

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					Speed Bump 2021				
CONTRACTOR					Gibraltar Construction					ROUTE & LOCATION					Speed Bump 2021				
PLANT NUMBER					20-10					PLANT LOCATION					Warren, MI				
BITUMINOUS MIXTURE (Circle One)					5E 3					Ajax Mix ID					20-5E3-7-01-T2				

		AGG. A	AGG. B	AGG. C	AGG. D	AGG. E	AGG. F	AGG. G	CONTROL POINTS							
PIT NUMBER		74-051	74-51	58-13	74-51	95-10	44-030	20-14 4.84			RESTRICTED ZONE	COMBINED GRADATION				
AGGREGATE TYPE		Degradation	3CS	3/8 X #4's	Man Sand	Man sand	3/8" X 0"	Rap								
BLEND % (10% Minimum)		2.0%	24.0%	9.0%	9.0%	15.0%	7.0%	34.0%								
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	96.4	100.0	100.0	98.1	98.9	90-100		99.2					
	P 4.75 mm	100.0	97.8	27.0	55.4	91.9	70.2	87.0	90 Max		81.2					
	P 2.36 mm	100.0	81.8	6.5	29.4	50.4	45.7	67.5	32-67		58.6					
	P 1.18 mm	100.0	70.2	5.9	17.1	26.3	32.0	54.0			45.5					
	P 0.60 mm	100.0	55.0	3.4	8.1	19.0	24.6	46.7			36.7					
	P 0.30 mm	95.0	29.0	2.2	4.0	11.9	17.6	24.0			20.6					
	P 0.15 mm	90.0	6.5	1.7	2.5	7.0	12.5	14.1			10.5					
	TOTAL P 0.075 mm	80.0	2.2	1.5	1.9	4.0	10.5	7.4	2.0 - 10.0		6.3					
CRUSH COUNT		1 SIDE	100.0	15.9	100.0	100.0	100.0	100.0	97.1	65	97.0					
		2 SIDE	100.0	14.2	100.0	100.0	100.0	100.0	96.5	-	96.8					
L.A. ABRASION		Value/Year	23	18	23	18	40	20	23	18	11	18	19	18	40	< 40
ANGULARITY INDEX			40.2	46.5	46.7	47.8	47.0		40 min.		45					
AWI NOMOGRAPH & QUARRYS			239.0	239.0	213.0	285.6	305.6	313.0	305.9	260	280.5					
COARSE AGGREGATE BULK SPECIFIC GRAVITY #4 UP			2.600	2.600	2.601	2.658	2.951	2.672	2.692		Tested Blend 2.655	Calculated W/ Rap 2.670				
COARSE AGGREGATE BULK SPECIFIC GRAVITY #8			2.600	2.600	2.595	2.642	2.944	2.651	2.692		2.655	2.670				
FINE AGGREGATE BULK SPECIFIC GRAVITY			2.591	2.591	2.591	2.633	2.929	2.655	2.692		2.705	2.703				
FLAT & ENOGLATED %			0.1	0.1	1.2	0.2	0.1	0.2	1.0	-	-					
SOFT STONE %			0.1	0.1	1.0	0.2	0.1	0.1	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		1.030	

SUBMITTED BY:		NAME (Print or Type)		John Nguyen		DATE		April 24, 2021	
		SIGNATURE							
DATE REC'D BY LAB		PROJECT ENGINEER		ENGINEERING FIRM		PHONE NO.		(248) 388-1026	
						FAX NO.		(248) 244 1086	
DATE P.E. NOTIFIED OF SUBMITTAL		P.E. PHONE NUMBER		P.E. FAX NUMBER					

