Report to:

The National Highway Traffic Safety Administration

Standard Reference Test Tire (SRTT) Correlation Validation Study

ASTM E1136 vs. ASTM F2493

Using ASTM E1337 Peak Braking Coefficient (PBC) Test

Conducted by:
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May 2020
TRC Inc. Project Number: 190321

Final Report Prepared for:
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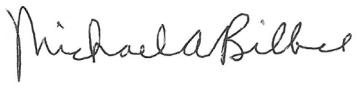
Report Prepared by:



Date: 5/7/2020

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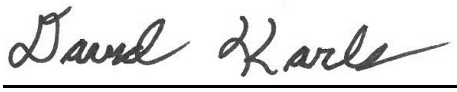

Date: 5/18/2020

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1.0 INTRODUCTION

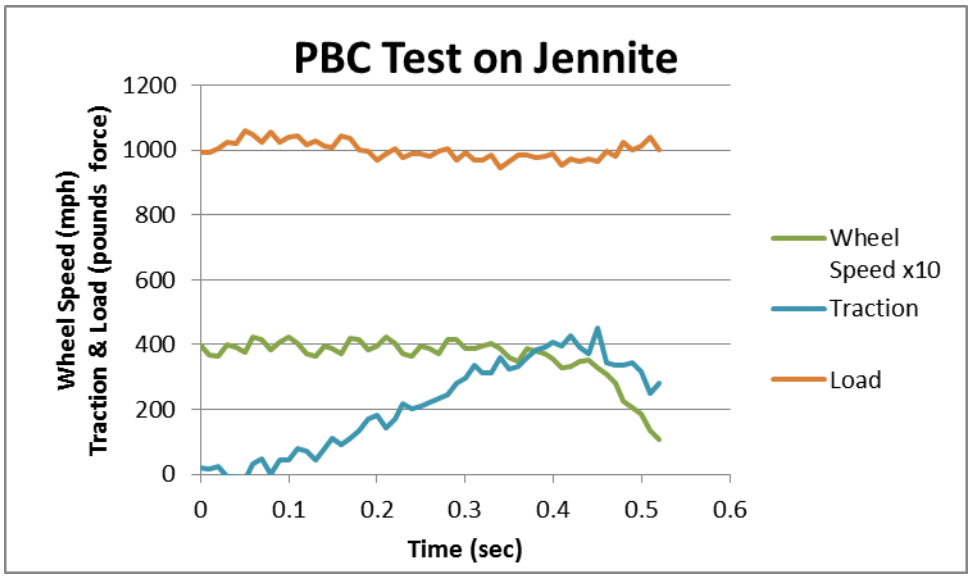
The National Highway Traffic Safety Administration (NHTSA) is an agency of the U.S. Department of Transportation (DOT). NHTSA is responsible for the Federal Motor Vehicle Safety Standards (FMVSSs) that are used to test vehicles for compliance to the requirements of the standards. Many of the FMVSSs refer to ASTM E1337, "Determining Longitudinal Peak Braking Coefficient (PBC) of Paved Surfaces Using Standard Reference Test Tire." By using this test standard, the tester can confirm the surface friction level is compliant with the requirements set forth in the particular FMVSS. The Standard Reference Test Tire (SRTT) that has been used since the inception of the standard has been the ASTM E1136, P195/75R14 radial made by Michelin and branded as a Uniroyal Tiger Paw. The raw material used to manufacture the tire has become increasingly difficult for Michelin to source over the years, as well as this is the only 14" SRTT tire that Michelin still produces. Michelin announced in 2015 to the government and industry that they would cease manufacturing the E1136 SRTT and recommended substituting with the ASTM F2493, P225/60R16 radial, also manufactured by Michelin and branded as a Uniroyal Tiger Paw as the replacement.

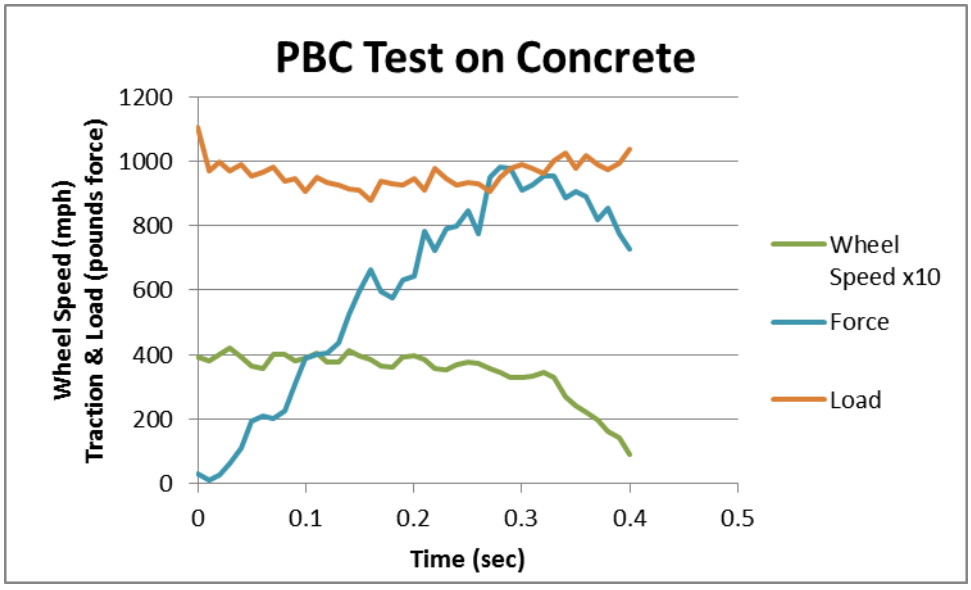
The ASTM E17.21 subcommittee has been addressing this issue since the announcement was made by testing the two tire models on various surfaces to gain an understanding of the correlation between the two tires. The ASTM E1337 standard was updated in 2019 to include the ASTM F2493 SRTT and offers a correlation equation to use for comparing test data collected with the 16" tire with the standards based on the older 14" tire. There is also a correlation equation for updating the standards based on the older 14" tire to be used with the newer 16" tire. Although the study completed in support of the ASTM subcommittee was performed on several surfaces and included other data supplied by NHTSA from their testing, NHTSA initiated a separate validation test with a larger sample size of tires.

NHTSA approached Transportation Research Center Inc. (TRC Inc.) to consult on this study due to two main factors; the TRC Inc. ASTM E274 Locked Wheel Friction Tester (LWFT) was used on the previous study, and the TRC Inc. holds contracts with NHTSA's Office of Vehicle Safety Compliance (OVSC) and thus uses several of the surfaces at the facility to perform compliance testing on new vehicles. These surfaces were included in the validation study for the two tires.

TRC Inc. ASTM E274 Locked Wheel Friction Tester on Ceramic Tile Course

The left wheel of the LWFT has a 2 channel load cell transducer that measures the horizontal traction force induced by the wheel locking, and the vertical load created by the normal force. The ASTM E1337 standard specifies that the PBC value is calculated by determining the maximum value achieved on the Traction (horizontal) channel and dividing by the corresponding Load (vertical) channel value. To assist in data management, this value is traditionally multiplied by 100 and referred to as the Peak Value. Thus, a calculated value of 0.456 would be referred to as a PBC value of 45.6. Here are typical graphs showing the Traction force and Load force versus time:

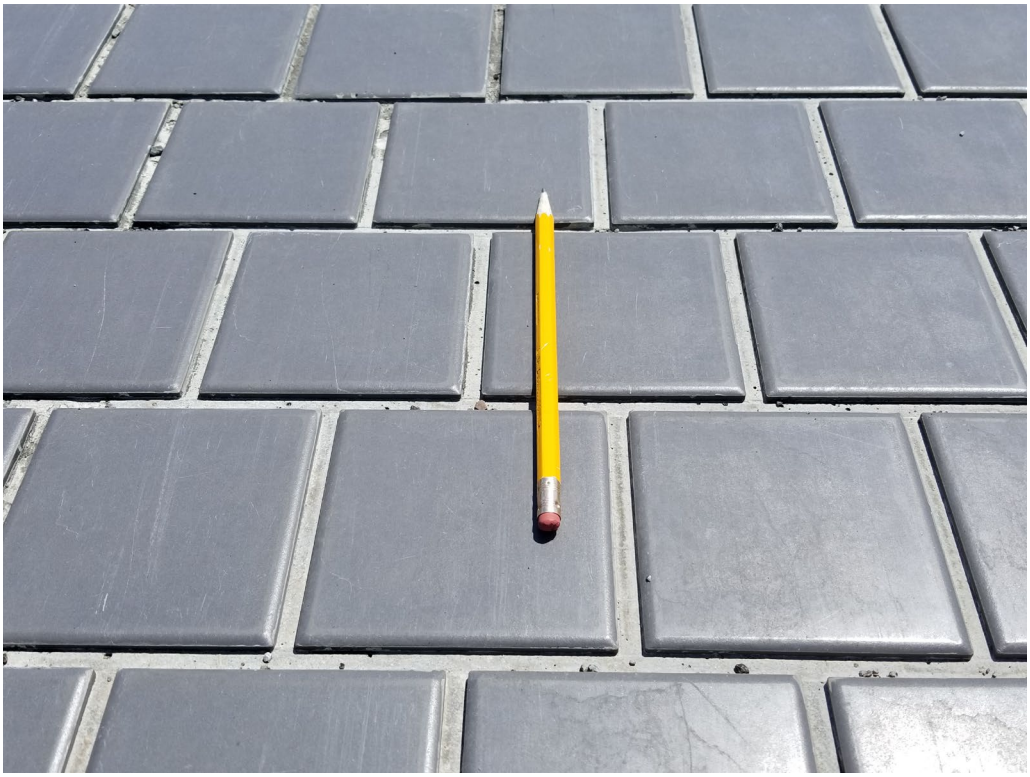




2.0 APPROACH

NHTSA determined the most effective approach was to test ten of each of the two tire models, 3 times total. Each time, the tire would be tested 10 times on each of 5 different surfaces. This would yield a total of 3,000 data points. Each SRTT would be assigned a number and the order would be maintained. Also, only two tires of one size would be tested before switching to the other tire size to assure any trends caused by outside factors would be captured. The 5 surfaces selected allowed a wide range in PBC values to be collected. The test surfaces are as follows:

The Ceramic Tile Course was selected for its very low coefficient characteristics. It was tested wet using the water supplied by the LWFT.



Ceramic Tile Close-up

Ceramic Tile Course

The Jennite Course was selected for its low coefficient characteristics. This type of surface is used for ABS performance sections of FMVSS test procedures. It was tested wet using the water supplied by the LWFT.

Jennite Surface Close-up

Jennite Course

An untreated Asphalt surface was used as part of the study. It was tested both wet and dry. The testing for wet and dry was performed on separate sections of the same test pad.

Dry Asphalt Close-up

Dry Asphalt Pad

Wet Asphalt Close-up

Wet Asphalt Pad

The Broomed Concrete surface on the Skid Pad was selected as it is used for the high coefficient compliance brake testing to assure compliance to stopping distance requirements. It was only tested dry.

Broomed Concrete Close-up

Broomed Concrete Surface

Each tire was mounted on an appropriate rim and the initial tread depth was measured prior to testing. Tire preconditioning was accomplished per the E1337 test standard by performing 10 “chirps” at 20 mph on a dry asphalt surface. The test weight of the E1136 tires was set to 1031 pounds, and the F2493 test weight was set to 1180 pounds.

SRTT 14-1 was tested 10 times on all 5 test surfaces. Then the sequence was continued as 14-2, 16-1, 16-2, 14-3, 14-4, 16-3, 16-4, etc. until all 20 SRTTs had been tested once and then the sequence was repeated two more times.

It should be noted that the ASTM E1337 standard requires the peak horizontal force to occur between 0.3 and 0.5 seconds after the wheel speed starts to decrease. The TRC Inc. LWFT is equipped with air flow control to adjust the rate of brake apply to accomplish this on all surfaces. It was found that the larger tire would not reach the peak in less than 0.5 seconds without increasing the air flow to accommodate.

Once all testing had been completed, the tread depth measurements were repeated so treadwear could be analyzed.

3.0 DATA ANALYSIS

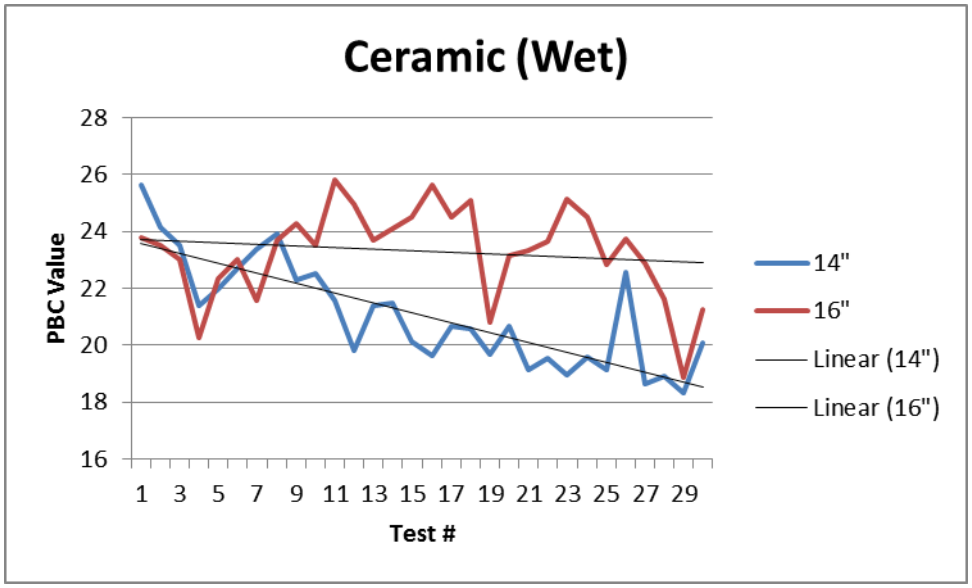
3.1 Tread depth was measured at the start and at the end of the test. Initial tread depth was very consistent across all the tires. The 14" tires all measured 12/32" initially, and the 16" tires all measured 10/32" initially. A typical tire depth gage was used that measures in 32nds of an inch. The measurements for each tire is the average of 16 readings.

Tread Wear			
SRTT 14" tire No.	Inch (32nds)	SRTT 16" tire No.	Inch (32nds)
14 – 1	1.06	16 – 1	1.19
14 – 2	1.31	16 – 2	2.13
14 – 3	0.88	16 – 3	1.56
14 – 4	2.00	16 – 4	1.88
14 – 5	.088	16 – 5	1.75
14 – 6	0.88	16 – 6	1.50
14 – 7	1.25	16 – 7	0.81
14 – 8	0.75	16 – 8	2.88
14 – 9	1.19	16 – 9	2.56
14 – 10	1.13	16 – 10	2.81
Average	1.13	Average	1.91
Minimum	0.75	Minimum	0.81
Maximum	2.00	Maximum	2.88

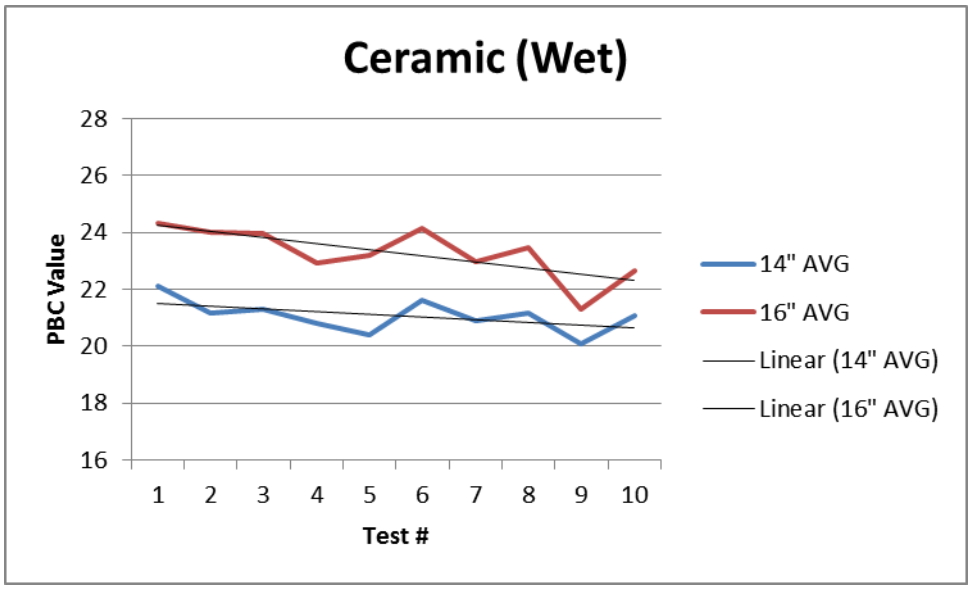
On average, the 16" SRTT appears to have a higher wear rate when exposed to the same quantity of testing as the 14" SRTT.

3.2 Following are summaries of the data collected from each tire on each test surface. The first graph of each set shows the 10-point averages from each time the tire was tested, resulting in 30 data points per tire model. The second graph of each set shows the average of the three separate tests for each tire resulting in 10 data points per tire model, and tends to reduce the highs and lows in the original data.

