APPENDIX A – DRAFT PERFORMANCE-BASED MIX DESIGN PROCEDURE FOR POROUS FRICTION COURSE

Standard Practice for Permeable Friction Course (PFC) Mix Design

AASHTO Designation:

1. SCOPE

1.1 This standard covers the mix design procedure of permeable friction course (PFC) asphalt mixtures.

1.2 *This standard may involve hazardous materials, operations and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. REFERENCED DOCUMENTS

2.1 *AASHTO Standards.*

- M 231, Weighing Devices Used in the Testing of Materials
- M 320, Performance-Graded Asphalt Binder
- M323, Superpave Volumetric Mix Design
- R 30, Mixture Conditioning of Hot Mix Asphalt (HMA)
- T 209, Theoretical Maximum Specific Gravity (G_{mm}) and Density of Hot Mix Asphalt (HMA)
- T 245, Resistance to Plastic Flow of Asphalt Mixtures Using Marshall Apparatus
- T 283, Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage
- T 305, Determination of Draindown Characteristics in Uncompacted Asphalt Mixtures
- T 312, Preparing and Determining the Density of Asphalt Mixture Specimens by Means of the Superpave Gyratory Compactor
- T 324, Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt
- T 331, Bulk Specific Gravity (G_{mb})and Density of Compacted Hot Mix Asphalt (HMA) Using Automatic Vacuum Sealing Method
- TP 108, Determining the Abrasion Loss of Asphalt Mixtures Specimens

2.2 *ASTM Standards.*

- D 3549, Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens

3. TERMINOLOGY

3.1 *Definitions:*

3.1.1 *asphalt binder* – an asphalt-based cement that is produced from petroleum residue either with or without the addition of modifiers.

3.1.2 *abrasion loss* – the loss of mass from an asphalt mixture specimen under the effect of abrasion.

3.1.3 *air voids* – the total volume of the small pockets of air between the coated aggregate particles throughout a compacted paving mixture, expressed as a percent of the total volume of the compacted specimen.

3.1.4 *draindown* – separation of asphalt binder from the coarse aggregate structure, generally during storage or transportation.

3.1.5 *permeable friction course (PFC)* – a special type of porous asphalt mixture with air voids of at least 18 percent used for reducing hydroplaning and potential for loss of friction resistance, where the function of the mixture is to provide a free-draining layer that permits surface water to migrate laterally through the mixture to the edge of the pavement.

3.1.6 *stabilizing additive* – materials used to minimize draindown of asphalt during transport and placement of PFC, which may include fibers, polymers, crumb rubber, or a combination of these additives.

4. SUMMARY OF PRACTICE

4.1 Aggregates, asphalt binder, and stabilizing additives are selected that meet specification values. Trial aggregate blend gradations and compacted using trial binder contents in order to evaluate the performance of the trial mixes. Once the trial mix testing is completed, the optimum asphalt binder content is selected based on meeting minimum air void requirements, maximum abrasion loss, minimum shear strength, and mixture permeability. The abrasion loss, from TP 108, is an indicator of the durability of the mixture. The designed mixture is then evaluated for resistance to moisture susceptibility, resistance to rutting, and draindown. An optional test for cracking resistance is also provided.

5. SIGNIFICANCE AND USE

5.1 The procedure described in this practice is used to design permeable friction course mixtures that will provide good performance in terms of permeability and durability.

6. MATERIALS SELECTION

6.1 Select aggregates that meet the quality requirements of Superpave mixtures for the appropriate traffic category based on M 323.

6.2 *Asphalt Binder* – Performance-graded asphalt binders meeting the requirements of M 320 are selected based on the project climate and traffic conditions. Because of the relatively high binder contents and open graded structure of the aggregate, a stiff asphalt binder is needed to ensure durability. Therefore, for high-volume roadways or pavements with slow to standing traffic, select the asphalt binder high-temperature grade two grades higher than the asphalt binder grade required for the climate. (See Note 1) Select the high-temperature binder grade one grade higher than the climatic grade for all other roadways.
Note 1 – Some southern states successfully use a PG 76 asphalt binder for high-volume roadways (which is only one grade higher).

