Construction Academy 2023
Asphalt Topics

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State Materials Office
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Asphalt 101

Ground Tire Rubber

Styrene-Butadiene-Styrene (SBS)

Materials

Asphalt Binders

- "Binds" the aggregate together
- Provides…
  - the "glue"
  - lubrication for compaction
  - Durability (resistance to cracking)
- The most expensive part of an asphalt mix

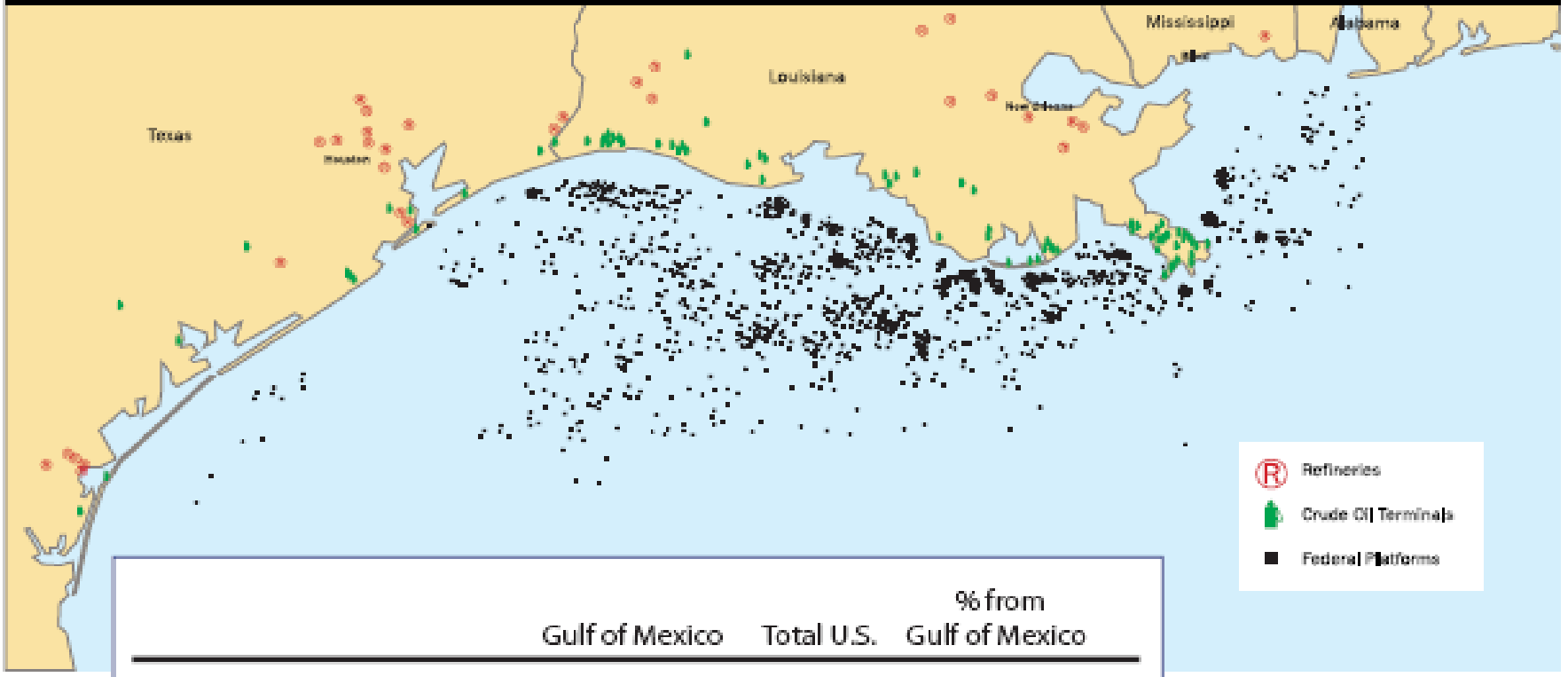
Aggregate

- Stability, constructability, and moisture resistance
  - Consensus properties (fine aggregate angularity, flat and elongated particles, and clay content)
  - Source properties (toughness, soundness, and deleterious materials)

Where Does Asphalt Come From?

Crude Oil

Gulf Coast Oil and Natural Gas Operations



	Gulf of Mexico	Total U.S.	% from Gulf of Mexico
Oil production (million b/d)	1.5	5.5	27%
Natural Gas production (bcf/d)	10.6	52	20%
Refinery Capacity (million b/d)	8.1	17	48%
of which in LA and MS	*3.1*	*17*	*18%*
Crude Oil Imports (million b/d)	6.5	10.8	60%
of which into LA and MS ports	*2.5*	*10.8*	*23%*

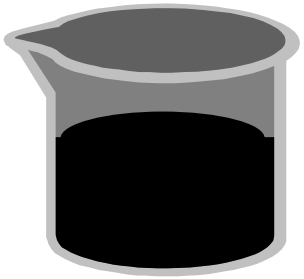
Source: U.S. Energy Information Administration

