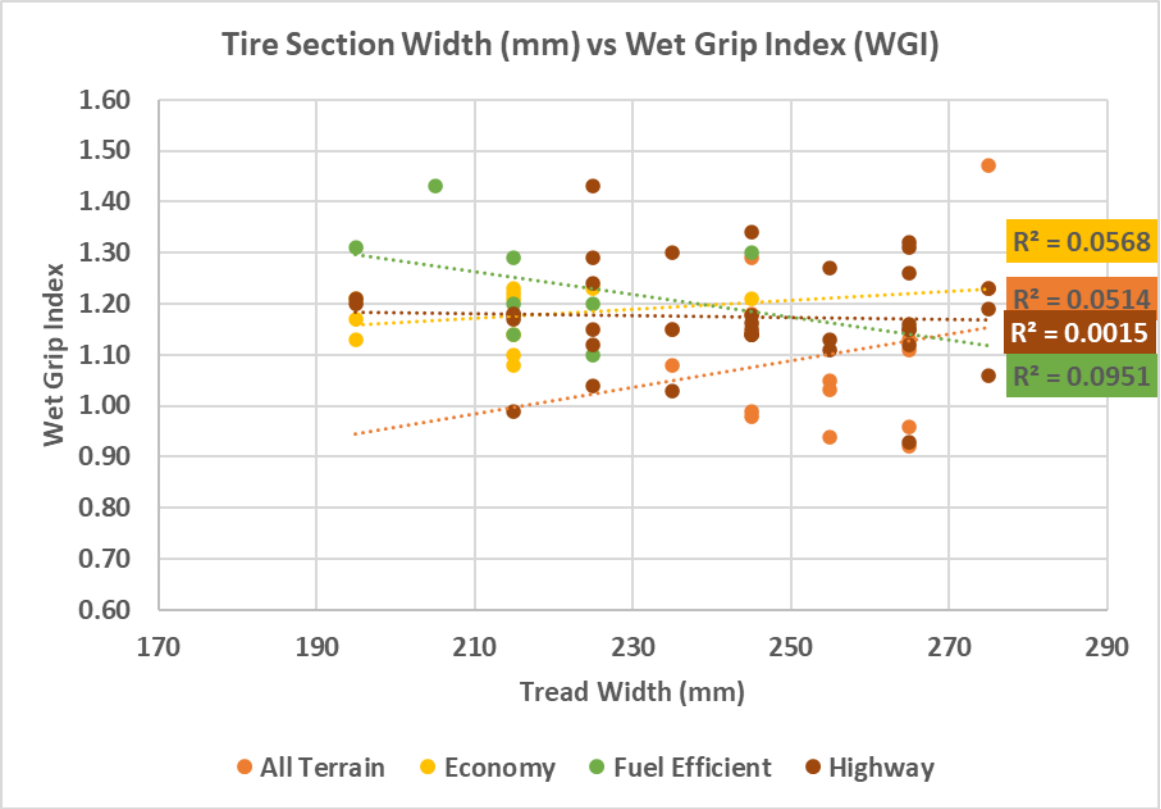


Chart 5.8D

Chart 5.8E

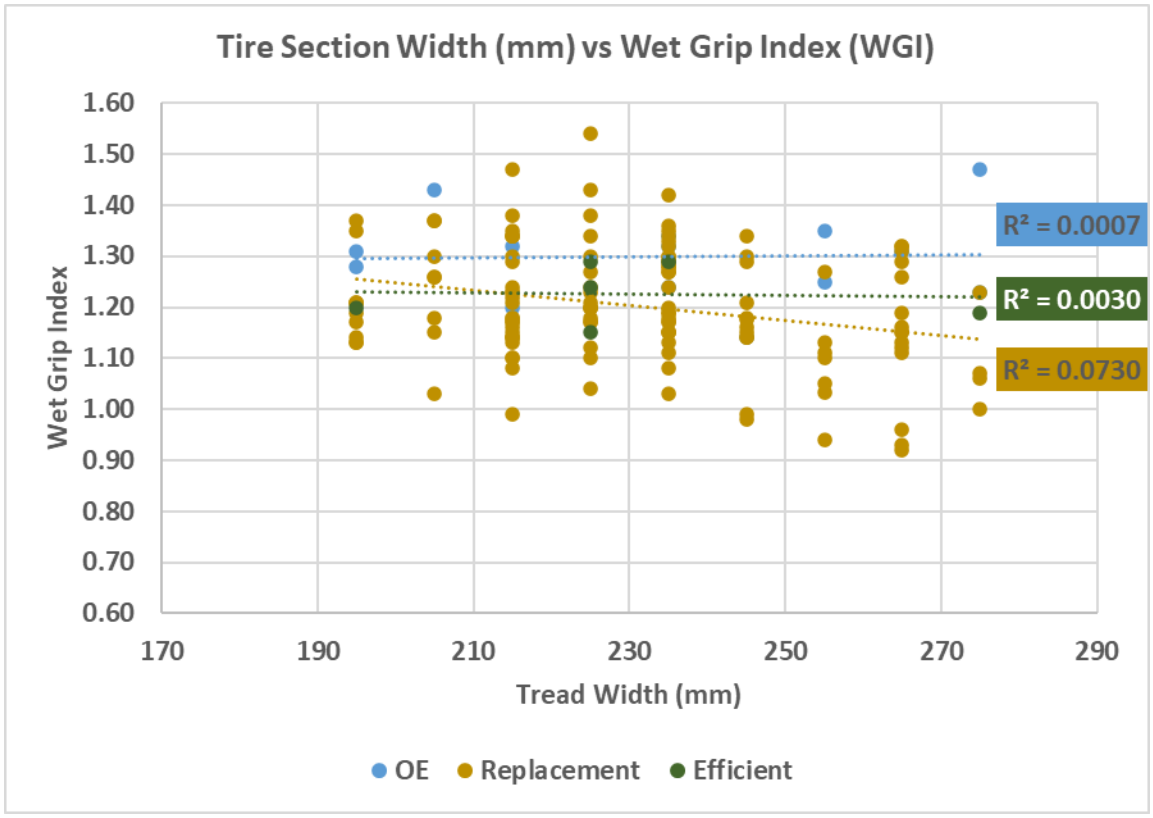


Chart 5.8F

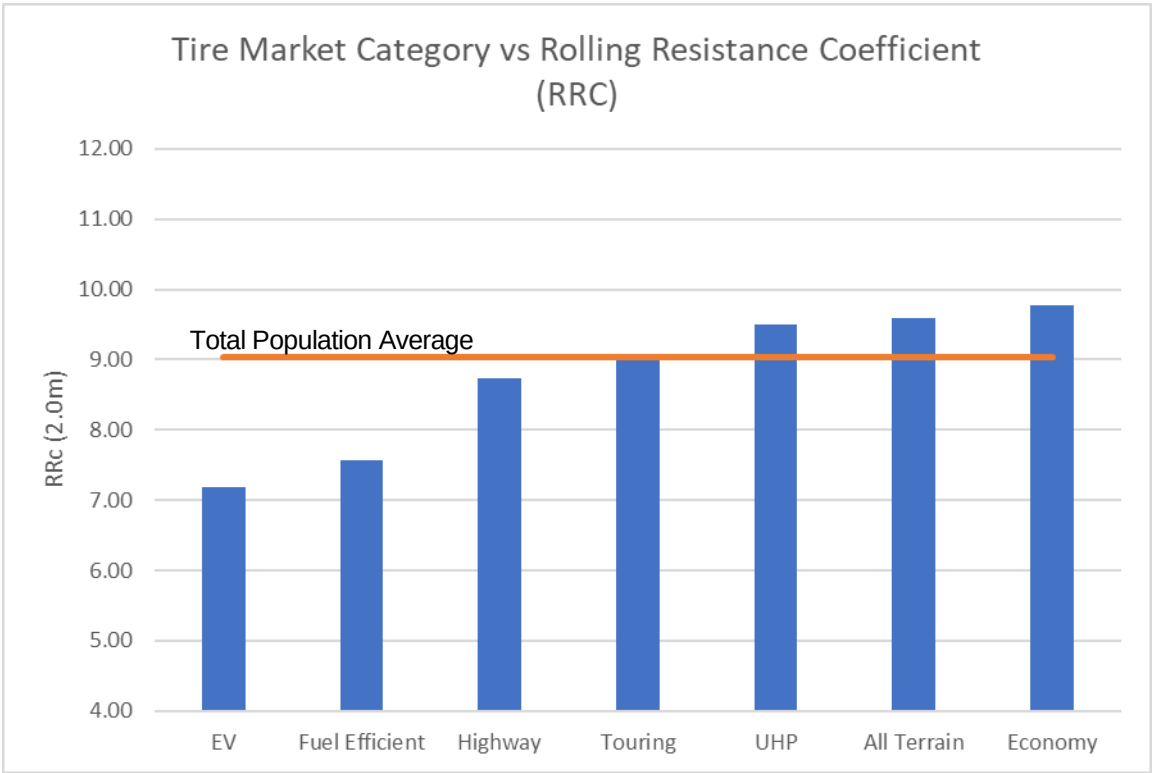


Chart 5.9A

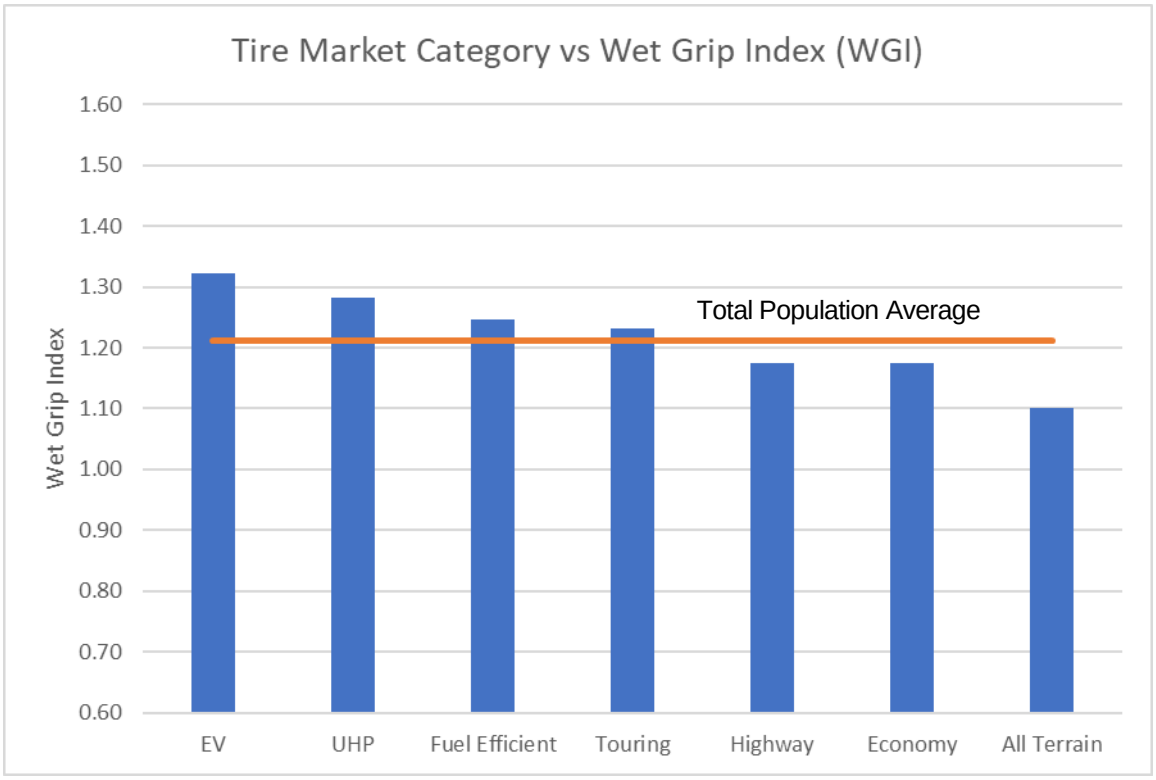


Chart 5.9B

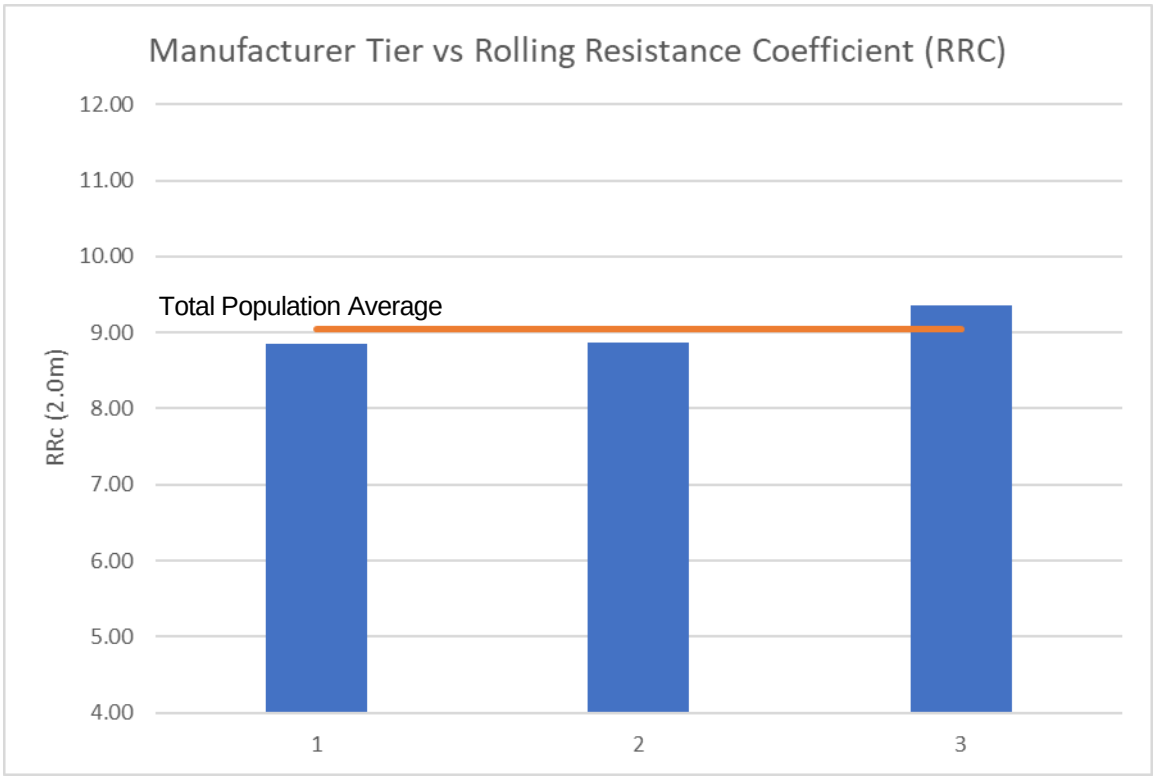


Chart 5.10A

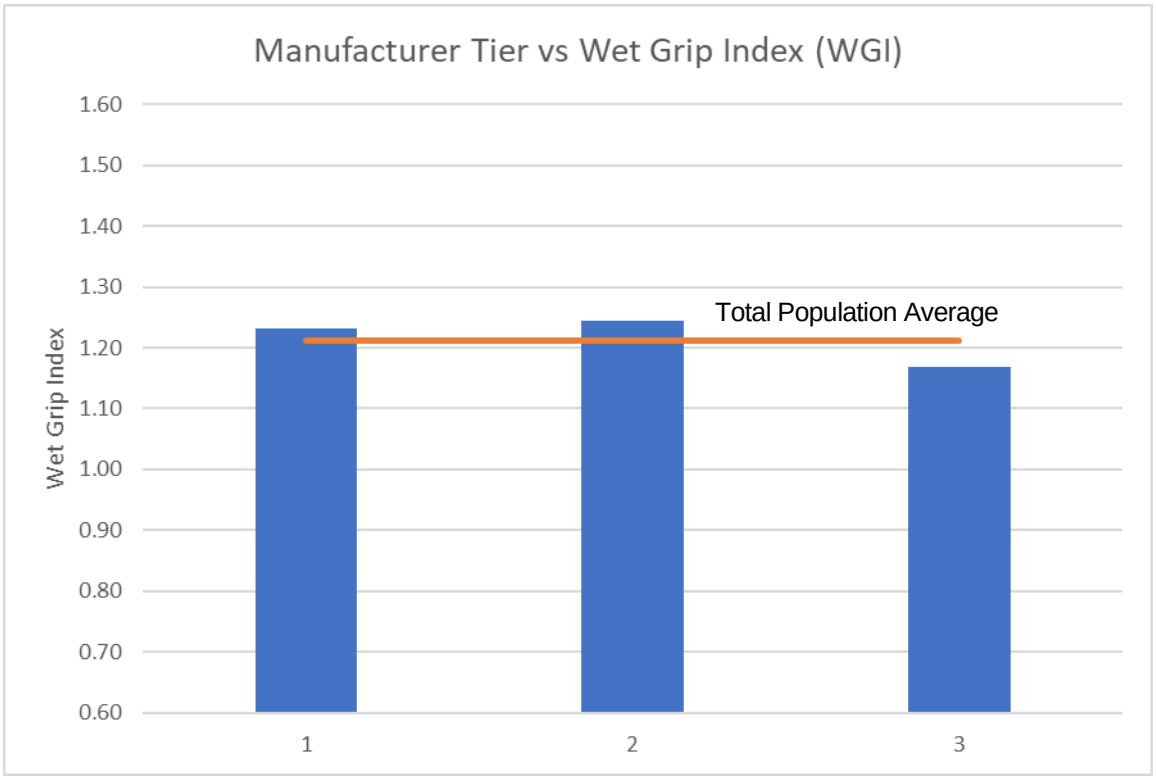


Chart 5.10B

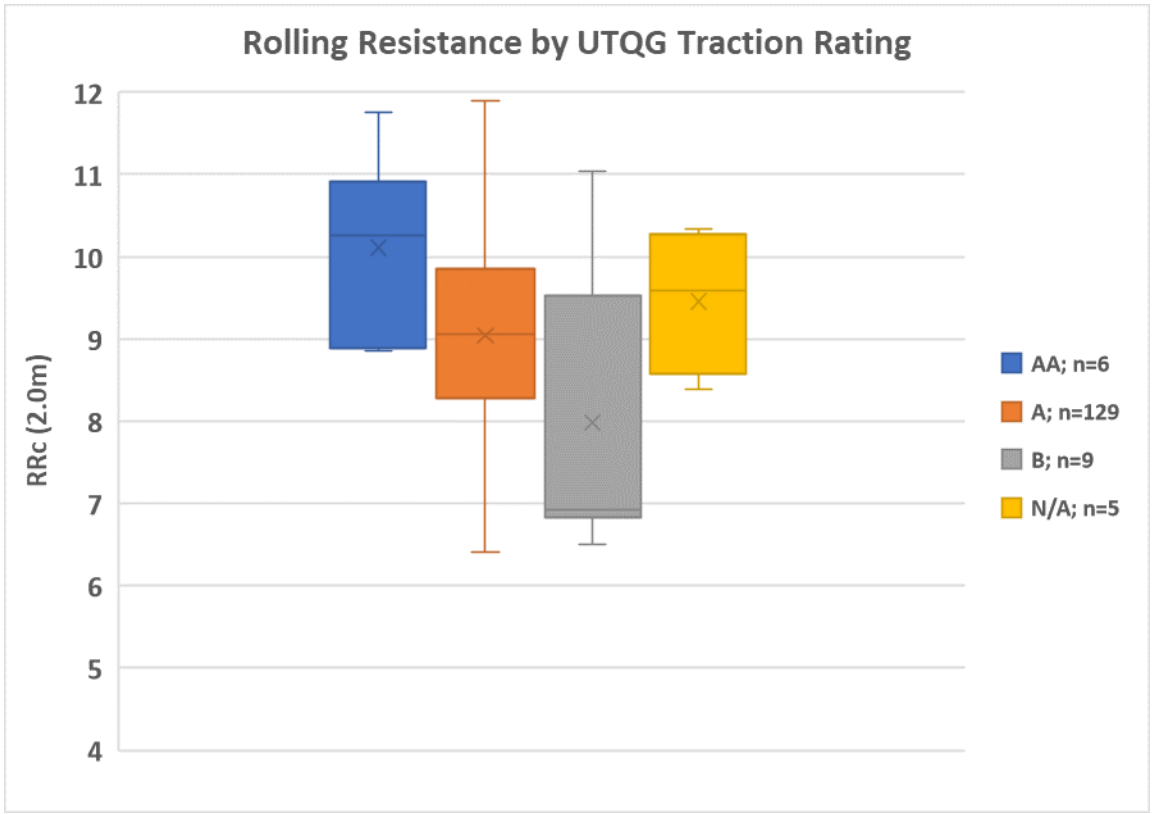


Chart 5.11A

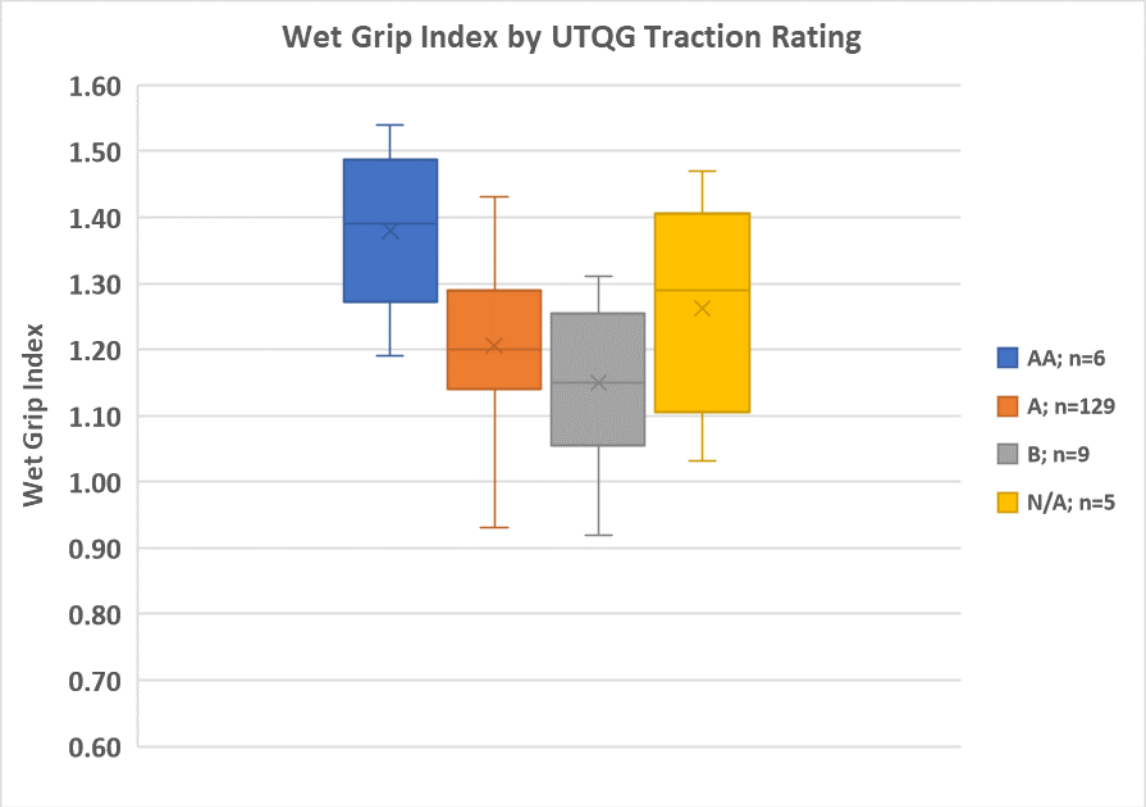


Chart 5.11B

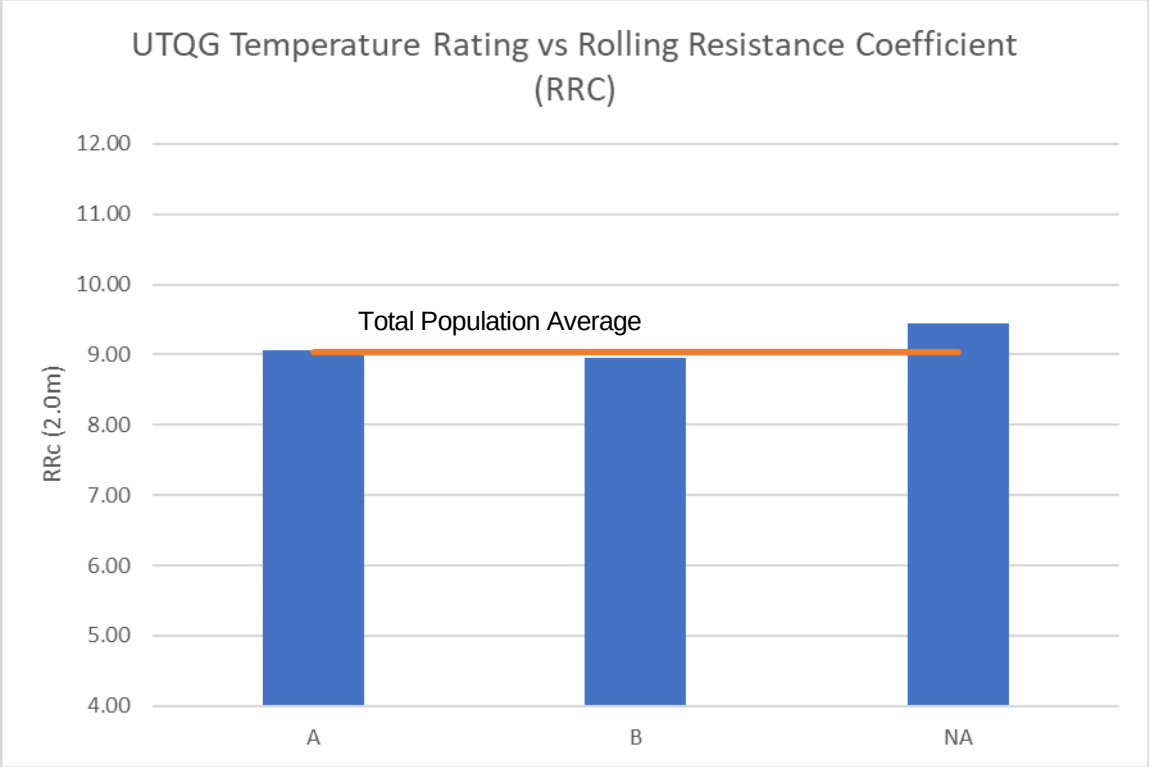


Chart 5.12A

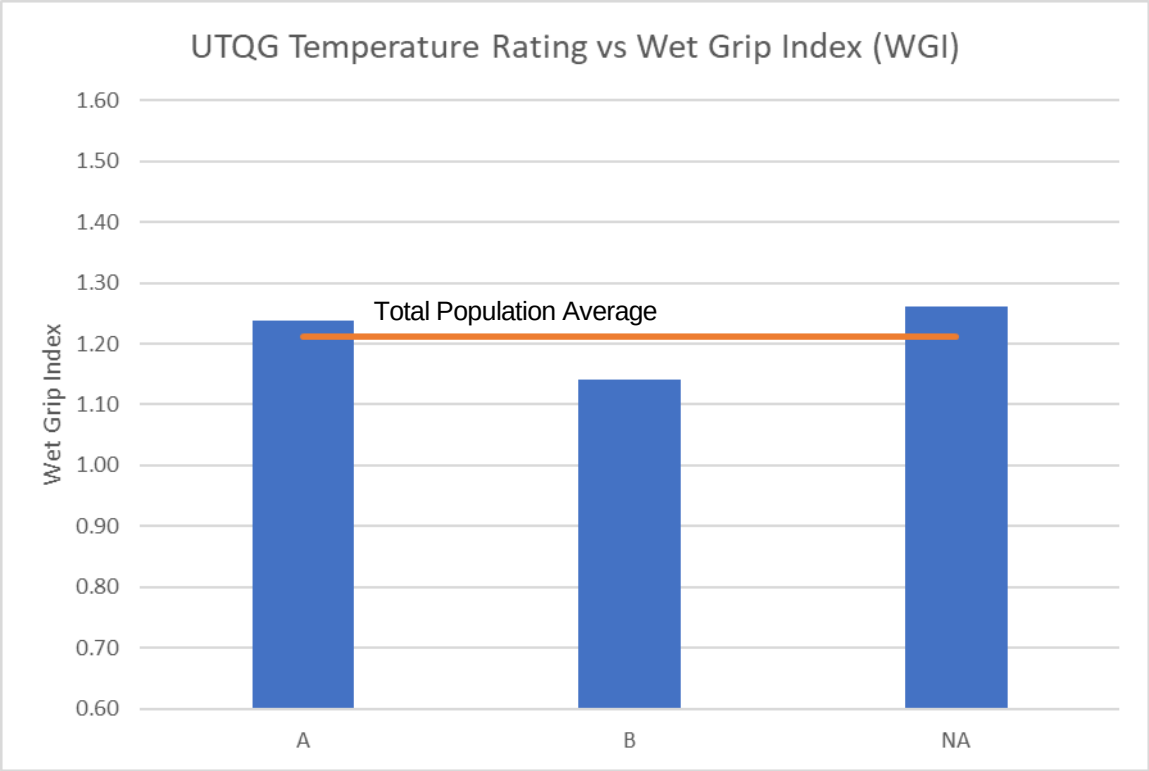


Chart 5.12B

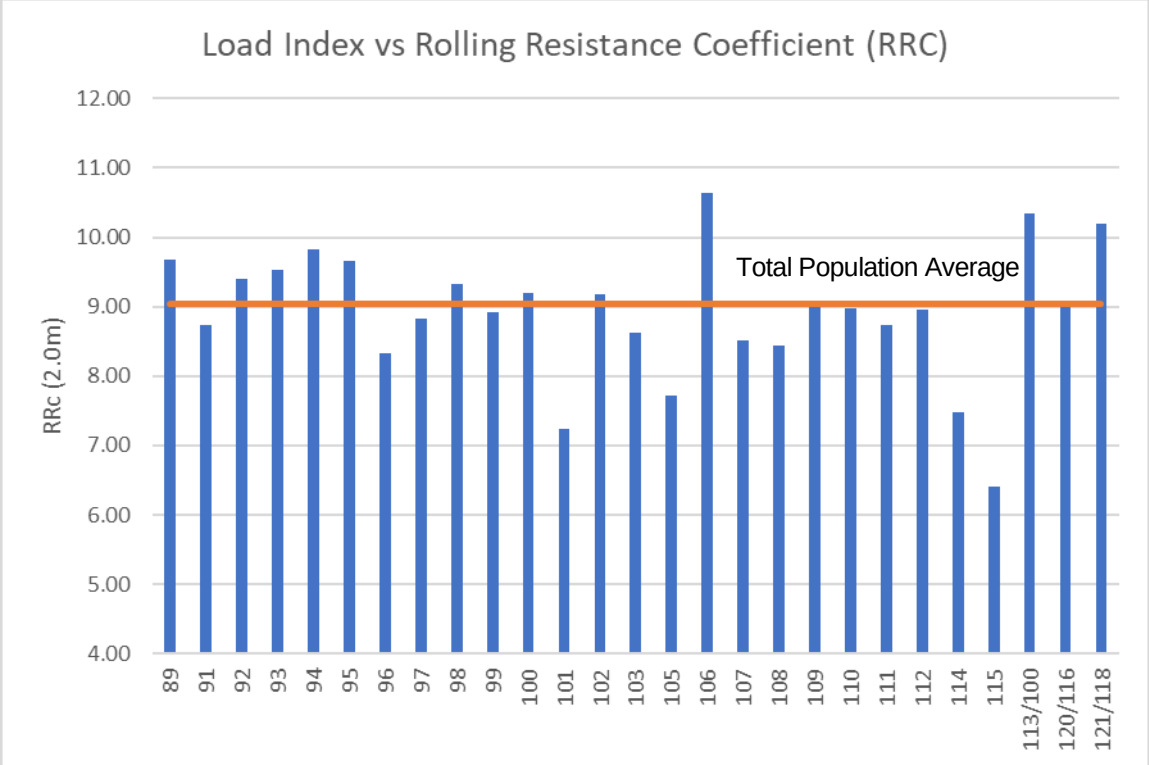


Chart 5.13A

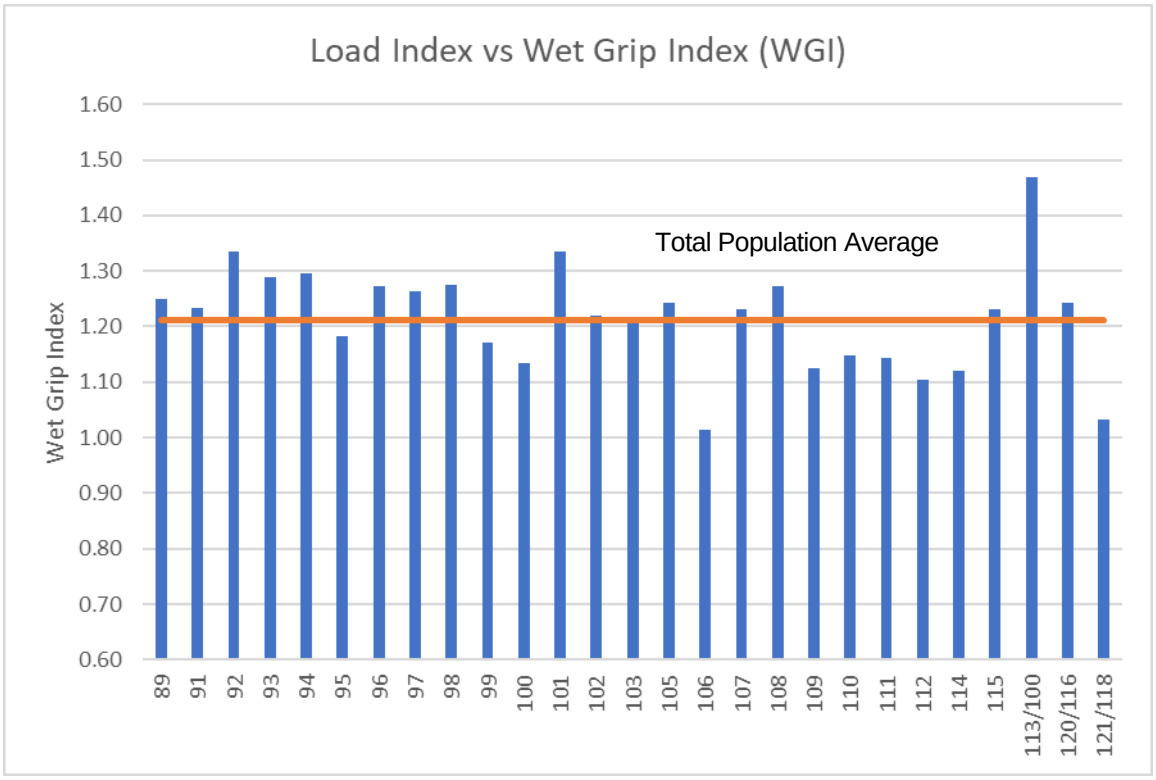


Chart 5.13B

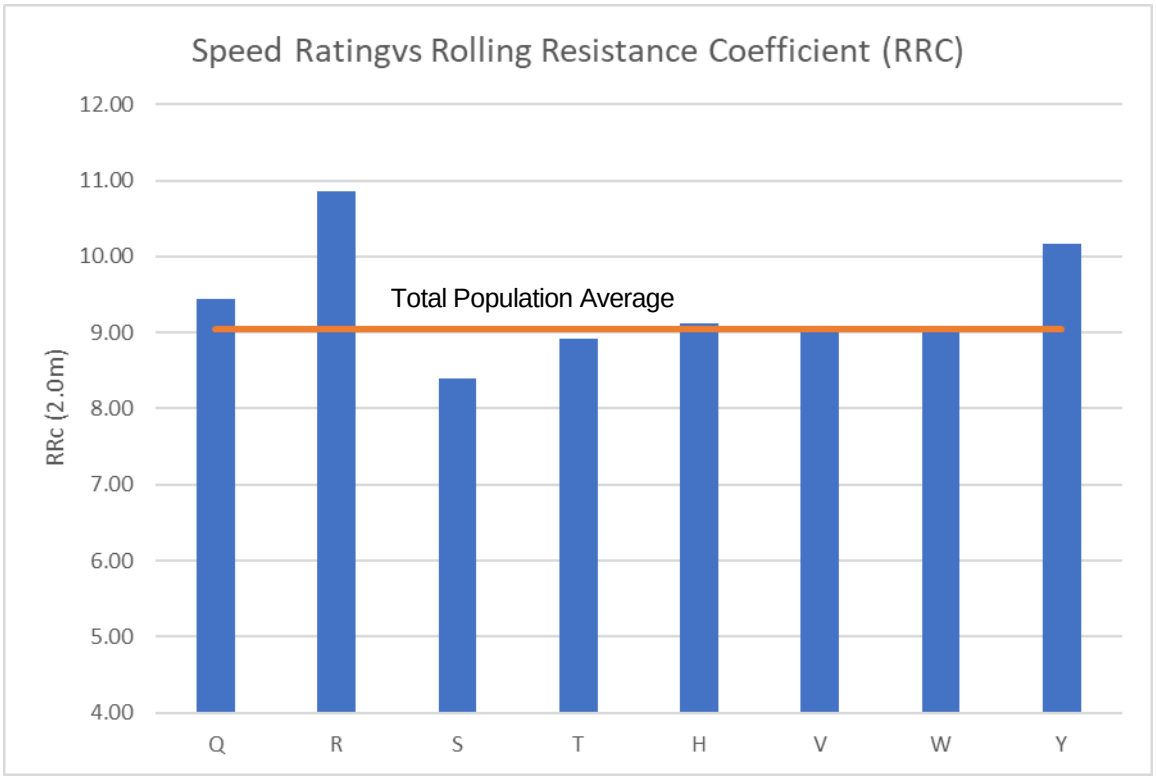


Chart 5.14A

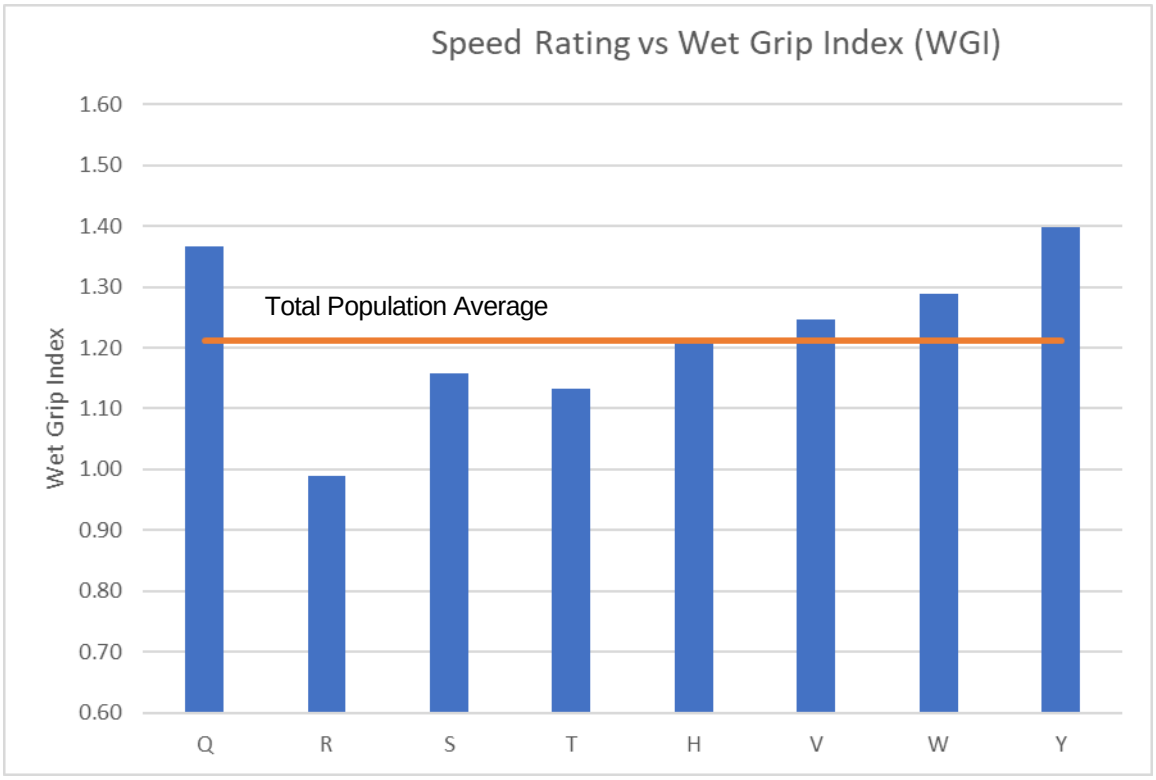


Chart 5.14B

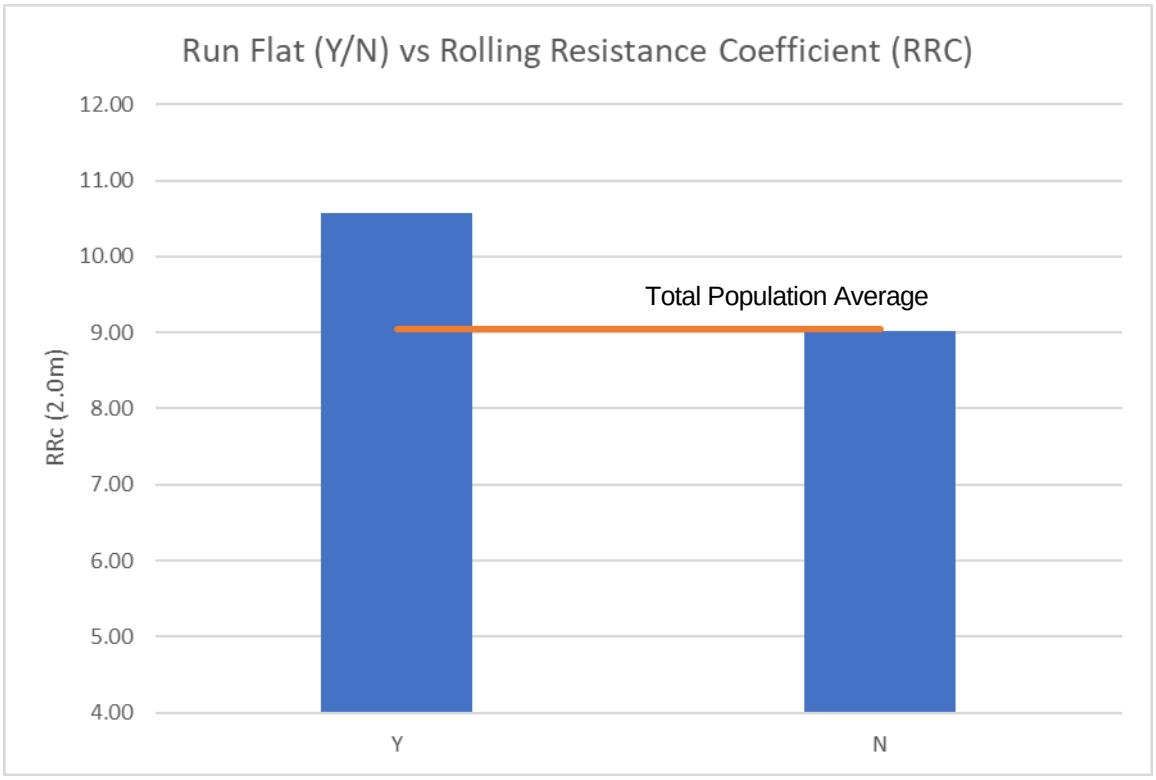


Chart 5.15A

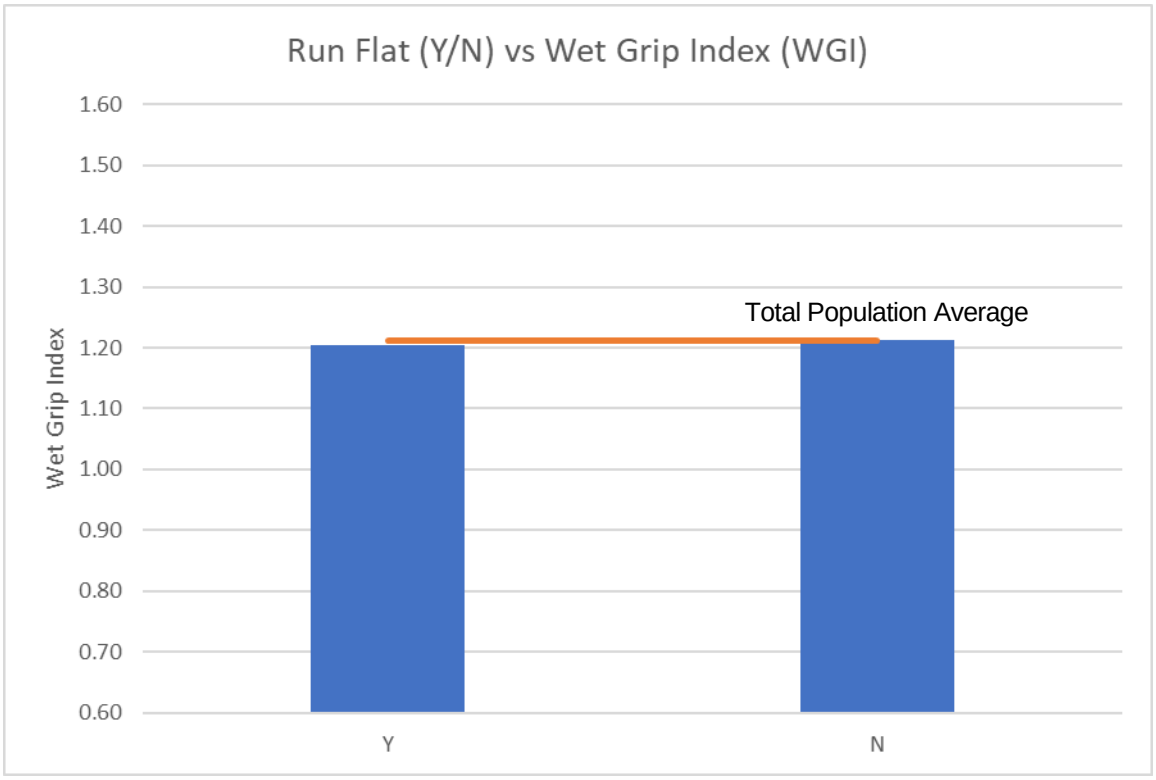


Chart 5.15B

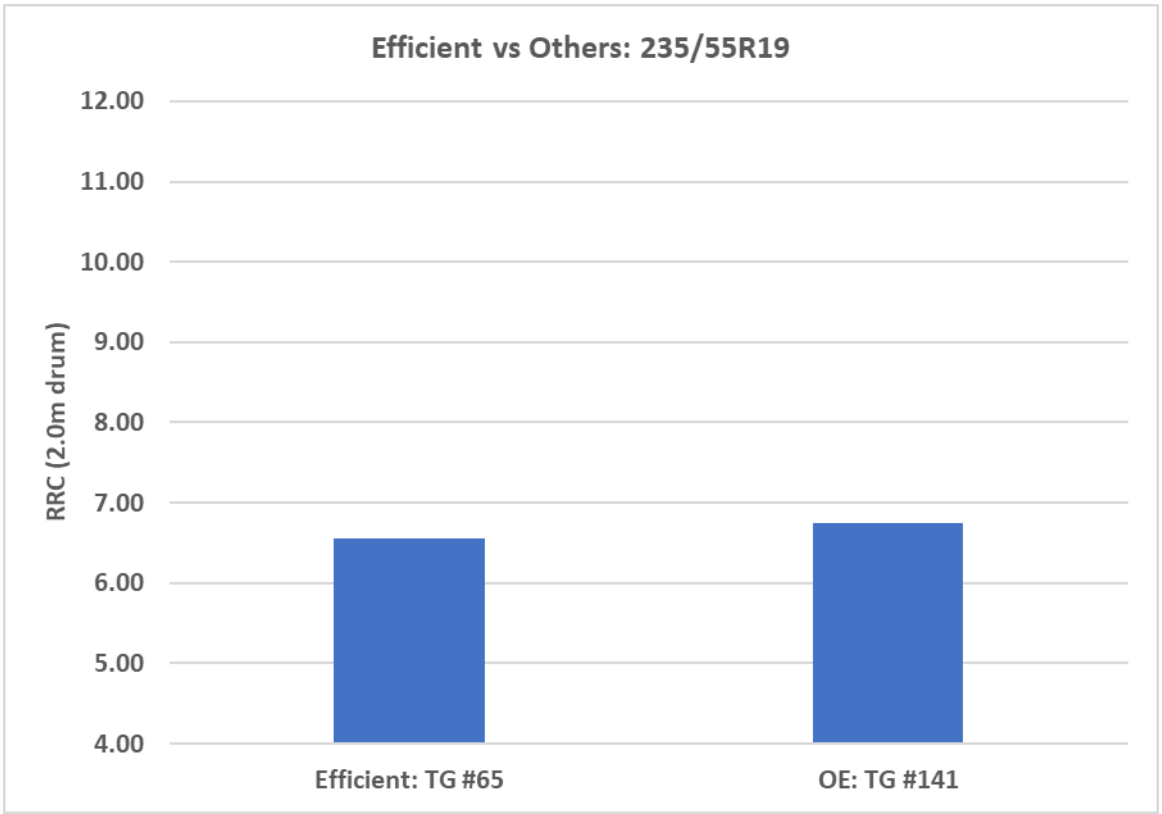


Chart 5.16A

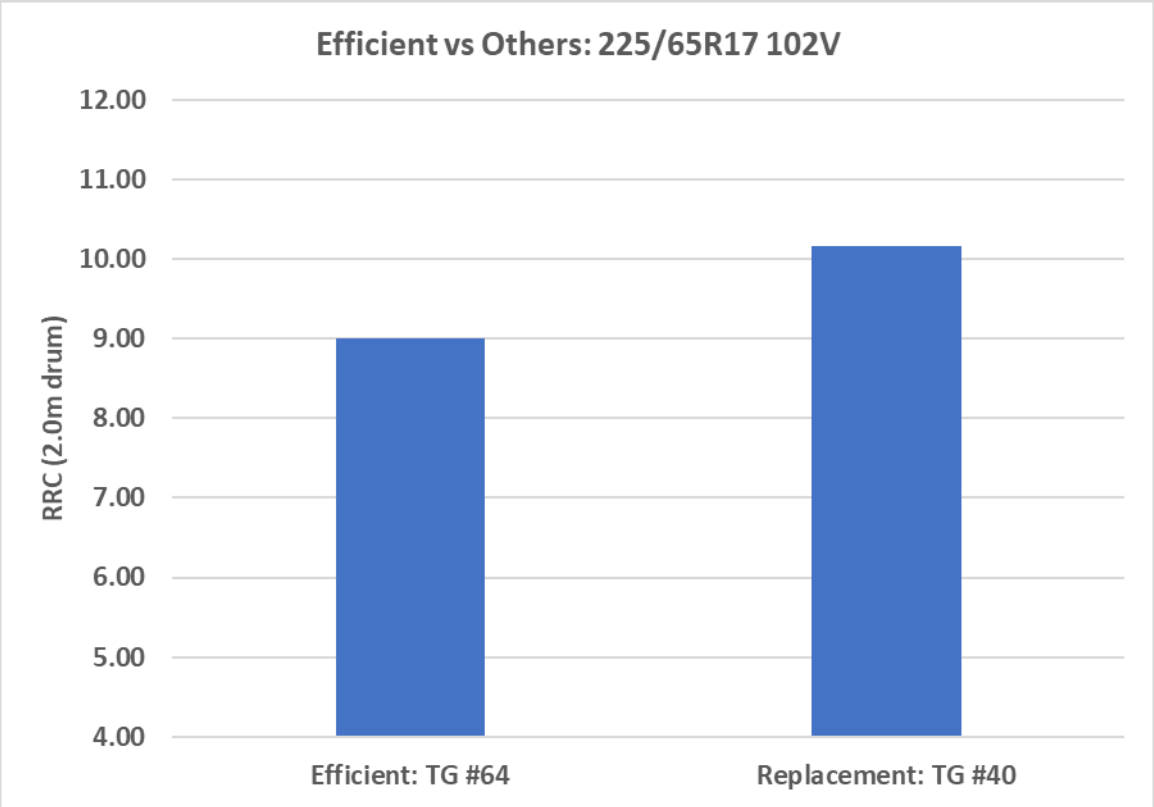


Chart 5.16B

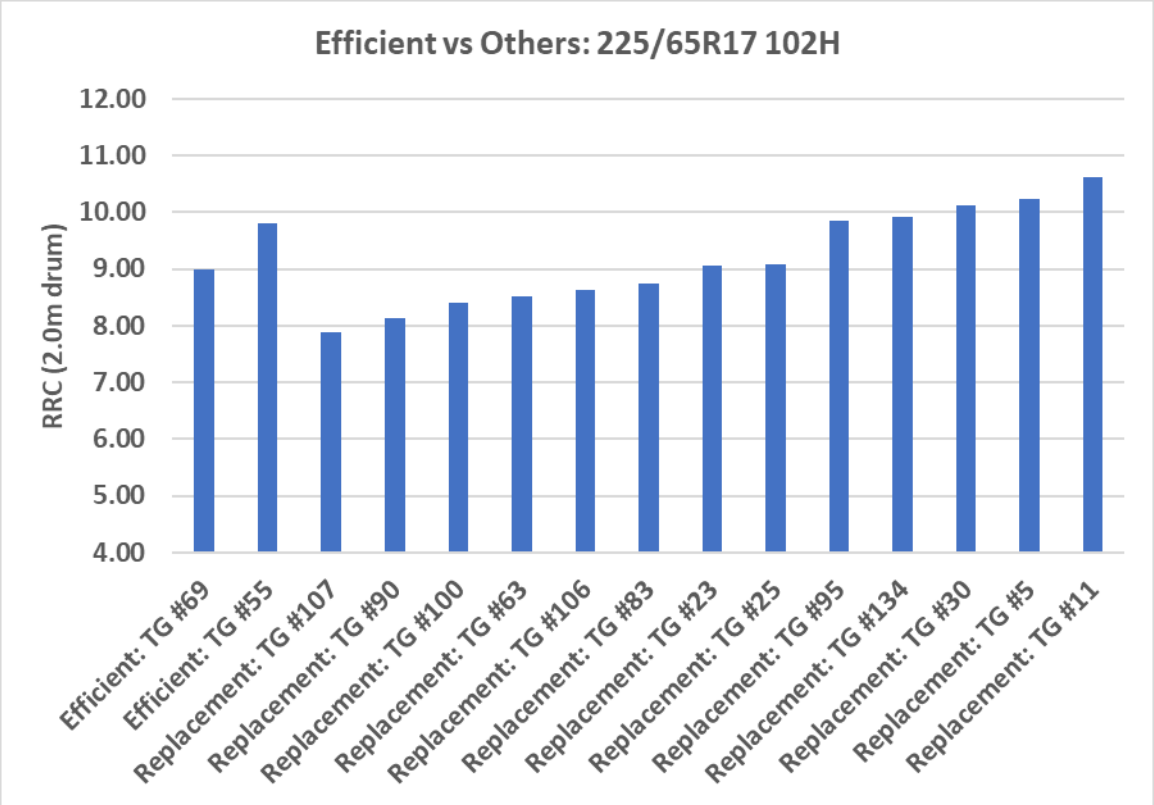


Chart 5.16C

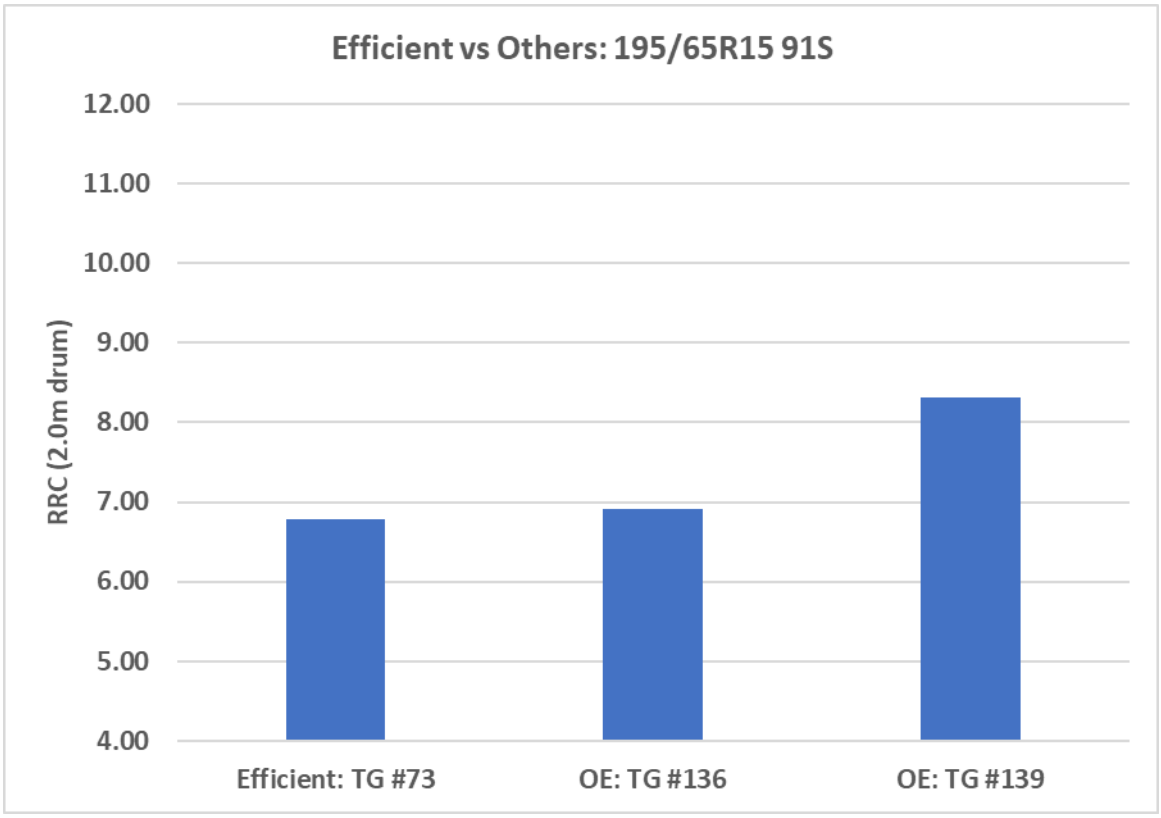


Chart 5.16D

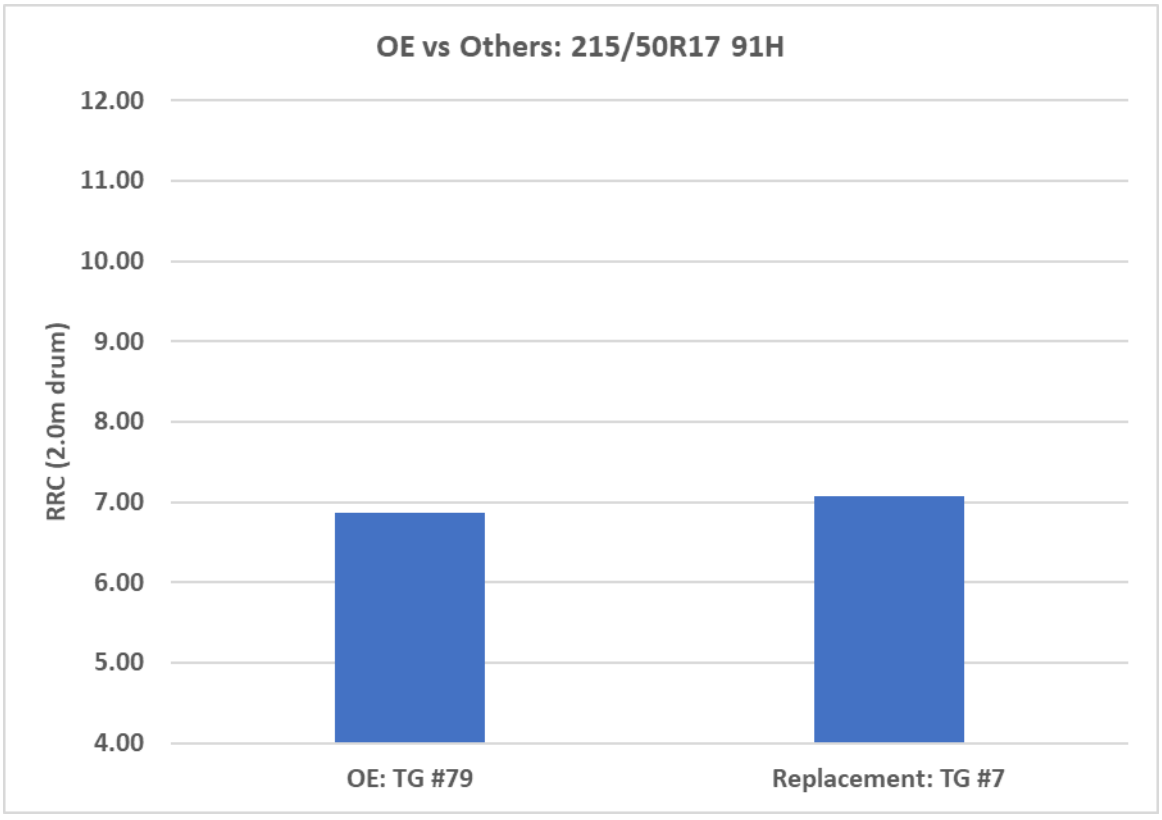


Chart 5.17A

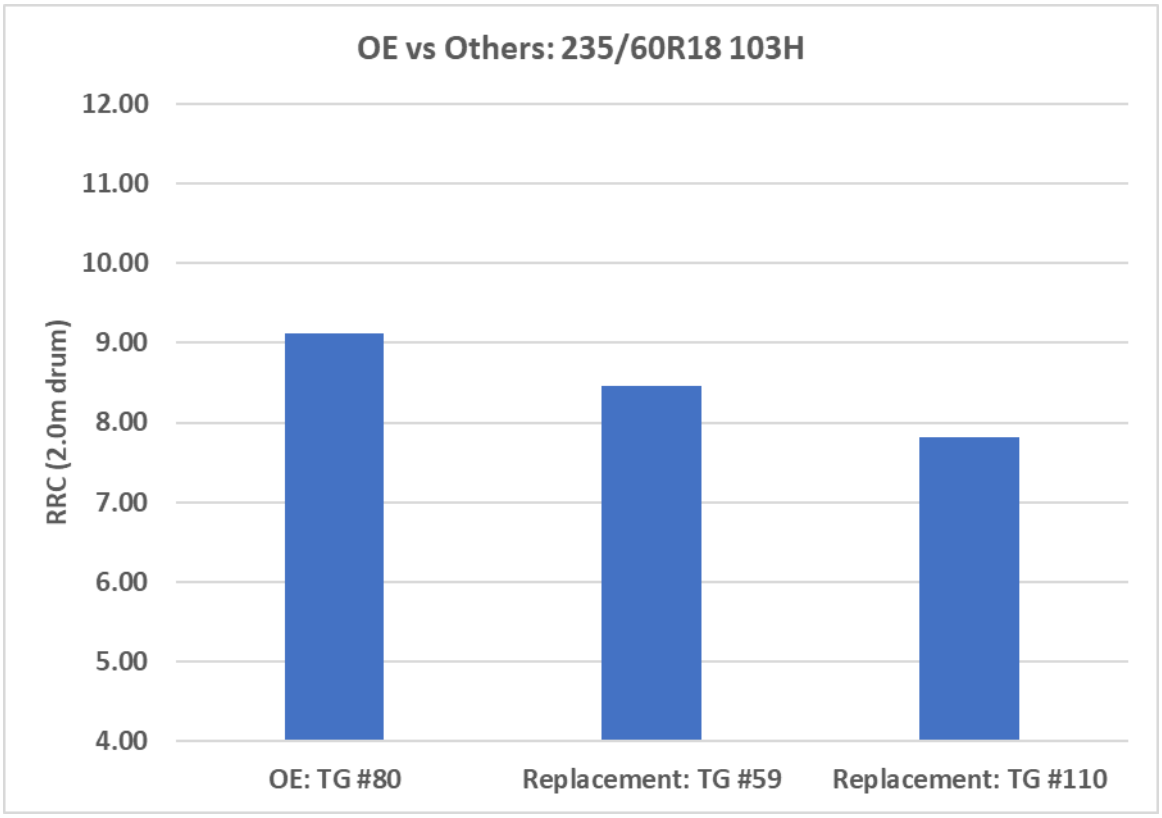


Chart 5.17B

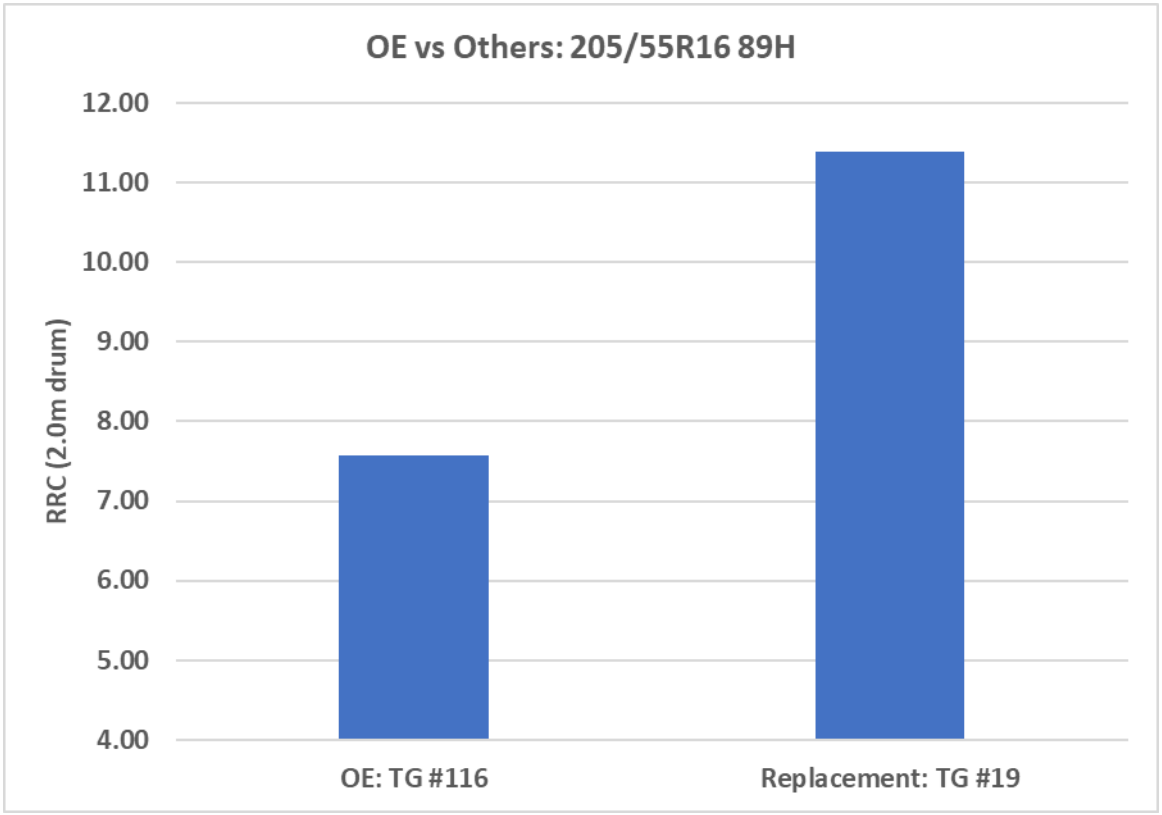


Chart 5.17C

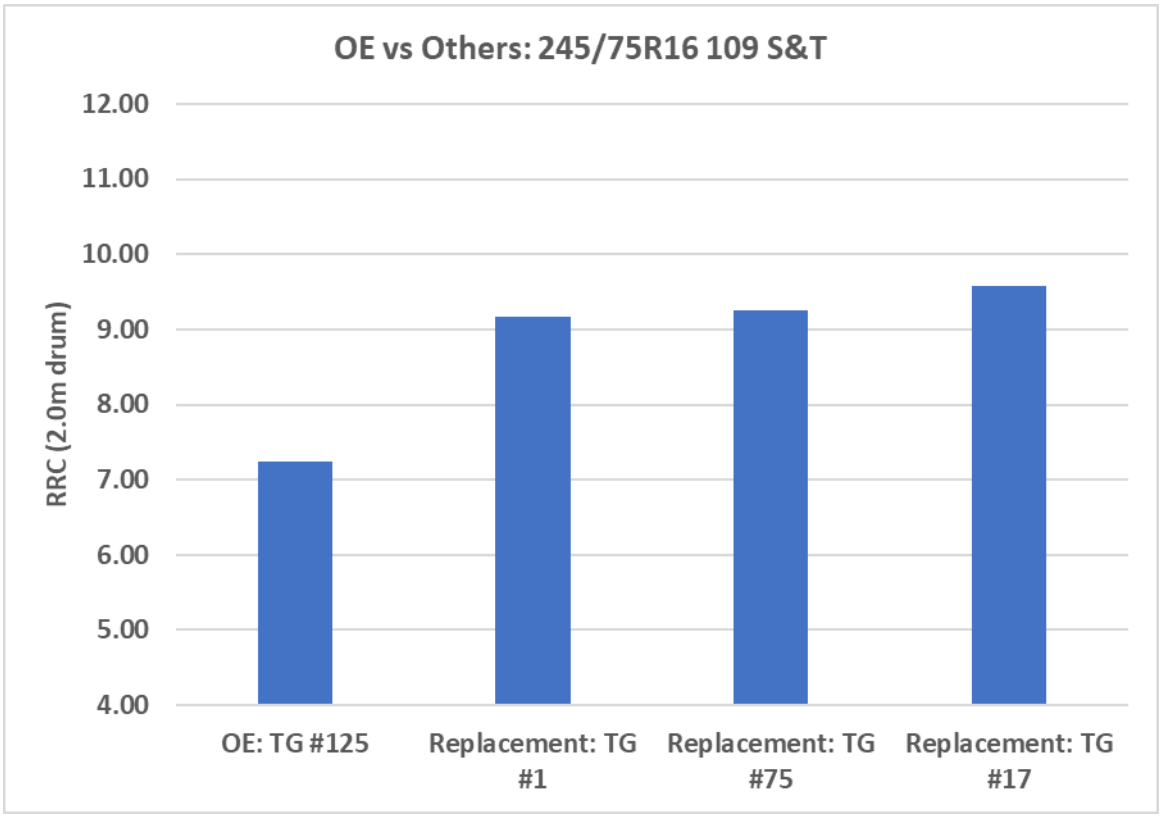


Chart 5.17D

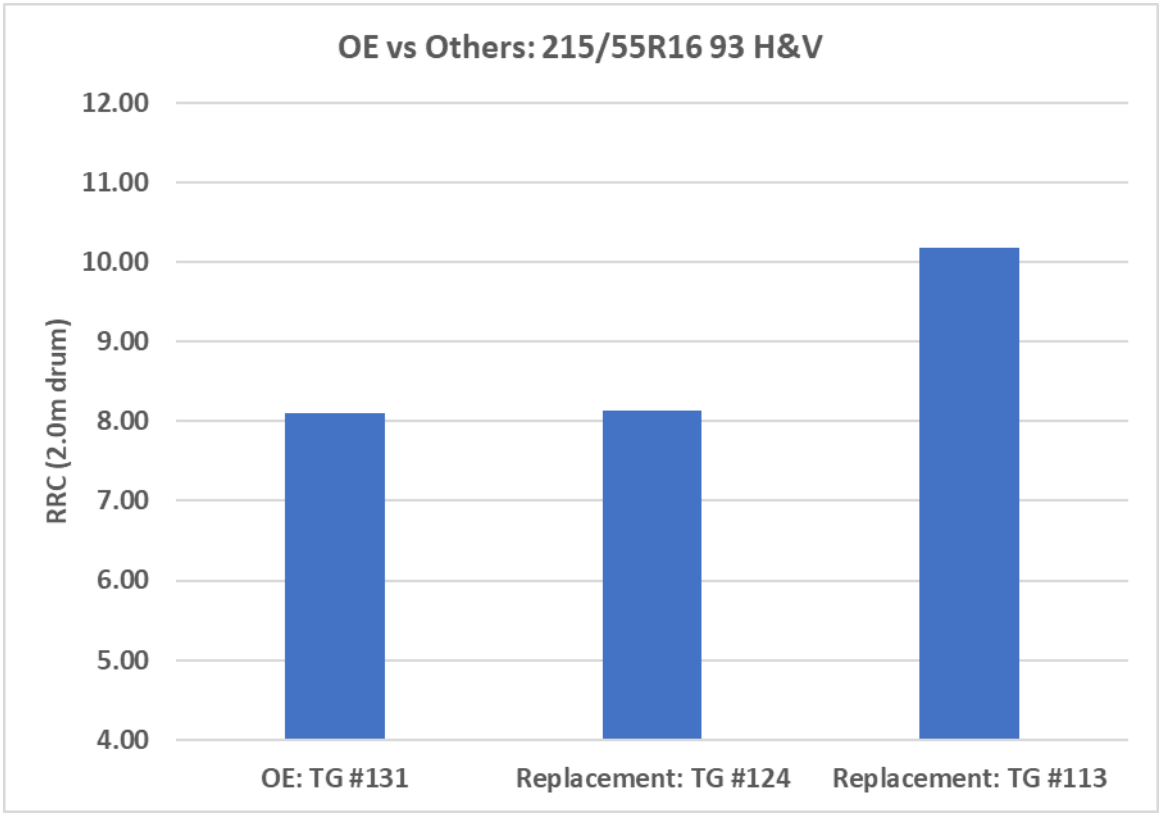


Chart 5.17E

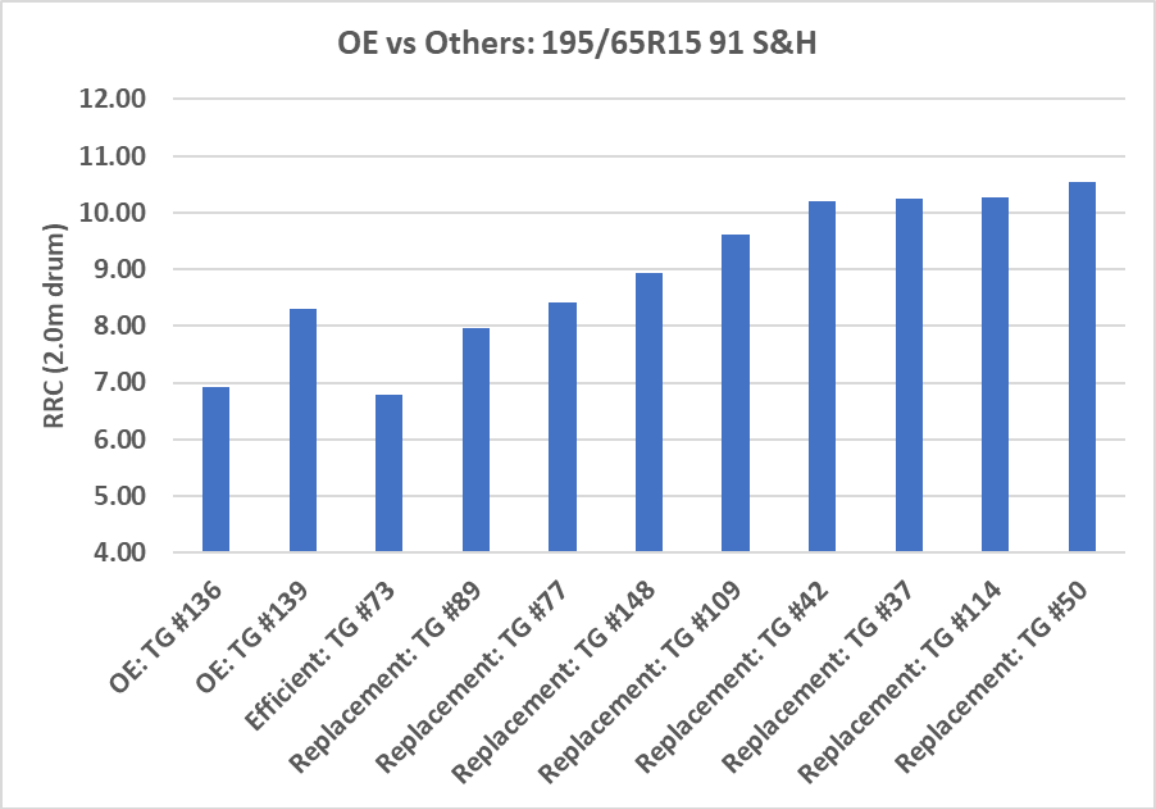


Chart 5.17F

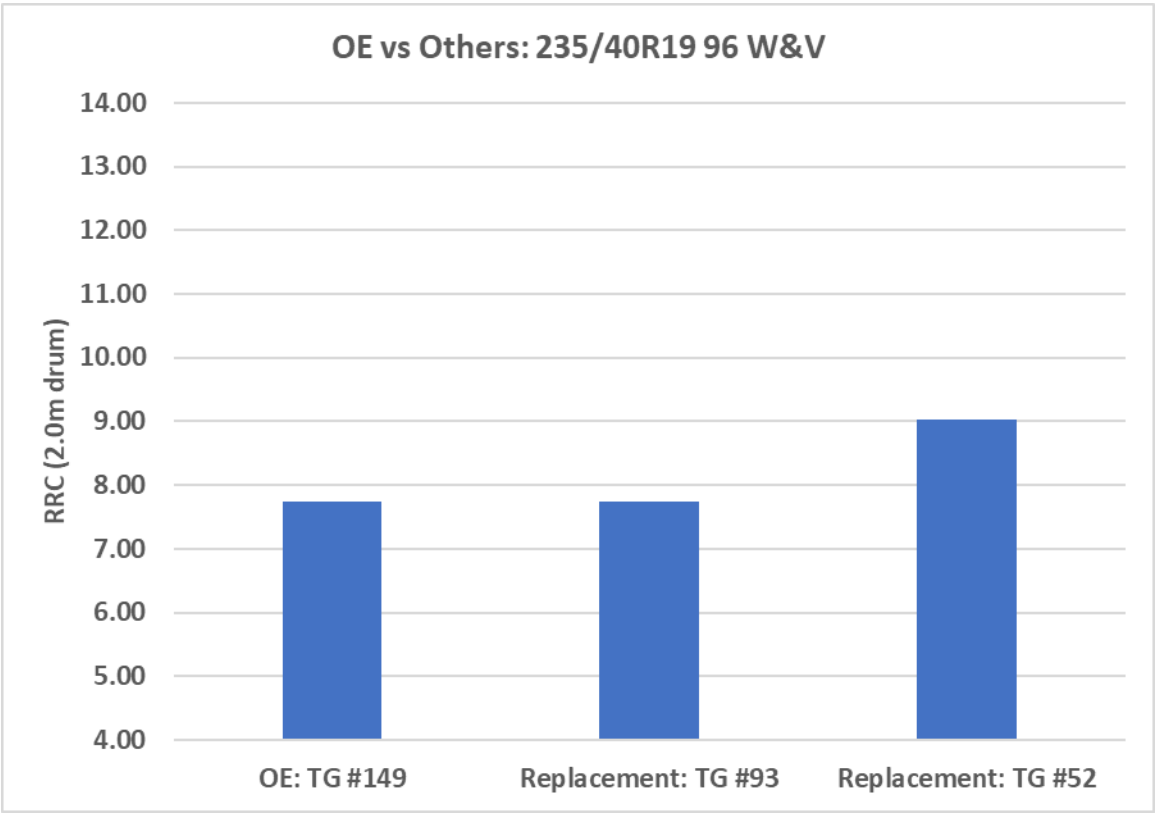


Chart 5.17G

Appendix

3. Tire Group Descriptive Statistics of Tire Rolling Resistance (RRC Values)

Descriptive Statistics of Tire Groups For Rolling Resistance

Column	Size	Mean	Std Dev	Std. Error	C.I. of Mean	Range	Max	Min	Median	Skewness	K-S Dist.	K-S Prob.	SWilk W	SWilk Prob	Sum	Sum of Squares
Group ID 1	3	9.172	0.0618	0.0357	0.153	0.122	9.238	9.115	9.162	0.677	0.228	0.567	0.982	0.745	27.516	252.381
Group ID 2	3	9.742	0.1640	0.0948	0.408	0.311	9.927	9.616	9.681	1.431	0.310	0.281	0.899	0.381	29.225	284.746