6.3 *Stabilizing Additive* – Stabilizing additives may be needed to prevent draindown of asphalt binder from the coarse aggregate skeleton during transportation and placement. Stabilizing additives such as cellulose fiber, mineral fiber, crumb rubber, and polymers have been used to minimize draindown potential.

6.4 *Design Gradaion* – In order to provide the high level of permeability desirable with permeable friction courses, an aggregate gradation having a very open gradation is needed. Table 1 includes the specific gradation ranges.

Table 1 – PFC Gradation Specification Bands

	Nominal Maximum Aggregate Size - % Passing					
	9.5 mm (3/8 in.)		12.5 mm (1/2 in.)		19.0 mm (3/4 in.)	
Sieve Size	Min	Max	Min	Max	Min	Max
25 mm (1 in.)					100	
19 mm (3/4 in.)			100		85	100
12.5 mm (1/2 in.)	100		80	100	55	70
9.5 mm (3/8 in.)	85	100	35	60		
4.75 mm (No. 4)	20	30	10	25	10	25
2.36 mm (No. 8)	5	15	5	10	5	10
0.075 mm (No. 200)	2	8	2	8	2	8

7. MIX DESIGN PROCEDURE

7.1 *Select Trial Gradation* – Select a trial gradation to fall within one of the master specification ranges shown in Table 1. Select gradation depending on the primary objective for the mix. Use coarse gradations for permeability and rutting resistance, fine gradation for noise reduction and with high 0.075 mm (No. 200) percent passing for improved durability. These trial gradations are obtained by adjusting the amount of fine and coarse aggregates in each blend, or by adding mineral filler, if needed.

7.2 *Prepare Aggregates* – Dry the aggregates to be used in the mixture to a constant mass and separate by dry-sieving into individual size fractions. (See Note 2) The following size fractions are recommended.

- 19.0 to 12.5 mm (3/4 to 1/2 in.)
- 12.5 to 9.5 mm (1/2 to 3/8 in.)
- 9.5 to 4.75 mm (3/8 in to No. 4)
- 4.75 to 2.36 mm (No. 4 to No. 8)
- 2.36 mm (No. 8) to 0.075 mm (No. 200)
- Passing 0.075 mm (No. 200)

Note 2 – Bulk batching of samples based on aggregate blend proportions may be permissible if the gradations used are representative of those in the stockpile.

7.3 *Select Trial Binder Contents* – For most aggregates with virgin and polymer modified binders, use binder contents of 5.0%, 6.0%, and 7.0% by weight of total mix. For GTR modified binder, use 6.0%, 7.0%, and 8.0% binder content by weight of total mix.

7.4 *Prepare Samples for Trial Blend* – Prepare a total of fourteen samples: two samples at the middle asphalt content for determining theoretical maximum specific gravity, Gmm, of uncompacted samples according to T 209; two samples at each asphalt content for determining the air void content of compacted specimens, permeability, and shear strength; and two samples at each asphalt content for determining abrasion loss based on TP 108.

7.4.1 Determine the mixing and compaction temperatures in accordance with T 245, Section 3.3.1. The mixing temperature shall be the temperature needed to produce an asphalt binder viscosity of 170±20 est. The compaction temperature shall be the temperature required to provide an asphalt binder viscosity of 280±30 cst. The selected temperatures may need to be changed for modified asphalt binders; in such a case, follow the binder supplier's guidelines for mixing and compaction temperatures.

7.4.2 For each test specimen, weigh into a pan the appropriate amount of each size fraction to produce the required sample size. Mix the aggregates in each pan and place in an oven set to a temperature no more than 28°C (50°F) above the mixing temperature determined in Section 7.4.1.

