Environmental and Safety Performance of Commercially Available Light-duty Tire Models in North America

Meeting Deck – June 11, 2018

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OUTLINE

Overview of Transport Canada / eTV Program

Background

- Tire Technology and Performance
- Developing Minimum Performance Standards

Project Methodology

- Testing Matrix

Test Results

- Studless winter tires (P195/65R15)
- All-season tires (P205/55R16)
- All-season tires (assorted sizes)

Conclusions

OVERVIEW OF TRANSPORT CANADA'S ECOTECHNOLOGY FOR VEHICLES PROGRAM

The ecoTECHNOLOGY for Vehicles II (eTV II) program

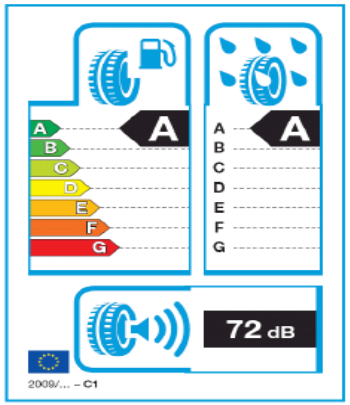
- supports Transport Canada (TC)’s strategic objective to develop a safe and environmentally responsible transportation system.
- supports a proactive and integrated approach to address environmental benefits and potential safety risks of advanced transportation technologies.

The initiative tests, evaluates and provides technical information on the environmental and safety performance of advanced light-duty vehicle (LDV) and heavy-duty vehicle (HDV) technologies, to:

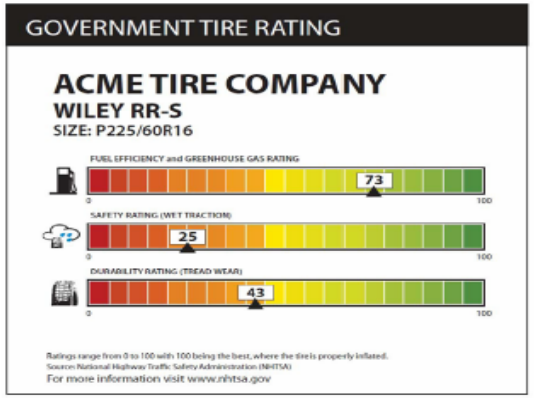
- guide the proactive development of new or revised safety regulations, standards, codes and guidelines;
- support the development of non-regulatory industry codes and standards that anchor the market and industry efforts to integrate new vehicle technologies; and,
- help inform the development of future vehicle emissions regulations.

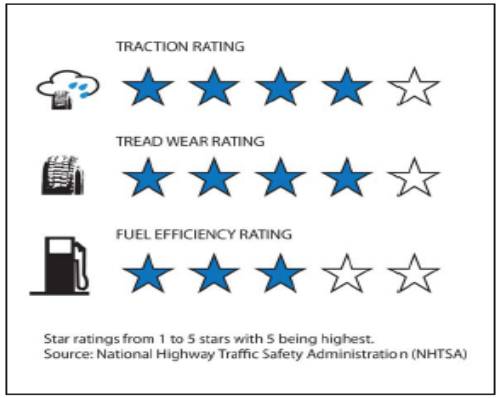
BACKGROUND – TIRE CONSUMER INFORMATION/LABELING PROGRAMS

- The European Union (EU) regulation 661/2009 sets mandatory maximum rolling resistance of 12 kg/t for all passenger car tires and EU regulation 1222/2009 requires defined mandatory consumer information be included on all tires produced after July 2012.
- The U.S. National Highway Traffic Safety Administration (NHTSA) issued a notice of proposed rule making (NPRM) in June 2009 to establish a rating system for rolling resistance, wet traction and tread wear.



EU Tire Label 2012





NHTSA Proposed Rating System and Rubber Manufacturers Association Alternative

BACKGROUND – TIRE TECHNOLOGY AND PERFORMANCE

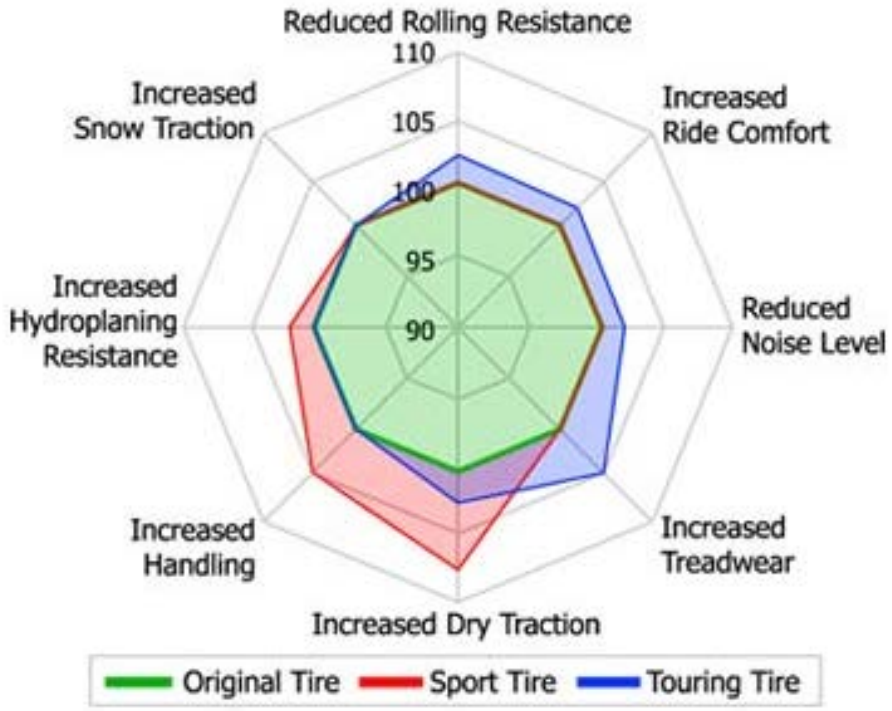
Tire Design Factors

- Tread pattern (lugs, sipes, gaps)
- Dimensions (profile, void ratio, tread depth)
- Material composition (rubber compounds, filler)
- Tire construction (belt overlay)
- Higher rated pressure

Maintenance & Driving Factors

- Inflation pressure
- Driving surface / speed
- Vehicle load
- Surface (concrete, asphalt, other)
- Weather (Precipitation, Temperature)

Tire Performance Factors



RATIONALE FOR TESTING – DEVELOPING CANADA'S TIRE EFFICIENCY STANDARDS

To develop a Tire Consumer Information Program (TCIP) or a Minimum Performance Standard several questions and challenges must be addressed.

<u>Environmental Performance</u>

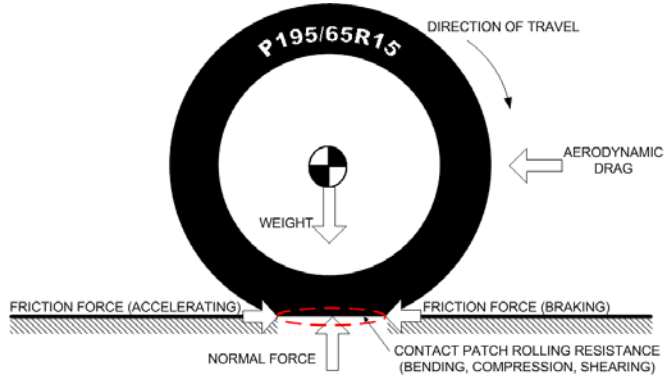
What is the typical environmental performance (energy efficiency) of commercially-available tires in Canada?

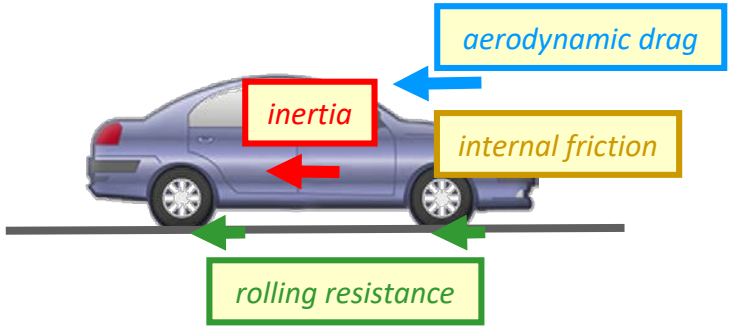
<u>Safety Performance</u>

What is typical safety performance (wet grip and snow grip) of commercially-available tires in Canada? And how is safety performance correlated with environmental performance?

<u>Consumer Preferences</u>

How do safety and environmental performance correlate with other consumer preferences (i.e. tread wear and purchase price)?