3.2.1 Wet Ceramic Tile

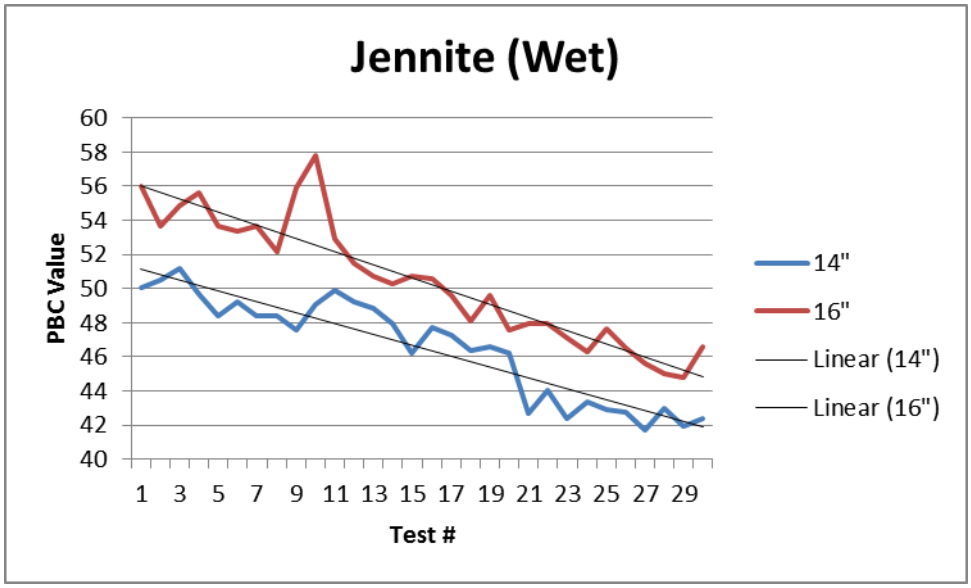


Both tires show a trend that indicates the Ceramic tile polished over the course of the testing; however, the trend line for the 16" tire is nearly flat compared to the trend line for the 14" tire. The initial testing would have given the impression that the tires were measuring nearly the same values; however, extended testing shows the true trend of each tire.

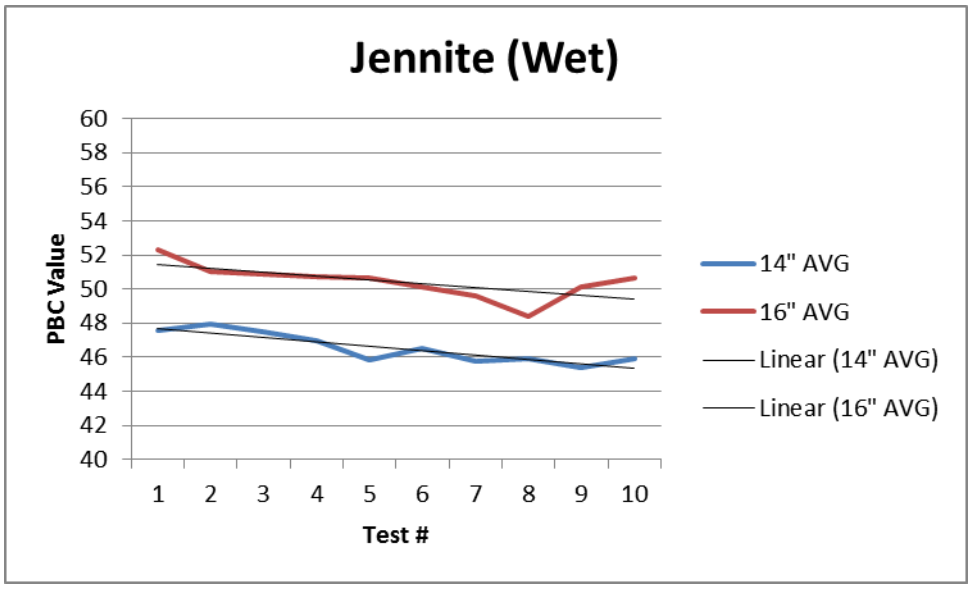


When the data is averaged together for each tire tested, the trend lines for each tire model are parallel.

3.2.2 Wet Jennite

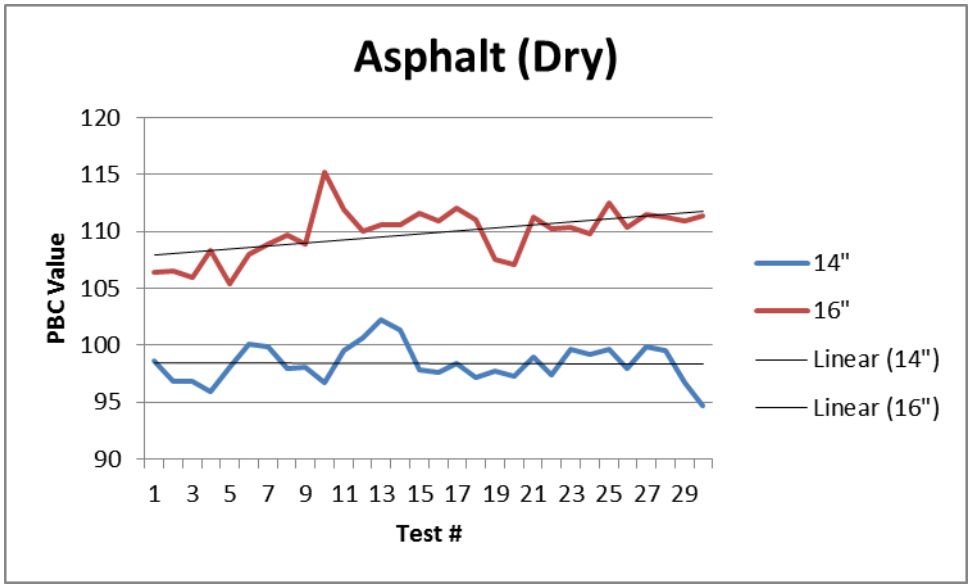


Both tires show a trend that indicates the Jennite surface polished over the course of the testing, and both tires responded similarly. The trend lines are nearly parallel.

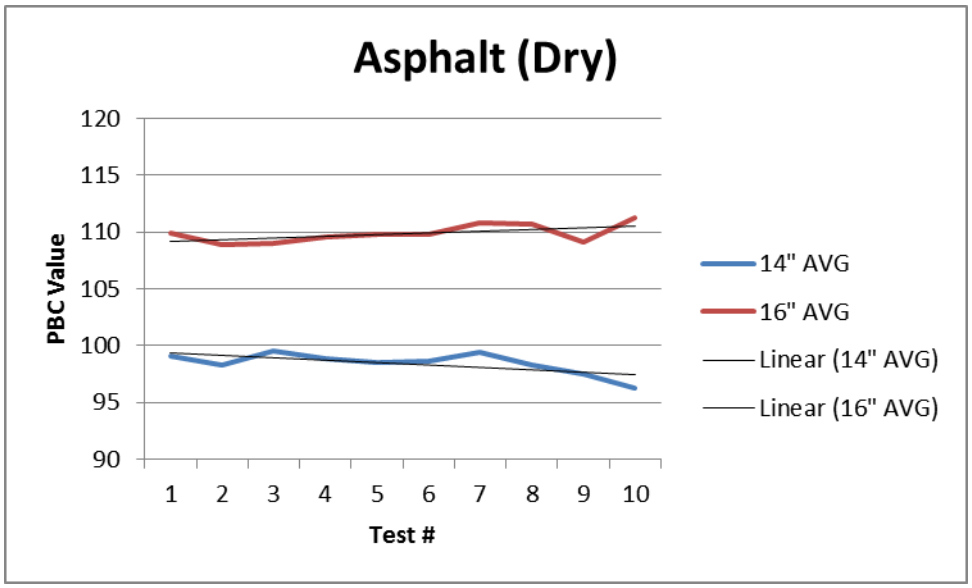


Again the trend lines are parallel with the tire data points averaged.

3.2.3 Dry Asphalt

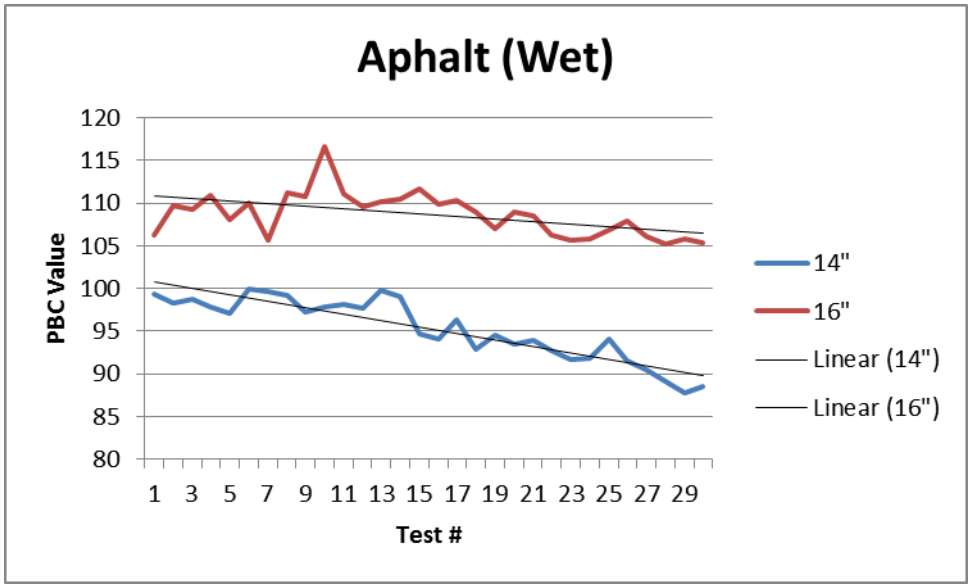


The response on the Dry Asphalt showed the 14” tire to have no change over time, whereas the 16” tire shows an increase in value over time.

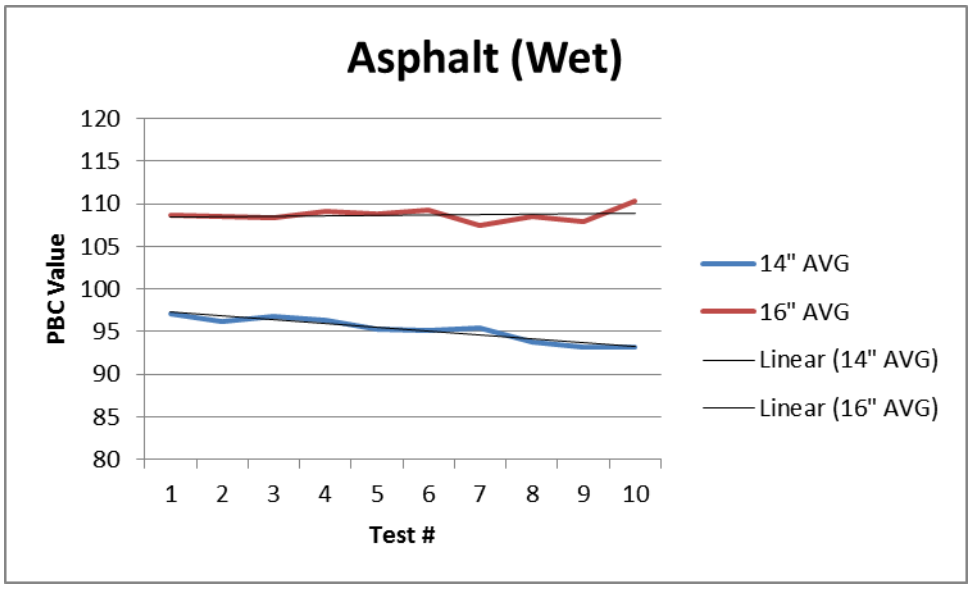


When the tire data is averaged per tire tested, it shows a slight increasing trend over time for the 16” tire model and a slight decreasing trend for the 14” tire model.

3.2.4 Wet Asphalt

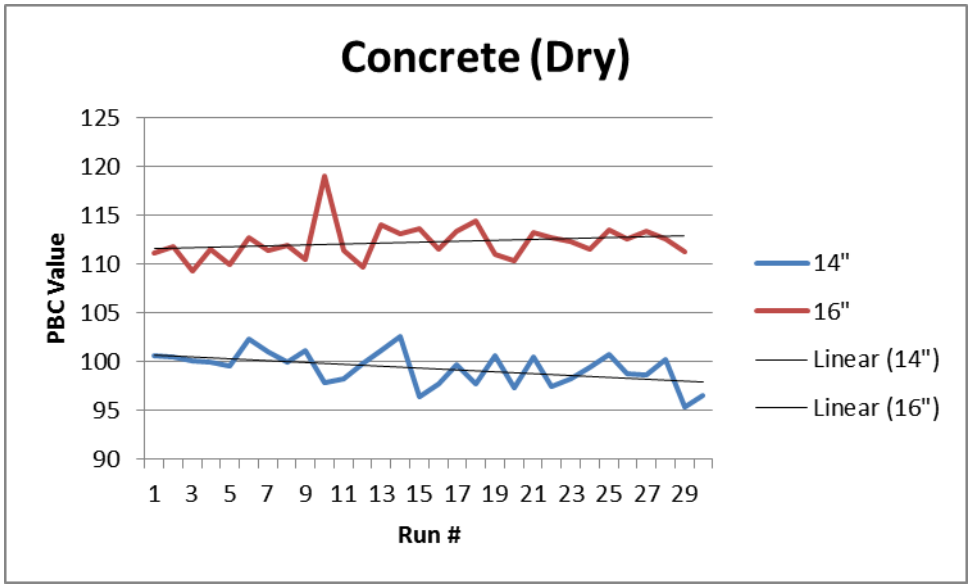


Both tires show a trend that indicates the water aided in the polishing of the aggregate in the Asphalt over the course of the testing, and both tires responded similarly.

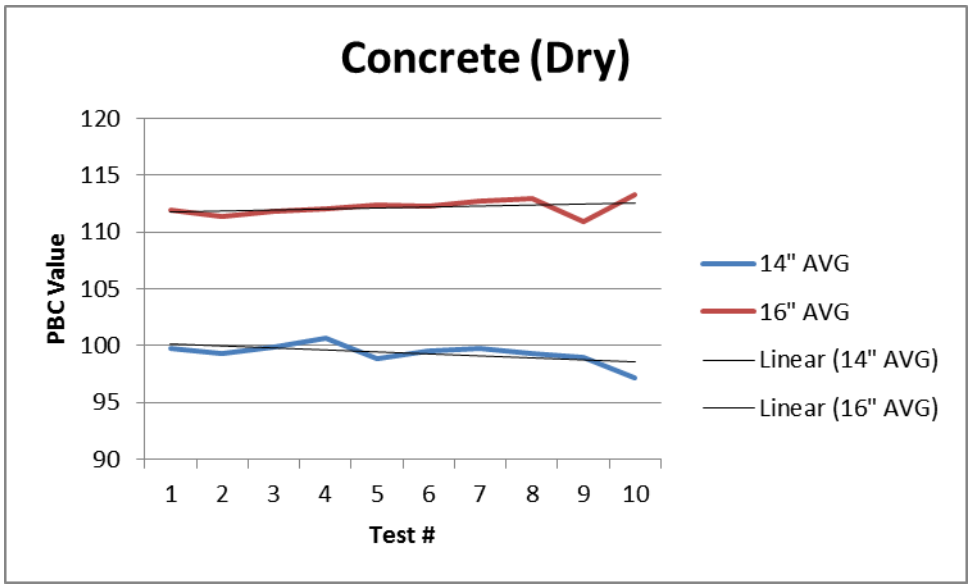


The averaged data shows the 16” tire model to have a relatively flat response while the 14” tire model has a decreasing trend.

3.2.5 Dry Broomed Concrete



On the Broomed Concrete surface, the two tires trended to have more difference as the testing progressed, with the trend line for the 14” tire decreasing, and the trend line for the 16” tire increasing.



The response remained the same with the averaged data as with the individual runs above.

4.0 SUMMARY EVALUATION

As stated in the Introduction, the purpose of this study was to validate the correlation equations published in the ASTM E1337-19 referenced in many Federal Motor Vehicle Safety Standards for test surface requirements. The correlation equation published in the 2019 version of the standard to convert data collected with the F2493 16" SRTT to compare with an original specification for an E1136 14" SRTT is (F2493 value x 0.83) + 5.18 = E1136 value. The following table uses data from this study to validate the above equation.

	Actual 16"	Calculated 14"	Actual 14"	% Error
Wet Ceramic	23.3	24.5	21.1	-16.4%
Wet Jennite	50.5	47.1	46.5	-1.1%
Dry Asphalt	109.9	96.4	98.4	2.1%
Wet Asphalt	108.7	95.4	95.2	-0.2%
Dry Concrete	112.2	98.3	99.3	1.1%

Likewise, the correlation equation published in the 2019 version of the standard to convert an original specification for an E1136 14" SRTT to data collected with the F2493 16" SRTT is (E1136 value x 1.17) – 3.60 = F2493 value. The following table uses data from this study to validate the above equation.

	Actual 14"	Calculated 16"	Actual 16"	% Error
Wet Ceramic	21.1	21.1	23.3	9.7%
Wet Jennite	46.5	50.8	50.5	-0.8%
Dry Asphalt	98.4	111.6	109.9	-1.5%
Wet Asphalt	95.2	107.8	108.7	0.8%
Dry Concrete	99.3	112.6	112.2	-0.4%

It can be seen by these tables that the correlation equations work quite well for the Jennite, Asphalt (both dry and wet), and the Concrete. We have learned that the two SRTT models responded differently to the polishing of the ceramic tile course over time and thus the equation did not do as well at predicting the corresponding values for this surface. However, the values recorded on this surface are quite low for a PBC test result and thus a small change in the value results in a larger percent error. It also should be noted the ceramic tile course at TRC Inc. is not currently used for any

compliance test and thus is of less importance than the other surfaces in this study. Based on the results from the other test surfaces, the correlation equations established in the ASTM E1337-19, “Determining Longitudinal Peak Braking Coefficient (PBC) of Paved Surfaces Using Standard Reference Test Tire,” appear to be valid for those test surfaces.

An analysis of the impact this new data would have on the correlation equations already established shows very minor effect. The following tables show the same data using a new equation established by including the data from this study.

