

# Warranties for Pavement Preservation Treatments

- **52 ANNUAL IDAHO ASPHALT CONFERENCE**
  - **October 25, 2012**
  - **Doyt Y. Bolling, P.E.**
- **National Center for Pavement Preservation**

1-1

## Presentation Outline

- **Types of Warranties**
- **Why Warranties**
- **Six Building Blocks**
- **Field Evaluation Studies**
- **Do Warranties Work**
- **Cost Effectiveness**
- **Preservation Warranty Examples**

1-2

## Top Reasons to use a Warranty

1. **Improved product performance and enhanced quality**
2. **Shift performance responsibility to Industry**
3. **Promote innovation and new technology**
4. **Improve public relations or minimize impacts on the public**
5. **Lower life-cycle and maintenance costs**
6. **Protection against early or catastrophic failures**

NCHRP 20-7(201)

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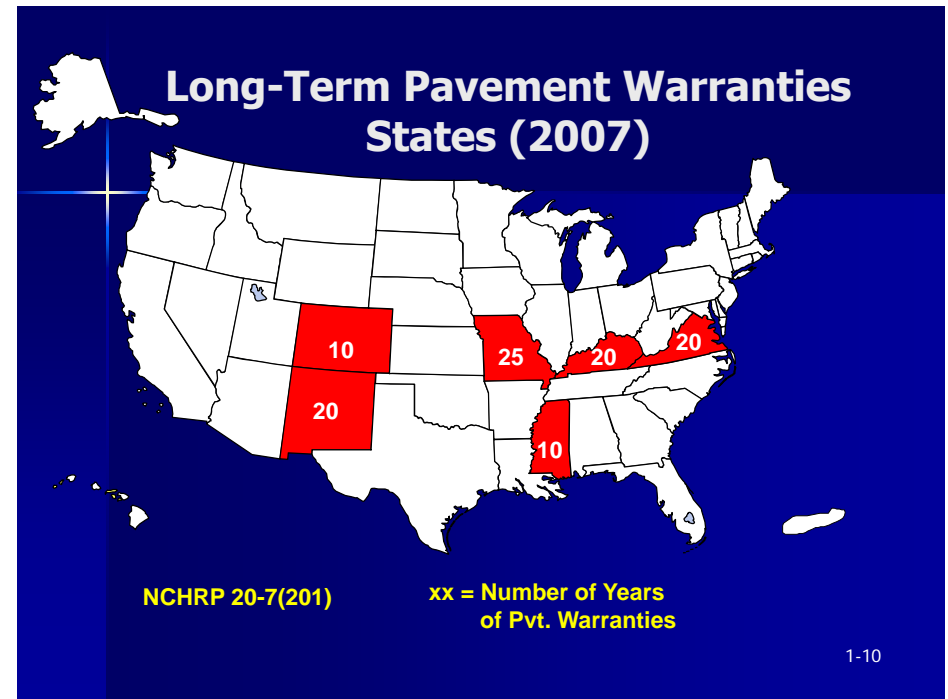
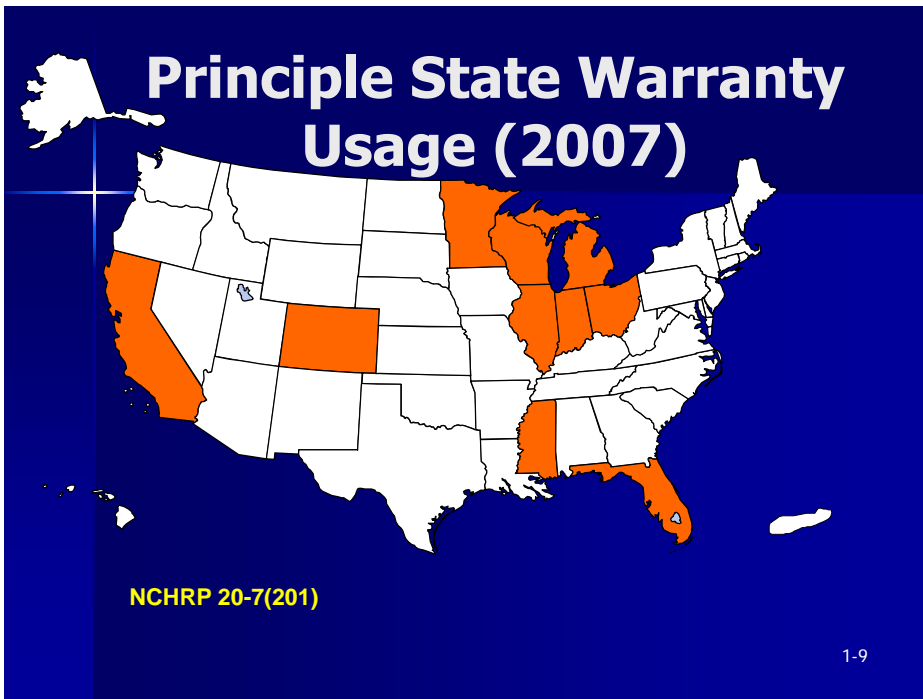
## Second: What Warranties are not