7.4.3 Heat the asphalt binder to the mixing temperature determined in Section 7.4.1.

7.4.4 When preparing PFC in the laboratory, use a mechanical mixing apparatus. Place the heated aggregate batch into the mechanical mixing container. Add the required amount of stabilizing additive, if required, into the container and thoroughly mix with the aggregate. Add the required amount of asphalt binder as described in Section 7.3 into the container and mix the aggregate, stabilizing additives and asphalt binder rapidly until thoroughly coated. Mixing times for PFC should be slightly longer than for conventional mixtures to ensure than the stabilizing additives are thoroughly dispersed within the mixture. After mixing, short-term age the PFC mixture in accordance with R 30.

Note 3 – Dry-mixing fibers, if used, into the aggregate before adding the asphalt binder has been found to help disperse the fibers uniformly throughout the mixture.

7.5 *Sample Compaction* – Compact individual specimens at the established compaction temperature using 50 revolutions of the Superpave gyratory compactor in accordance with T 312.

7.5.1 After the samples have been compacted and are stable enough to prevent damage, extrude them from the molds and allow them to cool. Determine the bulk specific gravity of each specimen using T 331 or by dimensional analysis. To use dimensional analysis, determine and record the dry mass of each specimen in grams. Determine and record the height of each specimen in centimeters in accordance with ASTM E 3549 using calibrated calipers. Determine the diameter of each specimen in centimeters as the average of four equally spaced measurements using the calibrated calipers. Calculate the area of the specimen using the average diameter, $A = \pi d^2/4$. Calculate the volume of the specimen by multiplying the specimen area by its average height. Calculate the bulk density of the specimen by dividing the dry mass of the specimen by the calculated volume. Convert the bulk density into the bulk specific gravity, G_{mbt} by dividing by 0.99707 g/cm^3, the density of water at 25°C (77°F).

7.5.2 Determine the theoretical maximum specific gravity, G_{mm}, of the uncompacted samples according to T 209. Calculate the percent air voids (VTM) as shown below:

$$VTM = 100x(1 - \frac{G_{mb}}{G_{mm}})$$

7.6 *Sample Evaluation* – Compare each trial mixture to the minimum air voids, maximum abrasion loss using TP 108, and permeability requirements in Table 2. If none of the trial blends satisfies the requirements, repeat the process with different trial blends or different aggregates.

Table 2 – PFC Mixture Specification Requirements

Property	Requirement
Air Voids, %	15 to 20 (CoreLok method); 17 to 22 (Dimensional)
Cantabro Abrasion loss, %	20 max
Permeability, m/day	Meet agency criteria (50 min. recommended)
Shear Strength, (Optional) psi	125
Conditioned tensile strength, psi	50 min.(May be agency specific based on binder grade)
Tensile strength ratio (TSR)	0.70 min
Draindown, %	0.30 max
Hamburg Wheel-Tracker, (Optional)	PG 64 or higher, ≥10,000 passes
cycles before reaching 12.5 mm (1/2 in.) rut depth	PG 70, ≥15,000 passes
	PG 76 or higher, ≥20,000 passes
Cracking, (Optional) I-FIT FI	25 min

7.6.1 *Conduct Additional Performance Tests* – Prepare additional specimens using the determined optimum asphalt content for further performance testing. Prepare and analyze the mixture samples as described in Sections 7.3 through 7.4.4. Compare test results to the remaining requirements in Table 2.

7.6.2 *Draindown Sensitivity* – Determine the draindown sensitivity of two uncompacted samples of the design gradation at optimum binder content in accordance with T 305, except use a 2.36 mm wire basket. Conduct the draindown testing at a temperature of 15°C (27°F) higher than the anticipated production temperature.