Superpave Asphalt Binders

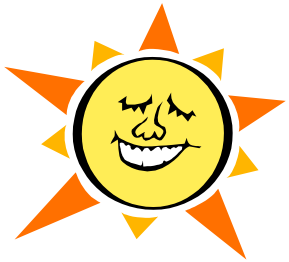
Grading system based on climate

PG 67-22

Performance Grade

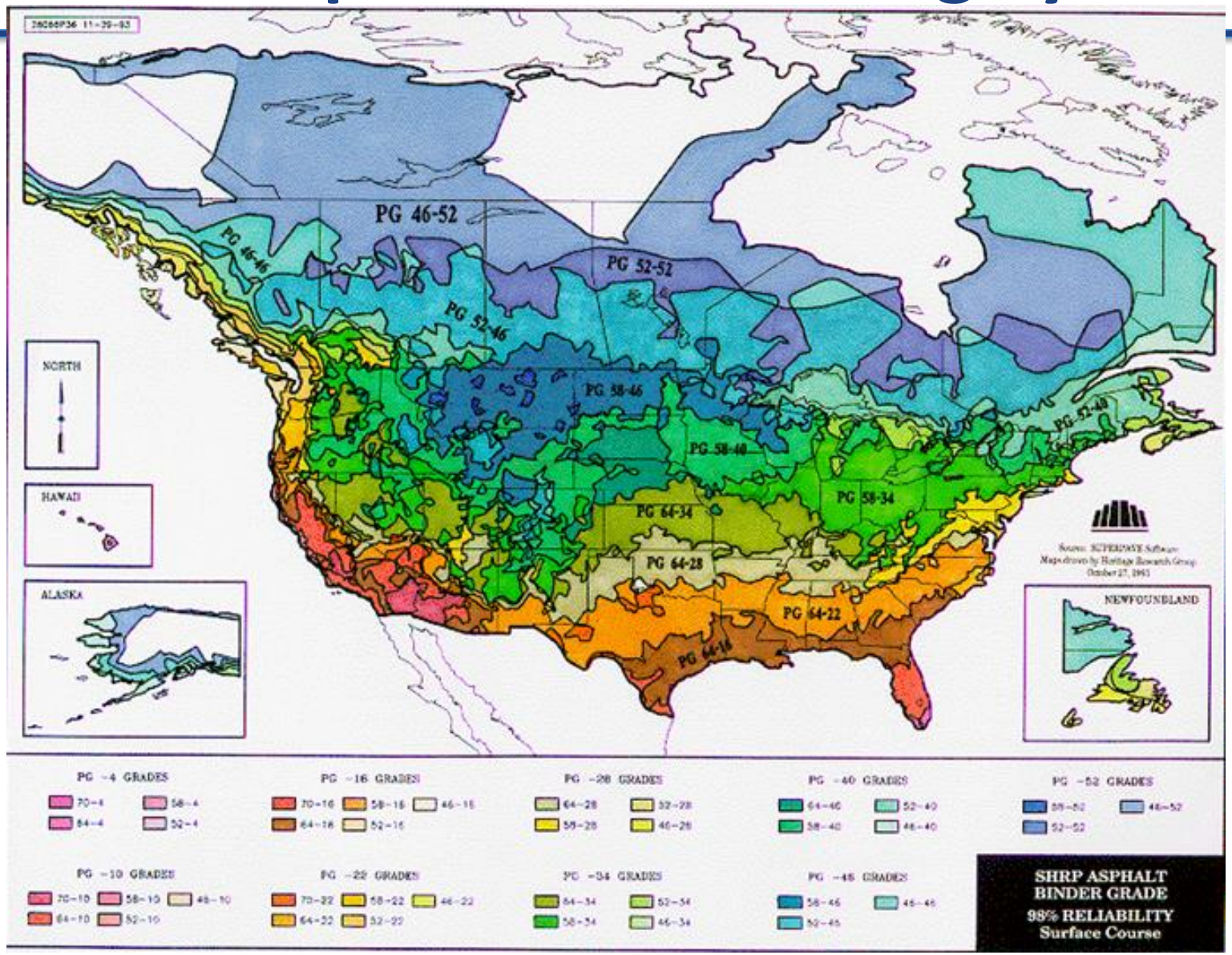


Average 7-day max pavement design temp



Min pavement design temp

Examples of PG Grading System



Neat Asphalt Binders

Table 334-2 Asphalt Binder Grade for Mixes Contains RAP	
Percent RAP	**Asphalt Binder Grade**
0 – 15	PG 67-22
16 – 30	PG 58-22
>30	PG 52-28

The bituminous material specification requirements are outlined in Section 916.

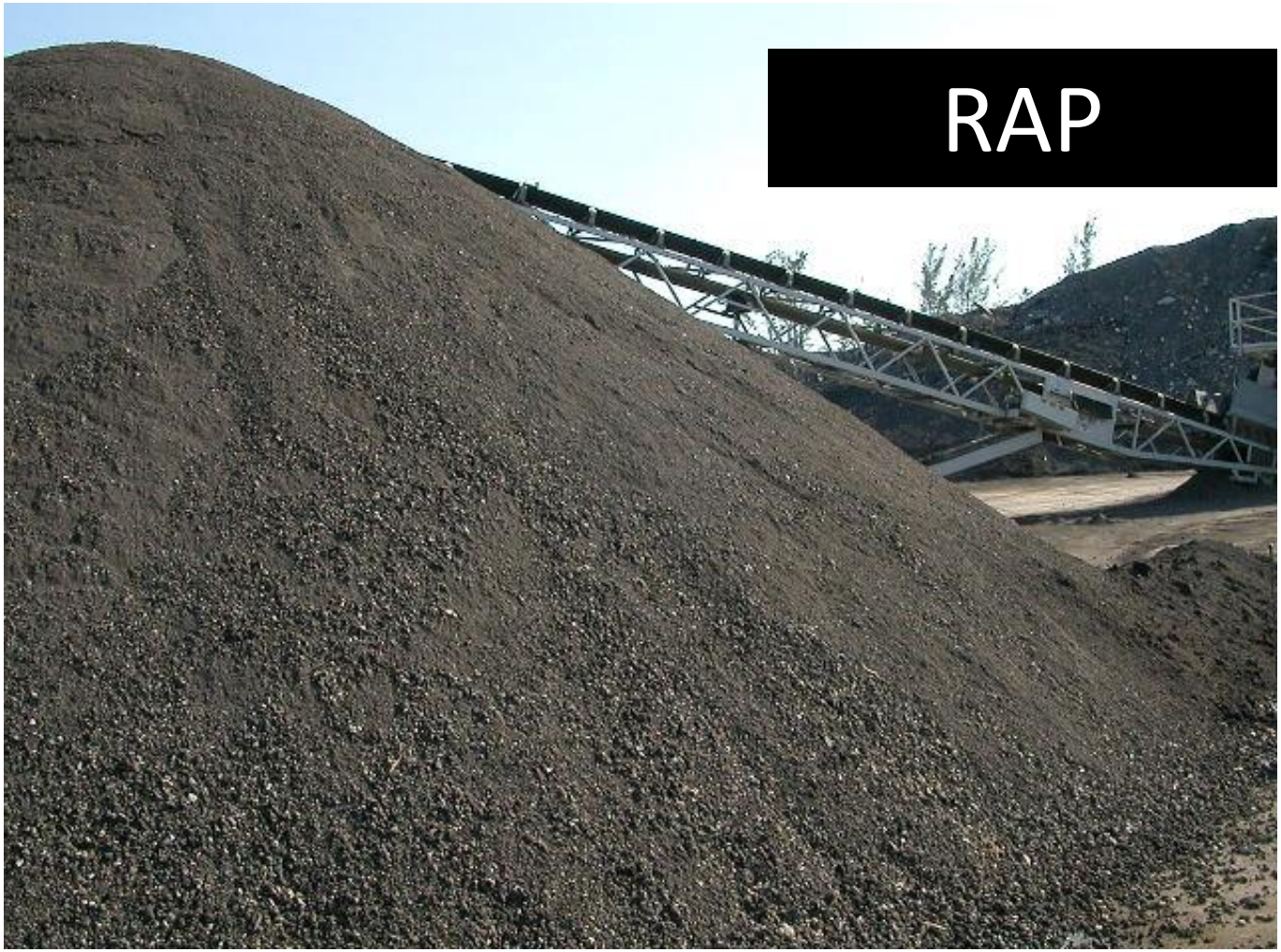
Modified Asphalt Binders (916)