Group ID 3	3	9.330	0.1810	0.1040	0.449	0.344	9.534	9.191	9.265	1.412	0.308	0.290	0.902	0.393	27.989	261.199
Group ID 4	3	10.474	0.2760	0.1590	0.686	0.550	10.764	10.214	10.444	0.479	0.210	0.612	0.991	0.822	31.422	329.271
Group ID 5	3	10.232	0.0826	0.0477	0.205	0.165	10.311	10.146	10.240	-0.435	0.206	0.620	0.993	0.838	30.697	314.109
Group ID 6	3	9.821	0.0684	0.0395	0.170	0.132	9.877	9.745	9.842	-1.241	0.286	0.367	0.931	0.491	29.464	289.393
Group ID 7	3	7.069	0.1620	0.0933	0.401	0.319	7.214	6.895	7.098	-0.785	0.238	0.536	0.976	0.701	21.207	149.963
Group ID 8	3	10.329	0.0880	0.0508	0.219	0.167	10.428	10.261	10.297	1.423	0.309	0.285	0.900	0.386	30.986	320.062
Group ID 9	3	9.513	0.1020	0.0588	0.253	0.191	9.629	9.437	9.472	1.508	0.321	0.244	0.881	0.328	28.538	271.497
Group ID 10	3	8.927	0.0788	0.0455	0.196	0.157	9.008	8.851	8.922	0.271	0.191	0.643	0.997	0.900	26.781	239.085
Group ID 11	3	10.614	0.1050	0.0609	0.262	0.211	10.718	10.507	10.616	-0.107	0.177	0.653	1.000	0.961	31.842	337.984
Group ID 12	3	7.301	0.0407	0.0235	0.101	0.073	7.348	7.275	7.280	1.706	0.365	0.128	0.798	0.110	21.903	159.910
Group ID 13	3	10.370	0.0227	0.0131	0.056	0.045	10.392	10.347	10.372	-0.295	0.193	0.640	0.997	0.891	31.111	322.627
Group ID 14	3	9.365	0.0815	0.0470	0.202	0.151	9.458	9.307	9.330	1.573	0.332	0.210	0.863	0.275	28.095	263.118
Group ID 15	3	10.575	0.0622	0.0359	0.154	0.110	10.647	10.538	10.542	1.724	0.374	0.109	0.777	0.062	31.726	335.526
Group ID 16	3	10.245	0.0800	0.0462	0.199	0.157	10.314	10.157	10.263	-0.963	0.256	0.477	0.962	0.625	30.734	314.875
Group ID 17	3	9.576	0.0901	0.0520	0.224	0.180	9.670	9.490	9.567	0.429	0.205	0.621	0.993	0.841	28.728	275.109
Group ID 18	3	10.917	0.0491	0.0284	0.122	0.090	10.951	10.861	10.940	-1.630	0.344	0.179	0.842	0.219	32.751	357.557
Group ID 19	3	11.377	0.1140	0.0661	0.284	0.226	11.481	11.255	11.397	-0.732	0.233	0.552	0.979	0.722	34.132	388.363
