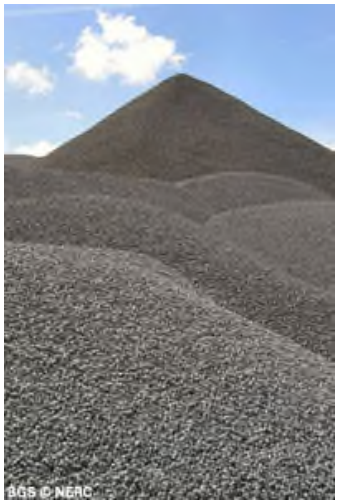
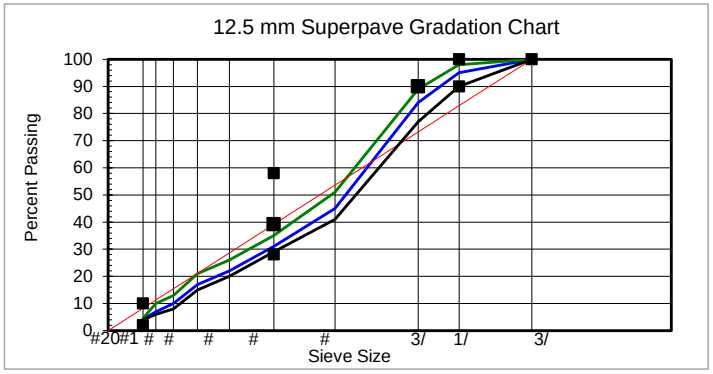
Florida Department of
TRANSPORTATION

Asphalt 101

Jim Musselman
State Asphalt Materials Engineer
2026

Asphalt 101





FDOT Florida Department of Transportation

Roadway System in Florida

- Total roadway network:
  - Over 275,000 lane miles of roads in Florida
    - ~78,000 centerline miles
  - Includes State Highway System, County Road System, and Local Roads
- State Highway System – Over 46,000 lane miles
  - Roads under the jurisdiction & maintained by FDOT
  - Includes: Interstate Highways, US Highways, State Roads and Toll Roads/Expressways

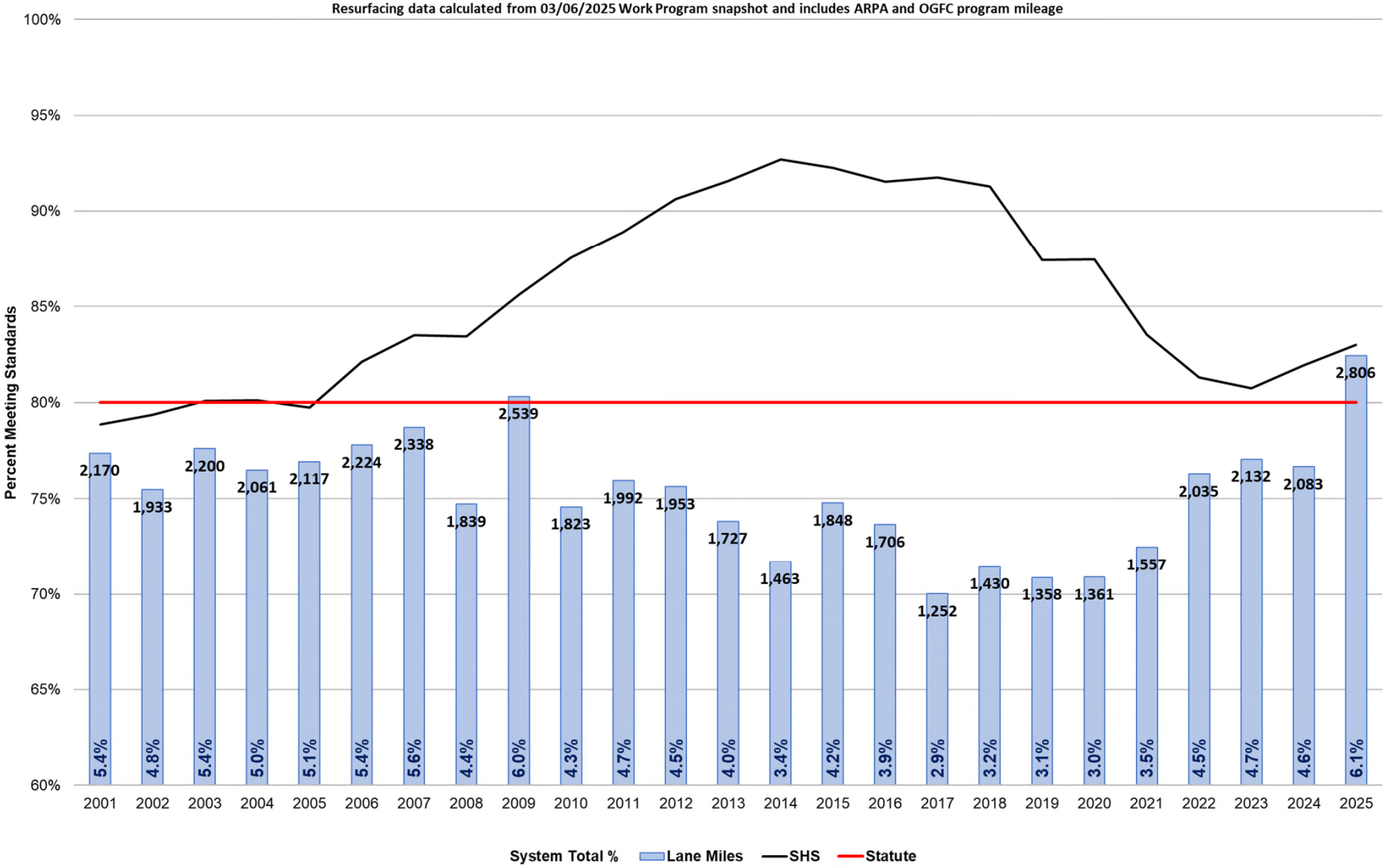
Standard route markers in Florida

State Highway System

- 46,031 lane miles
  - 8,861 Interstate lane miles (19.3%)
  - 34,588 Arterial lane miles (75.1%)
  - 2,582 Turnpike lane miles (5.5%)
- 43,888 lane miles of asphalt
  - 97.5% of pavements
- 2,143 lane miles of concrete
  - 2.5% of pavements

State Highway System
Lane Miles Resurfaced and Percent Meeting Standards

Resurfacing data calculated from 03/06/2025 Work Program snapshot and includes ARPA and OGFC program mileage



What is in an Asphalt Mixture?

Asphalt Binder

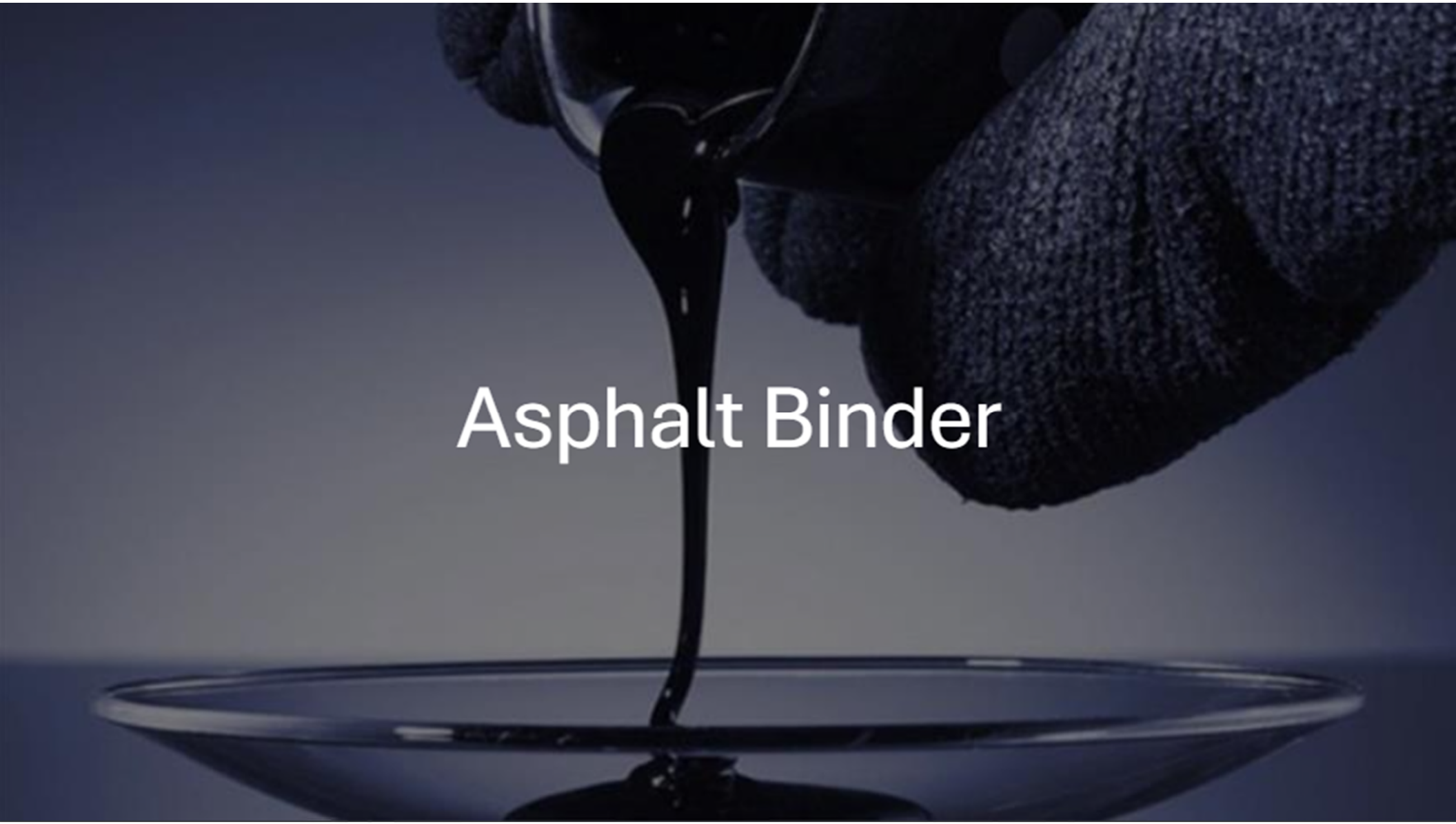
- Binds the aggregate together
- Provides…
  - the “glue”
  - lubrication for compaction
  - durability (resistance to cracking)
- The most expensive part of an asphalt mix
  - ~$600 – $800/ton