- PG 76-22 (PMA)
  - PG 67-22 base asphalt
  - Polymer Modified Asphalt (SB or SBS Polymer)
- PG 76-22 (ARB)
  - PG 67-22 base asphalt
  - Minimum 7% ground tire rubber (GTR)
  - Polymer modification optional
- High Polymer (PMA)
  - PG 58-22 base asphalt
  - Polymer Modified Asphalt (SB or SBS Polymer)


South Florida Limestone

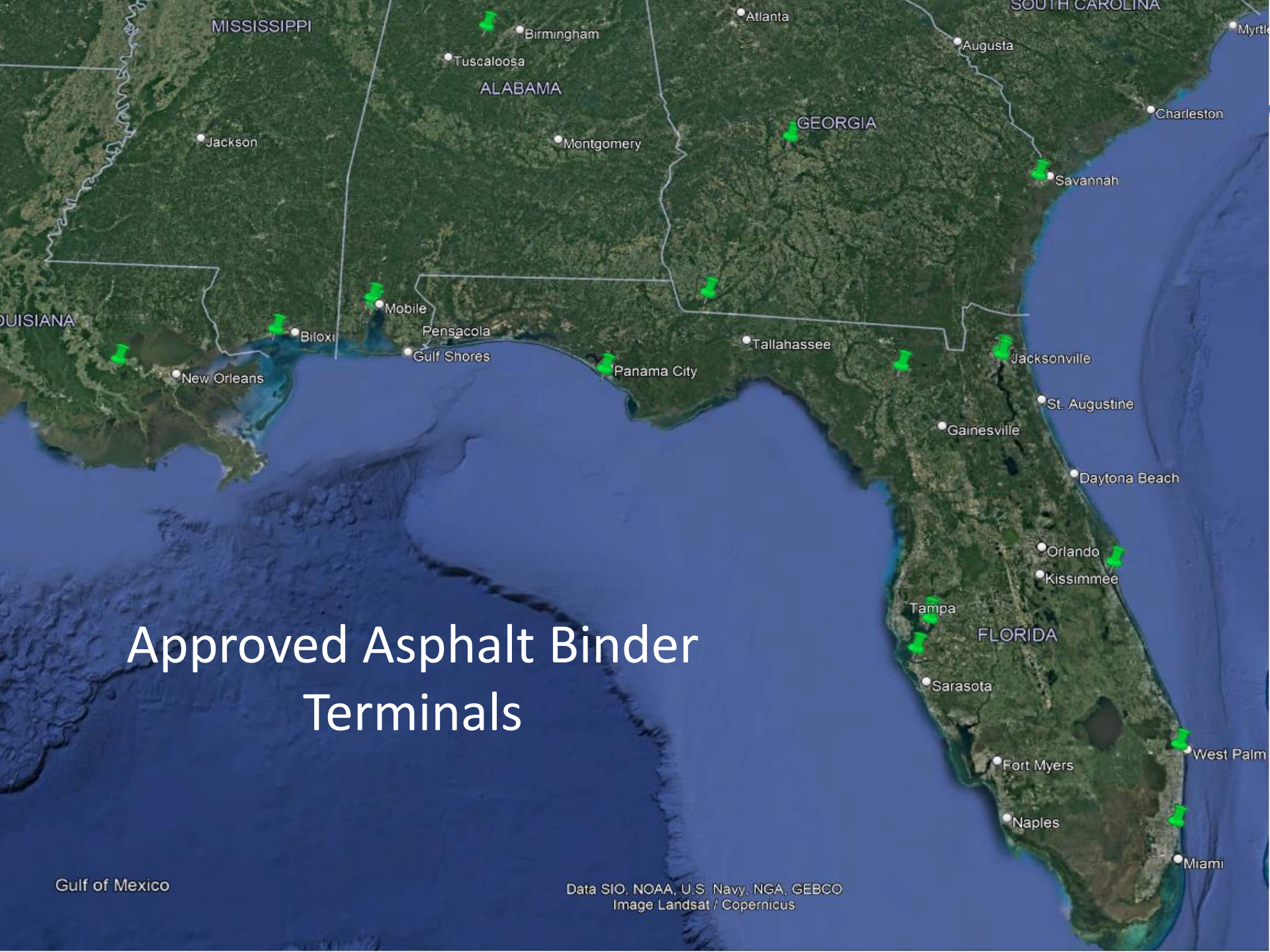

Granite

RAP Usage (2022)