SUBMITTED SUPERPAVE MIX DESIGN SUMMARY SHEET

CONTRACTOR		Gibraltar Construction		CONSULTANT	
CONTROL SECTION I.D.		City of Detroit	JOB NO.		Speed Bump 2021
				TYPE OF MIXTURE:	5E 3
N_{INT}		N_{DES}		N_{MAX}	
7		86		134	
MIXING TEMPERATURE RANGE °F			COMPACTION TEMPERATURE RANGE °F		
304 °F 325 °F			284 °F 306 °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	6.14	6.14
BULK SPECIFIC GRAVITY @ N _{DES}	2.364	2.388	2.419	2.436	2.408	2.411
BULK SPECIFIC GRAVITY @ N _{MAX}						2.455
THEORETICAL MAXIMUM (S.G.)	2.524	2.509	2.490	2.473	2.496	2.496
AIR VOIDS (%) @ N _{DES}	6.34	4.84	2.85	1.49	3.50	3.41
VOIDS IN MINERAL AGGREGATE % (VMA) @ N _{DES}	16.60	16.23	15.60	15.44	15.81	15.72
VOIDS FILLED WITH ASPHALT % (VFA) @ N _{DES}	62	70	82	90	78	78
% G _{mm} @ N _{INT}	86.8	87.9	89.7	90.7	89.0	89.1
% G _{mm} @ N _{DES}	93.7	95.2	97.1	98.5	96.3	96.6
% G _{mm} @ N _{MAX}						98.4
FINES/EFF ASPHALT RATIO	1.44	1.29	1.17	1.07	1.22	1.21

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 6.14

ASPHALT SPECIFIC GRAVITY 1.030

SPECIFIC GRAVITY OF COMBINED AGGREGATE G_{sb} 2.685

GYRATORY COMPACTED BULK SPECIFIC GRAVITY

WORKSHEET

PROJECT NUMBER	City of Detroit Bump 20	DATE	04/24/21	MIX DESIGN NUMBER	20-5E3-7-01-T2
CONTRACTOR	Gibraltar Construction	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	4798.2	4804.2	2774.1	2030.1	2.364
	2	4796.4	4800.8	2773.1	2027.7	2.365
AVERAGE						2.364

ASPHALT %

5.8	1	4825.4	4828.7	2805.4	2023.3	2.385
	2	4824.9	4828.3	2810.1	2018.2	2.391
AVERAGE						2.388

ASPHALT

6.3	1	4851.8	4855.0	2850.0	2005.0	2.420
	2	4849.7	4852.8	2846.6	2006.2	2.417
AVERAGE						2.419

ASPHALT %

6.8	1	4872.9	4874.9	2874.1	2000.8	2.435
	2	4873.8	4875.6	2875.5	2000.1	2.437
AVERAGE						2.436

ASPHALT %

VERIFICATION SPECIMEN COMPACTED AT OPTIMUM ASPHALT CONTENT TO Nmax

6.1	1	4868.2	4870.6	2872.8	1997.8	2.437
	2	4870.0	4872.1	2878.0	1994.1	2.442
AVERAGE						2.439

TESTER

Brandon Fuller

CHECKED BY

Richard Poe

THEORETICAL MAXIMUM SPECIFIC GRAVITY OF BITUMINOUS PAVING MIXTURES MODIFIED ASTM D 2041 (RICE METHOD)

PROJECT	City of Detroit - Speed Bump 2021	MIX DESIGN NUMBER	20-5E3-7-01-T2
CONTRACTOR	Gibraltar Construction		

% ASPHALT BINDER		5.30	5.80
ASPHALT SPECIFIC GRAVITY		1.030	1.030
SAMPLE and BOWL WEIGHT in AIR, g	A	4485.8	4496.1
BOWL WEIGHT in AIR, g	B	2341.0	2341.0
SAMPLE WEIGHT in AIR, g	C = A-B	2144.8	2155.1
SAMPLE and BOWL in WATER, g	D	2734.8	2735.8
BOWL in WATER, g	E	1439.6	1439.6
SAMPLE in WATER, g	F = D-E	1295.2	1296.2
VOLUME, cc	G = C-F	849.6	858.9
G _{mm}	C/G	2.524	2.509
G _{se}		2.748	2.753

