



construction managers

general contractors

design builders

SUBMITTAL REVIEW
Project # 417 The Residences at Echelon

Date: November 7, 2017

Submittal Number: 32-1216-01 Asphalt Paving
Type 3 Surface

Sequence Number: 15

Subcontractor: Calverts Paving
Rod Calvert

Submit To: NSPJ Architects
Tim Hauschild

SUBMITTAL FOR APPROVAL	
Job Name/No: 417 The Residences at Echelon	
☒ REVIEWED	☐ REVISE & RESUBMIT
☐ REVIEWED& NOTED	☐ REJECTED
Submittal received for general compliance with the Contract Documents. Contractor's review does not relieve sub/vendor of responsibility for dimension, quantities, accuracy or completion of submittals or from any responsibilities required by terms and conditions of Subcontract/PO with Luke Draily Construction Co., Inc.. Sub/Vendors shall follow all manufacturer installation instructions. Installing contractor shall be responsible to coordinate with trades for hookup, supports, routing, etc.	
By: JDW	Date: 11/7/17

Engineering Solutions	Shop Drawing Review
Project: Aldersgate	Date: 11-10-17
Submittal# PVMT 3	By: MJS
☒ APPROVED	☐ REJECTED
☐ APPROVED AS NOTED	



Hot Mix Materials, Inc.
2701 E. 85th Street
Kansas city, MO 64132

Project: Asphaltic Concrete Mix Design
APWA Type 3-01

Report #03532442-9-A1

Report date: Jun 14, 2017

Lab No: 4935 E

The Recycled Asphalt Concrete (RAC) is comprised of Reclaimed Asphalt Pavement (RAP) and virgin materials. The mix was performed utilizing Marshall design procedures in general accordance with methods in the Asphalt Institute Manual MS-2, AASHTO T245 and ASTM D2041. The master grade limits, job mix formula tolerances and Marshall characteristic requirements comply with Kansas City Metropolitan Chapter of American Public Works Association Standard Specifications, 2017 edition. The VMA is calculated utilizing virgin aggregate bulk, dry specific gravities and RAP aggregate effective specific gravity. The maximum theoretical specific gravity and Marshall specimens were cured 2 hours at compaction temperature prior to testing. Percent binder is reported on a total mix basis except where noted.

It may be necessary to adjust plant settings from designed values due to differences in plant and laboratory produced mixtures or variations in component materials.

Reviewed by
Professional Service Industries, Inc.


Eileen Peterson
Project Manager


Kelly E Rotert, PE, DBIA
Vice President

cc: Mr. Allen Conway

These test results apply only to the specific locations and materials noted and may not represent any other locations or elevations. This report may not be reproduced, except in full, without written permission by Professional Service Industries, Inc. If a non-compliance appears on this report, to the extent that the reported non-compliance impacts the project, the resolution is outside the PSI scope of engagement.

Hot Mix Materials, Inc.
APWA Type 3-01
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Lab # 4935 E

SUMMARY OF MIX DATA

MIX COMPOSITION

Component	% Agg	% Total Mix
#754 3/4"	20.0	19.0
#932 3/8" CHIPS	33.0	31.4
#981 DUST	30.0	28.5
SAND	17.0	16.2
PG 64-22		

MIX SPECIFIC GRAVITY DATA

Component	Specific Gravity
binder	1.032
calculated bulk of composite mix aggregates	2.566
calculated apparent of composite mix aggregates	2.700
calculated effective of mix aggregates	2.657
calculated maximum theoretical at recommended percent binder	2.469

GRAIN SIZE ANALYSIS - (percent passing)

Sieve Size	1 1/2	1	3/4	1/2	3/8	No 4	No 8	No 16	No 30	No 50	No 100	No 200
Opening, mm	37.5	25.0	19.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075
TRIAL MIX SINGLE POINT			100	93	86	64	43	32	24	14	8	7.0
MASTER GRADE LIMITS			100-	85-100	70-90	50-70	37-47	26-36	18-30	12-22	6-15	4-10
JOB-MIX FORMULA TOLERANCE			100-	89-97	82-90	60-68	40-46	29-35	21-27	11-17	6-15	6-8
TOLERANCE (+/-)				4	4	4	3	3	3	3		1
Difference between sieves (25% maximum)				7	7	22	21	11	9	10	6	

