Aramid Fibers

Applying the concept of BMD can be an excellent tool in demonstrating how aramid fibers can extend pavement life by increasing the resistance to pavement distresses such as fatigue cracking and rutting. For a conventional asphalt concrete without fibers, Figure 9 shows that increasing asphalt content increases cracking resistance but decreases rutting resistance. Increasing asphalt makes the asphalt concrete mixture more flexible and, therefore, increases the fatigue life by increasing the number of repeated stresses before cracking. On the other hand, increasing asphalt increases lubrication between aggregate particles and, therefore, reduces stability and increases the chance of permanent deformation. Thus, the asphalt concrete ingredients need to be properly controlled in order to balance between fatigue cracking resistance and rutting resistance. If the cracking and rutting limits are known, the BMD can be used to determine an acceptable range of asphalt content that satisfies both cracking and rutting resistance requirements as shown in Figure 9. The BMD approach provides flexibility to the designer to change the asphalt content to control cracking and rutting service lives.

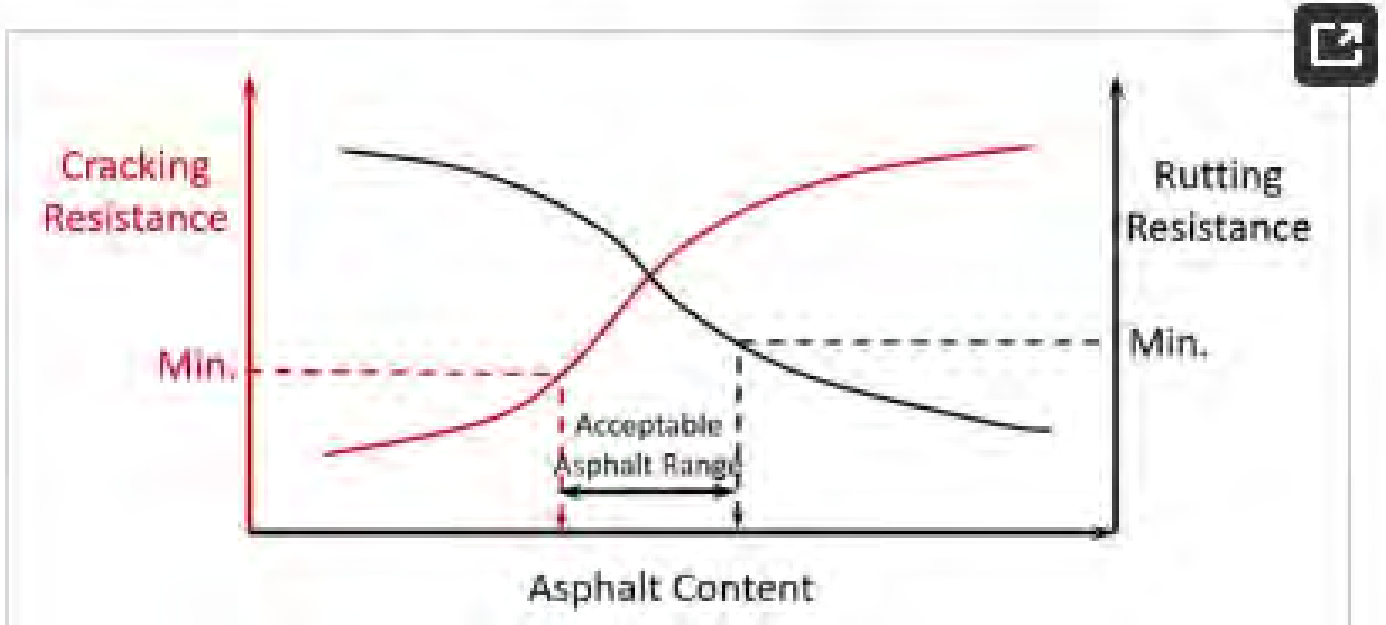


Figure 10 shows a conceptual effect of fibers on the BMD, given that fibers increase both cracking and rutting resistances as discussed earlier. Two methods can be used to evaluate the effect of fibers on improving cracking and rutting resistances as shown in Figure 10a,b. If the acceptable range of asphalt content for the mix without fibers is fixed, Figure 10a shows the increase in cracking and rutting resistances due to the use of fibers. Alternatively, if the minimum cracking and rutting resistance requirements are fixed, Figure 10b shows the increase in the acceptable range of asphalt content due to the use of fibers.

