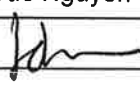


CONTRACTOR'S SUPERPAVE BITUMINOUS MIX DESIGN COMMUNICATION

This information is required by the Michigan Department of Transportation for mix design. The CONTRACTOR is responsible for complete and accurate information on this form. Failure to supply this information will result in delay of Bituminous Paving.

Complete and return to Michigan Department of Transportation, Materials & Technology Division, P.O. Box 30049, Lansing, MI 48909.

CONTROL SECTION		City of Detroit						JOB NUMBER		PWC 7023	
CONTRACTOR		Ajax Materials						ROUTE & LOCATION		Multipals Streets in City Detroit(Corner St)	
PLANT NUMBER		20-10						PLANT LOCATION		Warren, MI	
BITUMINOUS MIXTURE (Circle One)		5E 3						Ajax Mix ID		19-5E3-7-01	

		AGG. A	AGG. B	AGG. C	AGG. D	AGG. E	AGG. F	AGG. G	CONTROL POINTS								
PIT NUMBER		47-56	47-56	95-10	74-51	58-13	74-051	20-10 4.98									
AGGREGATE TYPE		Degradation	2ns	Man sand	Man Sand	3/8 X #4's	3/8x0	Rap									
BLEND % (10% Minimum)		2.0%	20.0%	19.0%	10.0%	10.0%	6.0%	33.0%		RESTRICTED ZONE	COMBINED GRADATION						
AVERAGE GRADATION	P 37.5 mm	100.0	100.0	100.0	100.0	100.0	100.0	100.0			100.0						
	P 25.0 mm	100.0	100.0	100.0	100.0	100.0	100.0	100.0			100.0						
	P 19.0 mm	100.0	100.0	100.0	100.0	100.0	100.0	100.0			100.0						
	P 12.5 mm	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100		100.0						
	P 9.50 mm	100.0	100.0	100.0	100.0	98.5	99.8	98.9	90-100		99.5						
	P 4.75 mm	100.0	98.5	93.3	90.1	30.0	62.2	86.0	90 Max		83.5						
	P 2.36 mm	100.0	91.0	61.2	52.2	7.6	43.0	66.1	32-67		62.2						
	P 1.18 mm	100.0	74.5	37.5	29.0	3.5	31.1	52.2			46.4						
	P 0.60 mm	100.0	49.5	23.5	19.6	3.4	28.0	43.9			34.8						
	P 0.30 mm	98.0	15.2	14.5	8.8	2.2	23.2	24.0			18.2						
	P 0.15 mm	95.0	4.0	7.0	4.0	1.7	15.1	14.1			10.2						
	TOTAL P 0.075 mm	78.0	2.0	4.0	3.0	1.5	11.0	7.2	2.0 - 10.0		6.2						
CRUSH COUNT		1 SIDE	100.0	17.1	100.0	100.0	100.0	100.0	97.1	65	97.7						
		2 SIDE	100.0	13.7	100.0	100.0	100.0	100.0	95.6	-	97.2						
L.A. ABRASION		Value/Year	26	06	26	06	9	14	23	15	30	13	23	16		40	< 40
ANGULARITY INDEX				33.0	47.8	46.7	46.7	47.0		40 min.	45						
AWI NOMOGRAPH & QUARRYS			239.0	238.0	306.0	280.0	258.1	282.0	277.0	260	277.1						
COARSE AGGREGATE BULK SPECIFIC GRAVITY #4 UP			2.610	2.610	2.951	2.658	2.601	2.655	2.695		Tested Blend 2.656	Calculated W/ Rap 2.669					
COARSE AGGREGATE BULK SPECIFIC GRAVITY #8			2.601	2.601	2.944	2.642	2.595	2.641	2.695		2.656	2.669					
FINE AGGREGATE BULK SPECIFIC GRAVITY			2.595	2.595	2.929	2.633	2.590	2.629	2.695		2.723	2.714					
FLAT & ENOLGATED %			0.1	0.1	0.1	0.2	1.2	0.5	1.0	-	-						
SOFT STONE %			0.3	0.3	0.1	0.2	1.7	0.2	1.0	10.0 max	1.0						
ASPHALT CEMENT SUPPLIER		Ajax Asphalt Terminal ABS 2500						FINAL GRADE		PG 64-22							
								VIRGIN GRADE		PG 58-28							
										1.029							
SUBMITTED BY:		NAME (Print or Type) John Duc Nguyen						DATE		PHONE NO. (248) 388-1026							
		SIGNATURE 						October 30, 2020		FAX NO. (248) 244 1026							
DATE REC'D BY LAB		PROJECT ENGINEER						ENGINEERING FIRM									
DATE P.E. NOTIFIED OF SUBMITTAL		P.E. PHONE NUMBER						P.E. FAX NUMBER									

SUBMITTED SUPERPAVE MIX DESIGN SUMMARY SHEET

CONTRACTOR		Ajax Materials		CONSULTANT	
CONTROL SECTION I.D.		City of Detroit	JOB NO.	PWC 7023	TYPE OF MIXTURE:
					5E 3
N _{INT}		7	N _{DES}	86	N _{MAX}
					134
MIXING TEMPERATURE RANGE °F			COMPACTION TEMPERATURE RANGE °F		
290 °F 301 °F			268 °F 277 °F		

SUPERPAVE MIX PROPERTIES AT TESTED & OPTIMUM ASPHALT CONTENT

ITEM	TEST POINTS				RECOMMENDED OPTIMUM Regression Value at Optimum Asphalt Content	VERIFICATION TEST RESULTS @ N _{MAX}
	4 POINT DESIGN					
	FINAL		BLEND			
ASPHALT CONTENT (%)	5.30	5.80	6.30	6.80	6.15	6.15
BULK SPECIFIC GRAVITY @ N _{DES}	2.379	2.401	2.421	2.447	2.416	2.411
BULK SPECIFIC GRAVITY @ N _{MAX}						2.448
THEORETICAL MAXIMUM (S.G.)	2.535	2.516	2.498	2.480	2.503	2.503
AIR VOIDS (%) @ N _{DES}	6.14	4.57	3.09	1.33	3.50	3.68
VOIDS IN MINERAL AGGREGATE % (VMA) @ N _{DES}	16.42	16.09	15.85	15.42	15.91	16.07
VOIDS FILLED WITH ASPHALT % (VFA) @ N _{DES}	63	72	81	91	78	77
% G _{mm} @ N _{INT}	86.5	88.0	89.2	90.7	88.7	88.9
% G _{mm} @ N _{DES}	93.9	95.4	96.9	98.7	96.3	96.3
% G _{mm} @ N _{MAX}						97.8
FINES/EFF ASPHALT RATIO	1.42	1.27	1.15	1.06	1.20	1.19

The submitted superpave mix design final blend shall have a minimum of 4 test points at 0.5 percent asphalt content increments. At least one full asphalt content (0.5%) above and below optimum asphalt content is required.

