Ultra-Thin Overlays:

"*Ohio's* Smoothseal"

Cliff Ursich, PE
Flexible Pavements of Ohio

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

Product Development

Product Development - 1991

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

Product Development - 1991

Where do we start? Guidance was found from…

- City of Rockville, Maryland, pavement maintenance contract… **"SMOOTHSEAL PAVEMENTS FOR VARIOUS STREETS"**
  - A systematic approach to pavement maintenance,
  - Facilitated preventive maintenance planning,
  - Took advantage of asphalt's attributes of restoring smoothness and speedy construction.

Product Development - 1991

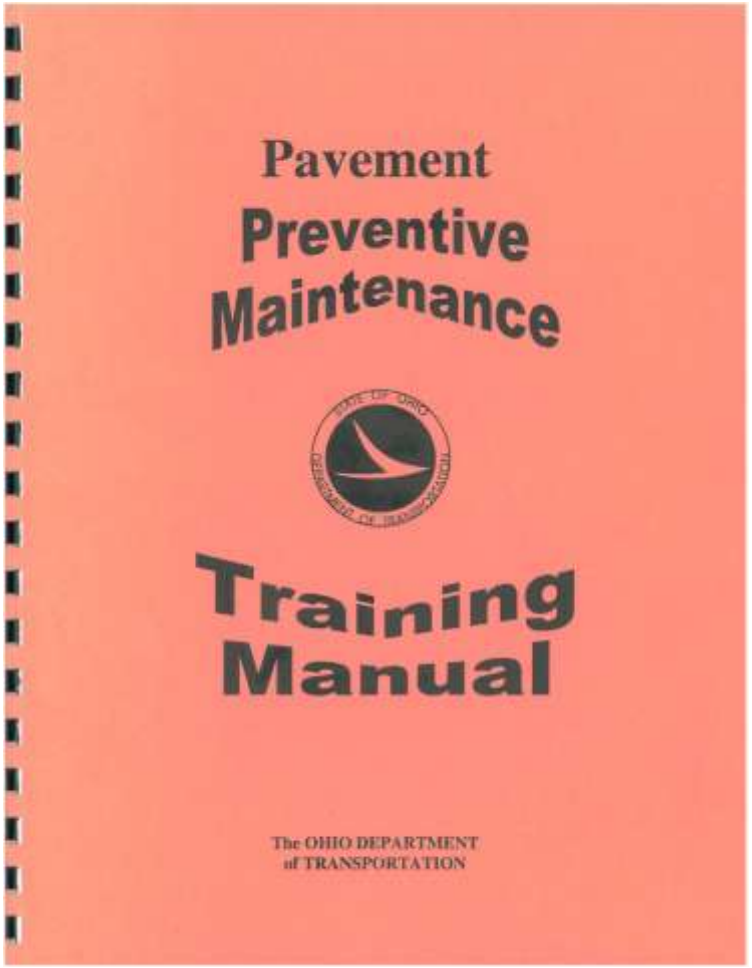
- Gradation and binder type of ODOT's microsurfacing specification served as the launching point for development.
- Marshall Method used for mix design.
- Sought to design a specification that would result in mixes rich in binder and volumetrics that would ensure good durability - Latex was also added for this purpose.
- Performance tests were not available so partnering with the Ohio DoT a test project was constructed.

Experimental Project - 1992


Experimental Project – Smoothseal
Placed 1993 on Logan Co., SR 508

Product Development - 2002

- FHWA PM initiative invigorates interest in preventive maintenance.
- Thin-lift asphalt surfacings are included in ODOT's catalog of PM treatment options



Product Development – 2005-12

- Smoothseal is accepted as a standard specification and renamed as Item 424, Fine Graded Polymer Asphalt Concrete.
  - For use as a pavement preservation (PM) treatment.
  - 2012 experimental project let to contract wherein Item 424 is being utilized as the wearing course in new construction.