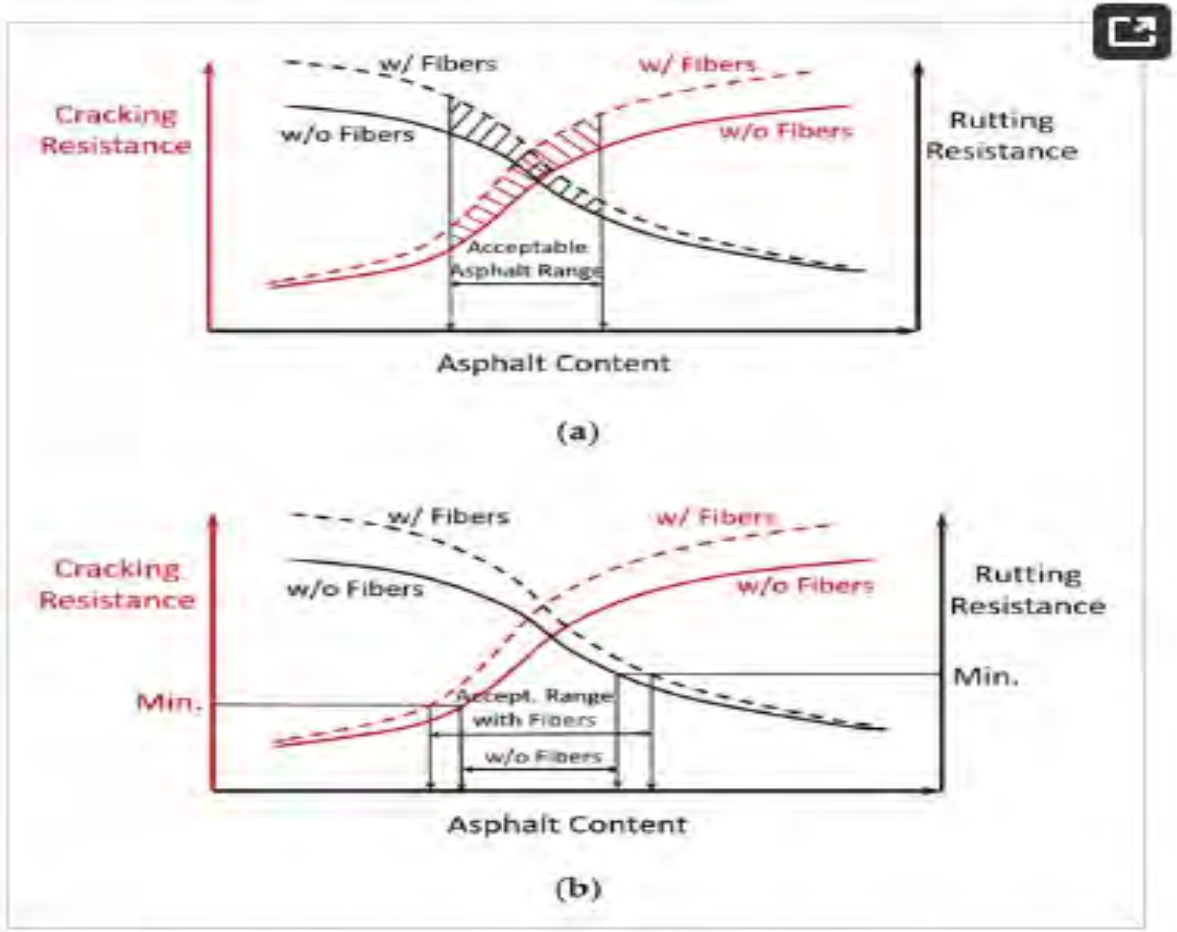
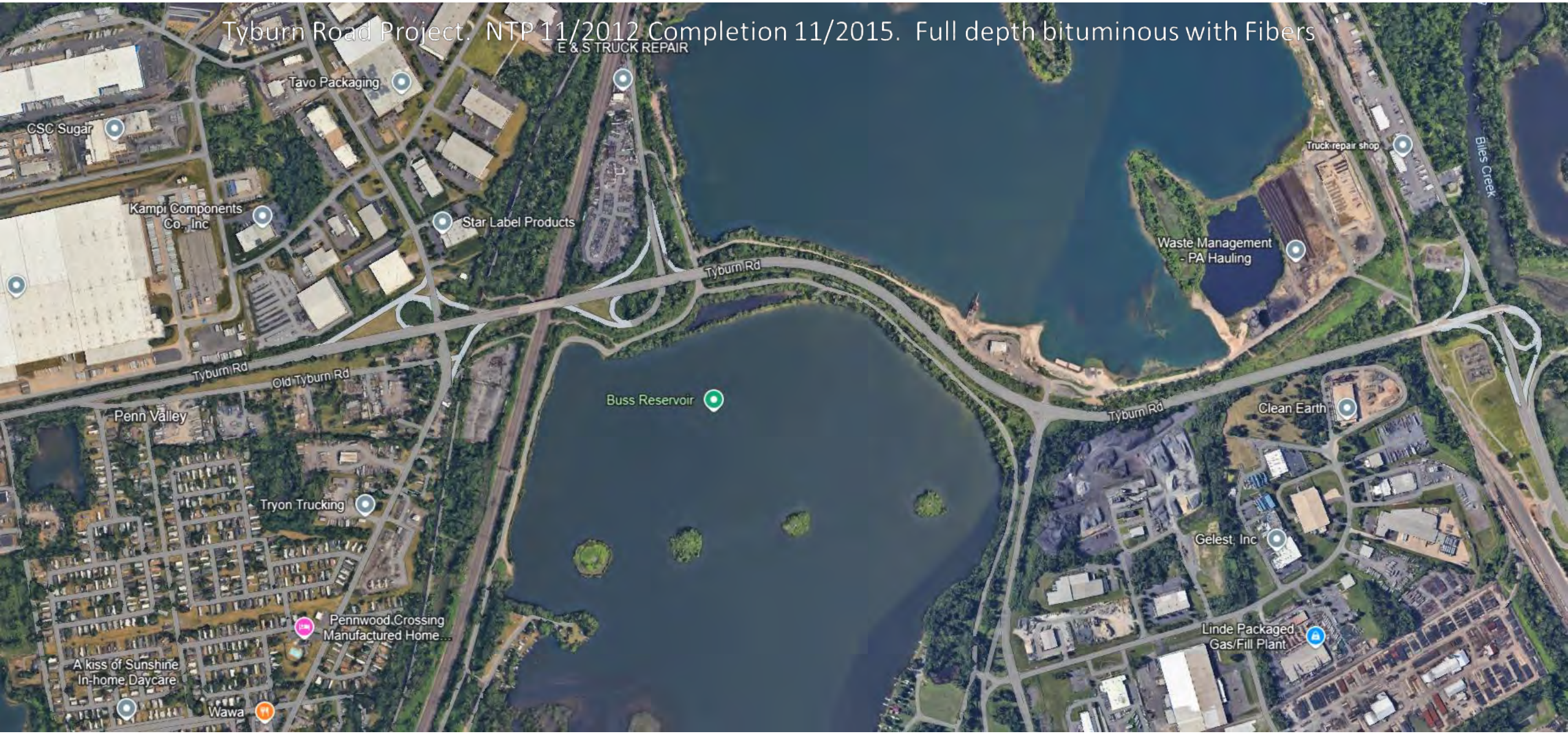
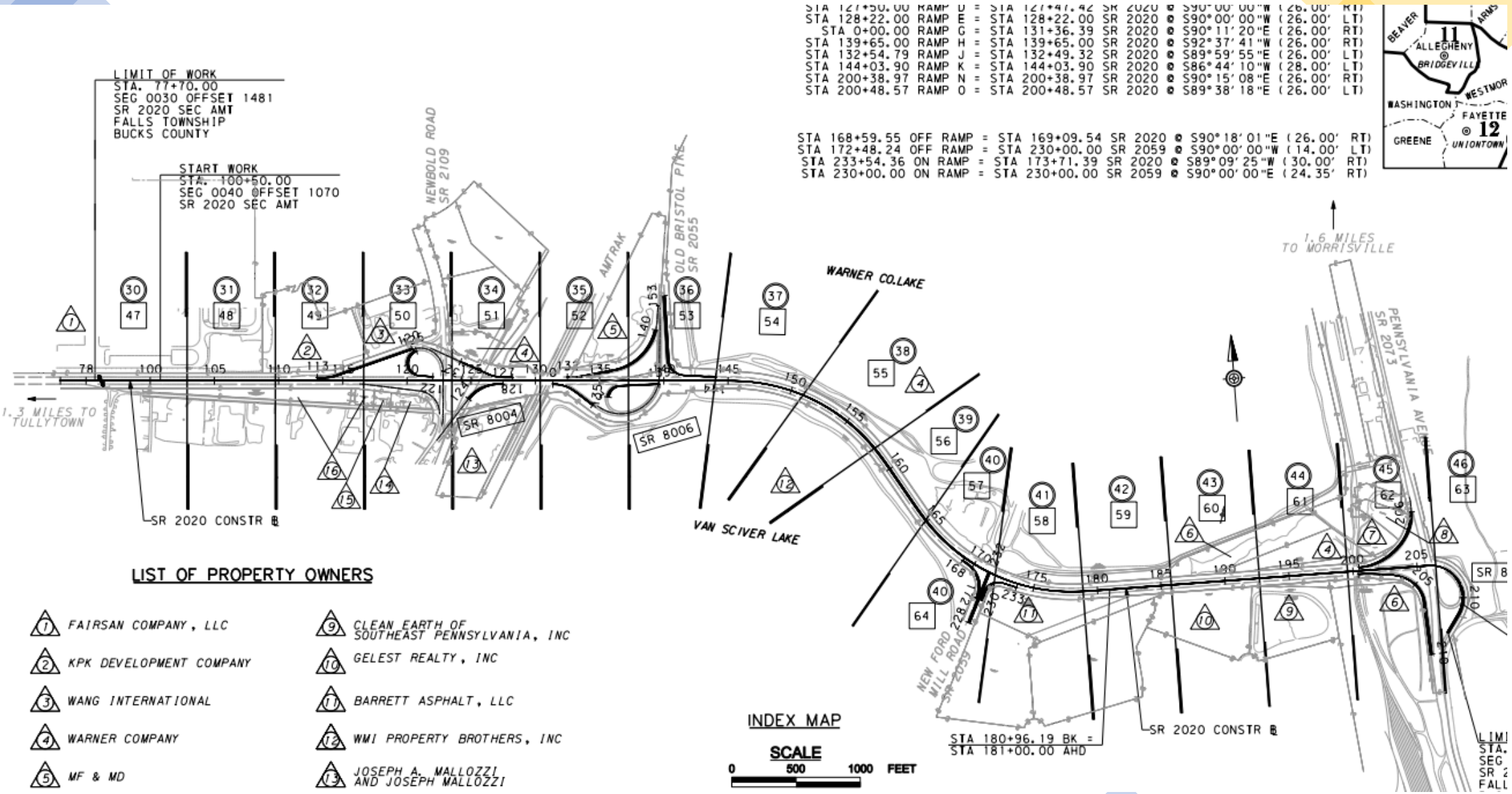


