

Kentucky's Experience with Pavement Warranties, Bidding Alternative Pavement Design and Long Life Pavements

2003 Southeast Pavement Management Conference

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Bidding Warranties

Pros:

- Encourage A Consistent Level of Workmanship
- Encourage Consistent Level of Service
- Encourage Contractor Innovation
- Distribution of Risk

• Cons:

- Administrative Issues
- Bonding
- Thresholds/Background data
- Distribution of risk

Types of Contracts

- Bidding Alternate Pavement Type With Warranties
- Pavement Warranties Without Bidding Alternate Pavement Types
- Incentives/Disincentives
- Fixed Completion Date

Bidding Alternate Pavement Types – Why?

- No Significant Engineering Factors Favoring One Pavement Type Over Another
- Life Cycle Cost Analysis
“Too Close To Call”
- Stimulate Competition

Bidding Alternate Pavement Types With Warranties

- Functional Equivalence Among Alternatives

Difference Between Functional and Structural Equivalence

- Pavement Designs are said to be “Structurally Equivalent” if they can accommodate the same number of axle load applications.
- Pavement Designs are said to be “Functionally Equivalent” if they provide the same intended purpose at the same level of service.

Example of Functional Equivalence

- In terms of pavement ride quality (RI, IRI, etc.) two pavement designs would be considered functionally equivalent if it could be demonstrated that the change in ride quality over time would be the same for both pavements.
- Similar examples for other distress modes.

Warranty Parameters

- Contractor Responsible for Mix Design
- Contractor Will Develop a QC Plan
- Contractor Permitted to Enhance Structural Design
- Initial and Annual Distress Identification
- Joint Review Team
- Traffic Monitoring Program

Contract Bidding Innovations Recent Kentucky Experience

Evaluation of Bids

- Low Bid – “A”
- Low Bid – “A+B”
- Low Bid – “A+B-C”
- Low Bid – “A-C”

A = Cost for Materials and Labor (\$)

B = Value of Time to Completion (Days x \$/day)

– Contractor Defines Days (Or Hours)

– Agency Defines Value of Time Increment (\$/Day, \$/hour, etc.)

C = Value of Warranty (\$/Year of Warranty)

Bidding Alternate Pavement Types With Warranties

- A+B-C
- A-C
- Variable Warranty Period
 - 5 Years Required
 - 5,6,7,8,9, or 10 Year Optional
- “C” – Credit For Extended Optional Warranty
- 2 Projects Awarded

Pavement Warranties Without Bidding Alternate Pavement Type

- Fixed Warranty Period - - 10 years
- Project Not Awarded

Incentives/Disincentives

- A+B
- Fixed Completion Date
- A+B-C

Incentives/Disincentives

- A+B Bidding
- "A" – Cost of Materials and Labor
- "B" – Value of Time to Completion
(Days x \$/Day)
- Numerous Projects

Incentives/Disincentives Fixed Completion Dates

- Specified Completion Date
- Incentive (\$/Day) for Early Completion
- Disincentive (\$/Day) for Late Completion
- Incentive/Disincentive for Intermediate Contract Phases
- Numerous Projects Without Warranties

Incentives/Disincentives

A+B Bidding with fixed completion date

- "A" – Cost of Materials and Labor
- Modified "B" – Value of Time to Completion
- One Project Awarded

Incentives/Disincentives with Warranty

A+B-C

- "A" – Cost for Materials and Labor
- "B" – Value of Time to Completion
(Days x \$/Day)
- "C" – Value of Warranty

One Project Awarded

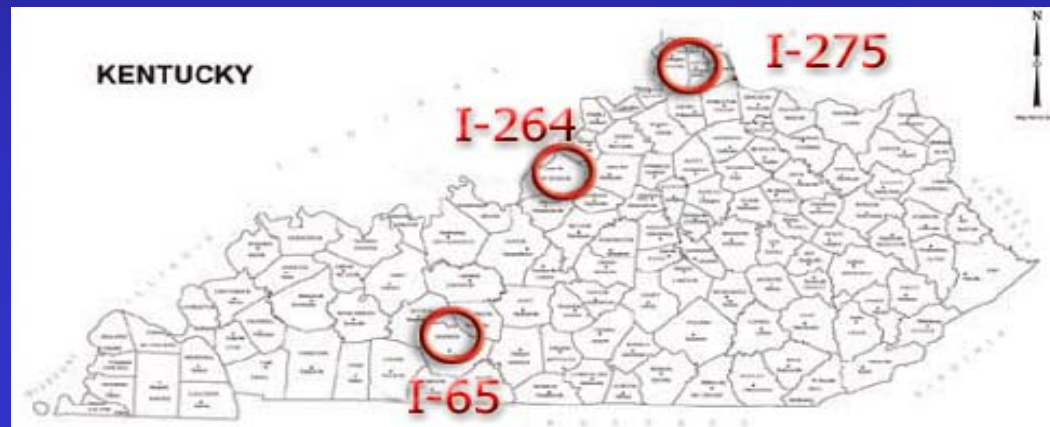
Example Projects

WARRANTY PROJECTS

- I-275 Northern Kentucky
 - A+B-C Bidding
- I-65 South-Central Kentucky
 - A-C Bidding

OTHER INNOVATIVE CONTRACTING

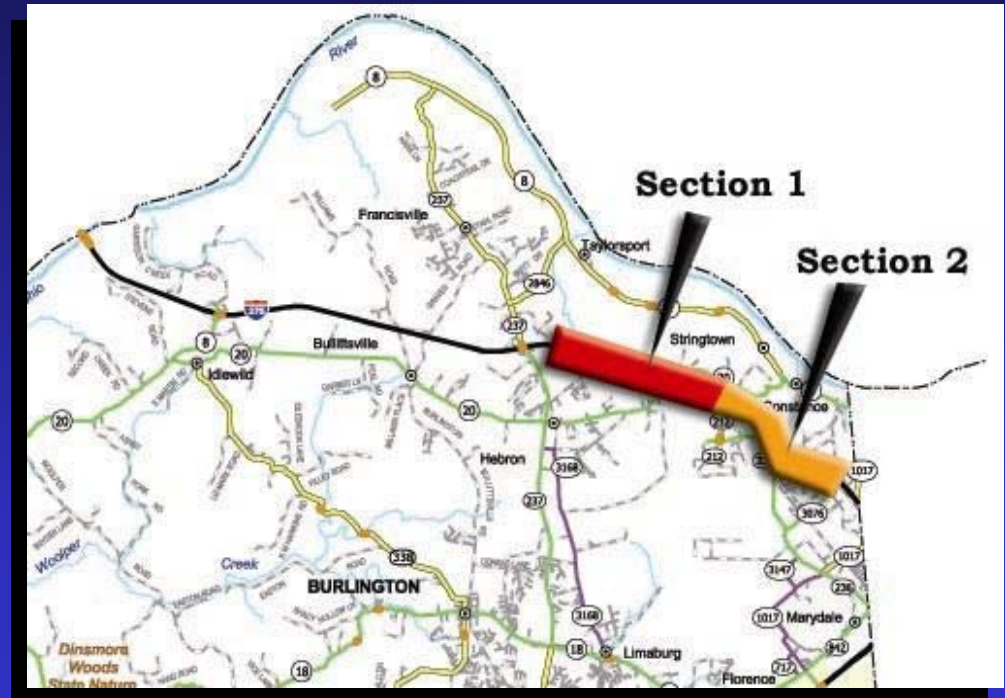
- I-264 Louisville
 - A+B Bidding with fixed completion date