Material Characterization

Material Characterization

Item 424, Mix Types

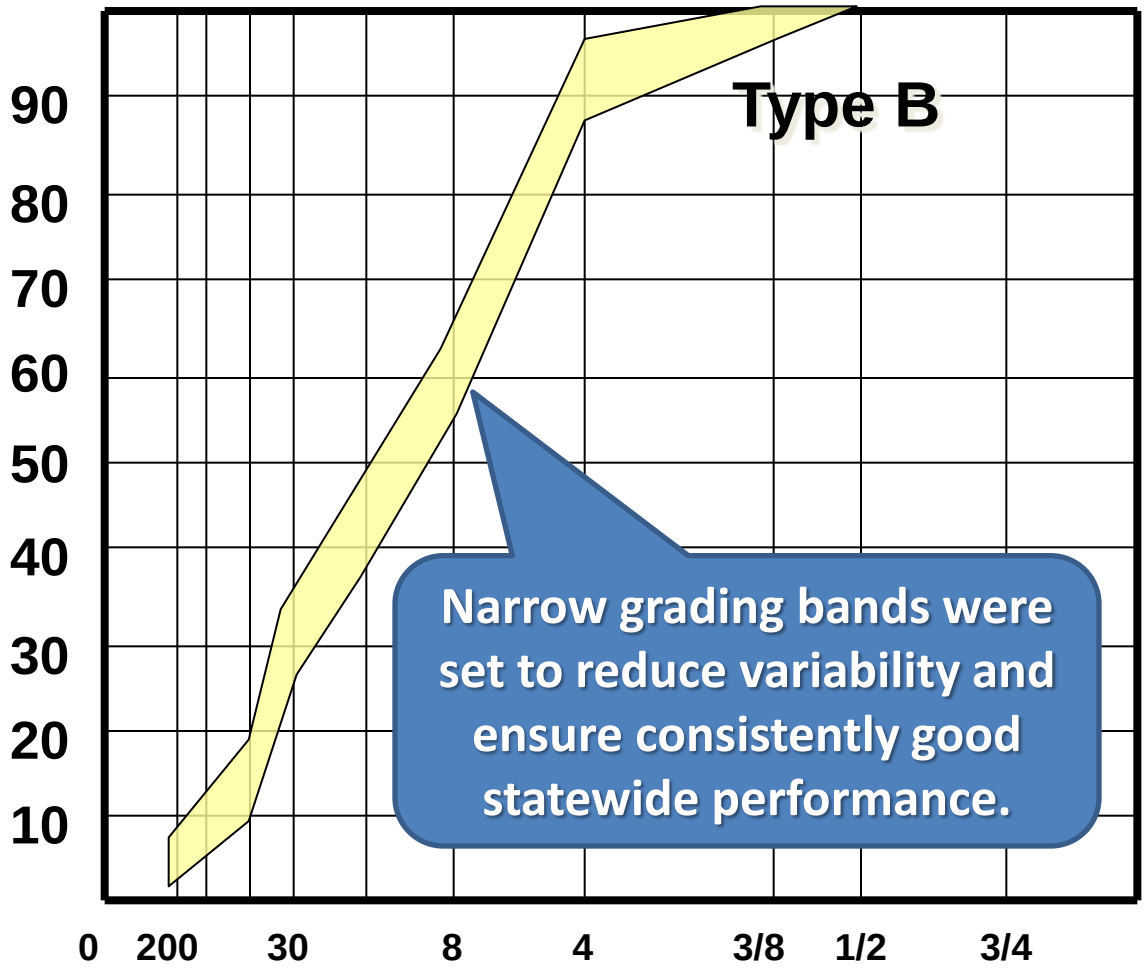
- ⊡ Type A
  - Mix Design – Recipe mix (all traffic types – light, medium, heavy applications)
- ⊡ Type B (*Smoothseal*)
  - Mix Design – Volumetric mix design using Marshall Method (light, medium or heavy traffic pavements)

Material Characterization

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, GTR, Elvaloy) 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

OHIO “SMOOTHSEAL”, TYPE B

Fine Texture and
Low Permeability

Candidate Projects

Candidate Projects

⊡ 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

Candidate Projects

⊡ Description of Candidate Projects

- Candidate pavements will have...
  - No unrepaired structural (fatigue) damage
  - No appreciable rutting (< ¼ 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.