- **Guarantee of defect free pavement**
- **Throwing away the spec book**
- **A way to get rid of DOT employees**
- **Using current specifications with performance warranty on top**
- **A way to put small contractors out of business**



1-4





### Types of Warranties

- Material and Workmanship 2-4 yrs
- Short-Term Performance 5-10 yrs
  - **Workshop emphasis**
- Long-Term Performance 10-20 yrs
- **There are pluses and minus of each**

1-11

### Why Warranties

- Quality, Quality, and Quality
- Long-Term Performance – We can't continue pay for projects that don't meet design life's
- Contractors need to be vested in the project
- **Paradigm shift for Agency and Industry Representatives**

1-12

## Cost and Quality



### NCHRP Study 2008:

- Majority of DOT's responded **costs and quality were similar to non-warranted projects.**
- **Benefits to DOT**
  - Reduced Disputes
  - More Knowledgeable Industry
  - More effective DOT Oversight
  - Better Performance

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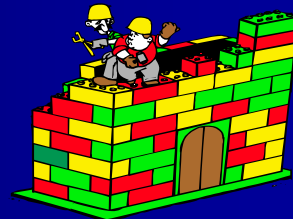


Short Term (5 years) Warranty Project, Age 10 years

## Six Building Blocks

### *Building Blocks for Warranties*

- ❑ Contract Administrative requirements
- ❑ Distress identifiers and applicable thresholds
- ❑ Distress remediation
- ❑ Quality programs for binders, aggregate, production and laydown
- ❑ Restrictions, traffic monitoring and evaluation of the pavement/project
- ❑ Bonding/guarantees



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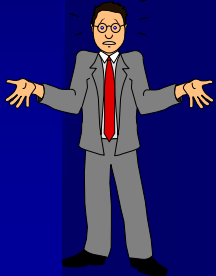
## Warranty Development Steps

- Establish warranty performance indicators
  - Objective (Highly Recommended)
  - Subjective (Only if you have to)
- Evaluate existing projects against proposed
  - warranty performance indicators
  - warranty length (2, 5, 7, 20 years)

1-16

## Example: HMA Warranty Items

Materials & Workmanship



- Deformation
- Cracking
- Raveling
- Rutting
- Ride quality
- Friction

Performance

1-17

## Materials and Workmanship

- 2 to 4 years
- Uses standard specifications
- Focuses attention on materials and construction details
- Minimal opportunity for innovation
- Examples:
  - Slurry Seals
  - Micro-surfacing
  - Chip seal
  - HMA thin overlay



## Performance Warranties

- 5 to 20 years
- Short-term - major emphasis on construction techniques
- Longer term - major emphasis on improved materials & structural designs