Group ID 20	3	9.443	0.0886	0.0512	0.220	0.169	9.543	9.374	9.413	1.359	0.301	0.314	0.912	0.425	28.329	267.528
Group ID 21	3	7.519	0.0697	0.0402	0.173	0.127	7.599	7.472	7.486	1.659	0.350	0.162	0.829	0.186	22.557	169.610
Group ID 22	3	9.960	0.2740	0.1580	0.681	0.515	10.163	9.648	10.069	-1.506	0.321	0.245	0.882	0.329	29.880	297.757
Group ID 23	3	9.060	0.1390	0.0803	0.346	0.267	9.172	8.905	9.105	-1.295	0.293	0.343	0.923	0.462	27.181	246.315
Group ID 24	3	9.831	0.0200	0.0115	0.050	0.039	9.848	9.809	9.836	-1.067	0.267	0.438	0.952	0.577	29.493	289.938
Group ID 25	3	9.079	0.0710	0.0410	0.176	0.141	9.155	9.014	9.070	0.590	0.220	0.589	0.987	0.779	27.238	247.313
Group ID 26	3	8.786	0.1290	0.0746	0.321	0.255	8.902	8.647	8.810	-0.799	0.240	0.532	0.975	0.695	26.359	231.627
Group ID 27	3	9.121	0.1230	0.0713	0.307	0.215	9.194	8.979	9.191	-1.731	0.381	0.096	0.759	0.020	27.364	249.623
Group ID 28	3	7.799	0.0553	0.0319	0.137	0.100	7.836	7.736	7.826	-1.670	0.353	0.155	0.823	0.172	23.398	182.494

Column	Size	Mean	Std Dev	Std. Error	C.I. of Mean	Range	Max	Min	Median	Skewness	K-S Dist.	K-S Prob.	SWilk W	SWilk Prob	Sum	Sum of Squares
Group ID 29	3	6.835	0.0440	0.0254	0.109	0.078	6.886	6.808	6.811	1.721	0.372	0.113	0.782	0.071	20.505	140.149
Group ID 30	3	10.112	0.0618	0.0357	0.154	0.123	10.169	10.047	10.121	-0.610	0.222	0.584	0.986	0.771	30.337	306.787
Group ID 31	3	7.861	0.1390	0.0803	0.346	0.245	7.945	7.700	7.937	-1.727	0.376	0.106	0.773	0.051	23.582	185.412
Group ID 32	3	8.830	0.0580	0.0335	0.144	0.111	8.876	8.765	8.849	-1.308	0.294	0.338	0.921	0.455	26.490	233.918
Group ID 33	3	9.854	0.1370	0.0790	0.340	0.241	9.937	9.696	9.929	-1.725	0.375	0.107	0.775	0.056	29.561	291.327
Group ID 34	3	8.961	0.0539	0.0311	0.134	0.104	9.005	8.900	8.977	-1.227	0.284	0.373	0.933	0.499	26.882	240.882
Group ID 35	3	9.629	0.1450	0.0837	0.360	0.281	9.749	9.468	9.669	-1.153	0.276	0.404	0.942	0.536	28.887	278.190
Group ID 36	3	10.088	0.0591	0.0341	0.147	0.118	10.143	10.025	10.095	-0.534	0.215	0.601	0.989	0.800	30.263	305.284