Thickness Guidelines

Overlay Thickness Guidelines

Placement Thickness (compacted)

- **Type A mix**

  5/8” ≤ thickness ≤ 3/4”

- **Type B mix**

  3/4” ≤ thickness ≤ 1”

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. 350ºF
    - Sufficiently hot to compact
    - Not so hot so as to cause binder draindown
    - At least 290^{o}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

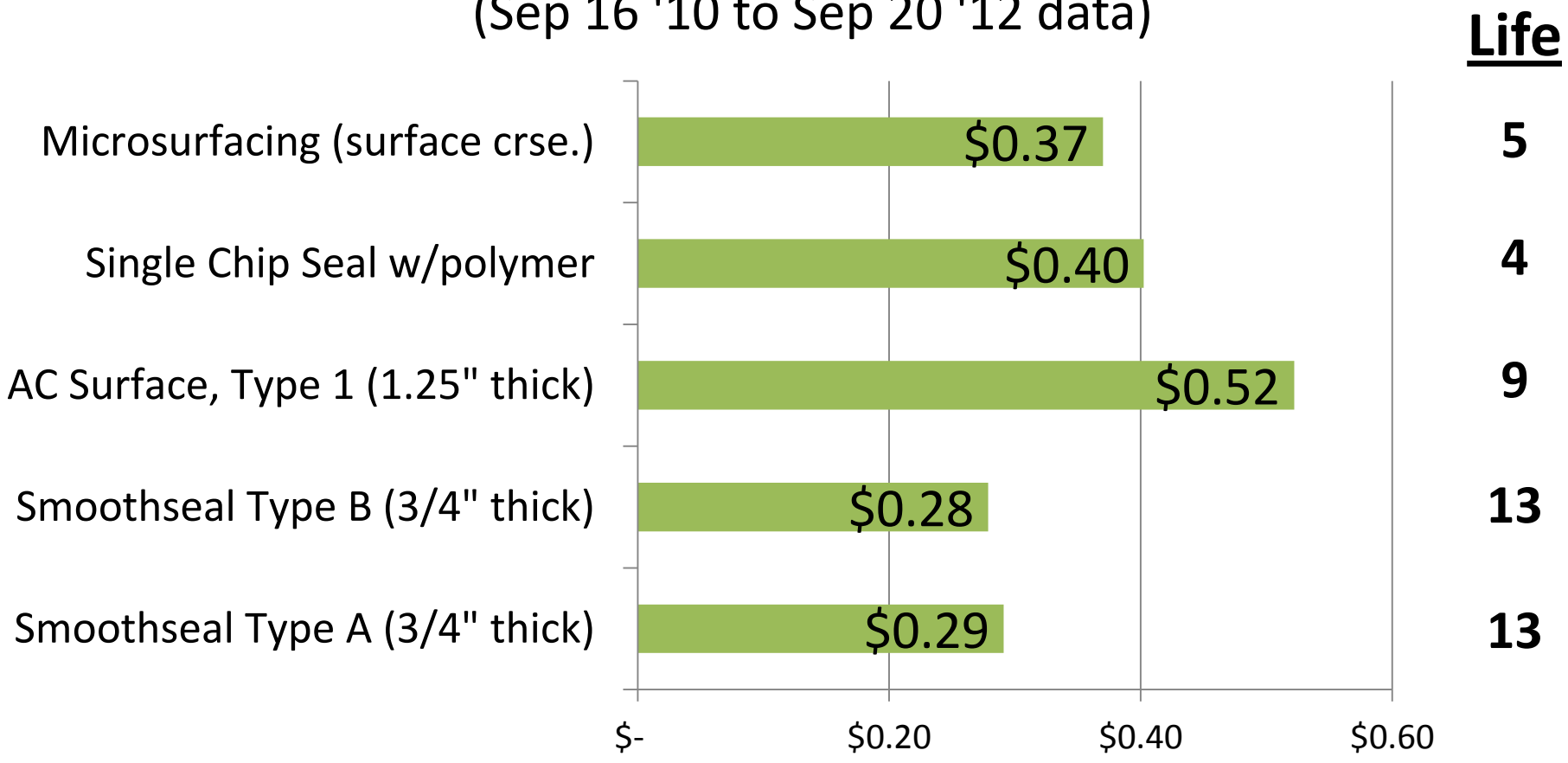
Economics

Annualized Cost per SY (OHIO data)

- no discount -

(Based on Ave. Years Between Treatment)

(Sep 16 '10 to Sep 20 '12 data)