I-275 Northern Kentucky Pavement Rehabilitation

A+B-C Bidding

- Initial Construction
 - MP 1.05 - 4.06 -- 1973
 - MP 4.06 - 7.15 -- 1977
- Current Traffic Levels
 - 39,200 -- 76,000, AADT, year 1999
 - 11% Trucks;
 - 10,700,000 -- 21,000,000 ESALs @ 20 Years
- Existing Pavement Structure
 - 11" PCC
 - 6" DGA



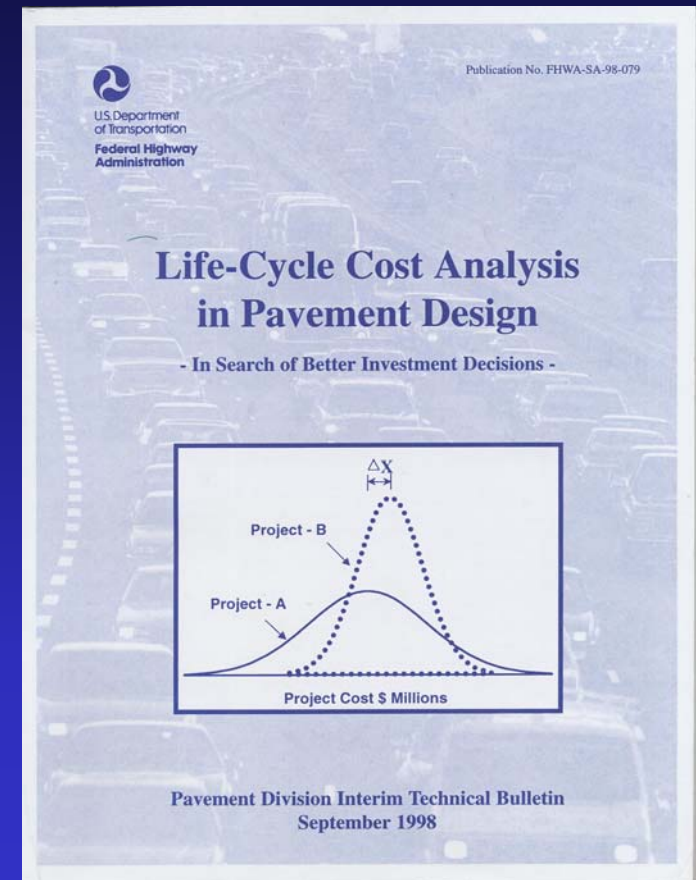
I-275 Northern Kentucky Pavement Rehabilitation

- Alternate Pavement Designs Considered
 - Unbonded PCC Overlay
 - 10 Inches Section 1
 - 9 Inches Section 2
 - Break and Seat and Asphalt Overlay
 - 13 Inches Section 1
 - 12 Inches Section 2
- Life Cycle Cost Analyses Indicated No Definitive Alternative –
“Too Close To Call”



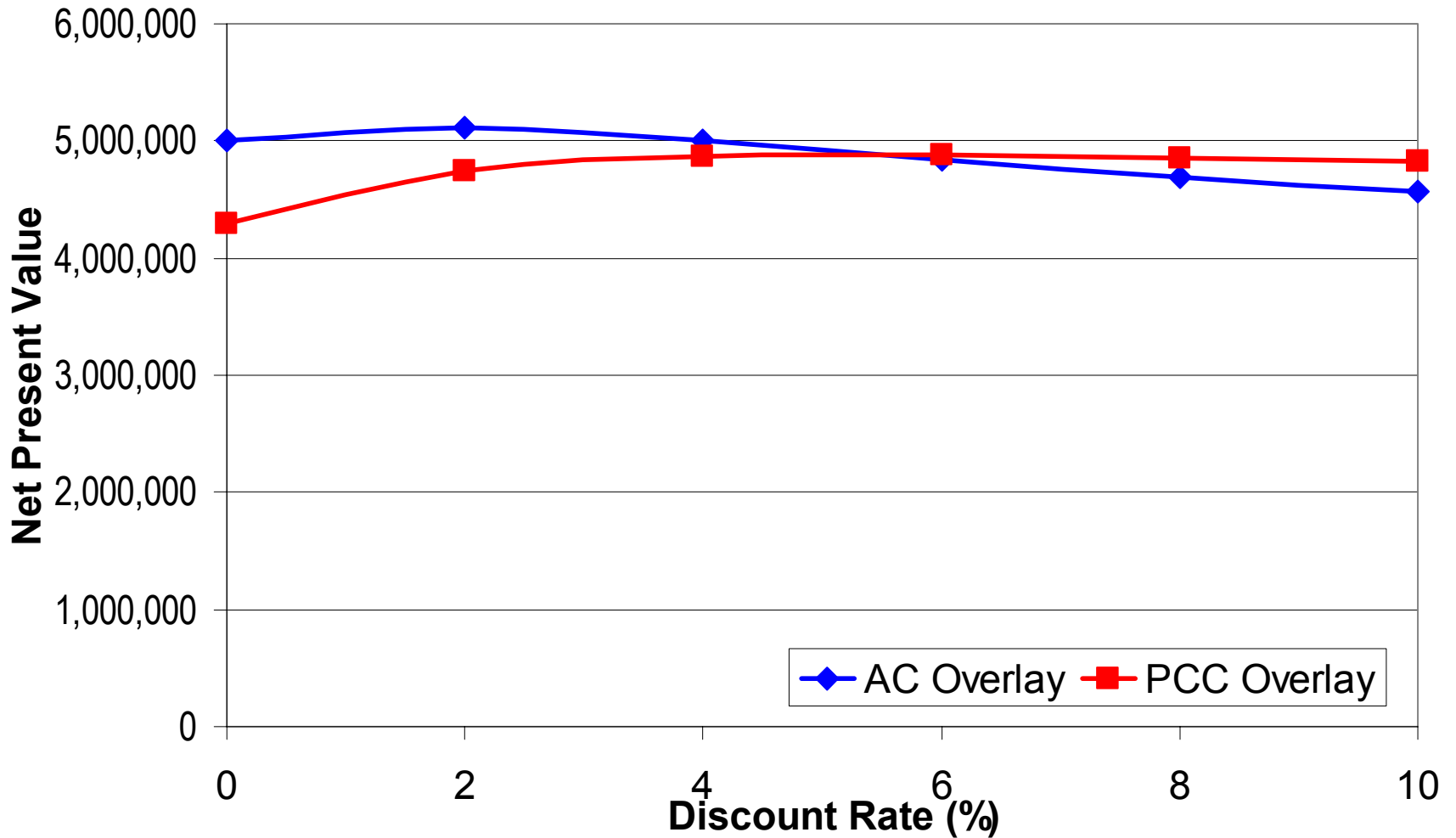
Kentucky LCCA Procedure

- 40-year analysis period
- Historical Average Unit Bid Prices
- User Costs Determined Using FHWA DP-115 Procedures