	Actual 16”	Calculated 14”	Actual 14”	% Error
Wet Ceramic	23.3	23.7	21.1	-12.7%
Wet Jennite	50.5	46.8	46.5	-0.6%
Dry Asphalt	109.9	97.3	98.4	1.1%
Wet Asphalt	108.7	96.3	95.2	-1.1%
Dry Concrete	112.2	99.3	99.3	0.0%

	Actual 14”	Calculated 16”	Actual 16”	% Error
Wet Ceramic	21.1	21.5	23.3	7.6%
Wet Jennite	46.5	51.1	50.5	-1.2%
Dry Asphalt	98.4	111.3	109.9	-1.3%
Wet Asphalt	95.2	107.6	108.7	1.0%
Dry Concrete	99.3	112.3	112.2	-0.1%

A comparison of the Percent Error from each set of tables shows the actual change for each tire and surface. The following table shows the percent error for the calculated 14" values using the current correlation equation and the calculations based on a new equation:

Calculated 14" Tire	Current Correlation Equation % Error	New Correlation Equation % Error	Change in % Error
Wet Ceramic	-16.4%	-12.7%	3.7%
Wet Jennite	-1.1%	-0.6%	0.5%
Dry Asphalt	2.1%	1.1%	1.0%
Wet Asphalt	-0.2%	-1.1%	-0.9%
Dry Concrete	1.1%	0.0%	1.1%

The following table shows the percent error for the calculated 16" values using the current correlation equation and the calculations based on a new equation:

Calculated 16" Tire	Current Correlation Equation % Error	New Correlation Equation % Error	Change in % Error
Wet Ceramic	9.7%	7.6%	2.1%
Wet Jennite	-0.8%	-1.2%	-0.3%
Dry Asphalt	-1.5%	-1.3%	0.2%
Wet Asphalt	0.8%	1.0%	-0.2%
Dry Concrete	-0.4%	-0.1%	0.3%

In both tables the change in percent error is shown. Excluding the Wet Ceramic values, the remaining 4 surfaces have an overall average change of only 0.2%, thus not warranting a change to the correlation equations included in the Standard published in 2019.

Appendix A

ASTM E1136 SRTT (14”)

The ASTM E1136 SRTT has been the designated test tire since the ASTM E1337 PBC Test was established. The tire identification number for each of the tires was APKA B3UU. Following is a photo of a new E1136 SRTT:

Following are the photos of each E1136 SRTTs after the testing was completed:


14 – 2


14 – 3


14 – 4


14 – 5


14 – 6


14 – 7


14 – 8


14 – 9


14 – 10

The raw data for each tire is as follows:

Tire Size	14
Tire #	1

Tread Depth (32nds of an inch)

Date: 10/29/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	12	12	12	12
Rib 2	12	12	12	12
Rib 3	12	12	12	12
Rib 4	12	12	12	12
Avg	12			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	10/29/19	10/29/19	10/29/19	10/29/19	10/29/19
Ambient (°F)	56	53	56	56	56
Surface (°F)	55	57	56	56	57
1	23.9	50.1	97.8	101.5	103.6
2	28.4	46.6	100.0	100.0	101.4
3	21.3	52.0	99.6	97.6	102.1
4	24.2	50.3	99.7	101.2	100.1
5	21.4	51.2	98.9	99.7	98.3
6	22.1	50.3	98.5	94.1	101.4
7	24.3	48.4	100.7	97.1	103.6
8	28.9	48.4	96.9	99.7	96.3
9	23.8	51.5	100.0	99.8	100.6
10	38.3	51.9	94.8	102.2	98.1
Avg.	25.7	50.1	98.7	99.3	100.6
Std Dev	5.14	1.77	1.78	2.42	2.40

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/8/20	4/8/20	4/8/20	4/8/20	4/8/20
Ambient (°F)	69	65	67	68	69
Surface (°F)	83	96	95	95	90
1	22.5	49.9	102.6	96.6	98.9
2	22.3	49.8	98.6	100.0	96.3
3	24.4	49.2	98.8	95.3	95.9
4	20.0	51.9	97.4	95.1	100.1
5	21.5	49.7	98.1	100.9	97.9
6	20.0	48.0	101.7	97.9	101.5
7	21.4	50.2	100.3	99.2	99.6
8	21.2	49.3	98.1	99.2	97.9
9	22.4	52.2	98.3	98.6	98.2
10	20.3	49.1	101.6	98.0	96.4
Avg.	21.6	49.9	99.6	98.1	98.3
Std Dev	1.37	1.27	1.84	1.92	1.80

Tire Size	14
Tire #	1

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/18/20	4/18/20	4/18/20	4/18/20	4/18/20
Ambient (°F)	41	41	41	41	42
Surface (°F)	55	64	63	63	63
1	20.0	44.0	99.0	91.9	98.7
2	18.8	42.1	97.9	97.7	102.8
3	20.4	41.2	100.5	96.1	100.2
4	17.6	43.5	99.5	91.2	101.0
5	20.8	42.2	99.4	97.4	99.0
6	16.6	45.3	99.7	95.9	99.8
7	20.6	41.5	98.8	91.4	101.9
8	17.3	43.0	97.5	96.4	105.0
9	21.4	40.7	98.9	90.9	96.2
10	18.0	43.6	98.6	89.9	100.2
Avg.	19.2	42.7	99.0	93.9	100.5
Std Dev	1.70	1.43	0.87	3.06	2.41

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	22.1	47.6	99.1	97.1	99.8
Std Dev	4.14	3.78	1.55	3.38	2.40

Tread Depth (32nds of an inch)

Date: 4/23/20 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	11	11	11	11
Rib 2	12	11	11	11
Rib 3	11	11	9	11
Rib 4	11	11	11	11
Avg	10.9375			

Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	1	1	1	1
Rib 2	0	1	1	1
Rib 3	1	1	3	1
Rib 4	1	1	1	1
Avg	1.0625			

Tire Size	14
Tire #	2

Tread Depth (32nds of an inch)

Date 10/29/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	12	12	12	12
Rib 2	12	12	12	12
Rib 3	12	12	12	12
Rib 4	12	12	12	12
Avg	12			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	10/29/19	10/29/19	10/29/19	10/29/19	10/29/19
Ambient (°F)	59	57	57	57	58
Surface (°F)	59	62	62	62	67
1	22.5	51.4	94.4	96.2	101.7
2	22.3	49.9	95.9	101.0	107.4
3	20.2	52.4	94.3	96.9	99.1
4	27.8	51.6	96.3	97.7	102.6
5	23.1	49.6	97.5	98.2	101.7
6	35.5	49.3	97.0	96.0	102.0
7	21.5	48.8	98.8	98.9	97.3
8	26.7	49.8	97.2	97.7	97.8
9	21.3	52.3	100.9	97.8	99.2
10	20.7	49.6	96.4	102.4	96.0
Avg.	24.2	50.5	96.9	98.3	100.5
Std Dev	4.70	1.32	1.96	2.03	3.31

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/9/20	4/9/20	4/9/20	4/9/20	4/9/20
Ambient (°F)	48	48	48	48	44
Surface (°F)	44	48	50	50	47
1	21.2	47.1	102.5	97.5	103.2
2	16.8	48.2	100.2	97.4	99.8
3	20.2	49.7	98.5	99.5	96.2
4	19.4	50.0	101.7	95.0	99.4
5	20.7	51.5	104.1	92.4	101.6
6	18.0	50.1	99.0	96.0	101.9
7	23.2	47.4	99.3	97.5	97.5
8	19.5	48.0	99.4	104.2	102.5
9	20.4	49.9	99.3	95.9	100.0
10	18.7	50.2	102.8	102.0	96.6
Avg.	19.8	49.2	100.7	97.7	99.9
Std Dev	1.78	1.44	1.94	3.43	2.48

Tire Size	14
Tire #	2

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/18/20	4/18/20	4/18/20	4/18/20	4/18/20
Ambient (°F)	45	45	45	45	45
Surface (°F)	71	75	65	65	73
1	20.9	44.5	97.3	92.8	94.3
2	19.3	44.7	96.7	88.3	91.5
3	21.6	43.2	98.7	93.4	98.1
4	19.5	44.3	96.5	89.7	92.5
5	20.3	43.4	96.9	89.1	102.2
6	16.4	44.5	101.2	92.0	98.8
7	21.8	44.3	99.1	98.1	97.7
8	19.1	41.1	89.2	95.1	100.7
9	19.0	44.7	96.9	93.7	101.3
10	17.5	45.7	101.3	95.3	97.6
Avg.	19.5	44.0	97.4	92.8	97.5
Std Dev	1.71	1.24	3.39	3.07	3.65

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	21.2	47.9	98.3	96.3	99.3
Std Dev	3.66	3.11	2.98	3.78	3.34

Tread Depth (32nds of an inch)

Date: 4/23/20 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	10	11	11	11
Rib 2	11	11	11	11
Rib 3	8	11	11	9
Rib 4	11	11	11	12
Avg	10.6875			

Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	2	1	1	1
Rib 2	1	1	1	1
Rib 3	4	1	1	3
Rib 4	1	1	1	0
Avg	1.3125			

Tire Size	14
Tire #	3

Tread Depth (32nds of an inch)

Date: 11/4/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	12	12	12	12
Rib 2	12	12	12	12
Rib 3	12	12	12	12
Rib 4	12	12	12	12
Avg	12			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	11/4/19	11/4/19	11/4/19	11/4/19	11/4/19
Ambient (°F)	49	49	49	49	49
Surface (°F)	47	51	50	50	49
1	24.8	48.6	96.1	97.4	99.9
2	26.5	47.4	97.6	102.9	97.3
3	20.3	52.7	93.8	99.3	99.3
4	32.0	54.0	98.3	96.2	103.3
5	21.7	52.5	100.0	100.4	99.9
6	21.0	50.7	92.2	95.4	100.7
7	21.9	49.4	98.8	97.7	100.6
8	25.2	53.0	95.4	98.9	96.1
9	20.3	52.1	97.3	98.6	99.3
10	21.5	51.6	98.4	101.1	104.6
Avg.	23.5	51.2	96.8	98.8	100.1
Std Dev	3.69	2.13	2.42	2.27	2.50

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/10/20	4/10/20	4/10/20	4/10/20	4/10/20
Ambient (°F)	40	40	40	40	40
Surface (°F)	42	47	46	46	44
1	21.8	48.4	107.7	98.0	102.3
2	20.4	47.9	103.6	99.7	100.7
3	23.4	48.8	101.9	100.0	103.2
4	19.8	48.3	104.9	99.3	99.4
5	21.3	49.7	105.2	100.9	102.0
6	18.6	51.0	99.8	98.3	102.6
7	22.2	51.4	103.7	98.1	102.0
8	20.3	44.3	94.7	106.0	101.1
9	22.3	50.0	99.5	97.5	99.5
10	23.7	48.5	102.0	100.7	99.0
Avg.	21.4	48.8	102.3	99.9	101.2
Std Dev	1.62	1.98	3.65	2.46	1.48

Tire Size	14
Tire #	3

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/20/20	4/20/20	4/20/20	4/20/20	4/20/20
Ambient (°F)	43	39	42	42	43
Surface (°F)	53	58	56	56	58
1	18.7	44.4	103.2	93.5	97.5
2	17.6	40.8	97.5	90.4	105.7
3	20.0	41.9	97.3	93.7	97.8
4	19.7	42.0	98.8	88.8	99.9
5	19.6	41.3	98.4	89.0	97.4
6	18.3	45.1	104.1	92.6	97.6
7	21.6	41.5	101.3	91.7	95.4
8	18.6	42.2	97.3	91.3	94.5
9	18.4	42.5	95.8	90.1	99.8
10	17.2	42.1	102.7	95.4	97.5
Avg.	19.0	42.4	99.6	91.7	98.3
Std Dev	1.29	1.35	2.93	2.16	3.08

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	21.3	47.5	99.6	96.8	99.9
Std Dev	3.02	4.19	3.72	4.32	2.65

Tread Depth (32nds of an inch)

Date	4/23/20	Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	12	11	11	12
Rib 2	11	11	11	12
Rib 3	11	11	8	11
Rib 4	12	11	11	12
Avg	11.125			

Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	0	1	1	0
Rib 2	1	1	1	0
Rib 3	1	1	4	1
Rib 4	0	1	1	0
Avg	0.875			

Tire Size	14
Tire #	4

Tread Depth (32nds of an inch)

Date: 11/4/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	12	12	12	12
Rib 2	12	12	12	12
Rib 3	12	12	12	12
Rib 4	12	12	12	12
Avg	12			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	11/4/19	11/4/19	11/4/19	11/4/19	11/4/19
Ambient (°F)	60	50	50	60	57
Surface (°F)	65	51	51	66	65
1	24.4	49.2	94.5	94.6	103.4
2	22.4	46.7	94.9	99.5	102.3
3	21.4	46.7	92.2	97.2	95.9
4	22.3	53.4	96.3	99.5	101.6
5	21.7	49.8	98.2	96.1	104.9
6	22.1	49.3	96.5	99.3	95.8
7	21.3	48.2	94.8	98.9	96.8
8	20.9	49.4	93.8	96.7	100.1
9	18.8	51.1	101.2	99.4	101.2
10	18.8	52.7	97.1	97.7	96.9
Avg.	21.4	49.7	96.0	97.9	99.9
Std Dev	1.67	2.25	2.53	1.71	3.32

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/10/20	4/10/20	4/10/20	4/10/20	4/10/20
Ambient (°F)	41	41	41	41	41
Surface (°F)	57	57	55	55	52
1	22.1	49.0	102.5	98.7	106.1
2	18.5	49.3	101.8	102.4	102.6
3	21.0	47.2	99.8	98.0	99.9
4	20.6	46.0	101.9	97.5	99.3
5	23.8	48.0	98.9	99.6	103.9
6	21.4	48.4	101.5	98.0	102.5
7	22.4	45.5	103.1	99.8	107.1
8	20.0	45.9	101.6	98.9	97.3
9	25.4	50.1	101.7	94.6	103.8
10	19.7	49.7	100.8	102.5	103.4
Avg.	21.5	47.9	101.4	99.0	102.6
Std Dev	2.03	1.68	1.24	2.32	3.03

Tire Size	14
Tire #	4

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/20/20	4/20/20	4/20/20	4/20/20	4/20/20
Ambient (°F)	45	45	45	45	45
Surface (°F)	62	70	67	67	66
1	20.2	47.2	99.2	88.8	98.2
2	19.5	44.1	100.7	91.9	95.9
3	20.6	44.0	98.7	93.6	98.6
4	19.9	42.9	99.1	88.3	104.3
5	19.2	42.0	96.6	90.8	100.8
6	16.6	45.0	100.0	94.9	104.0
7	20.0	41.6	96.0	96.3	99.7
8	19.9	41.3	100.4	94.6	98.6
9	21.4	44.2	101.2	86.5	100.1
10	18.5	41.2	100.5	93.3	94.7
Avg.	19.6	43.4	99.2	91.9	99.5
Std Dev	1.30	1.92	1.74	3.22	3.07

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	20.8	47.0	98.9	96.3	100.7
Std Dev	1.87	3.30	2.92	3.98	3.34

Tread Depth (32nds of an inch)

Date	4/23/20	Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	11	11	10	12
Rib 2	11	9	10	12
Rib 3	8	8	11	12
Rib 4	8	11	8	8
Avg	10			

Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	1	1	2	0
Rib 2	1	3	2	0
Rib 3	4	4	1	0
Rib 4	4	1	4	4
Avg	2			

Tire Size	14
Tire #	5

Tread Depth (32nds of an inch)

Date: 11/6/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	12	12	12	12
Rib 2	12	12	12	12
Rib 3	12	12	12	12
Rib 4	12	12	12	12
Avg	12			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	11/6/19	11/6/19	11/6/19	11/6/19	11/6/19
Ambient (°F)	51	49	52	51	50
Surface (°F)	60	64	66	66	60
1	23.7	51.9	99.9	93.8	101.7
2	21.0	46.7	96.5	98.2	103.0
3	21.7	45.5	97.3	95.0	94.2
4	18.9	49.5	99.3	96.9	101.1
5	27.3	49.0	94.5	95.7	102.2
6	20.8	43.0	98.0	96.2	99.1
7	23.3	49.4	99.5	98.8	100.1
8	21.0	47.4	98.7	102.0	95.1
9	22.6	52.0	97.3	95.7	98.1
10	19.7	49.8	99.6	98.5	100.5
Avg.	22.0	48.4	98.1	97.1	99.5
Std Dev	2.39	2.81	1.70	2.36	2.94

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/14/20	4/14/20	4/14/20	4/14/20	4/14/20
Ambient (°F)	42	42	42	42	42
Surface (°F)	55	62	63	63	59
1	20.9	47.1	102.1	84.9	98.2
2	18.4	45.0	96.8	99.2	95.8
3	21.4	45.6	97.6	96.8	95.9
4	19.8	45.4	93.8	94.9	94.7
5	21.5	44.5	98.2	91.7	98.8
6	18.1	49.4	99.9	92.7	95.4
7	21.9	41.5	99.2	95.2	93.7
8	18.8	46.7	96.9	93.6	97.0
9	20.0	48.3	96.6	98.8	99.9
10	20.5	48.8	98.0	99.6	94.6
Avg.	20.1	46.2	97.9	94.7	96.4
Std Dev	1.35	2.35	2.22	4.42	2.02

Tire Size	14
Tire #	5

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/21/20	4/21/20	4/21/20	4/21/20	4/21/20
Ambient (°F)	42	42	42	42	42
Surface (°F)	43	50	49	49	47
1	17.6	45.3	102.5	95.3	99.9
2	18.7	42.8	98.6	103.9	104.0
3	20.9	40.9	97.9	92.6	96.8
4	18.3	44.9	98.9	91.3	98.4
5	20.5	41.8	99.9	96.5	99.8
6	17.2	45.2	98.6	94.6	100.2
7	20.3	41.1	97.4	95.4	103.5
8	19.4	40.7	104.0	89.8	101.0
9	20.0	41.6	99.4	89.5	102.3
10	18.4	44.9	99.5	91.7	101.3
Avg.	19.1	42.9	99.7	94.1	100.7
Std Dev	1.28	1.94	2.06	4.23	2.21

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	20.4	45.9	98.5	95.3	98.9
Std Dev	2.08	3.26	2.10	3.88	2.98

Tread Depth (32nds of an inch)

Date: 4/23/20 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	12	12	12	11
Rib 2	11	11	11	11
Rib 3	12	11	11	11
Rib 4	10	8	12	12
Avg	11.125			

Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	0	0	0	1
Rib 2	1	1	1	1
Rib 3	0	1	1	1
Rib 4	2	4	0	0
Avg	0.875			

Tire Size	14
Tire #	6

Tread Depth (32nds of an inch)

Date 11/11/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	12	12	12	12
Rib 2	12	12	12	12
Rib 3	12	12	12	12
Rib 4	12	12	12	12
Avg	12			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	11/11/19	11/11/19	11/11/19	11/11/19	11/11/19
Ambient (°F)	41	41	41	41	41
Surface (°F)	41	42	43	43	44
1	23.6	48.9	99.0	99.8	103.3
2	21.3	48.8	96.8	99.2	105.2
3	22.3	48.0	97.6	100.1	99.9
4	23.0	48.2	98.6	97.6	100.8
5	23.2	48.7	101.7	99.5	103.0
6	19.3	52.9	100.7	99.3	102.5
7	23.5	51.8	99.0	102.6	105.3
8	23.1	43.3	102.8	101.6	103.4
9	21.9	49.7	101.0	99.0	100.2
10	25.9	51.6	104.2	101.5	99.6
Avg.	22.7	49.2	100.1	100.0	102.3
Std Dev	1.72	2.67	2.35	1.48	2.10

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/14/20	4/14/20	4/14/20	4/14/20	4/14/20
Ambient (°F)	43	43	43	43	43
Surface (°F)	59	72	65	65	66
1	21.8	54.0	99.1	91.3	95.8
2	18.4	50.3	98.9	93.3	93.3
3	20.6	44.8	99.6	94.0	97.2
4	19.3	46.5	95.1	93.2	97.2
5	20.0	45.3	96.7	98.4	101.1
6	17.3	47.3	96.4	92.1	98.9
7	21.8	48.5	100.2	92.5	95.7
8	18.3	45.2	100.7	95.7	100.3
9	19.7	47.1	94.9	92.7	97.6
10	19.2	47.8	95.0	97.3	99.6
Avg.	19.6	47.7	97.7	94.1	97.7
Std Dev	1.47	2.78	2.28	2.34	2.38

Tire Size	14
Tire #	6

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/22/20	4/21/20	4/21/20	4/22/20	4/22/20
Ambient (°F)	48	45	45	45	48
Surface (°F)	65	87	84	72	74
1	21.9	43.9	99.2	93.0	101.5
2	21.6	42.4	98.2	95.3	96.4
3	20.6	41.4	96.5	92.9	95.7
4	24.7	43.9	96.4	88.8	100.0
5	22.5	46.2	98.7	96.6	100.1
6	18.5	44.4	97.9	90.1	101.1
7	24.7	42.4	100.3	91.5	102.0
8	23.3	40.3	95.4	88.8	99.1
9	24.6	41.7	98.9	87.6	92.8
10	23.3	41.1	98.3	90.8	99.0
Avg.	22.6	42.8	98.0	91.5	98.8
Std Dev	2.00	1.80	1.48	2.92	2.93

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	21.6	46.5	98.6	95.2	99.6
Std Dev	2.21	3.66	2.29	4.26	3.14

Tread Depth (32nds of an inch)

Date: 4/23/20 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	12	11	12	12
Rib 2	11	11	12	10
Rib 3	11	11	11	8
Rib 4	11	11	12	12
Avg	11.125			

Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	0	1	0	0
Rib 2	1	1	0	2
Rib 3	1	1	1	4
Rib 4	1	1	0	0
Avg	0.875			

Tire Size	14
Tire #	7

Tread Depth (32nds of an inch)

Date 11/18/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	12	12	12	12
Rib 2	12	12	12	12
Rib 3	12	12	12	12
Rib 4	12	12	12	12
Avg	12			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	11/18/19	11/18/19	11/18/19	11/18/19	11/18/19
Ambient (°F)	51	52	52	52	50
Surface (°F)	54	66	64	64	58
1	24.5	49.1	99.2	98.4	103.4
2	26.5	46.9	98.3	102.7	101.6
3	21.6	48.3	95.3	97.7	101.5
4	21.1	46.5	101.2	98.4	99.9
5	22.0	45.7	99.1	101.4	97.5
6	20.2	52.0	102.7	102.7	99.6
7	24.4	47.4	100.3	98.9	100.4
8	25.0	47.0	99.5	99.4	103.5
9	19.4	51.5	100.2	97.0	100.9
10	29.2	49.8	103.1	99.9	101.2
Avg.	23.4	48.4	99.9	99.7	101.0
Std Dev	3.07	2.14	2.24	2.01	1.78

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/15/20	4/15/20	4/15/20	4/15/20	4/15/20
Ambient (°F)	47	43	43	44	47
Surface (°F)	63	68	64	65	67
1	20.9	50.3	99.8	95.7	100.3
2	20.7	45.5	100.5	99.6	98.9
3	23.6	46.6	98.3	98.6	95.3
4	19.6	46.8	93.4	95.6	101.7
5	21.9	45.4	98.9	97.2	98.7
6	18.6	47.3	98.6	92.4	98.4
7	20.2	48.3	97.4	92.2	98.5
8	19.3	46.4	99.6	95.6	103.3
9	22.3	46.6	102.3	97.7	99.2
10	19.6	49.2	95.7	99.2	102.0
Avg.	20.7	47.2	98.5	96.4	99.6
Std Dev	1.54	1.58	2.51	2.60	2.28

Tire Size	14
Tire #	7

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/24/20	4/24/20	4/24/20	4/24/20	4/24/20
Ambient (°F)	48	48	48	48	48
Surface (°F)	68	69	67	67	75
1	17.8	45.9	102.4	93.0	101.0
2	18.6	41.3	101.0	95.4	97.6
3	21.2	39.0	97.3	90.9	96.3
4	18.7	42.9	100.3	87.0	98.5
5	19.8	43.7	100.9	83.5	100.8
6	16.7	41.7	96.9	93.3	101.3
7	19.1	40.6	101.2	96.1	97.3
8	18.7	39.8	97.7	93.0	99.2
9	18.2	40.6	99.8	83.8	95.3
10	17.6	41.5	101.6	88.8	99.0
Avg.	18.6	41.7	99.9	90.5	98.6
Std Dev	1.24	2.02	1.94	4.53	2.04

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	20.9	45.8	99.4	95.5	99.7
Std Dev	2.84	3.51	2.27	4.96	2.20

Tread Depth (32nds of an inch)

Date: 4/27/20 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	12	8	12	12
Rib 2	9	8	12	11
Rib 3	8	11	12	11
Rib 4	11	11	12	12
Avg	10.75			

Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	0	4	0	0
Rib 2	3	4	0	1
Rib 3	4	1	0	1
Rib 4	1	1	0	0
Avg	1.25			

Tire Size	14
Tire #	8

Tread Depth (32nds of an inch)

Date 11/19/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	12	12	12	12
Rib 2	12	12	12	12
Rib 3	12	12	12	12
Rib 4	12	12	12	12
Avg	12			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	11/19/19	11/19/19	11/19/19	11/19/19	11/19/19
Ambient (°F)	42	42	41	41	41
Surface (°F)	43	48	48	48	47
1	23.1	49.1	98.1	100.9	102.8
2	25.9	47.8	98.9	96.9	104.0
3	23.4	44.8	99.7	101.4	99.6
4	25.4	47.8	97.1	95.3	100.3
5	23.6	47.7	97.1	101.7	100.6
6	20.6	47.7	93.1	100.4	98.2
7	22.6	49.1	98.6	95.5	98.7
8	22.0	48.0	99.5	99.9	99.4
9	22.8	51.7	97.2	98.0	99.0
10	29.8	50.5	100.9	101.7	97.2
Avg.	23.9	48.4	98.0	99.2	100.0
Std Dev	2.57	1.86	2.13	2.53	2.07

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/15/20	4/15/20	4/15/20	4/15/20	4/15/20
Ambient (°F)	47	49	49	48	47
Surface (°F)	60	82	74	74	72
1	21.9	45.0	98.9	93.1	94.8
2	19.3	45.3	95.7	93.1	100.5
3	21.8	44.0	99.7	92.0	94.7
4	17.3	45.0	96.0	95.5	99.9
5	20.6	45.6	98.4	92.0	95.8
6	20.7	49.4	96.9	96.9	95.9
7	22.3	47.7	99.7	92.6	98.7
8	19.1	47.2	92.1	91.9	96.1
9	23.2	48.0	96.7	93.1	101.9
10	19.8	46.1	97.9	88.1	98.9
Avg.	20.6	46.3	97.2	92.8	97.7
Std Dev	1.77	1.68	2.29	2.32	2.57

Tire Size	14
Tire #	8

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/24/20	4/24/20	4/24/20	4/24/20	4/24/20
Ambient (°F)	52	51	52	52	53
Surface (°F)	75	89	84	84	81
1	20.0	44.4	101.7	93.9	101.9
2	19.8	46.3	102.3	95.6	102.1
3	19.0	41.9	100.7	90.4	96.9
4	17.4	42.9	98.6	84.0	104.7
5	18.0	42.5	95.5	89.2	99.0
6	17.1	42.0	98.7	89.9	98.7
7	19.1	42.7	102.6	88.6	102.1
8	19.0	42.4	102.2	87.0	102.3
9	21.1	41.9	97.2	83.1	95.1
10	18.8	42.7	95.8	90.0	100.0
Avg.	18.9	43.0	99.5	89.2	100.3
Std Dev	1.21	1.38	2.74	3.87	2.89

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	21.2	45.9	98.3	93.7	99.3
Std Dev	2.82	2.78	2.52	5.10	2.71

Tread Depth (32nds of an inch)

Date	4/27/20	Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	12	12	11	12
Rib 2	11	12	11	12
Rib 3	12	12	8	12
Rib 4	11	12	8	12
Avg	11.25			

Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	0	0	1	0
Rib 2	1	0	1	0
Rib 3	0	0	4	0
Rib 4	1	0	4	0
Avg	0.75			

Tire Size	14
Tire #	9

Tread Depth (32nds of an inch)

Date 11/20/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	12	12	12	12
Rib 2	12	12	12	12
Rib 3	12	12	12	12
Rib 4	12	12	12	12
Avg	12			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	11/20/19	11/20/19	11/20/19	11/20/19	11/20/19
Ambient (°F)	41	40	41	41	42
Surface (°F)	41	45	47	47	49
1	22.7	51.7	97.8	95.7	102.3
2	22.1	49.0	98.2	95.4	107.3
3	23.8	46.0	95.3	94.9	101.3
4	18.7	47.4	97.2	96.9	100.8
5	22.6	48.3	102.3	94.3	101.1
6	21.4	48.0	101.8	103.5	100.7
7	23.2	47.7	98.2	101.6	98.4
8	20.7	45.2	93.6	99.6	98.0
9	20.2	46.6	99.2	93.3	100.0
10	27.4	45.7	96.8	96.6	101.0
Avg.	22.3	47.6	98.0	97.2	101.1
Std Dev	2.36	1.90	2.65	3.33	2.54

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/16/20	4/16/20	4/16/20	4/16/20	4/16/20
Ambient (°F)	41	40	40	40	41
Surface (°F)	55	75	71	71	62
1	19.1	46.5	98.2	96.6	103.4
2	18.8	47.0	100.5	93.9	103.4
3	21.8	48.9	90.1	93.4	100.8
4	20.0	46.4	98.4	96.1	103.1
5	20.0	47.6	96.0	89.9	97.1
6	17.9	46.4	101.4	93.3	100.1
7	23.0	45.5	95.1	92.9	97.4
8	18.6	46.5	98.1	96.8	104.2
9	20.8	47.3	99.7	91.7	102.2
10	16.8	43.7	99.6	100.4	94.4
Avg.	19.7	46.6	97.7	94.5	100.6
Std Dev	1.85	1.36	3.29	3.01	3.31

Tire Size	14
Tire #	9

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/27/20	4/27/20	4/27/20	4/27/20	4/27/20
Ambient (°F)	54	54	54	54	56
Surface (°F)	77	92	85	85	83
1	20.3	42.3	98.2	89.4	96.4
2	17.4	42.7	95.5	97.4	93.9
3	20.2	41.6	96.2	90.5	96.6
4	17.0	42.1	95.1	84.6	95.6
5	17.7	41.2	99.3	83.3	98.0
6	16.3	44.9	96.5	82.5	99.9
7	19.5	43.8	97.6	89.0	94.2
8	16.7	40.6	97.5	91.5	86.9
9	19.7	40.8	96.1	86.2	93.1
10	18.7	39.6	95.3	83.4	99.2
Avg.	18.4	42.0	96.7	87.8	95.4
Std Dev	1.51	1.57	1.38	4.69	3.73

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	20.1	45.4	97.5	93.2	99.0
Std Dev	2.50	2.94	2.54	5.41	4.08

Tread Depth (32nds of an inch)

Date: 4/27/20 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	12	12	12	11
Rib 2	12	11	11	8
Rib 3	9	11	10	11
Rib 4	8	12	11	12
Avg	10.8125			

Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	0	0	0	1
Rib 2	0	1	1	4
Rib 3	3	1	2	1
Rib 4	4	0	1	0
Avg	1.1875			

Tire Size	14
Tire #	10

Tread Depth (32nds of an inch)

Date 11/20/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	12	12	12	12
Rib 2	12	12	12	12
Rib 3	12	12	12	12
Rib 4	12	12	12	12
Avg	12			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	11/20/19	11/20/19	11/20/19	11/20/19	11/20/19
Ambient (°F)	48	46	48	48	48
Surface (°F)	58	58	59	59	57
1	21.6	51.4	99.4	95.8	100.9
2	20.5	48.0	95.0	102.7	98.3
3	22.2	49.1	94.1	97.1	94.8
4	20.9	51.0	98.1	98.2	100.1
5	22.3	51.1	98.8	96.1	84.8
6	22.3	50.0	95.8	99.4	99.9
7	23.2	45.2	95.5	98.6	98.1
8	28.8	42.8	96.7	97.2	101.7
9	21.9	52.1	96.9	97.0	102.0
10	21.4	50.2	96.6	95.8	98.5
Avg.	22.5	49.1	96.7	97.8	97.9
Std Dev	2.34	2.98	1.69	2.10	5.06

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/16/20	4/16/20	4/16/20	4/16/20	4/16/20
Ambient (°F)	42	42	42	42	42
Surface (°F)	63	78	74	74	67
1	26.6	45.8	100.3	95.4	97.5
2	18.2	46.7	95.4	97.9	102.8
3	22.7	44.0	94.8	97.3	101.2
4	19.2	45.1	96.2	93.3	97.6
5	19.7	46.7	97.9	91.4	84.1
6	18.7	45.7	97.6	91.8	97.6
7	24.0	48.0	98.8	94.8	99.2
8	18.7	48.5	99.2	90.1	100.3
9	20.7	44.2	95.0	89.4	97.1
10	18.3	47.8	98.1	92.7	95.6
Avg.	20.7	46.3	97.3	93.4	97.3
Std Dev	2.85	1.56	1.89	2.89	5.11

Tire Size	14
Tire #	10

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/27/20	4/27/20	4/27/20	4/27/20	4/27/20
Ambient (°F)	57	56	56	57	57
Surface (°F)	77	96	91	91	83
1	19.7	43.7	96.9	93.2	100.0
2	21.3	42.8	96.6	90.4	97.6
3	19.8	41.5	92.5	91.3	97.5
4	20.4	40.9	95.7	84.4	94.3
5	20.6	42.5	90.6	90.6	96.3
6	19.1	42.3	93.2	85.1	94.3
7	18.9	43.1	94.4	86.5	99.8
8	20.0	40.8	95.2	89.5	97.4
9	22.1	42.8	97.1	86.3	93.6
10	19.0	43.2	95.0	87.2	94.1
Avg.	20.1	42.4	94.7	88.5	96.5
Std Dev	1.04	0.99	2.10	2.94	2.36

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	21.1	45.9	96.2	93.2	97.2
Std Dev	2.38	3.42	2.15	4.66	4.26

Tread Depth (32nds of an inch)

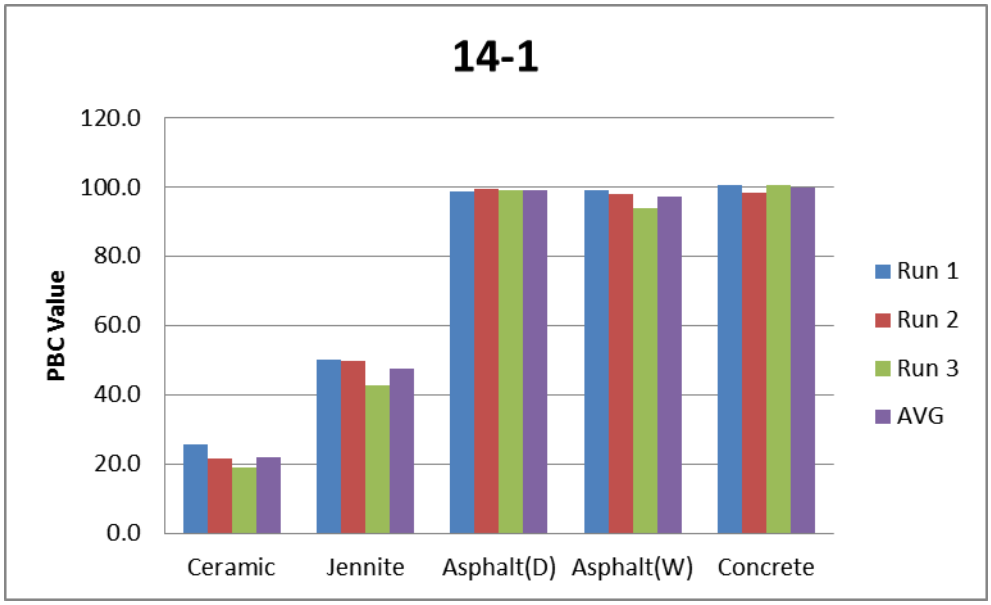
Date	4/27/20	Valve stem # 1, then clockwise, outside to inside