Performance Warranties



1-19

## Communication for Specification Development

- Agency and industry willing to communicate
  - Include FHWA Division Office
- Discuss everything openly
  - Potential pitfalls
  - Concerns
  - Experiences
  - Effectiveness of current programs



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## Performance Warranty Philosophy

- ✓ Contractor should control items related to materials and manufacturing since they are accountable for performance
- ✓ Agency retains ownership and responsibility for other items



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## Core Elements in Performance Warranty Specifications

1. Description – Performance Objective Values
2. Warranty Bond/Guarantee Requirements
3. Conflict Resolution Team
4. Highway Operation Permits
5. Distress Indicators, Thresholds, & Remedial Action
6. Elective/Preventive Actions
7. Agency Maintenance Responsibilities
8. Method of Measurement
9. Basis of Payment
10. Quality Control Plans
11. Verification and Evaluation – Objective vs. Subjective
12. Final Warranty Acceptance

1-22

## Short-Term Performance Warranties

- **Agency provides**
  - Traffic characteristics
  - Performance threshold values
  - Other potential requirements
    - Minimum grade of binder
    - Aggregate requirements
  - Structural design, typical section, and quantities
  - Project phasing
- **Contractor provides**
  - Quality management plans
  - Performance Results

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## Long-Term Performance Warranties

- **Agency provides**
  - Traffic characteristics
  - Geometrics
  - Quantities for payment (e.g., sq.yd., lane-mile)
  - Performance threshold values
- **Contractor provides**
  - Quality management plans
  - Structural design and typical section
  - Project phasing

1-24



## Setting Performance Criteria

1. Select pavements of target age
2. Establish evaluation section length
3. Evaluate performance data
4. Establish performance indicators threshold values

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## 1. Pavements of the Same Target Age

- Establish baseline thresholds by analyzing PMS project data based on
  - Age
  - Functional classification

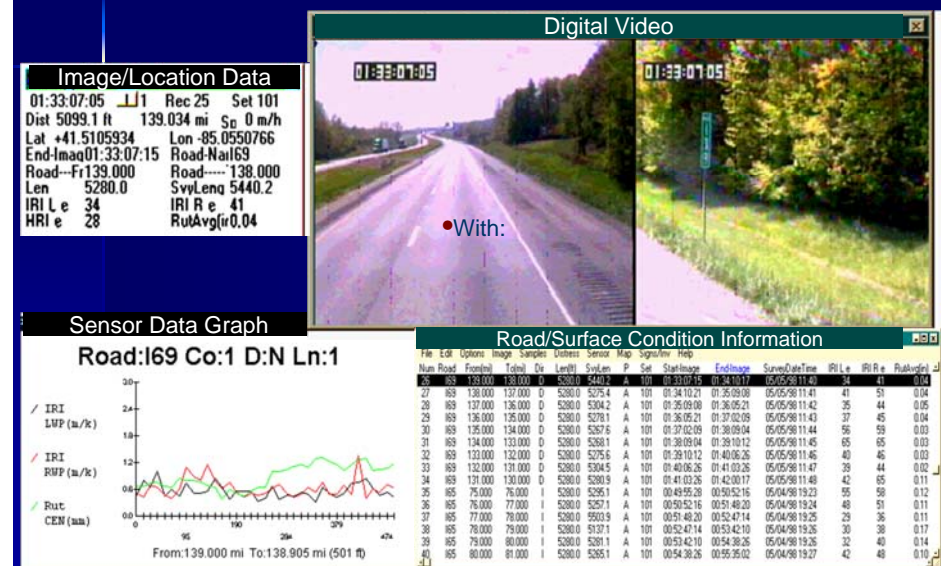
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## 2. Evaluation Segment Length

- PMS segments may be too long for evaluating warranty pavement condition
  - HPMS segments are typically 1.0 mile
  - Masks localized extreme values
- Recommendation: use 0.1 mile or less