Figure 10. Conceptual effect of fibers on BMD: (**a**) improving cracking and rutting resistance, and (**b**) increasing the acceptable range of asphalt content.


Tyburn Road Project. NTP 11/2012 Completion 11/2015. Full depth bituminous with Fibers
E & S TRUCK REPAIR
Tavo Packaging
CSC Sugar
Kampi Components Co., Inc
Star Label Products
Tyburn Rd
Old Tyburn Rd
Penn Valley
Buss Reservoir
Tryon Trucking
Pennwood Crossing Manufactured Home...
A kiss of Sunshine In-home Daycare
Wawa
Truck repair shop
Billes Creek
Waste Management - PA Hauling
Clean Earth
Gelest, Inc
Linde Packaged Gas/Fill Plant



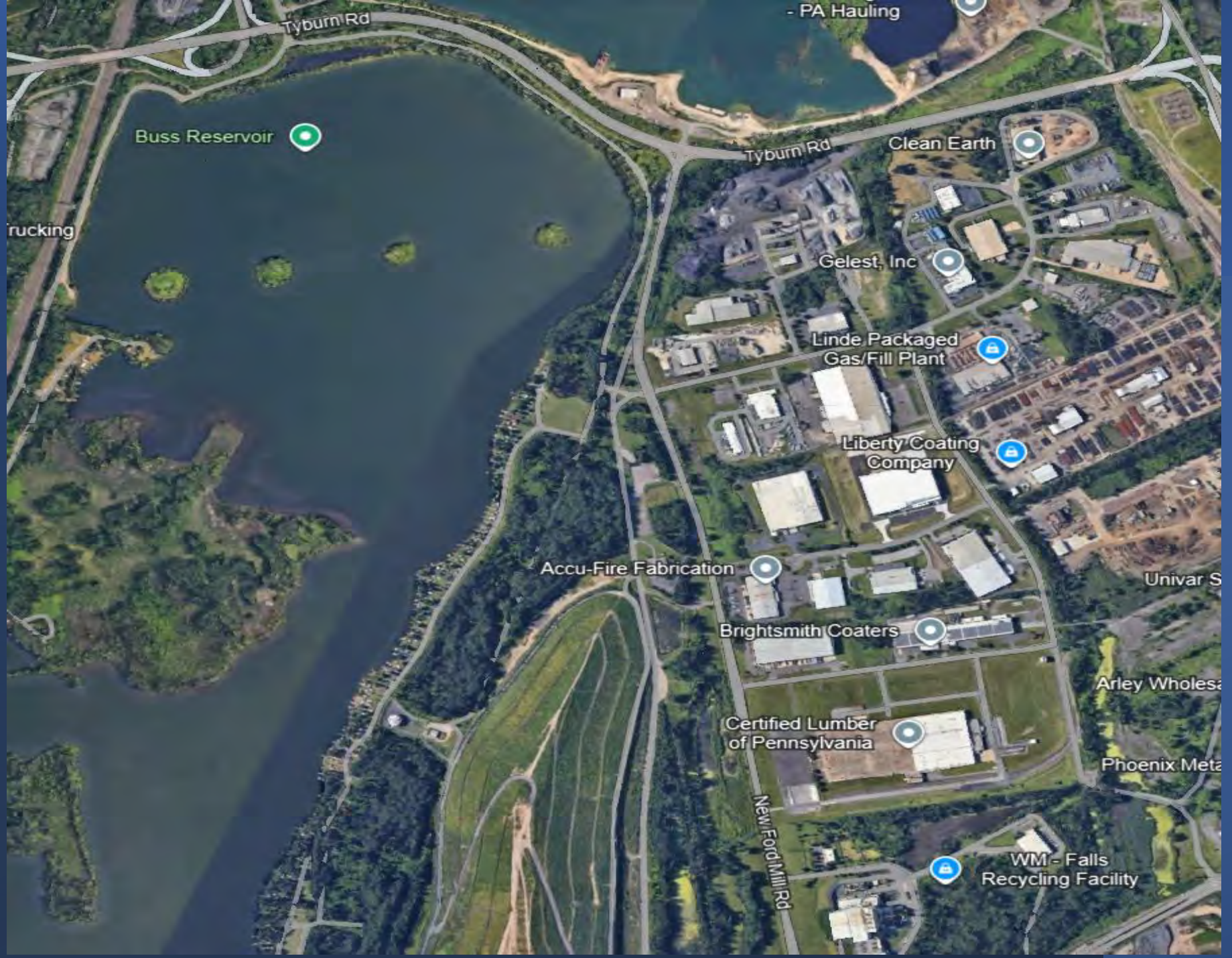
LIST OF PROPERTY OWNERS

1. FAIRSAN COMPANY, LLC
2. KPK DEVELOPMENT COMPANY
3. WANG INTERNATIONAL
4. WARNER COMPANY
5. MF & MD
9. CLEAN EARTH OF SOUTHEAST PENNSYLVANIA, INC
10. GELEST REALTY, INC
11. BARRETT ASPHALT, LLC
12. WMI PROPERTY BROTHERS, INC
13. JOSEPH A. MALLOZZI AND JOSEPH MALLOZZI

INDEX MAP

SCALE

0 500 1000 FEET


- PA Hauling
Tyburn Rd
Buss Reservoir
Tyburn Rd
Clean Earth
rucking
Gelest, Inc
Linde Packaged
Gas/Fill Plant
Liberty Coating
Company
Accu-Fire Fabrication
Univar S
Brightsmith Coaters
Arley Wholesa
Certified Lumber
of Pennsylvania
Phoenix Meta
New Ford Mill Rd
WM - Falls
Recycling Facility