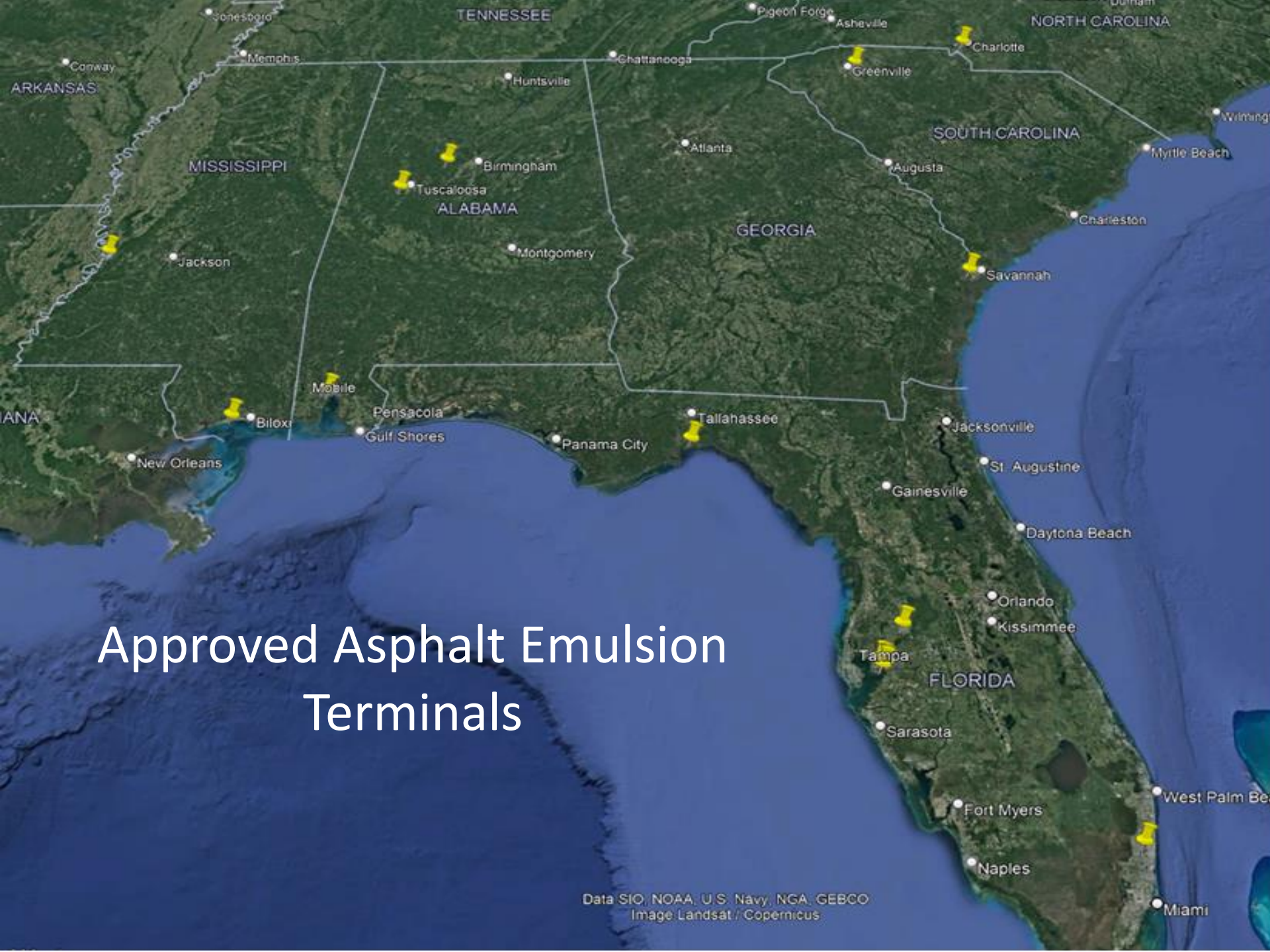


Asphalt Mix Tonnage (2022)

Calendar Year 2022	
Mix type	Tonnage
FC-12.5	554,369
FC-5	399,273
FC-9.5	139,271
SP-12.5	2,537,587
SP-19.0	28,159
SP-9.5	57,678
Grand Total	3,716,336

