

## HMA Thin Lifts for Pavement Preservation in Tennessee

Mark Woods – TDOT



## The Tennessee Program

- 5,109 Interstate Lane Miles
- 26,244 State Route LM
- 31,353 Total



## The Tennessee Program

Received 5<sup>th</sup> APA Perpetual Pavement Award last week.



## The Tennessee Program

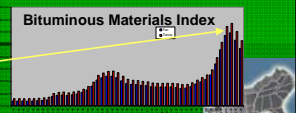
- Historically, resurfacing practices involved milling the surface and replacing with 3-4" binder and 1-1/4" surface.  
→ *The "Worst First" approach.*



## The Tennessee Program

"If it ain't broke, don't fix it."

"IT'S BROKE!!"



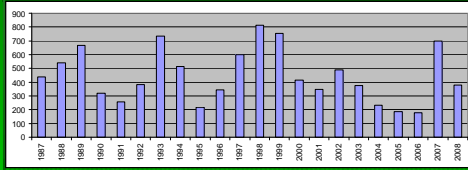
## Bituminous Adjustments

- **Bituminous Adjustments\***
  - Interstates - \$4,984,504.33
  - State Routes - \$8,268,530.42
  - Total - \$13,253,034.75
- Approximately 10% of TDOT's resurfacing program.

\* - As of 10/30/2008



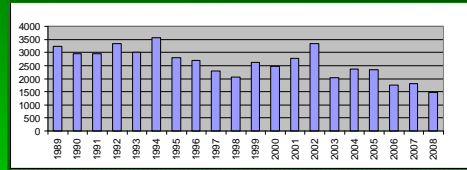
### Interstate LM's Paved



\* - 5,109 Total Interstate LM's statewide



### State Route LM's Paved



\* - 26,244 Total State Route LM's statewide



### Tennessee Pavement Preservation Initiative

- "The department has made the decision to increase our use of preventive maintenance treatments on state routes to approximately \$10 million (10%) of the budget for pavement management/resurfacing in 2008."

March 27, 2008



### Tennessee Pavement Preservation Initiative

- A July 25<sup>th</sup> Letter to TN FHWA Office – A "List of Preventive Maintenance Activities..."
- "Ultra-Thin (<1") and Thin (1" & 1-1/2") Asphalt Overlays"

July 25, 2008



### 4.75-mm Pooled Fund Project

- SR-50, Robertson Co.
- 2.5 miles
- 1 lane 15% Rap, 1 lane virgin
- Average core thickness 0.91"
- Range 0.73 – 1.25"



### 4.75-mm Pooled Fund Project

- July 2006 Phase One Draft Report:

Design ESAL Range (Millions)	N <sub>min</sub>	Minimum FAA	Minimum Sand Equivalent	Minimum Vbe	Maximum Vbe	%G <sub>max</sub> < N <sub>min</sub>	Dust Proportion
<0.3	50	40	40	17.0	15.0	≤91.5	1.0 to 2.0

Minimum Vbe	Maximum Vbe
12.0	15.0



4.75-mm Pooled Fund Project

		Virgin	Recycle
Design	Opt. AC	6.8	6.8
	Design Air Voids	6	6
	VMA	21	20.8
	VFA	70	72
	Vbe	15.0	14.8
	Stability (lb)	3677	3677
	Flow (0.01 in)	16.0	15.2
	DAR	1.78	1.78

N<sub>des</sub> = 50 gyrations



4.75-mm Pooled Fund Project

		Virgin	Recycle
Produced	Placement Date	6/17/2008	6/18/2008
	%AC	6.41	6.62
	Prod. Air Voids	3.5	2.5
	VMA	17.9	17.4
	VFA	80.4	85.4
	Vbe	14.4	14.9
	Stability (lb)	4283	3950
	Flow (0.01 in)	19.1	16.7
DAR	1.91	1.90	



4.75-mm Pooled Fund Project

- APA Rut Depths:
  - Virgin – 6.3 mm
  - RAP – 5.3 mm



4.75-mm Pooled Fund Project



4.75-mm Pooled Fund Project



Tennessee's New "Thin Lift" Mixes

- Prior to 2008, TN's smallest surface mix was 1/2" NMAS, typically placed at 1-1/4"
- Two new gradations were developed, for 3/8" (9.5mm) and 1/4" (4.75 mm) Marshall Mix Design