Aggregate

- Provides the majority of the load carrying ability of the pavement.
- Needs to be strong, durable, consistent, clean, and available
- Cost ~$25 – $50/ton

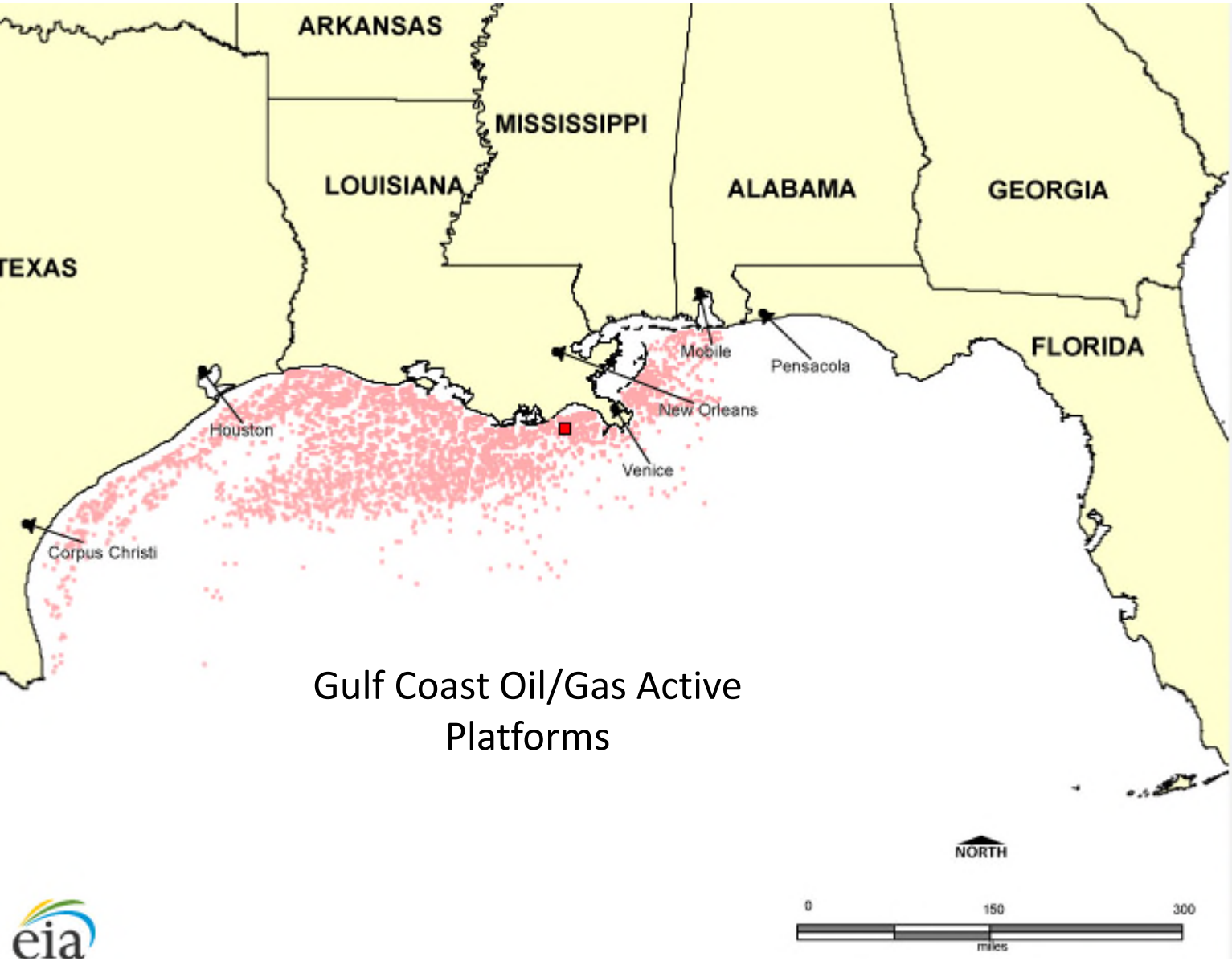
Other things:

- Reclaimed Asphalt Pavement (RAP), Stabilizing fibers, Hydrated lime, liquid anti-strip additives, warm mix additives


Asphalt Binder

Where does asphalt come from?

Crude Oil



Gulf Coast Oil/Gas Active Platforms

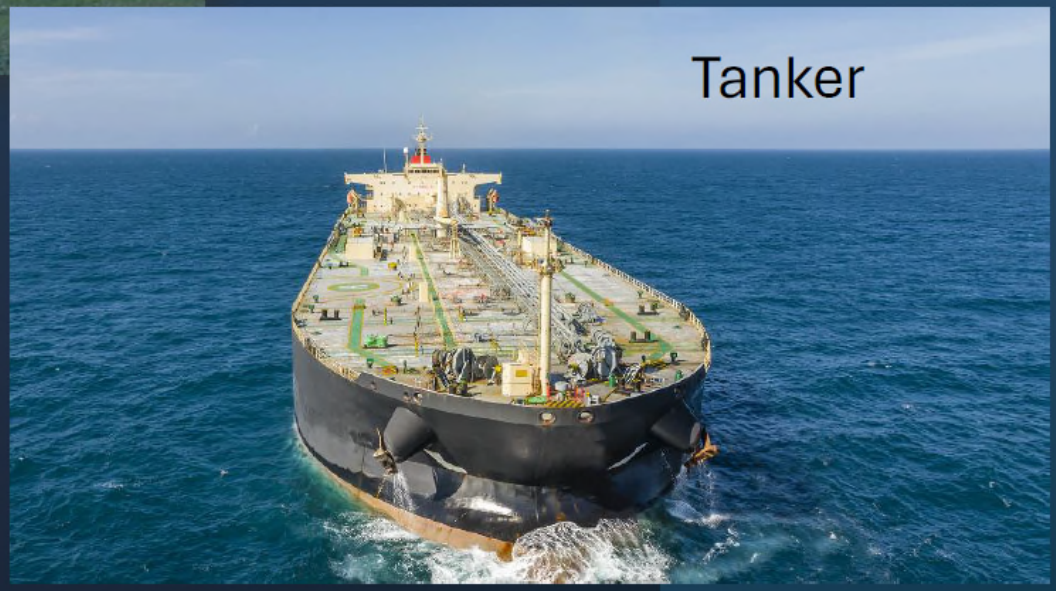
Uncheck or check an item to hide or show it in the map.

- [ ] Electric Power Plants (>=100 MW)
  - Coal
  - Petroleum
  - Hydroelectric
  - Wood
  - Natural Gas
  - Wind
  - Nuclear
  - Other
- [ ] Electricity Transmission Lines (>=345kV)
- [ ] Electricity Transmission Lines (<345kV)
- [ ] LNG terminals
- [ ] Natural Gas Market Centers (Hubs)
- [ ] Natural Gas Processing Plants
- [ ] Natural Gas Interstate, Intrastate, and Gathering Pipelines
- [ ] Oil Import Site & Oil Seaports
- [ ] Petroleum Refineries
- [ ] Propane Hub
- [x] Louisiana Offshore Oil Port
- [ ] Strategic Petroleum Reserves
- [x] Oil/Gas Active Platforms