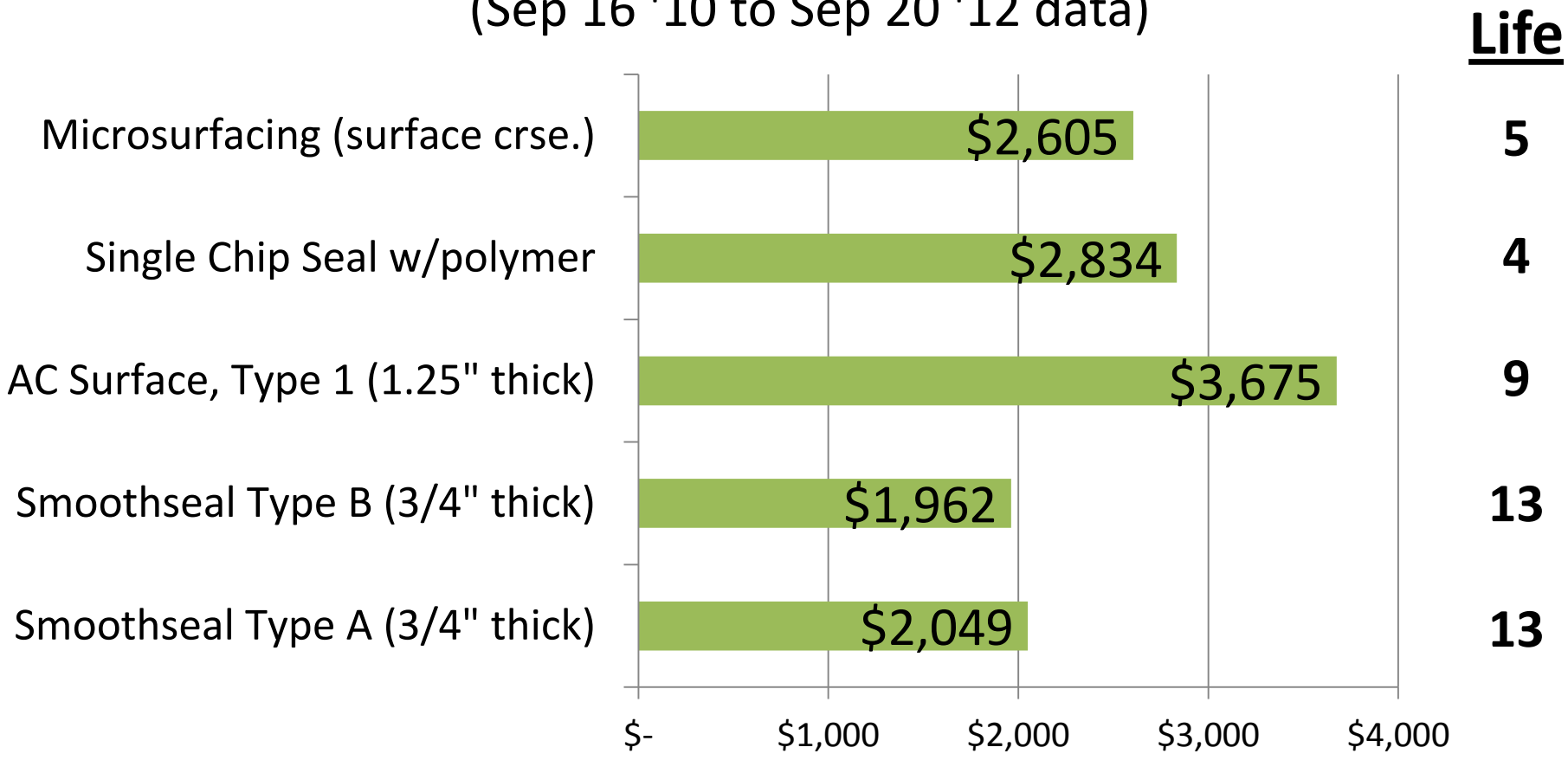
Economics

Annualized Cost per Lane Mile (OHIO data)

- no discount -

(Based on Ave. Years Between Treatment)

(Sep 16 '10 to Sep 20 '12 data)