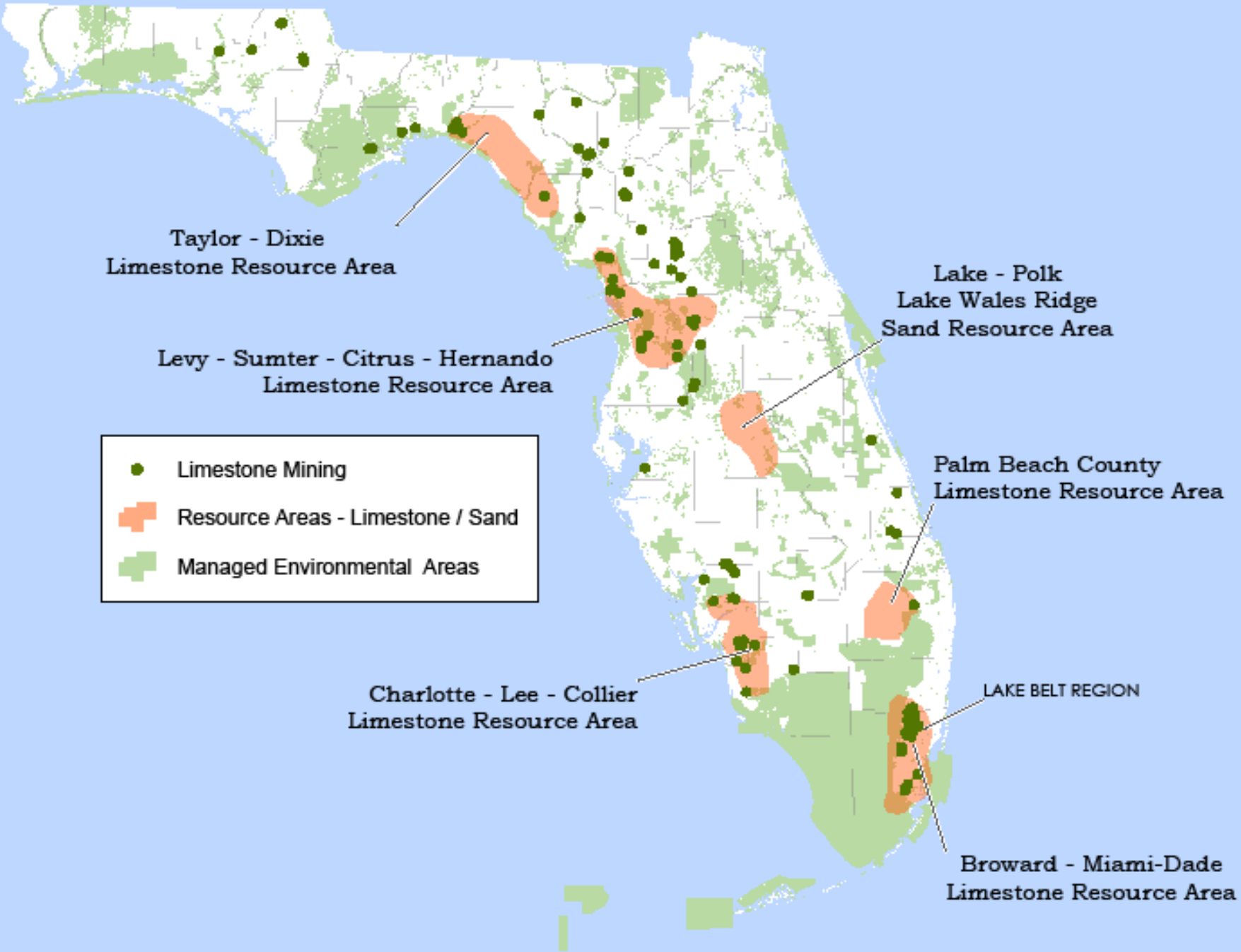


Approved Asphalt Binder Terminals



Approved Asphalt Emulsion Terminals

LIMESTONE AND SAND RESOURCE AREAS




ALABAMA
GEORGIA
Charleston
Jackson
Montgomery
Savannah
Mobile
Biloxi
Pensacola
Gulf Shores
Panama City
Tallahassee
Jacksonville
Orleans
St. Augustine
Gainesville
Daytona Beach
Kissimmee
Tampa
FLORIDA
Sarasota
West Palm Beach
Naples
Miami
Aggregate Mines and Terminals
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Approved Asphalt Plants

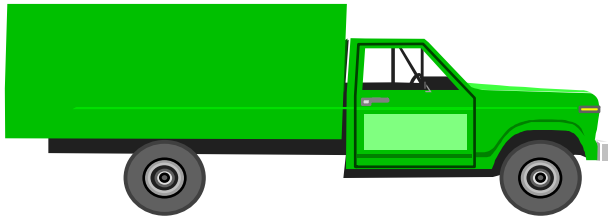
Florida Asphalt Mixtures

- Superpave Asphalt Concrete (334)
  - Structural asphalt mixtures
  - SP-9.5, SP-12.5, SP-19.0
- Asphalt Concrete Friction Courses (337)
  - FC-9.5, FC-12.5, FC-5 (OGFC)
- Superpave Asphalt Base (234)
  - B-12.5

Superpave – Structural (334)

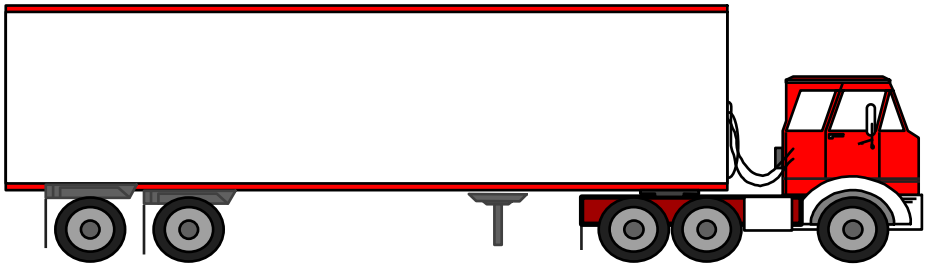
- Purpose: Load carrying portion of pavement
  - Superpave Mix Design
- Three mixes based on maximum aggregate sizes
  - 9.5 mm (SP-9.5)
  - 12.5 mm (SP-12.5)
  - 19.0 mm (SP-19.0)
- Five Traffic Levels (A-E)
  - Based on 18,000 lb. Equivalent Single Axle Loads (ESAL's)
  - Low traffic = A, High traffic = E

ESAL Examples



15,000 lb 6,000 lb

0.48 ESAL + 0.01 ESAL = **0.49 ESALs**



34,000 lb 34,000 lb 12,000lb

1.10 + 1.10 + 0.20 = **2.40 ESALs**

Mix Design Traffic Levels

Traffic Levels are found in the Contract

ESALS come from planning

Traffic Level	ESAL's
A	< 300,000 ESAL's
B	300,000 < 3 million ESAL's
C	3 million < 10 million ESAL's
D	10 million < 30 million ESAL's
E	≥ 30 million ESAL's

Concept: Put the right mix on the right road

Traffic Levels 2022

Traffic Level	Tonnage	Percentage
A	0.00	0.00%
B	36,504	0.98%
C	1,662,407	44.73%
D	748,299	20.14%
E	869,853	23.41%
NA	399,273	10.74%
Grand Total	**3,716,336**	100.00%