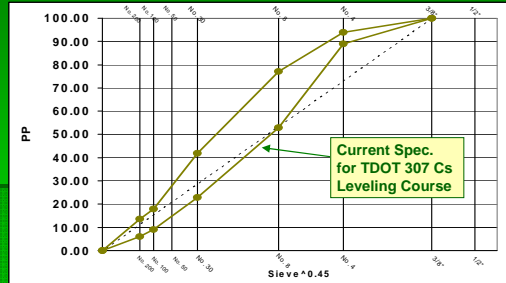


## Tennessee's New "Thin Lift" Mixes

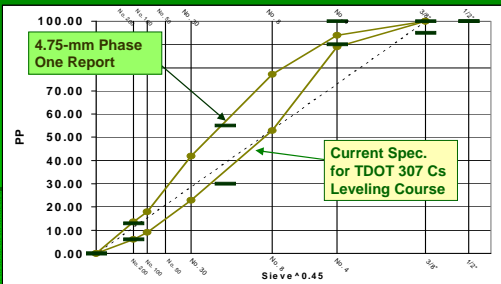
- The FIRST new mix specification:
  - Titled 411 "TL"
  - 1/4" (4.75-mm) NMAS
  - 75-blow Marshall spec
  - Developed based on:
    - 4.75-mm SP specification from the Pooled Fund Phase One draft report
    - Local materials
    - TDOT's current specification for 307-Cs leveling course.



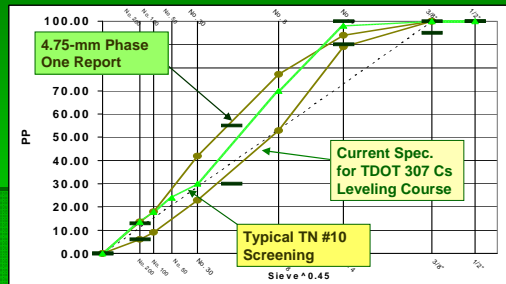
## Tennessee's New "Thin Lift" Mixes



## Tennessee's New "Thin Lift" Mixes



## Tennessee's New "Thin Lift" Mixes



## 411 TL Specification

- Gradation limits for 411-TL were set essentially the same as TDOT 307-Cs leveling course
- This specification allowed for less #4 and no 3/8, to permit lighter application rates.



## 411 TL Specification

- 1/4" (4.75-mm) NMAS
- 6.0-8.0 allowable optimum AC%
- VTM: 4.0±0.2%\*
- Minimum 16% VMA
- Minimum Stability: 2000 lb
- DAR: 1.0 - 2.0
- Maximum 15% natural sand
- Maximum 15% RAP (Processed -5/16")
- Minimum 50% approved non-polishing surface aggregates



### 411 TL Specification

- 4 Projects were let in June under this specification at prescribed spread rates of 85, 65, and 45 lbs/yd<sup>2</sup> (Approx. thickness of 7/8", 5/8", and 1/2", respectively)
- 2 project were awarded:
  - Greene Co. – 45 lbs/yd<sup>2</sup>
  - Hickman Co. – 65 lbs yd<sup>2</sup>

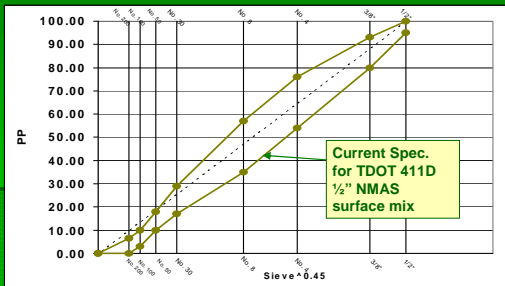


### Tennessee's New "Thin Lift" Mixes

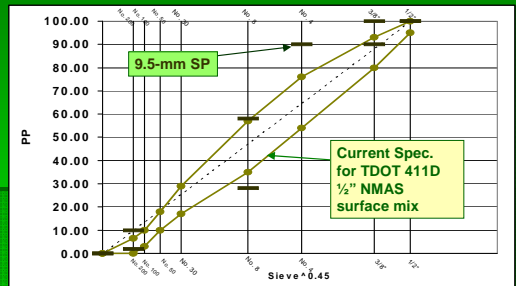
- The SECOND new mix specification:
  - Titled 411 "TLD"
  - 3/8" (9.5-mm) NMAS
  - 75-blow Marshall spec
  - Developed based on current TDOT specification for 411-D, typical 1/2" (12.5-mm) NMAS surface mix



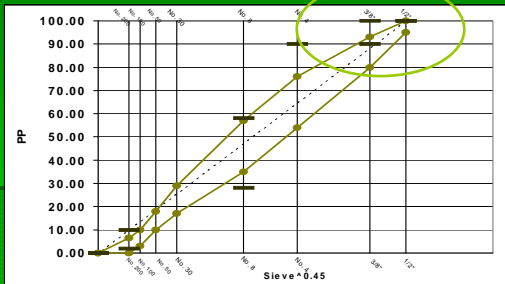
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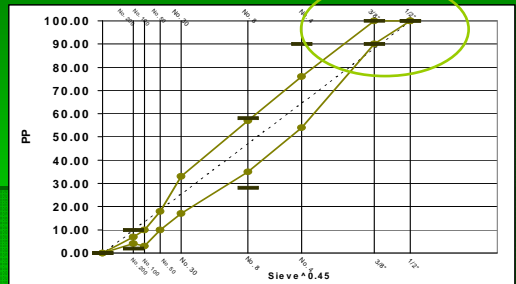
### Tennessee's New "Thin Lift" Mixes