I-275 Northern Kentucky

MP 1.05 - 4.06



I-275 Northern Kentucky Pavement Rehabilitation

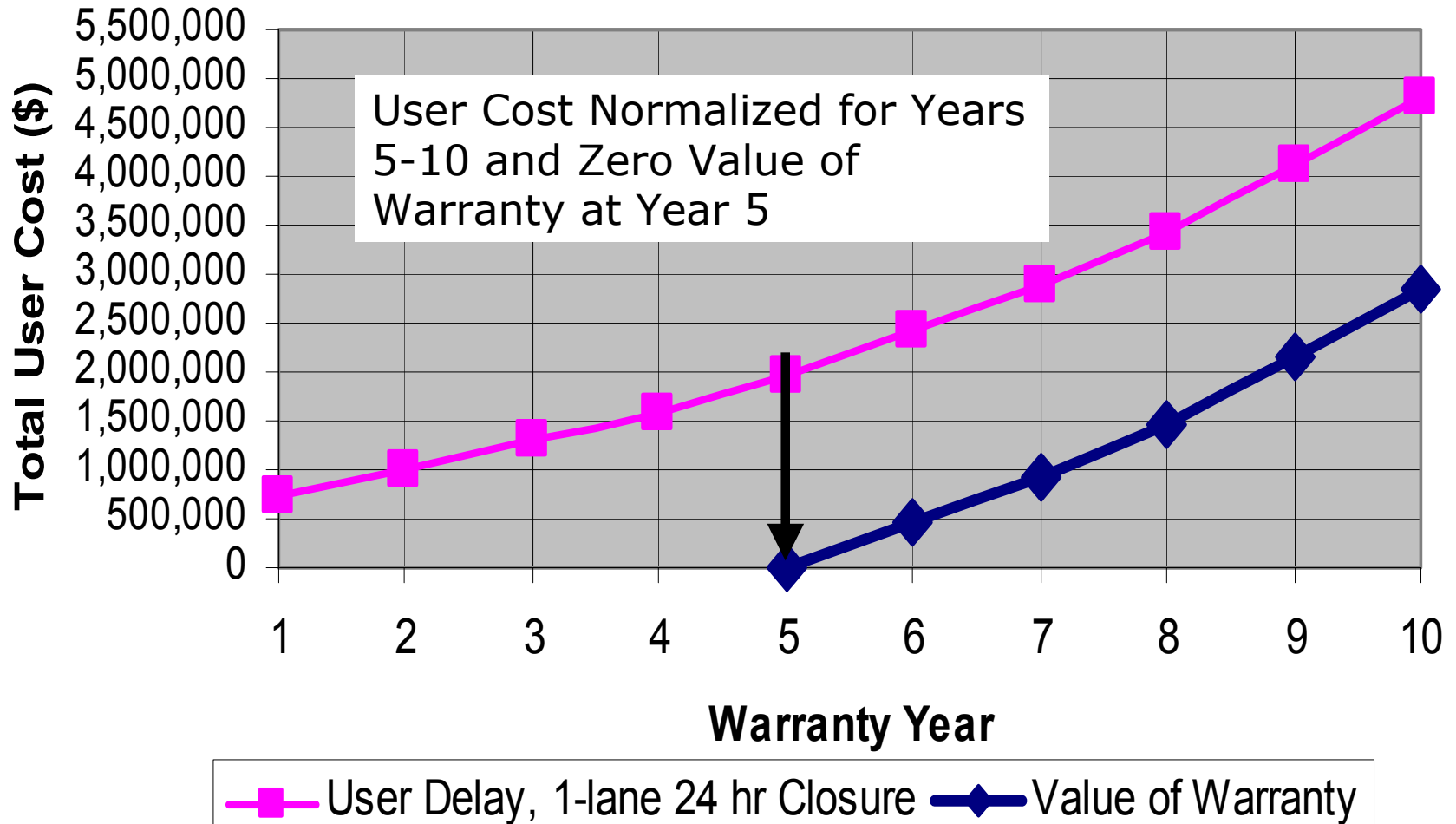
- Warranty
 - 5 Year Fixed Warranty (Required)
 - Optional Warranty (6 -10 Years)
- Incentive/Disincentive
 - \$25,000/day
- “A + B – C” Bidding



I-275 Northern Kentucky Value of Optional Extended Warranty

- Based on the Anticipated Future User Costs for Years 6 - 10
- Warranty Value
 - Year 5 \$0
 - Year 6 \$500,000,
 - Year 7 \$1,000,000,
 - Year 8 \$1,500,000,
 - Year 9 \$2,100,000,
 - Year 10 \$2,900,000.

I-275 Northern Kentucky Determination of Value of Warranty



I-275 Northern Kentucky Results

- Three Bidders
 - Two Bidders for Concrete Alternatives
 - One Bidder for Asphalt Alternative
- All Bid 10-year Warranty
- Successful Bidder 380 days
 - All Others 450 Days
- Project Complete – 194 Days
- Total Incentive -- \$2,900,000



I-65 South Central Kentucky A-C Bidding

- Initial Construction
MP 35.2 – 40.5 1969
- Current Traffic Levels
 - 42,000 2002
 - 36% Trucks; 40,417,000
ESALs @ 20 years
- Existing Pavement Structure
 - 10" PCC
 - 6" DGA



I 65 South Central Kentucky

- Initial Bidding
 - Asphalt Alternate ONLY
 - 10 Year Warranty Required
 - Could Not Be Awarded
- Administrative Decision to Bid Alternatives
- Alternate Pavement Designs
 - Unbonded PCC Overlay – 10 Inches
 - Break and Seat and Asphalt – 11 Inches

I 65 South Central Kentucky

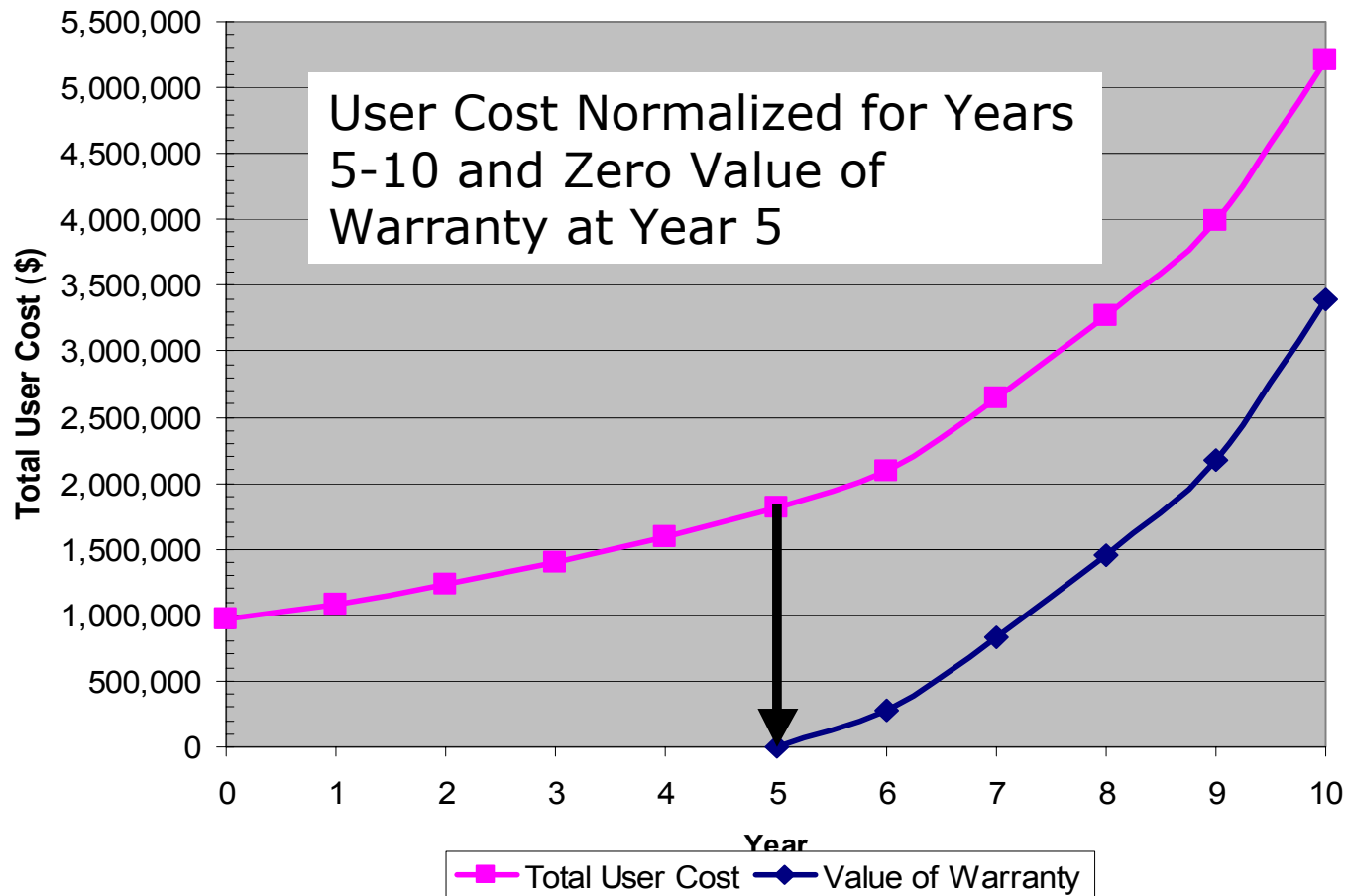
- Warranty
 - 5 Year Fixed Warranty (Required)
 - Optional (6-10 Years)
- Incentive/Disincentive
 - \$10,000/Day
- A-C Bidding