ASPHALT CONTENT OF SUBMITTED SUPERPAVE MIX DESIGN 6.15

ASPHALT SPECIFIC GRAVITY 1.029

SPECIFIC GRAVITY OF COMBINED AGGREGATE G_{sb} 2.696

GYRATORY COMPACTED BULK SPECIFIC GRAVITY WORKSHEET

PROJECT NUMBER		City of Detroit PWC 7023		DATE		10/30/20		MIX DESIGN NUMBER		19-5E3-7-01	
CONTRACTOR						Ajax Materials					
TYPE SAMPLE						5E 3 BITUMINOUS MIXTURE					

ASPHALT %	SAMPLE	A	B	C	D	E
		WEIGHT IN	SSD	WEIGHT IN	VOLUME OF SAMPLE	ACTUAL SPEC. GRAVITY
5.3	1	4809.7	4815.2	2792.8	2022.4	2.378
	2	4810.1	4816.0	2795.5	2020.5	2.381
AVERAGE						2.379

ASPHALT %						
5.8	1	4826.9	4831.0	2820.8	2010.2	2.401
	2	4833.1	4836.9	2824.4	2012.5	2.402
AVERAGE						2.401

ASPHALT						
6.3	1	4856.9	4859.0	2850.4	2008.6	2.418
	2	4853.9	4857.0	2854.8	2002.2	2.424
AVERAGE						2.421

ASPHALT %						
6.8	1	4873.3	4875.6	2884.2	1991.4	2.447
	2	4876.9	4879.0	2885.5	1993.5	2.446
AVERAGE						2.447

ASPHALT % VERIFICATION SPECIMEN COMPACTED AT OPTIMUM ASPHALT CONTENT TO Nmax						
6.2	1	4873.1	4875.0	2887.0	1988.0	2.451
	2	4875.9	4878.0	2884.0	1994.0	2.445
AVERAGE						2.448

TESTER		Brandon Fuller		CHECKED BY		Richard Poe	
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THEORETICAL MAXIMUM SPECIFIC GRAVITY OF BITUMINOUS PAVING MIXTURES MODIFIED ASTM D 2041 (RICE METHOD)

PROJECT	City of Detroit	PWC 7023	MIX DESIGN NUMBER	19-5E3-7-01
CONTRACTOR	Ajax Materials			

% ASPHALT BINDER		5.30	5.80
ASPHALT SPECIFIC GRAVITY		1.029	1.029
SAMPLE and BOWL WEIGHT in AIR, g	A	4489.8	4488.8
BOWL WEIGHT in AIR, g	B	2341.0	2341.0
SAMPLE WEIGHT in AIR, g	C = A-B	2148.8	2147.8
SAMPLE and BOWL in WATER, g	D	2758.0	2751.1
BOWL in WATER, g	E	1456.8	1456.8
SAMPLE in WATER, g	F = D-E	1301.2	1294.3
VOLUME, cc	G = C-F	847.6	853.5
G _{mm}	C/G	2.535	2.516
G _{se}		2.761	2.762

% ASPHALT BINDER		6.30	6.80
ASPHALT SPECIFIC GRAVITY		1.029	1.029
SAMPLE and BOWL WEIGHT in AIR, g	A	4494.3	4488.3
BOWL WEIGHT in AIR, g	B	2341.0	2341.0
SAMPLE WEIGHT in AIR, g	C = A-B	2153.3	2147.3
SAMPLE and BOWL in WATER, g	D	2748.2	2738.2
BOWL in WATER, g	E	1456.8	1456.8
SAMPLE in WATER, g	F = D-E	1291.4	1281.4
VOLUME, cc	G = C-F	861.9	865.9
G _{mm}	C/G	2.498	2.480
G _{se}		2.764	2.764
AVERAGE G _{se}		2.763	

SOURCE AND GRADE OF ASPHALT CEMENT USED	DATE TESTED
Ajax Asphalt Terminal ABS 2500 0	10/30/20
TESTER	CHECKED BY
Brandon Fuller	Richard Poe

Regression Analysis - Marshall Designs

Actual Test Data

AC Point	% AC	Gmb	Gmm	Air Voids	% @ Nint	VMA	VFA	% @ Nmax	Ut. Wt.	F/A Ratio
1	5.3	2.379	2.535	6.1	86.5	16.4	62.59	93.9	148.48	1.4
2	5.8	2.401	2.516	4.6	88.0	16.1	71.58	95.4	149.85	1.3
3	6.3	2.421	2.498	3.1	89.2	15.9	80.52	96.9	151.08	1.2
4	6.8	2.447	2.480	1.3	90.7	15.4	91.35	98.7	152.68	1.1

Using the 'AIR VOIDS' - 'CALCULATED' Column, ENTER THE AC POINT at which your AIR VOIDS come closest to the target for this mix type: 6.2 Pba 0.92