MARSHALL CHARACTERISTICS SUMMARY

50 Compaction blows per face		Trial Mix Data	Specification
Cure parameters: 4 hrs @ compaction temperature	Stability, lbs	3670	1500 minimum
(laboratory only)	Flow, 1/100 inch	9	8-16
mixing temperature of 300-310	% Voids total mix	3.5	3-5 design only
compaction temperature of 280-290	% Voids in mineral aggregate (VMA)	11.8	no specification
	% Voids filled with asphalt (VFA)	70.0	--
	Density, pcf / Gmb	148.2 / 2.383	--
	minus 200/effective binder ratio	1.3	--
	% Binder, total mix basis	4.85	aggregate basis 5.1

Hot Mix Materials, Inc.
APWA Type 3-01
Report #03532442-9-A1

Lab # 4935 E

COMPONENT MATERIAL IDENTIFICATION

#754 3/4"	Crushed limestone aggregate delivered to the laboratory March, 2017. Source identified as Martin Marietta Greenwood Quarry Gsb = 2.59, % Absorption = 1.7
#932 3/8" CHIPS	Crushed limestone aggregate delivered to the laboratory March, 2017. Source identified as Martin Marietta Greenwood Quarry Gsb = 2.56, % Absorption = 2.1
#981 DUST	Crushed limestone aggregate delivered to the laboratory March, 2017. Source identified as Martin Marietta Greenwood Quarry Gsb = 2.53, % Absorption = 2.7
SAND	Natural sand aggregate delivered to the laboratory March, 2017. Source identified as Holliday Sand & Gravel. Gsb = 2.60, % Absorption = 0.6
PG 64-22	Asphalt cement binder delivered to the laboratory March, 2017. See certificate of analysis.