I 65 South Central Kentucky

Value of Optional Extended Warranty

- Based on Anticipated Future User Costs for Years 6-10
- Warranty Value
 - Year 5 \$0
 - Year 6 \$250,000
 - Year 7 \$800,000
 - Year 8 \$1,500,000
 - Year 9 \$2,150,000
 - Year 10 \$3,350,000

I 65 South Central Kentucky Determination of Value of Warranty



I 65 South Central Kentucky Bid Results

- Two Bidders
 - One Concrete Alternative
 - One Asphalt Alternative
- Both Bid 10-year Warranty
- Construction Complete
June 2, 2003, 120 days ahead of
schedule

Kentucky's Experience with other Innovative Contracting

- I-264 in Louisville

I-264 Louisville A+B Bidding



- Initial Construction
1968-1971
- Current Traffic Levels
 - 39,000 to 85,000 (2000 AADT)
 - 12% Trucks; 55,000,000 ESALs @ 40 years
- Existing Pavement Structure
 - 10" PCC
 - 6" DGA

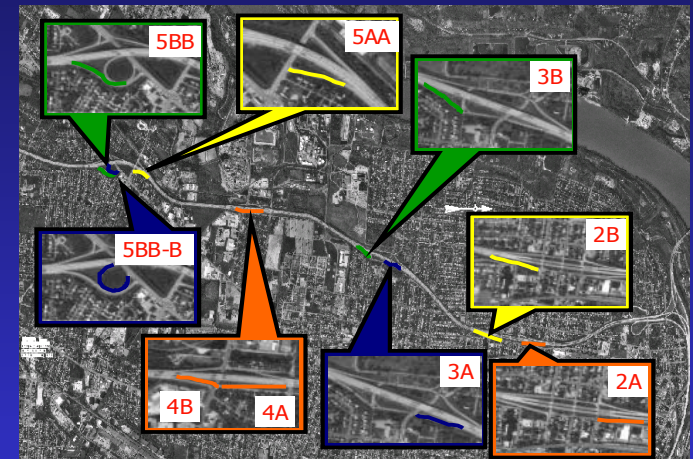


I-264 Louisville

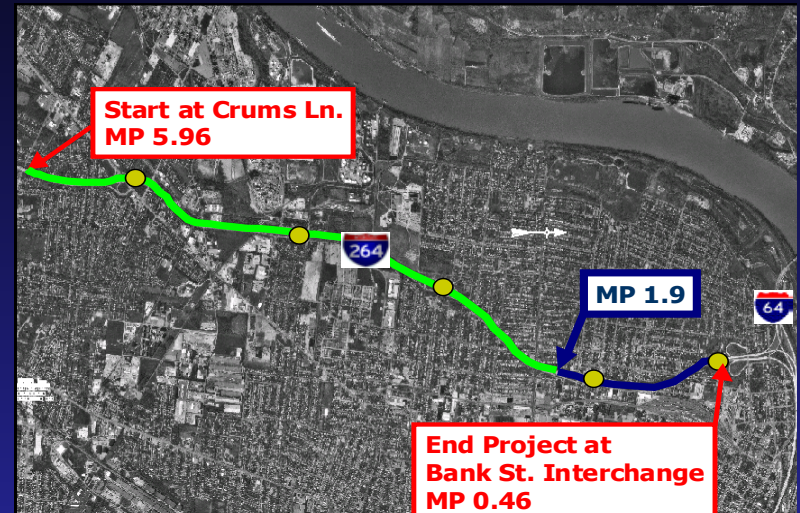
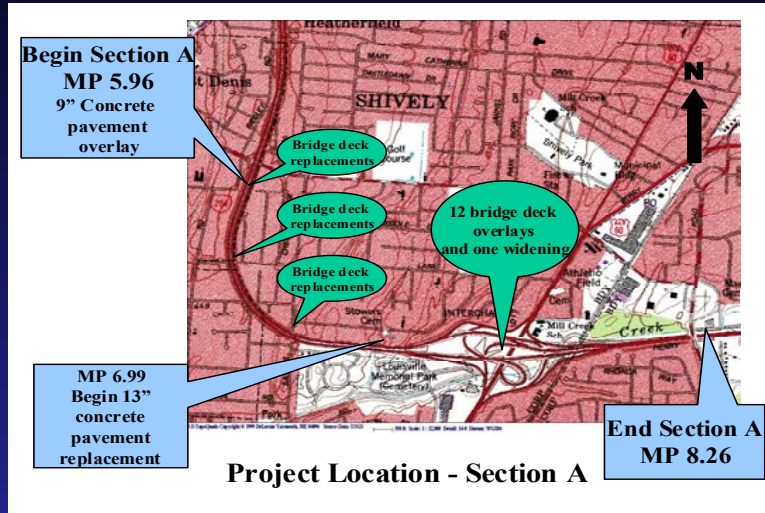


PROJECT SPECIFICS

- Pavement Rehabilitation
- Maintain 2 lanes each direction
- Minimize ramp closures
- Public Awareness Program
 - Coordination with Local Government
 - Media Partner
 - Public Awareness
- Separate Landscaping Contract



Project Specifics (cont.)