% ASPHALT BINDER		6.30	6.80
ASPHALT SPECIFIC GRAVITY		1.030	1.030
SAMPLE and BOWL WEIGHT in AIR, g	A	4487.8	4484.8
BOWL WEIGHT in AIR, g	B	2341.0	2341.0
SAMPLE WEIGHT in AIR, g	C = A-B	2146.8	2143.8
SAMPLE and BOWL in WATER, g	D	2724.1	2716.5
BOWL in WATER, g	E	1439.6	1439.6
SAMPLE in WATER, g	F = D-E	1284.5	1276.9
VOLUME, cc	G = C-F	862.3	866.9
G _{mm}	C/G	2.490	2.473
G _{se}		2.752	2.754
AVERAGE G _{se}		2.752	

SOURCE AND GRADE OF ASPHALT CEMENT USED	DATE TESTED
Ajax Asphalt Terminal ABS 2500 0	04/24/21
TESTER	CHECKED BY
Brandon Fuller	Richard Poe

Regression Analysis - Marshall Designs

Actual Test Data

AC Point	% AC	Gmb	Gmm	Air Voids	%@N Int	VMA	VFA	%@Nmax	Ut. Wt.	F/A Ratio
1	5.3	2.364	2.524	6.3	86.8	16.6	61.83	93.7	147.54	1.4
2	5.8	2.388	2.509	4.8	87.9	16.2	70.20	95.2	149.00	1.3
3	6.3	2.419	2.490	2.9	89.7	15.6	81.71	97.1	150.92	1.2
4	6.8	2.436	2.473	1.5	90.7	15.4	90.36	98.5	152.01	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:

6.1

Pba

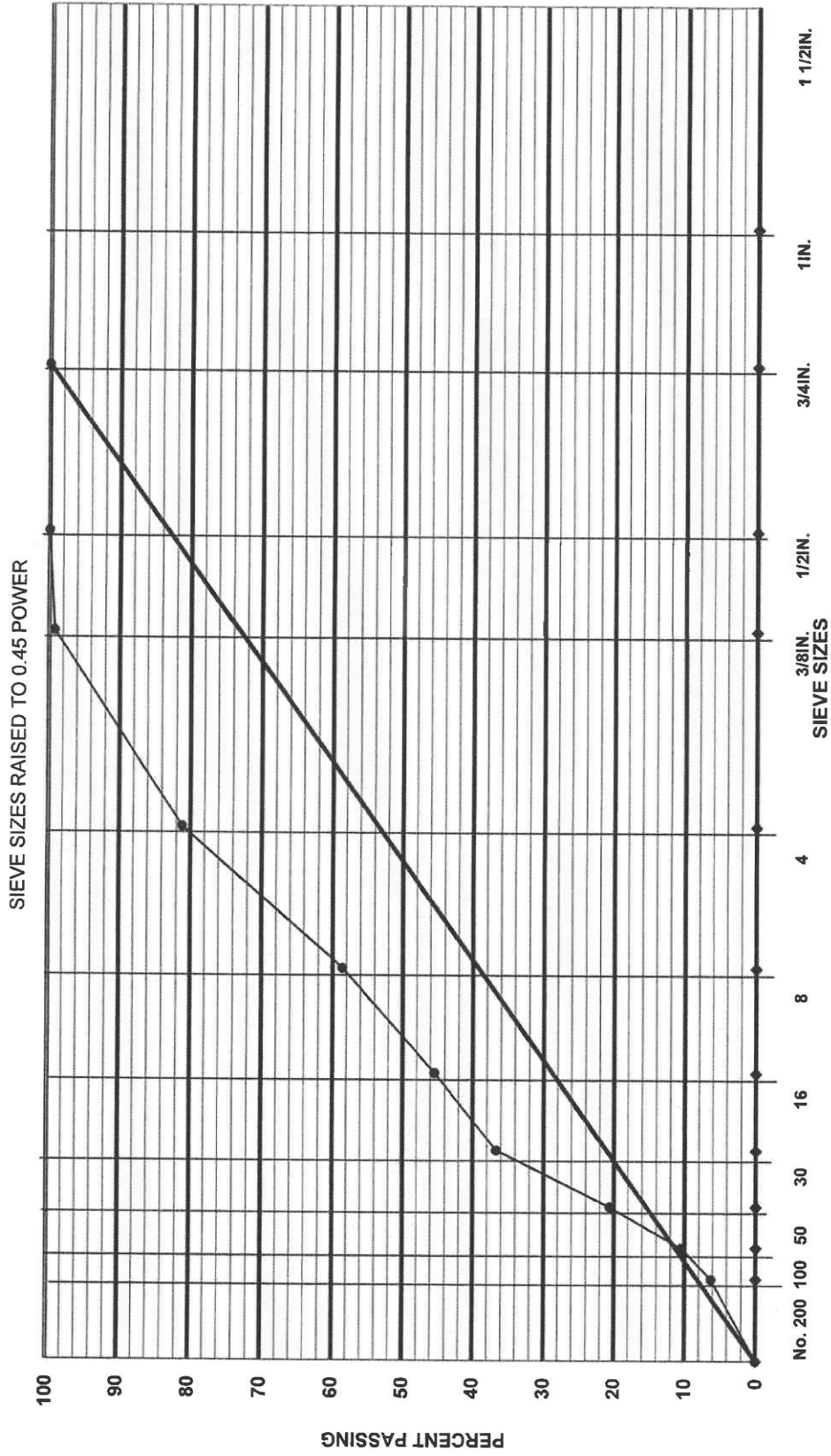
0.93

AC	Gmb @ Ndes		Gmm		Air Voids		%@N Int		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	2.364	2.363	2.524	2.525	6.3	6.39	86.8	86.69	16.60	16.64	61.8	61.5	93.7	93.61	147.5	147.5	1.4	1.44
5.40		2.369		2.522		6.04		86.99		16.53		63.4		93.96		147.8		1.41
5.50		2.375		2.518		5.70		87.28		16.42		65.3		94.30		148.2		1.38
5.60		2.380		2.515		5.35		87.57		16.31		67.3		94.65		148.5		1.35
5.70		2.386		2.511		5.01		87.85		16.21		69.2		94.99		148.9		1.32
5.80	2.388	2.391	2.509	2.508	4.8	4.67	87.9	88.14	16.23	16.12	70.2	71.1	95.2	95.33	149.0	149.2	1.3	1.29
5.90		2.396		2.505		4.33		88.42		16.03		73.0		95.67		149.5		1.26
6.00		2.401		2.501		4.00		88.70		15.94		75.0		96.00		149.8		1.24
6.10		2.406		2.498		3.67		88.97		15.86		76.9		96.33		150.1		1.22
6.20		2.411		2.494		3.34		89.24		15.78		78.9		96.66		150.4		1.19
6.30	2.419	2.415	2.490	2.491	2.9	3.02	89.7	89.51	15.60	15.71	81.7	80.8	97.1	96.98	150.9	150.7	1.2	1.17
6.40		2.420		2.487		2.70		89.78		15.64		82.8		97.30		151.0		1.15
6.50		2.425		2.484		2.38		90.04		15.57		84.7		97.62		151.3		1.13
6.60		2.429		2.480		2.06		90.30		15.51		86.7		97.94		151.6		1.11
6.70		2.433		2.476		1.75		90.56		15.45		88.7		98.25		151.8		1.09
6.80	2.436	2.437	2.473	2.473	1.5	1.43	90.7	90.81	15.44	15.40	90.4	90.7	98.5	98.57	152.0	152.1	1.1	1.07