Hot Mix Materials, Inc.
APWA Type 3-01
Report #03532442-9-A1

Lab # 4935 E

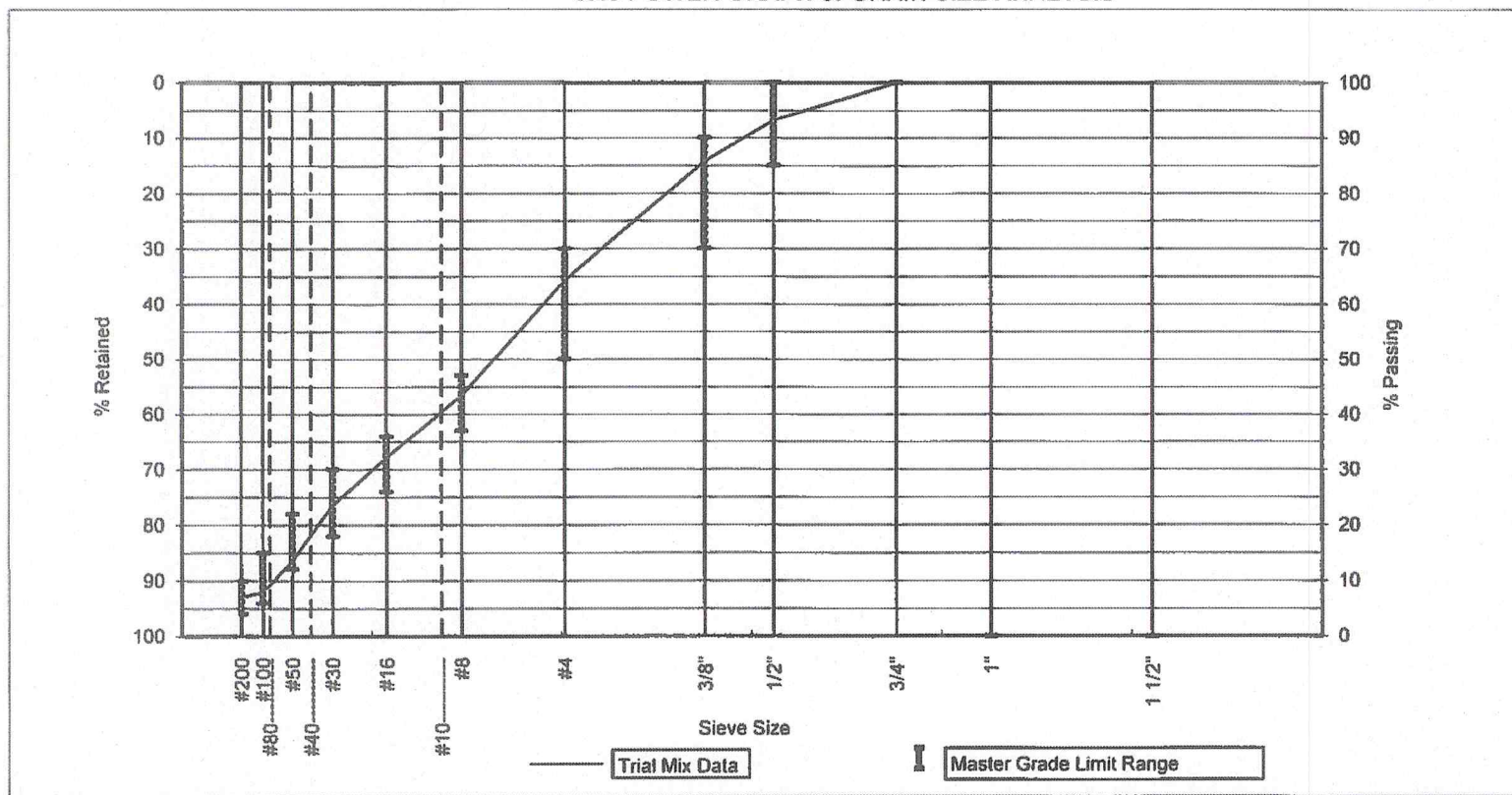
GRAIN SIZE ANALYSIS

	Sieve Size	1 1/2	1	3/4	1/2	3/8	No 4	No 8	No 16	No 30	No 50	No 100	No 200
	Opening, mm		25.0	19.0	12.5	9.5	4.75	2.36	1.18	0.600	0.300	0.150	0.075
MIX COMPONENT	ORIGINAL GRADATIONS (percent passing)												
#754 3/4"				100	66	29	3	2	2	2	1	1	1.4
#932 3/8" CHIPS				100	100	100	51	7	3	3	3	2	2.4
#981 DUST				100	100	100	100	83	56	40	30	23	19.5
SAND				100	100	100	99	93	82	60	20	1	0.6
MIX COMPONENT	% in Trial	% in Mix	% in trial										
#754 3/4"	20.0	20.0		20	13	6	1	0	0	0	0	0	0.3
#932 3/8" CHIPS	33.0	33.0		33	33	33	17	2	1	1	1	1	0.8
#981 DUST	30.0	30.0		30	30	30	30	25	17	12	9	7	5.9
SAND	17.0	17.0		17	17	17	17	16	14	10	3	0	0.1
				0	0	0	0	0	0	0	0	0	0.0
TRIAL MIX SINGLE POINT	100.0	100.0		100	93	86	64	43	32	24	14	8	7.0
MASTER GRADE LIMITS				100-	85-100	70-90	50-70	37-47	26-36	18-30	12-22	6-15	4-10
JOB-MIX FORMULA				100-	89-97	82-90	60-68	40-46	29-35	21-27	11-17	6-15	6-8
TOLERANCE (+/-)				0	4	4	4	3	3	3	3		1