- 7.76 Miles of Existing Expressway
- 39 Mainline Bridges
- 5 Interchanges
- Existing 4-Lane MP 0.46 to MP 1.9
(To be widened to 6-Lanes with this project)
- Existing 6-Lane MP 1.9 to MP 8.26
(Pavement Overlay/Replacement)



I-264 Incentive/Disincentive

Incentive = (# Days Bid - # Days Used)*\$25,000
(max. 500 days could be bid)

Disincentives

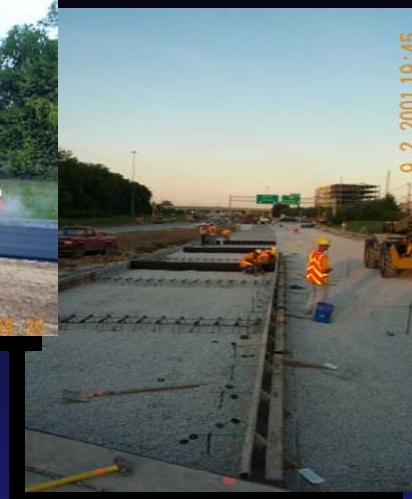
- \$25,000/day after bid calendar days elapses
- \$50,000/day additional after October 1, 2004
- \$25,000/day during Kentucky Derby Events
- Variable disincentives for ramp closures

I-264 Louisville Results

- Five Bidders
- 500 Days Allowed
- Fixed Completion: Oct. 1, 2004
- Successful Bidder: \$66M
 - Others: \$69M-\$76M
- Successful Bidder: 500 days
 - Others: 430, 486 & 500(2)
- Currently Under Construction



**Where Do We Go From
Here?**



Alternate Bidding: Present and Future

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1993 AASHTO Pavement Guide

- Type Selection Guidelines in Appendix B.
- Lists Primary and Secondary factors



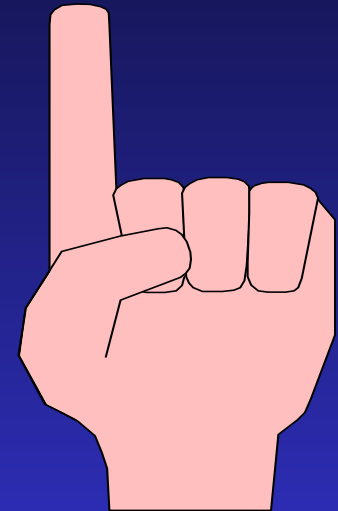
Asphalt



PCC

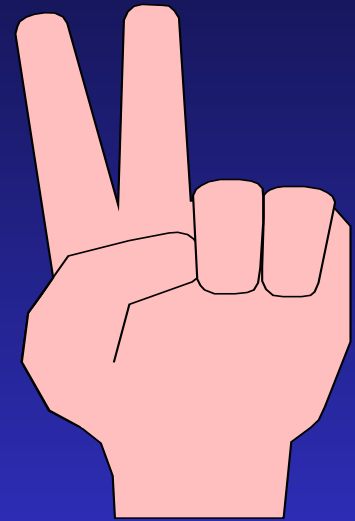
Primary Factors

- Traffic
- Soil Characteristics
- Weather
- Construction Considerations
- Recycling
- Cost Comparison

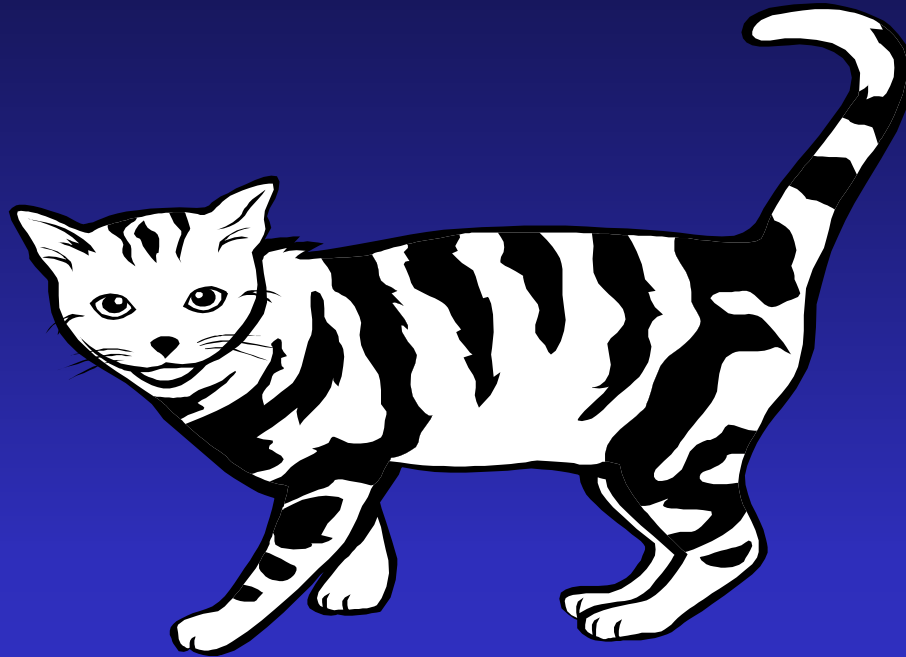


Secondary Factors

- Similar Pavements in the area
- Conservation of Materials
- Contractor Capabilities
- Traffic Safety
- Experimental Features
- Stimulation of Competition
- Municipal Preferences



It's Not Always Black or White



Alternate Bidding Approaches

- Initial Cost Alternative Bidding
- “Optional Bid” (ODOT)
- Others????



Initial Cost Bidding

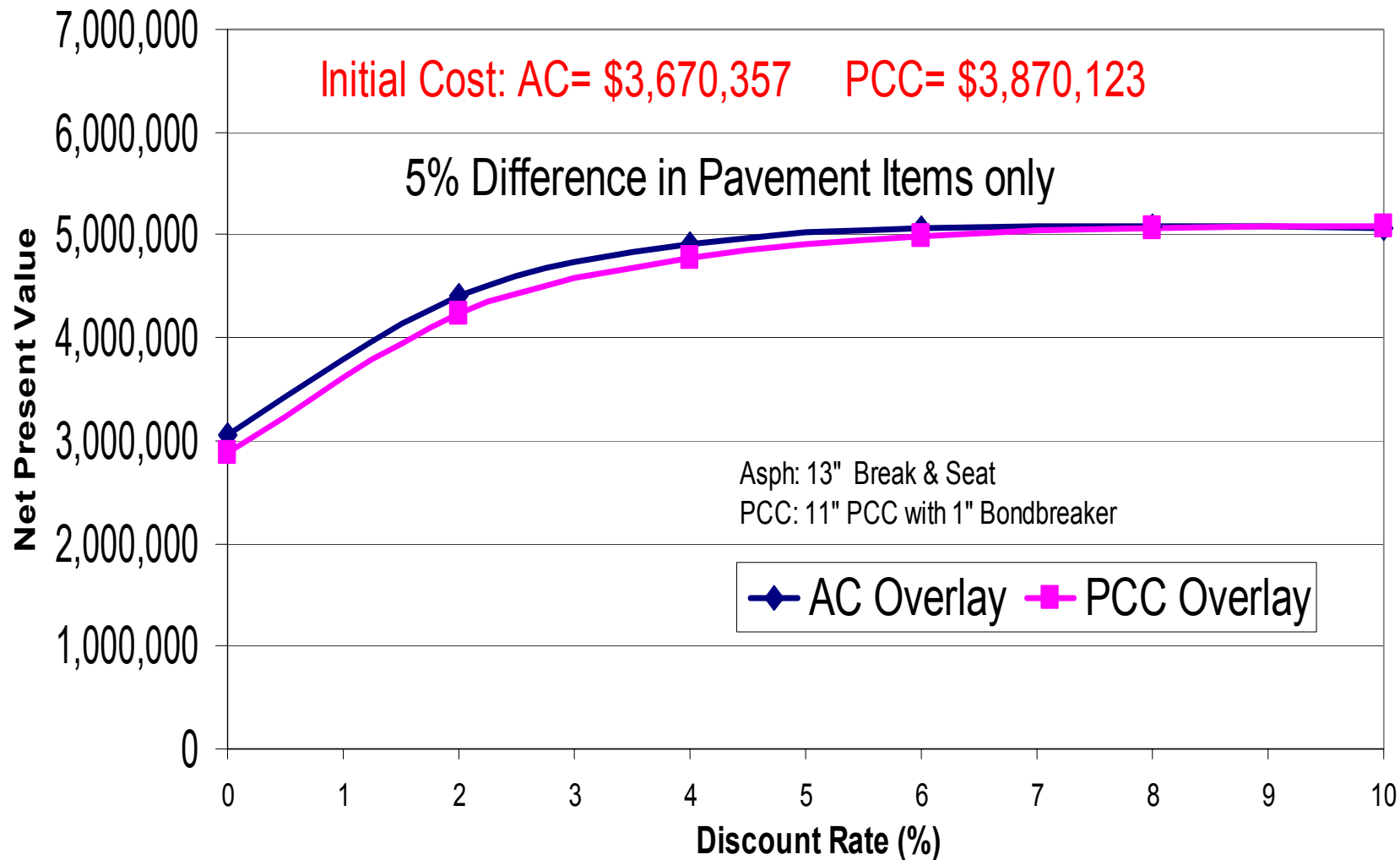
- No Significant Engineering Factors Favoring One Pavement Type Over Another
- Initial Cost within 5-10%
- Life Cycle Cost Analysis
“Too Close To Call”