Regression Values

AC Point	% AC	Gsb	Gmm	Air Voids	%@N Int	VMA	VFA	%@Nmax	Ut. Wt.	F/A Ratio
1	5.3	2.363	2.525	6.4	86.7	16.6	61.53	93.6	147.48	1.4
2	5.8	2.391	2.508	4.7	88.1	16.1	71.10	95.3	149.19	1.3
3	6.3	2.415	2.491	3.0	89.5	15.7	80.81	97.0	150.73	1.2
4	6.8	2.437	2.473	1.4	90.8	15.4	90.66	98.6	152.08	1.1

UNITED STATES BUREAU OF PUBLIC ROADS 0.45 POWER GRADATION CHART



IDENTIFICATION OF GRADATION:

20-5E30-7-01-T2

DATE:

11/13/20

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

Project Number		City of Detroit Speed Bump 2021			Date	4/20/2021		Mix Design Number			20-5E3-7-01-T2				
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		3814.6	3826.4	2186.2	1640.2	2.326	2.498	6.89	95.0	3.740					
2		3815.4	3828.0	2185.5	1642.5	2.323	2.498	7.00	95.0	3.740					
3		3816.7	3826.4	2187.2	1639.2	2.328	2.498	6.78	95.0	3.740					
4		3814.8	3825.1	2186.2	1638.9	2.328	2.498	6.81	95.0	3.740					
5		3815.2	3826.1	2188.2	1637.9	2.329	2.498	6.74	95.0	3.740					
6		3815.4	3827.4	2185.9	1641.5	2.324	2.498	6.94	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
2	114.9	3828.0	3912.2	73.3	4260	123.0	124.5
5	110.4	3826.1	3911.1	77.0	4310	124.4	
6	113.9	3827.4	3914.4	76.4	4370	126.1	

UNCONDITIONED SET

	M	N = 2M/(3.14*5.9*1)	S2
Sample #	Load (Lbs)	Tensile Strength (TS)	Avg. Tensile Strength
1	4970	143.5	144.5
3	5020	144.9	
4	5030	145.2	

(S1/S2)*100
Tensile Strength Ratio (TSR)
86.2%

Gmb At Ndes

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

5.3	1	2.364	115.6	2042.8	4798.2
	2	2.365	115.5	2041.1	4796.4
	3	2.364	115.6	2041.9	4797.3
5.8	4	2.385	115.2	2035.8	4825.4
	5	2.391	115.2	2035.8	4824.9
	6	2.388	115.2	2035.8	4825.2
6.3	7	2.420	115.0	2032.2	4851.8
	8	2.417	115.0	2032.2	4849.7
	9	2.419	115.0	2032.2	4850.8
6.8	10	2.435	114.6	2025.1	4872.9
	11	2.437	114.5	2023.4	4873.8
	12	2.436	114.6	2024.3	4873.4

		Gmb	WGHT	WEIGHT	WGHT	VOLUME
		N DES	IN AIR	SSD	IN H2O	
5.3	1	2.364	4798.2	4800.3	2770.2	2030
	2	2.365	4796.4	4798.5	2770.8	2028
	3	2.364	4797.3	4799.4	2770.5	2029
5.8	4	2.385	4825.4	4827.5	2804.2	2023
	5	2.391	4824.9	4827.0	2808.8	2018
	6	2.388	4825.2	4827.3	2806.5	2021
6.3	7	2.420	4851.8	4853.9	2848.9	2005
	8	2.417	4849.7	4851.8	2845.6	2006
	9	2.419	4850.8	4852.9	2847.3	2006
6.8	10	2.435	4872.9	4875.0	2874.2	2001
	11	2.437	4873.8	4875.9	2875.8	2000
	12	2.436	4873.4	4875.5	2875.0	2000

HIEGHT SUMMARY		
hx@ Ni	hx@ Nd	
124.8	115.6	
124.7	115.5	
124.7	115.2	
124.6	115.2	
124.6	115.0	
124.5	115.0	
124.4	114.6	
124.3	114.5	