Hot Mix Materials, Inc.
APWA Type 3-01
Report #03532442-9-A1

Lab # 4935 E

0.45 POWER GRAPH of GRAIN SIZE ANALYSIS





Phillips 66

12/2/2016 8:36

Certificate of Analysis
Petroleum Fuel & Terminal Granite City, IL

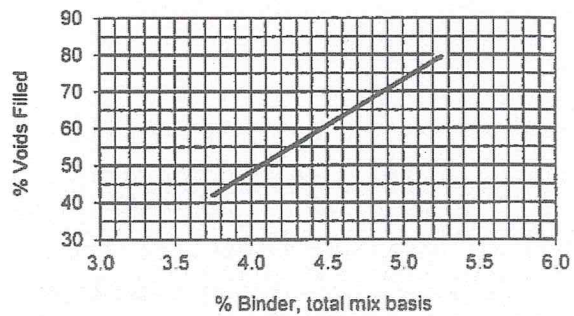
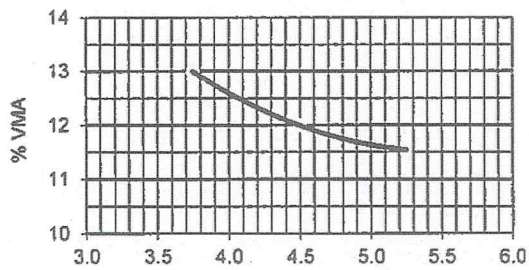
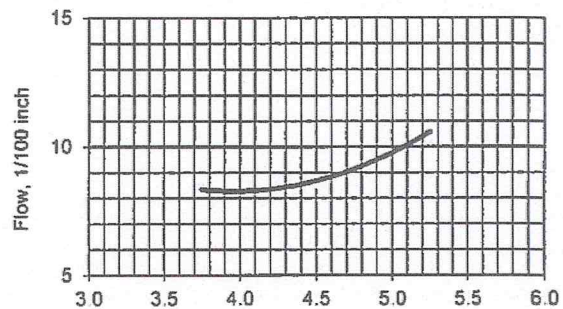
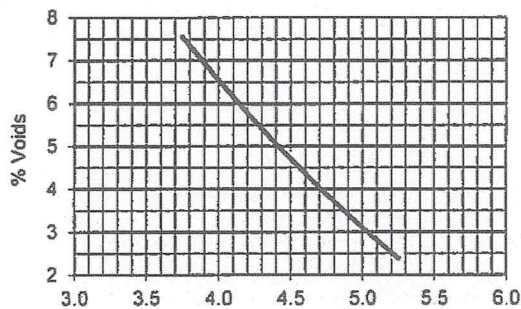
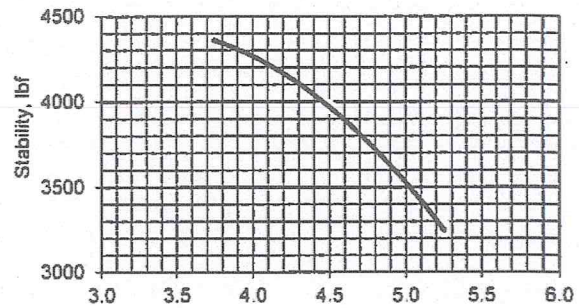
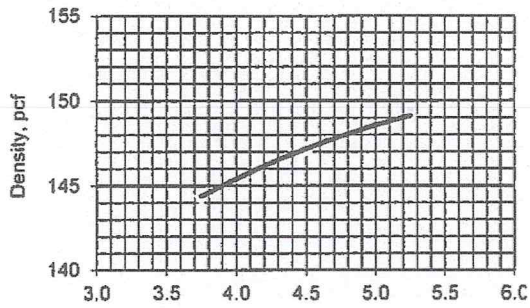
Ship Date:		Customer:	
Product Name:	PG64-22	Destination:	
Product Code:		Transport ID:	
Lablynx Log ID		Trip Number:	
Report Date:	11/29/2016	PINS NO:	
Date Sampled:	11/28/2016	Carrier:	
Centerpoint Terminal Sample ID	2016849	Rail Car Number:	
Tank :	80-6		

Method	Determinate	Results	Units
T228 Sp. Gravity. @ 15.6 °C	Specific Gravity	1.032	
API @ 15.6 °C	API	5.612	
T48 COC Flash, °C	Flash Point	310	°C
T202 Vacuum Visc. @ 60.0 °C	Absolute Viscosity	NA	Pa-s
T316 Viscosity @ 135 °C	Rotational Viscosity	0.370	Pa-s
T49 Penetration	Penetration	NA	dmm
T53 Softening Point	Softening Point	NA	°C
T315-DSR @ 64° C	G*	1.13	kPa
T315-Phase Angle @	Phase Angle @ Orig	87.7	Degrees
T315-DSR @ 64° C	G*/sin D	1.13	kPa
T240 RTFO	Mass Loss	-0.188	Wt %
T315-RTFO DSR @ 64° C	G*	3.19	kPa
T315-Phase angle on RTFO	Phase Angle on RTFO	83.8	Degrees
T315-RTFO DSR @ 64° C	G*/sin D RTFO	3.21	kPa
T315-PAV DSR @ 25.0° C	G*	5357	
T315-Phase angle on PAV	Phase Angle on PAV	44.8	Degrees
T315-PAV DSR @ 25.0° C	G*/sin D PAV	3774	kPa
T313-BBR Stiffness @ -12.0° C	S	166	MPa
T313-BBR m-Value @ -12.0° C	m-Value	0.313	
T301 -Elastic Recovery	ER on RTFO	NA	Percent
T350 -MSCR @ 64 °C	Jnr @ 0.1kPa	2.709	1/kPa
T350 -MSCR @ 64 °C	Jnr @ 3.2kPa	3.027	1/kPa
T350 -MSCR @ 64 °C	Jnr % Diff	11.7	%
T350 -MSCR @ 64 °C	Ave Recovery @0.1kPa	6.62	%

Material was found to meet AASHTO M320 Table 1 unless otherwise noted.
 Material analyzed by **AMRL** certified **Center Point Terminal Company** in Granite City, IL.
 T202 performed by Phillips 66