F/A Ratio

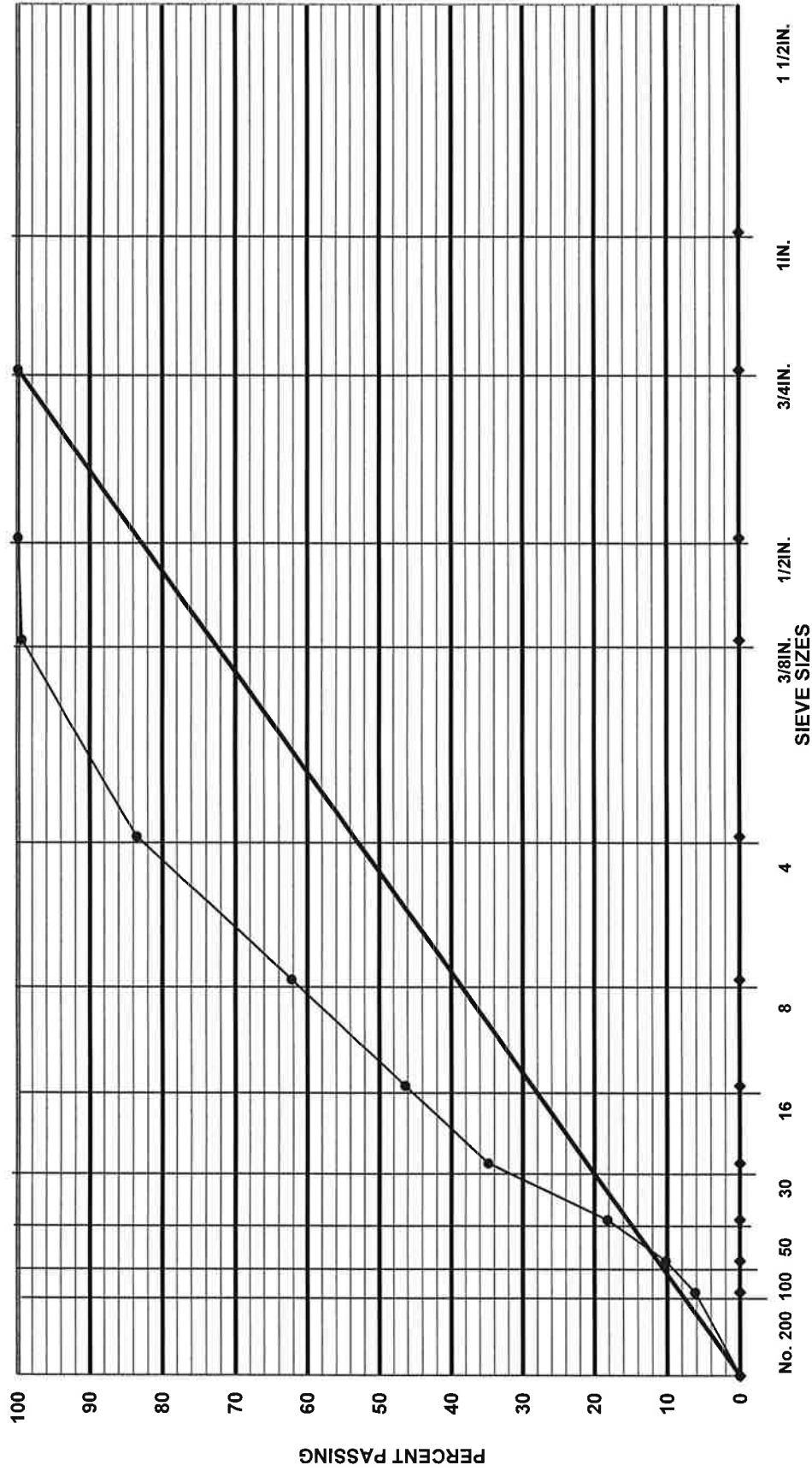
AC	Gmb @ Ndes		Gmm		Air Voids		% @ Nint		VMA		VFA		% @ N Max		Ut. Wt.		F/A Ratio	
	Actual	Calculated	Actual	Calculated	Actual	Calculated	Actual	Calculated	Actual	Calculated	Actual	Calculated	Actual	Calculated	Actual	Calculated	Actual	Calculated
5.30	2.379	2.380	2.535	2.535	6.1	6.13	86.5	86.52	16.42	16.41	62.6	62.7	93.9	93.87	148.5	148.5	1.4	1.42
5.40		2.384		2.531		5.83		86.79		16.36		64.3		94.17		148.7		1.39
5.50		2.388		2.528		5.54		87.06		16.30		66.0		94.46		149.0		1.36
5.60		2.392		2.524		5.24		87.34		16.25		67.7		94.76		149.2		1.33
5.70		2.396		2.520		4.93		87.61		16.19		69.5		95.07		149.5		1.30
5.80	2.401	2.400	2.516	2.517	4.6	4.63	88.0	87.88	16.09	16.14	71.6	71.3	95.4	95.37	149.8	149.8	1.3	1.27
5.90		2.404		2.513		4.32		88.16		16.08		73.1		95.68		150.0		1.25
6.00		2.409		2.509		4.00		88.43		16.01		75.0		96.00		150.3		1.22
6.10		2.413		2.506		3.68		88.71		15.95		76.9		96.32		150.6		1.20
6.20		2.418		2.502		3.36		88.99		15.88		78.8		96.64		150.9		1.18
6.30	2.421	2.422	2.498	2.498	3.1	3.04	89.2	89.27	15.85	15.81	80.5	80.8	96.9	96.96	151.1	151.2	1.2	1.15
6.40		2.427		2.495		2.71		89.55		15.74		82.8		97.29		151.4		1.13
6.50		2.432		2.491		2.37		89.83		15.66		84.9		97.63		151.7		1.11
6.60		2.437		2.487		2.04		90.11		15.59		87.0		97.96		152.0		1.09
6.70		2.441		2.484		1.70		90.40		15.51		89.1		98.30		152.3		1.07
6.80	2.447	2.446	2.480	2.480	1.3	1.35	90.7	90.68	15.42	15.43	91.4	91.3	98.7	98.65	152.7	152.7	1.1	1.06

Regression Values

AC Point	% AC	Gsb	Gmm	Air Voids	% @ Nint	VMA	VFA	% @ Nmax	Ut. Wt.	F/A Ratio
1	5.3	2.380	2.535	6.1	86.5	16.4	62.69	93.9	148.50	1.4
2	5.8	2.400	2.517	4.6	87.9	16.1	71.29	95.4	149.77	1.3
3	6.3	2.422	2.498	3.0	89.3	15.8	80.81	97.0	151.16	1.2
4	6.8	2.446	2.480	1.4	90.7	15.4	91.25	98.6	152.65	1.1

UNITED STATES BUREAU OF PUBLIC ROADS 0.45 POWER GRADATION CHART

SIEVE SIZES RAISED TO 0.45 POWER



IDENTIFICATION OF GRADATION:

19-5E3-7-01

DATE:

03/20/19

TENSILE STRENGTH RATIO (TSR) WORKSHEET (AASHTO T-283)

Project Number			City of Detroit PWC 7023			Date		10/26/2020				Mix Design Number		19-5E3-7-01			
Contractor			Ajax Materials Corporation										Type of Mixture			5E 3	
	A	B	C	D = (B-C)	E = (A/D)	F	G = (F-E)/F*100	H	I = H/25.4								
Sample #	Weight In Air	SSD Weight	Weight In Water	Volume of Sample	Gmb	Gmm	Air Voids	Height (mm)	Height (inch)								
1	3819.9	3830.5	2195.5	1635.0	2.336	2.506	6.75	95.0	3.740								
2	3820.1	3831.5	2194.4	1637.1	2.333	2.506	6.87	95.0	3.740								
3	3821.1	3832.9	2195.6	1637.3	2.334	2.506	6.85	95.0	3.740								
4	3820.6	3832.1	2196.1	1636.0	2.335	2.506	6.79	95.0	3.740								
5	3820.7	3831.8	2194.2	1637.6	2.333	2.506	6.88	95.0	3.740								
6	3820.4	3830.9	2193.4	1637.5	2.333	2.506	6.88	95.0	3.740								

CONDITIONED SET

	J = (G/100)*D	B	K	L=((K-B)/J)*100	M	N=2M/(3.14*5.9*1)	S1
Sample #	Volume of Air Voids	Initial SSD Weight	Saturated SSD Weight	Percent Saturation	Load (Lbs)	Tensile Strength (TS)	Avg. Tensile Strength
1	110.4	3830.5	3915.5	77.0	4500	129.9	
5	112.7	3831.8	3917.7	76.2	4480	129.3	129.3
6	112.7	3830.9	3915.2	74.8	4460	128.7	

UNCONDITIONED SET

	M	N=2M/(3.14*5.9*1)	S2
Sample #	Load (Lbs)	Tensile Strength (TS)	Avg. Tensile Strength
2	5130	148.1	
3	5180	149.5	148.9
4	5170	149.2	