Group ID 37	3	10.247	0.0678	0.0391	0.168	0.131	10.303	10.171	10.267	-1.198	0.281	0.385	0.937	0.514	30.741	315.004
Group ID 38	3	9.086	0.0234	0.0135	0.058	0.046	9.111	9.065	9.081	0.926	0.252	0.490	0.965	0.641	27.257	247.645
Group ID 39	3	11.749	0.1220	0.0705	0.303	0.238	11.851	11.614	11.781	-1.103	0.271	0.424	0.948	0.560	35.246	414.119
Group ID 40	3	10.165	0.1820	0.1050	0.453	0.331	10.287	9.956	10.254	-1.671	0.353	0.154	0.823	0.170	30.496	310.075
Group ID 41	3	8.260	0.0346	0.0200	0.086	0.069	8.292	8.223	8.266	-0.704	0.230	0.560	0.981	0.733	24.781	204.698
Group ID 42	3	10.205	0.0969	0.0560	0.241	0.188	10.312	10.124	10.178	1.131	0.274	0.413	0.945	0.547	30.614	312.421
Group ID 43	3	7.641	0.1130	0.0654	0.281	0.224	7.764	7.540	7.620	0.812	0.241	0.528	0.974	0.690	22.924	175.202
Group ID 44	3	8.857	0.0324	0.0187	0.081	0.062	8.882	8.820	8.867	-1.331	0.297	0.327	0.917	0.442	26.570	235.321
Group ID 45	3	8.835	0.1310	0.0757	0.326	0.256	8.979	8.723	8.802	1.055	0.265	0.443	0.953	0.583	26.505	234.202
Group ID 46	3	9.345	0.0324	0.0187	0.081	0.059	9.383	9.324	9.330	1.673	0.354	0.152	0.821	0.166	28.036	262.012
Group ID 47	3	9.103	0.0962	0.0556	0.239	0.181	9.174	8.993	9.141	-1.510	0.322	0.243	0.881	0.326	27.309	248.610
Group ID 48	3	11.206	0.1440	0.0834	0.359	0.288	11.343	11.055	11.219	-0.419	0.204	0.623	0.993	0.844	33.617	376.733
Group ID 49	3	10.287	0.1240	0.0719	0.309	0.245	10.422	10.177	10.262	0.885	0.248	0.504	0.968	0.659	30.861	317.504
Group ID 50	3	10.536	0.0839	0.0485	0.208	0.161	10.603	10.442	10.562	-1.287	0.291	0.347	0.924	0.467	31.607	333.013
Group ID 51	3	9.798	0.1590	0.0918	0.395	0.292	9.980	9.688	9.725	1.628	0.343	0.180	0.843	0.222	29.394	288.052
Group ID 52	3	9.019	0.0219	0.0127	0.055	0.040	9.034	8.994	9.030	-1.691	0.359	0.140	0.810	0.140	27.058	244.047
Group ID 53	3	9.769	0.0678	0.0391	0.168	0.118	9.847	9.729	9.730	1.731	0.381	0.096	0.759	0.021	29.306	286.296
Group ID 54	3	10.895	0.5610	0.3240	1.393	1.036	11.537	10.501	10.646	1.604	0.338	0.194	0.852	0.247	32.684	356.700