DEPARTMENT OF TRANSPORTATION

DRAWINGS

FOR

CONSTRUCTION

OF

STATE ROUTE 2020 SECTION AMT

IN BUCKS COUNTY

FROM STA 77+70.00 TO STA 213+00.00 LENGTH 10,996.19 FT 2.083 MI

FROM SEG 0030 OFFSET 1481 TO SEG 0080 OFFSET 4214

PUC APPLICATION DOCKET NUMBER A-2011-2224560

ALSO

STATE ROUTE 8004 INTERCHANGE

STATE ROUTE 8006 INTERCHANGE

STATE ROUTE 8008 INTERCHANGE

SCALE

HORIZONTAL 0 25 50 FEET

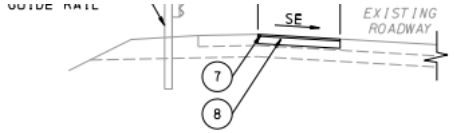
VERTICAL 0 5 10 FEET

DESIGN DESIGNATION

HIGHWAY CLASSIFICATION - MINOR ARTERIAL
DESIGN SPEED - 45 MPH
PAVEMENT WIDTH - 4-12 FT LANES
SHOULDER WIDTH - 5 FT

TRAFFIC DATA

CURRENT ADT - 19,175 (2012)
DESIGN YEAR ADT - 28,492 (2032)
DHV - 1,663
D - 50%
T - 5% - 27%



SR 2020 TEMPORARY SHOULDER PAVEMENT

STA 152+00 LT TO STA 160+00 LT

(7) - SUPERPAVE ASPHALT MIXTURE DESIGN, HMA WEARING COURSE, PG 64-22, 10 TO < 30 MILLION ESALS, 12.5 MM MIX, 2" DEPTH, SRL-H

(8) - SUPERPAVE ASPHALT MIXTURE DESIGN, HMA BASE COURSE, PG 64-22, 10 TO < 30 MILLION ESALS, 25.0 MM MIX, 6" DEPTH

PAVEMENT LEGEND:

(1) - SUPERPAVE ASPHALT MIXTURE DESIGN, HMA WEARING COURSE, PG 76-22, >/= 30 MILLION ESALS, 9.5 MM MIX, 2" DEPTH, SRL-E

(2) - SUPERPAVE ASPHALT MIXTURE DESIGN, HMA BINDER COURSE, PG 76-22, >/= 30 MILLION ESALS, 19.0 MM MIX, 3" DEPTH, MODIFIED

(3) - SUPERPAVE ASPHALT MIXTURE DESIGN, HMA BASE COURSE, PG 64-22, >/= 30 MILLION ESALS, 25.0 MM MIX, 6" DEPTH, MODIFIED

(4) - SUBBASE 8" DEPTH (NO. 2A)

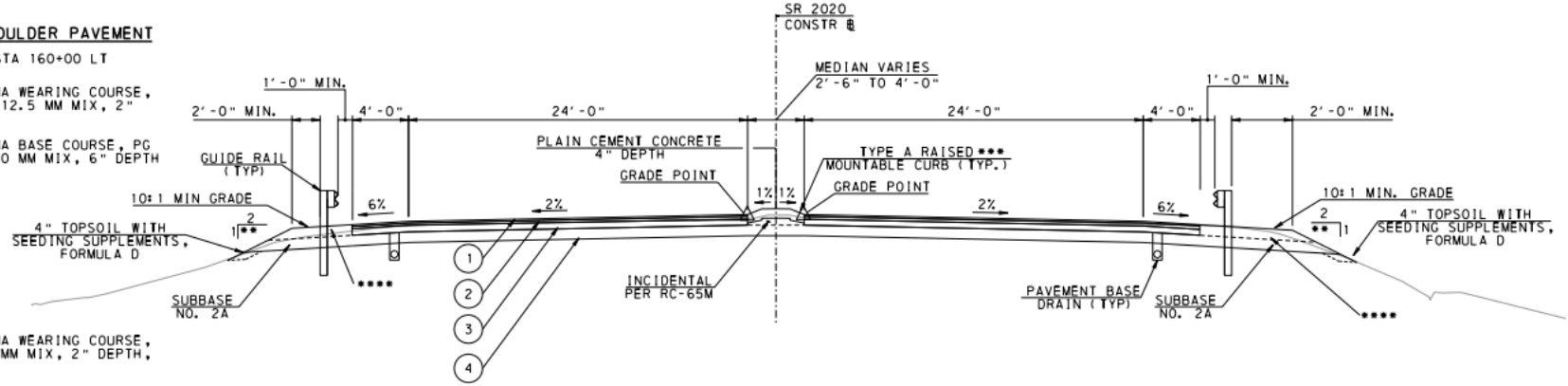
(5) - SLOPE THE SHOULDER ON THE HIGH SIDE OF THE SUPERELEVATED SECTION AT 2.0% AWAY FROM PAVEMENT WHEN SUPERELEVATION IS 2.0% TO 6.0%.

(6) - SLOPE THE TEMPORARY SHOULDER ON THE HIGH SIDE OF THE SUPERELEVATED SECTION AT THE SAME RATE AS THE ROADWAY SECTION.

NO. 2A ****

SR 2020 TYPICAL SECTION

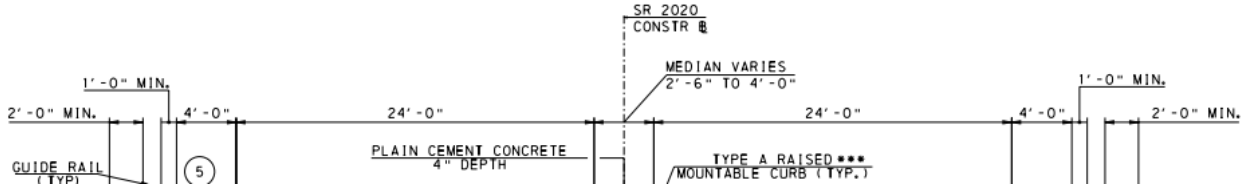
STA 101+00.00 TO STA 119+00.00



SR 2020 TYPICAL SECTION

STA 119+00.00 TO STA 140+41.94
STA 141+37.18 TO STA 143+45.10
STA 161+08.71 TO STA 162+18.73
STA 180+89.41 TO STA 199+20.04

* TAPERS 7'-0" TO 5'-0" FROM STA 117+00.00 TO 119+00.00
** REFER TO CROSS SECTIONS FOR FILL SLOPE GRADING (VARIES 1.5:1 AND 2:1 TYP.)
*** REFER TO PLANS AND CROSS SECTIONS FOR LIMITS OF 4' CONCRETE MEDIAN
**** SUBBASE ABOVE PAYMENT DEPTH IS TO BE CONSIDERED INCIDENTAL TO CONSTRUCTION



Header

ITEM 9409-0891 – SUPERPAVE ASPHALT MIXTURE DESIGN, HMA WEARING COURSE, PG 76-22, >/= 30 MILLION ESALS, 9.5mm MIX, 2" DEPTH, SRL-E

Provision Body

DESCRIPTION - Section 409.1.

MATERIAL – Section 409.2 and, **except from STATION 101+00 to 102+00**, add the following:

(g) Fiber Reinforcement. **Fibers to be supplied by the following:**

FORTA Corporation

100 FORTA Drive

Grove City, PA 16127

(800) 245-0306

www.fortacorp.com

Provide fibers conforming to the requirements below. Design the asphalt mix without the fiber in accordance with 409. Do not alter the final mix design for the addition of fiber at the plant. Use the fiber type specified at the rate of 1.0 pounds/ton (0.5 kg/metric ton) of total mix. Furnish with the mix design submittal certified test data for the fibers to be used on the project.

1. Physical Properties

Materials……..Polyolefin/Aramid

Length……..3/4" (19mm), ~~1-1/2" (38mm)~~

Form……..Twisted Fibrillated & Monofilament Fibers

Color……..Yellow, Black, Tan

Specific Gravity……..0.91/1.44

Acid/Alkali/ Resistance……..Inert

Tensile Strength……..70,000 psi / 400,000 psi

Melt Temperature……..212ºF / 800ºF (100ºC / 427ºC)

CONSTRUCTION – Section 309.2 and add the following:

(c) Bituminous Mixing Plant

3. Fiber Supply System. Add fiber through specialized equipment that can accurately proportion and meter, by weight (mass), the proper amount per batch for batch plants, or continuously and in a steady uniform manner for drum plants.