PROJECT METHODOLOGY

Winter Tires				All Season	
Studless	Studable	Studded	All-weather	H&V Rated	A/T Off-Road
					

TESTING MATRIX

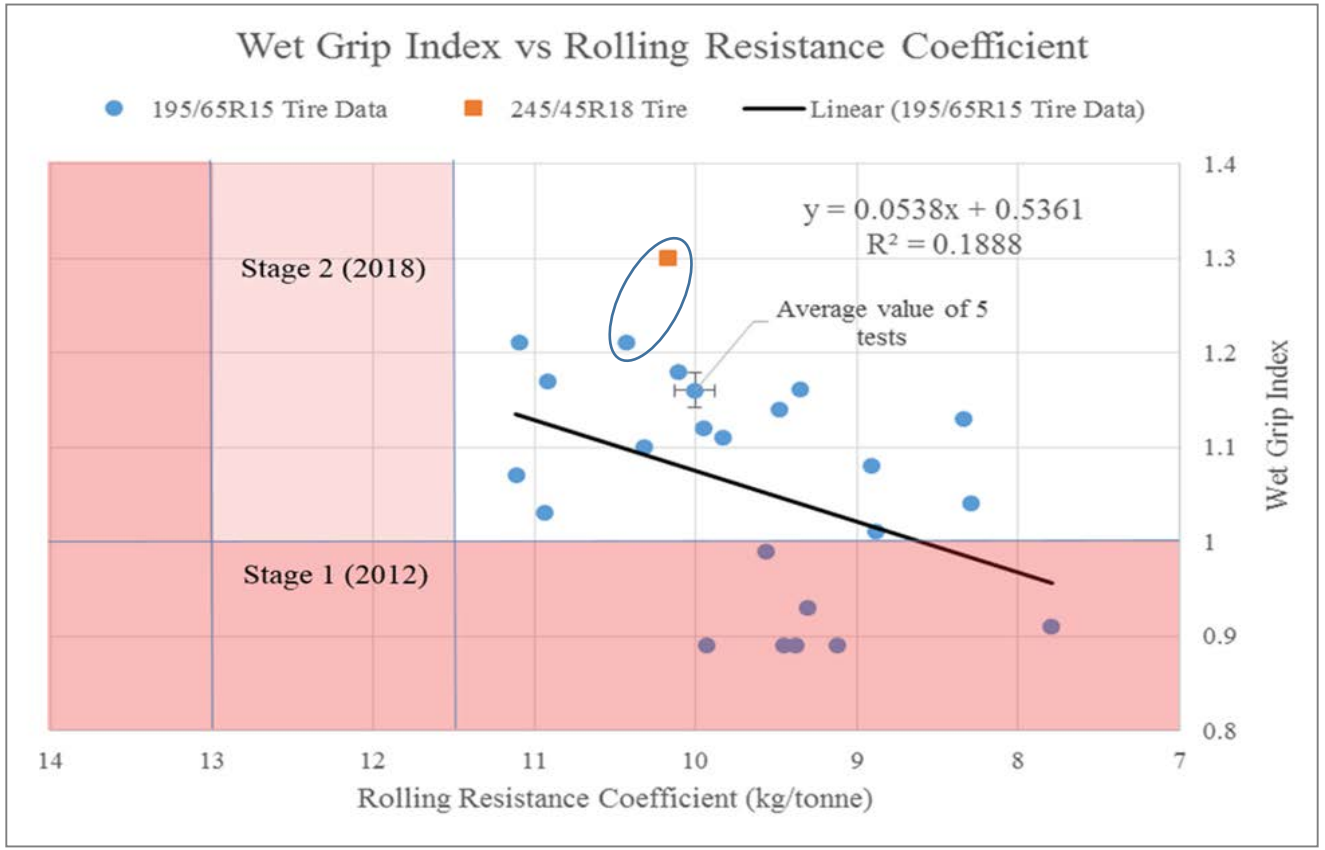
Grp	Tire Type	Tire Size^	TP#^^	SP#^^	SP#	RR	DMA	WG	SG	IG
1	Studless winter	P195/65R15	27/7	16/7	23	✓^^^	✓	✓	✓^^^	
2	All-season (M+S/H&V)	P205/55R16	69/37	42/8	50	✓	✓	✓		
3	All-season (various)	various	N/A	57/1	58	✓		✓		

^ The most popular size in that tire type (in terms of sales), provided by TRAC.
^^ TP – total population, SP – sample population (TRAC/non-TRAC).
^^^ Variability of test procedure (same tire size/different tire sizes).

WINTER TIRE (P195/65R15) TESTING - WET GRIP INDEX & ROLLING RESISTANCE

AVG RR: 9.68
MAX RR: 11.11
MIN RR: 7.79

AVG WGI: 1.05
MAX WGI: 1.21
MIN WGI: 0.89



- Correlation between rolling resistance and wet grip inconclusive (R^2 = 0.1888).
- Seven (7) winter tire models failed to meet the stage 1 EU wet grip index minimum (1.0).

WINTER TIRE TESTING - SNOW TRACTION

AVG RR: 9.68
MAX RR: 11.11
MIN RR: 7.79

AVG ST: 125.89
MAX ST: 136.80
MIN ST: 105.35

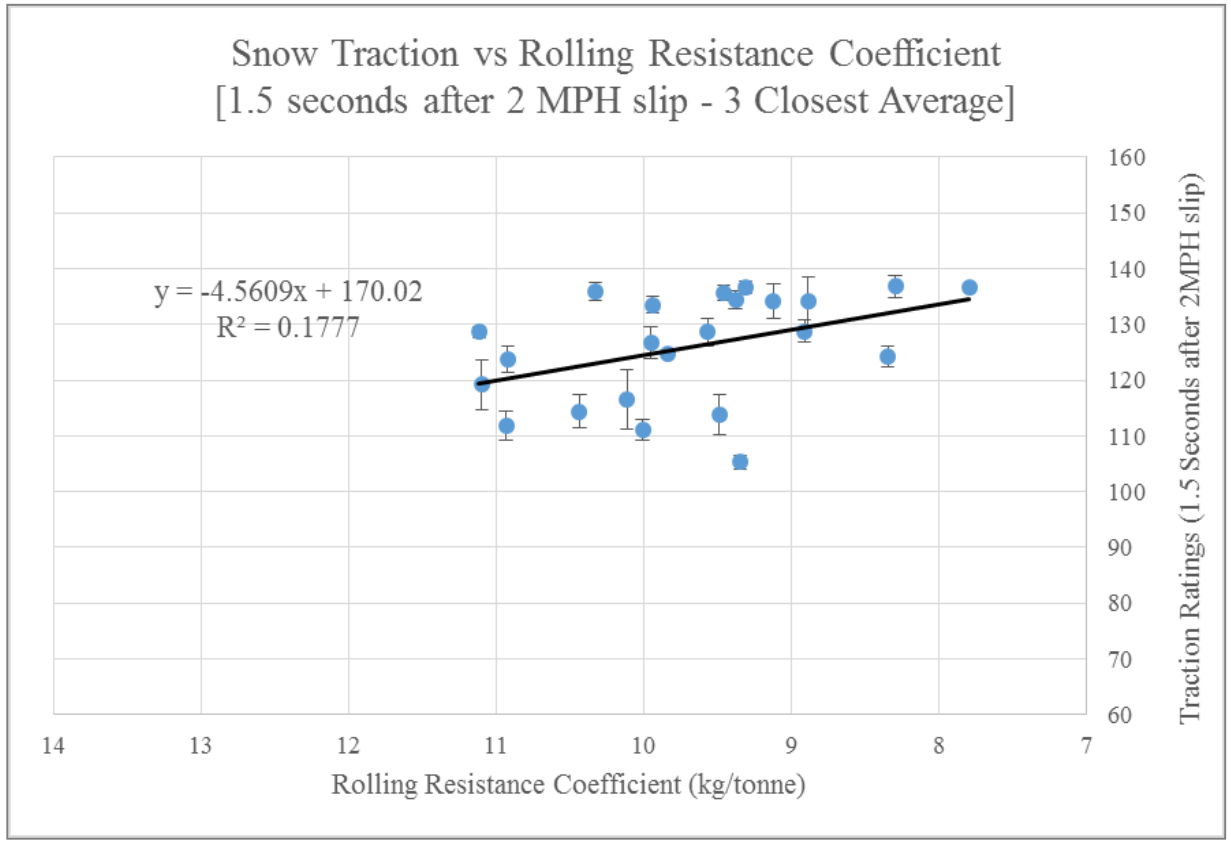


Figure 2. Snow Traction vs Rolling Resistance Coefficient (Winter Tire Sample - 23 Tires Tested - P195/65R15)

- Correlation between rolling resistance and snow traction inconclusive (R^2=0.1777).
- Two of the most energy efficient winter tires had good snow traction performance.