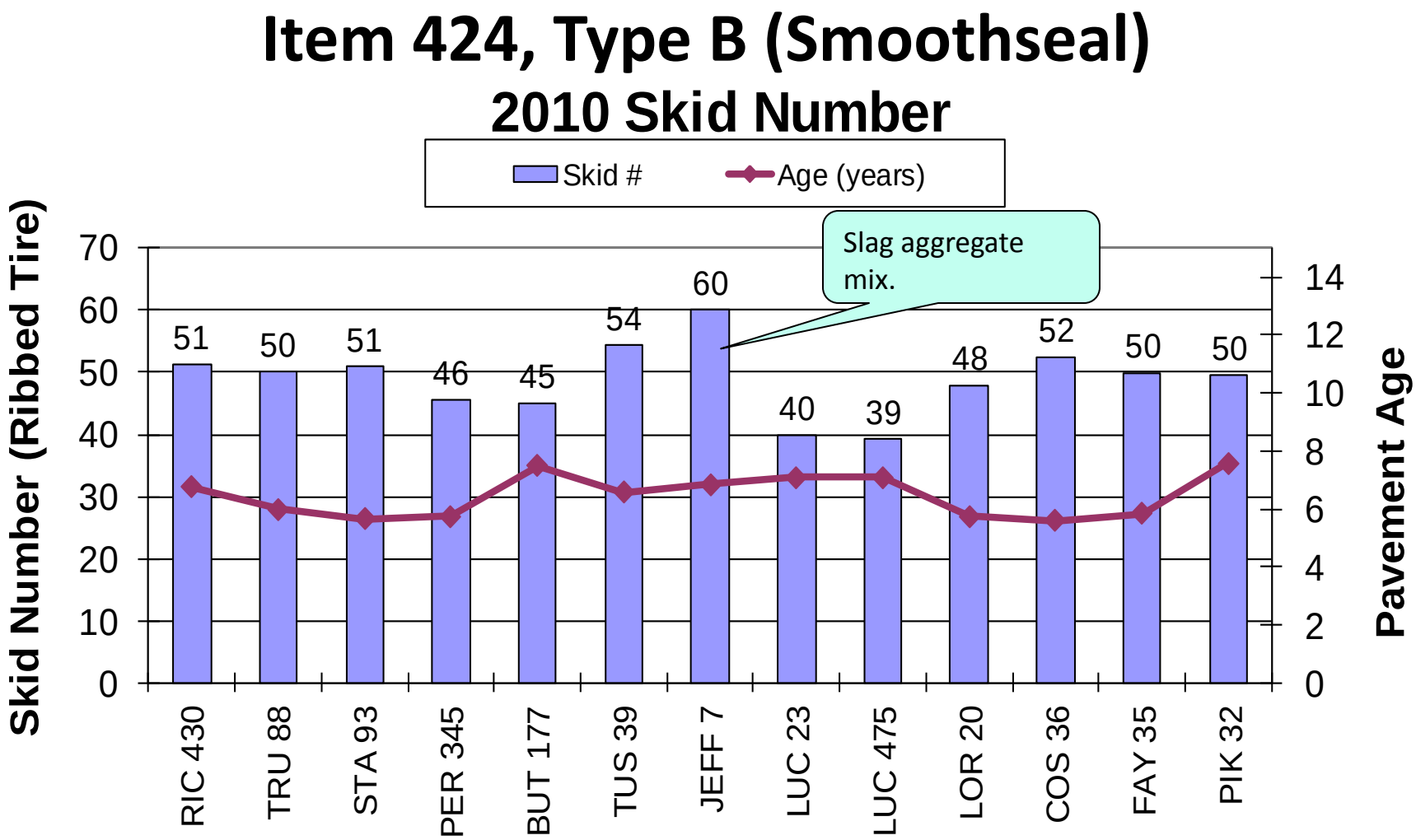


Assessing Value

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



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

Application: RURAL

Logan County, State Route 508 - 1993
Paved with *Smoothseal*, Type B

Application: RESIDENTIAL

Paving Englewood city streets with *Smoothseal* - 2002

Application: URBAN

Smoothsealing SR82 in Cuyahoga County

Application:

ALTERNATIVE TRANSPORTATION / RECREATIONAL

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

Application: HIGH-TYPE

IR 70 Franklin County – 2006

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

Flexible Pavements of Ohio

1962 50th ANNIVERSARY 2012

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

Thank you !