(S1/S2)*100
Tensile Strength Ratio (TSR)
86.8%

Gmb At Ndes

AC	SAMPLE #	Gmb N Des	hx @ N DES	VOL @ N DES	WT @ N DES
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5.3	1	2.378	115.7	2044.6	4809.7
	2	2.381	115.6	2042.8	4810.1
	3	2.379	115.7	2043.7	4809.9
5.8	4	2.401	115.6	2042.8	4826.9
	5	2.402	115.7	2044.6	4833.1
	6	2.401	115.7	2043.7	4830.0
6.3	7	2.418	115.4	2039.3	4856.9
	8	2.424	115.3	2037.5	4853.9
	9	2.421	115.4	2038.4	4855.4
6.8	10	2.447	115.1	2034.0	4873.3
	11	2.446	115.2	2035.8	4876.9
	12	2.447	115.2	2034.9	4875.1

		Gmb N DES	WGHT IN AIR	WEIGHT SSD	WGHT IN H2O	VOLUME
5.3	1	2.378	4809.7	4811.8	2789.4	2022
	2	2.381	4810.1	4812.2	2791.7	2021
	3	2.379	4809.9	4812.0	2790.6	2021
5.8	4	2.401	4826.9	4829.0	2818.8	2010
	5	2.402	4833.1	4835.2	2822.7	2013
	6	2.401	4830.0	4832.1	2820.7	2011
6.3	7	2.418	4856.9	4859.0	2850.4	2009
	8	2.424	4853.9	4856.0	2853.8	2002
	9	2.421	4855.4	4857.5	2852.1	2005
6.8	10	2.447	4873.3	4875.4	2884.0	1991
	11	2.446	4876.9	4879.0	2885.5	1994
	12	2.447	4875.1	4877.2	2884.8	1992

HIEGHT SUMMARY		
hx@ Ni	hx@ Nd	
125.6	115.7	
125.4	115.6	
125.5	115.6	
125.4	115.7	
125.3	115.4	
125.4	115.3	
125.2	115.1	
125.3	115.2	

ACCEPTED

Distribution: Project Engineer (1) -- TMI (1) -- Mix Design (1) -- Contractor (1) -- Bit File (1)

Control Section STU 50000		Job Number 202803A		Project Engineer Jim Goetzinger		Engineering Firm City of Richmond		Date April 2, 2019			
Contractor AJAX PAVING INDUSTRIES, INC.				Plant Location WARREN			Plant No. 020-10				
Mix Type 5E3	Mix Design Number 19MD140		Project Location Division Rd; west city limits to the east city limits				Specification SPECIAL PROVISION				
% Air Voids 4.00	VMA 16.00		VFA 75.0		P200/P _{ba} 1.20		AWI 275		AI 45.0		
Gmm 2.509	Gmb 2.409		Gb 1.029		Gsb 2.696		Gse 2.763		Film Thickness 7.14		
Pit Number	A	B	C	D	E	F	G	H	I	J	
Aggregate Type	47-56	95-10	74-51	58-13	74-51	Plant				Plant	% AC
Blend %	2NS	Man Sand	Man Sand	3/8 x #4's	3/8 x 0	Deg				Rap	6.00
Sieve Size	20.0%	19.0%	10.0%	10.0%	6.0%	2.0%				Rap/AC	26.85%
	GRADATION							% Binder of RAP		4.88	Combined Gradation
1 1/2" - (37.5mm)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%				100.0%	100.0%
1" - (25.0mm)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%				100.0%	100.0%
3/4" - (19mm)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%				100.0%	100.0%
1/2" - (12.5mm)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%				100.0%	100.0%
3/8" - (9.5mm)	100.0%	100.0%	100.0%	98.5%	99.8%	100.0%				98.9%	99.5%
#4 - (4.75mm)	98.5%	93.3%	90.1%	30.0%	62.2%	100.0%				86.0%	83.5%
#8 - (2.36mm)	91.0%	61.2%	52.2%	7.6%	43.0%	100.0%				66.1%	62.2%
#16 - (1.18mm)	74.5%	37.5%	29.0%	3.5%	31.1%	100.0%				52.2%	46.4%
#30 - (0.80mm)	49.5%	23.5%	19.6%	3.4%	28.0%	100.0%				43.9%	34.8%
#50 - (0.30mm)	15.2%	14.5%	8.8%	2.2%	23.2%	98.0%				24.0%	18.2%
#100 - (0.1mm)	4.0%	7.0%	4.0%	1.7%	15.1%	95.0%				14.1%	10.2%
#200 - (0.075mm)	2.0%	4.0%	3.0%	1.5%	11.0%	78.0%				7.2%	6.2%
1 FACE CRUSH %	17.1%	100.0%	100.0%	100.0%	100.0%					97.1%	97.7%
2 FACE CRUSH %											
L.A. ABRASION & YEAR		11-15	18-18	35-14	18-18						
Angularity Index	33	47.8	46.7	46.7	47						45.00
AWI FACTOR	1.0	1.0	1.0	1.0	1.0					1.0	
AWI VALUE #16	241	306	280	260	282					267	275
COMBINED Calc. Gsb	2.596	2.935	2.639	2.599	2.641					2.695	2.697
#4+ COARSE BULK S.G.	2.61	2.951	2.658	2.601	2.655					2.695	
#8 COARSE BULK S.G.	2.601	2.944	2.642	2.595	2.641						
FINE BULK S.G.	2.595	2.929	2.633	2.59	2.629					2.695	
FLAT & ELONGATED %	0.1	0.1	0.2	1.2	0.5					1	1.00%
SOFT PARTICLES %	0.3	0.1	0.2	1.7	0.2					1	1.00%
REMARKS:	Asphalt Binder		Grade PG 58-28		A.C. Supplier I.D. # ABS 2500		% New AC Added 4.39				
	Breakdown goes into pit 47-56, 2NS										

The bitumen content and aggregate characteristics are based on the submitted materials with the gradation and blend ratios indicated. Variation in materials or field conditions may require adjustments of this mix design (see TMI for form 1011 for field application). This laboratory design is valid for two construction seasons from date reported and should not be applied or adjusted without written approval of the Bituminous Services Unit. A signed copy is on file with the Bituminous Services Unit. Tested for Information.