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APWA Type 3-01
Report #03532442-9-A1

Lab # 4935 E



Summary Trial Mix Data

% Binder	3.75	4.50	5.25		
Effective % binder	2.42	3.18	3.94		
Bulk specific gravity	2.320	2.365	2.396		
Maximum theoretical specific gravity	2.509	2.481	2.454		
Density, pcf	144.4	147.2	149.1		
% Voids	7.5	4.7	2.4		
% Voids in mineral aggregate (VMA)	13.0	12.0	11.5		
% Voids filled with asphalt (VFA)	41.9	60.8	79.3		
Stability, lbf	4360	3970	3270		
Flow, 1/100 inch	8	9	10		
Dust/Binder ratio	2.9	2.2	1.8		

Hot Mix Materials, Inc.
APWA Type 3-01
Report #03532442-9-A1

Lab # 4935 E

MARSHALL CHARACTERISTIC DATA

	% Binder	Trial 1	Trial 2	Trial 3	Average	% Binder	Trial 1	Trial 2	Trial 3	Average
Weight in air, g	3.75	1229.5	1233.0	1233.8		4.50	1233.8	1233.9	1232.1	
SSD weight in air, g		1235.4	1237.7	1238.4			1236.4	1236.1	1233.6	
Weight in water, g		704.0	705.8	708.3			713.0	714.9	713.6	
Volume, cc		531.4	531.9	530.1			523.4	521.2	520.0	
Bulk specific gravity		2.314	2.318	2.327	2.320		2.357	2.367	2.369	2.365
Theoretical specific gravity		2.524	2.524	2.524			2.495	2.495	2.495	
Density, pcf		144.0	144.3	144.9	144.4		146.7	147.3	147.5	147.2
% Voids		8.3	8.1	7.8	8.1		5.5	5.1	5.1	5.2
% VMA		13.2	13.1	12.7	13.0		12.3	11.9	11.8	12.0
% VEA		4.9	4.9	4.9			6.7	6.8	6.8	
% Voids filled with asphalt		37.1	37.6	38.8	37.9		54.9	56.9	57.3	56.3
Stability dial reading		765	811	852			742	701	707	
Corrected Stability, lbf		4121	4367	4587	4360		3998	3937	3970	3970
Thickness, inch		2 9/16	2 9/16	2 9/16			2 9/16	2 1/2	2 1/2	
Flow, 1/100 inch		8	9	8	8		9	8	9	9
Weight in air, g	5.25	1230.7	1234.2	1230.8						
SSD weight in air, g		1231.9	1234.9	1232.0						
Weight in water, g		718.3	720.8	717.0						
Volume, cc		513.6	514.1	515.0						
Bulk specific gravity		2.396	2.401	2.390	2.396					
Theoretical specific gravity		2.468	2.468	2.468						
Density, pcf		149.1	149.4	148.7	149.1					
% Voids		2.9	2.7	3.2	2.9					
% VMA		11.5	11.4	11.8	11.5					
% VEA		8.6	8.6	8.6						
% Voids filled with asphalt		74.8	76.0	73.1	74.6					
Stability dial reading		586	582	578						
Corrected Stability, lbf		3296	3274	3251	3270					
Thickness, inch		2 1/2	2 1/2	2 1/2						
Flow, 1/100 inch		11	10	10	10					

RESISTANCE TO MOISUTRE DAMAGE OF PAVEMENT - AASHTO T283												
Date:		7/19/2017										
Report #		3532442-13-A1										
Mix Type:		APWA Type 3-01										
Asphalt Grade:		PG 64-22										
Asphalt %:		4.71										
% Saturation based on Dry Wt. (Y/N)		Y										
	SAMPLE #	T01	T02	T03	T04	T05	T06	T07	T08	T09	T10	
* 1	Diameter, mm	D	150.11	150.14	150.14	150.14	150.11	150.09	150.06	150.11	150.01	150.06
* 2	Thickness, mm	t	93.95	94.23	94.28	94.16	94.28	94.21	94.13	94.21	94.16	94.16
* 3	Dry mass, g	A	3684.6	3761.0	3739.7	3738.3	3739.0	3739.0	3739.0	3739.4	3739.3	3740.1
* 4	Mass in Water, g	B	2077.1	2143.8	2114.5	2126.1	2116.5	2120.5	2116.7	2117.3	2119.3	2119.7
* 5	SSD mass,g	C	3702.0	3776.1	3752.4	3754.2	3752.8	3752.5	3749.7	3753.1	3753.6	3752.3
6	Volume, mL (C-B)	E	1624.9	1632.3	1637.9	1628.1	1636.3	1632.0	1633.0	1635.8	1634.3	1632.6
7	Bulk Sp Gravity (A/E)	F	2.268	2.304	2.283	2.296	2.285	2.291	2.290	2.286	2.288	2.291
* 8	Max Sp Gravity	G	2.468	2.468	2.468	2.468	2.468	2.468	2.468	2.468	2.468	2.468
9	% Air Voids (100(G-F)/G)	H	8.1	6.7	7.5	7.0	7.4	7.2	7.2	7.4	7.3	7.2