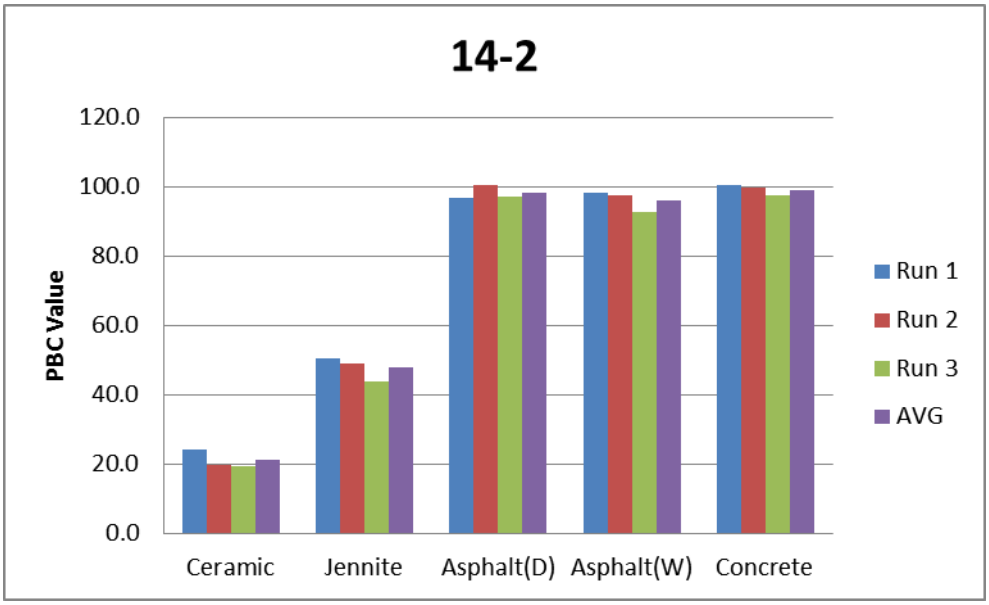
	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	10	11	11	11
Rib 2	11	11	11	9
Rib 3	11	11	11	11
Rib 4	11	11	12	11
Avg	10.875			

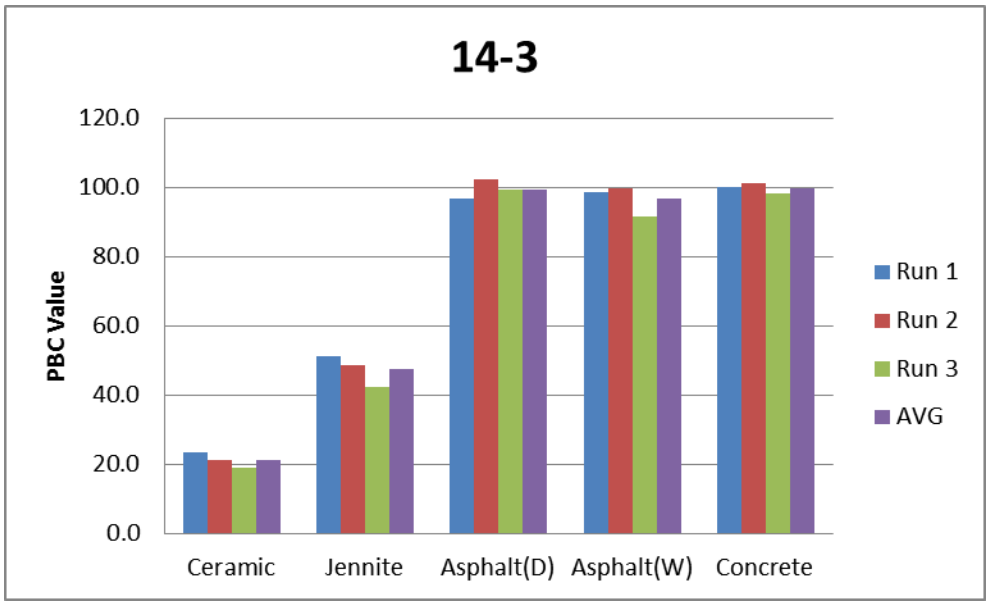
Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	2	1	1	1
Rib 2	1	1	1	3
Rib 3	1	1	1	1
Rib 4	1	1	0	1
Avg	1.125			

A graphical representation of the data for each run plus the average follows:






14-3
120.0
100.0
80.0
60.0
40.0
20.0
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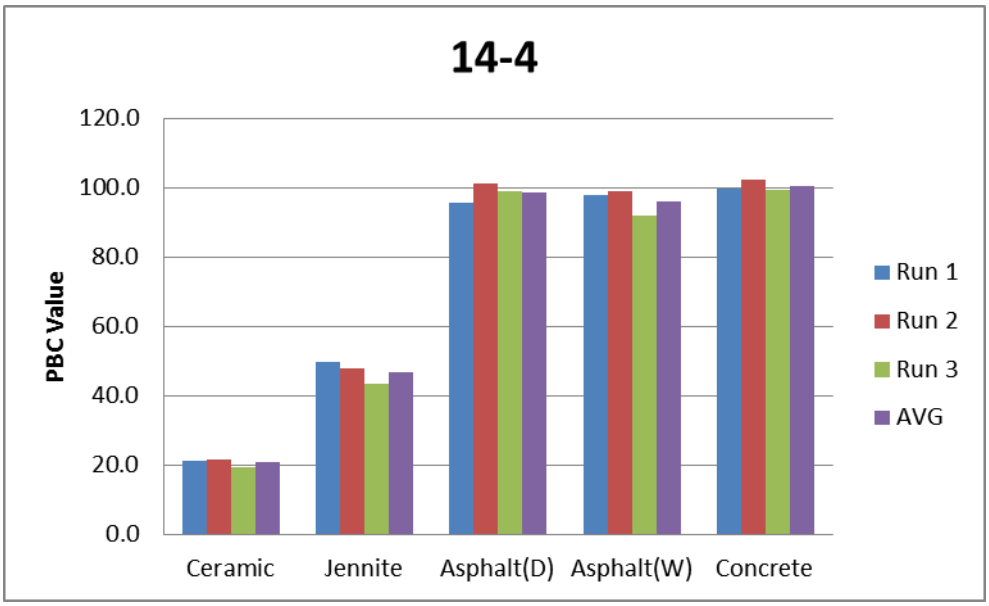
PBC Value
Ceramic
Jennite
Asphalt(D)
Asphalt(W)
Concrete
Run 1
Run 2
Run 3
AVG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60.0
40.0
20.0
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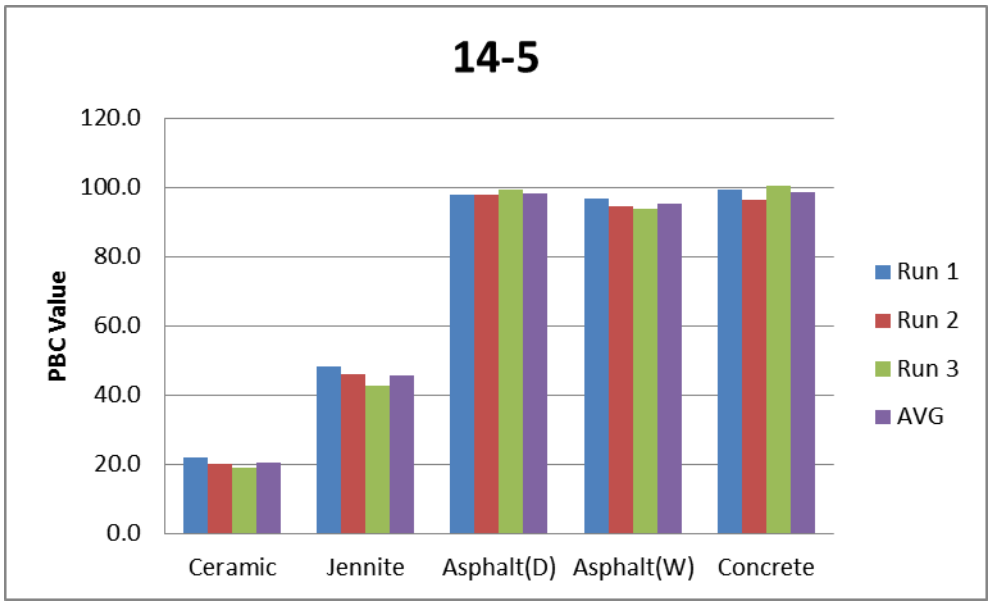
PBC Value
Ceramic
Jennite
Asphalt(D)
Asphalt(W)
Concrete
Run 1
Run 2
Run 3
AVG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40.0
20.0
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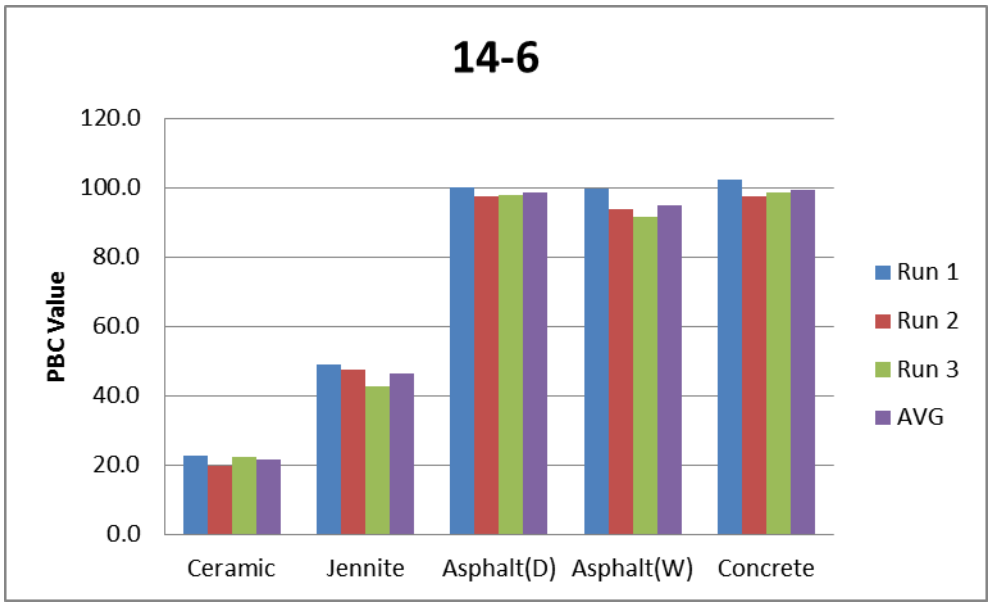
PBC Value
Ceramic
Jennite
Asphalt(D)
Asphalt(W)
Concrete
Run 1
Run 2
Run 3
AVG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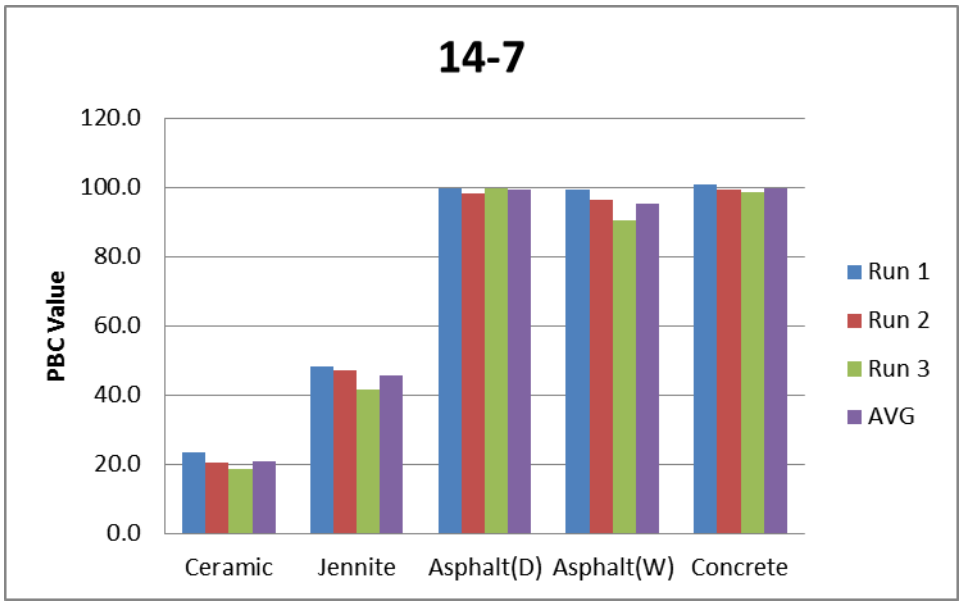
Ceramic
Jennite
Asphalt(D)
Asphalt(W)
Concrete
Run 1
Run 2
Run 3
AVG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60.0
40.0
20.0
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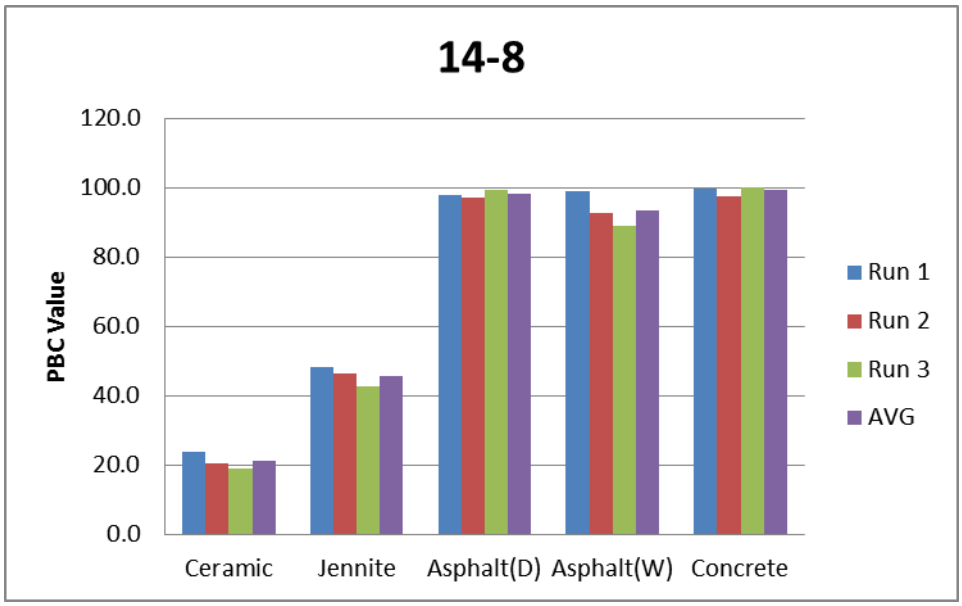
PBC Value
Ceramic
Jennite
Asphalt(D)
Asphalt(W)
Concrete
Run 1
Run 2
Run 3
AVG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60.0
40.0
20.0
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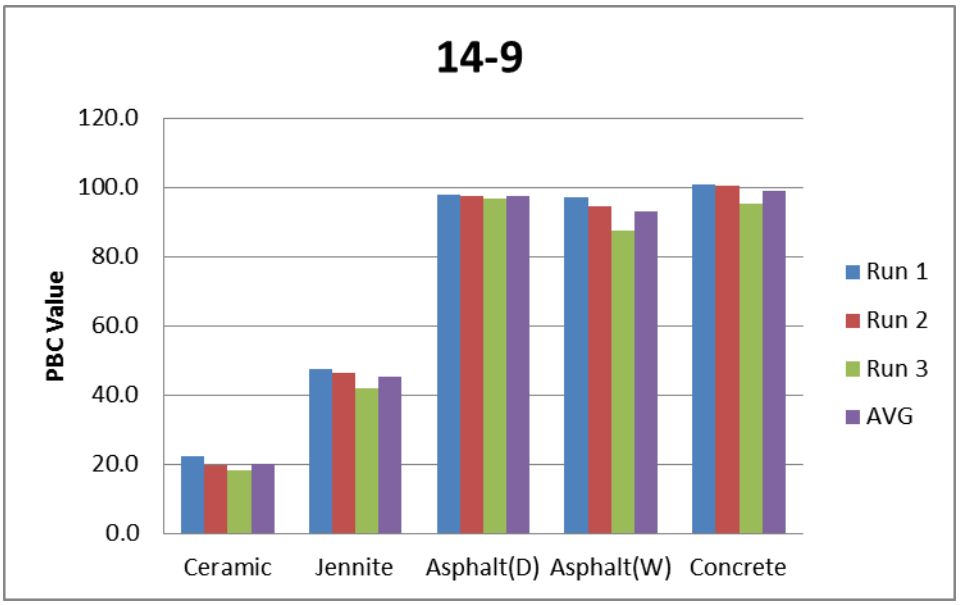
PBC Value
Ceramic
Jennite
Asphalt(D)
Asphalt(W)
Concrete
Run 1
Run 2
Run 3
AVG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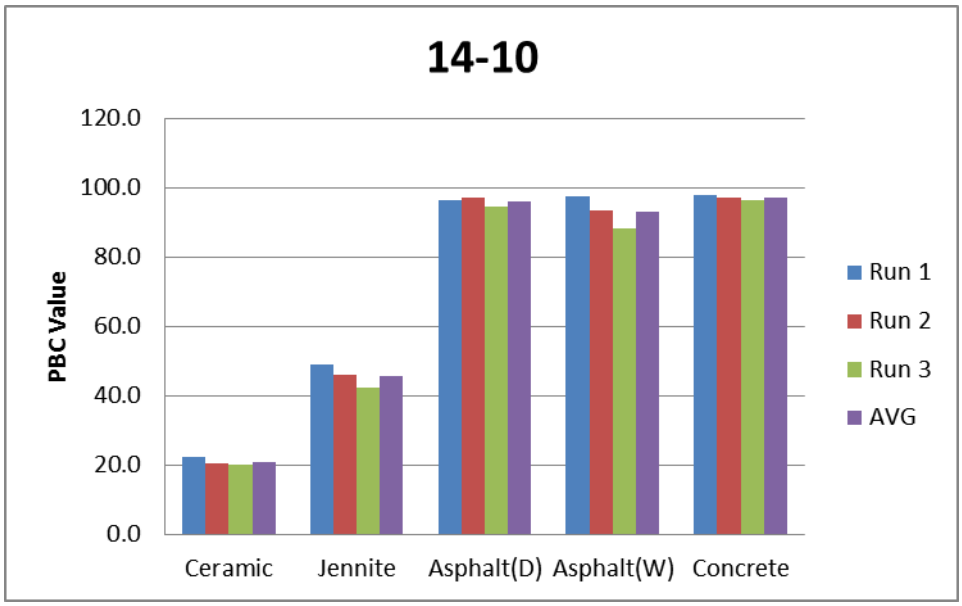
80.0
60.0
40.0
20.0
0.0
PBC Value
Ceramic
Jennite
Asphalt(D)
Asphalt(W)
Concrete
Run 1
Run 2
Run 3
AVG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120.0
100.0
80.0
60.0
40.0
20.0
0.0
PBC Value
Ceramic
Jennite
Asphalt(D)
Asphalt(W)
Concrete
Run 1
Run 2
Run 3
AVG