Nathan Maack Nathan Maack
Apr 2 2019 4:11 PM

Mix Design Engineer

Michigan Department of
Transportation form
1931 B

**Report of Test HMA Mix Design -
Regression**

Control Section: STU 50000

Job Number: 202803A

Mix Design: 19MD140

Date: April 2, 2019

AC%	Gmb	Gmm	Air	VMA	VFA	P200/Pbe
5.30	2.380	2.536	6.15	16.38	62.5	1.39
5.40	2.384	2.533	5.85	16.33	64.2	1.36
5.50	2.388	2.529	5.55	16.28	65.9	1.33
5.60	2.392	2.525	5.24	16.23	67.7	1.31
5.70	2.396	2.521	4.93	16.18	69.5	1.28
5.80	2.401	2.517	4.62	16.12	71.3	1.25
5.90	2.405	2.513	4.31	16.06	73.2	1.23
6.00	2.409	2.509	3.99	16.00	75.1	1.20
6.10	2.413	2.505	3.67	15.94	77.0	1.18
6.20	2.418	2.502	3.35	15.88	78.9	1.16
6.30	2.422	2.498	3.02	15.81	80.9	1.14
6.40	2.427	2.494	2.69	15.74	82.9	1.12
6.50	2.431	2.490	2.36	15.67	84.9	1.10
6.60	2.436	2.486	2.03	15.60	87.0	1.08
6.70	2.441	2.483	1.69	15.53	89.1	1.06
6.80	2.446	2.479	1.35	15.46	91.3	1.04

AC Optimized for 4% air voids

AC%	Gmb	Gmm	Air Voids	VMA	VFA	P200/Pbe
6.00	2.409	2.509	4.00	16.00	75.0	1.20

AC Optimized for 3.5% air voids

AC%	Gmb	Gmm	Air Voids	VMA	VFA	P200/Pbe
6.15	2.416	2.503	3.50	15.91	78.0	1.17

AC Optimized for 3% air voids

AC%	Gmb	Gmm	Air Voids	VMA	VFA	P200/Pbe
6.31	2.423	2.498	3.00	15.81	81.0	1.14

CONTRACTOR'S SUPERPAVE BITUMINOUS MIX DESIGN COMMUNICATION

This information is required by the Michigan Department of Transportation for mix design. The CONTRACTOR is responsible for complete and accurate information on this form. Failure to supply this information will result in delay of Bituminous Paving.

Complete and return to Michigan Department of Transportation, Materials & Technology Division, P.O. Box 30049, Lansing, MI 48909.

CONTROL SECTION		City of Detroit						JOB NUMBER		PWC 7023		
CONTRACTOR		Ajax Materials Corp						ROUTE & LOCATION		Multipals Street in City of Detroit(Corner St)		
PLANT NUMBER		20-10						PLANT LOCATION		Warren, MI		
BITUMINOUS MIXTURE (Circle One)		4E 3						Ajax Mix ID		20-4E3-7-01		
		AGG. A	AGG. B	AGG. C	AGG. D	AGG. E	AGG. F	AGG. G	CONTROL POINTS			
PIT NUMBER		47-56	47-56	95-10	58-13	58-13	20-10 2.52	20-10 4.88				
AGGREGATE TYPE		Degradation	2ns	Man sand	3/8 X #4's	1/2 X 3/8	3/8" Plus	Rap				
BLEND % (10% Minimum)		2.5%	12.5%	20.0%	10.0%	14.0%	27.0%	14.0%		RESTRICTED ZONE	COMBINED GRADATION	
AVERAGE GRADATION	P 37.5 mm	100.0	100.0	100.0	100.0	100.0	100.0	100.0			100.0	
	P 25.0 mm	100.0	100.0	100.0	100.0	100.0	100.0	100.0			100.0	
	P 19.0 mm	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100		100.0	
	P 12.5 mm	100.0	100.0	100.0	100.0	98.0	82.2	100.0	90-100		94.9	
	P 9.50 mm	100.0	100.0	100.0	98.5	55.0	65.2	98.9	90 Max		84.0	
	P 4.75 mm	100.0	98.5	93.3	27.0	9.4	44.6	86.0			61.6	
	P 2.36 mm	100.0	83.2	61.2	7.6	4.4	36.4	66.1	28-58		45.6	
	P 1.18 mm	100.0	71.4	37.5	3.5	1.8	26.7	52.2			34.0	
	P 0.60 mm	100.0	56.0	23.5	3.4	1.6	20.8	43.9			26.5	
	P 0.30 mm	95.0	9.2	14.5	2.2	1.4	14.8	24.0			14.2	
	P 0.15 mm	90.0	4.0	7.0	1.7	1.3	7.5	14.1			8.5	
	TOTAL P 0.075 mm	73.0	2.0	4.0	1.5	1.3	4.6	7.2	2.0 - 10.0		5.5	
CRUSH COUNT		1 SIDE	100.0	17.1	100.0	100.0	100.0	93.6	97.1	75	97.0	
		2 SIDE	100.0	13.7	100.0	100.0	100.0	92.1	95.7	-	96.3	
L.A. ABRASION		Value/Year	26	11	26	11	9	15	30	13	30	13
											35	< 35
ANGULARITY INDEX				33.0	47.8	46.5	45.9	44.0		43 min.	46	
AWI NOMOGRAPH & QUARRYS			239.0	239.0	306.0	260.0	258.1	264.1	277.0	260	270.1	
COARSE AGGREGATE BULK SPECIFIC GRAVITY #4 UP			2.610	2.610	2.951	2.598	2.604	2.712	2.695		Tested Blend 2.670	Calculated W/ Rap 2.673
COARSE AGGREGATE BULK SPECIFIC GRAVITY #8			2.601	2.601	2.944	2.596	2.600	2.712	2.695		2.670	2.673
FINE AGGREGATE BULK SPECIFIC GRAVITY			2.591	2.591	2.929	2.591	2.602	2.712	2.695		2.755	2.747
FLAT & ENOLGATED %			0.1	0.1	0.0	1.2	1.0	1.1	1.0	10.0 max	1.2	
SOFT STONE %			0.3	0.3	0.0	1.0	0.8	1.0	1.0	5.0 max	0.8	
ASPHALT CEMENT SUPPLIER		Ajax Asphalt Terminal ABS 2500						FINAL GRADE		PG 64-22		
								VIRGIN GRADE		PG 52-28		
										1.029		
SUBMITTED BY:		NAME (Print or Type) John Nguyen						DATE		October 30, 2020		
		SIGNATURE 								PHONE NO. (248) 388-1026		
										FAX NO. (248) 244 1061		
DATE REC'D BY LAB		PROJECT ENGINEER						ENGINEERING FIRM		Detroit Engineer		
DATE P.E. NOTIFIED OF SUBMITTAL		P.E. PHONE NUMBER						P.E. FAX NUMBER				

SUBMITTED SUPERPAVE MIX DESIGN SUMMARY SHEET

CONTRACTOR		Ajax Materials Corp		CONSULTANT	
CONTROL SECTION I.D.		City of Detroit	JOB NO.	PWC 7023	TYPE OF MIXTURE:
					4E 3
N _{INT}		7	N _{DES}	86	N _{MAX}
					134
MIXING TEMPERATURE RANGE °F			COMPACTION TEMPERATURE RANGE °F		
290 °F 301 °F			268 °F 277 °F		

SUPERPAVE MIX PROPERTIES AT TESTED & OPTIMUM ASPHALT CONTENT

ITEM	TEST POINTS				RECOMMENDED OPTIMUM Regression Value at Optimum Asphalt Content	VERIFICATION TEST RESULTS @ N _{MAX}
	4 POINT DESIGN					
	FINAL		BLEND			
ASPHALT CONTENT (%)	4.20	4.70	5.20	5.70	5.15	5.15
BULK SPECIFIC GRAVITY @ N _{DES}	2.393	2.423	2.446	2.473	2.445	2.451
BULK SPECIFIC GRAVITY @ N _{MAX}						2.473
THEORETICAL MAXIMUM (S.G.)	2.570	2.552	2.530	2.514	2.534	2.534
AIR VOIDS (%) @ N _{DES}	6.88	5.06	3.31	1.61	3.50	3.28
VOIDS IN MINERAL AGGREGATE % (VMA) @ N _{DES}	15.34	14.73	14.37	13.87	14.33	14.15
VOIDS FILLED WITH ASPHALT % (VFA) @ N _{DES}	55	66	77	88	76	77
% G _{mm} @ N _{INT}	86.1	87.4	88.9	90.6	88.6	88.6
% G _{mm} @ N _{DES}	93.1	94.9	96.7	98.4	96.3	96.7
% G _{mm} @ N _{MAX}						97.6
FINES/EFF ASPHALT RATIO	1.52	1.33	1.19	1.07	1.21	1.20

The submitted superpave mix design final blend shall have a minimum of 4 test points at 0.5 percent asphalt content increments. At least one full asphalt content (0.5%) above and below optimum asphalt content is required.