Group ID 55	3	9.797	0.0896	0.0517	0.223	0.176	9.895	9.720	9.777	0.964	0.256	0.476	0.962	0.624	29.392	287.983
Group ID 56	3	6.820	0.0817	0.0472	0.203	0.157	6.911	6.754	6.795	1.256	0.288	0.360	0.929	0.483	20.460	139.554
Group ID 57	3	8.449	0.0621	0.0359	0.154	0.120	8.500	8.380	8.467	-1.182	0.279	0.392	0.939	0.522	25.347	214.157
Group ID 58	3	11.900	0.1470	0.0849	0.365	0.269	12.000	11.731	11.968	-1.642	0.346	0.172	0.837	0.206	35.699	424.848

Column	Size	Mean	Std Dev	Std. Error	C.I. of Mean	Range	Max	Min	Median	Skewness	K-S Dist.	K-S Prob.	SWilk W	SWilk Prob	Sum	Sum of Squares
Group ID 59	3	8.465	0.0068	0.0039	0.017	0.013	8.471	8.458	8.466	-0.718	0.232	0.556	0.980	0.728	25.396	214.986
Group ID 60	3	8.891	0.0738	0.0426	0.183	0.148	8.964	8.817	8.894	-0.132	0.178	0.652	0.999	0.952	26.674	237.186
Group ID 61	3	8.893	0.0649	0.0375	0.161	0.126	8.947	8.821	8.912	-1.207	0.282	0.381	0.935	0.509	26.680	237.287
Group ID 62	3	8.757	0.0390	0.0225	0.097	0.075	8.788	8.713	8.768	-1.231	0.285	0.371	0.932	0.497	26.270	230.041
Group ID 63	3	8.526	0.0742	0.0428	0.184	0.148	8.601	8.452	8.524	0.081	0.177	0.653	1.000	0.970	25.577	218.075
Group ID 64	3	8.999	0.0949	0.0548	0.236	0.164	9.053	8.889	9.053	-1.732	0.385	0.089	0.750	<0.001	26.996	242.943
Group ID 65	3	6.548	0.0407	0.0235	0.101	0.071	6.572	6.501	6.572	-1.732	0.384	0.091	0.752	0.004	19.645	128.641
Group ID 66	3	10.191	0.0396	0.0229	0.098	0.079	10.233	10.155	10.185	0.655	0.226	0.573	0.983	0.753	30.573	311.569
Group ID 67	3	9.795	0.0579	0.0335	0.144	0.116	9.851	9.736	9.797	-0.181	0.183	0.650	0.999	0.933	29.384	287.811
Group ID 68	3	9.474	0.0231	0.0133	0.057	0.045	9.494	9.448	9.480	-1.084	0.269	0.431	0.950	0.569	28.422	269.269
Group ID 69	3	8.993	0.0976	0.0563	0.242	0.176	9.105	8.930	8.944	1.692	0.359	0.139	0.810	0.138	26.979	242.639
Group ID 70	3	8.455	0.0657	0.0379	0.163	0.121	8.530	8.410	8.425	1.628	0.343	0.180	0.843	0.222	25.365	214.466