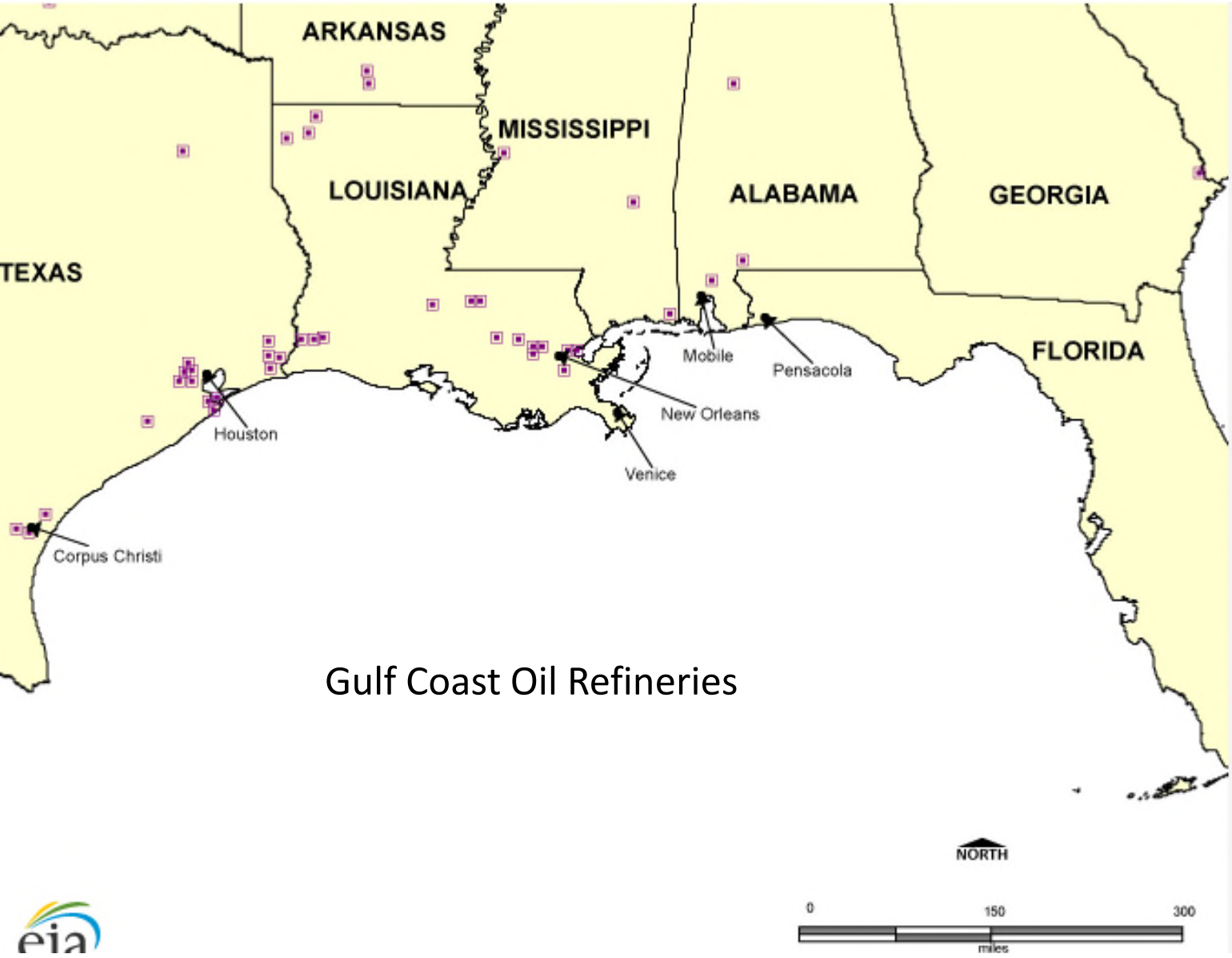
Show All | Hide All

eia

Crude Oil Transportation



Oil Refinery



Gulf Coast Oil Refineries

Uncheck or check an item to hide or show it in the map.

- [ ] Electric Power Plants (>=100 MW)
  - Coal
  - Petroleum
  - Hydroelectric
  - Wood
  - Natural Gas
  - Wind
  - Nuclear
  - Other
- [ ] Electricity Transmission Lines (>=345kV)
- [ ] Electricity Transmission Lines (<345kV)
- [ ] LNG terminals
- [ ] Natural Gas Market Centers (Hubs)
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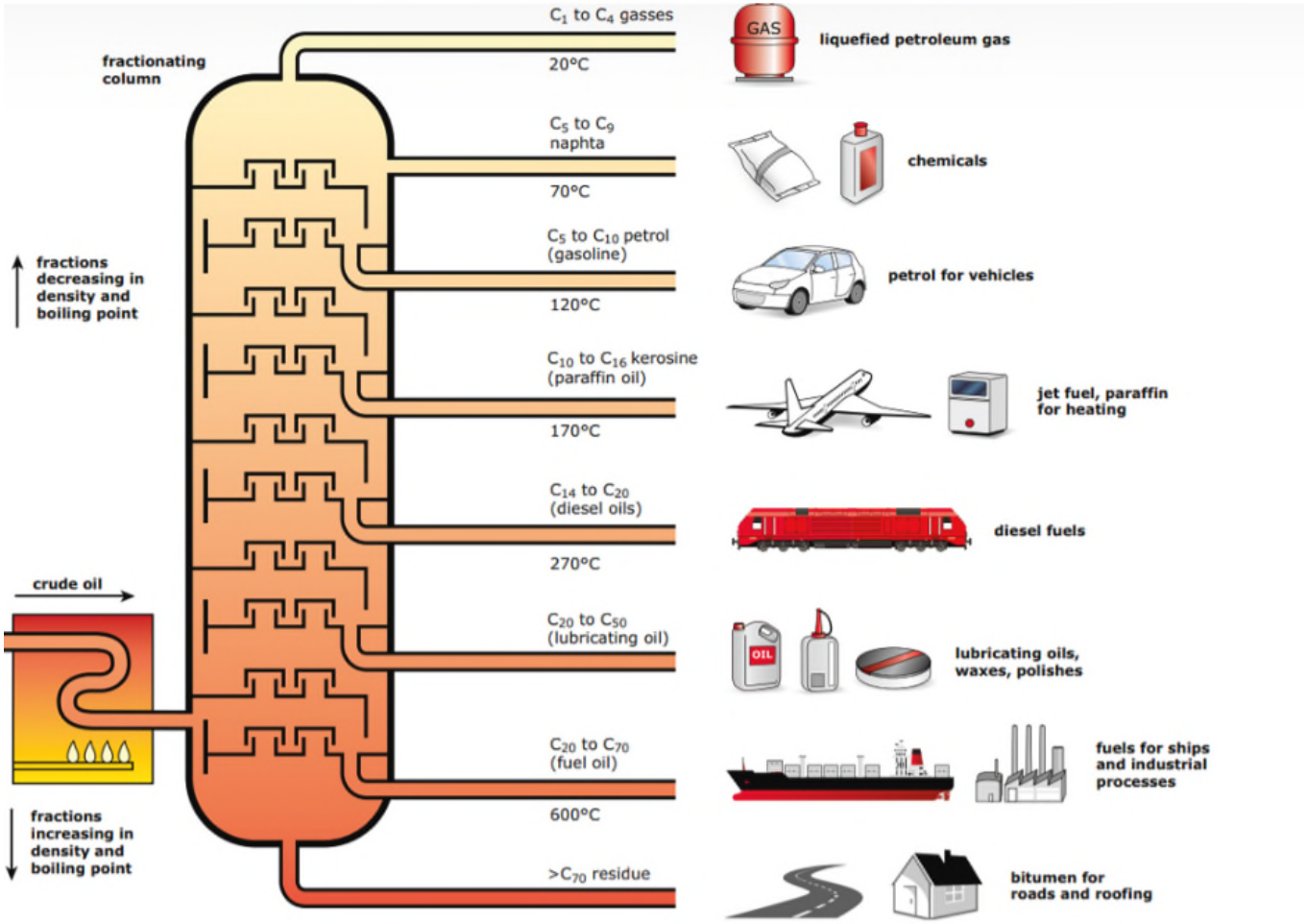
- [ ] Oil Import Site & Oil Seaports
- [x] Petroleum Refineries
- [ ] Propane Hub
- [ ] Louisiana Offshore Oil Port
- [ ] Strategic Petroleum Reserves
- [ ] Oil/Gas Active Platforms

