

Thin Lift Overlays: Points to Ponder



February 4, 2015

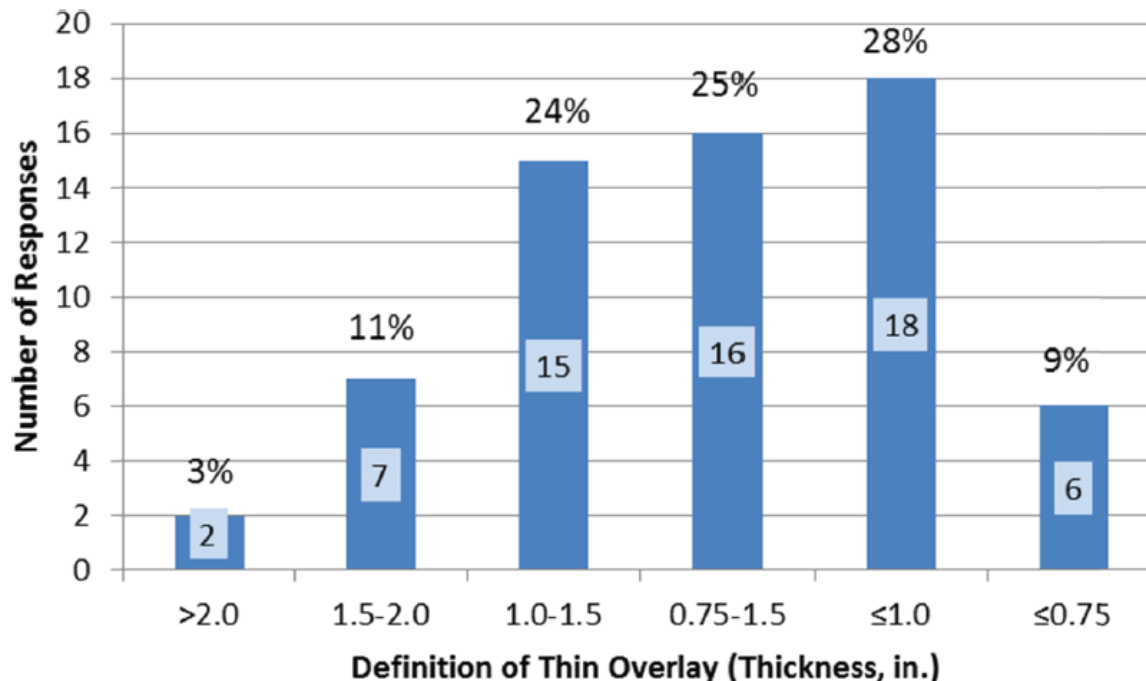
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- **Defining “Thin Lift Overlays”**
- **Benefits of Thin Lift Overlays**
- **When they should be used / not used**
- **What type of materials / mix designs are appropriate**
- **What we should be aware of when constructing Thin Lift Overlays**

Definition

- Thin Lift Overlays are typically defined as surface mixes of 1.5" or less in compacted thickness
- Can be dense-graded, gap-graded, or open-graded
- They are not typically intended to strengthen the pavement structure, but instead to address functional problems as part of Pavement Preservation



State survey responses -
NCHRP Synthesis 464:
Thin Asphalt Concrete
Overlays

Pavement Preservation

- Agencies have often applied maintenance *reactively* to roads in poor condition rather than *proactively* to roads still in good structural condition
- The Pavement Preservation concept applies several minor treatments while the road is minimally distressed at a far lower cost than one major rehabilitation or reconstruction

Benefits of Thin Lift Overlays

- Long service, low life-cycle cost
- Can better preserve grade and slope
- Can handle heavy traffic
- Seals the surface
- Can be constructed quickly, minimizing traffic delays
- Can be recycled
- Can use in stage construction
- Restores skid resistance
- Quiet
- Smooth
- *Looks and feels new to the travelling public*

**** It is critical to select the correct type of project for a thin lift overlay to ensure a long service life!***

General rules-of-thumb:

- 1) when the existing pavement is still structurally sound, but needs better skid resistance, drainage, or other functional improvement
- 2) when existing pavement is raveling, has longitudinal cracking not in the wheelpath, minimal thermal cracking, or limited rutting ($\leq 1/4''$).
- 3) if mill-and-fill is planned, when existing distresses are confined to the surface lift

When to use a thin asphalt overlay



Polishing

When to use a thin asphalt overlay



Raveling

** Take steps to ensure proper bond*

When to use a thin asphalt overlay



Longitudinal Cracking Not in Wheelpath

When to use a thin asphalt overlay



**Low-severity
thermal cracking**



**Low-severity
rutting**

When to use a thin asphalt overlay



If larger cracks are to be overlaid, they should be routed, cleaned, and sealed

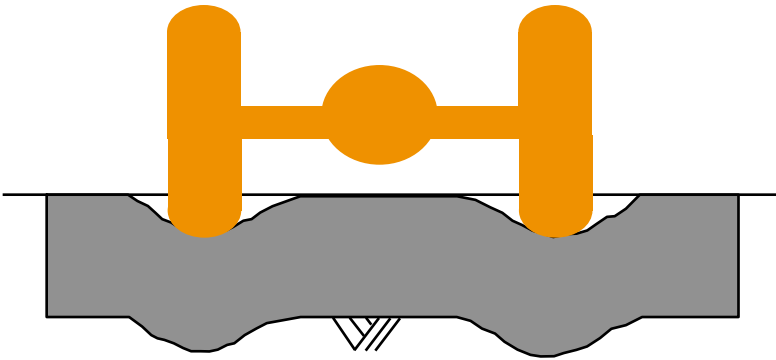
When to use a thin asphalt overlay



Plastic movement in top lift only - great candidate for a mill & fill

Why wouldn't you simply overlay this road?

When to use a thin asphalt overlay



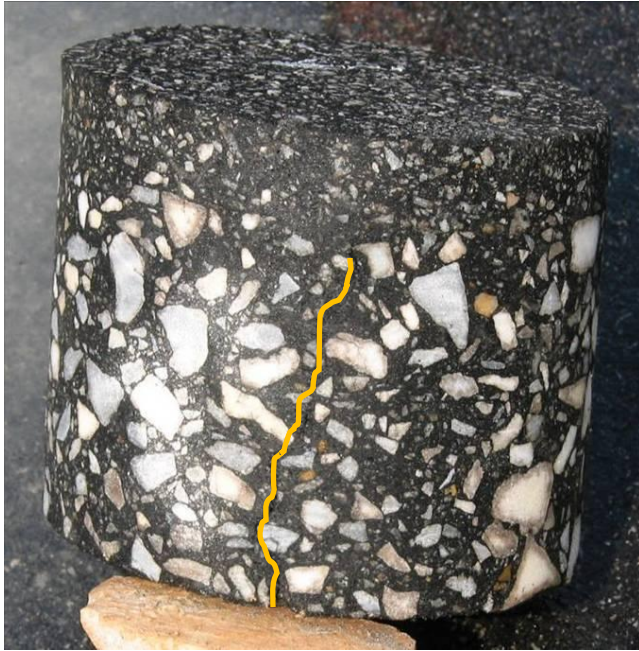
Soft subgrade - *if localized*, can patch & then overlay
(cut in nice, straight lines at least 1' on each side into sound pavement, clean & tack all faces)

When *not* to use a thin asphalt overlay

**Roads with unrepaired structural damage
and/or insufficient structural capacity**



When *not* to use a thin asphalt overlay



**Bottom-up
cracking**



**Stripped
layers**

When *not* to use a thin asphalt overlay



**Alligator
cracking**



**Reflective
cracking**

When *not* to use a thin asphalt overlay



**Excessive
rutting**



**Excessive
thermal cracking**

- For thin lift mixes, the Nominal Maximum Aggregate Size (NMAS) should be 1/2", 3/8", or No. 4. The lift thickness should be 3 to 5 times the NMAS.
- 1/2" NMAS mixes should maintain a gradation on the fine side of the maximum density line for dense-graded mixes.
- The aggregate must be capable of withstanding the design traffic loads without rutting or polishing.
- The permeability of a mix is related to the NMAS, so thin lift mixes are inherently less permeable

Smaller NMAS → less permeability



Water-Proofing

Dense-graded mixes used for thin overlays have smaller void sizes, with low-to-no permeability

Permeability in coarse, dense-graded asphalt w/1/2" NMAS

- For Superpave mixes, most states do not differentiate between binders specified for thin lift overlays and those for their regular mix usages. (Most select based on regional climate history and expected traffic level).
- Many states do require polymerized binders if specifying premium mixes such as Stone Matrix Asphalt or Permeable Friction Course.

Mix Types for Thin Lift Overlays

Dense-Graded : Superpave mixes are by far the most commonly used mixes in the United States

- RAP/RAS can be used successfully in thin lift mixes at appropriate percentages with proper design practices, but processing the RAP to screen out +1/2" aggregate is recommended.

Screening RAP



1/2 x 4
4% AC

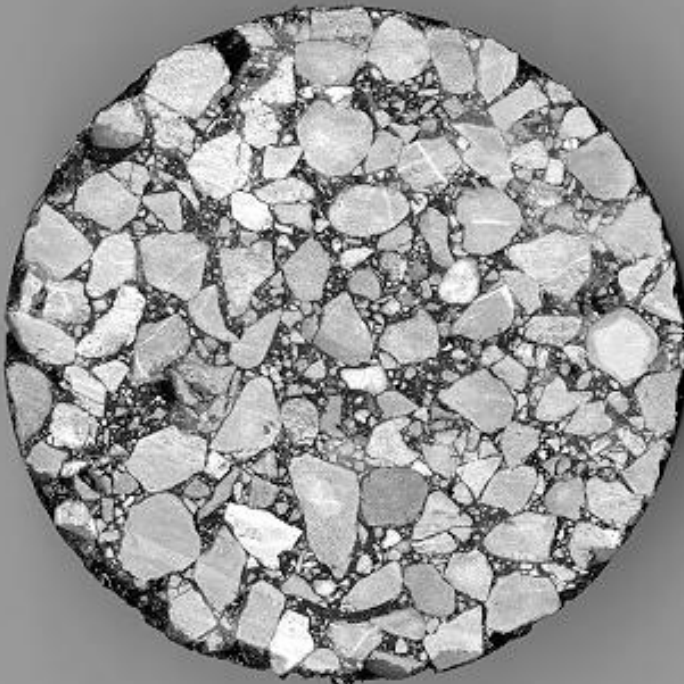


4 x 0
7% AC

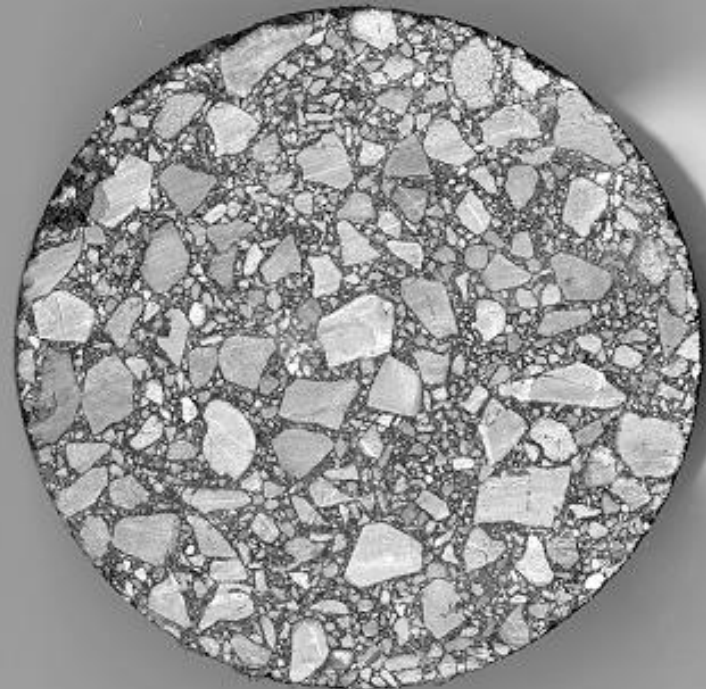
Mix Types for Thin Lift Overlays

Gap-Graded : Stone Matrix Asphalt (SMA) mixes are typically 1/2" or 3/8" NMAS, with a lot of coarse aggregate, a lot of fines, but not much intermediately-sized aggregates

SMA



SUPERPAVE



Mix Types for Thin Lift Overlays

Uniformly-Graded: Open Graded Friction Course (OGFC) or Permeable Friction Course (PFC) mixes are typically 1/2" or 3/8" NMAS, with mainly one size of chip and no fine aggregate

- OGFC and PFC are surface mixes which are intended to reduce wet weather spray and glare.
- PFC is composed of a high asphalt binder content, cellulose fibers, aggregate, and about 20% air. It is usually placed at 1-1/4" thick.

Mix Types for Thin Lift Overlays



At the plant:

- Thin lift mixes are composed of a high percentage of fine aggregate
- Fine aggregate stockpiles have higher moisture contents than coarse aggregate stockpiles
- Attention must be given to the proper drying of all aggregates, which may mean slowing down
- Moist aggregates contribute to stripping and also tenderness issues with mixes

Constructing Thin Lift Overlays

At the plant:

- There is a temptation to run the plant much hotter because of the faster heat loss of HMA placed in thin lifts
- This will evaporate the light fractions of the binder much more quickly and prematurely age the mix



Constructing Thin Lift Overlays

On the project:

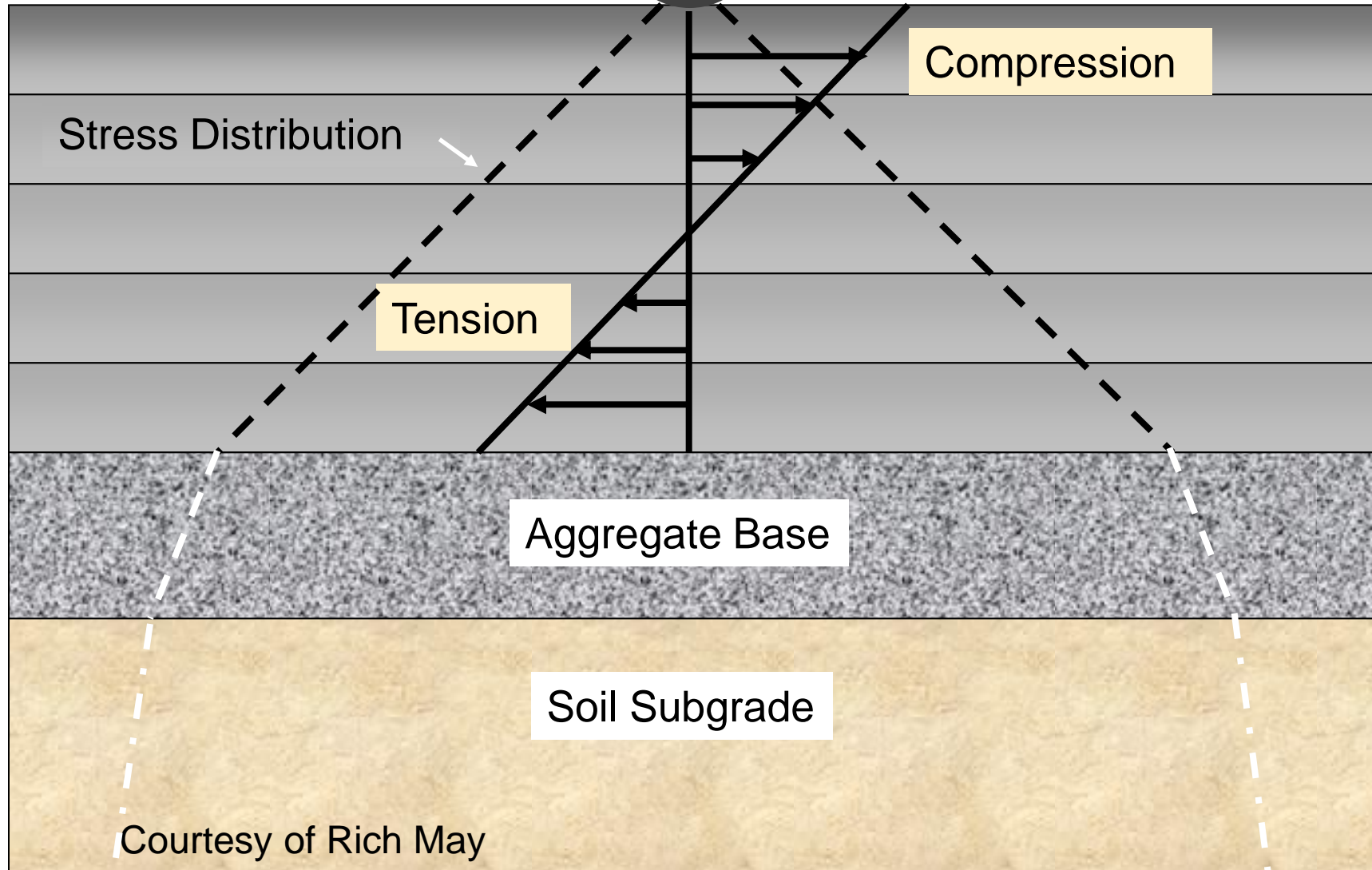
- Because the overlay is thin, the interface between the old and new pavement is in close proximity to the shear forces created by vehicles during turning and braking movements.
- Therefore, the bond between the old surface and the new overlay is especially important



Pavement Behavior

Load Distributed by Tire

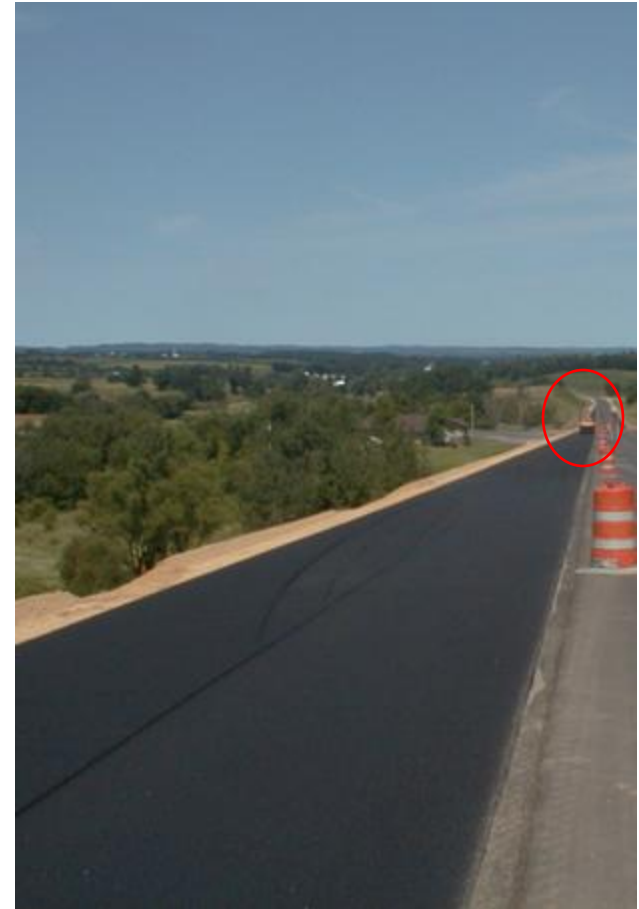
Shear Transfer?



Constructing Thin Lift Overlays

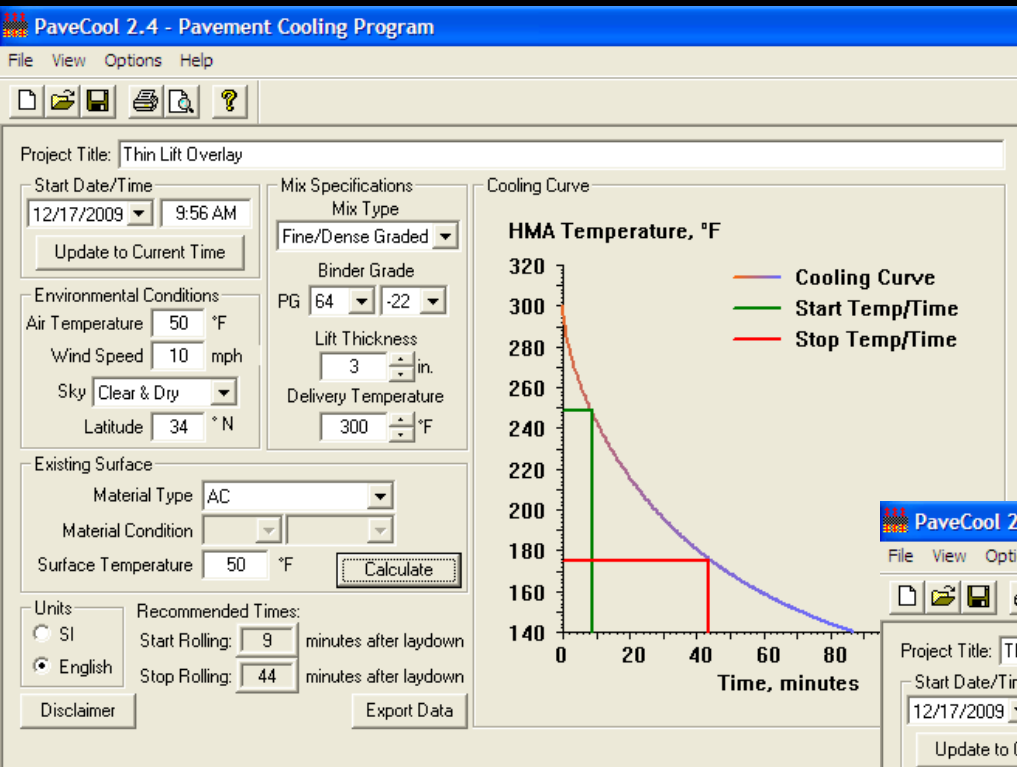
On the project:

- Realize that when paving thin lifts, each ton goes a long way and the paver can get down the road very quickly
- Don't allow the paver to leave the rollers behind
- Thin lifts cool very rapidly and need to be compacted more quickly than thicker lifts



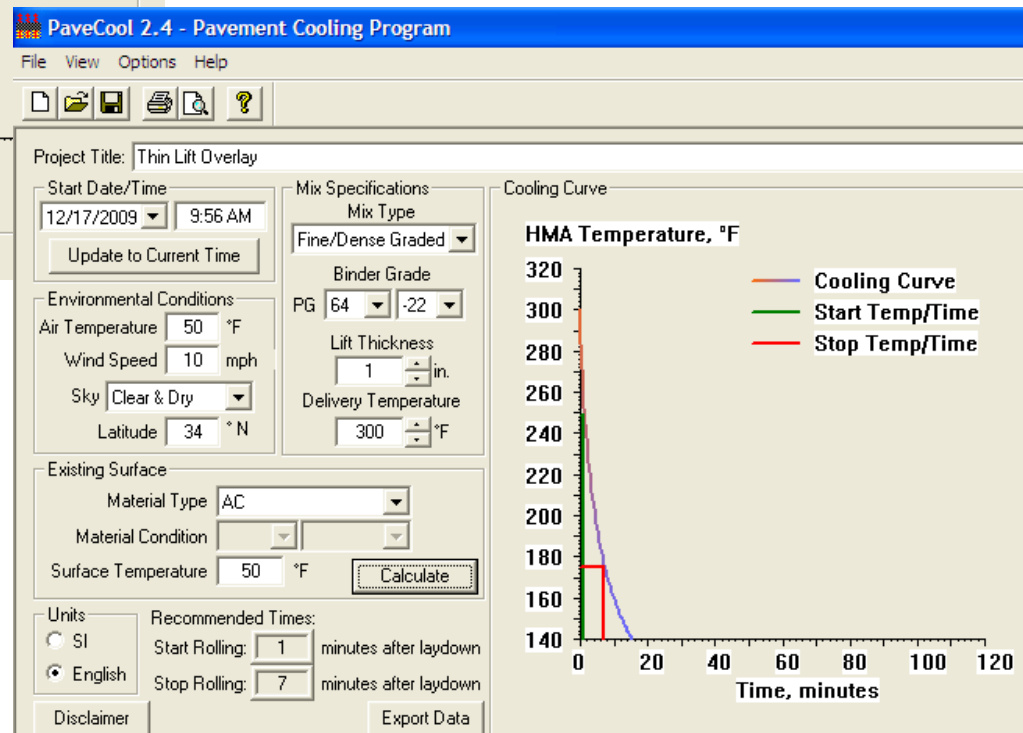
Hello-o-o-o-o back there!

Constructing Thin Lift Overlays



3 Inch Lift
50°F Air, Surface Temp
Mix Delivery temp - 300°F
44 minutes to complete compaction operations

1 Inch Lift
50°F Air, Surface Temp
Mix Delivery temp - 300°F
7 minutes to complete compaction operations



Constructing Thin Lift Overlays

On the project:

- Rolling strategies depend on the type of thin lift
- For Superpave and SMA, you *may* be able to use a vibratory roller - check for roughness, broken aggregate
- Otherwise, use static rollers. (may be able to use pneumatic on Superpave)



Constructing Thin Lift Overlays

On the project:

- For PFCs and OGFCs, use only static rollers, and one or two passes to seat the mix onto the existing surface. The mix is intended to be permeable, so don't overcompact.
- Don't use pneumatic rollers because they pick up badly on OGFC and SMA mixes

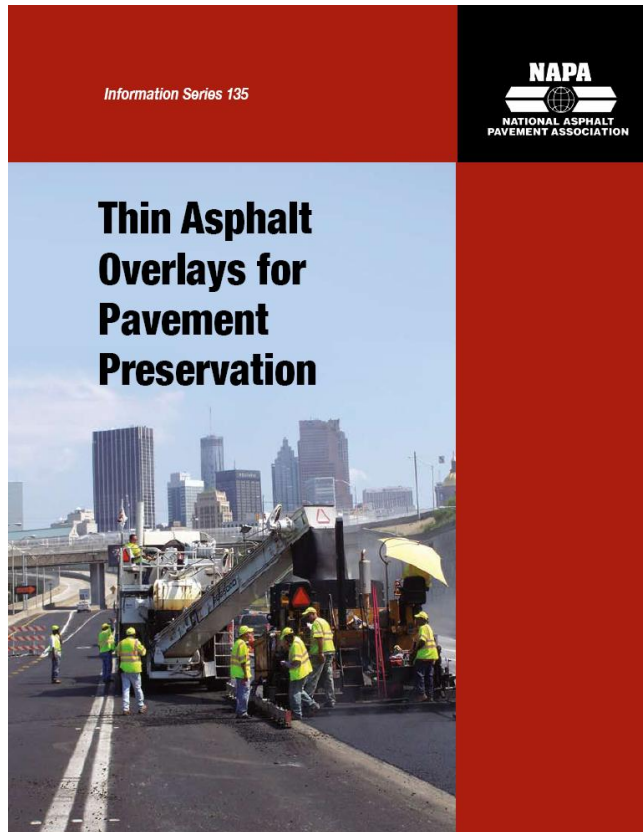


Determining roadway density on thin lifts:

- Cannot get accurate, repeatable results from thin roadway cores
- If the thickness is at least 1", thin lift nuclear gauges or electromagnetic gauges could be used
- Roller patterns are often set and documented as sole source of QC/QA



Resources - Free Downloads

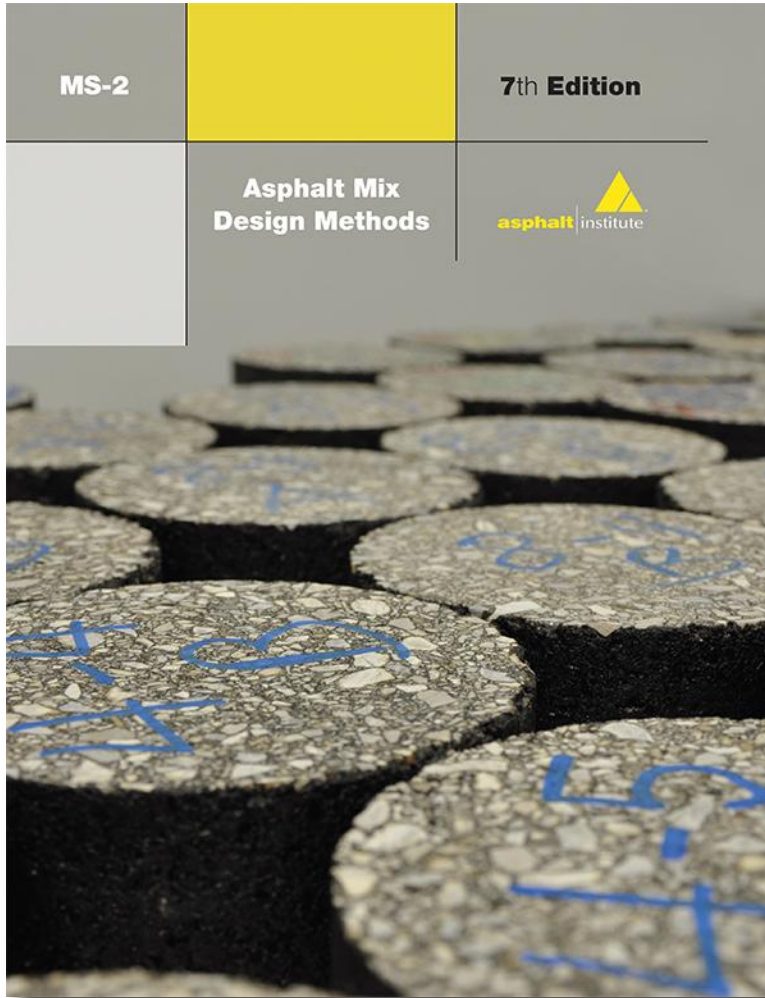


<http://store.hotmix.org/index.php?productID=696>



<http://www.fhwa.dot.gov/Pavement/preservation/ppcl03.pdf>

QUESTIONS?



MS-2 Asphalt Mix Design Methods

The 7th edition of MS-2 Asphalt Mix Design Methods marks the 56th year of continuous publication of an Asphalt Institute mix design manual. The manual is a practical guide based on proven technologies, incorporating the most current information available. This edition offers significantly expanded application and guidance relative to our previous mix design manuals. AASHTO, ASTM and other published standards are referenced often in addition to important research findings.

188 pages, **\$75**

Available Feb. 15th online

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