Appendix B

ASTM F2493 SRTT (16”)

The ASTM F2493 SRTT has been designated as the replacement tire for the ASTM E1337 PBC Test. The tire identification number for each of the tires was APX0 B2UU. Following is a photo of a new F2493 SRTT:

Following are the photos each of the F2493 SRTTs after the testing was completed:


16 – 2


16 – 3


16 – 4


16 – 5


16 – 6


16 – 7


16 – 8


16 – 9


16 – 10

The raw data for each tire is as follows:

Tire Size	16
Tire #	1

Tread Depth (32nds of an inch)

Date: 10/28/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	10	10	10	10
Rib 2	10	10	10	10
Rib 3	10	10	10	10
Rib 4	10	10	10	10
Avg	10			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	10/28/19	10/28/19	10/28/19	10/28/19	10/28/19
Ambient (°F)	46	42	44	44	48
Surface (°F)	40	41	45	45	46
1	27.2	61.5	107.8	108.6	112.8
2	21.6	54.5	107.3	108.2	114.6
3	27.7	50.8	104.5	110.6	112.7
4	20.4	57.9	107.3	102.9	112.8
5	23.8	59.6	106.9	103.4	107.8
6	21.5	54.0	106.0	108.0	112.6
7	24.0	55.6	106.4	106.1	112.8
8	20.2	49.8	106.0	103.5	106.0
9	23.4	59.1	108.6	105.4	106.9
10	28.1	57.4	103.8	106.2	111.9
Avg.	23.8	56.0	106.5	106.3	111.1
Std Dev	2.98	3.80	1.47	2.56	3.00

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/9/20	4/9/20	4/9/20	4/9/20	4/9/20
Ambient (°F)	48	46	48	48	48
Surface (°F)	68	72	77	77	73
1	26.8	56.9	112.0	110.7	109.3
2	22.2	53.8	112.4	109.9	108.8
3	25.6	53.8	113.2	111.5	111.9
4	23.2	48.9	110.3	110.7	111.0
5	29.6	52.1	111.5	109.8	115.2
6	24.8	55.5	110.3	109.8	111.3
7	26.3	50.4	113.7	114.2	114.3
8	24.6	51.5	113.5	112.0	116.0
9	27.2	52.2	113.6	109.0	103.8
10	28.0	53.8	108.7	113.7	112.7
Avg.	25.8	52.9	111.9	111.1	111.4
Std Dev	2.23	2.37	1.70	1.73	3.58

Tire Size	16
Tire #	1

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/18/20	4/18/20	4/18/20	4/18/20	4/18/20
Ambient (°F)	47	47	47	47	47
Surface (°F)	63	75	71	71	70
1	27.2	50.9	116.5	107.0	112.3
2	22.2	48.6	109.0	107.9	115.5
3	25.6	44.5	111.1	106.7	114.9
4	19.5	45.7	110.0	108.0	110.8
5	26.5	48.5	110.7	108.5	112.1
6	19.8	47.3	111.4	107.8	115.5
7	23.2	50.8	111.7	108.1	112.8
8	23.1	51.0	108.9	112.0	114.4
9	26.0	46.5	110.9	108.7	112.7
10	20.4	45.8	112.1	110.6	110.8
Avg.	23.4	48.0	111.2	108.5	113.2
Std Dev	2.87	2.38	2.14	1.61	1.79

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	24.3	52.3	109.9	108.7	111.9
Std Dev	2.84	4.40	3.01	2.80	2.94

Tread Depth (32nds of an inch)

Date: 4/23/20 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	9	9	8	9
Rib 2	9	9	8	9
Rib 3	9	9	8	10
Rib 4	9	9	8	9
Avg	8.8125			

Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	1	1	2	1
Rib 2	1	1	2	1
Rib 3	1	1	2	0
Rib 4	1	1	2	1
Avg	1.1875			

Tire Size	16
Tire #	2

Tread Depth (32nds of an inch)

Date: 10/28/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	10	10	10	10
Rib 2	10	10	10	10
Rib 3	10	10	10	10
Rib 4	10	10	10	10
Avg	10			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	10/28/19	10/28/19	10/28/19	10/28/19	10/28/19
Ambient (°F)	57	54	55	55	59
Surface (°F)	52	60	59	60	68
1	24.8	54.7	106.5	108.1	110.6
2	21.0	51.9	107.4	109.2	115.1
3	22.5	54.7	100.2	108.5	105.5
4	26.8	54.8	105.2	109.3	110.7
5	22.1	51.8	108.3	111.4	110.7
6	19.3	48.4	108.0	108.9	111.4
7	21.8	56.0	107.1	112.4	113.1
8	23.3	57.8	107.3	108.4	112.8
9	23.8	54.2	108.7	111.5	110.8
10	29.7	52.0	106.6	109.0	117.3
Avg.	23.5	53.6	106.5	109.7	111.8
Std Dev	3.00	2.65	2.44	1.51	3.14

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/9/20	4/9/20	4/9/20	4/9/20	4/9/20
Ambient (°F)	50	51	51	51	50
Surface (°F)	63	92	83	83	80
1	26.7	51.7	109.7	111.1	114.7
2	22.7	52.3	108.8	107.8	112.6
3	28.4	49.9	109.9	108.5	106.5
4	23.8	53.0	110.1	106.1	115.3
5	24.7	51.4	110.6	115.8	100.5
6	21.3	54.1	110.9	105.2	105.7
7	34.1	48.8	111.3	108.3	112.2
8	21.4	50.9	108.6	110.0	112.8
9	25.9	49.3	109.4	110.3	110.7
10	20.4	53.3	110.8	113.3	105.8
Avg.	24.9	51.5	110.0	109.6	109.7
Std Dev	4.12	1.76	0.90	3.21	4.80

Tire Size	16
Tire #	2

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/18/20	4/18/20	4/18/20	4/18/20	4/18/20
Ambient (°F)	49	49	49	49	49
Surface (°F)	72	79	74	74	79
1	26.7	51.6	110.4	106.7	113.9
2	20.4	50.2	112.1	107.6	115.5
3	26.6	47.5	113.1	109.7	112.4
4	21.1	45.6	110.5	102.8	113.9
5	29.7	47.5	112.5	106.7	112.3
6	18.4	50.1	108.2	103.6	112.2
7	25.9	49.7	109.0	108.2	115.3
8	20.3	47.1	109.1	105.8	110.4
9	27.9	48.0	108.0	104.1	111.6
10	19.4	41.8	110.0	107.6	110.1
Avg.	23.6	47.9	110.3	106.3	112.8
Std Dev	4.10	2.80	1.79	2.20	1.86

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	24.0	51.0	108.9	108.5	111.4
Std Dev	3.70	3.37	2.47	2.83	3.61

Tread Depth (32nds of an inch)

Date: 4/23/20 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	5	10	9	9
Rib 2	4	10	7	9
Rib 3	4	10	8	9
Rib 4	5	10	8	9
Avg	7.875			

Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	5	0	1	1
Rib 2	6	0	3	1
Rib 3	6	0	2	1
Rib 4	5	0	2	1
Avg	2.125			

Tire Size	16
Tire #	3

Tread Depth (32nds of an inch)

Date: 10/29/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	10	10	10	10
Rib 2	10	10	10	10
Rib 3	10	10	10	10
Rib 4	10	10	10	10
Avg	10			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	10/29/19	1029/19	10/29/19	10/29/19	10/29/19
Ambient (°F)	61	60	60	61	62
Surface (°F)	58	65	69	69	67
1	24.9	52.8	104.0	108.6	107.6
2	22.5	53.1	105.0	105.4	105.1
3	24.4	55.7	103.1	106.9	110.4
4	24.3	56.9	107.1	109.3	107.3
5	22.4	55.6	107.1	110.1	111.1
6	21.8	58.5	105.1	111.5	107.1
7	24.9	58.1	103.8	110.1	111.0
8	18.4	49.1	108.2	112.7	110.8
9	23.6	56.2	109.7	108.9	111.2
10	22.8	52.3	106.7	108.8	111.2
Avg.	23.0	54.8	106.0	109.2	109.3
Std Dev	1.96	2.94	2.12	2.09	2.27

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/14/20	4/14/20	4/14/20	4/14/20	4/14/20
Ambient (°F)	37	38	38	39	39
Surface (°F)	40	41	43	43	41
1	26.7	58.7	113.0	110.7	114.1
2	19.8	50.0	107.6	105.9	114.4
3	27.8	53.4	111.4	111.6	117.3
4	20.4	50.0	107.0	111.0	109.6
5	27.1	47.7	109.5	111.7	114.6
6	22.0	52.0	110.7	113.4	113.6
7	23.1	50.8	112.3	107.2	110.4
8	22.6	50.2	110.3	109.3	111.4
9	25.5	48.6	110.6	109.2	117.1
10	22.2	45.7	113.5	112.3	117.4
Avg.	23.7	50.7	110.6	110.2	114.0
Std Dev	2.86	3.54	2.13	2.33	2.83

Tire Size	16
Tire #	3

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/20/20	4/20/20	4/20/20	4/20/20	4/20/20
Ambient (°F)	51	51	51	51	51
Surface (°F)	76	95	90	90	78
1	31.0	47.8	112.8	103.3	112.8
2	20.1	48.2	112.3	102.0	113.4
3	37.0	46.0	110.3	106.8	114.8
4	21.2	47.8	105.9	109.2	107.3
5	23.5	46.5	109.7	108.4	111.4
6	22.2	45.7	108.2	110.2	116.8
7	31.7	50.2	110.5	103.9	111.1
8	20.1	44.9	113.2	104.6	112.6
9	25.2	46.8	111.1	101.0	111.3
10	19.5	46.9	110.1	107.6	112.1
Avg.	25.2	47.1	110.4	105.7	112.4
Std Dev	6.03	1.50	2.20	3.17	2.50

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	24.0	50.9	109.0	108.4	111.9
Std Dev	3.98	4.20	3.00	3.18	3.16

Tread Depth (32nds of an inch)

Date: 4/23/20 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	9	9	8	9
Rib 2	9	9	7	8
Rib 3	9	9	7	9
Rib 4	9	9	7	8

Avg: 8.4375

Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	1	1	2	1
Rib 2	1	1	3	2
Rib 3	1	1	3	1
Rib 4	1	1	3	2

Avg: 1.5625

Tire Size	16
Tire #	4

Tread Depth (32nds of an inch)

Date: 11/1/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	10	10	10	10
Rib 2	10	10	10	10
Rib 3	10	10	10	10
Rib 4	10	10	10	10
Avg	10			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	11/1/19	11/1/19	11/1/19	11/1/19	11/1/19
Ambient (°F)	40	40	40	40	40
Surface (°F)	53	60	61	61	57
1	22.8	57.5	107.2	110.9	112.8
2	18.4	52.0	109.0	112.4	111.1
3	21.9	51.2	108.1	111.7	113.9
4	25.4	58.8	103.6	110.7	106.8
5	19.9	54.0	107.3	111.5	111.7
6	18.9	62.4	105.2	107.4	113.1
7	22.0	58.8	111.7	112.9	112.0
8	18.6	47.4	110.1	109.1	109.1
9	17.2	53.7	110.9	109.5	112.2
10	17.4	60.6	110.1	113.2	112.2
Avg.	20.3	55.6	108.3	110.9	111.5
Std Dev	2.67	4.73	2.57	1.83	2.09

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/14/20	4/14/20	4/14/20	4/14/20	4/14/20
Ambient (°F)	40	40	40	40	40
Surface (°F)	41	46	46	46	45
1	26.8	53.7	111.8	111.9	112.8
2	22.1	49.5	110.8	109.4	111.5
3	27.6	46.8	112.2	109.5	112.0
4	21.0	52.0	110.6	108.6	115.5
5	27.8	48.5	113.3	111.2	115.9
6	20.4	51.5	109.4	111.7	110.7
7	26.1	51.1	109.1	107.9	114.3
8	22.4	51.4	109.5	110.9	114.6
9	26.8	49.2	111.5	110.9	111.2
10	20.0	49.4	108.1	113.1	112.6
Avg.	24.1	50.3	110.6	110.5	113.1
Std Dev	3.19	2.00	1.61	1.62	1.85

Tire Size	16
Tire #	4

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/20/20	4/20/20	4/20/20	4/20/20	4/20/20
Ambient (°F)	55	54	54	54	55
Surface (°F)	80	100	98	98	86
1	27.6	49.4	110.6	103.1	112.3
2	23.1	47.0	109.7	103.5	115.9
3	29.3	45.4	109.0	106.6	109.1
4	21.0	46.4	108.4	103.5	110.7
5	27.3	47.1	111.9	108.3	112.7
6	20.6	47.7	108.8	102.7	113.2
7	24.6	45.2	111.3	107.0	109.1
8	22.5	44.7	110.4	106.9	114.9
9	29.3	47.9	107.2	109.7	112.2
10	19.8	42.3	110.7	106.6	105.2
Avg.	24.5	46.3	109.8	105.8	111.5
Std Dev	3.64	2.00	1.45	2.42	3.13

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	23.0	50.8	109.6	109.1	112.0
Std Dev	3.65	4.95	2.11	3.05	2.46

Tread Depth (32nds of an inch)

Date: 4/23/20 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	9	8	7	8
Rib 2	9	8	7	8
Rib 3	9	9	8	8
Rib 4	9	8	8	7
Avg	8.125			

Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	1	2	3	2
Rib 2	1	2	3	2
Rib 3	1	1	2	2
Rib 4	1	2	2	3
Avg	1.875			

Tire Size	16
Tire #	5

Tread Depth (32nds of an inch)

Date: 11/4/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	10	10	10	10
Rib 2	10	10	10	10
Rib 3	10	10	10	10
Rib 4	10	10	10	10
Avg	10			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	11/5/19	11/5/19	11/5/19	11/5/19	11/5/19
Ambient (°F)	49	49	51	51	51
Surface (°F)	47	70	66	66	60
1	23.5	53.8	106.8	105.5	105.9
2	22.9	56.2	107.2	109.5	107.5
3	24.3	51.6	104.0	105.3	106.4
4	20.7	54.8	104.5	106.6	112.2
5	24.7	51.4	103.1	109.4	107.3
6	20.1	54.4	104.6	108.7	113.7
7	23.7	53.5	107.3	109.3	109.6
8	20.7	55.2	105.7	110.5	114.8
9	22.9	53.1	104.2	107.9	111.6
10	19.8	52.6	106.9	108.6	110.4
Avg.	22.3	53.7	105.4	108.1	109.9
Std Dev	1.83	1.55	1.54	1.77	3.12

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/14/20	4/14/20	4/14/20	4/14/20	4/14/20
Ambient (°F)	43	43	43	43	43
Surface (°F)	63	67	64	64	64
1	27.8	52.0	110.3	108.7	110.5
2	23.1	53.0	115.1	111.5	111.7
3	28.8	48.2	111.1	113.1	115.1
4	21.6	50.8	109.1	110.8	110.2
5	27.8	48.1	112.0	114.0	115.2
6	22.0	50.5	110.9	111.9	113.0
7	26.4	52.1	114.3	106.9	117.3
8	22.3	51.1	110.4	116.6	116.1
9	24.6	49.8	111.4	111.2	110.9
10	20.6	51.5	111.6	111.8	117.0
Avg.	24.5	50.7	111.6	111.7	113.7
Std Dev	2.99	1.62	1.82	2.68	2.76

Tire Size	16
Tire #	5

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/21/20	4/21/20	4/21/20	4/21/20	4/21/20
Ambient (°F)	43	43	43	43	43
Surface (°F)	59	60	59	59	63
1	25.5	49.6	114.9	102.6	111.9
2	19.9	49.8	114.3	104.1	114.3
3	27.8	47.5	114.1	106.1	115.2
4	21.3	48.5	110.2	106.6	109.2
5	25.0	46.9	112.5	111.1	116.5
6	18.4	50.7	109.2	110.0	114.6
7	24.1	46.0	114.5	112.5	117.4
8	23.0	45.6	112.6	106.2	118.5
9	23.4	48.5	112.5	104.0	104.6
10	19.9	43.3	110.5	104.7	113.4
Avg.	22.8	47.6	112.5	106.8	113.6
Std Dev	2.94	2.25	1.99	3.32	4.14

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	23.2	50.7	109.9	108.9	112.4
Std Dev	2.72	3.06	3.65	3.31	3.72

Tread Depth (32nds of an inch)

Date	4/23/20	Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	9	8	10	8
Rib 2	8	8	9	8
Rib 3	7	8	9	8
Rib 4	7	7	10	8
Avg	8.25			

Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	1	2	0	2
Rib 2	2	2	1	2
Rib 3	3	2	1	2
Rib 4	3	3	0	2
Avg	1.75			

Tire Size	16
Tire #	6

Tread Depth (32nds of an inch)