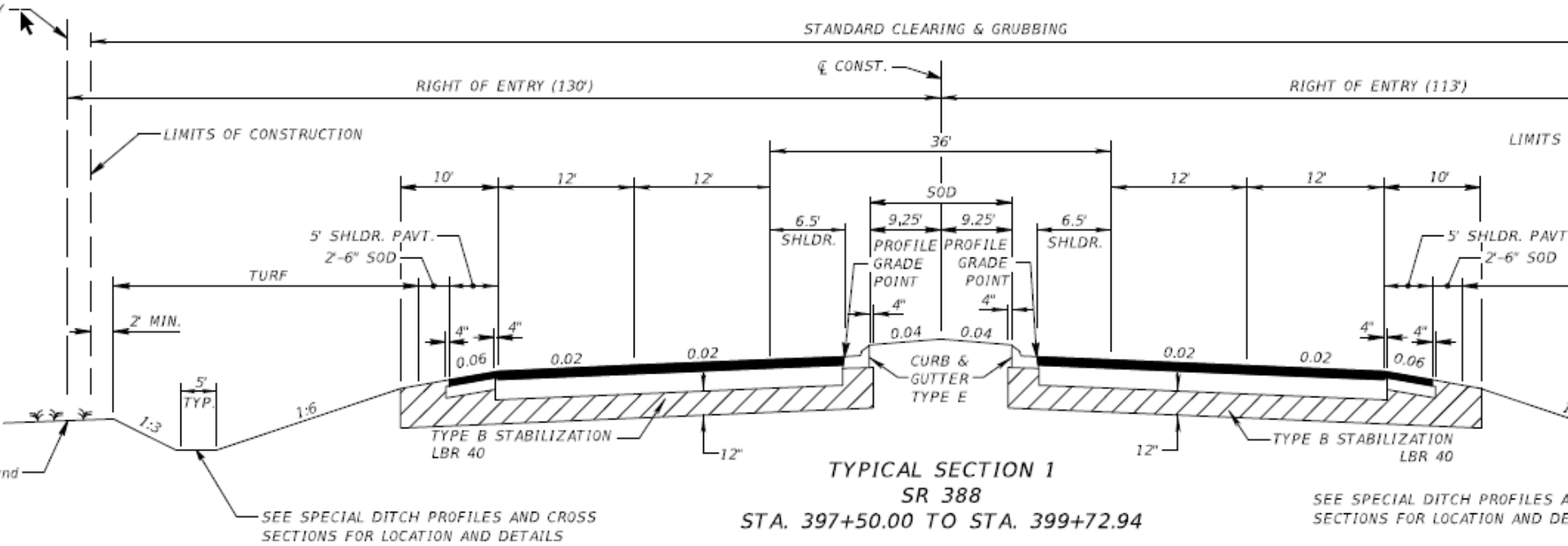
A
<300,000 ESAL's

B
300,000 to 3,000,000 ESAL's

E
>30,000,000 ESAL's

3,000,000 to 10

000,000 ESAL's



TYPICAL SECTION 1
SR 388
STA. 397+50.00 TO STA. 399+72.94

NEW CONSTRUCTION

OPTIONAL BASE GROUP 9 WITH
TYPE SP STRUCTURAL COURSE (TRAFFIC C) (3½") (PG 76-22)
AND FRICTION COURSE FC-5 (¾") (PG 76-22)

SHOULDER PAVEMENT

OPTIONAL BASE GROUP 1 WITH
TYPE SP, STRUCTURAL COURSE (TRAFFIC C) (1½") (PG 76-22)
AND FRICTION COURSE FC-5 (¾") (PG 76-22)

TRAFFIC DATA

CURRENT YEAR = 2014 AADT = 4,500
ESTIMATED OPENING YEAR = 2020 AADT = 10,500
ESTIMATED DESIGN YEAR = 2040 AADT = 20,600
K = 9.0% D = 55.8% T = 11.7% (24 HOUR)
DESIGN HOUR T = 5.85%

CLEAR ZONE = 24' (50 MPH)
NOTE: DESIGN CLEAR ZONE DOES NOT APPLY TO CLEAR ZONE WIDTHS FOR WORK ZONES.

Traffic Level and Binder Type Shown on Plans

NEW CONSTRUCTION

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OPTIONAL BASE GROUP 1 WITH
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AND FRICTION COURSE FC-5 (¾") (PG 76-22)

Asphalt Mix Design

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

ASPHALT MIX DESIGN

SUBMIT TO THE DIRECTOR, OFFICE OF MATERIALS, CENTRAL ASPHALT LABORATORY, 5007 NE 39TH AVE, GAINESVILLE, FL 32609

Contractor ..... Address ..... District 2 .....

Phone No. ..... Fax No. ..... E-mail .....

Submitted By ..... Type Mix ..... SP-12.5 Recycle Fine ..... Intended Use of Mix ..... Structural .....

Design Traffic Level ..... D ..... Gyrations @ Ndes ..... 100 .....

Product Description	Product Code	Producer Name	Product Name	Plant/Pit Number	Plant/Pit Terminal
1. Crushed R.A.P.	334-CR		1-18		
2. S1B Stone	C53		S1B		
3. S1B Stone	C52		S1B		
4. Screenings	F21		Screenings		
5. Sand	334-LS		Sand		
6.					
7. PG Binder	916-52		PG 52-28		

PERCENTAGE BY WEIGHT TOTAL AGGREGATE PASSING SIEVES

Blend	40%	24%	8%	23%	5%		JOB MIX	CONTROL	PRIMARY
Number	1	2	3	4	5	6	FORMULA	POINTS	CONTROL SIEVE
3/4" 19.0mm	100	100	100	100	100		100	100	
1/2" 12.5mm	99	94	100	100	100		98	90 - 100	
3/8" 9.5mm	95	63	98	100	100		89	- 89	
No. 4 4.75mm	80	17	32	100	100		67		
No. 8 2.36mm	62	4	5	80	100		50	40 - 58	39
No. 16 1.18mm	51	4	5	53	100		39	29 -	
No. 30 600µm	43	4	5	33	95		31	22 -	
No. 50 300µm	34	4	5	22	75		24	16 -	
No. 100 150µm	19	3	4	12	9		12		
No. 200 75µm	8.7	1.0	1.0	5.8	1.5		5.2	2 - 10	
G_{sb}	2.589	2.729	2.705	2.713	2.626		2.661		

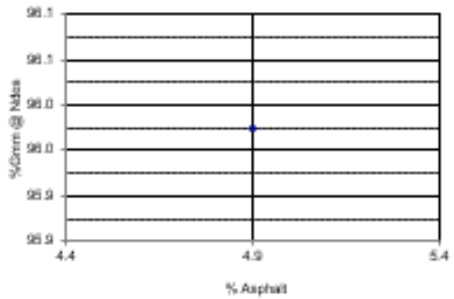
The mix properties of the Job Mix Formula have been conditionally verified, pending successful final verification during production at the assigned plant, the mix design is approved subject to F.D.O.T. specifications.