### Tennessee's New "Thin Lift" Mixes



### Tennessee's New "Thin Lift" Mixes



### Tennessee's New "Thin Lift" Mixes



### 411 TLD Specification

- 3/8" (4.75-mm) NMAS
- 5.3-7.0 allowable optimum AC%
- VTM: 3.8±0.3%\*
- Minimum 14% VMA
- Minimum Stability: 2000 lb
- DAR: 0.6-1.2
- Maximum 15% RAP (Processed -5/16")



### 411 TLD Specification

- 3 Projects were let in June under this specification at a prescribed spread rates of 85 lbs/yd<sup>2</sup> (Approx. thickness of 7/8")
- 1 project was awarded in Campbell Co.



### "Thin-lift" Letting

- 7 total thin lift projects were let in June of this year.
- 3 projects were awarded based on cost per square yard.



### "Thin-lift" Letting

PROJECT	TYPE MIX	NMAS	APPLICATION RATE (lbs/yd <sup>2</sup> )	COST (\$/ton)	COST (\$/yd <sup>2</sup> )
MICRO*	Micro	1/4" (4.75-mm)	22 (Agg)	173.28	2.13
CNG203	411TL	1/4" (4.75-mm)	45	112.00	2.52
CNG098	411TL	1/4" (4.75-mm)	65	84.50	2.75
CNG088	411TL	1/4" (4.75-mm)	65	98.25	3.19
CNG195	Micro	1/4" (4.75-mm)	32 (Agg)	173.28	3.20
CNG202	411TLD	3/8" (9.5-mm)	85	76.25	3.24
CNG174	411TLD	3/8" (9.5-mm)	85	82.00	3.49
CNG081	411TLD	3/8" (9.5-mm)	85	92.50	3.93
CNG204	411TL	1/4" (4.75-mm)	85	99.00	4.21
411D*	411D	1/2" (12.5-mm)	132.5	75.53	5.00

\*Hypothetical data collected from previous lettings



### Hickman Co. Existing Surface



Hickman Co.  
Existing Surface



Hickman Co.  
65 lb/yd<sup>2</sup> ¼" Mix



Hickman Co.  
65 lb/yd<sup>2</sup> ¼" Mix



Hickman Co.  
65 lb/yd<sup>2</sup> ¼" Mix



Hickman Co.  
65 lb/yd<sup>2</sup> ¼" Mix

Test Performed by TDOT Road Profiler					
Test Limits		Direction and Measured Roughness (HC-IRI Number Per Mile)			
Mile		NSEW	Pre Ride Number	Final Ride Number	Percent Improvement
From	To				
0.00	1.00	E	52	31	40
1.00	2.00	E	56	29	48
2.00	3.00	E	56	31	45
3.00	4.00	E	57	31	46
4.00	5.00	E	60	32	47
5.00	6.00	E	62	35	44
6.00	6.26	E	72	45	38
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0.00	1.00	W	68	41	40
1.00	2.00	W	55	32	42
2.00	3.00	W	64	38	41
3.00	4.00	W	56	32	43
4.00	5.00	W	56	30	46
5.00	6.00	W	61	32	48
6.00	6.27	W	58	33	43

Greene Co.  
45 lb/yd<sup>2</sup> ¼" Mix

Test Performed by TDOT Road Profiler					
Test Limits		Direction and Measured Roughness (HC-IRI Number Per Mile)			
Mile		NSEW	Pre Ride Number	Final Ride Number	Percent Improvement
From	To				
0.00	1.00	N	62	31	50
1.00	2.00	N	57	29	49
2.00	3.00	N	64	39	39
3.00	3.63	N	75	37	51
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0.00	1.00	S	88	43	50
1.00	2.00	S	71	30	58
2.00	3.00	S	66	32	52
3.00	3.63	S	72	35	51

## APA Rut Depths

- Campbell Co (3/8" NMAS) – 3.97 mm
- Greene Co. (1/4" NMAS) – 5.67 mm



## Conclusions / Recommendations

- All thin mixes are best accompanied by a proper application of tack coat, preferably polymer modified.
- The >2" NMAS lift thickness rule of thumb should still apply.
- TDOT currently plans on limiting these mixes to lower volume routes.
- TDOT will be placing a 4.75-mm, 25% RAP, WMA under maintenance contract in the near future.