7.6.3 *Evaluation of Moisture Susceptibility* – Determine the moisture susceptibility of the designed mixture according to T 283 with one freeze-thaw cycle. Modify the T 283 method as follows:

- Compact PFC specimens with 50 gyrations of the Superpave Gyratory Compactor at the optimum asphalt binder content;
- Verify air void content is within the range in accordance with Table 5;
- Apply a vacuum of 87.8 kPa (26 in. Hg) for 10 min to saturate the compacted specimens; however, no specific saturation level is required; and
- Keep the specimens submerged in water during the freeze-thaw cycle.

If the mixture does not meet the minimum tensile requirements in Table 2, either redesign the mixture using different materials or use an antistrip agent to increase the tensile results.

7.6.4 *(Optional) Hamburg Wheel Tracker Test (HWTT)* – Conduct HWTT according to T 324.

7.6.5 *(Optional) Cracking Test* – Conduct the I-FIT Flexibility Index Test according to Illinois Test Procedure 405: Determining the Fracture Potential of Asphalt Mixtures Using the Illinois Flexibility Index Test (I-FIT).

8. REPORT

8.1 *Report the following information and test results.*

8.1.2 Aggregate source(s); asphalt source, grade type, and amount of stabilizing additive, if needed; and material quality characteristics;

8.1.3 Selected aggregate gradation and optimum asphalt binder content;

8.1.4 Volumetric properties, abrasion loss, shear strength, and draindown for each trial blend from Section 7;

8.1.5 Results of moisture susceptibility testing and antistrip agent, if needed;

8.1.6 Results of HWTT test;

8.1.7 Results of SCB I-FIT test, if needed

9. KEYWORDS

9.1 Abrasion loss; aggregates; air voids; asphalt; asphalt binder; draindown; gradations; PFC mixtures; stabilizing additive; shear stress; tensile strength; Hamburg Wheel Tracker; I-FIT.

APPENDIX B – MIX DESIGNS EVALUATED IN THIS STUDY

Date:9-12-95

Department Of Transportation - State Of Georgia
Asphaltic Concrete Design Report

Mix Type: D-MOD Mix I.D. No: 102-DM1

This design is approved for use contingent upon approval by the Engineer of a Job Mix Formula.
A change in materials properties or unacceptable field performance may invalidate this design.

Materials	Size,Grade Type Code	% Used With Lime	% Used W.out Lime	Group	Source Number	Source Name And Location
	007	59	0	IIA	102C	- Blue Circle Aggregates,Inc. Buford,GA
	089	35	0	IIA	102C	- Blue Circle Aggregates,Inc. Buford,GA
Aggregate	W10	5	0	IIA	102C	- Blue Circle Aggregates,Inc. Buford,GA
		0	0		-	
		0	0		-	
		0	0		-	
[1] Asph. Cement	AC20				0033	- Plant Improvement Co. Gwinnett Co.,Ga
Hydr. Lime		1.0				- Approved Source
Additive			0.0			

% AC	Theor. Sp.Gr.	Actual Sp.Gr.	% Air Voids	Mix Density	% Vma	% Aggr. Voids Filled	Stab. Lbs.	Flow (.01 In.)
				50 Blows Hydrated Lime				
0.0	0.000	0.000	0.0	0.0	0.0	0.0	0	0.0
0.0	0.000	0.000	0.0	0.0	0.0	0.0	0	0.0
0.0	0.000	0.000	0.0	0.0	0.0	0.0	0	0.0
0.0	0.000	0.000	0.0	0.0	0.0	0.0	0	0.0
0.0	0.000	0.000	0.0	0.0	0.0	0.0	0	0.0
				75 Blows Hydrated Lime				
0.0	0.000	0.000	0.0	0.0	0.0	0.0	0	0.0
0.0	0.000	0.000	0.0	0.0	0.0	0.0	0	0.0
0.0	0.000	0.000	0.0	0.0	0.0	0.0	0	0.0
0.0	0.000	0.000	0.0	0.0	0.0	0.0	0	0.0
				Additive Only				
0.0	0.000	0.000	0.0	0.0	0.0	0.0	0	0.0
0.0	0.000	0.000	0.0	0.0	0.0	0.0	0	0.0
0.0	0.000	0.000	0.0	0.0	0.0	0.0	0	0.0
0.0	0.000	0.000	0.0	0.0	0.0	0.0	0	0.0