WINTER TIRE TESTING - PURCHASE PRICE

US
AVG RR: 9.64
MAX RR: 11.09
MIN RR: 8.29

AVG $: 84.42
MAX $: 93.70
MIN $: 77.41

CAD
AVG RR: 9.52
MAX RR: 11.09
MIN RR: 8.29

AVG $: 138.54
MAX $: 165.99
MIN $: 117.99

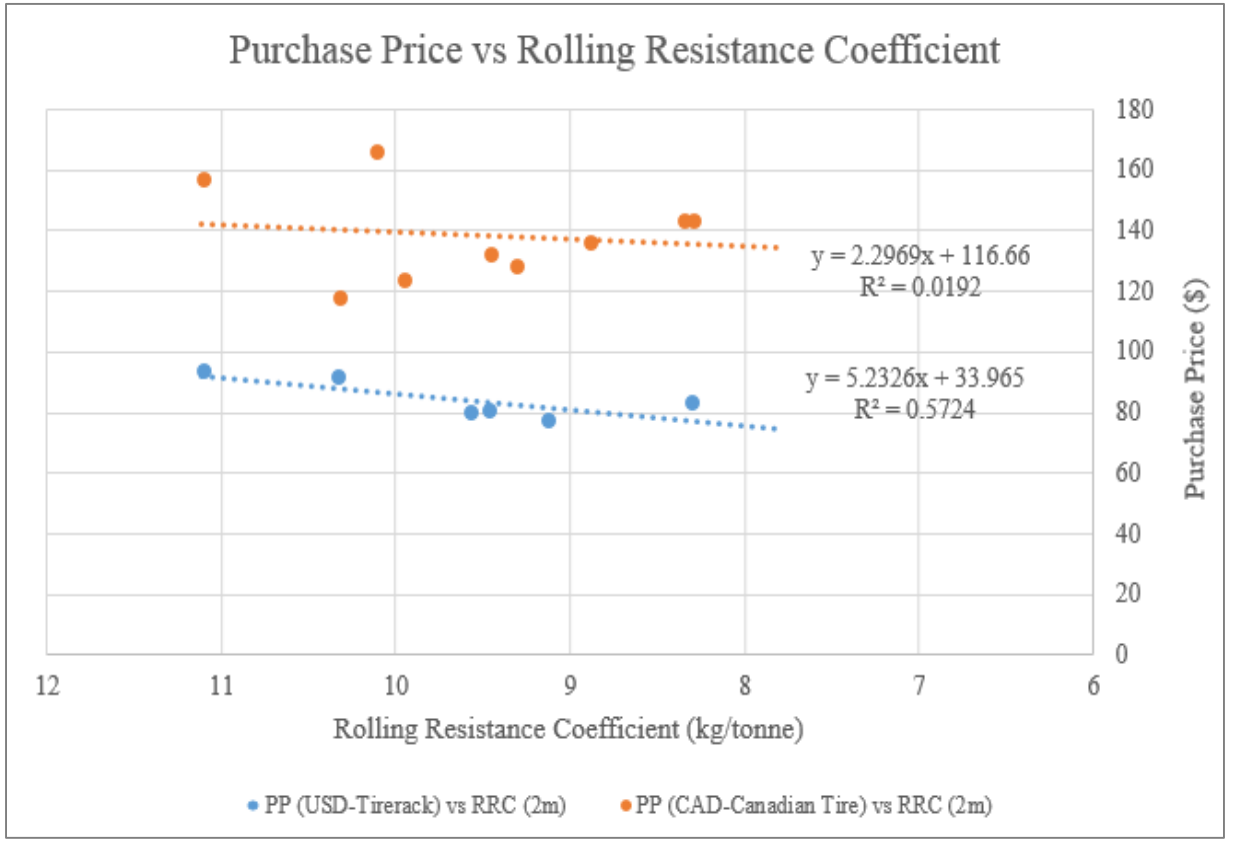


Figure 3. Purchase Price vs Rolling Resistance Coefficient (Winter Tire Sample - 6 USD, 9 CAD tires priced - P195/65R15)

Pricing data was taken as advertised manufacturer suggested retail price (MSRP) on August 1st, 2017 [1 USD = 1.25 CAD].

- Purchase price in both CAD & USD showed little relationship with RRC.

WINTER TIRE TESTING - PURCHASE PRICE

US
AVG WGI: 1.02
MAX WGI: 1.21
MIN WGI: 0.89

AVG $: 84.42
MAX $: 93.70
MIN $: 77.41

CAD
AVG WGI: 1.06
MAX WGI: 1.21
MIN WGI: 0.89

AVG $: 138.54
MAX $: 165.99
MIN $: 117.99

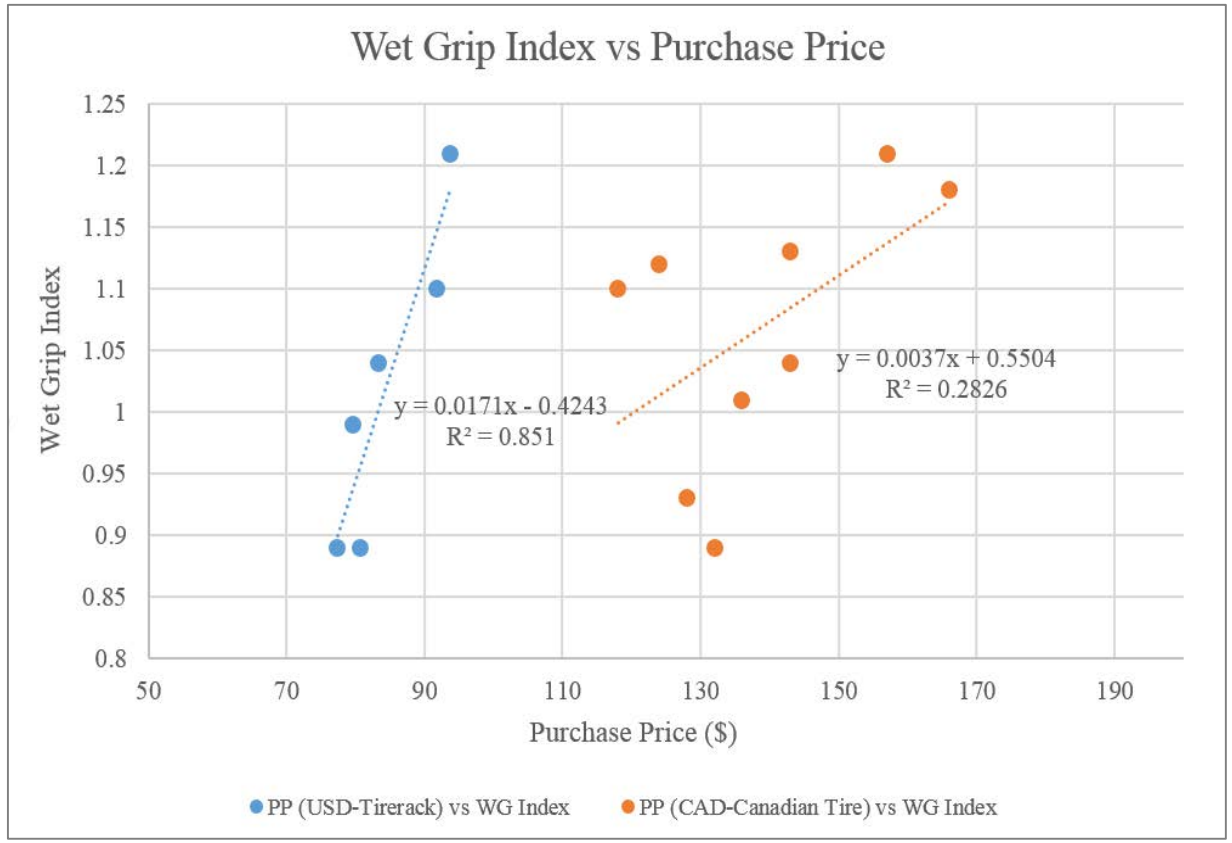


Figure 4. Wet Grip index vs Purchase Price (Winter Tire Sample - 6 USD, 9 CAD tires priced - P195/65R15)

- Purchase price showed a relationship with WGI in both CAD & USD.