Provide proportioning devices that are interlocked with the plant system and controlled to ±10% if the mass (weight) of the fibers required. Perform an equipment calibration to the satisfaction of the Representative to show that the fiber is being accurately metered and uniformly distributed into the mix.

Include the following on the fiber supply system:

1) Low level indicators

2) No-flow indicators

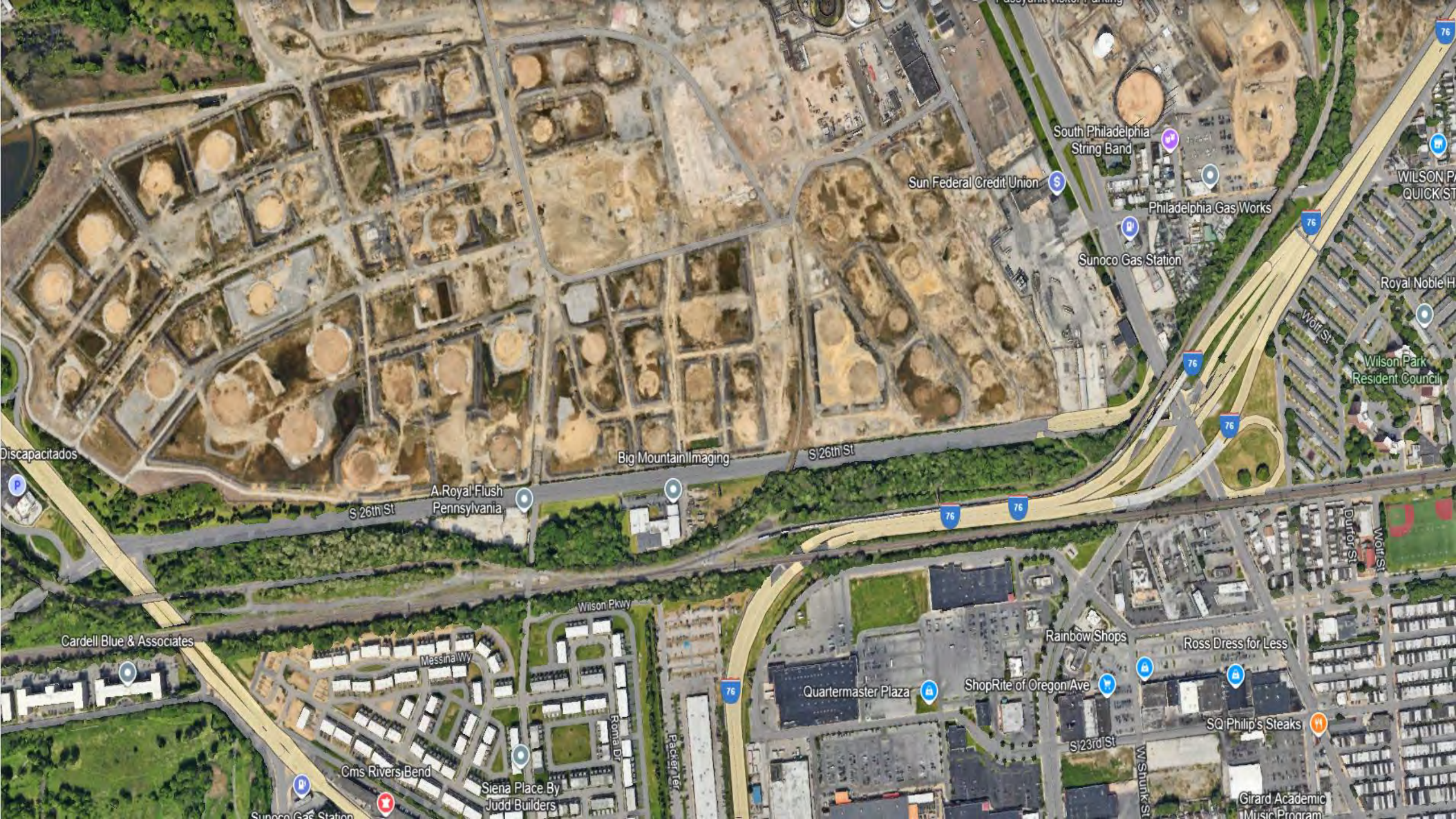
3) A printout of feed rate status in kg (pounds) / minute

4) A section of transparent pipe in the fiber supply line for observing consistency of flow or feed.


NORTH

Full Depth Tyburn Road Reconstruction
Without Fibers

Full Depth w/o Fibers


South Philadelphia String Band
Sun Federal Credit Union
Philadelphia Gas Works
Sunoco Gas Station
Royal Noble H
Wolf St
Wilson Park Resident Council
Discapacitados
Big Mountain Imaging
S 26th St
A Royal Flush Pennsylvania
Wilson Pkwy
Cardell Blue & Associates
Messina Wy
Rainbow Shops
Ross Dress for Less
Quartermaster Plaza
ShopRite of Oregon Ave
SQ Philip's Steaks
S 23rd St
Roma Dr
Packer Ter
Cms Rivers Bend
Siena Place By Judd Builders
Girard Academic Music Program
76

HMA Cracking and Rutting Performance Results

IDEAL-CT (ASTM D8225) & HWT (AASHTO T 324)

Project	I-95 & Allegheny Ave, Riverside Materials	Report Date	11/17/2022
BATT ID	**Source ID**	**Date Received**	**Test Date**
22-0296	PG 64S-22 15% RAP Control Mixture	10/19/2022	11/4/2022
22-0297	PG 64S-22 15% RAP 2x Dose ACE Fiber Mixture	10/19/2022	11/4/2022
22-0298	PG 64S-22 30% RAP 1.5x Dose ACE XP Fiber Mixture	10/19/2022	11/4/2022
22-0299	PG 64E-22 15% RAP Mixture	10/19/2022	11/4/2022

Equipment	*BATT ID*	*Calibration*	*Equipment*	*BATT ID*	*Calibration*
Auto_SCB	*B0075*	*2/1/2022*	*10k Load Cell*	*B0023*	*2/1/2022*
LVDT	*B0024*	*2/1/2022*	*Temp Control Bath*	*B0050*	*3/9/2022*
SmarTracker	*B0014*	*11/1/2022*			

Test Description

Plant mixed samples were delivered to BATT from Riverside Materials as requested by Site Supply. Four mixtures were evaluated for performance in cracking and rutting per ASTM D8225 IDEAL-CT and AASHTO T 324 HWT. Mixtures 22-0296 and 22-0297 contained PG 64S-22 binder and 15% RAP, but 22-0297 also contained 3/4" 2x dose wax coated aramid fiber (ACE XP). The standard dose of ACE XP is 3.2 oz/ton, mixture 22-0297 contained 6.4 oz/ton of ACE XP. Mixture 22-0299 was similar to the first two mixtures but used PG 64E-22 for binder and no ACE XP. The fourth

Blankenship Asphalt Tech & Training
125 S Killarney Ln, Richmond, KY 40475
(859) 544-6200

