

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 5th APA Perpetual Pavement Award last week.



The Tennessee Program

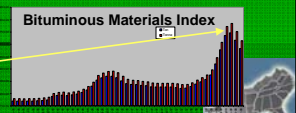
- Historically, resurfacing practices involved milling the surface and replacing with 3-4" binder and 1-1/4" surface.
→ *The "Worst First" approach.*



The Tennessee Program

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

"IT'S BROKE!!"



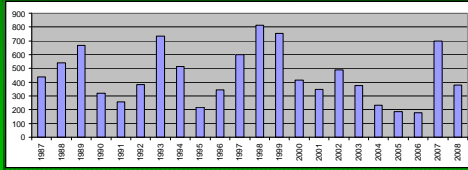
Bituminous Adjustments

- **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



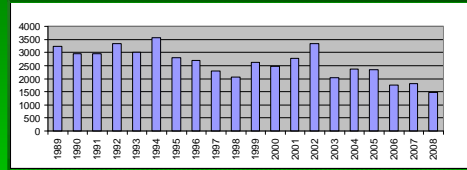
Interstate LM's Paved



* - 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 25th 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 _{min}	Minimum FAA	Minimum Sand Equivalent	Minimum Vbe	Maximum Vbe	%G _{max} < N _{min}	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_{des} = 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

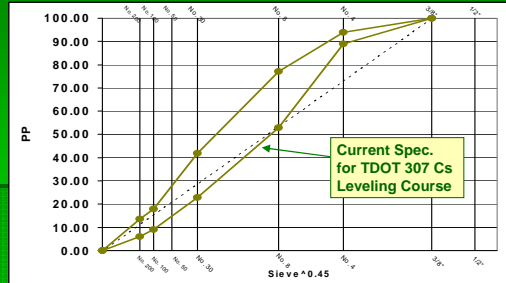


Tennessee's New "Thin Lift" Mixes

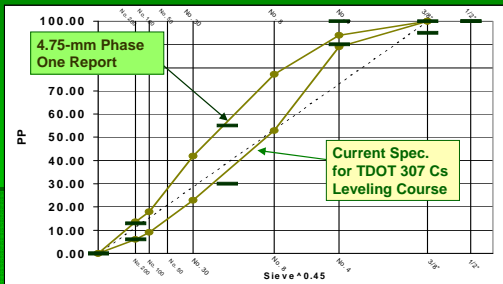
- The FIRST new mix specification:
 - Titled 411 "TL"
 - 1/4" (4.75-mm) NMAS
 - 75-blow Marshall spec
 - Developed based on:
 - 4.75-mm SP specification from the Pooled Fund Phase One draft report
 - Local materials
 - TDOT's current specification for 307-Cs leveling course.



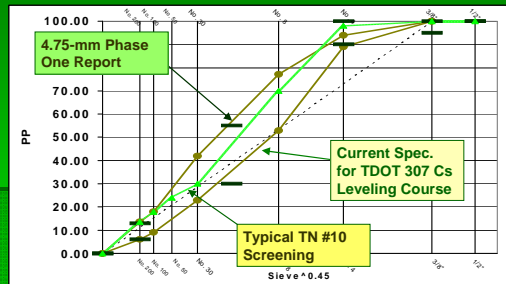
Tennessee's New "Thin Lift" Mixes



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/yd² (Approx. thickness of 7/8", 5/8", and 1/2", respectively)
- 2 project were awarded:
 - Greene Co. – 45 lbs/yd²
 - Hickman Co. – 65 lbs yd²

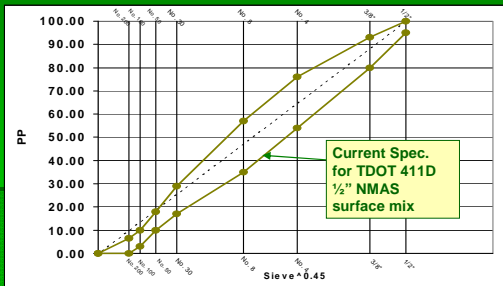


Tennessee's New "Thin Lift" Mixes

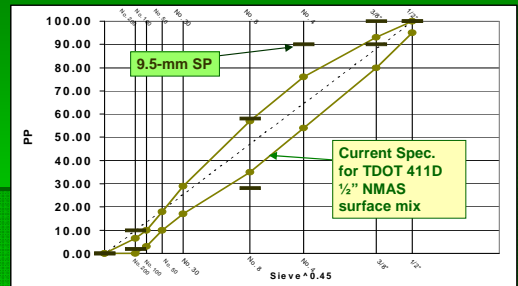
- The SECOND new mix specification:
 - Titled 411 "TLD"
 - 3/8" (9.5-mm) NMAS
 - 75-blow Marshall spec
 - Developed based on current TDOT specification for 411-D, typical 1/2" (12.5-mm) NMAS surface mix



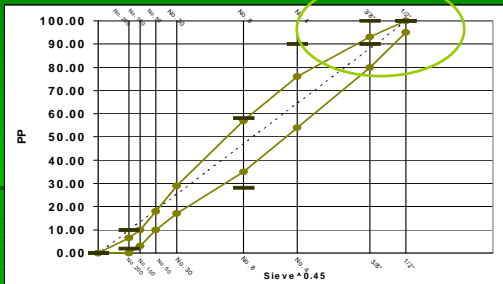
Tennessee's New "Thin Lift" Mixes



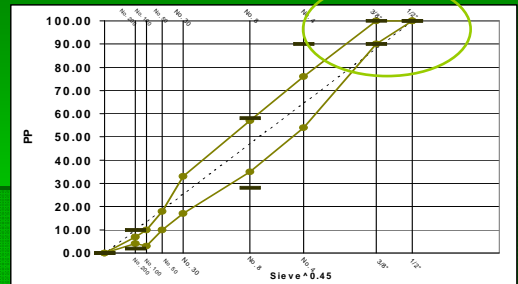
Tennessee's New "Thin Lift" Mixes



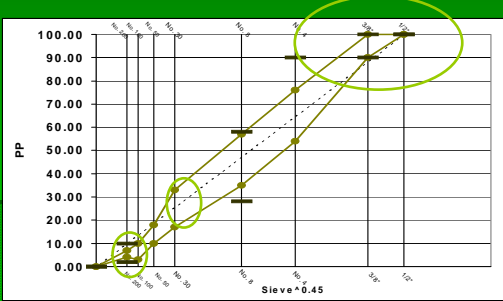
Tennessee's New "Thin Lift" Mixes



Tennessee's New "Thin Lift" Mixes



Tennessee's New "Thin Lift" Mixes



411 TLD Specification

- 3/8" (4.75-mm) NMA5
- 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/yd² (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	NMA5	APPLICATION RATE (lbs/yd ²)	COST (\$/ton)	COST (\$/yd ²)
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/yd² ¼" Mix



Hickman Co.
65 lb/yd² ¼" Mix



Hickman Co.
65 lb/yd² ¼" Mix



Hickman Co.
65 lb/yd² 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/yd² 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.