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## 3. Performance Data



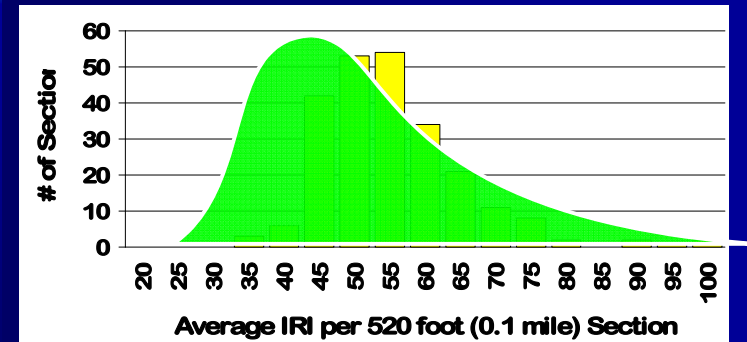
## Performance Indicator: Ride - Example

- Evaluation length selected: 520 feet (0.1 mile)
- Use laser profiler
  - Exclude bridge approaches
- Calculate IRI for 520 feet (0.1 mile) sections
- Determine distribution of IRI
- With:
  - Mean ( $\mu$ ) = 55
  - Standard deviation ( $\sigma$ ) = 10

1-29

## Performance Indicator: Ride - Example

- 5 year old pavements



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## Performance Indicators: Ride - Example

- 95% of projects meet performance criteria
- Ride threshold value is  $2\sigma$  greater than  $\mu$ 
  - 75 in/mile

Where:

- ❖ Mean ( $\mu$ ) = 55
- ❖ Standard deviation ( $\sigma$ ) = 10

1-31

## 4. Performance Threshold Values - (5-7 Years)

- Example\*
  - Ride (IRI) 75 in/mile
  - Rut 0.25 in
  - Friction 35
- Cracking
  - Longitudinal 0 ft
  - Transverse 0 ft

\* based on 520 feet (0.1 mile) evaluation sections

1-32



## Field Evaluation Studies

### ➤ **NCHRP 20-7(201) - USE OF WARRANTIES IN HIGHWAY CONSTRUCTION (A Synthesis of Highway Practice), April 2008**

- ❑ **Wisconsin DOT- 2001**
- ❑ **Colorado DOT – 2001, 2006, 2007**
- ❑ **Indiana DOT – 2003**
- ❑ **Ohio DOT – 2003**
- ❑ **Illinois DOT – 2004**
- ❑ **Caltrans – 2005**
- ❑ **Minnesota DOT – 2006**
- ❑ **Mississippi DOT -2006**

1-33

## Do Warranties Work

**Yes** – now let's define – “**working**”

“The Game is played the way  
the rules are written”

**Best Practices for writing the “rules”  
include the six building blocks and .....**

1-34

## Core Elements in Performance Warranty Specs

1. Description
2. Warranty Bond/Guarantee Requirements
3. Conflict Resolution Team
4. Highway Operation Permits
5. Distress Indicators, Thresholds, & Remedial Action
6. Elective/Preventive Actions
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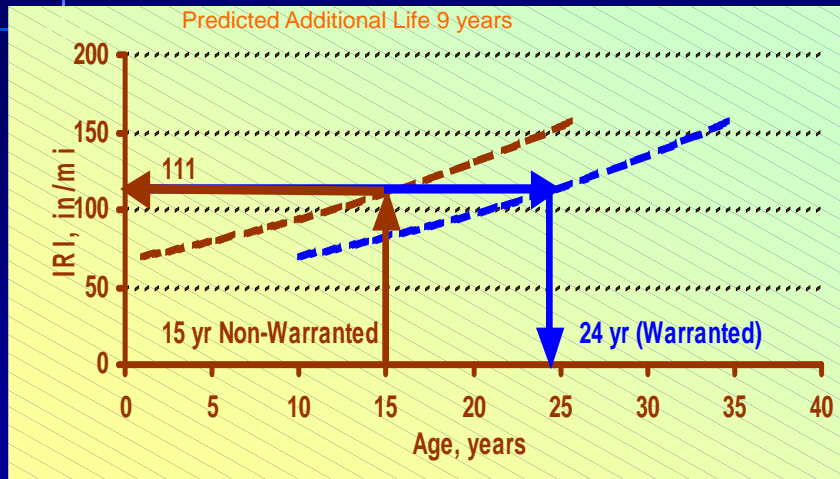
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## Benefits!!!