Table 1 - Indirect Tensile Asphalt Cracking Test (IDEAL-CT) Results

Test	ASTM D8225	Temperature	25°C	Loading Rate	50 mm/min

Mixture	Voids	Disp (mm)	Slope (kN)	Strength (kPa)	Energy (J/m^2)	CT_{Index}	SD	COV
22-0296 15% RAP 64S-22	7.0%	5.5	-3.2	978.8	9,036	**105.4**	20.9	19.8
22-0297 15% RAP 2x ACE 64S-22	7.1%	5.8	-2.5	909.7	9,356	**142.9**	17.9	12.5
22-0298 30% RAP 1.5x ACE 64S-22	7.1%	5.4	-3.8	1,112.8	10,064	**94.5**	6.2	6.6
22-0299 15% RAP 64E-22	6.8%	5.9	-2.8	927.0	9,296	**135.8**	23.8	17.5

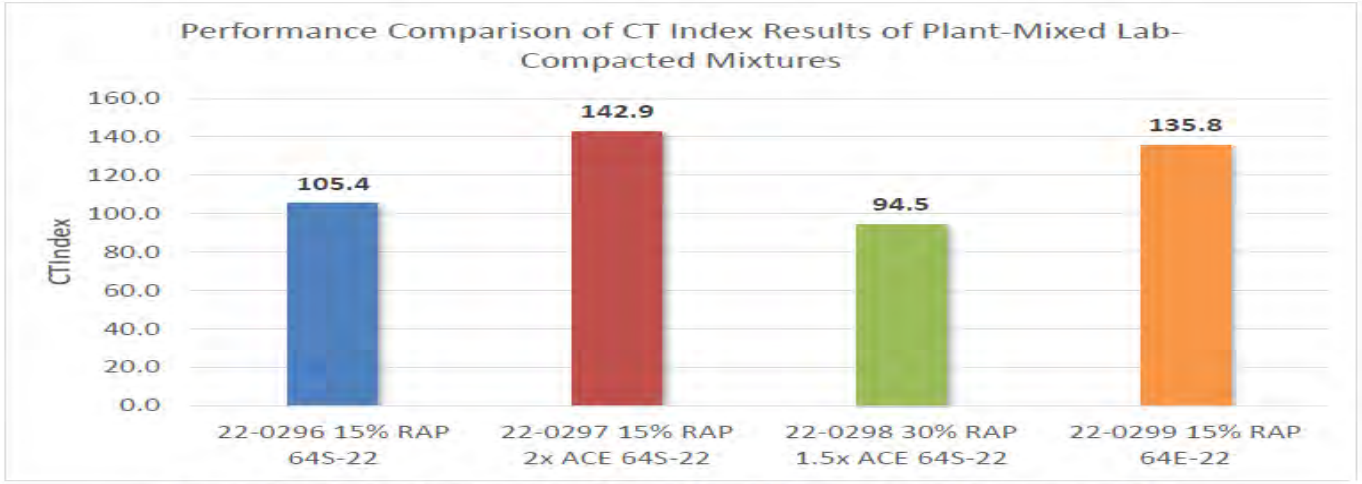


Figure 1 - CT Index Performance of Plant-Mixed Lab-Compacted Specimens at 25°C

Blankenship Asphalt Tech & Training
125 S Killarney Ln, Richmond, KY 40475
(859) 544-6200

Table 2 - Hamburg Wheel Tracker (HWT) Test Results

Test	AASHTO T 324	Temperature	50°C	Loading Rate	52 mm/min
				Wheel Load	705 N

Mixture	Voids	Disp (mm) 5,000	10,000	15,000	20,000	Total Passes	Rut Depth	SIP	RRI
22-0296 15% RAP 64S-22	7.4%	3.43	4.33	4.98	5.74	**20,000**	5.74		14,402
	7.4%	3.56	4.45	5.46	8.48	**20,000**	8.48	16,494	
22-0297 15% RAP 2x ACE 64S-22	7.2%	3.21	3.99	4.71	5.82	**20,000**	5.82	13,169	15,551
	7.1%	4.14	4.26	4.89	5.48	**20,000**	5.48		
22-0298 30% RAP 1.5x ACE 64S-22	6.9%	2.91	3.60	4.12	4.74	**20,000**	4.74		16,165
	6.8%	3.04	3.76	4.38	5.00	**20,000**	5.00		
22-0299 15% RAP 64E-22	7.1%	2.57	3.06	3.50	3.85	**20,000**	3.85		17,094
	7.0%	2.37	2.87	3.20	3.53	**20,000**	3.53		

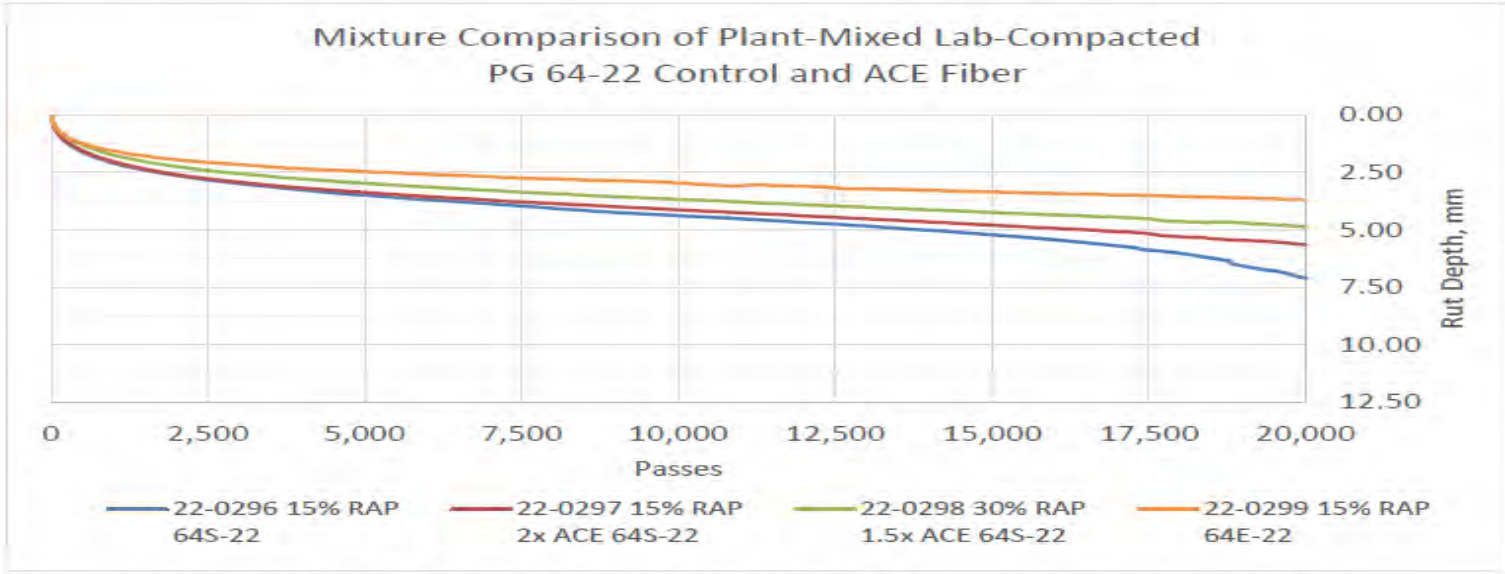


Figure 2 - HWT Rutting Profiles of Plant-Mixed Lab-Compacted Specimens at 50°C

Project: 104989 Go — Standard / Non - Federal (100% State)