COARSE AGGREGATE GRAVITY

CONTROL SECTION I.D.	City of Detroit	JOB #	Speed Bump 2021	MIX DESIGN #	20-5E3-7-01-T2
----------------------	-----------------	-------	-----------------	--------------	----------------

CONTRACTOR	Gibraltar Construction	MIXTURE TYPE	5E 3
------------	------------------------	--------------	------

TEST NUMBER	1	2	3	4	
BUCKET ID	A				
PAN ID	12				
A. SSD Agg. + Bucket	3155.1				
B. Weight of Bucket	858.0				
C.=Weight of SSD Aggregate (A - B)	2297.1				
D. Weight of SSD Agg. + Bucket in H ² O	1997.1				
E. Weight of Bucket in H ² O	553.0				
F.=Weight of SSD Agg. In H ² O (D - E)	1444.1				
G. Weight of Pan + Oven Dry Aggregate	3888.6				
H. Weight of Pan	1623.8				
J.=Weight of Oven Dry Aggregate (G - H)	2264.8				
C - F (SSD Volume)	853.0				
J - F (Dry Agg. - Dry Weight)	820.7				
C - J (SSD - Dry Weight)	32.3				AVERAGE
Bulk Dry S.G. = J/(C - F)	2.655				2.655
Bulk SSD S.G. = C/(C - F)	2.693				2.693
Apparent S.G. = J/(J - F)	2.759				2.759
Absorption, % = [(C - J)/J] x 100	1.426				1.43

REMARKS:

TEST PERFORMED BY:	Brandon Fuller	DATE	4/20/2021
--------------------	----------------	------	-----------

FINE AGGREGATE GRAVITY

CONTROL SECTION I.D. City of Detroit		JOB # Speed Bump 2021		MIX DESIGN # 20-5E3-7-01-T2	
CONTRACTOR Gibraltar Construction		MIXTURE TYPE 5E 3			
TEST NUMBER	1	2			
FLASK NUMBER	a				
PAN NUMBER	3				
A. Weight of Flask + SSD Agg.	662.9				
B. Weight of Flask	160.2				
C.=Weight of SSD Aggregate (A - B)	502.7				
D. Weight of Flask + SSD Agg. + H ² O	986.3				
E. Weight of Flask + H ² O	667.3				
F.=Weight of SSD Agg. In H ² O (D - E)	319.0				
G. Weight of Pan + Oven Dry Aggregate	1407.4				
H. Weight of Pan	910.5				
J.=Weight of Oven Dry Aggregate (G - H)	496.9				
C - F (SSD Volume)	183.7				
J - F (Apparent Volume)	177.9				
C - J (Absorbed Water Wt.)	5.8				AVERAGE
Bulk Dry S.G. = J/(C - F)	2.705				2.705
Bulk SSD S.G. = C/(C - F)	2.737				2.737
Apparent S.G. = J/(J - F)	2.793				2.793
Absorption, % = [(C - J)/J] x 100	1.165				1.17

REMARKS:

TEST PERFORMED BY:	Brandon Fuller	DATE	4/20/2021
--------------------	-----------------------	------	------------------

Ajax Materials Corporation

Detroit, MI

2021 typical (Rev. 1/4/21)

PG 58-28

Specific Gravity, 15.6° C (60° F)	1.037
Specific Gravity, 25° C (77° F)	1.030
Density, 15.6° C (60° F)	8.639

		<u>Pa s</u>	<u>cP</u>
Rotational Viscosity @	135 °C	0.257	257
Rotational Viscosity @	165 °C	0.077	77

	<u>Min, °C</u>	<u>Max, °C</u>	<u>Min, °F</u>	<u>Max, °F</u>
Lab Mixing Temperature	143	148	289	299
Lab Compaction Temperature	130	136	267	276