Aggregate Gradations

Agg. Size	007	089	W10				Lime	Comb. Grad.
1 1/2	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
3/4	100	0	0	0	0	0	0	100
1/2	87	0	0	0	0	0	0	92
3/8	42	100	0	0	0	0	0	66
4	2	52	100	0	0	0	0	25
8	2	7	75	0	0	0	0	8
16	0	4	48	0	0	0	0	5
30	0	3	32	0	0	0	0	4
50	0	2	22	0	0	0	0	3
100	0	2	7	0	0	0	100	2
200	0	1	3	0	0	0	100	2

Diametral Tensile Splitting

Property	Lime	Liquid
Conditioned Psi	0.0	0.0
Control Psi	0.0	0.0
Retained Stab(%)	0.0	0.0

Job Mix Formula Criteria

With H Lime	Optimum AC %	Film Thick
	6.00	33.35

Aggr. Eff. Gravity 2.630

Note [1] Asphalt Cement to be modified with a Thermoplastic Polymer to meet Section 820.02.
[2] Mineral Fiber meeting requirements of Section 819.02C shall be added at 0.4% of total mix.

Harry H. McGaughey
State Bituminous Construction Engineer

2.148B

PLANT LOCATION: Augusta	MIX DESIGN LAB NO.: APAC04	JOB MIX NO.: **E0171**	
TYPE MIX: Open Graded Friction Course	DATE APPROVED: 03/12/04		
CONTRACTOR: APAC-Southeast, Inc.	DATE OF LAST REV.: 03/12/04	NO. OF REVISIONS: 0	
TROL METHOD: QA	DATE VOID: 03/12/06		

	Source of Aggregate	Type of Aggregate	% Agg.	Gsb
1	Martin Marietta @ Augusta	#7 Stone	91	2.66
2	Martin Marietta @ Augusta	#89 Stone	8	2.68
3	Tenn Luttrell, Luttrell, TN	Lime	1	2.68
4				
5				
6				
7				

SIEVE	GRADATION							COMB.		
	1	2	3	4	5	6	7	GRAD.	TARGET	LIMITS
1 1/2" / 37.5 mm										
1" / 25.0 mm										
3/4" / 19.0 mm	100	100	100					100	100	100.0
1/2" / 12.5 mm	94	100	100					95	95	89.0 - 100.0
3/8" / 9.5 mm	67	98	100					70	69	63.0 - 75.0
#4 / 4.75 mm	17	60	100					21	20	15.0 - 25.0
#8 / 2.36 mm	6	16	100					8	7	5.0 - 10.0
#30 / 0.60 mm	4.2	4	100					5		
50 / 0.150 mm	3.8	3	100					4.7		
#200 / 0.075 mm	1.2	1.4	100					2.20	2.0	0.00 - 4.00
								OPTIMUM BINDER CONTENT,%	6.0	5.64 - 6.36

JOB MIX	PERCENT BINDER			
DATE	MARSHALL STABILITY, N			
PREPARED BY ACS 3-12-04	FLOW IN 0.25 mm			
REVIEWED BY CBS Elliott 3/12/04	MAXIMUM SPECIFIC GRAVITY			
APPROVED BY [signature] 3/22/04	BULK SPECIFIC GRAVITY			
	% AIR VOIDS IN TOTAL MIX			
	% V. M. A.			
	% VOIDS FILLED			

EFFEC. SPECIFIC GRAVITY: NA TSR(%): NA WET TS:(kPa) NA

GRADE OF BINDER: PG 76-22

DESIGN DUST TO ASPHALT RATIO: NA

6.0 % Asphalt recommended with permissible variation of: 0.36 This mix is satisfactory and meets SCDOT specification for use in Open Graded Friction Course