Group ID 71	3	8.571	0.0594	0.0343	0.147	0.118	8.627	8.509	8.579	-0.558	0.217	0.596	0.988	0.791	25.714	220.415
Group ID 72	3	9.912	0.2050	0.1180	0.509	0.371	10.148	9.776	9.812	1.673	0.354	0.152	0.821	0.166	29.736	294.824
Group ID 73	3	6.787	0.0573	0.0331	0.142	0.113	6.849	6.736	6.777	0.773	0.237	0.540	0.976	0.706	20.362	138.215
Group ID 74	3	9.927	0.2480	0.1430	0.617	0.481	10.204	9.723	9.856	1.187	0.280	0.390	0.938	0.519	29.782	295.788
Group ID 75	3	9.252	0.0695	0.0401	0.173	0.139	9.320	9.181	9.256	-0.253	0.189	0.644	0.998	0.907	27.757	256.822
Group ID 76	3	10.634	0.1160	0.0672	0.289	0.214	10.714	10.501	10.687	-1.625	0.342	0.182	0.844	0.225	31.902	339.271
Group ID 77	3	8.412	0.1360	0.0783	0.337	0.270	8.553	8.283	8.400	0.386	0.201	0.628	0.994	0.857	25.236	212.318
Group ID 78	3	11.319	0.1550	0.0897	0.386	0.296	11.440	11.144	11.374	-1.387	0.304	0.302	0.907	0.409	33.958	384.438
Group ID 79	3	6.867	0.1120	0.0648	0.279	0.199	6.937	6.738	6.927	-1.718	0.370	0.117	0.786	0.082	20.602	141.499
Group ID 80	3	9.118	0.1390	0.0804	0.346	0.265	9.276	9.011	9.068	1.413	0.308	0.289	0.902	0.392	27.355	249.478
Group ID 81	3	8.291	0.1270	0.0734	0.316	0.241	8.388	8.147	8.337	-1.422	0.309	0.285	0.900	0.387	24.872	206.230
Group ID 82	3	7.878	0.1860	0.1070	0.461	0.345	8.090	7.746	7.799	1.575	0.333	0.209	0.862	0.273	23.635	186.271
Group ID 83	3	8.735	0.1000	0.0578	0.249	0.175	8.795	8.619	8.791	-1.729	0.378	0.102	0.768	0.041	26.205	228.923
Group ID 84	3	8.894	0.0184	0.0106	0.046	0.036	8.909	8.874	8.900	-1.248	0.287	0.364	0.930	0.488	26.683	237.330
Group ID 85	3	11.043	0.0917	0.0529	0.228	0.183	11.139	10.956	11.033	0.454	0.207	0.617	0.992	0.831	33.128	365.843
Group ID 86	3	8.569	0.1940	0.1120	0.481	0.376	8.731	8.355	8.622	-1.129	0.273	0.413	0.945	0.548	25.708	220.369
Group ID 87	3	9.036	0.0537	0.0310	0.133	0.107	9.091	8.983	9.035	0.134	0.179	0.652	0.999	0.951	27.109	244.963
Group ID 88	3	8.060	0.0539	0.0311	0.134	0.094	8.092	7.998	8.091	-1.731	0.382	0.095	0.758	0.017	24.181	194.907