Conditioned Plugs #		T06	T08	T09	
* 1	Diameter, mm	D	150.09	150.11	150.01
* 2	Thickness, mm	t	94.21	94.21	94.16
* 3	Dry mass, g	A	3739.0	3739.4	3739.3
* 4	Mass in Water, g	B	2120.5	2117.3	2119.3
* 5	SSD mass,g	C	3752.5	3753.1	3753.6
6	Volume, mL (C-B)	E	1632.0	1635.8	1634.3
7	Bulk Sp Gravity (A/E)	F	2.291	2.286	2.288
* 8	Max Sp Gravity	G	2.468	2.468	2.468
9	% Air Voids (100(G-F)/G)	H	7.17	7.37	7.29
10	Vol Air Voids (HE/100)	I	117.0	120.6	119.1

Unconditioned Plugs		T05	T07	T10
Diameter, mm		150.11	150.06	150.06
Thickness, mm		94.28	94.13	94.16
Dry mass, g		3739.0	3739.0	3740.1
Mass in Water, g		2116.5	2116.7	2119.7
SSD mass,g		3752.8	3749.7	3752.3
Volume, mL (C-B)		1636.3	1633.0	1632.6
Bulk Sp Gravity (A/E)		2.285	2.290	2.291
Max Sp Gravity		2.468	2.468	2.468
% Air Voids (100(G-F)/G)		7.41	7.21	7.17

Saturating Plugs		T06	T08	T09	
Date Saturated:		07/20/2017			
* 12	SSD mass, g	B'	3826.1	3833.7	3829.8
* 13	Mass in water, g	C'	2195.2	2197.5	2194.6
14	Volume, mL (B'-C')	E'	1630.9	1636.2	1635.2
15	Vol Abs Water, mL (B'-A)	J'	87.1	94.3	90.5
16	% Saturation (100J'/I)		74.4	78.2	76.0
17	% Swell (100(E'-E)/E)		-0.1	0.0	0.1

Conditioned Plugs		T06	T08	T09	
Date Broke:		07/25/2017			
* 18	Diameter, mm	d"	150.32	150.16	150.16
* 19	Thickness, mm	t"	94.41	94.51	94.34
* 20	SSD mass, g	B"	3835.4	3835.9	3831.0
* 21	Mass in water, g	C"	2194.3	2192.9	2192.0
22	Volume, mL (B"-C")	E"	1641.1	1643.0	1639.0
23	Vol Abs Water, mL(B"-A)	J"	96.4	96.5	91.7
24	% Saturation (100J"/I)		82.4	80.0	77.0
25	% Swell (100(E"-E)/E)		0.6	0.4	0.3
*26A	Load (Pound Force)		4303	3936	4399
*26B	Load, N (Conditioned)	P"	19141	17508	19568
27	Wet Str. (2000P"/(t"Dp))	Strm	858.62	785.34	879.38
28					

Unconditioned Plugs		T05	T07	T10
Date Broke: 07/25/2017				
Diameter, mm		150.11	150.06	150.06
Thickness, mm		94.28	94.13	94.16

Load (Pound Force)		4434	4171	4537
Load, N (Uncond. plugs)		19723	18554	20182
Dry Str. (2000P/(tDp))		887.15	836.17	909.30

29	Avg. Dry Strength (kPa)	878
30	Avg. Wet Strength (kPa)	841
31	% TSR	95.8 Pass

* - represents information required for spreadsheet.	3 plugs per set
Average % Saturation(Cond):	76.2
Average % Voids(Cond):	7.28
Average Bulk SpGr(Cond):	2.288
Average % Voids(Uncond):	7.26
Average Bulk SpGr(Uncond):	2.289
T-Test(Uncond.):	Pass
T-Test(Cond.):	Pass

Tested By: Intertek-Professional Service Industries