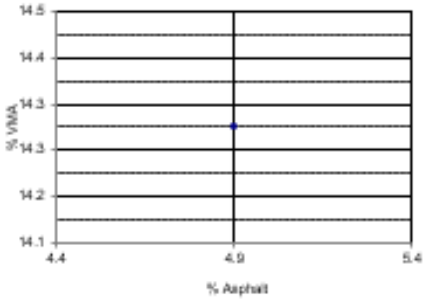
SP 19-18008A (TL-D)

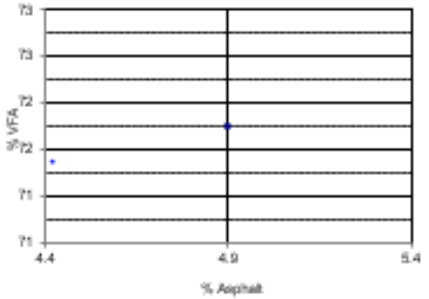
Asphalt Mix Design

SP 19-18008A (TL-D)

P_b	G_{sb} @ N_{des}	G_{se}	V_a	VMA	VFA	P_{be}	P_{be} / P_b	%G_{mm} @ N_{ini}	%G_{mm} @ N_{max}
4.9	2.399	2.499	4.0	14.3	72	4.4	1.2	89.8	







Total Binder Content 4.9 %

Spread Rate @ 1" 108 lbs/ud²

VMA 14.3 %

G_{se} Corr. Factor -0.004

FAA 45.1 %

%G_{mm} @ N_{des} 96.0

Ignition Oven Calibration Factor -0.09

[Plant] Mixing Temperature 300 °F 149 °C

[Roadway] Compaction Temperature 300 °F 149 °C

Antistrip Additive: See A.P.L. % % %

Optimum Asphalt	= 4.90%
Asphalt using 40% Crushed R.A.P. @ 5.6%	= 2.24%
PG 52-28 to be added	= 2.66%

Asphalt Mix Design

Total Binder Content	5.2	%	Gmb @ Ndes	2.378	
Ignition Oven Corr. Factor (+ To Be Added)/(- To Be Subtracted)	-0.04		Gmm	2.477	
Gmm Corr. Factor	0.000		Va	4.0	
Mixing Temp. (Plant)	305	°F	VMA	15.0	Effective Date 11/30/2017
Compaction Temp. (Roadway)	300	°F	VFA	73	Expiration Date 11/30/2020
Spread Rate @ 1"	107	lb/yd^2	P-200/Pbe	1.1	
Binder from Recycled Materials	1.12	%			
PG 58-22 to be added	4.08	%	Additives		

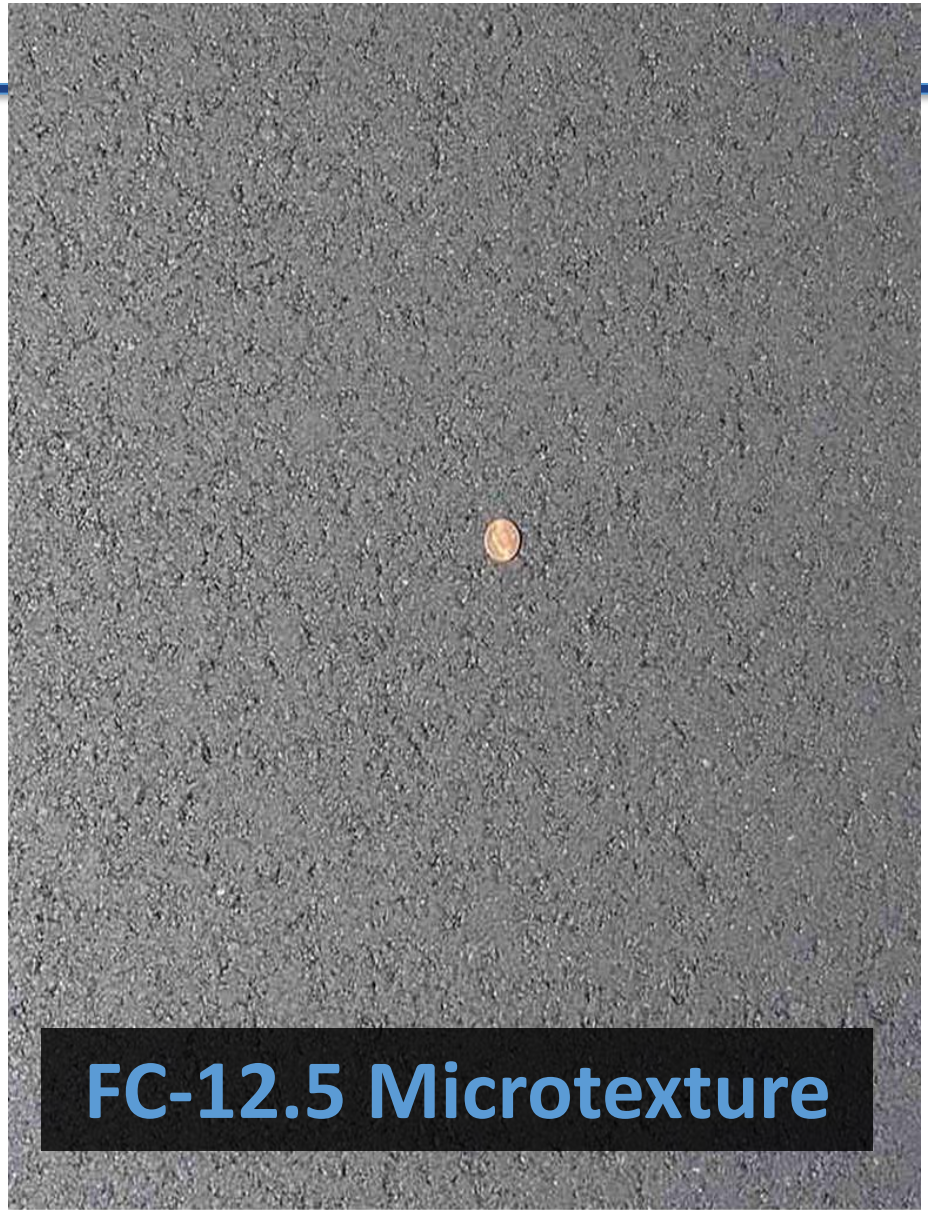
Dense-Graded Friction Courses (337 / 334)