LCCA (AC-10r, PCC-15-yr)

Initial Cost: AC= \$3,670,357 PCC= \$3,870,123

5% Difference in Pavement Items only



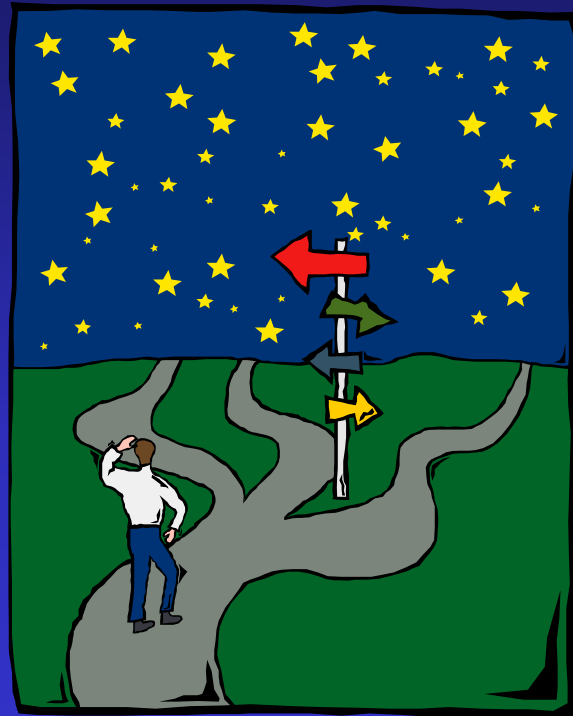
“Optional Bid” (ODOT)

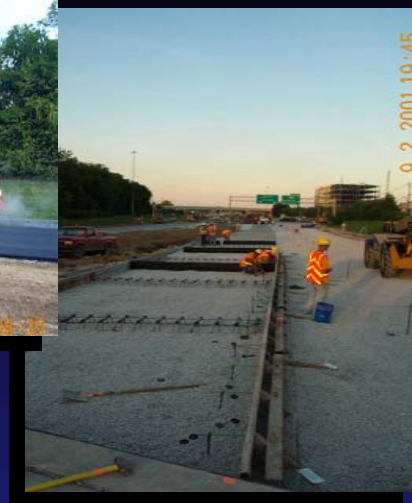
- \$60M construction project in Ohio
- ODOT “Pavement Selection Score” could not select one pavement type over another
- Alternatives
 - Unbonded PCC Overlay
 - Rubblize and Asphalt Overlay
- Contractors permitted to choose pavement structure they feel is the most economical and appropriate

“Optional Bid” (ODOT)

- Predetermined Future Maintenance costs will be added to bids
- Lowest responsive and responsible bidder will be awarded contract
- Project scheduled to sell in May 2004

Is there a better method?





Long Life Pavements Kentucky's Perspective

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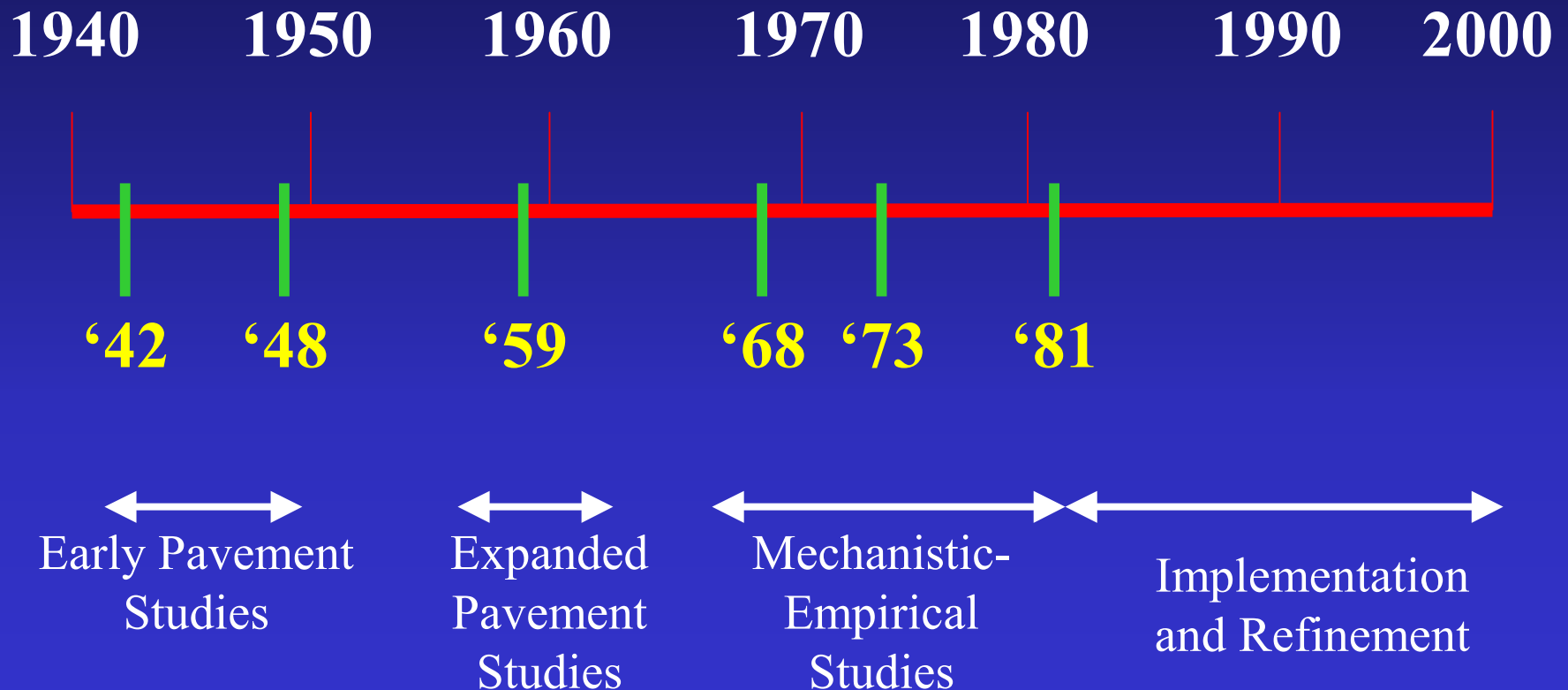
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Kentucky's Pavement Design History

- Mechanistic-Empirical Design Procedure
- Developed Since the 1940's
- Based on Mechanistic Analysis and Field Experience