Short Description: Philadelphia Cnty Resurfacing 2023 (P13)
County: Philadelphia — SR: 1005
District: 06 — Group ID: Group 6-22-P13

Items

Filter | Item Number | Go

Records 1 to 92 of 92 — Page 1 of 1

Total Estimate: $21,230,564.92

ALT	Item	Unit of Measure	Quantity	Unit Price
	0301-0004	Square Yard	200.000	$225.00
		PLAIN CEMENT CONCRETE BASE COURSE, 8" DEPTH		
	0316-0537	Ton	4,500.000	$150.00
		SUPERPAVE ASPHALT MIXTURE DESIGN, FLEXIBLE BASE REPLACEMENT, PG 64S-22, 3 TO < 10 MILLION ESALs, 25.0 MM MIX		
	0316-0636	Square Yard	600.000	$115.00
		SUPERPAVE ASPHALT MIXTURE DESIGN, FLEXIBLE BASE REPLACEMENT, PG 64S-22, 10 TO < 30 MILLION ESALs, 25.0 MM MIX, 12" DEPTH		
E	0413-0408	Ton	82,423.000	$94.00
		SUPERPAVE ASPHALT MIXTURE DESIGN, WEARING COURSE, PG 64E-22, 3 TO < 10 MILLION ESALS, 9.5 MM MIX, SRL-H		
O	9000-0408	Ton	82,423.000	$0.00
		Fiber Modified Wearing Course (FMC) as an alternative to Superpave Asphalt Mixture Design, Wearing Course, PG 64E-22, 3 TO < 10 Million ESALS, 9.5mm Mix		

Associated Items

Item Number	Unit of Measure	Item Description
9000-0408	TON	Fiber Modified Wearing Course (FMC) as an alternative to Superpave Asphalt Mixture Design, Wearing Course, PG 64E-22, 3 TO < 10 Million ESALS, 9.5mm Mix

Header

ITEM 9000 – 0408 -Fiber Modified Wearing Course (FMC) as an alternative to Superpave Asphalt Mixture Design, Wearing Course, PG 64E-22, 3 TO < 10 Million ESALS, 9.5mm Mix

Provision Body

I. **Description –** This work is the standard and RPS construction of using a plant-mixed Fiber Modified Courses (FMC) mix as an alternative to a Superpave Asphalt Mixture Design, Wearing Course, PG 64E-22, 3 TO < 10 Million ESALS, 9.5mm Mix. The producer will maintain the right to use a Superpave Asphalt Mixture Design, Wearing Course, PG 64E-22, 3 TO < 10 Million ESALS, 9.5mm Mix in its place. To do so the following conditions will need to be met:

1. Provide performance related testing for asphalt wearing course before construction begins that proves the (FMC) mix meets or exceeds the performance of Superpave Asphalt Mixture Design, Wearing Course, PG 64E-22, 3 TO < 10 Million ESALS, 9.5mm Mix containing similar aggregate structure. The following tests will be used in this determination: Cracking tolerance Index of Asphalt (ASTM D8225) and the Hamburg Wheel tracking test (AASHTO T 324).
2. A PG 64S-22 Asphalt can be used instead of a PG 64E-22 Asphalt in the manufacture of this (FMC) mix.
3. FMC mix can not exceed 30% RAP.
4. Add Aramid fibers at a double dose (4.2 ounces minimum) of aramid fibers per plant mix ton of asphalt. Do not exceed the manufactures maximum recommended amount of fibers per ton.
5. This mix will conform to the weather and seasonal limitations of a PG 64S-22 mix.
6. Once a roadway is started, the roadway will have to be finished with the (FMC) or a standard mix unless receiving approval by the DME to switch.
7. The following modifications will be made to Section 413.2:

II. **MATERIAL**—Section 413.2 with the following additions.

(k) Aramid Fibers. Use only Para-aramid fibers (aramid fibers) approved and listed in Bulletin 15 for use in Asphalt. Provide a supplier certification with each shipment as specified in Section 106.03(b)3. Certify that the aramid fibers conform to the physical requirements of TABLE 1.

Add aramid fibers at a rate of 4.2 ounces (minimum) of aramid fiber per ton of asphalt mix.

Aramid fibers may be packaged in loose form with other inert material, or packaged in a bundled form coated with wax (or other inert material) to aid in dispersion of the aramid fibers into the mixture.

Deliver fibers in sealed, undamaged, pre-weighed bags or as loose fibers in bulk containers. Identify the pre-weighed bags or bulk containers with legible labels, indicating fiber manufacturer name, product name or designation, manufacturer lot number, and weight.

Store materials in accordance with manufacturer's recommendations. Protect fibers from UV radiation. Do not allow fibers to become wet or contaminated. Discard and replace wet or contaminated fibers at no additional cost to the Department.

Project: 104989 — Standard / Non - Federal (100% State) — Construction

Short Description:	Philadelphia Cnty Resurfacing 2023 (P13)			**Org Code:**	0600
County:	Philadelphia	**SR:**	1005	**Section:**	P13
District:	06	**Group ID:**	Group 6-22-P13	**Municipality:**	PHILADELPHIA

Item Detail

Item:	0413-0408	**Item Type:**	Contract Item
Description:	SUPERPAVE ASPHALT MIXTURE DESIGN, WEARING COURSE, PG 64E-22, 3 TO < 10 MILLION ESALS, 9.5 MM MIX, SRL-H	**Unit Price:**	$103.00
Unit of Measure:	TON	**Item Total:**	$12,484,902.95
Diesel:	Yes	**Asphalt:**	Yes
Diesel Category Code:	Category C - Flexible Bases, Pavements, Pavement Patching, and Shoulders	**Asphalt Type Code:**	
Stored Materials:	Not Eligible for Stored Materials PrePayments		

Project: 104989 — Standard / Non - Federal (100% State) — Construction

Short Description:	Philadelphia Cnty Resurfacing 2023 (P13)		
County:	Philadelphia	**SR:** 1005	**Org Code:** 0600
District:	06	**Group ID:** Group 6-22-P13	**Section:** P13
			Municipality: PHILADELPHIA

Item Detail

Item: 9000-0437

Description: FIBER MODIFIED WEARING COURSE, RPS, PG 64E-22, 10 TO < 30 MILLION ESALS, 9.5 MM MIX, SRL-E (FMC)

Unit of Measure: TON

Special Provision: 00-ITEM 9000- 0437 FIBER MODIFIED WEARING COURSE, PG 64E-22,10 TO < 30 MILLION ESALS, 9.5 MM MIX, SRL-E

Diesel: No

Diesel Category Code:

Stored Materials: Not Eligible for Stored Materials PrePayments

Item Type: Contract Item

Unit Price: $138.00

Item Total: $2,967,989.46

Asphalt: No

Asphalt Type Code:

Riverside Materials Inc.