WINTER TIRE TESTING – EU BINNING

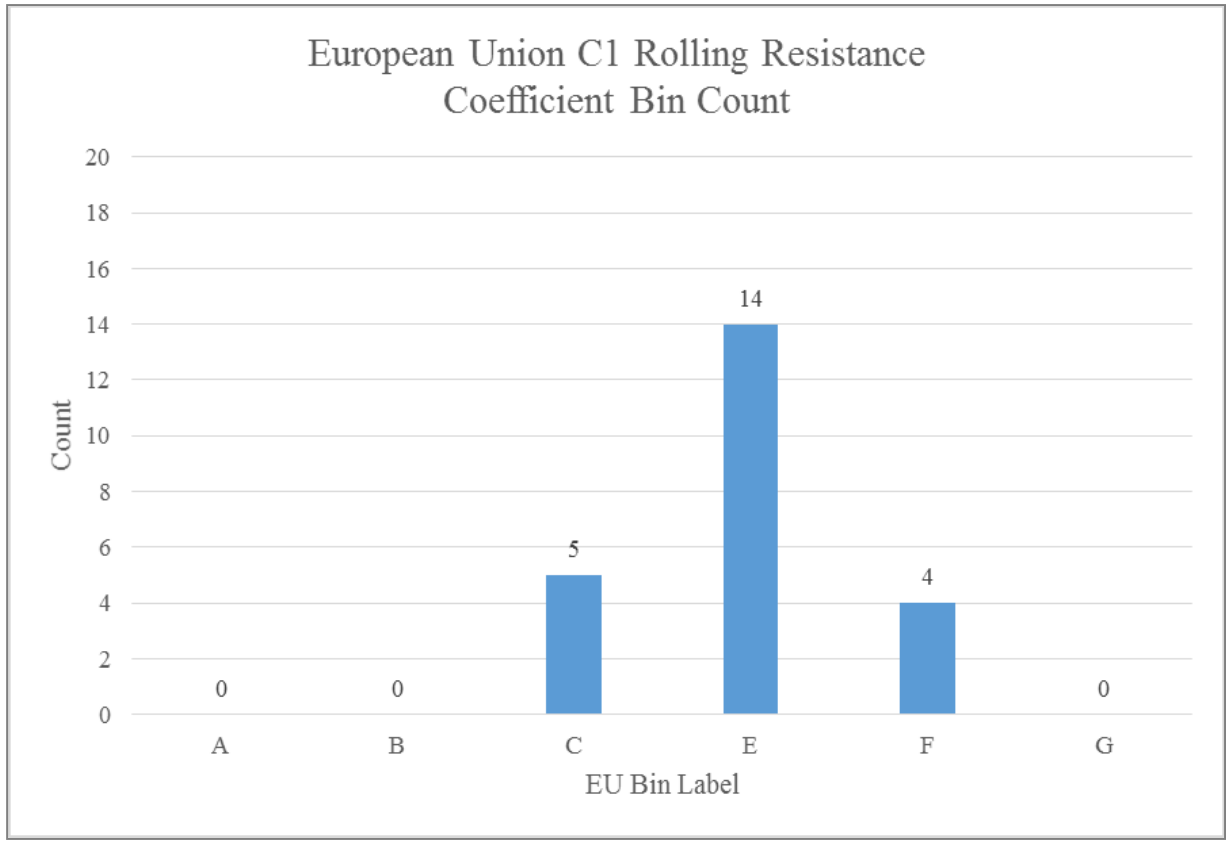


Figure 5. European Union C1 Rolling Resistance Coefficient Bin Count (Winter Tire Sample - 23 Tires Tested - P195/65R15)

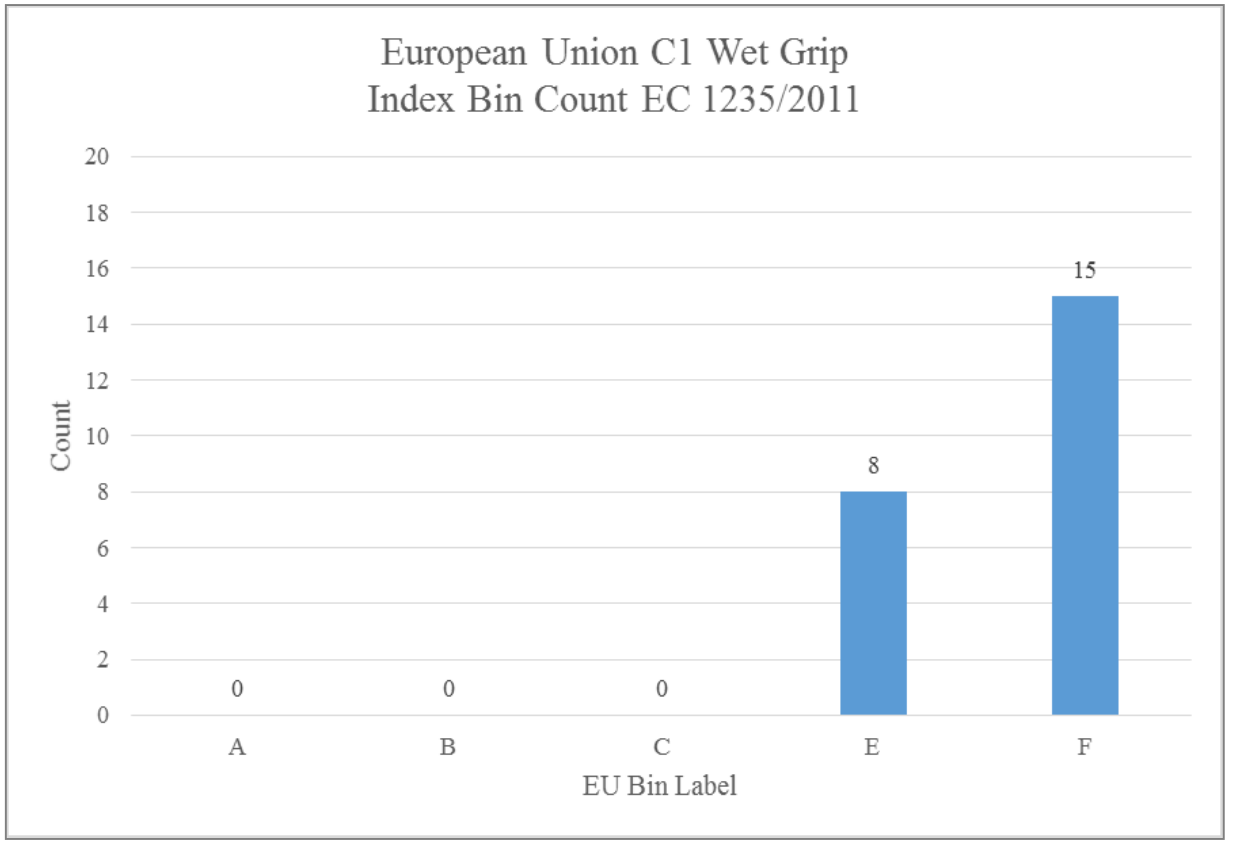


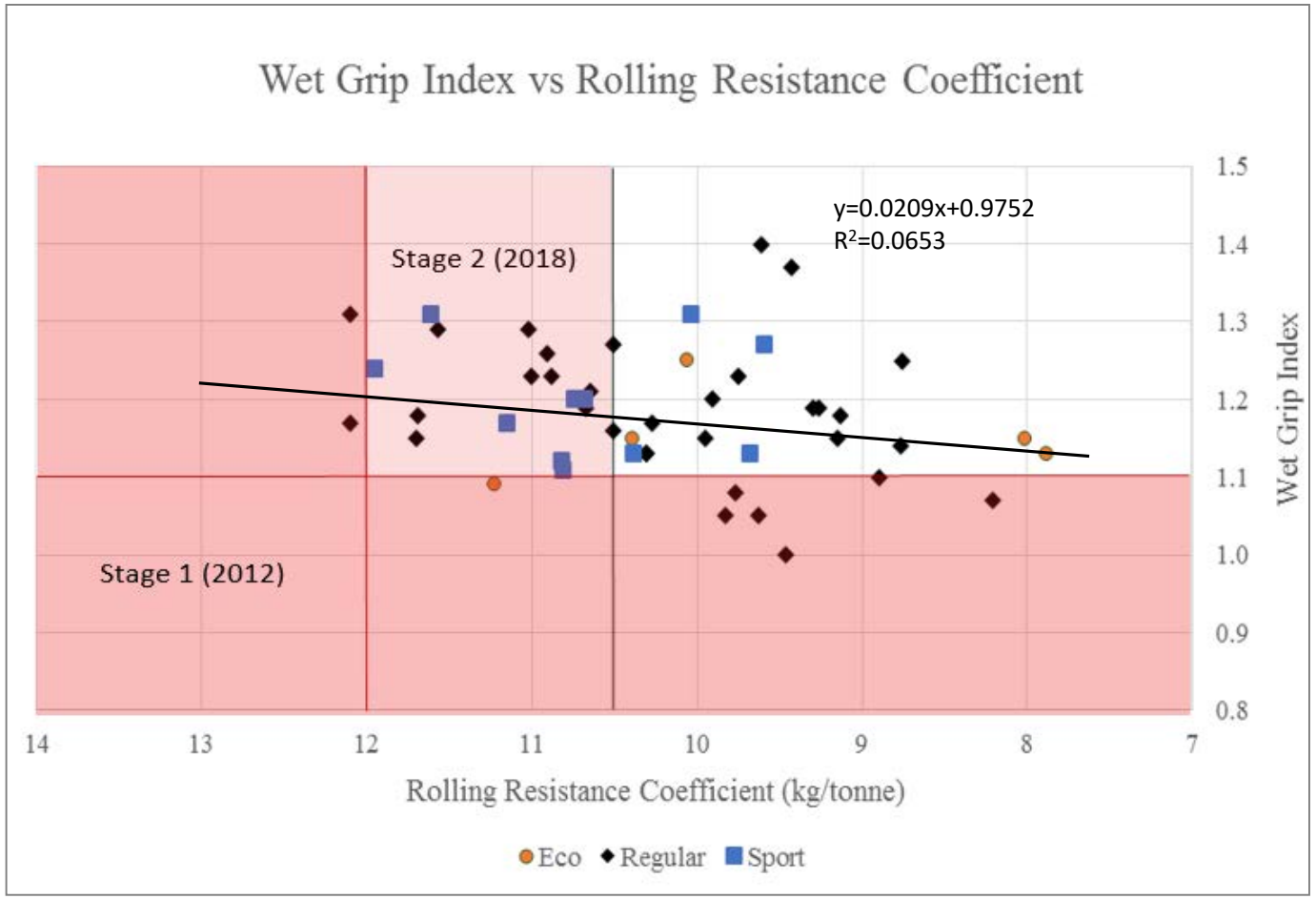
Figure 6. European Union C1 Wet Grip Index Bin Count (Winter Tire Sample - 23 Tires Tested - P195/65R15)