Timeline of Pavement Design Development in Kentucky

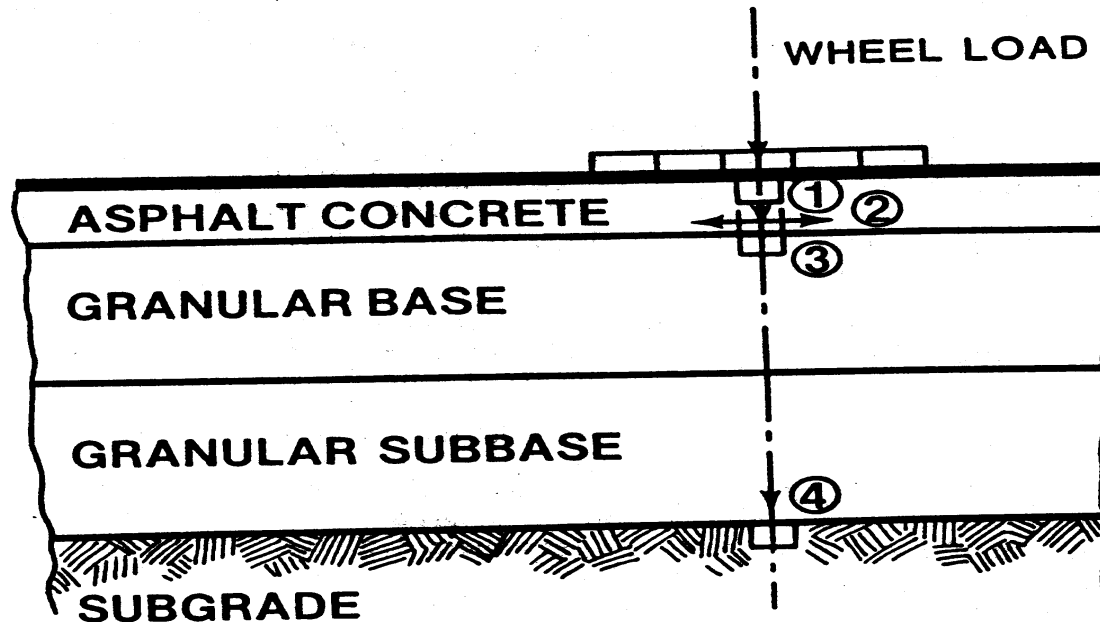


Achieving Long Life Pavements

- Limiting Strain Criteria
- Minimize Fatigue Cracking
- Improvements in Material Properties
- Performance Related Specifications
- Extended Design Life 40 - 50 year ESAL's
- What is Long Life
 - Functional Life
 - Structural or Fatigue Life

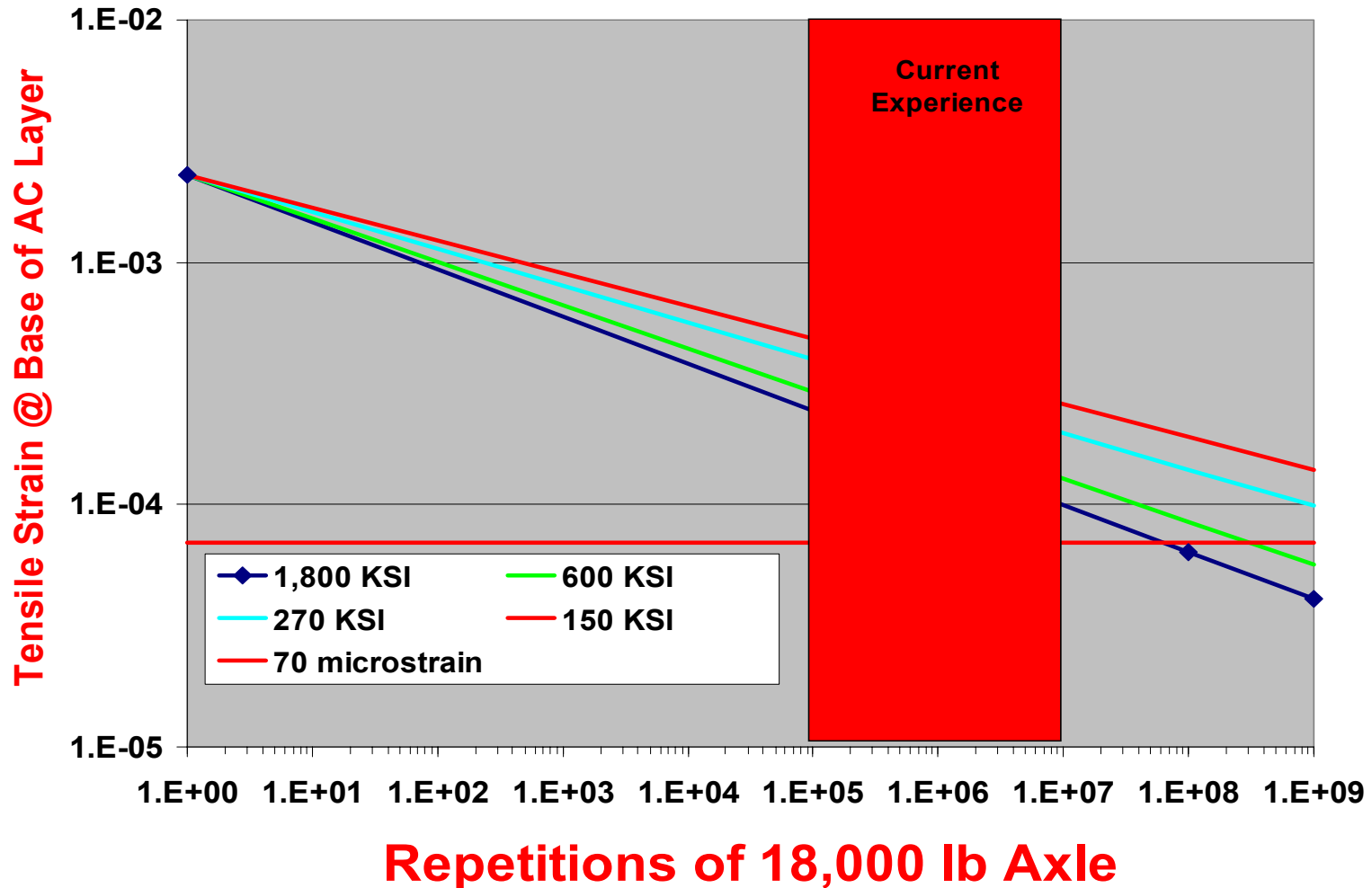
Classical AC Limiting Strain

- ①. Compressive strain - rutting.
- ②. Tensile strain - fatigue or alligator cracking.
- ③. Compressive strain - rutting.
- ④. Compressive strain - rutting, depressions.