Date: 11/6/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	10	10	10	10
Rib 2	10	10	10	10
Rib 3	10	10	10	10
Rib 4	10	10	10	10
Avg	10			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	11/6/19	11/6/19	11/6/19	11/6/19	11/6/19
Ambient (°F)	46	43	44	44	48
Surface (°F)	54	56	60	60	55
1	24.5	53.0	107.9	107.9	113.8
2	22.1	57.3	107.0	110.7	114.4
3	22.7	51.8	105.2	110.3	108.4
4	19.0	51.0	108.6	110.1	114.1
5	24.9	53.8	106.4	112.3	110.8
6	20.1	49.8	107.8	108.1	114.1
7	27.4	55.9	107.8	107.5	114.3
8	22.5	53.6	110.4	113.0	111.4
9	24.9	53.2	107.1	107.7	111.8
10	22.1	53.9	111.3	113.2	113.6
Avg.	23.0	53.3	108.0	110.1	112.7
Std Dev	2.48	2.19	1.80	2.23	2.00

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/15/20	4/15/20	4/15/20	4/15/20	4/15/20
Ambient (°F)	38	37	37	38	40
Surface (°F)	40	44	45	46	45
1	28.9	55.6	113.1	111.1	111.6
2	24.7	50.7	112.7	106.2	113.6
3	27.5	50.1	108.0	108.8	110.8
4	20.9	54.0	107.8	109.0	106.8
5	26.8	46.4	110.5	112.0	115.7
6	23.5	52.5	111.0	107.7	116.6
7	27.7	50.5	112.7	110.4	116.3
8	23.7	46.6	111.0	110.7	103.7
9	29.7	50.3	111.5	110.8	110.6
10	23.0	48.7	111.6	112.3	109.2
Avg.	25.6	50.5	111.0	109.9	111.5
Std Dev	2.88	2.94	1.83	1.94	4.22

Tire Size	16
Tire #	6

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/21/20	4/21/20	4/21/20	4/21/20	4/21/20
Ambient (°F)	45	45	45	45	45
Surface (°F)	65	80	75	75	72
1	27.5	46.7	112.0	107.3	103.8
2	21.5	47.7	112.3	111.0	115.0
3	27.9	46.1	108.6	107.5	112.9
4	20.9	47.9	108.6	104.3	113.0
5	24.8	45.3	110.1	111.4	116.6
6	19.1	47.6	108.6	103.7	111.1
7	26.2	47.6	111.4	111.7	113.1
8	21.1	45.1	111.9	106.4	115.6
9	26.4	45.3	109.2	107.2	114.4
10	22.2	45.8	110.9	108.1	110.5
Avg.	23.8	46.5	110.4	107.9	112.6
Std Dev	3.16	1.12	1.52	2.79	3.63

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	24.1	50.1	109.8	109.3	112.3
Std Dev	2.97	3.56	2.13	2.48	3.34

Tread Depth (32nds of an inch)

Date	4/23/20	Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	8	7	10	10
Rib 2	8	7	9	10
Rib 3	8	7	9	9
Rib 4	8	7	9	10
Avg	8.5			

Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	2	3	0	0
Rib 2	2	3	1	0
Rib 3	2	3	1	1
Rib 4	2	3	1	0
Avg	1.5			

Tire Size	16
Tire #	7

Tread Depth (32nds of an inch)

Date 11/11/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	10	10	10	10
Rib 2	10	10	10	10
Rib 3	10	10	10	10
Rib 4	10	10	10	10
Avg	10			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	11/11/19	11/11/19	11/11/19	11/11/19	11/11/19
Ambient (°F)	41	41	41	41	41
Surface (°F)	41	43	43	43	43
1	25.5	57.8	108.3	105.9	111.4
2	22.4	52.1	107.6	103.4	109.0
3	24.3	50.9	107.5	104.6	112.1
4	22.0	54.6	109.9	107.6	110.0
5	23.6	54.7	107.8	107.3	115.9
6	19.4	60.0	108.5	105.7	110.9
7	13.4	50.8	109.2	105.9	107.7
8	22.2	49.8	108.9	105.5	112.0
9	22.6	53.2	110.9	105.7	113.6
10	20.3	52.9	110.0	105.7	111.5
Avg.	21.6	53.7	108.9	105.7	111.4
Std Dev	3.37	3.22	1.14	1.19	2.30

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/16/20	4/16/20	4/16/20	4/16/20	4/16/20
Ambient (°F)	35	35	35	35	35
Surface (°F)	40	41	42	42	43
1	26.9	53.9	112.5	109.6	113.5
2	21.1	48.4	112.2	111.4	115.5
3	26.7	48.6	111.2	109.3	108.2
4	22.7	50.4	110.7	109.6	113.1
5	24.4	47.7	111.6	114.4	111.8
6	22.6	51.0	110.9	109.3	114.3
7	26.4	50.4	112.7	112.3	113.9
8	22.2	47.4	111.8	108.3	118.1
9	29.1	47.5	112.4	107.7	112.2
10	23.2	50.9	114.5	111.4	112.6
Avg.	24.5	49.6	112.1	110.3	113.3
Std Dev	2.60	2.07	1.10	2.03	2.57

Tire Size	16
Tire #	7

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/23/20	4/23/20	4/23/20	4/23/20	4/23/20
Ambient (°F)	46	46	46	46	46
Surface (°F)	50	50	49	49	52
1	26.6	45.9	114.5	108.2	111.5
2	22.4	44.5	116.1	105.5	117.6
3	26.5	40.8	108.9	105.8	117.2
4	22.9	46.1	111.2	106.3	113.2
5	22.0	46.4	112.7	107.2	110.1
6	20.4	50.4	112.4	105.2	110.6
7	22.7	47.5	110.1	109.8	115.3
8	19.1	44.4	108.7	106.0	112.0
9	23.0	43.6	109.4	104.2	110.5
10	23.2	46.4	110.6	103.1	116.2
Avg.	22.9	45.6	111.5	106.1	113.4
Std Dev	2.32	2.54	2.46	1.92	2.91

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	23.0	49.6	110.8	107.4	112.7
Std Dev	2.97	4.22	2.15	2.71	2.68

Tread Depth (32nds of an inch)

Date	4/23/20	Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	8	9	9	10
Rib 2	8	9	9	10
Rib 3	9	10	9	10
Rib 4	9	9	9	10
Avg	9.1875			

Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	2	1	1	0
Rib 2	2	1	1	0
Rib 3	1	0	1	0
Rib 4	1	1	1	0
Avg	0.8125			

Tire Size	16
Tire #	8

Tread Depth (32nds of an inch)

Date 11/11/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	10	10	10	10
Rib 2	10	10	10	10
Rib 3	10	10	10	10
Rib 4	10	10	10	10
Avg	10			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	11/18/19	11/18/19	11/18/19	11/18/19	11/18/19
Ambient (°F)	48	45	46	46	48
Surface (°F)	49	54	55	55	55
1	27.0	53.5	111.1	111.0	114.1
2	24.1	53.8	109.5	114.5	117.5
3	25.9	54.6	110.5	110.9	110.6
4	22.9	52.6	108.8	107.8	108.7
5	24.6	48.2	108.4	113.0	111.5
6	21.5	49.3	108.6	108.2	111.7
7	25.4	54.1	111.0	111.8	112.0
8	21.4	56.1	107.8	111.9	108.0
9	22.2	45.8	110.0	110.5	114.0
10	22.1	53.2	110.8	113.0	111.0
Avg.	23.7	52.1	109.7	111.3	111.9
Std Dev	1.98	3.25	1.20	2.09	2.76

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/16/20	4/16/20	4/16/20	4/16/20	4/16/20
Ambient (°F)	37	37	37	37	38
Surface (°F)	47	54	57	57	54
1	28.6	51.3	109.2	106.2	113.7
2	24.3	48.2	111.5	106.7	116.5
3	27.3	47.0	111.4	108.6	115.8
4	21.7	47.0	109.1	103.9	113.5
5	29.0	47.9	112.5	110.5	117.8
6	21.8	53.5	110.6	108.2	115.7
7	26.5	46.9	109.9	111.6	118.9
8	21.2	44.7	112.7	111.5	112.1
9	29.1	47.4	112.2	109.5	110.9
10	21.4	47.0	111.6	112.4	108.8
Avg.	25.1	48.1	111.1	108.9	114.4
Std Dev	3.37	2.51	1.31	2.73	3.16

Tire Size	16
Tire #	8

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/23/20	4/23/20	4/23/20	4/23/20	4/24/20
Ambient (°F)	52	50	50	50	57
Surface (°F)	51	55	54	54	85
1	23.3	50.3	110.4	103.2	115.0
2	21.2	45.6	113.2	104.0	116.2
3	25.8	45.2	111.7	104.4	112.8
4	18.5	44.1	111.1	102.8	108.0
5	22.9	45.2	112.4	109.8	112.6
6	21.0	44.1	113.7	106.9	115.9
7	24.9	46.7	107.8	104.7	112.3
8	18.7	39.9	108.9	104.0	109.7
9	23.0	45.5	110.8	104.1	116.6
10	16.8	43.7	112.6	108.5	107.1
Avg.	21.6	45.0	111.3	105.2	112.6
Std Dev	2.92	2.60	1.87	2.35	3.42

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	23.5	48.4	110.7	108.5	113.0
Std Dev	3.08	4.01	1.61	3.42	3.20

Tread Depth (32nds of an inch)

Date: 4/27/20 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	9	9	6	5
Rib 2	7	8	6	6
Rib 3	8	9	6	6
Rib 4	9	9	6	5
Avg	7.125			

Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	1	1	4	5
Rib 2	3	2	4	4
Rib 3	2	1	4	4
Rib 4	1	1	4	5
Avg	2.875			

Tire Size	16
Tire #	9

Tread Depth (32nds of an inch)

Date 11/19/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	10	10	10	10
Rib 2	10	10	10	10
Rib 3	10	10	10	10
Rib 4	10	10	10	10
Avg	10			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	11/19/19	11/19/19	11/19/19	11/19/19	11/19/19
Ambient (°F)	44	45	43	43	43
Surface (°F)	49	55	58	58	51
1	26.1	56.4	108.6	110.7	110.7
2	26.9	55.0	106.3	110.9	111.8
3	24.3	53.5	109.4	110.5	113.9
4	23.0	56.4	107.3	106.0	109.2
5	23.4	61.1	108.1	112.9	111.3
6	24.2	55.0	109.1	111.6	111.6
7	26.9	52.5	110.4	110.6	108.7
8	23.7	58.9	109.2	109.7	103.6
9	24.7	56.7	109.3	111.8	109.7
10	19.8	53.6	111.8	113.6	114.3
Avg.	24.3	55.9	109.0	110.8	110.5
Std Dev	2.11	2.61	1.54	2.06	3.03

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/18/20	4/16/20	4/16/20	4/16/20	4/18/20
Ambient (°F)	37	44	44	44	36
Surface (°F)	40	80	74	74	40
1	24.1	50.5	107.8	103.4	107.5
2	23.2	51.0	107.2	105.5	114.4
3	22.6	48.2	105.0	105.9	110.4
4	20.2	49.9	109.9	104.4	106.3
5	19.2	47.5	109.5	108.1	116.7
6	17.1	50.7	105.9	109.8	110.1
7	20.2	49.1	105.9	112.0	114.7
8	23.0	50.8	108.0	104.2	111.7
9	20.4	48.9	109.4	105.8	106.5
10	18.0	49.6	107.1	111.5	111.8
Avg.	20.8	49.6	107.6	107.1	111.0
Std Dev	2.35	1.18	1.68	3.10	3.57

Tire Size	16
Tire #	9

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/27/20	4/27/20	4/27/20	4/27/20	4/27/20
Ambient (°F)	42	41	45	45	43
Surface (°F)	42	45	59	59	54
1	20.0	46.2	109.1	104.0	114.4
2	12.9	46.6	114.3	106.3	111.9
3	20.2	47.7	111.9	106.9	112.7
4	16.1	44.9	111.0	106.5	112.2
5	19.7	43.8	112.1	109.3	103.4
6	15.7	44.0	113.5	103.7	109.2
7	28.5	47.3	109.7	104.4	113.0
8	20.6	44.2	110.4	104.0	112.3
9	17.0	43.3	108.4	106.2	113.5
10	17.8	39.9	108.6	106.1	109.6
Avg.	18.9	44.8	110.9	105.7	111.2
Std Dev	4.18	2.31	2.03	1.74	3.18

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	21.3	50.1	109.1	107.9	110.9
Std Dev	3.71	5.07	2.20	3.17	3.17

Tread Depth (32nds of an inch)

Date: 4/27/20 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	8	7	8	9
Rib 2	7	6	8	9
Rib 3	7	6	7	9
Rib 4	7	6	7	8

Avg: 7.4375

Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	2	3	2	1
Rib 2	3	4	2	1
Rib 3	3	4	3	1
Rib 4	3	4	3	2

Avg: 2.5625

Tire Size	16
Tire #	10

Tread Depth (32nds of an inch)

Date 11/19/19 Valve stem # 1, then clockwise, outside to inside

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	10	10	10	10
Rib 2	10	10	10	10
Rib 3	10	10	10	10
Rib 4	10	10	10	10
Avg	10			

Break in Tire (10 chirps at 20 mph Dry)

PBC Data

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	11/19/19	11/19/19	11/19/19	11/19/19	11/19/19
Ambient (°F)	46	45	45	45	45
Surface (°F)	47	61	62	62	57
1	25.2	59.3	112.9	116.6	116.2
2	23.2	58.0	116.8	115.4	116.6
3	24.6	58.2	110.8	114.8	119.5
4	23.1	59.1	114.5	116.3	117.9
5	25.4	58.8	114.2	113.8	119.9
6	20.9	59.7	117.7	119.1	120.4
7	24.2	53.1	114.2	116.1	123.1
8	22.2	58.8	115.3	118.5	119.2
9	22.3	57.1	117.6	117.3	119.8
10	24.0	55.6	118.6	118.8	117.5
Avg.	23.5	57.8	115.3	116.7	119.0
Std Dev	1.44	2.03	2.43	1.76	2.04

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/18/20	4/18/20	4/18/20	4/18/20	4/18/20
Ambient (°F)	38	38	38	38	39
Surface (°F)	45	50	50	50	48
1	27.7	49.2	107.8	109.9	111.0
2	18.4	49.2	107.8	112.9	109.8
3	25.2	48.0	107.0	110.1	112.8
4	19.5	47.8	101.9	106.8	110.1
5	21.9	46.6	106.1	110.4	108.6
6	16.5	46.5	107.3	109.6	106.6
7	42.3	47.4	109.4	107.0	114.7
8	18.3	48.4	109.2	107.5	109.5
9	20.6	44.4	102.5	106.4	112.1
10	21.0	48.5	111.6	109.7	108.9
Avg.	23.1	47.6	107.1	109.0	110.4
Std Dev	7.51	1.46	2.98	2.05	2.33

Tire Size	16
Tire #	10

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Date	4/27/20	4/27/20	4/27/20	4/27/20	4/27/20
Ambient (°F)	48	48	48	48	48
Surface (°F)	60	71	67	67	70
1	23.4	49.9	113.8	104.4	110.3
2	19.3	51.9	110.7	106.8	110.1
3	27.4	47.3	108.7	105.4	100.4
4	17.4	44.3	109.9	104.7	112.8
5	23.9	46.1	111.5	107.4	110.2
6	16.9	45.6	109.9	105.3	111.4
7	26.8	47.3	114.4	103.2	114.7
8	19.0	45.3	112.2	106.2	108.9
9	22.6	42.8	111.6	103.6	110.8
10	16.0	45.1	111.6	106.8	114.4
Avg.	21.3	46.6	111.4	105.4	110.4
Std Dev	4.11	2.68	1.76	1.42	4.00

	Ceramic	Jennite	Asphalt(D)	Asphalt(W)	Concrete
Avg.	22.6	50.6	111.3	110.4	113.3
Std Dev	4.94	5.54	4.14	5.08	5.00

Tread Depth (32nds of an inch)

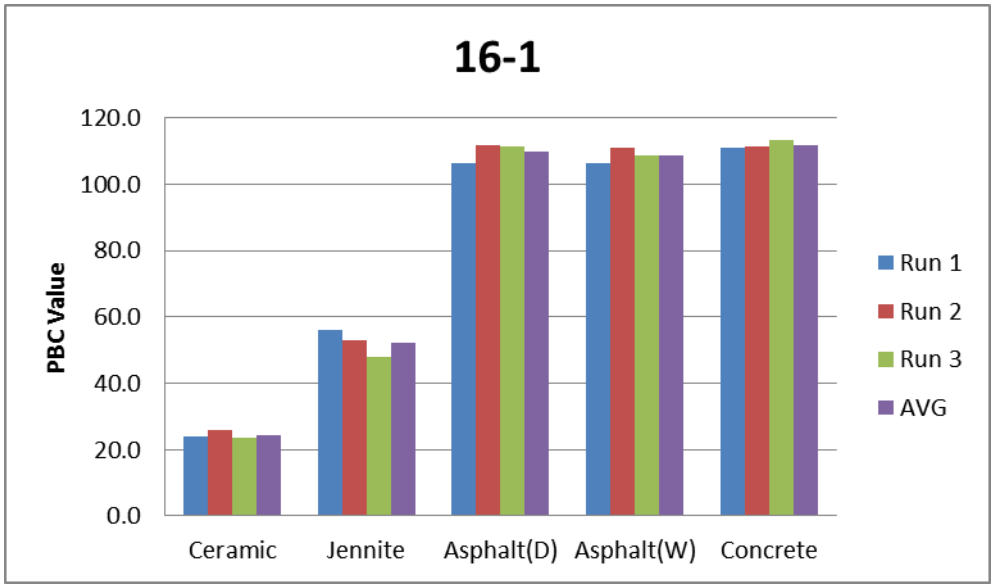
Date	4/27/20	Valve stem # 1, then clockwise, outside to inside

