Thin Lift Overlays:

Points to Ponder

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World of Asphalt 2012 SHOW & CONFERENCE

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TOPICS

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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

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- **Thin Lift Overlays are typically defined as surface mixes of 1.5” or less in compacted thickness**
- **They can be a simple overlay or part of a mill-and-fill operation**
- **They are not typically intended to strengthen the pavement structure, but instead to address functional problems as part of Pavement Preservation**

Pavement Preservation

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- **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 regular minor treatments while the road is minimally distressed at a far lower cost than one major rehabilitation or reconstruction**

Benefits of Thin Lift Overlays

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- 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!***

When to use a thin asphalt overlay

General rules-of-thumb:

1) when the existing pavement is <u>still structurally sound</u>, but needs better skid resistance, drainage, or other functional improvement
2) when existing pavement is raveling, has longitudinal cracking not in the wheelpath*, thermal cracking*, or limited rutting (< 1/4”).
3) if mill-and-fill is planned, when existing distresses are confined to top lifts

When to use a thin asphalt overlay

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Water-Proofing

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

When to use a thin asphalt overlay

Polishing

When to use a thin asphalt overlay

Raveling

When to use a thin asphalt overlay

Longitudinal Cracking Not in Wheelpath

When to use a thin asphalt overlay

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Low-severity thermal cracking

Low-severity rutting

Training, so necessary.

When to use a thin asphalt overlay

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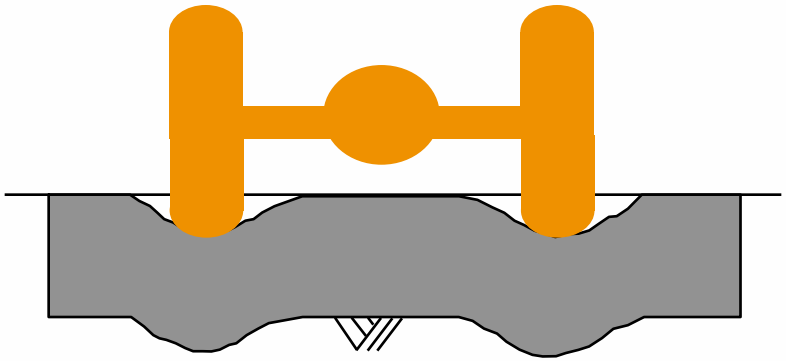
If larger cracks are to be overlaid, they should be routed, cleaned, and sealed

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

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Excessive rutting

(unless plastic mix is confined to the surface and can be milled off)

Excessive thermal cracking

Training, so necessary.

Materials - Aggregates

- **For thin lift mixes, the Nominal Maximum Aggregate Size (NMAS) must be 1/2” or preferably even smaller (3/8”, #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**

Materials - Binders

- For Superpave mixes, most agencies 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 agencies do require polymerized binders if specifying premium mixes such as Stone Matrix Asphalt or Permeable Friction Course.

Mix Types for Thin Lift Overlays

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- Superpave mixes are by far the most commonly used mixes in the United States
- Superpave lift thickness is optimally 4 times the NMAS.
- RAP can be used successfully in thin lift mixes, but processing the RAP to screen out +1/2” aggregate is recommended.

Screening RAP

Mix Types for Thin Lift Overlays

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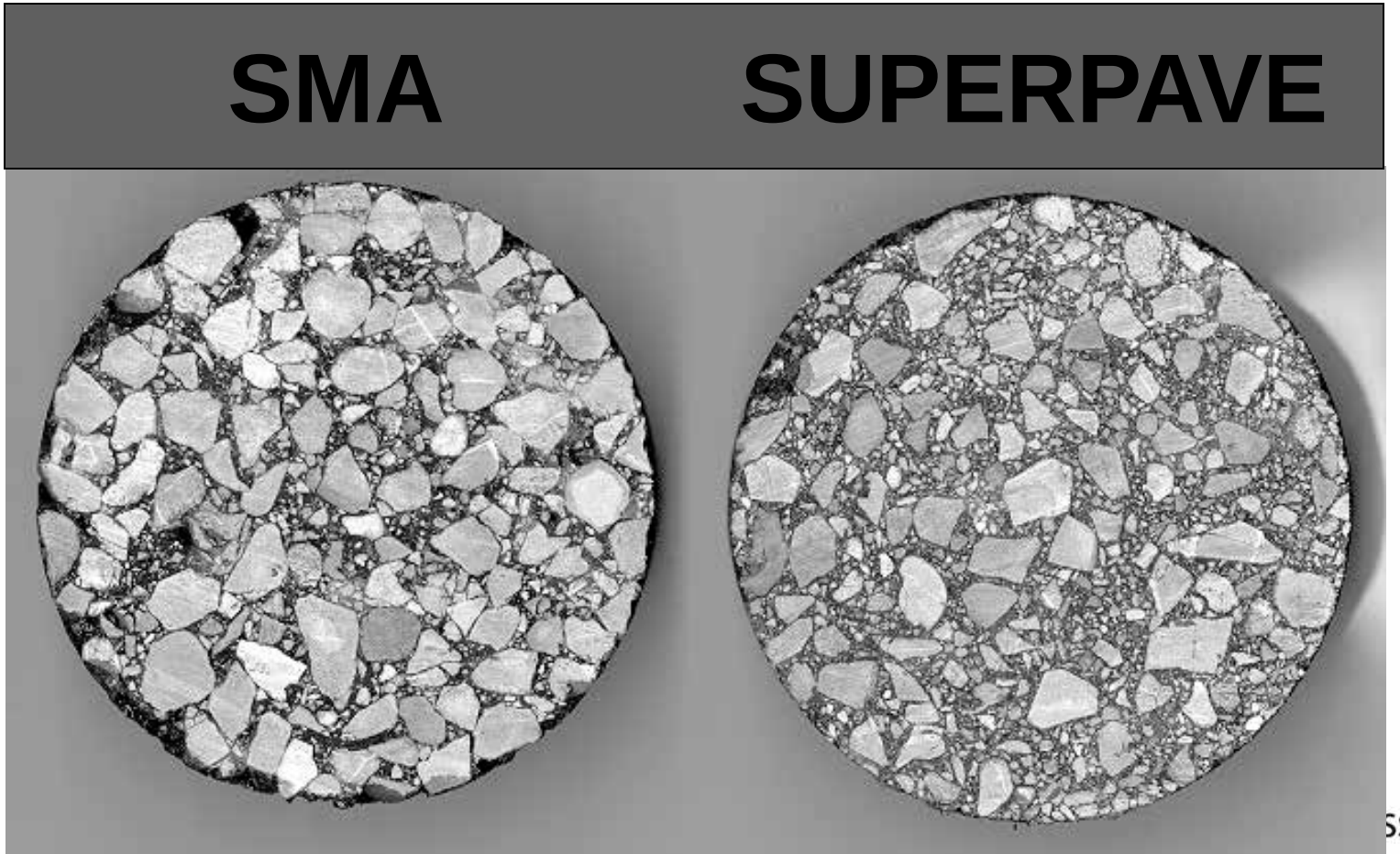
***Gap-Graded* :** Stone Matrix Asphalt (SMA) mixes are typically 1/2” or 3/8” NMAS, with a lot of coarse aggregate, a lot of fines, but not much intermediately-sized aggregates



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Mix Types for Thin Lift Overlays

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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

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Constructing Thin Lift Overlays

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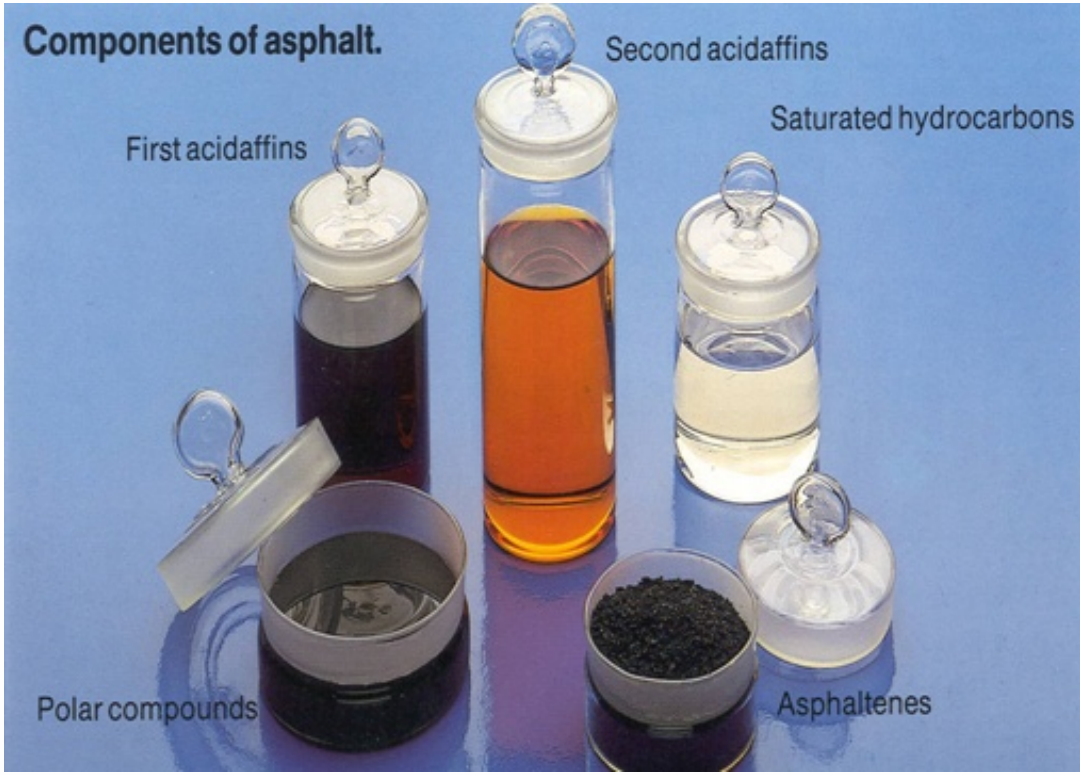
At the plant:

- 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

Tack Coat

GOOD

Uniform coverage

No puddles

No stripes

BAD

Uneven coverage

Clogged nozzles / improper orientation

Stripes are clearly visible

Constructing Thin Lift Overlays

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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

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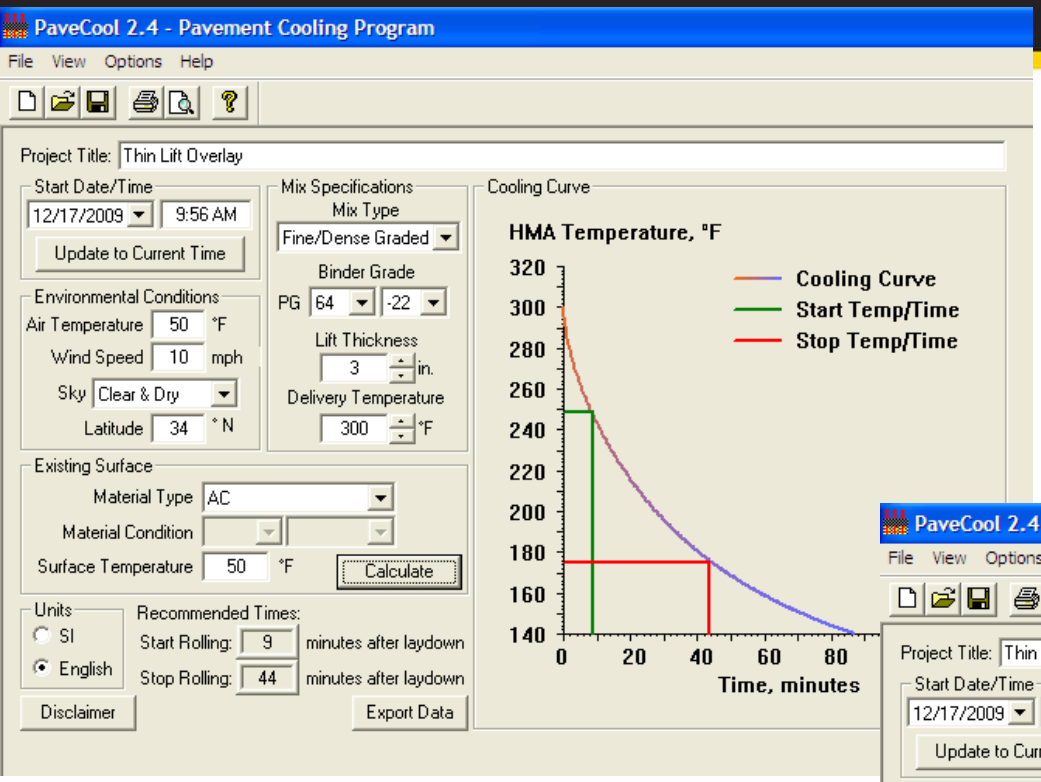


3 Inch Lift

50°F Air, Surface Temp

Mix Delivery temp - 300°F

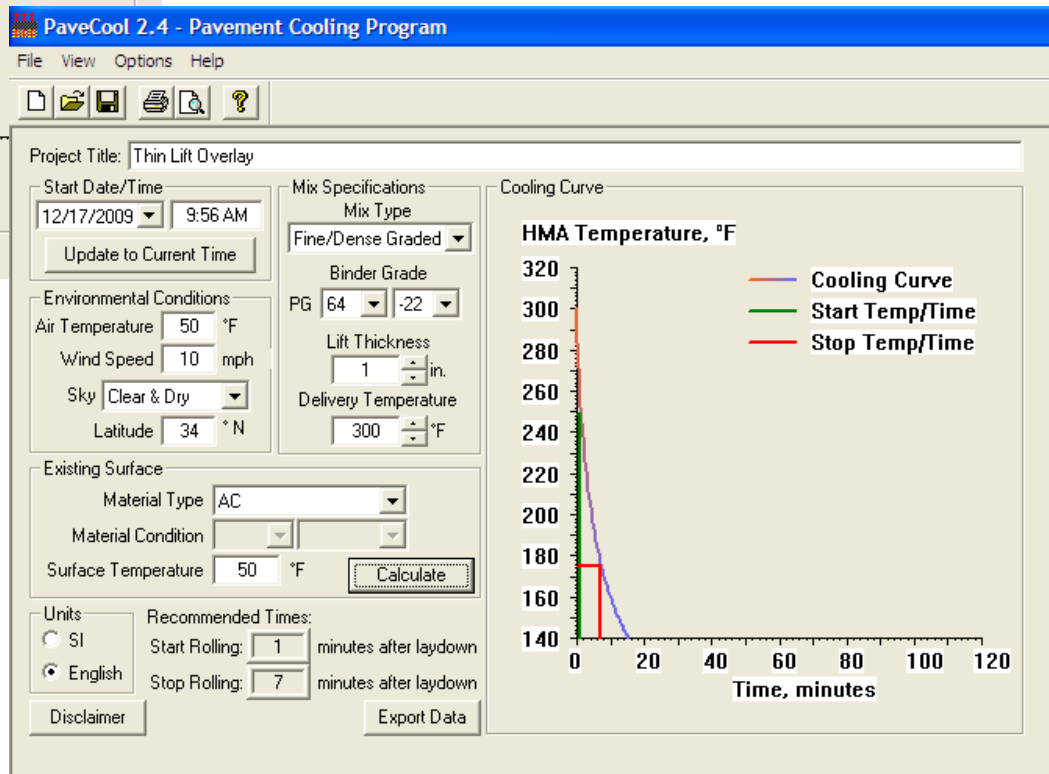
44 minutes to complete compaction operations

1 Inch Lift

50°F Air, Surface Temp

Mix Delivery temp - 300°F

7 minutes to complete compaction operations



Constructing Thin Lift Overlays

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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 at low amplitude - check for roughness, broken aggregate
- Otherwise, use static rollers. *(can use pneumatic on Superpave, but not recommended on SMA due to high binder content)*

Constructing Thin Lift Overlays

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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 these types of mixes

QC/QA Difference

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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

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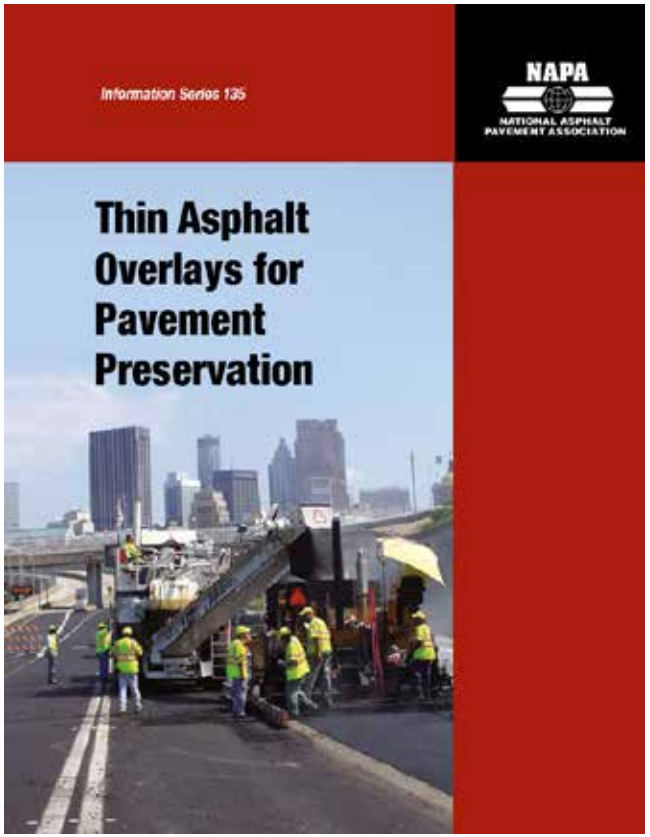
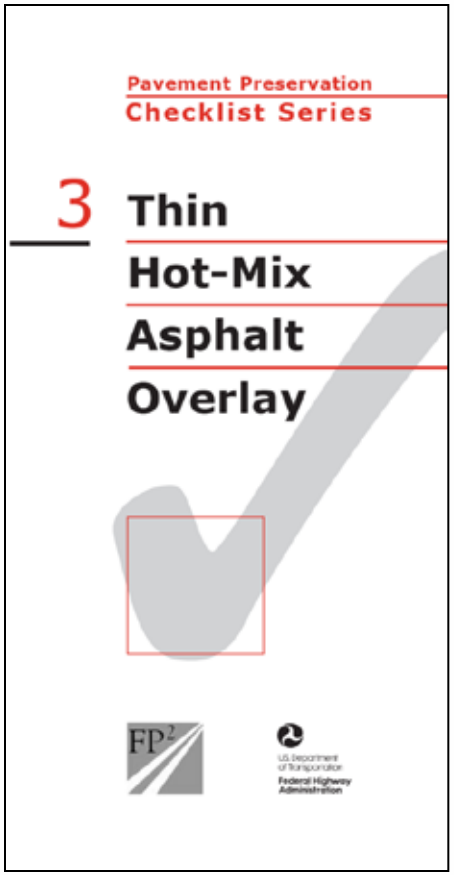


http://store.hotmix.org/index.php?productID=696



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

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