2870 E. Allegheny Ave. Philadelphia PA 19134

JOB: ECMS#: 104989 Philadelphia County / P13
CONTRACTOR: James J Anderson

PRODUCER: Riverside Materials Inc.
PADOT MIX#: W95731E4

RIVERSIDE MIX NAME: 9.5ECEFx216WR
HAMBURG WHEEL TRACKING

Date Sampled	Location	Date Tested	Test Equipment	Sample #	Max Gt	Voids	% AC Design	% AC Tested	Displ 75% (I75)	Peak Load - kN	Flow (mm)	Failure Energy Gf (joules/m2)	IDEAL CT Index	Post Peak Slope 75%(m75)	HWT Total Rut at 20,000 MAX 12.5		HWT Total Rut at 10,000		Specimens % Air Voids Avg	Specimens % Air Voids Avg
															LEFT (mm)	RIGHT (mm)	LEFT (mm)	RIGHT (mm)	LEFT	RIGHT
9/5/23		9/6/23	InstroTek	2	2.534	7.0	5.4	5.3	6.0	14.53	4.1	9538	111.4	3.413						
9/5/23		9/6/23	InstroTek	3	2.534	7.1	5.4	5.3	6.0	14.86	4.1	9935	143.2	2.767						
9/5/23		9/6/23	InstroTek	5	2.534	7.0	5.4	5.3	5.9	14.38	4.2	9348	111.6	3.314	3.72	4.16	2.74	2.72	6.6	6.8
9/5/23	**SR76EB Left Lane**	**9/6/23**	**InstroTek**	**AVG**	**2.534**	**7.0**	**5.4**	**5.3**	**6.0**	**14.59**	**4.1**	**9607**	**122**	**3.165**	**3.94**		**2.73**			
9/6/23		9/7/23	Pine	CT2	2.533	6.8	5.4	5.3	6.2	16.28	4.0	11858	173.6	2.817						
9/6/23		9/7/23	Pine	CT7	2.533	6.8	5.4	5.3	6.2	16.24	4.2	11791	170.0	2.878						
9/6/23		6/7/23	Pine	CT8	2.533	6.8	5.4	5.3	5.6	16.01	3.1	10769	137.6	2.935						
															3.58	3.51	2.51	2.57	6.6	7.1
9/6/23	**SR76WB Left Lane**	**9/7/23**	**Pine**	**AVG**	**2.533**	**6.8**	**5.4**	**5.3**	**6.0**	**16.17**	**3.8**	**11473**	**160**	**2.877**	**3.545**		**2.54**			
9/7/23		9/8/23	Pine	C1	2.536	6.7	5.4	5.3	6.0	15.54	3.6	10485	148.5	2.810						
9/7/23		9/8/23	Pine	C3	2.536	6.8	5.4	5.3	6.0	16.07	3.8	10769	130.3	3.287						
9/7/23		9/8/23	Pine	C6	2.536	6.7	5.4	5.3	5.7	15.79	3.2	10830	138.4	2.961						
9/7/23	**SR76EB Center Lane**	**9/8/23**	**Pine**	**AVG**	**2.536**	**6.7**	**5.4**	**5.3**	**5.8**	**15.93**	**3.5**	**10800**	**134**	**3.124**	**NO DATA**					
9/11/23		9/12/23	Pine	CT1	2.535	6.9	5.4	5.3	5.5	15.406	3.6	9675	106.1	3.370						
9/11/23		9/12/23	Pine	CT5	2.535	7.1	5.4	5.3	6.0	16.418	4.2	10472	112.1	3.741						
9/11/23		9/12/23	Pine	CT8	2.535	6.8	5.4	5.3	5.6	16.266	3.4	10659	109.1	3.638						
															3.55	4.45	2.94	3.2	7.4	7.5
9/11/23	**SR76WB Center Lane**	**9/12/23**		**AVG**	**2.535**	**6.9**	**5.4**	**5.3**	**5.7**	**16.03**	**3.8**	**10269**	**109**	**3.583**	**4.00**		**3.07**			
9/18/23		9/19/23	Pine	CT1	2.535	7.0	5.4	5.5	5.5	17.01	3.5	10861	111.1	3.603						
9/18/23		9/19/23	Pine	CT2	2.535	7.0	5.4	5.5	6.3	16.43	4.4	11388	145.3	3.292						
9/18/23		9/19/23	Pine	CT8	2.535	7.0	5.4	5.5	5.6	16.36	3.4	11338	129.2	3.262						
															3.14	3.28	2.45	2.77	7.3	7.3
9/18/23	**SR76WB Right Lane**	**9/19/23**	**Pine**	**AVG**	**2.535**	**7.0**	**5.4**	**5.5**	**5.9**	**16.40**	**3.9**	**11363**	**137**	**3.277**	**3.21**		**2.61**			

NOTES: All specimens were plant made materials
All specimens were 150mm & 62mm thick
All specimens were tested in Riverside's Lab
All Ideal Ct specimens were tested at 25°c

Mix Description: 9.5 E Aggregate with 64E-22 Double Dose of Fiber

All Hamburg specimens were plant made materials
All Hamburg specimens were 62mm thick
All Hamburg specimens were tested at 50°c


PA 41 & PA 926 Roundabout
6 / 22

District: 06 **Group ID:** --- **Municipality:** LONDONDERRY

Construction Special Provision Detail

Special Provision Name: c00065 ITEM 9000-0003 - FIBER MODIFIED WEARING COURSE, PG 64E-22, 3 TO <10 MILLION ESALS

Associated Items

Item Number
9000-0003

Header

ITEM 9000-0003 FIBER MODIFIED WEARING COURSE, PG 64E-22, 3 TO <10 MILLION ESALS, 9.5 MM MIX, 2" DEPTH, SRL-E (FMC)

Provision Body

I. DESCRIPTION—This work is the standard and RPS construction of plant-mixed Fiber Modified Courses (FMC) on a prepared surface using a volumetric mixture design developed with the Superpave Gyratory Compactor.

II. MATERIAL—Section 413.2 with the following additions.

(k) Aramid Fibers. Use only Para-aramid fibers (aramid fibers) approved and listed in Bulletin 15 for use in Asphalt. Provide a supplier certification with each shipment as specified in Section 106.03(b)3. Certify that the aramid fibers conform to the physical requirements of TABLE 1.

Add aramid fibers at a rate of 2.0 ounces (minimum) of aramid fiber per ton of asphalt mix.

Aramid fibers may be packaged in loose form with other inert material, or packaged in a bundled form coated with wax (or other inert material) to aid in dispersion of the aramid fibers into the mixture.

Deliver fibers in sealed, undamaged, pre-weighed bags or as loose fibers in bulk containers. Identify the pre-weighed bags or bulk containers with legible labels, indicating fiber manufacturer name, product name or designation, manufacturer lot number, and weight.

Store materials in accordance with manufacturer's recommendations. Protect fibers from UV radiation. Do not allow fibers to become wet or contaminated. Discard and replace wet or contaminated fibers at no additional cost to the Department.

TABLE 1

Aramid Fiber Properties

Property	Requirement
Length	3/4 inch ± 1/16 inch
Form	Filament Yarn
Color	Yellow
Tensile Strength	400,000 psi minimum
Decomposition Temperature	800 F minimum
Modulus	10.2×10^6 psi minimum
Specific Gravity	1.44 - 1.45 (g/cm^3)

III. Construction—Section 313.3 or 413.3 with the following additions.

- **Revise Section 413.3(c) Asphalt Mixing Plant to add the following:**

Make any plant modifications needed to add fibers in accordance with manufacturer's recommendation. Follow manufacturer's requirements for minimum mix production temperature when adding fibers.

- **Revise Section 413.3(c)1 Batch Plant to add the following:**