ASPHALT CONTENT OF SUBMITTED SUPERPAVE MIX DESIGN 5.15

ASPHALT SPECIFIC GRAVITY 1.029

SPECIFIC GRAVITY OF COMBINED AGGREGATE G_{sb} 2.708

GYRATORY COMPACTED BULK SPECIFIC GRAVITY WORKSHEET

PROJECT NUMBER		City of Detroit	PWC 7023	DATE	10/30/20	MIX DESIGN NUMBER	20-4E3-7-01
CONTRACTOR				TYPE SAMPLE			
Ajax Materials Corp				4E 3 BITUMINOUS MIXTURE			

ASPHALT %	SAMPLE	A	B	C	D	E
		WEIGHT IN AIR	SSD WEIGHT	WEIGHT IN WATER	VOLUME OF SAMPLE (B-C)	ACTUAL SPEC. GRAVITY (A/D)
4.2	1	4850.2	4856.9	2831.2	2025.7	2.394
	2	4851.2	4857.8	2829.5	2028.3	2.392
AVERAGE						2.393

4.7	1	4876.3	4880.3	2866.3	2014.0	2.421
	2	4870.3	4875.6	2867.1	2008.5	2.425
AVERAGE						2.423

ASPHALT %

5.2	1	4900.2	4903.5	2899.8	2003.7	2.446
	2	4900.6	4903.1	2900.2	2002.9	2.447
AVERAGE						2.446

ASPHALT %

5.7	1	4916.8	4920.0	2930.0	1990.0	2.471
	2	4920.4	4923.8	2936.6	1987.2	2.476
AVERAGE						2.473

VERIFICATION SPECIMEN COMPACTED AT OPTIMUM ASPHALT CONTENT TO Nmax						
5.2	1	4915.5	4918.0	2929.5	1988.5	2.472
	2	4916.0	4918.2	2931.1	1987.1	2.474
AVERAGE						2.473

ASPHALT %

TESTER		Brandon Fuller	CHECKED BY		Richard Poe
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THEORETICAL MAXIMUM SPECIFIC GRAVITY OF BITUMINOUS PAVING MIXTURES MODIFIED ASTM D 2041 (RICE METHOD)

PROJECT	City of Detroit	PWC 7023	MIX DESIGN NUMBER	20-4E3-7-01
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CONTRACTOR
Ajax Materials Corp

% ASPHALT BINDER		4.20	4.70
ASPHALT SPECIFIC GRAVITY		1.029	1.029
SAMPLE and BOWL WEIGHT in AIR, g	A	4496.6	4494.3
BOWL WEIGHT in AIR, g	B	2341.0	2341.0
SAMPLE WEIGHT in AIR, g	C = A-B	2155.6	2153.3
SAMPLE and BOWL in WATER, g	D	2763.0	2755.8
BOWL in WATER, g	E	1446.2	1446.2
SAMPLE in WATER, g	F = D-E	1316.8	1309.6
VOLUME, cc	G = C-F	838.8	843.7
G _{mm}	C/G	2.570	2.552
G _{se}		2.750	2.753

% ASPHALT BINDER		5.20	5.70
ASPHALT SPECIFIC GRAVITY		1.029	1.029
SAMPLE and BOWL WEIGHT in AIR, g	A	4489.7	4494.2
BOWL WEIGHT in AIR, g	B	2341.0	2341.0
SAMPLE WEIGHT in AIR, g	C = A-B	2148.7	2153.2
SAMPLE and BOWL in WATER, g	D	2745.6	2742.9
BOWL in WATER, g	E	1446.2	1446.2
SAMPLE in WATER, g	F = D-E	1299.4	1296.7
VOLUME, cc	G = C-F	849.3	856.5
G _{mm}	C/G	2.530	2.514
G _{se}		2.750	2.754
AVERAGE G _{se}		2.752	

SOURCE AND GRADE OF ASPHALT CEMENT USED	DATE TESTED
Ajax Asphalt Terminal ABS 2500 0	10/30/20
TESTER	CHECKED BY
Brandon Fuller	Richard Poe

Regression Analysis - Marshall Designs

Actual Test Data										
AC Point	% AC	Gmb	Gmm	Air Voids	%@Nint	VMA	VFA	%@Nmax	Ut. Wt.	F/A Ratio
1	4.2	2.393	2.570	6.9	86.1	15.3	55.15	93.1	149.33	1.5
2	4.7	2.423	2.552	5.1	87.4	14.7	65.63	94.9	151.20	1.3
3	5.2	2.446	2.530	3.3	88.9	14.4	76.94	96.7	152.64	1.2
4	5.7	2.473	2.514	1.6	90.6	13.9	88.37	98.4	154.34	1.1

Using the 'AIR VOIDS' - 'CALCULATED' Column, ENTER THE AC POINT at which your AIR VOIDS come closest to the target for this mix type:

5.2

Pba

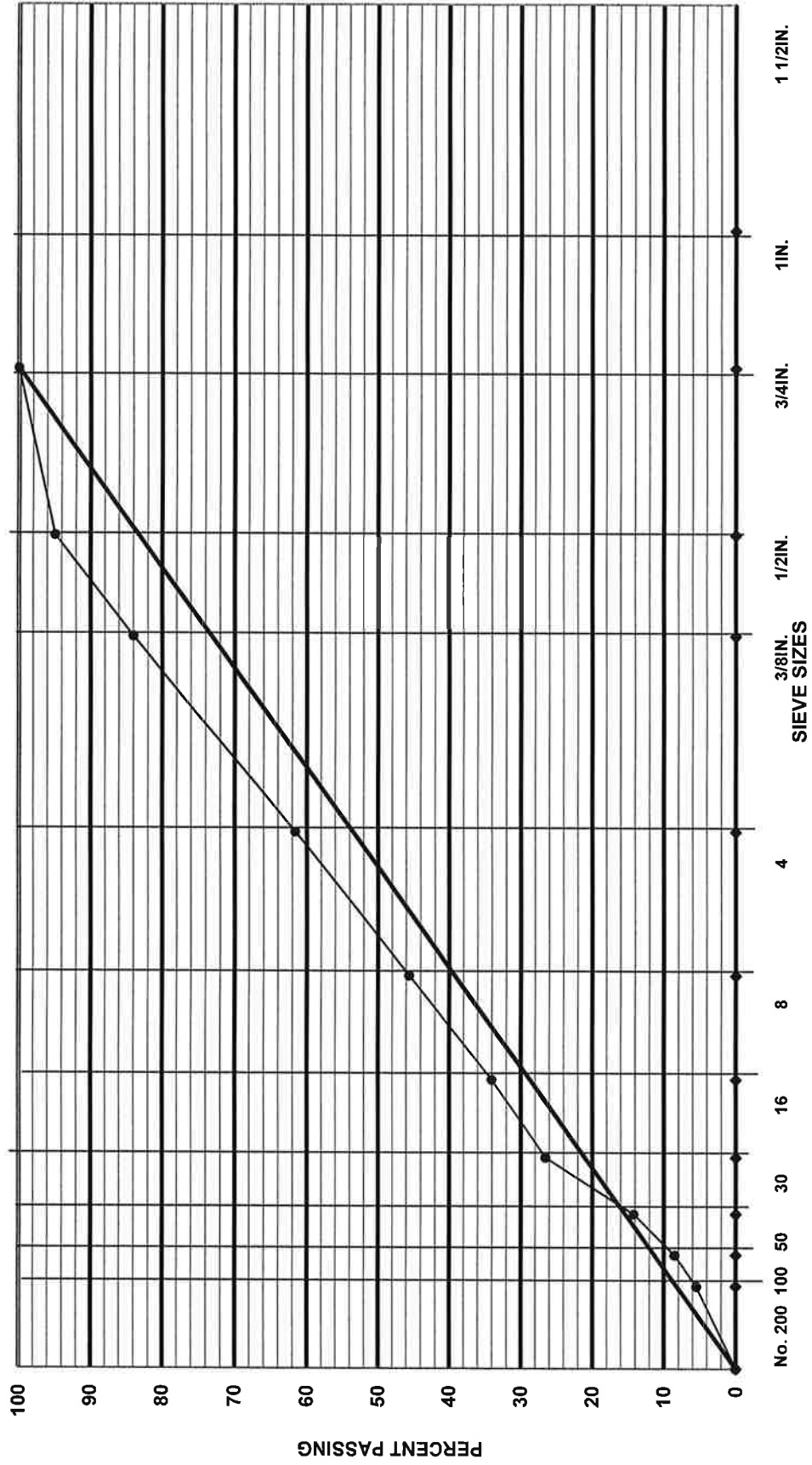
0.61

[illegible]

Regression Values										
AC Point	% AC	Gsb	Gmm	Air Voids	%@Nint	VMA	VFA	%@Nmax	Ul. Wt.	F/A Ratio
1	4.2	2.394	2.570	6.9	86.1	15.3	55.12	93.1	149.36	1.5
2	4.7	2.421	2.551	5.1	87.4	14.8	65.74	94.9	151.09	1.3
3	5.2	2.448	2.532	3.3	88.9	14.3	76.84	96.7	152.74	1.2
4	5.7	2.473	2.513	1.6	90.6	13.9	88.41	98.4	154.31	1.1

UNITED STATES BUREAU OF PUBLIC ROADS 0.45 POWER GRADATION CHART

SIEVE SIZES RAISED TO 0.45 POWER



IDENTIFICATION OF GRADATION:

20-4E3-7-01

DATE:

12/02/19

TENSILE STRENGTH RATIO (TSR) WORKSHEET (AASHTO T-283)

Project Number City of Detroit PWC 7023			Date 10/26/2020		Mix Design Number 20-4E3-7-01				
Contractor Ajax Materials Corporation			Type of Mixture 4E 3						
	A Weight In Air	B SSD Weight	C Weight In Water	D = (B-C) Volume of Sample	E = (A/D) Gmb	F Gmm	G = (F-E)/F*100 Air Voids	H Height (mm)	I = H/25.4 Height (inch)
Sample #									
1	3826.4	3837.8	2217.9	1619.9	2.362	2.535	6.83	95.0	3.740
2	3825.5	3837.0	2218.8	1618.2	2.364	2.535	6.76	95.0	3.740
3	3827.9	3839.5	2219.0	1620.5	2.362	2.535	6.83	95.0	3.740
4	3826.4	3837.6	2220.2	1617.4	2.366	2.535	6.69	95.0	3.740
5	3826.3	3837.8	2215.8	1622.0	2.359	2.535	6.95	95.0	3.740
6	3827.0	3838.7	2216.8	1621.9	2.360	2.535	6.93	95.0	3.740

CONDITIONED SET

Sample #	J = (G/100)*D Volume of Air Voids	B Initial SSD Weight	K Saturated SSD Weight	L = ((K-B)/J)*100 Percent Saturation	M Load (Lbs)	N = 2M/(3.14*5.9*I) Tensile Strength (TS)	S1 Avg. Tensile Strength
1	110.7	3837.8	3920.6	74.8	4250	122.7	123.2
2	109.3	3837.0	3922.1	77.8	4290	123.8	
3	110.7	3839.5	3923.8	76.2	4270	123.2	

UNCONDITIONED SET

Sample #	M Load (Lbs)	N = 2M/(3.14*5.9*I) Tensile Strength (TS)	S2 Avg. Tensile Strength
4	5020	144.9	145.2
5	5100	147.2	
6	4970	143.5	

(S1/S2)*100
Tensile Strength Ratio (TSR)
84.9%

Corrected Gmb At Ndes

AC	SAMPLE	Gmb	hx @	VOL @	WT @	Gmb
	#	MEASURED	N Des	N Des	N Des	N Des
		@ N Des				

4.2	1	2.394	116.2	2053.4	4850.2	2.362
	2	2.392	116.2	2053.4	4851.2	2.362
	3	2.393	116.2	2053.4	4850.7	2.362
4.7	4	2.421	115.7	2044.6	4876.3	2.385
	5	2.425	115.5	2041.1	4870.3	2.386
	6	2.423	115.6	2042.8	4873.3	2.386
5.2	7	2.446	115.3	2037.5	4900.2	2.405
	8	2.447	115.2	2035.8	4900.6	2.407
	9	2.446	115.3	2036.6	4900.4	2.406
5.7	10	2.471	115.1	2034.0	4916.8	2.417
	11	2.476	115.3	2037.5	4920.4	2.415
	12	2.473	115.2	2035.8	4918.6	2.416