Show All | Hide All

Crude Oil Distillation Process



Material Barged from Refinery to Terminal

Rail Transportation

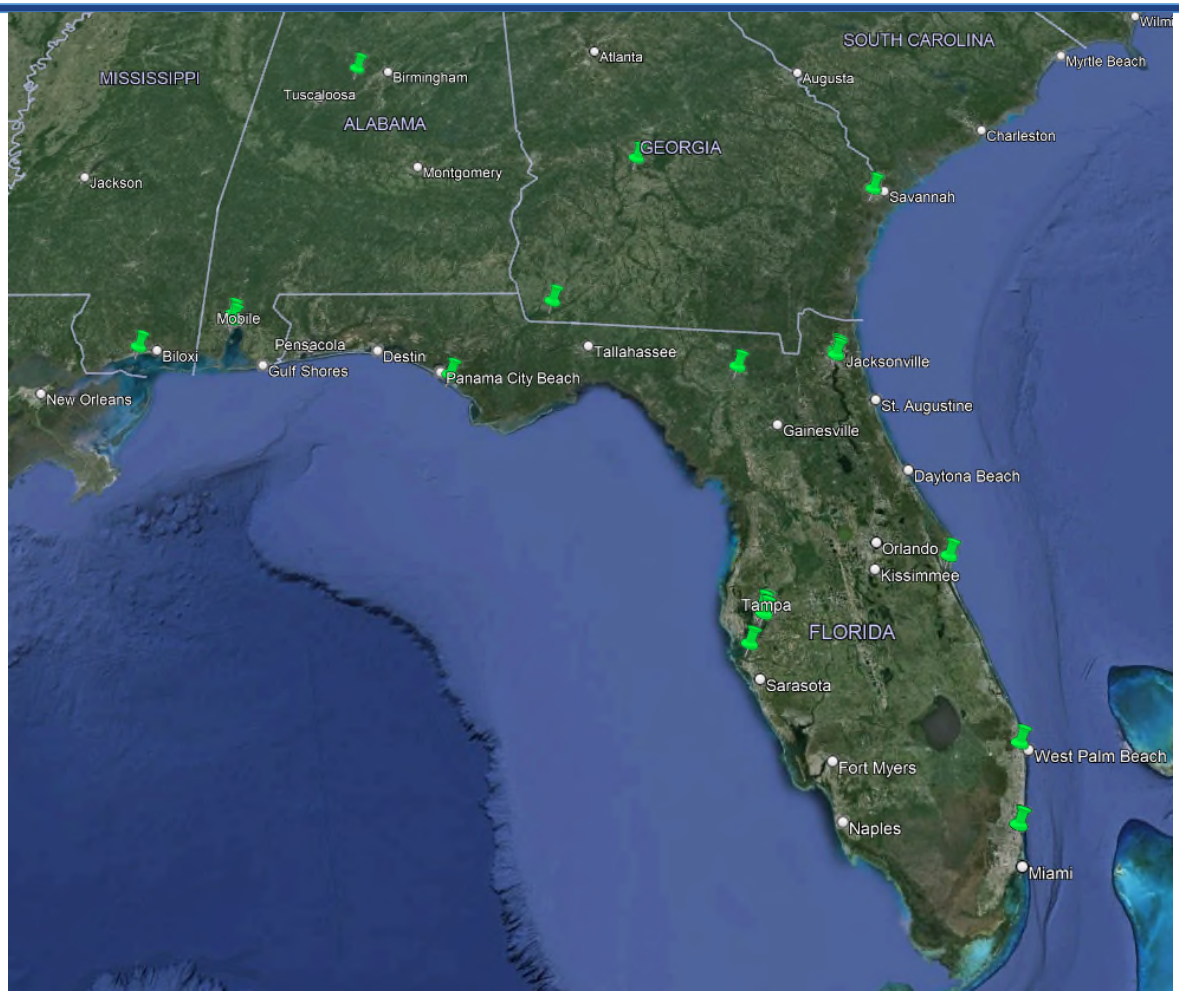
Asphalt Binder Terminal

Asphalt Binder Terminal

Binder Terminal

Binder Delivered to Asphalt Plant

Asphalt Binder Terminals in Florida

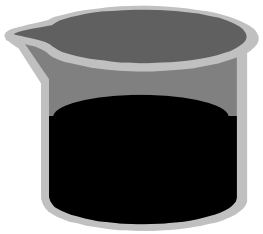


Superpave Asphalt Binders

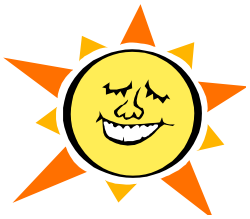
Grading system based on climate

PG 67-22

Performance Grade



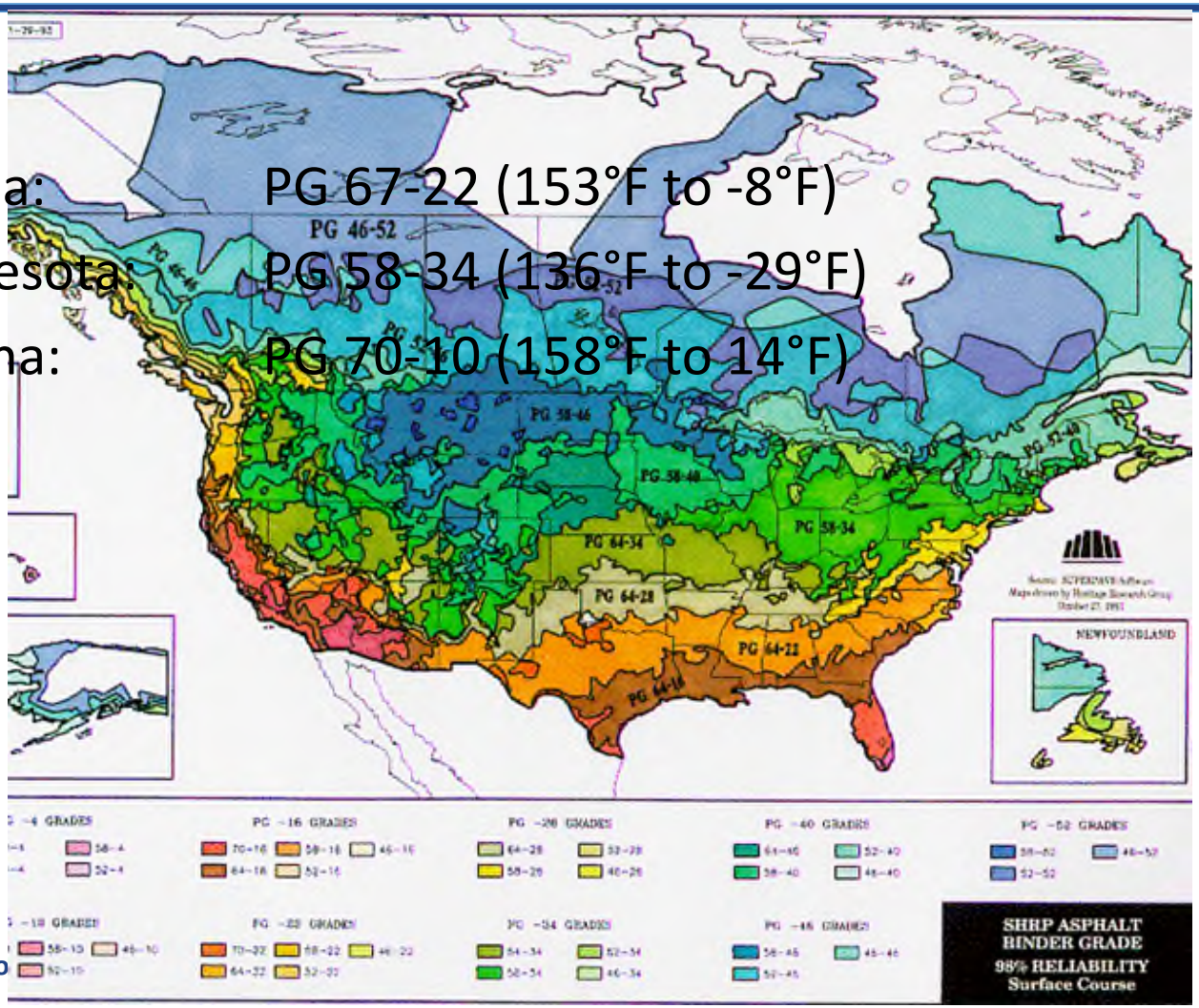
Average 7-day max pavement design temp (°C)



Min pavement design temp (°C)

EXAMPLES OF PG GRADING SYSTEM

- Florida: PG 67-22 (153°F to -8°F)
- Minnesota: PG 58-34 (136°F to -29°F)
- Arizona: PG 70-10 (158°F to 14°F)



FDOT Unmodified Asphalt Binders (Section 916)