REMARKS: Verified mix 0.3% by weight used of Interfibe - Cellulose Fiber QA Spec.s

der Film Thickness (Microns)= NA

Form TL-127 (Rev. 11/09)

VIRGINIA DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION
STATEMENT OF ASPHALT CONCRETE OR CENTRAL-MIX AGGREGATE JOB-MIX FORMULA

Submit to the District Administrator, Virginia Department of Transportation. The Materials Division must be notified by the contractor before work is begun using the submitted mix design. Once approved, this job-mix design may be used for all Department projects for the type of mix shown below.

New Mix: YES ☐ NO ☒

Contractor Design Mix No. _____ **Design Lab No.** C-2

Date 1-18-12 **Job Mix ID No.** 9002-2011-84 **Calendar Year:** 2012 **TSR Test No.** _____

Type Mix / Size Aggregate Porous Friction Course 9.5 PG 82-22 RM (Quiet Pavement)

Producer Name & Plant Location Superior Paving Corp. Leesburg **Phone** 703-729-0633

Materials	Job Mix Phase A	B*	C		Kind	Source
Aggregate	89			%	#8	Luck Stone Leesburg
Aggregate				%		
Bag House	1			%	Plant Breakdown	Superior Paving Leesburg
Mineral Filler				%		
Screening				%		
RAP	10			%	Processed	Superior Paving Leesburg
Asphalt Cement	6.40			%	PG 82-22 RM	Blackidge Greer SC
Tack					EM-50TT	Seaboard Baltimore, MD
Additives:						
Anti Strip	.3				Pavebond Lite	Rohm/Haas Cincinnati OH
Fiber	.3				Cellulose	Hi-Tech Asp. Sol .Mechanicsville

*** All Asphaltic Materials to Produce This Mix Must be Certified by VAAP***

Job-Mix Sieves	Job Mix Phase Total % Passing Lab JMF A	Production JMF B*	Tolerance % + or -	Acceptance Range Average of 8 Test(s) A	B	End of Year Average C	Design/Spec. Range
3/4"	100		0	100			100
1/2"	100		0	100			100
3/8"	86		2.8	83.2-88.8			85-100
#4	21		2.8	18.2-23.8			20-40
#8	9		2.8	6.2-11.8			5-10
#200	2.5		.7	1.8-3.2			2-4
Asphalt (%)	6.4		.21	6.19-6.61			Min. 6.0
VTM	18.7		50 gyrations				Min. 16
Rice (Gmm)	2.650						
Compacted Unit Wt							

Lay Down Temperatures	290-340 °F	Muffle Furnace Correction Factor:	.52
		Field Correction Factor ($G_{ss} - G_{sb}$):	
Lab Compaction Temperatures	310-320 °F	Pill Weight:	4450
		SMA Mixes	* 50 Gyration *
		VCA_{DRC}:	42.2
Producer Certification Technician's Signature	Daniel Poole	G_{CA}:	2.958

MATERIALS DIVISION USE ONLY – TO BE COMPLETED UPON CONTRACTOR SUBMISSION OF PART B

Remarks Addtem 2011 Need Test Strip

Nominal Max. Size Aggregate	9.5MM	Application Rates:	Min.	lb/yd² (kg/m²)	Max.	lb/yd² (kg/m²)

Checked By: _____

Approved tentatively subject to the production of material meeting all other applicable requirements of the specification.
*** Note: Part B 'Production JMF' and corresponding Material percentages will be filled out by the Contractor upon receipt of the additional requirements of the Contractor within the first lot.**

Copies:					
State Materials Engineer	Approved By	✓	Part A:	Frank For D. Shields	Date: 4-10-12
District Materials Engineer	Approved By		Part B:		Date:
Project Inspector					
Sub-Contractor and/or Producer	Approved By		Part C:		Date:

CORRECTED COPY CORRECTED COPY

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION
STATEMENT OF SOURCE OF MATERIALS AND JOB MIX FORMULA FOR BITUMINOUS CONCRETE

SUBMIT TO THE STATE MATERIALS ENGINEER, CENTRAL BITUMINOUS LABORATORY, 5007 NORTHEAST 39TH AVENUE, GAINESVILLE, FLA. 32609

Contractor: Community Asphalt Corp. Address: 14005 N.W. 186th Street, Hialeah, FL 33018

Phone No.: (561) 790-6467 Fax No.: (561) 790-1093 E-mail: ttrueblood@ctllabs.net

Submitted By: Todd B. Trueblood Type Mix: FC-5 Intended Use of Mix: Friction Course

TYPE MATERIAL	F.D.O.T. CODE	PRODUCER	PIT NO.	DATE SAMPLED
1. S-1-A Stone	41	White Rock Quarries	87-339	08 / 25 / 1997
2. S-1-B Stone	51	White Rock Quarries	87-339	08 / 25 / 1997
3. Asphalt Screenings	22	White Rock Quarries	87-339	08 / 25 / 1997
4. ARB-12	336-AR			
5.				
6.				

PERCENTAGE BY WEIGHT TOTAL AGGREGATE PASSING SIEVES

	Blend Number	50% 1	45% 2	5% 3	4	5	6	JOB MIX FORMULA	CONTROL POINTS	RESTRICTED ZONE
	3/4" 19.0mm	100	100	100				100	100	
	1/2" 12.5mm	80	100	100				90	85 - 100	
	3/8" 9.5mm	38	94	100				66	55 - 75	
	No. 4 4.75mm	6	35	100				24	15 - 25	
	No. 8 2.36mm	3	10	82				10	5 - 10	
	No. 16 1.18mm	3	4	57				8		
	No. 30 600µm	2	3	36				7		
	No. 50 300µm	2	2	20				6		
	No. 100 150µm	1	2	9				5		
	No. 200 75µm	1.0	1.0	2.0				3.5	2 - 4	
	G_{se}	2.407	2.412	2.527				2.415		

The mix properties of the Job Mix Formula have been conditionally verified, pending successful final verification during production at the assigned plant, the mix design is approved subject to F.D.O.T. specifications.

JMF reflects aggregate changes expected during production.

SP 05-3979A (FC-5)

Transferred from SP 03-2470A (FC-5)

CORRECTED COPY due to incorrect binder shown.

Director, State Materials Office

Original document retained at the State Materials Office

Effective Date: 02 / 23 / 2005

Expiration Date: 02 / 23 / 2008

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

STATEMENT OF SOURCE OF MATERIALS AND JOB MIX FORMULA FOR BITUMINOUS CONCRETE

SUBMIT TO THE STATE MATERIALS ENGINEER, CENTRAL BITUMINOUS LABORATORY, 5007 NORTHEAST 39TH AVENUE, GAINESVILLE, FLA. 32609

Contractor: APAC-Southeast, Inc., Southern Florida Division Address: P.O. Box 2579, Sarasota, FL 34230

Phone No.: (941) 483-3329 Fax No.: (941) 486-0170 E-mail: dlsheppard@ashland.com

Submitted By: Linda Sheppard Type Mix: FC-5 Intended Use of Mix: Friction Course

TYPE MATERIAL	F.D.O.T. CODE	PRODUCER	PIT NO.	DATE SAMPLED
1. S-1-A Stone	41	White Rock Quarries	87-339	02 / 07 / 2003
2. S-1-B Stone	53	White Rock Quarries	87-339	02 / 07 / 2003
3. PG 76-22	916-PG			
4.				
5.				
6.				
7.				