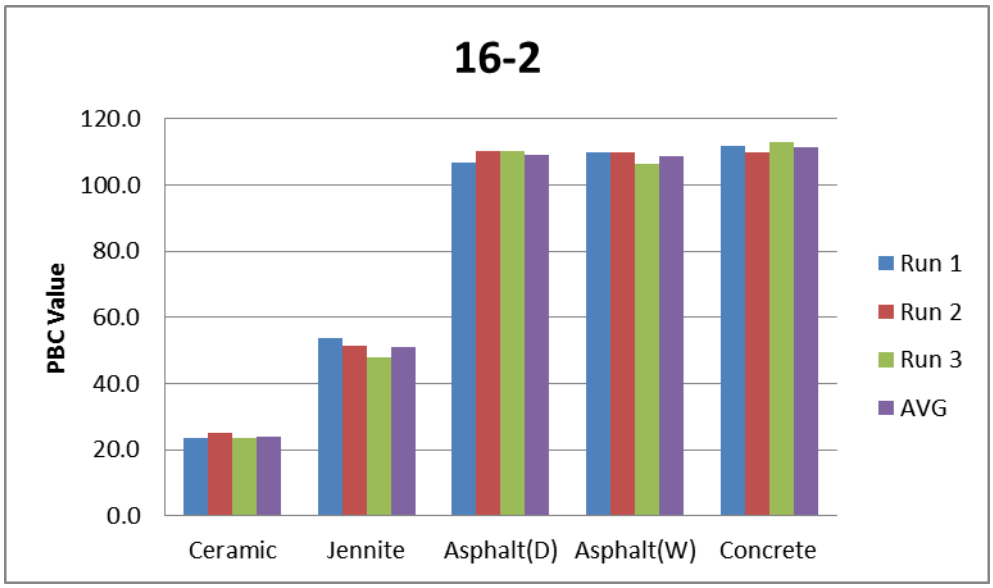
	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	7	7	8	8
Rib 2	7	6	7	8
Rib 3	7	5	8	8
Rib 4	7	5	8	9
Avg	7.1875			

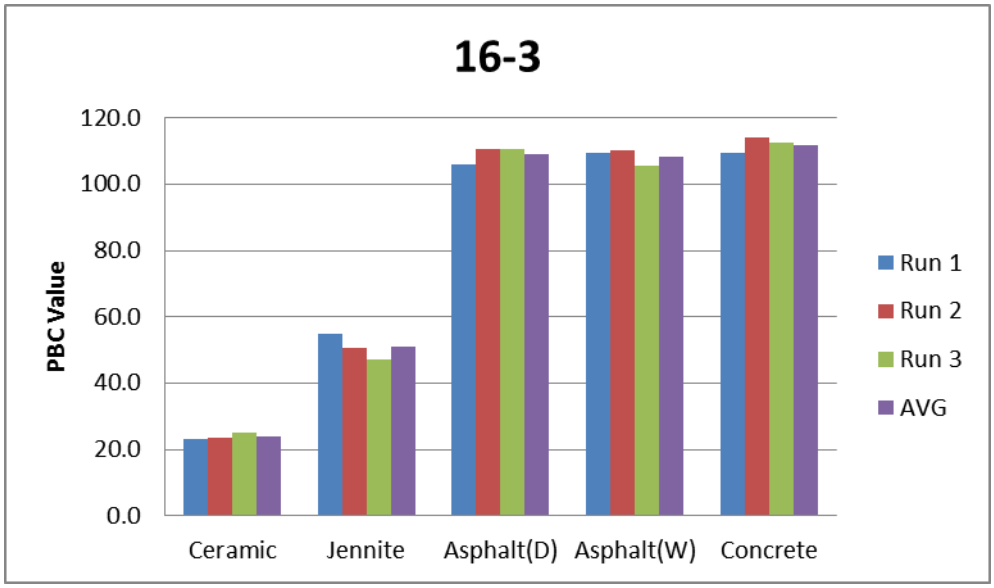
Tread Wear (32nds of an inch)

	Pos 1	Pos 2	Pos 3	Pos 4
Rib 1	3	3	2	2
Rib 2	3	4	3	2
Rib 3	3	5	2	2
Rib 4	3	5	2	1
Avg	2.8125			

A graphical representation of the data for each run plus the average follows:






16-3
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100.0
80.0
60.0
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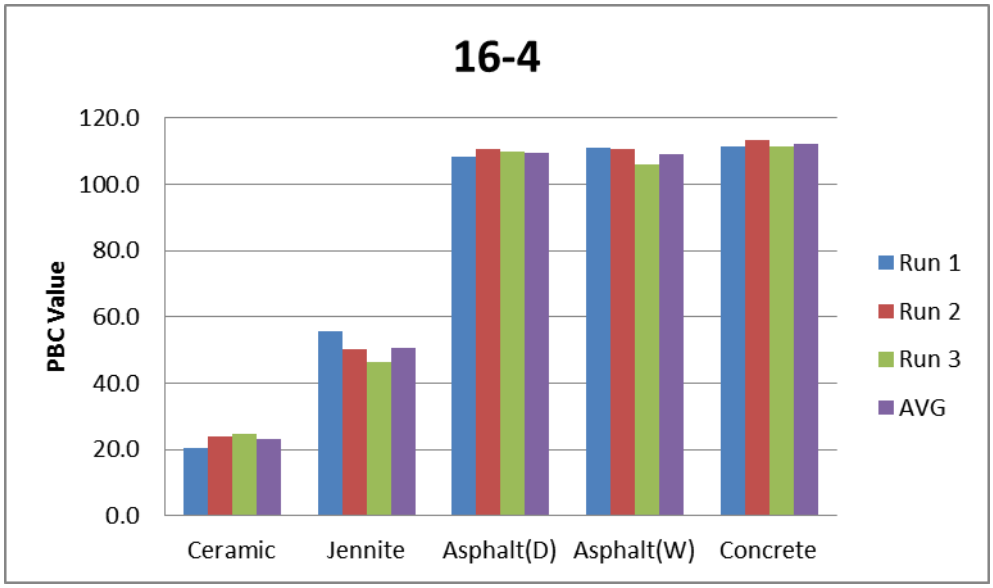
PBC Value
Ceramic
Jennite
Asphalt(D)
Asphalt(W)
Concrete
Run 1
Run 2
Run 3
AVG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80.0
60.0
40.0
20.0
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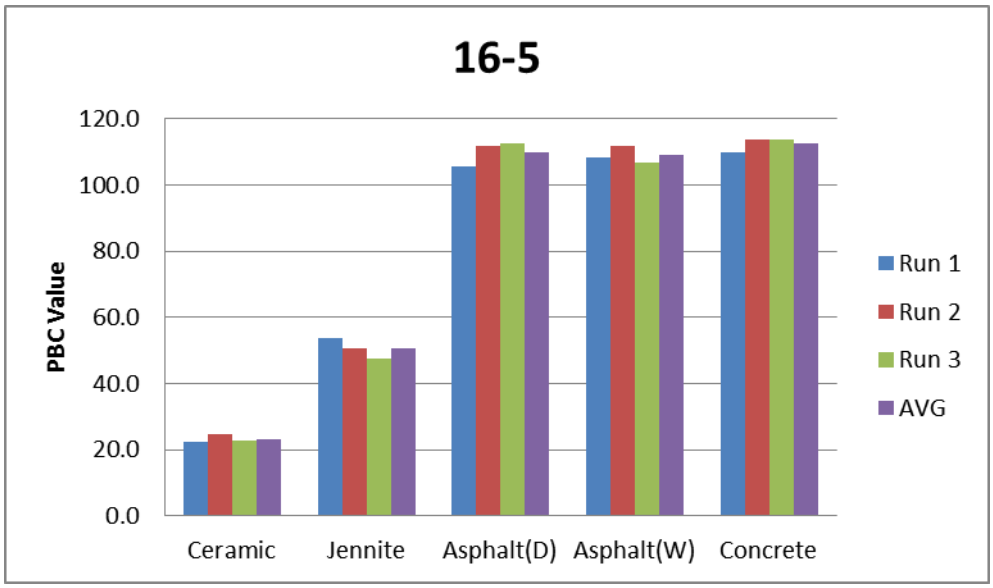
PBC Value
Ceramic
Jennite
Asphalt(D)
Asphalt(W)
Concrete
Run 1
Run 2
Run 3
AVG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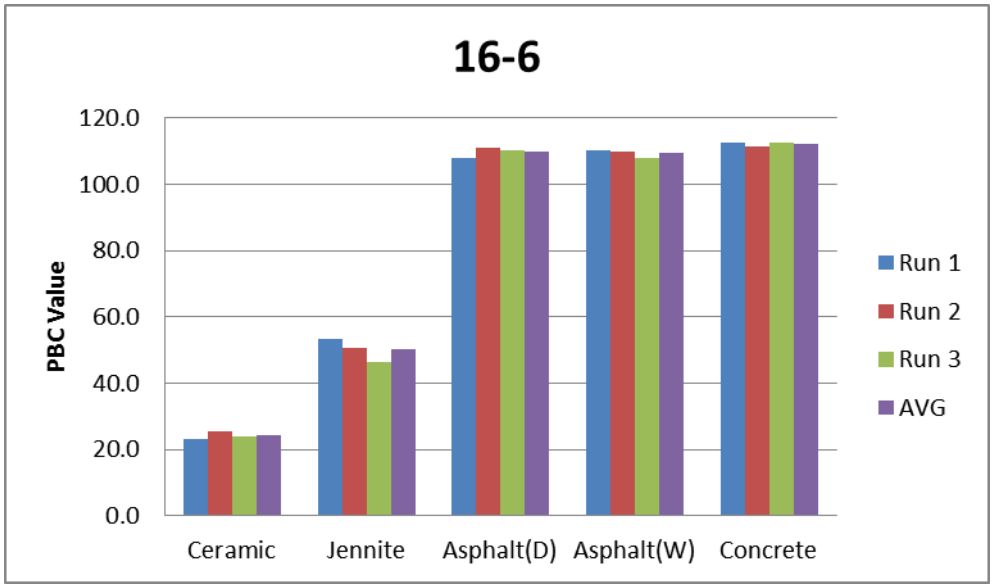
100.0
80.0
60.0
40.0
20.0
0.0
Ceramic
Jennite
Asphalt(D)
Asphalt(W)
Concrete
Run 1
Run 2
Run 3
AVG


16-6
PBC Value
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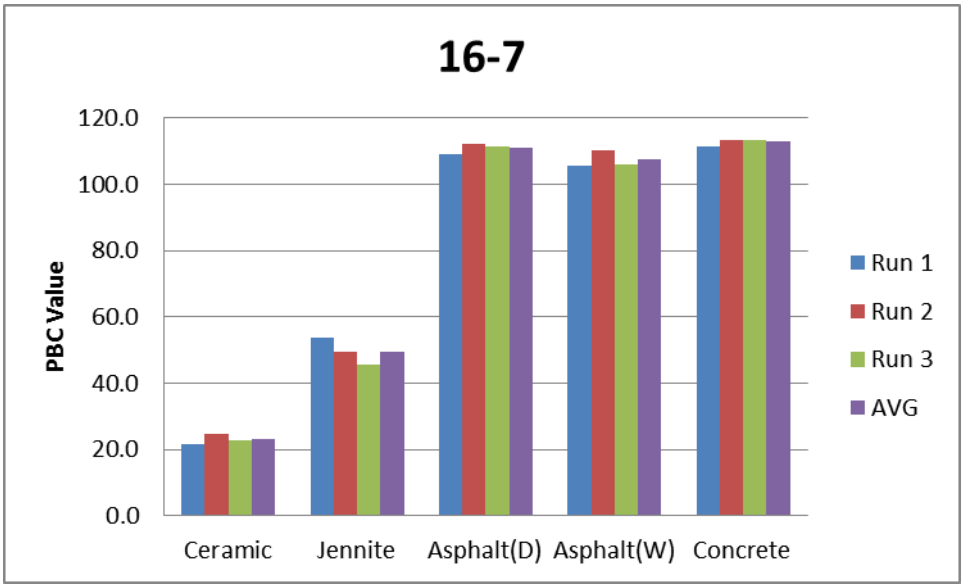
80.0
60.0
40.0
20.0
0.0
Ceramic
Jennite
Asphalt(D)
Asphalt(W)
Concrete
Run 1
Run 2
Run 3
AVG


16-7
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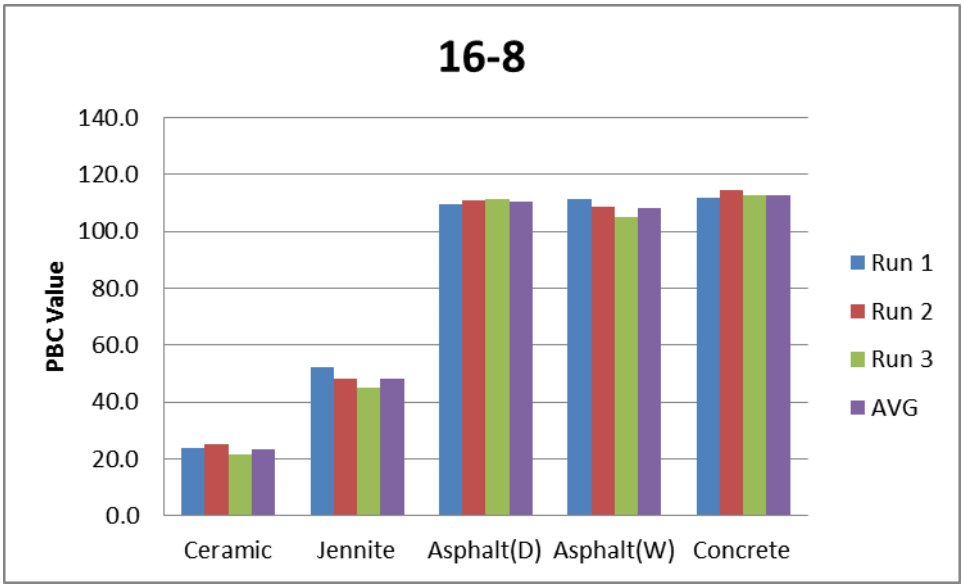
100.0
80.0
60.0
40.0
20.0
0.0
PBC Value
Ceramic
Jennite
Asphalt(D)
Asphalt(W)
Concrete
Run 1
Run 2
Run 3
AVG


16-8
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60.0
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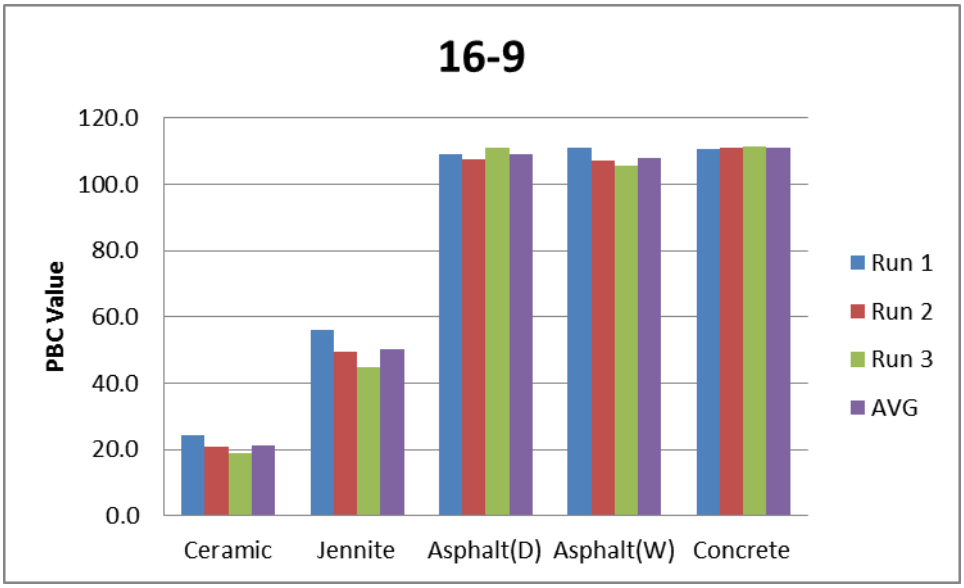
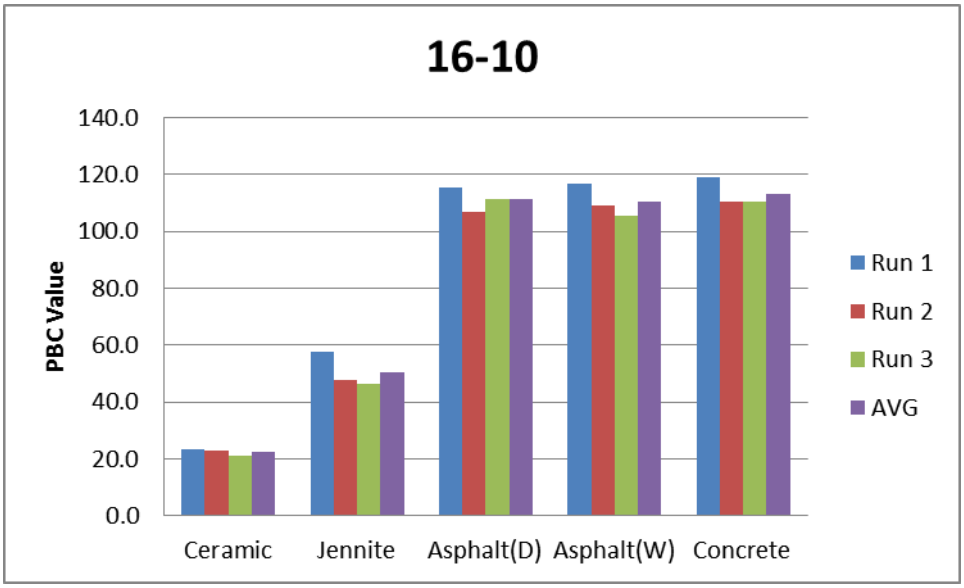
20.0
0.0
PBC Value
Ceramic
Jennite
Asphalt(D)
Asphalt(W)
Concrete
Run 1
Run 2
Run 3
AVG


16-9
120.0
100.0
80.0
60.0
40.0
20.0
0.0
PBC Value
Ceramic
Jennite
Asphalt(D)
Asphalt(W)
Concrete
Run 1
Run 2
Run 3
AVG


16-10
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
PBC Value
Ceramic
Jennite
Asphalt(D)
Asphalt(W)
Concrete
Run 1
Run 2
Run 3
AVG