Column	Size	Mean	Std Dev	Std. Error	C.I. of Mean	Range	Max	Min	Median	Skewness	K-S Dist.	K-S Prob.	SWilk W	SWilk Prob	Sum	Sum of Squares
Group ID 89	3	7.961	0.1470	0.0851	0.366	0.287	8.123	7.836	7.923	1.081	0.268	0.433	0.950	0.571	23.882	190.161
Group ID 90	3	8.136	0.0384	0.0221	0.095	0.069	8.161	8.092	8.155	-1.690	0.359	0.141	0.811	0.141	24.408	198.592
Group ID 91	3	9.461	0.0354	0.0204	0.088	0.070	9.493	9.423	9.467	-0.746	0.234	0.548	0.978	0.716	28.383	268.526
Group ID 92	3	9.179	0.0450	0.0260	0.112	0.087	9.215	9.129	9.193	-1.273	0.290	0.353	0.926	0.474	27.537	252.766
Group ID 93	3	7.740	0.0177	0.0102	0.044	0.035	7.757	7.721	7.742	-0.511	0.212	0.606	0.990	0.810	23.220	179.727
Group ID 94	3	7.781	0.1850	0.1070	0.460	0.353	7.926	7.572	7.844	-1.357	0.300	0.315	0.913	0.427	23.342	181.686
Group ID 95	3	9.853	0.1210	0.0701	0.302	0.239	9.985	9.747	9.827	0.928	0.252	0.489	0.965	0.640	29.559	291.273
Group ID 96	3	9.104	0.1040	0.0601	0.259	0.186	9.224	9.039	9.050	1.707	0.365	0.127	0.797	0.108	27.313	248.694
Group ID 97	3	8.392	0.0175	0.0101	0.044	0.032	8.404	8.372	8.400	-1.668	0.353	0.156	0.824	0.173	25.176	211.272
Group ID 98	3	9.596	0.0503	0.0290	0.125	0.100	9.650	9.551	9.587	0.763	0.236	0.543	0.977	0.710	28.788	276.255
Group ID 99	3	6.611	0.0409	0.0236	0.102	0.080	6.647	6.566	6.619	-0.892	0.249	0.502	0.968	0.656	19.832	131.103
Group ID 100	3	8.394	0.0679	0.0392	0.169	0.136	8.464	8.329	8.389	0.305	0.194	0.639	0.997	0.887	25.182	211.386
Group ID 101	3	9.088	0.0857	0.0495	0.213	0.165	9.184	9.018	9.062	1.228	0.285	0.372	0.933	0.498	27.264	247.793
Group ID 102	3	8.472	0.0993	0.0573	0.247	0.196	8.560	8.364	8.491	-0.846	0.244	0.517	0.971	0.675	25.415	215.333
Group ID 103	3	9.395	0.1750	0.1010	0.434	0.343	9.548	9.204	9.433	-0.938	0.253	0.486	0.964	0.636	28.185	264.868
Group ID 104	3	10.858	0.1080	0.0622	0.268	0.214	10.973	10.759	10.843	0.612	0.222	0.584	0.986	0.770	32.575	353.737
Group ID 105	3	7.652	0.0040	0.0023	0.010	0.008	7.656	7.648	7.652	-0.513	0.213	0.605	0.990	0.808	22.956	175.656
Group ID 106	3	8.636	0.2070	0.1200	0.515	0.364	8.875	8.511	8.521	1.728	0.377	0.103	0.769	0.043	25.907	223.817
Group ID 107	3	7.884	0.0319	0.0184	0.079	0.064	7.916	7.852	7.883	0.091	0.177	0.653	1.000	0.967	23.652	186.473
Group ID 108	3	10.350	0.2100	0.1210	0.522	0.406	10.584	10.178	10.287	1.218	0.283	0.377	0.934	0.504	31.050	321.448
Group ID 109	3	9.613	0.1670	0.0964	0.415	0.332	9.770	9.438	9.632	-0.487	0.210	0.611	0.991	0.819	28.840	277.299
Group ID 110	3	7.811	0.1070	0.0616	0.265	0.213	7.911	7.699	7.822	-0.469	0.209	0.614	0.992	0.826	23.432	183.037
Group ID 111	3	9.435	0.1690	0.0977	0.420	0.338	9.605	9.267	9.431	0.082	0.177	0.653	1.000	0.970	28.304	267.087
Group ID 112	3	6.887	0.0651	0.0376	0.162	0.122	6.935	6.813	6.913	-1.509	0.322	0.243	0.881	0.327	20.660	142.288
Group ID 113	3	10.181	0.1740	0.1000	0.431	0.332	10.317	9.985	10.240	-1.364	0.301	0.312	0.911	0.423	30.542	310.996
Group ID 114	3	10.260	0.0404	0.0233	0.100	0.077	10.305	10.227	10.246	1.323	0.296	0.331	0.918	0.446	30.779	315.778
Group ID 115	3	9.623	0.0673	0.0388	0.167	0.129	9.699	9.570	9.601	1.339	0.298	0.324	0.916	0.438	28.870	277.841
Group ID 116	3	7.567	0.0934	0.0539	0.232	0.185	7.667	7.483	7.551	0.758	0.236	0.544	0.977	0.712	22.701	171.789
Group ID 117	3	8.466	0.2500	0.1440	0.621	0.494	8.735	8.241	8.422	0.765	0.236	0.542	0.977	0.709	25.399	215.162
Group ID 118	3	8.823	0.1210	0.0697	0.300	0.240	8.936	8.696	8.836	-0.477	0.209	0.613	0.991	0.822	26.468	233.551

Column	Size	Mean	Std Dev	Std. Error	C.I. of Mean	Range	Max	Min	Median	Skewness	K-S Dist.	K-S Prob.	SWilk W	SWilk Prob	Sum	Sum of Squares
Group ID 119	3	8.383	0.1060	0.0613	0.264	0.208	8.474	8.266	8.407	-1.000	0.260	0.463	0.958	0.608	25.148	210.823
Group ID 120	3	8.949	0.1310	0.0754	0.325	0.260	9.087	8.827	8.932	0.567	0.218	0.594	0.988	0.788	26.846	240.262
Group ID 121	3	10.190	0.0684	0.0395	0.170	0.127	10.239	10.112	10.219	-1.570	0.332	0.212	0.864	0.278	30.570	311.517
Group ID 122	3	7.242	0.0425	0.0245	0.106	0.085	7.285	7.200	7.240	0.199	0.184	0.649	0.999	0.927	21.725	157.330
Group ID 123	3	10.015	0.2080	0.1200	0.517	0.400	10.182	9.782	10.081	-1.286	0.291	0.347	0.924	0.467	30.045	300.987
Group ID 124	3	8.135	0.0954	0.0551	0.237	0.189	8.237	8.048	8.119	0.706	0.231	0.559	0.981	0.733	24.404	198.532
Group ID 125	3	7.234	0.1650	0.0950	0.409	0.329	7.403	7.074	7.225	0.240	0.188	0.646	0.998	0.911	21.702	157.052
Group ID 126	3	6.503	0.0943	0.0544	0.234	0.185	6.605	6.420	6.482	0.936	0.253	0.487	0.964	0.637	19.508	126.866
Group ID 127	3	8.970	0.0456	0.0263	0.113	0.090	9.012	8.921	8.977	-0.645	0.225	0.575	0.984	0.757	26.910	241.383
Group ID 128	3	8.273	0.0745	0.0430	0.185	0.129	8.316	8.187	8.316	-1.732	0.385	0.090	0.750	<0.001	24.819	205.340
Group ID 129	3	7.724	0.0715	0.0413	0.177	0.142	7.799	7.657	7.716	0.506	0.212	0.607	0.990	0.811	23.173	179.003
Group ID 130	3	9.053	0.0380	0.0219	0.094	0.069	9.097	9.028	9.035	1.674	0.354	0.152	0.821	0.165	27.160	245.894
Group ID 131	3	8.104	0.0977	0.0564	0.243	0.192	8.210	8.018	8.084	0.875	0.247	0.508	0.969	0.663	24.313	197.054
Group ID 132	3	8.621	0.0237	0.0137	0.059	0.047	8.645	8.597	8.621	0.042	0.176	0.653	1.000	0.984	25.863	222.963
Group ID 133	3	9.805	0.1710	0.0986	0.424	0.333	9.993	9.660	9.760	1.084	0.268	0.431	0.950	0.570	29.414	288.447
Group ID 134	3	9.909	0.0948	0.0547	0.235	0.168	10.018	9.850	9.859	1.717	0.369	0.118	0.787	0.085	29.727	294.581
Group ID 135	3	8.267	0.0722	0.0417	0.179	0.140	8.327	8.187	8.288	-1.171	0.278	0.396	0.940	0.527	24.802	205.061
Group ID 136	3	6.920	0.0010	0.0006	0.003	0.002	6.920	6.919	6.920	-1.603	0.338	0.194	0.853	0.247	20.759	143.647
Group ID 137	3	9.928	0.0682	0.0394	0.170	0.123	10.007	9.884	9.894	1.686	0.358	0.144	0.814	0.148	29.785	295.733
Group ID 138	3	10.468	0.1020	0.0592	0.255	0.189	10.585	10.396	10.422	1.611	0.340	0.190	0.850	0.239	31.403	328.730
Group ID 139	3	8.316	0.2520	0.1450	0.625	0.487	8.596	8.110	8.241	1.220	0.284	0.376	0.934	0.502	24.947	207.570
Group ID 140	3	8.042	0.0342	0.0198	0.085	0.060	8.082	8.021	8.023	1.725	0.375	0.107	0.775	0.056	24.127	194.035
Group ID 141	3	6.747	0.0852	0.0492	0.212	0.166	6.841	6.675	6.723	1.144	0.275	0.407	0.943	0.541	20.240	136.562
Group ID 142	3	7.474	0.0801	0.0463	0.199	0.155	7.540	7.385	7.497	-1.206	0.282	0.382	0.936	0.510	22.421	167.585
Group ID 143	3	6.414	0.0537	0.0310	0.133	0.107	6.469	6.362	6.412	0.225	0.187	0.647	0.998	0.917	19.243	123.432
Group ID 144	3	10.846	0.0728	0.0420	0.181	0.143	10.925	10.783	10.829	0.985	0.258	0.469	0.960	0.615	32.537	352.888
Group ID 145	3	10.345	0.0458	0.0264	0.114	0.084	10.397	10.314	10.323	1.651	0.348	0.167	0.833	0.196	31.034	321.042
Group ID 146	3	9.539	0.0604	0.0349	0.150	0.115	9.607	9.492	9.518	1.376	0.303	0.307	0.909	0.416	28.616	272.972
Group ID 147	3	9.345	0.1350	0.0781	0.336	0.239	9.428	9.189	9.418	-1.723	0.373	0.111	0.779	0.066	28.034	262.008
Group ID 148	3	8.940	0.1050	0.0604	0.260	0.197	9.019	8.821	8.981	-1.478	0.317	0.258	0.888	0.349	26.821	239.802

Column	Size	Mean	Std Dev	Std. Error	C.I. of Mean	Range	Max	Min	Median	Skewness	K-S Dist.	K-S Prob.	SWilk W	SWilk Prob	Sum	Sum of Squares
Group ID 149	3	7.737	0.0915	0.0528	0.227	0.179	7.837	7.658	7.717	0.961	0.256	0.478	0.962	0.625	23.212	179.611

Appendix

4. Multiple Correlation Analysis of Rolling Resistance Data

Multiple Linear Regression Wednesday, October 05, 2022, 10:58:28 AM

Data source: Data 1 in Notebook1

RRC (2.0 meter) = 9.662 + (0.0841 * Load Index) + (0.000662 * Treadwear) - (0.00459 * Sidewall Max Load (lbs)) + (0.217 * Tread Depth (mm)) + (0.229 * Tire Weight (lbs)) - (0.293 * Bead Diameter) - (0.00734 * Price Paid) - (0.00259 * Section Width (mm)) - (0.0399 * Aspect Ratio)

N = 429 Missing Observations = 18

R = 0.667 Rsqr = 0.445 Adj Rsqr = 0.433

Standard Error of Estimate = 0.908

	Coefficient	Std. Error	t	P	VIF
Constant	9.662	3.329	2.902	0.004	
Load Index	0.0841	0.0412	2.041	0.042	45.475
Treadwear	0.000662	0.000355	1.864	0.063	1.243
Sidewall Max Load (lbs)	-0.00459	0.000851	-5.396	<0.001	54.676
Tread Depth (mm)	0.217	0.0635	3.424	<0.001	2.133
Tire Weight (lbs)	0.229	0.0233	9.834	<0.001	11.159
Bead Diameter	-0.293	0.0926	-3.166	0.002	7.535
Price Paid	-0.00734	0.00101	-7.290	<0.001	1.962
Section Width (mm)	-0.00259	0.00908	-0.286	0.775	20.400
Aspect Ratio	-0.0399	0.0154	-2.596	0.010	10.735

Warning: Multicollinearity is present among the independent variables. The variables with the largest values of VIF are causing the problem. Consider getting more data or eliminating one or more variables from the equation. The likely candidates for elimination are: Load Index , Sidewall Max Load (lbs) , Tire Weight (lbs) , Bead Diameter , Section Width (mm) , Aspect Ratio

Analysis of Variance:

	DF	SS	MS	F	P
Regression	9	277.220	30.802	37.346	<0.001
Residual	419	345.581	0.825		
Total	428	622.800	1.455		

Column	SSIncr	SSMarg
Load Index	17.190	3.436
Treadwear	9.301	2.864
Sidewall Max Load (lbs)	5.772	24.012
Tread Depth (mm)	113.093	9.671
Tire Weight (lbs)	53.247	79.766
Bead Diameter	28.275	8.267
Price Paid	42.165	43.828
Section Width (mm)	2.621	0.0673
Aspect Ratio	5.556	5.556

The dependent variable RRC (2.0 meter) can be predicted from a linear combination of the independent variables:

	P
Load Index	0.042
Treadwear	0.063
Sidewall Max Load (lbs)	<0.001
Tread Depth (mm)	<0.001
Tire Weight (lbs)	<0.001
Bead Diameter	0.002

Price Paid	<0.001
Section Width (mm)	0.775
Aspect Ratio	0.010

Not all of the independent variables appear necessary (or the multiple linear model may be underspecified).
The following appear to account for the ability to predict RRC (2.0 meter) (P < 0.05): Load Index , Sidewall Max Load (lbs) , Tread Depth (mm) , Tire Weight (lbs) , Bead Diameter , Price Paid , Aspect Ratio

Normality Test (Shapiro-Wilk) Failed (P = 0.004)

Constant Variance Test: Passed (P = 0.094)