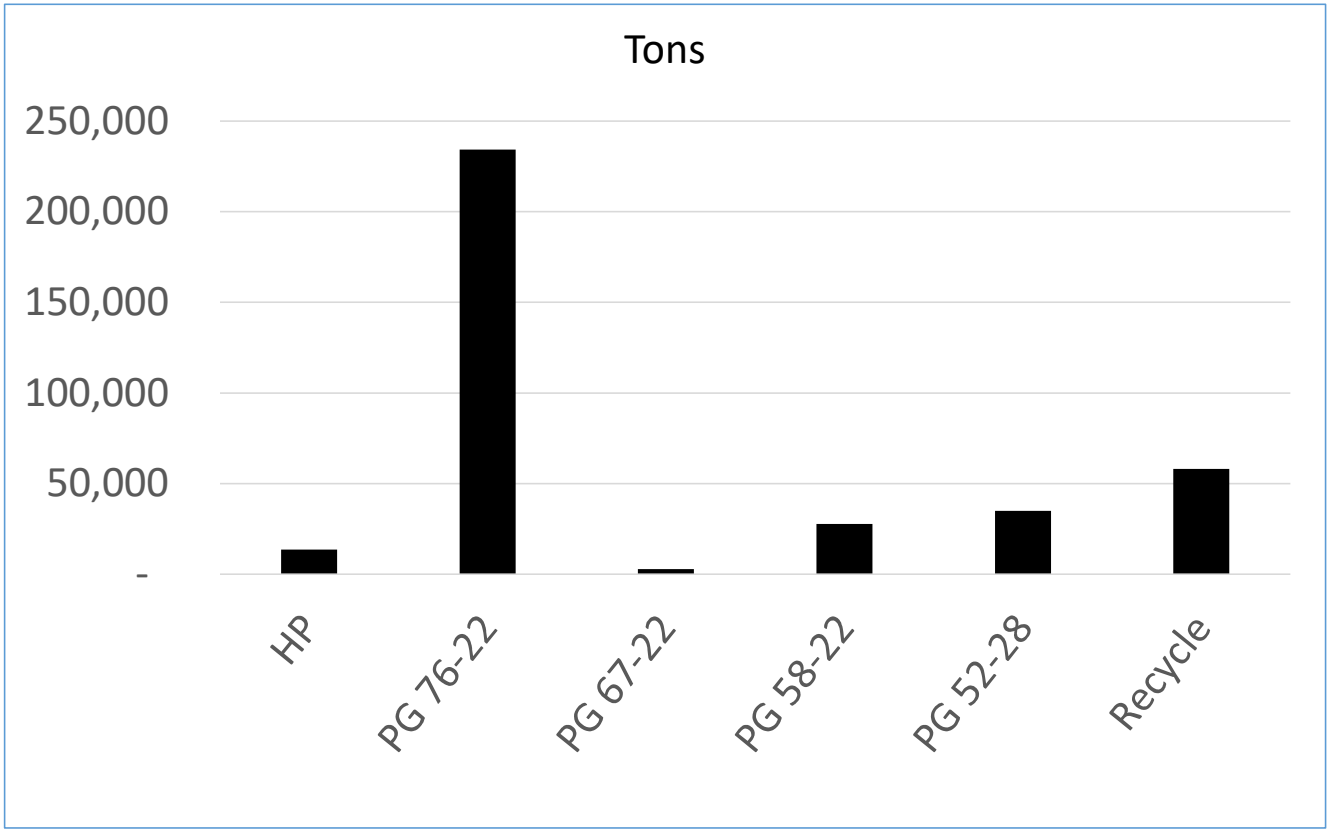
- PG 67-22:
  - Used with 0 – 15% Reclaimed Asphalt Pavement (RAP)
- PG 58-22:
  - Used with 16 – 30% RAP
- PG 52-28
  - Used with > 30% RAP

Softer binders are used to offset the stiffness from the oxidized RAP binder

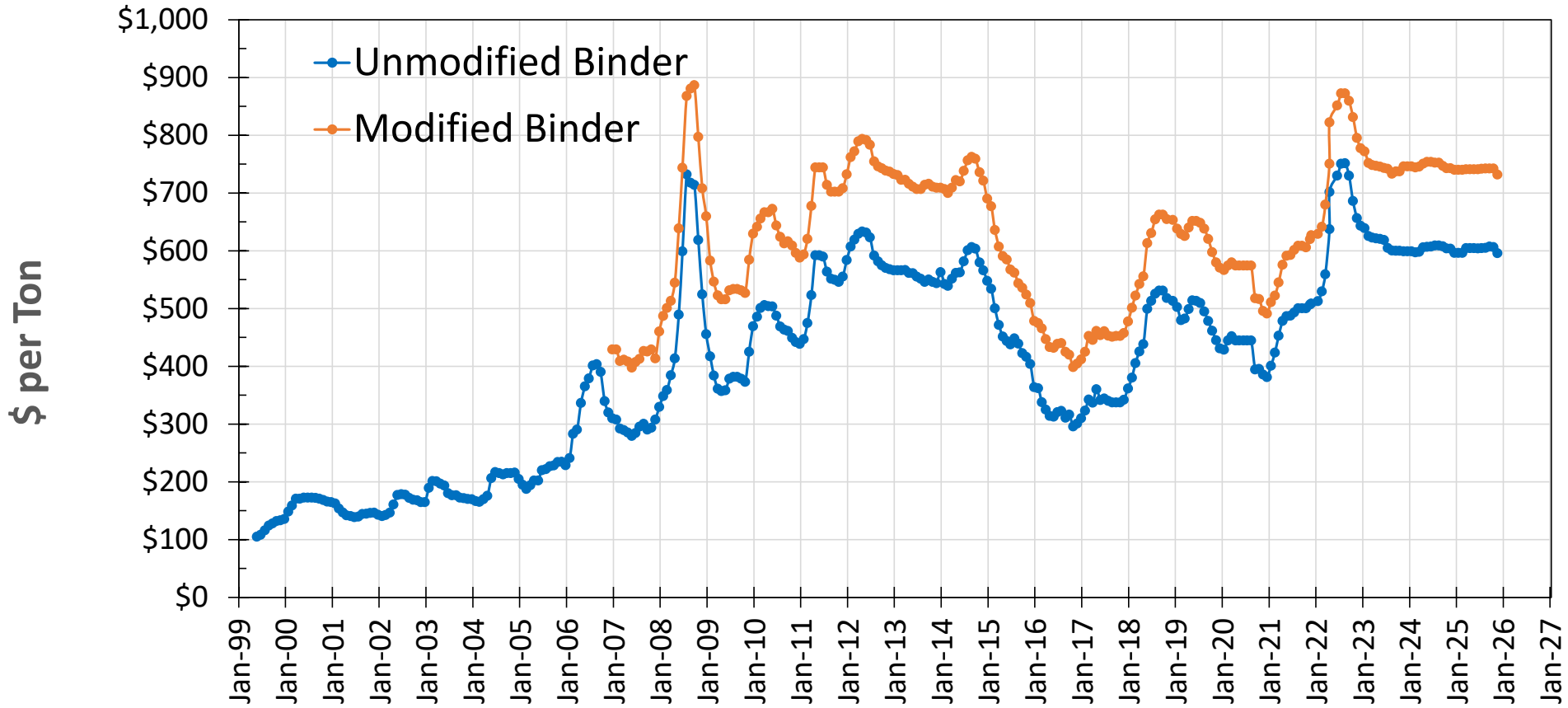
Modified Asphalt Binders (Section 916)

- PG 76-22 (PMA)
  - PG 67-22 base asphalt
  - Polymer Modified Asphalt
    - Syrene-Butadiene-Styrene (SBS) Polymer (~2-3%)
- PG 76-22 (ARB) – Not used
  - 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 ~ 7% SBS Polymer

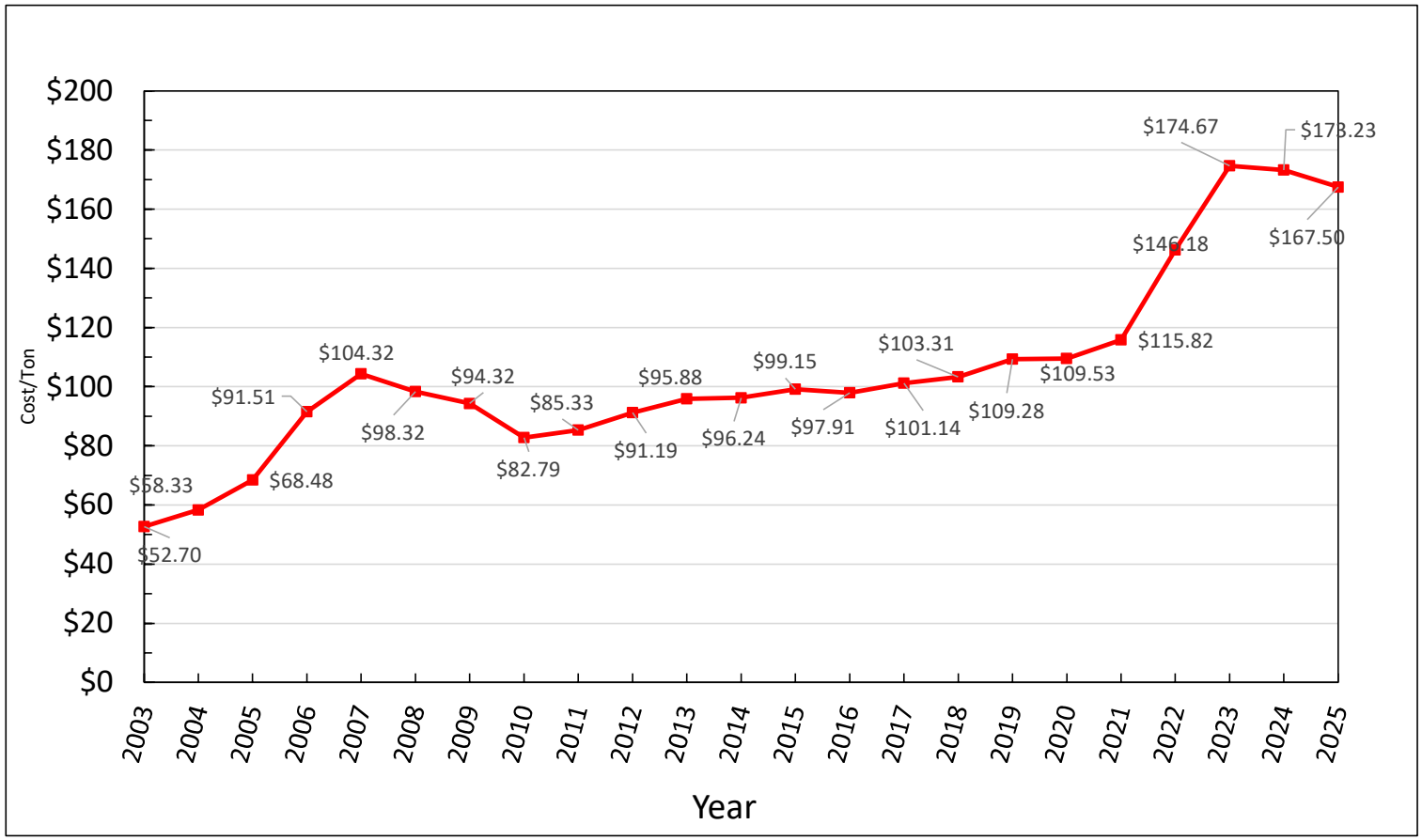
Binder Tonnage (FY 24/25)