PERCENTAGE BY WEIGHT TOTAL AGGREGATE PASSING SIEVES

	Blend Number	50% 1	50% 2	3	4	5	6	JOB MIX FORMULA	CONTROL POINTS	
	3/4" 19.0mm	100	100					100	100	
WI	1/2" 12.5mm	85	100					93	85 - 100	
N	3/8" 9.5mm	46	92					69	55 - 75	
—	No. 4 4.75mm	10	35					23	15 - 25	
∞	No. 8 2.36mm	7	10					9	5 - 10	
	No. 16 1.18mm	5	5					5		
WI	No. 30 600µm	4	4					4		
>	No. 50 300µm	3	3					3		
WI	No. 100 150µm	3	3					3		
—	No. 200 75µm	1.0	1.0					3.0	2 - 4	
∞	G_{se}	2.407	2.416					2.411		

The mix properties of the Job Mix Formula have been conditionally verified, pending successful final verification during production at the assigned plant, the mix design is approved subject to F.D.O.T. specifications.

JMF reflects aggregate changes expected during production

SPM 05-3987B (FC-5)

SPM 05-3987A revised to reflect change binder content.

Director, Office of Materials

Effective Date: 08 / 31 / 2006

Expiration Date: 02 / 03 / 2008

http://materials.dot.state.fl.us/Sinc/Bituminous/CentralBitLab/CentralBituminousLab.htm

New Jersey Department of Transportation

HMA Mix Design

12/21/2015

Region: Central

Mix ID#	C02DC0737VIR	Effective Date	3/4/2014
Mix Type	HMA,OPEN GR FRICTION CRS, ASPHALT RUBBER	Expiration Date	12/31/2049
Producer	TRAP ROCK INDUSTRIES - KINGSTON, NJ (HMA PLANT)	Verification Type	Lab Verification
Mix Temp. (F)	320	Designer	Michael Jopko
Compaction Temp. (F)	310		

SIEVE SIZE Inch	mm	Job Mix Formula	Broadband min.	max.	Production Tolerances min.	max.
2	50	100.0	100	100		
1 1/2	37.5	100.0	100	100		
1	25	100.0	100	100		
3/4	19	100.0	100	100		
1/2	12.5	100.0	85	100		
3/8	9.5	92.2	35	60	86.7	97.7
No.4	4.75	33.9	10	25	28.4	39.4
No.8	2.36	12.9	5	10	8.4	17.4
No.16	1.18	8.4	0	100		
No.30	0.6	8.4	0	100		
No.50	0.3	5.2	0	100		
No.100	0.15	3.7	0	100		
No.200	0.075	3.0	2	5	1	5
Virgin Binder Content		6.0				

Tests Performed	Test Results	Test Criteria min.	max.
%Air Voids (Va)	19.64		
%VMA			
%VFA			
Dust/Asphalt Ratio			
Drain Down			
VCA - Mix			<VCA dry
VCA - dry			
Max. Sp.Grav. (Gmm)	2.688		
Bulk Sp.Grav. (Gmb)	2.160		
% Gmm @ N Max			
Sp. Grav. of Binder (GB)			
Sp. Grav. of Agg. Blend (Gsb)	2.937		
Moist.Sensitivity TSR	94		
lbs./Square Yard/Inch	101.13		
% Gmm @ N Design	75.8		
Ignition Oven Agg. Correction Factor CFI		0.15 @ 538 Degrees C	
% Absorbed AC	0.10		

COMPONENT MATERIALS & LOCATION	TOTAL MIX %	COMPONENTS - PRODUCER &
AGGREGATES, STONE SAND, UNWASHED	12.0	TRAP ROCK INDUSTRIES - KINGSTON, NJ (AGGREGATES)
AGGREGATES, COARSE, #8, BROKEN STONE	88.0	TRAP ROCK INDUSTRIES - KINGSTON, NJ (AGGREGATES)
ASPHALT, BINDER, GRADE 76-22	6.0	AXEON SPECIALTY PRODUCTS, LLC - PAULSBORO, NJ

Remarks: