

Thin Asphalt Overlays for Pavement Preservation

*Mid-Year Asphalt Pavement
Technical Seminar*

Sponsored by Flexible Pavements of Ohio

Defining a Thin Asphalt Overlay?

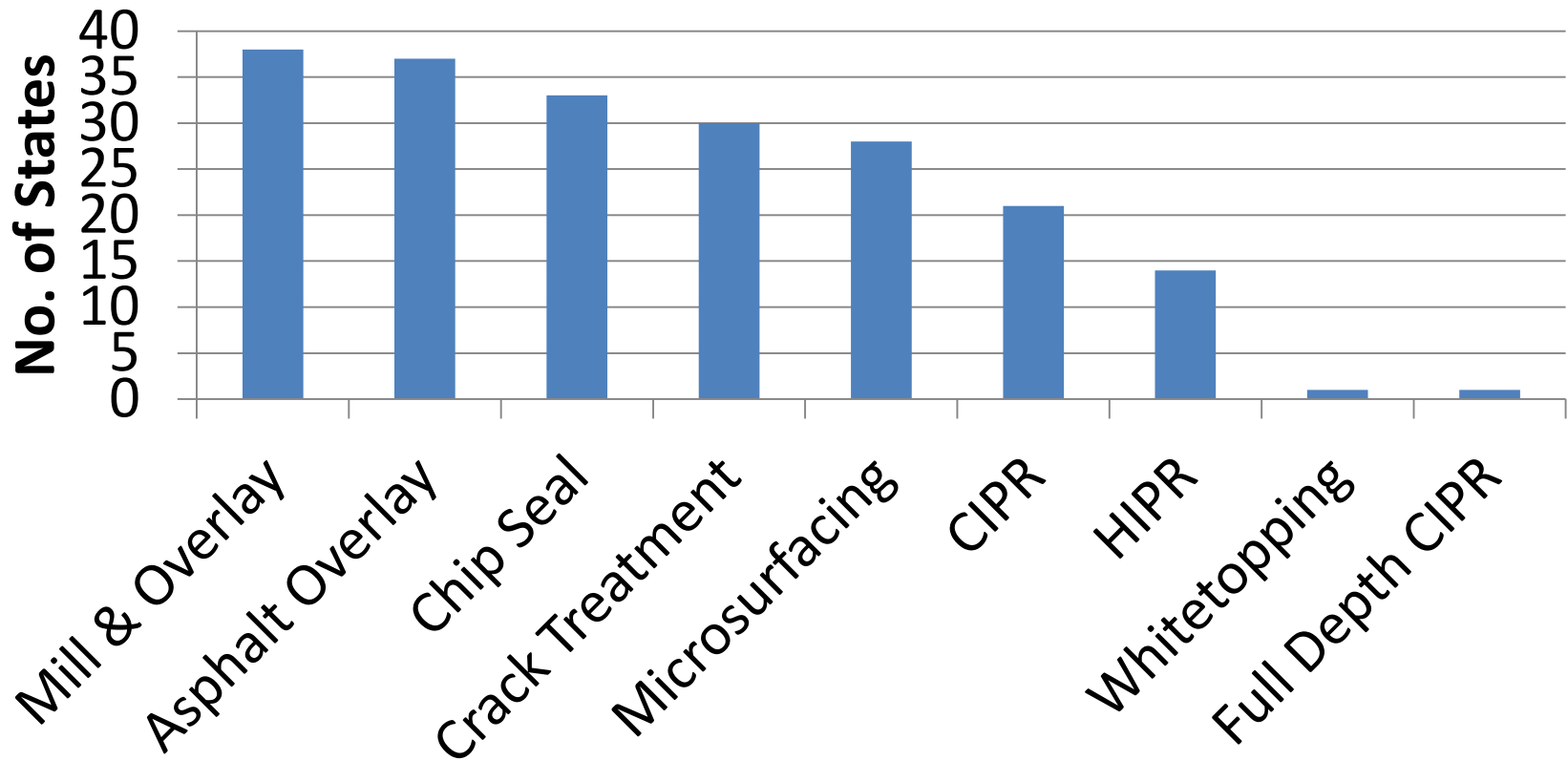
- ▣ Thin overlays are typically $\leq 1 \frac{1}{2}$ inch thick (ODOT defines as any overlay less than or equal to 2 inch thick)
- ▣ They can be a simple overlay or part of a mill-and-fill strategy
- ▣ They are not typically intended to strengthen the pavement but instead to address functional problems as part of a pavement preservation strategy.

Why Thin Asphalt Overlays?

- ▣ Shift from new construction to renewal and preservation
- ▣ Functional improvements for safety and smoothness needed more than structural improvements – Perpetual Pavements
- ▣ Material improvements
 - Performance Graded binders (PG) and Polymers
 - SMA, OGFC and Dense-Graded
 - Superpave mix design
 - Warm Mix
 - Reclaimed Asphalt Pavement (RAP) processing
 - Roofing Shingles

Thin Asphalt Overlays are Popular

1999 AASHTO Survey



Benefits of Thin Asphalt Overlays

- ▣ Long service, low life-cycle cost
- ▣ Maintain grade and slope
- ▣ Handles heavy traffic
- ▣ Smooth surface
- ▣ Seal the surface
- ▣ No loose stones
- ▣ Minimize dust
- ▣ Minimize traffic delays
- ▣ No curing time
- ▣ Low noise generation
- ▣ No binder runoff
- ▣ Can be recycled
- ▣ Can use in stage construction
- ▣ Easy to maintain
- ▣ Restore skid resistance

When is a Thin Overlay a Suitable Treatment?

Basic Evaluation

- ▣ Visual Survey
- ▣ Structural Assessment
 - No structural improvement required
- ▣ Drainage Evaluation
 - What changes are needed
- ▣ Functional Evaluation
 - Ride quality
 - Skid resistance
- ▣ Discussion with Maintenance Personnel

When is a Thin Overlay a Suitable Treatment?

▣ Description of Candidate Projects

- Pavements suitable for a surface treatment overlay show the following distresses:
 - Dry-looking, “bony” pavements that are porous or permeable
 - Pavements that have begun to ravel
 - Pavements with extensive cracking too fine for crack sealing
 - Pavements with cracking of the surface too extensive for crack sealing alone
 - Pavements where curb reveal does not permit heavy lift thicknesses

When is a Thin Overlay a Suitable Treatment?

▣ Description of Candidate Projects

- Candidate pavements will have...
 - No unrepaired structural (fatigue) damage
 - No appreciable rutting ($< \frac{1}{4}$ inch)
 - Sufficient remaining structural capacity to last the life of the treatment

Note:

- Rapidly deteriorating pavements are not good candidates for PM. Rapid deterioration is indicative of inadequate pavement strength.
- Not intended as a crack attenuating layer.

ODOT's Thin-Asphalt Overlay

A 1991 Industry Initiative with some very simple goals:

- ▣ Preserve the pavement
- ▣ Provide some structure
- ▣ Improve safety and ride by “truing-up” the pavement
- ▣ Be economical
 - Placed in thin lifts to reduce \$ per SY
 - Non-proprietary: allowing use of local contractors and materials

ODOT's Thin-Asphalt Overlay

- ▣ Marshall Method used for mix design.
- ▣ Sought to design a specification that would result in mixes rich in binder and composition that would ensure good durability/long life.
- ▣ Resulting specification is ODOT Item 424, FINE GRADED POLYMER ASPHALT CONCRETE (a.k.a. *Smoothseal*)
 - Used primarily for pavement preservation but more recently being piloted as a surface course for Perpetual Pavement.



1992



1993

Material Characterization

Material Characterization

Item 424, Mix Types

▣ Type A

- Mix Design – Recipe mix (all traffic types – light, medium, heavy applications)

▣ Type B (*Smoothseal*)

- Mix Design – Volumetric mix design using Marshall Method (light, medium or heavy traffic pavements)

Material Characterization



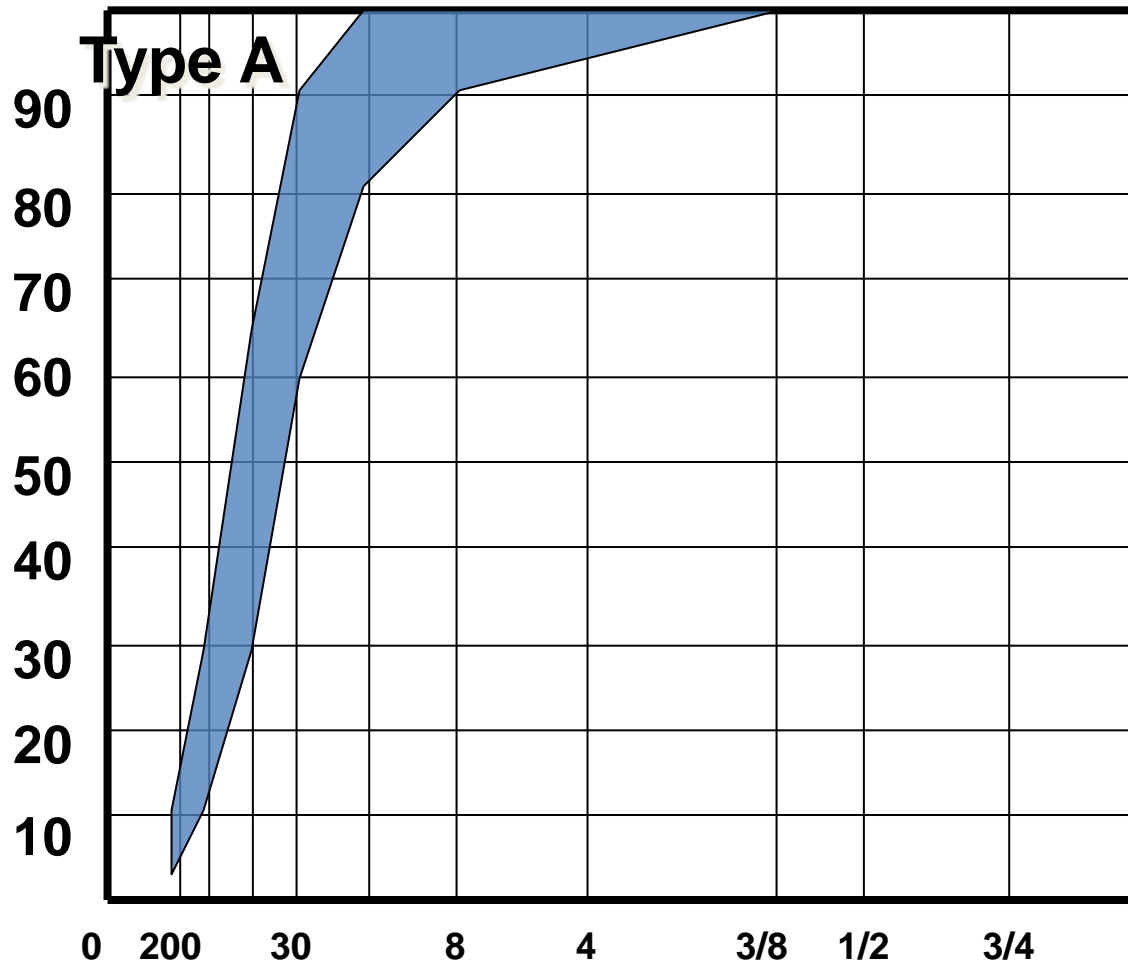
Material Characterization

Item 424, Mix Types

▣ Type “A” Composition

- Blend of sands w/ 8.5% polymer modified asphalt binder (76-22 SBS or 64-22 w/5% SBR)
- Silicon dioxide requirement on the fine agg. ensures good skid resistance
- Highest polymer dosage used in Ohio’s market enhances mix toughness, stability, and longevity

Material Characterization



Item 424, Type A	
1/2 inch	
3/8 inch	100
No. 4	95-100
No. 8	90-100
No. 16	80-100
No. 30	60-90
No. 50	30-65
No. 100	10-30
No. 200	3-10



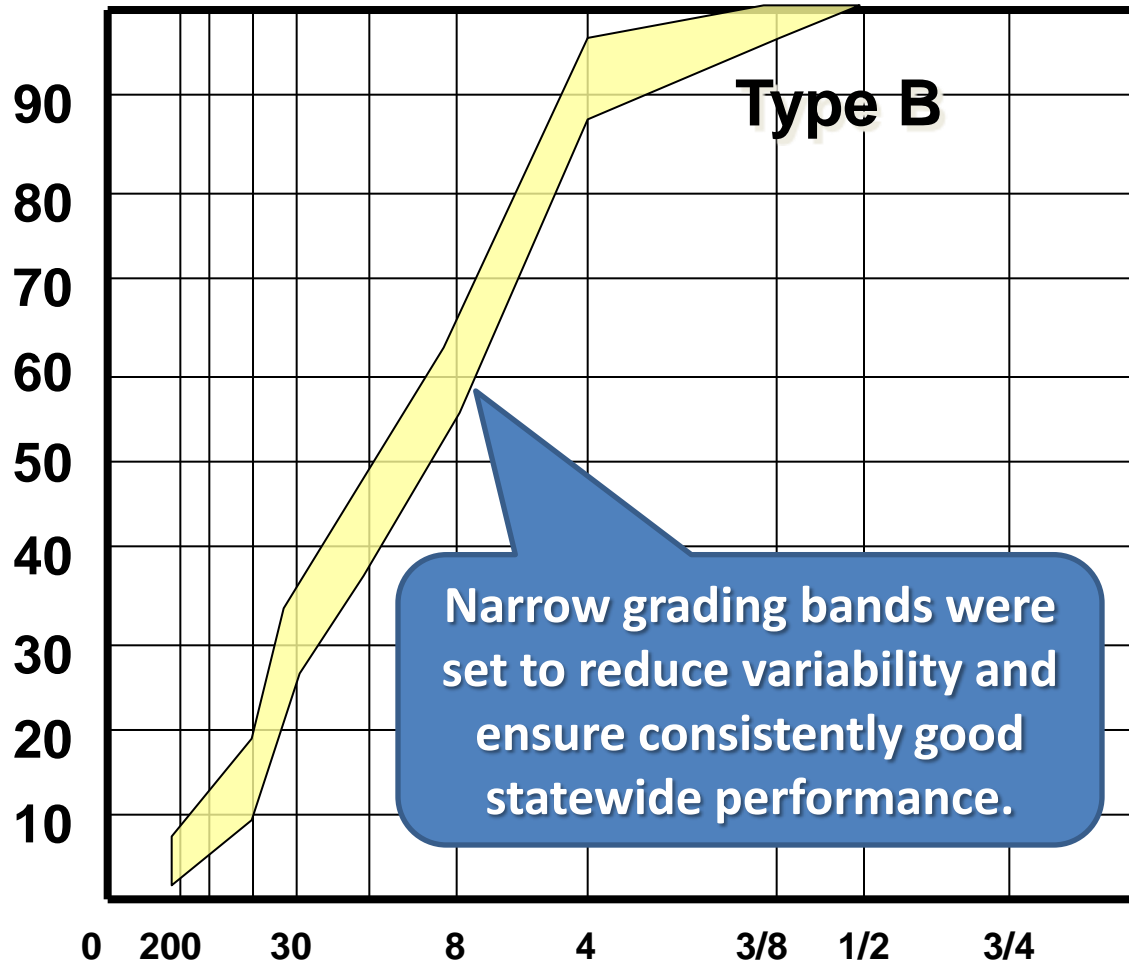
Material Characterization

Item 424, Mix Types

▣ Type “B” (*Smoothseal*) Composition

- ½-inch max. sized coarse agg. and sand particles w/ min. polymer binder content of 6.4% (76-22 SBS or 64-22 w/5% SBR)
- 100% two-faced crushed coarse agg. for heavy traffic mixes to provide stability
- Silicon dioxide requirement on the fine agg. ensures good skid resistance
- Polymer modification used to enhance mix toughness, stability and longevity
- 10% R.A.P. permitted

Material Characterization

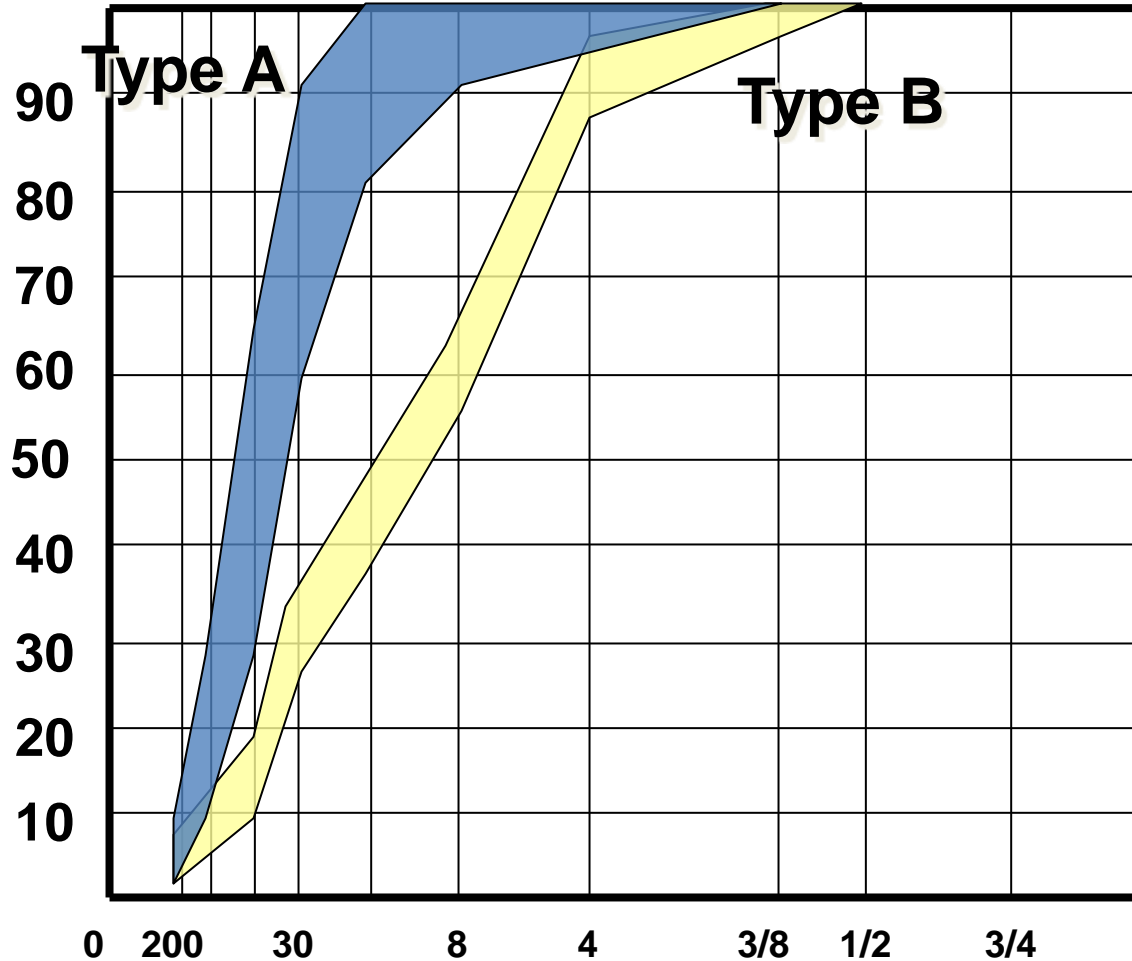


Item 424, Type B	
1/2 inch	100
3/8 inch	95-100
No. 4	85-95
No. 8	53-63
No. 16	37-47
No. 30	25-35
No. 50	9-19
No. 100	
No. 200	3-8

VISION

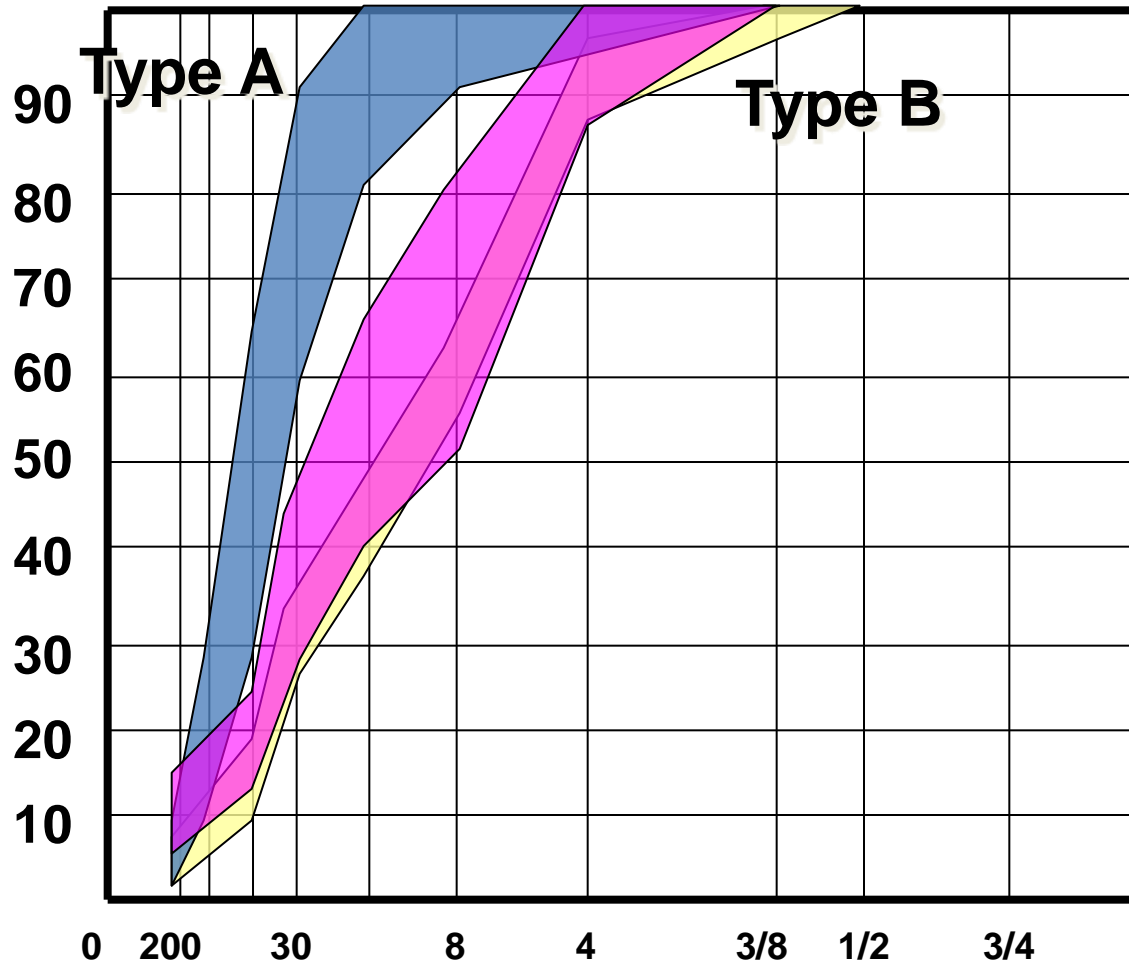


Material Characterization



Item 424, Type B	
1/2 inch	100
3/8 inch	95-100
No. 4	85-95
No. 8	53-63
No. 16	37-47
No. 30	25-35
No. 50	9-19
No. 100	
No. 200	3-8

Material Characterization



Microsurfacing	
3/8 inch	100
No. 4	85-100
No. 8	50-80
No. 16	40-65
No. 30	28-45
No. 50	13-25
No. 100	---
No. 200	5-15

Thickness Guidelines

Overlay Thickness Guidelines

Placement Thickness (compacted)

- **Type A mix**

$$5/8'' \leq \text{thickness} \leq 1\ 1/8''$$

- **Type B mix**

$$3/4'' \leq \text{thickness} \leq 1\ 1/2''$$

Note: Pavement surfaces having significant irregularity will require a leveling course or cold-milling prior to placement of *Smoothseal*.

Manufacturing & Placement

Manufacturing and Placement

Manufacturing *Smoothseal*

- ▣ Will be similar to other polymer-modified HMA
 - Greater heat during production
 - Elevated mix temperature at the project site - max. 350°F
 - Sufficiently hot to compact
 - Not so hot so as to cause binder draindown
 - At least 290°F at time of compaction when placed as HMA
 - Has been successfully manufactured as **WMA**

Manufacturing and Placement

Placing *Smoothseal*

- ▣ Heightened attention to factors affecting pavement smoothness
- ▣ Uniformity in production, temperature, mix delivery, head of material before screed, and compaction all become critically important
- ▣ Handling and raking should be minimized... very, very sticky mix!
- ▣ Avoid feathering
- ▣ Butt joints are preferred

Manufacturing and Placement

Ensuring a Successful *Smoothseal* Job

- ▣ Place material on clean and dry pavement.
- ▣ Place material on pavement having a minimum 60°F surface temperature.
- ▣ Ensure uniform application of tack coat (polymer modified tack not essential).
- ▣ Do not use pneumatic tire rollers.
- ▣ Construct hot longitudinal joints or seal cold joints with bituminous material thoroughly coating the vertical face without runoff.

Economics

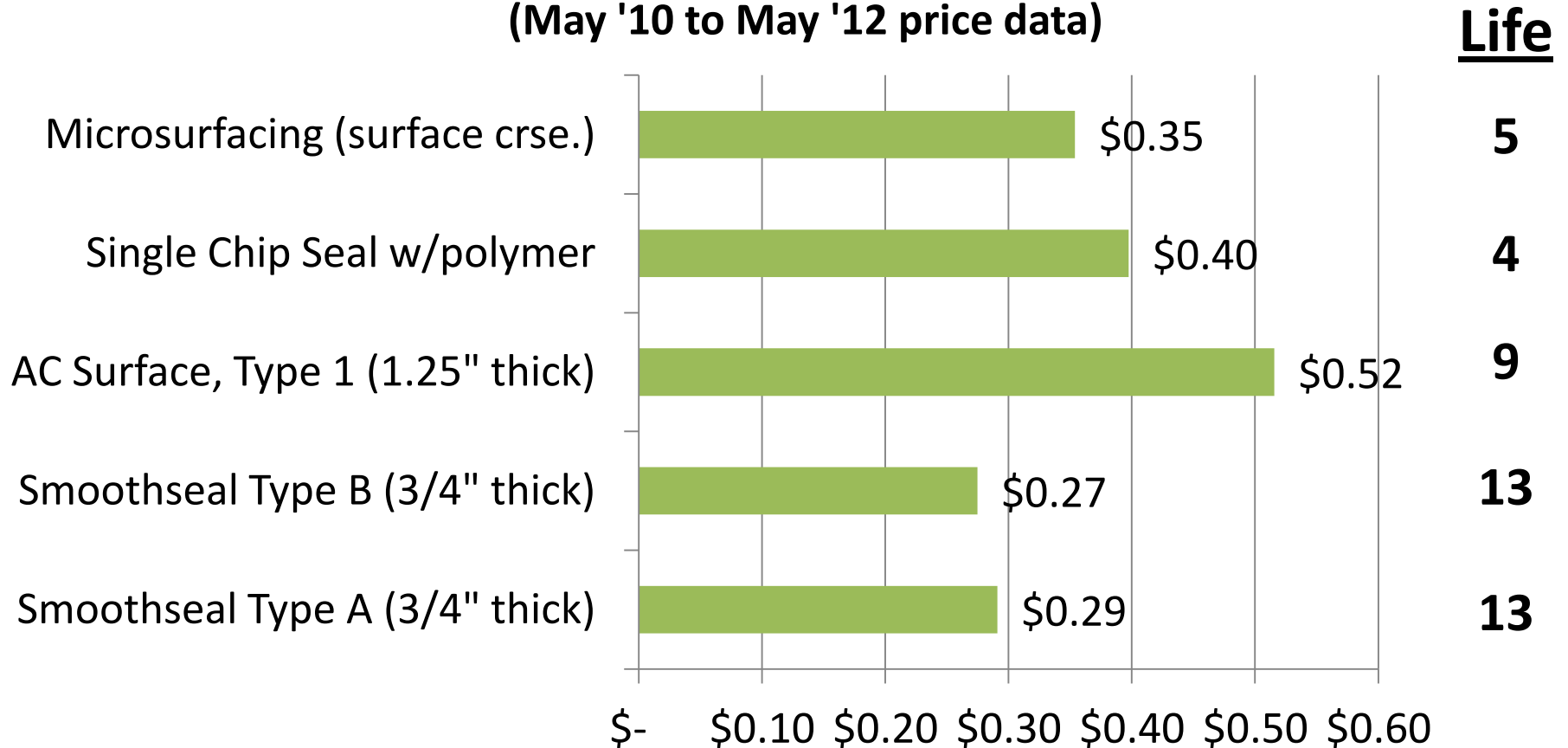
Economics

Annualized Cost per SY (OHIO)

- no discount -

(Based on Ave. Years Between Treatment)

(May '10 to May '12 price data)



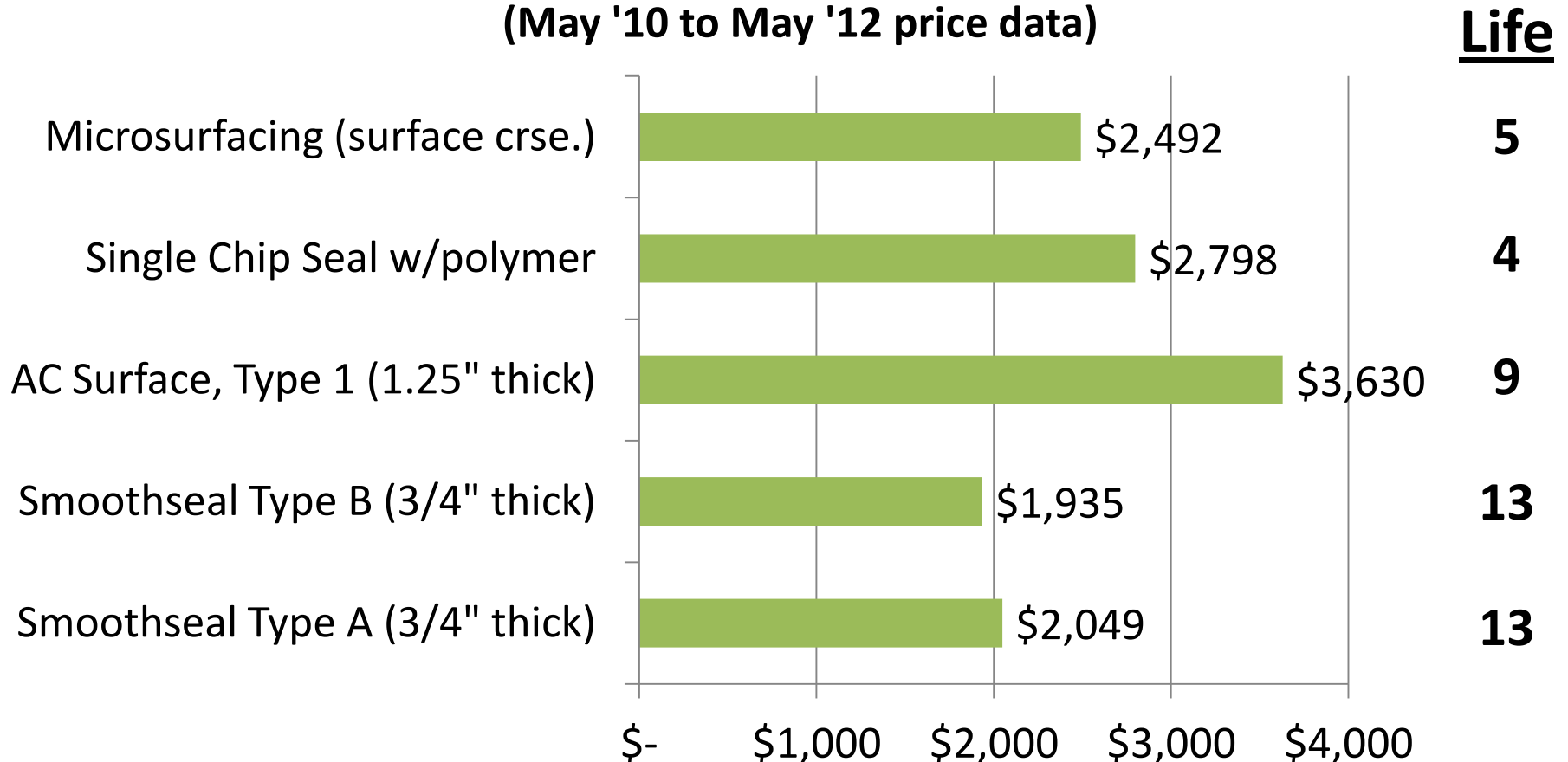
Economics

Annualized Cost per Lane Mile (OHIO)

- no discount -

(Based on Ave. Years Between Treatment)

(May '10 to May '12 price data)



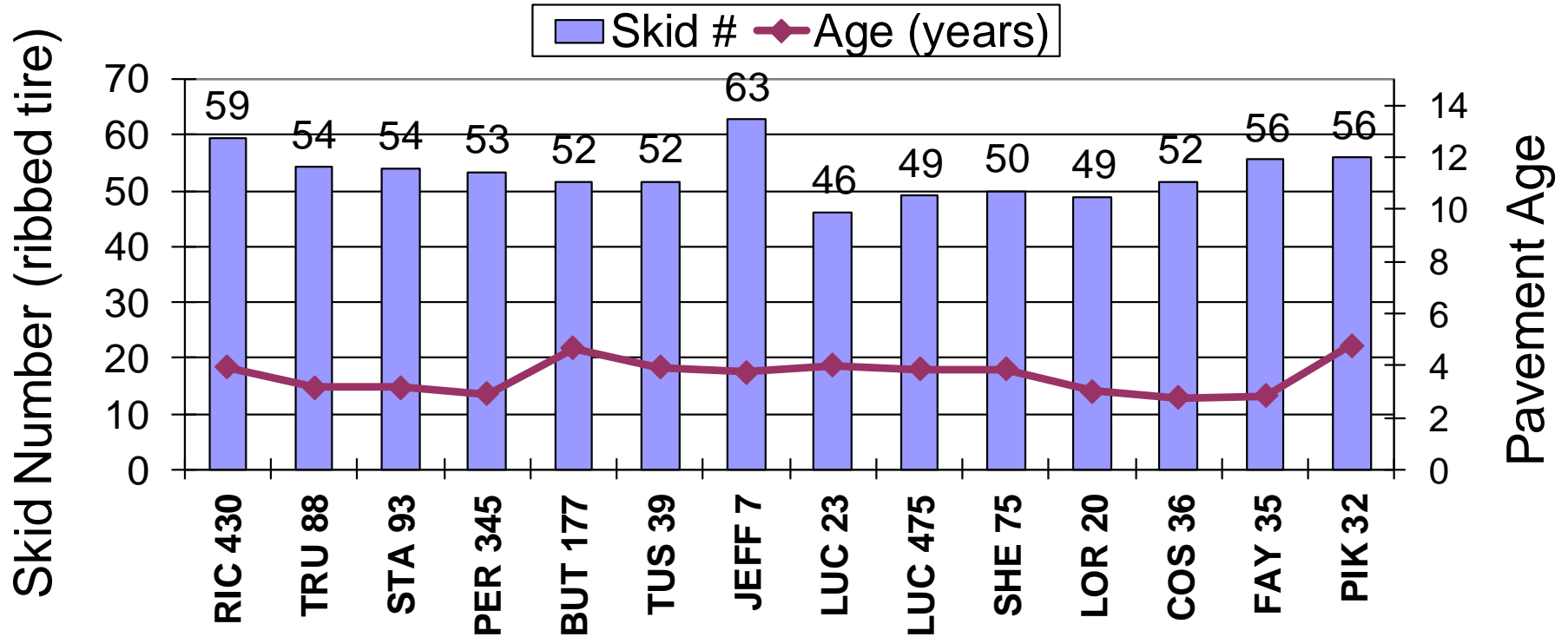
Assessing Value

Assessing Value

	Smoothseal	Microsurfacing	Chip Seals
Corrects surface distress	✓	✓	✓
Increases skid resistance	✓	✓	✓
Minimizes curb loss	✓	✓	✓
Eliminates dust and loose aggregate	✓	✓	
Corrects minor rutting	✓	✓	
Increases structural strength	✓		
Improves pavement drainage	✓		
Improves ride quality and driver safety	✓		

Assessing Value

Item 424, Type B (Smoothseal)



Assessing Value

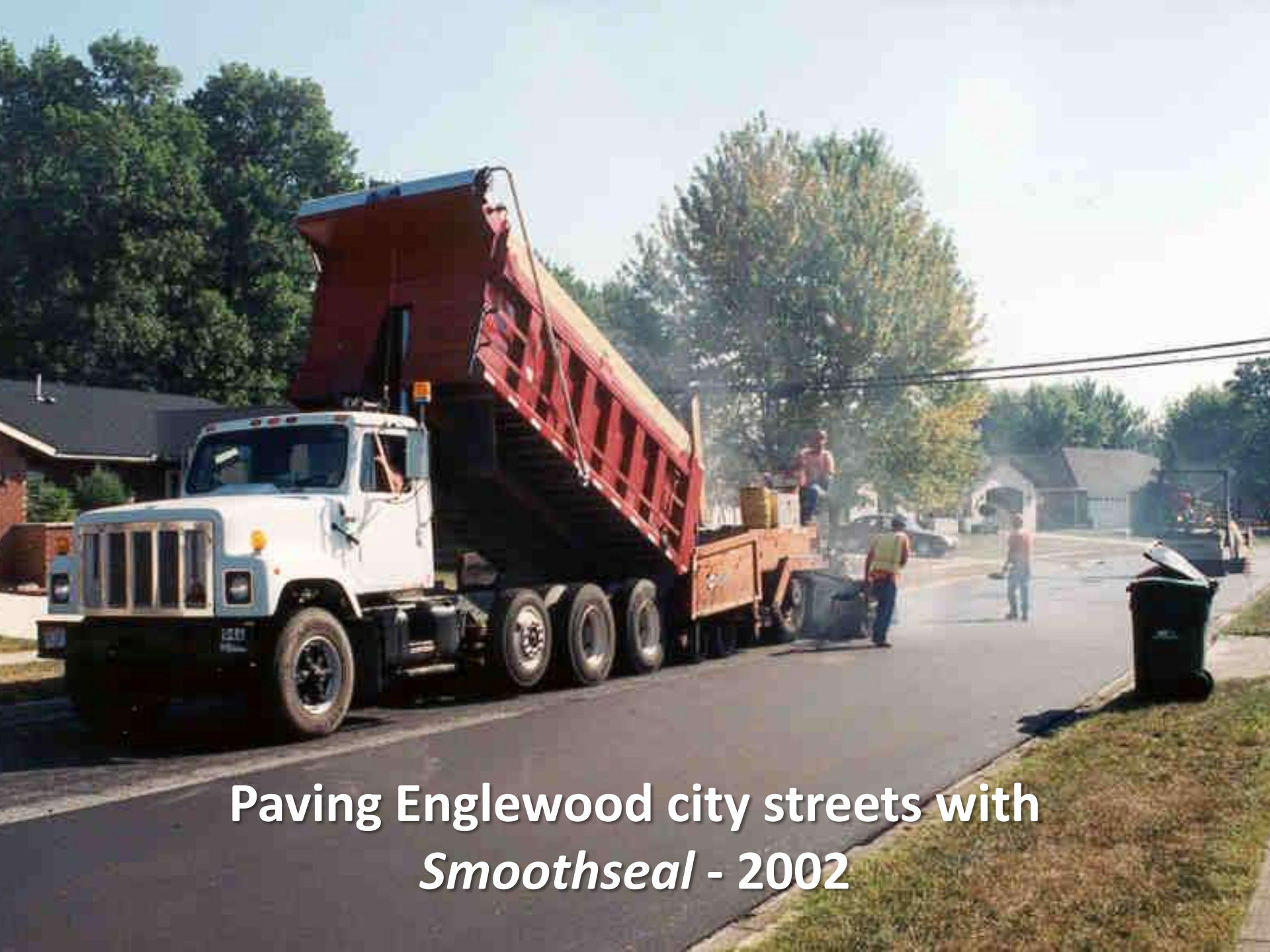
Rutting Study of 854 Type B Mixes (Smoothseal Ty B)

Mix ID	470	379	153	471
Design Type	Heavy	Medium	Heavy	Heavy
Binder Content (%)	6.9	7.9	6.9	6.9
Nat Sand (%)	30	40	45	15
Deformation (mm) @130F	3.2	7.2	1.9	1.0
Deformation (mm) @140F	4.1	12.2	3.0	2.1
Deformation (mm) @150F	4.6	8.8	4.0	2.8

Notes:

- Use 5 mm for limit on typical test for Design Type Heavy - dense grade mix
- Test duration: 8,000 cycles using GaDoT device
- All designs use PG76-22 modified with SBS

Typical Applications



Paving Englewood city streets with
Smoothseal - 2002



Smoothsealing SR82 in Cuyahoga
County

A photograph of a paved bike path stretching into the distance. The path is dark and smooth, flanked by green grass and dense bushes. A utility pole stands on the right side of the path. The sky is overcast.

North Coast Inland Bike Path
Paved with *Smoothseal*, Type A



IR 675 Montgomery
County –
Smoothseal, Type B

References

Economics / Pavement Life

- Effectiveness of Chip Sealing and Micro Surfacing on Pavement Serviceability and Life, Arudi Rajagopal, Ph. D., INFRAME, May 2010
- Preventive Maintenance Process Analysis, Draft Final Report, Hein, et al, Applied Research Associates, Inc., February 2007
- Evaluation of the Variation in Pavement Performance Between Districts, Dr. Eddie Chou, et al, University of Toledo, November 2004



An association for the development, improvement and advancement of quality asphalt pavement construction.

Questions ?

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Asphalt ... Defining Value !
Safe, Smooth and Sustainable