- 14 tire models rated as an “E” for energy efficiency, and binned towards the mid/lower end of the EU label
- 15 tire models rated as an “F” for wet grip, and binned towards the lower end of the EU label

ALL-SEASON TIRE TESTING (P205/55R16) - WET GRIP INDEX & ROLLING RESISTANCE

AVG RR: 10.20
MAX RR: 12.10
MIN RR: 7.88

AVG WGI: 1.18
MAX WGI: 1.4
MIN WGI: 1



- RRC showed a minimal relationship with WGI
- Certain all season tires failed to meet the EU Stage 1 RRC and WGI minimum standards

ALL-SEASON TIRE TESTING I - PURCHASE PRICE

CAD
AVG $: 146.44
MAX $: 179.99
MIN $: 101.99

US
AVG $: 110.33
MAX $: 165.25
MIN $: 68.15

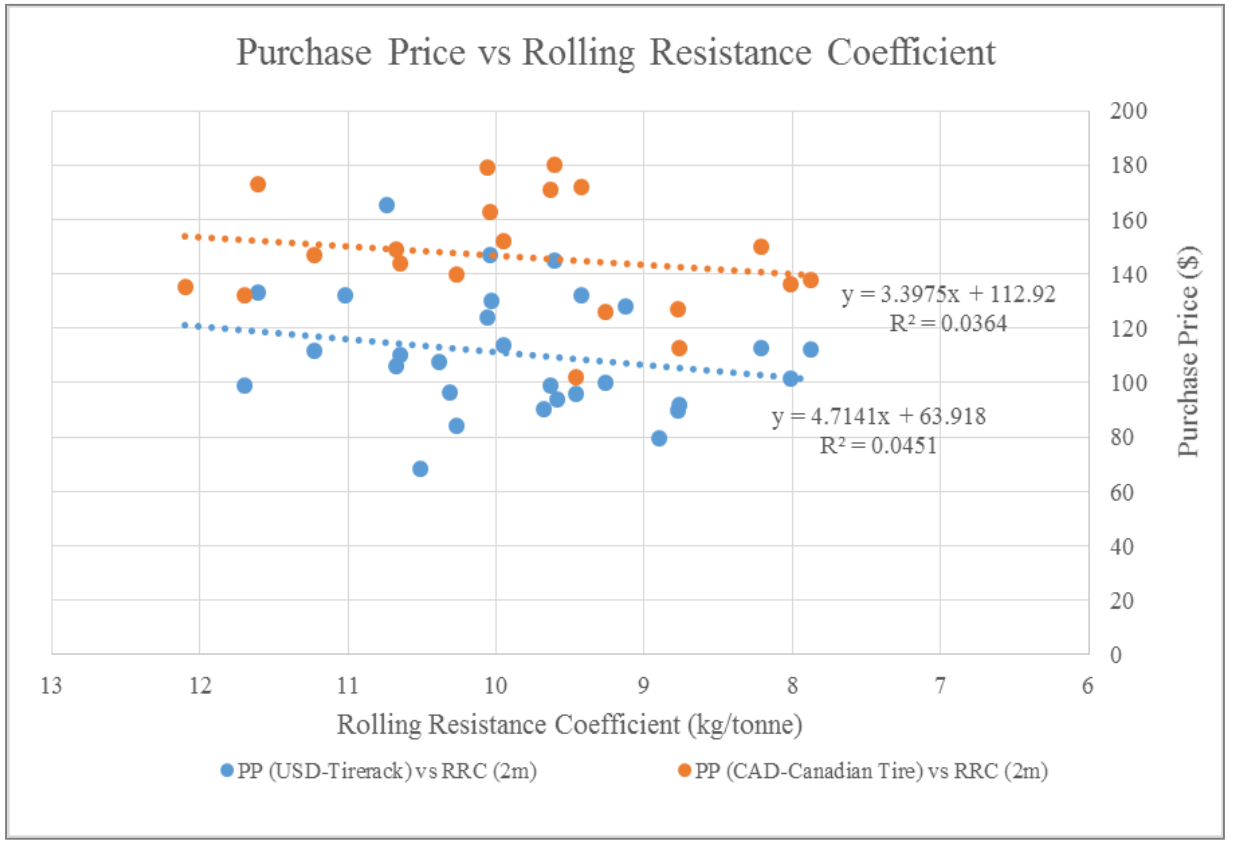


Figure 8. Purchase Price vs Rolling Resistance Coefficient (All-Season Tire Sample - 29 USD, 20 CAD tires – P205/55R16)

- Purchase price showed no relationship with RRC in USD & CAD

ALL-SEASON TIRE TESTING I - PURCHASE PRICE

CAD
AVG $: 146.44
MAX $: 179.99
MIN $: 101.99

US
AVG $: 110.33
MAX $: 165.25
MIN $: 68.15

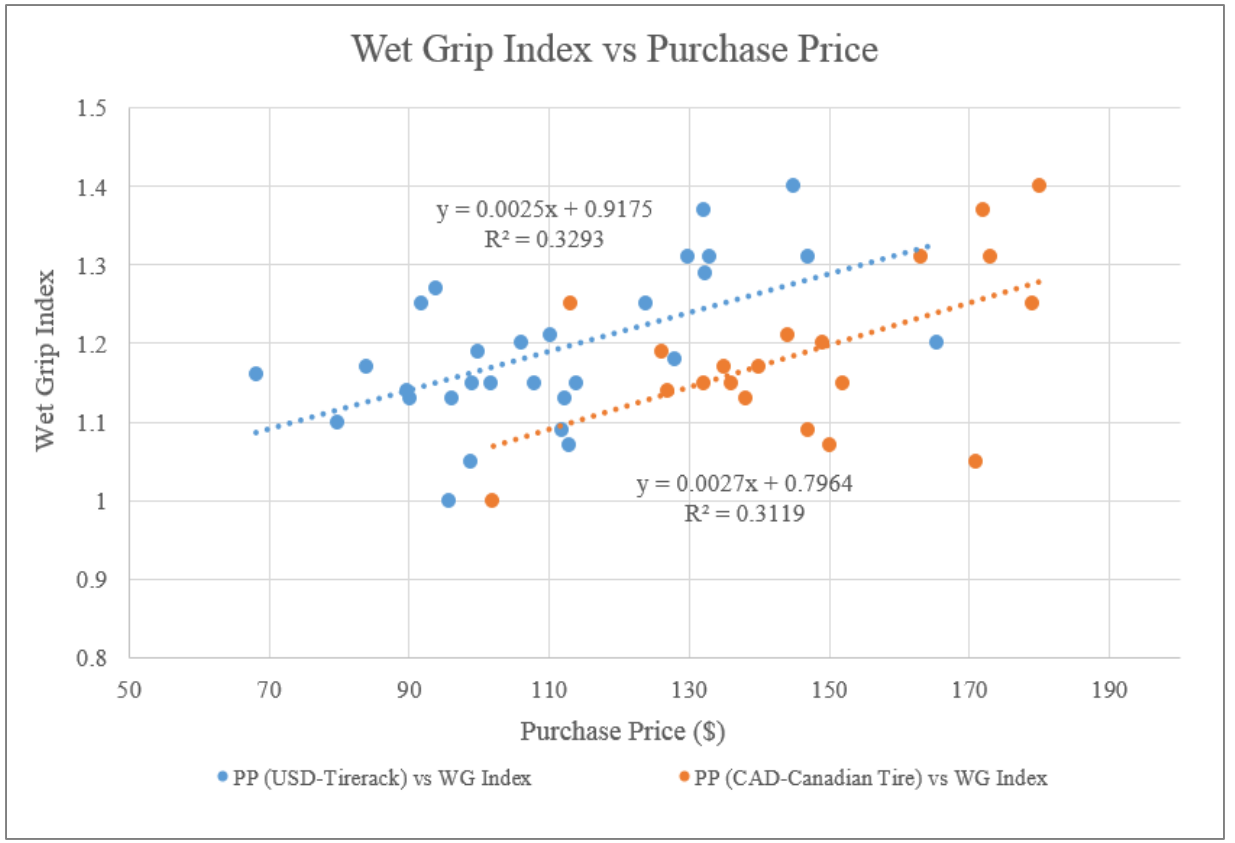


Figure 9. Wet Grip Index vs Purchase Price (All-Season Tire Sample - 29 USD, 20 CAD tires priced – P205/55R16)

- WGI showed a weak correlation with purchase price (R^2 ~ 0.32)