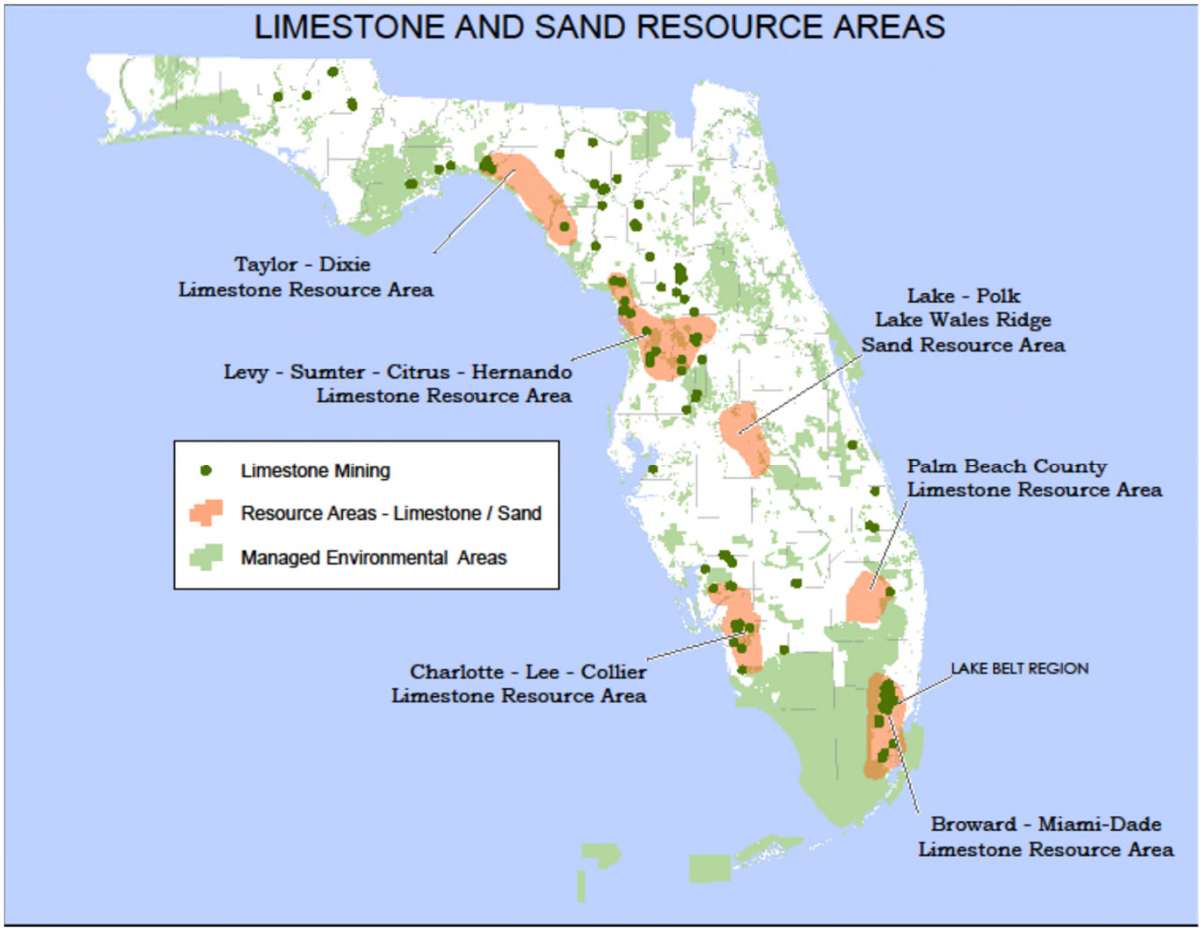
Asphalt Binder Price Index ($/Ton)



Asphalt Mixture Average Cost ($/ton)



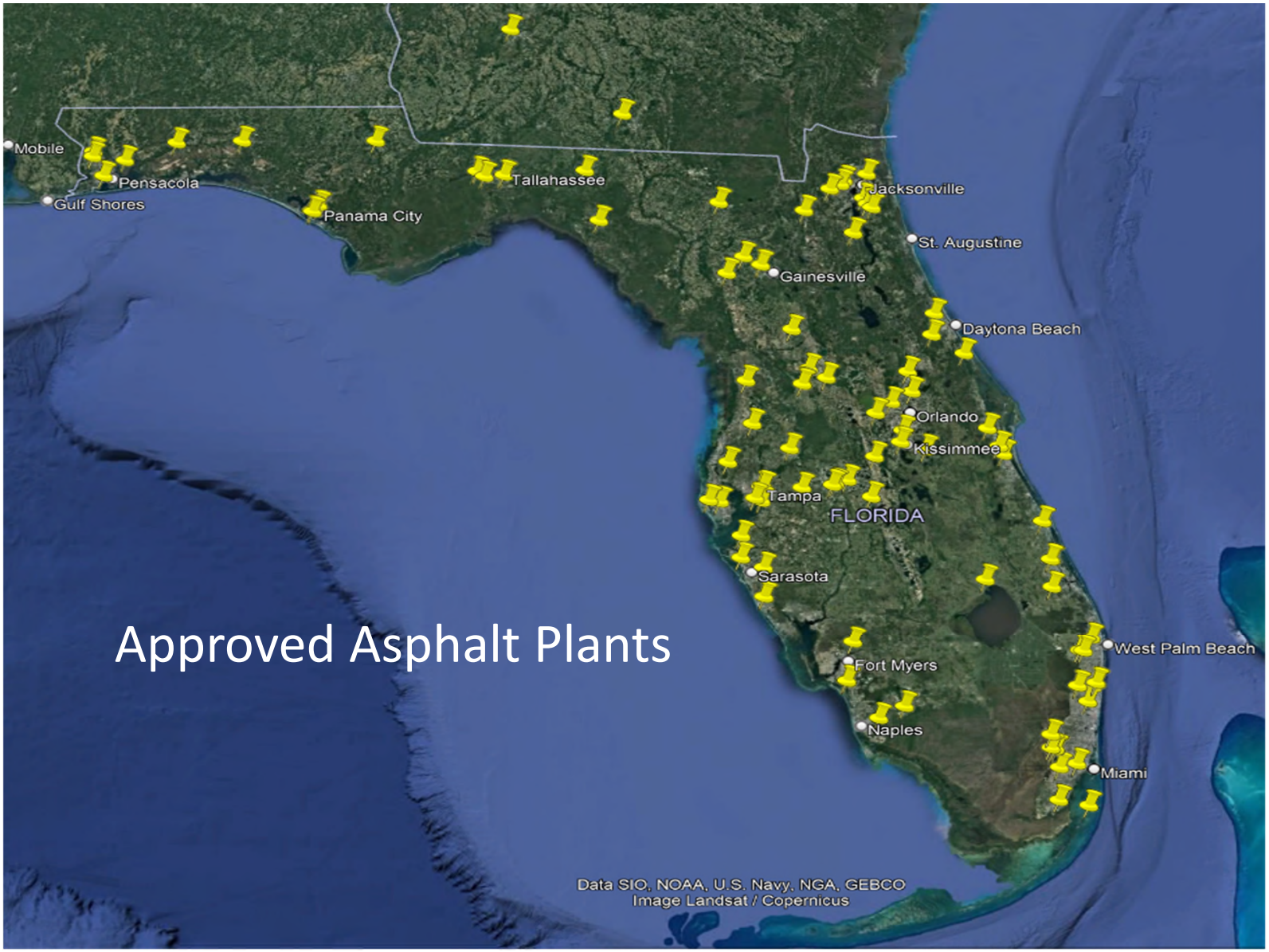
Aggregate


LIMESTONE AND SAND RESOURCE AREAS
Taylor - Dixie
Limestone Resource Area
Levy - Sumter - Citrus - Hernando
Limestone Resource Area
Lake - Polk
Lake Wales Ridge
Sand Resource Area
Palm Beach County
Limestone Resource Area
Charlotte - Lee - Collier
Limestone Resource Area
LAKE BELT REGION
Broward - Miami-Dade
Limestone Resource Area
Limestone Mining
Resource Areas - Limestone / Sand
Managed Environmental Areas


Limestone (Miami)


Granite (Georgia)


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


Mobile
Pensacola
Gulf Shores
Panama City
Tallahassee
Jacksonville
St. Augustine
Gainesville
Daytona Beach
Orlando
Kissimmee
Tampa
FLORIDA
Sarasota
Fort Myers
West Palm Beach
Naples
Miami
Approved Asphalt Plants
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus

Asphalt Mixtures

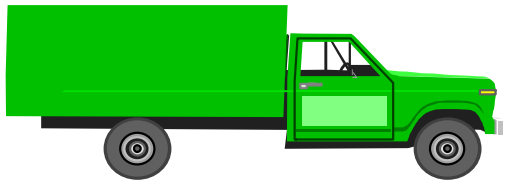
- Superpave Asphalt Concrete (Section 334)
  - Structural asphalt mixtures
  - SP-9.5, SP-12.5, SP-19.0
- Asphalt Concrete Friction Courses (337)
  - FC-9.5, FC-12.5
  - FC-5 & FC-7 (Open Graded Friction Course)
- Superpave Asphalt Base (234)
  - B-12.5

SP = Structural Course
FC = Friction Course
B = Base Course
9.5, 12.5. 19.0 = Largest Aggregate size

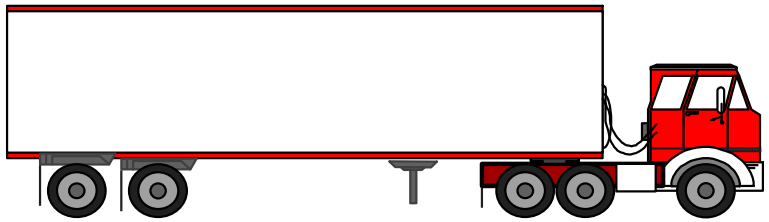
Type SP Mixtures - Structural (Section 334)

- 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)
- Three Traffic Levels (B, C, E)
  - Based on 18,000 lb. Equivalent Single Axle Loads (ESAL's)
  - Low traffic = B, High traffic = E

ESAL Examples

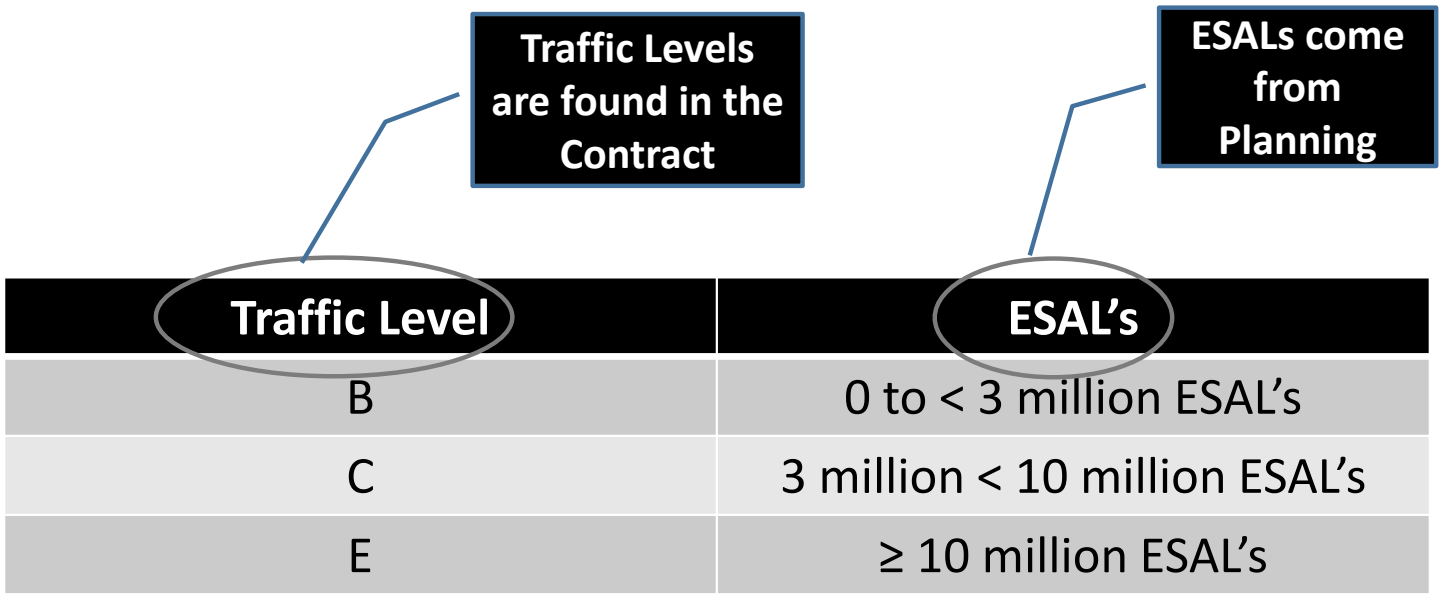


15,000 lb
0.48 ESAL
+
6,000 lb
0.01 ESAL
=
0.49 ESALs



34,000 lb
1.10
+
34,000 lb
1.10
+
12,000 lb
0.20
=
2.40 ESALs

Mix Design Traffic Levels



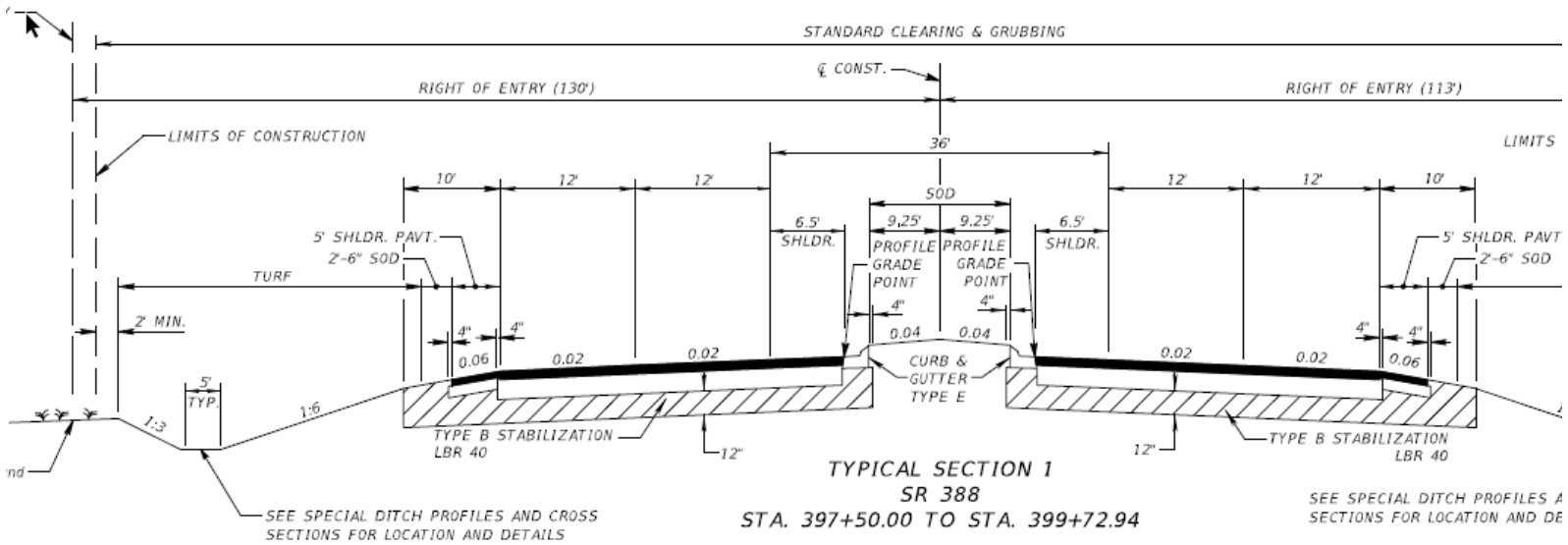
Traffic Level	ESAL's
B	0 to < 3 million ESAL's
C	3 million < 10 million ESAL's
E	≥ 10 million ESAL's

ESAL predictions are based on the design life of the pavement – typically 20 years.

Traffic Levels

Traffic Levels

Typical Section



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

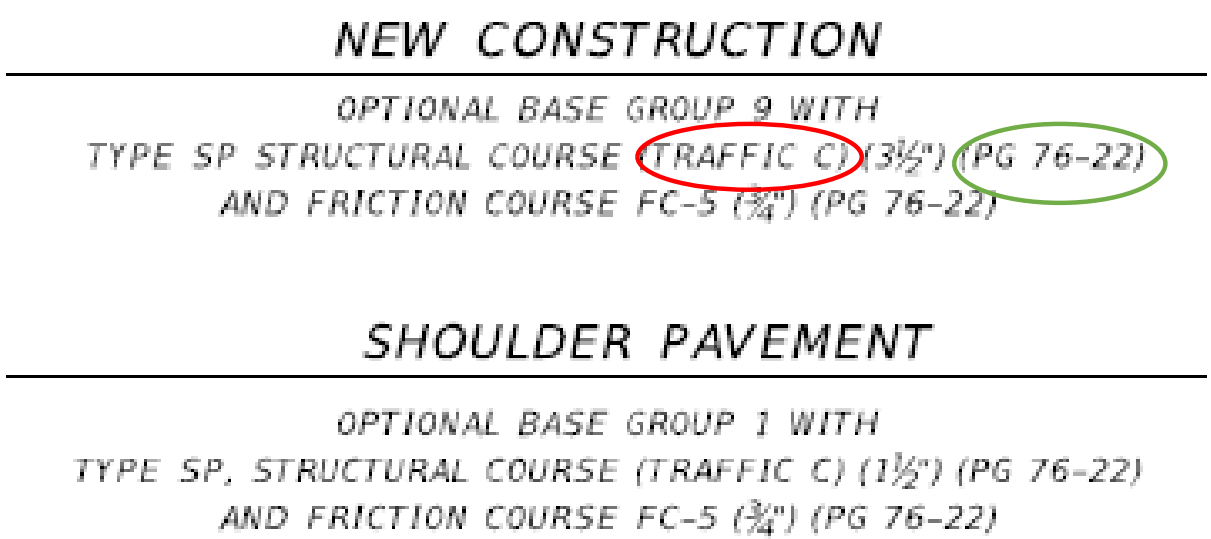
OPTIONAL BASE GROUP 1 WITH
TYPE SP, STRUCTURAL COURSE (TRAFFIC C) (1½") (PG 76-22)
AND FRICTION COURSE FC-5 (¾") (PG 76-22)

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.