- Quality of the pavement is generally better when the Agency and Industry have balanced the Risk of warranties.
- Longer life “less defects” pavements are achievable. Remember, this does not mean no defects.

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## Longer Life (Indiana Study)



## Cost Effectiveness

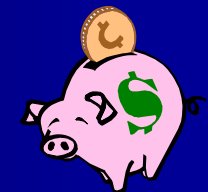
### Address the following questions

1. Does it include the anticipated maintenance costs for the Agency for the life of the warranty?
2. Does it include the material testing i.e., administration costs for the Agency?
3. Does it include just the initial construction costs?
  - Initial costs are 3-8 percent higher
4. Metrics of Cost-Benefits needs to developed

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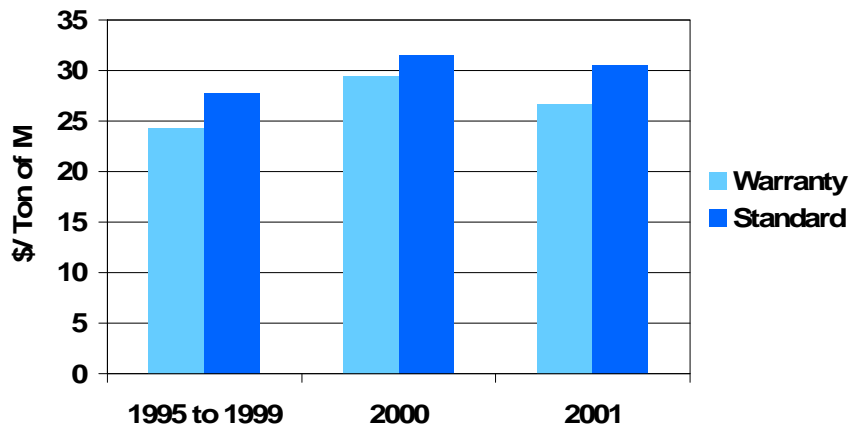
## What Affects Warranty Costs

- More restrictions = higher costs
- More contractor risk = higher costs
- Learning curve impacts costs



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## Cost Comparison of HMA (Wisconsin)



## Pavement Preservation Treatment Warrantees

**FOR:**  
**Chip seals**  
**Slurry Seals**  
**Micro-Surfacing**  
**Thin Hot Mix Asphalt**

## Montana DOT Seal Coat Warranty Key Elements

- Contractor warrants the seal coat.
- If chip seal loss, tracking, flushing, or bleeding occurs before first Wednesday of December of the same calendar year.
- Contractor must repair seal coat & replace pavement markings at no cost.
- Repairs in accord with MDT Seal Warranty Admin. Guide.

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### Montana Department of Transportation



2008  
Seal Coat Warranty Administration Guide



1-44



## Introduction

The purpose of this guide is to present guidelines for the evaluation of the finished seal coat. This guide presents examples of desirable seal coat appearance and acceptable longitudinal joint location as well as other conditions, which include tracking, flushing, bleeding, equipment damage to seal coat, and cover material loss. An emphasis is placed on recommended solutions in cases where unacceptable conditions exist.

Throughout the warranty period, MDT personnel must carefully document (photos, video, diary) the progression of the seal coat cure. Frequency and type of documentation will be dictated by the number and severity of potential problem areas.