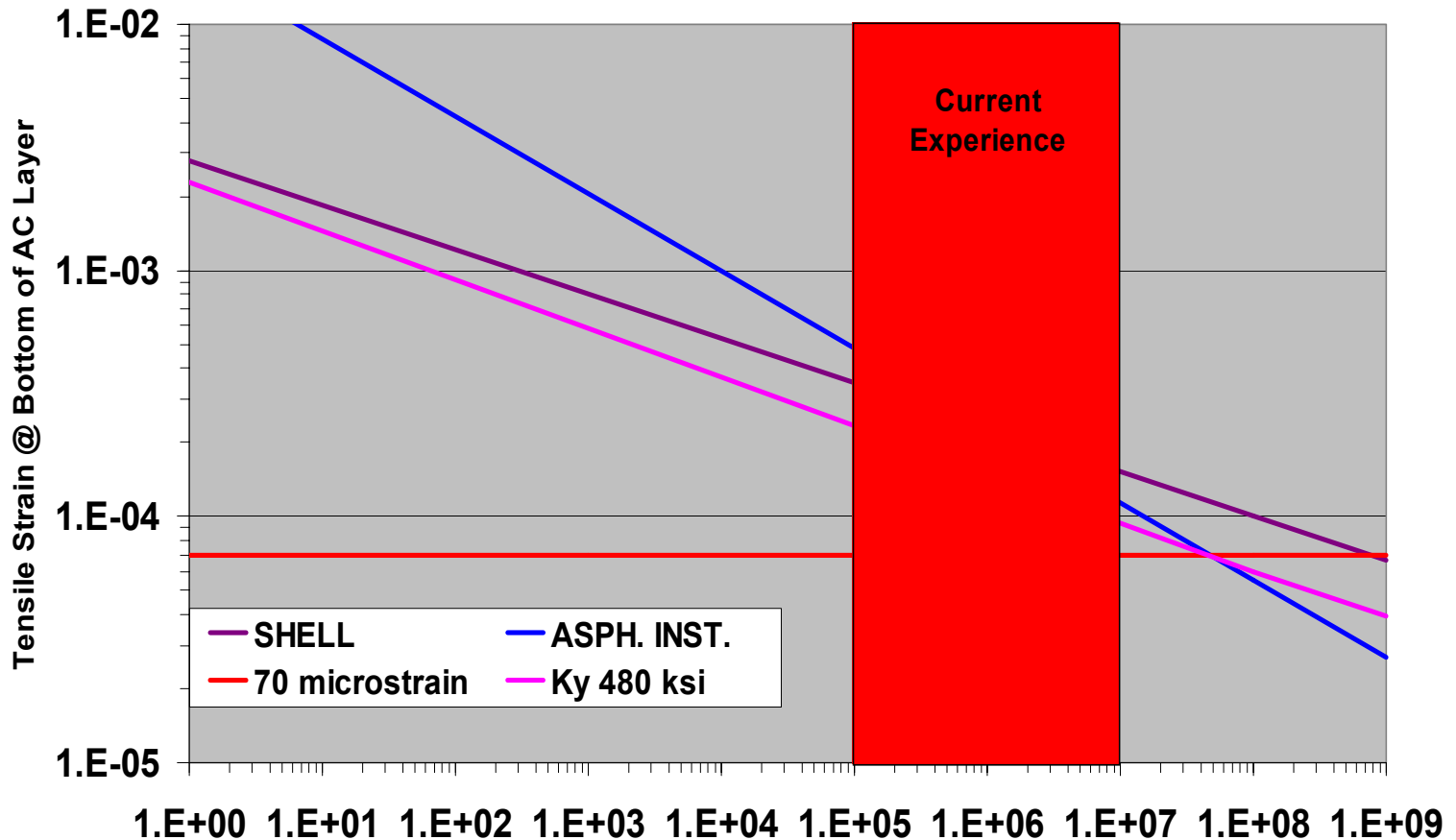


TYPICAL FLEXIBLE PAVEMENT
WITH GRANULAR BASE

AC Critical Strain Kentucky Criteria

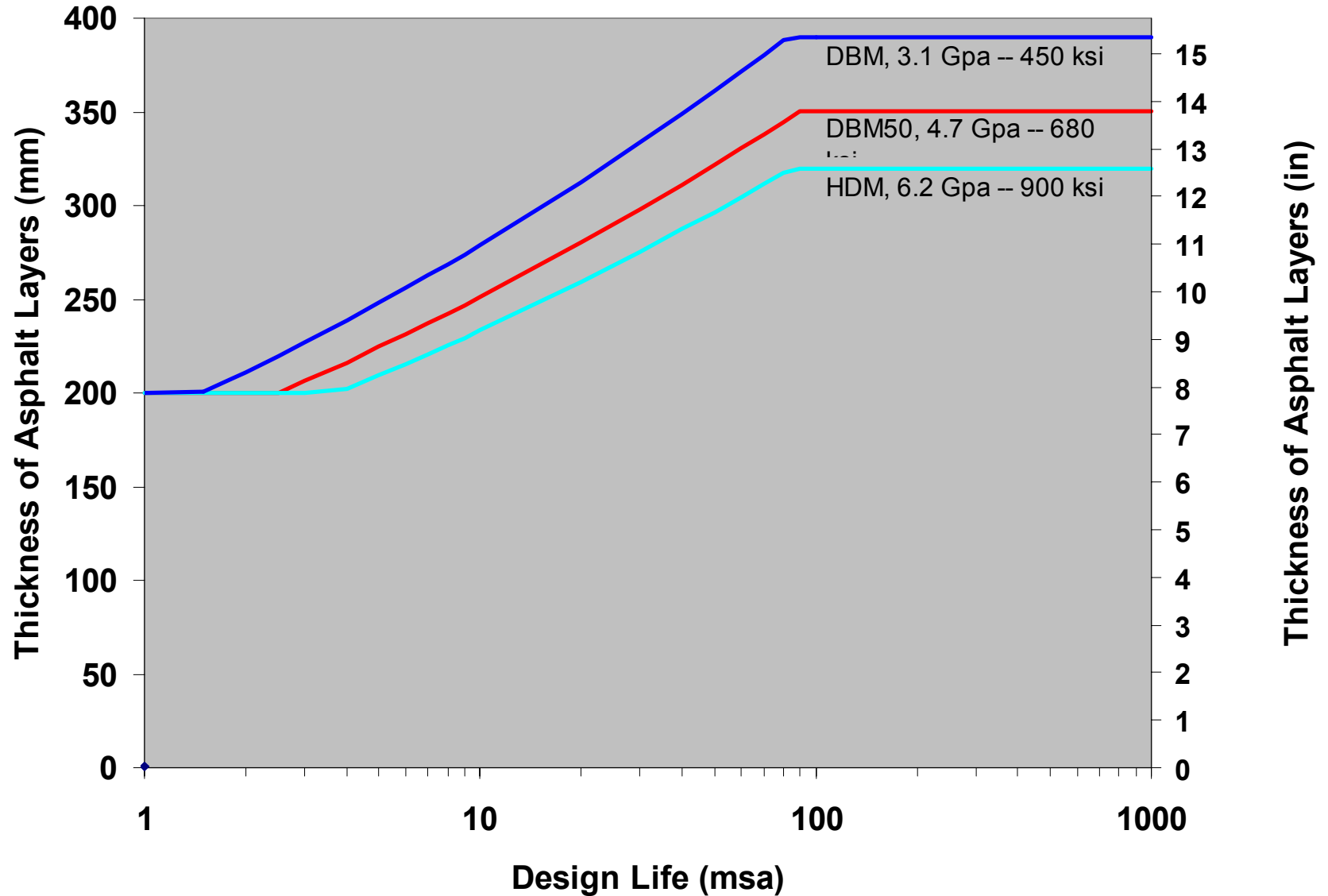


AC Strain Asphalt Institute, Shell, and Kentucky



Number of Repetitions

TRL Report 250



Kentucky's Current Approach to Long Life Pavements

- Long Life Designs are typically defined as having the ability to carry extended traffic loads.
- Typical High Type Pavement Facility Rehabilitations have been due to Functional Distresses and Not Necessarily Fatigue Related

Where Do We Go From Here?

- NCHRP 1-37A Design Procedure
- Other Design Procedures
- Fatigue Life vs. Functional Life
- Limiting Strain for Infinite Fatigue Life
- Forecasts for Long Range Traffic
- Innovative Materials
- New Construction Techniques



**Thank
You**