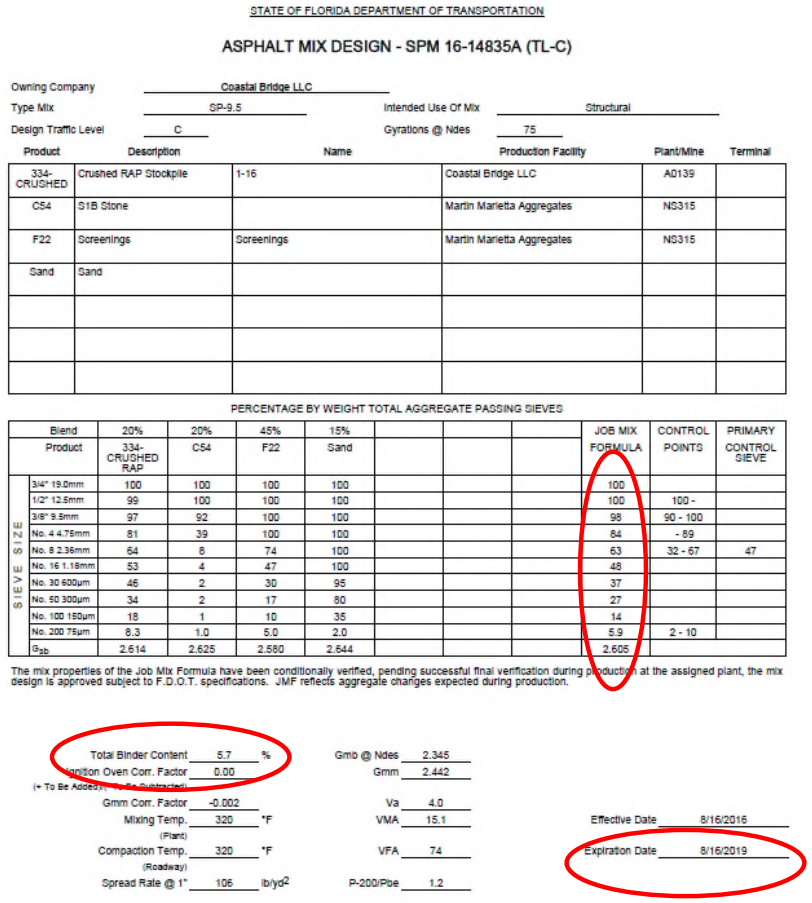
Traffic Level and Binder Type Shown on Plans



Asphalt Mix Design

Mix design is the “recipe” that the contractor will use to produce their mixture

Contains some of the targets that are used for payment



STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

ASPHALT MIX DESIGN - SPM 16-14835A (TL-C)

Owning Company: Coastal Bridge LLC
Type Mix: SP-9.5 — Intended Use Of Mix: Structural
Design Traffic Level: C — Gyrations @ Ndes: 75

Product	Description	Name	Production Facility	Plant/Mine	Terminal
334-CRUSHED	Crushed RAP Stockpile	1-16	Coastal Bridge LLC	A0139	
C54	S1B Stone		Martin Marietta Aggregates	NS315	
F22	Screenings	Screenings	Martin Marietta Aggregates	NS315	
Sand	Sand				

PERCENTAGE BY WEIGHT TOTAL AGGREGATE PASSING SIEVES

SIEVE SIZE	Blend 20% / Product 334-CRUSHED RAP	20% C54	45% F22	15% Sand				JOB MIX FORMULA	CONTROL POINTS	PRIMARY CONTROL SIEVE
3/4" 19.0mm	100	100	100	100				100		
1/2" 12.5mm	99	100	100	100				100	100 -	
3/8" 9.5mm	97	92	100	100				98	90 - 100	
No. 4 4.75mm	81	39	100	100				84	- 89	
No. 8 2.36mm	64	8	74	100				63	32 - 67	47
No. 16 1.18mm	53	4	47	100				48		
No. 30 600µm	46	2	30	95				37		
No. 50 300µm	34	2	17	80				27		
No. 100 150µm	18	1	10	35				14		
No. 200 75µm	8.3	1.0	5.0	2.0				5.9	2 - 10	
G_{sb}	2.614	2.625	2.580	2.644				2.605		

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.

Total Binder Content 5.7 %
Ignition Oven Corr. Factor 0.00
(+ To Be Added/- To Be Subtracted)
Gmm Corr. Factor -0.002
Mixing Temp. (Plant) 320 °F
Compaction Temp. (Roadway) 320 °F
Spread Rate @ 1" 106 lb/yd²

Gmb @ Ndes 2.345
Gmm 2.442
Va 4.0
VMA 15.1
VFA 74
P-200/Pbe 1.2

Effective Date 8/16/2016
Expiration Date 8/16/2019

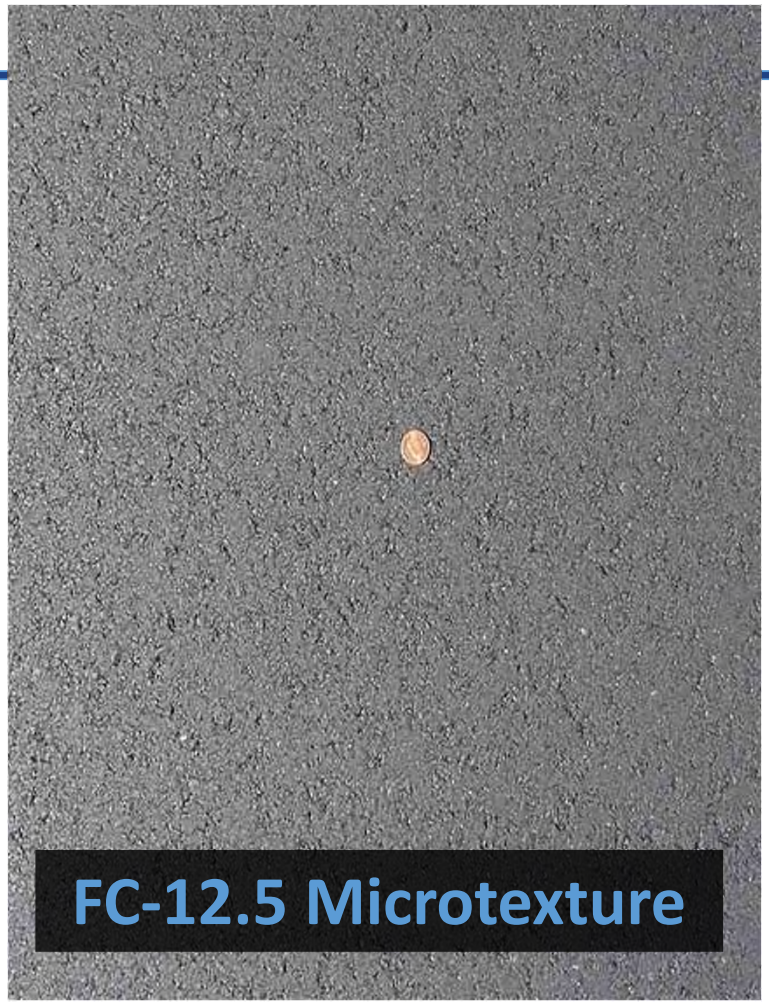
Dense-Graded Friction Courses (Sections 337 / 334)

- Good microtexture
  - Function of the aggregate
- Superpave mixes:
  - FC-9.5
  - FC-12.5
- Aggregate Types: Miami limestone, granite, basalt, gabbro, granitic gneiss, quartzite, shell rock
  - Polish resistant
- PG 76-22 (PMA) binder
- High Polymer binder when specified in the plans

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

- Required on high-speed multi-lane facilities
  - Design Speed ≥ 55 mph
- Good macrotexture
  - Minimize hydroplaning
- 100% friction approved aggregate (No RAP)
- PG 76-22 (PMA)
- 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

Asphalt Surfaces

- 50.3% of asphalt surfaces are dense graded (by lane mile)
- 49.7% of asphalt surfaces are open graded

Other Asphalt Mixtures

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

Questions/Comments?