At the end of the warranty period, the Project Manager will facilitate and conduct an on-site inspection. Based on findings from this inspection, the Project Manager will send a letter to the Contractor stating whether or not repairs are required and at which locations. Copies of this letter will be sent to the District Construction Engineer, Materials Bureau, Construction Engineering Services Bureau, Construction Administration Services Bureau, and the project file.

In the interest of uniform seal coat warranty administration statewide, coordinate warranty determinations with the appropriate Construction Bureau staff.

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# Evaluation Guide Performance Objective

Condition: Desired Final Appearance



1-46

## Evaluation Guide

### Recommended Solutions:

- Blot Live Oil Areas Throughout Warranty Period. Refer to Subsection 409.03.9. Application of Blotter Material.
- In Cases Where This Condition Persists at The End of The Warranty Period, Acceptance is Made Under Subsection 105.03.1.
- Due to The Loss of Service Life, Skid Resistance and Headlight Reflectivity, a 50% Price Reduction is Recommended for Affected Area.
- During Seal Coat Placement in High ADT And/or Turning Movement Areas, Consider Reducing Traffic Speeds And Continually Monitor Device Placement (i.e. Flagging Station Locations) to Avoid Aggregate Rollover During Curing Period

Condition: Heavy Tracking, Bleeding



1-47

## Evaluation Guide

### Comments:

- **Per Subsection 409.03.8 Warranty, Submit a Detailed Repair Plan to The Project Manager For Approval Within 14 Calendar Days of Notification of Required Repairs.**
- **This Condition is Unacceptable And Must be Repaired Prior to Final Acceptance.**

Condition: Cover Material Loss Attributed to Insufficient Embedment.



## IDAHO DOT SEAL COAT WARRANTY CORE ELEMENTS

- Contractor to provide CRS-2P binder or acceptable substitute, Class B Rural chip, & associated quality control test results.
- Use McLeod design method for seal coat design
- Submit asphalt supplier's recommended surface and application temperatures & elapsed time between application of asphalt and chips.
- Conduct seal coat test strip. (min. 1000 ft.)
- Application construction requirements.

1-49

## IDAHO DOT SEAL COAT WARRANTY CORE ELEMENTS

- IDT Engineer to conduct field review in April following the year of construction.
- IDT Engineer will use Montana DOT 2008 Seal Coat Warranty Inspection Guide.
- If Engineer finds failures ( chip loss, emulsion loss, severe tracking, flushing, or bleeding) contractor is to make repairs at his expense or may be accepted at a price adjustment or both.

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## IDAHO DOT SEAL COAT WARRANTY CORE ELEMENTS

- All incidental work associated with seal coat will not be paid for separately.
- Upon completion of initial work, IDT will pay contractor 85% of contract pay item.
- Remaining 15% to be paid once all repairs are made or if no failures found.
- If Contractor posts a warranty bond equal to total value of contract contractor will be paid 100 %. Failures assessed as cited previously.

1-51

## ISSA PERFORMANCE GUIDES

Recommended Performance  
Guideline  
For  
Micro Surfacing

A143  
(Revised February 2010)



Recommended Performance  
Guideline  
For  
Emulsified Asphalt Slurry Seal

A105  
(Revised February 2010)



1-52

## Slurry Seal Warranty Core Elements

- Provide asphalt emulsion Certified Analysis/Compliance with specifications, mineral aggregate, specified type & mix design. (Wet Track Abrasion Test).
- Materials quality control test results.
- Construction workmanship criteria.
- Weather limitations ( pavement temp <50 degrees or 45 degrees & rising).
- Warranty period ( 2 to 3 years).

1-53

## Micro-Surfacing Warranty Core Elements

- Provide polymer modified asphalt emulsion, mineral aggregate & mix design (Wet Track Abrasion Test).
- Materials quality control test results.
- Construction workmanship criteria.
- Weather limitations ( pavement temp <50 degrees or 45 degrees & rising).
- Warranty period ( 2 to 4 years).