ALL-SEASON TIRE TESTING I - EU BINNING

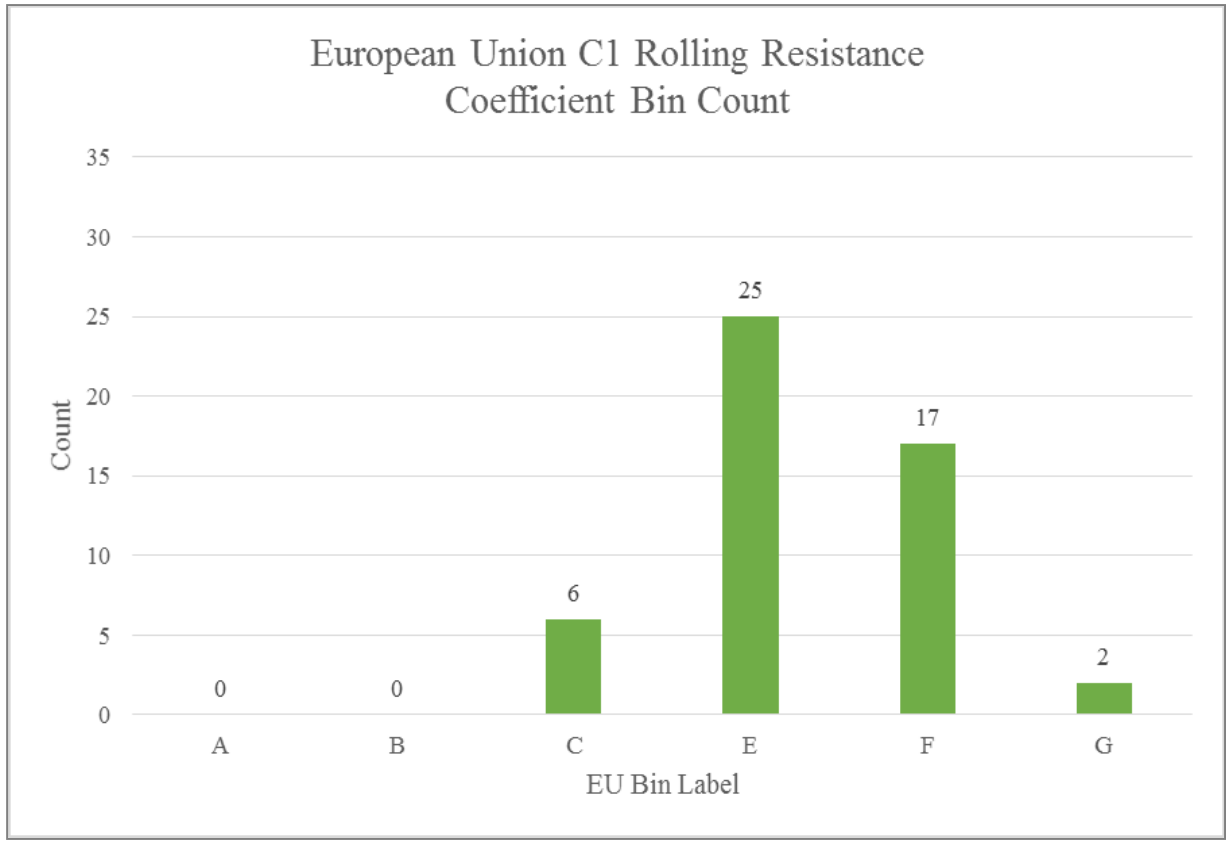


Figure 10. European Union C1 Rolling Resistance Coefficient Bin Count (All-Season Tire Sample - 50 tires tested – P205/55R16)

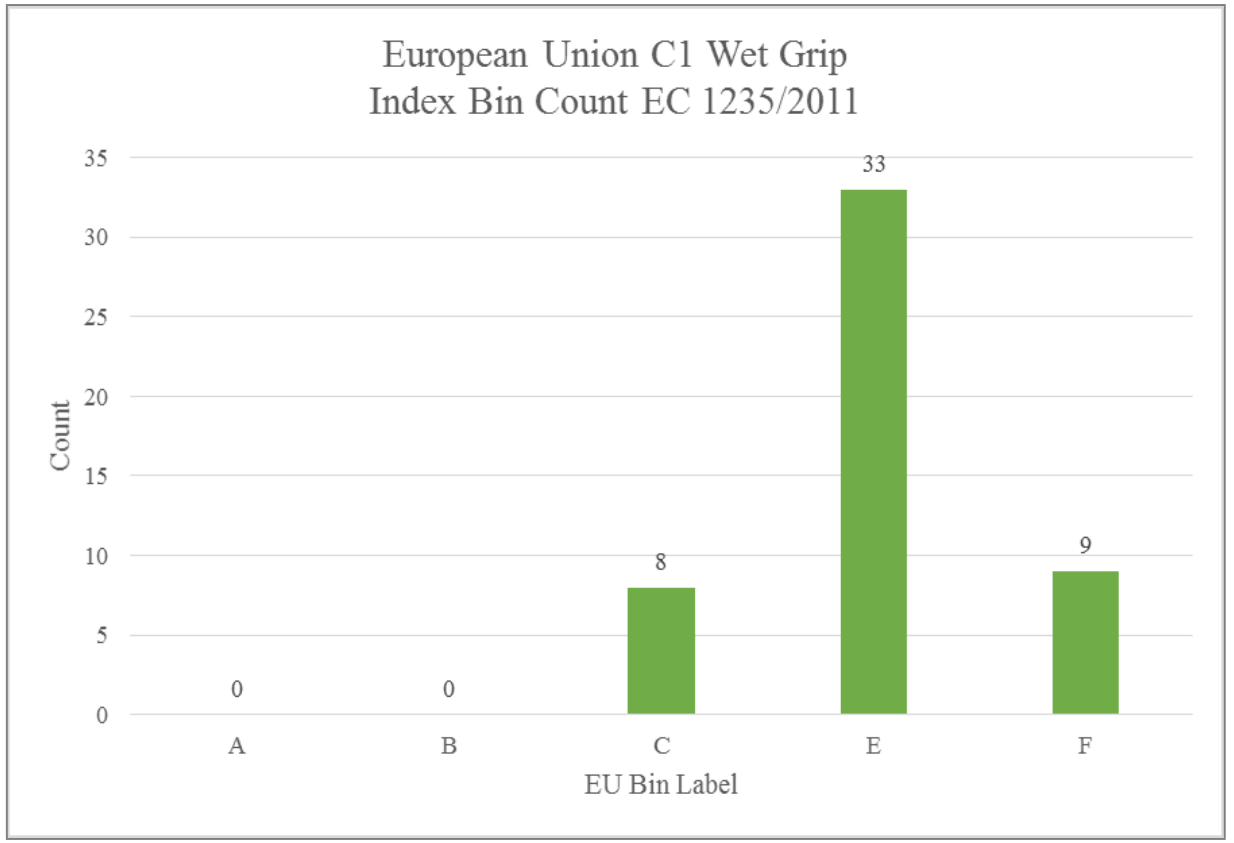


Figure 11. European Union C1 Wet Grip Index Bin Count (All-Season Tire Sample - 50 tires tested – P205/55R16)

- 25 tire models rated as an “E” for rolling resistance, RRC values binned towards mid/lower end of EU label
- 33 tire models rates as an “E” for wet grip, WGI values binned towards the lower end of the EU label