		Gmb	WGHT	WEIGHT	WGHT	VOLUME
		N Des	IN AIR	SSD	IN H2O	
4.2	1	2.394	4850.2	4852.3	2826.6	2026
	2	2.392	4851.2	4853.3	2825.0	2028
	3	2.393	4850.7	4852.8	2825.8	2027
4.7	4	2.421	4876.3	4878.4	2864.4	2014
	5	2.425	4870.3	4872.4	2863.9	2009
	6	2.423	4873.3	4875.4	2864.2	2011
5.2	7	2.446	4900.2	4902.3	2898.6	2004
	8	2.447	4900.6	4902.7	2899.8	2003
	9	2.446	4900.4	4902.5	2899.2	2003
5.7	10	2.471	4916.8	4918.9	2928.9	1990
	11	2.476	4920.4	4922.5	2935.3	1987
	12	2.473	4918.6	4920.7	2932.1	1989

HIEGHT SUMMARY		
hx@ Ni	hx@ Nd	
125.6	116.2	
125.7	116.2	
125.6	115.7	
125.4	115.5	
125.4	115.3	
125.3	115.2	
125	115.1	
125.2	115.3	

ACCEPTED

Distribution: Project Engineer (1) -- TMI (1) -- Mix Design (1) -- Contractor (1) -- Bit File (1)

Control Section IM 82022	Job Number 115863A	Project Engineer Bill Erben	Engineering Firm MDOT-Taylor TSC	Date March 19, 2020						
Contractor AJAX PAVING INDUSTRIES, INC.		Plant Location WARREN		Plant No. 020-10						
Mix Type 4E3	Mix Design Number 19MD411	Project Location I-94; I-275 to Beech Daly Rd		Specification SPECIAL PROVISION						
% Air Voids 4.00	VMA 14.46	VFA 72.3	P200/P _{bs} 1.24	AWI 279						
Gmm 2.539	Gmb 2.438	Gb 1.029	Gsb 2.707	AI 46.0						
			Gse 2.752	Film Thickness 7.44						
Pit Number	A	B	C	D	E	F	G	H	I	J
47-56	95-10	58-13	58-13	Plant					Plant	% AC
Aggregate Type	2NS	Man Sand	3/8 x #4's	1/2 x 3/8	Deg				Rap	Rap
Blend %	12.5%	20.0%	10.0%	14.0%	2.5%				27.0%	14.00%
Sieve Size	GRADATION							% Binder of RAP:	2.52	4.88
1 1/2" - (37.5mm)	100.0%	100.0%	100.0%	100.0%	100.0%				100.0%	100.0%
1" - (25.0mm)	100.0%	100.0%	100.0%	100.0%	100.0%				100.0%	100.0%
3/4" - (19mm)	100.0%	100.0%	100.0%	100.0%	100.0%				100.0%	100.0%
1/2" - (12.5mm)	100.0%	100.0%	100.0%	98.0%	100.0%				82.2%	100.0%
3/8" - (9.5mm)	100.0%	100.0%	98.5%	55.0%	100.0%				65.2%	98.9%
#4 - (4.75mm)	98.5%	93.3%	27.0%	9.4%	100.0%				44.6%	86.0%
#8 - (2.36mm)	83.2%	61.2%	7.6%	4.4%	100.0%				36.4%	66.1%
#16 - (1.18mm)	71.4%	37.5%	3.5%	1.8%	100.0%				26.7%	52.2%
#30 - (0.80mm)	56.0%	23.5%	3.4%	1.6%	100.0%				20.8%	43.9%
#50 - (0.30mm)	9.2%	14.5%	2.2%	1.4%	95.0%				14.8%	24.0%
#100 - (0.1mm)	4.0%	7.0%	1.7%	1.3%	90.0%				7.5%	14.1%
#200 - (0.075mm)	2.0%	4.0%	1.5%	1.3%	73.0%				4.6%	7.2%
1 FACE CRUSH %	17.1%	100.0%	100.0%	100.0%					93.6%	97.1%
2 FACE CRUSH %										
L.A. ABRASION & YEAR		11-15	40-20	40-20						
Angularity Index	33	47.8	46.5						44	
AWI FACTOR	1.0	1.0	1.0	1.0					1.0	1.0
AWI VALUE #16	239	306	260	260					284	306
COMBINED Calc. Gsb	2.593	2.935	2.597	2.604					2.712	2.695
#4+ COARSE BULK S.G.	2.61	2.951	2.598	2.604					2.712	2.695
#8 COARSE BULK S.G.	2.601	2.944	2.596	2.6						
FINE BULK S.G.	2.591	2.929	2.591	2.602					2.712	2.695
FLAT & ELONGATED %	0.1	0	1.2	1					1.1	1
SOFT PARTICLES %	0.3	0	1	0.8					1	1
REMARKS:	Asphalt Binder	Grade PG 58-28		A.C. Supplier I.D. # ABS 2500		% New AC Added 3.64				
	Breakdown goes Into pit 47-56, 2NS									

The bitumen content and aggregate characteristics are based on the submitted materials with the gradation and blend ratios indicated. Variation in materials or field conditions may require adjustments of this mix design (see TMI for form 1911 for field application). This laboratory design is valid for two construction seasons from date reported and should not be applied or adjusted without written approval of the Bituminous Services Unit. A signed copy is on file with the Bituminous Services Unit. Tested for information.

Nathan Maack

Nathan Maack
Mar 19 2020 2:29 PM

Mix Design Engineer

Michigan Department of
Transportation form
1931 B

**Report of Test HMA Mix Design -
Regression**

Control Section: IM 82022
Job Number: 115863A
Mix Design: 19MD411
Date: March 19, 2020

AC%	Gmb	Gmm	Air	VMA	VFA	P200/Pbe
4.20	2.394	2.571	6.91	15.29	54.8	1.52
4.30	2.399	2.567	6.54	15.18	56.9	1.48
4.40	2.405	2.563	6.18	15.07	59.0	1.44
4.50	2.410	2.559	5.82	14.97	61.1	1.40
4.60	2.416	2.555	5.46	14.86	63.3	1.37
4.70	2.421	2.551	5.10	14.76	65.5	1.34
4.80	2.427	2.547	4.74	14.66	67.7	1.30
4.90	2.432	2.543	4.38	14.56	69.9	1.27
5.00	2.437	2.539	4.02	14.47	72.2	1.24
5.10	2.443	2.535	3.66	14.37	74.5	1.22
5.20	2.448	2.532	3.31	14.28	76.8	1.19
5.30	2.453	2.528	2.95	14.19	79.2	1.17
5.40	2.458	2.524	2.60	14.10	81.5	1.14
5.50	2.463	2.520	2.25	14.01	84.0	1.12
5.60	2.468	2.516	1.90	13.92	86.4	1.10
5.70	2.473	2.512	1.55	13.84	88.8	1.07

AC Optimized for 4% air voids

AC%	Gmb	Gmm	Air Voids	VMA	VFA	P200/Pbe
5.01	2.438	2.539	4.00	14.46	72.3	1.24

AC Optimized for 3.5% air voids

AC%	Gmb	Gmm	Air Voids	VMA	VFA	P200/Pbe
5.15	2.445	2.534	3.50	14.33	75.6	1.20

AC Optimized for 3% air voids

AC%	Gmb	Gmm	Air Voids	VMA	VFA	P200/Pbe
5.29	2.452	2.528	3.00	14.20	78.9	1.17