1-54

## HMA WARRANTIES – Colorado DOT

- 10 Pilot projects constructed with Materials & Workmanship Warranties.
- Contractors responsible for work and materials within their control including related distress defects that may result within warranty ( 3 or 5 Yrs.).
- CDOT responsible for pavement design – (10 year design life).

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## Pavement Evaluation Factors

- International Roughness Index (IRI)
- Fatigue Cracking (alligator)
- Longitudinal Cracking
- Transverse Cracking
- Rutting

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# IRI Comparison

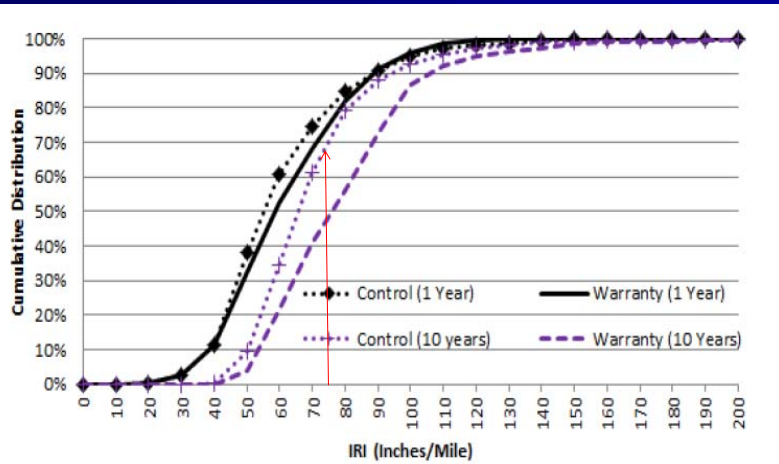


Figure 76. IRI comparison

# Rut Depth Comparison

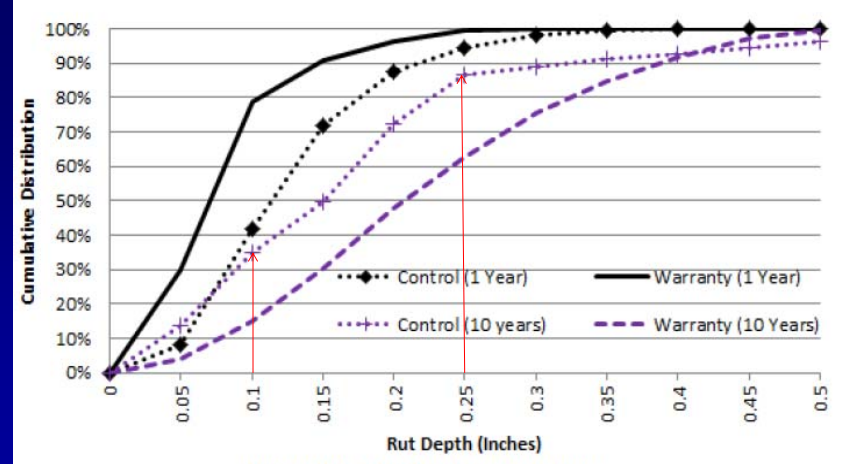


Figure 77. Rut depth comparison

# Longitudinal Cracking

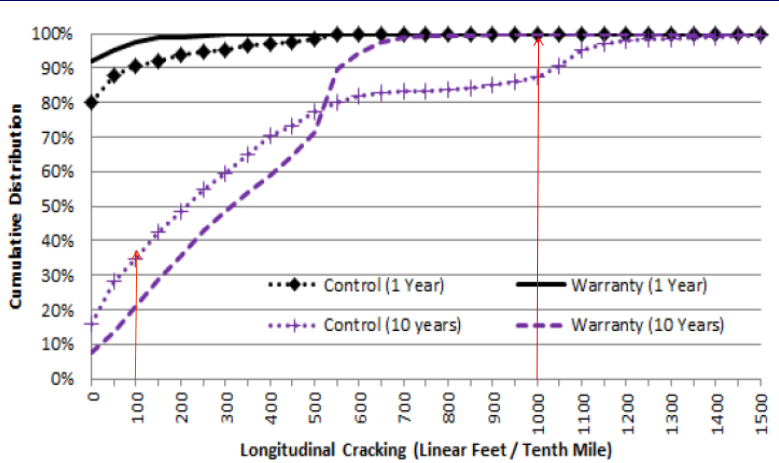


Figure 78. Longitudinal cracking comparison

# Transverse Cracking

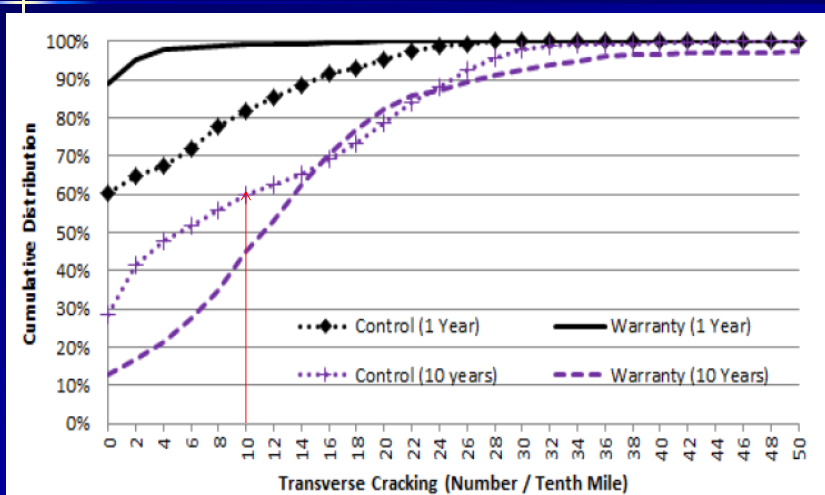


Figure 79. Transverse cracking comparison



## COST - BENEFIT EVALUATION OF SHORT TERM WARRANTIES FOR HMA

After ten years of comparison performance information between the warranty and control projects, the three and five-year, short-term warranty pavements had a rougher ride, slightly deeper ruts, a few more transverse cracks, and slightly less longitudinal cracking. The initial cost to construct the warranty projects was \$12,635 per lane-mile more than the control projects. This cost could be reduced by about \$5,548 per lane-mile