ALL-SEASON TIRE TESTING PART II (ASSORTED SIZES) – WET GRIP INDEX AND ROLLING RESISTANCE

AVG RR: 9.72
MAX RR: 12.10
MIN RR: 7.48

AVG WGI: 1.20
MAX WGI: 1.44
MIN WGI: 1.04

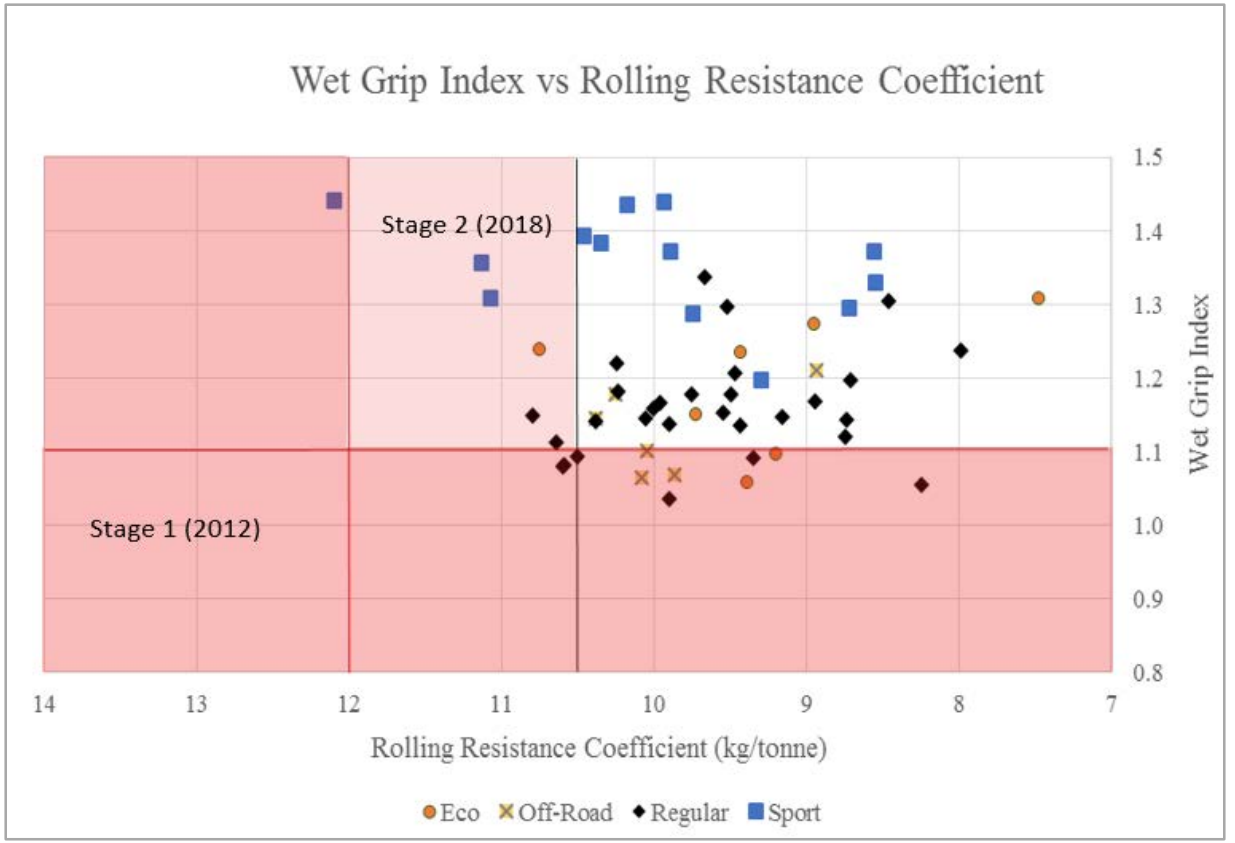


Figure 12. Wet Grip Index vs Rolling Resistance Coefficient (All-Season Tire Sample – 7 Eco, 29 REG, 6 OFF-ROAD, 13 SPORT – Assorted Sizes)

- RRC showed a minimal relationship with WGI ($R^2 = 0.0044$)
- A subset of all-season tires failed to meet the EU Stage 1 RRC and WGI minimum standards

ALL-SEASON TIRE TESTING PART II – PURCHASE PRICE

CAD
AVG $: 218.80
MAX $: 331.99
MIN $: 107.99

US
AVG $: 160.31
MAX $: 270.20
MIN $: 72.66

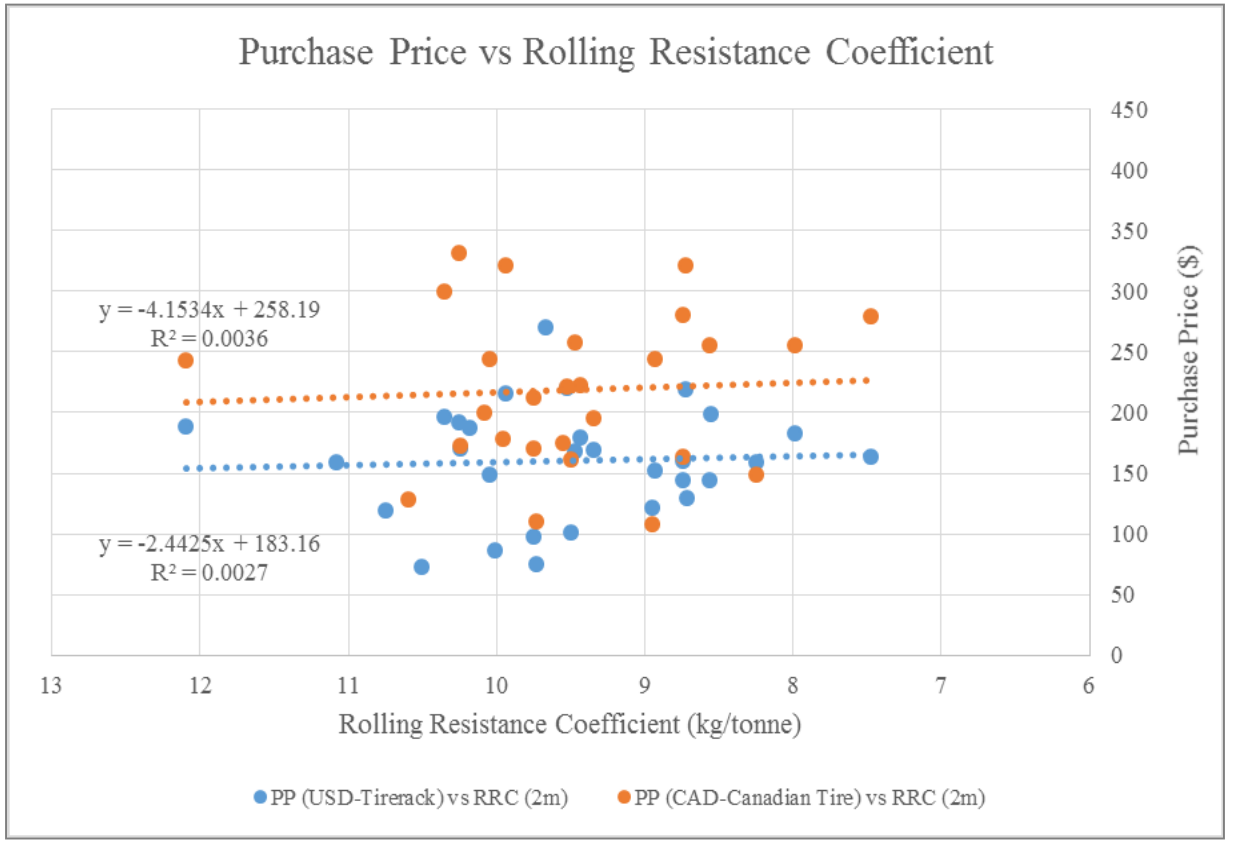


Figure 13. Purchase Price vs Rolling Resistance Coefficient (All-Season Tire Sample - 30 USD, 27 CAD tires priced – Assorted Sizes)

- WGI showed a small correlation with purchase price (R^2 ~ 0.23)

ALL-SEASON TIRE TESTING PART II – PURCHASE PRICE

CAD
AVG $: 218.80
MAX $: 331.99
MIN $: 107.99

US
AVG $: 160.31
MAX $: 270.20
MIN $: 72.66

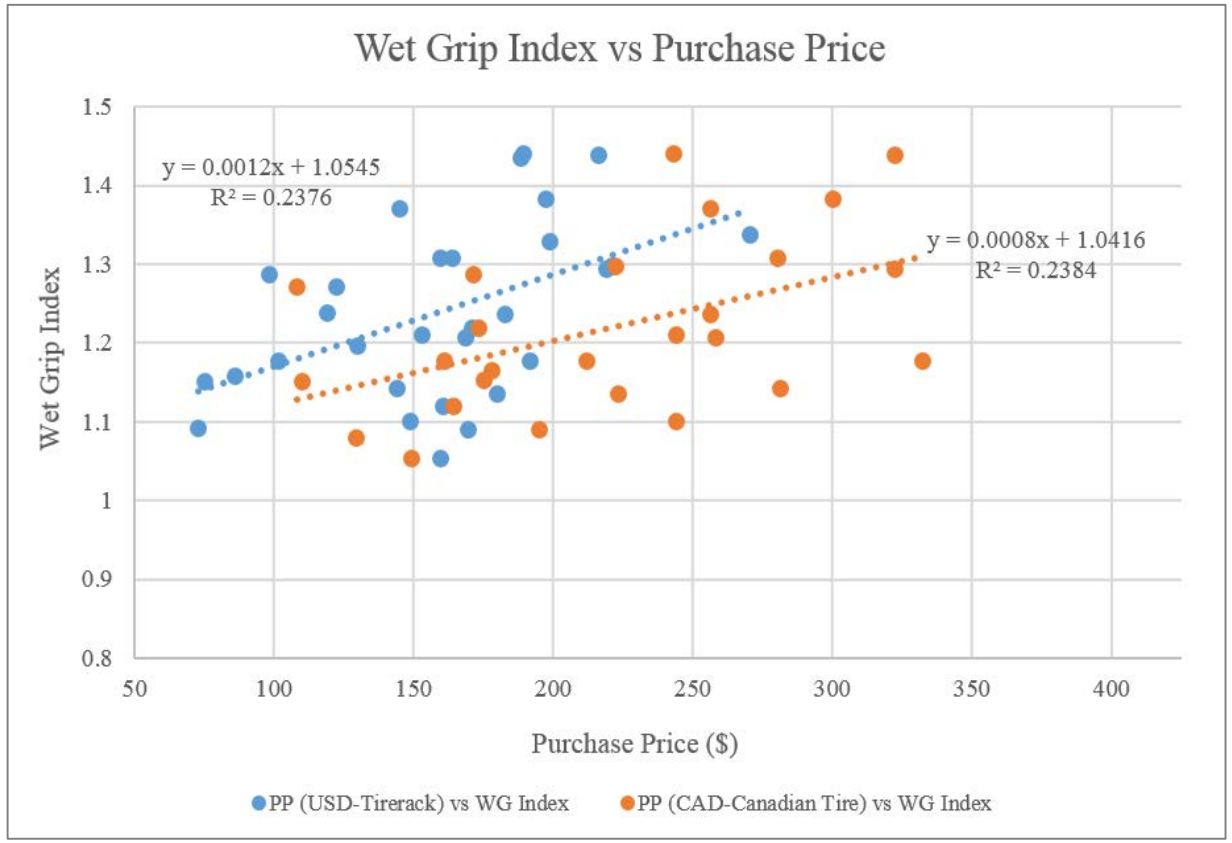


Figure 14. Wet Grip Index vs Purchase Price (All-Season Tire Sample - 30 USD, 27 CAD tires priced – Assorted Sizes)