Power of performed test with alpha = 0.050: 1.000

Appendix

5. Photos of ISO 28580 Rolling Resistance Test Setup

Photograph A5.1: Mounting Rolling Resistance Tire

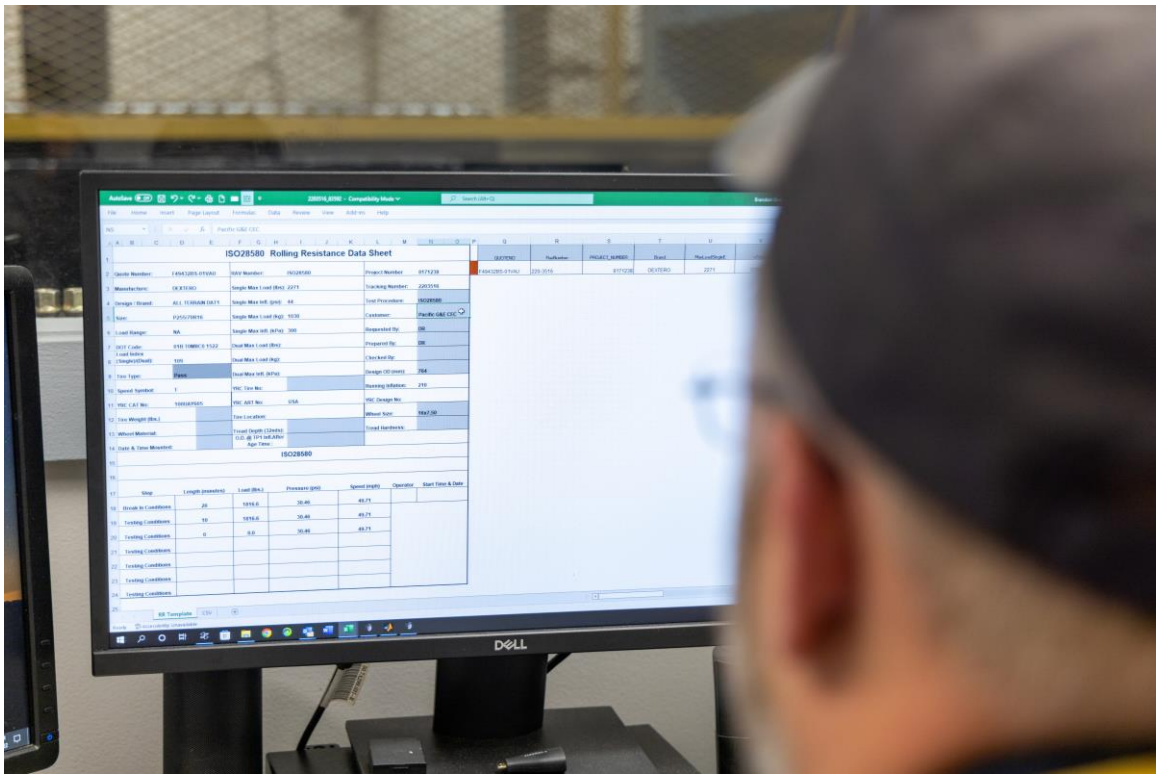
Photograph A5.2: Connecting Tire to Air Pressure

Photograph A5.3: Measuring Tread Hardness

Photograph A5.4: Measuring Tread Depth

Photograph A5.5: Measuring Outside Diameter

Photograph A5.6: Tire Ready for Testing



Photograph A5.7: Data is Recorded

Appendix

6.0 EU Rolling Resistance Correlation

EU Rolling Resistance Correlation

Smithers worked with a partner to develop a correlation to the EU virtual machine used for European Labelling.

EU Correlation: L2 RRC = 0.9605 x SmithersMC – 0.3828

Validity period: **Correlation Valid Through 31st of Dec 2023**

- The rolling resistance coefficient corrections, within the ranges studied, range from: -0.63 to -0.86.

- The candidate Smithers Lab machine is a test position dedicated for C1 and C2 tire classes.
- The reference machine MC#04.A (correlation machine) is a test position dedicated for C1 and C2 tire classes.
- Attention: the so called "Light Truck" or "LT/C" tires belong to the C3 tire class category: those tires **shall NOT** be tested in the Smithers machine object of this correlation, as it would lead to inconsistency in test results alignment. (Note, no C3 tires are currently present in this study)
- Class C3 tires are a European designation EU Regulation N0 661/2009 Article 8.

(c) class C3 tyres — tyres designed primarily for vehicles of categories M_2, M_3, N, O_3 and O_4 with one of the following load capacity indices:

(i) a load capacity index in single formation ≤ 121 and the speed category symbol ≤ 'M';

(ii) a load capacity index in single formation ≥ 122.

- No C3 Class tires were studied in this program
- Based on the test results, the Smithers lab machine complies with the repeatability requirements of the Regulation (EU) 2020/740.
- The correlation established permits alignment of test results from our Smithers lab machine to our partner in Europe, and afterwards, the alignment to the virtual EC Reference Laboratory.
- This correlation is **valid for Rolling Resistance Coefficient (RRC) in N/kN**. A set of **C1/C2 tires** was used for this study.
- The test procedure was following the ISO28580, standard test for rolling resistance and labeling (in line with the R117). The test plan was developed following labelling regulations in place.
- The correlation has a R-Square > 0.99.
- Attention: Period of validity of correlations shall be respected, as defined in the Regulation (EU) 2020/740. If the correlation comes to expiration, the data generated from Smithers lab will not be usable for labelling until next correlation is established.
- Other parameters were compared apart from RRC (rolling force, loaded radius, etc.) and resulted very close in terms of absolute values and repeatability.

Appendix

7.0 Definitions

Definitions

Aspect ratio. A tire's section height divided by its section width, multiplied by 100. Aspect ratio is listed in the size designation on the passenger tire sidewall. Typical tire aspect ratios range from 35 for tires used on sports cars to 75 for tires used on utility-type vehicles.
Bead. A ring of steel wire that anchors the tire carcass plies to the rim.
Belt. An assembly of plies extending from shoulder to shoulder of a tire and providing a reinforcing foundation for the tread. In radial-ply tires, the belts are typically reinforced with fine steel wire having high tensile strength.
Bias-ply tire. A pneumatic tire in which the ply cords that extend to the beads are laid at alternate angles substantially less than 90 degrees to the centerline of the tread. The bias-ply tire was the predominant passenger tire in the United States before 1980 but is no longer in common use; it has been supplanted by the radial-ply tire.
Carbon black. A very fine, nano-size particulate carbon used as a reinforcing filler in rubber compounds to provide abrasion resistance and other favorable properties.
Carcass or casing. The tire structure, except tread and sidewall rubber, that bears the load when the tire is inflated.
Coastdown. A process in which a vehicle or test machine is allowed to slow down freely from a high to a low speed without application of external power or braking.
Coefficient of friction. The ratio of friction force to normal force to cause sliding expressed as a unitless value (i.e., friction force generated between tire tread rubber and the road surface divided by vertical load).
Corporate average fuel economy (CAFE). A federal program that sets a minimum performance requirement for passenger vehicle fuel economy. Each automobile manufacturer must achieve an average level of fuel economy for all specified vehicles manufactured in a given model year. The National Highway Traffic Safety Administration administers the CAFE program. The U.S. Environmental Protection Agency develops the vehicle fuel economy test procedures.
EPA. U.S. Environmental Protection Agency. EPA is responsible for developing the federal test procedures for measuring and rating the fuel economy of new passenger cars and light trucks. The federal test procedures are used for new vehicle fuel economy labeling and the corporate average fuel economy program.
FMVSS. Federal Motor Vehicle Safety Standards. The FMVSS include regulations governing passenger tire safety.
High-performance tire. A passenger tire designed for the highest speed and handling, generally having the speed symbol W, Y, or Z in the United States.
Hysteresis. A characteristic of a deformable material such that the energy of deformation is greater than the energy of recovery. The rubber compound in a tire exhibits hysteresis. As the tire rotates under the weight of the vehicle, it experiences repeated cycles of deformation and recovery, and it dissipates the hysteresis energy loss as heat. Hysteresis is the main cause of energy loss associated with rolling resistance and is attributed to the viscoelastic characteristics of the rubber.
Light truck (LT) tire. A tire constructed for heavy loads and rough terrain that is usually used on medium-duty trucks in commercial service. These tires contain the prefix LT before the metric size designation molded on the tire sidewall and are inflated to higher pressures than are normal passenger tires.

NHTSA. National Highway Traffic Safety Administration. Among its responsibilities, NHTSA administers the Federal Motor Vehicle Safety Standards, the Uniform Tire Quality Grading system, and the corporate average fuel economy program.
Original equipment manufacturer (OEM). An automobile manufacturer.
Original equipment (OE) passenger tire. A tire that is provided as original equipment on new passenger vehicles. Such tires are often designed for particular vehicles to the specifications of the automobile manufacturer.
Passenger tire. A tire constructed and approved for use on passenger vehicles and that usually contains the prefix P before the metric size designation on the tire sidewall. Federal Motor Vehicle Safety Standards and Uniform Tire Quality Grading standards are established specifically for passenger tires.
Passenger vehicle. For the purposes of this report, a car or light truck used primarily for passenger transportation. Most of these vehicles use passenger tires. Most vans, pickup trucks, and sport utility vehicles that are categorized as light trucks by the federal government are considered passenger vehicles. Light trucks that exceed 6,000 pounds in gross vehicle weight are usually used for non-passenger commercial service. They are usually equipped with light truck (LT) tires.
Performance tire. A passenger tire intended to provide superior handling and higher speed capabilities and generally having a speed symbol of H or V in the United States.
Ply. A sheet of rubber-coated parallel tire cords. Tire body plies are layered.
Radial-ply construction. A pneumatic tire construction under which the ply cords that extend to the beads are laid at approximately 90 degrees to the centerline of the tread. Two or more plies of reinforced belts are applied, encircling the tire under the tread. Radial-ply tires were introduced in Europe during the 1950s and came into common use in the United States during the 1970s.
Reinforcing filler. Material added to rubber compounds to provide favorable properties, including resistance to abrasion. The two most common reinforcing fillers are carbon black and silica.
Replacement passenger tire. A tire purchased in the aftermarket to replace an original equipment tire.
Rim diameter. The diameter of a wheel measured at the intersection of the bead seat and the flange. The rim diameter is listed in the size designation on the passenger tire sidewall. Common rim diameters for passenger tires range from 13 to 20 inches.
RMA. Rubber Manufacturers Association. RMA is the national trade association for the rubber products industry in the United States. Most domestic and foreign tire makers who produce tires in the United States are members of the association.
Rolling resistance. The force at the axle in the direction of travel required to make a loaded tire roll.
Run-flat tire. A type of pneumatic tire constructed of special materials, supports, and configurations that allow it to travel for a limited distance and speed after experiencing a loss of most or all inflation pressure. While these tires usually have greater weight and resultant rolling resistance, they permit the elimination of storage space and weight associated with a spare tire and jack.
SAE. Society of Automotive Engineers. SAE technical committees have developed standardized test practices for measuring the rolling resistance of tires.
Section height. The linear distance between an inflated unloaded tire's overall (outside) tread diameter and the intersection of the bead seat and the flange.
Section width. The linear distance between the outside sidewalls of an inflated unloaded tire (not including decorations such as lettering) when mounted on the measuring rim. Treads are always narrower than the section width.
Sidewall. The portion of the tire between the bead and the tread. The tire's name, safety codes, and size designation are molded on the sidewall.

Silane. An organo-silicate compound that is sometimes mixed with silica to promote dispersion and bonding.
Silica. A very fine, nano-size particle, silicon dioxide, used as a reinforcing filler in rubber compounding.
Speed rating. A letter assigned to a tire denoting the maximum speed for which the use of the tire is rated (e.g., S = 112 mph, H = 130 mph). The speed rating is contained in the tire size designation molded on the sidewall.
Tire pressure monitoring system (TPMS). A warning system in motor vehicles that indicates to the operator when a tire is significantly underinflated. Some systems use sensors in the tire to transmit pressure information to a receiver. Some do not have pressure sensors but rely on wheel speed sensors to detect and compare differences in wheel rotational speeds, which can be correlated to differences in tire pressure.
Traction. The ability of a loaded tire to generate vehicle control forces through frictional interaction with a road surface.
Tread. The peripheral portion of the tire designed to contact the road surface. The tread band consists of a pattern of protruding ribs and grooved channels on top of a base. Tread depth is measured on the basis of groove depth. Traction is provided by the tread.
Tread compound. The general term that refers to the chemical formula of the tread material. The compound consists of polymers, reinforcing fillers, and other additives that aid in processing and slow degradations from heat, oxygen, moisture, and ozone.
Tread wear life. Total miles traveled by a tire until its tread wears out, which is usually defined as a remaining groove depth of 2/32 inch for a passenger car tire that exhibits even wear.
Uniform Tire Quality Grade (UTQG). A passenger tire rating system that grades a tire's performance in tread wear durability, traction, and temperature resistance. UTQG ratings are required by the federal government for most types of passenger tires and are molded on the tire's sidewall. The tread wear grade is a numeric rating, with a higher number suggesting longer tread wear capability. Most tires receive grades between 100 and 800. The traction grade is assigned on the basis of results of skid tests on wet pavements. Tires are graded AA, A, B, or C, with AA indicating superior wet traction. The temperature grade is assigned to tires tested at various speeds to determine the ability of a tire to dissipate heat. Tires are graded A, B, or C, with A indicating an ability to dissipate heat at higher speeds.
USDOT. U.S. Department of Transportation. The National Highway Traffic Safety Administration is an agency of USDOT.
Vehicle fuel economy. The average number of miles a vehicle travels per gallon of motor fuel (typically gasoline or diesel fuel).
Viscoelastic. A viscoelastic material is characterized by possessing both viscous and elastic behavior. A purely elastic material is one in which all energy stored in the material during loading is returned when the load is removed. In contrast, a purely viscous material stores no strain energy, and all of the energy required to deform the material is simultaneously converted into heat. Some of the energy stored in a viscoelastic system is recovered on removal of the load, and the remainder is dissipated as heat. Rubber is a viscoelastic material.
Wear resistance. Resistance of the tread to abrasion from use on a normal road surface.
Wet traction. The ability of a loaded tire to generate vehicle control forces through frictional interaction with a wet road surface

Source: Tires and Passenger Vehicle Fuel Economy: Informing Consumers, Improving Performance, TRB Special Report 286 2006

Coefficient of Variation. The standard deviation divided by the mean.
ISO 28580. A recommended practice of ISO that defines a standardized method for testing tire rolling resistance under controlled laboratory conditions.
ISO 23671. A recommended practice of ISO that defines a standardized method for testing tire wet grip braking performance index relative to a control tire.
Rolling resistance coefficient (RRC). The tested rolling resistance force divided by the test load.
RRC 2.0m. A calculated rolling resistance coefficient (basis of a 2.0m test drum) using the test data generated on a Smithers 1.7m test drum.

Appendix

8.0 References

References

1. California Energy Commission; Programs and Topics: “Replacement Tire Efficiency Program”; https://www.energy.ca.gov/programs-and-topics/programs/replacement-tire-efficiency-program

2. California Energy Commission; Proceedings: “Replacement Tire Efficiency Program Proceeding”; https://www.energy.ca.gov/proceedings/energy-commission-proceedings/replacement-tire-efficiency-program-proceeding

3. NHTSA Tire Safety Booklet; “Everything Rides On It”; DOT HS 810 900, dated February 2008

4. Order No: 20-1110-3; State Of California; State Energy Resources Conservation And Development Commission: “Data & Informational Collection For The Replacement Tire Efficiency Program”; Docket No. 20-Tire-01, Dated November 10, 2020.

5. Tire Test Protocol: ISO 23671(2021) “Passenger Car Tyres - Method for Measuring Relative Wet Grip Performance - Loaded New Tyres” (Trailer method)

6. Tire Test Protocol: ISO 28580(2018); “Passenger Car, Truck and Bus Tyre Rolling Resistance Measurement Method — Single Point Test and Correlation of Measurement Results.”

7. Transportation Research Board, TRB Special Report: “Tires and Passenger Vehicle Fuel Economy: Informing Consumers, Improving Performance” Special Report 286 dated 2006.

8. US Department of Transportation; National Highway Traffic Safety Administration; “Consumer Guide to Uniform Tire Quality Grading” DOT HS 812 210, dated November 2015.

9. US Department of Transportation; National Highway Traffic Safety Administration; “Consumer Guide to Uniform Tire Quality Grading” DOT HS 812 325, dated August 2016.

10. U.S. Department Of Transportation; National Highway Traffic Safety Administration; “Laboratory Test Procedure **TP-UTQG-T-02 for Tire Traction Testing”; Consumer Information Regulations Part 575.104 Uniform Tire Quality Grading; dated August 16, 2022.**