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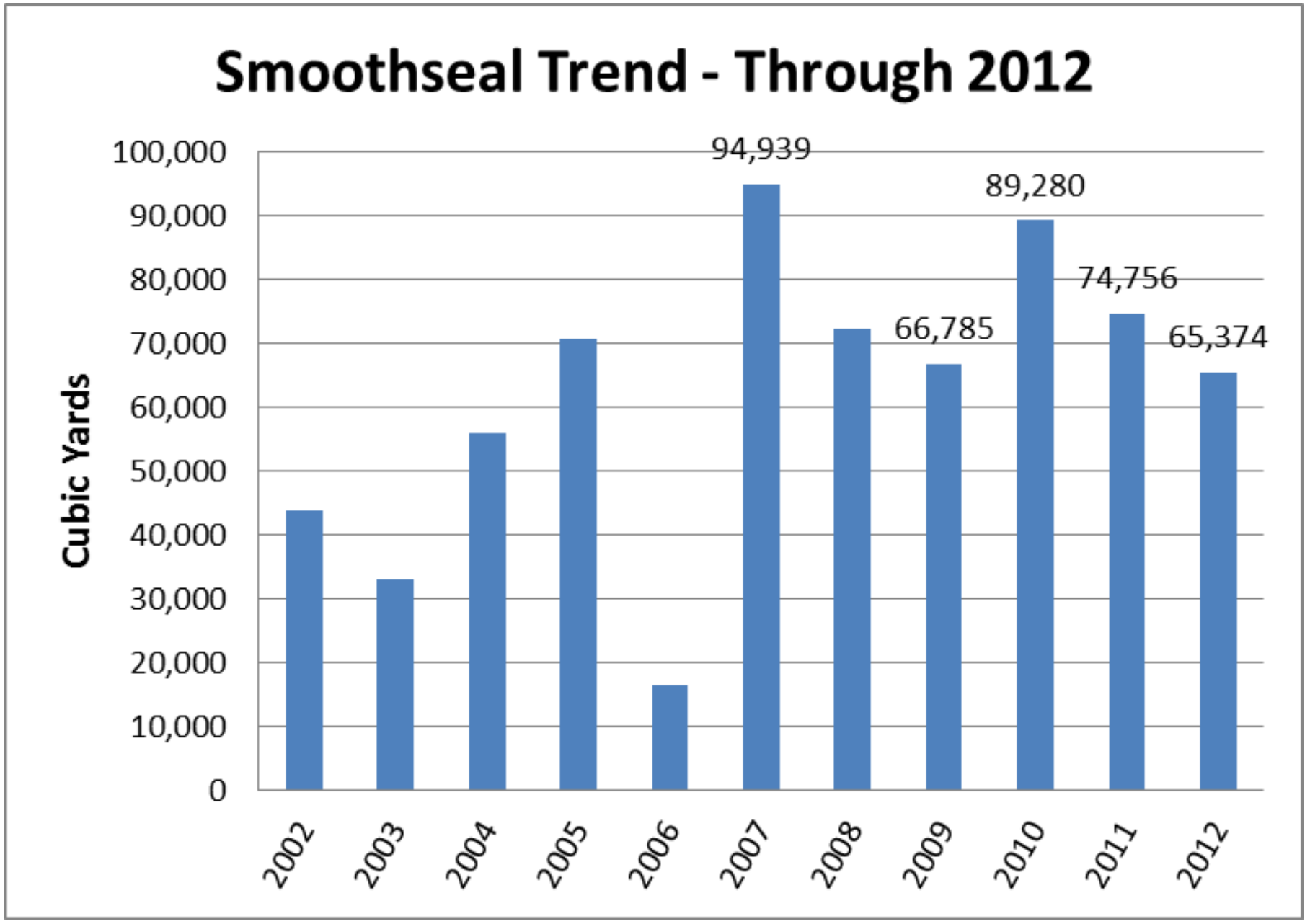
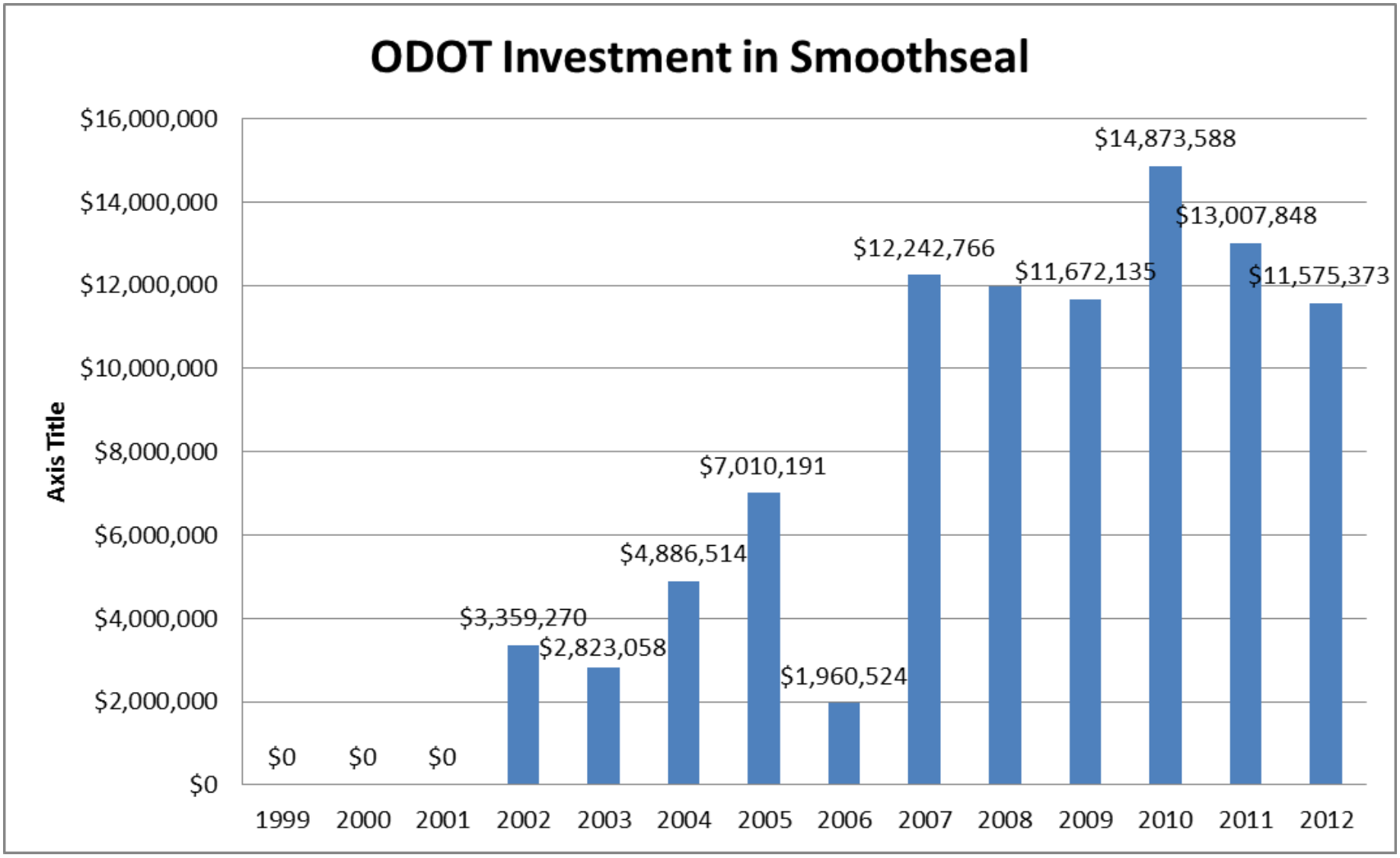

Smoothseal Trend - Through 2012
Cubic Yards
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
94,939
89,280
74,756
66,785
65,374
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012


ODOT Investment in Smoothseal
Axis Title
$16,000,000
$14,000,000
$12,000,000
$10,000,000
$8,000,000
$6,000,000
$4,000,000
$2,000,000
$0
$0
$0
$0
$3,359,270
$2,823,058
$4,886,514
$7,010,191
$1,960,524
$12,242,766
$11,672,135
$14,873,588
$13,007,848
$11,575,373
1999
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