- WGI showed a small correlation with purchase price (R^2 ~ 0.23)

ALL-SEASON TIRE TESTING PART II – EU BINNING

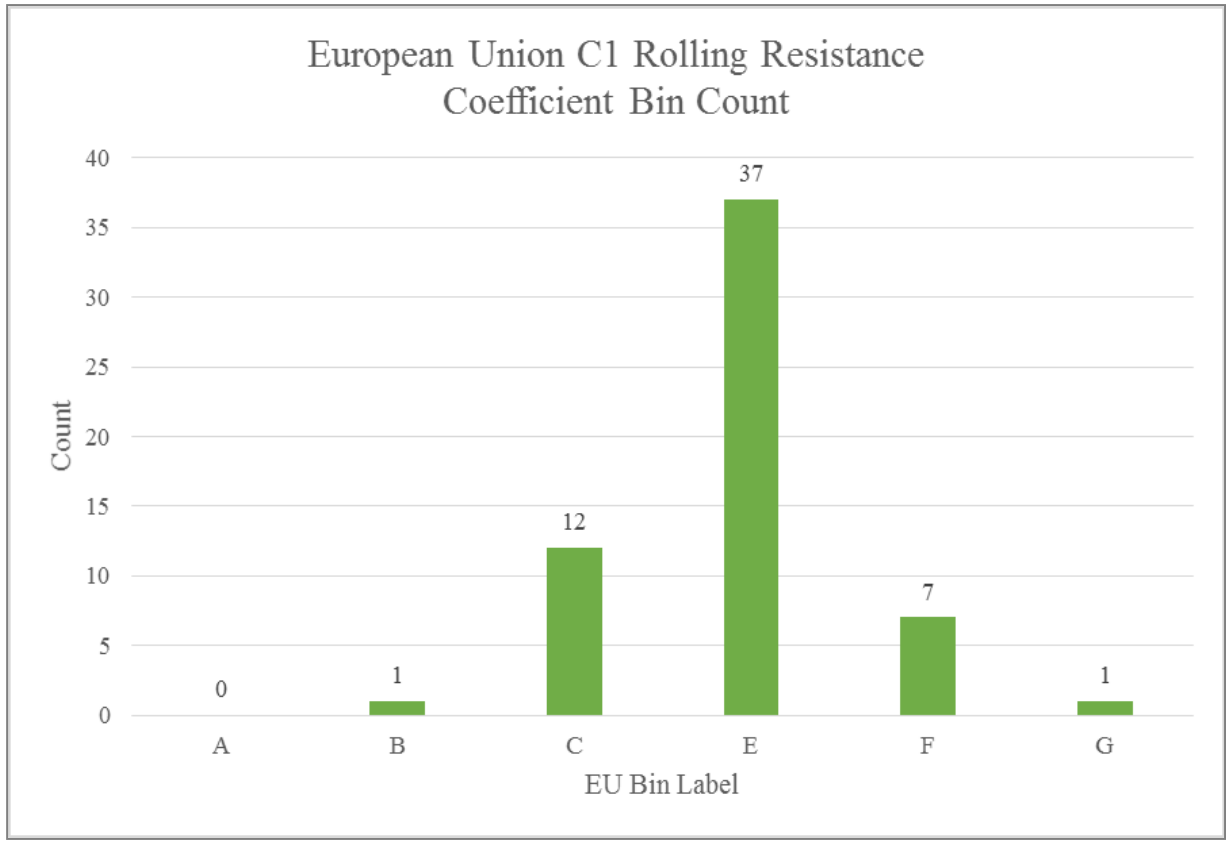


Figure 15. European Union C1 Rolling Resistance Coefficient Bin Count (All-Season Tire Sample - 58 tires tested – Assorted Sizes)

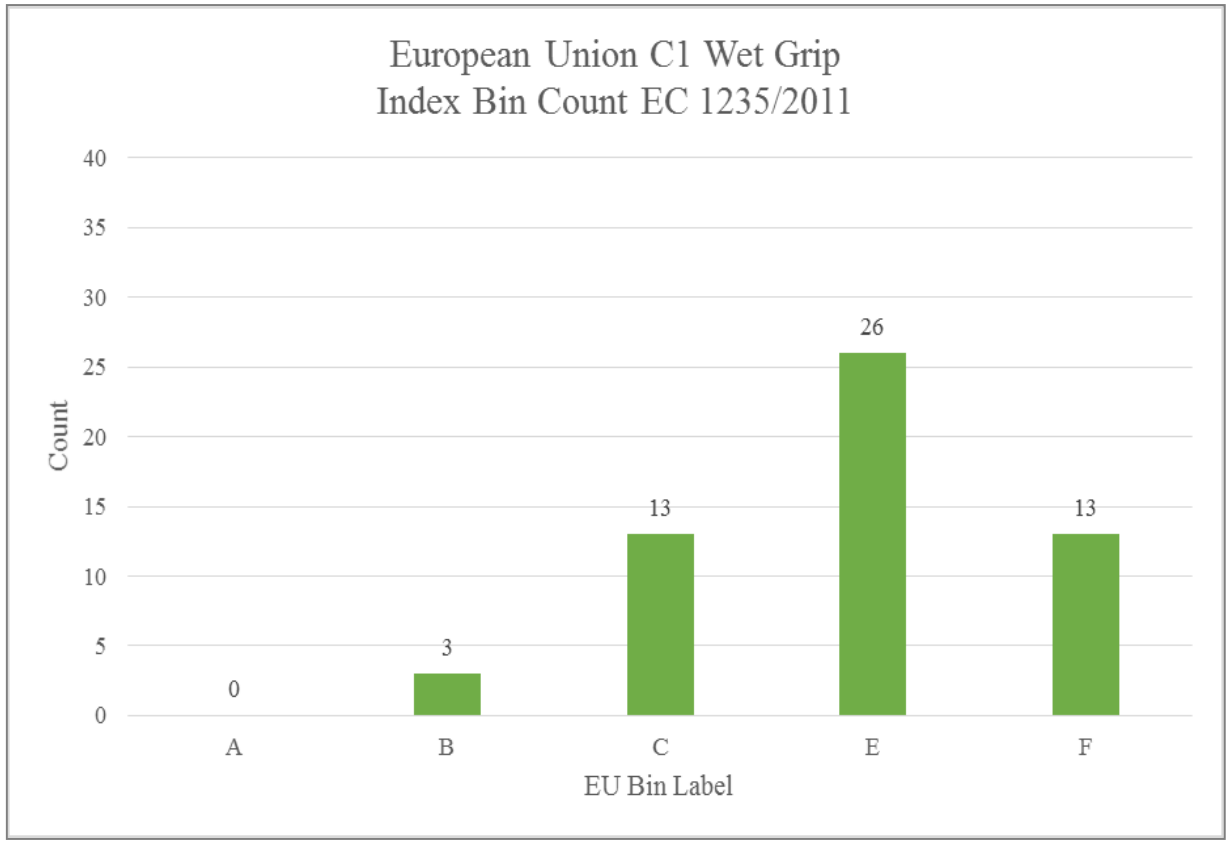


Figure 16. European Union C1 Wet Grip Index Bin Count (All-Season Tire Sample - 55 tires tested – Assorted Sizes)

- RRC values binned towards the mid/lower end of the EU label
- WGI values binned towards the lower end of the EU label

CONCLUSIONS

- For the sample of all-season tires, no correlation was observed between rolling resistance and wet grip ($0.004 < = R^2 <= 0.065$).
- For the sample of studless winter tires, a weak negative correlation was observed between rolling resistance and wet grip ($R^2 = 0.188$), and a weak positive correlation between rolling resistance and snow traction ($0.156 <= R^2 <= 0.177$).
- When categorized according to the tire labeling standards from EC 1222/2009 & amendment 1235/2011, sample populations trended towards the lower ends of the performance bins for both rolling resistance and wet grip.

THANK YOU & ACKNOWLEDGEMENTS

Thank you.

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