if CDOT were to eliminate the Pavement Evaluation Team and the need to construct weigh-in-motion stations. As of January 1, 2012, the average annual cost of maintenance for the warranty projects was \$5,616 per lane-mile less than the control projects. There is a shift in risk and responsibility as a result of the warranty projects, but there was no tangible benefit in extended life identified. Based on the evaluation of these pavements, the implementation of short-term warranties of HMA is currently not a cost-effective tool for CDOT.

## Warranties for 21<sup>st</sup> Century

- Change definition of success
- Improve quality (performance)
- Balance risk
- Reward innovation
- Non-confrontational construction

**“The Game is played the way the rules are written.”**



1-62

## REFERENCES

- **Warranties 101 Workshop**
  - Lee Gallivan, HIPT
  - Federal Highway Administration
- NCHRP 20-7 (201)
- [www.dot.gov/pavements/warranty](http://www.dot.gov/pavements/warranty)



September 10, 2008

## Warranty Workshops



### Basic Warranty Workshop for DOT/Industry

- Best Practices to develop warranty programs
- Experiences to evaluate and improve on current programs
- Provide specific assistance

Contact Lee Gallivan, HIPT, 317-226-7493

@ [Victor.gallivan@fhwa.dot.gov](mailto:Victor.gallivan@fhwa.dot.gov)

or Dennis Dvorak, RC, 708-283-3542

@ [Dennis.dvorak@fhwa.dot.gov](mailto:Dennis.dvorak@fhwa.dot.gov)

1-64

**Thank you**

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1-65