- Good microtexture
  - Function of the aggregate
- Superpave mixes:
  - FC-9.5
  - FC-12.5
- 100% approved south Florida limestone or 60% granite
  - If granite, then can contain 20% RAP, otherwise no RAP
- PG 76-22(ARB) or PG 76-22(PMA), contractor's option
- High Polymer binder when specified in the plans

Open-Graded Friction Courses, FC-5 (337)

- Required on high-speed multi-lane facilities
  - Design Speed ≥ 50 mph
- Good macrotexture
  - Minimize hydroplaning
- 100% friction approved aggregate (No RAP)
- PG 76-22(ARB) or PG 76-22(PMA), contractor's option
- High Polymer binder when specified in the plans
- Stabilizing fibers (more asphalt, less draindown)
- Granite aggregate requires hydrated lime


FC-5 Nassau County

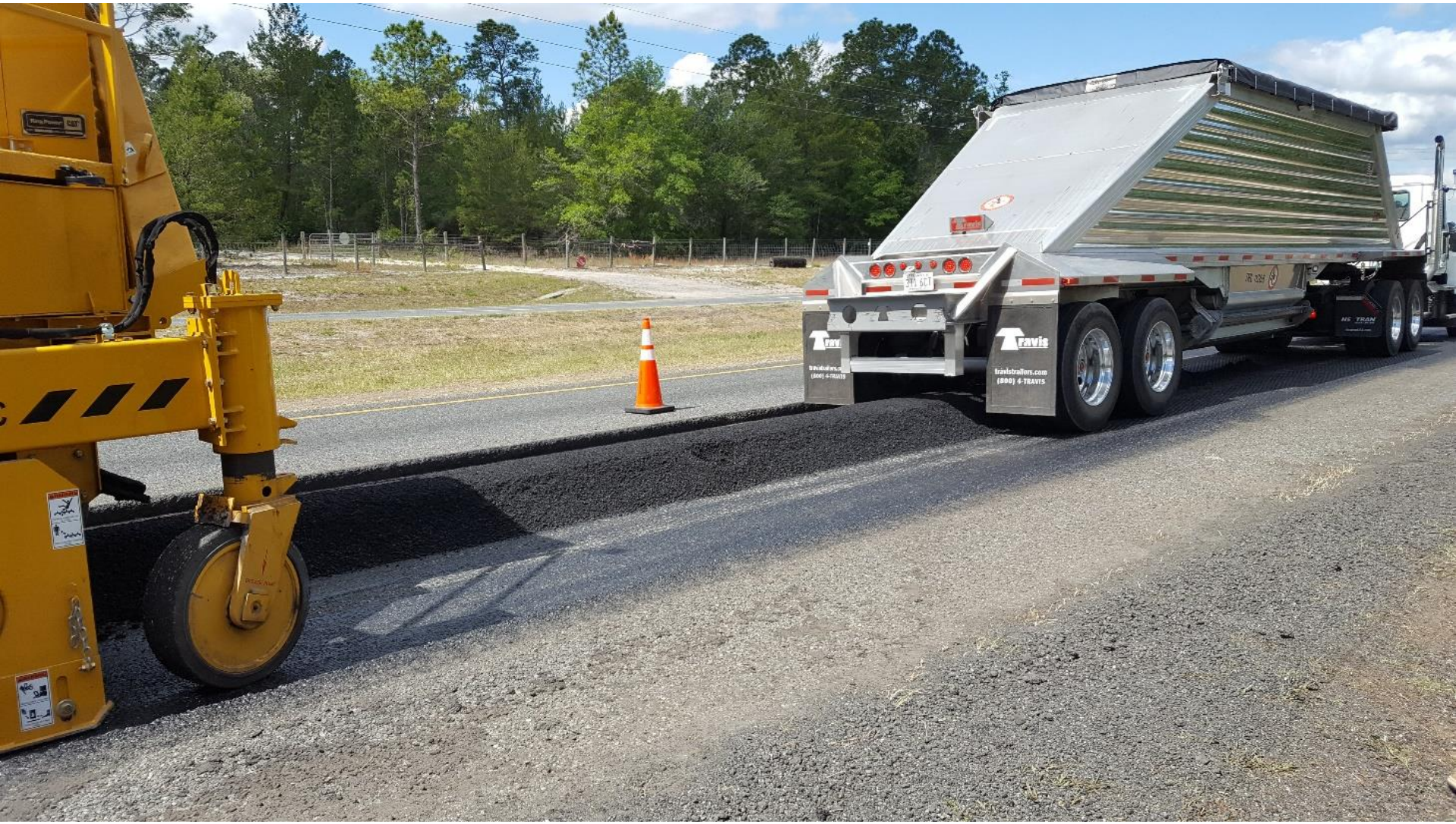

FC-12.5 Microtexture


FC-5 Macrotexture

Other Asphalt Mixtures

- Superpave Asphalt Base (234)
  - B-12.5 mm
  - Traffic Level B
  - May substitute an SP-12.5 or SP-19.0
  - Paid by the square yard (285 – Optional Base)

Questions/Comments?



Thank you!

Cassady Allen
Binder Lab Manager
Florida Department of Transportation
State Materials Office
Gainesville, FL 32609
E-mail: cassady.allen@dot.state.fl.us